Pakistan Institute of Development Economics

Readings in Pakistan's Energy Challenges

Edited by

Afia Malik

PAKISTAN INSTITUTE OF
DEVELOPMENT ECONOMICS

Pakistan Institute of Development Economics
Quaid-i-Azam University Campus
P. O. Box 1091, Islamabad 44000, Pakistan

E-mail: publications@pide.org.pk
Website: http://www.pide.org.pk
Fax: +92-51-9248065

Designed, composed, and finished at the Publications Division, PIDE.

Readings in Pakistan's Energy Challenges

Edited by

Afia Malik

PAKISTAN INSTITUTE OF DEVELOPMENT ECONOMICS
ISLAMABAD

CONTENTS

ACKNOWLEDGEMENT

Dr Nadeem Ul Haque, Vice Chancellor, PIDE, deserves all the credit for the idea and unwavering encouragement that brought this volume to life.

PREFACE

Energy is the driving force behind economic growth, but Pakistan has grappled with energy-related issues since its inception. Pakistan, an economy worth US$ 376 billion with a population of around 230 million, relies on imports for 49 percent of its primary energy supplies. It strains its already limited foreign exchange reserves of US$7.7 million (as of October 20, 2023). In FY2023, Pakistan spent US$17 billion on energy imports (excluding coal imports). From a geo-economic perspective, heavy energy imports and global market volatility constantly threaten Pakistan's economic and energy security.

Energy demand in Pakistan is increasing rapidly. Since 1980, it has grown by 5 percent per annum. However, per capita energy consumption is still one of the lowest in the world. Furthermore, around 50 million people in Pakistan do not have access to grid electricity. A significant portion of Pakistan's population still needs access to commercial energy for cooking purposes, which forces them to rely on biomass energy, mainly in rural areas. The rural population is estimated to meet 94 percent of their domestic energy needs by burning biofuels, posing health and environmental risks.

Most of Pakistan's primary energy supply comes from fossil fuels, specifically oil and gas. The use of coal, liquefied petroleum gas, and imported liquefied natural gas has grown to accommodate the surging demands in the country's energy sector. Indigenous gas production is decreasing, leading to increased imports of liquefied natural gas rather than a shift towards alternative and renewable energy sources.

Dependence on fossil fuels for electricity production has increased. In a world of plentiful energy supplies, evolving technologies are making it cheaper to generate electricity using renewable resources. In Pakistan, electricity generation energy costs are growing, and so are its prices. Despite having massive potential for hydro and other renewable resources, unfortunately, these indigenous resources have not remained our priority in the energy strategies. Due to greater import dependency and the limited contribution of low-cost energy production from hydroelectricity and other renewable resources like wind and solar, in addition to costly electricity production, supply shortages often occur.

Due to long-term dollar-based contracts with power generation companies, the capacity payments have surged significantly. Over the years, the focus remained on increasing capacity instead of using the existing capacity more efficiently. With the addition of ill-thought-out projects, Pakistan has transitioned from an energy deficit to an energy surplus but has yet to establish a stable energy mix.

The electricity sector in Pakistan has been facing a financial deficit (circular debt) since 2006, which was initially PKR 111 billion but has now grown to a massive PKR 2.3 trillion. The sector's total cumulative loss has now surpassed PKR 6 trillion. Additionally, the burden of electricity sector subsidies since FY2007 has exceeded PKR 5 trillion. This has significantly burdened the government. Despite a subsidised electricity tariff for the majority, the average consumer end tariff has increased by more than 550 percent over these years.

While Pakistan struggled with electricity sector circular debt, gas sector circular debt emerged in 2016 due to cost price difference. Politically motivated gas allocation and pricing policies in the presence of increasing reliance on imported LNG have led to the rise in this sector debt equivalent to about PKR 1.5 trillion (excluding interest payments).

Pakistan has been facing petroleum-related issues for several years. Although reliance on furnace oil for electricity production has decreased significantly, the country still depends on imports for 80 percent of its petroleum needs, mainly in the transport sector. Our refineries are protected through concessions/ subsidies but produce below-capacity and low-quality products; primarily, they are hydro-skimming technology capable of producing furnace oil, for which local demand is decreasing.

Since FY1991, net energy losses have increased by more than 400 percent. A lot of energy is wasted while supplying electricity and gas in the country. The idea of energy conservation and efficiency has never remained a priority.

Despite private participation, the state presence in the energy sector is about 78 percent (as estimated in the PIDE study *What is the Size of the Government Footprint on Pakistan's Economy?* published in 2021). It wouldn't be incorrect to say that the government controls all energy sub-sectors or makes major decisions. Furthermore, the decision-making is not by the sector professionals but under the influence of one or the other interest group.

Over the years, there have been no serious efforts towards achieving long-term energy sustainability in the country. The lack of investment in exploring indigenous energy reserves, construction of hydropower projects, and focus on alternative and renewable energy resources have resulted in numerous challenges. Due to the government's insufficient professional expertise, ad hoc measures have been relied upon to address energy challenges. Policy decisions are often based on donor guidance, mostly disconnected from the ground realities.

Achieving economic self-reliance is not feasible when a country's fundamental energy needs are unmet. This inadequacy in energy supply acts as a disincentive for investors/businesses. Better decision-making and implementation processes are essential for a sustainable energy sector. A well-functioning governance system, tailoring objectives to local needs and ensuring accountabilities for all stakeholders, is necessary to achieve this. Unfortunately, Pakistan's energy system currently falls short in these areas and requires reforms.

PIDE has extensively researched critical issues in Pakistan's energy sector. This volume compiles studies completed (published or unpublished) from 2020 to date.

The first part of the volume is about power sector failings. The first chapter in this part, *Circular Debt: An Unfortunate Misnomer*, covers circular debt history, growth, and causes. Its primary focus is that circular debt has confused policymakers to think it is a mere accounting problem and not a result of deep structural issues that must be carefully resolved. Besides creating budgetary challenges, it has badly affected the overall sustainability of the electricity supply chain for many years.

The second study in the first part focuses on *Corporate Governance in State-owned Electricity Distribution Companies*. Although these companies are legally separate entities, they have yet to become independent institutions and fail to adhere to basic corporate governance frameworks. The study recommends that compulsory disclosure of all distribution companies owned by the public sector on the stock market is essential. Additionally, independent boards and competent management, with a clear corporate vision and business plans, are necessary for organising the utility on commercial lines.

In the third chapter, the topic of discussion is the *Privatisation of Electricity Distribution Companies*. Based on international and local experience, the chapter suggests that good corporate governance and effective management are more important than ownership. Whether the management is public or private, it performs best when there is an efficient regulatory framework, incentives and penalties, and supportive city dynamics and governance systems.

The fourth chapter in this part is *Electricity Tariff Design*. It highlights its weaknesses and presents an alternate tariff design for the country.

The fifth chapter, *Urban Resilience and Its Impact on Electricity Provision in Karachi, Islamabad, and Peshawar*, focuses on the resilience of three urban centres in Pakistan. It analyses the correlation between the operational and commercial performance of an electricity utility and the urban resilience of a city. Islamabad is found to be a more resilient city, followed by Karachi and Peshawar. Thus, IESCO in Islamabad faces fewer challenges than K-Electric in Karachi and PESCO in Peshawar. K-Electric operates in an over-regulated environment, which affects its operations.

Part II of the volume covers the regulatory framework in the overall energy sector. It examines the performance of the two central regulatory bodies, *NEPRA* and *OGRA*. Despite being legally independent, both organisations have failed to build their capacity to function independently and effectively. They have remained under the influence of interest groups, particularly the government and its aligned departments. The third small chapter of this part, *Power Sector: Effective Regulation, not Regulatory Burden*, discusses institutional fragmentation within the power sector. Multiple institutions with overlapping functions exist without coordination, which leads to confusion and administrative and regulatory burdens on the system.

The third part of the volume deals with the petroleum and gas sector dynamics. It comprises four chapters: *Energy Market Structure: Oil and Gas, Gas Crisis in Pakistan, Petroleum Pricing in Pakistan, and A Review of Oil Marketing Companies (OMCs) and Petroleum Dealers' Margins on Petroleum Products*. These four studies delve into greater detail in all these topics. The main suggestion in these chapters is to move towards complete deregulation. The market should determine petroleum prices. The country relies on imports of petroleum and gas (due to depleting local gas resources). Politics should not influence allocation and pricing decisions. Effective utilisation of scarce resources is compulsory.

Part IV consists of three chapters. The first chapter, *Local Coal for Power Generation in Pakistan*, examines the indigenous coal potential and newly commissioned coal power plants in Pakistan. The study mentions that the world is shifting towards more advanced and efficient technologies to mitigate the environmental impact of coal power plants. However, Pakistan's emphasis on coal for power generation (relatively new) ignores plant location and technology. These factors directly or indirectly affect the environment. The study emphasises the need to reduce energy imports by using domestic resources while at the same time not ignoring the environment. This requires upgrading or retrofitting existing or upcoming power plants to improve efficiency and environmental friendliness.

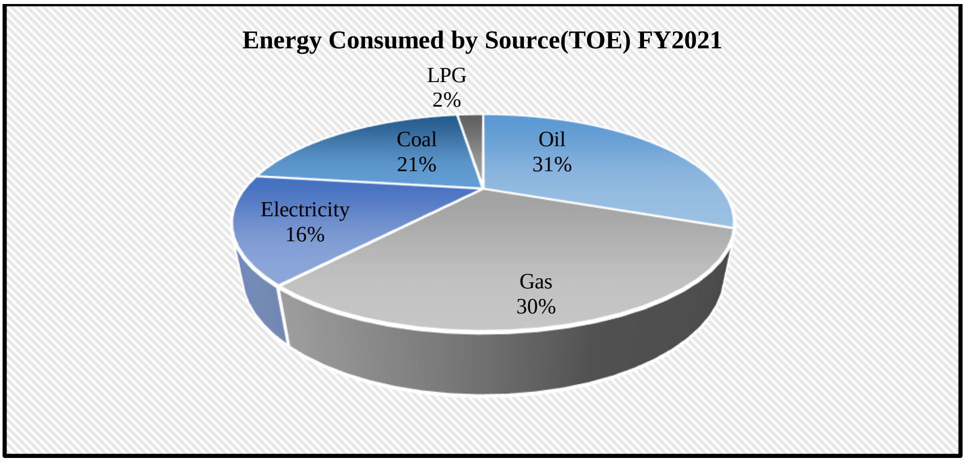
There has been a growing interest in nuclear energy due to concerns over carbon emissions and the unpredictable nature of fossil fuel prices. The second chapter in Part IV, *Pakistan's Nuclear Energy Outlook*, explores the potential and challenges of nuclear energy in Pakistan. The chapter highlights that Pakistan has developed significant expertise in constructing, operating, and designing nuclear reactors, resulting in a reliable and safe nuclear power industry that meets global standards. Therefore, in the future, Pakistan can increase its nuclear energy production while also incorporating renewable sources to promote a greener future. The study underlines that although the construction of large nuclear plants can be expensive, their operational life is longer than fossil fuel and other renewable power plants, lasting up to 60 years.

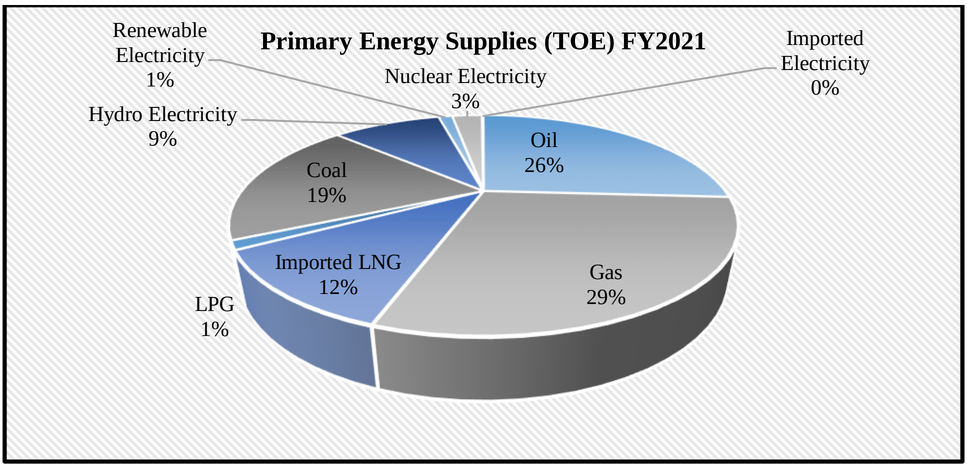
The third chapter, *Energy Efficient Buildings to Save Energy in Pakistan,* emphasises that energy-efficient building codes are paramount. The research highlights that a significant amount of energy is consumed during extreme weather conditions to condition buildings, including residential, commercial, public, and private ones. The high energy consumption in buildings is mainly due to their construction materials and designs. By implementing building codes, energy can be saved significantly.

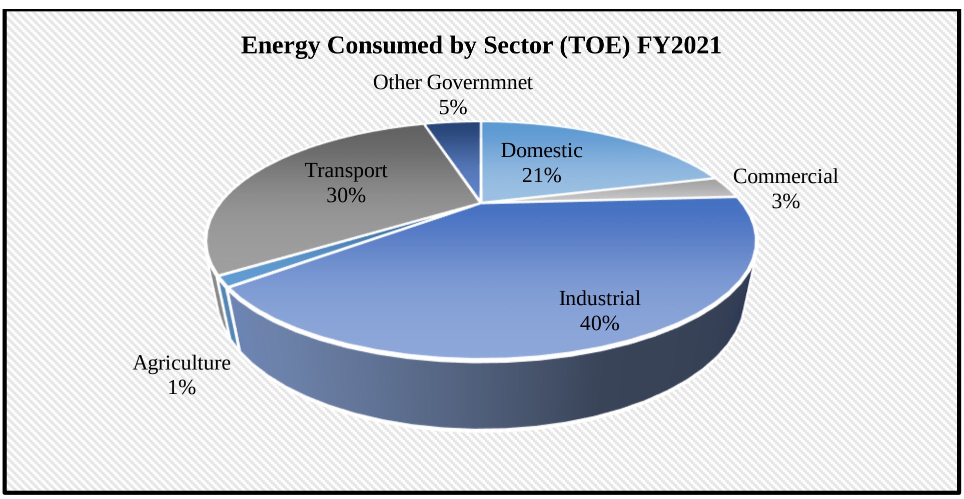
This volume is one of the PIDE-edited volume series. The objective behind it is to promote the reform efforts made by PIDE by initiating discussions on reforms in the energy sector. Secondly, it aims to spread PIDE's research to a broader audience, thus enabling them to make informed decisions. Finally, for the research community, this volume will serve as a springboard for further exploration of Pakistan's energy sector.

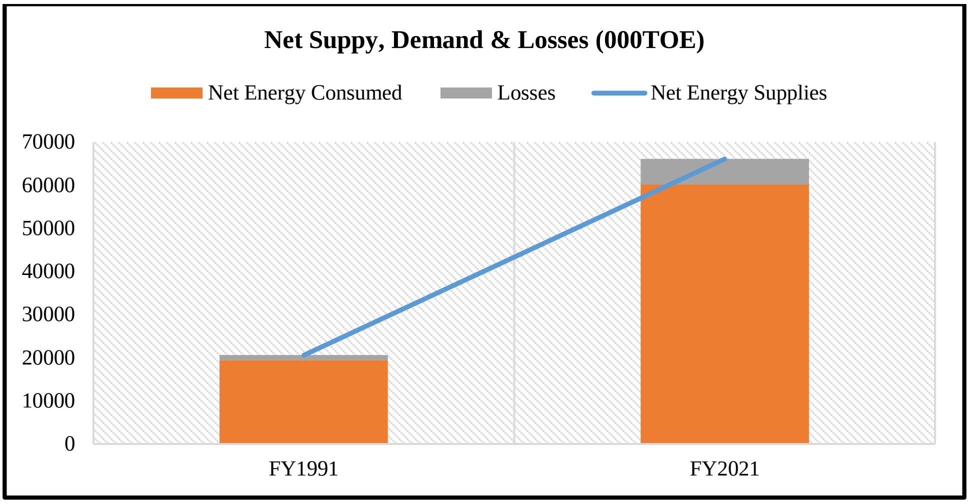
AFIA MALIK

PAKISTAN ENERGY SECTOR

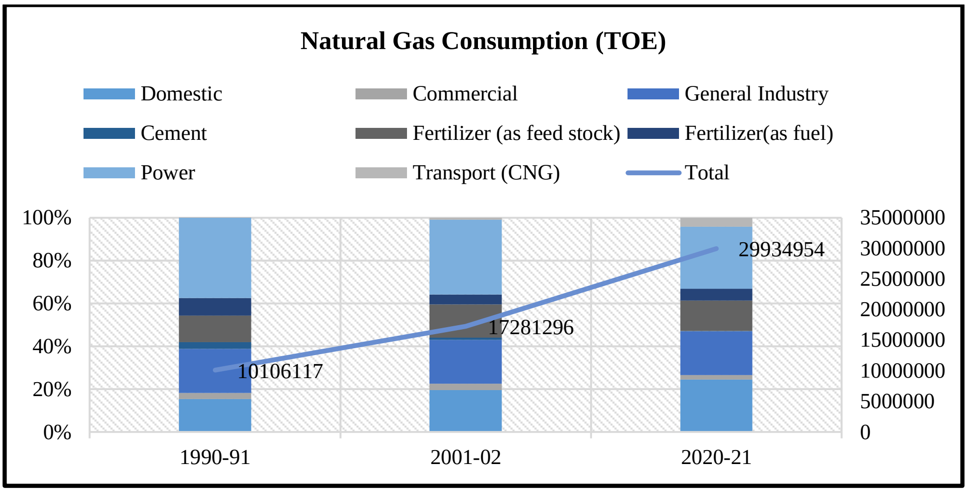




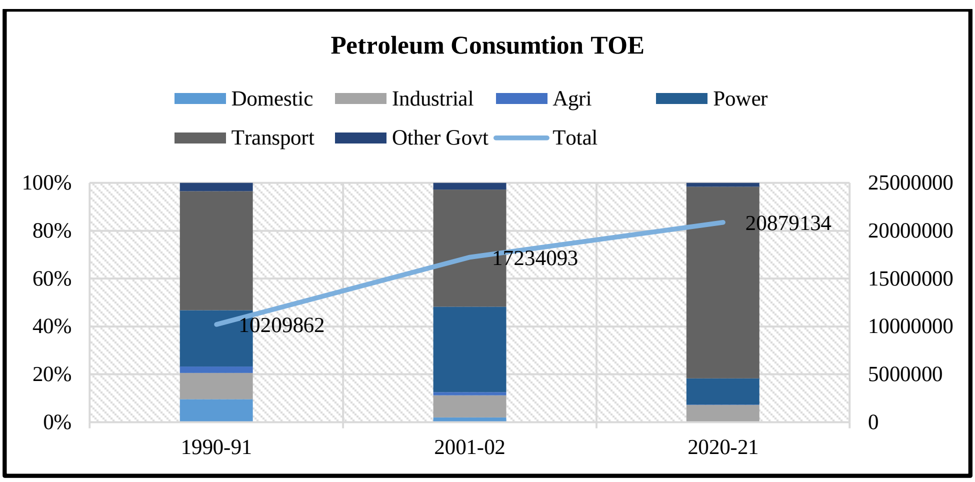




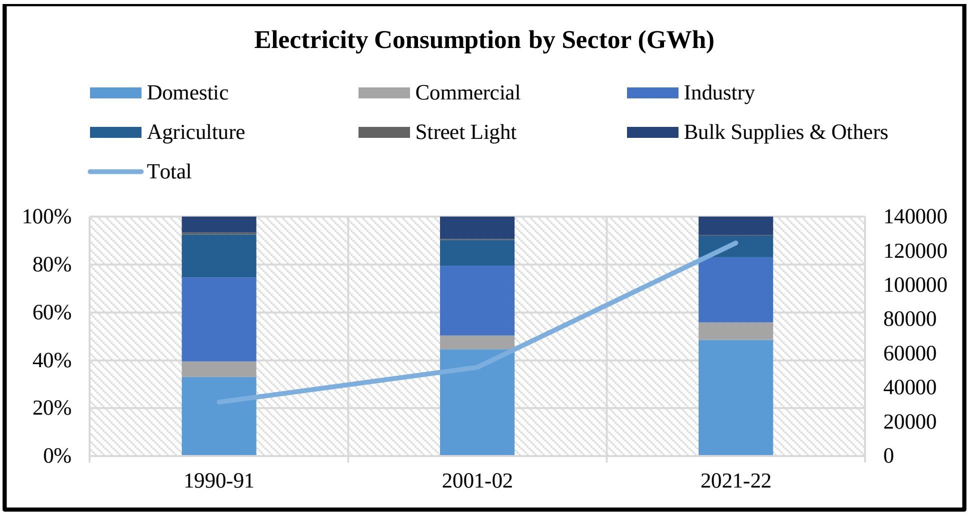
Net Suppy, Demand & Losses (000TOE)
Net Energy Consumed
Losses
Net Energy Supplies
70000
60000
50000
40000
30000
20000
10000
0
FY1991
FY2021



Natural Gas Consumption (TOE)
Domestic
Commercial
General Industry
Cement
Fertilizer (as feed stock)
Fertilizer(as fuel)
Power
Transport (CNG)
Total
100%
80%
60%
40%
20%
0%
35000000
30000000
25000000
20000000
15000000
10000000
5000000
0
10106117
17281296
29934954
1990-91
2001-02
2020-21



Petroleum Consumtion TOE
Domestic
Industrial
Agri
Power
Transport
Other Govt
Total
100%
80%
60%
40%
20%
0%
25000000
20000000
15000000
10000000
5000000
0
10209862
17234093
20879134
1990-91
2001-02
2020-21


Electricity Consumption by Sector (GWh)
Domestic
Commercial
Industry
Agriculture
Street Light
Bulk Supplies & Others
Total
100%
80%
60%
40%
20%
0%
140000
120000
100000
80000
60000
40000
20000
0
1990-91
2001-02
2021-22

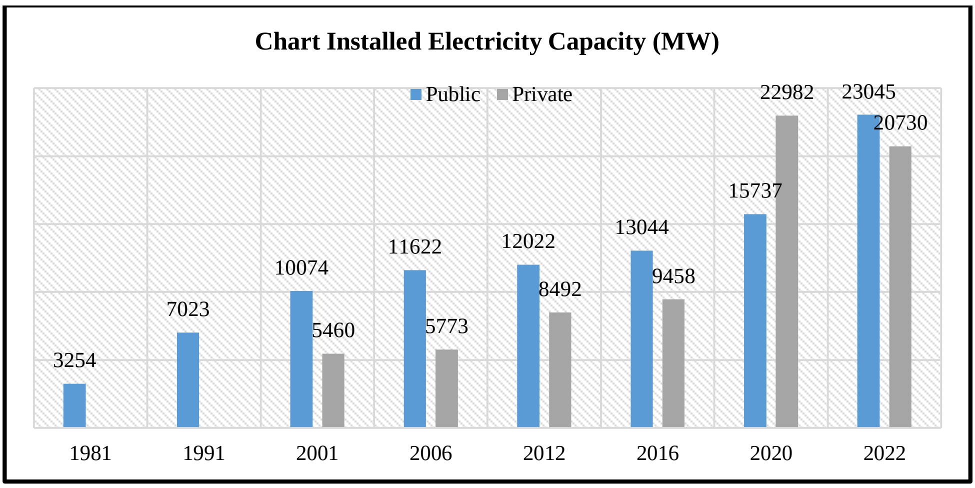
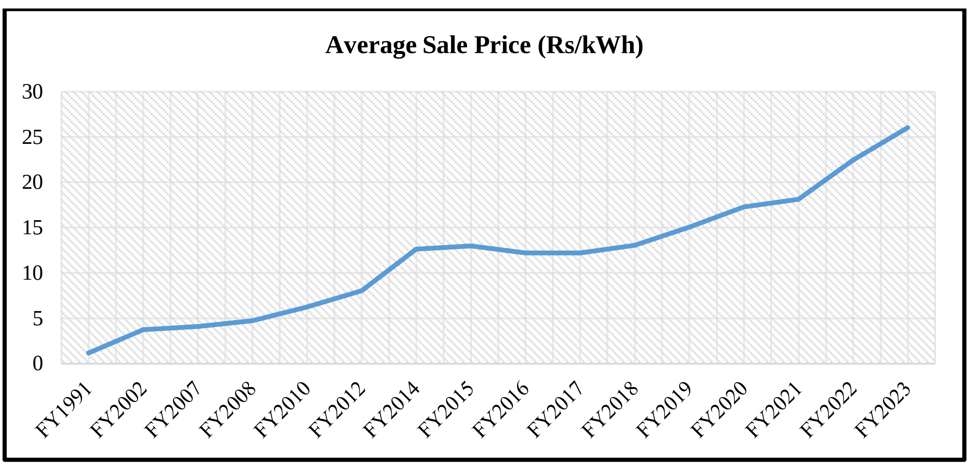
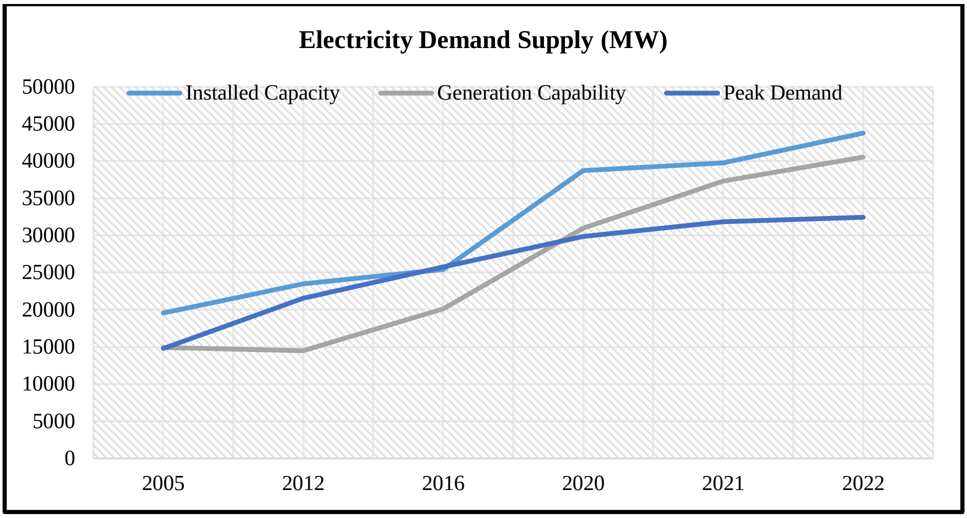
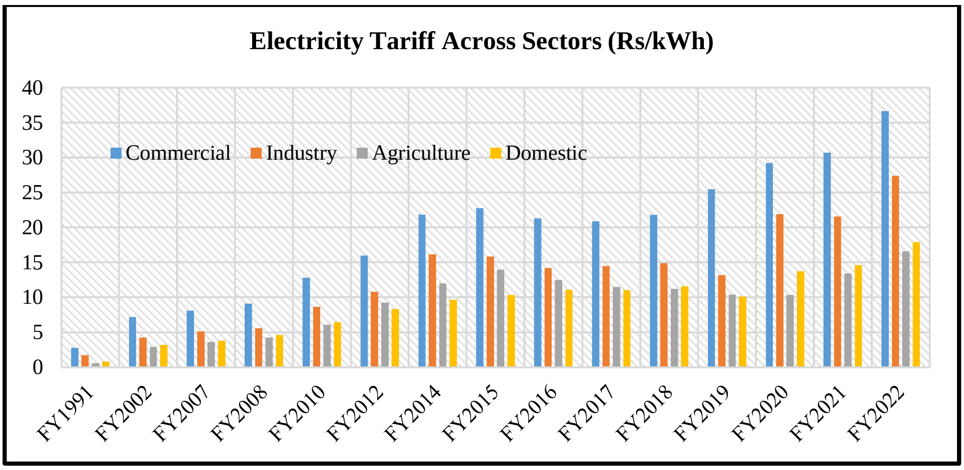
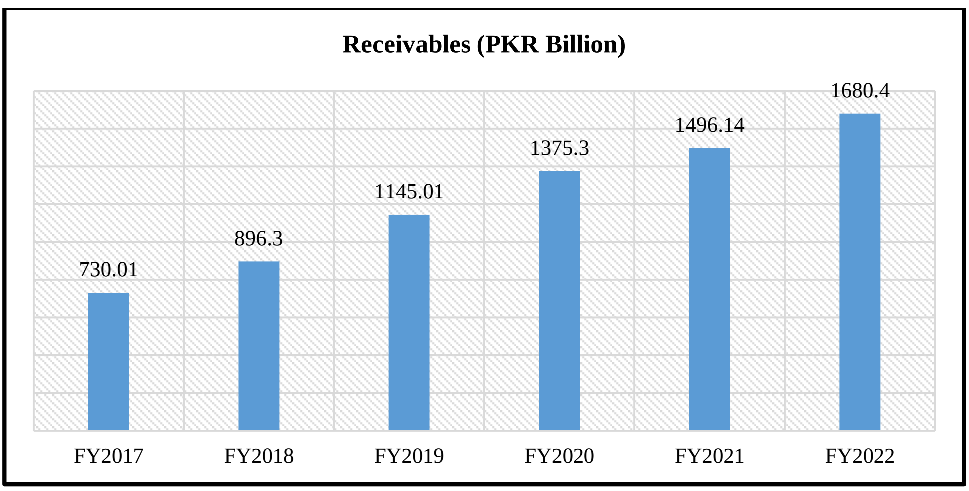


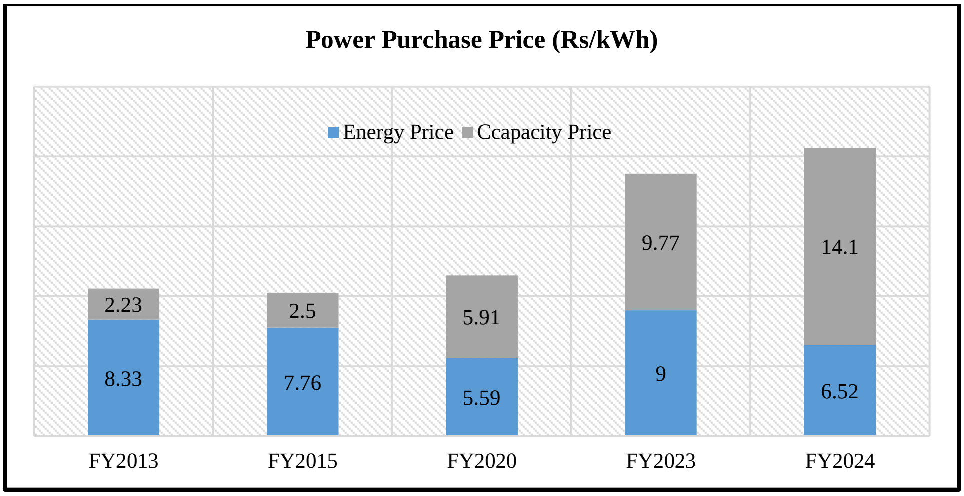
Chart Installed Electricity Capacity (MW)
Public
Private
3254
7023
10074
5460
11622
5773
12022
8492
13044
9458
15737
22982
23045
20730
1981
1991
2001
2006
2012
2016
2020
2022

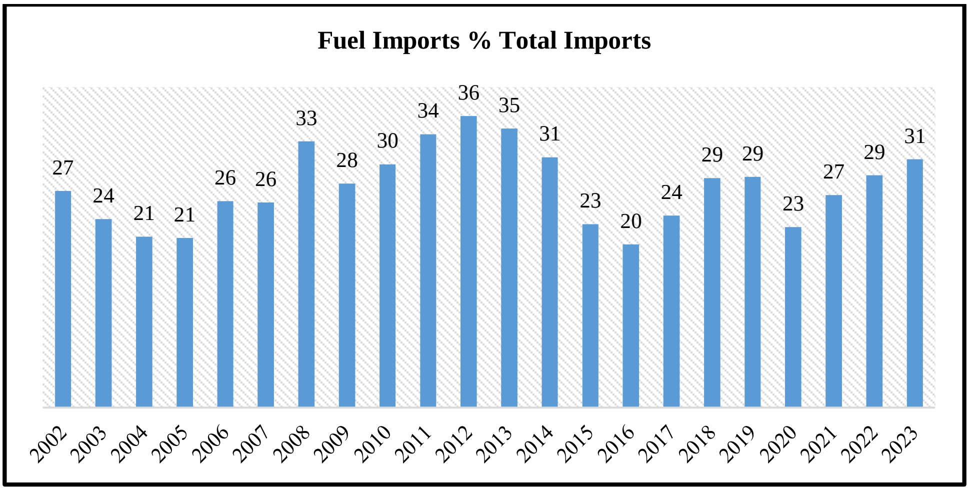

Average Sale Price (Rs/kWh)
30
25
20
15
10
5
0
FY1991
FY2002
FY2007
FY2008
FY2010
FY2012
FY2014
FY2015
FY2016
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022
FY2023

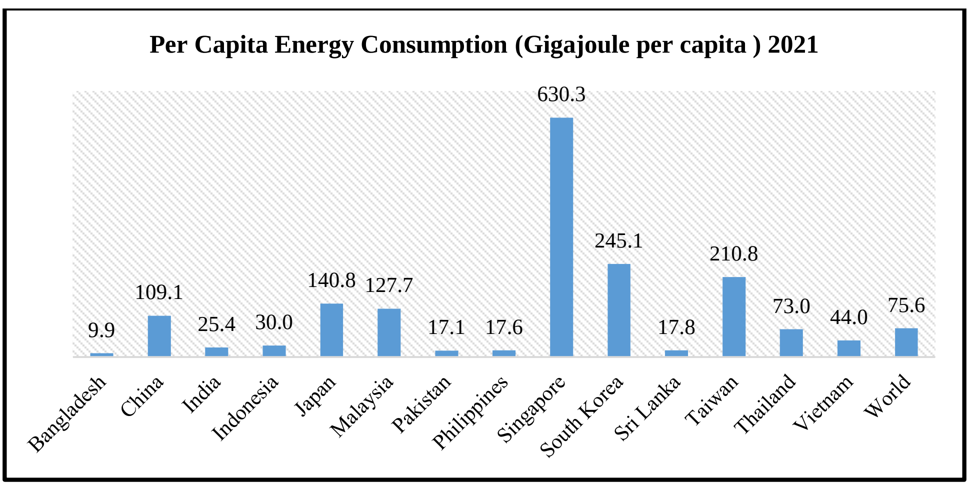

Electricity Demand Supply (MW)
Installed Capacity
Generation Capability
Peak Demand
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
2005
2012
2016
2020
2021
2022

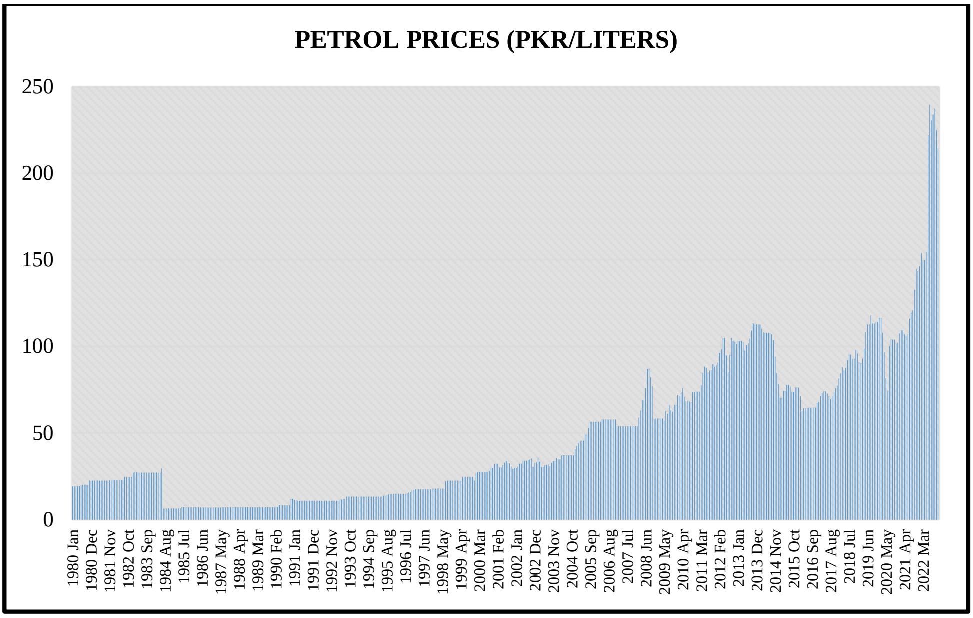

Electricity Tariff Across Sectors (Rs/kWh)
Commercial
Industry
Agriculture
Domestic
40
35
30
25
20
15
10
5
0
FY1991
FY2002
FY2007
FY2008
FY2010
FY2012
FY2014
FY2015
FY2016
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

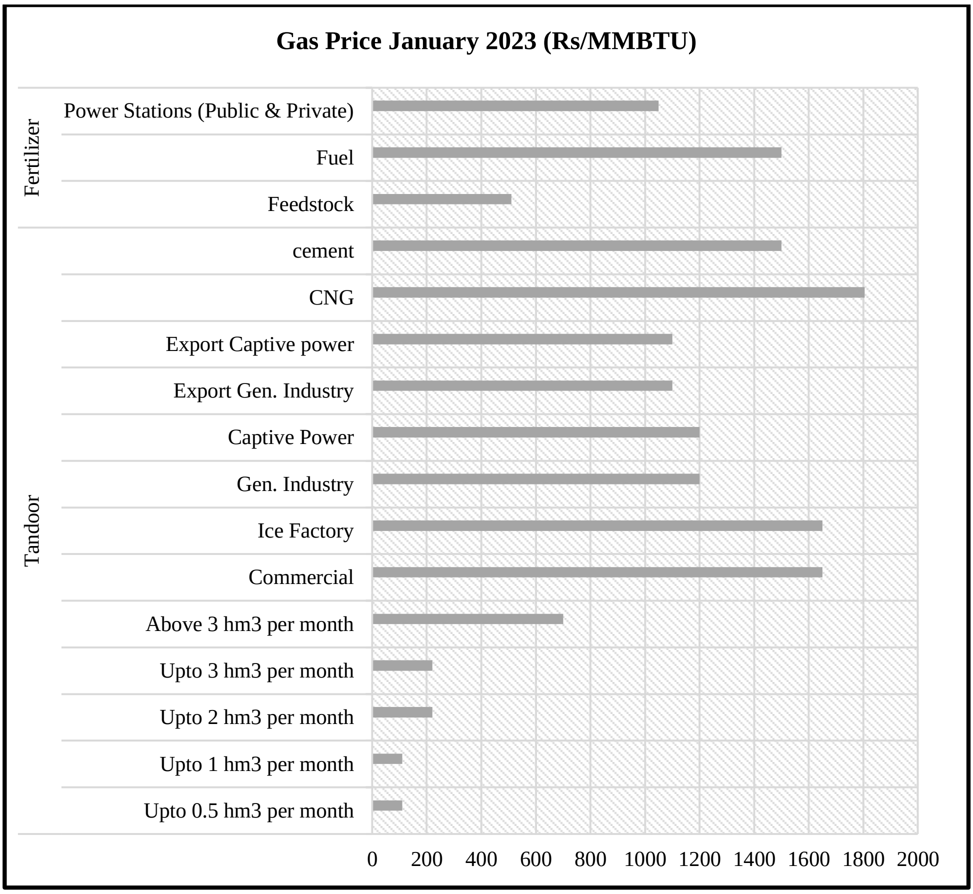

Receivables (PKR Billion)
730.01
896.3
1145.01
1375.3
1496.14
1680.4
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

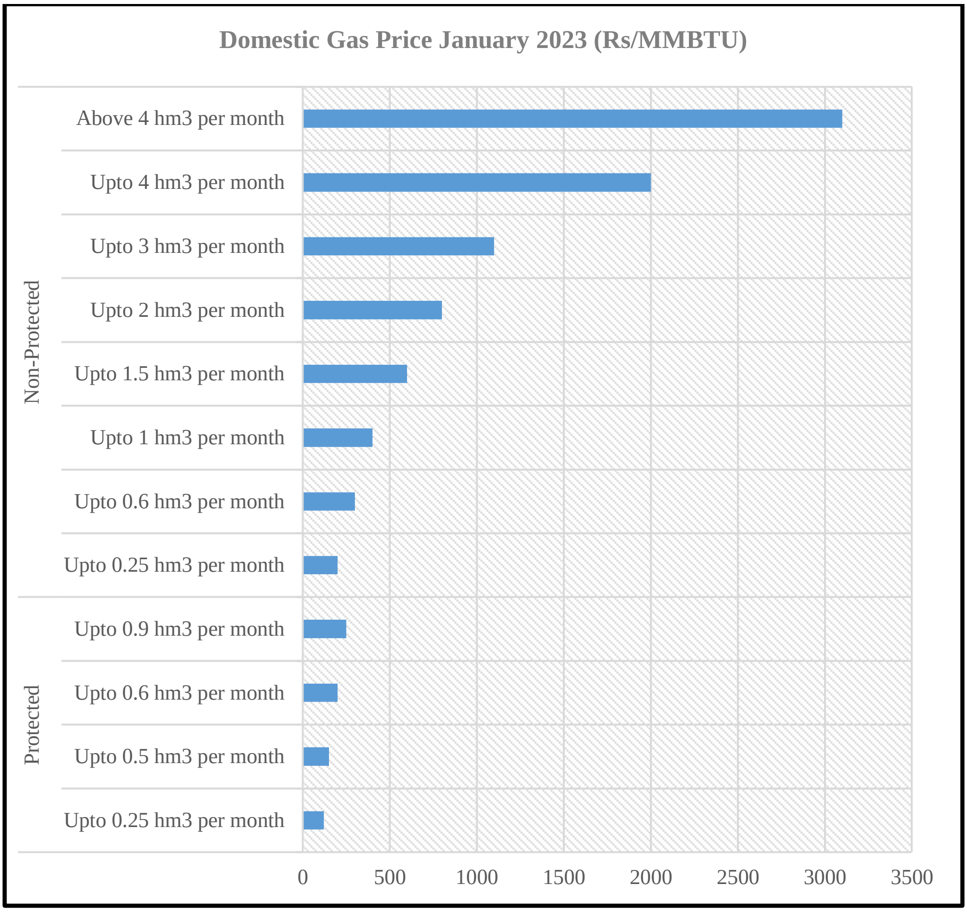

Power Purchase Price (Rs/kWh)
Energy Price
Ccapacity Price
2.23
8.33
2.5
7.76
5.91
5.59
9.77
9
14.1
6.52
FY2013
FY2015
FY2020
FY2023
FY2024


Fuel Imports % Total Imports
27 24 21 21 26 26 33 28 30 34 36 35 31 23 20 24 29 29 23 27 29 31
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023


Per Capita Energy Consumption (Gigajoule per capita) 2021
9.9 109.1 25.4 30.0 140.8 127.7 17.1 17.6 630.3 245.1 17.8 210.8 73.0 44.0 75.6
Bangladesh China India Indonesia Japan Malaysia Pakistan Philippines Singapore South Korea Sri Lanka Taiwan Thailand Vietnam World


PETROL PRICES (PKR/LITERS)
250
200
150
100
50
0
1980 Jan
1980 Dec
1981 Nov
1982 Oct
1983 Sep
1984 Aug
1985 Jul
1986 Jun
1987 May
1988 Apr
1989 Mar
1990 Feb
1991 Jan
1991 Dec
1992 Nov
1993 Oct
1994 Sep
1995 Aug
1996 Jul
1997 Jun
1998 May
1999 Apr
2000 Mar
2001 Feb
2002 Jan
2002 Dec
2003 Nov
2004 Oct
2005 Sep
2006 Aug
2007 Jul
2008 Jun
2009 May
2010 Apr
2011 Mar
2012 Feb
2013 Jan
2013 Dec
2014 Nov
2015 Oct
2016 Sep
2017 Aug
2018 Jul
2019 Jun
2020 May
2021 Apr
2022 Mar


Gas Price January 2023 (Rs/MMBTU)
Fertilizer
Power Stations (Public & Private)
Fuel
Feedstock
Tandoor
cement
CNG
Export Captive power
Export Gen. Industry
Captive Power
Gen. Industry
Ice Factory
Commercial
Above 3 hm3 per month
Upto 3 hm3 per month
Upto 2 hm3 per month
Upto 1 hm3 per month
Upto 0.5 hm3 per month
0
200
400
600
800
1000
1200
1400
1600
1800
2000



Sources: Pakistan Energy Yearbook (Various Issues), NEPRA State of Industry Report (Various Issues), NRDC Electricity Marketing Data, OGRA. BP Statistical Review, 2022.

PART I

POWER SECTOR FAILINGS

Commercialisation, Decentralisation, and New Tariff Design

Circular Debt—An Unfortunate Misnomer[*]

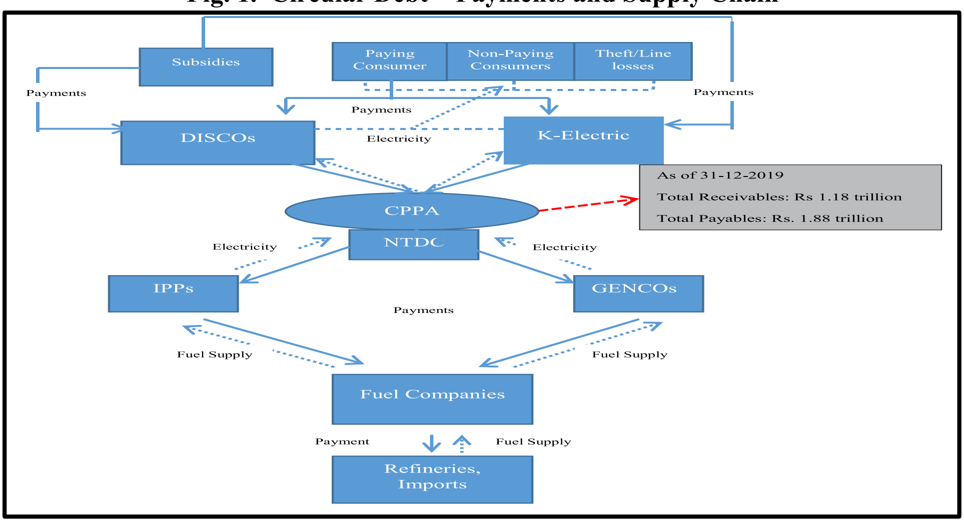
AFIA MALIK

INTRODUCTION

Pakistan's power sector confronts serious challenges in the form of institutional weaknesses, weak governance, and financial sustainability. Despite having surplus supplies, consumers are getting not only expensive electricity but sometimes have to face power outages due to inefficiencies in the power system. Inept corporate governance and unsustainable financial management in Pakistan's power companies have led to a chronic shortfall between cash inflows and outflows_ famously known as circular debt.

"Circular debt" is a shortfall of payments at the Central Power Purchasing Agency (CPPA). CPPA does not receive outstanding payments from power distribution companies (DISCOs) due to a shortfall in receivables by the state-owned distribution companies (DISCOS) and privatised K-Electric (K-El). Thus, CPPA does not make payments to other power companies in the supply chain, that is, state-owned generation companies (GENCOs), Independent Power Producers (IPPs), and National Transmission and Dispatch Company (NTDC). GENCOs fail to clear their dues to fuel suppliers. Due to delayed payments from the government, IPPs couldn't pay fuel suppliers, who then defaulted on payments to refineries and international suppliers. As a consequence, most of the thermal plants are forced to operate at a very low' capacity factor'.

Fig. 1. Circular Debt—Payments and Supply Chain



---

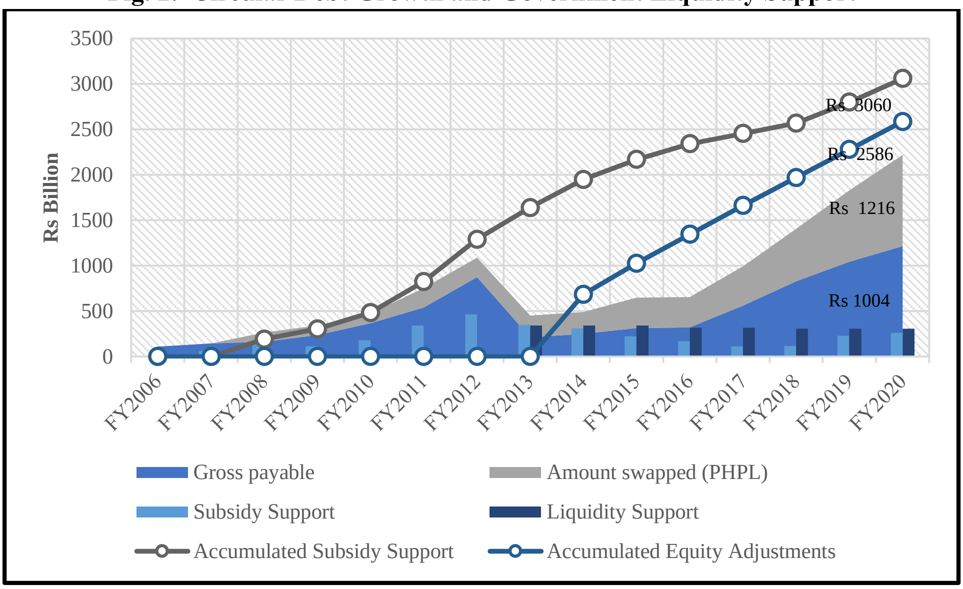
[*] It was published in PIDE Working Paper Series, 2020:20.

Outflows are guaranteed payments as they are contractual. On the other hand, inflows are not certain due to absence (in some cases) or delay (in others) in tariff payments, subsidies, or other discrepancies. This means that inflows (or receivables) from the distribution sector to CPPA always lag behind outflows (payables to generators), creating a deficit.

As on June 10th, 2020, the power sector liability stood at Rs. 1.22 trillion. With addition of loans of Syndicated Term Finance Facility (STFF), that is, Rs. 1.00 trillion parked at the Power Holding Private Limited (PHPL), the total figure is more than Rs 2.22 trillion (Sattar, 2020). In FY2019, 122802 GWh was procured in the system, at the cost of Rs.766.6 billion (CPPA, 2019). This implies that the total value of circular debt or power sector deficit is far greater than the annual generation cost.

Since FY2013 about 2.6 trillion have been injected into the power sector as equity adjustments to clear circular debt. In addition, about Rs 3.1 trillion has been injected as subsidy since FY2007 (Figure 2).

Fig. 2. Circular Debt Growth and Government Liquidity Support



Source: CPPA Annual Reports 2017, 2018, 2019, Budget in Brief (various years), Government Documents, USAID (2013) and Sattar (2020).

Note: Equity payments in FY2020 are assumed to be the same as in FY2019.

The power sector is eating up a bulk of budgetary sources, which otherwise could have been used in other development activities. In FY2020, electricity subsidies account for almost 8 percent of net revenue. In comparison, education is hardly 2.6 percent (Budget in Brief, 2021). Despite various measures taken by successive governments, power sector financial losses are increasing. These are affecting not only the available capacity; the creditworthiness of the country/sector in the investor's eye is also badly affected. Above all, it is adversely impacting the country's economy.

Circular debt is now like a chronic disease, Pakistan is suffering since 2006. Unless its underlying causes are deeply explored and treated, it will continue to haunt our financial managers. The goal of this paper is to carry out an in-depth analysis of the sector_ on supply-side and demand-side to understand the underlying causes of continuously rising debt despite receiving enormous financial support over the years. The analysis is based on available evidence/ data in various reports, research studies etc.

Plan of the paper is: Section 2 describes the governance structure of Pakistan's power sector. Section 3 reflects on the origin and growth of circular debt. Section 4 discusses in detail the supply and demand side issues behind the unstoppable debt. Finally, Section 5 offers a summary and suggestions for the future.

GOVERNANCE STRUCTURE

The Government of Pakistan prepared the strategic plan for restructuring in the electricity sector to improve efficiency, service, and quality in 1992. The government unbundled WAPDA's vertically integrated power wing into separate generation, transmission, and distribution companies, whereas the hydroelectric power development and operation functions remained with WAPDA. Pakistan Electric Power Company Private Limited (PEPCO), a separate company, within WAPDA was made responsible for the restructuring and preparation for privatisation of the generation and distribution companies in due course through the Privatisation Commission.

In 1994, the government formulated a Private Power Policy to invite private producers into the sector. In 1997, the National Electric Power Regulatory Authority (NEPRA) was created to ensure fair competition and consumer and producer protection; and to introduce transparent and judicious economic regulation. In 2009, Central Power Purchasing Guaranteed Limited (CPPA-G) was incorporated (as market operator) in the National Transmission and Dispatch System (NTDC) as a government body. Later in 2015, the Central Power Purchasing Agency (CPPA) was reformed as a corporate entity separate from NTDC; and NTDC remained as system operator.

Now Pakistan power sector includes both private and state-owned companies. In the generation sector, almost 58 percent of the total installed capacity is in the private sector (IPPs) and the rest is in the public sector. In FY2019, about 61 percent of the total electricity generation was by the private sector companies. Transmission and distribution are mainly state-owned. The only exception is Karachi, where not only generation, transmission and distribution are controlled by privatised K-Electric. In the distribution sector, about 90 percent of total consumers are served by state-owned companies.

The power sector restructuring process which began in 1992 is still in transition from a vertically integrated state-owned sector to a competitive multi-buyer structure. Currently, the power system is operating as a single-buyer model_ where the CPPA buy power from GENCOs, IPPs and WAPDA and other producers, pools it and sell it to all the DISCOs.

GROWTH OF CIRCULAR DEBT

Circular debt is gross payables[1] as on CPPA financial statements plus the loan amount parked at Power Holding Private Limited (PHPL) [2].

---

[1] This includes an amount payable under the late payment surcharge (Rs. 96828 million in 2018-19). Out of which, Rs 69989 million is disputed in respect of liquidity damages penalties, imposed on power producers due to non-fulfillment of contractual provisions of PPAs (CPPA, 2019a).

[2] PHPL uses government guarantees to borrow from commercial banks at KIBOR plus 2 per cent to reduce CPPA liabilities to generation companies. Servicing of half of these loans is through surcharge (Rs 40

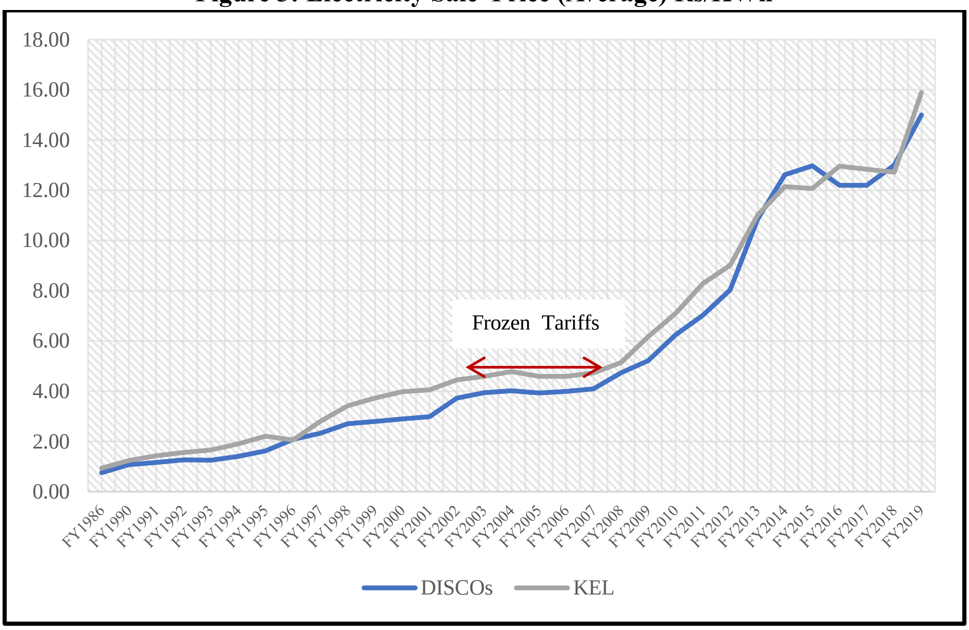
Origin

The problem of circular debt (power sector deficit) first broke out in 2006 when electricity prices were not allowed to rise in line with a steep rise in international oil prices[3]. Pakistani Rupee also got depreciated significantly in those years. The military government in that period did not allow the rise in electricity prices for obvious political reasons. Notified electricity tariffs remained below cost-recovery level. Tariffs were frozen between FY2003 and FY2007 at a very low level (Figure 3).

Fuel cost in electricity generation rose but notified tariffs were not sufficient enough to cover the increased cost. High operational (technical and non-technical) losses of distribution companies (DISCOs) further add to the cost of service. Besides, delay in payments by consumers contributed to low revenue collection from electricity sale[4].

There was a huge gap between the cost of service and the government notified uniform tariff across all DISCOs to be covered through tariff differential subsidy. However, the government did not compensate power companies accordingly against the provision of increasingly subsidised electricity at the consumer-end. The power companies, therefore, were not in a position to make payments to the oil companies, and oil companies, in turn, were not in a position to import oil needed for thermal power plants. As a result, the debt (of about Rs 111 billion) emerged in 2006 for the first time.

Figure 3: Electricity Sale Price (Average) Rs/KWh



Source: Electricity Marketing Data, 43rd Edition.

---

billion annually), whereas, the residual amount is covered by power sector revenues, which again generates additional arrears (IMF, 2019).

[3] The price of imported furnace oil which represents about one third of the fuel mix for power generation in that period increased by 76 per cent from 2003-04 to 2007-08. Global gas prices also increase significantly (76 percent between 2007 and 2008).

[4] Law and order situation in certain areas also effected payment collection negatively (Cheema, 2020).

Growth

(a) *PPP Government (2008-2013)*

In 2008 and 2009, oil prices increased further in the global financial crisis and so was the stock of circular debt (Rs 236 billion in 2009). The government did increase notified tariff, but it remained below the NEPRA determined tariff[5], as the global crude oil prices continued to increase[6]. This was accompanied by frequent delays in tariff determination and delays in tariff differential subsidy payments, while other inefficiencies in the sector were also not addressed.

This led to the accumulation of power sector arrears and underutilisation of existing capacity[7]. As a result, power outages increased to an alarming level of 8 to 10 hours and the stock of circular debt rose to about Rs 366 billion in 2010.

The electricity sector formally becomes hostage to the circular debt in FY2009. The government (PPP) did intervene but on an ad hoc basis by pumping in money many times (more than Rs 1 trillion) between FY2008 to FY2012 to rescue the system from total collapse and keep debt to a manageable limit (Malik, 2012). Since default amount was more than the government's capacity to pay at a given time; the circular debt kept building up and reached to Rs 872 billion in FY2012.

The injection of money compelled the government to borrow billions of rupees from commercial banks through various instruments. From 2008 onwards, the government (directly or indirectly) started converting debts owed by GENCOs, NTDC, CPPA, DISCOs and other power sector entities to banks and other creditors into public debt. That is, the government started swapping the energy payables with commercial loans and Ijara Agreement from banks. Since 2008, these syndicated term finance facilities have been parked in Power Holding Private Limited (PHPL) under the Ministry of Energy (CPPA, 2019a).

The government also took a tough decision of regularly revising the power tariffs in line with international oil prices on a quarterly basis to recover the cost of power despite political compulsions and severe criticism. The government notified tariff increased by about 82 percent in this period. Yet and most importantly, this increase was insufficient (as the government kept on paying a subsidy to cover the cost). To pass on the changes in oil prices more frequently, the government then decided for monthly fuel adjustments to be passed on to the DISCOs (Malik, 2012). But despite all these changes in the tariff structure, circular debt kept piling up, as the government failed to answer the root causes of circular debt, that is, inefficiencies in the system weak governance structure.

---

[5] In FY2011, in addition to increase in tariffs, general sales tax was also imposed on the consumption of more than 100 units of electricity. Given the progressive nature of tariffs (i.e., higher rate at higher levels of consumption), the price of electricity was greater than the cost of supply in the highest slab for domestic consumers. However, this does not significantly reduce the fiscal burden as there are relatively fewer consumers in the higher slabs (Trimble et al., 2011).

[6] Average fuel cost on FO based generation was Rs.8.59/kWh in FY2009, which increased to Rs.12.02/kWh in 2010-11, i.e., 40 percent; generation cost using HSD increased from Rs.11.55/kWh to Rs.14.81/kWh, i.e., 28 percent; and generation cost using gas as fuel in the same period increased by about 9 percent (NEPRA, 2011).

[7] Most of the thermal power plants were forced to operate at a very low 'capacity factor'_ the country lost between 2000 MW to 2500 MW of potential thermal power generated by private power companies as they remained off grid due to non-availability of fuel supply coupled with lack of funds due to increasing dues (cited from Malik, 2012).

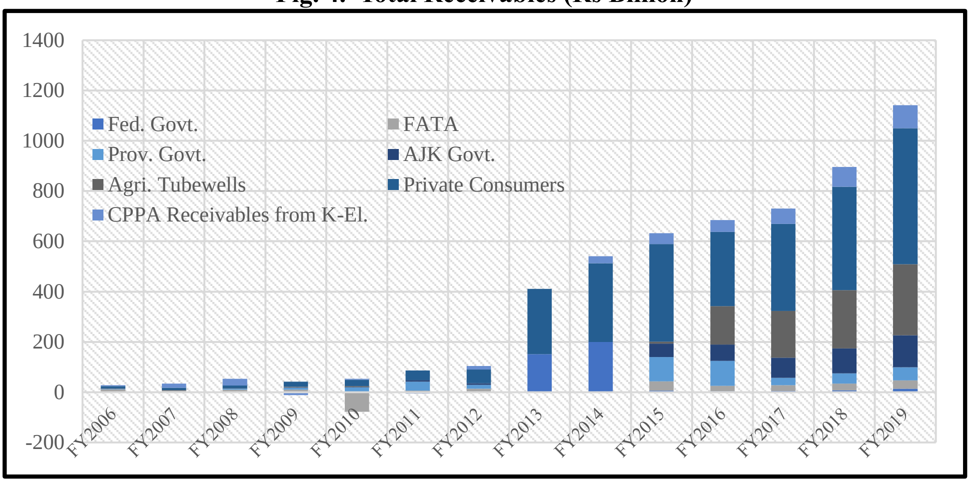
(b) *PML-N Government (2013-2018)*

In June and July of 2013, the newly elected government (PML-N) cleared the entire stock of circular debt (Rs 480 billion) using budgetary support as well as direct liquidity injection of Rs 342 billion. However, there was little focus on reforming the expensive generation mix[8]. Similarly, no serious effort was made to remove inefficiencies in the system. Instead NEPRA revised the T &D loss target upwards (from 13.19 percent to 15.23 percent in FY2016) under government advice, reducing incentive (if any) for improvement (Cheema, 2020). Policymakers again choose for the quick fix, that is, to settle payables.

By the end of 2013, circular debt re-emerged (i.e., Rs 266 billion). The capacity utilisation which improved from 56 percent to 73 percent after the clearance of debt; declined again to 63 percent in less than a year, as the circular debt reduced cash flows to power generation companies (SBP, 2014).

In September 2015, the government introduced a comprehensive circular debt management plan to gradually reduce flows and eliminate the stock. The plan focused on the privatisation of DISCOs with the hope to increase their efficiency, and to resolve subsidy and tariff issues and discrepancies. However, DISCOs receivables kept on increasing (Figure 4). Later, the government shelved the decision to privatise DISCOs.

Fig. 4. Total Receivables (Rs Billion)



Source: NEPRA State of Industry Reports (Various Years).
Note: For 2013 and 2014, separate data for provincial, federal, FATA, AJK Govt. and Agri. Tube-well not available.

Instead of addressing the existing tariff policy issues[9], the government introduced three different surcharges in the tariff structure in 2015[10], besides increase in general tariff by about 44

---

[8] In FY2013, about 40 percent of the total power generated in the country was based on furnace oil (up from 32 percent in FY2008). Conversion of gas based plants to oil due to gas shortages and the commissioning of new FO based plants increased import demand of oil. Thus, making Pakistan's external account vulnerable as the oil prices kept rising (SBP, 2014).

[9] That is low tariff arrangements in certain regions, unpaid arrears of government (provincial and federal) electricity bills, recovery issues in Baluchistan and FATA and inadequate taxation structures by FBR.

[10] (i) Tariff Rationalisation Surcharge (Rs1.54 per KWh) for recovering the determined cost of power producers. This surcharge was meant to cover line losses and non-collection of revenues; financing costs due to delays in tariff determination; and eliminating subsidies on non-residential consumers, and equalising tariffs across DISCOs; (ii) debt servicing surcharge (Rs 0.43 per KWh) for clearing the financing cost of various power sector loans obtained under PHPL; and Surcharge of Rs 0.1per KWh for Neelam-Jhelum Hydro Power Project.

percent.[11] To overcome supply shortages, the government made huge investments (in the light of Power Policies 2013 and 2015) in the generation sector. Not only inefficiencies in the transmission and distribution sector were ignored; no effort was made to utilise the existing installed capacity to the maximum level. As a result of newly installed capacity, electricity generation became expensive due to the increase in capacity payments and expensive fuel mix.

Receivables kept on piling up in this period and the basic challenge of shortage of cash inflows continued_ forcing non-payments or delayed payments to generation companies and onward disruptions in the supply chain. Gross payables reached Rs 560 billion by the end of FY2017. Besides, the debts raised to retire the previous liabilities became another source of the circular debt. That is, the amount parked in PHPL increased to Rs 432 billion by the end of FY2017.

(c) *PTI Government (2018 to date)*

The power sector was/ is a major challenge for the newly elected policymakers. As on July 31, 2018 (when the PTI government took charge) the circular debt amounted to Rs1.18 trillion, including Rs582 billion parked in PHPL (Bhutta, 2018).

So far this government has followed a policy (more or less) similar to the previous ones. Their main focus is on increasing prices. The government continued with the policy of uniform tariffs and direct subsidies for tariff differential, FATA, AJK, agriculture tube-wells and industry[12]. In July 2019 the government discontinued the industrial support package but approved it again in February 2020. Under this plan, electricity tariffs would be reduced by Rs 3.50 per unit to boost industrial exports.

In January 2019, the government notified the consumer tariff for various categories in ten distributions companies (DISCOs) via SRO1 (I)/2019 to SRO12 (I)/2019. Instead of a national average unified tariff of Rs. 15.53 per unit, the government notified the average unified consumer tariff of Rs. 11.95 per unit. The difference was left to be covered through subsidies. Besides, in one year the government increased prices three times for all the consumer categories except for domestic consumers below 300 units and imposed two surcharges to cover deficits. But all in vain, as the payables are rising continuously.

> *Since 2013 (when the debt was cleared) the total amount of debt has increased by about 393 percent. As on June 10, 2020, the total circular debt reached Rs. 2.2 trillion, including the amount parked at PHPL. The debt stock parked in the PHPL, which stood at Rs105 billion in 2008, has inflated by 856 percent to Rs 1.004 trillion. Including liquidity interventions, that is, Rs 3.06 trillion of subsidy support (largely for tariff differential)[13] (FY2007 to FY2020) and equity adjustments[14]of Rs 2.59 trillion for clearance of circular debt (FY2013 to FY2020), power sector has eaten up about Rs 7.87 trillion since FY2006 (Figure 2).*

[11] The average tariff should have come down ranging from Rs1 to Rs4 per unit for various consumer groups due to fall in oil prices in 2015. But a surcharge of around Rs3 was imposed on domestic consumers and Rs4 on commercial and industrial consumers to absorb the fall in prices.

[12] Industrial Support package of Rs 3per unit in off peak hours was introduced by PML-N government.

[13] Government policy of uniform tariff.

[14] In 2012-13, the government sanctioned payment of Rs 342 billion annually to PEPCO, for the clearance of circular debt. In April 2016 the amount reduced by Rs 23962 million, which was further reduced by Rs 9900 million on January 22, 2018, to annual equity adjustment of Rs 308 billion (CPPA, 2019a).

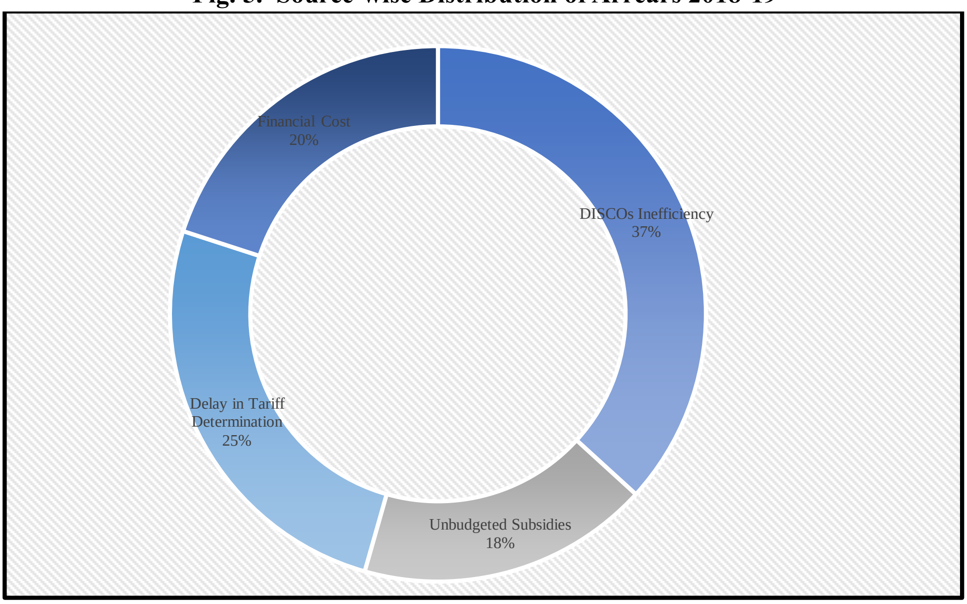
Without any doubt, every successive government pays attention to the issue of circular debt, but it was mainly a short-term response to rescue the system from total collapse. None of them tried to cure the reasons behind the circular debt. Easing the pressure in the short-term only shift the underlying systemic issues to the back burner and does not eliminate it. As the power sector continues to rely on subsidy support, equity payments and sovereign credit guarantees to maintain their operations. Continuous bank borrowing for energy sector deficit financing is also crowding out private borrowing (ADB, 2019).

REASONS OF CIRCULAR DEBT_ DISCUSSION

According to Ministry of Energy documents, debt flows are due to delayed tariff notifications, insufficient subsidies, taxation issues[15] and financial costs generated by the existing stock of debt, including late payment surcharge payable to generators, while rest of them are due to distribution inefficiencies (receivables), that is, low collections and the difference between the allowed and actual distribution losses by NEPRA (Figure 5 and Figure 6).

No doubt, the above-mentioned are responsible for monthly arrears. Yet, there are some other underlying issues responsible for these arrears to appear repeatedly and adding to power sector losses in the form of circular debt. Outcomes of our planning/ policy failures over the years on the supply side and subsidy and pricing policy on the demand side are creating distortions in the power system leading to circular debt issue in Pakistan. Additionally, governance and mismanagement issues prevalent in the system (Cheema, 2020), also mentioned in the government documents and in other earlier studies (Faraz, 2018; Lodhi, 2019; USAID, 2013; & Malik, 2012) are mainly responsible for the existing stock of debt. All these issues are analysed below in detail.

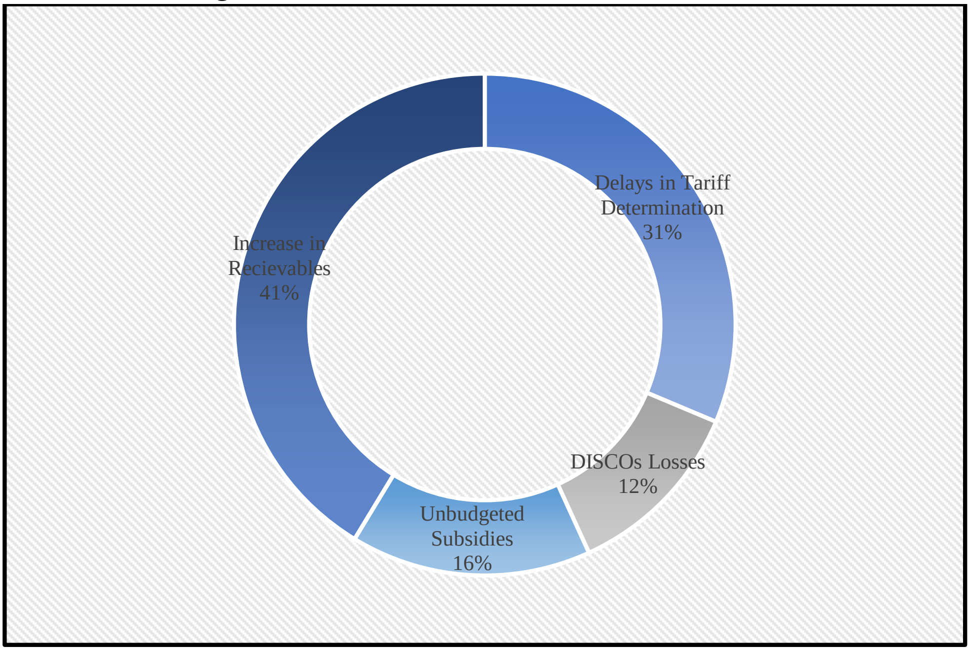
Fig. 5. Source-wise Distribution of Arrears 2018-19



Source: IMF (2019).

[15] FBR charged sales tax on billed units rather than the realised units, gap is added to deficit.

Fig. 6. Source-wise Distribution of Arrears 2019-20



Source: Sattar (2020).

(a) Lack of Effective Planning

(i) *Planning Failures and Independent Power Plants (IPPs)*

Lack of informed long-term vision in our policymakers has cost Pakistan dearly (Alahdad, 2012). Although induction of private capital via IPPs has proved to be an efficient means of increasing installed capacity around the world. Likewise in Pakistan, induction of IPPs has relieved some burden from the public sector but has increased the cost of generation considerably because of ballooned capacity payments. Besides other factors (discussed in later sub-sections) this has depleted the sector's liquidity considerably.

Governments' capacity to plan and bid determines the quality and outcome of IPP projects. The price and guarantees offered by the government when accompanied by vested interests and political considerations limit the market correcting mechanism (Albouy and Bousba, 1998). In Pakistan, the lack of cost-effective planning resulted in direct deals with IPPs (Hasan, 2010). Strict take or pay contracts with sovereign guarantees provided by the government have created severe financial issues in Pakistan's power sector.

The absence of competitive bidding for these projects and non-transparent procurement processes has always raised serious concerns about the potential for corruption. Many a time, these IPPs also get involved in corruption accusations, disputes/ litigations over the set rates and payments (Malik, 2007 and Report on the Power Sector, 2020). The guarantee clauses in power purchase agreements (PPA) with these IPPs have not only restrained the dispatching efficiency but overburdened the power sector and the government with hefty liabilities.

Fig. 7. IPPS in Pakistan

1994 Power Policy
• 16 IPPs with capacity of 4100 MW; bulk tariff of US cents 6.5 per KWh for the first 10 years and a levelled tariff over the life of the project (25-30 years) of 5.9 cents per KWh; Furnace oil and gas based plants. (Invested Rs 51.8 billion; and earned (so far) Rs. 415 billion).
2002 Power Policy
• 13 IPPs with capacity 2934MW; IRR 15 percent; and project life 25-30 years; furnace oil and gas based plants. (Invested Rs. 57.81 billion; and earned (so far) Rs. 152billion).
2015 Generation Policy
• 7 IPPs with capacity 8253MW; IRR 15 percent to 17 percent; and project life 20-25 years; Imported coal and RLNG based plants. (One imported coal power plants has already recovered 71 percent of its investment in two years of its operation, and second one has recovered 32 percent of its investment in the same period. These plants have been offered 17 percentIRR in US$, which in Pakistani Rs after recent devaluation is equal to 43 percent.
Total IPPs
• 40 IPPS with capacity of 17551MW; and 25 IPPs with 12464MW in the pipeline (by 2028).
Source: www.ppib.org.pk and Report on the Power Sector, 2020

Since the 1994 power policy, IPPs are playing a leading role in the electricity generation[16]. The policy allowed IPPs to select location, technology, and fuel. There was no corporate income tax on income from these projects with guarantees for free repatriation of their equity and dividends with no import tax or duty. The 1994 Power Policy resulted in projects which did not meet the "least cost" generation test due to small size, unsuitable location, excessive reliance on oil and steam turbines technology instead of more efficient combined-cycle plants (Fraser, 2004).

Two-part tariff structure was allowed including fixed capacity charges and variable energy costs, with a guaranteed payment of capacity charges of about 60 percent by the government[17], regardless of whether power is purchased or not. Long term contract and guarantees leaves no room for competition (Saeed, 2013).

The same mistake was repeated in the Power Policy 2002. The policy encouraged the exploitation of indigenous resources but attracted plants with the same expensive fuel mix. Similarly, in 2013 and later in 2015, despite severe criticism of the 1994 and 2002 power policies, the new policies come up with the same set of incentives for the generators. That is guaranteed capacity charges and guaranteed off-take[18]. Not only these policies have

[16] Hub Power Plant commissioned prior to 1994 policy.

[17] The government not only gave guarantee for power purchase but also for fuel supply.

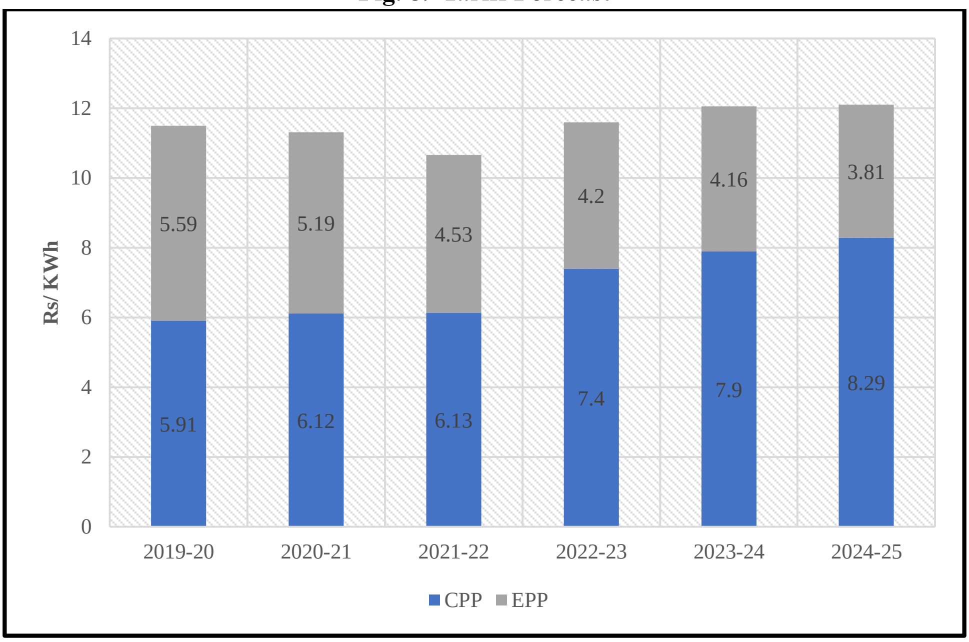
[18] CPEC power projects under 2015 Power Generation Policy have also been allowed 80 percent obligatory off-take even when these do not come within the realm of the economic dispatch order.

led to expensive fuel mix, these IPPs are primarily paid in US $, thus putting more pressure on foreign exchange reserves.

These policies supporting guaranteed capacity payments have deeply affected the cost structure of electricity generation in Pakistan. As in June 2018, the generation capacity of about 42349 MW has made contracts with CPPA against the maximum billed demand of 28687 MW (CPPA, 2019b). That is, installed capacity is far greater than demand, but still, we are paying huge capacity payments.

Prior to the recent capacity additions, the capacity purchase price (CPP) was 30 percent of the total power purchase price (PPP). But due to the unplanned addition of large capacity in the system, the CPP has increased from Rs. 664 billion to Rs. 907 billion. Thus, causing an increase in per unit CPP by more than Rs. 1.5 per KWh. Based on the projects that are in the pipeline, due to these capacity payments, despite a decrease in energy price component from FY2020 to FY2025, PPP will increase from Rs. 11.50 per KWh to Rs. 12.10 per KWh (Figure 8).

Fig. 8. Tariff Forecast



Source: CPPA (2019b).

At present, all generation plants (except for renewables) are designed with capacity payments, but there is hardly any monitoring of actual capacity (as per capacity payments) and availability. Also, there is no verification of IPPs claims of power supply and what is actually supplied. Due to the lack of transparency and an independent regulatory audit, IPPs are getting paid for the electricity they have not generated. This is increasing the cost of generation.

For cost reduction, NEPRA needs to ensure that generation plants are operational in compliance with their respective generation licenses. Proper check and balance processes must be in place (Haque, *et al.*, 2020 and ADB, 2019b) which so far missing.

Moreover, excess profitability of these IPPs (Figure 7) is due to their misreporting to NEPRA while seeking tariff or its adjustment at the time of commercial operations (Report on the Power Sector, 2020). It is probably due to these factors there is always strong resistance by the IPPs for an independent audit.

Absence of competitive bidding in the power procurement process and long-term contracts has brought structural rigidity and hindrances to the creation of a competitive market and competitive prices. These unplanned contracts have forced consumers to pay an uncompetitive price for electricity.

As estimated in Faraz (2018) per unit increase in price by Rs 1 would add to an additional loss of more than Rs 10 billion; as it affects the paying capacity of consumers that in turn will increase poverty, theft and delayed or no payment resulting in an increase in arrears. Secondly, payables to IPPs are in US$ (as per their agreements) and revenue from tariffs (or subsidies) is in rupees. Decreasing rupee dollar parity due to devaluation, further add to these arrears.

In other words, the power sector is expected to remain in this capacity trap and under circular debt in the years to come in the absence of effective remedial measures.

(ii) *Inefficient Public Sector Generation Plants (GENCOs)*

Public sector generation plants (GENCOs) are another area of great concern. Almost 48 percent of the installed capacity is in the public sector but generation capacity is hardly 39 percent. These GENCOs are running below their net available capacities because the desired maintenance and scheduled outages over the years as per standard industry practices are not in place. Lack of maintenance has increased the cost of generation. Using similar fuel, energy price component (EPP) in these plants is higher than IPPs. The Framework of Economic Growth by PIDE (2020) reports that an amount of Rs 251.6 billion was lost due to inefficiency in these public sector generation companies (Table 1). Similar findings were revealed in two audit reports (as cited in Malik, 2012).

The unproductive use of resources in these plants is adding to the power sector deficit. It also denies the sector of relatively cheaper electricity (NEPRA, 2019). Over the years, policymakers have kept their focus towards new projects rather than maintaining the available capacity, thus hurting their fuel efficiency, and putting costly electricity in the system.

Table 1

Losses in GENCOs

Capacity Loss due to Mismanagement	1500MW	Rs 130 billion
Efficiency loss due to mismanagement on average	5%	Rs 8.6 billion
Extra use of fuel due to inefficient plants		Rs 103 billion
Leakages in Fuel Supply estimated		Rs 10 billion

Source: Framework of Economic Growth, PIDE, 2020.

(iii) ***Shortage of Transmission and Distribution (T&D) Network***

On the top of planning failures in Pakistan, is the shortage of T&D networks. Investments to increase generation capacity are not complemented by equivalent investment in downstream T&D infrastructure. Capacity payments are being made but there is no way to transmit the available electricity to the consumer. More than one-fourth of electricity generated is lost due to ruined networks, theft, and insufficient energy accounting. T&D capacity is much less than the installed generation capacity. The transmission network allows only 23000 MW-peak, with loss levels of close to 3 percent. About 10GWh of generation cannot be evacuated due to system constraints (ADB, 2019b). The mismatch between generation and T&D network is another reason for the capacity trap, exhausting sector's liquidity and adding to circular debt woes.

Given the slow economic growth and current covid19 crisis, it has been a challenge to keep capacity payment per unit at the current levels, as this would require energy sales to grow significantly. Besides, no serious efforts are being made to increase electricity sales in Sindh, Baluchistan and KP, where many areas are still not connected to the national grid.

(iv) ***Sub-optimal Energy Mix***

As more than 40 percent of generation is based on imported fuels. Any increase in international fuel prices or devaluation of the Pakistani rupee exacerbates the power sector deficit. Our policymakers have always chosen quick fixes. In the 1990s, they could have opted for other options, as they had space to undertake long-term policy decisions. The generous tariffs offered to IPPs, if were extended to hydro plants, our power sector would have been far better off (SBP, 2014). Lack of long-term planning capacity (Alahdad, 2012) has led to an expensive power generation mix in the country.

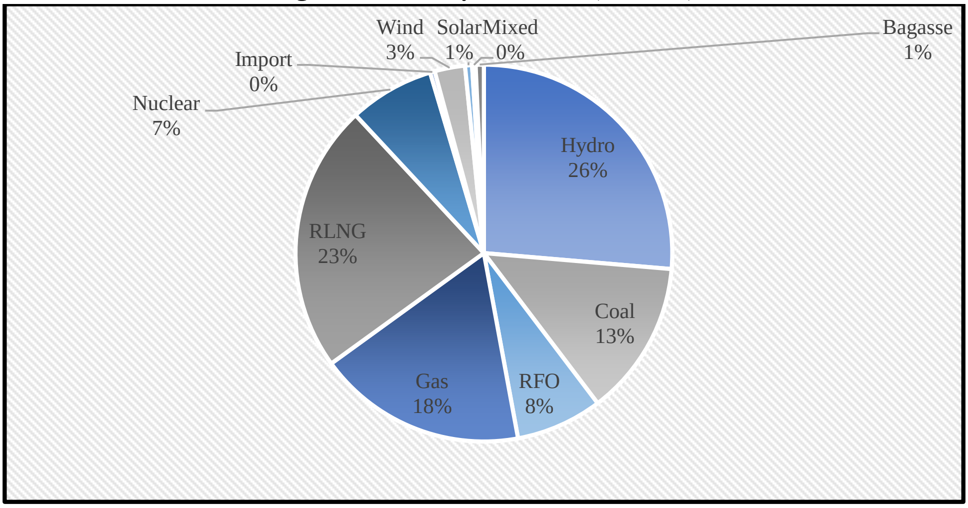
Alahdad (2012) also talked about the impact of lost opportunities in the 1980s and 1990s_ if our policymakers had handled these effectively, the situation would have been different.

As discussed in Section 4.1.1, incentives given in successive policies helped in the development of thermal power plants. Now the dynamics of the electricity supply chain is changing with fast depleting cheap indigenous resources of natural gas and with the retirement of furnace oil plants, but unfortunately not our dependence on imported fuels. All the new projects are increasingly dependent on imported fuels.

For instance, the share of oil in has decreased from 47 percent in FY1998 to only 7.4 percent in FY2019[19] in our generation mix. But our dependence on another imported fuel RLNG has increased from 0.7 percent in FY2015 to 23 percent in FY2019. Similarly, the share of coal in electricity fuel mix has increased from 0.5 percent in FY2014 to 13.3 percent in FY2019. Where most of the new coal-fired power plants are fueled by imported coal, which has become extremely expensive after rupee devaluation. Both coal and RLNG plants will keep Pakistan's reliance on expensive imported fuels.

[19] With the retirement of some of 1994 IPPs.

Fig. 9. Electricity Fuel Mix (FY2019)



Source: CPPA_G (2019).

In our total energy supplies, the share of hydro was 13.1 percent in FY1998 which stands at 7.7 percent in FY2018. Similarly, share of renewables was 0.3 percent in FY2015, which now stands at 1.1 percent in FY2018 (in electricity fuel mix its share is less than 4 percent). Renewables have clear advantages over polluting thermal coal plants[20]. But their share in our fuel mix is increasing at a snail's pace.

Failure to add new hydro capacity in the system over the years due to lack of political consensus among the provinces (Hasan, 2010 and FODP, 2010) and continued dependence on imported fuels resulted in an unbearable financial burden of subsidies and circular debt. In our planning strategies, the utilisation of indigenous resources has always been at the forefront, but unfortunately, these plans have not been timely implemented (Malik, 2012). We started Neelum-Jhelum from Rs18 billion in 2008 and completed in 2018 at the cost of Rs510 billion (levelised tariff of Rs. 13.5 per unit). Rs510 billion is more than $5 million per MW when countries around us are doing the same at under $2 million per MW.

Similarly, nuclear power projects increasingly suffer large cost and time over-runs around the world. Pakistan is building nuclear power units at a time when nuclear power is declining globally, and its outlook is clouded (Nicholas and Buckley, 2018).

Coordinated policy formulation has remained a fundamental issue in Pakistan. Due to which decision-making in the sector has remained essentially flawed (Alahdad, 2012).

(b) Subsidies and Pricing Strategy

In this section, we reflect on the demand side issues. System of electricity subsidies (that is, cross-subsidisation across sectors as well as across different geographical regions _ DISCOs, and inability to pass on the actual cost to some consumer categories) is another area of great concern and responsible for circular debt in Pakistan. These subsidies put an

[20] Given the new generation projects in the pipeline (18705 MW) in which coal will contribute about 43 percent (39 percent imported and 3.5 percent local)in our power generation mix by 2022. Whereas share of solar would be 8.5 percent and that of hydro 21 percent (ADB, 2019b)

enormous burden on the government, which sometimes the government is unable to pay or have to delay (Figure 10 and Figure 11) or pass on to compliant consumers through taxes, surcharges, and tariff hikes.

Fig. 10. Subsidies to WAPDA/PEPCO

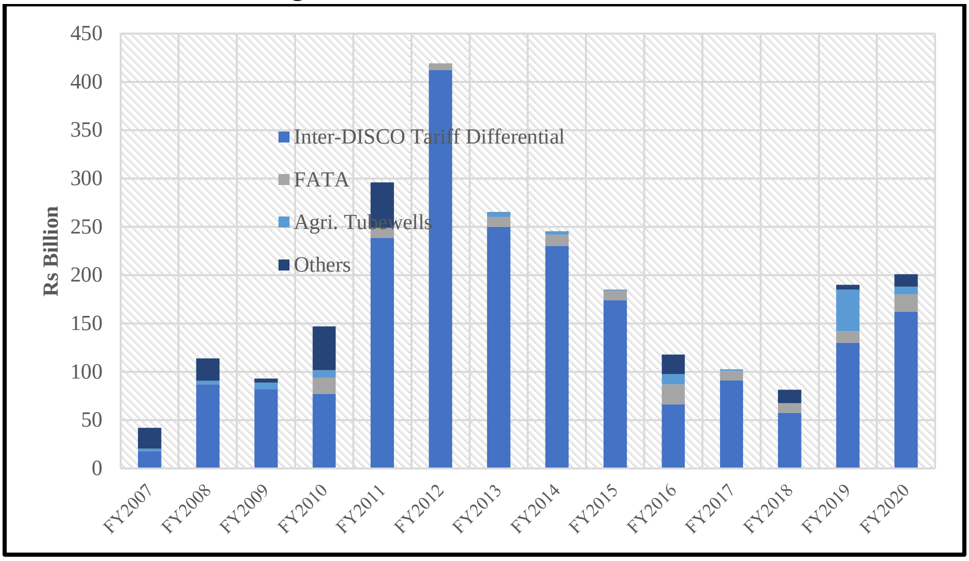
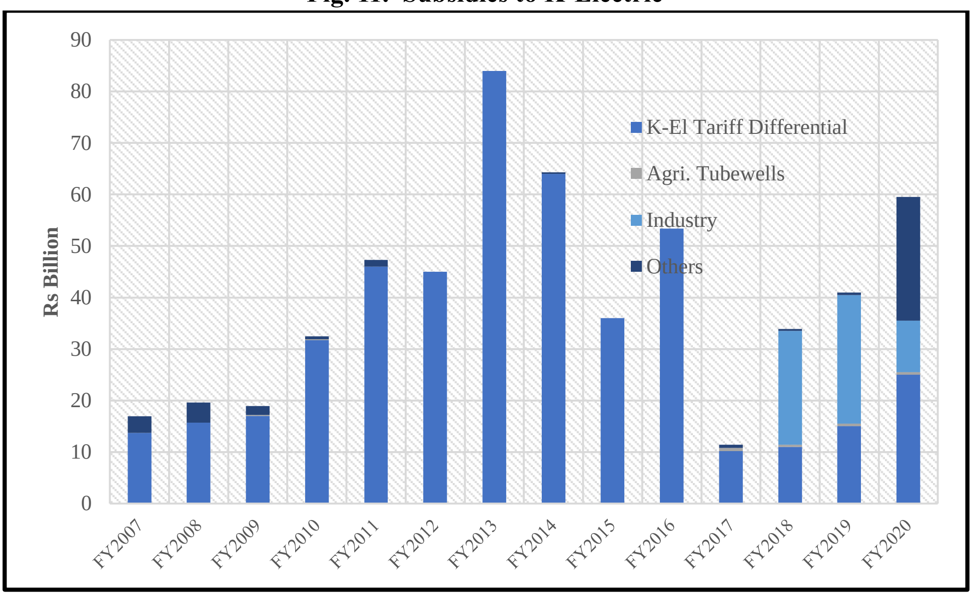


Fig. 11. Subsidies to K-Electric



Source: Budget in Briefs (FY2008 to FY2021).

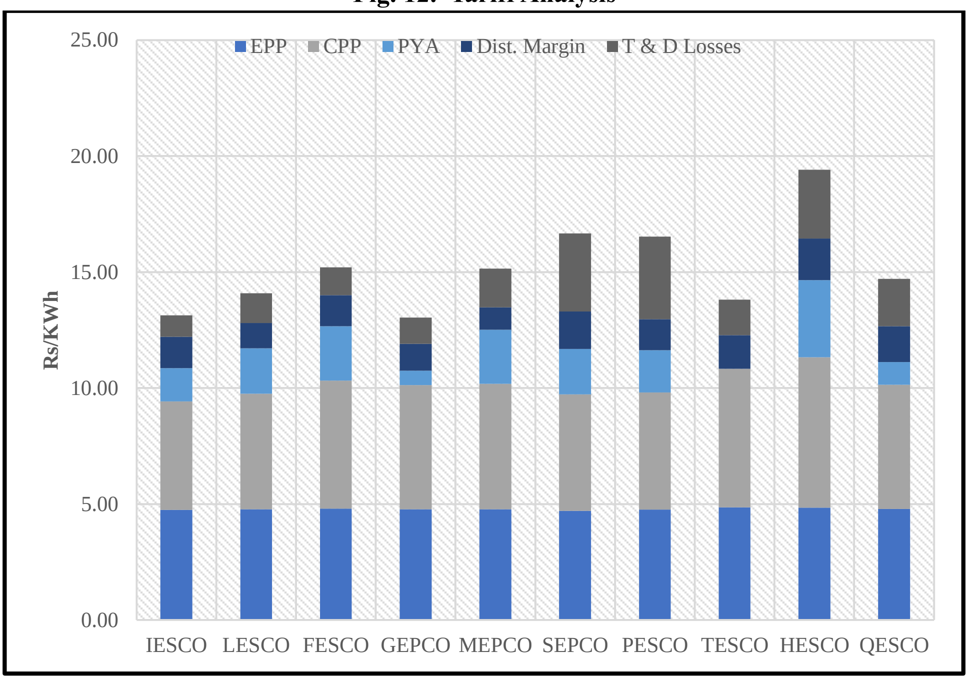
Apparently, subsidies are introduced as welfare measure, but international evidence suggests this as an inefficient tool to achieve the said objective (Walker, *et al*., 2016). That's why many countries are abolishing these subsidies (IISD, 2018 and IMF, 2013).

Tariff structure in which costs are not recovered from all consumer categories indiscriminately, besides creating financial difficulties for the government, also create inefficiencies in the system and misleads investment decisions in the supply system.

Over the years, a weak link between price and demand and substantive cross-subsidisation has skewed consumption in favour of less-productive domestic consumers. Domestic consumption has increased substantially over the years. Domestic consumption (energy sale) of electricity in FY2019 was more than 55 per cent in PEPCO areas and more than 59 per cent in K-Electric. In comparison, industry consumes 22 per cent and 20 per cent in both the areas respectively. The industry is relying on other sources of energy due to expensive electricity from the national grid. In other words, the productive sectors that require a continuous supply of electricity either have to restrict their production or have to rely on other sources when electricity service is considered as a 'right' (Burgess, *et al*., 2020).

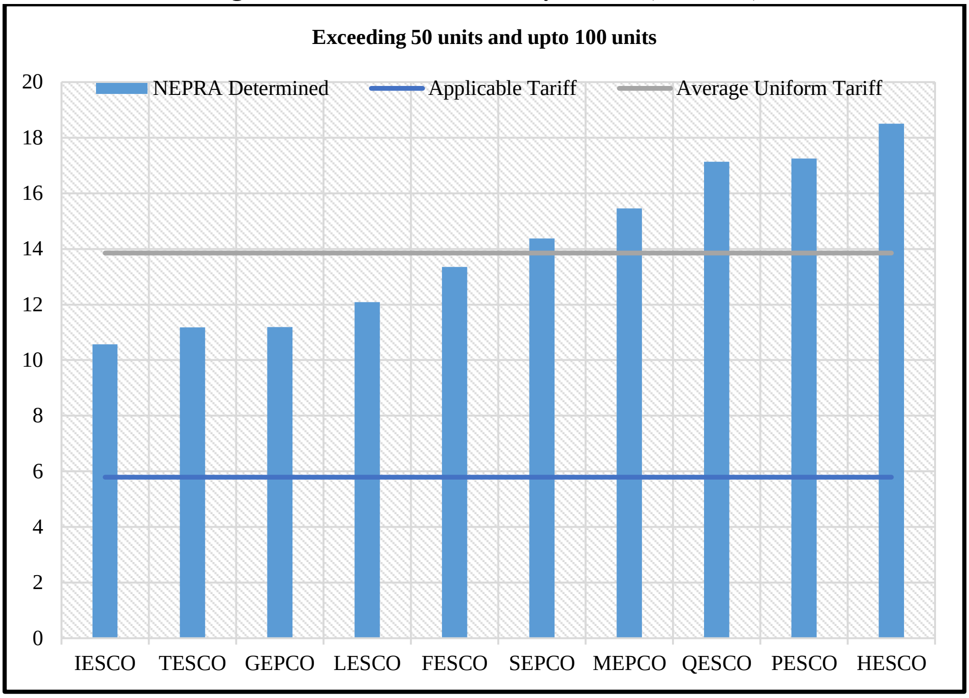
The Government of Pakistan provides several subsidies to the power sector. The largest portion of this subsidy is for inter-DISCO tariff differential. It is the difference between government notified uniform tariff and the tariff determined by NEPRA. NEPRA determined tariff for different DISCOs based on energy price, capacity payment, distribution-margin, and T & D losses of DISCOs allowed by NEPRA (Figure 12). The tariff determined is different for each DISCO. *The government as a policy apply uniform tariffs across all the geographical areas.* The minimum consumer-end tariff for a particular consumer category is applied across all DISCOs. The difference is paid by the government in the form of subsidies to DISCOs.

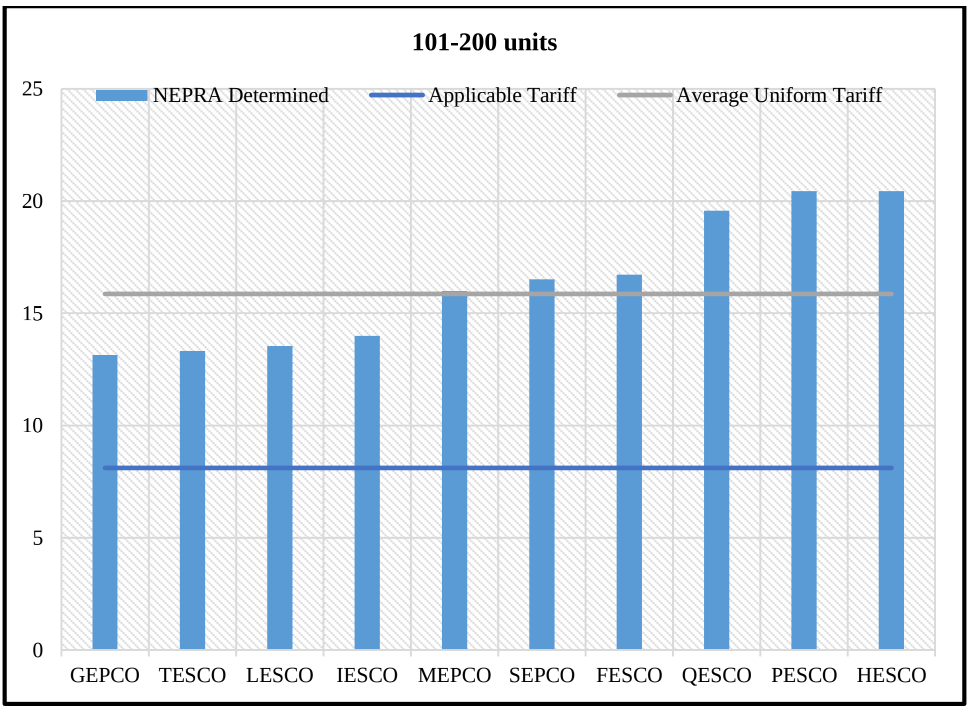
Fig. 12. Tariff Analysis

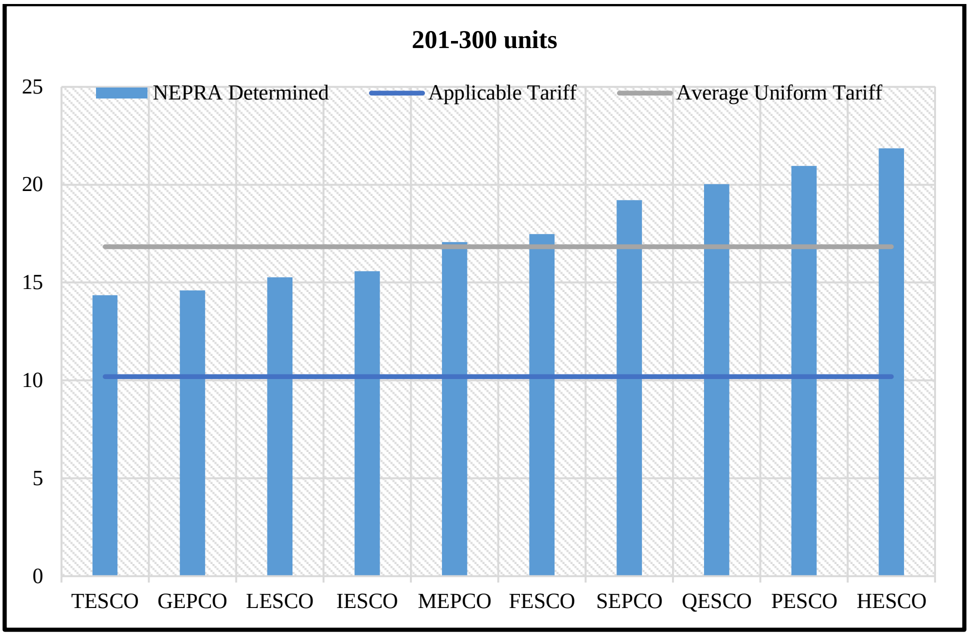


Source: SRO 01 (01) 2019, Ministry of Energy, Government of Pakistan.

Fig. 13. Residential Electricity Tariffs (Rs/KWh)







Source: SRO 01 (01) 2019, Ministry of Energy, Government of Pakistan.

Out of Rs 260.5 billion of power subsidy in FY2020, 72 percent (Rs. 187 billion) was for inter-DISCO tariff differential. Since FY2007, the government has paid over Rs. 3 trillion subsidies to the power sector out of which Rs. 2.5 trillion are for tariff differential. It means this huge burden of subsidy is due to the policy decision to maintain a uniform tariff across different geographical regions in the country, irrespective of the efficiency level (measuring costs) in these regions (DISCOs). Through these subsidies, the government is providing electricity to consumers at below-market price and shield them from the impact of high input costs, high capacity payments and inefficiencies across the supply chain (SBP, 2019).

Apparently, the objective of the government is to protect the end-consumers. Therefore, K-electric despite being privatised is also the major beneficiary of energy subsidies (Figure 11). So even if prices are increased for consumers, it would only be to the extent of maintaining uniformity across the country; the rest of the increase is settled at the government level through subsidies.

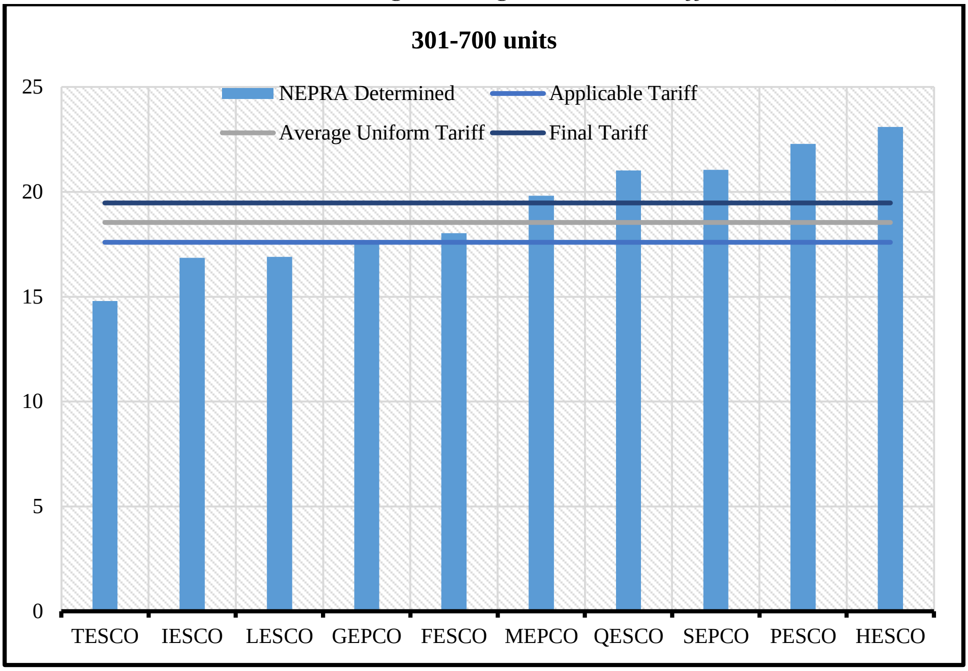
As mentioned earlier, the government also provide subsidies to certain consumer groups like agriculture tube wells in Baluchistan, consumers in FATA and AJK and export-oriented industry.

Whenever the government is unable to manage this subsidy amount or delay the payment (as happened most of the time due to fiscal constraints), it is added to the circular debt. Additionally, there are some distortionary effects associated with these subsidies and price structure.

First, this welfare move by the government is encouraging inefficient behaviour in some of the distribution companies. If a different tariff is charged in different DISCOs, the profitable DISCOs will be in a position to sell adequate and affordable electricity to its consumers (Malik, 2012).

Secondly, it is putting an extra burden on compliant consumers, through various surcharges, taxes, and tariff hikes. The consumer tariff notified in January 2019 created a financial gap of Rs. 371.5 billion, to be covered through direct subsidies by the government, and through a surcharge, named as financial cost surcharge (Rs. 0.43 per unit) to be charged from all the electricity consumers except the lifeline consumers[21].

Fig. 14. Final Residential Electricity Tariff Rs/kwh
(including surcharges and three tariff hikes, 2019)



Source: SRO 01 (01) 2019, Ministry of Energy, Government of Pakistan.
Note: Final Tariff does not include fuel price adjustments in the year.

As per the tariff notification in January 2019, residential consumers are given the benefit of one previous slab. As we can see in Figure 13, for domestic consumers who consume up to 300 units of electricity, the applicable uniform tariff is even lower than what NEPRA determines for the most efficient distribution company (even after including surcharges). Whereas consumers (especially those consuming more than 300 units) of efficient distribution companies like IESCO, LESCO and GEPCO are paying a very high price; only because of inefficient DISCOs as well as because of the government policy of uniform tariff and extra surcharges (Figure 14). Moreover, whatever increase in tariff is announced by the government (e.g., three times in the last year[22]) is only applicable to those who consume 300 plus units.

[21] Besides, government also charges a Neelum Jhelum Surcharge of Rs. 0.10 per KWh from all the consumers (except lifeline consumers); general sales tax @ 17 percent, electricity duty @ 1.5 percent; and TV fees of Rs 35 from all the consumers.

[22] First increase was of Rs. 1.49 / kwh (applicable Rs. 0.75/ kwh), second of Rs. 0.53 / kwh and third one of Rs. 0.07 / kwh.

So not only the government is bearing the burden of tariff hike (to cover cost escalation) through subsidies; it is partially shared by compliant consumers (more than 300 units).

This government policy is meant to insulate the poor and the lower middle income (0-300 units) from the tariff hike. As of May 2019, 86 percent of domestic consumers use electricity up to 300 units while the remaining 14 percent consume electricity above 300 units in Pakistan. It means that notwithstanding the nominal increases, there have been no real increases in the electricity tariff for approximately 86 percent of domestic consumers.

But who are these 86 percent? In rural areas, about 46 percent of the population is not connected to the national grid. In urban localities, this group (0-300 units) normally resides in congested localities. However, there are apprehensions that congested areas mean more power theft (through meter-tempering) and line losses. Distribution companies avoid technological upgradation in those areas considering them low revenue areas. Similarly, there is ample evidence of the misuse of electricity in rural areas too, where people, instead of paying regular bills prefer to pay a monthly fixed amount to the lower staff of DISCO.

Besides, in urban areas there is a culture of having two to three meters in a house to distribute power load between them; and below 300 units in most of the cases. So indirectly, all of the above groups are unnecessarily getting the subsidised tariff. In other words, subsidies may not necessarily be going to genuinely deserving consumers.

Maximum subsidy is availed by the domestic sector. Unless or until tariffs are allowed to cover the cost of providing electricity to consumers, the power sector will continue to face financial difficulties.

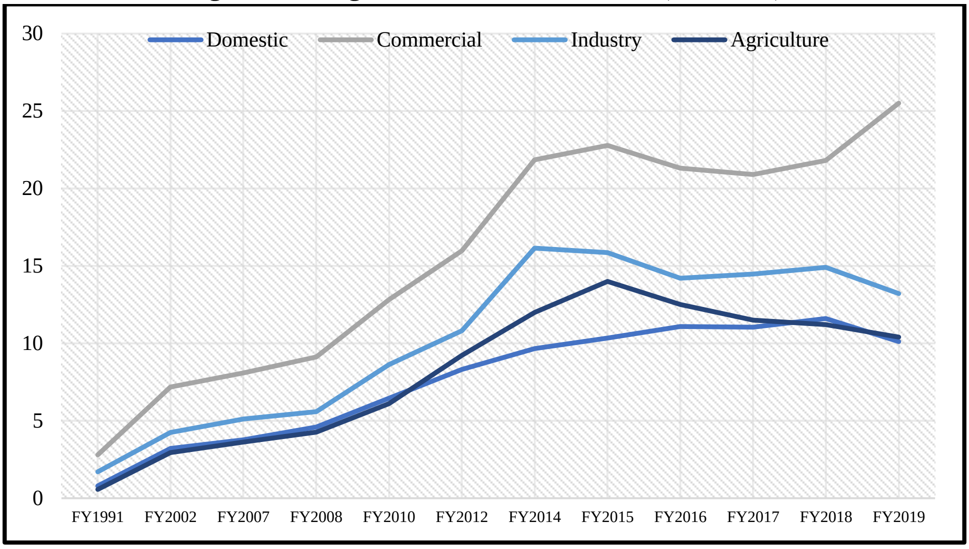
As argued by Burgess, *et al*. (2020) the issue arises when we start treating electricity as a right rather than as a private good. It leads to subsidies, theft, supply without payment, and losses for distribution companies, which may at the end limit supply.

Agriculture is the second major beneficiary of electricity subsidies. Since FY2007 Rs 47 billion of subsidy is provided for agriculture tube-wells in Baluchistan. *This policy has increased pressure on groundwater resources (Khair, et al., 2012) as well as has increased the wastage of water resources (Ahmad, 2006).* According to ENERCON, there is about 25 percent electricity wastage in the agriculture sector. This unconditional and huge subsidy to the sector is encouraging them to continue with the current practice of consuming electricity (other related issues are discussed in Section 4.3). The plan of solarisation of agriculture tube-wells and drip irrigation system (by the government of Baluchistan in collaboration with Alternative Development Board) may reduce the subsidy burden but chances are that it will further increase the wastage of under-ground water resources.

Some industries (export-oriented) are now also getting subsidised tariffs, but in general, there is *a significant presence of cross-subsidy from industrial and commercial consumers to agricultural and domestic consumers* (below 300 units). Over the years, limited progress has been made in reducing cross-subsidies (Figure 15).

For instance, the government announced a uniform quarterly adjustment of Rs. 1.49 in July 2019 (for 1st and 2nd quarter of 2018-19) for all consumer categories, but the applicable tariff in the domestic sector was of Rs. 0.75per unit; but only those domestic consumers who consume above 300 units. All the difference is paid by the government via subsidy. But this rebate was not applicable to the commercial and industrial consumers. Although the average sale price for industry has decreased due to subsidy (especially in the last year), it is still higher than domestic and agriculture sectors.

Fig. 15. Average Sale Rate across Sectors (Rs/ KWh)



Source: Author's Estimation.

Another shortfall associated with the current structure of subsidies is, it lifts pressures from inefficient power producers who continue to use more expensive fuels for thermal generation. For instance, as we can see in Figure 12, in the end-user NEPRA determined tariff, the power purchase price (PPP=CPP+EPP) constitutes on average 65 percent. Tariff notified by the government to subsidise households consuming up to 200 units is Rs 8.11 per KWh (Figure 13), is even lower than the price at which DISCOs procure electricity from CPPA[23]. This implies that while subsidising power to end-consumers, the government pays not only for the inefficiencies at the DISCOs level; but also, for inefficiencies and excess capacities in the generation sector (Khalid, 2019). This subsidy policy led to inefficient power producers continuing with their on-going practice (as discussed in Section 4.1.1 and 4.1.2).

Price reforms since 2015, which involves an increase in prices, not only exempt around 86 percent of domestic consumers, gives direct subsidies to FATA and AJK as well. For instance, the government is providing subsidies to WAPDA for receivables from AJK. But it is not sufficient as the government in AJK does not accept NEPRA determined tariffs and allows a tariff of only Rs 2.59 per KWh (agreed at the time of Mangla Dam Construction). The difference adds to the receivables of suppliers, that is, IESCO, GEPCO and PESCO. Similarly, issues at FATA impelled the government to split TESCO from PESCO and subsidise domestic consumers. But consumption is more than the allocated subsidy, and the difference is left as arrears (ADB, 2019). Inadequate budgeting of subsidies thus adds to the circular debt.

[23] Three tariff hikes in 2019 were meant to cover this gap.

Subsidies in the sector have not been phased out as planned, and distribution companies are asking for more subsidies. They claim that the estimation of actual costs is too low. It includes only efficient costs and leaves a shortfall in cost recovery even with the subsidy and surcharges_ adding more to the circular debt. DISCOs want to transfer all their inefficiencies to consumers via tariff or to the government via subsidy.

The government envisioned that after the privatisation of DISCOs, private management would lower costs. It would lower subsidies automatically. After almost 15 years of privatisation, K-El is still receiving a subsidy; yet its payables are still very high. In FY2019, Rs 91.7 billion was due from K-El; what it owes to NTDC for the 600MW it receives from the grid and payables to fuel suppliers (NEPRA, 2019).

Over the last ten years or so, these subsidies have exhausted fiscal resources immensely, leaving little (in the form of PSDP) for renovation or expansion of transmission and distribution infrastructure[24] (SBP, 2019).

The tariff structure since 2015 is tackling the circular debt issue by partially transmitting the cost of mismanagement and inefficiencies in the power system to compliant consumers. Any increase in theft or increase in unpaid bills, due to tariff hike is paid by consumers who are already paying their bills. The plan to reduce the future accumulation of circular debt is still dependent on continuous upward adjustments in tariffs. Whatever decrease in subsidies is recorded; is by putting an extra financial burden on consumers who are paying their bills regularly[25].

As discussed earlier, delay in determining and applying the tariff also adds to payment arrears. A multiyear tariff mechanism was introduced to reduce tariff-setting delays for some efficient DISCOs. However, DISCOs were unsatisfied with the determination and filed a complaint in courts against NEPRA in 2016. According to DISCOs the determination underestimated system losses and overestimated collections by NEPRA. This led to a delay in tariff revisions for these DISCOs. In 2017, the court decided in their favour. However, for the time when the case was under trial, these utilities bill their consumers on the basis of old tariff notification (i.e., 2015). Thus, the growth in revenues could not keep pace with the cost[26], and these DISCOs recorded losses in their balance-sheets. By the time tariffs got revised in 2017-18, a large buildup of uncharged system costs contributed significantly to the circular debt (SBP, 2019 and ADB, 2019b).

The government put an additional burden of Rs 405 billion on consumers through an increase in prices (FY2018 to FY2019). Subsidies have also gone up from Rs 115 billion in FY2018 to Rs 261 billion in FY2020. But this increase is not sufficient to cover the cost, which has increased tremendously. The gap is adding to the circular debt. It means this pricing strategy is not working. But the government is planning to continue with the uniform tariff policy as stated in National Electric Supply Policy 2020 (draft).

[24] Installment of high voltage transformers and smart grids and safety protocols such as proper earthing and plugging current leakages is left for DISCOs to undertake. But weak administrative and financial capacity in DISCOs does not allow them to invest in these areas.

[25] The tariff rationalisation surcharge introduced in 2015 brought down subsidy to the power sector subsidy from Rs 292 billion in FY2014 to Rs 118 billion in FY2017.

[26] Fuel price changes are adjusted automatically in tariffs but not the increase in capacity payments which are paid in US$. The impact of capacity payments aggravates as the Pakistan rupee depreciated by nearly 48 percent during 2016–2019.

(c) Mismanagement and Inefficiencies in the Electricity Supply Chain

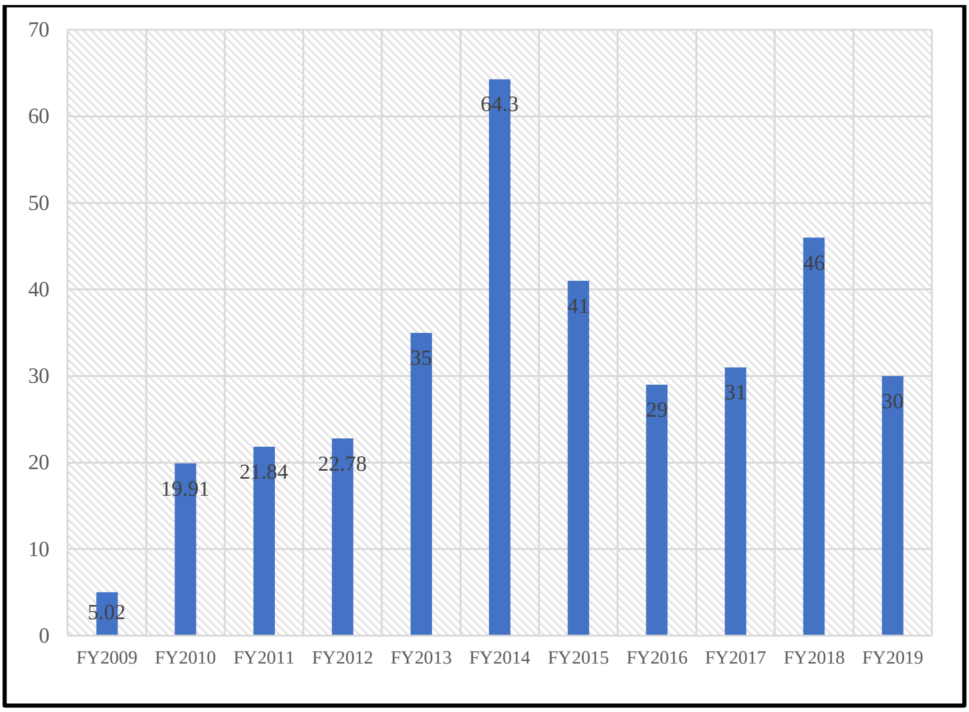
The functioning of the power system in Pakistan is unsatisfactory since the mid-1980s. Even after major reform measures in the 1990s, the inefficiencies in the sector still persist.

(i) *Operational Performance*

Consumer end tariffs are highly sensitive to the losses in the transmission and distribution (T&D) systems. With every percentage increase in losses, the tariff increases exponentially (as the cost of generation goes up). When a certain percentage of these losses are not accounted in tariffs, it adds to the circular debt.

One of the policy tools adopted by NEPRA to improve the operational performance is to set some target for T & D losses for each DISCO in their revenue requirements. When the respective DISCO does not meet the target, it is added to the payables of that respective distribution company as it is not compensated by tariff differential subsidy. Via this tool, NEPRA anticipates that to avoid deficits DISCOs would make improvement in their operational efficiency. However, this strategy is not working for most of the DISCOs, as there is no penalty associated with utility mismanagement and operational inefficiency. DISCOs are aware they will be subsidised at the end of the day.

Fig. 16. Impact of T&D Losses on Circular Debt
Rs Billion



Source: NEPRA State of Industry Reports (various years).

Table 2 shows losses claimed by various DISCOs and K-El in their T&D systems. It seems that the distribution companies have failed to control their inefficiencies. Except for IESCO, LESCO, GEPCO, and FESCO; the rest of them have extremely high losses. IESCO, GEPCO and FESCO have had low rates for the whole period (2006 to 2019) and close to the target set by NEPRA. However, the rest of DISCOs, especially, PESCO, HESCO, SEPCO and QESCO have shown no significant improvement, thus adding to the circular debt (Figure 16). The accumulated impact of these losses, after the clearance of debt in 2013, was about Rs 241billion (FY2014 to FY2019).

Table 2

Distribution Losses

FY	2006	2009	2012	2015	2018	2019
PESCO	34.1	37.4	36.0	34.81	38.15	36.6
TESCO				21.68	12.47	10.4
IESCO	13.2	10.8	9.5	9.41	9.14	8.9
GEPCO	10.2	10.7	11.2	10.72	10.01	9.9
LESCO	13.1	13.3	13.5	14.10	13.83	13.2
FESCO	11.6	10.7	10.9	11.03	10.53	9.8
MEPCO	20.5	18.4	17.9	15.50	16.59	15.8
HESCO	39.2	35.1	27.7	27.08	29.88	29.5
SEPCO			39.5	38.29	36.67	37.0
QESCO	20.7	20.4	20.9	23.10	22.44	23.6
K-El	37.5	38.5	29.7	23.7	20.4	19.1

Source: NEPRA State of Industry Report (Various Years).

Safe and reliable transmission and distribution of electricity have remained a major problem in Pakistan. The situation of huge power losses over the years has hardly improved. In FY2019, these losses stand at around 18 percent in public sector DISCOs and 19 percent in private sector K-El, equivalent to about Rs. 352.4 billion. As per NEPRA tariff determination of January 2019; we are paying extra Rs 2/KWh in our tariffs due to these losses. This is based on NEPRA targets for T&D losses. If actual losses are accounted for in tariffs, this will increase.

Neither unbundling nor price structures introduced by NEPRA seems to improve efficiency in distribution utilities. Even the profit motive associated with privatisation leads to limited improvement in K-El operational efficiency (Bacon, 2019). Some of the state-owned DISCOs performed better than K-El.

In comparison to the international benchmark, these losses are extremely high[27]. In the distribution losses, non-technical losses (mainly theft) are almost 68 percent while the rest of them are technical losses (overloading of transformers and the limited capacity of transmission lines to transfer power to consumers efficiently). In the period (FY1986 to FY1995) units of electricity supplied which were also billed grew at the rate of about 10 percent, while in the period (FY1995 to FY2007) units billed grew at the rate of about 5

[27] Comparison to other Asian countries: South Korea and China, T&D losses are only 3 percent and 5 percent. Even in Bangladesh T&D losses are only 9 percent.

percent. In the period (FY2008 to FY2019) units billed increased at the rate of 4 percent. This indicates declining efficiency to curtail power theft.

Electricity is stolen mainly by domestic consumers with the help of meter readers and officials from the electric supply companies (as also discussed earlier. 11kV and below feeders (which primarily caters to the household power needs) accounted for almost 91 percent of distribution losses to DISCOs during FY2019 (NEPRA, 2019). In other words, domestic consumers are not only subsidised, but they are also contributing more to T&D losses.

Corruption by the DISCO officials[28] and sheer negligence by the senior management of DISCOs as well as in the ministry are mainly responsible for the theft and other technical losses. Bribery culture in DISCOs prevents managers from investing in theft controlling techniques (NEPRA, 2014 and Abro, 2019).

(ii) *Commercial Efficiency*

Adding further to circular debt is the low recovery ratio of DISCOs. In tariff determination, NEPRA counts 100 percent recovery. However, the actually reported recovery percentage of DISCOs remained around 90 percent in FY2019. This resulted in an annual shortfall of around Rs. 130 billion (NEPRA, 2019).

As in Table 3, companies with high system losses also suffer from low recoveries of the billed amount. Secondly, over the years, recovery ratio deteriorated except for FESCO and to some extent LESCO. Even in IESCO, one of the best performing utilities in terms of T&D losses, recovery ratio has come down from 98 percent in FY2008 to 88 percent in FY2019. QESCO had a recovery ratio of 86 percent in FY2008, after declining consistently was recorded at 27 percent in FY2019. Even the privatised K-El is showing a billing loss of about 10 percent since 2011. Sector-wise, in FY2019, the highest recovery ratio was recorded for the commercial (98 percent), followed by industry (92.4 percent) and domestic sector (91.6 percent). The lowest recovery ratio was recorded for the agriculture sector (48 percent).

Table 3

% Recovery

FY	2008	2010	2012	2014	2016	2018	2019
PESCO	92	85	83	86	89	89	89
TESCO				7	437	67	68
IESCO	98	96	96	90	91	90	88
GEPCO	98	96	99	96	99	97	96
LESCO	98	96	96	98	99	98	98
FESCO	99	97	100	100	100	99.6	99.2
MEPCO	97	94	97	96	100	97	99
HESCO	77	60	69	79	72	77	75
SEPCO			51	60	55	60	63
QESCO	86	76	36	42	72	26	27
K-El		100	91	87	88	91	92.6

Source: NEPRA State of Industry Report (Various Years).

[28]Theft is carried out with the support of the DISCO employees as well as officers.

The basic principle of exchange in economics is the willingness to pay for the service used. Due to poor revenue collection, DISCOs are unable to pay for power cost. Despite getting subsidies from the government, receivables as on June 31, 2019, from the private consumers and agriculture tube-wells stand at Rs. 857 billion and Rs 283 billion respectively (Figure 4).

Total receivables owed to DISCOs have grown at the rate of about 31 percent from FY2006 to FY2019. Amounts owed by private sector consumers excluding private consumers in FATA have grown by 34 percent in the same period. This growth rate in part be attributed to poor recovery rate, but it may also highlight the point that private consumers reaching an elasticity point whereby they are more willing to pay or delay for electricity because of recent large tariff increases and extra surcharges imposed. Another reason could be their dissatisfaction with service delivery. Consequently, it leads to an additional unjustified cost to those consumers who are paying their bills regularly or extra costs to the government in the form of subsidy.

The second largest amount is owed by agriculture tube-wells, followed by AJK government, K-Electric, provincial governments, FATA, and Federal government. The amount owed by provinces is small but over the years have grown by 25 percent. One of the reasons for this increase is a dispute of provincial governments with the federal on their share in NFC award[29].

Beyond these receivables, the distribution companies do not acknowledge the mark-up on delayed payments, on the ground that NEPRA do not allow them to claim in their tariff determination[30]. Insufficient payments by DISCOs to CPPA further add to circular debt (CPPA, 2019a).

No doubt, the underlying governance problems in DISCOs are mainly responsible for these operational and commercial inefficiencies. The role of existing policies and regulatory practices cannot be ignored.

As reported in (SBP, 2019), delays and disputes over multi-year tariff determination caused accumulation of losses for DISCOs like IESCO, GEPCO and FESCO. Gross receivables from these three DISCOs increase by about 43 percent from FY2018 to FY2019 (CPPA, 2019a). Similarly, QESCO low recoveries (Table 3) are due to subsidy policy on tube-wells, and delays in tariff notifications[31]. More than 75 percent of the electricity procured by QESCO is consumed by agriculture consumers for running tube-wells. While agriculture consumers constitute the bulk of QESCO's defaulters (79 percent), the Government of Baluchistan and the Federal Government also collectively owe Rs 59.86

[29] Provincial governments do not allow the federal government to deduct the provincial electricity dues at source out of the NFC award amount.

[30] Rs 110.6 billion are still pending under this head (CPPA, 2019a).

[31] As per the subsidy policy (from 2001 to 2010), agriculture consumers had to pay Rs 4,000 per month; and remaining amount to be paid by QESCO, Baluchistan government and the Federal government in a ratio of 30:30:40, respectively. Subsidy program ceased in 2010; but restored again from December 2012, without any clarification regarding distribution of outstanding dues across the respective entities. In this period of 27 months, consumers were reluctant to pay their share of electricity bills beyond Rs 4000, therefore defaulted on their bills for these 27 months. This outstanding amount (Rs 55.3 billion) affects subsequent billing. So even if these consumers desire to clear their current period liabilities, they were unable to do so without clearing the accumulated backlog. The said notification regarding the proportion and liability of payments is still pending. That's why the average recovery by QESCO has come down significantly (SBP, 2019).

billion to the entity (NEPRA, 2019). In one year from FY2018-FY2019, gross receivables of QESCO increased by 26 percent (CPPA, 2019a)

Over 5.3 million electricity consumers, despite being defaulters, are getting electricity. In June 2018, total outstanding payments from these connections were Rs 404.8 billion. Largely, these defaulters are in QESCO, PESCO, SEPCO and HESCO. In addition to mismanagement in these DISCOs, security conditions and lawlessness, as well as political interference, are playing a major part (for details see SBP, 2019). As per CPPA financial statement FY2019, PESCO is the largest defaulter with gross payables Rs 394 billion, followed by QESCO (Rs 351 billion), HESCO (Rs 275 billion) and SEPCO (Rs 237 billion).

One more reason cited for low recoveries is the wrong energy billing by DISCOs. The two reports cited in Malik (2012) suggest that the power sector is losing more than Rs 390 billion annually because of mismanagement in these DISCOs.

(iii) *Governance Issues*

Mismanagement and poor governance at various levels are at the heart of circular debt issues. *At the national level*, these can be attributed to political interference, short-sighted and defective policies, ineffective subsidy policy and under-budgeting of subsidies, unnecessary delays in decision making (due to cumbersome bureaucratic procedures) and non-settlement of issues.

The Federal Government is the ultimate decision-maker in all the power sector matters. Final tariff notification is also made by the government. Many times, as a political entity, the government is swayed by both political and socio-economic considerations, undermining the commercial orientation of these state-owned companies. For instance, the decision to apply uniform tariff across the country is merely under political considerations. Similarly, other decisions in these companies related to the appointment of managerial staff are also not without government intervention. Their constant interference has often compromised merit-based performance and accountability.

Similarly, as discussed in Section 4.1, policymakers have caused enormous damage to this sector by approving and sanctioning investments in inappropriate projects or by endangering extremely essential projects for their own interests or because of their incompetency. The power sector has always remained in the limelight because of corruption in financial matters, whether it is an IPP program, RPPs, LNG power plants, or Thar coal projects under CPEC.

Similarly, the subsidy strategy by the government is creating inefficiencies in the system as benefits of these subsidies go beyond the desired consumer group. Additionally, the financial, accounting, and data systems related to subsidies are also not well-managed (USAID, 2013). Lack of transparency in government decision making has harmed the sector more than anything else.

At the provincial level, even after the 18th Amendment, governments are not playing their part in resolving issues related to electricity bills, payment of tube-well subsidies arrears, arrears of provincial departments, and arrears due to court orders. If, for example, the issue of proportion and liability of payments due from agriculture tube-wells in Baluchistan and the tariff rate issue for Azad Jammu & Kashmir (AJK) is resolved, a significant portion of circular debt could be reduced.

Similarly, if provincial governments and law enforcement agencies under them support DISCOs effort to check theft or to catch defaulters in their areas, T&D losses can be reduced, and recoveries can be increased significantly.

As far as *corporate governance* in state-owned companies is concerned, GENCOs and DISCOs lack technical and managerial skills to operate independently. The structure of these companies based on corporate governance principles has not been established in a true sense. For instance, DISCOs besides having inferior operational and commercial performance (Section 4.3.1 and 4.3.2), are not aware of their role and need of good governance as a corporate entity (Malik, 2012). Similarly, GENCOs have no incentive to improve their performance (Section 4.1.2).

Bacon (2019) compared corporate governance (using various indicators) between Lahore Electric Supply Company (LESCO) one of the best-performing state-owned company with K-Electric (K-El) (privatised utility) and some Indian Distribution companies and found corporate governance in LESCO below average[32]. The state of corporate governance in other DISCOs and GENCOs is not much different.

The weak administrative performance of all the power companies in the public sector is due to constant government interference in matters relating to finance, employment, and pricing. There is no incentive to improve performance as there is no penalty associated with weak performance.

The autonomy and capability of board members is important to control the opportunistic behaviour of managers and to protect the interests of shareholders (Zubaidah, *et al*., 2009). But the Board of Directors (so-called independent) in GENCOs and DISCOs either have no ability or authority to guide and monitor company performance.

It is the lack of capacity and skills in DISCOs management that does not allow them to make efforts to reduce T&D losses or to improve the company's financial positions. Similarly, DISCOs have failed to have direct agreement with the generation companies because they don't have capacity and understanding of the concept of 'distributed generation'. The only exception is an agreement between MEPCO and a generation company to carry out the 'wheeling of power'; otherwise, DISCOs are resisting NEPRA's regulations (NEPRA, 2020).

On the other hand, good corporate governance indicators in privatised K-El have so far not translated into good commercial and operational efficiency. That's why K-El is facing financial challenges associated with payables to and receivables from the government and state-owned companies.

All the distribution companies including K-El are still unable to recover dues especially from the public sector and provincial government departments, thus causing high losses in the distribution systems. Delay in the payment of subsidies by the government and the lack of discipline in these companies has forced them to default; significant arrears in payments to generation companies have resulted in the upsurge of the circular debt problem.

Cash injections by the successive government have impeded the efforts of power companies to improve their governance, efficiencies and reduce their losses. Whenever the

[32]The composition of the board until 2016 was not in compliance with the Securities and Stock Exchange Commission of Pakistan (SECP)'s Public Sector Companies Corporate Governance Rules of 2013, which it is supposed to follow.

power companies face problems, the government extends financial help either through subsidies or by increasing tariffs, resulting in more inefficiencies and system losses.

Although the federal government encourages DISCOs to borrow directly from commercial banks to finance their working capital needs, 47 percent of the guarantees are used to balance cash flow constraints originating from circular debt. Parking of money in PHPL is only supportive in the short-term; for sustainable functioning of the sector, a massive overhaul is needed (SBP, 2019).

Government intervention and market competition cannot go together. As often their different objectives clash with each other. The restructuring has been done in Pakistan but without proper commercialisation and induction of professional management to bring about improvements in the system (Malik, *et al*., 2009).

(iv) *Regulation*

The weak administrative governance in NEPRA takes the form of a lack of autonomy, resulting in the overall institutional inability to carry out the desired function effectively. NEPRA is either lacking in professional expertise or they don’t have authority to supervise and control the power sector and establish a rational pricing regime (Malik, 2007 and USAID, 2013).

NEPRA has often been accused of most of the problems in the power sector including system losses, increasing costs and high tariffs. Besides other reasons, method of tariff determination is considered responsible for the circular debt issue. NEPRA lacks the authority to make DISCOs accountable for their performance, whether it is related to operational and commercial inefficiency or related to over-billing to consumers. Similar is its role with reference to the accountability of generation companies (whether in public or private sector). In particular, the enforcement of service quality is weak. A mechanism to incentivise for good performance or penalty in case of poor performance is not in place.

NEPRA has been unsuccessful in developing and pursuing a regulatory framework to guarantee reliable, efficient, and affordable electricity to consumers. It is in NEPRA’s mandate to attract investment in the power sector, but no significant addition has been made in projects that are generating electricity from renewable sources. All the decisions/ activities are under the government’s influence and without due competitive procedures. Unnecessary delays in market entry regulation are discouraging renewable projects (Bacon, 2019).

Furthermore, a lack of uniform regulation in the energy sector creates distortions between the gas and electricity sectors. Inconsistent regulation between the National Electric Power Regulatory Authority (NEPRA) and the Oil and Gas Regulatory Authority (OGRA) sends confusing signals to investors and creates disharmony in pricing strategies between gas and electricity (FODP, 2010).

CONCLUSION AND WAY FORWARD

In Pakistan, our energy sector is caught in an acute energy crisis in the form of circular debt for more than a decade (cumulative loss of about Rs. 5 trillion, roughly 12 percent of current GDP). Distortions on both the demand and supply side as well as governance issues are so much absorbed in the system that even the decline in oil prices in 2015, increase in tariffs (many a time) along with several surcharges did not help in eliminating the debt. Successive governments have attempted to rescue the system by paying part of the debt, however, without taking care of structural inefficiencies in the system.

It is difficult to understand with so many years of energy crisis why the government is still carrying the burden of prevalent inefficiencies in the system through the uniform pricing policy and subsequent subsidies. The government is reporting to have brought down the average monthly rate of arrears accumulation in the last six months. But all that has been done is by putting an extra financial burden on consumers, who are paying their bills regularly. Now the government has agreed with the IMF to recover the stock of circular debt from the current consumers through surcharges over the next five years. This amendment, if approved by the parliament would increase tariffs for all consumers by 50 percent.

There is no serious initiative (taken or planned) towards improving system inefficiencies. No incentive or penalty mechanism is in place to overcome shortcomings in the generation and distribution systems. The result is financial losses are increasing continuously.

Way Forward

(a) *Integrated Planning*

Integrated planning is an important policy tool to reach Sustainable Development Goal 7 of clean and affordable energy besides reducing the financial burden for the government.

Lack of integrated planning since 1985, has cost Pakistan dearly. Not only frequent demand and supply imbalances; it has led to costly generation fuel mix, uneven swapping of costs between gas and power sectors, and an imbalance between idle generation capacity and network availability. Without an integrated energy sector approach, Pakistan cannot realise an optimal power generation mix from imported fuels and indigenous resources (PIDE, 2020; ADB, 2019b; IRENA, 2018; and Alahdad, 2012).

(b) *Reduction in Generation Costs*

To reduce costs, reliance on expensive imported fuels (whether it is furnace oil, RLNG or imported coal)[33] should be reduced. Again, we need a coordinated approach to incentivise and increase the share of hydro and other renewable sources in our fuel mix.

Hydroelectric power stations are classified as the most efficient power plants as they can have an operational efficiency of up to 90 percent given the availability of water. Unlike Neelum-Jhelum, all hydropower projects (under construction) should be completed in time to avoid cost escalation and to enhance cheap electricity generation capacity.

Similarly, renewable energy including wind and solar is now the cheapest form of electricity generation. By increasing reliance on renewables and hydro energy, Pakistan can reduce the cost of electricity generation, thereby reducing energy price component in electricity tariffs.

[33] For instance, the import of liquefied natural gas (LNG) since 2016, no doubt helped in dealing with gas shortage, but it is expensive.

(c) *Revision of Generation Contracts*

Given the liquidity crunch the power sector is facing, it is high time to review the contractual terms of our IPPs for the future to make tariffs consumer-friendly rather than producer friendly. If the capacity payment structure remains unchanged, the desired objective of providing affordable energy to the public is unlikely to materialise.

No doubt, part of our problem of capacity payments would be resolved with the retirement of nearly 4,000 MW of thermal power plants (IPPs who came in the system under 1994 Policy), as the power purchase agreements (PPAs) of all these plants are going to expire by 2024. For the rest, NEPRA must certify that all the IPPs are operational in compliance with technical benchmarks of their respective generation licenses. An independent forensic audit of all the IPPs is necessary for reviewing their actual capacity and fuel intake to change the capacity payment structure in our tariff determinations.

Competitive bidding should take place for all the new projects to ensure that the market determines the tariff.

(d) *Cost-effective Pricing*

Separate tariffs for each distribution area and elimination of tariff differential subsidy—for decreasing financial burden on the government. It will have an automatic impact on the end-consumer price for the efficient distribution company. It will also force the other distribution companies to improve their recovery position and minimise line losses and become efficient.

Similarly, there is a need to *re-visit the policy of imposing surcharges*. Besides increased costs to compliant consumers, surcharges can also result in more inefficiency in the distribution system. It reduces DISCOs incentives to improve and control costs. And in the case of the Neelum-Jhelum project, surcharge shifts utility business risks away from investors and put extra pressure on consumers.

Electricity subsidies should be re-evaluated as a means of providing social protection. There are alternative policy instruments, like direct cash transfers for energy use. Need-based/targeted subsidy approach besides reducing fiscal burden, improves the welfare of the weak segments in society (Khalid and Salman, 2020; Awan, *et al*., 2019).

There should be fair pricing, where each consumer has to pay according to their amount of consumption on a progressive trend, i.e., the more per unit energy is used, the more it has to pay on average. And there are no free riders.

A national consensus is required for the formulation of a coherent energy price policy.

(d) *Improved Transmission and Distribution System*

To bring down T&D losses, heavy capital investments are required to phase out unreliable low-voltage transmission and distribution lines. Currently, given their weak financial positions, most of the DISCOs are not in a position to undertake the needed upgradation.

The amount government allocates for tariff differential subsidy should be used for the improvement of transmission and distribution infrastructure in DISCOs especially in PESCO, SEPCO, HESCO and QESCO.

An effective crackdown against defaulters in high-security risk areas like PESCO with the support of law enforcement agencies is a must. Here the role of provincial governments is significant. They can facilitate their respective DISCOs in bill recovery, theft control and protection of utility staff.

Effective implementation of legislation to improve governance and reduce theft is necessary. So far it is the weakness from the side of government (both provincial and federal) to implement such decisions effectively[34]. Theft can easily be reduced by applying technical solutions (i.e., replacement of meters with modern metering technology and digital AMR systems) and managerial methods (such as regular inspection and monitoring). Technological innovations cannot be successful in the absence of corporate culture, managerial skills, and desire (Smith, 2004).

(e) *Improved Governance*

Active participation of provincial governments is needed. Currently, provincial governments even after the 18th amendment are not effectively participating in the resolution of issues related to electricity bills, payment of tube-well subsidy arrears, arrears of provincial departments, and arrears due to court orders. If provincial governments actively deal with the recovery issues a significant portion of the receivables could be reduced.

Effective coordination between Federal and Provincial Governments is required to resolve all the outstanding issues between the two as well as for resolving the pending issues of DISCOs.

Improved corporate and operational governance of power sector companies is important for the sustainability of the sector.

Unless all distribution companies are made accountable for all their decisions and finances, it will not be possible to bring in efficiency in the power sector. Too much emphasis is on the privatisation of DISCOs. It is not the solution. All that we need is an independent corporate company. We need to learn from countries like Norway who have efficient and competitive electricity markets without privatisation.

There is a need to restrict the role of the government in the decision making of power sector GENCOs and DISCOs. The government should only be responsible for legislation.

NEPRA needs to re-examine its policies and functioning (in the light of good governance practices). For instance, unnecessary delays in tariff determinations often lead to cash shortfalls for DISCOs. The authority also needs to improve its executive powers to check the over-billing and performance of companies in compliance with their licenses. NEPRA must assert its authority to enforce penalties for non-compliance.

Transparency at every stage of an energy supply chain is necessary to do away with inefficiencies in the system.

We need a complete overhaul of the system accompanied by commercialisation and professional management without government intervention. The appointment of managerial staff and board members in state-owned companies should not be based on

[34] An antitheft campaign was started with the formation of special task forces in Punjab and KPK in October 2018. Government claims remarkable progress, but its impact on circular debt growth is yet to be seen (Syed and Yasin, 2019).

political affiliation but merit-based (professionals), and the contract must have a clause of perform-or-exit.

(f) Energy Efficiency

In Pakistan, the idea of energy conservation and demand management has not remained popular because of government neglect and because of lack of public awareness of its overall benefits. According to one estimate, we can reduce 20 percent to 25 percent of energy demand only through its productive use in various sectors. For instance, in agriculture instead of subsidising, we can encourage them to use efficient water pumping and avoid wastage of water resources. But certainly, before this, the pending subsidy issue should be resolved on an urgent basis with the support of the provincial government.

We need a clearer and targeted approach to increase the productive use of energy in all the sectors.

(g) *Competitive Electricity Market*

The development of a competitive electricity market is the ultimate solution to all problems in the power sector. In 2015, the Market Rules and Commercial Code were approved by NEPRA that guides the CPPA to move towards the competitive regime. Similarly, in April 2018 some major modifications related to competitive market have been made in the NEPRA Act (for details see Lodhi, 2019). However, due to the obvious lack of capacity and understanding of DISCOs, they have failed to have direct agreements with the generation companies. Their diffidence to adopt the change has further promoted centralisation of activities at CPPA (NEPRA, 2019).

'Distributed generation' is a norm in electricity markets globally. However as reported in NEPRA State of Industry Report for 2019, DISCOs are creating hurdles in allowing 'wheeling' and 'net-metering' regimes, which are supposed to bring competition in the sector.

The draft of National Electricity Policy 2020 also called for sustainable and competitive power sector with efficient and liquid markets. But one thing should be kept in mind that government intervention and market competition cannot go along together given their different objectives. In competitive markets, all should be treated fairly, with no preferential treatment. Consumers should not be asked to pay for the inefficiencies of other entities (Aziz, 2020). Charging to bulk supply consumers or captive power plants for the availability of backup supply should be unbiased and avoid double payment to make our export-oriented sector competitive (Fichtner, 2020).

In brief, when inefficiencies in the system are removed and we move towards a competitive market in a true sense, the problem of circular debt (power sector deficit) will resolve automatically. Otherwise, its impact on the liquidity of the entire energy chain would continue to haunt.

REFERENCES

Abro, A. A. (2019) Circular Debt: Disease or Symptom? National Herald Tribune, https://dailynht.com/story/57100

ADB (2019a) Proposed Programmatic Approach and Policy-Based Loan for Subprogram Islamic Republic of Pakistan: Energy Sector Reforms and Financial Sustainability Program. Project Number: 53165-001, Report and Recommendation of the President to the Board of Directors, Asian Development Bank.

ADB (2019b) Pakistan: ADB's Support to Pakistan Energy Sector (2005-2017). Sector Assistance Evaluation Program, Asian Development Bank.

Ahmad, S. (2006) Issues Restricting Capping of Tube well Subsidy and Strategy for Introducing the Smart Subsidy in Baluchistan'. Water for Baluchistan Policy Briefings. 2(1). TA-4560 (PAK) Project for "Supporting Implementation of IWRM Policy in Baluchistan – Government of Baluchistan - ADB and Royal Government of Netherlands.

Alahdad, Z. (2012) Pakistan's Energy Sector: From Crisis to Crisis-Breaking the Chain. PIDE Monograph No. 6, Pakistan Institute of Development Economics, Islamabad.

Albouy, Y and R. Bousba (1998) The Impact of IPPs on Developing Countries_ Out of the Crisis and into the Future. Note No. 162, Public Policy for the Private Sector, The World Bank.

Awan, H. S., G. Samad & N. Faraz (2019) Electricity Subsidies and Welfare Analysis: The Perspective of Pakistan. PIDE-Working Paper 2019: 164.

Aziz, R. (2020) Implications of Imposing Additional Wheeling Costs and Capacity Charges on Captive Power, on the Economy, Key Sectors and Consumers. Background Report prepared for NEPRA.

Bacon, R. (2019) Learning from Power Sector Reform: The Case of Pakistan. Policy Research Working Paper No. 8842, The World Bank, Washington D. C.

Bhutta, Z. (2018) Circular Debt of Rs 1.1tr Passed on to New Government. The Express Tribune, August 18, 2018.

BR (2013) New Power Policy: old wine in new bottle? Business Recorder, August 26, https://fp.brecorder.com/2013/08/201308261224999/

Burgess, R., M. Greenstone, N. Ryan & A Sudarshan (2020) The Consequences of Treating Electricity as a Right. Journal of Economic Perspectives, Vol. 34, No. 1, pp.145-169.

Cheema, T. B. (2020) Circular Debt, presentation at the PIDE Roundtable Meeting on "Circular Debt_ An Unfortunate Misnomer", June 25, 2020.

CPPA (2019a) Achieving Excellence through Passion, Innovation & Integration, Annual Report 2019, Central Power Purchasing Agency, Islamabad.

CPPA (2019b) Power Purchase Price Forecast, Central Power Purchasing Agency, Islamabad.

Faraz, S. (2018) Circular Debt: Issues and Solutions. Report of the Special Committee on Circular Debt on Components of Circular Debt, Measures Taken & Required to Reduce the Same. Senate of Pakistan. Islamabad.

Fichtner (2020) Wheeling Framework in Pakistan. International Best Practice for Wheeling and Recommendations for Pakistan. Report conducted on behalf of Fatima Energy Limited, Pakistan.

FODP (2010) Integrated Energy Sector Report and Plan. Report prepared by Friends of Democratic Pakistan (FODP), Energy Sector Task Force, Asian Development Bank and Government of Pakistan.

Haque, N., S. Sattar & A. Abbas (2020) Issues in Energy for Development. Business Recorder, https://www.brecorder.com/2020/02/575195/issues-in-energy-for-development/
Hasan, M.H. (2010) Pakistan Power Sector Challenges and the Way Forward. Policy Perspectives, Vol. 7, No. 2, pp. 205-113.
IISD (2018) Improving and Refocusing Electricity Subsidies: Options for Optimisation in Mexico. International Institute of Sustainable Development. Available at https://www.energypartnership.mx/fileadmin/user_upload/mexico/media_elements/reports/ElectricitySubsidies-MEX.pdf.
IMF (2013) Case Studies on Energy Subsidy Reform: Lessons and Implications. International Monetary Fund: Washington, DC.
IMF (2019) Pakistan, IMF Country Report No 19/380, International Monetary Fund, Washington, D.C.
IRENA (2018) Renewables Readiness Assessment_ Pakistan. International Renewable Energy Agency (IRENA), Abu Dhabi.
Khair, S. M., R. J. Culas & S. Mushtaq (2012) Evaluation of the Financial Impact of Electricity Subsidy on the Returns of Tube-well Owners and Water Buyers under Declining Water-tables in Baluchistan, Pakistan. Available at https://www.researchgate.net/publication/267826694_Evaluation_of_the_financial_impact_of_electricity_subsidy_on_the_returns_of_tubewell_owners_and_water_buyers_under_declining_watertables_in_Balochistan_Pakistan.
Khalid, A. (2019) Why are Power Tariffs in Pakistan Consistently High? Special Section I, The State of Pakistan’s Economy, The State Bank of Pakistan.
Khalid, S. A. & V. Salman (2020). Welfare Impact of Electricity Subsidy Reforms in Pakistan: A Micro Model Study. Electricity policy, Vol. 137, Issue (February).
Lodhi, A. B. (2019) Future of Competitive Electricity Market in Pakistan, ICMA, Pakistan.
Malik, A. (2007) Effectiveness of Regulatory Structure in the Power Sector of Pakistan. PIDE Working Paper No. 25, Pakistan Institute of Development Economics, Islamabad.
Malik, A. (2012) Power Crisis in Pakistan: A Crisis in Governance? PIDE Monograph No. 4, Pakistan Institute of Development Economics, Islamabad.
Malik, A., M. A. Mahmood, and A. Ahmad (2009) Power Sector Reforms in Pakistan: A Critical Review. Middle East Business and Economic Review, Vol. 21 (2), 1-29.
NEPRA (2014) State of Industry Report, National power Regulatory Authority
NEPRA (2018) State of Industry Report, National power Regulatory Authority.
Nicholas, S., and T. Buckley (2018) Pakistan’s Power Future: Renewable Energy Provides a More Diverse Secure and Cost-Effective Alternative. Institute of Energy Economics and Financial Analysis. http://ieefa.org/wp-content/uploads/2018/11/Pakistans-Power-Future_December-2018.pdf
PIDE (2020) Framework of Economic Growth, Pakistan Institute of Development Economics, Islamabad.
Report on the Power Sector (2020) Prepared by Committee for Power Sector Audit, Circular Debt Resolution and Future Roadmap, Ministry of Energy, Pakistan.
Saeed, K. (2013) Pakistan Power Crisis: Challenges and the Way Forward. Criterion Quarterly, Vol. 8, No. 4.

Sattar, S. (2020) Circular Debt, presentation at the PIDE Roundtable Meeting on “Circular Debt_ an Unfortunate Misnomer”, June 25, 2020.

SBP (2014) Annual Report 2013-14, State Bank of Pakistan.

SBP (2015) Annual Report 2014-15, State Bank of Pakistan.

SBP (2019) Evaluating the Fiscal Burden of State-owned Enterprises in the Power Sector, Special Section 2, The State of Pakistan’s Economy, State Bank of Pakistan.

Smith, T. B. (2004) Electricity Theft: A Comparative Analysis. Energy Policy, Vol. 32, Issue 18, 2067-2076.

Syed, R. and M. Yasin (2019) Electricity losses continue in the country caught in electricity crisis, *Daily Times,* https://dailytimes.com.pk/347354/electricity-losses-continue-in-the-country-caught-in-electricity-crisis/

Trimble, C., N. Yoshida, and M. Saqib (2011) Rethinking Electricity Tariffs and Subsidies in Pakistan (Policy Note), World Bank Report No. 62971 –Pk, The World Bank, Washington, D.C.

USAID (2013) The Causes and Impact of Power Sector Circular Debt in Pakistan. Study commissioned by the Planning Commission of Pakistan and Funded by United States Aid for International Development, Islamabad.

Walker, T., E. Canpolat, F.K. Khan & A. Kryeziu (2016) Residential Electricity Subsidies in Pakistan: Targeting, Welfare Impacts, and Options for Reform. Working Paper No. 7912, The World Bank, Washington D. C.

Corporate Governance in the State-owned Electricity Distribution Companies*

AFIA MALIK

INTRODUCTION

In electric power systems, the financial health of the distribution sector is critical. A financially weak distribution company can weaken the flow of funds in the entire supply chain, and their operational limitations can lead to the wastage of energy resources. There is a shortfall between cash inflows and outflows in the power supply chain of Pakistan_ circular debt. In FY2020, more than 50 per cent of arrears were due to low bill recoveries and the difference between the allowed and actual distribution losses by NEPRA (Malik, 2020).

Apart from sectoral policy issues, the power distribution sector challenges, that is, institutional weaknesses, centralised control (under the Ministry of Energy-Power Division) and weak corporate governance, are mainly responsible for the circular debt.

STRUCTURE OF ELECTRICITY DISTRIBUTION SECTOR

After the formal bifurcation of WAPDA in November 2007, eight separate distribution companies (DISCOs) (which later increased to ten) were established. KESC (now K-Electric (K-El)) remained vertically integrated; in December 2005, it was privatised_ the Government sold 73 per cent of its shares to a private conglomerate. These companies are distributing electricity to the end-consumers in their respective geographical areas as a monopoly.

Issues in the Distribution Sector

(a) *Operational Efficiency*

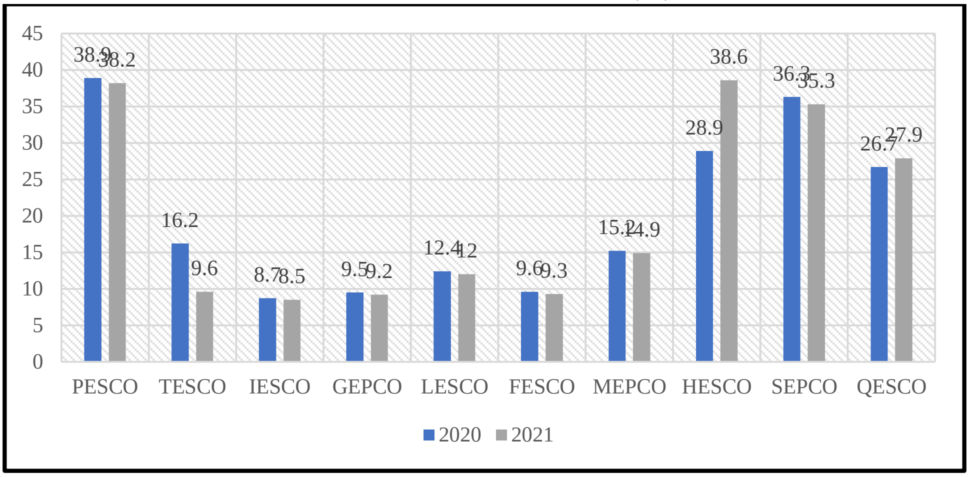
In FY2021 almost a fifth of the electricity generated in the country was lost in the transmission and distribution (T&D) network (including K-Electric losses). There is an enormous variation in performance across state-owned distribution companies (Chart 1).

On the other side, when a certain percentage of these losses are not accounted for in tariffs, it adds to the circular debt as it is not compensated by tariff differential subsidy. NEPRA is using this T&D target as a tool to improve the operational performance of distribution companies. However, this strategy is not working for most of the DISCOs. There is no penalty associated with utility mismanagement which leads to operational inefficiency.

---

* It was earlier published as PIDE Knowledge Brief, 2022:40.

Chart 1. Distribution Losses (%)



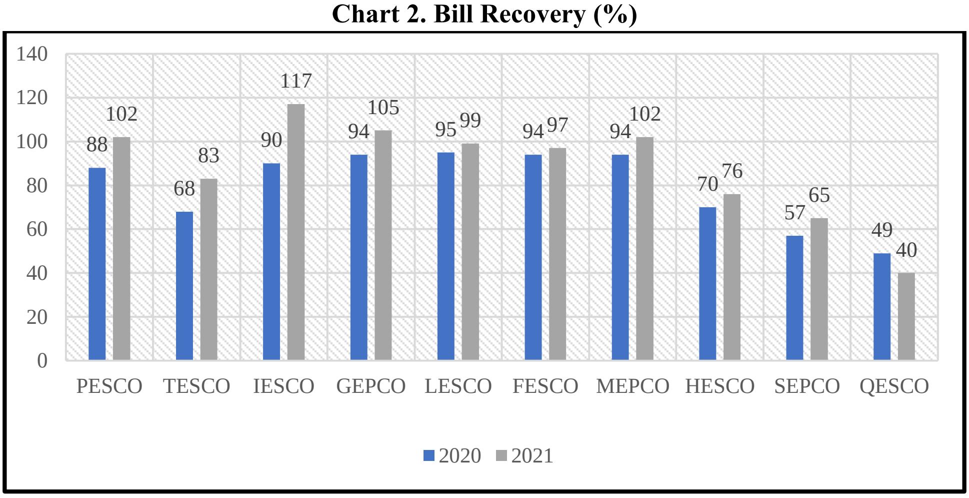
Source: NEPRA State of Industry Report, 2021.

(b) *Commercial Efficiency*

The revenue collection rates in distribution companies range from 40 percent in QESCO to 117 percent in IESCO in FY2021 (Chart 2). On average recovery percentage of all DISCOs was around 97 percent in FY 2021, despite more than 100 percent collection in IESCO, PESCO and GEPCO. With the same collection rate for other DISCOs, the average may not remain the same in the next year. For instance, bill recovery of 117 percent in IESCO is due to a one-time deposit of AJK arrears by the Government of Pakistan. Otherwise, the actual recovery in IESCO in FY2021 was roughly 89 percent.

Generally, the distribution companies with high system losses also suffer from low recoveries of the billed amount. In other words, in geographical areas where there are more leakages via fraud (meter tampering), stealing (illegal connections), and billing irregularities; there is also less willingness to pay for the power consumed.

Chart 2. Bill Recovery (%)



Source: NEPRA State of Industry Report, 2021.

Despite a significant improvement in bill recoveries in FY2021, the receivables from DISCOs in FY2021 increased by Rs. 63.7 billion, which accumulated as circular debt (NEPRA, 2021).

(c) *Unreliable Supplies*

Despite the increase in the installed capacity, in the reliability of electricity supply, Pakistan is still ranked 99 out of 141 economies in the Global Competitiveness ranking of 2019. According to Rule 4 (a) of Performance Standards (Distribution) Rules 2005, a distribution company shall ensure that the System Average Interruption Frequency Index (SAIFI) does not exceed 13 and System Average Duration Index (SAIDI) does not exceed 14. Except for IESCO, none of the DISCO satisfies this criterion (Table 1)[35].

Instead of correcting for their failures in minimising inefficiencies, DISCOs have adopted a policy of revenue-based load-shedding. The low cost and uninterrupted supply of power (solar) is taking compliant consumers away from DISCOs (NEPRA, 2020). If this trend continues, it will be another big challenge for the cash-starved DISCOs.

Table 1
SAIFI and SAIDI in FY 2020

	PESCO	IESCO	GEPCO	LESCO	FESCO	MEPCO	HESCO	SEPCO	QESCO	K-El.
SAIFI	187.93	0.06	25.64	33.03	35.65	375.98	162.85	478	99.12	27.56
SAIDI	14924.40	1.36	42.40	3593.73	1331.10	31920.87	9751	4095	8375.85	2655

Source: NEPRA Performance Evaluation Report_ Distribution Companies, 2019-20.

CORPORATE GOVERNANCE

Corporate governance defines the rights and responsibilities of a board, managers, shareholders, and other stakeholders. It outlines rules and procedures for making decisions (Haque and Hussain, 2021). Corporate governance of the utility_ private or state-owned is crucial for its effective operations. Its mechanisms such as monitoring, board of directors and executive plans are significant (Gunay, 2016). Developing any state-owned company as a modern corporate entity may help improve its proficiency via regular monitoring and accountability of its managers, transparent information, and a decrease in political interference in its matters (Vagliasindi, 2008). The autonomy and capability of board members are vital.

DISCOs lack technical and managerial skills to operate independently[36]. The structure of these companies based on corporate governance principles has not been established. Poor corporate governance is the main reason behind the poor technical and financial performance of DISCOs. Zhang (2019) finds significant potential to reduce losses through better management in DISCOs in Pakistan.

Weak administrative performance in DISCOs is due to centralised control. All of the ten DISCOs are under the administrative control of the Ministry of Energy (Power Division). There is no incentive to improve performance as there is no penalty associated with weak performance. Not only there is an absence of transparency in investment decisions, but no merit-based staff performance evaluation and promotion. Promotions are based on seniority. All decisions about finance, employment and pricing are not without government (political) intervention.

[35] SAIFI and SAIDI are the least focused areas in NEPRA priorities.

[36] As reported by Former MD PEPCO, in PIDE webinar on "Reforming Electricity Distribution Companies".

Table 2

International Experience

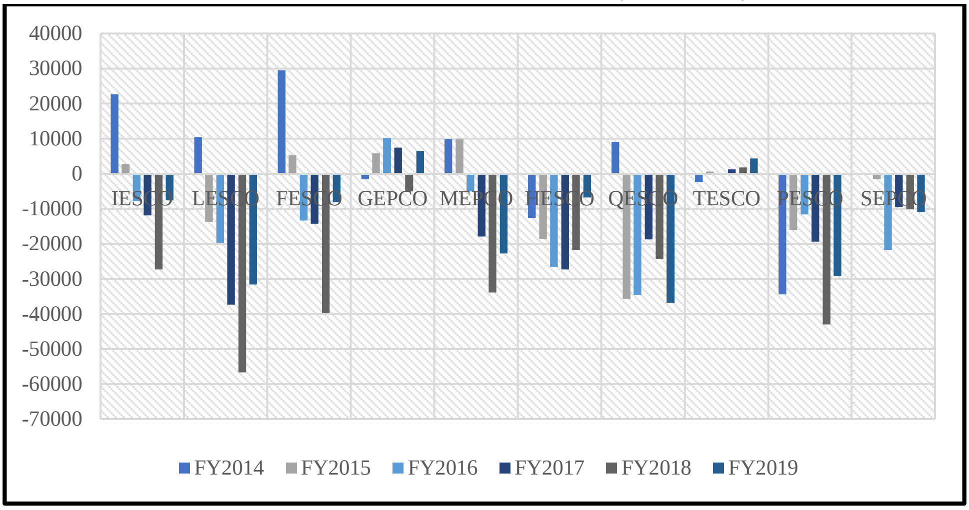
Study	Main Inference
Srivastava and Kathuria (2020)	Improvement in corporate governance even in state-owned utilities in India found significant for improving their financial and operational performance.
Sheveleva (2018)	Board membership balance is an objective requirement for corporate governance that affects its positive perception by the investor in the Russian conditions.
Fremeth and Holburn (2018)	Boards of directors play a central role in the governance of local electricity distribution companies (LDCs), monitoring organisational performance and risk, and guiding long-term strategy in Ontario, Canada.
Liu et al. (2015)	Independent directors have an overall positive effect on firm operating performance in China.
Wei (2007)	State-owned shareholdings have negative impacts on company performance. Even a relatively small shareholding of non-state-owned have a positive effect on company performance.
Dube and Jaiswal (2015)	Independent directors played a significant role in increasing the market size, profitability, and sustainability reporting of the companies in India.
Castro et al (2010)	The corporate governance practices adopted by electricity sector companies (public and private) in Brazil contributed to improved performance on the stock market and to attract finance for their development needs.
Irwin and Yamamoto (2004)	Improved corporate governance reduces political capacity to use utilities for their political gains. State-owned utilities with company laws, transparency in their operations/ decisions, commercial culture through the appointment of independent directors from successful businesses and listing of shares (even small) may help improve performance.

Financial Performance and Business Model

Between FY2015 to FY2019, total assets of DISCOS have increased by 7.5 percent. A maximum increase was recorded in LESCO, almost 12 percent. The asset base of these ten state-owned distribution companies was roughly Rs 2 trillion in FY2019, equivalent to about 5 percent of current GDP in the same year. However, the involvement of these DISCOs in the stock business is zero, as none of them is a listed company. Except for IESCO, in all DISCOs, either Government of Pakistan or WAPDA is a 100 percent shareholder. In IESCO, 12 percent of shares belong to Employee Trust Fund since FY2014-15 (transferred under Benazir Employees Stock Option Scheme) previously owned by WAPDA (Table 3).

There is no business model followed in these companies. The level of strategic planning and business model is evident in Chart 3. These companies on average recorded a net loss of Rs 143 billion in FY2019. The net loss has increased by 18 percent in the last five years. A corporate governance system guides and operate companies to yield high financial performance (MacMillan and Downing, 1999). Unfortunately, it is missing in DISCOs.

Chart 3. Net Profit/ Loss after Tax (Rs Million)



Source: Federal Footprint, State-owned Entities (SOE) Performance Review, Various Years.

Board of Directors

According to SECP Public Sector Companies (Corporate Governance) Rules, 2013, it is mandatory for each company to have independent directors_ 40 percent of its total members. On paper, each of these DISCOs has independent board members, but with limited authority to make decisions[37].

As per the Companies Act 2017 and SECP Public Sector Companies (Corporate Governance) Rules, 2013, it is the prerogative of the government to appoint a Board of Directors (BOD) after satisfying the 'Fit and Proper Criteria'. But in the appointment of DISCO board members, rules are generally not followed. Political interference in board appointments is also common.

For instance, in the last seven months, new boards have been appointed in all the ten DISCOS. As reported in newspapers, in the selection process, the Power Division relied on their enlistment as Independent Directors with the Pakistan Institute of Corporate Governance (PICG), their CVs and an affidavit from each proposed nominee that they fulfil the 'Fit and Proper Criteria' as required under the law and rules. While going through the profile[38] of these independent directors, wherever available, we find that the actual practice is different from what was stated in papers.

Some facts on current boards are below:

- Until the recent past, except for TESCO, each DISCO had its BOD with independent directors. Now it is decided that the PESCO BOD will also function as the TESCO BOD.

[37] These companies are under full government control; board and management positions at DISCOs are held either by government employees or political appointees with limited experience. Officials sitting on multiple energy boards aggravate this issue.

[38] As of September 6, 2021, a detailed profile of GEPCO, HESCO, SEPCO, QESCO and MEPCO board members is not available. Only names are posted. As per law, the companies are required to publish these details in their annual reports. But publishing Annual reports is not a practice in the majority of these DISCOs.

- Each DISCO has 4 or more independent directors.
- Out of the total 40 independent directors, only 3 are PICG certified directors[39].
- Out of the 10 appointed chairmen, none of them is a PICG certified director. At least five of them are ex-employees of a privatised distribution company, K-electric. Others include a professor, a general manager of a manufacturing company, an ex-employee of hydro IPP and a power sector consultant[40].
- In the selection of independent directors, the focus seems to be on those with K-electric experience. Including chairmen, in total, ten independent directors remained affiliated with K-electric, in various capacities. In addition, consultants (energy or otherwise) are given preference in the selection[41].
- In each board, there is civil society representation (2 to 3 members).
- 11 Directors are on the board of 2 DISCOs and one of them is on 3 boards.
- Board chairman is *appointed* against the Corporate Governance rules, 2013 which states, that the chairman to be *elected* by the Board *to achieve an appropriate balance of power, increasing accountability, and improving the Board's capacity to exercise independent judgement*; but in these DISCOs, the chairman is appointed by the government.
- CEO is appointed by the government against rules, which state, CEO is to be appointed by the board. Besides, as informed by various utilities, all major decision-making remained with the government. As is obvious from the minutes of the board meetings[42], the meetings only discuss human resource related issues.

Table 3

Governance Profile of State-Owned DISCOs

	Independent Directors**	Ex-officio/ Non-executive Directors	Change in CEOs since 2016	Shareholding
FESCO	5	2	4	100%Govt.
HESCO	8	3	5	100%WAPDA
QESCO	5	1	3**	100%WAPDA
TESCO	4	4	4	100%WAPDA
PESCO	4	4	4	100%WAPDA
LESCO	6	3	5	100%Govt
IESCO	7	3	5	88%WAPDA; 12% others
GEPCO	5	5	4	99% Govt; 1%others
MEPCO	7	2	4	100%WAPDA
SEPCO	7	NA	3	100%WAPDA

Source: Financial Footprint: SOE Annual Report 2018-19, Ministry of Finance, Government of Pakistan; and official websites of these companies. * Independent directors excluding chairman and company secretary, ** current information not available, different information in different source.

[39] Apart from the personal affiliations of selectors, the fee they are paid (meeting attendance fee) could be the reason for not finding truly independent professionals to be on DISCO boards. The director fee is an issue in companies other than the power sector as well (Ameer, 2013).

[40] The identity of the QESCO board chairman is not clear.

[41] As reported in newspapers, the reliance on K-electric employees is to prepare for future privatisation of these companies.

[42] This information is extracted from newspaper clippings, studies, informal discussions with some DISCO officials etc.

Transparency

Transparency is one of the basic principles to ensure a sound governance framework in any organisation or company_ in the public sector and in the private sector. Transparency is only possible when information on commercial and non-commercial operations and financial results are timely available for evaluation, not only to the government but to the public as well.

- Among the ten DISCOs, except for FESCO, MEPCO and IESCO, none of them publishes its Annual Company Report. Even the latest that is available for MEPCO and FESCO is for 2019 and for IESCO it is for 2013.
- The latest financial statement (FY2020) is publicly available only for IESCO, FESCO, MEPCO and GEPCO. For the rest of the DISCOs, a publicly available financial statement is two to four years old.
- Only MEPCO publishes details of its board meetings in its Annual Report, that is number of meetings etc. It is the only DISCO, with minutes of meetings posted on its website.
- Each DISCO has a website, but with limited information on corporate matters.
- Each DISCO does post names of directors on their websites, but as of September 08, 2021, only IESCO, LESCO, FESCO, PESCO have shared profiles of their board members.

Monitoring and Accountability

Another principle of good corporate governance is accountability. Accountability can be ensured when managerial performance and the role of independent boards are evaluated by parliament, public and the shareholders. But in the case of DISCOs, none of these is listed on any stock exchange of Pakistan, therefore, no accountability by shareholders. The boards have never been empowered to take decisions. At the same time, they are not held accountable. This trait is common in other Pakistani companies_ the board of directors do not consider them accountable for what they do (Aziz, et al. (2019).

CEOs have changed quite frequently in these DISCOs (Table 3) randomly and not for the sake of accountability[43]. For instance, recently appointed CEO at IESCO, previously served at PESCO. PESCO performance is evident in Chart 1 to Chart 3 and in Table 1 and Table 2.

Cash injections by the successive government have impeded the efforts of power companies to improve their governance, efficiencies and reduce their losses. Whenever the power companies face problems, the government extends financial help either through subsidies or by increasing tariffs, resulting in more inefficiencies. Lack of expertise in the form of financial and commercial skills is a serious impediment in the way of accountability, quick decision-making, and commercial orientation. Defaults are now a routine matter.

WAY FORWARD

NEPRA has approved the detailed design and implementation plan of Competitive Trading Bilateral Contract Market (CTBCM) of electricity, to be implemented in a year. The model envisages that all the future contracts for the sale/purchase of electricity will be

[43] CEOs are normally appointed when they are about to retire.

bilateral between the parties, that is, sellers (generation companies) and buyers (distribution companies or bulk power consumers). But for a competitive electricity market, we need an efficient and financially viable distribution sector first—where a well-developed corporate governance system could be the solution.

- Outright privatisation may not be a solution. It might increase the financial burden of the government.
- Mandate listing of DISCOs in the stock exchange and appoint principal shareholders on the board.
- Sell a certain percentage of shares to DISCO employees and give them representation on the board.
- Facilitate a corporate culture in DISCOs with a viable business model as also envisaged in the National electricity policy 2021. Each company needs its business model based on its domestic market conditions.
- An independent/ apolitical board with professional directors (power sector specialists) with sufficient capabilities to develop a business model. It should be mandatory for the power sector professionals to get trained from an institute like PICG to qualify as independent directors. Once these directors are appointed, they must have the power to take decisions. In addition, hold them accountable for their decisions.
- For increasing transparency and accountability, a well-designed website of each authority. Minutes of each board meeting or at least major decisions should be publicly available. Their annual reports, as well as financial statements, should be timely available for public scrutiny.
- There should not be any conflict of interest for the government as owner as well as a policymaker. The government should only be a facilitator; and can play its role by improving the business environment via enforcing contracts, improving laws, and simplifying tax administration.
- Professional and competitive management who have a clear corporate vision and business plans for organising the utility on commercial lines. These professionals must have the capacity to develop a comprehensive revenue collection and theft prevention program in their respective companies.

REFERENCES

Aziz, M., Gondal, Z. H. and Ali, S. (2019). Problem Relating to Corporate Governance in Pakistan. Research Advances in Social Sciences Journal, 6 (6), 353-358.

Castro, N. J., Soares, I., Rosentel, R. and Sellare A. J (2010) Impact of Corporate Governance on Companies in Brazil's Electricity Sector. TDSE No 24, GESEL, Institute de Economia.

Dube, I. and Jaiswal, N. (2015) Corporate Governance in the Energy Sector. *Journal Global Law Review*, 6 (2), 143-178.

Fremeth, A. R. and Holburn, G. L. F. (2018) Corporate Governance of Publicly-Owned Electric Utilities: Survey Evidence from Ontario's Municipally Owned Distribution Companies. Ivey Business School University of Western Ontario, Canada.

Gassner, K., Popov, A., & Pushak, N. (2009). Does Private Sector Participation Improve Performance in Electricity and Water Distribution? Trends and Policy Options No. 6, Public-Private Infrastructure Advisory Facility, The World Bank, Washington D.C.

Gunay, G. Y. (2016). The Test of Corporate Governance System in Electricity Utilities Industry. *Journal of Management and Sustainability*, 6(1), 132-140.

Haque, N. and Hussain, A. (2021) A Small Club: Distribution, Power, and Networks in Financial Markets of Pakistan. PIDE Working Paper 2021: 3.

Irwin, T and Yamamoto, C. (2004). Some Options for Improving the Governance of State-Owned Electricity Utilities. Energy and Mining Sector Board Discussion Paper Series No. 11, The World Bank, Washington D.C.

Liu, Y., Miktkor, M.K., Wei, Z., and Yang T. (2015) Board Independence and Firm Performance in China. *Journal of Corporate Governance*, 35, 223-244.

MacMillan, K. and Downing, S. (1999) Governance and Performance: Goodwill Hunting. *Journal of General Management*, https://doi.org/10.1177/030630709902400302

Malik, A. (2020) Circular Debt: an Unfortunate Misnomer, PIDE Working Paper Series 2020: 20.

Sheveleva, G. I. (2018) Corporate Governance in Russian electric power industry in terms of consumer requirements to its funding sources. https://doi.org/10.1051/e3sconf/20185802004

Srivastava, G., and Kathuria V. (2020). Impact of corporate governance norms on the performance of Indian utilities. *Energy Policy*, 140, https://doi.org/10.1016/j.enpol.2020.111414

Vagliasindi, M. (2008). Governance Arrangements for State Owned Enterprises. Policy Research Working Paper 4542, The World Bank, Washington D.C.

Wei, G. (2007) Ownership Structure, Corporate Governance and Company Performance in China. *Asia Pacific Business Review*, 13 (4), 519-545.

Zhang, F. (2019). In the Dark: How much Power Sector Distortion Costs South Asia? South Asia Development Forum, International Bank for Reconstruction and Development, The World Bank, Washington, D.C.

Privatisation of Electricity Distribution Companies—A Way Forward? *

AFIA MALIK

INTRODUCTION

The private sector has long been promoted as a solution to the service delivery gap and to overcome financial constraints faced by the developing countries. The general belief is that state-owned utilities have no incentive to improve (Estrin and Pelletier, 2018). Political pressures and rent-seeking activities do not allow them to operate efficiently. The recruitment of managerial staff is under political pressure rather than merit, thus compromising management efficiency in the distribution utility. Therefore, the expectation is that the private management/ ownership with the profit motive will lead to efficiency gains and cost savings, besides improving service delivery (Scott and Seth, 2013).

Box 1. Why Privatise Distribution Utilities?

(i) To expand distribution capacity through increased investments.
(ii) To improve operational and financial performance of distribution systems, which is operating poorly under state ownership; and above all.
(iii) To minimise public sector budgetary constraints and expand revenues by divesting state owned (distribution) companies.

PRIVATISATION EXPERIENCE IN ELECTRICITY UTILITIES

Privatisation of electricity utilities was one of the components of energy reforms of the 1980s and early 1990s. The origin of this reform effort can be traced back to 1937 in the 'Wealth of Nations" by Adam Smith, then later by Milton Friedman in 1955. Yet, private sector control of electricity distribution was not common before energy sector reforms of the late 1980s and early 1990s, even in developed countries. After these reforms, many developing countries like developed countries also opened their electricity utilities to the private sector. In most cases, it was for expanding generation capacities. Privatisation of state-owned utilities was an effort towards a free-market economy.

Under energy reform programs, several countries in Latin America and the Caribbean, Europe, Asia, and Sub-Saharan Africa attracted private capital to the power distribution sector as well. The speed of private participation in electricity

* It was earlier published as PIDE Knowledge Brief, 2022:52.

distribution dropped after 2000. Exceptions were Brazil, Bulgaria, India, Russia and Turkey, private transactions in these countries account for about 60 percent (Vlahinić-Dizdarević, 2011; ESMAP, 2015; Pudney, 2018; and Foster and Rana, 2019).

In early reforming developing countries, the most successful (privatisation of distribution companies) were only middle-income countries with large urban centers. These countries had stable governments and political motivation to get rid of a system of subsidised tariffs at the time of the privatisation decision. Above all, successful privatisation in these countries was due to a competent regulatory framework in the electricity sector. In other countries or cases, private participation/ privatisation in distribution utilities had remained challenging. Most of the documented cancellations took place after almost five years; either through re-nationalisation by the government or by private operators_ who dissatisfied with contractual conditions left willingly (Izaguirre, 1998; Victor et al., 2015; Alkhuzam et al., 2018; and Foster and Rana, 2019).

Box 2. Privatisation Failure—Examples

Ukraine successfully privatised its five distribution companies in 1998. However, the privatisation of six more distribution companies between 2001 and 2004 faced corruption allegations. The lack of effective regulatory frameworks and governance structures did not allow the sector to solve its critical issues. Consequently, the privatisation process ceased.

In Sub-Saharan Africa, about 30 percent of the contracts get cancelled (i.e., reversed back to the state control).

In absolute terms, maximum cancellations (almost half of the total cancellations) took place in Latin America. The Dominican Republic was one of the first countries to renationalise two distribution utilities in 2003. Other countries followed.

In terms of total transactions, in Latin America, only 2 percent of regional transactions got cancelled or reversed. Whereas, in Sub-Saharan Africa, cancellation affected only 7 cases, 22 percent of transactions in the region.

Europe and Central Asia also witnessed a few cancellations of privatised distribution utilities.

Indian privatised distribution company in the state of Odisha also faced difficulties and was renationalised.

Source: Foster and Rana (2019) & Hall, et al. (2005).

PRIVATISATION CHALLENGES

Preference for Large Urban Centres

Evidence suggests privatisation of only selected areas and not the entire distribution sector. Even among the middle-income countries (opting for privatisation), very few privatised all their distribution companies. The private utilities provide services to large commercial centres, and the rest of the country is served by state-owned distribution utilities. For instance, the Philippines has privatised its urban distribution utilities, whereas cooperatives are providing electricity in rural areas (ESMAP, 2015). In Colombia, the strong municipal presence in the electricity sector led to a hybrid approach_ where only a few urban distribution companies got privatised, while others remained under municipal control (Foster and Rana, 2019).

The decision to privatise depends on the commercial feasibility of the service areas and the local political environment. The private sector preferred large cities with more commercial and industrial demand. By privatising revenue-generating urban areas rather than rural areas with more issues reflect the mendacity of governments in solving power sector issues (Etieyibo, 2011 and Srijan, 2009)[44].

Weak Legal and Institutional Environment

Electricity distribution services by their nature demonstrate natural monopoly characteristics and feature significantly in the political and social discourse of governments across the globe. Privatisation of this utility is not an easy task, especially in developing countries, given their weak legal and institutional environments (Gassner et al., 2009). Similarly, political interference, lack of transparent decisions and corruption prevalent in developing countries do not allow the power reforms to succeed. The motive behind privatisation is important (Victor et al., 2015).

In a privatised monopoly, transparency is also an issue. In a public company, it is easier to oversee the operations of a public asset via numerous regulations under which public agencies operate. After privatisation, this transparency in operations reduces (Schoenberg, 2006).

Over-staffing in State-owned Utilities

In developing countries overstaffing in distribution companies is prevalent. It’s easier for the privatised utility to target employees rather than improving bill collection or distribution losses. Downsising cut costs quickly without enormous investments. Therefore, from an employee’s perspective, privatisation is not a popular decision (Abbasi, 2012).

Evidence also suggests that the cost of over-staffing is less than other inefficiencies in the distribution systems of the developing countries. In Sub-Saharan Africa, overstaffing costs represented only 10 percent of the hidden costs of inefficiency, compared to 40 percent due to pricing challenges, 30 percent due to transmission & distribution losses, and 20 percent due to low recovery rates. Similarly, in the Middle East and North Africa region, excess staff accounted for only 5 percent of the hidden costs of inefficiency in the sector.

Weak Regulatory Environment

From a consumer’s perspective, privatisation involves higher (tariffs), with hardly any improvement in service delivery (Foster and Rana, 2019). To expand the network, i.e., increase the number of consumers, and improve service delivery, is not in the interest of private operators as it involves risk. To ensure such investments generally requires reliability targets fortified by a robust regulatory framework (Foster and Rana, 2019). Otherwise, the focus of private distribution utilities will only be to reduce costs through downsizing and increasing profits through tariff hikes (Pudney, 2018; and Foster and Rana, 2019).

[44] Cited from Victor, at al., 2015.

Privatisation of the electricity distribution sector tends to make a winner or loser among the relevant stakeholders. For balance, an effective and efficient regulatory setup is compulsory. Which, in most developing countries, is missing. The post-privatisation monitoring (regulatory) mechanism has remained weak in Pakistan. The evidence from past privatisations, not only in the power sector but in general, revealed violations of sale agreements by buyers. Privatisation has worked against the public interest (Tahir, 2014).

A well-informed regulatory framework is a key to improving utility efficiency. In particular, when the privatised operator is working in a monopoly environment. In the electricity sector, a proper regulatory framework and contract enforcement are necessary for a company to abide by its commitments (Berthélemy et al., 2004). In Pakistan, like most developing countries, weaknesses in the regulatory processes in the electricity sector is compromising the efficiency of both private and state-owned distribution utilities.

Importance of Contract

A contract is significant in any privatisation process. The contractual terms define which assets, rights, and limitations are to be transferred to the buyer and under what conditions. The clauses related to the_ quality of service, revenue or cost-sharing, penalties if one party does not live up to these clauses, must be outlined in the contract. The possible implications and remedial measures should be a part of these contracts (Schoenberg, 2006).

For electricity distribution companies, explicit contractual terms are needed to guarantee that private operators invest in the distribution infrastructure. Otherwise, their focus would be on profit enhancement through cost reduction. The objective of cost reduction does not require hefty investments compared to investments for infrastructure expansion and up-gradation for improving service reliability (Foster and Rana, 2019). The privatisation contracts require expertise, which may not exist in bureaucratic circles. Consequently, bureaucracy may end up in a wrong decision and sometimes reversal.

Managerial Expertise

The managerial experience of the bidder and the professional know-how of the company he is buying is significant for the transactions to be successful. In developing countries, this factor is often ignored. The highest bidder, irrespective of its managerial capacity and professional knowledge, ends up signing the contract. For instance, in Pakistan, in the engineering units privatised in the past, the buyers did not have the requisite managerial and professional experience. These engineering units were nationalised precisely for this lack of capacity. The highest bidder is not necessarily the best manager (Tahir, 2014).

Privatisation for the sake of Privatisation

The lesson drawn from the privatisation experience in the last three decades is (not only in electricity utilities but in other sectors), to privatise for the sake of privatisation, without a due thought process, can lead to a disaster. The chances of failure in public and private companies are the same (Tahir, 2014). In a survey of studies, Alkhuzam et al. (2018) find no significant evidence supporting private ownership of electricity distribution. There is evidence for an increase in profitability after privatisation, but no substantial evidence suggesting any efficiency gains, improvement in service quality, or tariff reduction.

The public sector has a social responsibility, while the aim for the private operator is to maximise profit. Society at large is an ultimate loser if both performs carelessly (Tahir, 2014). Service efficiency and reduction in tariffs for consumers can be ensured only through competition. Privatisation of a utility (monopoly) does not guarantee competition (Schoenberg, 2006).

PRIVATISING ELECTRICITY DISTRIBUTION IN PAKISTAN

The power sector in Pakistan traditionally was owned by two vertically integrated utilities—Water and Power Development Authority (WAPDA) and Karachi Electric Supply Corporation (KESC). The Government of Pakistan (GOP) prepared the strategic plan for restructuring the electricity sector to improve efficiency, service, and quality in 1992. The GOP unbundled WAPDA's vertically integrated Power Wing into separate generation, transmission, and distribution companies in 1998. The result was eight separate distribution companies called DISCOs (which later increased to ten). KESC remained vertically integrated.

In December 2005, the GOP privatised KESC and sold 73 per cent of its shares to Hassan Associates, Saudi Al-Jomaih Group of Companies and Kuwait's NIG; and charged a fee of US$ 264.90 million. The conglomerate guaranteed better services via professional management, new investment, technology, and employment benefits (Abbasi, 2012).

The privatisation of KESC (now K-Electric) was the first in a broader privatisation program for all distribution utilities. But the plan was later shelved because of the poor performance of K-Electric even after privatisation. In 2013, the privatisation of DISCOs again came under discussion as a solution to generate efficiency in the distribution sector. Privatisation of DISCOs was one of the main elements in the Circular Debt Mapping Plan 2015. The plan was to use the revenue generated through privatisation, for clearing circular debt. But again, the plan was shelved.

Now again, the incumbent government is all set to start the process of DISCOs privatisation. New boards have been appointed. As per the information available on the website of the Privatisation Commission, all state-owned distribution companies, irrespective of their financial and commercial performance, excluding TESCO, are the potential candidates for privatisation.

Privatisation of K-Electric

K-Electric (KE) is a large, vertically integrated utility that serves the commercial and industrial hub of the country, that is, Karachi. For KE, it was the year FY1996 when the situation worsened considerably. Net profit margin turns negative (-2.87 percent). After that, KE started facing net loss continually. The decision to privatise KE in 2005 was unwelcomed politically. The military government at that time bypassed routine procedures. Privatisation of K-El was viewed as illegal in political circles and got challenged in the courts (Foster and Rana, 2019).

The major problems faced by KE before privatisation were its poor financial management, governance structure, and operational and commercial inefficiency. However, even after privatisation, the situation remained unsatisfactory (Malik et al., 2009). In Karachi, unannounced load-shedding, frequent power breakdowns (with no one to register, respond to or resolve the complaints) with tariff hikes; created severe discontent among consumers.

KE was re-sold in 2009. After the change in management, the situation, in terms of commercial and operational efficiency, started improving. Meanwhile, the average tariffs have increased by more than 200 percent between FY2009 and FY2021. Its staff, who tried to collect outstanding bills or check on power theft, faced violence in several Karachi neighborhoods' (Malik and Khawaja, 2021) apart from public protests. Even sixteen years later, the privatisation of K-Electric remains an issue under discussion.

As of now, the utility has improved its performance partially in terms of service delivery. However, the utility is facing constraints in capital investments due to regulated tariffs, despite being privatised (Malik and Khawaja, 2021). From the consumer perspective, electricity tariff is high in KE areas compared to service improvement. At the same time, it is important to point out that the urban environment in which KE is working is not resilient to allow resilient electricity services to its consumers (Malik and Khawaja, 2021).

In addition to contractual obligations, it is the job of the regulatory authority to set and enforce reliability targets and allow for tariff-based compensation accordingly to the privatised electricity distribution company. Perhaps, these are the missing links in the case of Karachi KE.

DISCO Challenges

As far as operational and commercial efficiency is concerned, KE and DISCOs are close. In fact, some of the DISCOs are more efficient commercially and operationally than KE (Malik, 2020). According to Zhang (2019), the disparity in the operational and commercial efficiency among DISCOs in Pakistan could be due to differences in their managerial capacity. DISCOs lack technical and managerial skills to operate independently. They also are not allowed to do so. The structure of these companies based on corporate governance principles has not been established in a true sense. Decisions about finance, employment and pricing are not without government (political) intervention (Malik, 2021).

The challenges faced by DISCOs are enormous, which their privatisation may not resolve. But unfortunately, policymakers at the behest of donor organisations are all for the privatisation of DISCOs without realising ground realities and their repercussions. PIDE's research on urban resilience and its impact on electricity services has highlighted the importance of the urban environment under which electricity utility (private or public owned) operates. Socio-economic dynamics of the city, city governance and politics, and environment, all play a role in the (private or public) utility's efficient performance (Malik and Khawaja, 2021). A single solution cannot be applied across the board.

City dynamics could be one of the reasons that better corporate governance in KE[45] has not translated into its improved performance. Some of the DISCOs, e.g., those operating in Islamabad, Faisalabad, and Gujranwala, are performing better than KE. If corporate governance in these DISCOs improve, they would be far better than any privatised utility.

---

[45] Bacon (2019) finds better corporate governance in K-Electric as compared to other distribution companies.

CONCLUSION

The experience across countries suggests that *it's not the ownership that matter but better management and good corporate governance. Meanwhile, the management performs best in the presence of an effective regulatory framework with incentives/ penalties, and supportive city dynamics and governance systems.*

For improving the electricity distribution sector in Pakistan, the focus now should shift from the question of ownership—private or public. Privatisation may have some benefits, like better corporate governance leading to improved financial performance. But there are costs too. The privatised utility chooses the easy path of downsising its employees to minimise costs; instead of investing in infrastructure to improve operational efficiency and better service delivery. Above all, successful privatisation demands the technical and financial capacity to make a privatisation contract. *Past privatisation experience in Pakistan suggests the incapacity of our bureaucracy in making a business agreement and its implementation.*

Tahir (2014) explored an overall privatisation experience from 1988 to 2014. He finds mixed results on privatisation decisions in the study period. Quite a few privatisation contracts were challenged in courts. Lack of transparency in these decisions also raised questions. Besides, the author noted that contrary to what was expected, public resources from loss-making SOEs privatised did not lead to an increase in development expenditure in the social sector. Nor there was any reduction in public debt. "In addition to economic and social costs, there are important political costs associated with the privatisation programs. The mantra of the autonomy of the state from the elites was a mirage. Effectively, it meant relative autonomy from the interests of workers and ordinary consumers. Economic policymaking continued to be a matter of rent-seeking between contending interests. In this context, privatisation was privatisation of state assets for the private parties by the private parties" (Tahir, 2014, p. 20).

It's the competition that leads to efficiency. Privatisation of a monopoly does not necessarily promote efficiency and competition. Therefore, the myopic focus on privatisation of DISCOs as the ultimate solution to distribution ills should give way to improving its management by appointing independent boards and professional managers. Focus on strengthening the corporate governance_ managerial practices of state-owned distribution companies, targeting financial discipline (Malik, 2021). As Tahir (2014) has cited Stiglitz "the theoretical case for privatisation is at best weak or non-existent."

The future strategy for each state-owned company needs to be thoroughly grounded in the political, economic, social, environmental, and urban governance realities of its service area. The same strategy cannot be applied to every distribution company, as each is working in a different environment. Secondly, for better administration of these companies, it is better to divide them into smaller units. Private sector participation in distribution can be considered only when enabling conditions are met, and after a debate policy debate with all the stakeholders for political acceptance of the decision.

Not only in the backdrop of privatisation failures but a technological advancement in industrialised countries is leading to a change in policy direction. Returning energy infrastructure assets into public ownership back is part of a movement of consumer empowerment in electricity services in developed countries. For instance, in Germany between 2007 and 2015, 234 municipalities withdrew concessions of electricity and gas networks from their previously private operators[46]. In Pakistan, we are still finding solutions in privatisations of public assets.

REFERENCES

Abbasi, A. H. (2012). *Pakistan Power Sector Outlook: Appraisal of KESC in Post Privatisation Period*. Sustainable Development Policy Institute (SDPI), Pakistan.

Alkhuzam, A. F., Arlet, J., & Rocha, S. L. (2018). Private versus Public Electricity Distribution Utilities: Are Outcome Different for End-users? Retrieved from https://blogs.worldbank.org/developmenttalk/private-versus-public-electricity-distribution-utilities-are-outcomes-different-end-users

ESMAP (2015). Private Sector Participation in Electricity Transmission and Distribution: Experiences from Brazil, Peru, the Philippines, and Turkey. *ESMAP Knowledge Series 023/15*, Energy Sector Management Assistance Program, The World Bank, Washington D.C.

Estrin, S. and Pelletier, A. (2018). Privatisation in Developing Countries: What are the Lessons of Recent Experience? *Research Observer*, 33(1), 65-102.

Foster, V. and Rana, A. (2019). Rethinking power Sector Reform in the Developing World. *Sustainable Infrastructure Series*, The World Bank, Washington D.C.

Gassner, K., Popov, A., & Pushak, N. (2009). Does Private Sector Participation Improve Performance in Electricity and Water Distribution? *Trends and Policy Options No. 6*, Public-Private Infrastructure Advisory Facility, The World Bank, Washington D.C.

Gómez-Ibáñez, J. (2007). Alternatives to Infrastructure Privatisation Revisited: Public Enterprise Reform from the 1960s to the 1980s. *Policy Research Working Paper No. 4391*, The World Bank, Washington D.C.

Gunay, G. Y. (2016). The Test of Corporate Governance System in Electricity Utilities Industry. *Journal of Management and Sustainability*, Vol. 6(1), 132-140.

https://www.researchgate.net/publication/236121975_The_Effects_of_Privatization_in_Electricity_Sector_The_Case_of_Southeast_European_Countries.

Irwin, T and Yamamoto, C. (2004). Some Options for Improving the Governance of State-Owned Electricity Utilities. *Energy and Mining Sector Board Discussion Paper Series No. 11*, The World Bank, Washington D.C.

Izaguirre, A. K. (1998). Private Participation in the Electricity Sector_ Recent Trends. *Public Policy for the Private Sector, Note No. 154*. The World Bank Group for Finance, Private Sector and the Infrastructure Network, The World Bank, Washington D.C.

Malik, A. (2020). Circular Debt: An Unfortunate Misnomer", *PIDE Working Paper Series 2020: 20.*

Malik, A. and Khawaja, I. (2021) Urban resilience and Its Impact on Electricity Provision in Karachi, Islamabad, and Peshawar" *PIDE Urban Monograph Series*, Pakistan Institute of Development Economics (PIDE), 2021.

Malik, A. (2021) Corporate Governance in the State-owned Electricity Distribution Companies" *PIDE Knowledge Brief*, 2021:40.

[46] https://www.renewableenergyworld.com/baseload/the-failure-of-privatization-in-the-energy-sector-and-why-todays-consumers-are-reclaiming-power/#gref

Malik, A., Mahmood, M. A., & Ahmad, A. (2009). Power Sector Reforms in Pakistan: A Critical Review. *Middle East Business and Economic Review*, 21(2), 1-29.

Schoenberg, J. M. (2006) Government Privatisation: History, Examples, and Issues. Available at https://cgfa.ilga.gov/Upload/2006Gov_Privatization_Rprt.pdf

Vlahinić-Dizdarević, N. (2011). The Effects of Privatisation in Electricity Sector: The Case of Southeast European Countries. Retrieved from

Pardina, M. R. and Schiro, J. (2018). Taking Stock of Economic Regulation of Power Utilities in Developing Countries: A literature Review. *Policy Research Working Paper 8461*, The World Bank, Washington D.C.

Pudney, D. (2018). Benefits of Privatising the Electricity Distribution Sector. Retrieved from https://www.ee.co.za/article/privatisation-of-electricity-utilities-can-improve-financial-viability-customer-service.html

Scott, A. and Seth, P. (2013). The Political Economy of Electricity Distribution in Developing Countries: A Review of the Literature. Retrieved from https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/8332.pdf

Tahir, P. (2014) Economic and Social Consequences of Privatisation in Pakistan. Economy of Tomorrow, Friedrich Ebert Stiftung.

Victor, O.E., Aziz, N. A., & Jaffar, A. R. (2015). Privatisation of Electricity Service Delivery in Developing Nations: Issues and Challenges. *International Journal of Built, Environment and Sustainability*, 2(3), 202-210.

Zhang, F. (2019). *In the Dark: How much Power Sector Distortion Costs South Asia?* South Asia Development Forum, International Bank for Reconstruction and Development, The World Bank, Washington, D.C.vi

Electricity Tariff Design: A Survey*

AFIA MALIK and AMENA UROOJ

INTRODUCTION

In a perfectly competitive market, electricity is priced at the Marginal Cost (MC); MC pricing guarantees economic efficiency (Gunatilake, et al., 2008). In other words, efficient electricity tariffs consider all power supply costs. To a great degree, it also accounts for capital investments for future expansion and up-gradation (Kojima, et al., 2014). In a free market, market forces of demand and supply pushed for MC recovery.

In contrast, for a regulated market, the regulator sets the tariff according to the costs and reasonable return determined through the regulatory process. The regulator followed pre-determined guidelines, parameters, and standards set by the government; it may or may not be MC pricing. When a regulated tariff is set at a low level, it distorts the development/ functioning of the market at both the wholesale and retail levels.

"If regulated end-user prices are not in line with wholesale market conditions, suppliers without significant low-cost generation capacity or equivalent long-term contracts will not be able to make competitive offers that will allow them to recover their costs. Consequently, with a limited number of suppliers, there will be no development of the wholesale markets. Liquidity will remain at a low level. As a result, neither the wholesale nor retail markets will be competitive" (Cited from Suzzoni, 2009, p. 5)

The electricity tariff includes the operating and maintenance costs involved in generating, transmitting, and distributing electricity and a return on investment for a company engaged in these activities. Besides, it considers subsidies, surcharges, or taxes as per government policy, especially in the case of regulated tariffs.

This survey presents different electricity tariff structures and designs across countries. It heavily relies on regional and global surveys (Foster and Witte, 2020; AfDB-ERERA, 2019; and INNOGATE, 2015)47. On top, it reflects on Pakistan's electricity tariff structure, identifies loopholes, and suggests a way to improve them.

---

* It was published in The Pakistan Development Review, 61(4).

[47] The information is mainly drawn from these studies, otherwise cited.

ELECTRICITY TARIFF CATEGORIES

Box 1. Tariff Categories

There are four types of volumetric tariffs:

Linear Tariff_ every unit consumed is charged the same rate.

Increasing Block Tariff (IBT)_ unit rate increases with an increase in successive bands/blocks of marginal consumption stepwise.

Decreasing Block Tariff (DBT)_ unit rate decreases with successive bands/ blocks of marginal consumption increasing stepwise.

Volume Differentiated Tariff (VDT)_ linear tariff increases (or decreases) if total monthly consumption crosses a specific volume limit; otherwise, a single linear rate is charged.

In some countries/ consumer categories, volumetric charges are accompanied by fixed load charges.

Fixed Load Charges_ capacity rather than the energy consumed determines fixed costs on the power system. These are linear load charges per KW.

Time-of-use Charges_ that apply multipliers to standard charges depending on consumption during peak or off-peak hours. These are linear but vary with time blocks.

Across the world, a volumetric tariff is applied—linear, and IBT structures are common (Table 1). ***Linear tariffs*** are generally applied to agricultural, commercial, and industrial consumers but are used less frequently for residential consumers, especially in developing countries. Load-based tariffs sometimes combine with other volumetric tariff structures in commercial and industrial schedules. For commercial and industrial customers, linear charges are modified by time-of-use factors and complemented with load-related fixed charges. Evidence suggests the simultaneous presence of various tariff designs in countries; variation is across sectors.

Tariffs with ***demand-based charges*** are more widely used for industrial and commercial and industrial customers but rarely exist for residential consumers and are more prevalent in high-income countries. In almost all countries where demand charges exist, these are linear load charges per kW.

Time-Based Rates are designed to reflect the real impact of the peak-hour load more accurately. It is designed to encourage customers to participate in reducing overall system costs or achieving other goals. Time-based rates (peak and off-peak) can provide more accurate price signals to customers, better reflecting the marginal cost of supplying and delivering electricity during specific day hours. These price signals may lead customers to change their consumption patterns to reduce peak and total consumption. It is common in industrial and commercial tariff schedules but rarely applied in residential tariff schedules.

In countries applying time-of-use blocks mainly consists of peak and off-peak hour blocks. Less common are broader divisions into day and night times and seasonal variation applied to those that do not use their facilities year-round (e.g., a cottage). Some of the modern utilities offer weekend /holiday rates to residential consumers. When time-of-use is practiced, unit charges during peak hours are almost double that of off-peak hours.

Table 1

Tariffs Followed Across Countries

Volumetric Tariff Types	Countries			Description
	Residential	Commercial	Industrial	
Linear Tariff	Germany, Chile, Czech Republic, Slovak Republic, Austria, Georgia, UK, Canada, Congo, US, Guatemala, Malawi, Niger, Nigeria, Rwanda, Solomon Islands, Turkey, Uganda	Algeria, Austria, Bangladesh, Benin, Burkina Faso, Cambodia, Chile, Congo, Côte d'Ivoire, Egypt, Germany, Greece, Guatemala, Guinea, Iran, Kenya, Korea, Kyrgyz, Lebanon, Madagascar, Malawi, Mali, Malaysia, Mongolia, Nepal, Nicaragua, Nigeria, Pakistan, Rwanda, Solomon Islands, Tanzania, Tunisia, Turkey, Uganda, Vanuatu, Venezuela, Yemen, Zambia, Zimbabwe	Algeria, Benin, Bolivia, Burkina Faso, Cambodia, Chile, Congo, Egypt, Ethiopia, Ghana, Guinea, Haiti, India, Iran, Jordan, Kenya, Kyrgyz, Lebanon, Madagascar, Malawi, Malaysia, Mongolia, Morocco, Mozambique, Nepal, Niger, Nigeria, Pakistan, Philippines, Rwanda, Senegal, Sierra Leone, Solomon Islands, Tanzania, Turkey, Uganda, Vanuatu Venezuela, Yemen, Zambia, Zimbabwe	Mostly developed Countries
Increasing Block Tariff (IBT)	Pakistan, India, Bangladesh, Philippines, Bhutan, China, Indonesia, Iran, Malaysia, Japan, Algeria, Guinea, Haiti, Honduras, Jordan, Benin, Bolivia, Burkina Faso, Burundi, Cambodia, Cameroon, Côte d'Ivoire, Egypt, Ethiopia, Ghana, Greece, Indonesia, Iran, Kenya, Korea, Kyrgyz, Lebanon, Madagascar, Malaysia, Mali, Mongolia, Morocco, Mozambique, Myanmar, Philippines, Senegal, Sierra Leone, Tanzania, Togo, Vanuatu, Yemen, Zambia, Zimbabwe	Bolivia, Cameroon, Ethiopia, Ghana, Haiti, Honduras, Indonesia, Jordan, Morocco, Mozambique, Philippines, Sierra Leone, Thailand, Togo	Thailand, Togo	Mostly Developing Countries
Decreasing Block Tariff (DBT)	Australia, Benin,	Australia		
Volume Differentiated Tariff (VDT) Fixed Load Charges	Sri Lanka, Nepal, Vietnam, Albania, Angola, Armenia, Nigeria, Sri Lanka, Venezuela	India	Armenia, Bangladesh	
Volume Differentiated Tariff (VDT)_Time-of-use Charges	Russia, Nepal, Thailand, Tunisia	Armenia, China	China, Côte d'Ivoire, Nicaragua	
Non-Linear Block Tariff	Nicaragua, Myanmar		Myanmar	

Source: Countries' electricity Tariff websites and Foster and Witte (2020).

Increasing Block Tariffs (IBTs) are commonly applied to residential customers. These are designed to provide a social safety cover where all consumers can access electricity at an affordable tariff, including low-end consumers. In this tariff design, a shortfall in revenue is recovered from high-end consumers. The first block is usually priced to cover about 50 per cent or less of operating costs, while in the final block/blocks, the tariff applied is above the average operating expenses or actual cost of service. The design of IBTs varies with these blocks' number, size, and unit price across countries applying this tariff design. The number of blocks incorporated in the residential tariff design varies from two to eight.

Apart from IBT, countries rely on other forms of complex volumetric design, including ***decreasing or non-monotonic block structures***. Based on available information, Australia and Benin are the two countries found with evidence of DBT[48].

Energy tariff structures for each customer classification may be different but are designed (in general) to closely align them with the cost of service for that class. Tariff design is the process by which the cost of providing the services is allocated among the customers who use those costs. When designing a tariff mechanism, the following principles should be considered:

- Economic efficiency, i.e., a tariff ensuring MC recovery.
- Cost recovery, i.e., a tariff covering operating, maintenance, and capital costs.
- For users' acceptance_ simplicity and transparency, i.e., easily understandable with transparent features.
- Non-discriminatory, i.e., a tariff which treats all users equally.
- Social affordability and political acceptance are other vital considerations requiring a gradual approach supported by transitional arrangements.

Generally, most of these considerations are not considered in developing countries with regulated tariff structures. But these are considered in countries (primarily developed countries) with well-established electricity markets.

TARIFF STRUCTURE

The electricity tariffs depend on the factors, as shown in Figure 1, but the combination of factors varies across countries. The last two factors are typically found in EU countries[49]. A single variable or a combination of these variables is used to allocate users to a given tariff category. For instance, in Denmark, Estonia, Romania and Slovenia, only the voltage level is used to allocate users to a certain consumer tariff category.

Two-part or three-part tariff structures are commonly applied in many countries across the globe. The objective is to correctly reflect the cost of providing electricity to a particular consumer category. In the case of a two-part tariff, residential consumers have a fixed charge and a variable energy charge as recorded by the meter. For industry, a two-part tariff consists of a demand charge (capacity agreed in the contract) and the variable energy charge recorded by the meter. A two-part tariff is justified because it provides

[48]https://www.energy.gov.au/sites/default/files/watts_in_your_business_fact_sheet_5_-_electricity_tariffs.pdf

[49]https://ec.europa.eu/energy/sites/ener/files/documents/20150313%20Tariff%20report%20fina_revREF-E.PDF

Fig. 1. Factors Considered in Tariff Design

Type of load or Voltage level
Metering system—smart metering, time of use consumption or time at which load is required, peak demand, etc.,
Power factor of the load
Amount of energy used
Contractual capacity/ power (contractual power according to users demand profile)
Consumer group—small house, household, agriculture farm, commercial consumers, small/ large industry, public lighting, public recharging of electric vehicles, etc.
Annual consumption—tariff levels are sorted out according to different intervals or bands of annual consumption (KWh/year)
Geographic Zone

stability for the service provider, thus preventing large swings in revenue that may result from changes in usage conditions. On the consumer's side, they may make better choices in their energy use under this tariff.

A three-part tariff is used only for specific consumer categories, e.g., bulk power consumers. The consumer electricity bill covers fixed costs (D), semi-fixed costs (Ax) and variable costs (By). That is,

$$C = Ax + By + D$$

Where C is the total charge for a period, x is the maximum (peak) demand during the period in units, and A is the cost per unit of maximum demand; y is the total energy units consumed during the period, and B is the total cost of energy units consumed; and D is the fixed charge during each billing period.

- The fixed costs typically include what the service provider incurs in reading meters, billing and collections, and a charge for the installation/ repair/ maintenance necessary to provide electricity service to the consumer.
- The energy costs vary depending upon the amount of energy consumed.
- The service provider incurs the demand costs in providing the peak load of the consumer at any given time during the billing period. The service provider incurs the costs of providing the facilities for meeting a designated peak load of the customer, regardless of whether the customer uses that peaking amount during the month or the year.
- Distribution tariff structures by user groups are different among countries.

In the African region and many Asian countries, the tariff includes fixed, capacity, and energy charges. The energy charge is further categorised as flat charge (a flat rate for all units consumed, irrespective of the level of consumption), consumption block (different prices applied to the KWh according to the consumption level) and TOU (different prices depending on the time of use).

Cross-subsidisation across Consumer Groups

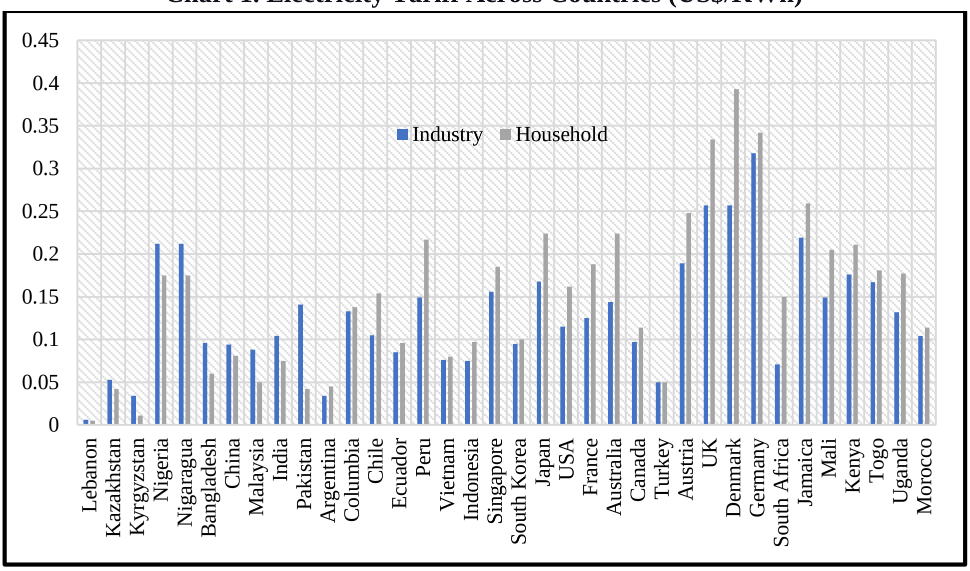
Cross-subsidisation across various consumer groups is quite common. Evidence suggests that cost-recovery from a politically favoured group, i.e., domestic and agriculture consumers, is challenging in developing countries. The tariff structures in most of these countries cross-subsidise domestic and agricultural consumption at the expense of industry and commercial users. Some residential tariff categories are about half or below industrial and commercial tariffs. At the same time, agricultural users tend to pay only about a fifth of what other user categories are charged.

In over 60 per cent of the countries (mainly low and middle income), industrial customers pay more than residential customers despite imposing likely lower costs on the system. Likewise, in almost 80 per cent of the countries, commercial customers spend more than residential customers despite imposing similar charges on the utility (Foster and Witte, 2020). In contrast, in the developed countries, e.g., in the United States, EU countries, Japan, and South Korea residential tariff rate is more than that of the industry, commercial and transport sectors[50].

Even in some low- and middle-income countries that have prioritised their industrial growth, the industrial and commercial tari-ffs are lower than residential tariffs, for instance, Argentina, Peru, Indonesia, Vietnam, Columbia, South Africa, Morocco, and Kenya. Even some African countries like Mali, Rwanda, and Togo, with low income per capita, prefer productive business activities more by charging a lower tariff than household electricity tariff (Chart 1). It is beyond doubt that price variation across sectors creates horizontal injustice to the productive sectors of the economy.

Most countries cross-subsidising domestic consumers apply increasing block tariffs (IBTs). There is a significant variation in tariff across tariff blocks or slabs within the same consumer category; the number of slabs also varies across countries. In other words, cross-subsidisation within the sector as well. The aim is to protect the disadvantaged group of consumers against tariff hikes.

Chart 1. Electricity Tariff Across Countries (US$/KWh)



Source: https://www.globalpetrole prices.com/electricity_prices

[50] https://www.eia.gov/energyexplained/electricity/prices-and-factors-affecting-prices.php

There is extensive evidence that IBTs are ineffective at protecting lifeline consumers. Even if they are effective in protecting them, it is at the cost of supporting those who may not necessarily fall into the low-income group (Komives et al., 2005). Cross-subsidisation or IBTs yields positive results only when a higher percentage of poor households are connected to the grid (Huenteler, et al., 2017). Perhaps, the opposite is the case in actual practice in developing countries, where many rural poor are not connected to the national grid. Another issue common in African countries is that poor households often share meter/ connection to divide high upfront connection costs. This increases their total consumption, preventing them from taking benefits of lower slabs in IBTs (Kojima and Trimble, 2016).

Besides, IBT creates a deadweight loss relative to transfers_ such targeting of the poor is less effective than direct cash transfers for the poor. It has no cost basis and nurtures a conflict between efficiency and distributional goals (Borenstein, 2012). Non-linear electricity tariffs and taxation complicate economic decisions via charging varied marginal prices for the same good (Ito, 2014).

TARIFF REGULATION

Two types of cost-based tariff regulation are common:[51]

- **Rate-of-return regulation_** assures the regulated company a specific pre-defined rate of return on its regulatory asset base.
- **Cost-plus regulation_** provides a pre-defined profit margin to be added to the company's costs.

There is little incentive to minimise costs in the rate-of-return regulation because a service provider can increase its profits by simply expanding the assets or cost base. Whereas, in cost-plus regulation, a company may have an incentive to signal incorrect costs to the regulator or waste resources to increase the cost base in extreme cases. Cost-based tariffs are based on assumptions and forecasts as tariffs are calculated for future periods. The regulator gauges the necessary costs based on the actual operation of the company but remains uncertain regarding the service provider's efficiency.

- I**ncentive-based regulation** was developed to overcome shortcomings in cost-based regulation. The focus of this regulatory approach is on efficiency.

The United Kingdom (UK) was the first to introduce this approach. Later, followed by many other countries in developed countries and some developing countries like Pakistan and India before the privatisation or intended privatisation of network companies. This regulatory approach has been dependent on reliable data on costs and additional information for several years.

The overall policy towards energy pricing in the European Union and other developed countries is market-based wherever it is practical. Generation and supply procurement and tariffs are generally through a competitive market. Where regulated tariffs

[51] Cost of service regulation or average cost (AC) is primarily applied in developing countries with no competitive market. The apparent preference for cost-of-service regulation is the complexities in determining other pricing principles, e.g., MC pricing.

are applied, the underlying principles are that they should be fair, transparent, cover reasonable costs, allocate the cost efficiently between consumers, and provide for necessary investment and a valid return (INOGATE, 2015).

When most EU members have regulated tariffs, either rate-of-return regulation or cost-plus regulation were used. But now, these countries have switched to an incentive-based tariff. The objective is to incentivise performance, reduce the asymmetry of information between the regulator and the subject companies and improve the efficiency of the tariff-setting process. Yet, incentive-based regulation is effective only when the network companies are privately owned and the operational cost and asset valuations are fixed (INOGATE, 2015).

The tension between regulated and market-based tariffs can be removed once the tariffs are based on Marginal Costs (MC).

ELECTRICITY TARIFFS IN PAKISTAN

National Electric Power Regulatory Authority (NEPRA) determines electricity tariffs in Pakistan. Table 2 highlights the types of tariffs applied across various consumer groups. Figure 2 elaborates the tariff structure for generation, transmission, and distribution. Although the rules for competitive bidding in generation and transmission exist but are rarely applied, cost-plus and up-front are typically used. The tariff Regime/ Procedures followed are elaborated in Figure 3.

Table 2

Tariff Types Across Different Consumer Groups

Consumer Groups	Tariff Applied
Residential	IBT (Since FY2014 moved from all slab benefit to only previous slab benefit)/ TOU
Industry	Linear (Varies with load; higher price for lower load)/ TOU
Commercial	Linear (Varies with load and TOU)
Agriculture	Linear (Lower for tube wells as compared to Scarp)/ TOU
Public Lighting	Linear

Fig. 2. Tariff Structure

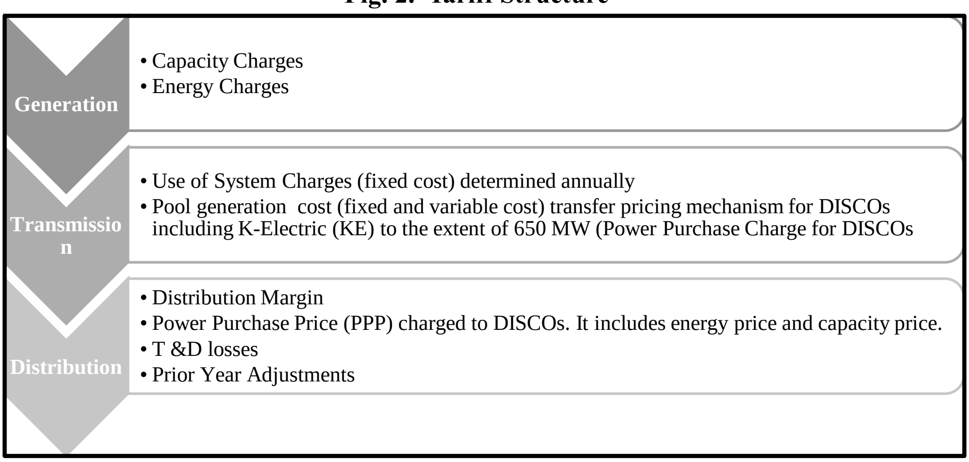
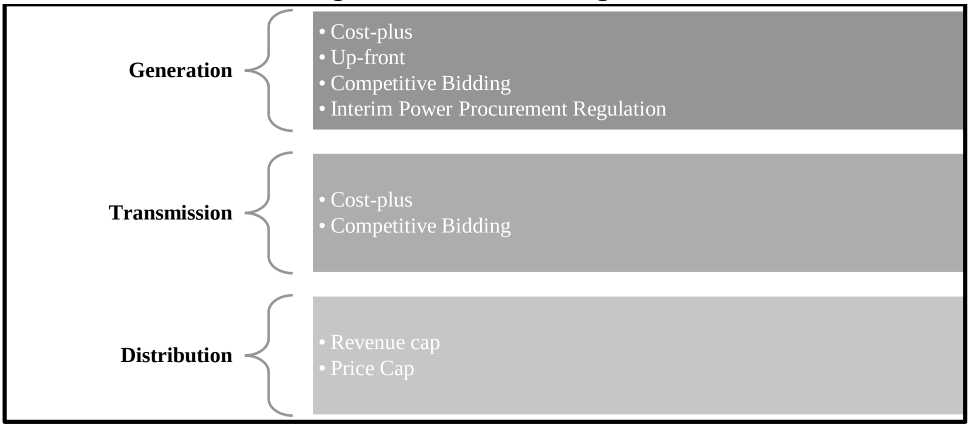
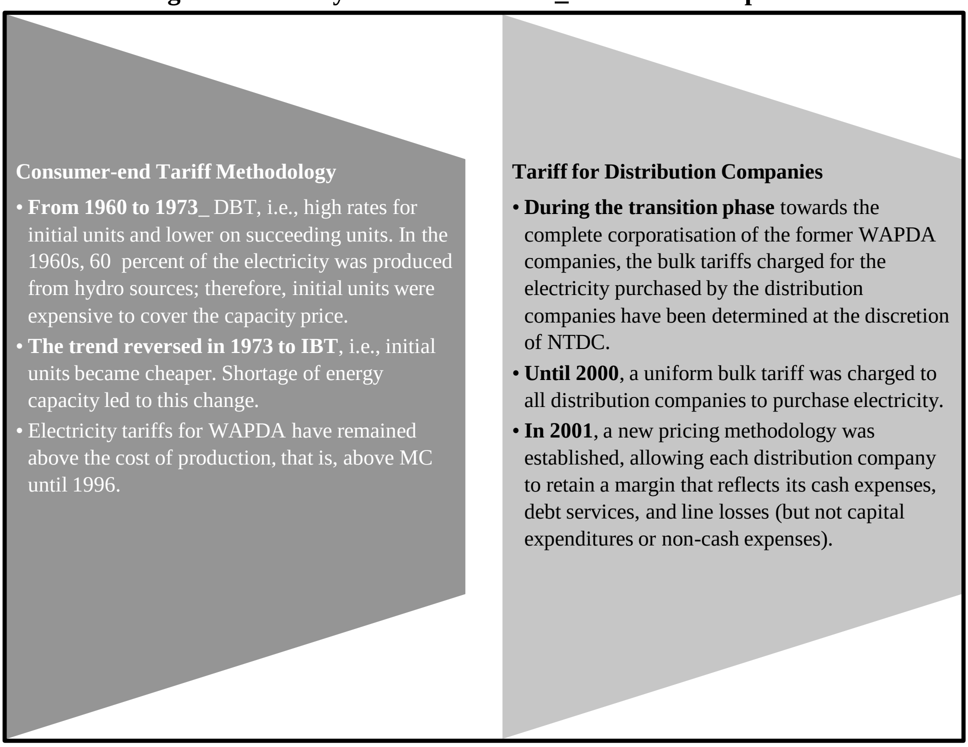


Fig. 3. NEPRA Tariff Regimes



Multi-year tariff (MYT) regulatory framework was introduced for KESC in 2002 for seven years, given its expected privatisation. Later, the same tariff regime was established for FESCO, IESCO and GEPCO, anticipating their privatisation. The objective behind MYT is to obviate regulatory uncertainty and incentivise efficiency. Since March 2001, an automatic tariff Adjustment mechanism for fuel cost variations has also been adopted, applied every month.

Fig. 4. Electricity Tariff in Pakistan_ Historical Perspective



Source: Suhail (2014) & Malik (2022).

SOME REFLECTIONS ON PAKISTAN'S ELECTRICITY TARIFF STRUCTURE

The tariff structure in Pakistan is not based on regional and consumer-specific long-run marginal costs but political considerations. NEPRA determines consumer-end tariffs. In deciding the average sale price, NEPRA considers the annual revenue requirement of DISCOs which includes all the costs involved in the supply chain. The main factors in the annual revenue requirements or tariff determined include Power Purchase Price[52](a combination of Energy Purchase Price (EPP), Capacity Purchase Price (CPP)), Use of System Charges (UoSC) or market operator fee, net distribution margin,[53] Transmission & Distribution (T&D) losses, and Prior-year Adjustments (PYA).[54]

In addition, electricity utility bills are increasingly cluttered with taxes, fees, and surcharges. Consumers also pay:

- For investment in hydro projects, a Neelum Jhelum Surcharge of Rs 0.10 per unit.
- For servicing of circular debt parked in the Power Holding Private Limited, a financial cost surcharge of Rs. 0.43 per unit.
- Sales tax @ 17 percent per unit, electricity duty @ 1.5 percent per unit and a TV fee of Rs 35 per meter.
- Sales tax is also charged on fuel price adjustments. There are few additional taxes for non-filers of income tax.

These are charged irrespective of units consumed. The proliferation of these surcharges generally shifts risks away from utility operators/ investors and onto consumers. Besides increased costs to compliant consumers, surcharges can also result in more inefficiency in the distribution system. It reduces DISCOs' incentives to improve and control costs. And in the case of the Neelum-Jhelum project, the surcharge shifts utility business risks away from investors and puts extra pressure on consumers (Malik, 2020).

As demonstrated in Chart 2, taking the weighted average of tariffs (WATF) across DISCOs, we find that consumers in distribution companies like IESCO, LESCO, FESCO, GEPCO and TESCO are subsidising consumers of SEPCO, PESCO, HESCO and QESCO by paying more than their actual determined tariffs.

Before the amendment to the NEPRA Act in 2018_ NEPRA determined consumer-end tariffs for each distribution company (DISCOs) separately. The tariff determined for each DISCO was different because of its distinct characteristics: the difference in annual revenue requirement and T & D losses (as evident in Chart 2). NEPRA evaluates cost and revenue requirements and sends its recommendation to the Government of Pakistan (GOP). The GOP notified the uniform tariff after adjusting for subsidies.

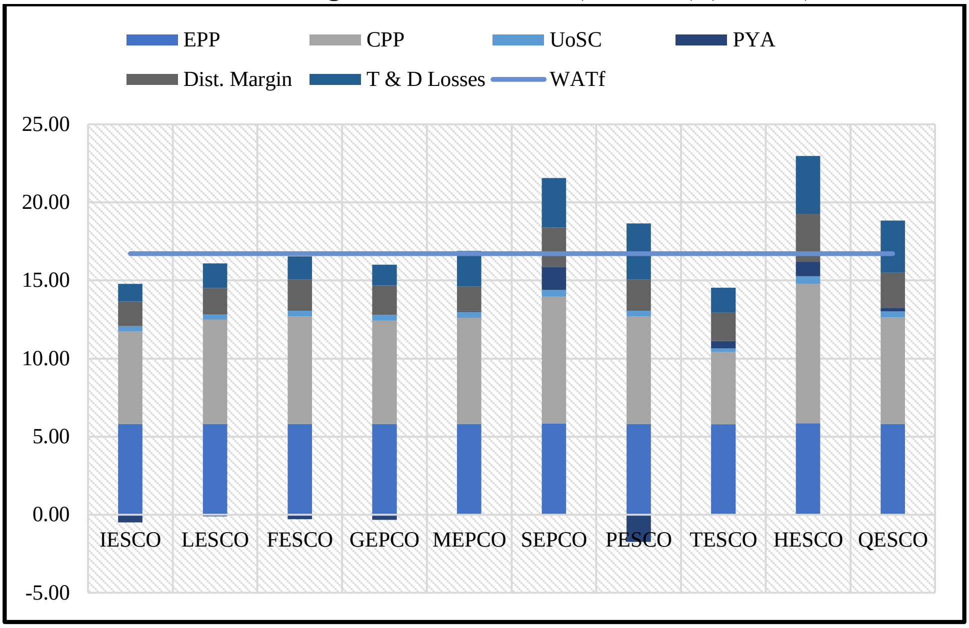
---

[52] It includes the generation and transmission costs of the power a DISCO has projected to purchase.

[53] It is the difference between DISCOs gross margin and other income. Gross margin includes operation and maintenance (O&M) costs, depreciation and returns on the asset base of DISCO. Other income refers to remuneration of deferred credit, meter and rental income, late payment surcharge, profit on bank deposit, sale of scrap, income from non-utility operations, commission on PTV fees and miscellaneous incomes.

[54] It is the gap between the projected and the actual cost in the previous year, built into tariffs for that year. This adjustment is for the difference between the projected and actual electricity units purchased by DISCOs; the difference between the projected and actual distribution margins; the difference between actual and notified previous year adjustment; the difference between projected and actual other income; and the difference between the projected and actual consumption mix.

Chart 2. Average Tariff Determined (Rs/ KWh) (2019-20)



Source: SROs 182(1)/ 2020 to 190(1)/2020, February 12, 2021.
Note: WATF is the weighted average of tariffs across DISCOs, weights are based on units consumed.

After the amendment to NEPRA Act in 2018_ NEPRA determines a uniform tax for distribution licensees wholly owned and controlled by a common shareholder based on their consolidated accounts, even though all distribution companies are separate corporate entities. This compromises the inefficient behaviour of some of the DISCOs. The Government of Pakistan notified the final applicable tariff after adjusting for subsidies.

Subsidy & Cross-subsidy Across Sectors

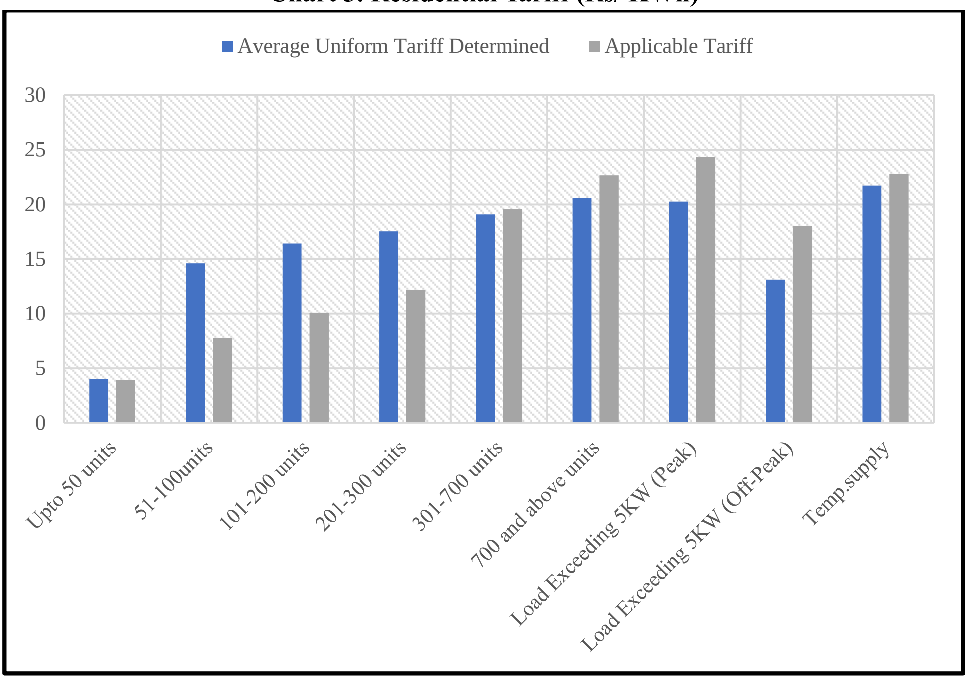
Uniform tariffs as determined by NEPRA, and the applicable tariffs as notified by the GOP are displayed in Charts 3 to 6. For the end-consumer, the current tariff structure is uniform throughout the country. Still, it distinguishes between residential, commercial, industrial, agriculture, and other customer categories. It is further divided by consumption level (tariff slabs), load, or time of use. The tariff structure is progressive for residential consumers. At higher consumption levels, it is more expensive. For residential consumers, the price of electricity is greater than the supply cost in the highest slab. But for agriculture tube wells, a tariff is linear and heavily subsidised.

The system of electricity subsidies, cross-subsidisation across sectors and different geographical regions (DISCOs), and the inability to pass on the actual cost to some consumer categories are of great concern. Besides creating financial difficulties for the government, a tariff structure in which charges are not recovered from all consumer categories indiscriminately creates inefficiencies and misleads investment decisions in the supply system (Malik, 2020).

The Government of Pakistan provides several subsidies to the power sector. The most significant portion of this subsidy is for inter-DISCO tariff differential. Out of Rs 366.4 billion of electricity subsidy in FY2021, 55 per cent (Rs 201.8 billion) was for inter-DISCO tariff differential, and about 2 per cent (Rs 7.5 billion) was for Agriculture tube wells[55]. Since FY2007, the government has paid over Rs. 3.4 trillion as subsidies. Out of which about 75 per cent are for the policy to maintain the same tariff across the country. Due to fiscal constraints, the government can't manage this subsidy amount in time. Thus, adding to circular debt. The consumer tariff notified in February 2021 created a financial gap of more than Rs 180 billion, to be covered through direct subsidies by the government. This is apart from tariff hikes due to fuel and other adjustments.

Apart from inefficient use of resources, some distortionary effects are associated with these subsidies and price structures. This welfare move discourages inefficient companies from improving their performance. Suppose a different tariff is charged in each DISCO. In that case, there will be pressure on companies like SEPCO, HESCO, PESCO and QESCO to improve, but companies like IESCO, GEPCO and FESCO would be able to sell electricity at a lower rate. Uniform tariff and subsidy policy burden compliant consumers through various surcharges, taxes, and tariff hikes.

Chart 3. Residential Tariff (Rs/ KWh)



[55] Consumption of electricity in agriculture is about 9 percent of the total.

Chart 4.Agriculture Tariff (Rs/ KWh)

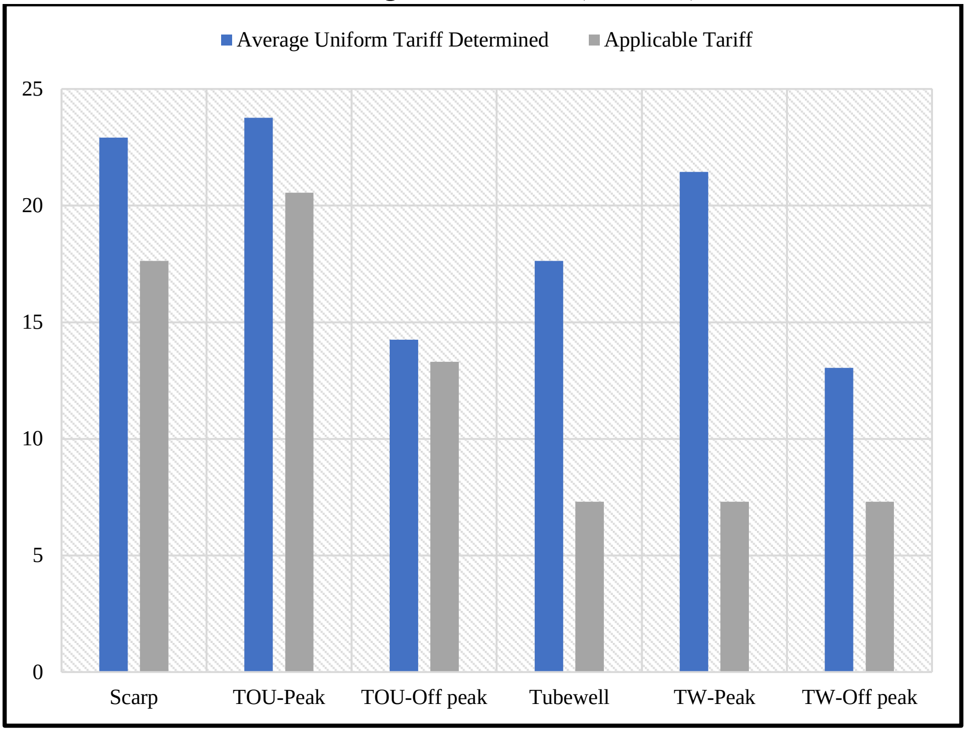


Chart 5. Industrial Tariff (Rs/KWh)

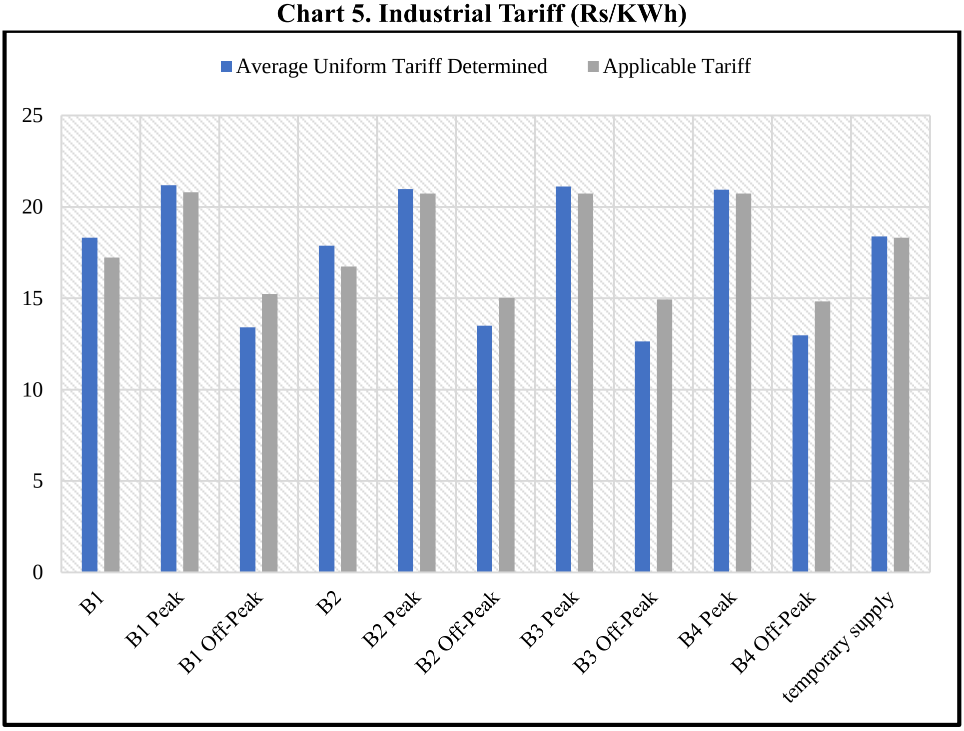
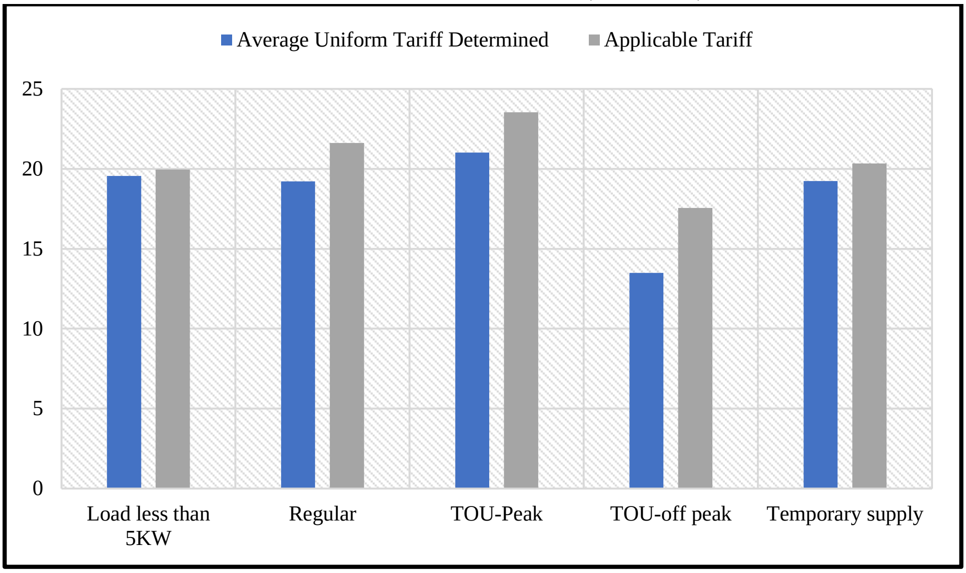


Chart 6. Commercial Tariff (Rs/ KWh)



Source: SROs 182(1)/ 2020 to 190(1)/2020, February 12, 2021.

IBT (Non-linear Tariff)—Domestic Sector

Since 2013-14, the tariff structure has moved from all slab benefits to only a previous slab benefit. The residential consumers are given the advantage of one last slab. As we can see in Chart 3, for domestic consumers who consume up to 300 units of electricity, the applicable uniform tariff is much lower than the NEPRA determined uniform tariff. Moreover, whatever the government announces, an increase in tariff is only applicable to those who consume 300 plus units (most of the time). As per the tariff notification of February 12, 2021, 67 per cent of domestic consumers use electricity up to 300 units, while the remaining 33 per cent consume electricity above 300 units in Pakistan. In other words, 67 per cent of the consumption is below the weighted average cost of service. This government policy is meant to insulate the poor and the lower middle income (0-300 units) from the tariff hike.

Are all these 67 per cent poor and lower-middle-income households? About 46 per cent of the population is not connected to the national grid in rural areas. In urban areas, poor and lower-middle-income households that presumably consume (0-300 units) reside typically in congested localities. However, there are apprehensions that crowded areas mean more power theft (through meter-tempering) and line losses.

Moreover, there is ample evidence that the households opted for options to remain in lower slabs, for instance, two to three meters in a residential premise dividing load, meter tampering or electricity theft, or payment of a fixed amount to the lower staff of a company (Malik, 2020). So perhaps, this group is getting the subsidised tariff unnecessarily, increasing the burden for the government and the complaint consumers.

Unless or until tariffs are not allowed to cover the cost of providing electricity to consumers, the sector will continue to face financial difficulties. As Burgess et al. (2020) argued, the issue arises when we start treating electricity as a right rather than a private good. It leads to subsidies, theft, supply without payment, and losses for distribution companies, which may limit supply.

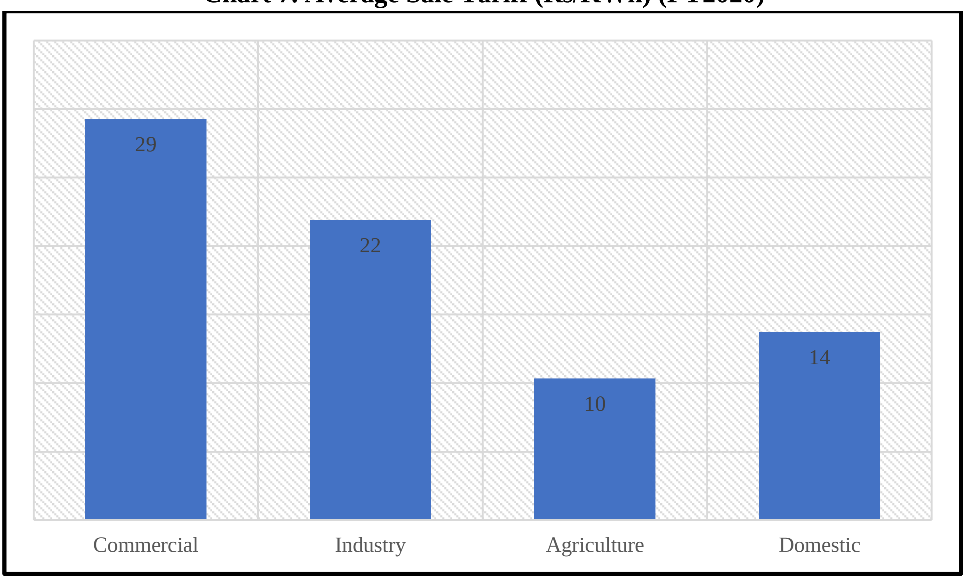
Cross-subsidisation across Sectors

Over the years, a weak link between price and demand and substantive cross-subsidisation has skewed consumption toward less-productive domestic consumers. Domestic consumption of electricity in FY2021 was more than 50 per cent. In comparison, industry consumes 26 per cent. The industry relies on other energy sources due to expensive electricity from the national grid. In other words, the productive sectors that require a continuous supply of electricity either must restrict their production or rely on other sources when electricity service is considered a 'right' (Burgess et al. 2020).

The unit cost of service to the industry is around Rs. 13.7/KWh for the year 2020 in Pakistan (PIDE, 2021). However, the average unit price charged to industrial units is around Rs. 21.90/kWh (Chart 7) during 2020[56]. There is a significant cross-subsidy from industrial and commercial consumers to agricultural and domestic consumers (below 300 units). Over the years, limited progress has been made in reducing cross-subsidies. Some of our low value-added exports rely heavily on electricity consumption. The high cost of electricity has reduced the competitiveness of our exports, thereby impacting on the country's trade deficit and balance of payment. Large cross-subsidies (especially in favour of domestic and agriculture consumers) and heavy tax incidence are contributing to grid defection by large consumers (industry, commercial and high-end consumers) ((cited from Malik (2022)).

The energy tariffs are high due to governance issues, operational, financial, and commercial inefficiencies, inapt policies, distortions in applicable tariff schemes, irrational cross-subsidies, and sub-optimal energy mix (Malik, 2020). The policymakers try to cover all these inefficiencies through subsidies or by charging a higher tariff to industry, commercial and high-end residential consumers. Over the last ten years, these subsidies have exhausted fiscal resources immensely, leaving little (in the form of PSDP) for the renovation or expansion of transmission and distribution infrastructure (SBP, 2019).

Chart 7. Average Sale Tariff (Rs/KWh) (FY2020)



Source: NEPRA State of Industry Report 2021 and PIDE (2021)

[56] It is despite the subsidy rates to zero-rated industry.

ELECTRICITY TARIFF AND POWER SECTOR CHALLENGES

Tariff and Circular Debt Nexus

Consumer end tariffs are highly sensitive to the losses in the transmission and distribution (T&D) systems. With every percentage increase in losses, the tariff increases exponentially (as the generation cost increases). When a certain percentage of these losses are not accounted for in tariffs, it adds to the circular debt. Likewise, in tariff determination, NEPRA counts 100 percent recovery. However, the reported recovery percentage of DISCOs remained around 90 percent on average (Malik, 2020).

In 2021, T & D losses were equivalent to *Rs 473 billion, Rs 402 billion were recovered through tariff, and a financial loss of Rs 71 billion was added to circular debt. Power sector loss from low bill recovery was Rs 39 billion in the same year.* Unless or until tariffs are not allowed to cover the actual cost of service to consumers, the power sector will continue to face financial difficulties, and the circular debt will continue to rise.

It is estimated that a per unit increase in price by Rs 1 adds to an additional loss of more than Rs 10 billion; as it affects the paying capacity of consumers, that in turn will increase poverty, theft and delayed or no payment; increasing arrears (Faraz, 2018). *Increasing tariffs will not resolve circular debt or power sector inefficiencies.*

Moreover, as mentioned in the previous section, a significant portion of power sector subsidy is for inter-DISCO tariff differential. Due to fiscal constraints, the government cannot manage this subsidy amount in time, consequently adding to the sector's deficit (that is, circular debt).

Tariff Design & Privatisation of Distribution Companies

K-Electric is a privatised entity operating in a regulated environment. The same uniform tariff policy is applied to K-Electric consumers. The utility faces delays in tariff determination, delays in the disbursements of Tariff Differential Claims, and delays in receivables from the government departments (Malik & Khawaja, 2021). Thus, affecting the utility's ability to pay back and increasing its payables to Rs 225 billion.

As per National Electricity Policy 2021, the uniform tariff policy will continue_ meaning the continuation of tariff differential subsidy. The privatisation of state-owned distribution companies is on the GOP plan. *A uniform tariff policy is no incentive for a privatised company*.

Additionally, theoretically, it should have been relatively more straightforward for K-Electric as a privatised company to make investment decisions based on tariffs, to upgrade or replace distribution infrastructure. However, the company still needs regulatory approvals from NEPRA.

Tariff Structure & Independent Power Plants

Another shortfall associated with the current structure of tariffs and subsidies is shifting pressures away from inefficient power producers who continue to use more expensive fuels for thermal generation. For instance, as we can see in Chart 1, in the end-user NEPRA-determined tariff, the power purchase price (PPP=CPP+EPP) constitutes more than 73 percent (on average). The tariff notified by the government to subsidise households consuming up to 200 units is Rs 10.06 per KWh (Chart 2), which is much lower than the price at which DISCOs procure electricity from CPPA. This implies that while subsidising power to end-consumers, the government pays not only for the inefficiencies at the DISCOs level; but for inefficiencies and excess capacities in the generation sector (Khalid, 2019). *The current tariff/ subsidy policy led inefficient power producers to continue their ongoing practice.*

Tariff Design and Market Development—CTBCM

The GOP is in the process of implementing the Competitive Trading Bilateral Contract Market (CTBCM). The ultimate objective of CTBCM is to generate competition among market players to benefit consumers in terms of service quality and pricing. There will be *no competition when accounts of inefficient and efficient DISCOs are treated as one, and the uniform tariff is charged.*

WAY FORWARD FOR PAKISTAN

A tariff structure in which costs are not recovered from all consumer categories indiscriminately, besides creating financial difficulties for the government, also generates inefficiencies in the system and misleads investment decisions in the supply system (Malik, 2020).

In Pakistan, more than 60 per cent of electricity is produced by thermal sources providing costly electricity. Further, the tariff mechanism adopted provides electricity charges different across categories, time of use and sanctioned load etc., creating inefficiencies and making electricity expensive for productive sectors (industry and businesses) of the economy.

Pakistan is among the top thirty countries globally with relatively high tariff rates. Due to long-term agreements with guaranteed capacity payments to thermal generation companies, switching to cheaper indigenous energy sources is impossible in short to medium term. Therefore, the complex tariff mechanism needs to be revised to reduce electricity prices in Pakistan. The sector is about to implement a wholesale market model (CTBCM), demanding significant tariff reforms.

There should be fair pricing, where each consumer pays according to their consumption on a progressive trend, i.e., the more per unit energy is consumed, the more the consumer pays on average.

- *The best way is to move from increasing block tariff to a flat linear tariff. It will not only maximise revenues but minimise inefficiencies in the sector.*
- *Moving from a uniform tariff to a different flat rate across DISCOs will also minimise inefficiencies significantly.*
- *Tariffs should be based on the actual cost of services to all geographical markets.*

Based on data from Tariff Determination of February 12, 2021, total revenue is estimated for NEPRA determined uniform tariff, GOP applicable tariff, and for a flat (linear) tariff, i.e., the weighted average across DISCOs. Estimates are reported in Table 3 and Table 4. Maximum revenue is generated if we apply a linear (flat) rate which (in this case) is the weighted average across DISCOs[57], without any subsidy.

[57] Only a hypothetical exercise.

However, the flat (linear) tariffs may not be a win-win situation for all (e.g., poor households) but will reduce tariff-related distortions and inefficiencies. Empirical literature highlights that direct cash transfers, compared to electricity subsidies, have proved to be a better welfare alternative for low-end consumers (Borenstein, 2012; Khalid and Salman, 2020; and Awan, et al., 2019).

A tariff structure, as in Turkey, is the best option to adopt before moving towards a wholesale market structure. Our estimations also suggest that the sector would be better off adopting a linear tariff mechanism.

Box 2. Tariff Structure in Turkey

- A flat (linear) rate is charged for all consumption per consumer category (i.e., domestic, industry, agriculture and commercial).
- Consumers can pay a single price or a variable price depending on the time of day using a smart meter.
- All regulated tariffs are based on the cost of service, and there is no electricity subsidy for the low-income households or any other sector.
- Turkey relied primarily on its social safety services to address the adverse impacts of electricity tariff reforms on low-income households

Source: CONECC, 2018

Empirical evidence also suggests that service provision is cheaper for the industry than domestic consumers. Besides, in countries prioritising productive sectors, tariffs are lower for industry and business than domestic consumers. Currently, our billed demand is lower than the contracted generation capacity, increasing the capacity payment burden (CPPA, 2020). There is a need to increase billed demand to reduce the burden of capacity payments. In our exercise, we focus on the same (flat) tariff for all sectors. The option of a flat or linear tariff, different across sectors, as per their service cost, can also be considered, as in many European countries like Germany, Austria, and the UK.

- *Increase billed demand by making grid electricity attractive to the productive sectors of the economy by offering them lower tariffs.*

Table 3

Revenue Generated using Different Tariffs

		Total Revenue Generated (Rs Billion)		
Sector	Sales across DISCOs Gwh	NEPRA Determined Uniform Tariff	Govt. Applicable Tariff	Flat (Linear) Tariff (Weighted Average across DISCOs)
Residential	48948	828.61	650.57	816.94
Industry	25857	371.42	411.11	431.55
Commercial	7117	121.66	137.97	118.78
Agriculture	10405	166.01	79.15	173.66
Single Point	3327	49.53	69.13	55.53
Gen. Services	2575	43.9	50.24	42.98
Public Lighting	287	5.46	5.92	4.79
Res. Col.	59	1.24	1.22	0.98
Total		1587.83	1405.31	1645.22

Table 4

Revenue Generated using uniform and different Flat (Linear) Tariffs Across DISCOs

(Rs Billion)

	IESCO	LESCO	FESCO	GEPCO	MEPCO	SEPCO	PESCO	TESCO	HESCO	QESCO	Total
Flat (Linear) Tariff (Weighted Average across DISCOs)	161.11	369.68	229.19	168.65	277.92	58.43	187.50	28.56	73.14	91.04	1645.22
Flat (linear) rate different across DISCOs	137.94	354.18	223.28	158.55	281.09	75.48	189.97	24.88	100.65	102.77	1648.79

Source: Author's Estimates

There is a need to re-visit the policy of imposing surcharges. *A simplification of tariffs_ for every consumer category/geographical market is required. We need a tariff based on MC.*

REFERENCES

AfDB-ERERA (2019) Comparative Analysis of Electricity Tariffs in ECOWAS Member Countries. Accessed at http://africa-energy-portal.org/sites/default/files/2019-12/Electricity%20Tariffs%20Study%202019.pdf

Awan, H. S., G. Samad & N. Faraz (2019) Electricity Subsidies and Welfare Analysis: The Perspective of Pakistan. PIDE-Working Paper 2019: 164.

Borenstein, S. (2012) The Redistributional Impact of Nonlinear Electricity Pricing. American Economic Journal: Economic Policy, Vol. 4, No. 3, pp. 56-90.

Burgess, R., M. Greenstone, N. Ryan & A Sudarshan (2020) The Consequences of Treating Electricity as a Right. Journal of Economic Perspectives, Vol. 34, No. 1, pp.145-169.

CPPA (2020) Annual Report, Central Power Purchasing Agency, Islamabad.

Faraz, S. (2018) Circular Debt: Issues and Solutions. Report of the Special Committee on Circular Debt on Components of Circular Debt, Measures Taken & Required to Reduce the Same. Senate of Pakistan. Islamabad.

Foster, V. and Witte, S. (2020) Falling Short_ A Global Survey of Electricity Tariff Design. Policy Research Working Paper 9174, World Bank, Washington, DC.

Gunatilake, H., Perera, P., & Carangal-San Jose, M. J. F. (2008). Utility Tariff Setting for Economic Efficiency and Financial Sustainability —A Review. ERD Technical Note Series No. 24, Economics and Research Department, Asian Development Bank.

Huenteler, J., Dobozi I, Balabanyan A. and Banerjee, S.G. (2017) Cost Recovery and Financial Viability of the Power Sector in Developing Countries: A Literature Review. Policy Research Working Paper 8287, World Bank, Washington DC.

INNOGATE (2015) A Review of Energy Tariffs in INNOGATE Partner Countries. Accessed at http://www.inogate.org/documents/A_Review_of_Energy_Tariffs_in_INOGATE_Partner_Countries.pdf

Ito, K. (2010). Do Consumers Respond to Marginal or Average Price? Evidence from Nonlinear Electricity Pricing. University of California Berkeley Energy Institute at Haas Working Paper 210.

Khalid, A. (2019) Why are Power Tariffs in Pakistan Consistently High? Special Section I, The State of Pakistan's Economy, The State Bank of Pakistan.

Khalid, S. A. & V. Salman (2020). Welfare Impact of Electricity Subsidy Reforms in Pakistan: A Micro Model Study. Electricity policy, Vol. 137, Issue (February).

Kojima, M., Bacon, R., & Trimble, C. (2014). Political Economy of Power Sector Subsidies: A Review with Reference to Sub-Saharan Africa. The World Bank Group on Energy & Extractives, Washington DC.

Kojima, M., Trimble, C., (2016). Making Power Affordable for Africa and Viable for Its Utilities. The World Bank, Washington, D.C.

Komives et al. (2005). Water, Electricity, and the Poor_ Who Benefits from Utility Subsidies? The World Bank, Washington DC.

Malik, A. (2020). Circular Debt: An Unfortunate Misnomer. *PIDE Working Paper Series 2020: 20.*

Malik, A. (2022). National Electric Power Regulatory Authority (NEPRA), in *Evaluations of Regulatory Authorities, Government Packages and Policies*, Pakistan Institute of Development Economics (PIDE).

PIDE (2021). Regionally Competitive Energy Tariffs and Textile Sector's Competitiveness, *Research Report*, Pakistan Institute of Development Economics, March 2021.

SBP (2019). Evaluating the Fiscal Burden of State-owned Enterprises in the Power Sector, Special Section 2, The State of Pakistan's Economy, State Bank of Pakistan.

Sohail, A. (2014). Review of energy sector with focus on electricity tariff determination, in solutions for energy crisis in Pakistan, Volume II.

Suzzoni, P. (2009). Are Regulated Prices Against the Market? European Review of Energy Markets, Vol. 3, No. 3.

Urban Resilience and its Impact on Electricity Provision in Karachi, Islamabad, and Peshawar*

AFIA MALIK and M. IDREES KHAWAJA

INTRODUCTION

Pakistan has one of the highest population and urbanisation growth rates in the world. Globally, it is the sixth most populous country. In the last three decades, the urban population has increased three folds, while the number of urban areas has increased from 468 in 1998 to 624 in 2017 (Hussnain, et al. 2020).

Rapid urbanisation places pressure on existing infrastructure facilities and the carrying capacity of cities. Urbanisation is a complex socio-economic process that transforms the built environment, converting formerly rural areas into urban settlements, while also shifting the spatial distribution of a population from rural to urban areas.

According to the World Bank, urbanisation in Pakistan, in general, is messy and hidden as cities are expanding beyond administrative boundaries to include ruralopilises—densely populated rural areas and outskirts not officially designated as cities. Similar findings are shared by an urban scholar, Reza Ali. According to him, 70 percent of Pakistan's population is non-rural, that is, living in concentrated areas in or around some urban centers (cited from Abdul and Hai, 2020).

Urban resilience is the capacity of cities to act efficiently so that their businesses, institutions, residents, communities, and workforce, especially the vulnerable people endure the stresses or shocks they encounter in their everyday lives because of climate change, urbanisation, or globalisation. The word resilience means "the persistence of relationships within a system" and "the ability of these systems to absorb the changes of state variables, driving variables, and parameters" (Abdul and Yu, 2020).

*Sustainable Development Goal (SDG) 11 says "M*ake cities and human settlements inclusive, safe, resilient and sustainable." That is, we need to build *modern, sustainable cities. For all of us to survive and prosper, we need a new, intelligent urban planning that creates safe, affordable, and resilient cities with green and culturally inspiring living conditions for all. In other words, to increase the resilience of cities to absorb shocks and unforeseen events.*

The 5.7 per cent of land under forest cover is much below the recommended benchmark of 25 per cent, often leads to urban flooding in cities like Karachi, Lahore, Peshawar, and many other cities in the country, disrupting human lives, property, and

* This chapter has been published previously as PIDE Monograph No. 6, 2021.

existing infrastructure. This demands effective strategies to build resilience to deal with such a situation (Shahid, 2020).[58]

In Pakistan, rapid urbanisation is not accompanied by equivalent investment in new and existing urban spaces. This puts an extra burden on existing city systems, creating social/ ethnic tensions, undermining their resilience, and creating concerns for their sustainability (Mahendra and Seto, 2019). For instance, Karachi, among the world's top ten largest cities, often faces power challenges, water shortages, transport problems, rising informal settlements, environmental issues, urban flooding, and poor waste management issues. The situation in other cities is not different.

The resilience of cities may be contextualised in the performance of its public service delivery such as the provision of energy services as they are critical to liveability in urban spaces. It is perhaps due to a lack of urban resilience that despite sizable reforms in the country's energy sector, the delivery of reliable electricity services still remains a challenge. Even none of the current proposals for reforming urban electricity markets has a deeper analysis on their back resulting in little faith in their workability. This necessitates that the performance of electric utilities, for quality electric service delivery may be understood in the context of overall city governance. This can be achieved in two ways: either by comparing utilities of different nature (e.g., electric, water, and gas) with the same city governance context or by comparing similar utilities in different city governance contexts. This study chooses the latter option.

The first objective of the study is to compare urban resilience across three major cities, Karachi, Islamabad, and Peshawar. How does it impact the provision of electricity services in these three cities? The study examines the linkage between various operational (transmission and distribution losses, safety systems, outages etc.) and commercial (recovery rates) performance of a utility and urban resilience of the city. The second objective is to draw lessons from IESCO, PESCO and K-Electric regarding safety hazards related to electricity utility for each other and for other distribution companies. Safety hazards that arise because of urbanisation or its consequences, e.g., urban sprawl. The study highlights possible policy actions to enhance resilience in Pakistani cities and a resilient electricity system to cope with urban challenges.

***Research Questions*:**

- ✓ What is the state of urban resilience in Pakistani cities? How is it affecting the quality of electricity services?
- ✓ Is Karachi less resilient than Islamabad and Peshawar?
- ✓ How are IESCO (in Islamabad), PESCO (in Peshawar) and K-Electric (in Karachi) dealing with urban sprawl issues in particular, safety hazards?

Hypothesis:

(1) H_0: Pakistani cities are resilient to absorb the impact of rapid urbanisation, thus, there is no issue of service delivery, safety in electricity systems and in the collection of payments by electricity distribution companies.

[58] https://www.dawn.com/news/1574424

H_1: Rapid urbanisation leads to the expansion of slums/ informal settlements in Pakistani cities creating issues of service delivery. Illegal extensions /encroachments create safety hazards and hinders in reducing losses and in collection of payments by electricity distribution companies.

(2) H_0: Karachi urban dynamics is like Islamabad and Peshawar.
H_1: Karachi urban dynamics is different from Islamabad and Peshawar due to relatively greater economic vibrancy and relatively more troubled spots because of various socio economic, governance and political reasons.

The study is organised into five sections. Preamble is followed by conceptual framework and methodology. Section 3 will discuss city profiles and will estimate and compare urban resilience across three cities using various indicators. Section 4 will relate urban resilience with utilities performance and discuss their coping strategies. Section 5 is the conclusion.

CONCEPTUAL FRAMEWORK AND METHODOLOGY

Rapid urbanisation creates several serious challenges for cities. For instance, water shortages, lack of sanitation facilities, traffic woes, lack of affordable housing and unreliable electricity supplies. Therefore, the provision of electricity services or the performance of an electricity utility cannot be studied in isolation, especially in cities expanding horizontally and vertically. There are several other factors (economic, social, institutional, governance, community) at play affecting utility performance. For electricity distribution utilities, sometimes it is a trade-off between affordability and reliable supplies as these companies have to create a balance between their financial sustainability and arranging investments to expand and improve utility services to urban poor residing in informal settlements like slums. This challenge is often aggravated by property rights issues that define many informal or illegal urban settlements. Often these settlements and expansions create safety hazards, sometimes within and sometimes beyond the control of the utility company.

Urban governance plays a critical role in coordinating the activities of various components of the energy system and minimising safety hazards. Urban governance refers to how government at various levels and other stakeholders plan and manage urban areas_ cities (UKAID, 2016). Literature suggests that in cities that are less resilient and have weak governance systems, it is difficult for various utilities to perform there efficiently.

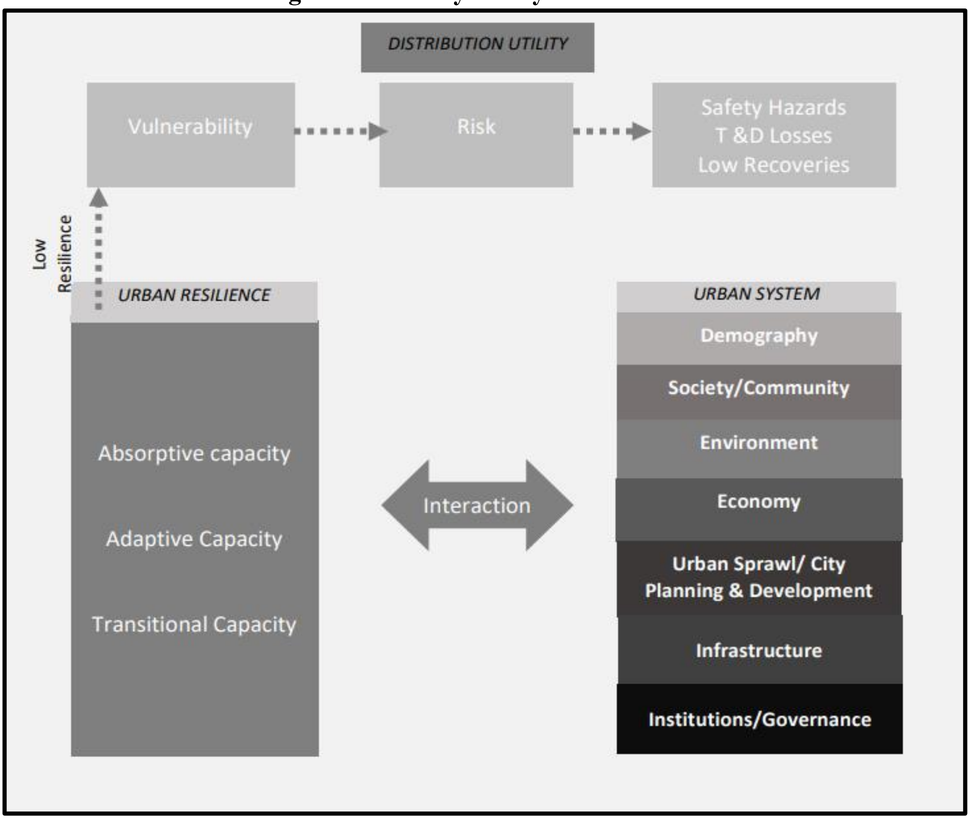
Each urban space may have its ecology which suggests that while lessons can be learned, there is no panacea or universal governance solution to ensure cities' liveability and prosperity (White, 2019). Even within the same country, cities may be subject to different social, economic, political, and institutional reality making them a candidate for differential treatment. And so are the utilities performing in these city systems, these can't be treated equally.

For example, Karachi offers great poverty reduction potential which facilitates informal land markets resulting in an urban sprawl of unparalleled magnitude in the country (WB, 2018). This together with poor governance, institutional fragmentation hampers the quality of public service delivery, reduces the city's resilience, and raises concerns over the sustainability of this urban space—sometimes called 'civic emergency' (Abbas, 2021).

Literature suggests that utility performances do not take place in a vacuum and can only be assessed in the light of utility characteristics and the contextual variables or the city environment in which it operates. Utility's own characteristics may be realised as various measurable attributes such as utility ownership, size of the network, safety systems, reliability in supplies, profitability, operational and commercial efficiency.[59]

Context on the other hand is a multidimensional concept comprising various complex indicators. Among those important in an urban context may be the following: infrastructure planning and development; demographic characteristics; urban sprawl characteristics; social/ community and economic landscape; environment; and governance and institutional settings (Figure 1).

Fig. 1. Electricity Utility Performance



A city is a complex system composed of natural systems, social systems, and structural systems. Each system itself is important. For comparative purposes, various urban resilience indicators and utility characteristics would be used. The conceptual framework can better be understood via Figure 1. The framework is adapted from Zhang et al (2020), with several modifications. Urban systems are interlinked and are the key

[59] Electricity utility is a company in the electric power industry that engages in all or only one aspect of the electricity supply chain, that is, generation, transmission, and distribution. These utilities include privately-owned, publicly owned, cooperatives or nationalised entities.

systems affecting urban abilities to resist, absorb and adapt to transformation. Each of these seven dimensions is further divided into various sub-dimensions that can be assessed[60]. These sub-dimensions are illustrated in Figure 2.

Fig. 2. Urban Resilience Dimensions/ Sub-Dimensions

Demography

- Population Density
- Average Household Size
- Urban Population Growth

Society/Community

- Poverty Incidence
- Ehsaas Beneficiaries
- Population access to Health Facilities
- Children out of School
- Living Standards

Economic Vibrancy

- Per Capita Income
- Per Capita Income Tax Collection
- Employment Rate

Infrastructure Development

- Acces to Piped Water/ Water Pumping
- Acces to Electricity
- Acess to Gas utility
- Population with Internet
- Solid waste generated per day

Urban Sprawl

- Ratio of Land Consumption growth to Population Growth
- Urbanisation Rate
- % population living in Slums
- % Built-up Area

Environment

- % Particular Matter Air and Urban Flooding

Governance/ Institutions

- Crime Index
- Safety Index
- Integrated Governance Capacity
- Ethnic Conflict/ Terrorism Activities

We have estimated the urban resilience index for the three Pakistani cities—Karachi, Islamabad and Peshawar using the following formula:

[60] The selection of sub-indicators is dependent on the availability of data; there is no systematic compilation of city databases in Pakistan.

$$URI = \sum_{i=1}^{7} \quad w_i D_i \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (1)$$

$$D_i = \sum_{j=1}^{nj} \quad u_{ij} Y_{ij} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (2)$$

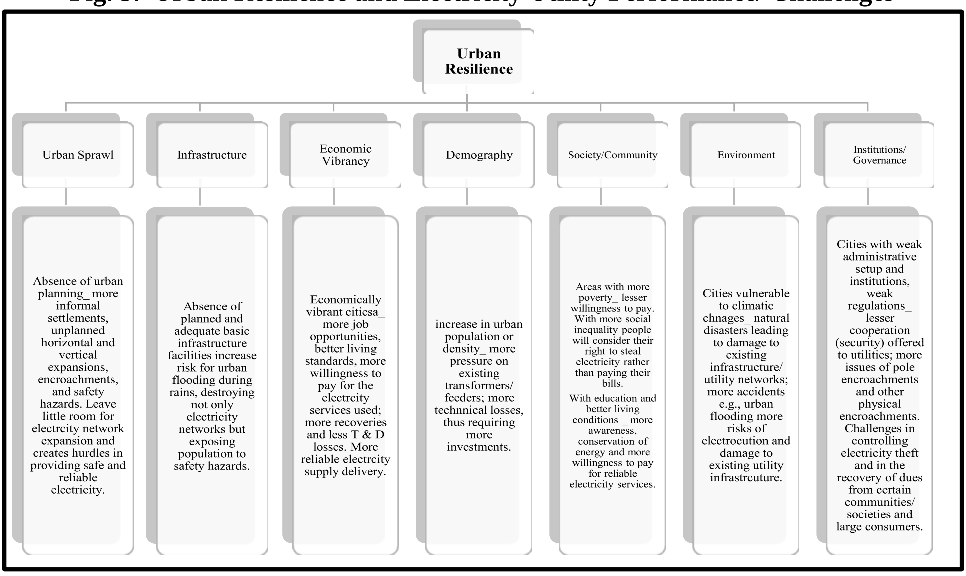
Where URI is urban resilience index; Di is resilience component index; Yij is the standardised value of each indicator; wi is the weight of each dimension and uij is the weight of each sub-dimension. *The value of urban resilience closer to one will indicate higher resilience.*

Urban Resilience Index is estimated to compare the present developmental progress of three cities in this study. Indices are set with 23 sub-dimensions (indicators) based on seven dimensions as listed in Figure 2. Additionally, positive and negative signs are assigned to every indicator to indicate the impact of urban resilience. Besides, the value of these indicators is normalised. The normalised values are adjusted between 0 and 1.

Weights assigned to each dimension and sub-dimensions are derived from the significance of that variable to urban resilience as perceived in the literature and from the electricity utility perspective.

Besides estimating urban resilience for each city, each of its dimensions and sub-dimensions are linked to the electricity utility performance and issues faced by these utilities using a problem tree analysis as depicted in Figure 3.

Fig. 3. Urban Resilience and Electricity Utility Performance/ Challenges



Data Sources

- GIS mapping data, census data, PSLM 2019-20, published reports/ articles and information collected from utility officials in informal interviews.
- Utility data from NEPRA State of Industry Reports, Performance Evaluation Reports and primary information shared by three Distribution Companies.

Data Limitation: Comparative analysis regarding urban resilience for several years is not possible because of the lack of time-series data of city characteristics. Besides, the collection of city-level data has not been institutionalised in Pakistan. Therefore, we have relied on proxy variables. For some variables, for instance, integrated governance capacity, ethnic conflict/ terrorism activities, we have assessed the value of variables based on available information. Likewise, information on city income and employment status is not collected regularly. We have cited these figures from the State of Pakistani Cities Report, 2018. However, utility performance has been compared for the last five years.

URBAN RESILIENCE AND CHALLENGES IN PAKISTANI CITIES

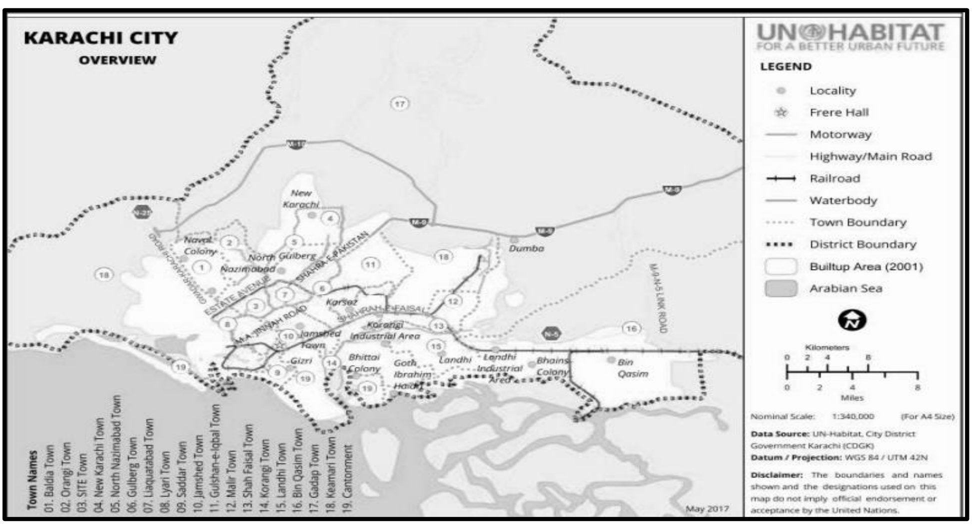
City Profiles

As mentioned earlier, the research targets three Pakistani cities—Karachi, Islamabad, and Peshawar.

(a) *Karachi*

Karachi is the largest city in the country. It is the sixth most populated city in the world[61]. The city is home to more than 16 million (unofficially 21.2 million or above). In the 1960s and 1970s, it was called the city of lights because of its economic vibrancy. The population influx in Karachi began right after independence when 0.6 million migrants arrived from India; inducted into a city of 0.4 million. The trend continues till today, economic opportunities are attracting migrants from across the country. With an area of 3648 square kilometers, divided into 178 Union Councils (UCs) and a population of 16.1 million (urban & rural) is growing at the rate of 2.6 percent.

More than 2.5 million of its inhabitants are political, economic, or illegal migrants; half of these migrants are living in informal settlements. The extraordinary urbanisation growth in Karachi has deeply impacted the city's politics and social fabric. Despite being the economic hub[62], there are grave urban governance issues, creating difficulties in the provision of utility services across the city.



Source: Cited from State of Pakistani Cities, UN- Habitat, 2018.

---

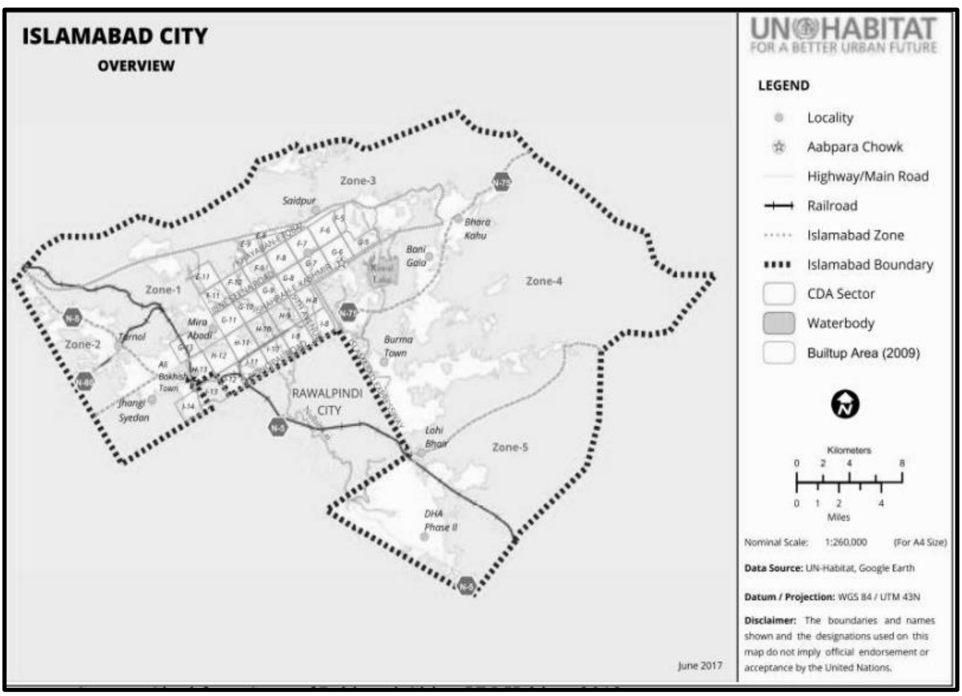
[61] According to Hasan (2015), Karachi is the fastest-growing large city in the world. He reports that between 1998 and 2011, the city grew by 115 percent.

[62] Most of the trade flows into the country through this city and it is home to the largest number of industries.

(b) Islamabad

Islamabad is in the Potwar Plateau, which is one of the most thickly populated regions in Pakistan. The city was built in 1961 as the national capital. The administrative region of Islamabad is divided into five zones. Zones I and II are divided into sectors with a size of about 2 km by 2 km. Some sectors are well-developed, while others are under-developed. Zone-III mainly refers to the Margalla Hills national park. Zone-IV and the north Zone-V are distinguished as agricultural landscapes, whereas, the south Zone-V is close to Rawalpindi City featuring private houses, social and industrial facilities.

The territorial limits of Islamabad have expanded. The urban area has increased from 58.854 sq.km in 1990 to 309.697 sq.km in 2018. Whereas the population of the city has increased more than three folds from 0.559 million in 1979 to 2 million in 2017. Out of these two million, about 50.5 percent live in the rural areas and the remaining 49.5 percent in the urban areas of Islamabad. From 1979 to 2019, there is an increase of 377 sq. km in a built-up area and 47 sq. km of agricultural land in Islamabad. The main reasons cited for urban sprawl in Islamabad are population growth, migration from other cities due to increase in economic activities, road and railway transportation system, security issues in KPK and Afghan war, neighboring urban effect and above all increased investment in real estate and development of new housing schemes. With an area of 906 square kilometers, divided into 50 UCs and a population of 2 million (urban & rural), is growing rapidly at the rate of 4.9 percent.

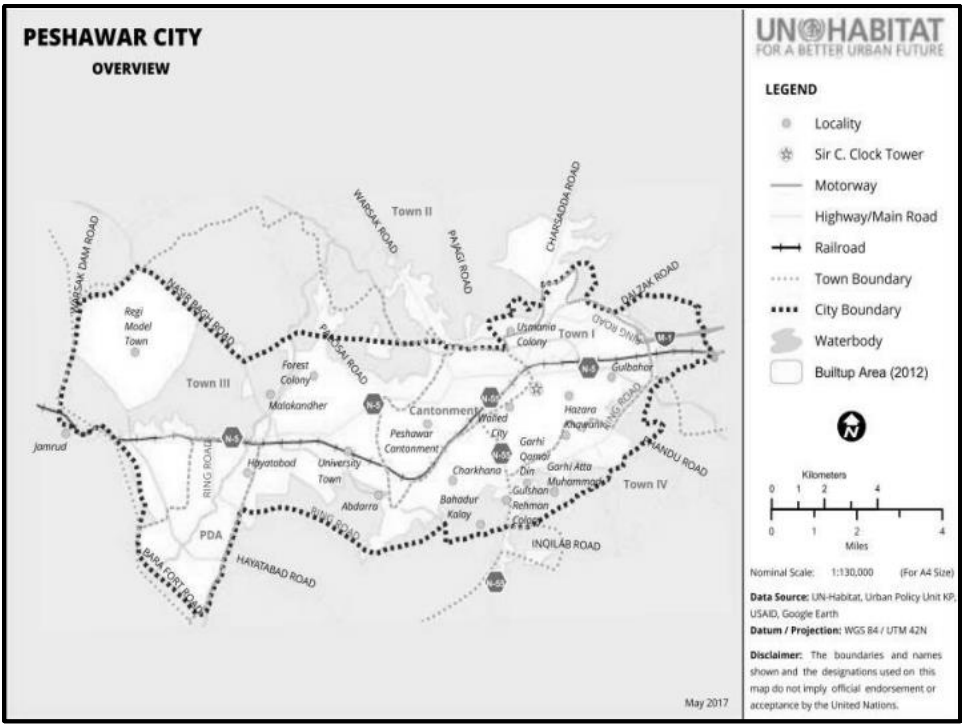


Source: Cited from State of Pakistani Cities, UN-Habitat, 2018.

(c) Peshawar

Peshawar—the capital of Khyber Pakhtunkhwa (KPK) is connected to Khyber Agency in the West, Mohmand Agency in the North, Kohat in the South, Charsadda and

Nowshera in the North and Northeast respectively. With an area of 1518 square kilometers, divided into 97 UCs and a population of 4.3 million (urban & rural), is growing rapidly at the rate of 3.99 percent. Apart from rural-urban migration, Afghan Refugees, and Internally Displaced People (IDPs) are mainly responsible for rapid urbanisation and rising population in the city. These migrants with limited financial resources end up settling in informal settlements (slums) (Urban unit, 2013). The urban population of Peshawar is growing at a fast pace; it is expected to reach 2.8 million by 2030 (Safdar, 2018). With alarmingly high growth, the city is facing acute shortages of housing leading to an increase in the number of slums[63]. Peshawar is the second poorest provincial capital in the country after Quetta, Baluchistan (State of Pakistani Cities, 2018).



Source: State of Pakistani Cities, UN-Habitat, 2018.

URBAN RESILIENCE IN PAKISTANI CITIES

Urbanisation is a socio-economic process that leads to the shifting of the population from rural to urban settlements. Generally, more job opportunities and improved services are associated with cities. This perception attracts more and more people to urban centers in search of better living. It is central to economic development but at the same time poses serious challenges when cities lack the capacity to absorb, adapt and transform in accordance with changing dynamics. A city with poor capacity to absorb, adapt and

[63] According to the Housing Census 2015 and data available with the Peshawar development authority (PDA), the total number of houses in Peshawar was 0.167 million in 1981. It went to 0.236 million in 1998 and the number of houses in Peshawar remained 0.897 million in 2015.

transform to changing city dynamics due to population growth, environmental changes or deteriorating city law and order etc., put the lives of the most vulnerable to natural and safety hazards; and create difficulties for the utilities to perform efficiently.

In Pakistani cities, lack of urban planning, limited and unplanned infrastructure, weak administration and governance, social variation, poverty, conflict, and environmental issues are common. Informal settlements with limited access to basic utilities are prevalent. Unplanned urban growth often led to congestion, poor housing, pressure on limited public services, air and water pollution and associated health issues (cited from Avis, 2016).

(d) Urban Sprawl

Urban sprawl is the geographical expansion of cities/ towns accompanied by a significant loss of density (Morollón and Yserte, 2020). It is often linked to increased energy use, pollution, congestion, and a decline in community distinctiveness (Rafferty, Britannica). The most common indicator used to compare urban sprawl is the ratio of the growth in the physical extent of urban areas to the population growth.

Literature suggests haphazard urbanisation in Pakistani cities, where lopsided and outdated zoning laws further aggravates the rational use of urban land for residential, commercial, and industrial needs. In terms of urban sprawl measured as a ratio of the growth in the physical extent of urban areas to growth in population, Islamabad is at the top with a ratio of 1.9 followed by Peshawar and then Karachi. The proportion of the built-up area is also maximum for Islamabad (Table 1). Even in the supposedly planned city of Islamabad, 55 percent of the land is earmarked for residences, while only 5 percent for commercial activities, thus increasing the built-up area.

Whereas, both Karachi and Peshawar are even worse in terms of urban planning. Both cities have experienced exponential growth in informal settlements (slums/ Katchi Abadi's) without basic facilities. Both Karachi and Peshawar have large informal settlements and have grown beyond the boundaries of the planned urban areas (Fazal and Hotez, 2020). The percentage population living in slums in both cities is exceptionally very high (Table 1).

Karachi is among the world's most dense megacities; 62 percent of its population resides in 8 percent of the residential area, increasing densification. Whereas 38 percent of the population (mainly middle-income, elite class, bureaucrats, and politicians) is settled in the remaining 92 percent of the area (Hussain, 2016). There are more than 600 slums in Karachi[64]. Karachi is also home to the largest slum in Asia, that is, Orangi Town, with an estimated population of 2.4 million (UNICEF, 2020). The huge number and size of slums in Karachi is partially explained by urbanisation without structural transformation. However, because of the lack of urban planning in the city, everything is on an ad hoc basis. The policymakers have never responded effectively to the needs of people migrating to the city (Hussain, 2016).

In the city, the service delivery of electricity is affected by these informal settlements and physical encroachments which not only result in frequent power breakdowns but also pose serious safety concerns and are a major reason for significant

[64] According to Sindh Katchi Abadi Authority, the number of the city's 'Katchi Abadi' is 575.

electricity theft. As reported in Hasan (2016) most of the development in Karachi is taking place on the periphery of the city, particularly in the Malir and West district. Large formal housing has gained momentum, whereas poor and vulnerable communities have become denser in the existing informal settlements and spread to new settlements in the periphery. More than 60 percent of Karachiites live in informal settlements on 23 percent of the city's residential lands. Densities in these settlements are between 1,500 to 4,500 persons per hectare and continue to increase. Meanwhile, the rest of Karachiites live in "planned" settlements on 77 percent of the city's residential lands. Densities can be as low as 80 persons per hectare and continue to decrease in new settlements (Hasan, 2016). About 35 percent of slums are in Karachi West, 20 percent in Karachi East, 22 percent in Karachi Central, 12 percent in Malir and 11 percent in Karachi South (Hussain, 2016). There is little to zero coordination on planning and development between the various land-owning organisations in the city. This creates a problem for electricity utility.

The case of Peshawar is no different from Karachi as more than 70 percent of the city population lives in slums/underserved areas, which is an indication of unplanned city growth, poor urban management, and lack of resources. The only difference is, planning and development of the city is the sole responsibility of Peshawar Development Authority (PDA), other than Defense Housing Authority (DHA) and cantonment areas. Reportedly, almost 156 illegal housing societies[65] have been set up in Peshawar District without any approval or No-objection Certificate (NOC) from Peshawar Development Authority[66]. All the buying selling and transferring of plots is going on with the support of government departments and the police.

That's why these societies are provided with electricity. PESCO officials are of the view that there is a flaw in administrative law, which needs to be rectified. However, the fact is more than 70 percent of illegal housing are not approved because of size but because they are built on agricultural land. By characteristics, they are defined as informal settlements/ slums[67].

Table 1

Urban Growth and Sprawl

	Area Square km	Ratio Land Cons. to Pop. Growth	Built-up Area Km^2	% Population Living in Slums)	Urban Population Growth %
Karachi	3648	0.772	666.18	62	2.43
Islamabad	906	1.866	474.8	38	3.48
Peshawar	1518	1.075	84.39	78	3.72

Source: World Cities Report, 2020, Raza, et al (2020), Shah et al (2020) and UNICEF (2020).

[65] Some sources quote 181 illegal housing societies.

[66] https://www.thenews.com.pk/print/753457-156-illegal-housing-societies-set-up-in-peshawar

[67] Slums are a connecting settlement where the inhabitants are characterised as having inadequate housing and basic services. A slum household is defined as a group of individuals who live under the same roof that lacks one or more of the following conditions: limited access to improved water and sanitation; weak housing structures; insufficient living area; and uncertain about legal ownership of the residential area. It is often not recognised and addressed by the public authorities as an integral or equal part of the city (UNICEF, 2020). That's why PESCO management was of the view that there are no 'Katchi Abadi's in Peshawar.

Islamabad has also expanded extensively in the last two decades, thus creating serious challenges for the city administration and utilities in providing basic amenities to these new settlements. Although initially, the city was planned, the rising urbanisation has led to unplanned expansion at the periphery[68]. This unplanned urban sprawl is continuing unchecked due to lack of monitoring of the land use, poor adherence to the land-use policies and lack of real-time data (Mannan et al., 2018).

The people migrating to the capital city often got settled in more formal, planned townships and housing schemes (mainly for the middle- and upper-income groups) such as Bahria Towns, DHAs, and many such approved societies at the periphery. These societies have extended the de facto urban limits making it difficult for the authorities (mainly the Capital Development Authority (CDA)) to guide the urban growth as planned. For instance, housing growth has created a demand for infrastructure and services in directions other than the planned growth of Islamabad's sectors (State of Pakistani cities, 2018).

Islamabad has a relatively low share of informal settlements as compared to the other two cities (officially). The reason cited is its closeness to an old cant city of Rawalpindi (Shah, et al, 2021). However, some experts are of the opinion, Islamabad's rural areas (officially) in fact reflect the development of slums around the urban region. Huge population growth has been in areas at the Islamabad periphery[69]. About 65 percent of the population shown in the National Census as rural is slum development (Butt, 2017). As per CDA official website, there are about 140 illegal housing societies_ some of which are complete and densely populated. By definition, some of these are considered informal settlements or slums.

In short, the urban development in Islamabad is haphazard. The urban growth in Zone I and II was due to the master plan; the growth in Zone 4 is cited as due to urban-neighbor effect; in Zone-V related to industrial and real estate development. Insufficient urban capacity in Islamabad leads to the development of informal settlements. The area encompassing slums has increased from 5.534 sq.km in 1990 to 28.979 sq.km in 2018 (Liu, et al, 2020). The Afghan War is also one of the reasons behind the increase in number and size of slums in the city.

Such huge expansion and illegal build-up have increased challenges for city administration_ increased demand for electricity and gas, shortage of ground water resources, basic infrastructure deficiency including sewerage and waste management, urban flooding, traffic congestion on roads increasing travel time, deforestation, loss of barren lands, and increase in street crimes (Shah, et al, 2021). Urban development in Islamabad is considered unsustainable, as it is not linked with creating resilience to natural and man-induced disasters, a green and clean transportation system, a planned expansion of industrial and economic extension (Abdul & Yu, 2020). The urban sprawl of Islamabad is putting pressure on the regulator (CDA) to regularise the unauthorised construction and unapproved developmental schemes in the peripheries of the city. In some cases, the regulator has done so (Shah, et al, 2021).

[68] The barren land is depleting fast from 489.1sq.km in 1979 to 155.4 sq. km in 2019.

[69] Tarnol, Sihala, Rawal Dam, Bani Gala, Barakahu, Bari Imam, Golra, Shah Allah Ditta, Nilore Road and Jhangi Sayedan.

Even if they are unapproved, these housing societies exist[70]. Urban flooding in E-11, this month (July 2021) is an example, where the size of rainwater nullah was reduced a few years back to accommodate more housing units in an illegal housing society (constructed without CDA NOC and people are living there).

It is a tough call to compare urban sprawl in three cities. For estimation purposes, we are relying on official data in published reports and articles in international journals.

(e) Demography

Table 2 & Table 3 compare demographic variables across three cities. As discussed in Section 3.1 *Karachi is the most densely populated city with a population growth of 2.6 percent. In terms of population growth, Islamabad is at the top, while in urban population growth, Peshawar has grown at the fastest speed.*

Rapid urbanisation has increased housing demand in the Pakistani cities in general, and in these three cities in particular. Lack of housing for low-income urban populations and or for the people migrating from rural areas with limited financial resources has led to the creation of large informal settlements, both within cities and more towards city boundaries. These unauthorised neighborhoods have limited to zero access to public utilities including electricity, infrastructure, and places for social activities. They often opt for illegal means to fulfil their needs.

Table 2

Demographic Profile

District	Area (Square Km)	Population Total	Population Urban %	Density	Pop. Gr. (1998-2017) %	Urban Pop. Gr. (1998-2017) %	Average HH Size (members)
Islamabad	906	2001579	50.5	2209	4.9	3.48	5.9
Peshawar	1518	4269079	46.1	2812	3.99	3.72	8.4
Karachi Central	69	2972639	100	43082	1.41	–	–
Karachi East	165	2909921	100	17636	3.64	–	–
Karachi West	929	3914757	92.8	4214	3.35	3.14	–
Karachi South	122	1791751	100	14686	1.02	–	–
Malir	2268	2457019	100	1083	3.86	3.11	–
Korangi	95	2008901	100	21146	2.41	–	–
Karachi (Total)	3648	16054988		4401	2.6	2.43	5.7

Source: Population Census, 2017.
Note: Urban population includes slum population.

Table 3

Population

	1951	1961	1972	1981	1998	2017
Islamabad			77000	208000	529180	2001579
Peshawar	391000	529000	807000	1113000	2019000	4269079
Karachi	1137667	2044044	3606746	5437984	9802134	16054988

Source: Census Reports.

[70] It is reported at CDA website, as on May 5, 2021, there are 140 illegal housing societies in Zone I to Zone V.

(f) Infrastructure Development

The provision of urban services_ clean drinking water, sewerage system, waste collection etc. is the responsibility of government institutions. Despite the provision of better basic services like access to clean water, power, and sanitation etc. in the urban areas as compared to the rural areas, these basic amenities are scarce in the three urban regions under study. Especially, people living in informal housing have limited access to such services.

Karachi has severe water supply problems. The supply of clean water to Karachi's residents has remained around 550 million gallons per day against a daily demand of 1100 million gallons. Karachi's population is increasing but the areas with access to piped water are still the same (State of Pakistani Cities, 2018). In the absence of formal facilities, residents often use illegal connections; they have installed water motors inside their small houses in congested localities, creating safety hazards. Some people in relatively better locality (who can afford) also rely on informal water sources such as expensive water tankers, reflecting the poor state of urban governance in these two cities.

The situation for Islamabad is not different either, the total production of water supply does not go beyond 84 million gallons per day against an average demand of 176 million gallons per day. The city receives its water supply from Simly Dam (about 107 million gallons per day) and groundwater sources. Despite the claims about the improvement of water supply made by the Capital Development Authority (CDA), the situation remains challenging especially during summers. People residing in many neighborhoods, including the peri-urban locations, often rely on water tankers (as in Karachi), supplied by private operators at high prices.

Table 4

Infrastructure Services

	Main **Source** of Drinking **Water (% share)**			Waste
	Piped water	Motorised Pumping	Tankers	Generated Tons/Day
Karachi	85.4	1.0	9.8	9000
Islamabad	20.8	37.1	3.5	500
Peshawar	78.5	16.9	–	564

Source: State of Pakistani cities, 2018.
Note: Main source of drinking water explains safe drinking water infrastructure as provided by municipalities and other sources.

An increase in urban population coupled with inefficiencies in water use leads to groundwater depletion and the declining quality of surface water in Pakistani cities. Droughts, unexpected water supply interruptions, or dilapidated networks may further jeopardise the water resilience of urban areas (Abdul and Yu, 2020). Similarly, sewerage system and waste disposal management are serious concerns in the three cities, but the magnitude varies. Although an exact figure is not available, the problem is very severe in

Karachi, as evident from media reports_ showing footage of heaps of garbage in various parts of the city.

Waste management, sewerage and provision of clean drinking water all are under the domain of local government. But the changing status of local governments, frequent amendments in their duties/ domain and nature of relationships with federal and provincial governments, have deeply impacted their performance, especially in Karachi (State of Pakistani Cities, 2018). In Karachi, the authorities lack the capacity to lift all garbage (more than 9000 tons per day). Peshawar faces similar issues; out of 564tonnes of waste collected, only 40 percent reaches dumping sites. Perhaps, the problem is not as acute as in Karachi due to the relatively smaller population in the city. The exact figure is not available for Islamabad.

A large amount of the sewage (including hospital waste) is disposed into rivers without treatment which pollutes the rivers[71]. Besides, solid waste is disposed of at open dumping sites located near water streams which often block the flow of water in these natural drains. The presence of dumping spots near residential areas, water reservoirs or water drains is the result of ill-planning in all three cities. There is no monitoring mechanism in place to avoid serious health and environmental risks.

It is the lack of basic infrastructure facilities and deforestation that urban flooding and other natural disasters have now become a common feature in all three cities, destroying not only electricity networks but exposing population to safety hazards. For instance, in the floods of 2010, thousands of households were affected in Peshawar; similarly in 2016. Additionally, Peshawar is about 200 kilometers from the Hindu Kush seismic region which makes it exposed to earthquakes.

Likewise, Karachi is vulnerable to natural disasters like earthquakes, floods, cyclones, and urban heat island phenomena due to the expansion of built-up areas and increase densification. Due to high population density as well as encroachments along the drainage, the city often faces water accumulation affecting existing infrastructure. In recent years, urban floods have damaged communication, transportation, and public infrastructure networks significantly. As mentioned earlier, the authorities in Islamabad should seriously take the recent incident of urban flooding in E-11 Islamabad that causes damage to life, property, and infrastructure.

Though households in these cities have in general access to electricity and natural gas for cooking purposes. But reliable power supply remains an issue, in particular, in some areas of Karachi and Peshawar. It is interesting to note that household electricity access is 100 percent in Islamabad. Where the evidence shows the existence of about 140 housing societies without NOC or LOP[72].

---

[71] In a survey of 100 Katchi Abadis in Karachi, it has been estimated that people have invested Rs 84.4 million in water and sanitation while the government has invested Rs 180.6 million. However, water is often not available and sewage systems do not function due to the absence of disposal points. All such settlements dispose of their sewage in natural drainage channels (Hasan and Mohib, 2003).

[72] No objection certificate (NOC) and Letter of Possession (LOP).

Table 5

Household Characteristics

District	HH with Internet %	HH with Access to Electricity %	HH with Gas as Cooking Fuel	HH with Toilet Facility	Pre-natal Consultations
Islamabad	70	100	93	99	97
Peshawar	51	96	73	95	86
Karachi	51	97	97	99	91

Source: PSLM 2019-20
Note: PSLM is a representative sample, it may not include illegal connections.

(g) Economic Vibrancy

Pakistani cities vary not only in terms of their physical size but the size of the economy, employment opportunities and tax revenue collection. In the three cities, services and industry are the primary employment generating sectors.

Table 6

Economic Profile

City	Income Tax Revenue Rs Billion 2017-18	Per Capita Income Tax (Rs)	Per Capita Income 2014-15 (Rs)	City Employment rate %
Karachi	424.8	28476	56000	36.8
Islamabad	204.2	202161	70000	35
Peshawar	13.6	6926	67000	29.6

Source: State of Pakistani cites, 2018, FBR Tax Directory, 2018
Note: Per capita income is based on PSLM 2014-15 survey which is only a representative sample, not the exact national account figure. Additionally, tax figures include taxes from the corporate sector, while income is for individuals only. For estimating per capita income tax, only urban population is used.

Karachi has a comparative advantage as most of the international trade passes through Karachi port, it is home to the Pakistan Stock Exchange, about 30 percent of the manufacturing sector is in its vicinity, and account for 20 percent of the country's GDP_ making it the largest business and financial center (Fazal and Hotez, 2020). Of the city's total labour force, 37 percent are employed (64 percent in the services sector and 36 percent in industry)[73]. The per capita income of the city is Rs 56,000, the lowest among the three cities (Table 6). It is worth mentioning here that the city has a large informal economy, not reflected in the country's GDP estimates or in income and expenditure surveys.

Peshawar is not only at the top in poverty estimates but has the second-highest per capita income among the three, reflecting income inequality. Out of the total 30 percent employed (lowest among the three), 86 percent are employed in the services sector. The low share in the industry reflects the city's low production base. Islamabad, with an

[73] The data on employment is extracted from PSLM 2014-15, cited in the State of Pakistani, 2018. It covers mainly salaried employment in the formal sector. Self-employed not included and informal employment not included.

employment rate of 35 percent, again is a service economy, as 87 percent of its employed population are in the services sector. Per capita income in Islamabad is the highest among the three.

Income tax collected indicates economic vibrancy as well as culture of compliance to the law. In absolute terms, Karachi is at the top. The city collects Rs 425 billion of income tax in 2018 (41 percent of the country's total tax revenue), twice the amount Islamabad collected (Rs 204 billion) in the same year. In comparison to these two, income tax collection in Peshawar is minimal (2 percent of total tax revenue) showing a lack of tax culture and informal economy. However, after controlling the population size, Islamabad is more tax compliant than Karachi. It collects Rs 202,161 tax per capita compared with Rs 28,476 by Karachi (cited from Hasan and Chaudhry, 2020)[74].

Karachi is an economically vibrant city therefore the rate of migration into Karachi is high. However, a large segment of the labour force that migrates into Karachi is poor, employed in the informal economy and cannot afford to live in formal housing. In comparison, the economic activities in Islamabad have increased substantially in the last decade. Business activities in the real estate and housing sector. It is a Capital city, home to diplomatic and Federal Government activities. Besides, there is an increase in the commercial activities with the construction of new malls and high-rise buildings in the peri-urban areas, due to the availability of relatively cheap land.

(h) Social/ Community Profiles

Selected social indicators of the three cities under study are reported in Table 7. There is a considerable difference among the three cities in terms of social indicators. Peshawar is at the lowest end in all indicators, except for out of school children. The maximum out of school children are in Karachi. Peshawar is the poorest city among the three, it is the second poorest provincial capital in the country after Quetta with a poverty rate of 31 percent (State of Pakistani Cities, 2018). About 2.5 percent of Peshawar's population availed Ehsaas Kafalat Program last year. The Average Intensity of Deprivation[75] for Khyber Pakhtunkhwa, in general, is at 57 percent (UNICEF, 2020).

Rapid urbanisation has led to the emergence and expansion of slums in both Karachi and Peshawar. However, in terms of overall living conditions, Karachi is much better off than Peshawar. Lack of sewage treatment and health facilities; low literacy and education attainment rate; contaminated water and poor sanitation facilities in houses is common in Peshawar.

---

[74] The income tax collected from the city includes personal income tax as well as corporate income tax. Thus, a city that has more businesses is likely to generate more income tax. Having a business firm depends upon several factors including business prospects, infrastructure, income levels etc. Secondly, as under the income tax law, the corporate income tax is to be paid by the Head office (regardless of where the branches of a firm operate). One of the reasons for more tax collection from Islamabad could be that Head offices of certain big firms are located in Islamabad. The same is true of Karachi.

[75] Average Intensity of deprivations is part of multi-dimensional poverty index. It reflects average number of deprivations a poor person suffers. It is calculated by adding up the proportion of total deprivations each person suffers (for example, access to good health clinic, quality education, housing quality, etc.) and dividing it by the total number of poor persons.

Table 7

Social Profile

City	Poverty Incidence %	Out of School Children	Overall, Health Indicator	Ehsaas Beneficiaries % of Total Population	Living Standards %
Karachi	4.5	25.9	24.4	0.77	26
Islamabad	3.1	10	26.5	0.36	25.2*
Peshawar	31.5	25	23.2	2.45	22.2

Source: PSLM 2019-20; Living standard is extracted from PSLM (based on education, health, information and communication technology and household living standards.

*This data is based on PSLM survey_ it is a representative survey, may not reflect actual data. Per capita income as reported in Table 6 is based on PSLM Survey 2014-15, whereas, living standard data here is based on PSLM Survey 2019-20. Some discrepancy is possible.

(i) Environment

Islamabad is the most planned city among the three. Yet, with the passage of time and mushroom growth in the built-in area and decline in forest cover has led to severe environmental degradation. Not only air quality has deteriorated, but the city is also experiencing relatively warmer temperatures. The absence of waste-water treatment and dumping of solid waste in open land-fill sites has destroyed the overall environment of the city. Now the quality of air is much below WHO standard. Road traffic is increasing rapidly to cater for the demands of rapid urbanisation, where emissions from vehicles are another key contributor to high particulate matter in the city. The average level of Particulate Matter (PM) in the air was 39 ug/m^3 in 2020.

Peshawar also faces growing environmental issues due to rapid urbanisation, population explosion and exploitation of natural resources. Besides, unplanned urban expansion and rapid growth in Peshawar's population has resulted in a significant rise in temperature and urban flooding. Likewise, visible smoke and dust all around the city are creating serious health risks.

Karachi just like other cities in the country has witnessed relatively warmer temperatures and unexpected monsoon rains over the past few years because of climate change. Unpredictable rains are also causing damage to the existing infrastructure. Besides, increased densification is further adding to environmental challenges. The city witnesses exceptionally high levels of traffic congestion and environmental pollution with an increasing number of motor vehicles, especially fuel-inefficient vehicles. Besides, the absence of waste-water treatment and inefficient as well as insufficient solid-waste management are a further contribution to climatic woes in the city. The level of air quality is decreasing rapidly, the average level of Particular Matter (PM) in the air was 43.8 ug/m^3 in 2020.

In the last two decades, Karachi has experienced cycles of drought and intense rainfall in certain districts. Hub, Lyari and Malir rivers were used to be the main drainage sources in Karachi; with a capacity to discharge extra water safely to the Arabian Sea. However, unplanned informal or illegal settlements in surrounding and especially encroachments on natural nullahs have seriously affected riverbeds, making Karachi more vulnerable to the harmful effects of monsoon season flooding (State of Pakistani Cities, 2018). Regardless of serious challenges, there is no serious disaster monitoring system in the city.

(j) Governance/ Institutions

Urban governance is not just about the formal structures of city government involving planning, finance and management but includes economic and social forces, institutions, and relationships—formal and informal (Avis, 2016). In cities with weak administrative setup and institutions, lesser cooperation is offered to utilities by law enforcement agencies in controlling theft and in the collection of payments.

Rapid urbanisation in Pakistani cities has led to several challenges including poverty, inadequate housing, infrastructure deficits, traffic congestion, natural and man-made disasters, and diseases. Besides, it has led to security issues related to terrorism, crime, ethnic conflicts and so on. In Karachi, one of the serious challenges is high crime rates and lack of citizen safety. Undoubtedly, in recent years, after Ranger's operations, the crime rate and violence have decreased substantially. Still, it is more than 50 percent and is highest among the three cities (Table 8).

Table 8

City Governance Indicators

	Karachi	Islamabad	Peshawar
Crime index %	53.65	29.15	46.14
Integrated Institutions*	0.2	0.6	0.3
Safety Index %	46.35	70.85	53.86
Ethnic Conflict/ Terrorism**	0.6	0.1	0.6

Source: https://www.numbeo.com/crime/country_result.jsp?country=Pakistan;

* Assessment based on literature, available information, number of institutions involved in administrative activities, its value ranges between 0 and 1; ** assessment based on number of conflicts and terrorist activities in the city in the last 20 years (documented evidence), its value ranges between 0 and 1 depending upon the frequency of events.

Accentuating the problems of urbanisation, poverty, and climate change have been political instability resulting from wealth disparities and ethnicity issues and conflicts in Karachi (Fazal and Hotez, 2020). Karachi is ethnically diverse with the poor of different communities residing in a particular slum. Specific communities residing in neighborhoods add to the woes of utility agencies as each community may enjoy the support of one or the other political party or interest group, thus creating problems in the collection of dues from the residents. Given these strong and well-knit communities, it is difficult to control electricity theft. Electricity theft via 'Kunda' is a special feature in Karachi. K-Electric efforts to control power theft are discussed in detail in Section 4.3. While the role of the Commissioner's office is coordination and managing the balance between municipal and utility services, unfortunately clear boundaries on a district level are not available. Administrative control is with the Commissioner office, but planning is delegated to KDA, MDA and Local Governments

After the Afghan War, Peshawar became an important center for Afghan refugee settlements. Consequently, abductions for ransom, extortion, and illegal activities by organised crime syndicates along with violent attacks by religious militants added to the hazards to the lives and fundamental freedoms of citizens. The dumping of bodies in different parts of Khyber Pakhtunkhwa and the adjoining tribal areas became a recurring phenomenon[76]. The stress Peshawar has experienced over the last three decades has weakened its economic stability. In Peshawar, the government failure in showing flexibility in development plans strategies has further weakened the overall governance landscape in the city[77].

The roots of urban crimes in both Karachi and Peshawar have more to do with dysfunctional urban development than any other factor. The criminal outfits in both Karachi and Peshawar are flourishing on the back of the illegal economy. The division of the city between planned and unplanned areas, the rivalry over limited resources as well as public amenities and the adverse relationship between political parties or interest groups have affected the city's social fabric.

Though, unplanned urban growth in Islamabad has compromised the quality of life and environment. Islamabad is a relatively safe city. There is one authority, that is, Capital Development Authority (CDA) mainly responsible for city planning and development. Apart from DHA, all housing societies 'planning, development and maintenance of the Master Plan for Islamabad' is the responsibility of CDA. Though there are many illegal and unauthorised societies (without LOP or NOC) from CDA, because of the proximity of the city to the powerhouse, these are developed unchecked. Metropolitan Corporation Islamabad (MCI) and union councils for the city's governance were established in 2015 through Islamabad Capital Territory Local Government Act; with responsibility for managing and providing municipal services and infrastructure, regulating markets, and promoting cultural, social, and economic development activities (Haque, 2020); but so far are not very effective.

Municipal Councils have limited say in major planning decisions, not only in Islamabad but in other cities as well. Though on paper, they have the responsibility of urban management, major decisions are taken by various other government departments including district administration. As a result, private and individual actions and public interventions do not come together, but rather, conflicting situations are created that require crisis management more than planned interventions (State of Pakistani cities, 2018).

Peshawar Development Authority (PDA) is the main governing body in the city. Unlike Islamabad and Peshawar, Karachi has multiple governing authorities. In all, the city is managed and governed by 13 different departments simultaneously. Lack of coordination among this leave little room for a comprehensive urban framework as is the norm in metropolitan cities around the globe (Hussain, 2016). Thus, more issues for city utilities, e.g., K-Electric, SSGC and KWSB.

URBAN RESILIENCE IN PAKISTANI CITIES—ESTIMATION

Based on Equations (1) and (2), urban resilience index is estimated for the three cities using seven dimensions and several sub-dimensions. The weights and signs (positive means increase in urban resilience and negative means decreasing effect on urban resilience) assigned to these dimensions are illustrated in Table 9.

---

[76] http://hrcp-web.org/hrcpweb/data/ar14c/2-1%20Law%20and%20order%20-%202014.pdf

[77] https://tribune.com.pk/story/1145097/fragile-economy-peshawar-policy-failure

Table 9

Urban Resilience—Weights and Signs

Urban Resilience Dimensions	Weight	Sub Dimensions	Integrated Weight	Sign
Urban Sprawl/ Urban Planning	0.200	Land Consumption Growth to population growth Ratio (2000-2015)	0.055	–
		Built-up Area Km^2	0.052	–
		% Population living in informal housing (Slums)	0.058	–
		Urbanisation Rate	0.035	+
Demography	0.056	Population Density	0.0187	–
		Urban Population Growth	0.0186	–
		Average Household Size	0.0187	–
Social/ Community	0.116	Poverty Incidence	0.021	–
		Ehsaas Beneficiaries	0.022	–
		Children in School	0.021	+
		Health	0.025	+
		Household Living Standard	0.027	+
Economic Vibrancy	0.195	Income per Capita	0.061	+
		Income Tax Collected per Capita	0.081	+
		Employment rate	0.053	+
Infrastructure	0.180	Access to Piped Water/ Water Pumping	0.036	+
		Population with Internet	0.036	+
		Access to Electricity	0.036	+
		Access to Gas for Cooking	0.036	+
		Solid waste generated	0.036	–
Environment	0.05	% Particular Matter Air and urban flooding	0.05	–
City Governance/ Institutions	0.203	Crime Index	0.051	–
		Safety Index	0.062	+
		Integrated Governance Capacity/ Effective Institutions	0.065	+
		Ethnic Conflict/ Terrorism Activities	0.025	–

Source: Author's Assessments.

The main issue in developing an integrated assessment index is how dimensions or inputs are weighted. The three cities are more or less similar in terms of social progress, institutional ability, urbanisation trends/ sprawl, infrastructure planning, city governance and environmental pressures, this makes it difficult to assess. Therefore, we have applied different weights using Analytical Hierarchy Process (AHP) based on information available in the literature. More weightage is given to the sub-dimension, whose significance in the context of urban resilience is more. Secondly, in weight assessment, we also take into account the perspective of electricity utility management, e.g., the problems they face because of urban sprawl, poverty, city governance and so on.

Table 10

Urban Resilience Across Pakistani Cities

	Urban Resilience Index
Islamabad	0.20
Karachi	0.12
Peshawar	0.10

Source: Author's Estimates.

As the estimated index shows, ***none of the three cities in Pakistan is resilient enough to absorb changes/ shocks to urban systems, none of the estimated index is close to 1.*** However, among the three cities, Islamabad is relatively more resilient, which is not a surprise. Being the Federal capital, it is the most privileged city. Both Peshawar and Karachi are close, but Peshawar is at the lowest level.

The rising population in Pakistani cities, in particular, in Karachi and Peshawar, calls for expansion of utility infrastructure at a fast pace and the fact that a significant demand for expansion comes from slums or informal housing units makes the job of the utility agencies even more difficult. Overall, there seems to be a convergence of accelerated urbanisation, climate change, political instability, and poverty. This mix of issues has created a toxic mix to disturb the existing electricity infrastructure facilities.

URBAN RESILIENCE AND ELECTRICITY UTILITY

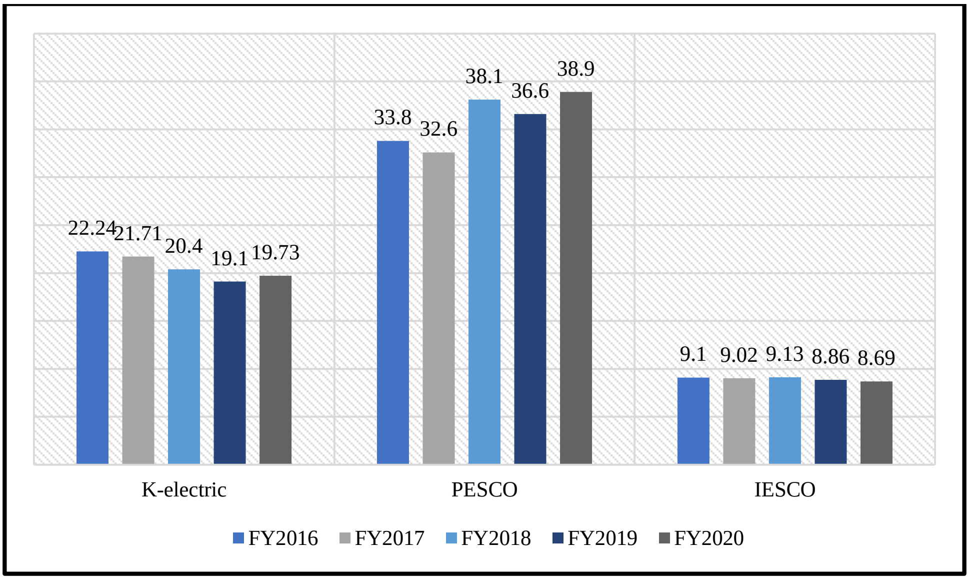
Utility networks, including clean drinking water, waste disposal management, electricity, gas, and telecommunication systems, reinforce the economic, social, and environmental performance of modern life. The availability of these networks provides the medium through which a modern city operates. In the last two decades, rapid urbanisation has created serious issues/ challenges in the management and provision of utility systems in Pakistani cities.

For instance, in the case of electricity utility, increase in demand caused by city expansion or sprawl, the challenge of ageing and badly maintained networks; the need to create more environmentally sustainable networks; the increased costs of investment; constraints on investments because of the lack of investment-friendly tariffs and other regulatory hurdles. All these factors create challenges for utility management.

These transformations have important implications for urban planning. As discussed in the previous section, in the cities which are more resilient, it is easier for the electricity utility to perform there efficiently (as explained in Figure 3). This is pretty obvious from various standard Key Performance Indicators (KPIs) among the three electricity utilities (Chart 1 to Chart 5 and Table 11 and Table 12). The performance of IESCO is relatively better than PESCO and K-Electric. In less resilient cities_ Peshawar and Karachi, it is challenging for the electricity utility to transform their systems to cope with the changing needs and to absorb shocks.

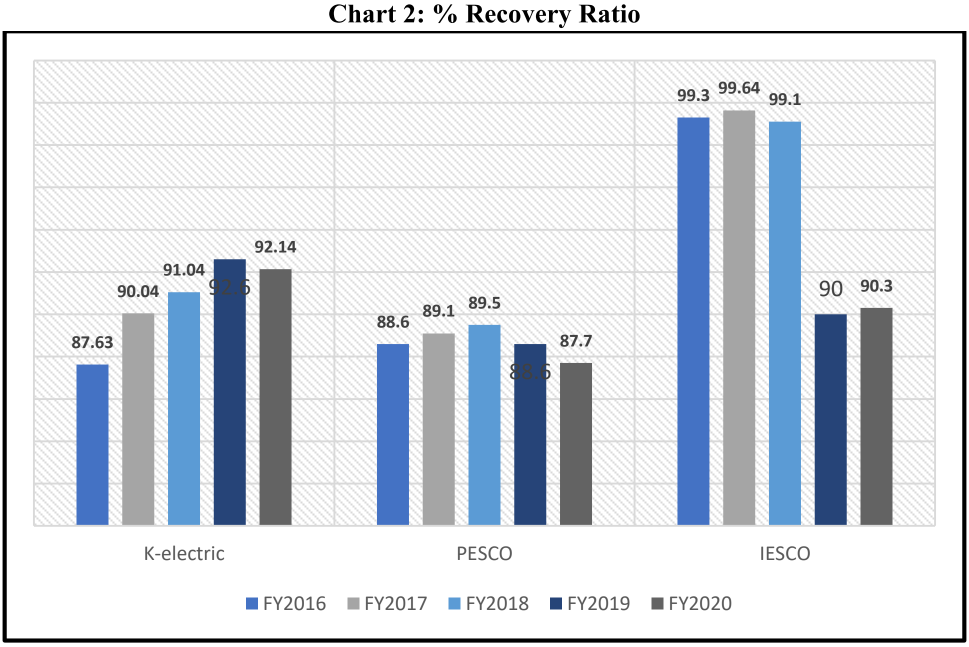
In the absence of these transformations, infrastructure systems are forced to be used beyond the available capacity. The result is overload, congestion, and adverse implications on service and reliability for utilities operating in such settings. The overall operation becomes inefficient and costly both to the managing agency and the user. This is exactly what is happening in the case of K-Electric and PESCO. However, in absolute terms the magnitude of governance issues and problems related to lack of urban development protocols is much deeper in Karachi. Despite this, K-Electric is performing much better than PESCO in all the performance indicators (except for overloaded distribution transformers) illustrated below in Charts and Tables. As reported in NEPRA State of Industry Report (2020), PESCO invested Rs11.3 billion in FY 2018, it is reflected in the % decrease in overloaded distribution transformers.

Chart 1: % T & D Losses



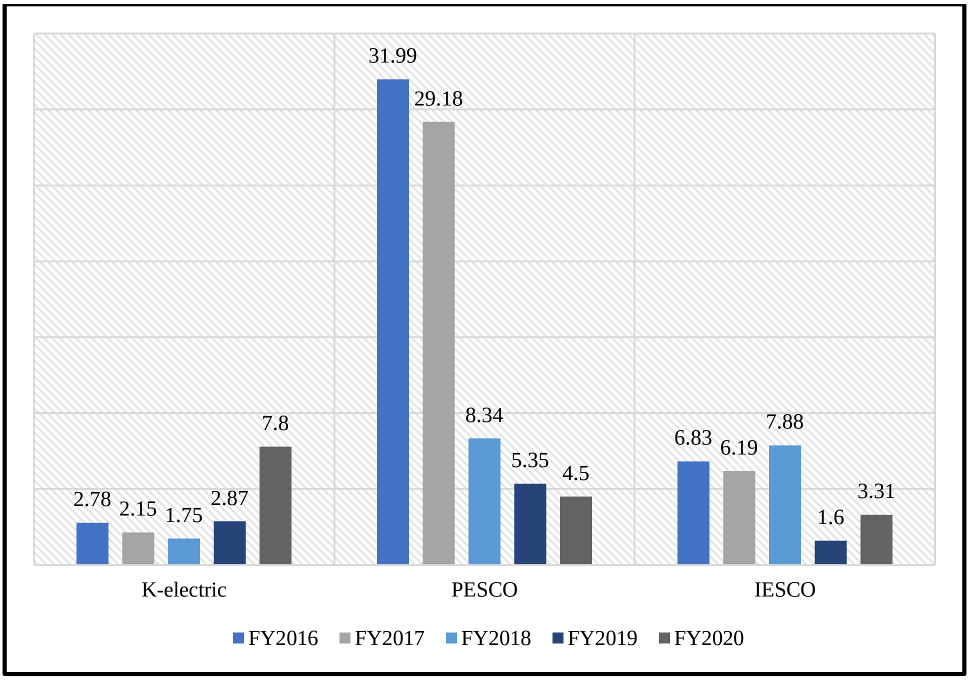
Source: NEPRA Performance Evaluation Report_ Distribution Companies, 2019-20.

Chart 2: % Recovery Ratio



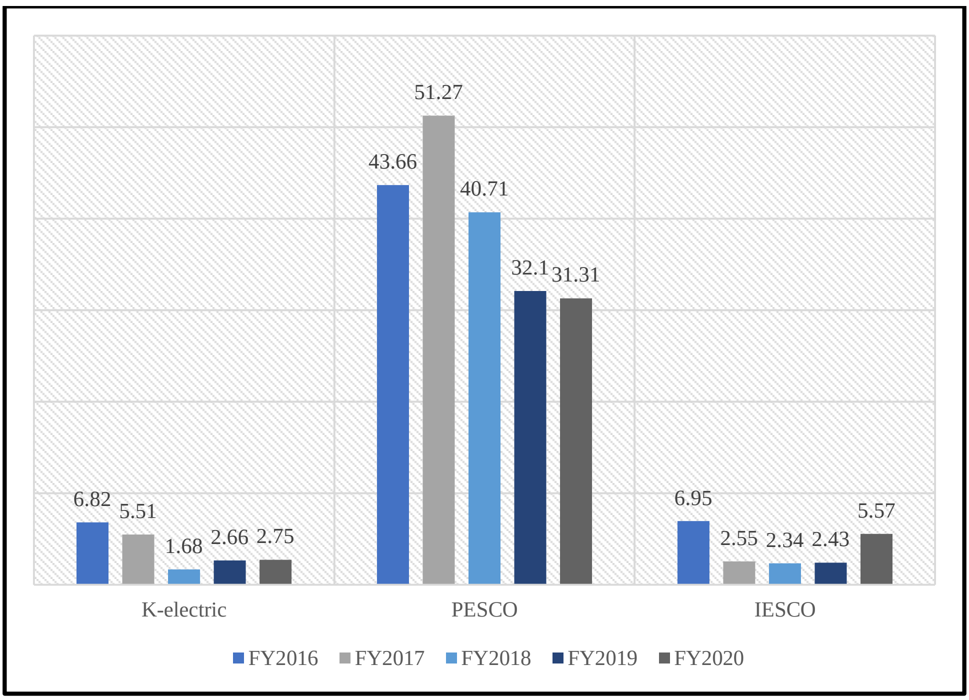
Source: NEPRA Performance Evaluation Report_ Distribution Companies, 2019-20.

Chart 3: Distribution Transformers Overloaded Above 80%



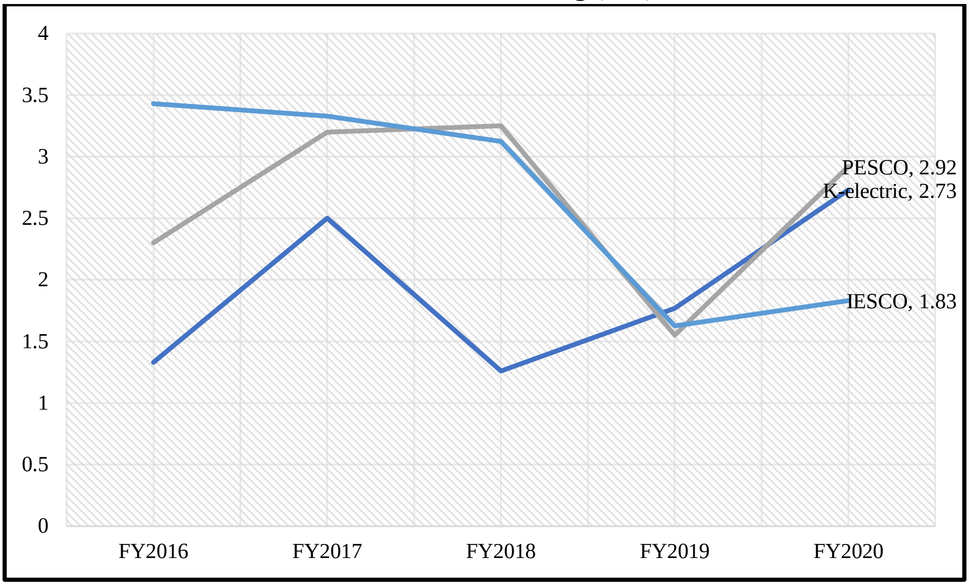
Source: NEPRA State of Industry Report, Various Years.

Chart 4: 11KV Feeders Overloaded above 80%



Source: NEPRA State of Industry Report, Various Years.

Chart 5. Load Shedding (hrs.)



Source: NEPRA State of Industry Report, Various Years.

In high loss areas, both PESCO and K-Electric have adopted a policy of revenue-based load-shedding. IESCO with relatively better records of T&D losses and recoveries has not adopted this strategy (as reported). In areas under IESCO, there is no 'Kunda' culture or electricity theft. There were issues of meter tempering, especially at night; the issue is resolved mostly through regular monitoring by the IESCO officials. Besides, many meters have been replaced over the last couple of years to curb electricity theft. Most of the losses in the IESCO are due to technical reasons. But the IESCO officials are working on these as well through the replacement of electricity infrastructure; the utility has surplus supplies of distribution equipment in its stock. Through these measures, the utility is largely meeting the targets set by NEPRA.

There is no commercial or revenue-based load shedding in IESCO[78]. In recoveries, there are delays, but once the company approaches defaulters, they cooperate and pay their bills. Sometimes, IESCO does disconnect supplies, but without creating any law-and-order situation, bills are paid. It is because of the relatively better socio-economic status of the Islamabad populace. City administration and law enforcement agencies are cooperative[79].

In Islamabad, although there are issues of urban sprawl, lack of civic amenities, informal settlements, impact of climate change etc., its impact on electricity infrastructure is not as grave as in other two cities, in particular, Karachi. One reason is relatively new power infrastructure; and secondly, in most of the large (new) housing societies, it is underground. Therefore, it is relatively safer.

[78] As shown in Chart 5, NEPRA Performance Evaluation Report 2019-20 reports an average load-shedding of 1.83 hours in IESCO, the reason is not clear whether it is due to demand-supply gap or due to commercial reasons, but the company officials claimed there is no commercial load-shedding in IESCO.

[79] As reported by IESCO, the recovery rates in IESCO are expected to be around 98 to 99 percent in FY2021.

Commercial load-shedding or revenue-based load-shedding is not a good policy[80] as it penalises compliant consumers. The low cost and uninterrupted supply of power (solar) is shifting compliant consumers[81] away from distribution companies, creating another big challenge for the cash-starved distribution companies[82]. However, as informed by utilities, e.g., in the PESCO jurisdictions, the entire blocks of consumers are non-compliant. Therefore, there is no chance of penalising 'compliant consumers' as all are non-compliant.

Table 11

System Average Interruption Frequency Index (SAIFI)

	FY2016	FY2017	FY2018	FY2019	FY2020
K-Electric	20.52	19.6	17.55	28.95	27.56
PESCO	261.65	160.6	170	189.01	187.93
IESCO	0.03	0.029	0.04	0.05	0.06

Source: NEPRA Performance Evaluation Report_ Distribution Companies, 2019-20

Table 12

System Average Interruption Duration index (SAIDI)

	FY2016	FY2017	FY2018	FY2019	FY2020
K-Electric	1210	1142.5	1451.42	2950.22	2655
PESCO	24927.12	14643	16222.79	16696.51	14924.4
IESCO	0.82	0.79	0.73	1.27	1.36

Source: NEPRA Performance Evaluation Report_ Distribution Companies, 2019-20

Since here it is the comparison between cities, it is important to mention here, as informed by PESCO officials, more non-compliance is in areas in the outskirts of Peshawar. A total of 20 percent to 30 percent of the total area in PESCO's jurisdiction can be considered as a challenging area. In some cases (e.g., Mattani) the non-compliance has been prevailing for over 20 years[83]. All efforts including instalments and engaging elders have not yielded. In some cases, the accumulated arrears are more than the market worth of the house in question.

Within Peshawar city, the magnitude of non-compliance is relatively low. A special police task force has also been constituted to help in the recovery of dues, but this has not

[80] This policy is adopted by distribution companies after the National Power Policy, 2013 which states 'focus load-shedding in areas where collections are low'.

[81] In several low-income areas in Karachi, e.g., Liaquatabad, Federal B. Area, Surjani Town, Orangi, Landhi, Korangi and Baldia now have many service delivery outlets (mostly informal) for solar panels (UN Habitat, 2018).

[82] Cross-subsidisation policy of the government, that is, high-end consumers subsidising low-end consumers is encouraging the use of alternate sources of energy like solar panels. According to K-Electric sources, most of these consumers are affluent or high-end consumers, which under the existing tariff setting cross-subsidise low-end consumers. By shifting to solar or self-generation these high-end consumers are able to avoid charges above the actual cost of service.

[83] The problem aggravates after the Afghan War when security concerns emerged in Pakistan, in particular, KPK province. People stopped paying bills.

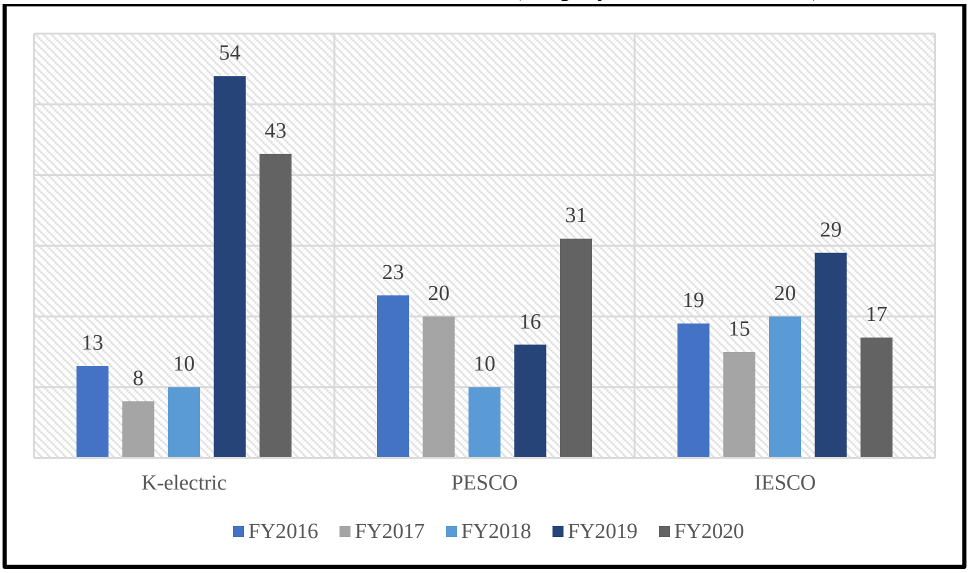
proved fruitful – the police cannot register FIRs against the entire neighbourhood. According to PESCO, it is more of a political issue and needs political settlement. Beyond that, the non-complaint or high loss areas are not supplied electricity round-the-clock, hardly 4 to 5 hours of electricity is supplied to them.

More support from civic authorities and law enforcement agencies to curtail commercial or revenue-based load shedding is required. Now the new power policy is announced, that is, National Power Policy 2021. Its implementation on the grounds is required to improve recovery rates rather than choosing the option of commercial load-shed policy. Respective Provincial Governments must provide all necessary support to the power companies for recoveries, bill collection, theft detection and other legal processes. For efficient recovery systems, the support of law enforcement agencies is compulsory.

K-Electric is the only privatised utility in the country. Its strategy to deal with commercial and operational issues are discussed in detail, in Section 4.2.1. and Section 4.3. However, it is important to mention here that the utility is working in an environment with deeper and more old urban challenges, which may not be reflected in numbers.

Safety Hazards

Chart 6. No. of Fatal Accidents (Employees & Gen. Public)



Source: NEPRA State of Industry Report, Various Years and NEPRA Performance Evaluation Report_ Distribution Companies, 2019-20.

One major issue common in all three cities (though proportion differs) is the encroachment around or in the vicinity of electricity distribution networks. This kind of encroachment happens continuously due to weak governance checks by the civic authorities. Rapid urbanisation in the absence of urban planning has resulted in an illegal (vertical and horizontal) expansion of buildings/ houses beyond the allowed limit. Thus, creating safety hazards. City agencies, in general, in all the three cities under study, are not responsive to curb the encroachment of electricity infrastructure.

In Islamabad, encroachment is common in areas located at the periphery, where people have built or expanded houses beyond approved and allowed boundaries or heights. As informed by IESCO officials, the company, however, is vigilant about it. Daily record keeping is done at the utility, not only to identify the safety hazards but to address these as well through operation or shifting of electricity networks to appropriate places, away from the hazard radius[84]. In many of these cases (75 percent in June 2021), IESCO is re-routing lines to avoid accidents. In Islamabad, it is relatively easy as still vacant space around such possible hazards is available. Moreover, IESCO is not facing any 'right of way' issue_ neither in monetary terms nor in terms of approvals_ IESCO is not required to pay 'right of way' charges.

In Peshawar, especially the old city, has narrow unplanned streets – it is a challenge to find the right place to install feeders in these unplanned narrow streets. People have constructed houses under high tension cables (like 66 KV) wires or close to these wires. This causes safety hazards. PESCO approaches municipal authorities and the police to prevent such unauthorised construction but to little avail – the authorities have not been of much help in this regard. A total of around 6000 plus hazard points have been identified in the jurisdiction of PESCO. An amount of Rs.60 million had been committed by the Power Division (Ministry of Energy), but the funds were not disbursed.

Moreover, encroachment of electricity poles (unauthorised use of these poles by internet and cable operators without the permission of utility also sometimes becomes the reason for accidents. In Islamabad, concerning pole intrusion by internet or cable operators, there exists a policy 'rent a pole' but it is hardly implemented. Beyond that, the issue is not as grave as in Karachi and Peshawar. In Peshawar, PESCO has tried to implement a pole-rent policy, but the cable operators have gone to court against the policy and the matter is under litigation.

Karachi is the largest city among the three, so is the magnitude of safety hazards in the city. There is widespread encroachment of sensitive distribution and transmission infrastructure to the extent that entire homes are built around electricity homes. In addition, there is encroachment of the electricity wires by internet and cable wires which are haphazardly placed on electricity poles due to no alternate arrangements. There is also tremendous resistance on the part of the cable TV operators, many of whom are based in Karachi to invest in building safety into their networks or shifting them underground. According to K-Electric, they undertook a Constitutional Petition in the Sindh High Court against the encroachment of its infrastructure in 2019, however the case is still pending in 2021. The utility is investing regularly to remove these hazards—through the replacement of old infrastructure, running earth-wire on LT network, replacement of delipidated HT/LT poles, PMT structures, installation of HT double earth & guard wires, and conversion of LT mains to LT Aerial Bundled Cables (ABC) etc. The revalidation of earthing/ grounding of K-electric network which comprises of over 250,000 poles is completed. K-Electric has earmarked over Rs 30 billion for safety and rain mitigation plans during the period 2017-2023 subject to regulatory approvals[85]. But not only the magnitude of the problem is big in Karachi, challenges the utility (K-electric) is facing are also more in terms of seeking the 'right of way' and its costs. Sometimes, even if 'land right' is secured after payment, the land gets occupied by illegal encroachers.

[84] Literature suggests more monitoring leads to better outcomes.

[85] Source: K-Electric officials.

Utility Characteristics and Challenges

Certain characteristics of electricity utilities operating in the three cities are shown in Table 13. K-electric is a vertically integrated utility, engaged in generation, transmission, and distribution of electricity. It supplies electricity across Karachi, Dhabeji and Gharo in Sindh, and Uthal, Vinder and Bela in Baluchistan. Whereas IESCO and PESCO are only distribution companies. IESCO supply electricity across Islamabad, Rawalpindi, Attock, Jhelum and Chakwal; and PESCO supplies across Peshawar, Bannu, Hazara, Khyber, Mardan, Swabi, and Swat. It is pertinent to mention here that net profit margin is for the whole utility, while number of consumers and consumer density is for the city under study.

Table 13

Utility Characteristics

	Governance	Shareholders	Net Profit (Loss) Margin 2019-20	No. of Consumers in City	Consumer Density
K-Electric	Private Independent Board (With 3 Govt. representatives)	Private 66.4%) Govt. (24.36%)	-1%	2596251	712
IESCO	State-owned (Under the administrative control of Power Division; with Independent Board	88%WAPDA, 12% others**	-7.8%	476068	525
PESCO	State-owned (Under the administrative control of Power Division; with Independent Board	100%WAPDA	-17.6*	606962	400

Source: Financial Footprint: SOE Annual Report 2018-19, Ministry of Finance, Government of Pakistan; Financial Statements of Companies; and information shared by the company. * 2018-19, as financial statement for 2019-20 is not publicly available. **12 percent of shares belong to Employee Trust Fund since FY2014-15 (transferred under Benazir Employees Stock Option Scheme).

(a) *K-Electric*

In Karachi, electricity theft through ‘Kunda’ is common in several areas. It is like an organised crime, making it difficult for the utility to deal with it. The utility removes thousands of ‘Kundas’ daily, but these are re-installed within hours. Besides, it is not easy for the utility company (K-Electric) to register an FIR for theft. FIR registration for power theft is through utility courts, which have been found to be ineffective, as several pre-requisites have to be met before formally registering a complaint and any action by the court to be taken. Given that kundas are temporary installations that are easy to apply and remove at will, building long-term evidence against such power theft is difficult. Among the three utilities being examined in this study, only K-Electric faces this situation, while both IESCO and PESCO did not cite FIR registration as a challenge. Consumers who are not paying their bills are liable for penalties under the Land Revenue Act, which can go as far as seizing the defaulter’s property and can also include jail time. This authority exists but is never applied.

The area-wise data shows, more-loss areas are at the city periphery with relatively more informal settlements or illegal housing, for instance, Orangi, Korangi, Gadap, Layari, Baldia, Landhi, Malir, Surjani, etc. (with distribution losses more than 20 percent). As mentioned in Section 3.2.1, in general, more deprived are residing in these areas with less civic amenities. These are congested areas where in many cases, it is difficult for the utility staff to operate rather than even enter the area. On top of that, most of such areas are sensitive from political, ethnic or income perspective. In the absence of reasonable city infrastructure, these areas are more prone to natural and man-made disasters as well, making it more vulnerable to accidents.

Additionally, as mentioned in Section 3.3.7, security issues related to terrorism, crime are more common in these areas. In the absence of adequate support from law enforcement agencies, it is difficult for the company staff to go there and work efficiently. In such congested and risky areas, not only it is difficult to identify safety hazards, but to move utility networks away from such hazardous areas as there is no space left for installation.

For K-Electric, securing the ‘right of way’ and installing infrastructure is a lengthy and expensive process. In practice, none of the concerned departments grants the ‘right of way’ without hefty charges and various approvals, which consume a lot of time. In addition, given the city density and massive horizontal encroachments, not enough space is available to shift electricity infrastructure. Additionally (as discussed earlier), even if the ‘land-right’ is secured for the pole after the payment and other processes, the land gets occupied by illegal encroachers. Consequently, the utility has to spend more time and money in litigations against those encroachments.

Similarly, illegal use of K-Electric’s network and encroachments creates safety hazards, specifically during monsoon rains when water is filled in those areas, which in most cases is not K-Electric fault. There is no proper rainwater drainage system as this is often blocked by unauthorised encroachments, thus creating problems sometimes beyond the control or capacity of electricity utility.

Planning is absent for underground conduits which can carry internet/tv/telephone cables. Public infrastructure is encroached by unauthorised cables that can damage electricity infrastructure and become the source of electrocution. K-Electric is facilitating cable operators in implementing a pilot project whereby tv/internet cables within a defined area are being shifted underground - about 19 kilometers has been completed in the South District, and the remaining work is in progress.

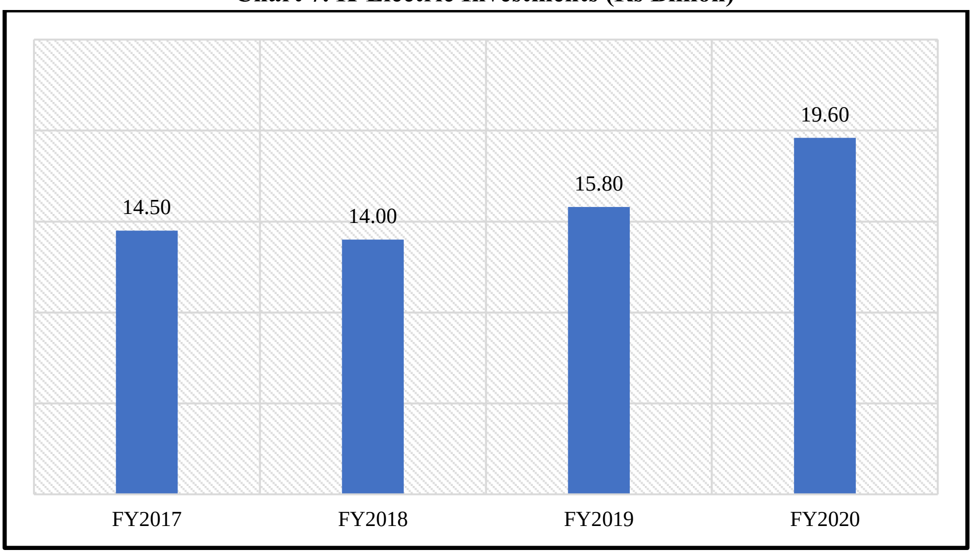
Encroachment of roads is a challenge as houses constructed on them prevent access to underground infrastructure. However, Provincial Coordination Implementation Committee (PCIC) is taking up this matter. The operation against nullah encroachment is proceeding on a fast-track basis. As informed by the K-Electric officials, capital expenditures for K-Electric are going up because it is working on Project ENSURE that includes elevating the infrastructure to avoid rain-related incidents and to enhance the overall safety and resilience of the distribution system. The rain-related issues (as discussed in previous sections) are due to or aggravated due to climatic changes and the lack of proper sewerage systems, and lack of waste management systems etc.

In Karachi, as mentioned earlier, there are several organisations, where each department has different SOPs for dealing with utility agencies like K-Electric. Politicking between the provincial government and the local authorities is also creating challenges for utility agencies. Likewise, different political parties being at the helm at the federal and provincial levels (with limited coordination) is causing problems for utility agencies. For example, to curb power theft support of the local police is crucial – while electricity is a federal subject, the police, which can help in curbing power theft, is under provincial control. With different political parties ruling at the center and in the province, the will to deploy police to curb power theft is missing.

Despite all the challenges, K-Electric is trying its best to overcome these challenges. K-Electric is investing across the city to upgrade and strengthen the distribution network (Chart 7). The utility has attempted to move towards the Smart Grid. At present, there are over 56,000 Automated Meter Readers (on the HT and LT network) in its system, giving the utility visibility of its network at the PMT level, which is a first amongst all power distribution companies. Over 11,000 PMTs in the KE network have been converted to ABC. These are insulated, theft-resistant cables that help curb losses and ensure the supply of safe and reliable electricity to Karachi. K-Electric is using ESRI's ArcGIS platform and Schneider's ArcFM suite to strengthen the digitised network, that is, using an electrically intelligent data model specific to power networks. The implementation of the advanced system of Schneider's ArcFM suite is for the first time in Pakistan[86].

The utility is also investing in social uplift programs in some of the poor localities (densely populated and predominantly informal settlements) under their flagship project 'Sarbulandi'. Through this consumer-centric project, the company has been successful in reducing line losses and improving recovery rates substantially (details in Section 4.3).

Chart 7. K-Electric Investments (Rs Billion)



Source: K-Electric.

(b) PESCO

PESCO is among the high loss-making state-owned companies in the country. As mentioned earlier, although in Peshawar city there are less problem of theft or low recoveries. But in the older city areas, because of congested housing units, there is a

[86] Source: K-Electric

significant problem of network encroachment (as mentioned in previous section). Just like Karachi, there are several such areas where there is no space left_ making it difficult for the utility to maintain or shift network away from hazardous area. The existing distribution infrastructure is old and in dilapidated form requiring immediate replacement/ improvement.

The primary issue faced by PESCO is human resource capacity – 20 years ago PESCO was serving 1.8 million consumers with a staff strength of 27,000. Today it serves more than double the consumers that it served 20 years ago with less than half the strength (present number of consumers: 3.8 million, Staff strength: 13,000)[87]. Beyond that, existing employees are overburdened and aging, and cannot handle distribution network problems, which is already in bad shape. More than 279 employees at PESCO lost their lives in the last few years because of accidents resulting from work overload.

The board of PESCO is empowered now to hire staff. In the past, several factors, including lack of board's capacity to take decisions and confusion as to whether the DISCO would remain with the state or will be privatised has held up fresh recruitment while the existing staff continued to move out due to superannuation or resignations. Human resource constraint has influenced the performance of PESCO.

Another main issue is lack of investments and government approvals. If timely funding is provided to them, they can easily remove safety hazards from densely populated streets/ areas through shifting of network (where possible) and through using latest technologies in more congested areas/ streets[88]. Replacement and strengthening of electricity infrastructure are critical for reliable electricity supplies to its consumers. Currently, PESCO is unable to provide maintenance service because of resource constraints in high-loss areas. As a result, the consumer develops 'why should we pay' kind of attitude. Regarding the 'right of way', the company has to pay the relevant land-owning department, in some cases.

As mentioned earlier, several housing societies do not fulfil the legal requirements for the land development and the construction undertaken. Accordingly, the concerned housing development authorities do not issue NOC to them. As societies do not have the NOC, PESCO is not allowed to provide them with electricity connection. However, these societies are connected to grid illegally[89]. The bigger housing societies have their infrastructure within their jurisdiction and PESCO provides electric connection at one point to the entire society – the infrastructure within the society is installed and managed by the society itself. However, in the case of smaller housing societies door-to-door electricity connection is provided by PESCO. Almost all societies demand a separate feeder, but PESCO cannot provide a separate feeder to smaller housing societies due to low demand.

The PESCO staff apprehends that with the introduction of Competitive Trading Bilateral Contract Model (CTBCM) the low-cost producers, like PEDO, may capture a portion of their compliant segment thereby increasing their share of challenging segment, however the staff is not too sure about the effects of the CTBCM.

---

[87] This number refers to total number of consumers in PESCO jurisdiction and not just Peshawar.

[88] Recently, they have converted 70 feeders into Arial Bundle Cables under a USAID project.

[89] Corruption in government departments.

(c) IESCO

In comparison, it is relatively simple and convenient for IESCO, and the company is doing it quite effectively. The area under the jurisdiction of IESCO is the area of people with powers and influence. In comparison to Karachi, there are fewer government authorities to deal with regarding seeking permissions etc. Above all, authorities are relatively more cooperative. Apart from DHA, CDA is mainly responsible for all housing societies. Though there are many illegal and unauthorised societies (without letter of approval (LOP) or No Objection Certificate (NOC) from CDA), but because of weak regulatory laws, weak city governance, corruption, these are supplied electricity. At times, action is taken against unauthorised 'Katchi Abadi' where the poor are residing. Sometimes, their electricity is also cut at the request of CDA. Besides, IESCO has never faced any law-and-order situation, as they respond quickly to complaints. Priority is given to consumer satisfaction.

There is no issue of 'right of way' in IESCO jurisdiction and no fee is charged from IESCO for the 'right of way' or for pole installation as in Karachi. In most of the new localities or housing societies (approved or un-approved by CDA), like PESCO, the internal network is installed by the society itself. IESCO is only asked to energise at one point from outside.

Situation Analysis

As observed in previous sections, the lack of urban resilience is creating challenges for electricity utilities. IESCO is working in a relatively better urban environment, is facing lesser challenges. Its operational performance is better than the other two. In FY2020, its T & D losses were recorded at 8.69 percent, distribution transformers overloaded above 80 percent were 3.31 percent, SAIFI was 0.06, SAIDI was 1.36 and average load-shedding hours were 1.83.

Among the other two, although both are working in a less resilient urban environment, the challenges are more for K-Electric as a private company; and as a company working in a city environment with challenges that are larger in magnitude (in absolute terms) and deeper. Yet, the K-Electric performance has shown significant improvement over the years. In terms of recovery in FY2020, K-electric was at the top among the three. During the period FY2016 to FY2020, K-Electric's recovery rate has gone up from 87.6 percent to 92.1 percent, that is, an improvement of 4.5 percent. In FY2020, 2.75 percent of 11KV feeders were overloaded above 80 percent, lowest among the three. In terms of T & D losses, the utility has reduced losses by 2.51 percent during the period FY2016 to FY2020. In comparison, in PESCO, recovery rates have decreased by 0.95 percent and T & D losses have increased by 5.1 percent (Chart 1 and Chart 2).

In the public sector, it is often difficult to make investment decisions to stay ahead of demand until there is a crisis of service and a level of public inconvenience which motivates action. Generally, there is a lesser tendency to spend on improving infrastructure in the public sector until there is significant pressure to improve service. The pressure normally comes from overall city governance, awareness and socio-economic class residing in the area (Bishop, 1997). Besides, overall organisational capacity to make timely decisions is important. This is obvious from the difference in the performance of IESCO and PESCO.

Whereas, K-Electric_ privatised entity, despite facing deep structural and governance issues in Karachi city manages to do better than PESCO. Mainly it has been driven by targeted and accelerated investments that K-Electric has made over the last decade[90]. However, as K-Electric operates under a regulated environment (just like state-owned distribution companies in the country), the power utility depends on timely regulatory approvals to execute its investment plans. Despite all the challenges K-Electric is facing in the form of approvals and exorbitant charges for the 'right of way', delays in tariff determinations, delays in the disbursements of Tariff Differential Claims (TDCs), and delays in receivables from the government departments, is investing in the upgrading and strengthening of distribution infrastructure (Chart 7). However, delays in Tariff determination and regulatory approvals of the investment plans, and delays in the disbursement of TDCs by the government_ all are affecting the working capital of the utility.

In Karachi, as said above, overall city governance is not in favour of private utility. In a city like Karachi, with a large number of informal settlements with less willingness and less ability to pay utility bills, encroachments, investment in the utility infrastructure is critical to ensure uninterrupted supply to all consumers. Investment is also essential to overcome safety hazards, to reduce transmission and distribution losses and to avoid environment-related challenges and accidents. *This requires an investment-friendly tariff, its timely determination, and timely disbursements of TDCs if the government likes to apply the national uniform tariff policy to Karachi as well.* The resolution of all these issues is crucial for sustainable investments in the upgradation and expansion of distribution infrastructures, which in turn, benefits consumers through safe and reliable electricity services. No doubt, the utility (K-Electric) despite all odds is investing across the city to upgrade and strengthen the distribution network.

The utility is also investing in social uplift programs in some of the poor localities (densely populated and predominantly informal settlements) under their flagship project 'Sarbulandi'. The company under this project is building a relationship with communities, involving them, and creating awareness. Via offering different payment packages, low-cost meters, and investment in upgradation of infrastructure, instalment of Aerial Bundle Cables (ABC). The utility has achieved some success in curbing 'Kunda' connections, reducing losses and increasing recoveries. For instance, in Korangi (Karachi), under this project the utility has successfully reduced distribution losses from 41 percent to 16 percent and improved recovery rate from 63 percent to 94 percent in Ghous Pak & G-Market feeder; and reduced distribution losses from 38 percent to 13 percent and improved recovery rate from 71 percent to 95 percent in Madina colony.

Being a private company, they must have an incentive to invest. Without adequate returns on investments, together with the resolution of all pending issues of outstanding payments from government entities, it would be difficult for the company to continue with its investments plans for upgrading, expanding, and enhancing overall network safety.

Reduction in utility losses via social uplift programs is a good strategy to be followed in other loss-making utilities, e.g., PESCO. Peshawar is a relatively poor city; it needs such projects not only from a utility perspective but for improving the overall resilience of the city as well. Beyond restructuring, the focus should be on making a long-

[90] Source: K-Electric staff.

overdue investment in strengthening and upgrading the crumbling infrastructure and in the enhancement of technical human capacity. In short, *improvement in the organisational capacity and public investments in PESCO could help in containing losses, in ensuring reliable electricity supplies to the consumers, and in the expansion activities of PESCO.*

Population-dense cities are huge sources of power demand. Not only does it consume more energy but emitting a similar proportion of carbon as well. That's why large cities are at the heart of the climate change discussion. So is the case of cosmopolitan city_ Karachi; where electrical infrastructure needs to be developed in a way that supports economic growth and high quality-of-life while also integrating more sources of renewable energy to mitigate climate change impact. A smart city is an answer for sustainable energy management.

Energy efficiency and demand-side management strategies represent an essential component of the smart city's energy matrix. K-Electric is doing well on this front. It has institutionalised energy conservation measures by setting up a separate Energy Conservation department. K-Electric is active in reducing its carbon footprint. That is, reducing energy consumption in its operations, converting its offices to 'Green Buildings' etc. Its Energy Conservation department is actively creating awareness among consumers through various initiatives_ through a door-to-door campaign under 'Sarbulandi' and schools etc. But without support from city authorities, it is impossible to have a meaningful impact on a large scale.

In Pakistani cities, urban development policies and energy policies are required to be integrated_ via improving the energy efficiency of housing, buildings etc., as done in Toronto. Similarly, *local urban planning must include land use and regulations of the physical environment considering renewable energy. Any conflicts between distributed energy facilities and urban design can be addressed by the landscape rules*, as done in Perpignan (France) (Cited from Sugahara (2016)).

Besides, *distributed energy or microgrid projects offer a localised energy infrastructure that can help improve system resilience.* For several years now, cities around the globe have been integrating the use of new technologies in their energy systems (Gontar, 2018). The distributed generation (DG) in Pakistan is still in its early stages but rising (Table 14). DG offers one of the most promising solutions to advancing the clean energy transition in Pakistan.

Table 14

Net- metering Licenses

	PESCO		IESCO		K-electric	
Year	No. of Licenses	Capacity KW	No. of Licenses	Capacity KW	No. of Licenses	Capacity KW
FY2018	2	37.56	114	1732.81	28	288.40
FY2019	10	96.60	377	3849.07	253	4270.21
FY2020	131	3200.84	863	9990.0	730	12240.0

Source: NEPRA State of Industry Report, 2020.

Power grids in Pakistan, in general, are underinvested, overburdened, and subject to many new challenges, that is, uncertainty related to market development and the infiltration of renewable energy systems. In densely populated cities, the Smart Grid offers long-term solutions to urban energy dilemmas. Despite the threat seemingly presented by the emergence of distributed generation, existing utilities (e.g., K-Electric) still have a critical role to play in preparing current grids for more advanced *smart city technologies*. But of course, this requires huge investments.

Public-private partnerships are an option to finance the necessary improvements. Similarly, performance contracting, and other concession agreements provide ways to enhance investments without exerting an undue burden on consumer bills. Smart cities for the future offer an opportunity for electricity utilities, all that is required is a progressive mindset to make a jump. That, unfortunately, seems lacking in the two state-owned companies under study here. But the way K-Electric has proceeded in the last few years, the company can set an example for others to follow.

CONCLUSION

In the study, we have explored urban resilience across three cities in Pakistan_ Karachi, Islamabad, and Peshawar. Using available statistical information, we have estimated the urban resilience index for these cities. In the study, the linkage between various operational (transmission and distribution losses, safety systems, outages etc.) and commercial (recovery rates) performance of a utility and urban resilience of the city is also examined. We find that none of the cities is resilient enough to absorb the impact of rapid urbanisation. However, the Federal Capital Islamabad with a score of 0.20 is relatively more resilient as compared to Karachi (0.12) and Peshawar (0.10).

Modern cities require innovative procedures and processes to address the urban sprawl, which we find missing in all the three cities under study, urban resilience index for none of the three cities is closer to 1. Therefore, ***we reject the hypothesis that Pakistani cities are resilient enough to absorb the impact of rapid urbanisation.*** We conclude that rapid urbanisation leads to the expansion of slums/ informal settlements, illegal housing in Pakistani cities creating issues of service delivery. Illegal extensions /encroachments create safety hazards and hinder reducing losses and in the recovery of charges against electricity consumed.

Regarding our second hypothesis, that urban dynamics of Karachi are similar to Islamabad and Peshawar, although Peshawar is the least resilient city among the three; ***we reject the null hypothesis and conclude that the urban dynamics of Karachi are different from the other two cities because of its size, density, population, vulnerability to calamities because of rising sea levels, weak governance_ partly owed to the political relationship between the federal and provincial governments and fragmented institutional structure.*** Though all three cities are suffering from the impact of urban sprawl, its impact on Karachi began relatively earlier and is much greater in magnitude and so is its impact on electricity utility, i.e., K-Electric.

The magnitude of encroached electricity infrastructure, which resultantly becomes a foremost reason for safety hazards, is more in Karachi as compared to Peshawar and Islamabad. The population living in just one of the Karachi slums_ Orangi Town (2.4 million) is more than the total slum population in Peshawar (1.5 million). Besides, the challenges faced by K-Electric, as a privatised company are different from PESCO and IESCO_ state-owned companies. For instance, regarding seeking permission for the 'right of way' or for installing electricity poles, K-Electric has to deal with several parallel agencies, whereas it is relatively better and simple for both IESCO and PESCO. Although PESCO pays for the 'right of way' in certain cases, charges are more for K-Electric[91].

The impact of urban resilience is also reflected in the performance of the three utilities. IESCO is better than K-Electric and PESCO in terms of transmission and distribution losses, existing distribution infrastructure, load-shedding hours, and supply reliability. However, K-Electric, despite working in a less resilient environment is not only at the top in terms of recovery rates, line losses over the last couple of years have improved substantially. Such radical improvement is not obvious in PESCO. In K-Electric, the consumer centric 'Sarbulandi' project is paying off significantly. Additionally, K-Electric is investing in the upgradation of infrastructure across the city[92].

No doubt it is the job of the utility to ensure reliable and safe electricity to city dwellers. But it needs support from the administrative management of the city. While comparing three utilities IESCO, PESCO and K-Electric we find, IESCO is working in a city with a relatively better governance system. It also gets due support from various administrative units, when required. But this is not the case with PESCO or K-Electric, which must deal with safety hazards created due to tampering and encroachment of its infrastructure. Both PESCO and K-Electric are not getting support from law enforcement agencies. Among these two, the situation is more challenging for K-Electric on account of external challenges.

In the last two decades, natural calamities are occurring more frequently as a result of global warming. Cities play an increasingly important role in tackling climate change because their exposure to climate and disaster risk increases as they grow. In less resilient cities, infrastructure, particularly, electricity distribution networks/ equipment is more vulnerable to such calamities. Similarly, rapid urbanisation in the absence of required urban development is resulting in large informal settlements, often creating hurdles for electricity utilities (sometimes encroaching existing electricity infrastructure too).

In Pakistani cities, urban expansion is near hazard-prone areas and built through informal and unplanned settlements. For building sustainable and resilient cities requires intensive policy coordination and investment choices. The government at every level (Federal, Provincial and Local or Municipal) have an important role to play in taking timely decisions to shape the future of city development and to create opportunities for all.

A city economy depends on reliable electricity services. Thus, building the resilience of electricity systems is crucial for human welfare and economic growth. A utility company must have the capacity (sufficient investments) to remain prepared for absorbing the effects of dangerous events_ in a timely and efficient manner (ESMAP, 2016). Similarly, it must have the human and financial capacity to replace/ upgrade/ expand its infrastructure for ensuring reliable supplies to the rising urban population.

Building a resilient power sector is challenging because of the dilapidated infrastructure and lack of timely periodic maintenance of infrastructure in Pakistani cities, because of lack of resources. Although investment decisions seem relatively easier for the

[91] Though the exact amount is not shared by utilities, the inference is drawn from the informal discussion with the management.

[92] Investments are allowed by NEPRA in a Multi-Year Tariff Determination. For investments over and above NEPRA allowed levels, NEPRA approval is required (K-Electric officials).

privatised utility (K-Electric), it needs regulatory support in terms of timely determination of investment-friendly tariffs and their approvals. Whereas organisational/ human resource capacity apart from lack of financial resources is a serious constraint in PESCO, a state-owned company.

Above all, the compilation of city level data on a regular basis is essential to build the resilience of energy companies. The readily available data can help forecast future trends/ risks/ changes in city dynamics. Thus, helping utilities in making investment decisions in time.

Pakistani cities demand planning, innovative solutions for water and sanitation, affordable housing, standard education and health facilities, improved law and order, and a sustainable environment. Urban population growth demands an efficient electricity infrastructure to cope with rising demand and changing circumstances. For densely populated cities like Karachi, a smart city with smart energy systems could be an option for the future.

On November 12, 2020, NEPRA approved the detailed design and implementation plan of the Competitive Trading Bilateral Contract Market (CTBCM). NEPRA has given a timeline of 18 months for the preparation and its implementation. The model envisages that all the future contracts for the sale/purchase of electricity will be bilateral between the parties. The wholesale market model is envisaged to be implemented by 2022. Under the NEPRA amended Act 2018, the two distribution functions, that is ‘wire or distribution network’, and ‘sale’ are required to be separate licensed activities by 2023 to allow for retail competition in future. A level playing field for all utilities, whether in the private sector or the public sector, is essential to create a competitive market environment.

A financially viable sector and a reliable payment chain are crucial for a market to function. In CTBCM, the distribution companies would be required to provide credit cover for future procurement of power. This will not be possible, given the current poor balance sheets of several state-owned distribution companies (DISCOs). If buyers, that is, DISCOs, are financially unsound how the envisaged wholesale or retail power market will function? Moreover, the benefits of market competition are unlikely to be passed to end-users if market power is concentrated either in the generation or in the distribution sector.

A stable macroeconomic, political, and social environment is necessary for the market to develop and function. Institutions play a crucial role in the success of any market, not just electricity. The dismal state of our institutions and governance failures as discussed in the report[93] warrant that the current conditions are not feasible for the development of a full-fledged electricity market. A resilient urban environment is critical for the smooth transition and for its sustainable operation of energy market.

Thus, a sustainable framework must be developed to address challenges currently faced by the sector. That is, restructuring in the power sector must focus on tariff reforms to ensure the financial viability of power sector companies. No doubt, ‘wheeling of power’ is a precursor to market development. It is the job of the regulator to ensure that wheeling charges are enough for the sustainable performance of distribution companies, as well as these not hurting the interests of those involved in ‘wheeling of power’. A fair mechanism is required for the recovery of stranded costs that arise as a result of the open-access regime. Besides, the development of a pragmatic strategy for the recovery of bad debts/ arrears,

[93] The situation is not different in other cities.

and replacement of cross-subsidy with direct and targeted subsidy, are pre-requisites for the sustainable open market regime.

It is equally important to adopt an integrated power sector planning approach to achieve an adequate balance in the energy system. This approach must include accurately forecasting demand, adding generation capacity, improving transmission and distribution systems, increasing efficiency, and bringing costs down, and ensuring environment and economic sustainability.

Finally, before the formal implementation of open market competition, a detailed assessment study must be conducted, to identify the fears of all distribution companies and to suggest optimal solutions for a sustainable transition to an open market framework.

REFERENCES

Abbas, M., 2021. How to manage unmanageable Karachi. The News.

Abdul, L., and T. Yu (2020) Resilient Urbanisation: A Systematic Review on Urban Discourse in Pakistan, Urban Science, Vol, 4, No. 76.

Alam, F., Salam, M., Khalil, N. A., Khan, O., and Khan M. (2021) Rainfall trend analysis and weather forecast accuracy in selected parts of Khyber Pakhtunkhwa, Pakistan, https://doi.org/10.1007/s42452-021-04457-z.

Avis, W. R. (2016). Urban Governance (Topic Guide). Birmingham, UK: GSDRC, University of Birmingham.

Bacon, R. (2019). Learning from Power Sector Reform: The Case of Pakistan. Policy Research Working Paper No. 8842, The World Bank, Washington D. C.

Bishop, A. B. (1997) Urban Infrastructure: Transportation, Public Utilities, Waste Management and Pollution Control, College of Engineering, Utah State University.

Butt, T. (2017) Islamabad_ A City with Maximum Slums, The News, September 02, 2017.

ESMAP (2016) Enhancing Power Sector Resilience: Emerging Practices to Manage Weather and Geological Risks, Energy Sector Management Assistant Group, The World Bank.

Fazal O, Hotez PJ (2020) NTDs in the age of urbanisation, climate change, and conflict: Karachi, Pakistan as a case study. PLoS Negl Trop Dis 14(11): e0008791. https://doi.org/10.1371/ journal.pntd.0008791.

Gonçalves, C. and Eduarda, M.C. (2013) Framework and Indicators to Measure Urban Resilience: Essay in Calda Da Rainha and Evora urban Systems, https://www.researchgate.net/publication/259996559_Framework_and_Indicators_to_Measure_Urban_Resilience?enrichId=rgreq-2e34e714a9d42a823f1432843c323005-XXX&enrichSource=Y292ZXJQYWdlOzI1OTk5NjU1OTtBUzoxMDQ1MzM1Mzk2ODg0NjhAMTQwMTkzNDE0NzAxMw%3D%3D&el=1_x_2&_esc=publicationCoverPdf

Gupta, A.K., Singh, S., Wajih, S.A., Mani, N., and Singh, A.K. (2017). Urban Resilience and Sustainability through Peri-Urban Ecosystems: Integrating Climate Change Adaptation and Disaster Risk Reduction, Gorakhpur Environmental Action Group, Gorakhpur (U.P.) India.

Hasan, l and Chaudhry, A. (2020) Lower Tax Rates and Simplified Procedures_ The Tax Directory Analysis 2018, PIDE Blog.

Hasan, A. and Monib, M. (2003) The Case of Karachi Pakistan, Understanding Slums_ Case Studies for the Global Report on Human Settlements.
Hasan, A. (2015) Land Contestation in Karachi and the Impact on Housing and Urban Development, Environment and Urbanisation, Vol. 27, No.1.
Hasan, A. (2016) Emerging Urbanisation Trends: The Case of Karachi, C-37319-PAK-1, International Growth Centre (IGC).
Hussain, A. (2016) Urban Sprawl, Infrastructure Deficiency and Economic Inequality in Karachi, Sci. Int. (Lahore), 28 (2), 1689-1696.
Hussnain, M. Q., Waheed, A., Wakil, K. Petit, C. J., Hussain, E., and Naeem M. A. (2020) Shaping up the Future Spatial Plans for Urban Areas in Pakistan, Sustainability, http://dx.doi.org/10.3390/su12104216.
Keogh, M., and C. Cody (2013) Resilience in Regulated Utilities, NARUC, Washington, DC.
Liu, Y., Din, D. and Jiang, Y. (2020) Urban growth sustainability of Islamabad, Pakistan, over the last 3 decades: a perspective based on object-based backdating change detection, Geo Journal, https://doi.org/10.1007/s10708-020-10172-w
Mahendra, A., and Seto, K.C., 2019. Urban resilience for Whom, What, when, Where and Why? Urban Geography, 40, 309-329.
Malik, A., Mahmood, M. A., & Ahmad, A. (2009). Power Sector Reforms in Pakistan: A Critical Review. Middle East Business and Economic Review, 21(2), 1-29.
Mangi, M. Y., Yue, Z., Kalwar, S. and Lashari, Z. A. (2020) Comparative Analysis of Urban Development Trends of Beijing and Karachi Metropolitan Areas, Sustainability, http://dx.doi.org/10.3390/su12020451.
Molyneaux, L. et al., (2012) Resilience and electricity systems: A comparative analysis, Energy Policy, Vol 47.
Morollón , F. R. and Garrido-Yserte, R. (2020) Recent Literature about Urban Sprawl: A Renewed Relevance of the Phenomenon from the Perspective of Environmental Sustainability, Sustainability, http://dx.doi.org/10.3390/su12166551
SBP (2019). Evaluating the Fiscal Burden of State-owned Enterprises in the Power Sector, Special Section 2, The State of Pakistan's Economy, State Bank of Pakistan.
Shah, A., Ali, K. and Nizami, S.M. (2021) Spatio-temporal Analysis of Urban Sprawl in Islamabad, Pakistan during 1979–2019, using Remote Sensing, Geo Journal, https://doi.org/10.1007/s10708-021-10413-6.
Sharifi, A. and Y. Yamagata (2016), Principles and Criteria for Assessing Urban Energy Resilience: A Literature Review, Renewable and Sustainable Energy Reviews, Vol. 60, 1654-1677.
State of Pakistani Cities (2018), Report prepared by Un-Habitat in collaboration with Ministry of Climate Change, Pakistan, and Australian Aid.
Sugahara, M. (2016) Energy and Resilient Cities, OECD Library.
Tunio, A. F. (2018) Action and Challenges for Urban Resilience in Karachi, South Asia Hydromet Forum.
UNICEF (2020), Report of Coverage Survey in Slums/Underserved Areas of 10 Largest Cities of Pakistan. UNICEF, Pakistan.
World Bank, 2018. Transforming Karachi into a Liveable and Competitive Megacity. The World bank group, Washington, DC.
Zhang, M., Yang, Y., Li, H. and Dijk, M. P.V. (2020) Measuring Urban Resilience to Climate Change in Three Chinese Cities, Sustainability, http://dx.doi.org/10.3390/su12229735.

PART II

REGULATORY FRAMEWORK IN ENERGY

Effective, Efficient, but not a Burden

National Electric Power Regulatory Authority (NEPRA)[*]

AFIA MALIK

BACKGROUND

Historically, electricity sector policymaking, regulation, and service provision were all under the State's control. However, they lacked the managerial capacity and financial resources necessary to keep up with the growing demand for their services.

The government in 1992 prepared a strategic plan for restructuring the electricity sector. It unbundles vertically integrated utility, WAPDA, into separate generation, transmission, and distribution companies for better management. The government invited private capital in the generation sector to augment state-owned generation resources. The establishment of an autonomous regulatory agency to introduce transparent and judicious economic regulation in the power sector of Pakistan was also part of this plan.

The National Electric Power Regulatory Authority (NEPRA) was established under Section 3 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (NEPRA Act No. XL 1997) to regulate the provision of electric power services in Pakistan. In 2018, the NEPRA Act was amended to create a legal basis for developing a competitive electricity market.

Initially, NEPRA was established as an autonomous body with no administrative control from the government. However, for interaction with Federal and Provincial Governments, it was an attached department to the Ministry of Water and Power. Later, it was linked with the government through the Ministry of Law and Justice. Since June 2000 NEPRA has been under the Cabinet Division (Malik, 2007).

NEPRA Act

As in the NEPRA Act 1997, the aim behind the formation of NEPRA was to have an independent regulatory body to improve the efficiency and availability of electric power services while protecting the interests of consumers, investors, and the operators equally, and to promote competition and deregulate power sector activities where competition exists.

---

[*] It was published in *Evaluations of Regulatory Authorities, Government Packages and Policies*, Pakistan Institute of Development Economics (PIDE), 2022.

Box 1. Major regulatory obligations under NEPRA Act No. XL 1997

- Grant of licenses, approval of power acquisition programs.
- Determination of tariff, terms and conditions and rates.
- Prescription and enforcement of quality-of-service standards, approval of operating codes and investment standards; and
- Industry structure/privatisation including the transition towards a competitive market where feasible; and
- Consumer rights and obligations_ complaint redressal.

Under the act, NEPRA's policy guidelines for power sector reforms revolve around: cost-effective tariff structure to ensure investments in the short run; expansion of generation, transmission, and distribution capacities in the long run to meet the growing energy demand; and to ensure a reliable provision of electricity to consumers (Malik, 2007).

However, the Regulation of Generation, Transmission and Distribution of Electric Power (Amendment) Act, 2018 has increased its responsibilities to include not only the regulation of generation, transmission and distribution of electric power and matters connected therewith and incidental thereto, but also to ensure high standards of transparent, certain and effective regulation of the electric power markets of Pakistan; specification of the legal framework within which a competitive electric power market can develop and sustain; and to manage conflict of interest between the state and the development of the electric power markets. Key amendments are reported in Appendix A.

Besides, ensuring the elimination of energy poverty and facilitating the development of environment-friendly renewable electricity markets are among the major responsibilities of NEPRA.

Box 2. NEPRA Mandate under Amended Act [Act No. XII of 2018]

In addition to grant licenses and tariff determination, NEPRA is given authority to,

- *Specification of procedures & standards for registration of persons providing electric power services.*
- *Advisory to the Federal Government in the formulation of electricity plan, policy, and public sector projects.*
- *Specification and enforcement of performance standards for generation companies and persons licensed or registered under the Act.*
- *Specification of procedures & standards for investment programs by generation companies and persons licensed or registered under the Act.*
- *Specification of accounting standards and establish a uniform system of account by generation companies and persons licensed or registered under the Act.*
- *Ensuring efficient tariff structures and market design for sufficient liquidity in the markets.*
- *Specifying fees.*
- *Review of its own decisions.*
- *Settle dispute between licenses in accordance with the specified procedure.*
- *Issue guidelines and operating procedure to promote market development, including trading in accordance with national electricity plan and policy.*
- *Review of organisational affairs of generation companies and persons licensed or registered under the Act for efficient supply of services.*
- *Encourage uniform industry standards and code of conduct for generation companies and persons licensed or registered under the Act for efficient supply of services; and*
- *Submit report on the activities of generation companies and persons licensed or registered under the Act to the Federal Government.*

In short, under the amended act, NEPRA's policy guidelines revolve around creating a legal basis for moving to a competitive market structure.

Purpose of Evaluation

The purpose of this evaluation is: to review the operational structure, governance, and effectiveness of the National Electric Power Regulatory Authority (NEPRA), to identify flaws in the current regulatory infrastructure, and to suggest ways to improve it.

Methodology

To evaluate regulatory effectiveness in NEPRA, a case study approach is adopted. The data is collected from interviews (interactive sessions) with officials at the authority, sector experts, and government officials.

Besides, the evaluation relies on secondary data sources_ NEPRA Annual Reports, State of Industry Reports, and other published reports and documents available.

> *Limitation*: The evaluation relies only on information (both qualitative and quantitative) gathered from informal interviews/discussions and published sources; no perception survey is conducted.

Audience

Authority and the policymakers are the primary audiences for this evaluation, as both can influence the design of the regulatory framework.

Scope of Evaluation

The evaluation covers the subject matter under three main headings:

Organisational Structure and Regulatory Framework

- What is the organisational structure at NEPRA? How does NEPRA carry out its functions and make its decisions?
- What is the status of its policies, strategies, various processes (that is, regulatory framework) involved in the grant of licenses, in the determination of tariffs, and in the making of rules, regulations, standards, and specifications? What are the flaws in execution? To what extent its rules/ regulations are facilitating market development and competition?

Regulatory Governance

- Does NEPRA Act facilitates an effective governance structure at NEPRA?
- To what extent does NEPRA establish its independence, competence, integrity, and accountability while performing its duties?

Effectiveness of Regulatory Framework

- What is the impact of the regulatory framework at NEPRA on power sector outcomes?
- Did NEPRA achieve its objectives as in NEPRA Act, 1997?

Structure of Evaluation

Findings in this evaluation are developed after carrying out detailed discussions and review of available documents.

Recommendations in the evaluation identify specific areas/ policies that can be revised for improved outcomes.

ORGANISATIONAL STRUCTURE AND REGULATORY FRAMEWORK

What is the organisational structure at NEPRA? How does NEPRA carry out its functions and make its decisions?

Findings

NEPRA is a *quasi-judicial organisation* to regulate the power sector of Pakistan, including issuing licenses, determining tariffs, monitoring for maintenance of proper standards and quality of services as well as addressing complaints of consumers. NEPRA issue licenses for generation, transmission, and distribution; and after the amendment in the ACT in 2018, issuing licenses for an electricity supplier, market operator, system operator, and a market trader is the mandate of NEPRA.

Box 3. Experience/ Qualification of the Authority

1997 Act*, Section 3 (3) states that the Chairman shall be an eminent professional of known integrity and competence with at least twenty years of related experience in law, business, engineering, finance, accounting, economics, or the power industry. While Section 3 (4) states that every member shall be a professional of known integrity and competence with at least fifteen years of related experience in law, business, engineering, finance, accounting, economics, or the power business.*

2018 Amended Act*, Section 3 (3) states that the chairman shall be person known for his integrity and eminence having experience of not less than twelve years in any relevant field including law, business, engineering, finance, accounting, or economics preferably in the electric power services business. Same rule is applicable to four members as stated in Section (4).*

Section 3 (1) of the Act defines the *governing structure* of the ‘Authority’. The ‘Authority’ consists of a chairman to be appointed by the Federal Government; and four members, one from each province, to be appointed by the Federal Government after considering the recommendations of the respective Provincial Governments. While section 3(2) states that the Vice-Chairman shall be appointed from amongst the members for one year, by rotation.

At present, the chairman and three members are all engineers with experience directly/ indirectly in the power sector. Member Punjab completed his tenure a few months backs, and he was from the civil service of Pakistan (District Management Group). The new Member Punjab is yet to be appointed.

In the new Act, the experience in the power sector shall be given preference in the selection of the chairman and four members (Box 3), which is a positive change. The aim of the amendment is apparently to make the Authority more responsive to the needs and challenges in the power sector.

In terms of *organisational structure*, NEPRA is designed with various units/ departments corresponding to each basic function of the regulatory body as in NEPRA Act, 1997, that is, licensing, tariff, consumer affairs & complaint and monitoring and enforcement. Then there is the legal department, information technology department, coordination and implementation department, finance, media, and human resource (development and management) departments to support the above-mentioned departments. There are specific roles and responsibilities for each staff member. Apart, so far, no significant change is evident in its organisational structure in the light of the amended Act to support the development of a competitive electricity market.

The key challenge in this kind of setup is the *lack of communication across various units*. Though, the staff at NEPRA claim that good communication exists between various units and staff members when required to respond to organisational priorities. But in reality, while analysing NEPRA's intended objectives in NEPRA Act 1997, one can observe no progress regarding market development, competition, elimination of monopolies, or privatisation. It could be because of a lack of inter-departmental communication; most issues and discussions take place at the managerial level among individual departments (USAID, 2019).

As per Section 5 (1), the Authority has powers to perform its functions and conduct proceedings under regulations made under this Act. As per section 5 (2) of the Act, the 'Authority' to decide must have three members to make up a quorum. Besides, the 'Authority' may delegate its powers to the Chairman, any member or any of its officers or a special tribunal constituted under section 11, all, or any of its powers to carry out its functions or duties under this Act. However, the *decision-making* is only at the top, and various departments only provide input when required.

NEPRA has become increasingly more centralised; overburdening authority in such routine matters which otherwise could have been dispensed at the divisional level. This has increased regulatory meetings on every matter, which not only delays decisions but affects their quality.

Due process of consultations with all stakeholders, including consumers through public hearings, is followed. However, it is observed by experts that the time allocated to general consumers is relatively small.

NEPRA is statutorily empowered to enhance its *human resources*, that is, to appoint employees, consultants, experts, advisers, etc., on such terms and conditions as the regulator deems fit. The Act also lays down a requirement of prescribing these conditions through statutory regulations. The authority is incapacitated in terms of professionals for competent working at the authority. International consultants were engaged in evaluating IGCEP, CTBCM, wheeling and supply regime, etc. (NEPRA Annual Report, 2019-20).

The serious constraint identified in all interviews, whether at NEPRA or with experts, is the lack of competent staff with regulatory knowledge, experience, and training. The view at the organisation is they don't find suitable/ qualified persons[94].

---

[94] Despite repeated attempts, the information on number of professional staff, that is, number of economists, engineers, tariff specialists, lawyers etc. is not shared by NEPRA.

As a result, there is an inadequacy in emergency planning and preparedness; in the preparation to participate in national decision-making and communiqué concerning power sector challenges. Above all, there are delays in preparing the regulatory framework required for the establishment and development of a competitive market. However, it is noted that NEPRA, being aware of the need to improve its human resource capacity, is taking steps[95].

Theoretically, to be effective, NEPRA as a regulatory body must have some regulatory standards, regulatory guides, and internal guidance for use by the regulatory staff. This suite of documentation not only needs to exist, but it needs to be reviewed regularly and updated according to need. But it is revealed in an informal discussion with the staff, the set-up at NEPRA is no different from other organisations (especially in the public sector). Most of the trainings are also not very helpful, as the ground realities in Pakistan differ from other countries. The report on NEPRA (USAID, 2019) revealed that the officials at the authority are learning from experience. With time they have successfully managed most of the issues, for instance, in the grant of licenses.

In the amended Act, Section 10A provides *legal protection* to NEPRA authority, officers, and employees for their actions in good faith or intended to be done in pursuance of this Act or any rules or regulations made. This provision shall facilitate officers in carrying out their functions, in particular, monitoring and enforcement without fear of courts. As reported in NEPRA Annual Report, 2020, 1304 litigations are pending in different courts on June 06, 2020, in which either a decision of NEPRA is challenged, or NEPRA is made a party. A significant number of pending cases also indicates a shortage of a sound legal team at NEPRA; also pointed out by experts.

Regarding NEPRA's *financial Resources,* the 'Authority' approves the annual budget of NEPRA to ensure effective monitoring and control of operating and capital receipt/spending items. In pursuance of section 14 of the NEPRA Act, the statutory audit of annual accounts of NEPRA is carried out by the Auditor General of Pakistan. Similarly, an external audit of NEPRA accounts is also carried out annually via some well-reputed chartered accountant firm. This initiative by NEPRA needs appreciation, as NEPRA is not bound by the Act to do so.

The initial funding of NEPRA was provided through a grant from the Federal Government amounting to Rs 100.5 million. Since then, NEPRA has been meeting its expenses from licensing fees on a constant basis and filing fees for tariff applications, etc. At present, an annual license fee is its major source of income. NEPRA collects annual license fees under the base rates, as defined in NEPRA (Fees) Rules, 2002 computed/indexed with the most recent Consumer Price Index (CPI) published every month by the Pakistan Bureau of Statistics (PBS) (NEPRA Annual Report, 2020).

Under total administrative expenses, salaries and benefits account for 76 percent to 80 percent in the last five years; whereas the budget allocated for training and development remained 1 percent or less of total administrative expenses (Table 1).

---

[95] The chairman's message in the NEPRA Annual Report 2019-20 mentions online training programs on different subjects were developed for the employees to enhance their professional knowledge and skills. Besides, Massachusetts Institute of Technology (MIT) and Florence School of Regulation were engaged for the capacity building of NEPRA employees.

Table 1

NEPRA Income and Expenditure Account (Rs million)

Year	Fee Income	Other Income	Administrative Expenses	Finance Cost	Tax	Surplus after tax
2016	918.96	36.2	815.1	4.1	38.2	97.8
2017	1026.4	29.4	935.6	4.0	43.8	72.4
2018	1163.4	34.8	1013.5	3.95	53.2	127.6
2019	1264.0	69.8	1047.1	3.9	114.2	168.5
2020	1405.03	115.5	1157.2	3.7	123.9	235.7

Source: NEPRA Annual Financial Statements (Various Years).

Via section 12 of the Finance Act 2012, NEPRA is required to deposit its surplus funds, fines, and penalties with the Federal Consolidated Fund (FCF) of the Government of Pakistan. As evident from its financial statements, NEPRA has been depositing its surplus funds since 2011 (Table 2).

Although, NEPRA claims that this is not affecting its financial planning and management. In the future, the amendment may hamper in maintaining high human resource standards, IT standards, IT systems, research & development activities, extensive consultations with stakeholders, etc. Besides, these surpluses also raise the question of a high fee collected by NEPRA, as suggested by some licensees from time to time (Khan and Qawi, 2014).

Table 2

NEPRA Surplus Transferred to Federal Consolidated Fund (Rs Million)

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	300	400	–	93.2	169.3	150.0	157.8	67.7	110.0	45.0

Source: NEPRA Annual Financial Statements (Various Years).

In the IT department, some positive developments have been taking place since 2015-16. The department is evolving to introduce e-Governance, paper-less environment, and Open Electricity Data concept in NEPRA. As a first step, NEPRA Dashboard is developed. In 2019-20, the digitisation of files and records started, which will be made available in the SharePoint ECM intranet server. Besides, the online complaint management system was launched for the general public in 2018; it is expected to be functional soon. Similarly, e-licensing is also on the cards.

What is the status of its policies, strategies, various processes (that is regulatory framework) involved in the grant of licenses, in the determination of tariffs and in the making of rules, regulations, standards and specifications? What are the flaws in execution? To what extent its rules/ regulations are facilitating market development and competition?

Findings

To be effective, NEPRA needs to have processes to deliver licensing, determining tariffs, monitoring, review and assessment, and enforcement functions, including the withdrawal of previous authorisations. Within the broader framework of the 1997 Act, NEPRA has prescribed rules, regulations, guidelines, codes to oversee the power sector. Processes are defined clearly in the NEPRA Regulatory Framework (Figure 1).

However, after the amendment in 2018, new rules, regulations, and specifications of standards are required. As per the amended Act, distribution will be separate from the electricity supply by 2023, which requires new standards/rules/regulations. Similarly, a competitive market is envisaged to be developed by 2023.

Section 50(1) of the NEPRA Act requires the secondary legislative instruments notified before 2018 to be brought in line with the amended NEPRA Act within one year from the date of coming into effect of the Regulation of Generation, Transmission, and Distribution of Electric Power (Amendment) Act, 2018. However, three years have passed, but the requisites are not in place. There are delays in the finalisation of all the rules/ regulations/ guidelines required for the market.

Its latest Annual Report 2019-20, its websites, and inquiry at various levels revealed that most of the new rules/ regulations are still in the making process. The exception is NEPRA Licensing (Application, Modification, Extension, and Cancellation) Procedure Regulations, 2021.

Further, NEPRA has approved a Competitive Trading Bilateral Contract Market Model (CTBCM) on 5 December 2019, which was prepared under rules made before the passage of the amended NEPRA Act. Section 14A of the NEPRA Act requires the Federal Government to develop "an efficient and liquid power market design" along with any matter on development, reform, improvement, and sustainability of the power sector. It is the regulator's job to ensure that the CTBCM Model is in line with the amended NEPRA Act. But the irony is CTBCM was evaluated by a foreign consultant on behalf of NEPRA.

It is pertinent to mention here, according to the NEPRA Act, it is the prerogative of the Federal government to make rules; authority can only recommend or ask of it. But the government must consult the Authority and the Provincial Governments. While NEPRA has powers to formulate regulations, issue directives, codes, guidelines, circulars, or notifications as are necessary to carry out the purposes of the NEPRA Act. Further, it is stated in 14A (5), the Authority shall perform its functions under the national electricity policy and plan, which after long delay, has been announced in the last week of June 2021. The processes allow for a timely response as rules, regulations, and guidelines mention the time frame. However, it is only the organisation's capacity that can ensure that all its' regulatory decisions and requirements are met in a timely and correct manner. The fundamental constraint highlighted in the evaluation is the *lack of ability at NEPRA to carry out its functions in a timely manner.* It is elaborated further below in the discussion on the existing regulatory framework.

Fig. 1. Regulatory Framework at NEPRA

(a) *Grant of Licenses*

Licensing is one of the principal activities at NEPRA. No company may carry out generation, transmission, and distribution without getting a license from NEPRA. NEPRA is performing this function in the light of NEPRA Licensing (Application and Modification Procedure) Regulations, 1999; NEPRA Licensing (Generation) Rules, 2000 and NEPRA

Licensing (Distribution) Rules, 1999. As per the NEPRA regulations 1999, Section 5(2), it is an instrument used to allow market entry; an instrument to check the development of capacity more than required; fuel mix; to evaluate the professional ability of an operator to execute the project; and the financial viability of the project.

The procedure for allotting licenses starts by submitting an application; and is stated in the NEPRA legal framework. These rules state licenses' fees, terms for issuance and renewal, revocation and suspension; licensees' accounting practices and audit, provision of information, fines and penalties, resolution of disputes, and so on. In law, there is a specified period in which NEPRA must approve or refuse a license application. *The process involves a public hearing.*

The process is cumbersome in terms of the documentation required and the time involved in the final decision. In most cases (as is obvious from the dates for final decisions), the time taken in making the final decision is more than what is prescribed in the rules. For instance, in the case of generation licenses to IPPs, the determinations took more than a year in some cases against the four months allowed time.

There are provisions to force companies to relinquish licenses or permits for a legal or contractual violation, though, as with penalties for violating contractual terms, they are seldom applied.

In the generation licensing decision, the professional ability of an operator to execute the project, financial and technical feasibility of the project are reviewed, but no focus to check the capacity required or towards fuel mix. The fact is it is the government that decides about the projects; the job of the regulator is to check for the technicalities and issue licenses. Officials at NEPRA complain about the non-availability of the national electricity plan to guide them.

Market entry regulatory framework has remained weak in Pakistan, mainly due to the limited role of NEPRA in Power Purchase Agreements. The prices and guarantees offered to new entrants in the generation sector did not allow competition among the generation companies. Contrary to NEPRA regulation, which says that the review and approval of a project are based on least-cost considerations, new contracts have been justified in filling the demand and supply deficit. NEPRA was not involved in the review and approval of the contract, but it determines the generation tariff that will apply to a power plant, and the PPA must follow.

NEPRA competitive bidding tariffs (approval procedure) regulations were notified in 2008, amended in 2014, 2017, and then in 2019 but not applied in practice. The absence of competitive bidding for these projects and non-transparent procurement processes has always raised serious concerns about the potential for corruption. The guarantee clauses in power purchase agreements (PPA) with these IPPs have not only restrained the dispatching efficiency but overburdened the power sector and the government with hefty liabilities.

Section 3(6) of NEPRA Licensing (Generation) Rules, 2000, allowed NEPRA for additional terms and conditions for the good cause. But it is the lack of regulatory oversight that today Pakistan's power sector is in a "capacity trap."

The details of all categories of licenses granted by NEPRA under Sections14B, 14C, 16, 17, 19, and 20 of the NEPRA Act up to June 2020 are given in Figure 4.2 and new license categories established under the amended Act are listed in Figure 3.

Fig. 2. Licenses issued under Three Main Categories

Generation

- Hydro (34)
- Nuclesr (5)
- GENCOs (4)
- IPPs (53)
- K-Electric (1)
- Wind/ Solar/ Bagasse/ biomass (129)
- SPPs (17)
- CPPs (79)
- Net-metering (3334)
- Others (31)

Transmission

- NTDC (1)
- K-Electric (1)
- Private (3)

Distribution

- DISCOs (10)
- K-Electric (1)
- SPPs (9)
- CPPs (1)

Fig. 3. New license Categories in the Amended NEPRA Act, 2018.

- Generation: to be de-licensed after 2023
- Transmission:
  National Grid Company; Provincial Grid Company
- Distribution:
  DISCOs
- Market Operator:
  Existing CPPA-G
- System Operator: Envisaged to be National Power Control Centre (NPCC)
- Electricity Supplier: Existing DISCOs & Other Companies
- Elecriciy Trader: Existing IPPs & Other Companies

For distributed generation (DG), the "National Electric Power Regulatory Authority (Alternative & Renewable Energy) Distributed Generation and Net Metering Regulations" (2015) specify the rules for connecting these generators to the main grid. The regulator is responsible for determining whether distributed generators can sell power back to the utility.

As reported in a research report by Bacon (2019), new entrants (mainly solar) have faced problems getting through the various initial stages of approval. For both wind and solar, the number of Letters of Intent (LOI) issued with associated land allocation rights is greater than the land available and the interconnection potential of the grid. As a result, only those private participants who have links with the government have land identification and allocation and have moved on to the stage of conducting the feasibility; otherwise, not.

Another issue is the delay in getting the interconnection permit from NTDC. Under the influence of the Ministry, not only did NTDC take more than the allowed 30 days (sometimes more than a year) to comment on the inter-connection study, its Planning department (responsible for interconnection permits) also delayed the process. Though utilities are required to connect distributed generation assets to the grid within a specified period, this gets delayed generally.

Licensing for transmission and distribution licensing was not an issue in the past because of restricted market entry[96]. But with the implementation of CTBCM, market participation in transmission and energy supply will increase, thus increasing license requirements.

In the view of NEPRA officials, the existing processes and procedures do not require immediate reform, but the experts had a different viewpoint. However, the hope is, once e-licensing is in practice, the delay issue would resolve to some extent.

(b) Tariff Determination

NEPRA determines electricity tariff, keeping in view the principles of economic efficiency and service quality according to the prescribed Tariff Standards and Procedure Rules, 1998. Under Section 7 (3) of the NEPRA Act,1997, NEPRA has been bestowed with the power to determine tariff rates/ charges and other terms and conditions for supplying electric power services by generation, transmission, and distribution companies.

NEPRA Tariff Standards and Procedure Rules (1998) provide guidelines for process and parameters for setting tariffs. Any licensee, consumer, or person interested in the tariff may file a petition with the NEPRA by submitting it before the Registrar along with such fee as may be determined by the Authority. On receipt of tariff petition, the process is followed as elaborated in Figure 4.

Tariff determined by NEPRA is forwarded to the Federal government pursuant to Section 31(4) of the NEPRA Act for notification in the Official Gazette. It was stated in the NEPRA Act, 1997 that the Federal Government may file a reconsideration request with reference to the determination/decision of the Authority in 15 days. The authority within 15 days shall decide upon the matter and intimate the Federal government for notification in the official gazette. As per the rules, five days are allowed to file a motion for a recalculation; and ten days to file a review motion.

[96] For the first time in 2015, a license was granted to a private transmission company.

The tariff structure for generation, transmission, and distribution is elaborated in Figure 5.

Fig. 4. Steps Involved in Tariff Notification

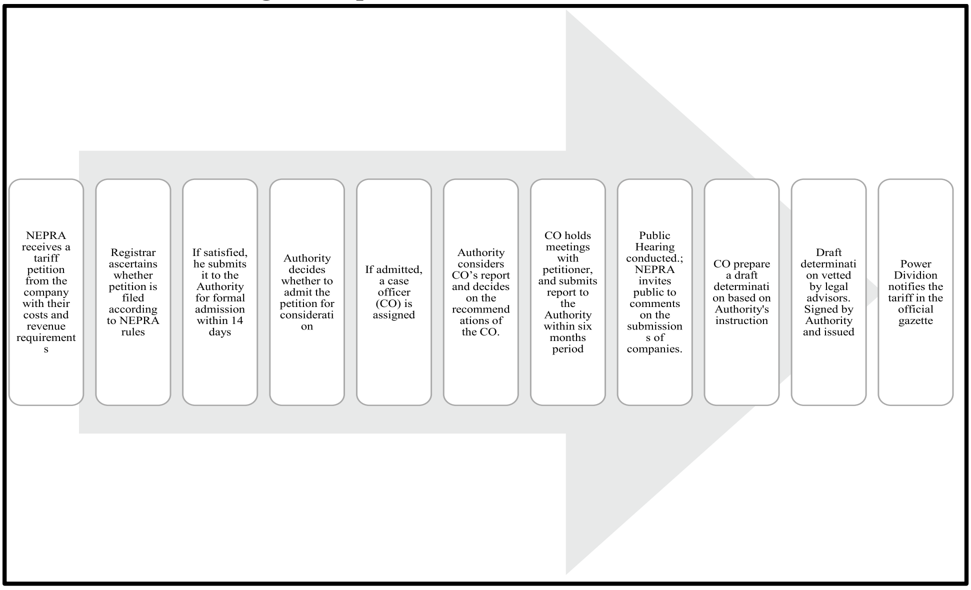
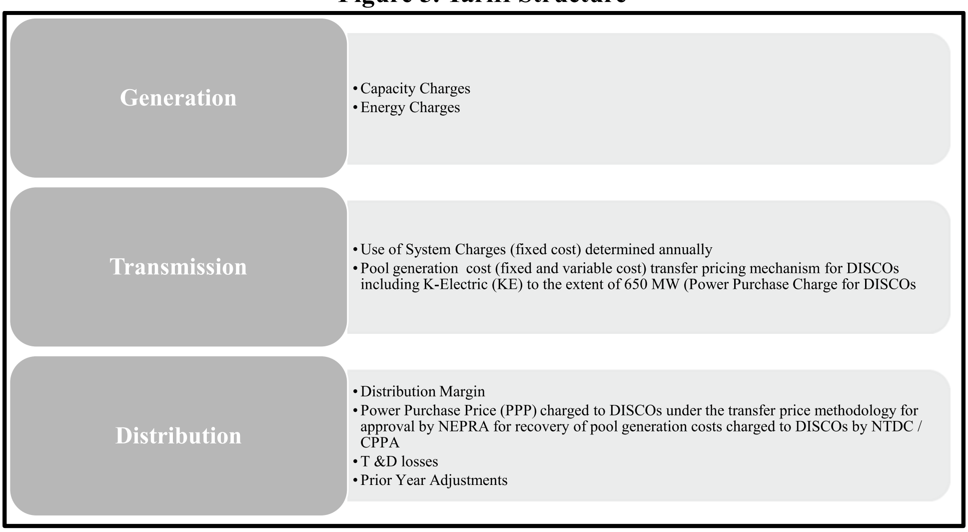


Figure 5. Tariff Structure



Before the amendment in NEPRA ACT, NEPRA determined consumer-end tariffs for each distribution company (DISCOs) separately. Consumer-end tariff determined by NEPRA was meant to recover the cost of the whole supply chain[97]. In deciding the average

[97] During the transition phase towards the full corporatisation of the former WAPDA companies, the bulk tariffs charged for the electricity purchased by the distribution companies have been determined at the discretion

sale price, NEPRA considers the annual revenue requirement of DISCOs which considers all the costs involved. The main factors in the annual revenue requirements include power purchase price[98], net distribution margin[99], transmission and distribution (T&D) losses, and prior-year adjustments[100].

The tariff so determined was different for each DISCO because of its distinct characteristics: the difference in annual revenue requirement and T & D losses. NEPRA used to make its valuation of cost and revenue requirements, determine the average sale price of each DISCO, set tariffs for different slabs of various categories of consumers for each DISCO, and send its recommendation to the Government of Pakistan (Power Division).

The government of Pakistan notified the final tariff for different consumer categories but the same across all DISCOs. Usually the minimum consumer-end tariff for a particular consumer category among all DISCOs was adopted for application across the board to all DISCOs.

However, in the Amended Act, 2018, NEPRA shall determine a uniform tariff for distribution licensees wholly owned and controlled by a common shareholder based on their consolidated accounts. In the amended Act, it is further stated that guidance will be taken from the National Electricity Policy to determine, modify or revise rates, charges, and terms and conditions for the provision of electricity services.

To sum up, *the tariff structure in Pakistan is not based on regional and consumer-specific long-run marginal cost but is used as an instrument to achieve political and socio-economic objectives.*

Apart from monthly fuel price adjustments, NEPRA also allows for quarterly adjustments in the determined tariff of DISCOs. This in itself is the result of regulatory failure, as it is made when DISCOs do not use the allowed energy quota and ask for a quarterly adjustment. Instead of regulating DISCOs, the burden is transferred to the consumers.

Besides, over the years, the determinations process has seen issues in terms of delays; and the regulator not allowing prudent cost (Box 4). In the generation tariff, the BOOT tariff was applied to the BOO regime—a payment of 80 percent plant cost in the first 10-15 years. The 15-18 percent returns on equity with return in dollars despite substantial cost incurred in Pakistani rupees caused huge capacity payments. Not only higher outages were allowed; higher capital costs were allowed making capacity purchase price higher (Sohail, 2014).

---

of NTDC. Until 2000, a uniform bulk tariff was charged to all distribution companies for their purchase of electricity. In 2001, a new pricing methodology was established, through which each distribution company would retain a margin that reflects its cash expenses, debt services, and line losses (but not capital expenditures or non-cash expenses).

[98] It includes generation and transmission costs of the power that a DISCO has projected to purchase.

[99] It is the difference between gross margin and other income of DISCO. Gross margin includes operation and maintenance (O&M) costs, depreciation and returns on the asset base of DISCO. While other income refers to remuneration of deferred credit, meter and rental income, late payment surcharge, profit on bank deposit, sale of scrap, income from non-utility operations and commission on PTV fees and miscellaneous incomes.

[100] It is the gap between the projected and the actual cost in the previous year which is built into tariffs for that year. This adjustment is for the difference between the projected and actual electricity units purchased by DISCOs; the difference between the projected and actual distribution margins; the difference between actual and notified previous year adjustment; the difference between projected and actual other income; and the difference between the projected and actual consumption mix.

Box 4. Tariff Anomalies

- Actual heat rate/efficiency of GENCOs plant are more than NEPRA determined heat rate. The additional heat rate consumed per unit produced is not covered in any tariff.
- Increased pay and allowances due to the hiring of employees in GENCOs, NTDC and DISCOS beyond NEPRA determined manpower cost, and is not covered in any tariff (generation, transmission, and DISCOs).
- NTDC tariff is set on 2.5 percent transmission losses whereas actual losses are much higher. As a result, the cost relating to excess transmission loss is not being recovered from any tariff which ultimately adds to the circular debt.
- Late payment surcharges paid by CPPA-G to the IPPs resulting from the inability of the DISCOs to pay for the power cost in a timely manner is also not covered in any of the tariff setting mechanisms.
- DISCOs network loss is more than NEPRA determined T&D loss which ranges from 0.5 percent to 11 percent among efficient performing DISCO to worst performing DISCO. The cost pertaining to excess loss of and above the NEPRA determined loss level is not being recovered from any tariff; is added to circular debt.
- Poor revenue collection by the DISCOs due to which liabilities of power sector towards power cost is not being paid and this poor revenue collection is adding to the circular debt as wells as load shedding.
- Prolonged stays on fuel price adjustments granted by the Courts and impact of court decisions that delayed payments to DISCOs.

It would be unfair to attribute all issues to NEPRA. Sometimes delays are from the side of licensee or because of legal challenges[101] or government interventions due to political considerations. But still, it is primarily the regulator which will have to take responsibility and lead reform in this area, especially in terms of providing guidelines and solutions.

To give the credit where it is due, NEPRA established for the first time in South Asia a CPI-X based Multi-Year Tariff (MYT) regulatory framework. In 2002, NEPRA approved a framework of MYT for KESC for seven years from its privatisation (given its expected privatisation). Later, the same tariff regime was established for FESCO, IESCO, and GEPCO, anticipating their privatisation.

(c) Performance Standards and Enforcement

According to section 7(2) clause c and section 34 of the NEPRA Act (XL of 1997), the authority is obliged to prescribe performance standards for the generation,

[101] As per the NEPRA Annual Report 2019-20, the regulator is presently facing litigation in around 1304 cases pending before various courts. Some of the important issues among others in litigation were Exclusivity of DISCOs, Inclusion of "surcharges" in the "Schedule of Tariff" by NEPRA upon re-consideration request filed by Federal Government, Fuel Adjustment Charges, Recovery of fixed charges during load-shedding.

transmission, and distribution companies for safe and reliable service. All the required Standards under NEPRA Act 1997 for distribution, transmission, and generation are put in place, although after a long and delayed process. While after the amendment, new performance standards for generation, transmission, distribution, electricity supply, and electricity trader are in the making. NEPRA has not prescribed environmental standards; all the generation companies granted a license by NEPRA are required to maintain environmental standards as may be prescribed by the Federal Environmental Protection Agency.

On papers, the regulatory framework for service quality is there[102]. All the companies (generation, transmission, and distribution) are bound by law to meet these standards for quality, supply, and commercial service; otherwise, they would be eligible for a fine or penalty. For quality-of-service enforcement regulated entities are required to report various indicators, such as System Average Interruption Duration Index (SAIDI), System Average Interruption Frequency Index (SAIFI), voltage indicators, recovery rates and transmission & distribution losses. These are evaluated by NEPRA, and the report is uploaded on its website.

But, in general, the enforcement mechanism is extremely weak at NEPRA. Fines are rarely applied (as is evident from NEPRA its annual reports[103]); also, there is no consistent approach to apply a penalty if the company fails to meet standards. Above all, there is no evidence of recovery of these fines.

NEPRA's role is limited to sending an advisory to the government about DISCO's performance. But the authority itself is unable to enforce these performance standards.

(d) Consumer Affairs and Complaint

The Consumer Affairs Division (CAD) is responsible for handling the complaints of consumers who can approach NEPRA under NEPRA Complaint Handling and Dispute Resolution (Procedure) Rules, 2015 read with Section 39 of the NEPRA Act against a Licensee for breach of any provision of the Act or any Order, Rule, Regulation, License, or instructions made or issued thereunder. NEPRA has established Regional Offices to facilitate consumers for the speedy redressal of their grievances.

As reported in NEPRA Annual Reports, the complaints are mostly regarding excessive and detection billing, delay in the provision of connections and replacement of defective meters, low voltage problem, augmentation of transformers, non-receipt of electricity bills, delay in replacement of damaged transformers, and excessive load shedding, etc. As the reported data revealed, in the last five years, on average, about 92 percent of complaints were resolved. Any information from other resources is not available to countercheck NEPRA's claims.

---

[102] Old rules are applicable as long as the new ones are finalised and announced.

[103] In 2019-20, fines were imposed on DISCOs on account of violations of Performance Standards, Distribution Code, and other applicable documents as well as occurrence of fatal accidents. Similarly, a fine of Rs. 50 million was imposed on K-Electric on account of 19 fatal accidents that occurred in Karachi as a result of heavy rainfall during the months of July and August 2019.

(e) Competitive Market Development

The driving force behind the Amended NEPRA Act is to guide NEPRA to adapt to new challenges involved in creating a competitive electricity market. Though, NEPRA was mandated in the previous Act to smooth the transition towards a competitive market where it is possible. But unfortunately, it didn't happen.

The Amendment creates a legal basis for the licensing of various stakeholders in the market to smooth the transition towards a 'competitive market' structure by 2023. Many new stakeholders (units) were introduced, which require the development of a comprehensive framework by the regulator to implement and enforce competitive market reforms.

Besides, under the NEPRA amended Act, the two distribution functions, that is 'wire or distribution network', and 'sale' are required to be separated by 2023, which traditionally were covered in a single distribution license. The amended act also provides for a gradual cessation of the licensing requirement for generation companies after 2023 and a complete exemption for 'Captive Power Plants' to obtain a license.

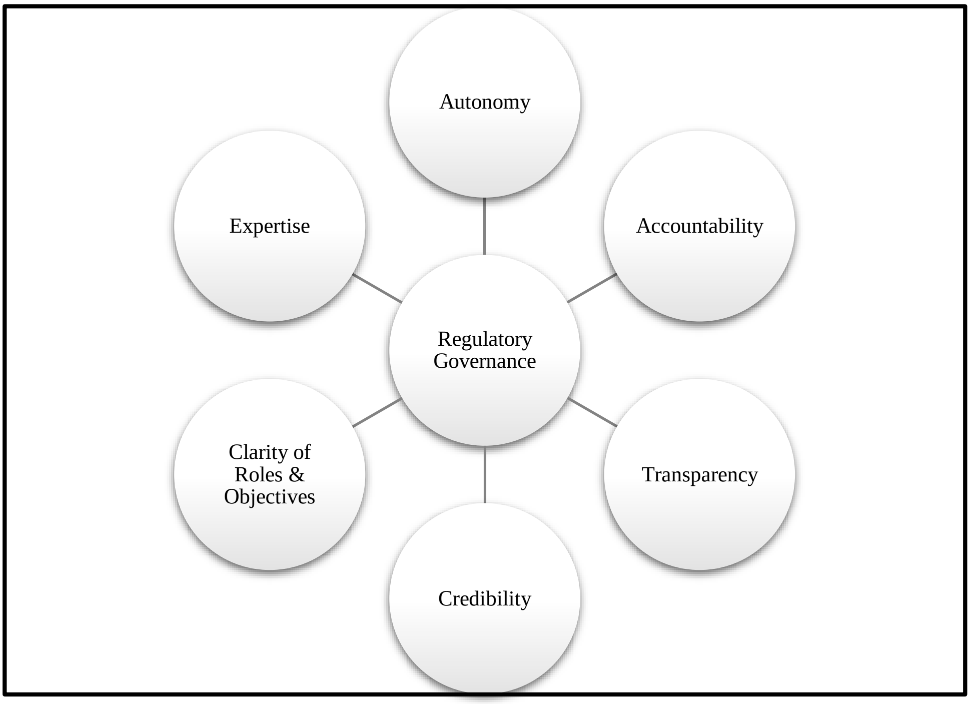
Under the amended act, the regulator has been granted powers to monitor and enforce the competitive market. However, the amendments only provide a legal basis for developing a competitive electricity market, that is, legal guidelines for guaranteeing de jure regulatory performance. The successful transition towards a competitive market requires de facto regulatory performance, which is dependent on significant preparation not only at NEPRA but at the Power Division, Central Power Purchasing Agency-Guarantee (CPPA-G), PPIB, and all other related institutions. It requires new pricing and procurement rules, new software at each entity, capacity building of staff to enable them to handle market forces while meeting their basic objective of supplying electricity to consumers.

The USAID Report (2019) also testifies what is informed by experts that various departments at NEPRA are not yet ready for this change. Management has little knowledge of different competitive market models, their strengths, and weaknesses. NEPRA's expertise in supervising long-term bilateral contracts and spot purchasing is minimal at present.

So far, the plus point is, to facilitate wheeling of power, NEPRA made NEPRA (Wheeling of Electric Power) Regulations in 2016. Under these regulations, generation companies connected to the transmission and distribution networks or those who intend to be connected to these networks can transport their power using the transmission network of NTDC or distribution networks of DISCOs to the Bulk Power Consumers. This is the first step considered towards the development of the market[104].

[104] Bulk Power Consumers wanted to pursue 'Wheeling of Power' under the Wheeling Regime. But hurdles are being created by Power Division & CPPA-G to protect DISCOs,

REGULATORY GOVERNANCE



Does the NEPRA Act facilitates effective governance structure at NEPRA? To what extent does NEPRA establish its independence, competence, integrity, and accountability while performing its duties?

Findings

(a) Regulatory Autonomy

In the law, NEPRA needs to be provided with powers to perform licensing; determine tariffs; specify standards, review, and assess their implementation; and regulate processes. To be effective, NEPRA should be institutionally *independent* of the influence of power sector companies, which it regulates, and also independent from the influence of the Ministry of Energy (Power Division) who is effectually running public sector generation companies (GENCOs), National Transmission and Dispatch Company (NTDC) and state-owned distribution companies (DISCOs).

By the provisions of the Act, NEPRA is an autonomous organisation under the Cabinet Division according to rule Schedule II of Rule 3(3) Distribution of Business among the Divisions. In the past, some efforts were made by the Ministry of Energy (when a new amended Act 2018 was in the making) to bring it directly under the Ministry of Energy for better coordination, but it was resisted.

However, amendments in the law, where have given more powers in some aspects, also have compromised regulatory independence in others. For instance, Under Section 14A (5), it is mandatory for NEPRA to perform its regulatory duties in accordance with the government of Pakistan electricity policy and plan. The law requires that all the clauses will be implemented through various rules and regulations, where rules are formed by the government.

The authority is empowered to "issue such directives, codes, guidelines, circulars or notifications as are necessary to carry out the purposes of this Act and the rules and regulations made hereunder." With reference to rules or regulations, previously, NEPRA was empowered (under Section 12D) to make or repeal rules or regulations. In the amended Act, it is only authorised to "recommend rules, or to make or repeal regulations". This may impact the regulatory autonomy of NEPRA in carrying out its functions.

The rules and regulations provide processes and guidelines to determine tariffs, issue licenses, and monitor the company's performance. If the rules give enough leeway to NEPRA to obtain all necessary information, the regulator would be able to take decisions objectively based purely on technical considerations. Otherwise, NEPRA's ability to make objective assessments could be affected (USAID, 2018).

NEPRA is not autonomous in matters of tariffs as the government continues to exercise considerable control over it. Although there is no formal condition or rule allowing the ministry to reverse NEPRA's decisions, yet major decisions, i.e., tariffs rates, are subject to Ministry approval. The regulator determines tariffs and can only recommend, which are notified by the Ministry. Moreover, the Ministry may ask NEPRA to re-reconsider its determined tariffs or charges.

Additionally, in recent years, particularly in generation projects under China Pakistan Economic Corridor (CPEC), the government has been influencing the tariffs that NEPRA determines. Undue interference and influence of the government hamper the independent functioning, which in turn affects the consumers and producers. The success of electricity restructuring in Argentina and Chile is attributed to a very large extent to the performance of their independent regulators (Stern, 2000).

Besides, under section 31 (31) of the amended Act, NEPRA powers to perform its functions have been reduced if not curtailed. Under this clause, NEPRA determines a *uniform* tariff for all government-owned DISCOs based on their consolidated financial accounts. Differentiated tariffs are, however, allowed in the case of privatised utilities (currently only K-Electric). This will create difficulty for the regulator to evaluate the managerial performance of DISCOs based on objective criteria and accordingly reward or penalise them.

For effective monitoring of DISCOS, it is essential that company-specific performance, challenges, and issues are compiled and assessed regularly. However, when ISCOs financial accounts are consolidated, the disparity among companies will be camouflaged, thus, creating difficulty for NEPRA to evaluate each company independently.

On the other side, NEPRA is given more autonomy in enforcing regulatory standards, rules, etc. Section 27(A) allowed NEPRA to investigate any matter that is violating this Act, or any rule, regulation, code, or license issued under the Act. NEPRA is empowered to appoint investigating officers and levy fines on licensees that are found to violate the Act. The power to conduct the investigation was not with NEPRA in the past. The authority had to request the police, NAB, FIA, or other agencies to conduct the required investigations. This change will help NEPRA to conduct its affairs with reference to enforcement more effectively.

But again, even though NEPRA's decisions are legally binding. However, there is no reliable penalty if the distribution or generation company fails to meet regulatory standards in practice. In other words, the de facto decision-making autonomy is much lower than de jure.

To enforce its integrity, NEPRA does send advisories to the Ministry of Energy (Power Division) from time to time for effective utilisation of available generation sources and for improving efficiency in the distribution companies. But unfortunately, their advisories are generally ignored.

Financially, NEPRA is independent. NEPRA has the power to determine its structure and allocation of budget. In comparison, in our neighboring country India, the regulator's budget comes directly from the government budget (Bacon, 2019). NEPRA's funding is established by law (NEPRA Act) and is taken from license fees, filing fees, etc., as prescribed by it from time to time and approved by the Federal Government. Therefore, there is no chance of any influence or 'political capture'.

The success or failure of power sector restructuring, i.e., development of the competitive market, depends upon the effective and independent functioning of NEPRA. As discussed above, NEPRA has its funds, therefore, it must have the authority to invest or otherwise utilise them. Even if there is surplus, the authority has the right to use them to pursue their stated objective.

As discussed in the Organisation Structure of NEPRA, through section 12 of the Finance Act 2012, NEPRA is required to deposit its surplus funds, fines, and penalties with the Federal Consolidated Fund (FCF) of the Government of Pakistan. NEPRA as a regulator, is performing policy functions of the state. It is established as a body independent from the influence of ministries, so it must function free of bureaucratic considerations. NEPRA, giving up its surplus to the Federal Consolidated Fund and asking the government to make up for shortfall (if any) in its expenditures may make it vulnerable to political and bureaucratic pressures, thus, weakening its independence.

Regarding leadership autonomy, NEPRA was established through an Act. It has the power to allocate its budget but has no power to decide about its organisational structure and rules. According to the NEPRA Act, the regulator's leadership, composed of a chairman and four members, is selected by the Federal government based on nominations by the provinces. The selection of a new regulator or a member often involves long delays, thus affecting NEPRA's capacity to deliver in a timely manner.

(b) Regulatory Expertise

Adequate human capital resources are essential for quick and effective decision-making. The personal qualification of a regulator is also a key in independent decision-making. Under section 3(3), the experience requirements have been reduced. But their association with the power sector is made compulsory. The new selection criteria and process may favour evaluating an individual's capabilities and adequacy for a position based on his/her performance and not only on the length of service. This way, Act has enabled a selection process based on technical/academic strengths and performance. This amendment will block the appointment of retired civil servants, army officials as members or chairman, which used to be the practice at NEPRA.

In the past, NEPRA leadership had problems in terms of regulatory expertise as people from bureaucracy or military didn't have power sector background. By the time the regulator (member) may develop some understanding of the sector's complexities his/her tenure is over.

Whereas, regarding other staff, NEPRA has not been able to develop expertise in relevant areas that may facilitate effective interventions in the future. In addition, NEPRA has not acquired the services of professional support staff transparently that could establish a proper regulatory framework for the benefit of the consumers and producers alike. Most of the existing professional staff have zero to little exposure to regulatory concepts and functions or are drawn from the sectors which have no relevance to the operational requirements of a power utility.

It is because of the lack of expertise that NEPRA so far is unable to develop or explore new tariff methodology to counter excess installed capacity or to improve the financial viability of the sector. There are several instances where DISCOs, K-electric, even provinces in case of net hydel profit remained unsatisfied with NEPRA decisions and often have gone to courts against NEPRA determinations.

(c) Accountability & Transparency

The regulator's independence needs to be compliant with measures to ensure that the regulator is accountable for its action. For accountability of the regulator, legislation should ensure *transparency* of the decision-making process; detailed justifications of decisions; opportunities for all interested parties to take part in public hearings; and provisions for the removal of regulators in case of the proven misconduct or incapacity. Proper checks and balances can ensure that the regulator does not drift away from its mandate, engage in corrupt practices, or become grossly inefficient (Malik, 2007).

According to Section 42 of the NEPRA Act, NEPRA is required to prepare its Annual Reports and the State of Electric Power Services Report. The report shall be submitted to the Council of Common Interests (CCI) and the Federal government. No doubt, NEPRA has been publishing its annual reports since 2003-04 and state of industry reports since 2006 regularly. These reports are available on its website. But as such, these are never evaluated at the Federal level or in CCI.

Additionally, according to the NEPRA Act, the regulator shall keep public files open in a convenient form for public inspection. This Act also establishes that NEPRA shall maintain complete and accurate books of accounts of its actual expenses and receipts, which shall be audited annually by the Auditor General of Pakistan. There are also several rules, procedures, and guidelines which provide transparency to the distinct regulatory processes.

As mentioned earlier, in pursuance of section 14 of the NEPRA Act, the statutory audit of annual accounts of NEPRA is carried out by the Auditor General of Pakistan. Similarly, an external audit of NEPRA accounts is also carried out annually via some well-reputed chartered accountant firm. Moreover, transparency at NEPRA is ensured through public participation in the decision-making process by holding public hearings, inviting written comments of stakeholders and the general public, availability of public documents including Rules/Regulations, licenses, tariff determinations, petitions, etc., on the NEPRA website. Most of NEPRA's decisions are publicly available on their website. However, information regarding its staff expertise is not publicly available.

The law also allowed for removing the chairman or any member. Section 4(2) says that the Chairman or a member may be removed by the Federal Government after he is found incompetent or found guilty of misconduct in an inquiry by the Federal Public Service Commission. Though, no such example exists.

The amended Act (section 12 A) allows to establish an Appellate Tribunal, chaired by a former high court judge nominated by the Federal government or provinces, by rotation. Besides, the tribunal will have member finance and member electricity, nominated by the Federal government or provinces, by rotation. Under the 1997 Act, concerning legal appeals, there were legally established processes to allow regulated companies or other affected parties to challenge or appeal against the decisions of NEPRA. The process was established under the NEPRA (Procedure for filing appeals) Regulations, 2012. The appeal body was NEPRA itself. However, there was a provision for resorting to courts in case of dissatisfaction with the NEPRA appeal system.

This provision of Appellate Court may provide a forum to check or review NEPRA decisions. It may be considered accountability, as the orders and determinations of the Appellate Tribunal shall be binding on the Authority. Though appealable before the High Court. The formation of an Appellate Court is common in other countries as well (USAID, 2018). However, apprehension is that this provision may compromise the independent decision-making of the Authority if the Tribunal makes decisions under the government's influence.

(d) Credibility

In the optimal design of any regulatory institution, there is always a risk of organisational failure unless credibility and transparency in regulatory decisions are in place. Independence, accountability, and proficiency of the regulator are crucial for credibility (Malik, 2007). Direct involvement of ministers/ bureaucrats in pricing and licensing decisions can affect regulatory credibility and investment decisions (as in CPEC power projects).

For short-term political goals, politicians turn down the justified increase in tariff at the expense of long-term benefits of consumers and investments, thus undermining regulatory credibility. In the absence of regulatory credibility, investors being aware of organisational risks associated with their investments will demand high tariffs (as happened in IPPs case) to compensate for increased risk. The preference of any investor would always be to invest in industries with an independent regulatory agency (with no government involvement).

(e) Clarity of Roles and Objectives

In the case of Asian regulators, as Jacob (2004) observed, many conflicting public policy missions, government intervention and market competition go along together and are emphasised equally. So is in Pakistan. *Powers and Functions* are spelt out in Section 7(1) and (2). About NEPRA and government relationship, section 7(2ab) is clear that it will aid and advise the Federal Government, in formulation of the national electricity plan.

However, about electricity tariffs, section 7(2ac) states that it is the responsibility of NEPRA to ensure efficient tariff structures and market design for sufficient liquidity in the power markets; while section 31(4) is contradictory as it states that the authority in the public interest determines a uniform tariff for distribution licensees wholly owned and controlled by a common shareholder, based on their consolidated accounts. This clause challenges the efficient tariff structure condition, as the uniform tariff cannot justify the true market principle, where electricity prices reflect the actual cost of service. Besides, this provision of uniform tariffs will seriously jeopardise any effort or incentive for efficiency.

Additionally, the lack of relevant expertise of the regulatory staff makes it difficult to define regulatory missions clearly and carry out the functions effectively.

EFFECTIVENESS OF REGULATORY FRAMEWORK

What is the impact of regulatory framework at NEPRA on power sector outcomes? Did NEPRA achieve its objectives as stated in the NEPRA Act, 1997?

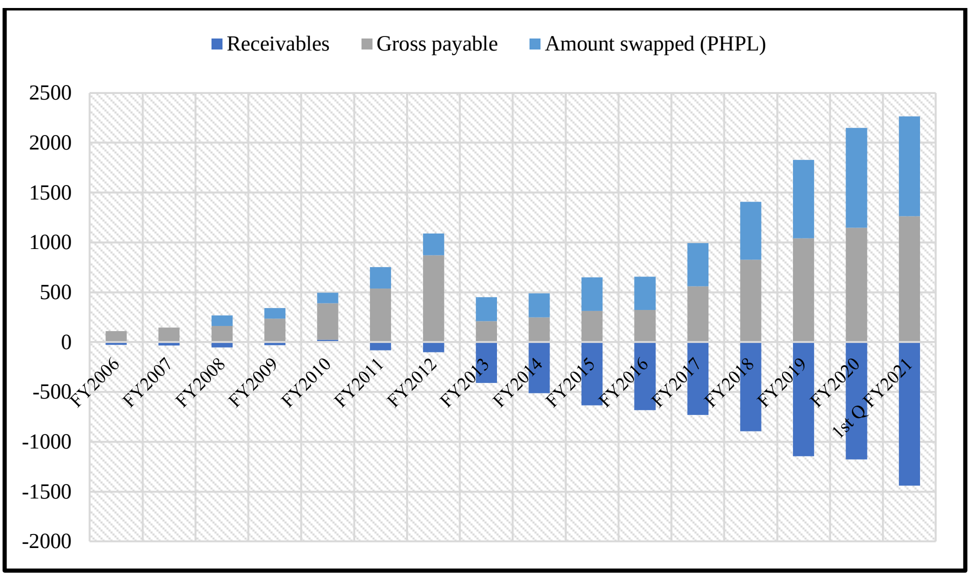
Findings

What ultimately matters are sectors outcomes, not regulatory processes, institutional characteristics, or regulatory governance. The key objective behind the formation of NEPRA was to develop and pursue a regulatory framework to improve efficiency and reliability and to provide affordable electricity to consumers while protecting the interests of consumers, investors, and operators equally. In addition, to facilitate the transition from a protected monopoly structure to a competitive environment was also NEPRA mandate in NEPRA Act 1997.

(a) A Balance between Consumer, Investor, and Operator

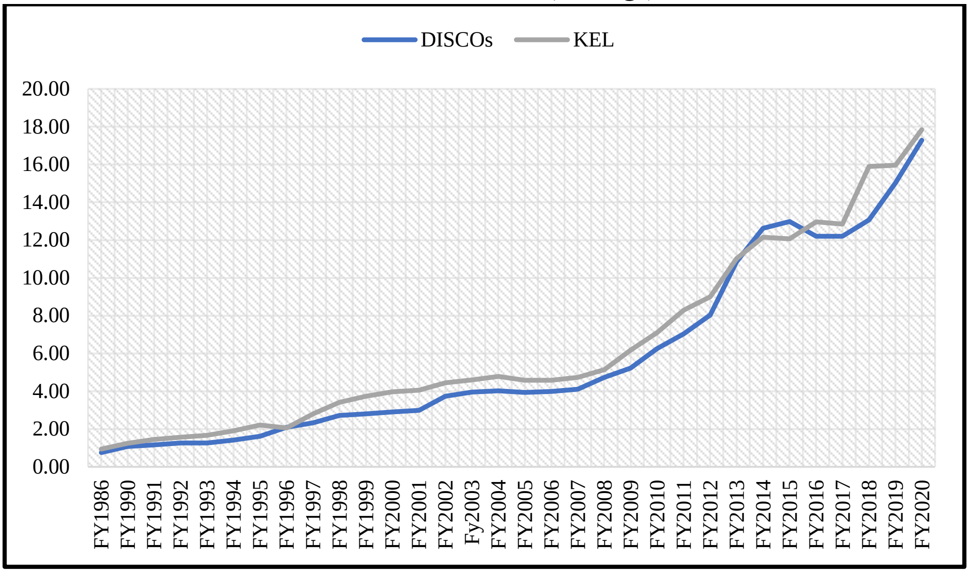
NEPRA was mandated to create a balance between investors and consumers, where it failed as the problems faced in the power sector in the last two decades are unexemplary. Apart from the government fiscal and financial issues due to enormous and rising circular debt (Chart 1), consumers remained the worst sufferers. Not only power outages of 8 to 10 hours in urban areas and up to 16 hours in rural areas; a significant increase in electricity prices (Chart 2 and Chart 3).

Chart 1. Circular Debt Growth



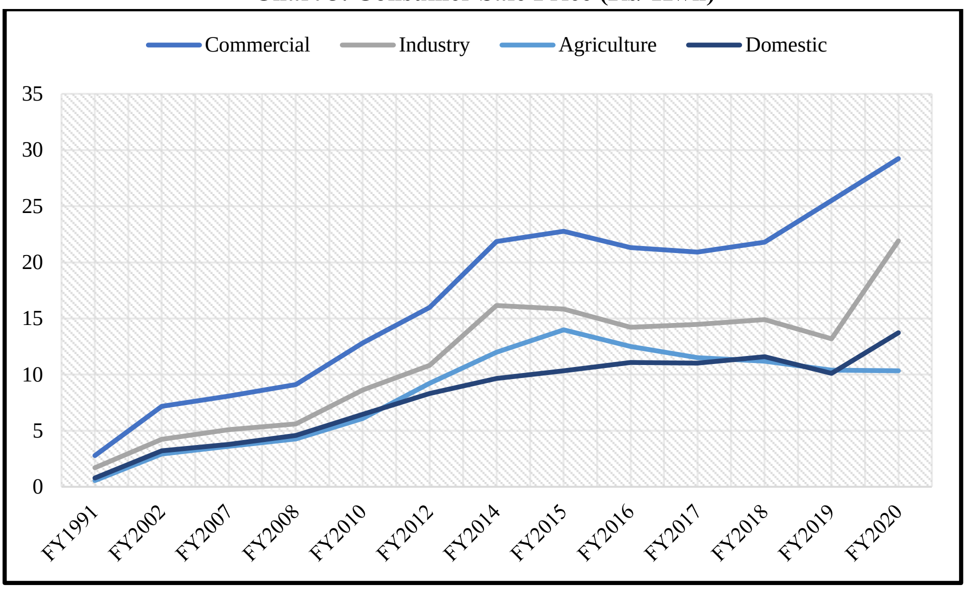
Source: NEPRA State of Industry Reports, CPPA-G Annual Reports, and Various Government Documents.

Chart 2. Consumer Sale Price (Average) Rs/ KwH



Source: Electricity Marketing Data (Various Years) and NEPRA State of Industry Report (Various Years).

Chart 3. Consumer Sale Price (Rs/ Kwh)



Source: Electricity Marketing Data (Various Years) and NEPRA State of Industry Report (Various Years).

While power sector policies allowed unreasonably very high profits to independent power plants[105]. Excess payments have been made to power producers because of either misreporting by the producers or regulatory oversight (Report on the Power Sector, 2020).

[105] Profits generated were as high as 18.26 times the investment and dividends were taken out as high as 22 times the investment (Report on the Power Sector, 2020).

Pakistan has the highest cost of electricity across all major consumer groups in South Asia (Table 3). Some of our low value-added exports rely heavily on electricity consumption. The high cost of electricity has reduced the competitiveness of our exports, thereby impacting on the country's trade deficit and balance of payment. Large cross-subsidies (especially in favour of domestic and agriculture consumers) and heavy tax incidence are contributing to grid defection by large consumers (industry, commercial and high-end consumers) (Report on the Power Sector, 2020).

Table 3

Cost of Electricity- Regional Comparison

Cents/ KwH	Residential	Commercial	Industry
Pakistan	1.3-15.4	12.4-15.9	118.12.5
India	4.2-11.2	8.4-11.9	10.9
Bangladesh	4.1-12.6	10.8	6.8

Source: Power Sector Report, 2020.

(b) Efficiency, Reliability, and Financial Viability

No serious effort by a regulator has been made by NEPRA to minimise if not reduce inefficiencies in the public sector generation (GENCOs) and distribution companies (DISCOs).

The performance of (GENCOs) remained lacking in terms of all Key Performance Indicators (KPI) for the past many years. These GENCOs are running below their net available capacities because the desired maintenance and scheduled outages over the years as per standard industry practices are not in place. Lack of maintenance has increased the cost of generation. These power plants not only have poor operational results, the workforce, which is already on the higher side on a per MW basis, remained idle due to their closure and non-operation, contributing towards higher cost of generation. The Framework of Economic Growth by PIDE (2020) reports that an amount of Rs 251.6 billion was lost due to inefficiency in these public sector generation companies.

Similarly, the state-owned distribution companies (DISCOs) and even privatised utility K-Electric, KPIs indicate poor performance and inefficiency. One of the policy tools adopted by NEPRA to improve the operational performance is to set some targets for T & D losses for each DISCO in their revenue requirements. Via this tool, NEPRA anticipates that to avoid deficits, DISCOs would improve their operational efficiency. However, this strategy has not worked in most of the DISCOs. Rather, when the respective DISCO does not meet the target, it is added to the payables of that respective distribution company, as it is not compensated by tariff differential subsidy.

Likewise, in tariff determination, NEPRA counts 100 percent recovery. However, the reported recovery percentage of DISCOs remained around 90 percent. Wrong energy billing is also responsible for low recoveries by DISCOs. The Transmission system is also constrained by overloaded transformers and transmission lines.

These all indicate regulatory oversight in monitoring and enforcement of KPIs in generation, transmission, and distribution companies. These inefficiencies jeopardise sectors' financial viability and negate NEPRA's objective to ensure a reliable supply of electricity to consumers. NEPRA lacks the authority to make DISCOs accountable for their performance, whether related to operational and commercial inefficiency or over-billing to consumers. Similar is its role regarding the accountability of generation companies (whether in the public or private sector). In particular, the enforcement of service quality is weak. There is no mechanism to incentivise for good performance or impose a penalty in case of poor performance.

Table 4

Distribution Losses

FY	2006	2009	2012	2015	2018	2019	2020
PESCO	34.1	37.4	36.0	34.81	38.15	36.6	38.69
TESCO				21.68	12.47	11.97	16.19
IESCO	13.2	10.8	9.5	9.41	9.14	8.9	8.69
GEPCO	10.2	10.7	11.2	10.72	10.01	9.9	9.51
LESCO	13.1	13.3	13.5	14.10	13.83	13.2	12.4
FESCO	11.6	10.7	10.9	11.03	10.53	9.8	9.62
MEPCO	20.5	18.4	17.9	15.50	16.59	15.8	15.23
HESCO	39.2	35.1	27.7	27.08	29.88	29.5	28.82
SEPCO			39.5	38.29	36.67	37.0	36.27
QESCO	20.7	20.4	20.9	23.10	22.44	23.6	26.68
K-El	37.5	38.5	29.7	23.7	20.4	19.1	19.8

Source: NEPRA State of Industry Report (Various Years).

Table 4.5

% Recovery

FY	2008	2010	2012	2014	2016	2018	2019	2020
PESCO	92	85	83	86	89	89	89	88
TESCO				7	437	67	68	68
IESCO	98	96	96	90	91	90	88	90
GEPCO	98	96	99	96	99	97	96	94
LESCO	98	96	96	98	99	98	98	95
FESCO	99	97	100	100	100	99.6	99.2	94
MEPCO	97	94	97	96	100	97	99	93
HESCO	77	60	69	79	72	77	75	73
SEPCO			51	60	55	60	63	57
QESCO	86	76	36	42	72	26	27	49
K-El		100	91	87	88	91	92.6	92.1

Source: NEPRA State of Industry Report (Various Years).

The overloading of power transformers of DISCOs is shown in Table 6. It is evident that (except for FESCO) power transformers of all the DISCOs are overloaded.

Table 6

Overloading of Distribution Transformers

DISCOs	Total Distribution Transformers		% Distribution Transformers loaded above 80 %	
	2015-16	2019-20	2015-16	2019-20
PESCO	60365	77307	31.99	4.50
TESCO	15634	18903	1.11	35.35
IESCO	45438	50210	6.83	3.31
GEPCO	60080	72007	2.58	2.70
LESCO	97048	116030	43.23	22.19
FESCO	97761	113079	3.36	0.58
MEPCO	152806	178730	4.65	3.26
HESCO	35334	37896	23.59	3.20
SEPCO	35029	38616	18.39	6.93
QESCO	53646	62337	16.30	10.93
K-El	653141		15.31	

Source: NEPRA State of Industry Report (Various Years).

(c) Privatisation and Market Competition

Privatisation was not directly the function or responsibility of NEPRA, nor is it after the amended Act. But under law, NEPRA was supposed to facilitate the process to bring efficiency in the power sector and helps in ensuring competition where feasible. The privatisation process remained slow in the last two decades. Except for K-electric and Kot Addu Power Plant, the privatisation of ex-WAPDA distribution companies has been pending. After unbundling, these distribution companies have been corporatised with independent Boards of Directors, yet operationally they are still under the administrative control of the government.

Moving toward competition and market forces represents the major element of the sector reform program which has still not been implemented in Pakistan -- partly because of the lack of government willingness and capacity and partly because of the exemptions given to IPPs -- whose operations were exempted from market forces by sovereign guarantees provided by the Government of Pakistan.

Besides, a financially viable sector and a reliable payment chain are crucial for a market to function. The creditworthiness of all, in particular, distribution utilities is critical. Presently, the power sector is not fully solvent; its deficit, that is, circular debt, is rising continuously and has reached an all-time high of Rs. 2.4 trillion.

The weak administrative governance in NEPRA results in the overall institutional inability to carry out the desired function effectively. As we find in previous sections, NEPRA lacks the professional expertise to supervise and control the power sector and the authority to establish a rational pricing regime. Being the regulator, it was NEPRA's job to resolve all the power sector problems, including system losses, rising costs, and high tariffs. Again, the outcome of regulatory oversight is that the circular debt emerged for the first time in 2006. Since then, it has been there and rising. Besides the increasing costs of generation and sector inefficiencies, it is the method of tariff determination and delays in tariff determinations responsible for the circular debt issue.

An overall assessment of NEPRA regulatory performance indicates that the overall de jure performance is high, indicating a regulatory system with many necessary qualities for the power sector. However, de facto performance highlights a significantly poor regulatory functioning in practice. The regulatory reform required to make the transition towards a competitive market has historically been resisted in Pakistan. This reluctance could be because of fear of losing control over assets that provide socio-political leverage to the State. NEPRA being an autonomous organisation (by law) didn't make serious efforts to improve regulatory infrastructure in the power sector.

RECOMMENDATIONS

- The transition towards a competitive market requires substantial preparation at NEPRA; NEPRA needs to build the capacity of its staff to work and cope with market forces while meeting their obligations as a regulator.
- Capacity building through the employment of more tariff specialists, regulatory economists, and analysts, equipped with better and advanced techniques and sufficient background knowledge of Pakistan's Power sector. In addition, negligible expense by NEPRA in training and development, in the presence of surplus accounts, emphasised the need to invest more in training and development of its staff for improving efficiency in its regulatory duties.
- The human resource department should be closely associated with other departments dealing with primary regulatory functions for understanding these functions and the expertise required to carry out those functions.
- A research wing at NEPRA may also help handle challenges related to market development, new technologies and for giving input in government policy and planning, keeping in mind the ground realities.
- Decentralisation of decision-making powers for effective and speedy decisions in routine matters is suggested. The power sector used to have such a structure under WAPDA.
- One of the ways to reduce the tariff determination period is to strengthen NEPRA's tariff division by employing more staff. In the tariff department, tariff specialists and economists are required to explore new tariff methodologies to ensure the financial viability of the sector and to ensure competitive electricity tariffs for reducing the cost of doing business and the country's trade deficit.
- NEPRA needs to improve its institutional capacity to supervise the electricity business; acclimatise itself with newer challenges being emerged as a result of a constantly evolving technological framework of the sector, including smart grid development, distributed generation, grid integration as well as the development of new innovative models of financing.
- NEPRA is in the process of making new rules/regulations/guidelines in line with the Amended Act; have to complete it at the earliest to ensure that the requisite regulatory framework is in place before the formal commencement of competitive wholesale market.
- More use of information and communication technologies is recommended to minimise delays. To improve coordination among the departments, something like e-office and digitisation of its operations can be helpful.

- The monitoring and enforcement department needs to be strengthened, redefined, and should focus on the overall performance of the power sector. Review/ revise the existing KPIs for the energy companies to improve their performance.
- There is an urgent need to simplify regulatory processes and enhance Federal Government and NEPRA coordination.
- For effective accountability, NEPRA reports (Annual and State of the Industry) must also be evaluated by independent experts, just like its financial reports. Above all, it is essential to have some KPIs for NEPRA, covering not just sector outcome but also internal efficiency and human resource development of the organisation.
- The financial accounts may also be submitted to Parliament for review and discussion. This will create a balance between granting financial autonomy to the regulator and its accountability to ensure that the regulator uses its funds in compliance with the law.
- In law, NEPRA is allowed to play purely an advisory role, its recommendations are required to be made publicly available, as well as the responses of the government. Moreover, if the government body receiving the recommendations rejects or modifies them, it is required to provide a public explanation for doing so. This will ensure the regulators' integrity.
- One of the NEPRA objectives is to alleviate energy poverty; NEPRA must provide an enabling environment for increasing access to those who are under-served or un-served; strategies to promote sustainable energy for all. Ensure standards and measures which encourage the provision of low-cost meters for urban poor and facilitation of distributed generation for rural areas all over the country.
- Some external factors are also influencing the effectiveness of NEPRA. The most important of these would be the court orders. There is a tendency in Pakistan for frivolous litigation by vested interests to evade regulatory measures against them. For instance, a petition against the initiation of investigations or inspections by the regulator may impede regulatory action. In such cases, great care has to be taken to ensure that judicial intervention does not deter regulatory decision-making. A strong in-house litigation team is required at NEPRA to defend stay orders before the various courts.

REFERENCES

Bacon, R. (2019) Learning from Power Sector Reform: The Case of Pakistan. Policy Research Working Paper No. 8842, The World Bank, Washington D. C.

Jacobs, S. (2004) Governance of Asian Utilities: New Regulators Struggle in Difficult Environments. The Governance Brief, ADB Quarterly Publication, Issue 10, Governance and Regional Cooperation Division, Regional and Sustainable Development Department.

Khan, N.J and A. Qawi (2014) The Impact of Institutional Design on Regulatory Performance, Diagnostic Report by JICA Consultants (unpublished).

Malik, A. (2007) Effectiveness of Regulatory Structure in the Power Sector of Pakistan. PIDE Working Paper No. 25, Pakistan Institute of Development Economics, Islamabad.

NEPRA (Various Years), Annual Reports, National Electric Power Regulatory Authority, Islamabad.

PIDE (2020) Framework of Economic Growth, Pakistan Institute of Development Economics, Islamabad.

Report on the Power Sector (2020) Prepared by Committee for Power Sector Audit, Circular Debt Resolution, and Future Roadmap, Ministry of Energy, Pakistan.

Sohail, A. (2014) Review of Energy Sector with Focus on Electricity Tariff Determination, in Solutions for Energy Crisis in Pakistan, Volume II.

Stern, J. (2000) Electricity and Telecommunication Regulation in Small and Developing Countries. Regulation Initiative Working Paper Series No. 41.

London Business School. USAID (2018) Review of Amended Act, 2018, Final Report, Sustainable Energy for Pakistan (SEP) Project, United States Agency for International Development.

USAID (2019) Energy Regulatory Partnership_ Pakistan, Final Report on A Limited – Scope Assessment of License Requirements and Conditions for the Regulatory oversight of the Electric Power Competitive Market Environment in Pakistan, United States Agency for International Development.

Annex A: Key Modifications in New NEPRA Act

- *It defines market operator, electricity trader, electricity seller and system operator; and identify their responsibilities, qualifications, and duties of each of them. The Amendment creates a legal basis for the licensing of all these by the authority.*
- *NEPRA is mandated to perform its regulatory functions in accordance with the national electricity policy and national electricity plan, which the government will prepare and update with the approval of the Council of Common Interests (CCI).*
- *Appellate Tribunal (appointed by the federal government) is allowed to which aggrieved parties can appeal against any NEPRA decision. Previously, complaint or grievance redressal was through high courts or through tribunals that NEPRA itself was authorised to establish.*
- *NEPRA powers to 'make or repeal rules or regulations' is replaced with NEPRA powers to 'recommend rules, or to make or repeal regulations.*
- *NEPRA will determine a uniform tariff for all government-owned DISCOs, based on their consolidated financial accounts. Differentiated tariffs are allowed only for privatised utilities (currently only K-Electric).*
- *NEPRA is now authorised to conduct investigations required for managing its regulatory affairs, appointing investigating officers, and levy fines on licensees that are found to be in violation of the Act. The quantum of the fines has been enhanced. Earlier NEPRA had to request the police, NAB, FIA or other agencies to conduct the required investigations. This provision will thus add further clout to NEPRA's decisions and help strengthen their enforcement.*
- *The Amendment eliminates Section 22, which required the addition of DISCO cross-subsidies to any business-to-business (B2B) transaction tariffs.*
- *The experience and qualification requirements for NEPRA's Chairman and Members have been reduced.*
- *Generation licenses will no longer be required after 2023. However, generators will still be required to comply with technical and safety standards.*
- *Criteria for additional licensees (e.g., private investors, provincial governments) in the transmission sector have been clarified. This amendment follows the path of power sector reforms, common to all countries—and removes the exclusivity which public sector (or publicly-owned) companies or entities previously enjoyed in providing transmission services.*

Effectiveness of Oil and Gas Regulatory Authority*

AFIA MALIK

BACKGROUND

The regulatory framework in Pakistan’s energy sector has remained weak. In the 1960s, the natural gas industry was regulated by independent regulators. But they soon lost their independence, as most regulated companies were state-owned. After that, the sector remained under government control. The petroleum sector (oil and gas) was managed by the Oil and Gas Development Corporation (OGDC) (Kemal et al., 2002).

In the 1990s, it was realised that the government couldn’t be a policymaker, regulator, and service provider simultaneously because of fiscal and management constraints. Efforts were made to liberalise, deregulate, and privatise. The objective was to overcome a weakness in the regulatory process and ensure efficiency in the economic systems. The policy function of the government was separated from regulation and service providers to offer a level playing field to service providers in the private sector. Independent regulatory authorities were established to supervise and develop different sectors. The Oil and Gas Regulatory Authority (OGRA) is one of these regulatory authorities[106].

OGRA was established on March 28, 2002, via the Oil and Gas Regulatory Authority Ordinance (2002). The ordinance got amended slightly in 2009, 2011 and 2021. Powers to regulate the midstream and downstream oil sector were transferred formally to OGRA in March 2006. Regulation of upstream activities and explosives department remained with the Ministry of Petroleum and Natural Resources, now Petroleum Division, Ministry of Energy.

Establishing an independent authority to regulate public utilities was a step towards restructuring and effectively regulating the midstream and downstream oil and gas industry. OGRA is a corporate body under the Cabinet Division.

OGRA Ordinance 2002

As stated in Ordinance No. XVII of 2002, the objective behind the establishment of OGRA was—***to foster competition, increase private investment and ownership in the***

---

* It was published in the PIDE Monograph series, 2022.

[106] In 2000, Natural Gas Regulatory Authority (NGRA) was established under the Gas Regulatory Authority Ordinance, promulgated in March 1995. The objective at that time was_ to promote competition and attract private investment to divest the government holdings in the gas companies and regulate the gas companies' operations.

midstream and downstream petroleum industry, protect the public interest while respecting individual rights and provide effective and efficient regulations.

Under Section 3 (2), the Authority is a corporate body independent of the performance of its functions. As per Section 6 of the Ordinance 2002, the Authority has the exclusive right to grant licenses for any regulated activities to promote efficiency, cost-effectiveness, best practices, high safety, service standards etc.

It has the power to regulate activities, e.g., construction of pipelines, development, storage, distribution or transportation, and marketing of oil, natural gas, Liquified Natural Gas (LNG), Liquified Petroleum Gas (LPG) and Compressed Natural gas (CNG). OGRA can amend or revoke licenses for regulated activities and enforce compliance with license conditions. OGRA's responsibility is to promote effective competition and develop and implement performance and service standards to create efficiency in the activities within its jurisdiction.

Additionally, the Authority is empowered to:

- Resolve complaints!
- Ensure the provision of open access and oversee investment programs and capital spending!
- Make rules and regulations according to the ordinance!
- Administer, and establish prices while safeguarding the public interest!
- Prescribe fines for misconduct!
- Determine rates for licensees!
- Enforce standards and specifications for refined oil products!

Box 1. Functions

- Determine revenue requirements for each natural gas licensee and advise the Federal Government to determine the prescribed price.
- Specify and enforce accounting and technical standards.
- Prescribe procedures and standards for investment programs of the gas utilities and oversee their capital expenditure to ensure prudence.
- Enforce standards and specifications for refined oil products as notified by the Federal Government.
- Implement policy guidelines of the Federal Government, issued under Section 21 of the OGRA Ordinance, subject to their being consistent with the provisions of the Ordinance.
- Computing and notifying ex-refinery price of SKO, including ex-depot prices of SKO and E-10 and Inland Freight Equalisation Margin (IFEM) for all products.
- Monitoring prices of petroleum products under the deregulated scenario.
- Computation of road and pipeline freight for transportation of petroleum products.
- Resolution of public complaints and disputes against and between the licensees.

Purpose of Evaluation

OGRA was established two decades ago. Sufficient time has passed for an organisation to get established and play an active role in the sector. This report intends to evaluate the effectiveness of OGRA. It will cover the quality of work done and the level of performance at

OGRA. It will highlight loopholes and offer suggestions, that is, the steps to improve regulation of the oil and gas sector to ensure a reliable, sustainable supply of energy for the people and economy of Pakistan. While evaluating OGRA's performance, the report will focus on OGRA's capacity needed to perform its regulatory duties effectively.

Methodology

A case study approach is adopted for this evaluation. The data (information) is collected from interviews (interactive sessions) with officials at the Authority, sector experts and government officials. Besides, the evaluation relies on secondary data sources like OGRA Annual Reports, State of the Regulated Petroleum Industry Reports, and other literature on OGRA and regulatory authorities in other countries.

Limitation: The evaluation relies only on information (both qualitative and quantitative) gathered from informal interviews/discussions and published sources; no perception survey is conducted.

Audience: Authority itself and the policymakers are the primary audiences for this evaluation, as both can influence the design of the regulatory framework and its outcomes on the sector's overall performance.

Scope of Evaluation

This evaluation is an attempt to answer the following questions:

(a) Did OGRA achieve its objectives as stated in the OGRA Ordinance?
(b) Is the regulatory mandate of OGRA effective in terms of strategies, various processes involved in the grant of licenses, the determination of tariffs, and the monitoring of regulated activities?
(c) Is OGRA engaging effectively with consumers, civil society representatives and other stakeholders?
(d) How efficient is the governance structure at OGRA in terms of the execution of its duties? Does OGRA Ordinance 2002 facilitate an effective governance structure?
(e) What is the organisational structure at OGRA? How does OGRA carry out its functions and make its decisions?
(f) Does the Authority have enough capacity to address systemic issues in the oil and gas sector?
(g) How can its work be made consistent with international best practices?

The evaluation answers these questions under two main headings:

- Regulatory Mandate and its Effectiveness
- Governance and Institutional Capacity

Structure of Evaluation

Findings in this evaluation are developed after detailed discussions and reviewing available documents.

Recommendations in the evaluation identify specific areas/ policies that can be improved or revised for effective outcomes. Recommendations will also draw lessons from international best practices wherever possible.

REGULATORY MANDATE AND ITS EFFECTIVENESS

The mandate of OGRA is defined in the OGRA Ordinance, 2002, which specifies its powers and functions. Rules and Regulations are fundamental to achieving the objectives and performing OGRA's responsibilities under the ordinance. The Authority has powers (under Section 41(1) to make rules but can notify after getting approval from the federal government. Whereas, under Section 42 (1), OGRA has powers to make regulations consistent with the provision of the ordinance or rules for carrying out its functions. These can be notified in the official gazette without government approval. The OGRA ordinance 2002 offers the necessary procedural details.

The mandate of a regulator, apart from being specific, must be supported by other provisions of law, where the regulator can take autonomous decisions while remaining within the broad policy framework laid down by the government. Merely identifying the functions of a regulator but not granting power will not serve the purpose. Administrative autonomy is a critical aspect of a regulatory mandate. However, at OGRA (in some cases), the decision-making process, in continuation of its mandate, has practically been made subject to the approval of the federal government (details in Section 3.1).

We do not see any role of OGRA in developing the sector. Partly, it can be attributed to its omission in the statutory mandate. A law governing the oil and gas sector should be clear and conducive to the growth of the sector and overall economic growth.

In addition, although the clarity of the mandate defines a regulator's performance to a certain degree, external factors also influence the mandate's effectiveness. In the case of OGRA, the main external factor is the unwarranted influence of the court systems. In Pakistan, there has been a tendency for frivolous litigation by vested interests to delay the regulatory and administrative measures against them. So is the case in the oil and gas sector. For instance, granting a stay in matters related to the investigation or inspection hamper regulatory action by the Authority. Although judicial review is a check on the regulator, the judiciary must take great care to ensure that judicial intervention does not become an alternate for regulatory decision-making.

Regulatory Framework

OGRA Ordinance grants the Authority the exclusive power to make rules and regulations that may be required to determine rates and tariffs of regulated activities; issuance, review, modification, amendments, cancellation, revocation, renewal etc., of licenses; along with the establishment of technical standards.

Since its inception in March 2002, the Authority has put up a regulatory framework as described in Figure 1. Besides, about 45 amendments have been made to these notified rules/ regulations. Maximum modifications are made to OGRA Service Regulations, 2005, i.e., twenty-four. Followed by eight amendments in LPG production and distribution rules 2001[107].

Frequent delays can be observed in preparing the regulatory framework in OGRA's 20-year history. Natural Gas Theft Rules remained under preparation for several years but later shelved for a reason not mentioned in its annual reports. Pakistan Oil (Refining, Blending, Transportation, Storage and Marketing) Licensing Rules, 2005, get notified in 2016 after a delay of 14 years. Likewise, OGRA (Fines and Recovery) Rules, 2009, which

[107] Evaluating the effectiveness of these rules/ regulations is not the mandate of this study but will be touched upon while discussing OGRA's effectiveness.

remain under the preparation/approval stage for a few years, are untraceable. However, it is essential to reiterate that notification of rules is subject to government approval.

The evidence suggests a regular and adequate review of regulatory performances can improve the Authority's overall functioning, leading to better sectoral development and an improved investment climate (Khan and Qazi, 2014). It may also put pressure on the government to facilitate OGRA wherever required. OGRA submits a yearly report on its regulatory affairs for that financial year and the state of the petroleum industry in Pakistan. But an independent evaluation of these reports has never been undertaken.

Fig. 1. Regulatory Framework

Rules

- Natural Gas Licencing Rules, 2002.
- Natural Gas Tariff Rules, 2002.
- Compressed Natural Gas (CNG) Production and Marketing Rules 1992, adopted & notified in March 2003; amended in Oct. 2008; amended in April 2009.
- Liquified Petroleum Gas (LPG) Production & Distribution Rules 2001, adopted and notified by OGRA in March 2003; amended in March 2007; amended in Oct. 2008.
- Pakistan Petroleum (Refining, Blending and Marketing) Rules 1971, adopted under Section 44(3) of the Ordinance, notified in March 2006.
- Budget Committee Rules, 2004.
- Liquified Natural Gas (LNG) Rules, 2007.
- Amendment in OGRA Ordinance, 2002 Section 43(B) in July 2009.
- OGRA Natural Gas (Regulated Third Party Access) Rules, 2012.
- Pakistan Petroleum (Refining, Blending and Marketing) Rules 2016, substituting Petroleum (Refining, Blending and Marketing) Rules 1971.

Regulations/ Standards

- Complaint Resolution Procedure (Natural Gas, LPG, CNG) Regulations, 2003; amended adding oil in December 2006.
- Performance and Service Standards for Gas Utilities, 2003.
- Natural Gas Uniform Accounting Regulations, 2003.
- Natural Gas Transmission (Technical Standards) Regulations, 2004.
- Natural Gas Distribution (Technical Standards) Regulations, 2004.
- OGRA Financial Regulations, 2005.
- OGRA Service Regulations, 2005; amended regulation 14, 2009; amended in 2012; .
- Natural Gas (Well-head Price) Regulations, 2009
- Natural Gas Measurement (Technical Standard) Regulations, 2019.
- Performance and Service Standards, 2019.

Technical Standards Oil

- Oil Transportation (Pipeline) Technical Standard, SRO No. 622, July 2009.
- Technical Standard for Petroleum Industry (Retail Outlets), SRO No. 623, July 2009.
- Technical Standard for Petroleum Industry (Depot for Storage of Petroleum Products), SRO No. 624, July 2009.
- Technical Standards for Oil Refineries, SRO No. 819, Sep. 2009.
- Technical Standard for Petroleum Industry (Road transport Vehicles, Containers and Equipment used for the Transporation of Petroleum Products, SRO No. 900, Oct. 2009.

Regulatory Effectiveness

The regulatory framework is quasi-judicial for issuance of licenses; tariff setting, including determination of estimated and final revenue requirement of natural gas transmission and distribution licensees at the beginning and the end of each financial year, respectively, and its review during the year; and maintenance of proper standards and quality of services by the licensees. The Authority is vested in delivering decisions for various activities under its jurisdiction. In addition, it addresses consumer complaints.

(a) Licenses

The ordinance provides OGRA with the right to exclusively exercise power in the grant of license under sections 22, 23, and 24. The licensing rule defines the criteria for granting a license, license fee, term and renewal of license, tariff, revocation, and license suspension. These rules are broadly categorised into transmission, distribution, and sales license.

Although timelines are given for executing these actions to provide the required operational certainty (Box 2), there are delays in these activities.

Box 2. OGRA Activities Timeframe

- Application for construction or operation license of pipelines_ for natural gas, transmission, distribution, and sale of natural gas in 6 months.
- Application for LPG related licenses in 2 weeks.
- Application for CNG station licenses in one day.
- Determination of revenue requirements of a gas utility in 6 months.
- Review Motion against Authority's decision in 8 weeks
- Public Complaint in 30 days Request for dispute resolution in 4-8 weeks.
- Appeal against decision on a complaint of a Designated Officer in 90 days.

As per the ordinance, the Authority has the power to consult the stakeholders in these regulatory procedures. The Authority, by law, is not bound to do it. In other words, public participation is limited. Evidence suggests negligible public hearings are held while giving licenses. Therefore, the fundamental factors considered in deciding tariff determination and subsequent grant of the license remain unclear to stakeholders and the public. Political influence in the decision-making at OGRA is also documented (CRCP, 2013).

In addition to natural gas, the Authority is empowered to grant licenses for Oil, CNG, LPG and LNG related regulated activities. OGRA efficiency in terms of granting licenses is evident in Table 1. When natural gas resources were depleting, OGRA issued licenses in the CNG sector. OGRA issued these licenses in line with the government gas allocation policy. But, as a regulator, it was OGRA's responsibility to check whether the mushroom growth in CNG stations is in line with the existing natural gas resources. Besides, this mushroom growth in CNG stations resulted in an imbalance in the natural gas distribution sector due to the massive usage of natural gas in the transportation sector (CRCP, 2013).

It was also OGRA's responsibility to pinpoint problems in government policy. In contrast, OGRA took credit for increased investments in the CNG sector (OGRA Annual Report 2009-10). Permission for 3395 CNG marketing licenses was allowed from 2002 to 2011. Some of these licenses were issued as political favours.

Likewise, OGRA issued licenses to oil marketing companies but did not monitor their performance effectively. Only granting licenses is not serving the purpose of competition. The enforcement mechanism is weak at OGRA (more details in Section 2.2.3).

Table 1

Licenses Issued at OGRA

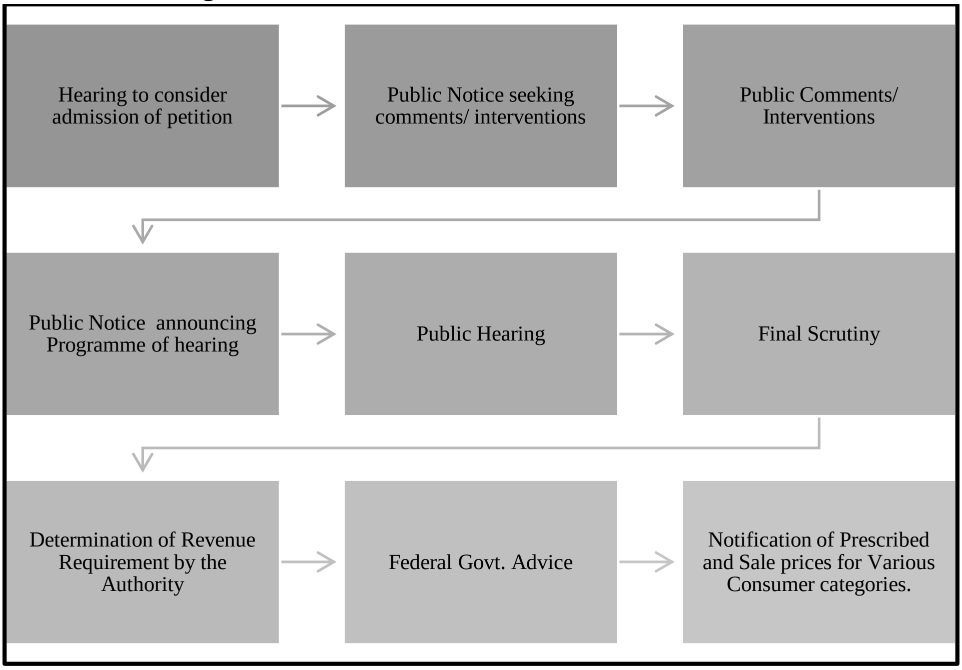
Sector	Category	No. of Licenses Issued as of June 30, 2020
Oil	Operational Oil Marketing Companies	34
	Operational Oil Refineries	6
	Lubricant Marketing Companies	93
	Lubricant Plants	85
Gas/ LNG	Transmission, Distribution & Sales_ Natural Gas	2
	Gas Storage	1
	Natural Gas Sale	5
	Transmission of Natural Gas	7
	Transmission and Sale of Natural Gas	2
	Transmission of Natural Gas from LNG receiving Terminal	1
	Sale of Natural Gas (RLNG) to OGRA's Licensed CNG Stations	1
	Transmission of Natural Gas, construction and Operation of pipeline and connected facilities for transmission of natural gas	1
	Sale of Natural Gas / RLNG.	2
	Construction & Operation of Natural Gas Pipeline Projects	1
	Construction and operation of pipeline for transmission of natural gas	1
LPG	Producers	11
	Marketing Companies	250
	Auto-refueling stations	22
CNG	Operational CNG Stations	3609

Source: OGRA Annual Report 2019-20.

(b) Tariff

OGRA has focused on tariff determination instead of tariff regulation (Figure 2). It determines the revenue requirements of each license (for carrying out regulated activities of transmission, distribution, and sale of natural gas) as per rules and prescribed prices of natural gas utilities for various retail consumers under Section 8 (1) of the OGRA Ordinance, 2002.

Fig. 2. Tariff Determination and Notification Process



Source: OGRA Annual Report 2019-20.

The revenue requirement consists of the following major components:

- Cost of gas paid to the gas producers.
- Transmission and distribution costs of SNGPL and SSGCL, including the unaccounted-for-gas (UFGs) as allowed by OGRA.
- Depreciation
- Market-based rate of return (at present, 17.43 percent of the net operating fixed assets)

For determining the revenue requirements and prescribed tariffs, the gas utility companies submit their economic rate of return to OGRA for each financial year by December 1 following the OGRA Ordinance 2002 and the Natural Gas Tariff Rules 2002. These petitions are scrutinised, processed, and decided under the rules and all stakeholders' comments and suggestions. The final rate of return is determined in almost seven months by the end of the financial year.

The gas companies may also file for review against any decision of the Authority, within thirty days, under the relevant provisions of law, and they more often avail this opportunity. The Authority claims (as reported in its Annual Report 2019-20) that the process of determination of revenue requirements is transparent and ensures effective participation of consumers and the public via hearings. However, the process is lengthy, and there are frequent delays in the whole exercise. In addition, there is a wide gap in the dissemination of information. Experts believe the hearing exercise is useless from a consumer perspective, as relevant information is not easily accessible.

Apart from gas price determination, OGRA computes & notify the ex-refinery price of Superior Kerosene Oil (SKO), including ex-depot prices of SKO & Ethanol (E-10). It calculates and notifies Inland Freight Equalisation Margin (IFEM) for petroleum products (MS, HSD, SKO and LDO); monitor prices of petroleum products under the deregulated scenario; and compute road and pipeline freight for transportation of petroleum products. But the whole exercise is based on government-set parameters, making the entire regulatory exercise meaningless from an independent regulation perspective.

The federal government empowered OGRA in 2009 to determine and notify CNG consumer prices. However, deregulated CNG consumer prices on December 13, 2016, and CNG stations were allowed to charge a price in line with market forces. OGRA has been delegated the powers to determine Re-gasified Liquefied Natural Gas (RLNG) price every month (under Petroleum Products (Petroleum Levy) Ordinance, 1961 and Petroleum Products (Petroleum Levy) Rules, 1967) in line with that of other petroleum products and the same is notified by PSO. Here again, the pricing parameters are set by the federal government.

Likewise, before the LPG Policy, 2016, LPG producer and consumer prices were deregulated. As per the LPG policy 2016[108], amendments to the LPG production and distribution rules 2001. After amendments, OGRA notifies and regulates LPG prices per LPG Policy/Rules, and the Ministry of Energy determines the price. Being a regulator, it was OGRA's responsibility to monitor LPG prices in a deregulated environment and check the unnecessary hike in LPG prices. But the Authority didn't do it. Consequently, there is a change in government policy.

So basically, there is no effective role of OGRA in regulating oil and gas sector prices. The Authority is only computing prices based on already set parameters by the government.

(c) Quality Assurance and Enforcement

The objective behind OGRA was to foster competition, increase private investment and ownership in the midstream and downstream petroleum industry, protect the public interest while respecting individual rights and provide effective and efficient regulations. There is little evidence to suggest that regulations in the oil and gas sector have positively impacted quality. The slow disposal of caseload and overall institutional capacity have undermined the enforcement powers at OGRA.

Ensuring reliable and high-quality uninterrupted natural gas supply and efficient services is one of the critical aspects of the regulatory process. This indicator assesses how well the regulator adopts the required mechanisms to meet this responsibility. From the consumer perspective, the quality of service is paramount. There is a procedural need within the regulatory authority operations for a systematic mechanism for monitoring the

[108] As per the policy, LPG is a poor man's fuel. However, it is priced much higher than natural gas. Therefore, this situation warranted immediate intervention. The Ministry of Energy considered it expedient to put a framework to regulate the LPG prices both at the producer's and consumer's level (OGRA Annual Report 2019-20).

actual performance in terms of consumer service and quality of supply. OGRA must undertake periodic reviews to evaluate compliance with the performance standards. But as evident from the OGRA Annual Reports, no serious effort is taking place in OGRA regarding the enforcement of quality standards in the gas sector.

The gas distribution companies must maintain adequate pressure in the transmission pipelines and distribution networks and upgrade the system where necessary to ensure the supply of contractual volume and pressure to its consumers. The licensee must conform to the performance and service standards as specified by the Authority from time to time in respect of any aspect of the licensee's performance, including service, efficiency, and safe operation of its regulated activities. For two prominent gas distribution companies, SNGPL and SSGCL, OGRA failed to ensure efficiency benchmarks. Despite setting targets for UFGs over the years, the UFGs in these two companies have increased (Table 2).

Table 2

Unaccounted for Gas

	FY2003	FY2019
SNGPL	8.16%	11.5%
SSGCL	7.6%	17.8%

Source: OGRA Annual Report 2002-03, PIDE (2020).

In the gas sector, the two main integrated transmission and distribution gas companies obtain approval of the 'Authority' for undertaking extension in their transmission and distribution networks to cater to different sectors' demands. OGRA is doing quite effectively, as is evident from its annual reports. Gas exploration and production activities slowed down after early discoveries. Consequently, the gas produced indigenously became insufficient in FY2006 and onwards. But the expansion of the T & D network continued at the same pace. From FY2007 to FY2020 gas distribution network in Pakistan expanded at about 8 per cent per annum (Table 3). The current demand-supply gap is more than 2BCD.

Table 3

Transmission and Distribution Network (Km)

	Transmission		Distribution	
	SNGPL	SSGCL	SNGPL	SSGCL
2007	6142	3290	36919	23448
2020	9588	4126	135887	47520

Source: Pakistan Energy Yearbook, 2012 and OGRA State of Regulated Petroleum Industry Report, 2019-20.

As a regulator, it is responsible for catering to consumer demand, keeping in mind the available supplies. In the absence of any viable business model, both the gas companies are expanding their assets as their financial returns are not linked to their operational efficiency but the expansion of assets. The regulator is allowing this expansion. If the regulator allows this expansion, it must check whether all consumers are supplied with enough gas. Unfortunately, this is not happening, as several hours of gas load shedding in a day during winters is experienced by domestic and CNG consumers and export industries.

OGRA Annual Reports gives details of quality checks to various oil companies and products through the Hydrocarbon Development Institute of Pakistan (HDIP). These reports also provide details of penalties imposed (Table 4). However, there is no evidence of collecting these fines/ penalties in its financial statements. That makes the whole process irrelevant. The inquiry report on the petroleum crisis in June 2020[109] also certified the failure of OGRA in checking the quality produced in local refineries and the adulteration of petroleum products by oil marketing companies. The report also highlights the below-par performance of HDIP since 2007, "Despite all-too-often complaints from customers about the low-quality fuel containing higher Sulphur contents, HDIP cries all good. The role of HDIP, thus, has been reduced to a testing agency that only goes through the motion" (GOP, 2020, p. 126).

Table 4

Enforcement Activities at OGRA (2019-20)

	Inspections (Nos.)	Show Cause Notice (Nos.)	Penalty Imposed (Rs Million)
Oil	290	97	30.8
CNG	2636	270	6.125
LPG	No Details	No Details	No Details

Source: OGRA Annual Report 2019-20.

(d) Consumer Complaints

The complaints department at OGRA is responsible for catering to consumer complaints under Complaints Resolution Procedure Regulations, 2003. The designated officers decide on complaints. Initially, the complainant goes to the licensee. If there is no positive redressal in 90 days, the complaint goes to the OGRA registrar. OGRA registrar decides in ten days to accept or reject the application. If accepted, give 15 days for a response from a license. After that designated officer has 90 days to give his decision and notify the complainant and licensee. Within 30 days, either party may appeal against the decision to the Authority. Any person/ party unhappy with the Authority decision may appeal to the High court.

Not only complaint redressal mechanism is lengthy, but the departmental capacity for the redressal mechanism is also weak. As the annual reports show, the complaints department at OGRA is facilitating only gas consumers of utility companies (SNGPL & SSGCL) by handling complaints related to the provision of gas connection, excessive/wrong billing, meter tampering/gas theft charges etc. There is no clarity regarding the role of OGRA in redressing complaints of CNG, LPG or petroleum products consumers.

[109] Report of the Inquiry Commission on Shortage of Petroleum Products in Pakistan, Volume I, Cabinet Division, Government of Pakistan, 2020.

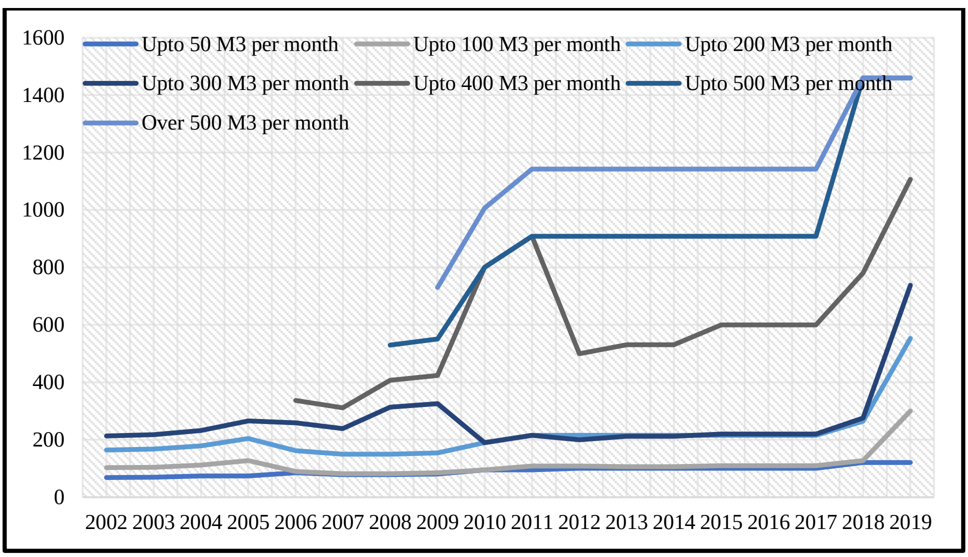
(e) Sectoral Growth and Role of OGRA

Sector growth and the associated policies should be the common goal of the Ministry and the regulator, i.e., OGRA. But unfortunately, there is no evidence to suggest a proactive role of OGRA in the oil and gas sector. The role of OGRA in effectively determining the level of competition in the oil sector is also vague. OGRA, even after twenty years, is determining tariffs rather than regulating them.

As per Pakistan Oil Rule 2016, clause 35(1)(g), it is mandatory for every oil marketing company (OMC) to first uplift petroleum products produced by the local refineries before opting for import of the same. In breaking this rule, OMCs continuously avoided their responsibility to uplift their allocated quota from refineries from January to April 2020. The OMCs refused to lift a capacity of 190,892 MT of Motor Spirit from the refineries. OGRA, a Regulatory Authority, failed to apply Rules 66 & 69 against OMCs on this continuous violation. Because of this refusal of OMCs to lift glutted the local refineries. Resultantly, the government banned imports on March 25, 2020, which adversely affected the market in the coming months, and the oil crisis happened. According to one of the licensing conditions mentioned in Rule 53 (xiv), OGRA was mandated to specify minimum stock requirements of crude oil by refineries. OGRA ignored this essential duty through the years (GOP, 2020).

Besides, the government interference in service providers' affairs has led to cross-subsidy and an overall deficit in the gas sector. Delaying the revision of consumer prices has created a financial obligation (circular debt)in the sector. OGRA is not active to counter this. There was no significant increase in consumer prices from 2015 to 2018. The gas sector deficit is increasing because of the differential in consumer prices and the determined revenue requirements (ICAP, 2020). According to one recent estimate, this deficit has reached Rs 1.5 trillion[110].

Chart 1: Domestic Consumer Gas Price Rs/MMBTU



[110] Cited from Malik and Ahmad (2022).

Chart 2: Gas Prices in Industry and Power Rs/ MMBTU

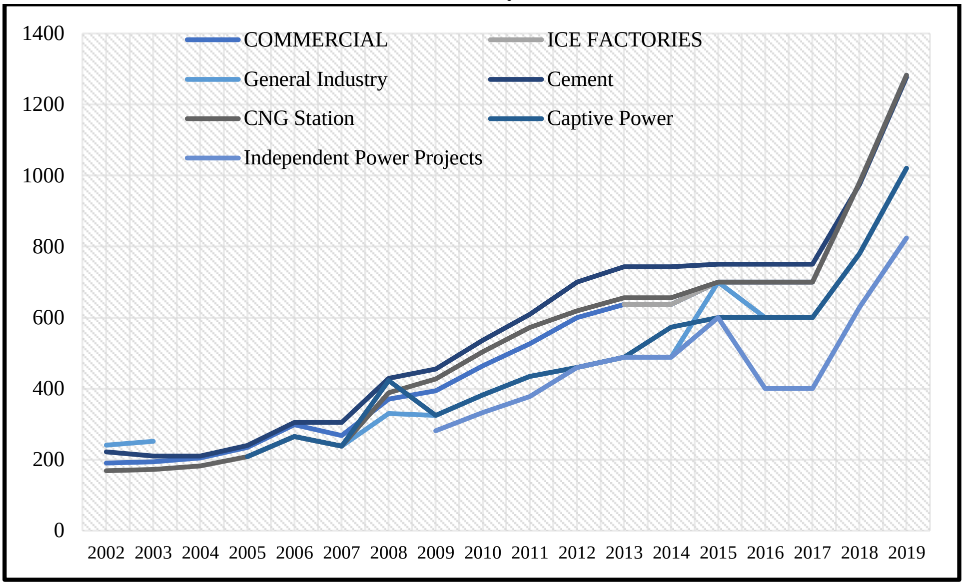
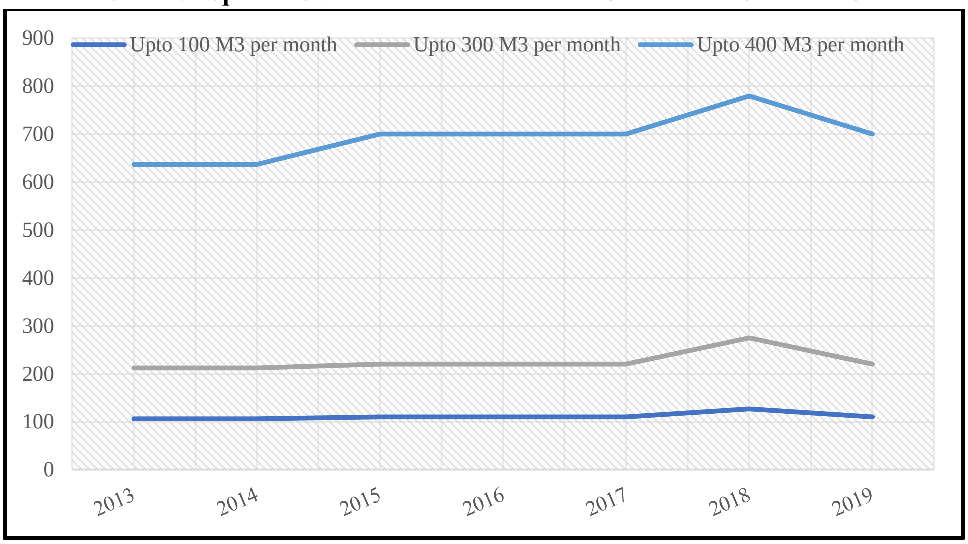


Chart 3: Special Commercial Roti Tandoor Gas Price Rs/ MMBTU



Source: OGRA (2020) & Pakistan Energy Yearbook (2020).

To give the credit where it is due!

- The credit for increased private investments in the LPG supply infrastructure (midstream and downstream) goes to OGRA. During FY 2019-20, Rs. 29.26 billion has been made in the LPG supply infrastructure, whereas total investment in the sector to date is almost Rs. 66 billion (OGRA Annual Report, 2019-20).
- It is only under OGRA's constant pressure that oil marketing companies are increasing their storage capacity.

Table 5

Storage Capacity (MT)

	2016	2020
High Speed Diesel	270740	1011423
Motor Gasoline	93141	613488

Source: OGRA State of Regulated Petroleum Industry Report 2015-16 and PACRA (2020).

GOVERNANCE AND INSTITUTIONAL CAPACITY

Governance at OGRA

OGRA is delegated to regulate midstream and downstream oil and gas sectors. The leading tasks of OGRA, as in the OGRA Ordinance, 2002, include granting licenses to carry out regulated activities and subsequent regulation, whether those regulated activities are per conditions of the license. Safeguarding stakeholders' interests are among the most critical duties of OGRA. However, certain powers have been vested in the federal government regarding policy formulation, infrastructure development planning, and petroleum product pricing, including petroleum levy, creating confusion and ambiguity in roles, thus affecting OGRA's performance.

(a) The Governing Body

OGRA governing body is the 'Authority', which is statutorily empowered to approve or disapprove any decisions relating to OGRA functions. The 'Authority' comprises a chairman and three members_ member gas, member oil and member finance. The quorum for any decision must constitute at least a chairman and two members.

For administrative ease, the 'Authority' is statutorily competent to delegate its powers to any individual member or officer at OGRA. In practice, no such precedence is documented nor reported by OGRA employees in discussions. Currently, OGRA is working in a centralised manner. The regulatory decision-making and all the policymaking related to organisational affairs are at the level of the 'Authority'.

Despite three months period available (in statute) to appoint a chairman or any member, there are delays by the federal government in the new appointments, thus, affecting regulatory decision-making. For instance, the (current) chairman was appointed with a lapse of about seven months. Similarly, the government appointed member oil (current) after a gap of five months. Due to these delays in appointments, OGRA Authority practically remained ineffective (non-functional) due to the lack of a quorum for about five months in the second half of the last calendar year. There are several instances in OGRA history when the Authority remained without member gas or member oil for at least two years or without a chairman for more than the specified period. Recently, member finance has been appointed after the lapse of several months.

In the ordinance, there is no provision for civil servants to be appointed at OGRA, neither in the 'Authority' nor as an employee. However, the law does not categorically bar retired civil servants' employment at OGRA as chairman, members, or officers. No cooling time for civil servants or sector professionals is specified in the ordinance. Since OGRA's establishment, by and large, retired civil servants or personnel from the Ministry of

Petroleum and Natural Resources (now Ministry of Energy-Petroleum Division) have been appointed as chairman or members at OGRA. It means that the oil and gas sector regulation practically remained under the federal government[111]. It could be because of a lack of suitable candidates in the private sector. But it raises the question: if the federal government wished to self-regulate the industry[112], why is there a need for an independent regulatory body?

Box 3. 'Authority' under the OGRA Ordinance 2002

- Chairman_ is an eminent professional with a minimum of twenty years of experience in law, business, engineering, finance, accounting, economics, or petroleum technology.
- Each member holds a relevant degree and a minimum of twenty years of related experience in their respective fields.
- The retirement age for all four is 65 years.
- These shall not be from the civil service. But deemed to be public servants.
- The power to appoint a chairman and the three members rests with the Federal Government.
- The chairman shall be appointed for four years and eligible for reappointment for a similar term. In comparison, member oil and member gas shall be appointed initially for three years and qualified for reappointment for a four-year term. Member Finance shall be appointed initially for only two years but eligible for reappointment for four more years.
- Under Section 3(10), the Federal Government shall appoint another qualified person within a period not exceeding three months from the date the vacancy occurred for the chairman or any member.
- The Federal Government shall designate one of the members as Vice-chairman, acting as chairman in his absence.
- Any member may resign by writing to the Federal Government. The Federal Government may remove a member from his office if, on inquiry by the Federal Public Service Commission, he is found unable to perform his office's functions or has committed misconduct.

Besides, mostly those appointed are 60 years of age or above, with little time to serve actively at OGRA. Retired people join OGRA for another job with little knowledge of OGRA regulatory affairs. By the time they developed their understanding of the OGRA regulatory affairs, it was time for their retirement.

(b) Regulatory Autonomy

The right decisions of the Authority are crucial for developing the oil and gas sector, consumers, and investors. OGRA must have significant procedural power and autonomy for an effective regulatory process. In the law, as mentioned in Section 1.1, OGRA is provided with powers to perform licensing; determine tariffs; specify standards, inspect, review, and assess their implementation; and regulate processes. To be effective, OGRA should be institutionally *independent* of the influence of private and public sector companies in the oil and gas sector, which it regulates. Also, independent from the

[111] There are at least two instances where the acting charge of a member oil was given to Ministry officials (in-service civil servants), although for not more than two to three months.

[112] It must be noted here that the Ministry regulates upstream activities and explosives departments.

influence of the Petroleum Division, Ministry of Energy, who have stakes in state-owned gas companies (e.g., Sui Northern Gas Pipeline Limited (SNGPL) & Sui Sothern Gas Company (SSGC)), oil marketing company (Pakistan State Oil (PSO)), and LNG companies.

According to the provisions of the Ordinance, OGRA is an autonomous organisation under the Cabinet Division. However, the law, which has given powers in some respects, also has compromised regulatory independence in others. For instance, the OGRA ordinance empowers the Authority to investigate any matter falling under its jurisdiction and impose a penalty for violating rules and regulations made under the OGRA Ordinance. Hence, OGRA enjoys the required legal power to enforce compliance with its decisions within its jurisdiction. Likewise, Authority is vested under the law with the appellate power against the decisions of its delegates and has the power to review its own decisions.

But, under Section 22(1), OGRA must perform its regulatory duties following the government of Pakistan policies[113]. Besides, the law requires that OGRA implement all clauses through various rules and regulations, where rules are notified in the official gazette after approval from the government. Apart from rules, the ordinance allows OGRA to make regulations not inconsistent with the provision of the law or rules for carrying out its functions. These may be notified in the official gazette as well.

On the other hand, the rules and regulations provide processes and guidelines to determine tariffs, issue licenses or monitor the company's performance. The Authority, by law (Sections 30 and 31 of the OGRA Ordinance), has *the power* to seek all necessary information from any entity involved directly or indirectly in any regulated activity. The person or the company are liable to provide the information needed, in case of failure, susceptible to a penalty. It means the regulator can take decisions objectively based purely on technical considerations. OGRA's ability to make objective assessments could be affected if such information is not provided. According to the ordinance, a person shall be liable to provide the information and subject to a fine in case of failure. While (as discussed earlier), it is not as easy to apply for and collect from state-owned companies.

Regarding tariffs, OGRA is not autonomous as the government exercises considerable control over it. Likewise, in determining tariffs (Section 7), OGRA is bound to follow policy guidelines and rules as approved by the government. Although no formal condition or rule allows the Ministry (Petroleum Division) (Petroleum Division) to reverse OGRA's decisions, significant decisions, i.e., tariff rates, are subject to Ministry approval. The regulator determines tariffs and can only recommend what the Ministry notify. There are instances where the government does not allow the gas price to increase for five to six years for socio-political reasons, creating challenges for the sector. Besides, functional authority assigned to OGRA is controlled through various predetermined parameters. For example, natural gas purchase costs/ procedures, necessary guidance of line ministry, taxation limits, efficiency standards etc. These factors directly affect the quality of OGRA's regulatory autonomy (CRCP, 2013). Such influential factors make the role of the regulator ineffective.

[113] The ordinance allows the federal government to issue policy guidelines to OGRA when it considers necessary. The Authority shall comply with the policy guidelines in exercising its powers and functions and making regulations or decisions.

The regulator must act proactively as an independent entity for effective regulation. This role (as mentioned earlier) is missing in the case of OGRA. The oil and gas sector has faced many crises in the last two decades. OGRA became active only after the crisis. That's why the Authority is often criticised for its role in the sector[114]. Although it is found that the OGRA is not independent in its functions, the Authority is found complacent with it. However, the staff clearly states that OGRA is not independent in its decisions, thus affecting its effectiveness.

One additional reason behind the lack of a proactive role by OGRA is the lack of clarity in the Ministry and regulator roles. In the oil sector, after the notification of Pakistan Oil Rules, 2016, all oil-related functions related to the demand, supply, import, stocks etc., should have been transferred to OGRA. OGRA ordinance of 2002 and Pakistan Oil Rules 2016 specify that OGRA would ultimately handle all functions relating to the oil industry. The power to make these decisions is still with the Ministry of Energy- Petroleum division. The Ministry (DG/Oil) kept exercising the role of import, refinery quotas, and demand/supply but ignored stock maintenance; it may have left this role for OGRA. This confusion has persisted for the last five years. It is affecting the OGRA's performance. In the absence of control on demand, supply, or imports, how can the Authority regulate stock maintenance? But powers related to licensing remain exclusively with OGRA.

(c) Financial Autonomy

OGRA is financially autonomous, with no government support or budgetary allocations for its operations. Following Section 17 (1) of the Ordinance, the Authority prepares its budget and maintains an accurate book of accounts (expenses and receipts) and OGRA funds. Section 18(1) allows OGRA to approve and maintain the annual budget of the organisation to carry out its functions, including the salary/ allowances of the Authority and other employees. In pursuance of section 17 (3) of the OGRA Ordinance, the audit of the annual accounts of OGRA is carried out by the Auditor General of Pakistan and by some well-reputed chartered accountant firms.

The federal government provided the initial funding (Rs 50 million) of OGRA, which was later returned to the government[115]. Since then, OGRA has constantly been meeting its expenses from fees (turnover, licensing, tariff determination, renewal, transfer, etc.). Under total administrative costs, salaries, allowances, and benefits account for 63 percent to 68 percent in the last five years, whereas the budget allocated for training and development remained less than 1 percent (Table 6).

Till 2011, OGRA was independent in making decisions about surplus funds. That is, to invest or utilise surplus in any way the 'Authority' deemed fit. Yet, ensuring that OGRA meets its stated objectives. Its accounts were duly audited, and its annual report got submitted to the federal government. Through the Finance Act 2012, the law is amended. Like in many other regulatory authorities, the law compels OGRA to deposit its surplus funds, fines, and penalties with the Federal Consolidated Fund (FCF) of the Government of Pakistan. After this amendment, OGRA can only retain the amount of the fees (it charges) to manage its overheads. As informed by the 'Authority', the organisation is not

[114] Report of the Inquiry Commission on Shortage of Petroleum Products in Pakistan, 2020.
[115] Source: OGRA Employee

Table 6

OGRA Income and Expenditure Account (Rs million)

Fiscal Year	Fee Income*	Other Income	Administrative Expenses	Finance Cost	Salary/ Allowances etc. % of Administrative Expenses	Capacity Building % of Administrative Expenses	Surplus in Federal Consolidated Fund
2016	750.29	47.49	543.48	3.4	65	0.9	NA
2017	634.73	58.14	633.34	3.4	63	0.6	NA
2018	914.25	80.52	658.79	3.3	66	0.6	66.77
2019	1401.64	193.76	724.67	3.2	66	0.2	238.31
2020	1321.59	279.61	888.85	3.1	68	0.6	619.72

Source: OGRA Annual Financial Statements (Various Years) *in Fee income the source of 0.1 percent to 0.5 percent is not specified.

facing any financial issues—available funds are sufficient to run its affairs. Staff shared a different opinion. They didn't seem happy with the salary structure, information technology (IT) facilities and other benefits.

OGRA is performing the policy functions of the state. In future, there is a possibility that the fee amount may not be sufficient to support high human resource standards, IT systems, capacity buildings of staff, research, and development activities, etc. Giving up its surplus to the FCF and asking the government for funds for any shortfall in the future may lead to more political and bureaucratic interference in its obligatory functions.

(d) Accountability

The regulator's independence needs to comply with measures to ensure that the regulator is accountable for its action. For accountability of the regulator, legislation should ensure transparency of the decision-making process; detailed justifications of decisions; opportunities for all interested parties to participate in public hearings; and provisions for removing regulators in case of proven misconduct or incapacity. Proper checks and balances can ensure that the regulator does not drift away from its mandate, engage in corrupt practices, or become grossly inefficient (Malik, 2007).

International best practices highlight the need for transparent rules and processes in regulatory authorities to build stakeholders' trust (Webster, 2006). According to Section 19(1) of the OGRA Ordinance, the Authority shall maintain public files for inspection and examination. Yet, not all, only those files it deems fit (Section 19 (2)). It is unclear from the Ordinance provisions which documents can be available for public analysis. Additionally, there is no list of documents available on OGRA's official website, making it challenging to obtain or examine any document.

Likewise, transparency at OGRA is also muted through Section 9 (1) of the Ordinance, which states that the Authority has the power to decide for holding a meeting of the 'Authority' without prior public notice or public hearing unless it is expressed otherwise in the Ordinance. This provision itself not only curbs transparency in decision-making but also limits public participation in the decision-making process. Unlike NEPRA, hardly any detailed decisions or petitions are publicly available on its website or annual reports. The only exception is the revenue requirement determination and number and name of licensees in its yearly reports. The petition for revenue requirement/ tariff determination is supposed to be publicly available on fee payment; however, difficulties are reported in accessing such information (CRCP, 2013).

Unless all stakeholders, including consumers, are informed of the basis for regulatory decisions, they will not fully judge the impact of these decisions on them. In addition, the requirements to provide reasons for decisions and respond to public comments/ objections are essential for promoting accountability within the regulatory body (CRCP, 2013).

According to Section 20(1) of the OGRA Ordinance, OGRA must prepare its Annual Reports and the State of Petroleum Industry Report and submit them to the federal government. OGRA has been publishing its Annual Reports since 2001-02. However, OGRA started publishing State of Petroleum Industry Reports separately from 2015-16. Furthermore, OGRA started sharing its audit report (in Annual Reports) in 2017-18. These reports are available on its website.

However, these reports are not evaluated at the federal level or any other forum. That's why the content of these reports has hardly improved. There is no, as such, specific provision in the OGRA Ordinance regarding evaluating these Reports (Annual or Industry). Only its financial accounts are audited by the Auditor General (via Section 17 (3) of the Ordinance). Only the financial report is submitted to both Houses of Parliament through the President_ Article 171 of the Constitution of the Islamic Republic of Pakistan, 1973. But again, such submission is only related to financial accounts and not the regulatory body's performance.

Several rules, procedures, and guidelines provide transparency to the distinct regulatory processes. For instance, the OGRA Ordinance allows removing the chairman or any member. Section 3(11) says that the federal government may remove the chairman or a member after being found incompetent or guilty of misconduct in an inquiry by the Federal Public Service Commission. Though, no such example exists where the chairman or member was removed through Federal Public Service Commission. But there is a case where the chairman was removed by the Supreme Court[116].

Under the Ordinance, a legally established process allows regulated companies or other affected parties to challenge or appeal decisions (Section 12). The appeal body is OGRA itself. The Authority is vested with the appellate power against the findings of its delegates (assigned to them under Section 10(1), and power to review its own decisions. There is also a provision for resorting to courts in case of dissatisfaction with the OGRA appeal system. Section 12 (2) states the High Court may intervene if it finds that no satisfactory remedy is provided on the application of the aggrieved party.

On the other hand, the Ordinance provides immunity to the 'Authority'_ Chairman or any Member, employee, expert, consultant, or adviser regarding anything done or intended to be done in good faith under this Ordinance, the rules, or regulations. Despite this provision, there is always a fear of NAB and Judicial inquiries[117]. There are several instances of judicial interference in OGRA affairs_ the immunity is neither granted to the

[116] Mr. Tauqeer Sadiq was appointed Chairman OGRA in 2008 but was removed in 2012 on corruption charges. His appointment was challenged in courts on charges of breach of the procedure with serious irregularities ranging from an arbitrary and lawless selection.

[117] Sometimes asking for files as old as 19 years.

‘Authority’[118] nor OGRA employees[119]. The constant judicial interference in its affairs and unnecessary demand for previous records and files discourage independent and effective working at the organisation.

(e) Participatory Decision Making

Governance is the process of decision-making and its implementation. However, the participation of all stakeholders in the decision-making process complements good regulatory practices. Effective public participation is critical in effective regulatory strategies. OGRA Ordinance does not realise the significance of public involvement. Section 9(1) of the Ordinance does not ensure a compulsory space for public participation. It does not necessitate the involvement of the affected groups while making decisions. It is left to the ‘Authority’ to decide if it considers the matter worth a hearing.

The open proceedings with public participation can allow for diverse perspectives in regulation and ownership of these regulatory decisions. Evidence suggests public hearing is not a norm at OGRA. Some cases are decided without public hearings. Even in cases where the public hearing takes place, relevant documents are not easily accessible, making the whole exercise of public participation ineffective.

Institution Capacity

(a) Employees

OGRA ‘Authority’ is statutorily empowered to enhance its human resources (HR), that is, to appoint employees, consultants, experts, advisers etc., on such terms and conditions as the regulator deems fit. Recruitment of employees is the sole responsibility of the ‘Authority’ (Section 14(1)). The ordinance also specifies a requirement of prescribing regulation for an appointment, promotion, termination, or other employment terms and conditions (Section 14 (2)). OGRA is deficient in terms of professionals for competent working at the organisation (Figure 3).

OGRA Service Regulation 2005 provides the terms and conditions of employment, and remuneration policy for staff, consultants, advisors, and the Authority (members and the chair). It is the only regulation modified 24 times since it was first notified in July 2005. The HR department at OGRA is clueless about it. Policies also get changed with a change in ‘Authority’, i.e., members or chairman.

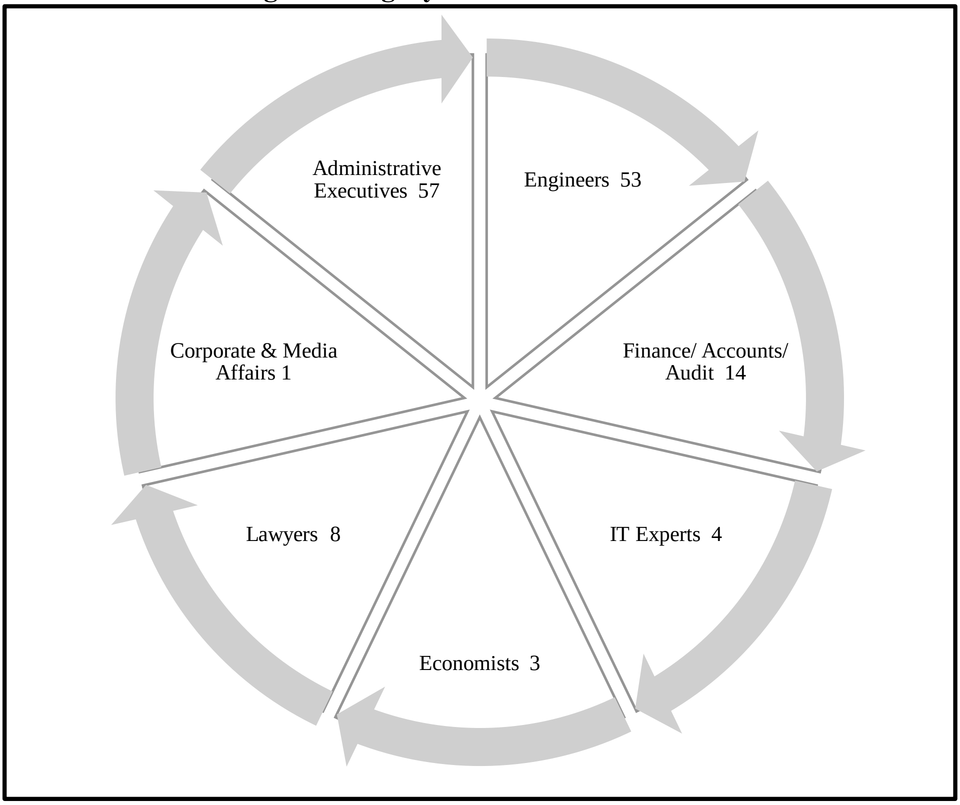
Ideally, it should be the responsibility of the HR department to design human resource recruitment and capacity building of staff policies. Unfortunately, all these decisions are made at the top, as the law has allowed them to do so. The HR department is only informed for notification.

---

[118] Removal of Mr. Taqueer Sadiq

[119] Officers complained about not being able to do their jobs properly as they do not have immunity in a real sense, complaints of NAB harassment.

Fig. 3. Category-wise Professionals at OGRA



Informal discussions with various department officials at OGRA revealed that almost every department is understaffed. There is a lack of competent staff with regulatory knowledge, sectoral experience, and training. That is one of the main reasons for delays in executing essential functions.

In addition, OGRA has not transparently acquired professional support staff services that could establish a proper regulatory framework for the benefit of consumers and producers alike. Most of the existing professional staff have minimum exposure to regulatory concepts and functions or come from sectors that have no relevance to the operational requirements of the oil and gas sector.

Similarly, if the departmental head is non-professional or is from a different background, he (or she) may not be able to understand the specific requirements of that department[120]. Furthermore, frequent inter-departmental transfers do not allow employees' capacity to develop. As a result, there is an inadequacy in emergency planning and preparedness to play a proactive role; in the preparation to participate in national decision-making and communiqué concerning oil and gas sector challenges. It is also noted that OGRA is not keen to improve its human resource capacity. Staff at OGRA is demotivated because of the salary structure. Lack of transparency in appointment and promotion

[120] For instance, the Information Technology (IT) department, headed by a non-IT person, may not understand the IT requirements and importance in the organisation's overall development.

procedures/ criteria has created discontent among officers at OGRA. These factors do affect their performance. There is a disconnect between the ‘Authority’ and the staff.

OGRA, at present, is de jure and de facto politically independent in its HR management. The ‘Authority’ decides about the number of staff and their promotion. However, OGRA is not applying market-based wages to attract qualified personnel with the required expertise. The terms and conditions behind the employment of an officer play a critical role in ensuring that employees are motivated and committed to their functional responsibilities. While on the one hand, civil servants are governed by the provisions of the Civil Servants Act, 1973 and the rules and regulations made thereunder, on the other hand, private sector employment is entirely dependent on the terms determined by the employer. It is unclear what the status of the employees at OGRA is. Neither the pay structure of employees is under the civil service nor at par with the private market rates.

It is also noted enforcement of standards and quality checks has not been as effective as it should have been. Slow disposal of court cases[121] discourages officers from doing enforcement duties. Besides, there are hundreds of entities to be examined in every city, which is impossible. The regional offices are almost non-existent[122]. These are understaffed. The number of complaints is far more than the staff employed there, making it difficult to deal with these cases efficiently.

Consequently, there are delays in the resolution of complaints. In addition, the officers employed in these offices don’t have the required skills and resources to monitor and enforce standards. The working environment is also not desirable. These regional offices lack not only in terms of human capital but also physical infrastructure[123], making them almost ineffective.

It is also noticed that the requisite investigative and legal skills and training to commence investigations and inspections are generally missing among professional staff at OGRA. The organisation relies on a third party for various checks, which is sometimes ineffective. That may be why enforcement activities at OGRA are not as successful as desired. Besides, the officers assigned to investigate, especially in criminal matters, learn only through experience. But once an individual acquires some skill, he is transferred to the other department at OGRA. The development of an officer as an investigator/ inspector is limited.

In developed countries like the United Kingdom, regulators, as a matter of policy, employ certified/ qualified investigators in their enforcement departments to ensure that the powers and functions of the regulator relating to enforcement actions are implemented effectively and within the legal limits (Khan and Qawi, 2014). In such cases, the chances to challenge a decision in court are limited.

As mentioned in the previous section, the ordinance allows the ‘governing body’ at OGRA to delegate its statutory powers to its employees, including enforcement powers, administrative powers, or any other power to perform its functions. In addition, employees undertake the governing body’s day-to-day work, such as providing legal support, research and development, tariff determination, enforcement of standards, monitoring or regulating sectors, and secretarial/clerical functions. The quantity, quality, and HR performance at OGRA are as significant as its ‘Authority’ for all these activities.

---

[121] Judges don't have the technical know-how of the sector.

[122] There are four regional offices (in Karachi, Quetta, Lahore, and Peshawar) with designated officers.

[123] There is no fuel testing man or equipment at OGRA.

(b) Departments

Regarding organisational structure, OGRA is designed with various units/ departments corresponding to each sub-sector, i.e., oil, gas, LNG, LPG and CNG. Unlike NEPRA, there is no separate license department. Gas, oil, LNG, LPG, and CNG departments perform this activity for the products under their jurisdiction. Likewise, all these departments are responsible for regulating and monitoring their respective sectors. There is no separate enforcement department. Each sub-sectoral department is responsible for taking care of enforcement activities as well.

During FY2010, OGRA set up a separate enforcement department to enforce its ordinance, rules, regulations, and license conditions for providing quality products to the public in the correct quantity at notified prices. This department was responsible for effectively implementing standards and monitoring through efficient checks and balances on the operations of the licenses and the better functioning of the regulatory framework promulgated by the Authority. This department was dissolved in FY2018 for a petty reason, i.e., required staff in other departments. It seems to have affected the enforcement of respective rules and regulations.

Then there are the legal department, complaint department, appeals department, corporate and media affairs, finance, legal and litigation, finance, and human resource (development and management) departments to support the abovementioned departments.

The IT department is vital in any regulatory authority for ensuring transparency and speedy processes. At OGRA, its IT department works under media and corporate affairs. The department is understaffed. Yet, after remaining in the infancy stages for several years, it has shown positive developments since FY2015. The department is evolving to introduce an e-office, paperless environment, online complaint and status, and file tracking system to facilitate organisation internally and check the online status of license applications. Besides, other projects like oil stock checks and CNG scanning software are on the cards.

OGRA's planning and coordination section is working under media and corporate affairs. Its primary duty is to coordinate with all departments to produce material for preparation and printing OGRA Annual Reports and Report on the State of the Regulated Petroleum Industry, as per the OGRA Ordinance, 2002. However, these reports are published after the due date, as allowed in the law. OGRA is bound by law to publish these reports as soon as possible. After the end of every financial year but before the last day of December in the following year. The Annual Report and State of Regulated Petroleum Industry Report for 2019-20 were made public after a delay of almost six months, i.e., in June 2021.

The quality of these reports and delays in their publications reflect the capacity of this department. Besides, this department is also responsible for conducting/ managing training courses for capacity building of employees through the provision of local and foreign training and participation in seminars, symposiums & workshops etc., at the local and international levels. That ideally should be the responsibility of the HR department.

The HR Section has been assigned to manage the organisation's human resources affairs under OGRA Service Regulations 2005. The HR Section is responsible for facilitating the recruitment and retention of highly qualified and experienced professionals in the Authority's technical and general service groups. As informed, the department does not seem to have the power to upgrade the skills at OGRA per departmental need. HR policies and rules are not designed in this department. They only notify or implement 'Authority' decisions.

The Finance Department is another crucial department at OGRA, performing one of the critical functions assigned to OGRA, i.e., determining tariffs, as allowed under the OGRA Ordinance, 2002. However, despite staff deficiencies and delays in tariff determinations, the finance department has contributed to the third-party access regime_ formulation of a new gas tariff regime. It is also providing inputs on the government's gas sector reforms agenda.

The litigation department at OGRA is responsible for handling court cases for and against OGRA before various courts throughout the country. As reported in OGRA Annual Reports, the litigation department has represented the Authority through counsel and in-house counsel in more than 9323 cases. A significant number of pending cases and the engagement of counsels indicates a shortage of sound in-house legal capacity at OGRA.

Table 7

Litigation Activities at OGRA

	Cases Received	Disposed Off	Pending	Counsels Engaged
FY2018	784	194	375	174
FY2019	756	237	352	173
FY2020	582	182	-----	207

Source: OGRA Annual Reports, difference between cases received, disposed of and pending are those cases in which OGRA was not directly involved.

There is a disconnect between the 'Authority' and the employees and between various departments. This disconnect makes it difficult to understand the issues/ challenges faced by the staff, thus affecting the overall organisational capacity. Thus, causing delays and affecting the overall departmental performance. One more issue noticed in the organisational structure of OGRA is the misallocation of functions.

Regulatory Capacity

Adequate human capital resources are essential for quick and effective decision-making. The personal qualification of a regulator is also crucial in independent decision-making. Section 3(clauses 4 to 7) states the experience requirements and qualifications for the chairman and three members. As in law, their association with the petroleum industry is not compulsory. The focus is on experience and competence in any related field. That is, in favour of an individual's capabilities based on their length of service. As mentioned above, the ordinance blocks the appointment of civil servants, but no bar on retired civil servants.

As evident from the publicly shared profiles, (for the first time) the current chairman and none of the members are retired civil servants. However, in the past, OGRA leadership had problems with regulatory expertise as people from the bureaucracy didn't have a sectoral background. When the regulator (or member) may develop some understanding of the sector's complexities, his tenure is over.

Concerning other staff, OGRA has not been able to build expertise in relevant areas that may facilitate effective interventions. In the past, due to the lack of expertise, OGRA could not reduce unaccounted-for-gas (UFGs) in gas distribution companies to enforce quality and safety standards (more examples discussed earlier in previous section). There are several instances where companies remained unsatisfied with OGRA decisions and often went to courts against OGRA determinations (as evident from numerous court litigations).

Effective regulatory capacity demands a strong, well-qualified, experienced governing body and a support staff (professionals). Lack of regulatory experts and insufficient funding may hamper the regulatory process (Aryeetey and Ahene, 2005). OGRA, with time, has been able to find personnel (only in the governing body) that satisfies the criteria. However, disproportionate interference of law enforcement agencies in regulatory affairs has undermined decision-making capability and regulatory capacity.

The quality of the governing body directly impacts the execution of regulatory functions. Therefore, the regulatory authority must develop its governance systems to a degree where personality change can have a limited influence on the 'Authority' performance and overall institutional capacity. In OGRA, frequent changes in personality at the top have led to changes in overall governance and institutional policy. It creates uncertainty and discontent among the staff and their effective performance. OGRA is still lacking in other qualified staff. OGRA lacked human resource policies that can encourage competitiveness rather than bureaucracy. Inadequate training and R&D for the personnel are evident from the funds allocated for capacity building (Table 6).

Lack of human resource development and deficiency in the dedicated workforce, in combination with disjointed departmental activities, is hurting the organisation's overall capacity. Above all, non-clarity in parental law prevents the regulatory authority from improving its regulatory capacity. OGRA does not enjoy adequate governance power to perform its regulatory duties effectively.

WAY FORWARD—RECOMMENDATIONS

The creation of OGRA and its regulatory framework has not kept pace with the changing oil and gas market dynamics. Based on our discussions, review of available documents, and literature on regulatory authorities in other countries, it is concluded that amendments in OGRA Ordinance can handle some of the regulatory challenges at OGRA. The law allows too much mandatory government involvement in the current oil and gas regulatory system. That has made the 'Authority' unable to disagree or unwilling to risk their job.

There is a need for a clearly worded law with provisions for OGRA's autonomy in decision-making. That is the law that bars any government interference in the Authority's decisions. For example, regarding the tariff, OGRA should be responsible for both the consumer-end tariff and for setting its underlying parameters/ methodology. The current lack of clarity on roles and functions can open the door to undue government interventions in OGRA operations. Like European countries (EU, 2019), OGRA statutes should explicitly determine adequate criteria to ensure the regulator's independence from politics and the petroleum industry.

Periodical reviews of the appropriateness of the regulatory regime are compulsory for effective outcomes in the oil and gas sector.

- There is an urgent need to simplify regulatory processes and enhance federal government and OGRA coordination. Maintaining good communication with the government departments would be helpful for effective sectoral outcomes. All upstream, midstream, and downstream activities should be under one window operation for better coordination in the sector, i.e., OGRA. The federal government only provide policy guidelines.
- OGRA should implement a clear and transparent consultation and public participation policy. All these steps will increase OGRA's credibility.
    - Before issuing rules and regulations, OGRA should make efforts to hold stakeholder consultations. Interaction with the stakeholders will give them a sense of ownership of the legislation, and they are less likely to feel threatened by new rules/regulations. OGRA may seek the opinion of regulated entities on a half-yearly or yearly basis to obtain data on existing rules/regulations. Regular interactions with the sector entities are common in the United Kingdom and even at NEPRA.
- The ordinance allows reliance on a third party for inspections. It is ineffective and sometimes counterproductive to the goal of quality assurance. There is a need to build the capacity of OGRA for decreasing, if not eliminating, such reliance on thirty parties for various inspections, quality checks etc.
    - OGRA has quasi-judicial powers, such as setting fines and penalties for non-compliance or acting arbitrators in disputes among industry participants. These processes should be published. The financial statements should mention the amount when a penalty is applied.
    - Certified enforcement officers should be inducted to fulfil this function effectively and efficiently.
- For effective accountability of the regulator, OGRA reports (Annual and State of the Petroleum Industry) must be evaluated by independent experts regularly.
    - There is a need for establishing a systematic approach for monitoring work done at OGRA; self-assessment at the level of an organisation is required.
- OGRA, a regulator, must play a proactive role in the sector. It must send a timely advisory to the government in all relevant fields. Besides, OGRA's recommendations and the government response must be publicly available. It will ensure OGRAs' integrity.
- Where a regular oversight of the performance of the governing body of a regulator is necessary, equally important is a chairman, any member, or any officer must not feel insecure about their positions and in taking tough decisions. In other words, the ability of a regulator to take independent decisions free from the influence of government, free from the fear of NAB or the Judiciary.
    - Courts should take great care to ensure judicial intervention does not deter regulatory decision-making. Besides, a strong in-house litigation team at OGRA that can proactively defend stay orders or other inquiries is required.

- The provision of the Appellate Court (just like NEPRA) may provide a forum to check or review OGRA decisions. It may be considered accountability, as the orders and determinations of the Appellate Tribunal shall be binding on the Authority. The formation of an Appellate Court is prevalent in other countries (USAID, 2018). However, the only thing which needs to be ensured is that this provision may not compromise the independent decision-making of the Authority.

- Extensive use of IT is recommended to minimise delays and improve coordination among the departments.
- For effective and speedy decisions, decentralising decision-making powers in routine activities is necessary.
- OGRA should ensure adequate human and financial resources (in line with their tasks) to ensure operational independence. Capacity building is required by employing more tariff specialists, regulatory economists, IT specialists, and analysts, equipped with better and more advanced techniques and sufficient background knowledge of Pakistan's and international oil and gas sector.

    - To enable qualified experts from the sector to avoid conflict of interest, an adequate cooling-off period (e.g., six months) should apply to key staff and 'Authority' members. A short cooling-off period may jeopardise OGRA independence, and a long cooling-off period may limit the interest of highly qualified candidates from the industry to apply for a mandate (as it narrows post-employment opportunities) [124].
    - Negligible expense by OGRA in training and development, in the presence of surplus accounts, emphasised the need to invest more in the training and development of its staff. It is compulsory to ensure that the regulator evolves with changing times.
    - The HR department should conduct an in-house study on workload analysis to aid in developing the quantity and quality of the human resources required in each department.
    - The hiring of fresh graduates should be encouraged. Such candidates can be hired at the lowest cadre of employment or as interns and put through a six-month to a year's training before being confirmed as permanent employees.
    - For an effective organisational structure, appointment and promotion through transparent procedures limits nepotism and will not create bad feelings among staff. A transparent evaluation procedure based on objective and published criteria should be applied for key OGRA staff members appointed by the Authority. It will allow OGRA as an institution to grow. Each department has its requirements; the staff of each department should be evaluated accordingly.
    - To increase HR capacity, employees must develop professionally over time. Financial gain is significant to encourage an employee. It is the responsibility of an institution to provide opportunities and mechanisms where an employee's professional, personal, and economic growth takes place.

[124] In Italy, the cooling-off period is four years, and in Serbia, it is two years.

REFERENCES

Aryeetey, E., and A. A. Ahene (2005) Utilities Regulation in Ghana. Working Paper Series No. 111. CRC Centre on Regulation and Competition, University of Manchester.

CRCP (2013) Natural Gas Governance in Pakistan. Report prepared by Consumer Rights Commission in Pakistan with the support of USAID.

EU (2019) Assessing the independence and effectiveness of National Regulatory Authorities in the Field of Energy. https://op.europa.eu/en/publication-detail/-/publication/e5f886d6-917d-11e9-9369-01aa75ed71a1/language-en

GOP (2020) Report of the Inquiry Commission on Shortage of Petroleum Products in Pakistan, Volume I, Cabinet Division, Government of Pakistan, 2020.

Kemal, A. R., Bilqees, F. and Malik, A. (2002) Economy and the Government: Privatisation and Regulation in Pakistan. CRC International Workshop on Regulation, Competition and Development: Setting a New Agenda. September 2002.

Khan, N.J and A. Qawi (2014) The Impact of Institutional Design on Regulatory Performance, Diagnostic Report by JICA Consultants (unpublished).

Malik, A. (2007) Effectiveness of Regulatory Structure in the Power Sector of Pakistan. PIDE Working Paper No. 25, Pakistan Institute of Development Economics, Islamabad.

Malik, A. (2021) Gas and Petroleum Market Structure and Pricing", PIDE Monograph Series, May 2021.

Malik, A. and Ahmad, U. (2022) Gas Crisis in Pakistan, PIDE Knowledge Brief 2022:83.

OGRA (Various Years), Annual Reports, Oil and Gas Regulatory Authority, Islamabad.

USAID (2018) Review of Amended Act, 2018, Final Report, Sustainable Energy for Pakistan (SEP) Project, United States Agency for International Development.

Webster, M. C. (2006) Energy Regulatory Authority Assessment Report, Mongolia Economic Policy Reform and Competitiveness Project (EPRC) Report.

Power Sector: Effective Regulation not Regulatory Burden*

AFIA MALIK

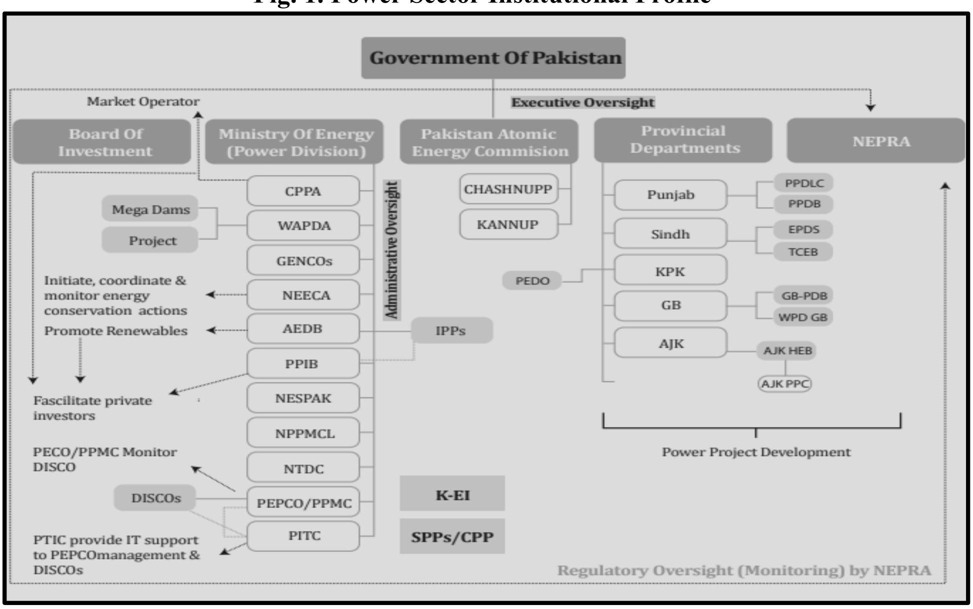
INTRODUCTION

Currently, there are more than 20 institutions, not including distribution and generation companies, involved directly in the power sector. There are several institutions with overlapping functions (Figure 1). At least three organisations National Electric Power Regulatory Authority (NEPRA), Central Power Purchasing Agency (CPPA) and Pakistan Electric Power Company (PEPCO), are responsible for monitoring and regulating the management and operations of distribution companies.

Similarly, Private Power Infrastructure Board (PPIB), Alternative Energy Development Board (AEDB) and NEPRA, apart from seven provincial departments, have powers directly and indirectly to facilitate and guarantee the technical compliance of private generation companies. The Board of Investment (BOI), though not involved directly in the power sector, performs similar functions.

Institutional bulk of the administrative burden, power sector challenges in the form of inefficiencies, institutional disconnections in the management and the priority of issues are increasing.

Fig. 1. Power Sector Institutional Profile



* It was published as PIDE Policy Viewpoint, No 35:2022.

The number of organisations regulating or monitoring the power sector is unwarranted in Pakistan; in comparison to countries with the relatively better-performing power sector, e.g., Bangladesh and the Philippines (Table 1). Not only number of organisations is less in these countries, but all are also performing different functions.

Table 1

	Organisations	Functions
Bangladesh	Bangladesh Energy Regulatory Commission	Tariffs & operations in oil, gas, & electricity
	Sustainable and Renewable Energy Authority	To promote renewable energy and energy efficiency
	Bangladesh Power Development Board	To manage electricity under the Ministry of Power, Energy and Natural Resource; and acting as 'single buyer'
Philippines	Department of Energy	Energy governance and policy
	Energy regulatory Commission	Sets wheeling rate charges and approves bilateral power supply agreements
	Independent Electricity Market Operator	Handles wholesale market operations, including demand forecasting, real time market pricing and power dispatch schedules.
	Power Sector Assets and Liabilities Management Group	To oversee privatisation, selling state power assets and the right to control generation capacity under long term agreements.

Source: Oxford Business Group (2021)[125] and ADB (2020)[126]

REGULATING AND MONITORING DISTRIBUTION COMPANIES

Pakistan Electric Power Company (PEPCO) was established in 1998. After the unbundling of WAPDA, PEPCO was made responsible for the restructuring and preparation for privatisation of the state-owned generation (GENCOs) and distribution companies (DISCOs) in due course. But unfortunately, its centralised control over the operations of the unbundled companies made the boards and management of these separated companies ineffective.

In 2011, the Government of Pakistan (GOP) approved the dissolution of PEPCO; and the functions were first transferred to National Transmission and Dispatch Company (NTDC) and later to Central Power Purchase Agency (CPPA). However, the functions of PEPCO, in the real sense, were not transferred to CPPA. The Power Division, Ministry of Energy (PD-MoE)[127] took the administrative role earlier performed by PEPCO.

In the current setup, CPPA is playing the role of 'single buyer' on behalf of DISCOs. However, in its assigned functions, it is also authorised to monitor distribution companies. CPPA registered with NEPRA as a market operator in 2018. It has the mandate to play the

[125] https://oxfordbusinessgroup.com/overview/powerful-shift-year-disruption-allows-government-re-evaluate-priorities-and-chart-new-path-future

[126] https://www.adb.org/sites/default/files/linked-documents/49423-005-ssa.pdf

[127] Earlier Ministry of Water and Power.

role of a Central Coordinator by NEPRA to facilitate the implementation of the Competitive Trading Bilateral Contract Model (CTBCM) by April 2022.

The Cabinet Committee on Energy (CCOE), on the recommendation of the PD-MoE, has decided to revive PEPCO with the new name Power Planning and Monitoring Company (PPMC) and shift its headquarters from Lahore to Islamabad. As stated in the National Energy Policy 2021, this new institution would be responsible for monitoring the performance of DISCOs. As reported in newspapers[128], PPMC will have a sovereign mandate to get donor support for capacity building to perform its duties effectively.

Table 2

PEPCO Funding—Examples

FESCO	FY2020	Rs 31,674,800 (PEPCO fees)
MEPCO	FY2020	Rs 162,567,586 (Management fees including PEPCO)
HESCO	FY2019	Rs 57,796,069 (PEPCO fees)
PESCO	FY2019	Rs 29,268,482 (PEPCO fees)

Source: Financial Statements

Additionally, the funding for the PEPCO now PPMC is and will be paid by DISCOs in the form of fees. DISCOs are already short of the investment required for the up gradation/ maintenance of their infrastructure. The fee DISCOS are paying (along with free electricity to PEPCO employees) could be used in the long-overdue investments.

NEPRA statutorily is an autonomous regulatory authority with a mandate to regulate/ monitor power sector companies. What good PEPCO in the new name PPMC would do to the DISCOs, which NEPRA can't do?

Moving Forward

- By law, DISCOs are independent corporate entities with Independent Boards. Its operations and reforms (if required) are the responsibility of company management and board. There is no need for any other institution (PPMC or CPPA) to manage, monitor, or regulate its financial, commercial, and operational affairs.
- The Independent Board, minus the influence of bureaucracy[129], guide the company management to develop a business model for the company, and ensure the fulfilment of service standards set by the regulator, i.e., NEPRA.
- Let DISCOs grow independently_ financially, administratively outside the umbrella of PEPCO or PPMC. In other words, from donor influence. Give necessary powers to NEPRA to regulate distribution companies.
- In future, CPPA will act as a market operator; only when the wholesale market is functional[130]. Otherwise, it is also an administrative burden.

[128] https://www.dawn.com/news/1651283

[129] Malik, A. (2021) Corporate Governance in the State-owned Electricity Distribution Companies, PIDE Knowledge Brief, 2021 (Forthcoming).

[130] It is yet to be seen, given complexities in the generation and distribution sector.

REGULATING AND FACILITATING POWER GENERATION

For regulating and supporting private investors in power generation, there are several institutions at the Federal and Provincial levels. At the Federal level, PPIB under PD-MoE, established in 1994, was made a statutory organisation through the Private Power and Infrastructure Board Act 2012. Then there is, Board of Investment (BOI), established in 1989 through an administrative order. Later, given statutory status through the Board of Investment Ordinance in 2001. BOI, also assist companies and investors_ who intend to invest in Pakistan. It facilitates the implementation and operation of their projects. AEDB, also under the PD-MoE facilitates private renewable energy projects.

What is the justification of PPIB in current circumstances? PPIB was created: to facilitate private investors, recommend and facilitate power policies, coordinate with provincial governments, draft, negotiate and enter into agreements and guarantee the contractual obligations of entities. After the 18th amendment in the constitution, electricity is the Provincial subject. Every province has its energy department.

Additionally, the impact of long-term agreements with guaranteed capacity payments facilitated by PPIB is haunting and will continue to haunt in the form of circular debt. For future energy projects, do we still need this institution? There is no justification for AEDB either. One organisation under PD-MoE, i.e., AEDB, is talking about promoting renewables. The other organisation under PD-MoE, i.e., CPPA is opposing net-metering to protect DISCO's revenues.

NEPRA is playing its part in promoting renewables. It has initiated work to develop a framework for establishing a micro/mini grid for those with no access to electricity[131].

Moving Forward

- No doubt the future belongs to renewable energy. It is regulator, i.e., NEPRA's responsibility to allow the right combination between various energy sources after assessing their feasibility from all dimensions. It is for NEPRA to ensure the compliance of generators to technical and safety standards and not of PPIB or AEDB[132]. It is also NEPRA responsibility to create the right balance to promote net metering.
- For the wholesale market (CTBCM), develop the capacity of distribution companies. So that they no longer required any third-party (PPIB or AEDB) support to assist them in finalising the power purchase agreements (capacity procurement based on their projected demand and financial capacities) with the generation companies.
- BOI, with relatively varied objectives and functions, can deal effectively with private investors in energy.

CONCLUSION

Several institutions are involved in the power sector. There are parallel institutions with the same functions, i.e., monitoring and regulating. The option to strengthen energy

[131] NEPRA State of Industry Report, 2021.

[132] As per NEPRA amended Act (2018), the generation companies will no longer require licenses after 2023. However, generators will still be required to comply with technical and safety standards.

functions under the existing institutional setup will not lead to sustainable solutions. No need for PPMC, PPIB and AEDB; shut down these while consolidating NEPRA.

The GOP should empower and ensure that NEPRA performs its functions effectively. It is the job of the GOP to monitor the effectiveness of NEPRA. If NEPRA is not performing effectively, the authority must be held accountable.

The power sector in Pakistan needs effective regulation and not a regulatory burden. A single power sector regulatory authority, i.e., NEPRA with adequate and effective regulatory powers, itself monitored by the government will_ send consistent signals to company operators, overcome the issue of insufficient professional capacity, and strengthen the authority's vulnerability to political interference.

Part III

OIL AND GAS DYNAMICS AND CHALLENGES

Deregulate, Open Access, Let the Market Thrive

Energy Market Structure: Oil & Gas[133]

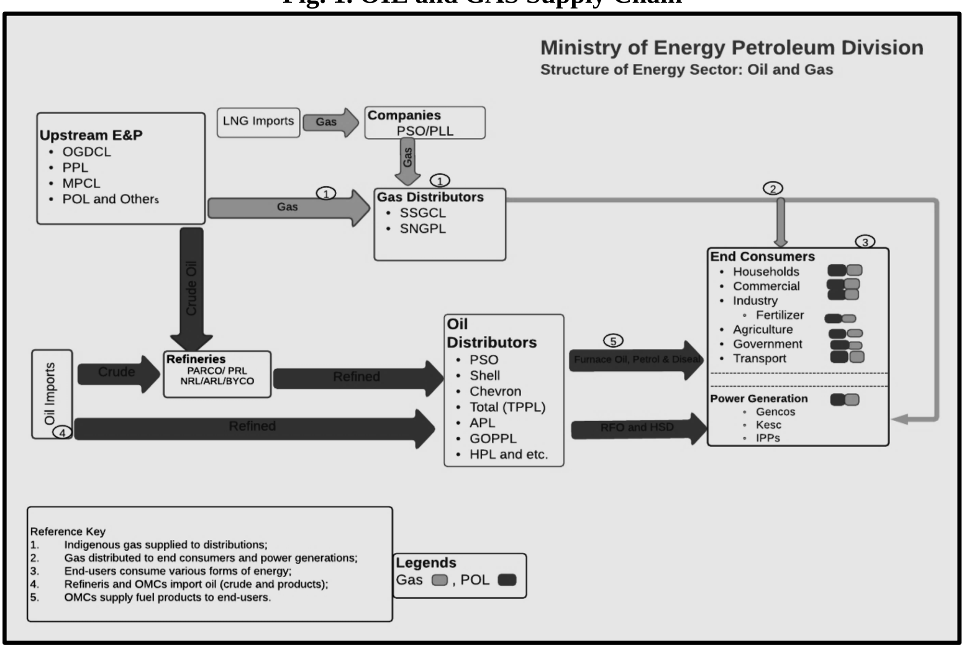
AFIA MALIK, AMNA UROOJ, UZMA ZIA, SABA ANWAR, and SAUD AHMAD KHAN

INTRODUCTION

Oil and gas play a prominent role in the energy matrix of Pakistan. In FY2019, oil and gas account for 61 per cent of final energy supplies and 63 per cent of final energy consumed (Chart 1 and Chart 2). With limited oil resources and declining gas reserves, dependence on imports is increasing.

The supply chain of both petroleum and gas consists of several activities connected with the flow of goods and services from the raw material stage till the final product reaches the consumer. It involves the interactions of independent companies; various structures are typically involved in the supply chain (Figure 1). An important variable in the constitution of the chain is the financial as well as contractual obligations of these companies and of course the responsibilities of the regulator to monitor those obligations. The problem at any point may have its impact at the final consumer end. This chapter provides an overview of the oil and gas market structure.

Fig. 1. OIL and GAS Supply Chain



[133] This chapter was earlier published in *PIDE Monograph Series, May 2021*.

Chart 1. % share in Energy Supplies (FY2019)

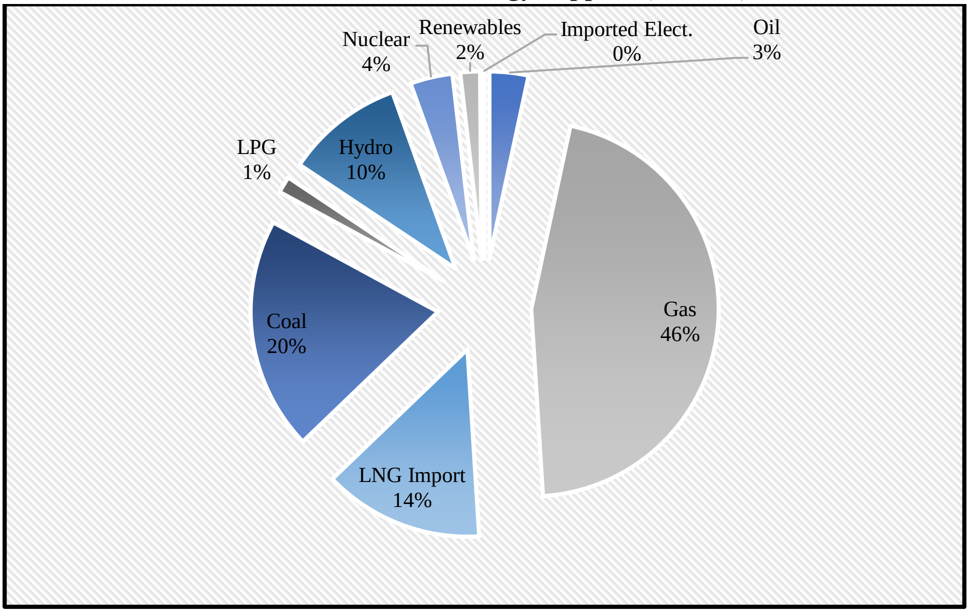
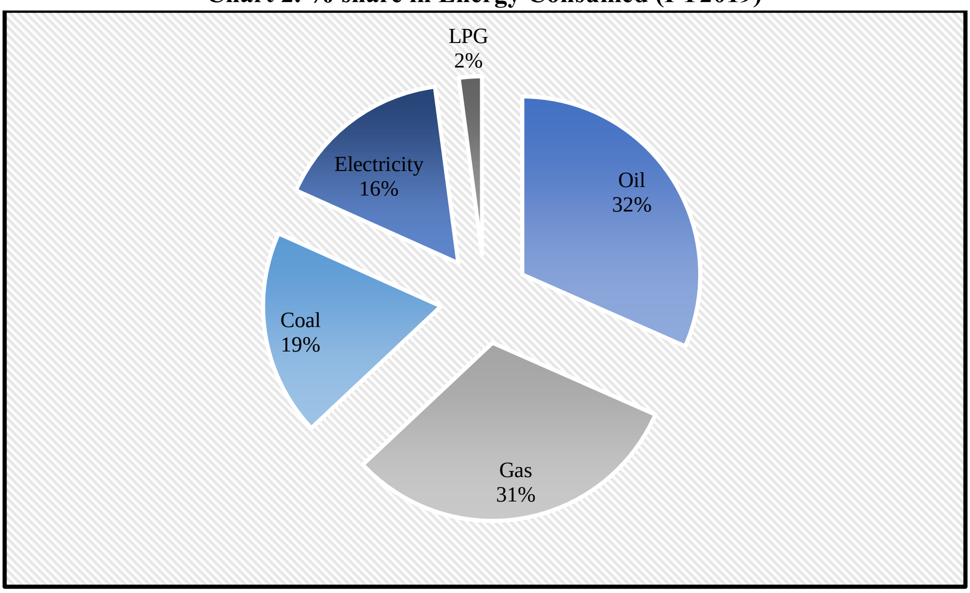


Chart 2. % share in Energy Consumed (FY2019)



Source: Pakistan Energy Yearbook, 2020

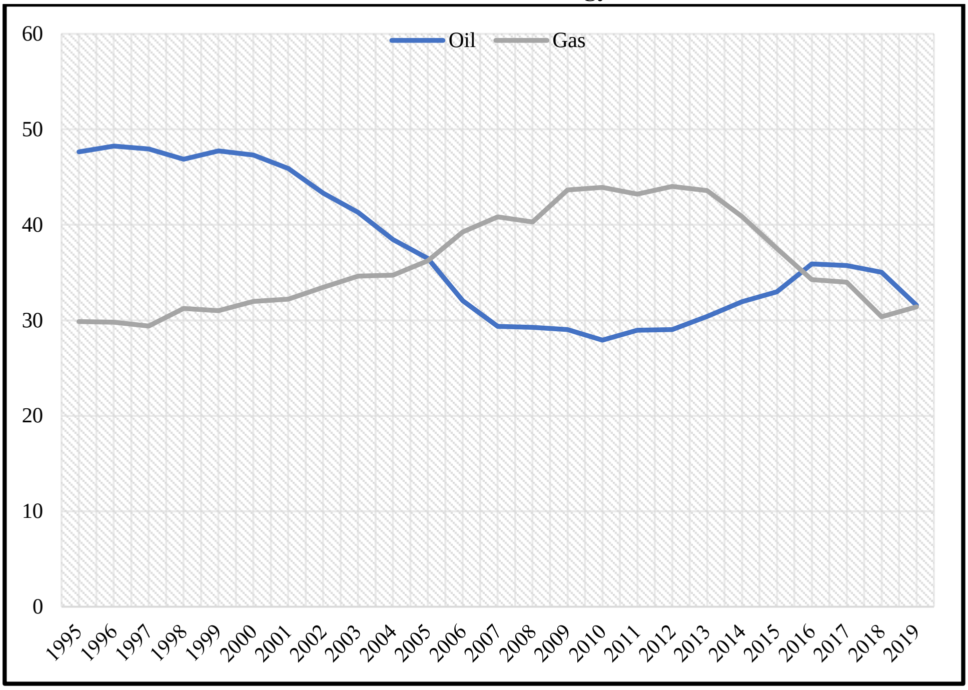
OIL MARKET STRUCTURE AND SUPPLY CHAIN

Until 1999, the government had tight control over the petroleum sector in Pakistan. All the decisions were made solely by the government and were often based on political as opposed to economic considerations. Since 2000, the government has initiated an ambitious pro-market reform program in the sector.

As a developing country, Pakistan's energy requirements are growing gradually over time, from 7 million TOE in FY1972 to 55 million TOE in FY2019. Over the years, the country has seen a change in its energy mix from the dominance of oil in the 1990s to the dominance of gas until FY2015. With the depletion of natural gas resources, the trend again upturned in FY2016, and oil consumption exceeded gas consumption (Chart 3).

Due to the massive domestic demand for oil, a large quantity of crude oil is imported every year. Demand for refined petroleum products greatly exceeds domestic oil refining capacity, so nearly half of the Pakistani imports are refined products.

Chart 3. % share in Total Energy Consumed



Source: Pakistan Energy Yearbook (Various Years).

Petroleum Supply Chain

Petroleum supply chain infrastructure in Pakistan starts from port facilities at Karachi. Crude oil, white-oil products, Low Sulphur Furnace Oil (LSFO) are received at the Karachi port, while LPG and High Sulphur Furnace Oil (HSFO) are received at the Fauji Oil Terminal at Port Qasim. In FY 2019, the total import of (black and white oil) in Pakistan was 18.6 million TOE. The port facilities are connected to the tankage/storage facilities of the refineries and oil marketing companies (OMCs).

Similarly, oil explored and produced (E & P) locally is transferred from E & P companies (Chart 4) to refineries, and from refineries to oil marketing companies, and from oil marketing companies to thermal power plants and other petroleum consumers (individuals, industries).

Oil Upstream

Chart 4. Resources Meeting Domestic Petroleum Demand

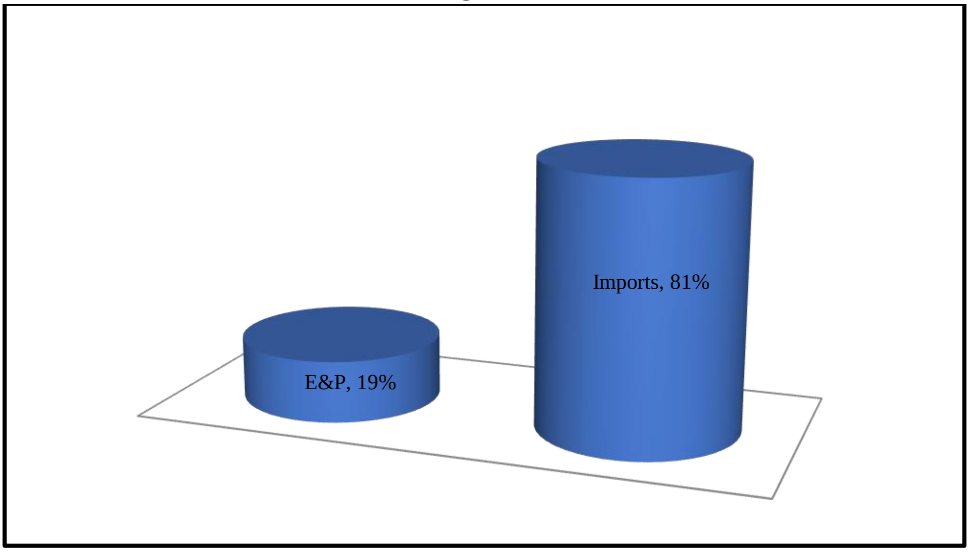
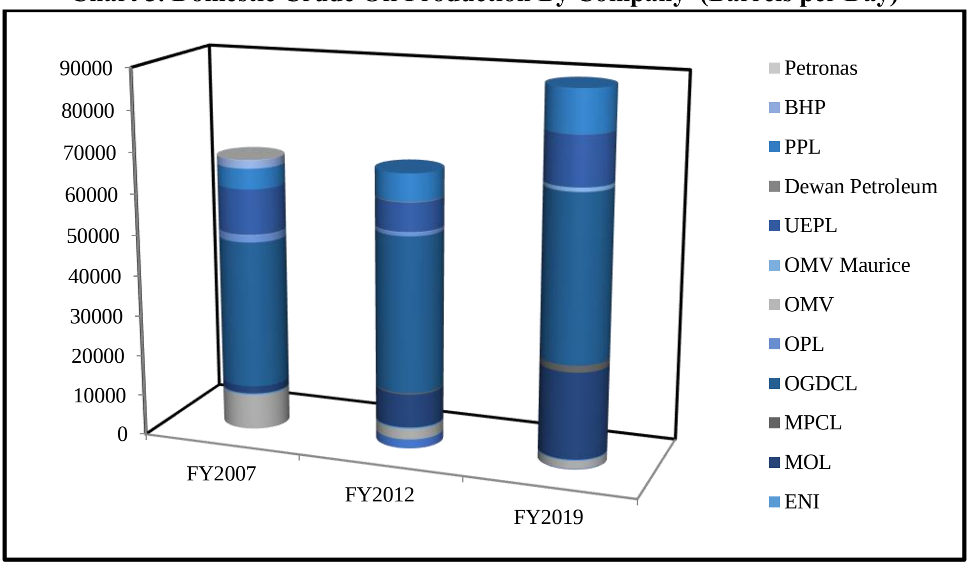


Chart 5. Domestic Crude Oil Production By Company (Barrels per Day)



Source: Pakistan Energy Yearbook, Various Years.

Pakistan has oil reserves of around 568.5 million barrels as of June 2019 (Table 1). A major part of produced oil comes from the reserves located in the southern half of the country, where the three largest oil producing fields are located (in the Southern Indus Basin). In addition, some producing fields are in the middle and upper Indus Basins. After late 1980s, Pakistan did not find many new oil fields. However, from FY2013 to FY 2015 83 oil and gas discoveries have been made. These added 631 million cubic feet per day of gas and 27,359 barrels per day of crude oil to the total reserves of Pakistan (Hussain, et al., 2019).

Table 1

Crude Oil Reserves (Million Barrels) as of June 30, 2019

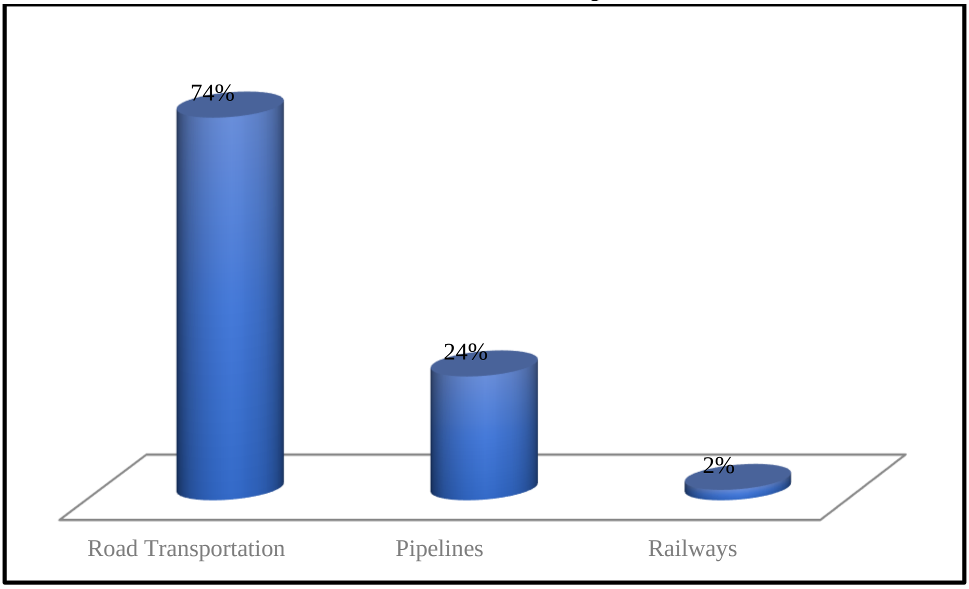
Original recoverable Reserves	Cumulative Production	Balance Recoverable Reserves
1498.773	930.327	568.446

Source: Pakistan Energy Yearbook (2020).

There are almost twelve companies involved in crude oil production. Among these twelve, Oil and Gas Development Company Limited (OGDCL) has the highest share of almost 45 % as 40356 barrels per day is produced during 2019. Hungarian Oil and Gas Company (MOL) and United Energy Pakistan (UEP) contributed 24 % and 13 percent respectively, while the contribution of Pakistan Petroleum Limited (PPL) was 12 percent (Chart 5). The rest is shared by other companies.

Oil Midstream

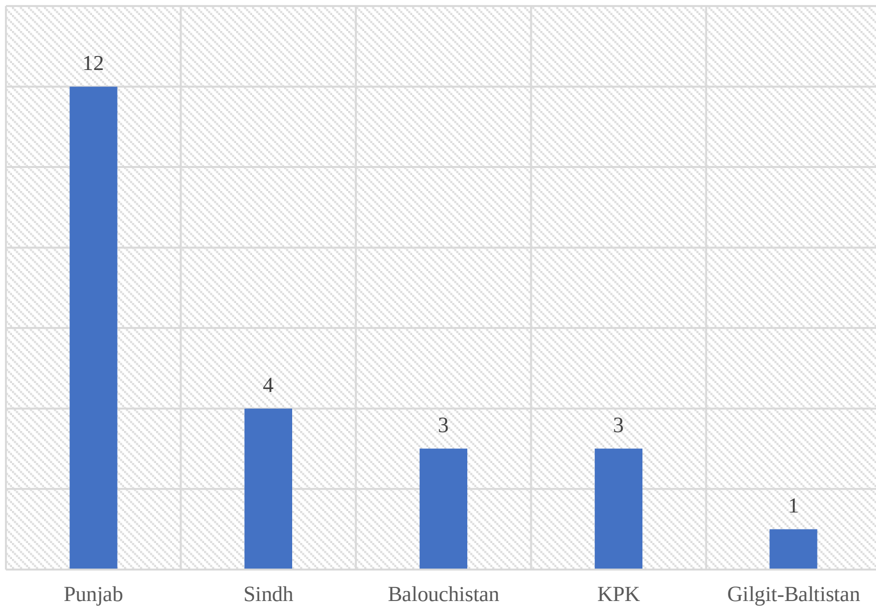
Chart 6. Mid-Stream Transportation



Source: OGRA State of Industry Report, 2018-19.

In the midstream _ the bulk of 19.22 million tons of petroleum products required by Pakistan's market is transported by road, oil pipelines and railways (Chart 6). Refineries, Oil Marketing Companies (OMCs) and large consumers own terminals and storage facilities to receive and store crude oil and petroleum products throughout Pakistan. The key installations/terminals are the primary supply points for transportation of petroleum products to regional depots. There are 22 depots spread throughout the country (Chart 7). The total storage capacity of the installations and depots, however, amounts to only 21 to 23 days of consumption equivalent, which may well be insufficient during a supply crisis.

Chart 7. Oil Depots in Pakistan (FY2019)



Source: OGRA State of Industry Report, 2018-19

Box1. Strategic Oil Stocks

Strategic oil stocks are the main defence governments have to protect their economies from oil price shocks and other security concerns. Strategic stocks are not exactly intended to guard against high prices; their main objective is to ensure availability in the event of a physical disruption in supply. Pakistan's strategic oil storage capacity is insufficient to ensure its energy security. Further, there is no distinction between oil marketing companies (OMCs) commercial inventories and strategic stocks, which is necessary to make a difference between its various needs and ensure supply during any unforeseen event.

The OMCs (i.e., PSO, SPL and TPPL) hold equity partnerships in the White Oil Pipeline (WOP), which provides the strategic infrastructure to transport petroleum products from Karachi to the Up-Country locations. WOP has a transportation capacity of 12 million tons / annum.

Oil Downstream

Chart 8. Refineries Percentages Shares in Crude Oil Refining- FY2019

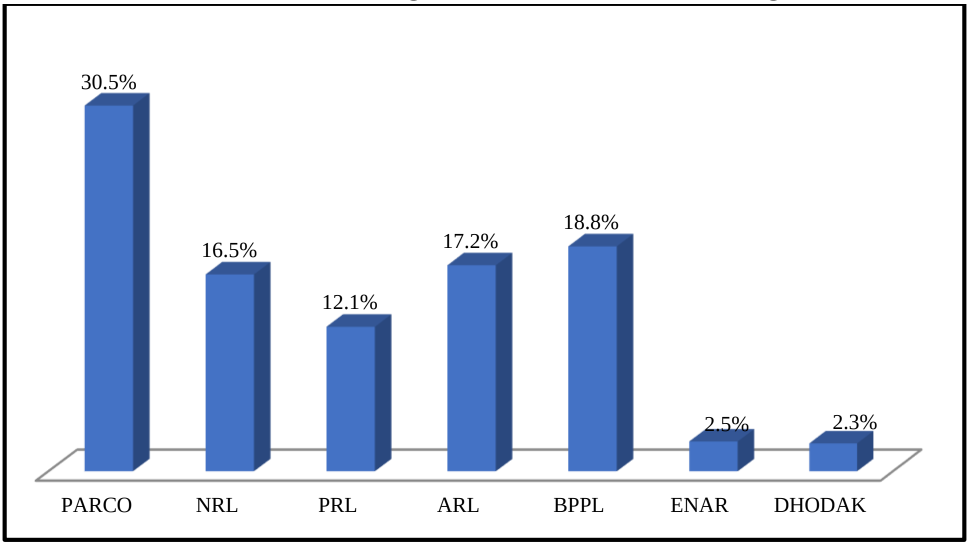
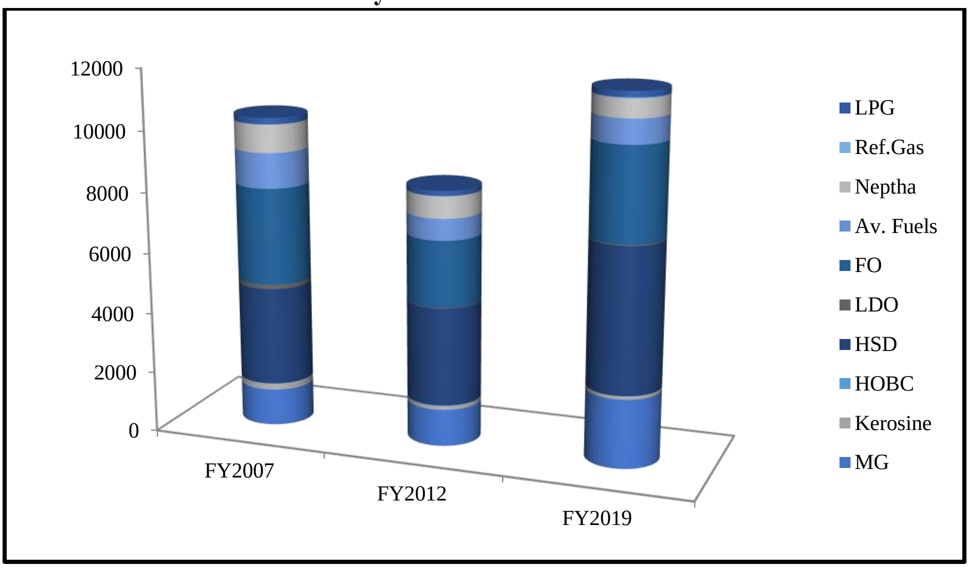


Chart 9. Refinery Production of Petroleum Products



Source: Pakistan Energy Yearbook (Various Years) and OGRA State of Industry Report 2018-19.

In the downstream oil sector, there are seven refineries_ Pak-Arab Refinery Limited (PARCO), National Refinery Limited (NRL), Byco Petroleum Pakistan Limited (BPPL), Pakistan Refinery Limited (PRL), Attock Refinery Limited (ARL), ENAR and DHODAK (Chart 8). These refineries have a total capacity of 19.37 million tons per annum. In FY2019, refineries produced 12.40 million tons. PARCO was the major contributor in POL production with 30.50 per cent share followed by BPPL with 18.80 per cent, ARL and NRL with 17.23 per cent and 16.48 per cent share respectively during FY 2019.

Box 2 Oil Refinery

Features

- Demand for Petroleum Products: 19.22 MT; Refining Capacity, 62 percent of country's demand (11.86 MT)
- Import of Petroleum Products: 38 percent (7.36MT)
- Crude Oil Requirement for Refineries: 400,000 Barrels/per day out of which 22 percent is supplied by Local E&P and 78 percent is imported.

Challenges

- Volatility in margins because of fluctuating crude oil prices.
- Unfavourable changes in pricing regime_ removal of deemed duty.
- Circular debt in power sector affects financial flows.
- Exchange rate depreciation.
- OMCs procuring substantially from local refineries are likely to have limited impact on profitability in the current macroeconomic situation as compared to those relying on imports.

Source: Pakistan Energy Yearbook (2020) and PACRA (2019).

Table 2

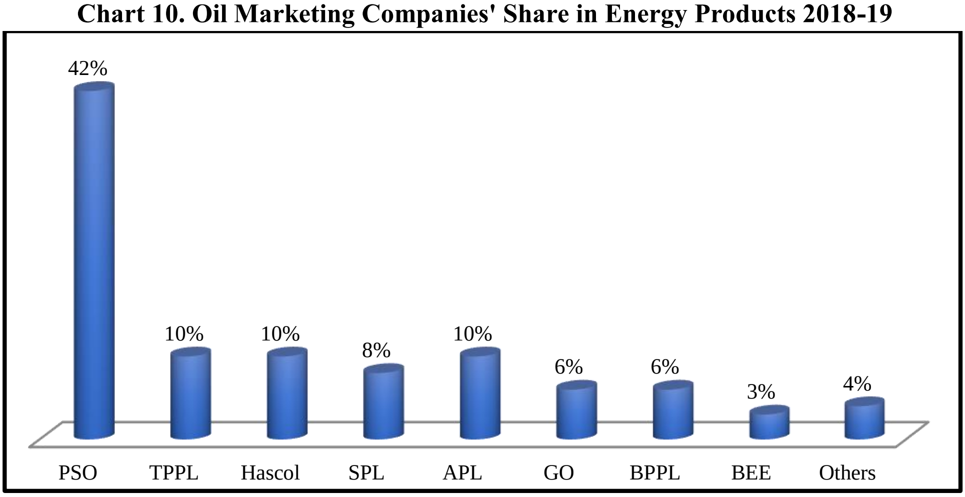
Business Risk- Refining Capacity (Million Tons) and Utilisation (%)

Refinery	Capacity	Utilisation	Capacity	Utilisation	Capacity	Utilisation	Capacity	Utilisation
BYCO	7.19	22	7.19	18	7.17	38	7.17	33
PARCO	4.5	100	4.5	100	4.5	100	4.5	89
NR	2.71	85	2.83	85	2.83	86	2.83	81
ATTOCK	1.96	86	2.44	91	2.44	93	2.44	94
ENAR	0.33	97	0.33	88	0.33	97	0.33	97
PR	2.10	81	2.10	76	2.10	81	2.1	76

Source: Pakistan Energy Yearbook (2020).

In the downstream, there are twenty-eight Oil Marketing Companies (OMCs) operating in Pakistan and fifty-nine have been granted licenses by OGRA. However, the top five companies' holds 80 per cent of the market share in FY2019. In FY 2019, the market share of Pakistan State Oil (PSO) was at the top (41.8 per cent of the total energy Supply); followed by Attock Petroleum Limited (APL) with 10.5 per cent, Total Parco Pakistan Limited (TPPL) 10.1 per cent, Hascol 10.1 per cent and Shell Pakistan Limited (SPL) 8 per cent (Chart 10).

Chart 10. Oil Marketing Companies' Share in Energy Products 2018-19



Source: OGRA, State of Industry Report, 2018-19.

Table 3

Share of OMCs in White and Black Oil

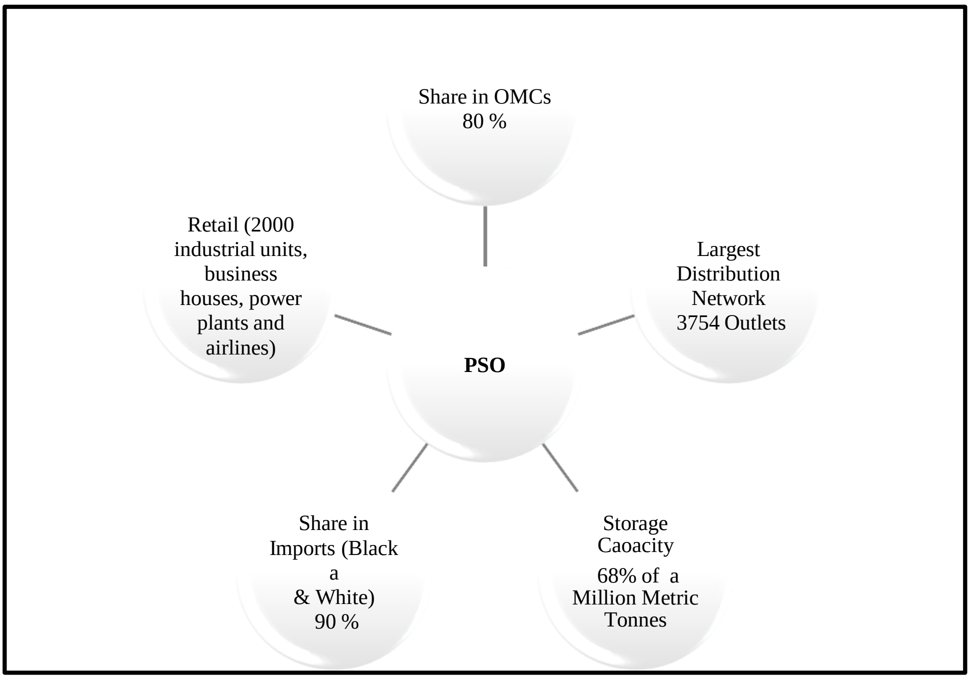
	White Oil	Black Oil
PSO	41%	52%
PARCO	12%	8%
ARL	10%	13%
HASCOL	10%	12%
SPL	10%	-----
Others	10%	16%

Source: PACRA (2019).

MG (Petrol), diesel and HOBC are sold through retail outlets. OMCs hold nearly 1.0 million tons of storage capacity, with PSO having nearly 68 per cent of this capacity. Most of the OMC storage is for finished products, of which nearly half is for HSD. So, when supply chain involves so many agents/ structures its effective management, monitoring and regulation at every level become necessary to avoid a crisis. PSO leads the way in White Oil (MG, HSD, LDO and Jet Fuel) as well as Black Oil (FO, lubes & Greases) (Table 3). Although the share of PSO is declining over the years, it is still the market leader (Figure 2).

Pakistan has more than 8600 retail outlets. PSO has the largest share of more than 40 per cent, followed by TPPL (10.2 per cent) and SPL (10.1 per cent). In FY2019, adjusting for FO (as it is not sold in retail outlets) PSO also leads in revenue earned per pump (Rs 349 million), followed by ARL (Rs 293 million) and SPL (Rs 258 million) (PACRA, 2019).

Fig. 2. Oil Market Leader_ PSO



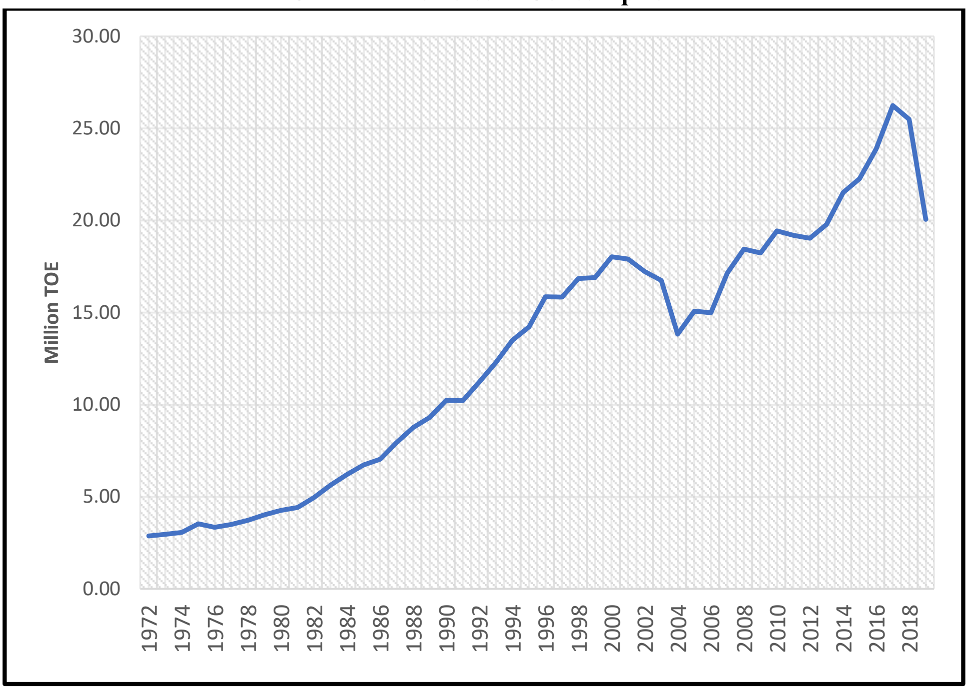
Issues

- PSO is losing its share in the retail sector, but a high horizontal and vertical concentration_ Non-Competitive Market Behaviour.
- Reform of energy industries_ to create market structures and institutions that promote competition

Petroleum Demand

The Consumption of petroleum products in the country during FY2019 was 19.2 million TOE. The consumption of petroleum products increased sharply during the 1980s and 1990s at about 6 per cent per annum. Between FY2001 and FY 2006, growth slowed, in fact, become negative because of fuel switching (Chart 3). But in FY2007 with a decline in gas resources and increased demand for furnace oil in the power sector, total demand for petroleum products increased. The demand for petroleum products increased at an annual growth of 4 per cent between FY2007 and FY2017. Since FY2018, with a decrease in demand for furnace oil in the power sector, overall petroleum demand is declining (Chart 11).

Chart 11. Petroleum Consumption



Source: Pakistan Energy Yearbook (Various Years).

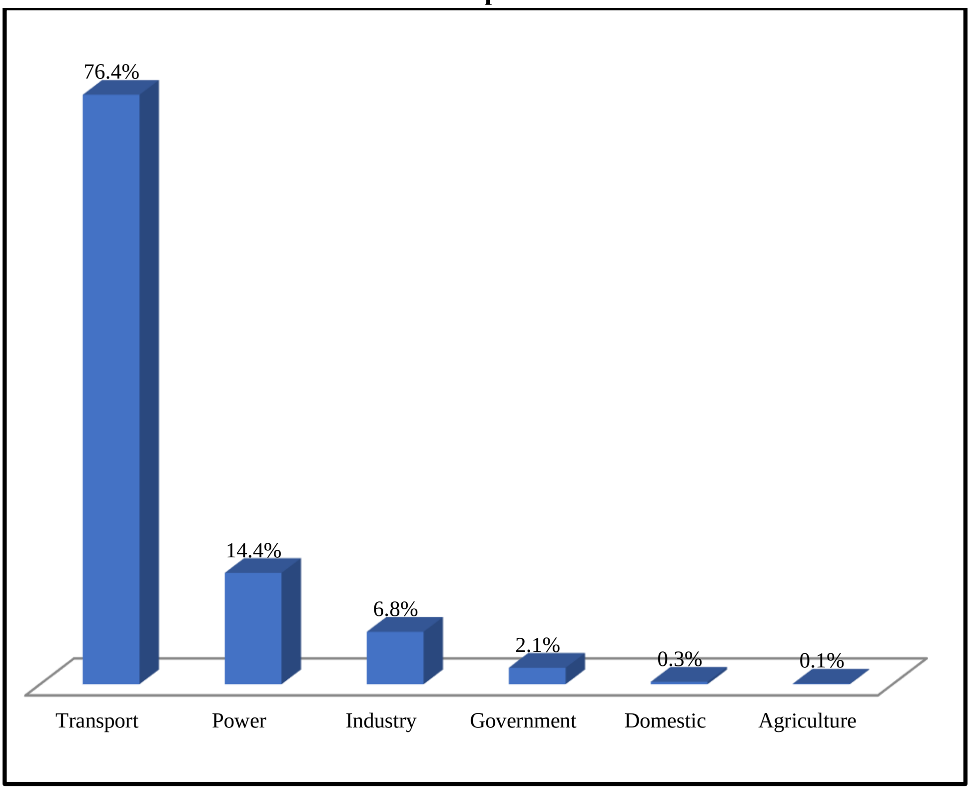
As in FY 2019, transport is the major user of the petroleum products which accounts for about 76 percent followed by power generation which uses about 14 percent and industrial sector which has a share of 7 percent while remaining is shared by the residential, agriculture and other government sectors (Chart 12). Motor gasoline (MG) and high-speed diesel (HSD) are the two main petroleum products consumed in Pakistan (Chart 13).

The demand for MG is increasing continuously and so is its local production and imports (Chart 14 and Chart 15). However, stagnant industrial activity affects the consumption of HSD in industry and transport in FY2019 and its imports also declined in FY2019 (Chart 14 and Chart 16). Additionally, illegal traffic of HSD (from Iranian border) is a challenge for OMCs because of its cheap price. Local production of petrol is also increasing (Chart 14).

In the power sector replacement of LNG and coal has decreased the demand for furnace oil (FO) (Chart 14 and Chart 17). The government of Pakistan (GOP) restricts the import of FO in December 2017, to save foreign exchange reserves.

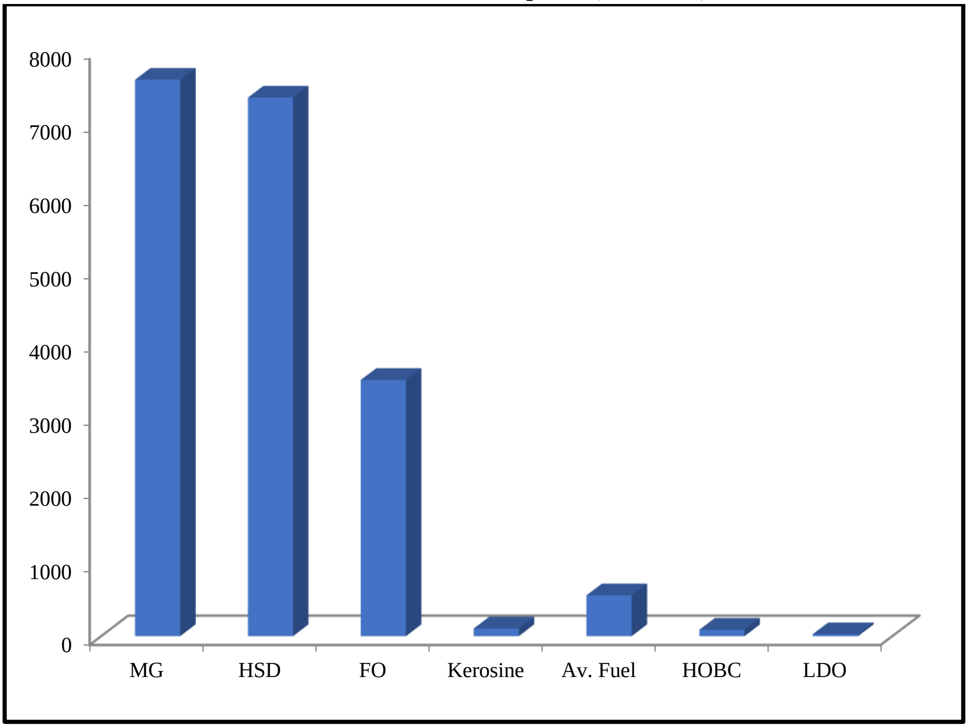
Pakistan is a net importer of crude oil. For petroleum products, Pakistan remained the net importer until FY2018. Since FY 2017, imports of petroleum products have been declining. In FY2017, imports of petroleum products was 15.1 million tons, which declined to 13.3 million tons in FY2018 and then to 8.8 million tons in FY2019.

Chart 12. Sectoral Consumption of Petroleum FY2019



Source: Pakistan Energy Yearbook, 2020.

Chart 13. Product Wise Consumption (000 Tons) FY2019



Source: Pakistan Energy Yearbook, 2020.

Chart 14. Total Petroleum Consumption & Main Products Consumed

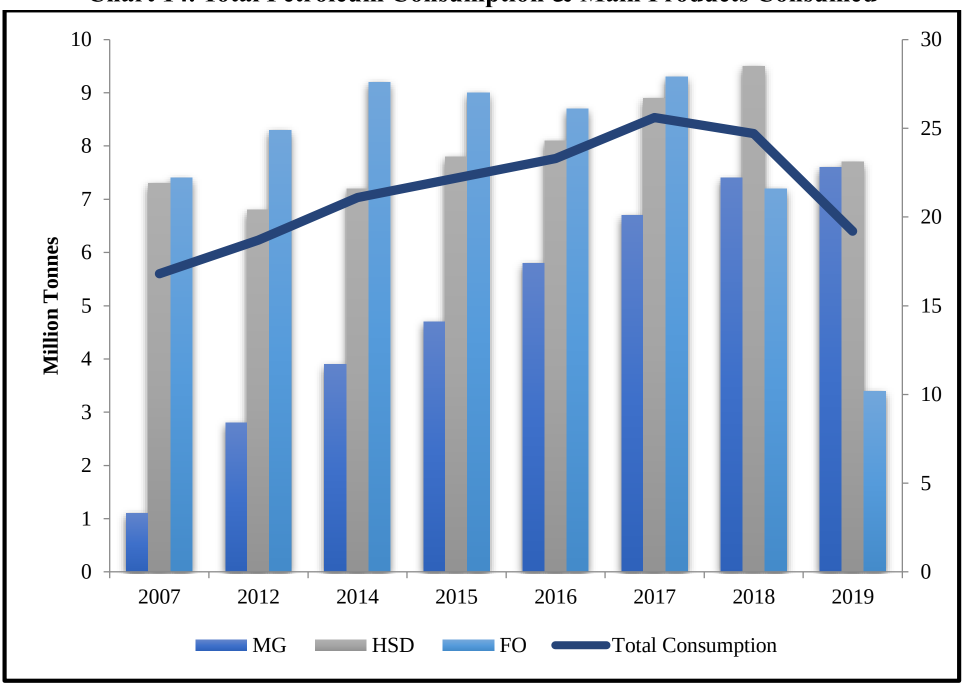


Chart 15. MG Consumption (Million Tons)

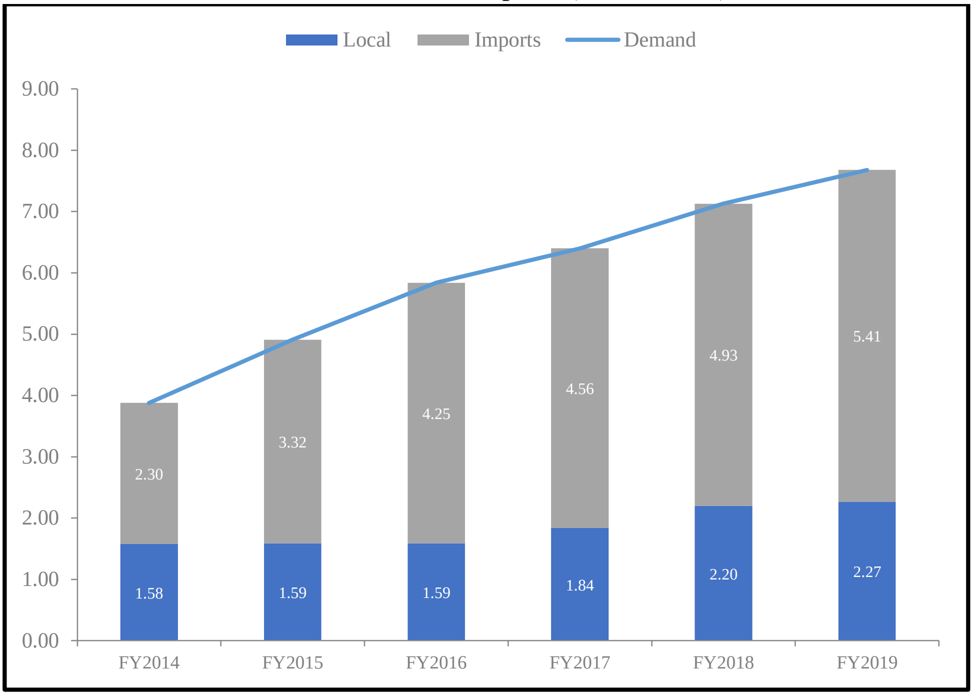


Chart 16. HSD Consumption (Million Tons)

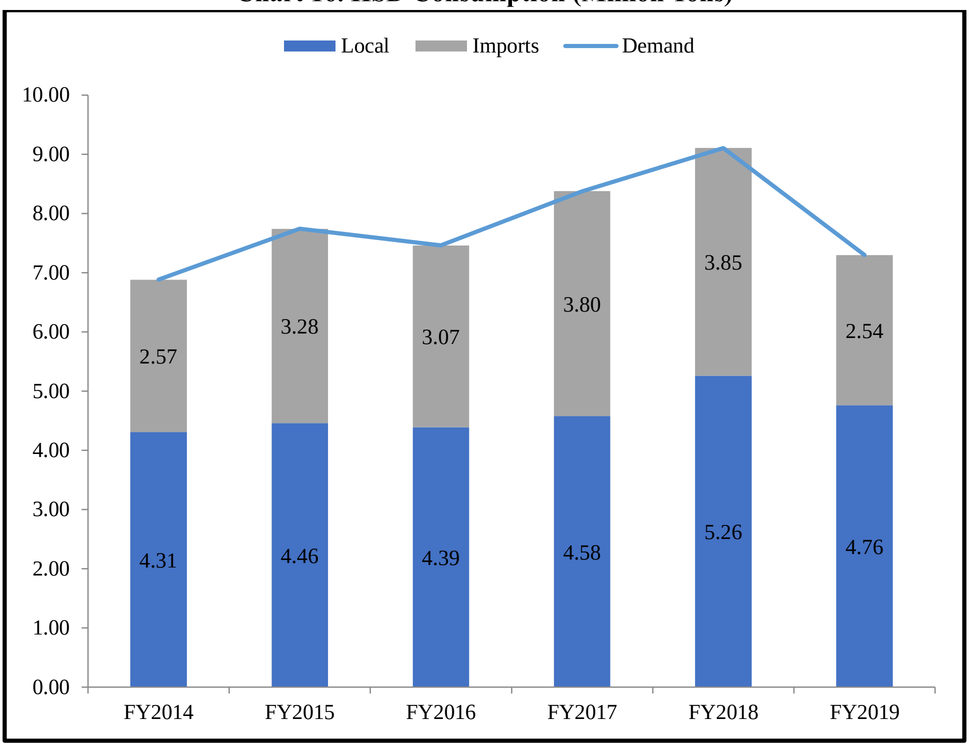
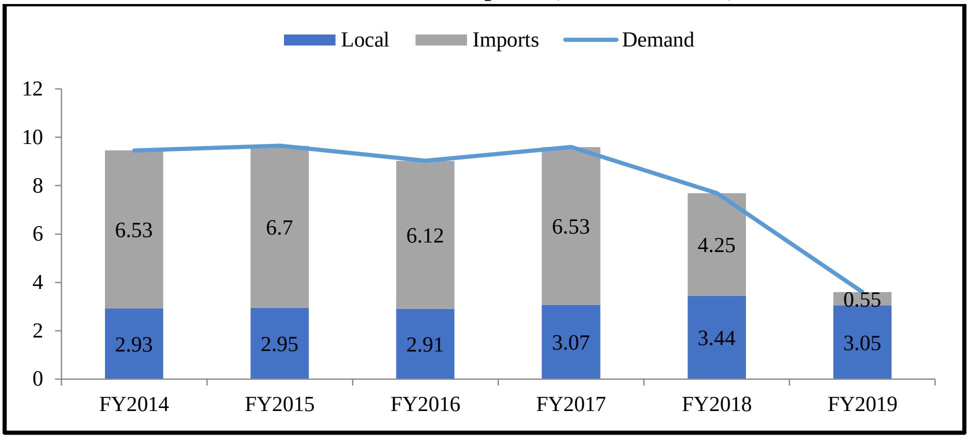


Chart 17. FO Consumption (Million Tonnes)



Source: Pakistan Energy Yearbook (Various Years).

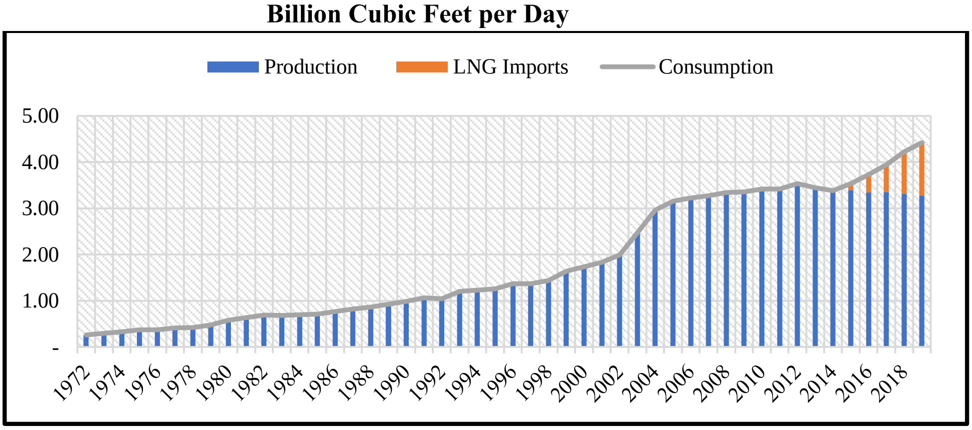
GAS MARKET STRUCTURE AND SUPPLY CHAIN

Natural gas is the most important indigenous fossil fuel, accounting for 35 per cent of commercial energy supplies and about 31 per cent of commercial energy use in Pakistan (Chart 1 and Chart 2). Pakistan is the 19th largest consumer of natural gas in the world, with the established natural gas industry. Out of the total 4.42 billion Cubic feet/ Day consumed in FY2019, 75 per cent is produced domestically (Chart 18).

Over the last two decades, gas consumption has increased substantially (4.8 per cent per annum). In comparison, Pakistan's gas production is almost stagnant at about 4 Bcf/D. Since FY 2015 we have been importing liquefied natural gas (LNG).

In Pakistan, first natural gas discovery was made in 1952. Pakistan Petroleum Limited (PPL) was established in 1950. Their first project was the drilling in Baluchistan, which results in the discovery of the largest gas field in Sui (Hussain, et al., 2019). In 1952, gas reserves of more than 10 trillion cubic feet were found in Sui (Gomes, 2013). This discovery leads to the development of a huge network of gas transmission and distribution in the country.

Chart 18. Gas Consumption, Production and LNG Imports
Billion Cubic Feet per Day



Source: BP Statistical Database, 2020

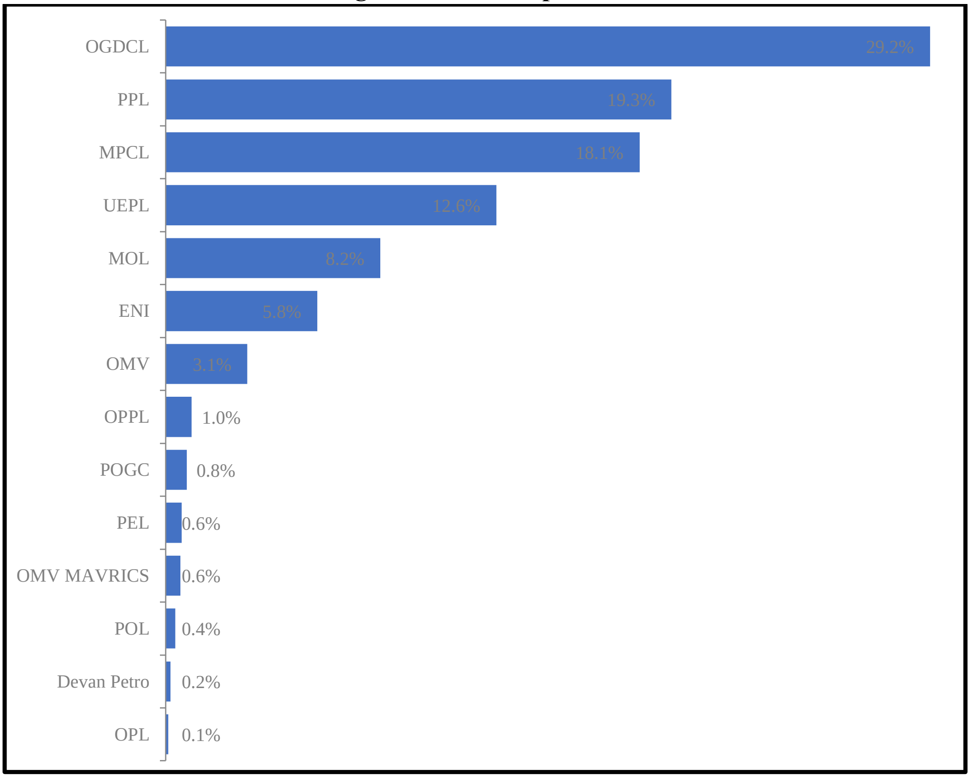
Gas Supply Chain

The supply chain of natural gas just like oil starts from the gas fields, but it is relatively simple as compared to the oil supply chain. Gas explored and produced is transferred to two main gas utilities Sui Northern Gas Pipeline Limited (SNGPL) and Sui Southern Gas Company Limited (SSGCL) via pipelines for further distribution to the end consumers.

In comparison, the supply chain of imported LNG starts at the Port Qasim Karachi. The LNG imported is re-gasified at the plants installed at the port. The re-gasified LNG is then transferred via pipelines to the two utilities for further transmission.

Gas Upstream

Chart 19. Percentage Share of Companies in Gas Production



Source: Pakistan Energy Yearbook (2020)

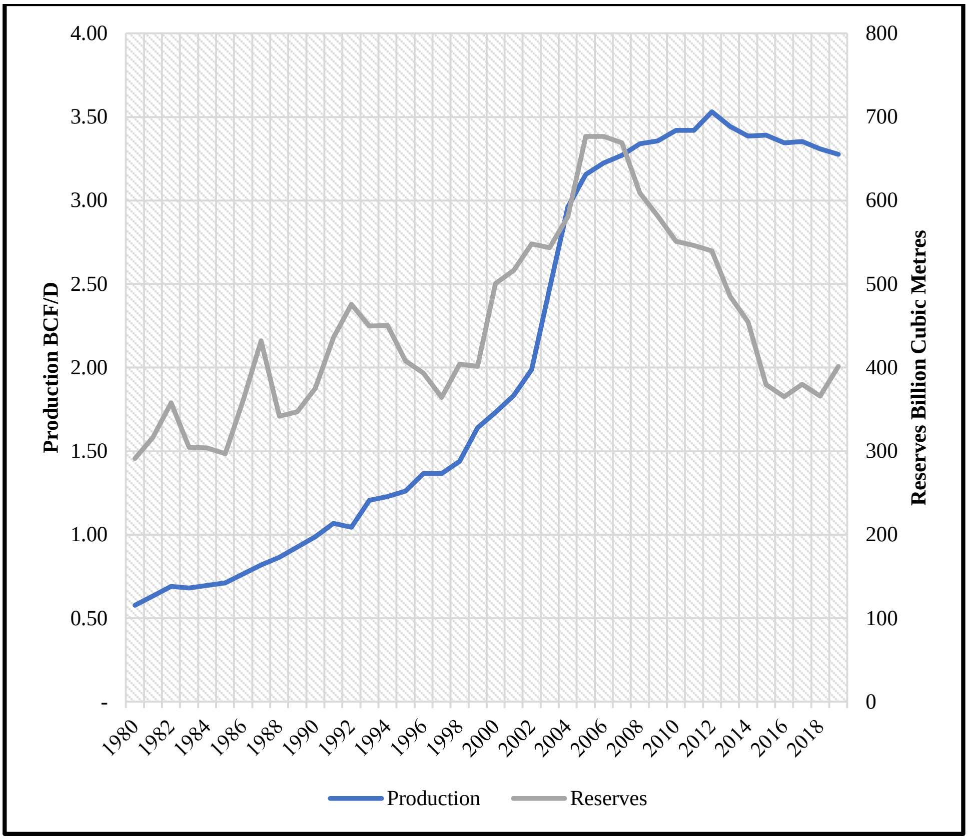
In the upstream, there are 15 gas exploration and production companies working in 55 gas fields, spread throughout the country. The major gas fields of the country include Sui, Uch, Qadirpur, Sawan, Zamzama, Badin, Bhit, Kandhkot, Mari and Manzalai.

The upstream gas sector is led by three state-owned companies (majority shares owned by the state). In FY2019, Oil and Gas Development Cooperation Limited (OGDCL) has the largest share in total gas production (29 per cent). OGDCL was followed by Pakistan Petroleum Limited (PPL) with a share of 19 per cent and Mari Petroleum Company Limited (MPCL) with a share of 18 per cent (Chart 19). Among all the E&P

companies, Mari petroleum has the highest well success rate in Pakistan (69.23 per cent). In comparison, for other companies, the average success rate is 30.1 per cent (Minhas, 2020).

Overall, with no new major gas discoveries in recent years, gas production after reaching a peak in FY2012 has started decreasing. With no significant addition, gas proven reserves are also on the decline (Chart 20). Basin studies have suggested huge gas potential in the country; roughly 10 times the gas proved reserves (Sattar, 2020).

Chart 20. Gas Proven reserves and Production



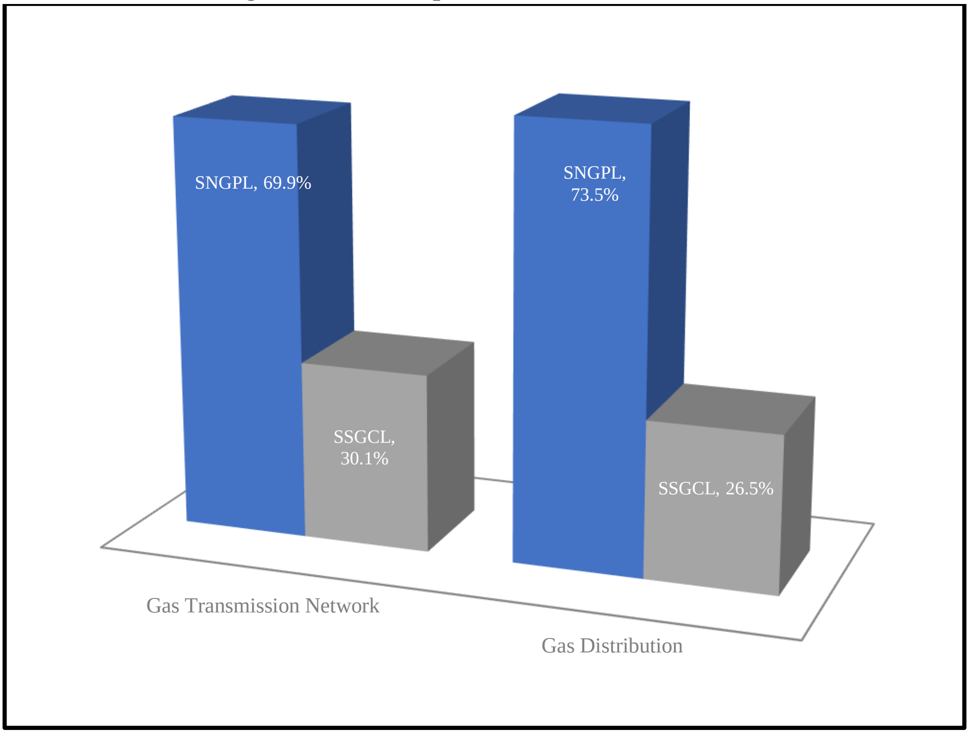
Source: BP Statistical Database, 2020.

In FY 2019, around 25 per cent of the country's gas supplies were met through the imported RLNG. Two state-owned companies, that is, Pakistan State Oil (PSO) and Pakistan LNG Limited (PLL) are authorised by the GOP to import LNG. PSO has signed a long-term contract (span of 15 years) with Qatar. PLL has relatively short-term contracts with Gunvor and Shell.

LNG imported by PSO is re-gasified at the Engro Elengy Terminal Limited (EETL) at Port Qasim, Karachi at a tolling tariff. EETL has a peak capacity of up to 690MMCFD for re-gasification. Similarly, PLL has hired the capacity of PGP Consortium Limited (PGPCL) for re-gasification of LNG at Port Qasim, Karachi. PGPCL has a peak re-gasification capacity of 750 MMCFD (OGRA, 2020).

Gas Midstream

Chart 21. Percentage Share of Companies in Gas Transmission and Distribution



Source: OGRA State of Industry Report, 2018-19.

The midstream gas sector is dominated by two monopolies, SNGPL and SSGCL. The two are state-owned companies (the majority share is owned by the state). As mentioned earlier, the responsibility for gas transportation, marketing and distribution lies with these two companies. In addition to these utilities, some independent pipelines from Mari and Uch are supplying gas to nearby power and fertiliser plants (Ali, 2020).

Right after the huge gas discovery in Sui, the GOP started developing a gas transmission and distribution network. The transmission networks are now spread across the four provinces. Almost all urban areas in these provinces have access to gas distribution networks. SNGPL supplies gas to Punjab and KPK, whereas SSGCL supplies gas to Sindh and Baluchistan.

The sustained growth in gas production in the early years made the authorities complacent, and they started giving connections to everyone as the demand was quite below supplies. Gas tariff methodology also encouraged capital investments in the expansion of transmission and distribution (T & D) network.

Gas exploration and production activities slowed down after early discoveries. Consequently, the gas produced indigenously became insufficient in FY2006 and onwards. But the expansion of the T & D network continued at the same pace. From FY2007 to FY2019 gas distribution network in Pakistan expanded at the rate of about 6 per cent per annum (Table 4). Extension of the T & D infrastructure enabled gas utilities to continue providing gas to an increasing number of consumers (Figure 3).

Table 4

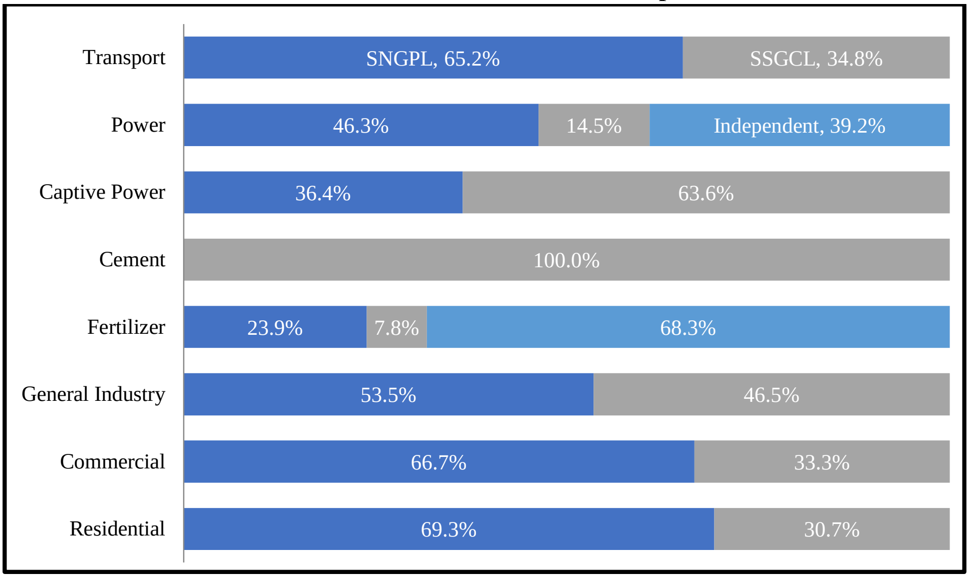
Transmission and Distribution Network (Km)

	Transmission		Distribution	
	SNGPL	SSGCL	SNGPL	SSGCL
2007	6142	3290	36919	23448
2019	9399	4054	130157	46872

Source: Pakistan Energy Yearbook (2012) and OGRA State of Industry Report, 2018-19.

Gas Downstream

Chart 22. Sectoral Share of Gas Companies



Source: OGRA State of Industry Report, 2018-19.

Gas Demand

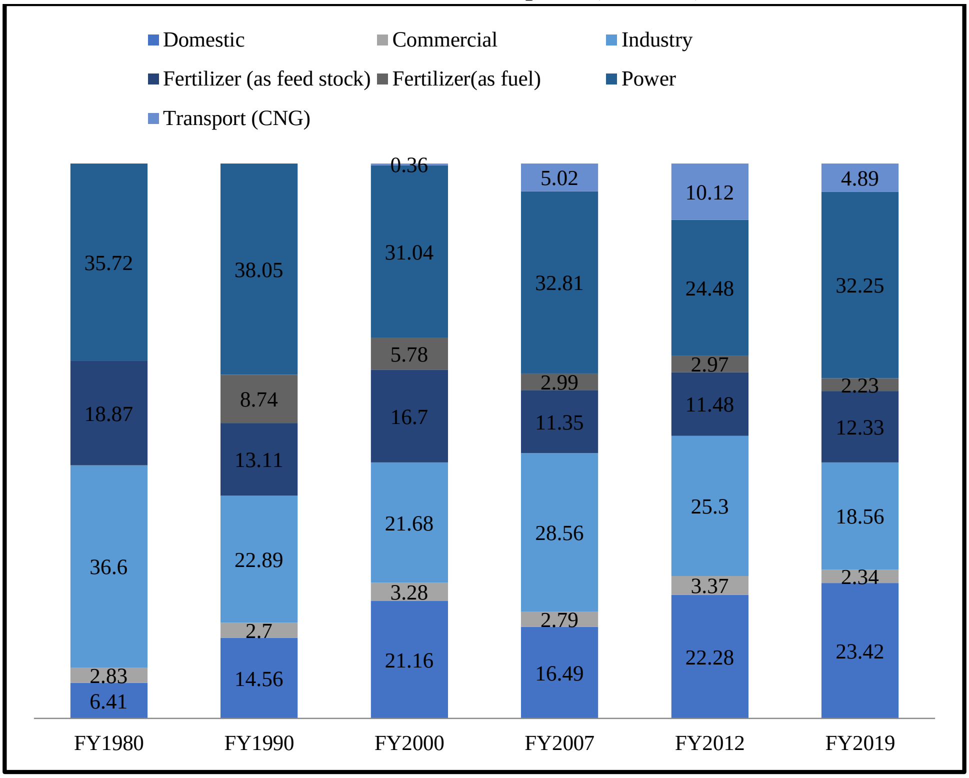
The consumption of natural gas in FY2019 was 31.2 billion TOE. The demand for gas increased fairly rapidly in the 1970s (8 per cent per annum). There was moderate growth of around 5 per cent per annum in the 1980s and onwards until FY2009.

Gas consumption slowed down in 2010 and onwards given the shortage in supplies. In 2013 constrained demand and supply gap was estimated as 2 BCF/D and unconstrained demand and supply gap was almost 4 BCF/D (GOP, 2020). In FY2019, the constrained demand-supply gap, despite the import of LNG was about 2 BCF/D. This shortage necessitated gas load management across the country.

In FY2019, the power sector was leading as a gas consumer with a share of 32 per cent, followed by domestic consumption of 23 per cent. Over the years domestic consumption has increased tremendously at the expense of all other sectors (Chart 23). Not only relatively very low tariffs for domestic consumers (gas pricing policy), but GOP gas priority policies have also played a significant role in increasing the share of domestic consumers. In addition, gas and electricity price differential encouraged more gas consumption in Pakistan (Sattar, 2020).

Moreover, the gas is used quite ineffectually in Pakistan. Pakistan is energy intense country, with huge potential for energy conservation (Malik, 2020). In most countries (especially in the developed countries) a single source of energy is provided at the domestic level. But in Pakistan, both power and gas are provided at the domestic level. Providing two types of infrastructure at the domestic level is not only costly, but also encourages inefficiencies in the supply chain. Just like power sector T & D losses, there is a significant problem of unaccounted for gas (UFG) in the gas sector (Figure 3).

Chart 23. Gas Consumption (% share)

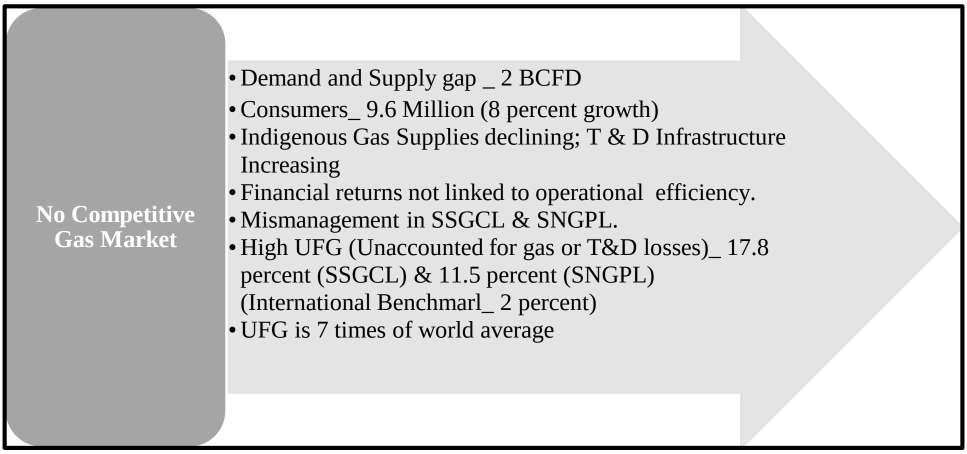


Source: Pakistan Energy Yearbook (various years)

Fig. 3: Gas Industry_ Facts and Issues

Gas Industry Facts

- SNGPL and SSGCL are integrated utilities (quasi monopoly).
- 40 per cent of their shares owned by private entities.
- They do not own gas molecules, therefore, not in competition with gas producers, unlike many in emrging gas markets.
- They buy gas from the well-head, transport and distribute gas under 10-25 years contract at prices , determined when E &P concessions were awarded.
- T & D fees relatively modest as compared to other gas markets, e.g., Brazil.



Source: PIDE (2020), Minhas (2020) and OGRA (2020).

LPG Supply and Demand

In FY2019, the total market demand for LPG was around 1061447 MT/ Annum. It is mainly supplied by 72 field plants (605025 MT/ Annum) followed by refineries (Attock, Byco, PARCO, PR, and NR), which supplied 191060 MT/ Annum. Around 265362 MT/ Annum of LPG were imported in FY2019 (Chart 24).

Mainly, LPG is consumed in the domestic sector and industries like textile, ceramic, steel, glass, edible oil, beverage, and chemical (Chart 25). LPG primarily supplies domestic fuel requirements, especially in natural gas-starved areas/ sectors and peak shaving times in urban territories. It is mainly consumed in the most populous province, Punjab (Chart 26).

Over the years, LPG consumption has increased by about 4 percent annually since FY2007. The share of the industry has grown over the years (Chart 27). The increase in demand is mainly caused by the shortage of natural gas availability, which is on the rise.

Chart 24. Percentage Share of LPG Supplies by Source FY2019

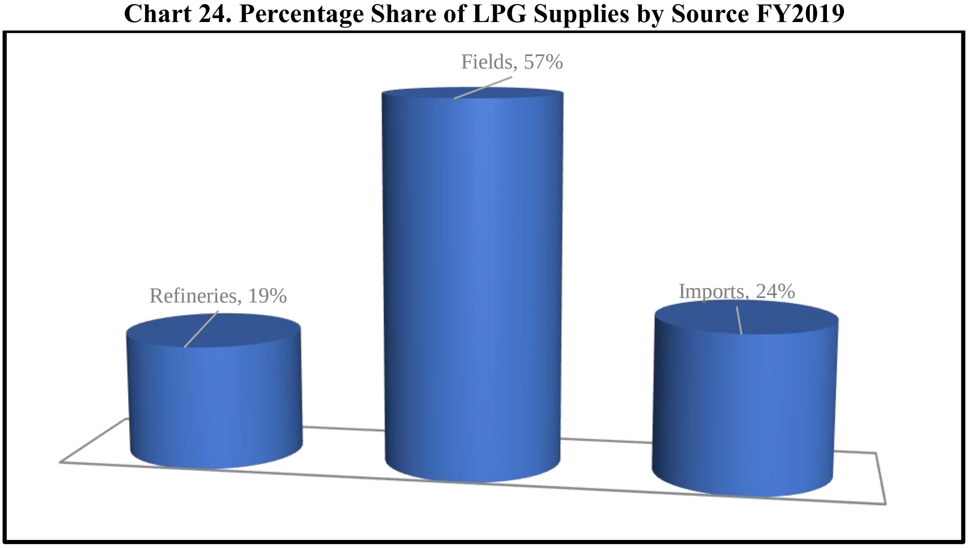


Chart 25. Sector-wise Consumption of LPG FY2019

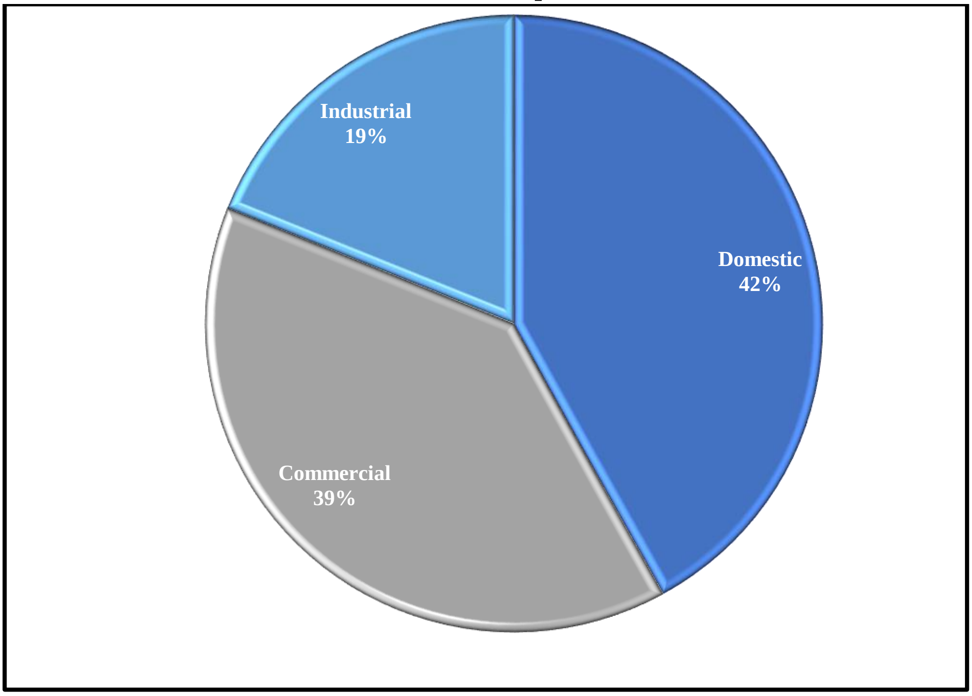


Chart 26. Province wise LPG Consumption FY2019

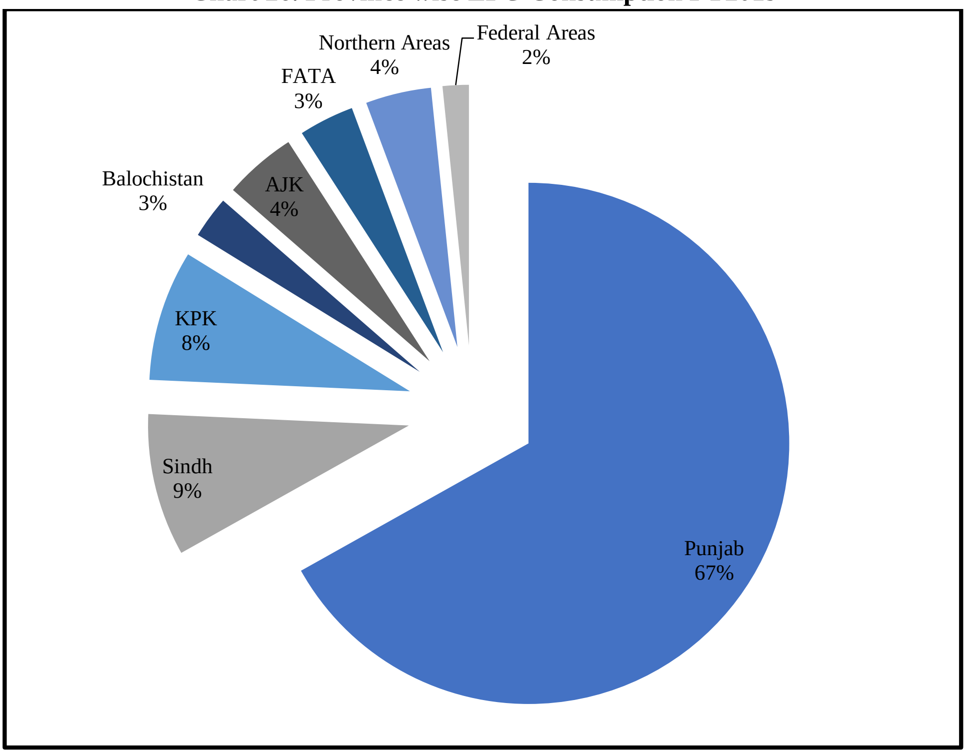
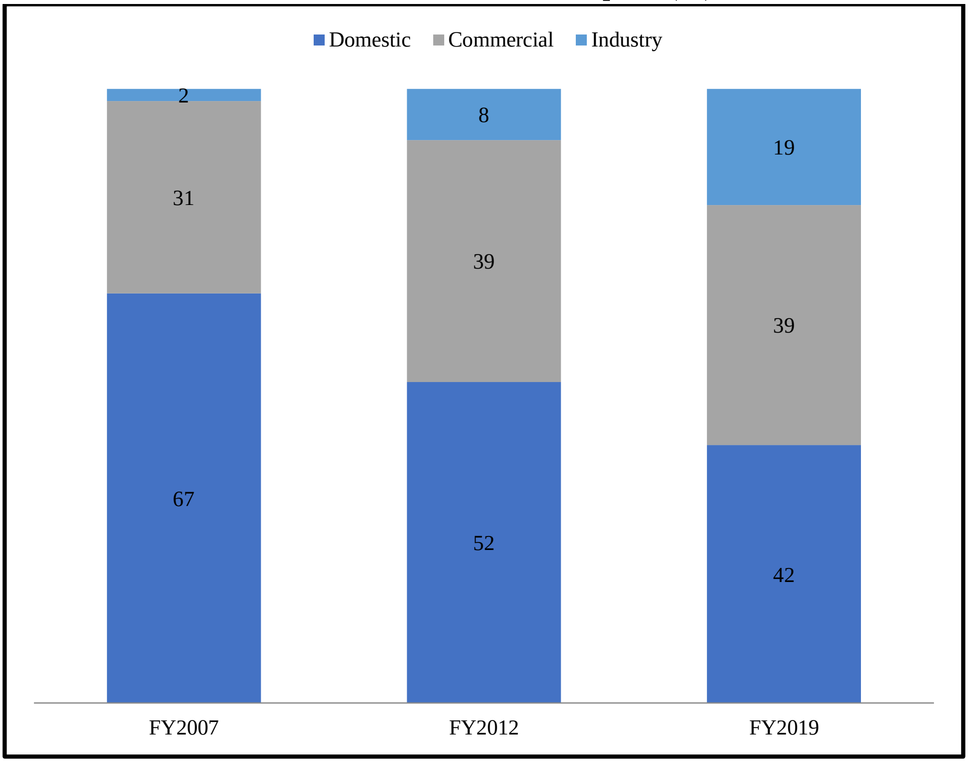


Chart 27. Sector-wise Consumption (%)



Source: PGRA State of Industry Report, 2018-19.

There are 12 LPG producers, 190 LPG marketing companies, having more than 5,500 authorised distributors (FY 2018-19). Each LPG marketing company has several 'Authorised Distributors' – authorised by OGRA to sell on behalf of the company.

LPG accounts for only 1.3 percent of the total primary energy supply in the country. This low share of LPG in the overall energy mix is primarily caused by supply limitations and the higher cost of LPG compared to other competing fuels such as natural gas and wood.

REGULATIONS AND POLICIES IN OIL AND GAS SECTOR

The Ministry of Energy, Petroleum Division (MEPD) under Regulations of Mines Act, Petroleum Policies and relevant Rules governs E&P activities in Pakistan. MEPD is a primary regulator.

Directorate General of Oil (DG Oil) regulates the crude oil sales to refineries and the sale of refined products such as diesel, petrol, kerosene oil, etc. by the oil marketing companies such as PSO, Shell, Total Parco, etc. Directorate General of Gas (DG Gas) regulates the gas sales to Sui Northern Gas Pipelines Company Limited (SNGPL) and Sui Southern Gas Company Limited (SSGC).

Oil and Gas Regulatory Authority (OGRA) regulates midstream and downstream activities in the oil and gas sector. Some of the regulatory and policy features are outlined in Box 4 and Box 5.

Box 4. Regulations

- MEPD allocates gas from gas fields and imports after approval from ECC.
- First right to buy crude/ condensate from the upstream E&P is with the GOP.
- GOP nominates a refinery.
- The GOP has the first right to purchase all gas produced in the country (directly or indirectly) through govt.-controlled companies (SNGPL, SSGCL). SSGCL and SNGPL overregulated.
- LPG (locally produced) can be sold to LPG distribution companies, which are licensed by the Government.
- Selling price (crude oil, condensate & gas) is stated in the relevant contract with Government_ it is linked to the international crude oil price.

Box 5. Policies

- Under the 1948 Regulations of Mines and Oil Fields & Mineral Development Act, the GOP has regularly issued uninterrupted petroleum policies, starting from 1991.
- The main modification in policies relates to prices, return on investments and fiscal incentives.

Latest 2012 (amended 2020)

- Aimed at attracting private investors (local & international).
- Granting of Petroleum Exploration Licences for entering into petroleum concession agreement (PCA) or production sharing agreement (PSA) concerning onshore and offshore blocks offered through competitive bidding.
- Granting of licence for PCA or PSA without competitive bidding to Strategic Partner Companies (govt. to govt. basis).
- 2018 gas allocation policy: domestic and commercial sectors (1st priority) followed by power and zero-rated industry (2nd priority); general industry, fertiliser, and captive power (3rd priority); cement and its captive power (4th priority); and CNG (5th priority).

CHALLENGES AND OPPORTUNITIES IN OIL AND GAS UPSTREAM

Basin studies suggest the total oil resource potential of 27 billion barrels and total gas resource potential of 282 trillion cubic feet (Abbasi, 2018). The issue lies with the government, they lack commitment. Not only the well-head prices, but too much government interference is creating hurdles in upstream exploration and production activities (Sattar, 2020).

Figure 4 Challenges and opportunities in the Upstream

Challenges

- High taxes_ withdrawal of many tax exemptions and new taxes at the import stage_ SROs.
- Government's role/ rules in SOCs hinders growth.
- SOCs hesitate in investing in new technologies_ fear of bureaucracy and NAB.
- PEPRA rules focus on the cheapest source, quality of the product not taken into account.
- Circular debt in power sctor_ consequent tighter cash flow affects companies' liquidity and ability to invest in technology & development of wells.
- Political instability.
- Discontinuation of oil and gas drilling activities_ COVID -19.
- Security Protocols_ difficulty in O& G drilling activities in Baluchistan & KPK.
- Long civil trials with no clear outcome are discouraging_ small companies facing litigations relating to the interpretation of contract terms and taxes.
- High cost of doing business.
- Discriminatory share of certain companies_ preference to western investors.
- High administrative costs_ several audit proceedings and long bureaucratic procedures are discouraging.

Opportunities

- Concessionary import duty of 5 percent for the E & P industry for items not manufactured in Pakistan_ SRO 678(1)/2004.
- Public-private partnerships_ foreign companies are allowed to work with public limited exploration E &P companies (OGDCL, PPL, MPCL and POL).
- Chinese investors have 'price' advantage over Western competitors in various bidding processes.
- Improved security situation on Western borders_ attracted investments in mega projects, CPEC.
- Geological surveys confirm vast potential reserves with potential estimated at 300 TCF versus the 54 TCF discovered so far. Baluchistan has large areas still unexplored, especially in the frontier.

Companies also exploiting; they bid for blocks but do not start work on them. Government has clauses in the contract that can penalise or take back blocks but has never really enforced these and not taken one back in decades. The attitude of companies in the upstream sector explains regulatory weaknesses in the oil and gas sector.

KEY TAKEAWAYS

- Despite increasing focus on renewables, oil and gas will remain significant for the energy matrix of Pakistan. Pakistan has vast oil and gas resources (yet to be discovered). For the exploitation of these resources, we need a robust regulatory infrastructure in place. A single regulator across the supply chain can deal with issues more effectively.
- Despite private participation, state dominance is prevalent in the oil and gas sectors. Too much government interference in the company activities creates hurdles in the company's/ industry's growth.
- The free market is the only solution_ with equal opportunities for all participants.

- Improvement in energy productivity_ decoupling of energy and economy is indispensable for Pakistan. We need a more transparent and targeted approach to increase energy productivity in all sectors.
- An effective regulatory apparatus must be in place to minimise gas leakages in the supply chain. There is a need for market-based pricing to curtail misuse.
- In the oil sector, there is an urgent need to expand our strategic stock capacity.

REFERENCES

Ali, A. (2020), "The Dynamics of Energy in Pakistan", Research on Economy and Politics (REAP).

Arshad, A. (2018), Hydrocarbon Exploration and Licensing Policy_ Way Forward to Self-sufficiency in Oil and Gas, Policy brief, Centre for Research and Security Studies, https://crss.pk/wp-content/uploads/2018/10/Hydrocarbon-Exploration-and-Licensing-Policy-.pdf

Gomes, I. (2013), Natural Gas in Pakistan and Bangladesh: Current Issues and Trends, The Oxford Institute for Energy Studies, University of Oxford.

Hussain, I, Quershi, A. A. and Nadeem, H. (2019), "A Brief History of Exploration", The DAWN, May 5th.

Malik (2020), "Energy Productivity for Sustainable Development" PIDE Blog, July 02.

Minhas, N. (2020), "Pakistan Energy Mix: Overview of Gas sector (Upstream)", https://www.globalvillagespace.com/pakistan-energy-mix-overview-of-gas-sector-upstream/

OGRA (2020) Annul Report. Oil and Gas Regulatory Authority, Pakistan.

OGRA (Various Years), State of Industry Report, Oil and Gas Regulatory Authority, Pakistan.

PACRA (2019) http://www.pacra.com.pk/uploads/doc_report/OMC sector Study November 2019_1573733618.pdf.

PACRA (2019) https://pacra.com.pk/uploads/doc_report/Sector%20Report_LPG_Mar19.pdf

Pakistan Energy Yearbook (Various Years), Hydrocarbon Development Institute of Pakistan.

PIDE (2020) "The Gas System in Pakistan", PIDE Webinar, October 24, 2020.

Raftaar (2016), Gas Report, Report No. R1502, Consortium of Development Policy Research (CDPR), https://cdpr.org.pk/wp-content/uploads/2020/03/Gas-Report-merged-final.pdf

Sattar, S. (2020) "Gas sector" presentation at the PIDE Energy Webinar on "The Gas System in Pakistan, October 24, 2020.

Sherpao, B. A. (2016), Country Report of Pakistan, JICA Training on Energy Policy, https://eneken.ieej.or.jp/data/6883.pdf.

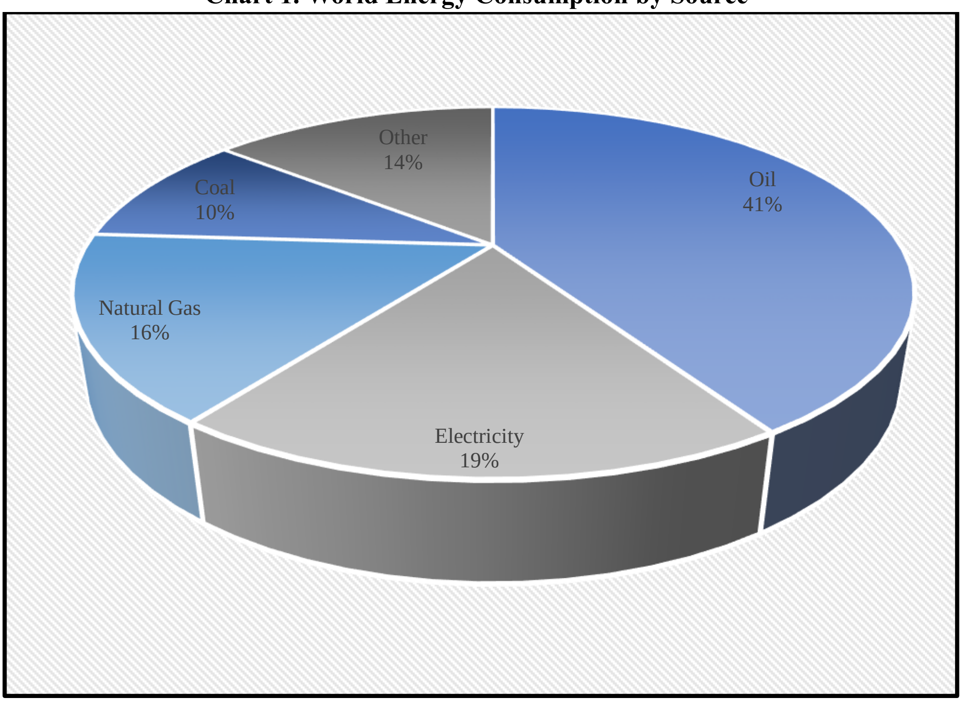
Gas Crisis in Pakistan*

AFIA MALIK and USMAN AHMAD

INTRODUCTION

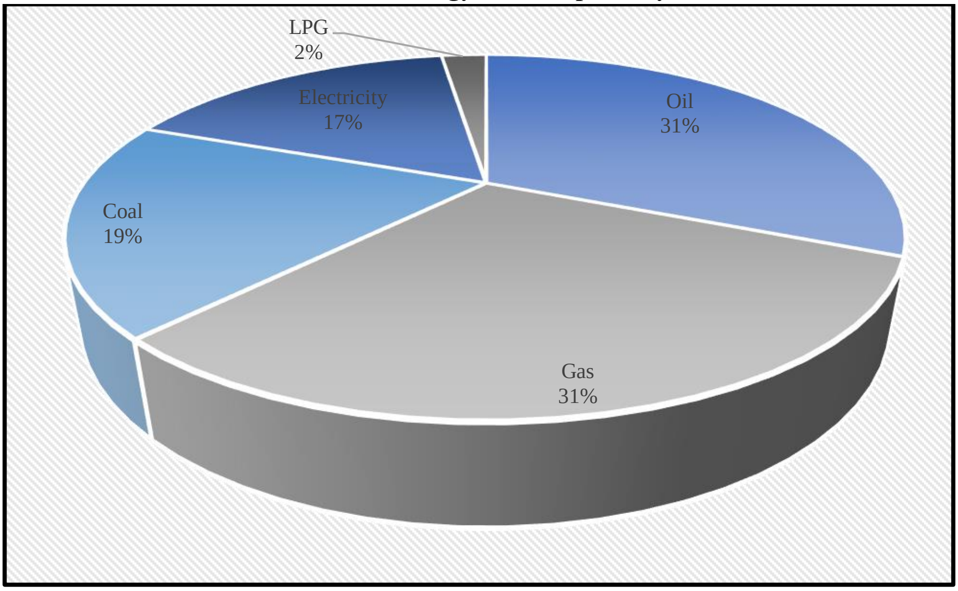
Gas is the third-largest energy source consumed around the world. Pakistan has less than a 1 per cent share in world gas consumption. It meets its energy demand through imported and indigenous resources in the ratio of 44:56. Natural gas and imported LNG contribute more than 40 per cent to the country's current energy mix, including gas resources used in electricity generation. In recent years, the demand for gas has increased rapidly in Pakistan. However, gas exploration and production have declined, and the LNG operational and regulatory framework is weak, leading to a nationwide shortage and increased supply costs.

Chart 1. World Energy Consumption by Source



* This chapter has been published previously as PIDE Knowledge Brief, 2022:83.

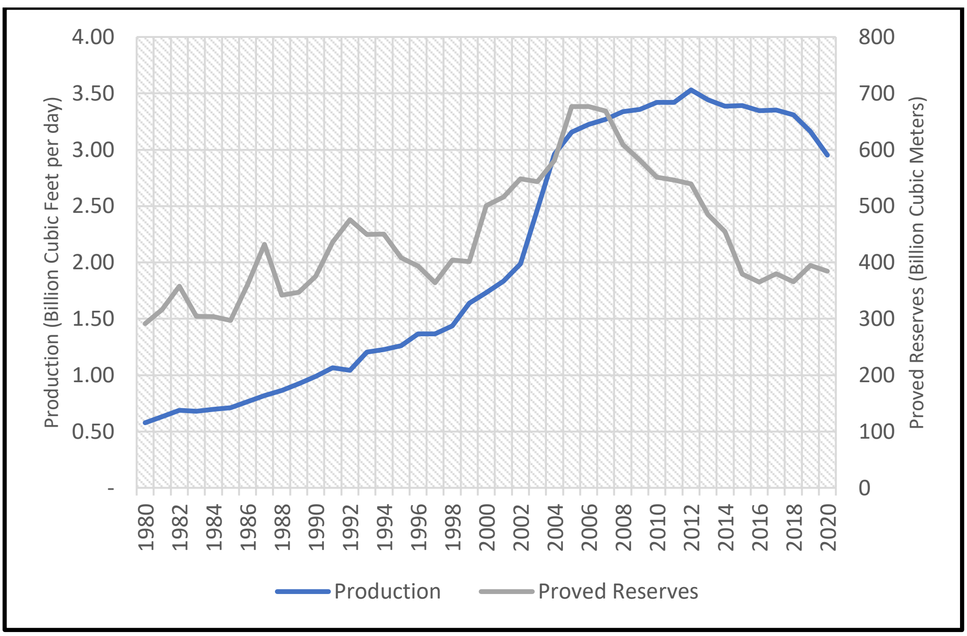
Chart 2. Pakistan Energy Consumption by Source*



Source: IEA and Pakistan Energy Yearbook.

* Gas, Oil, & Coal share does not include these fuel shares used in electricity generation.

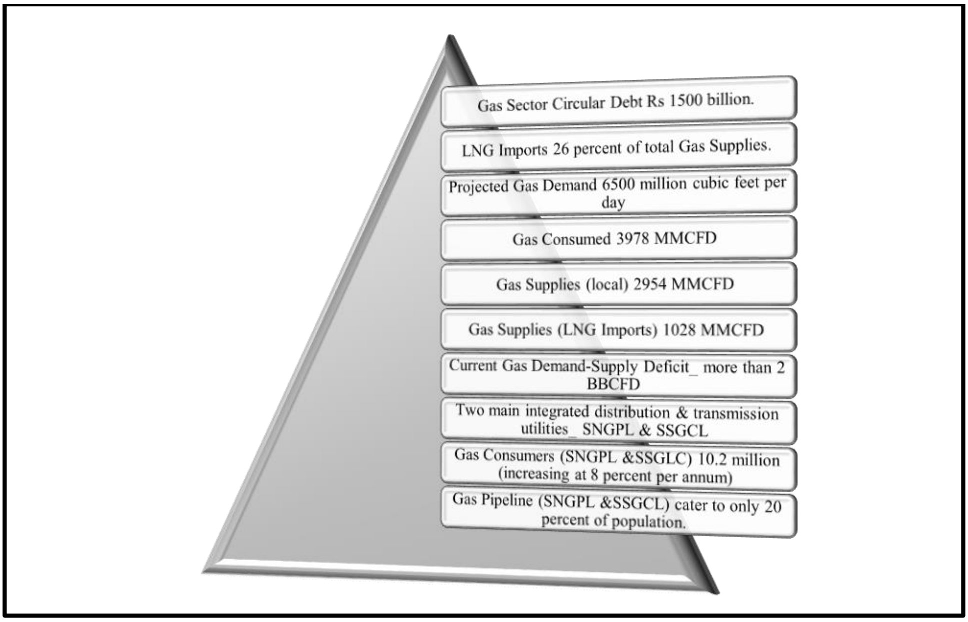
Chart 3. Pakistan Gas Reserves and Production



Source: BP Statistical Review 2021.

PAKISTAN NATURAL GAS SECTOR

In the upstream, 15 gas exploration and production companies work in 55 gas fields spread throughout the country.



The gas distribution and transmission are mainly owned and operated by two state-owned companies _ Sui Northern Gas Pipeline Limited (SNGPL) and Sui Southern Gas Company Limited (SSGCL). A few independent pipelines from Mari and Uch also supply gas to nearby power and fertiliser plants. SNGPL and SSGCL are listed companies with the majority of shares owned by the government.

After the colossal gas discovery in Sui in 1952, the GOP started developing a gas transmission and distribution network. The transmission network (13714Km) and distribution network (183407Km) are spread across four provinces' main urban areas. The gas exploration/production industry and gas distribution/transmission industry lack competition in Pakistan.

Chart 4. Exploration Companies Share in Gas Production

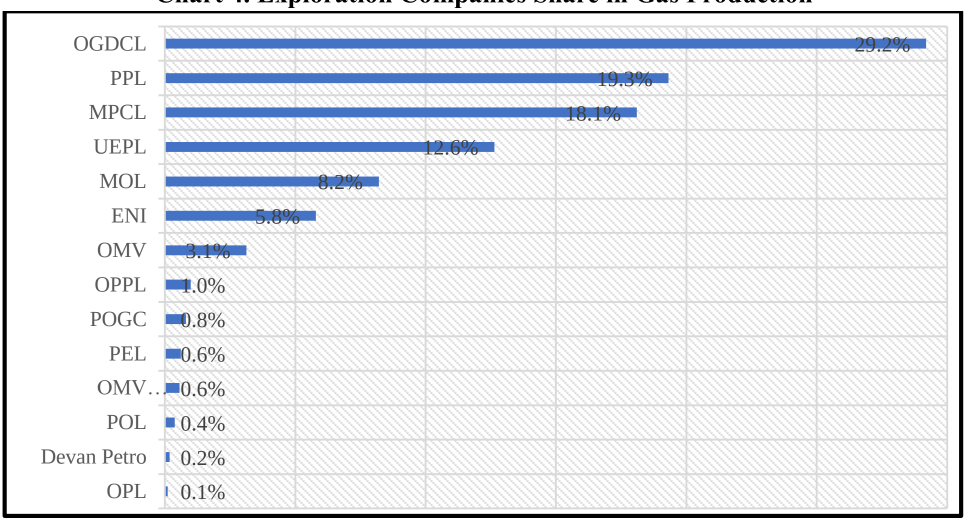
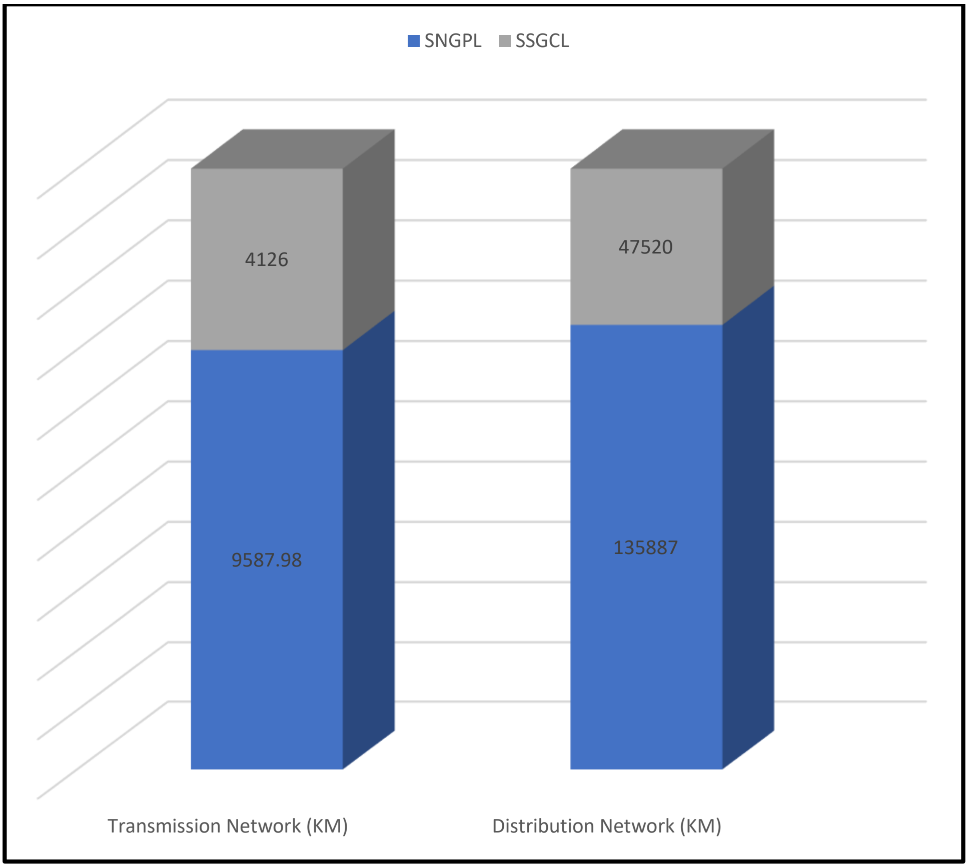


Chart 5. Share in Trans. & Dist. Network



Source: Pakistan Energy Yearbook 2020 and OGRA Petroleum State of Industry Report 2020.

GAS SECTOR CHALLENGES

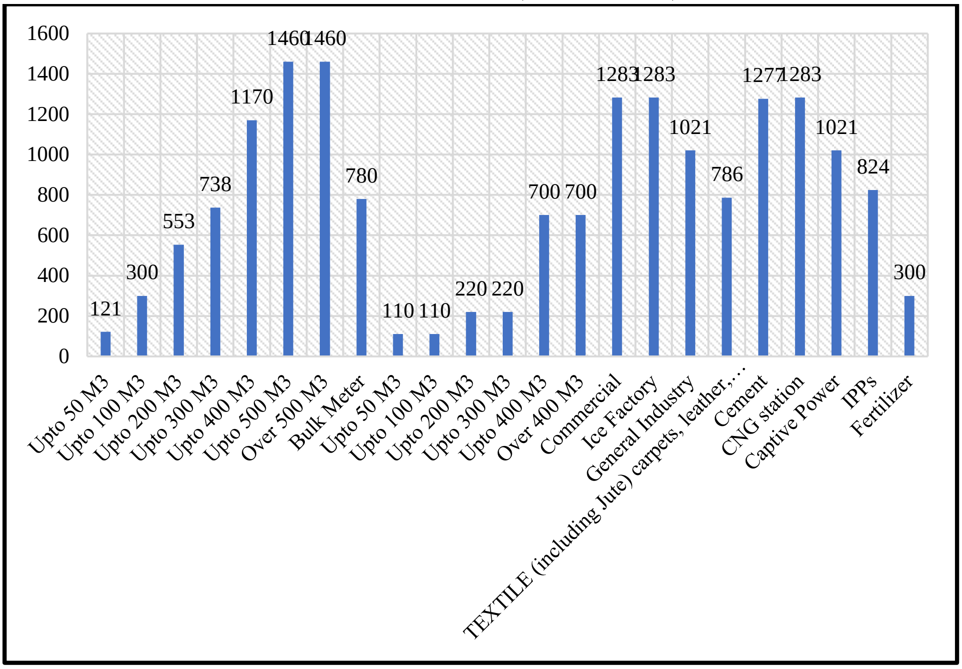
Demand Mismanagement

The sustained growth in gas production in the early years made authorities complacent, and they encouraged consumption—and gave connections to everyone. Gas tariff methodology also enabled capital investments to expand the transmission and distribution (T & D) network (Malik, 2021).

- Pakistan is the most gas-intense country in the world. Over the years, the gas has been used quite ineffectually.
- Cross-subsidisation across sectors encouraged inefficient use, and it continues.

Household consumers have a share of around 25 percent of total gas consumption (in 2020), and the percentage of fertiliser plants (feedstock) is about 16 percent. The majority groups/ slabs in these two categories are charged a lower price (much below the costs) than all other consumer types_ incentivising inefficient use. Other consumer categories are charged a price higher than the actual cost.

Chart 6. Gas Tariff (Rs/ MMBTU)



Source: OGRA Gas Schedule as on September 01, 2020 (latest available on OGRA website).

Although 78 percent of households have no access to natural gas in Pakistan, natural gas consumption in the domestic sector has grown by about 11 percent over the years_ maximum growth among all the sectors. Supplying gas to households requires significant investments. The cost of gas supply to households is much higher than the cost of supply to the industry or power sector. In our gas prioritisation policies (over the years), this has not been reflected, leading to a shortage of gas supplies.

- Gas allocation policy has remained based on political priorities rather than on the objective of maximising value addition.
- Low gas prices and inefficient gas allocations have encouraged higher demands.

In 2005, the government announced *Natural Gas Allocation and Management Policy,* which was revised later a few times. The latest revision was in 2018. Different sectors have been prioritised as in Table 1.

Table1

Gas Allocation Priorities

Consumer Categories	Priority
Domestic and Commercial	1st
Power and Zero-rated Industry	2nd
Fertiliser, Captive Power, and General Industry	3rd
Cement including its Captive Power	4th
CNG	5th

In most countries (mainly developed countries), a single energy source is provided at the domestic and commercial levels. In Pakistan, both power and gas are supplied at the household level. Providing two types of infrastructure at the domestic level is costly and encourages inefficiencies in the supply chain.

Single-pass gas geysers dominate household gas consumption bills (almost 80 percent). These geysers are incredibly inefficient (efficiency level less than 30 percent). At the same time, very few pay the actual cost in the household category as most slabs are cross-subsidised (Chart 6). In comparison, the industry can achieve supply-side efficiencies up to 90 percent. The industry's gas tariffs are relatively high, in addition to gas outages. Expensive gas makes goods' costs high and reduces local and global competitiveness (Farid, 2021).

Subsidised gas supply to fertiliser is for food security and protecting small farmers. But evidence suggests fertiliser prices are not always below the imported fertiliser costs. Local fertiliser manufacturers are making enormous profits (Raftaar, 2016). While the reduced supply of gas to power or high tariffs for the power sector sometimes aggravates the power shortage. It increases power generation costs, adversely affecting the economy (Malik, 2021).

Likewise, despite the forecast of a rising demand-supply gap, in FY2006, when international oil prices were rising, GOP promoted CNG to replace motor gasoline by keeping its prices substantially lower than motor gasoline. It was a government policy of maintaining a substantial difference in the price of petrol and CNG to promote the CNG industry in the country, despite the declining natural gas resources. Policymakers/ regulators failed to perceive the gap arising from the oil to gas shift.

Insufficient Supplies

With 30.6 billion cubic meters of natural gas, Pakistan shares 0.8 percent of global production (BP, 2021). There is a sharp increase in gas demand in Pakistan, but due to the inefficient distribution of natural gas resources, Pakistan has been facing a colossal gas shortfall.

- With no significant gas discoveries in recent years, gas production has started decreasing after reaching a peak in FY2012.
- No significant addition, proven gas reserves are also declining (Chart 3).
- Basin studies suggest a total gas resource potential of 282 trillion cubic feet (Abbasi, 2018) [134].
- There are only four exploratory wells per 1000 Sq. KM, three times less than the world average (Sattar, 2020).

OGDCL predicts that Pakistan's indigenous oil reserves will be exhausted by 2025. Current reserves will last a maximum of 15 years if demand is capped at present-day gas levels by 2030 (Sattar, 2020).

[134] According to Sattar (2020), only 8 percent of total gas potential (1400TCF) has been discovered.

Box 1. Factors Responsible for Low Exploration Activities

- Well-head Gas Prices
- Political Instability
- Unnecessary and lengthy court trials with no clear outcome
- Security Concerns, e.g., in KPK and Baluchistan
- Excessive Government Control and Interference
- High Administrative Costs and Bureaucratic Hurdles

For local companies with state ownership

- PEPRA rules_ the focus is on the cheapest source; product quality is ignored.
- The fear of NAB discourages investment in modern technologies.

Source: Malik (2021) & Sattar (2020).

Maintaining all operations or controlling all activities by the GOP create inadequacies, costing welfare and economic loss. Pakistan's upstream sector has become unattractive for foreign investment because of the factors listed in Box 1. A few years back, there were 22 foreign companies in exploration & production activities, but we are now left with only 3 (Sattar, 2020).

Large areas in the country remain unexplored due to security concerns and the law-and-order situation. For instance, Baluchistan's Pishin basin is considered a valuable block. However, there is no exploration activity in this basin because of the law-and-order problem. Likewise, the well-head price policy, the structure of the bidding process for the blocks, and the government's role in state-run companies are discouraging companies. Political instability and related policy uncertainty is also not an incentive for investors.

Companies are also exploiting; they bid for blocks but do not start working on them. The government has clauses in the contract that can penalise or take back blocks but has never really enforced these and has not taken one back in decades. The attitude of companies in the upstream sector explains regulatory weaknesses in the oil and gas sector.

LNG Import Complications

Since FY 2015, Pakistan has been importing LNG to meet domestic gas shortages. Two state-owned companies, Pakistan State Oil (PSO) and Pakistan LNG Limited (PLL), are importing LNG. PSO has signed a long-term contract (15 years) with Qatar. PLL has relatively short-term contracts with Gunvor and Shell[135]. LNG imported by PSO and PLL is re-gasified at the Engro Elengy Terminal Limited (EETL) and PGP Consortium Limited (PGPCL), respectively[136].

---

[135] Pakistan recently signed another G2G deal with Qatar to import 200 MMCFD of LNG from 2022 onwards at an applicable Brent slope of 10.2 percent. This would increase to 400 MMCFD after three years.

[136] EETL has a peak capacity of 690 million cubic feet per day (MMCFD) for re-gasification. PGPCL has a peak re-gasification capacity of 750 MMCFD (OGRA, 2020).

Box 2. Issues in LNG Imports

- Government is the only player in the LNG-importing business_ no competition.
- Procedural delays in making import decisions due to bureaucratic hurdles_ PPRA Rules do not allow to take benefit from low prices in the spot market. Under PPRA rules, the complete import process (on average) takes more than 60 days.
- Demand projection is critical in procuring LNG in the spot market. In Pakistan, it is challenging due to ambiguities associated with LNG consumption in the power sector_ consuming more than half of LNG supplies.
- The spot LNG market exhibits more volatility than other fuels; prices can move substantially in either direction when the LNG vessel arrives.

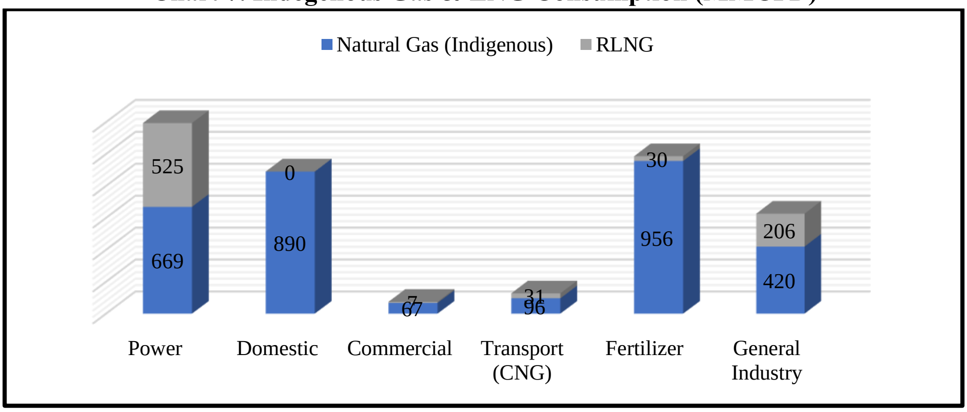
Source: SBP, 2021.

Rising LNG price trends in the global energy market are creating problems in securing LNG supplies in Pakistan[137]. The LNG price shock is expected to continue over the coming several years due to global developments in the wake of the Ukraine War.

Substantial government involvement across the LNG supply chain, the distorted subsidy structure[138], and political preference for the subsidised category make the actual recovery of LNG costs difficult[139]. Like exploration activities, the current operational, regulatory, and procedural challenges have more to do with government control and exclusive involvement in the business. How much to import LNG in the spot market or through a long-term contract is unclear.

There is a dual gas pricing system; local gas and RLNG are priced independently (Malik, 2021). The Senate of Pakistan in February 2022 approved the Weighted Average Cost of Gas (WACOG) bill. Under WACOG, all gas sources, including Re-gasified Liquefied Natural Gas (RLNG) and local gas, will be pooled in, and a weighted average cost will be taken for gas purchase. But a month later, the bill was challenged in court, and a stay was granted.

Chart 7. Indegenous Gas & LNG Consumption (MMCFD)



Source: Pakistan Energy Outlook, 2020

[137] Spot Asia LNG rates are three times higher than normal for this time of year (Hasan, 2022).

[138] Pakistan featured in the top 10 countries providing the most subsidies to the natural gas sector in 2019, with the level close to the one observed in the gas-exporting countries. The subsidy amount was around US$ 1,750 million in real terms compared to US$ 873 million in India and US$ 824 million in Bangladesh.

[139] Low quality appliances consume more gas than national or international set standards. Consuming LNG in these products is criminal (Sattar, 2020).

Over Regulated

All the activities in the gas sector in Pakistan, directly or indirectly, are under government control (Figure 1). An independent regulator was established in 2002 to regulate mid and downstream activities. Still, it remained hostage to government decisions because of the extensive state presence in all activities in the supply chain. The OGRA law allows too much mandatory government involvement in the current oil and gas regulatory system. That has made the regulator powerless[140].

Government interference in service providers' affairs has led to cross-subsidy and an overall deficit in the gas sector. The circular debt in the gas sector has crossed Rs 1.5 trillion, contributed by both the utilities SNGPL and SSGCL. The gas sector deficit is increasing because of the differential in consumer prices and the determined revenue requirements (ICAP, 2020).

Figure 3. Government Controlled Activities in the Gas Sector

Producer Pricing & Gas Allocation	• Allocation of gas from different sources_ local wells to LNG imports are made by the Government of Pakistan (GOP). • Well-head prices are fixed by the Oil and Gas Regulatory Authority (OGRA) per Petroleum Concession Agreements/contracts made by the GOP.
Revenue Requirements	• OGRA determines revenue requirement / prescribed prices of natural gas utilities for various categories of retail consumers (under Sec. 8, OGRA Ord., 2002), but the GOP sets the parameters.
Consumer Pricing	• GOP determines consumer-end prices for various consumer categories after adjusting subsidy or GDS to the prescribed prices and advises OGRA for notification.
Pricing Mechanism	• Uniform consumer tariff policy all over the country_ to achieve political motives by the GOP. • Cross-subsidization across various consumer categories.
RLNG	• RLNG Pricing by OGRA monthly_ under Petroleum Product (Petroleum Levy) Ordinance, 1961 and Petroleum Products (Petroleum Levy) Rules, 1967. • RLNG pricing notified by Pakistan State Oil (PSO).
Gas Companies	• Upstream activities are dominated by State-owned companies, and GOP regulates upstream activities. • RLNG Import supply chain is under state ownership. • All the mid & downstream activities are owned and operated by two state-owned utilities_ SNGPL and SSGCL.

[140] Cited from OGRA Evaluation, Effectiveness of Oil and Gas Regulatory Authority (Malik, Unpublished).

Government irregularities in regulatory frameworks and poor policy formulation are hindering sectoral growth and creating inefficiencies in the supply chain. Politically influenced allocations and monopolistic business operations are all bottlenecks (Sattar, 2020).

Apart from issuing licenses, there is no effective role of OGRA in regulating gas sector prices. The Authority is only computing prices based on already set parameters by the government. Due to the gigantic state presence in the gas sector, the enforcement of performance standards by OGRA has also remained weak.

Midstream & Downstream Inefficiencies

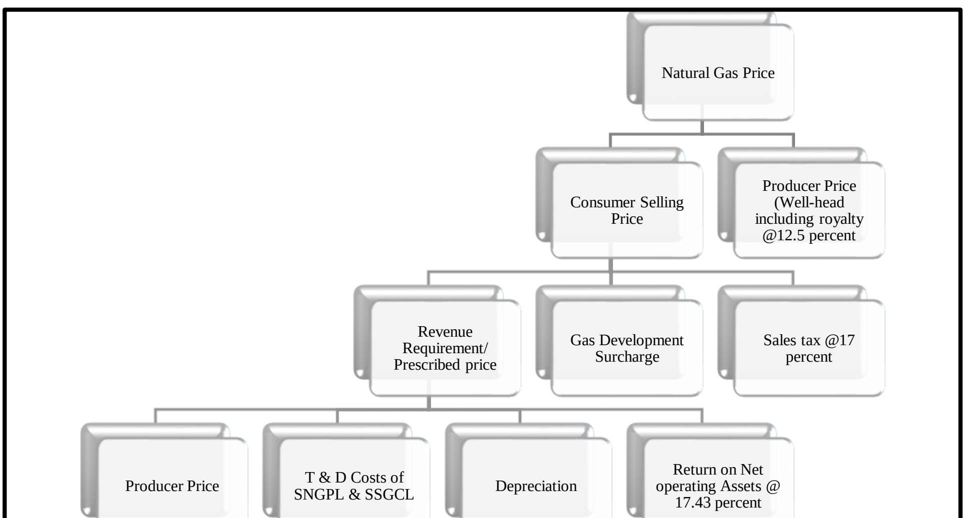
The objective behind OGRA was to foster competition and increase private investment and ownership in the midstream and downstream petroleum industry. But the privilege state monopolies have enjoyed has not allowed this to happen.

Unlike many gas markets, they do not own gas molecules; therefore, they are not in competition with gas producers. They buy gas from the wellhead, transport and distribute gas under a 10–25-year contract at prices determined when E &P concessions were awarded. Transmission & distribution fees are relatively modest compared to gas markets like Brazil (Malik, 2021).

- Financial returns to these companies are linked to the transmission and distribution assets (network).
- Tariff setting rewards capital investment in network expansion over pipeline maintenance.

The calculation of the revenue requirements (in tariffs) incentivises network expansion over pipeline maintenance. New connections increase the utility's fixed assets, and the companies are guaranteed a market-based return of 17.43 percent on their net operating fixed assets (OGRA, 2020).

Fig. 4. Consumer Gas Price Mechanism (Cost-Plus)



- Ensuring reliable and high-quality uninterrupted natural gas supply and efficient services is one of the critical aspects of the regulatory process. The gas distribution companies must maintain adequate pressure in the transmission pipelines and distribution networks and upgrade the system where necessary to ensure supply of contractual volume and pressure to its consumers. Gas resources are depleting, but these monopolies are expanding their transmission and distribution networks to maximise their financial returns (Table 2). These companies, especially SNGPL, have earned enormous profits over the years (Charts 8 & 9).

Table 2

Transmission and Distribution Network (Km)

	Transmission		Distribution	
	SNGPL	SSGCL	SNGPL	SSGCL
2007	6142	3290	36919	23448
2020	9588	4126	135887	47520
Growth	3.2%	1.6%	9.7%	5.2%

Source: Pakistan Energy Yearbook (2012) & OGRA State of Industry Report, 2019-20.

Chart 8. UFGs Growth

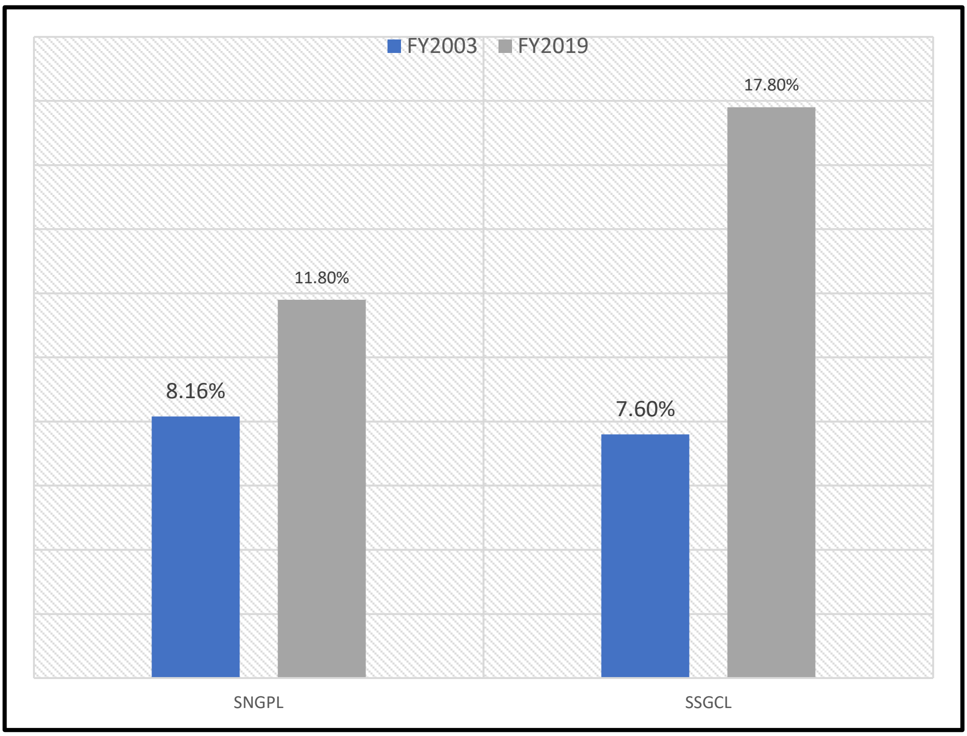
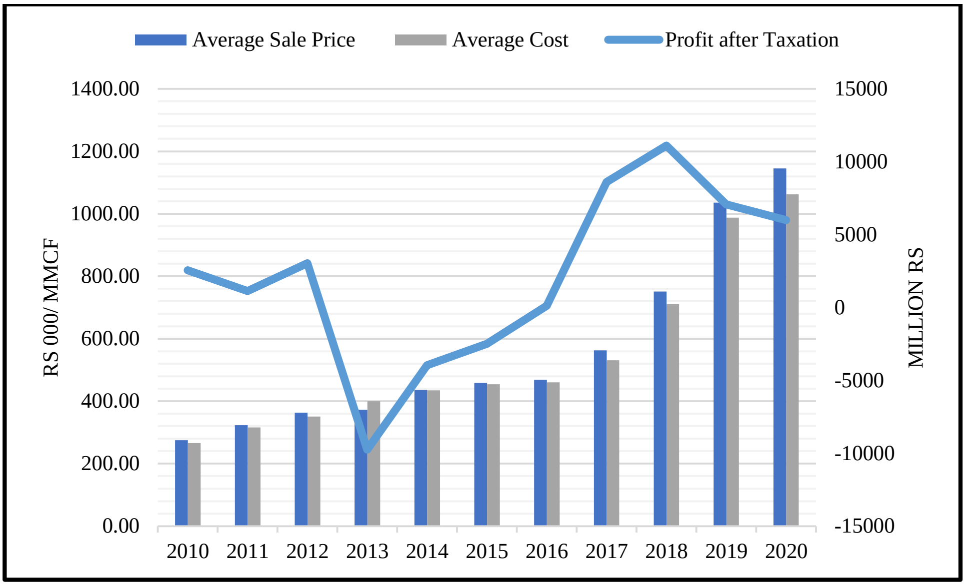


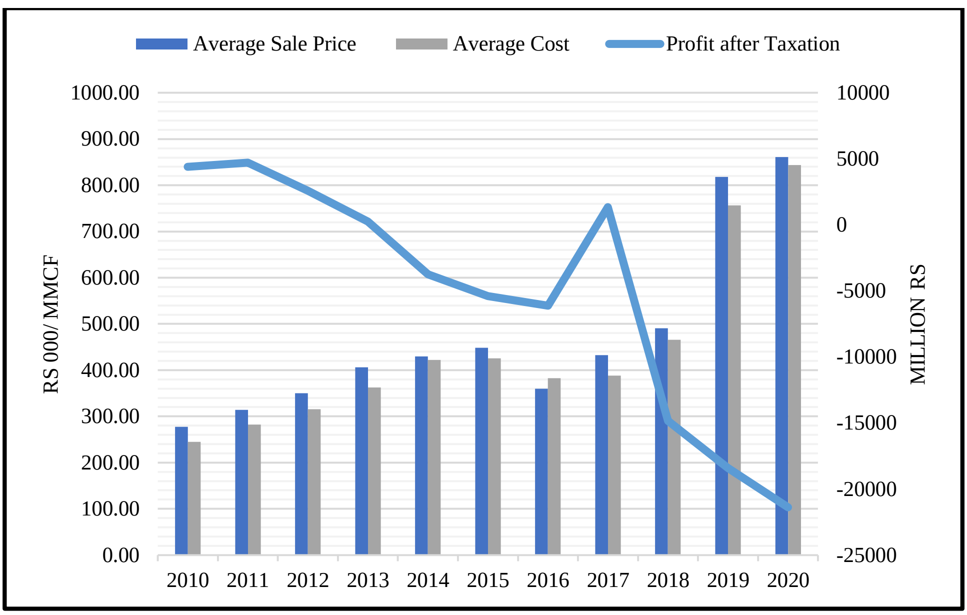
Chart 8. SNGPL Profit Trend



Source: SNGPL and SSGCL Annual Reports.

In both utilities, mismanagement and irregularities have affected their operational performance. Though private entities own 40 percent or more of their shares, these companies have no business model. There is no regulatory mechanism to link their financial returns to their operational efficiency; UFGs in these companies are seven times the world average.

Chart 9. SSGCL Profit Trend



Source: OGRA Annual Report 2003 & PIDE (2020).

Underground leakage from ageing pipelines, poor maintenance, measurement errors, wrong billing, law & order, and theft have contributed significantly to Pakistan's unaccounted-for gas (UFG) (KPMG, 2017). The two integrated companies, SNGPL and SSGC, are over-regulated monopolies with no incentive to improve their inefficiencies and service delivery. Against the OGRA allowance of UFG at 4.5 percent, the gas losses in these companies remained relatively high. After 2017, this allowance increased to 7 percent and 8.5 percent for SNGPL and SSGCL to compensate for declining profits.

Box 3. International UFG Allowances

- Germany_ 0.22 percent
- US, UK, Canada, and New Zealand_ 1.0 percent to 2.6 percent.
- Actual UFGs in some states of the US is 0.36 percent.
- Australia_ 0.5 percent to 4 percent.
- Croatia_ 3.3 percent
- Turkey, Russia & Bangladesh_ 4.2 percent to 5.0 percent

Source: KPMG, 2017.

Box 4. Gas Market Reform_ Lessons from Japan and South Korea

- Japan and South Korea embarked on market liberalisation over two decades ago. Both are dependent on LNG imports. Japan meets one-fourth of its energy needs through LNG imports from Australia, USA, Qatar, and Russia.
- In both countries, the power sector is the leading gas consumer.
- Before Reforms
- In Japan and South Korea, because of high fixed costs and economies of scale, the retail gas sector was a monopoly_ the retail sector enjoyed government support via tariff regulations and supply and safety obligations.
- Before reforms, Japan's import, wholesale, and retail sectors had private-sector participation (regional monopolies), unlike South Korea. In South Korea, a single state-owned Company (KOGAS) was responsible for all gas sector activities _ owner and operator of the pipeline network, as well as all of the country's LNG import and regasification terminals and storage facilities.
- After Restructuring
- The government in the two countries unbundled the pipelines' service business and allowed new entrants to use the pipeline networks. The reforms promoted retail competition in the pipeline network and the import and terminal networks.
- The new entrants in the retail sector are now free to sell gas in any area. Tariff restrictions are also removed.
- To encourage third parties' access to LNG terminals, the terminal owners are prohibited from rejecting third-party use and are required to report and publish their annual utilisation plans.
- Liberalisation in Japan aimed at commencing competition in the retail business. Whereas South Korea focused on the privatisation of KOGAS and on introducing competition into the import and wholesale sectors of the market.
- The objective in both countries was to increase competition. The experience in these two countries is similar to the liberalisation process in European gas markets.
- Comparison between Japan and South Korea suggests that an open-access regime is more crucial for de-regulating SOE-dominated markets.
- Market reform is a complex legal, political, and economic process that demands consistency in policies and political commitment, notwithstanding political crises.

Source: Choi (2019) & SBP (2021)

Regarding the return on assets, the mechanism was adopted some thirty years back when the Asian Development Bank and World Bank lent both companies for their infrastructure development and wanted a guaranteed return. Now this guaranteed return is disincentivising efficiency. No efforts are underway to get away from this mechanism.

WAY FORWARD

- Prioritise exploration activities for relying minimum on LNG imports_ correct well-head prices and minimise government interference.
- A progressive and market-based exploration policy is needed.
- Pakistan should de-regulate the natural gas sector and liberalise the pricing structure. A market-based pricing system will also curtail the misuse of gas.
- For LNG imports, third-party access_ increased involvement of the private sector in the LNG supply chain, as happening in mature LNG markets like Japan, South Korea and even in India[141]. Higher private sector participation in these countries facilitates cheaper fuel availability, smooth procurement processes and allow market-based price discovery (SBP, 2021).
- To maximise returns from private sector involvement and guarantee the sustainability of the natural gas sector, it is essential to first solve the profound structural and operational challenges.
- Without rationalising the subsidy structure, the financial viability of the natural gas sector is difficult to achieve. The tariff must be set on a cost-of-service basis for a reliable and sustainable gas sector.
- WACOG or any other price pooling formula does not seem politically feasible. The government must begin passing LNG costs to the consumers. Otherwise, the circular debt will continue to inflate as in the power sector.
- Gas allocation to sectors should be from a growth perspective and not based on political decisions. Energy efficiency legislation and strict implementation in all sectors are compulsory.
- Restructuring of gas utilities is required to improve their operational and managerial efficiency. Unbundling these monopolies between ‘pipeline’ and ‘retail’ is inevitable before allowing for other private participants in the ‘pipeline’ and ‘retail’ business.
- To improve management and administration in SNGPL and SSGC, slicing them into smaller units may also help.
- It’s high time to get rid of guaranteed returns based on network expansion. Companies must have a business model to earn profits from operational efficiency.
- UFGs can be reduced by strictly monitoring the supply chain and putting the cost of the losses on the distribution companies, which will ultimately ensure their efficiency.
- All gas companies should operate commercially without any political interference by any government.

[141] India recently has de-regulated its natural gas sector.

- Government should limit its role to policy making and effective legislation for market liberalisation.
- There should be a single autonomous regulatory authority for upstream, midstream, and downstream activities. But the regulator must have powers and capacity to monitor the sector effectively and ensure market development.

REFERENCES

Choi, J. (2019). Developing Free and Open Markets: Gas Market Reform in Japan and South Korea. NBR Special Report 81, https://www.nbr.org/wp-content/uploads/pdfs/publications/sr81_revolutionizing_lng_oct2019-1.pdf

Farid, N. R. (2021) Gas Allocation Policy: A Skewed Priority and a Vicious Cycle. Available at https://www.brecorder.com/news/40084607

Hasan, M. (2022) Pakistan Takes Another Shot at LNG Import. The News, June 17, 2022.

ICAP (2020), "Oil & Gas Sector – Exploration, Production & Distribution: Surviving the Crisis & Entering the New Normal", Post Webinar Paper, Institute of Charted Accountants of Pakistan.

KPMG (2017). Oil & Gas Regulatory Authority Un accounted for Gas – Study. Final Report July 2017. Karachi: Klynveld Peat Marwick Goerdeler.

Malik, A. (2021) Gas and Petroleum Market Structure and Pricing. PIDE Monograph Series, 2021.

PIDE (2020). The gas system in Pakistan. PIDE Webinar, October 24, 2020.

Raftaar (2016). Gas report. (Report No. R1502), Consortium of Development Policy Research (CDPR), https://cdpr.org.pk/wp-content/uploads/2020/03/Gas-Reportmerged-final.pdf

Sattar, S. (2020) Gas Sector in Pakistan, presented in PIDE Webinar on 'The Gas System in Pakistan' October 24, 2020.

SBP (2021) LNG-Attaining Sustainability Through Deregulation and Structural reforms, State Bank of Pakistan, Second Quarterly Report, 2020-21.

Petroleum Pricing in Pakistan*

HAFSA HINA and AFIA MALIK

INTRODUCTION

The petroleum pricing is significant for a fuel economy like Pakistan. Where, the dependence on oil is not expected to decline in near future but increase; as the country's infrastructure continues to rely on petroleum-based products. In Pakistan, oil is the largest source of energy consumed. In FY2019, despite the decline in oil consumption, it fulfils 32 per cent of our total energy demand.

The petroleum industry is also a major contributor to government revenues. In FY 2019, petroleum taxes contribute about 51 per cent to total tax revenues. Additionally, Pakistan is dependent on imports for 81 per cent of its oil requirements. The petroleum pricing is also a sensitive issue from a consumer's perspective, given low per capita income in the country (US$ 1284.7).

This brief provides an overview of petroleum pricing in Pakistan.

PETROLEUM PRODUCT PRICING IN PAKISTAN

Chronology of Petroleum Pricing Deregulation

The government used to have tight control over the petroleum sector in Pakistan. All the decisions were made solely by the government and were often based on political as opposed to economic considerations. Petroleum prices were also under tight government regulation (Malik, 2007).

In 2000, the government initiated pro-market reforms in the petroleum sector to limit the role of the government for policy making only. The government also changed the guaranteed return formula of the refineries to an Import Parity Price (IPP) formula. Prior to these reforms, refineries were working under a fixed return formula where the return was capped in the range of 10 to 40 per cent of their equity. Thus, the government was liable to meet any loss in the profitability of the refineries (Ansari, 2004).

In 2001, the government authorised the Oil Companies Advisory Committee (OCAC) to review, fix and announce the prices of petroleum products on fortnightly basis in accordance with the approved pricing formula, as a part of deregulation policy. Therefore, between July 1, 2001, and April 1, 2006, OCAC reviewed and announced the ex-depot prices of motor spirit (gasoline), kerosene, and light diesel oil fortnightly in accordance with the approved formula.

---

* It was published in PIDE Monograph Series, May 2021.

In 2002, the Oil and Gas Regulatory Authority (OGRA) was established to perform pricing and regulatory responsibilities as an independent agency. Later in 2006, the function of price fixation was transferred to OGRA.

> Government of Pakistan (GOP) delegated the powers to OGRA to fix petroleum prices via Cabinet's decision No. 41/03/2006 as per Government's prescribed formula, under Section 6(2)(r) (relating to powers and functions of OGRA) and Section 21(2)(b) (regarding policy guidelines) of Oil and Gas Regulatory Authority Ordinance, 2002 (OGRA, 2019).

In 2011, the GOP further deregulated the prices of petroleum products of Motor Gasoline (MS), High Octane Blending Component (HOBC), Light Diesel Oil (LDO), JP1, JP4 and JP8. As a result, refineries and OMCs fix and announce the ex-refinery prices and ex-depot prices of the same. Later in September 2012, the GOP deregulated ex-refinery price of High-Speed Diesel (HSD); whereas ex-depot price of HSD has already been deregulated since September 2001.

Government Approved Fuel Pricing

Price Build-up formula consists of:

(i) Ex-refinery import parity price/PSO weighted average cost of purchases
(ii) Federal Excise duty _ as per FBR rates
(iii) Inland Freight Equalisation Margin (IFEM)
(iv) Distribution Margin
(v) Dealer's Margin
(vi) Petroleum Levy or surcharge (fixed and notified by Ministry of Energy, Petroleum Division)
(vii) Sales tax (fixed and notified by FBR)_ 17 percent

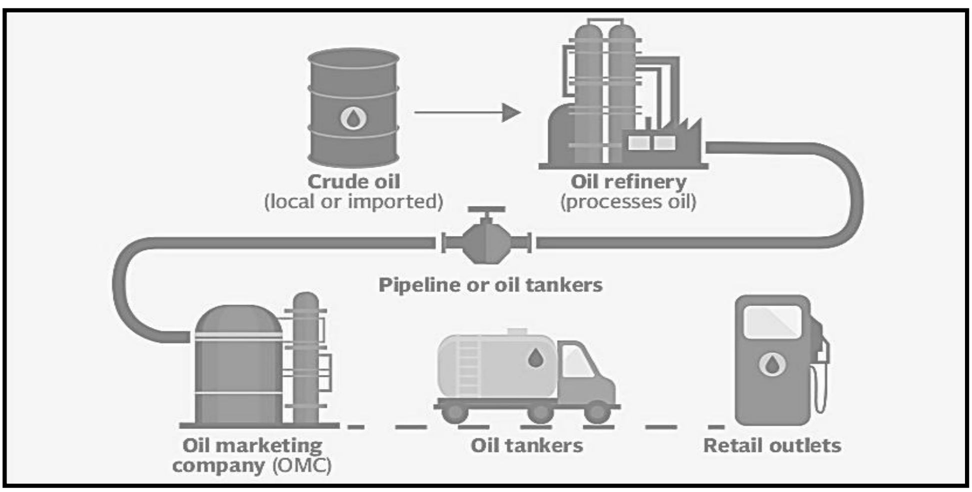


Photo Courtesy: The Express Tribune

Figure 1 to Figure 6 demonstrates the price build-up for various petroleum products for 2020, that is, the share of various components in the final price of fuel. A major portion is of ex-refinery price in all the petroleum products, followed by sales tax and petroleum levy surcharge; exception is E-10 gasoline where petroleum levy is more than 20 per cent in final fixed price (Figure 2).

Fig. 1. Kerosene

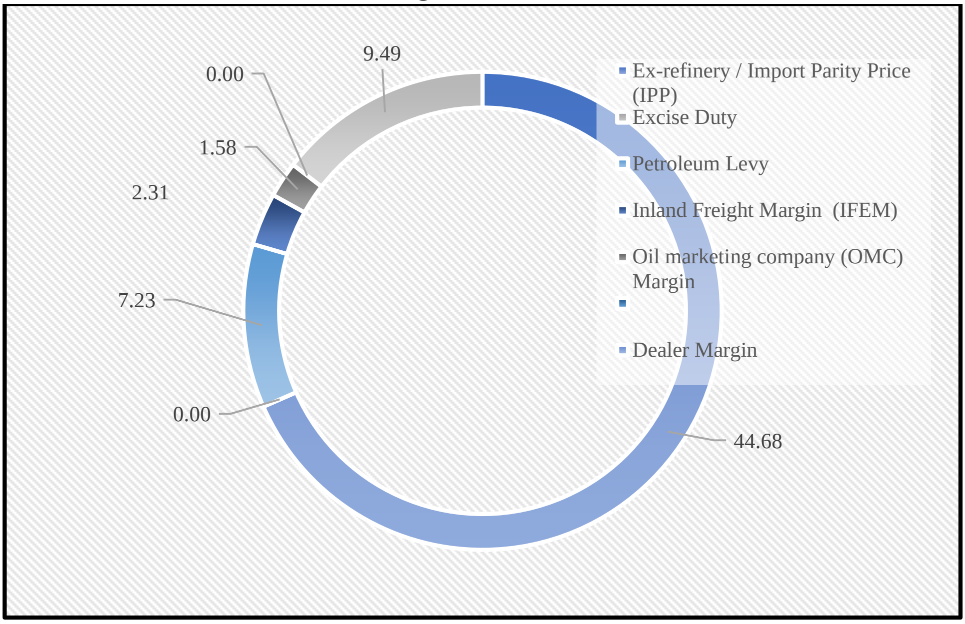


Fig. 2. E-10 Gasoline

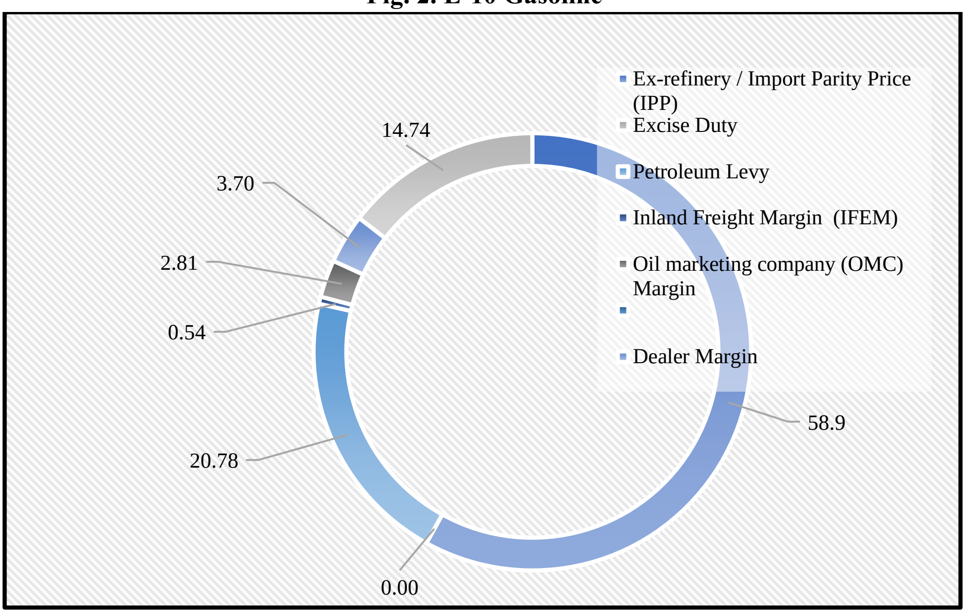


Fig. 3. MG

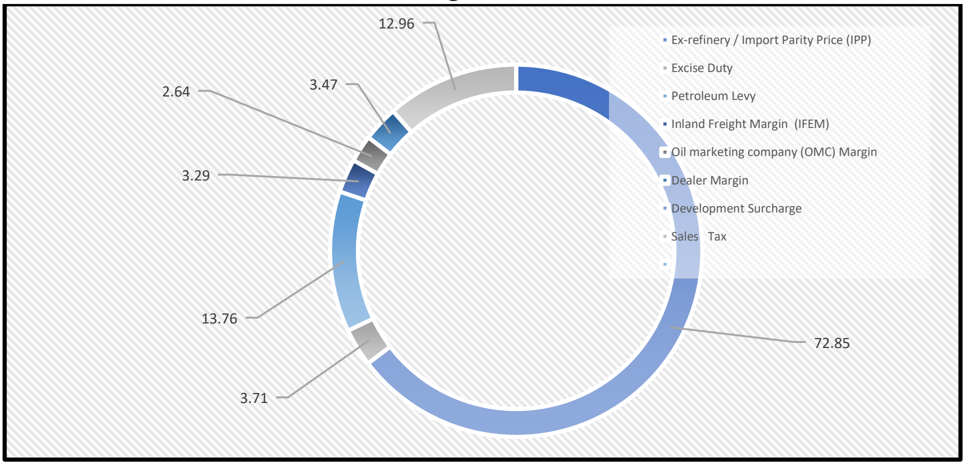


Fig. 4. HSD

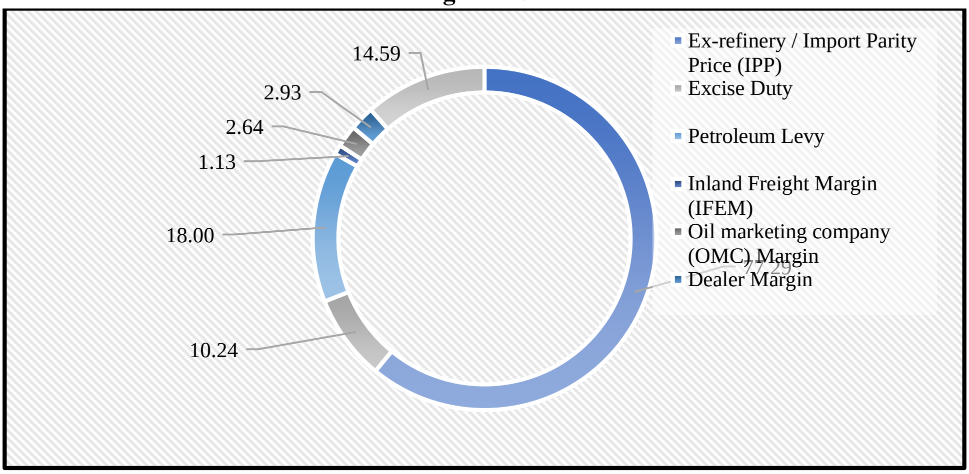


Fig. 5. LDO

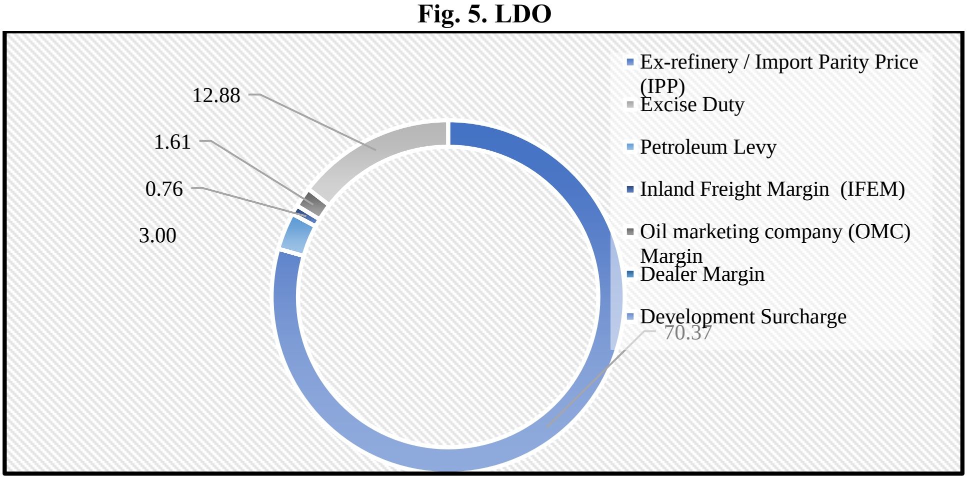


Fig. 6. HOBC

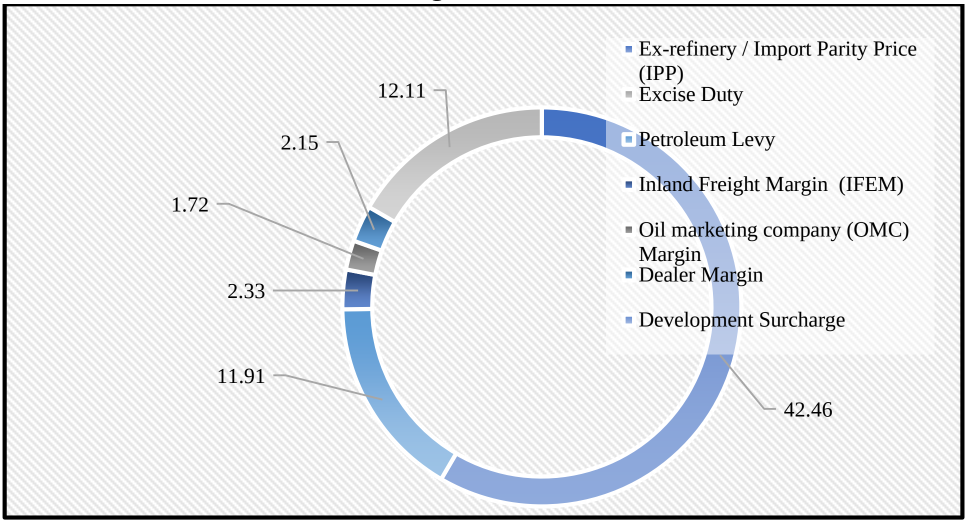
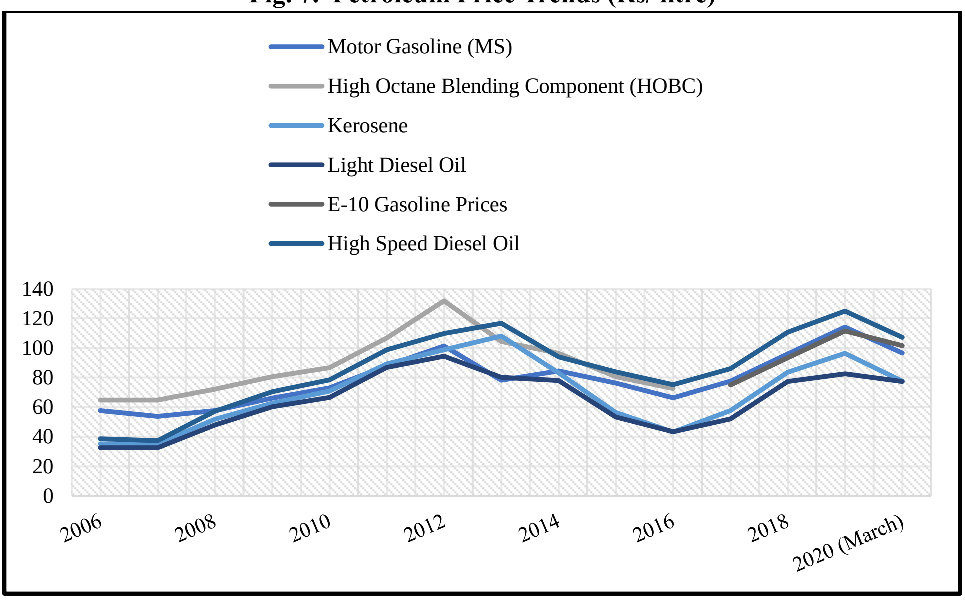


Figure 7 illustrates the fuel price trends over the years. Since 2008, all petroleum products have been following a similar pattern. Petroleum prices were capped in FY2007, later they increased. The GOP was paying subsidies on LDO, Kerosene and HSD to keep prices low prior to FY2008. Later the subsidy was removed gradually. The difference between subsidised products and HOBC and MG can easily be seen in Figure 7. It is important to highlight that about 70 per cent of HSD consumed in FY 2019 was locally produced. Similarly, the demand for LDO and Kerosene is satisfied through local refineries.

Fig. 7. Petroleum Price Trends (Rs/ litre)



Source: OGRA, 2020 and Pakistan Energy Yearbook, 2020.

(a) Ex- Refinery Price

Ex-Refinery price of all petroleum products _MS, HSD, LSD, JP1, JP4 and JP8 cannot be more than the PSO average actual import prices of the previous month excluding PSO import incidentals. For ex-refinery formula of HSD & MS, PSO actual import incidentals excluding ocean losses are adopted.

It is the price at which all refineries sell their finished products. In case of non-availability of PSO import prices, the refineries fix their ex-refinery price as per existing Import Parity Pricing formula. It is calculated by the Oil Companies Advisory Council (OCAC). Import Parity Price is determined after taking an average of past 30-days international prices as published in the Platt's Oil gram (a source of pricing benchmark in the physical energy markets). All other allowed expenses of refineries (including handling, bank & ocean charges, marine insurance, wharf age and surcharges as well as its factory overheads) are then adjusted to this average (Moiz, 2019).

(b) Inland Freight Equalisation Margin (IFEM)

Since 2008, the responsibility of management/ computation of IFEM are with OGRA. The IFEM is charged on all petroleum products to maintain uniform rates at 22 depots spread throughout the country: irrespective of difference in transportation costs. The price of HOBC is exempted from IFEM charges since 2011.

All the country's petroleum imports, or indigenous supplies are concentrated in the South (Keamari in Karachi), while the demand for petrol is everywhere. If the freight costs or transportation charges from Karachi to any part of the country were to be part of the pricing structure, then there would have been different prices of gasoline or diesel.

Secondary transportation cost from depot to retail outlets is deregulated and the dealers have been allowed to recover it from the retail consumer by including it in the pump/retail price. Furthermore, secondary freight in special areas (Chitral, Gilgit Baltistan, AJK and some parts of Baluchistan) is also picked up through IFEM mechanism to provide relief to the consumers of special areas.

Box 1: IFEM includes:

- Costs involved in the transportation of petroleum products to 22 storage depots.
- Adjustments of extra margins earned by OMCs. Extra Margin is part of ex-depot price of HSD & MS, applicable to all OMCs except Pakistan State Oil Company Limited (PSO).
- PARCO Price Differential Claim (PDC), difference between the OGRA announced ex- refinery price and the PARCO Import Parity Price (IPP), allowed under PARCO Implementation Agreement and Petroleum Policy 1994.
- ARL is allowed to recover the crude transportation claim of Adhi and Dhurnal fields from the IFEM.
- HSD price differential surplus by refineries, except PARCO, ARL & NRL.
- Adjustment of MS RON 92 penalty/differential from local refineries not producing MS RON 92 grade.

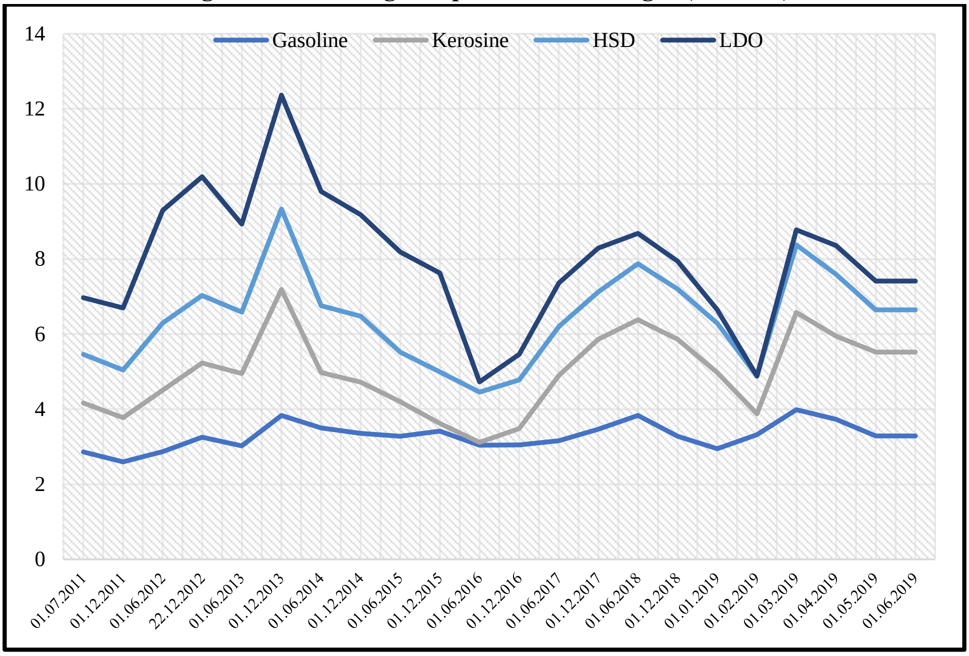
Source: OGRA, 2020

When we look at the price build up formula for petroleum products in the last few years, we found IFEM has been changing over time (every month) for all the products, sometimes moving up and sometimes moving down (Figure 8).

Despite government move towards market liberalisation, competition level on the supply side of the oil industry is almost insignificant. It is the lack of proper incentives not giving space to competition and efficient operation of companies. As a result, no benefits of market reforms have so far trickled down to consumers. Regulatory benefits are going mainly to industry (through protected profits). There is a need for a level playing field to enable competition.

However, with the deregulation of IFEM (which as reported in newspapers, GOP has decided) the prices would vary between cities, as well as between OMCs. The consumer close to ports and refineries would get products at lower rates compared to those away from ports and oil installations (Kiani, 2020).

Fig. 8. Inland Freight Eqaualisation Margin (Rs/ litre)



Source: OGRA State of Industry Report, 2020.

(c) Distribution Margin

It is the Oil Marketing Companies (OMCs) margin per litre upon sales of petroleum products petrol and diesel both to industrial and retail distributors. It is charged on all fuels_ gasoline, HSD, LDO and kerosene.

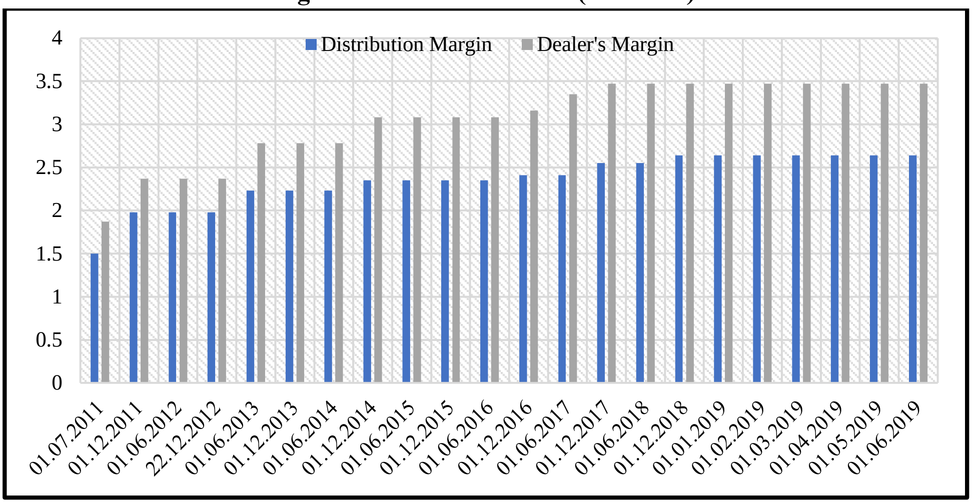
(d) Dealer's Commission

From retail perspective, the OMCs are eligible to sell their volumes coming from storage depots to the nearest retailers or petrol pumps at price, with the addition of franchise fee and non-fuel retail charges (for facilities like tuck shop, car wash, oil & tyre change).

After market-based reforms in early 2000, the margins of oil marketing companies were capped at 3.5percentof the retail price of the petroleum product, whereas dealer's commission was capped at 4 per cent (Malik, 2007). Later in 2014, the margins of OMCs and dealer's commission on gasoline and HSD are revised annually based on the Consumer Price Index (CPI) for doing their business.

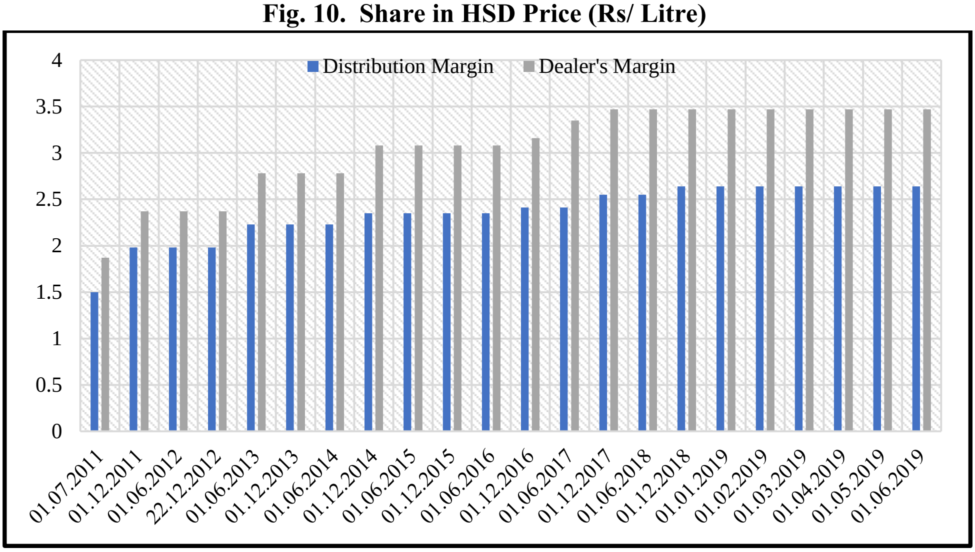
Ex-depot price is mainly dependent on the international price crude oil (more than 70 per cent for both MG and HSD); whereas distribution and dealer margin are both fixed revenue streams for the businesses. The OMC margins are fixed in terms of Pakistani Rupees for gasoline and HSD. The margin related to furnace oil remains linked with the imported price.

Fig. 9. Share in MG Price (Rs/ Litre)



Source: OGRA Reports (Various Years).

Fig. 10. Share in HSD Price (Rs/ Litre)



Source: OGRA Reports (Various Years).

(e) Petroleum Taxes

Fuel taxes have important revenue implications for Pakistan. Oil sector accounts for a significant share of government revenues. Taxes on petroleum products are the largest source of indirect revenues in Pakistan. Petroleum product prices are higher than the import parity price because of these taxes. Petroleum products contributed Rs 1551 billion to government revenues in the form of indirect taxes (federal excise duty, custom duty, petroleum levy and sales tax) in FY2019. It was 35 per cent of total tax revenues in the year. In FY2006, this share was only 15 per cent.

In the final fixed sales price of MG (June 2019), federal excise duty, sales tax, and fixed development surcharge account for about 27 per cent. Similarly, in the final sales price of HSD taxes (sales tax, FED, and petroleum development levy) accounts for 34 percent.

The share of petroleum development levy/ surcharge in FY 2019 was 14 per cent and 12 per cent for HSD and MG. From the business perspective, taking such high amount in the form of taxes is discouraging; when there is hardly any development taking place (Moiz, 2019).

On one hand the GOP is charging such hefty amount from consumers in the form of taxes. Yet, on the other hand, the government has often used petroleum development levy to keep the end user price in check, given the fluctuations in the international price of oil.

Petroleum Taxes

Figs. in %

Product	Taxes
MG (June 2019)	27
HOBC (Oct 2016)	33
Kerosene (Sep 2020)	26
LDO (June 2019)	18
HSD (June 2019)	34
E-10 (Sep 2020)	35

PRICE CAPPING AND OIL PASS THROUGH

Despite deregulation in the oil sector, some elements of regulation have remained its part. To protect the consumer from the impact of high oil prices internationally government often capped the domestic sale prices of petroleum products.

Box 2: The Pass-Through of International Prices

The pass-through from international to domestic retail fuel prices is defined as the ratio of absolute changes in the after domestic taxes retail price of fuel to the local currency price of the relevant fuel import product. World prices are converted into local currency; therefore, the pass-through ratios reflect both exchange rate and price changes. The formula is:

$$Pass\ through = \frac{(P_t^d - P_{t-1}^d)}{(P_t^w - P_{t-1}^w)}$$

Where P^d is domestic and P^W are the domestic and world fuel prices, and *t* and *t-1* refer to current and previous period. In case of increase in international price government decreases the tax rates to limit the impact of impact of international prices.

Pass through Values

	Increase in International Price	**Decrease in International Price**	
Increase in tax	>1	<1	• Overburden the consumer! • Does not protect the consumers! • Aim to correct the fiscal deficit
Decrease in tax	<1	>1	• Protect the consumer! • May have some political interest!
No change in Tax	=1	=1	• Complete pass through!

Kerosene- International Oil Price Pass Through

From July 2011 to September 2020, about 23 out of 56 times increase in import prices for Kerosene are more than fully passed-on the consumer. In complete sample 51 out of 105 times change in international oil price are more than fully passes on to the consumer and only 33 out of 105 times government protect the consumer from increase in international oil prices by reducing taxes.

Table 1

Kerosene International Price Increase and Decrease

International price Increase	Count	International price Decrease	Count	Total
Number of periods	56	Number of Periods	49	105
Increase in taxes/ Pass through >1	23	Increase in taxes/ Pass through <1	28	51
Decrease in taxes/ Pass through <1	33	Decrease in taxes/ Pass through >1	21	54
Same tax/ complete pass through =1	0	Same tax/ complete pass through =1	0	

Fig. 11a. Pass Through in Case of Decrease in International Price

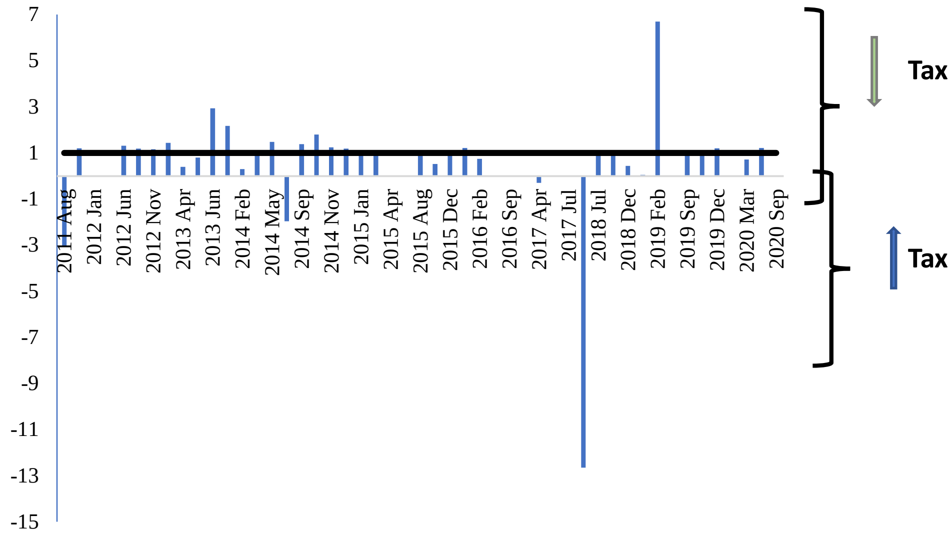
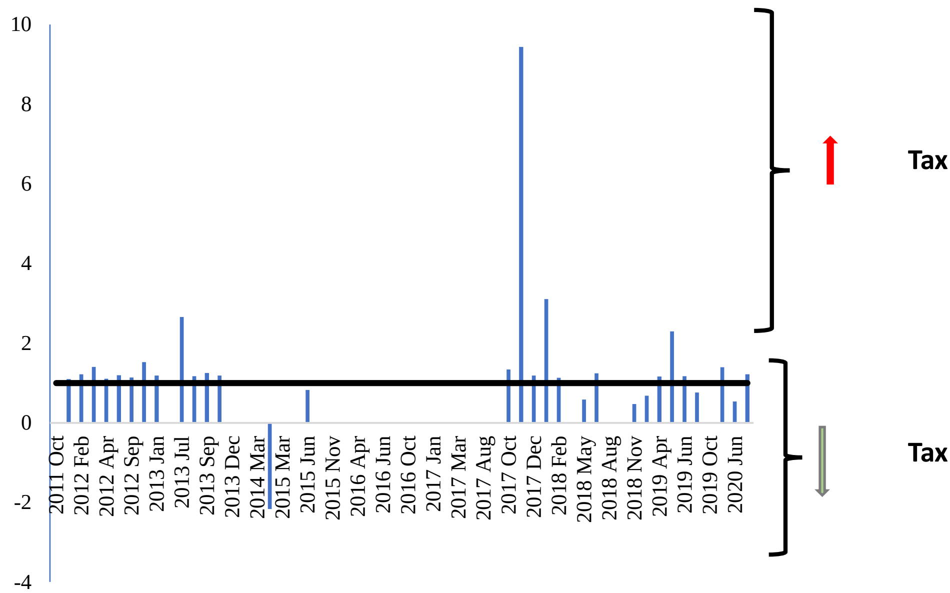


Fig. 11b. Pass Through in Case of Increase in International Price



HOBC—International Oil Price Pass Through

From July 2011 to October 2020, about 16 out of 34 times increase in import prices for HOBC are more than fully passed-on the consumers. In complete sample 32 out of 61 times change in international oil price are more than fully passes on to the consumer and only 18 out of 61 times government protect the consumer from increase in international oil prices by reducing taxes.

Table 2

HOBC International Price Increase/ Decrease

HOBC International price Decreases	Count	HOBC International price Increase	Count	Total
Number of Periods	27	Number of Periods	34	61
Increase in taxes/ Pass through <1	16	Increase in taxes/ Pass through >1	16	32
Decrease in taxes/ Pass through >1	11	Decrease in taxes/ Pass through <1	18	29
Same tax/ complete pass through =1	0	Same tax/ complete pass through =1	0	0

Fig. 12a. Pass Through in Case of Increase in International HOBC Price

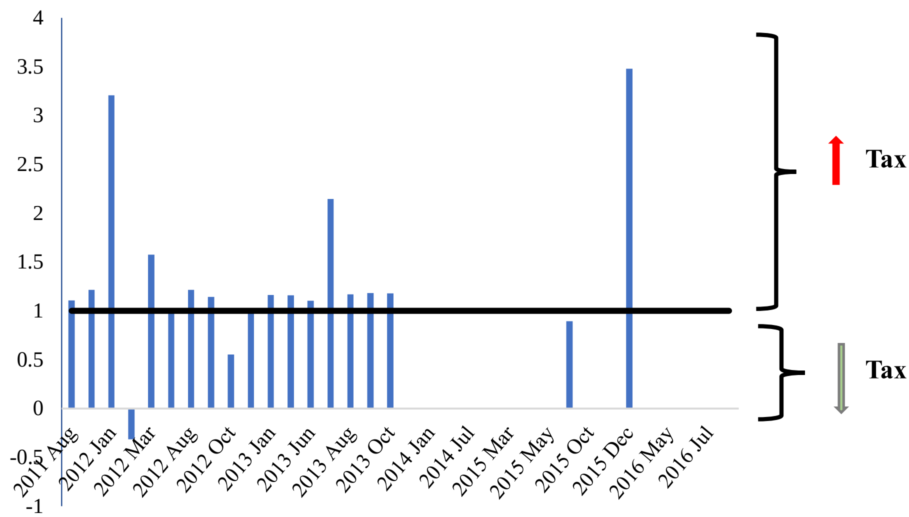
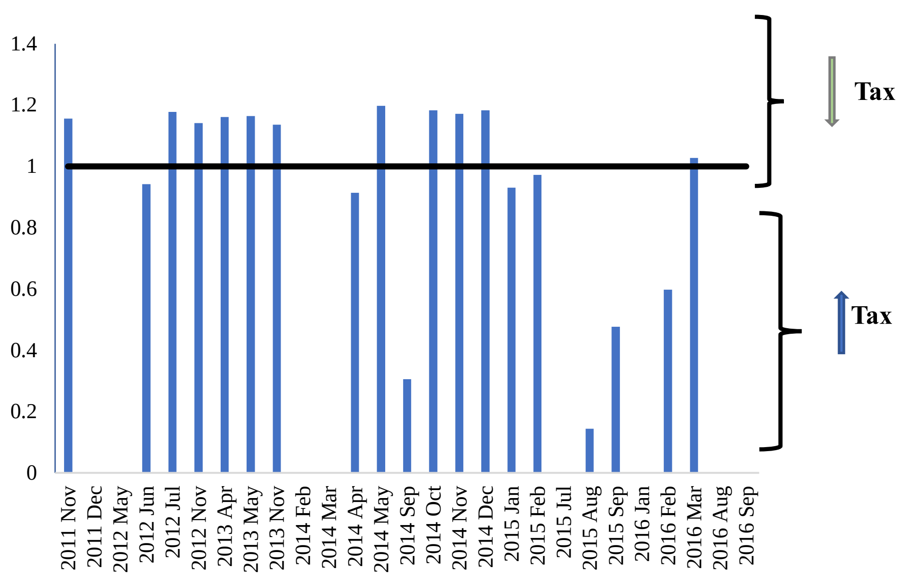


Fig. 12b. Pass Through in Case of Decrease in International HOBC Price



Gasoline—International Oil Price Pass Through

From July 2011 to July 2019, about 23 out of 45 times increase in import prices for gasoline are more than fully passed-on the. In complete sample 51 out of 86 times change in international oil price are more than fully passes on to the consumer and only 13 out of 86 times government protect the consumer from increase in international oil prices by reducing taxes.

Table 3

Gasoline International Oil Price Increase/ Decrease

Gasoline International price Decreases	Count	Gasoline International price Increase	Count	Total
Number of Periods	41	Number of Periods	45	86
Increase in taxes/ Pass through <1	28	Increase in taxes/ Pass through >1	23	51
Decrease in taxes/ Pass through >1	13	Decrease in taxes/ Pass through <1	29	42
Same tax/ complete pass through =1	0	Same tax/ complete pass through =1	0	0

Fig. 13a. Pass Through in Case of Increase in International Gasoline Price

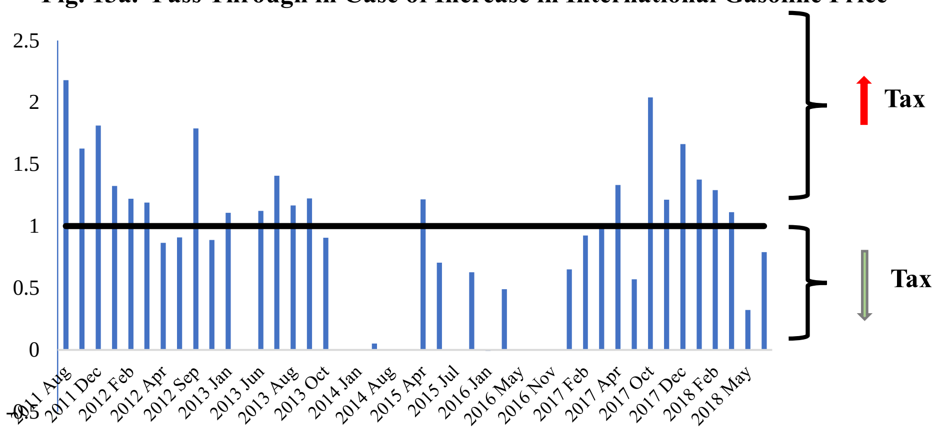
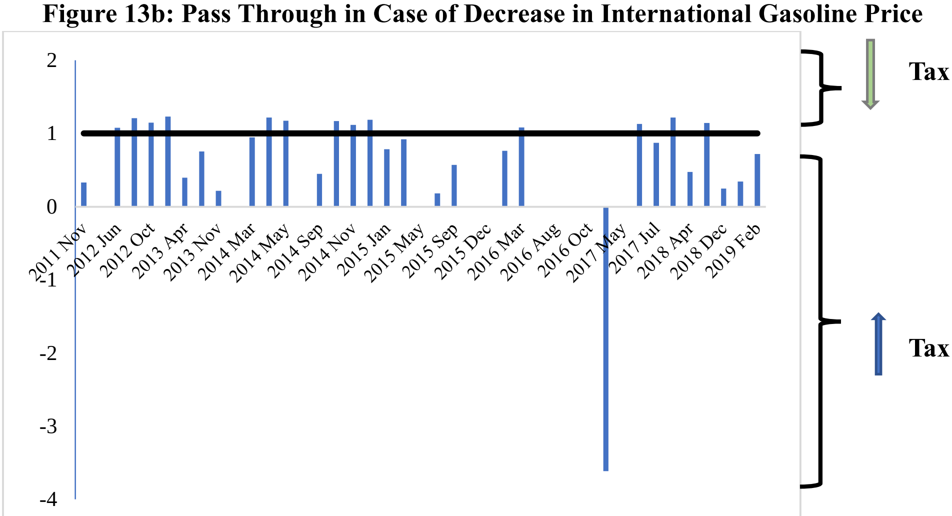


Figure 13b: Pass Through in Case of Decrease in International Gasoline Price



Light Diesel—International Oil Price Pass Through

From July 2011 to June 2019, about 21 out of 54 times increase in import prices for light diesel are more than fully passed-on the consumers. In complete sample 33 out of 92 times change in international oil pass are more than fully passes on to the consumer and only 25 out of 92 times government protect the consumer from increase in international oil prices by reducing taxes.

Table 4

LDO International Price Increase/ Decrease

LDO International price Decreases	Count	LDO International price Increase	Count	Total
Number of Periods	38	Number of Periods	54	92
Increase in taxes/ Pass through <1	12	Increase in taxes/ Pass through >1	21	33
Decrease in taxes/ Pass through >1	25	Decrease in taxes/ Pass through <1	33	58
Same tax/ complete pass through =1	1	Same tax/ complete pass through =1	0	0

Fig. 14a. Pass Through in Case of Increase in International LDO Price

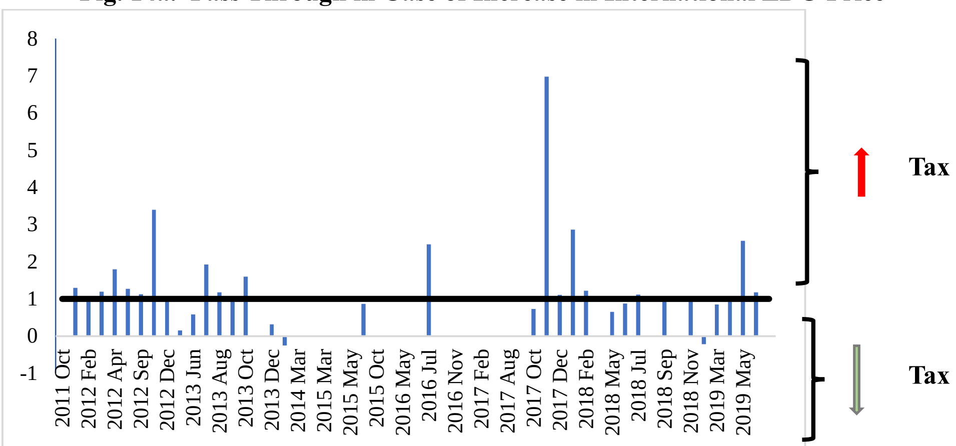
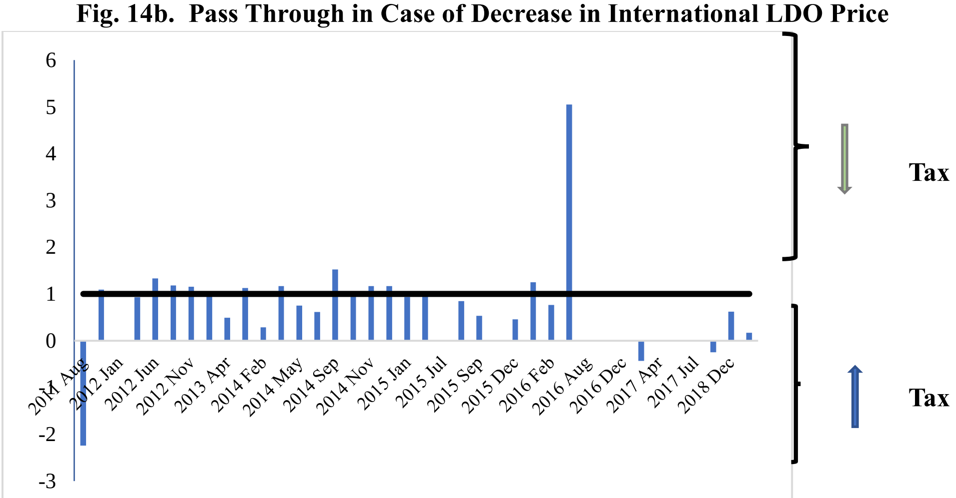


Fig. 14b. Pass Through in Case of Decrease in International LDO Price



High Speed Diesel—International Oil Price Pass Through

From July 2011 to June 2019, about 21 out of 46 times increase in import prices for high-speed diesel oil are more than fully passed-on the consumers. In complete sample 33 out of 91 times change in international oil pass are more than fully passes on to the consumer and only 32 out of 92 times government protect the consumer from increase in international oil prices by reducing taxes.

Table 5

HSD International Price Increase/ Decrease

High Speed Diesel International Price Decreases	Count	High Speed Diesel Oil International Price Increase	Count	Total
Number of Periods	45	Number of Periods	46	91
Increase in taxes/ Pass through <1	12	Increase in taxes/ Pass through >1	21	33
Decrease in taxes/ Pass through >1	32	Decrease in taxes/ Pass through <1	25	57
Same tax/ complete pass through =1	1	Same tax/ complete pass through =1	0	0

Fig. 15a. Pass Through in Case of Increase in International HSD Price

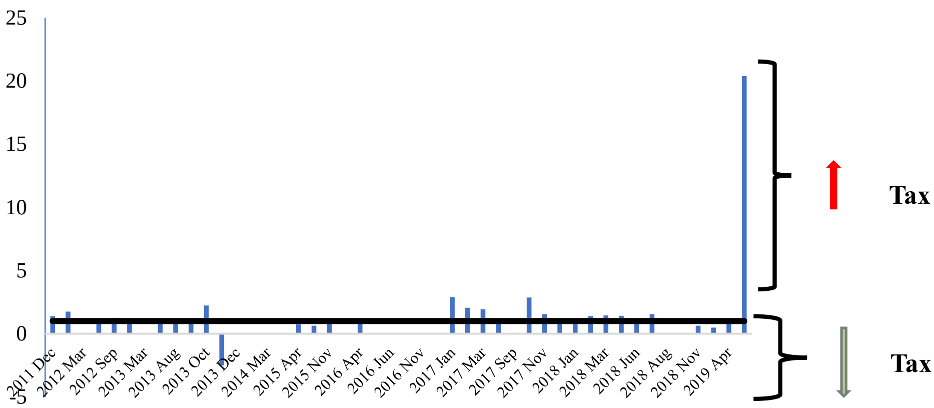
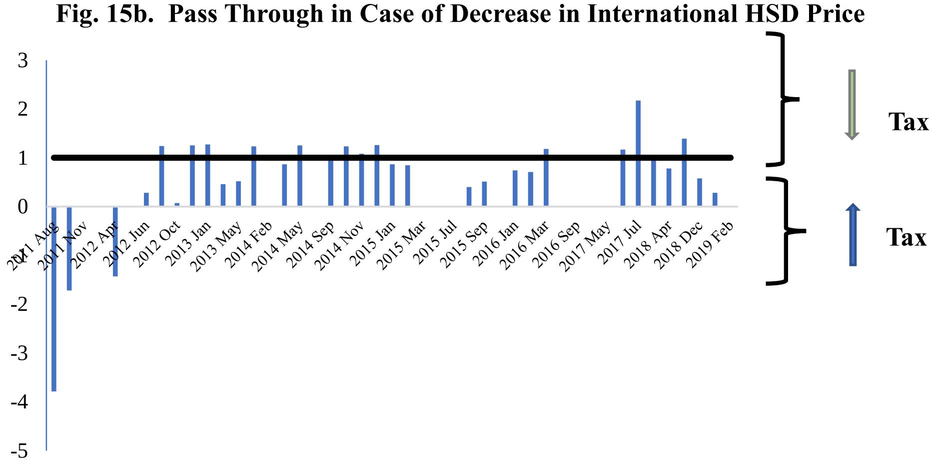


Fig. 15b. Pass Through in Case of Decrease in International HSD Price



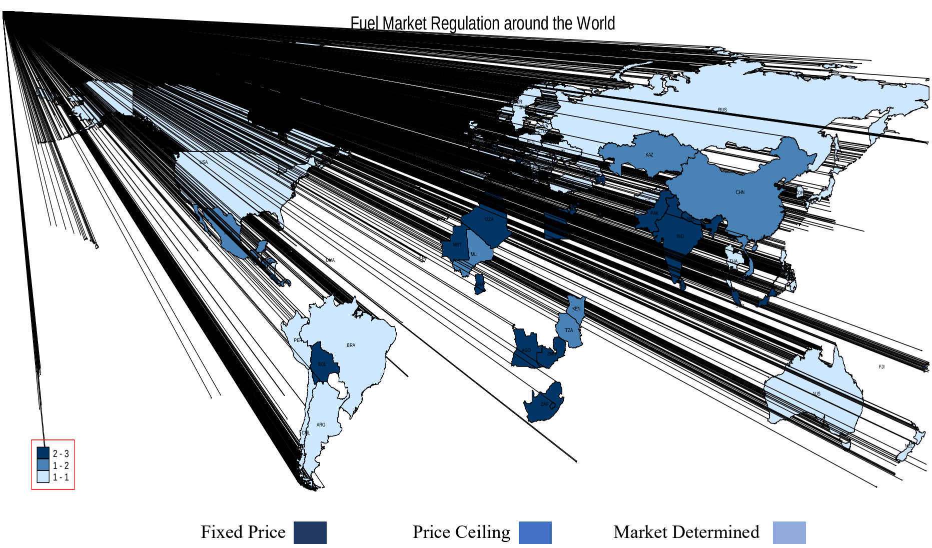
Pakistan over the years has followed a cautious policy for the pass-through of the decline in international oil prices. It made more decrease in domestic oil prices compared with a number of other regional countries, yet also retain some of the ‘potential consumer surpluses with itself. Not only did the government made tax revenues, this policy rather helped in demand management also (SBP, 2016).

Oil Price Mechanism Across Countries

In many oil importing countries, petroleum prices are determined according to world crude oil prices and exchange rate movements. However, the government intervention in the energy market varies across countries depending upon the characteristics of energy market.

Box 3. Methods—Retail Fuel Price Determination
Market-determined retail fuel prices. State intervention is limited. Fuel retailers set their selling prices freely without major restrictions. Therefore, the fuel prices at different stations and in different regions of the country could vary. Price ceiling. Fuel retailers are free to determine their selling prices as long as they do not exceed the specified ceiling set by the government to protect consumers from sudden upward increase in prices. Fixed price. The most extreme form of price control is when the government or another authorised

Following map classifies fuel market regulation in 90 countries depending on which of the three main retail fuel pricing methods they apply.



Source: Data for map is taken from www.globalpetrolprices.com.

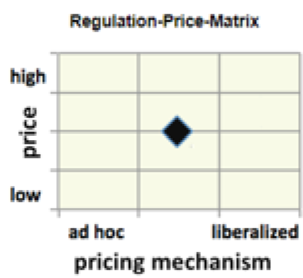
In 60 per cent of the reviewed countries fuel markets are liberalised and the retail fuel prices are market-determined. Except for few (like Afghanistan, Uganda, and Kyrgyzstan), these are highly developed countries_ USA, Japan, Australia, New Zealand, and most European countries.

Pakistan is among the remaining 40 per cent, where government is involved in the retail fuel pricing with a price ceiling or a fixed price. In this category, apart from developing countries, some of the developed countries (like for example, Belgium, Luxembourg, and Malta) also falls in this category.

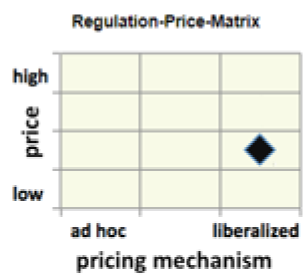
Regulation Price Matrix in Selected Countries

The following regulation price matrix also explains that in Pakistan despite being liberalised, some sort of government check is in place unlike developed countries like USA and Japan, and similar to India and China.

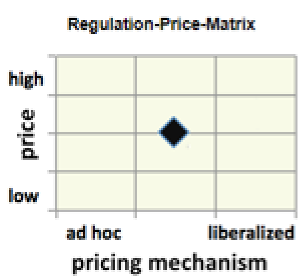
China



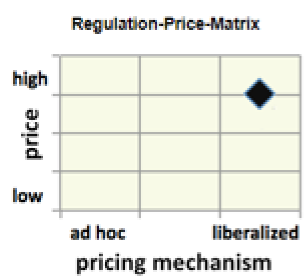
USA



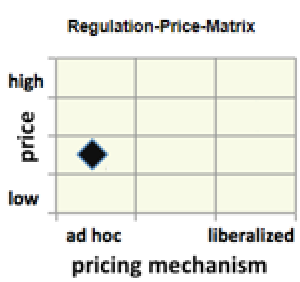
India



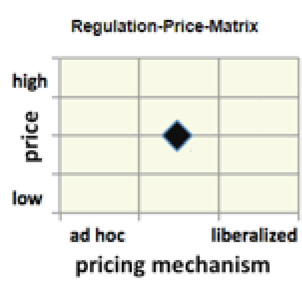
Japan



Bangladesh



Pakistan



However, in terms of transparency Pakistan is better than countries like India and China (Table 6a and Table 6b).

Table 6a

Transparency of Price Composition

Country	No information available	Only partial information / available or poor / unclear / hard to find information	Full information available
China	✓		
USA			✓
India		✓	
Japan			✓
Bangladesh	✓		
Pakistan			✓

Table 6b

Transparency of Price Mechanism/ Monitoring

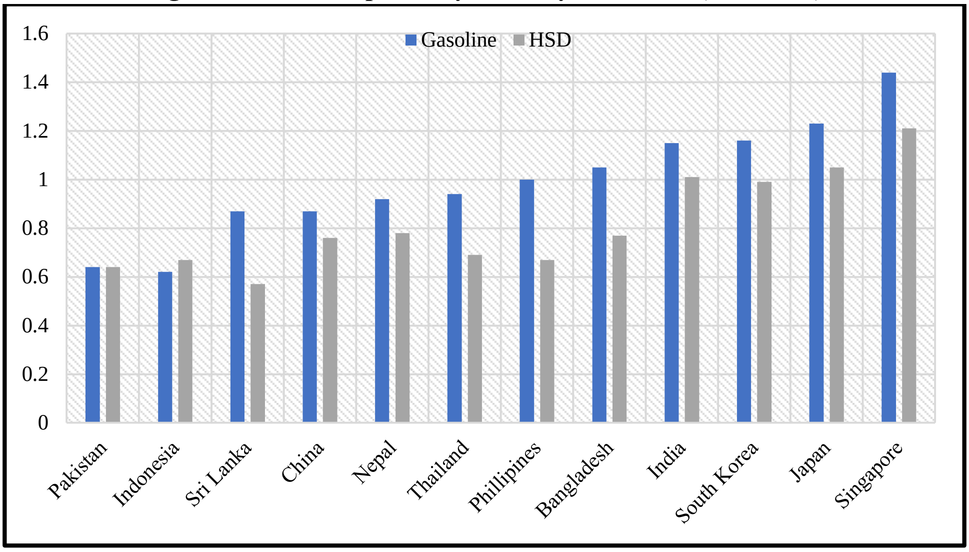
Country	No information available	Only partial information / available or poor / unclear / hard to find information	Full information available
China	✓		
USA			✓
India		✓	
Japan			✓
Bangladesh	✓		
Pakistan			✓

Source: www.energypedia.com.

International Price Comparison

It is obvious in Figure 16, that petroleum prices despite the increase (Figure 7) and despite taxation (Section 2.2.4) are still lower in the region.

Fig. 16. Petroleum prices by Country, Oct. 2020 (US$/ litre)



Source: www.globalpetrolprices.com.

KEY TAKEAWAYS

- Fuel price mechanism has transformed significantly in the last two decades.
- Despite liberalisation some sort of government regulation is still in place to keep prices affordable for the consumers.
- The dependence on fuel taxation as a source of government revenue has increased over the years.
- Given Pakistan's significant dependence on imports, there is a need for market-based mechanism for the determination of prices.
- Complete deregulation is the way forward.

REFERENCES

Ansari, M. (2004) Unexplored Country: Pakistan's Oil and Gas Sector. BLUE.CHIP, The Business Peoples Magazine.

Kiani, K (2020) Petroleum Prices likely to be Deregulated. DAWN, June 8th, 2020, https://www.dawn.com/news/1561992/petrol-pricing-likely-to-be-deregulated

Malik, A. (2007) How Pakistan is Coping with High oil Prices? The Pakistan Development Review, Vol. 46 (4), 551-575.

Moiz, R. (2019) Oil Price Build-up. Business Recorder, August 1st, 2019, https://fp.brecorder.com/2019/08/20190801501914/

OGRA (2020) Annul Report. Oil and Gas Regulatory Authority, Pakistan.

Pakistan Energy Yearbook (Various Years), Hydrocarbon Development Institute of Pakistan.

SBP (2016) Annual Report, State Bank of Pakistan.

A Review of Oil Marketing Companies (OMCS) and Petroleum Dealers' Margins on Petroleum Products*

AHMAD WAQAR QASIM and OMAR SIDDIQUE

INTRODUCTION

The pricing of petroleum products is a sensitive issue, especially in the countries such as Pakistan where petroleum products prices are regulated as well as in developing countries with low-income levels. The governments in such countries face a dilemma: on the one hand, the governments want to keep the prices at a reasonable level so that it does not put an undue burden on the users of petroleum products. On the other hand, the governments also do not want to put the downstream petroleum industry at a disadvantage since the petroleum industry is a major source of revenue for the government and brings in a major investment to the country.

In Pakistan, petroleum prices have always been at the centre of discussion. The discussion has intensified with the increase of oil prices in the international market and the depreciation of the exchange rate. Naturally, the scrutiny of margins of the OMCs and the dealers has also intensified. Previously, when oil prices were stable and when domestic petroleum product prices were kept well below the international levels, the margins were not even discussed apart from amongst the direct stakeholders.

Given the importance of the petroleum sector, there should be an objective analysis of the OMCs' and petroleum dealers' margins. Based on facts, and discussions with all stakeholders and experts, this review attempts an analysis of the current margins of the OMCs and petroleum dealers. The purpose of this review is to suggest a way forward for the margins of the OMCs and petroleum dealers, keeping in view past practices, international situation, and analysis based on ground realities.

BACKGROUND AND HISTORICAL OVERVIEW

Pakistan's petroleum industry is regulated, albeit partially, in which the prices are administered by the government. In comparison, in some countries, the petroleum industry is completely deregulated where prices are left to market forces. In such an arrangement, marketing companies and retailers are allowed to earn their margins according to the market conditions and their cost and revenue structures. Hence, margins in these markets

---

* This study was completed in 2021.

reflect reasonable profitability. Whereas the completely deregulated mechanism is mostly a hallmark of developed countries, the regulated mechanism is usually practiced in developing countries, amongst which Pakistan is one. The objective in the regulated petroleum markets is to keep the prices in check to safeguard the welfare of the consumers, among other things.

The OMCs' and petroleum dealers' margins are set by the government and are revised from time to time. Up till 2009, the margins were fixed in percentage terms (percentage of the selling price). Later, in 2010, the margins were changed from percentage terms to absolute (fixed margin) terms. It was done probably to mitigate the effect of increases in oil prices starting circa 2004. Before that, the combination of margins in percentage terms and a sharp increase in international oil prices meant handsome profits both for OMCs and petroleum dealers. It must be noted that when margins were allowed in percentage terms the downstream petroleum industry, especially at the retail end of the business, witnessed significant improvements in terms of increased investments, which in turn reflected in a better quality of petroleum products and better service at the retail outlets. This indicates that the petroleum industry responded to the gains they made due to higher margins compared to the present.

After the change in the margins from percentage terms to absolute terms, the margins have increased periodically over the years. In 2014, the margins were indexed to inflation using the consumer price index (CPI). However, the CPI-based margin adjustment has been sporadic, and revisions have not been made annually. As can be seen from tables 1 and 2, the margins of both OMCs and dealers, as a percentage of the selling price, have been decreasing over time except during the times when the prices of products decreased. Therefore, fixed margins benefit OMCs and petroleum dealers when the petroleum products' prices decrease and hurt them when the prices increase.

Table 1 below presents the margins of both OMCs and dealers on the motor spirit (MS), whereas Table 2 presents the margins on high-speed diesel (HSD).

Table 1

MS Margin as a Percent of Selling Price

Period	Price Rs/Liter	Retailers Margin (Dealers) Rs/Liter	Retailers Margin (Dealers) % of Selling Price	OMC Margin Rs/Liter	OMC Margin % of Selling Price
01/01/2017	66.27	3.16	4.78%	2.41	3.63%
01/06/2017	72.80	3.16	4.34%	2.41	3.31%
01/01/2018	81.53	3.35	4.10%	2.55	3.12%
01/06/2018	87.70	3.35	3.81%	2.55	2.90%
01/01/2019	90.97	3.47	3.81%	2.64	2.90%
01/06/2019	112.68	3.47	3.07%	2.64	2.34%
01/01/2020	116.60	3.70	3.17%	2.81	2.40%
01/06/2020	74.52	3.70	4.96%	2.81	3.77%
01/01/2021	106.00	3.70	3.49%	2.81	2.65%
01/06/2021	108.56	3.91	3.60%	2.97	2.73%

Table 2

HSD Margin as a Percent of Selling Price

Period	Price[142] Rs/Liter	Retailers Margin (Dealers) Rs/Liter	Retailers Margin (Dealers) % of Selling Price	OMC Margin (Distributors) Rs/Liter	OMC Margin (Distributors) % of Selling Price
01/01/2017	75.22	2.67	3.54%	2.41	3.20%
01/06/2017	81.40	2.67	3.28%	2.41	2.96%
01/01/2018	89.91	2.67	2.96%	2.41	2.68%
01/06/2018	98.76	2.67	2.70%	2.41	2.44%
01/01/2019	106.68	2.93	2.74%	2.64	2.47%
01/06/2019	126.82	2.93	2.31%	2.64	2.08%
01/01/2020	127.26	3.12	2.45%	2.81	2.20%
01/06/2020	101.46	3.12	3.07%	2.81	2.76%
01/01/2021	110.24	3.12	2.83%	2.81	2.54%
01/06/2021	110.76	3.30	2.97%	2.97	2.68%

Source: Oil & Gas Regulatory Authority (OGRA), 2021 and Pakistan State Oil (PSO), 2021

INTERNATIONAL PRACTICES

Nepal

In Nepal, the Cabinet of Ministers holds the ultimate authority of fixing the prices. Upon receiving approval from the Cabinet, the Nepal Oil Corporation (NOC) discloses the wholesale prices, which are ex-depot prices and vary from depot to depot, depending on the transportation cost. Retail pricing is deregulated in Nepal in the sense that it is set by the NOC-appointed dealers. However, since 2004 Nepal has adopted a wholesale pricing system under which NOC is required to announce wholesale prices and the dealers are free to charge the retail price according to their costs and profit margin. Prior to that, Nepalese oil dealers were given a commission (or margin) by the NOC.

Africa

In eight out of twelve African countries of Burkina Faso, Côte d’Ivoire, Mali, Niger, Senegal, Botswana, Kenya, Madagascar, Malawi, South Africa, Uganda, and Tanzania, controlled pricing of the petroleum products is still practiced. And only four countries, one of which is Tanzania, have provisions for regular review and adjustment of different parameters, including margins.

South Africa

In South Africa, dealers’ margin is updated annually based on the formula devised by the South African Ministry of Minerals and Energy. The retail profit margin is fixed by the Department of Minerals and Energy (DME) and is determined based on the actual costs incurred by the service station operator in selling petrol. In this cost structure, an account is taken of all proportionate driveway-related costs such as rental, interest, labour, overheads, and entrepreneurial compensation. The OMCs’ margins are set based on an annual oil industry profitability review based on the Regulatory Accounting System (RAS) methodology.

[142] Maximum Ex-Depot Sale Price

New Brunswick, Canada

In New Brunswick, Canada, the regulation of petroleum products was introduced on July 1, 2006. The regulation is overseen by the New Brunswick Energy & Utilities Board. The regulation covers the marketing margin (the sum of wholesale and retail margins plus delivery costs) of gasoline, diesel, and heating fuel. The maximum retail price for each fuel across New Brunswick is uniform. However, the final selling price may vary because of competition and differences in delivery costs. In New Brunswick, despite the setting of maximum wholesale and retail margins, the Act allows the parties to opt-out of regulation and to apportion the marketing margin between them as they see fit. If any of the stakeholders see the need to revise any of the components of fuel prices, a review of prices, margins, delivery costs or full-service charges may be initiated by a wholesaler or retailer, or by the Board. In making any adjustment to the current margins or costs, the Board must be satisfied that the adjustment is "justified".

Nova Scotia, Canada

In Nova Scotia, Canada, the regulation of fuel prices is overseen by Nova Scotia Utility and Review Board. In Nova Scotia as well the mechanism similar to that used in New Brunswick, Canada, is followed to review existing margins and suggest any changes that are required.

India

In India, the petroleum market is fully deregulated, and prices are determined by the OMCs based on supply and demand conditions.

Turkey

In Turkey, retail sales prices are formed considering the competitive conditions and the free pricing system is in effect since January 1, 2005. According to this system, while the fuel distribution companies in the sector are free to determine the warehouse sales price according to their different price policies, dealers are free to apply the ceiling pump sales prices recommended to them by the distribution companies or to apply their own pump prices according to the competitive conditions of the region in which they operate.

Table 3 below gives the OMCs and petroleum dealers' margin as a percentage of selling prices of MS and HSD in Pakistan and other selected countries. In passing, it is pertinent to mention that not all countries explicitly give the data on margins, especially in the countries where petroleum product prices are regulated. This fact is also acknowledged on a website[143] that has collected information on fuel pricing policies across the world.

The table shows that, as a percentage of the selling price, the margins of OMCs and dealers, both for MS and HSD, are lower compared to other countries included in the analysis. At the same time, however, it must be noted that when the prices of petroleum products, especially MS and HSD were lower (see Tables 1 & 2), the margins, as a percentage of the price, were higher. Therefore, the margins, as a percentage of the price, are linked to changes in petroleum product prices, which are changed based on changes in international oil prices.

[143] <https://energypedia.info/wiki/International_Fuel_Prices>

Table 3

OMCs' & Dealers' Margins - International Comparison

	High-Speed Diesel (HSD)					Motor Gasoline (MS)				
Country	Price/ Liter	OMC's Margin	% of Price	Dealer's Margin	% of Price	Price	OMC' Margin	% of Price	Dealer's Margin	% of Price
India[144]	89.36	6.17	6.9	2.59	2.9	99.86	4.39	4.4	3.79	3.8
South Africa[145]	1,548.98	77.66	5.01	--	--	1,834	40.5	2.21	221.6	12.08
Canada[146]	1.331	8.3	6.24	8.3	6.24	1.57	8.3	5.29	8.3	5.29
Nova Scotia[147]	1.2745	9.15	7.29	7.4	5.81	1.3835	9.15	6.61	7.4	5.35
Pakistan	142.62	2.97	2.08	3.3	2.31	145.82	2.97	2.04	3.91	2.68
Tanzania[148] [149]	2,243	123	5.48	108	4.81	2,439	123	5.03	108	4.43

Source: Websites of countries' respective energy regulatory authorities.

OIL MARKETING COMPANIES (OMCS) CHALLENGES

Some of the issues that currently affect OMCs' profitability and create bottlenecks in conducting their business smoothly are discussed below.

(a) Turnover Tax

A turnover tax of 0.75 percent is currently applicable to OMCs. This increased from 0.5 percent in 2019. The turnover tax has to be paid even if the company incurs losses, which puts additional pressure on the company's cash flow. In addition, companies treat this differently based on future projections. A few companies treat tax paid as turnover tax as deferred tax (assets in the balance sheet) whereas other as an expense. The turnover tax of the OMCs stood at Rs. 0.45/liter in 2020.

(b) White Oil Pipeline (WOP/MFM) Costs

The WOP is being converted to multiproduct (HSD/MS), which will result in an increase in the deadstock of MS, in addition to the HSD deadstock already in the pipeline. The tariff for WOP/MFM is based on US$ and the line requires a massive investment in terms of deadstock. Due to the depreciation of the rupee and increase in oil prices, the investment of OMCs has increased substantially. Moreover, the stock in WOP/MFM is also not counted towards mandatory stock and OMCs will have to finance this out their margins, which are already thin. The OMCs will also arrange the first fill of the multiproduct pipeline, which will result in additional working capital financing requirements and financing costs.

(c) Demurrage Costs

The petroleum product supply chain of the country is adversely impacted due to port constraints. Although there are 3 oil piers at Kemari, only one pier is available to

144 https://www.coverfox.com/petrol-price-in-india/

145 http://www.energy.gov.za/files/esources/petroleum/petroleum_fuelprices.html

146 https://www.canadianfuels.ca/our-industry/gasoline-prices/

147 https://www.canadianfuels.ca/our-industry/gasoline-prices

148 https://www.ewura.go.tz/wp-content/uploads/2021/11/Cap-Prices-for-Petroleum-Products-wef-3rd-November-2021-English.pdf

149 https://www.ewura.go.tz/wp-content/uploads/2020/10/Cap-Prices-for-Petroleum-Products-wef-07-October-2020-%E2%80%93-English.pdf

discharge POL cargoes along with other liquid cargoes resulting in excessive demurrage charges by shipping companies along with supply disruptions. In addition to current constraints as mentioned above, after commissioning of WOP, major imports will be through Post Qasim which is not fully equipped for handling the current level of imports. Therefore, it is expected to increase demurrages cost for imports.

The congestion at Karachi ports only results in putting OMCs in a challenging situation to build up stock but also incurs elevated demurrage costs for them. Given forecasted growth in the consumption of petroleum products, this situation will deteriorate unless actions are taken immediately. Due to increasing port congestion, vessels have to wait weeks before discharging.

(d) Foreign Exchange Exposure

Foreign exchange (FX) exposure is created as a result of considering only the actual payment rate of PSO and not all other importing OMCs in the product pricing. FX impacts as a result of the difference of rate used on price calculation date vs the letter of credit (LC) retirement date need to be implemented. A new mechanism to curtail these losses was introduced based on PSO as a benchmark, subject to a 60-day limit. Although these losses have been substantially curtailed, the industry, excluding PSO is still incurring significant FX losses due to different import profiles, i.e., percent of imports and LC duration of the industry vis-à-vis PSO. This required urgent attention to improve the FX outflows of the country as well as saving the country from these losses. Furthermore, the industry is not allowed forward cover to hedge FX losses.

(e) Storage Development Costs

Storage development costs are generally US$ denominated. Therefore, the storage development costs have increased substantially due to the rupee devaluation.

(f) Real-Time Stock Monitoring—Digitisation

After the supply crisis of June 2020, MEPD initiated the digitisation project intending to provide real-time information of products throughout the supply chain – from import/refinery to consumer. This project will bring better visibility and reliability of stock levels of different products on a real-time basis, resulting in efficient planning and avoiding any incident like June 2020. However, it is a capital-intensive project and cannot be undertaken by the OMCs with current thin margins.

(g) Cost Increases Beyond Inflation

There are several costs, such as salaries, administration, storage, retail development, and lease rentals of sites that have escalated beyond inflation. In the absence of an adequate increase in margins, these cost escalations have put immense pressure on the OMC margins.

(h) Fixed Margins in Rupees

The fixed margin regime may have been suitable in a low oil price–low PKR/US rate environment. However, it is not feasible for the industry in the current environment.

Currently, the OMC margin is fixed in rupee terms at Rs. 2.97/liter, which is approximately 2 percent of the retail price. It is nowhere close to a market-compatible return. On the other hand, in 2006, when the oil price was US$ 62.94/bbl and the USD/PKR parity was Rs. 60.15, and the petrol price was Rs. 56.29 per liter, the OMC margin was implemented in percentage terms at 3.5 percent at approximately Rs. 2/liter.

Table 4 below shows the OMCs' profitability, before and after taxation, in per liter terms. It can be seen from the table that the profitability has gone down from 2018 to 2020. In 2020, the OMCs' profitability has turned negative. It must be noted that the last year presented extraordinary challenges not only to the downstream petroleum sector but also to the global and Pakistani economy.

Table 4

OMCs: Profitability (Per Liter)

	2018	2019	2020
Profit Before Taxation	1.34	1.03	-0.29
Profit after Taxation	0.76	0.62	-0.36

Source: Authors' calculations.

OMCS—MARGIN CALCULATIONS

In a study on petroleum margins in Tanzania, Ernst & Young (2013) have used the accounting approach to calculating margins. According to Ernst & Young (2013), the revenue required by a regulated entity is determined by two essential cost components: operating and marketing (O&M) expenses and capital component. On this basis, Ernst & Young (2013) have used the accounting approach. This approach concludes that the revenue requirements to be built in the margin calculations include an operating plus a capital component as follows:

O&M cost + depreciation + markup over costs/desired return on investment/entrepreneurial compensation

For this, the same level of regulated return for all OMCs is assumed. This is essentially what the current formula tries to achieve by capping the level of margins for both the wholesale and retail parts of the supply chain. Based on Ernst & Young (2013), the components considered in calculating the margins for dealers include operating expenditures, return on investment, working capital required, and evaporation losses.

We consider 2020's figures for *operating and marketing expenditures, and other costs* which includes costs on handling petroleum products and losses due to temperature.

In Pakistan, OMCs are required to maintain the stock of around 20 days as per the rules of the business in the petroleum sector. OMCs finance and keep the stock to remain operational in the market. We assumed, as in the case of return on investment, that the working capital required to maintain the required stock is financed by debt. The cost of working capital for mandatory 20 days stock has been calculated using the following formula.

$$Working\ Capital\ Cost = \frac{(Mandatory\ Stock\ Holding\ Days)(Cost\ per\ Unit)(Commercial\ Lending\ Rate)}{365}$$

The cost per unit in the numerator of the above formula is taken as the ex-refinery price, while the commercial borrowing rate is again assumed as 10 percent. Given the ex-refinery prices as of November 05, 2021, the above formula yields the following working capital costs:

- Motor Spirit: Rs. 0.79/liter
- HSD: Rs. 0.78/liter

For *depreciation/asset replacement cost, the* average depreciation expenditure during the period 2018-2020 period is taken.

The last component to calculate margins is a *markup over costs*. We assume that the OMCs would want to earn markup over their costs. The reasonable markup is assumed to be 25 percent. We assume that the lending rate currently is 10 percent, and the OMCs would want to earn a 15 percent profit over the commercial lending rate. Based on these assumptions, the desired markup over costs amounts to Rs. 0.79/liter.

The calculated OMC margin on MS and HSD is reported in Table 5 below.

Table 5

OMCs' Estimated Margin

	MS (Rs/Liter)	HSD (Rs/liter)
Calculated Margin	3.96	3.96
Calculated Margin (% of price)	2.85	2.91

Source: Authors' calculations.

It must be noted that in calculating the margin as a percent of the price, we considered the prices of MS and HSD excluding OMCs' and dealers' margins because the margin percentage (of price) should not be calculated by including the OMCs' and dealers' margins.

PETROLEUM DEALERS' ISSUES AND CONCERNS

The analysis in this section is based on two types of petrol pumps operating in Pakistan, namely, Company-Owned, Company-Operated (COCO), and Company-Owned, Dealer-Operated (CODO). Petroleum dealers are faced with the following issues and concerns that affect their ability to run the business in the current environment.

(a) High Human Resources and Operating Expenditures

Petroleum dealers' main expenditures on running a petrol pump are on human resources. Due to high inflation and policies, such as the minimum wage laws, the HR expenditures, as well as other operating expenditures, have skyrocketed. In such a situation it is difficult for petroleum dealers to keep operating on thin margins.

(b) Delay in Margin Revision

The last margin revision was in April 2021 and the next revision was due in June 2021. However, the margins have not been revised. Inflation has increased considerably since April 2021, which is bleeding their working capital.

(e) Electricity Costs

Similarly, electricity costs have soared, acting as a further drain on the petroleum dealers’ finances.

(f) Evaporation Losses

Petroleum products, especially MS, are volatile products. MS evaporates due to fluctuations in temperature. The product is also lost due to decantation and handling. All these losses – temperature, decantation, and handling – are known as evaporation losses. Evaporation losses are directly linked to the product price because it is estimated at 0.5% of the product, and as the price of MS increases, evaporation losses increase proportionately, which is yet another drain on petroleum dealers’ working capital.

(g) Withholding Tax (WHT)

Petroleum dealers’ margins are subjected to 12 percent WHT, which is deducted by OMCs. According to Section 156A (Petroleum Products) of the Income Tax Ordinance:

(i) Every person selling petroleum products to a petrol pump operator shall deduct tax from the amount of commission or discount allowed to the operator at the rate specified in Division VIA of Part III of the First Schedule.

(ii) The tax deducted under sub-section (1) shall be a final tax on the income arising from the sale of petroleum products to which sub-section (1) applies.

Since this tax is treated as final income tax, it cannot be reclaimed or refunded.

(h) Local Administration Requirements

The petroleum dealers are not required to have security guards on their sites as per regulations. However, local administrations have imposed the Shop Security Act, according to which the petroleum dealers are required to have security guards on the premises for 24 hours. Similarly, the petroleum dealers are required to maintain clean toilets not only for customers but also for other people who do not even purchase fuel or other products at the petrol stations. Again, this is a regulation that affects their finances.

(i) Land Prices and Lease Agreements

When petroleum dealers enter into an agreement with OMCs for setting up a petrol pump, both the parties agree on a rent. However, according to the petroleum dealers, the agreed-upon rent is very nominal and is not commensurate with the market-based rents. Moreover, the lease agreements are often of long duration, normally starting at 10 years and the petroleum dealers cannot break the lease. If the petroleum dealers put the land on which petrol pumps are situated to other uses they can probably earn a higher return. Therefore, such agreements impose an opportunity cost on the petroleum dealers.

PETROLEUM DEALERS—REVENUE AND COST CENTERS

Revenue Centers

Although the petroleum dealers’ main source of revenue is the sale of MS and HSD, they also earn revenues from other sources, which include:

- Tuck shop
- Car wash
- Tyre and oil shop

Cost Centers

As far as petroleum dealers' costs are concerned, these can be broken down as follows:

- HR expenses
- Power and electricity
- Generator
- Transport and travel
- Office and supplies expense
- Purchase expenses
- Repair and maintenance
- Franchise fee
- Others

Besides, withholding tax and evaporation losses on MS are also among dealers' major expenses. As per the information collected, petroleum dealers' main expense is human resources. The other significant component of the dealers' expenses is the electricity expense. The petroleum dealers' operating expenses are reported to have increased by 28 percent from 2018 to 2021, because of the rise in inflation and other factors.

PETROLEUM DEALERS—MARGIN CALCULATIONS

We have followed Ernst & Young (2013) to calculate the dealers' margins. According to Ernst & Young (2013), the revenue required by a regulated entity is determined by two essential cost components: operating and marketing (O&M) expenses and capital component. However, we have modified the approach based on the characteristics of the retail end of the petroleum market in Pakistan. In the modified approach, the following components are included to calculate petroleum dealers' margins.

- O&M cost
- Working capital for stock
- Entrepreneurial compensation
- Evaporation losses.

As assumed by Erns & Young (2013), the same level of regulated return is assumed. This is essentially what the current formula tries to achieve by capping the level of margins for the retail part of the supply chain.

In the *O&M expenditures* of petroleum dealers, we incorporated non-adjustable WHT. In working out the working capital required to maintain fuel stock to run the business smoothly, we have assumed that petroleum dealers have to maintain fuel stock for 5 days, as assumed by Ernst & Young (2013). We further assume that 60 percent of the working capital requirement is financed through borrowing while the remaining is financed through equity. It is assumed that the petroleum dealers borrow 60 percent of the working capital requirement at a 10 percent interest rate. To calculate the financing cost per liter, we divided this markup by annual sale volume.

The next component to calculate petroleum dealers' margins is *entrepreneurial compensation*. The reasonable compensation is assumed to be 15 percent. We have assumed that the return on equity that is employed for stock financing should also be 10 percent. We have assumed that entrepreneurial compensation should be given as a markup over costs.

The *evaporation losses* of petroleum dealers on MS is based on the MS price prevailing on November 05, 2021. According to international practices, petroleum dealers are allowed to factor in 0.50 percent evaporation losses on MS, since MS is a volatile commodity. The evaporation losses are directly linked to the price of MS, which increases as the price of MS increases and vice versa.

The calculations of the dealers' margins on MS and HSD are reported in Table 6. The margin on MS is higher than HSD due to the evaporation losses of petroleum dealers on MS.

Table 6

Petroleum Dealers—Margin Calculations

Cost Component	MS (Rs/Liter)	HSD (Rs/liter)
Calculated Margin	4.76	3.90
Calculated Margin (% of price*)	3.43%	2.86%

* The prices used excludes OMCs' and Dealers' margins. The calculations are based on the petroleum product sale prices as of 5th November 2021, and dealers' costs in 2021.

According to the estimation, the estimated margins translate to 3.43 percent of the price of MS and Rs. 2.86 percent of the price of HSD. To calculate margins as a percentage of the selling price, we excluded OMCs' and dealers' margins from the prices of these products.

WAY FORWARD

Above analysis shows that there are reasonable grounds for an upward revision in the current margins of both OMCs and petroleum dealers. Such an observation is based on several facts and realities. To begin with, the margins have increased only marginally over the years which is not sufficient to consider the rising cost of doing business, inflation, rising salaries, and volatile—mostly upward—international oil prices. The cost of doing business has also increased significantly over the years due to various factors, the most important of which are rising wages and increased utility costs. Although the petroleum prices and general price level, as well as wages, move in a spiral because petroleum products, especially HSD, are fundamental factors behind prices, which leads to an increase in employees' compensation, this does not mean that petroleum prices should not be rationalised.

Another concern of the OMCs and dealers was to include various taxes which are levied on their business in calculating margins. Specifically, the OMCs demanded that turnover tax and petroleum dealers demanded that WHT be included in their respective margins. As discussed above, the taxes should not form the basis for calculating margins as these are independent of petroleum product prices. However, as far as turnover tax is concerned, it is a burden on the OMCs for the following reasons. To mitigate this added burden on the OMCs, while it is not recommended to make turnover tax a part of the margin, one option could be to levy the turnover tax on gross profits rather than on total turnover. Another option could be to reduce the rate of turnover tax from its present level of 0.75 percent.

It is recommended, therefore, that there should be a reasonable mechanism for formulating OMCs and dealers' margins.

Margin Revision Mechanism

(a) First-Best Solution—Deregulation

Deregulation is the removal of entry barriers to private participation in all aspects of the oil market. In the case of Pakistan, there is some degree of deregulation in the downstream petroleum market as there is the relative ease of entry in the sector. Even though the prices of petroleum products[150] are deregulated to a degree, there is still government control on the pricing of MS and HSD. Currently, the prices are calculated based on a government-approved formula. The prices are calculated based on the import parity pricing principle. The current prices mechanism allows domestic prices to move in line with the movement in international oil prices. However, the marketing and retail margins are fixed by the government. Therefore, there is government control on the pricing of MS and HSD in Pakistan. The deregulation of petroleum products in the context of Pakistan means that the government does not set the OMCs' and dealers' margins; rather the margins are left to be determined by the supply-demand forces.

Box 1: Herfindahl-Hirschman Index (HHI)

The Herfindahl-Hirschman Index (HHI) is a commonly accepted measure of market concentration. It is calculated by squaring the market share of each firm competing in a market and then summing the resulting numbers. It can range from close to zero to 10,000. If the index value is close to zero, it means that the market is perfectly competitive. On the other hand, if its value is closer to or equal to 10,000, it means that there is only one firm in the market, which implies a monopoly in the market. The index is commonly used to gauge the market conditions for potential deregulation of the market as well as merger issues.

The index is calculated as:

$$HHI = s_1^2 + s_2^2 + s_3^2 + \cdots s_n^2,$$

where s_n is the percentage market share of firm n (expressed as a whole number).

According to the U.S. Department of Justice, the following rule is applied to gauge the extent of market concentration:

- HHI <1,500: Competitive market
- HHI = 1,500 – 2,500: Moderately concentrated market
- HHI ≥ 2,500: Highly concentrated market

[150] HOBC prices are fully deregulated since 2011.

The government control over petroleum prices is driven by the idea that oil is a sensitive commodity and that its pricing cannot be left to market forces. The objective of the current regulated oil pricing mechanism perhaps is to provide affordable petroleum products (i.e., MS and HSD) so that price hikes do not result in cost-push inflation from pass-through effects of oil price hikes. However, there are considerable benefits to be had from the deregulation of oil prices. Firstly, it will encourage greater private investment in the oil industry, supporting growth and job creation. Secondly, the government will be able to focus on the formulation of oil sector policies and ensure that they are implemented. Thirdly, consumers will benefit from better service, higher quality products, and competitively set prices.

Several developing countries have adopted deregulation policies for developing a liberalised market while ensuring an adequate supply of products. Two relatively recent examples are the Philippines (see Box 2) and India (see Box 3). Both have now deregulated the oil market and moved to market-based prices for petroleum products. The deregulation of the downstream (i.e., marketing and retailing) petroleum sector is inevitable as government involvement in price-setting creates distortions. On the other hand, the deregulation of the petroleum products pricing can guarantee reasonable returns on investments. Getting a reasonable return on investment is the *raison d'être* for private enterprises. An obvious advantage of deregulation is increased competition, which results in increased efficiency, lower prices, lower production costs, and increased supplies (Oshilim & Oritsematosan, 2015). The regulation of the petroleum products pricing, on the other hand, also results in low investment opportunities in the sector, smuggling of petroleum products, compromises on quality, and sometimes the scarcity of petroleum products.

The advantage of market-based pricing is the complete depoliticisation of oil pricing. However, this requires adequate competition in the oil market and proper administrative and regulatory capacities to monitor the performance of the oil companies and prevent cartelisation. Pakistan has a fair degree of competition in the downstream petroleum sector. Under a liberalised regime, the role of the government is to ensure that fuel markets are competitive and there is free entry and exit from the sector.

As discussed previously, one of the prerequisites for market deregulation is that the market is sufficiently competitive. One of the most common measures to gauge the market concentration is the Herfindahl-Hirschman Index (HHI) (see Box 1). For the case of Pakistan, the HHI for the last five years, from FY2016 to FY2020, is given in Table 7 below.

Table 7

Herfindahl-Hirschman Index (HHI): Pakistan Oil Marketing

Year	2015-16	2016-17	2017-18	2018-19	2019-20
HHI	2,559.21	2,290.75	2,252.46	1,981.71	2,241.83
HHI (Excluding PSO)	1,625.55	1,510.18	1,629.36	1,440.98	1,413.52

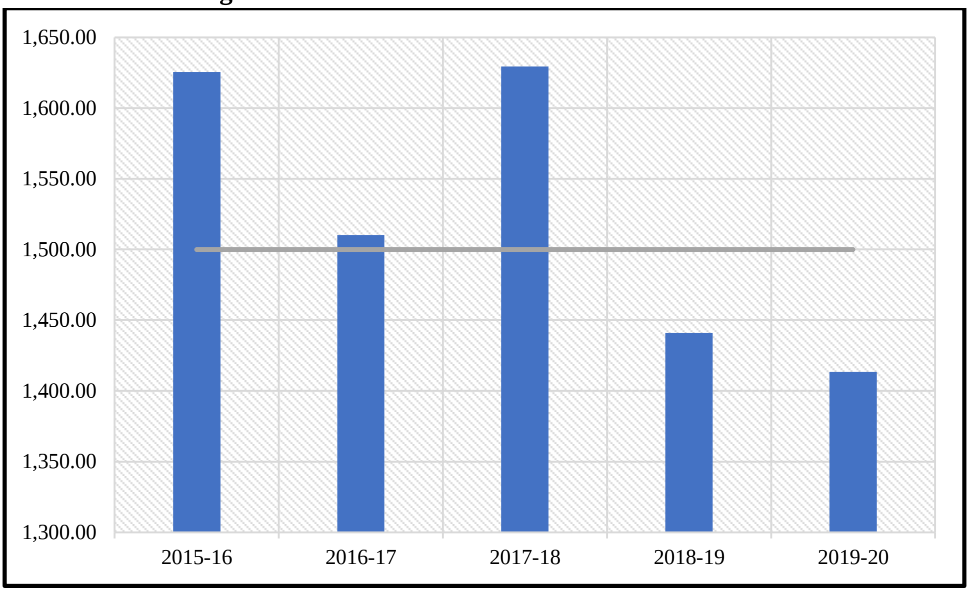
Source: Authors' calculations based on OCAC data.

According to the HHI in Table 7, the market for oil products marketing has become moderately concentrated in 2019-20 from being highly concentrated in 2015-16 (see Box

1 for details on the interpretation of the HHI values). However, Table 7 also shows that – despite increasing in 2019-20 from the previous year – the market concentration in the downstream petroleum sector is on a downward trend. The downward trend in the downstream petroleum market concentration – in other words, an increase in the competition in the downstream petroleum market – is indeed an indication that the market can cope with the price deregulation.

If the HHI is calculated excluding PSO's share, the market becomes competitive in 2019-20 from moderately concentrated in 2015-16. The HHI without PSO from 2015-16 to 2019-20 is presented in Figure 2 below. In the figure, the horizontal black line at 1,500 shows the threshold. If the value of HHI is below this threshold, the market, according to the HHI, is competitive, whereas, above the line, the market starts to become concentrated. We can see from the figure that if we exclude PSO's share, the market in the last two years, i.e., 2018-19 and 2019-20, has become competitive. The values of the HHI excluding PSO are given in Table 8 below.

Fig. 1. Herfindahl-Hirschman Index Without PSO



Source: Authors' calculations based on OCAC data.

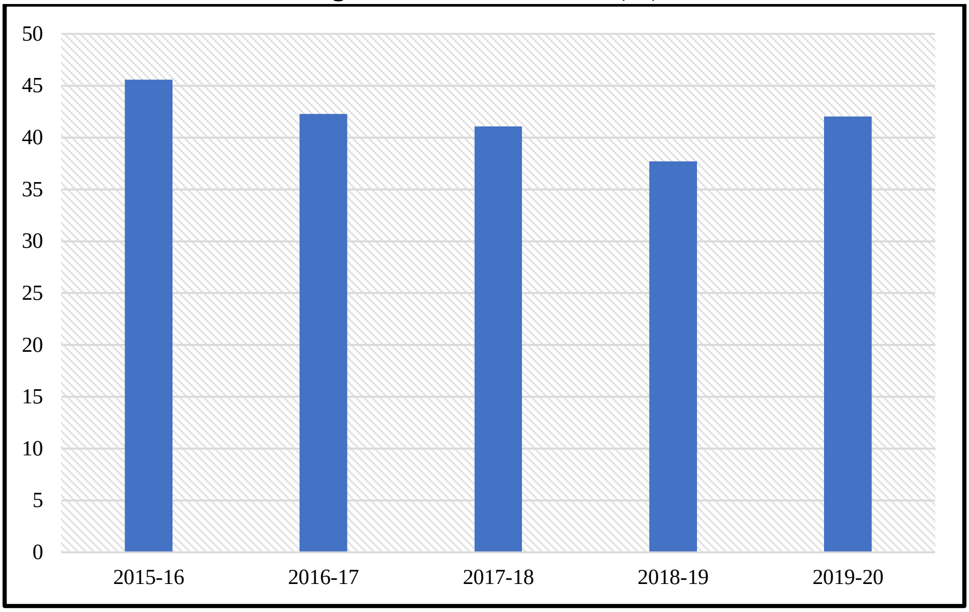
In Pakistan, the top three[151] companies had a market share of 69.25 percent in 2015-16, which has come down to 63.18 percent in 2019-20. In fact, the share of the top three OMCs had dropped to 60.15 percent in 2018-19. The major share of the market, however, is that of Pakistan State Oil (PSO), which has hovered around 40 percent during the past five years (Figure 2). If we exclude PSO, the share of the top three companies was 31.37 percent in 2015-16, as shown in Table 8. In 2019-20, the share of the top three companies, excluding PSO, is 30.38 percent. The shares of the top three, five, and ten OMCs are also given in Table 8.

[151] While the top position is constantly held by the Pakistan State Oil, different OMCs have occupied second and third positions over the years.

Box 2.

Pakistan's petroleum marketing market appears concentrated because of the high share of PSO, which is a state-owned enterprise. If we exclude PSO's share, the market appears competitive.

Fig. 6. PSO Market Share (%)



Source: Authors' calculations based on OCAC data.

Table 8

Share of Top OMCs (%)—Excluding PSO

Share/Years	2015-16	2016-17	2017-18	2018-19	2019-20
Top Three	31.37	33.51	35.49	32.48	30.38
Top Five	45.60	46.46	49.38	50.36	46.49
Top Ten	53.60	57.39	58.63	61.61	56.92

Source: Authors' calculation based on OCAC data.

The increase in the competition in the downstream petroleum market in Pakistan is also evident from the rising number of OMCs during the last two decades. In the early 2000s, the number of OMCs operating in Pakistan was five. In 2020, the number increased to 66 licensed OMCs. Out of these 66 licensed OMCs, 34 licensed companies actively participate in the market. In comparison, in the Philippines and India, the two countries that have deregulated their oil markets in the 2000s, there are 28 and 7 OMCs, respectively. In the Philippines, there were 16 OMCs in 2010, and the top three oil marketing companies had a market share of 77.2 percent. The top three's share went down to 53.44 percent in 2020. This has all happened after the deregulation in the petroleum sector of the Philippines was adopted in the early 2000s.

Box 3.

Price leadership occurs when a leading firm in a given industry can exert enough influence in the sector that it can effectively determine the price of goods or services for the entire market. This type of firm is sometimes referred to as the price leader.

Currently, 9,432 retail outlets (petrol pumps) are operating in Pakistan, of which PSO operates more than one-third outlets (approximately 3,500). Therefore, PSO's market share is the highest both in terms of sale volume and the number of retail outlets. PSO's retail outlets are spread all over Pakistan, which makes it easier for the public sector OMC to influence prices in diverse geographical areas.

Pakistan's market situation is opportune for deregulation because the OMC with the highest share in the market is PSO is a state-owned enterprise (SOE). The other OMCs have significantly lower shares. For example, Total PARCO was the second-largest OMC in 2019-20, with less than 12 percent share in the market. In fact, during the last five years, from 2015-16 to 2019-20, no OMC has had a share greater than 15 percent. Moreover, during this period, the second position was occupied by three different OMCs, namely, Shell Pakistan (2015-16 and 2016-17), HASCOL (2017-18), and Total PARCO (2018-19 and 2019-20). This shows that if we exclude PSO, the petroleum marketing market in Pakistan is competitive.

Based on the analysis presented above on the structure of the petroleum products market, i.e., MS and HSD, we propose that the process of deregulating the petroleum products, i.e., MS and HSD, margins should be initiated. A major reason, other than the political considerations, for the continued regulation of the prices of MS and HSD, is that leaving the prices to the market forces could lead to collusive behaviour among the OMCs. According to economic theory, collusion in a market could lead to a significant increase in prices. Since petroleum products are sensitive commodities, an increase in the prices of petroleum products results in inflation.

However, it must be noted that collusion is hard to sustain when barriers to entry are low. Even though economies of scale are significant in the petroleum sector, the market concentration in the downstream petroleum sector is on a downward trend as the number of OMCs is increasing in Pakistan, which makes sustaining collusive agreements difficult due to the threat of competition from entrants. Besides, collusive agreement, explicit or implicit, for higher prices is unworkable without the involvement of PSO, which has the largest market share and is present throughout Pakistan. Therefore, given that it is in the government's interest to prevent excessive profit margins in the petroleum sector, PSO will never participate in collusion of any kind out of fear of political backlash. This makes collusion even more unlikely without the largest market player.

Therefore, based on the HHI in the OMC market of Pakistan, market concentration levels are low and can even be classified as competitive after 2018 when one excludes PSO. In game theory, a firm is considered a 'dominant firm' if its market share is at least 40 percent. In Pakistan's case, PSO's average market share during 2015-2020 has indeed been around 40 percent. Therefore, in Pakistan's downstream petroleum market PSO is the dominant firm. The other firms form a 'competitive fringe' (e.g., TOTAL, Shell, etc.). The fringe firms are small to influence the price and act as price takers. Therefore, the fringe firms will follow the price set by PSO but will adjust output so that their marginal cost equals the price set by the leader.

Box 4. The Instability of Collusions

According to game theory, collusion is hard to sustain since often the collusive set of strategies, which will be pricing decisions by OMCs, do not constitute a Nash equilibrium. Since the product can be considered homogeneous in this industry, individual OMC's unilateral deviations in the form of price undercutting will be profitable to attract larger market shares. These unilateral incentives to deviate constitute a classic prisoner's dilemma problem due to which the OMC's will not be able to sustain the Pareto optimal equilibrium of higher prices for all OMC's. Thus, the inherent instability of collusion in the petroleum marketing and retailing industry implies that deregulation is unlikely to create anti-competitive pricing.

Even if one considers the repeated interaction scenario between OMCs, which allows the possibility of punishments for the undercutting firms, collusive agreements are unlikely to sustain themselves in this industry. The competitive fringe can punish other firms in this fringe by reducing prices for longer periods if anyone OMC defects by not maintaining high prices. However, these punishments will be ineffective toward PSO since the government will ensure that it charges a low price with low/moderate profit margins already. Thus, PSO cannot be incentivised to charge high collusive prices with the threat of punishment through low prices, and the fringe will lose significant market share to PSO if they form a cartel with high prices among themselves.

Moreover, economic theory also tells us that in an oligopolistic market in which the firms can interact, there is a possibility of one stable 'focal price.' This focal price is sustained because firms fear that further undercutting will hurt their profitability, and if they increase prices, the competitors will not follow suit. This focal price is likely to be close to marginal costs without excessive profit margins since that is what creates the fear of undercutting. We believe that PSO can help establish such a focal price through its price leadership even in a dynamic oligopoly setting. Since the government no longer fixes prices, deregulation will provide stronger incentives for cost-cutting and improved productivity since the competitive fringe can successfully undercut PSO's focal price when they reduce their costs. This competitive dynamic will also make PSO more productive since it will lose market share and leadership status if the costs of Shell, Total, etc., are lower than those of PSO.

Allowance of Independent Petrol Pumps

In Pakistan, there are two types of fuel retail outlets operating. These two arrangements are COCO and CODO. In COCO-type retail outlets, as the name implies, the OMCs own and operate the petrol pump, whereas, in CODO-type arrangements, the land is usually owned by the dealer, but the OMC invests, and the dealer operates the petrol pump. The dealer pays the OMC a franchise fee. The CODO-type arrangement binds the OMC and the dealer in a long-term contract; the dealer cannot buy the fuels from any other OMC.

There is also a third type of arrangement in developed countries and some developing countries: independent or dealer-owned, dealer-operated (DODO) fuel retail outlets. In such type of an arrangement, the dealer negotiates and buys fuel from any OMC.

In case of the adoption of price deregulation, the regulator must allow DODO sites because it will foster competition. The OMCs will offer the dealers fuels at lower prices to compete with other OMCs to sell higher volumes. As a result, consumer prices will be lower compared to COCO or CODO sites. This, in turn, will also compel COCO and CODO sites to sell fuels at lower prices.

It is often argued that since markets have not worked in Pakistan, a sensitive commodity like fuel should not be left to the whims of the market. However, the reason for the inefficient working of the markets in Pakistan is that the state often meddles with the markets. A classic example is that of the sugar market. Furthermore, bowing under the influence of pressure groups, who seek undue advantages from the state (through SROs, for example), also leads to market failures, i.e., inefficient outcomes. Therefore, for the smooth functioning of the markets, the role of the regulator is crucial.

Box 5: Oil Pricing Reforms in the Philippines: The Role of the Regulator

Philippines historically pursued a fixed price regime for petroleum products. The Energy Regulatory Board (ERB) fixed these prices. A budgetary allocation was provided to the Oil Price Stabilisation Fund (OPSF) that automatically absorbed any cost increase in international oil prices not reflected in the selling price set by ERB. In 1998 the government decided to deregulate the oil industry through the Downstream Oil Industry Deregulation Act of 1998 (Government of Philippines, 2005; IMF 2013). The deregulation was done in two phases. In phase 1, oil importation was liberalised, and an automatic pricing mechanism was established. In phase 2, full deregulation was implemented whereby all controls over oil pricing were removed, the foreign exchange cover was taken away and the OPSF was abolished. Philippines now has a fully deregulated oil market with market-based prices. Prudential regulations are in place to prevent abuse including predatory pricing and cartelisation (IMF, 2013).

Consistent with the regime of deregulation, the Oil Deregulation Law (ODL) did not prescribe a specific formula. The market is expected to set the prices. Notwithstanding deregulation however, players in the industry must adhere to the fundamental principle of fair prices as provided under the ODL. It is reported that Philippines has benefitted from deregulation, as prices of oil products would be higher if the industry was not deregulated.

The deregulation move allows new entry into the market, which is key to having a competitive market, which not only brings in more competitive prices, but also better-quality products and much improved service levels. After deregulation, it is now estimated that there are as many as 80 service providers (PIDS, 2000; Oil Deregulation, 2016). Deregulation has been taken to a point where even ordinary citizens can set up their own retail stations. Safety and skills issues have been addressed through the Oil Deregulation Law (ODL).

The Philippines deregulation law prohibits cartelisation and predatory pricing on the part of oil companies and dealers. The law defines cartelisation as “any agreement, combination or concerted action by refiners, importers and/or dealers, or their representatives, to fix prices, restrict outputs or divide markets, either by products or by areas, or allocate markets, either by products or by areas, in restraint of trade or free competition, including any contractual stipulation which prescribes pricing levels and profit margins.” On the other hand, predatory pricing is defined as “selling or offering to sell any oil product at a price below the seller’s or offeror’s average variable cost for the purpose of destroying competition, eliminating a competitor or discouraging a potential competitor from entering the market.” However, pricing below average variable cost in order to match the lower price of the competitor, and not for the purpose of destroying competition, is not considered predatory pricing under the law.

The DOE Secretary can investigate any unreasonable increase in the prices of oil products. The ordinary consumer can report any violation of the law to the Joint DOE-DOJ (Department of Justice) Task Force. If the DOE-DOJ Task Force finds that there is indeed a violation of the law, it can order the violator to take proper actions to ensure full compliance with the law.

Philippines, while deregulating the sector, had also declared incentive measures for new investment in refining, storage, marketing, and distribution of petroleum products. The industry has been given the same incentives granted to the Board of Investment (BOI)-registered enterprises engaged in a preferred area of investments pursuant to Executive Order No. 226, otherwise known as the “Omnibus Investments Code of 1987”.

The Role of the Regulator

It must be noted that price deregulation does not imply the absence of government regulations. Even when petroleum prices are deregulated, the government will have a crucial role to play relating to monopoly control, safety standards, protection of consumer interests, and taxation. Indeed, prudential regulations are critical to ensure a healthy, competitive market that also protects public interests, such as safety and quality. In fact, if and when the petroleum market is deregulated, OGRA will have to play an even more active role. To keep prices from increasing unduly, we propose that OGRA collect information on prices of every OMC from different geographical locations and post the prices on its website. Since the ex-refinery prices are calculated using import parity formula, based on Platts Oilgram prices, and taxes and levies are known by all the stakeholders, including consumers, collusion and unjust price increase would be easy to detect. If there is any evidence of collusion or other uncompetitive practices, OGRA could act accordingly.

Box 6: Fuel Pricing Reforms in India: Piecemeal Deregulation

The Indian oil market deregulation started in bits and pieces during the 1990s. India sequentially liberalised private investors in oil exploration, production, and importation but the government retained control over pricing policy. As a result, the private participation and competition was limited. Prices were set through the Administrative Pricing Mechanism (APM) that involved a complex pricing formula with cross-subsidisation. In 1997, the government decided to dismantle the APM in a phased manner over a 5-year period. In practice, political economy considerations hampered full implementation and the government retained its control over oil prices even after dismantling the APM. Faced with mounting cost of oil subsidies, balance of payments problem, and low investments, the government took a fresh resolution to go back on the reform track. In 2010 the government deregulated the petrol prices. It also allowed a steady adjustment to diesel prices to bring it in line with international prices. In October 2014 the Indian government fully deregulated diesel prices in India (Kojima, 2016).

With this 2014 pricing reform and previous reforms that removed the entry restrictions for domestic and foreign private investors in oil, India has now established a fully deregulated oil market (except for kerosene). Both public and private enterprises are now competing in the oil sector. Indeed, the largest refining capacity in India is privately owned by the Reliance Group, located in Jamnagar, Gujarat. The refinery has the capacity of refining 1.24 million barrels a day.

Cost-plus compensation did not provide adequate incentive for cost reduction leading to inefficiencies.

In order to shift to Market Determined Pricing Mechanism (MDPM) the Government decided to resort to soft landing approach through careful phasing-in in line with the recommendation of the Expert Technical Group and did not de-regulate the prices of crude and petroleum products at one go (as suggested by the Sundararajan Committee). The reason for resorting to soft-landing approach was attributed to higher adjustment cost that would have arisen due to large increases in relative prices of subsidised petroleum products for one-time shift to MDPM. In other words, the phase-in period could be visualised as a period of gradual reconciliation of apparent short-term conflicts that would have arisen among the interests of three groups of economic agents: the consumers or end-users of petroleum products, the oil producers and refiners and the government itself.

Benefits of Deregulation

Under a deregulated environment, the industry players would have to compete against each other for customers, and consequently, returns on their investments. The threat of new entrants and loss of market share would also provide an incentive for better service and quality of petroleum products. Additionally, with the deregulation of the industry backed by prudential regulations, suppliers will try and avoid malpractices, such as violating environmental laws, and providing adulterated fuel products, not only because of the presence of regulators but also owing to competition. A supplier that is found guilty of violating the regulations and safety standards would not only face legal penalties but also get a bad name and lose customers.

Deregulating the Inland Freight Equalisation Margin (IFEM)

In the case of Pakistan, the government is regulating the petroleum industry at three different stages. At the first stage, the Government regulation of IFEM could be sighted. The second and third stages consist of the OMCs' and dealers' margins. Therefore, deregulation does not only imply the complete elimination of the regulation, but it might also be partial.

Now consider the first case, that is, the deregulation of the IFEM. Three petroleum products HSD, MS, and Kerosene Oil capture the major share of the market in Pakistan. However, the market share of the other products like Furnace oil and JP-1, 4, and 8 is quite low. OGRA presently regulates the selling price of MS, high octane blending component (HOBC), Kerosene Oil, Light Diesel Oil, and JP-1, 4, and 8. The HSD is partially deregulated i.e., it is regulated to the extent of ex-refinery price. Similarly, furnace oil is completely deregulated.

The ex-depot sale price is regulated based on the following components.

(1) Ex-refinery Price
(2) Inland Freight Equalisation Margin (IFEM)/ Primary Transportation Charges
(3) OMCs Margins
(4) Dealer's Margin
(5) Petroleum Development Levy

The landed cost of the imported petrol is generally higher than the ex-refinery prices of locally produced petrol. As the market is regulated, therefore, the OMCs are required to sell it at the fixed price based on the local ex-refinery price regardless of the landed cost of the imported shipments. To tackle the difference between the landed cost of the imported petrol and local refinery, in 1966 the concept of Inland Freight Equalisation Margin (IFEM) was introduced. It represents the cost of transportation of fuel from the source to the depots, also known as the Primary Transportation cost.

Primary transportation cost is the cost incurred by the individual OMC when petroleum products are transported from the refinery and ports to depots across the country. Every month the total estimated cost incurred by the OMCs is pooled and weighted-average on the projected country-wide movement of the products by each OMC and a per-liter rate is arrived at, which is built up and recovered through the retail price for each product from the first day of the following month. Besides this primary transportation cost, the secondary transportation cost is also present. This is incurred during the transportation of the product to the retail outlet, which is borne by the owner of the retail outlet.

The objective of introducing the IFEM in Pakistan was to keep the prices at an equalised level across the county. This sort of equalisation of margin is unique and no other country follows such an arrangement. The basic logic of the IFEM, which is the equalisation of prices across the country, is not justified on any grounds since the consumer who is located near the source should not bear the transportation cost for those who are located far away. Moreover, even in the case of other commodities, such a mechanism is not practiced. Due to this IFEM mechanism, the system is prone to different malpractices such as dumping, virtual depots, and back freighting, as described in the Bhagwandas Report.

The IFEM seems the first place from where to initialise the deregulation of the petroleum industry in Pakistan. This would serve as a litmus test for the overall deregulation of the petroleum industry in Pakistan. As there is no other example present in the world of such a mechanism, therefore, it can be safely argued that equalisation of oil prices across the country is not based on any coherent logic, empirical evidence, or economic theory. Moreover, if we do away with IFEM, it would increase the price by only a few *paisas* per liter or a maximum of a couple of rupees in far-flung areas. Our suggestion of deregulation is based on the belief in efficiency and removing the incentive for malpractices. By deregulating the IFEM, the competition among the OMCs would be high in terms of using efficient methods of transportation as well as malpractices, such as dumping, could be tackled.

(a) Inflation-Indexation Approach

An alternative approach to adjust OMCs' and dealers' margins periodically could be based on inflation indexation. The components of OMCs' and dealers' costs that are affected by inflation are approximately 50 percent of total costs. Based on these numbers, the margins can be revised, periodically, on the following basis.

For this approach, it is assumed that 50 percent of the dealers' costs are affected by inflation, whereas the other 50 percent are affected by other factors such as interest rates, etc. Therefore, it is suggested that 50 percent of the margin is linked to CPI and increase the margin annually based on CPI. The other 50 percent component of the margins should be revised every two years based on an analysis of the data obtained from the petroleum dealers and OMCs.

(b) Margins as a Percentage of MS and HSD Prices

Yet another way to revise the MS and HSD margins is to set them as a percentage of petroleum products prices excluding the margins. In Pakistan, till November 2010, OMCs and dealers were allowed margins as a percentage of the selling price, excluding GST and PDL. An advantage of this approach is that it is an automatic mechanism for adjusting the petroleum products margins. However, one issue with this mechanism is that margins would skyrocket if the petroleum products prices increased drastically, while margins would be squeezed if there is a precipitous fall in prices. To tackle this problem, caps and floor could be set so that margins neither increase too high nor decrease too low.

Other Issues—Possible Solutions

(a) Turnover Tax

The turnover tax should either be applied to the OMC margin instead of the price of the fuel or reduced to 0.25 percent to ensure that the same reflects the underlying profitability of the industry.

b) Storage Development and Demurrage

To avoid disruption in the import supply chain of petroleum products in the country, it is proposed to consider the development of infrastructure and operations of third-party jetties or buoys. Demurrage claims due to port constraints and limited unloading capacity should be included in the actual landed cost calculations.

(c) Foreign Exchange Losses

FX impact should be based on the average of previous fortnight exchange rates announced by the State Bank of Pakistan instead of a notional one based on PSO's cargoes and the actual import incidentals. The Economic Coordination Committees (ECC) has approved to reflect the impact of the actual exchange rate in the pricing calculations and put in place a mechanism for recovery of FX losses since 2018. However, no progress has been made so far in the mechanism implementation/modalities of the recoveries. The decision should be implemented. If FX forward cover is implemented, it would not only provide certainty to the industry but will also help reduce FX rate volatility. In an age of volatile oil prices and FX rates, hedging has become a crucial part of business for most successful companies. The principal goal of hedging is to prevent the price and FX risk. OMCs should, therefore, be allowed to hedge their oil imports and FX exposure.

REFERENCES

Ernst and Young (2013). Review of Petroleum Wholesalers and Retailers Margins.

Godfrey, N. O. & Oritsematosan, O. (2015). Deregulation of the Downstream Sector of the Nigerian Petroleum Industry: The Role of Leadership. European Journal of Business and Management, Vol. 7, No.8.

Part IV

EFFICIENCY AND CLEAN ENERGY

Sustainable and Secure Energy Supplies for the Future

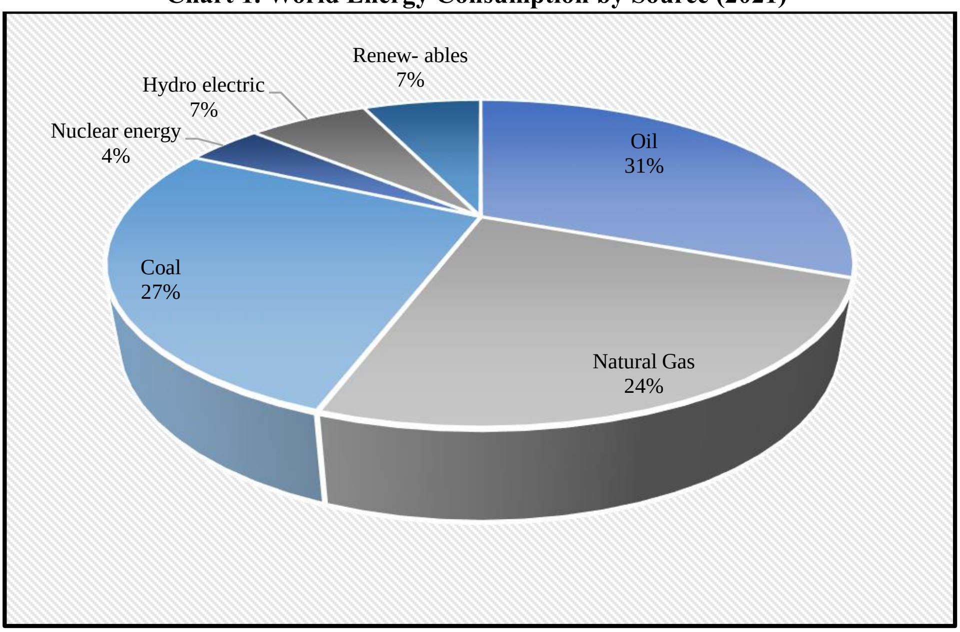
Local Coal for Power Generation in Pakistan*

AFIA MALIK

INTRODUCTION

Coal contributes significantly to global energy supplies. In 2021, coal was the second-largest energy source consumed globally (Chart 1). Over the years, coal demand has increased substantially from 2.6 billion tons in 1980 to 5.5 billion tons in 2021 (Chart 2). Because of environmental concerns and the increasing trend towards renewables, its share declined in the United States and many European countries, decreasing global consumption in 2014 and onwards. But the trend reversed in 2020. It is because of the Russia-Ukraine war leading to the worldwide energy crisis that the demand for coal has increased[152].

Chart 1. World Energy Consumption by Source (2021)



Source: BP Statistical Review 2022.

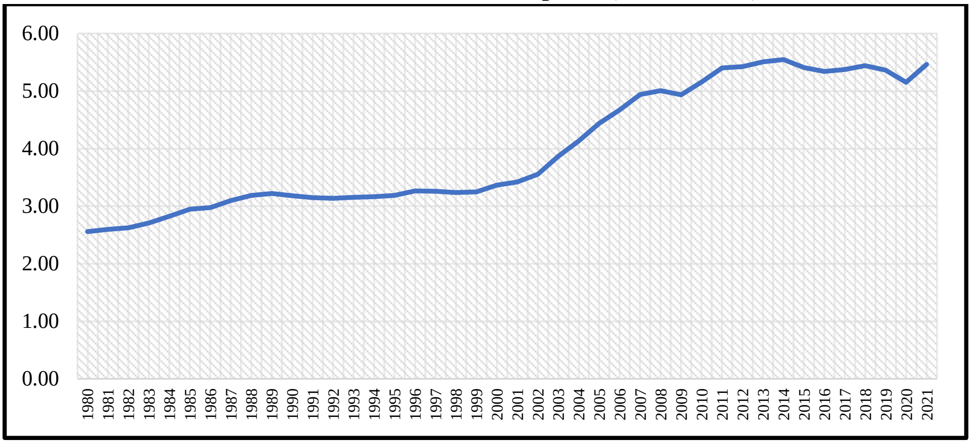
---

* It was published as PIDE Knowledge Brief 2023:103.

152 https://www.iea.org/news/the-world-s-coal-consumption-is-set-to-reach-a-new-high-in-2022-as-the-energy-crisis-shakes-markets

According to the International Energy Agency (IEA) forecast, coal demand is expected to exceed the previous coal demand record of 2014 in the next few years. The United States and many European countries are shifting back to coal as it is still one of the cheapest energy sources.

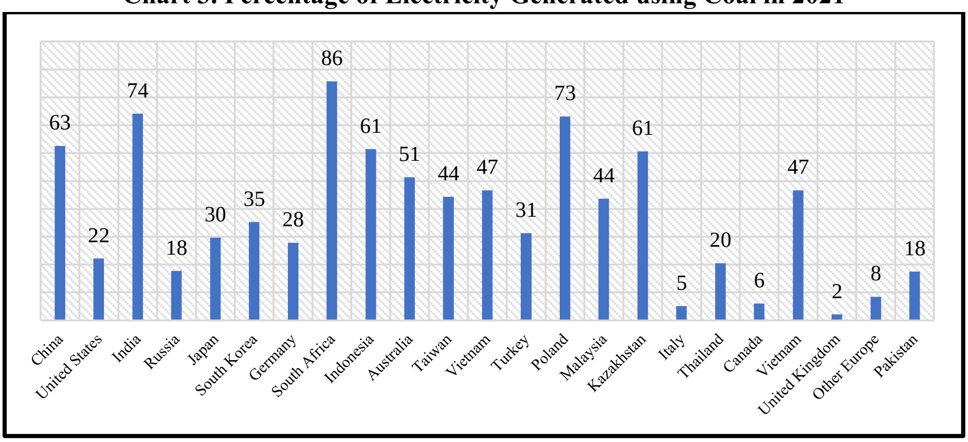
Chart 2. World Coal Consumption (Billion Tons)



Source: BP Statistical Review 2022.

The primary coal-consuming sector is electricity generation. High natural gas prices have increased reliance on coal for generating power. Coal consumption in electricity generation is expected to grow by more than 2 percent[153]. If the gas prices continue to increase in 2023 or onwards, dependence on coal will remain, and demand will surge further[154]. Besides gas prices, coal prospects will depend on the transition speed towards renewable energy sources[155].

Chart 3. Percentage of Electricity Generated using Coal in 2021



Source: BP Statistical Review, 2022.

[153] In 2022, coal was the primary source of electricity generation, accounting for 36 percent of the share compared to 22 percent of natural gas share (Statista, 2023). These shares were 35 percent for coal and 24 percent for gas in 2020 (BP Statistical Review, 2022).

[154] Fossil fuels are deemed suitable for meeting baseload demands.

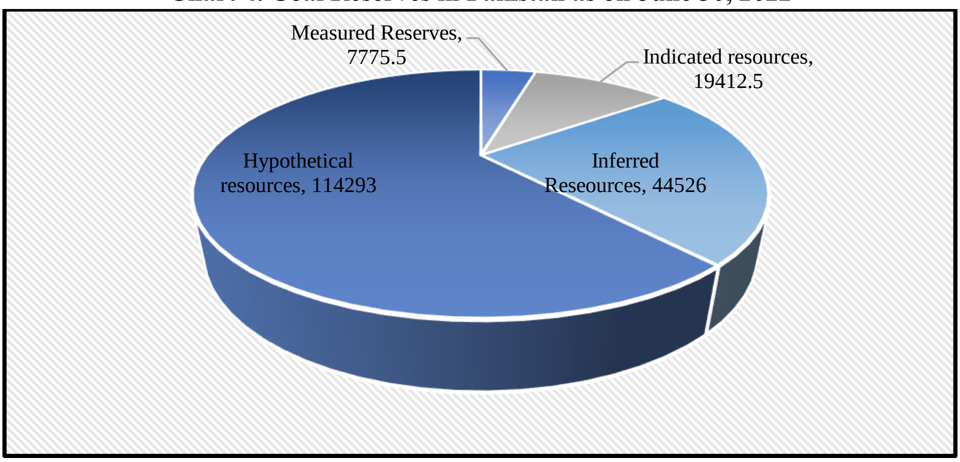
[155] https://www.barrons.com/articles/coal-use-hits-new-record-the-stocks-are-soaring-51671473657

PAKISTAN COAL POTENTIAL

Pakistan has 186 billion tons of coal reserves, primarily located in the province of Sindh (Chart 4). Only Thar desert (10,000 sq. km) contains the world's 7th largest coal reserves of about 175 billion tons (Chart 5), equivalent to 50 billion tons of oil equivalent (more than Saudi Arabia and Iran's oil reserves) and 2000 trillion cubic feet of gas (68 times more than Pakistan's total gas reserves).

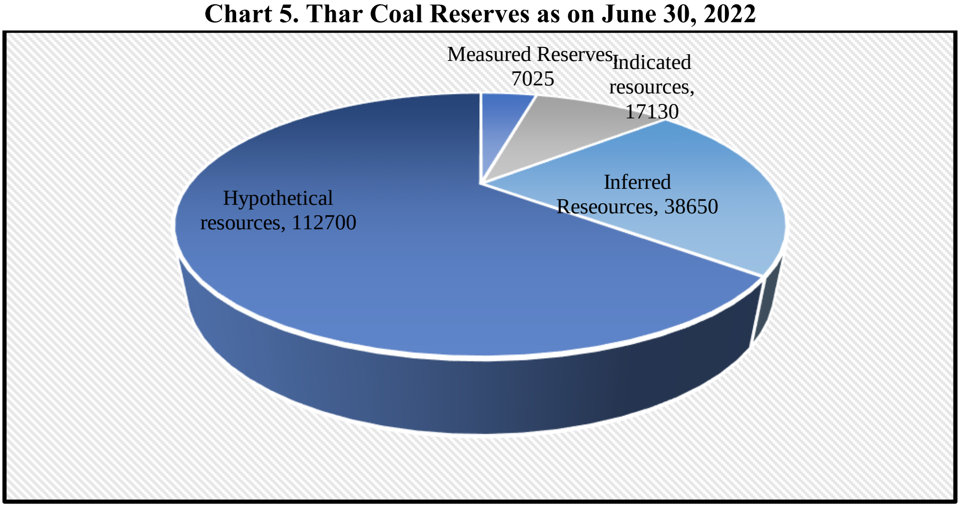
Thar Block-II alone contains 2 billion tons of lignite reserves, of which 1.57 billion tons are exploitable. This Thar Block-II can produce 5,000MW of electricity for 50 years, while the total Thar reserves can sustain 100,000MW for over two centuries[156]. Most of the coal in Pakistan is lignite (with more moisture content, up to 50 percent).

Chart 4. Coal Reserves in Pakistan as on June 30, 2022



Source: Pakistan Energy Yearbook, 2022.

Chart 5. Thar Coal Reserves as on June 30, 2022



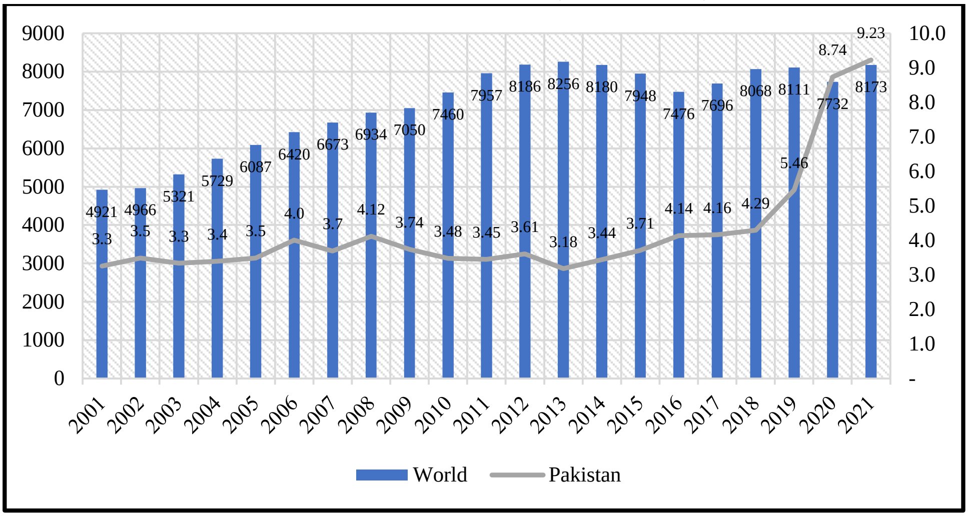
Source: Pakistan Energy Yearbook, 2022.

[156] https://www.secmc.com.pk/

PAKISTAN COAL CONSUMPTION, PRODUCTION, AND QUALITY

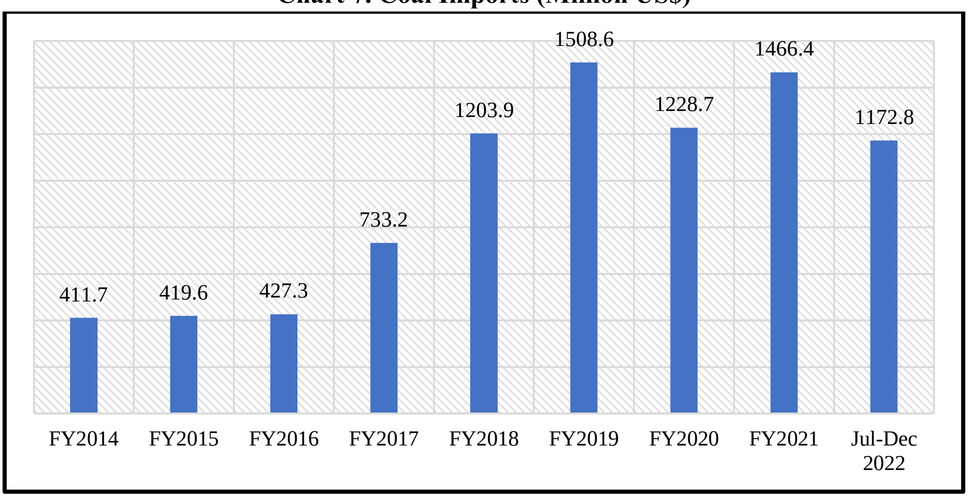
Globally, 8,172.6 million tons (Mt) of coal was produced in 2021. The top five coal producers were China[157], India, Indonesia, the USA, and Australia, with a share of 50 percent, 10 percent, 8 percent, 7 percent, and 6 percent, respectively. Coal mining is critical to many economies[158], enabling them to grow stronger and tackle the dual challenges of poverty and development (PACRA, 2020).

Chart 6. Coal Production (Million Tons)



Source: BP Statistical Review 2022 and Pakistan Energy Yearbook 2022.

Chart 7. Coal Imports (Million US$)



Source: State Bank of Pakistan, 2023.

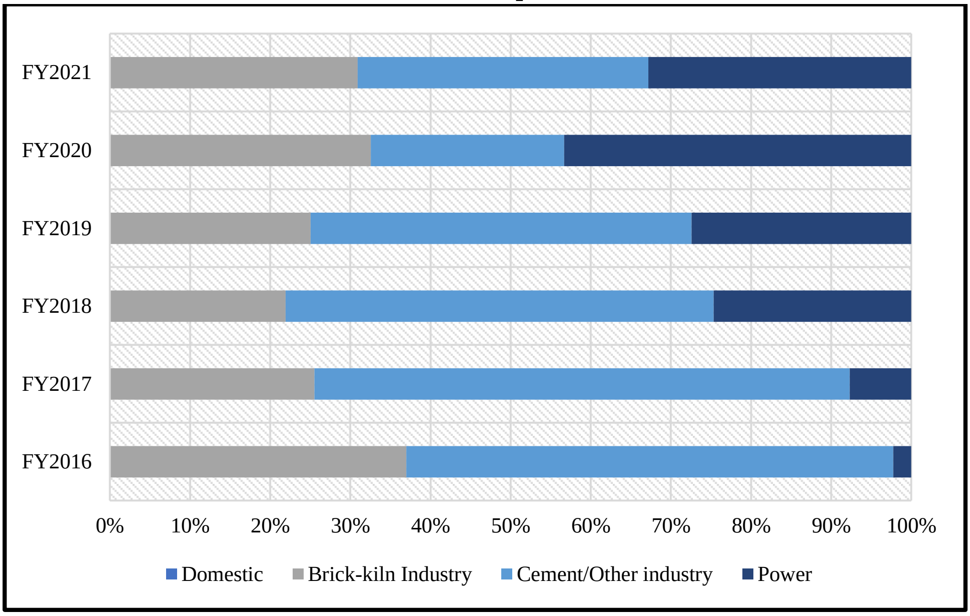
[157] China's energy output doubled from 1990 to 2005, and its electrification rate surpassed 99 percent due to the abundant coal reserves (World Coal Association Report 2012)

[158] Coal mining provided more than seven million jobs worldwide in 2010 (World Coal Association Report 2012).

Despite having colossal coal potential, coal production in 2021 was only 0.1 percent of the coal produced globally. About 67 percent of the country's total coal consumed (28.1 million tons) in 2021 was imported. Pakistan spent about US$ 1.5 billion on coal imports in FY2021 (Chart 7) [159]. An import-dependent energy policy is unsustainable for Pakistan, especially given its limited foreign exchange reserves and in the global context. The global economy has been experiencing a commodity super-cycle due to many factors, including the Russia-Ukraine conflict and COVID-related logistical issues leading to rising prices and disruptions in global supply chains due to the Ukraine-Russia War (Sheikh, 2022).

Even after an 8 percent growth in Pakistan's coal consumption in the four decades, its share in world consumption is 0.4 percent. Power generation, the cement industry, and brick kilns are major coal consumers in the country (Chart 8). Imported coal is used in coal fire power plants and the cement industry, about 50 percent each (Ali, 2022). The main argument for not using local coal is its quality, mostly lignite with more moisture content (Table 1 and Table 2). However, it is also a fact that lignite quality produced in Pakistani fields is better than coal produced and used for electricity generation in India (Table 3). The second primary concern is the expense of transporting Thar coal to the power plants, e.g., Sahiwal and Port Qasim due to the absence of a railway connection with the Thar coal site.

Chart 8. Coal Consumption in Pakistan



Source: Pakistan Energy Yearbook, 2022.

Out of total reserves at Thar amounting to 175,506 million tons, 16 percent are divided into twelve blocks with an area covering 1,121 sq km. Blocking of the remaining 84 percent of reserves still needs to be done. Phase I of Block II was commissioned in July 2019.

[159] With the dollar hike and increase in global coal prices, the trend of the first two-quarters of FY2022 is doubling coal imports. The exact figure from the source is not available.

Table 1

Thar Coal Qualities for Blocks I to XII

Block	Ares (km^2)	Total Reserves (billion ton)	Moisture (%)	Ash (%)	Vol. Matter (%)	Sulphur (%)	Heating Value (As Received) (Btu/lb)	Fixed Carbon (%)
I	122.0	3.56	43.13	6.53	30.11	0.92	6,398	20.11
II	79.6	2.24	47.89	7.37	25.15	1.12	5,008	19.68
III-A	99.5	2.00	45.41	6.14	28.51	1.12	6,268	19.56
III-B	76.8	1.45	47.72	9.30	25.49	1.15	4,808	16.79
IV	82.0	2.47	43.24	6.56	29.04	1.20	5,971	21.13
V	63.5	1.39	46.82	8.92	30.24	1.20	5,682	13.26
VI	66.1	1.65	46.80	5.89	29.34	0.90	5,727	16.6
VII	100.0	2.17	48.27	8.03	25.30	1.16	5,440	25.30
VIII	100.0	3.03	49.57	7.78	24.32	1.44	5,302	18.10
IX	100.0	2.86	48.60	5.92	29.03	0.96	5,561	15.73
X	100.0	2.87	48.99	6.35	30.79	1.17	4,840	13.54
XI	100.0	1.61	49.97	8.07	24.16	1.61	5,228	17.26
XII	100.0	2.34	50.82	5.71	25.00	1.11	5,459	17.26

Source: JICA (2013).

Table 2

Coal Quality of Coalfields in Pakistan

Province/ Coal Field	Coal Quality Proximate Analysis (in percent)					Rank, ASTM Classification	Heating Value (mmmf) Btu/lb	Heating Value (mmmf) Kcal/kg	Average Annual Production 2000-2001 (tonnes
	Moisture	Volatile Matter	Fixed Carbon	Ash	Total Sulphur				
SINDH									
Lakhra	9.7 = 38.1	18.3 = 38.6	9.8 = 38.2	4.3 = 49.0	1.2 = 14.8	LigB to SubC	5,503 = 9,158	3,057 = 5,088	1,112,406
Sonda-Thatta	22.6 = 48.0	16.1 = 36.9	8.9 = 31.6	2.7 = 52.0	0.2 = 15.0	SubC to hvBb	8,878 = 13,555	4,932 = 7,531	–
Jherruk	9.0 = 39.5	20.0 = 44.2	15.0 = 58.8	5.0 = 39.0	0.4 = 7.7	SubC to hvCb	8,800 = 12,846	4,889 = 7,137	–
Ongar						LigB to SubA	5,219 = 11,172	2,899 = 6,207	–
Indus East						LigA to SubC	7,782 = 8,660	4,323 = 4,811	–
Meting-Jhumpir	26.6 = 36.6	25.2 = 34.0	24.1 = 32.2	8.2 = 16.8	2.9 = 5.1	LigA to Subc	7,734 = 8,612	4,297 = 4,784	–
Badin*	15.4 = 29.8	29.8 = 39.8	31.0 = 36.3	8.2 = 14.6	3.4 = 7.4		6,740 = 11,100	3,744 = 6,167	–
Thar Coal	29.6 = 55.5	23.1 = 36.6	14.2 = 34.4	2.9 = 11.5	0.4 = 2.9	LigB to SubA	6,244 = 11,045	3,469 = 6,136	–
BALOCHISTAN									
Barkhan-Chamalang	1.1 = 2.9	24.9 = 43.5	19.4 = 47.1	9.1 = 36.5	3.0 = 8.5	HvCb to hvAb	12,500 = 14,357	6,944 = 7,976	NA
Duki	3.5 = 11.5	32.0 = 50.0	28.0 = 42.0	5.0 = 38.0	4.0 = 6.0	SubB to hvAb	10,131 = 14,164	5,628 = 7,869	276,516
Mach Abegum	7.1 = 12.0	34.2 = 43.0	32.4 = 41.5	9.6 = 20.3	3.2 = 7.4	SubA to hvCb	11,110 = 12,937	6,172 = 7,187	317,004
Sor Range-Deghan	3.9 = 18.9	20.7 = 37.5	41.0 = 50.8	4.9 = 17.2	0.6 = 5.5	SubA to hvBb	11,245 = 13,900	6,247 = 7,722	279,564
Pir Ismat Ziarat	6.3 = 13.2	34.6 = 41.0	19.3 = 42.5	10.3 = 37.5	3.2 = 7.4	SubA to hvCb	10,786 = 11,996	5,992 = 6,664	384,108
Khost-Shahrig-Harnai	1.7 = 11.2	9.3 = 45.3	25.5 = 43.8	9.3 = 34.0	3.5 = 9.55	SubB to hvAb	9,637 = 15,499	5,354 = 8,611	227,784
PUNJAB									
Makarwal	2.8 = 6.0	31.5 = 48.1	34.9 = 44.9	6.4 = 30.8	2.8 = 6.3	SubA to hvAb	10,688 = 14,029	5,938 = 7,794	47,928
Salt Range	3.2 = 10.8	21.5 = 38.6	25.7 = 44.8	12.3 = 44.2	2.6 = 10.7	SubC to hvAb	9,471 = 15,801	5,262 = 8,776	221,964
NWFP									
Hangu-Orakzai	0.2 = 2.5	16.2 = 33.4	21.8 = 49.8	5.3 = 43.3	1.5 = 9.5	SubA to hvAb	10,500 = 14,149	5,833 = 7,861	77,000
Cherat/Gulla Khel	0.1 = 7.1	14.0 = 31.2	37.0 = 76.9	6.1 = 39.0	1.1 = 3.5	SubC to hvAb	9,388 = 14,171	5,216 = 7,873	36,006
AZAD KASHMIR									
Kotli	0.2 = 6.0	5.1 = 32.0	26.3 = 69.5	3.3 = 50.0	0.3 = 4.8	LigA to hvCB	7,336 = 12,328	4,076 = 6,854	

Source: Geological Survey of Pakistan (June 30, 2011), Badin*: Sindh Coal & Energy Department, Gos, 2010.
Note: Table is cited from JICA (2013).

hvAb = high volatile A bituminous coal	ASTM = American Society for Testing and Materials
hvAB = high volatile B bituminous coal	To convert Btu to Kcal/Kg multiply by 0.556.
HvCb = high volatile C bituminous coal	To convert Kcal/Kg to Btu/lb multiply by 1.789

Table 3

Thar Coal Comparison with Other Mines

	Heating Value (Net) (Kcal/ kg) Higher is better	Sulfur (%) Lower is better	Ash Lower is better	Moisture Lower is better	Stripping Ratio (m^3/t) Lower is better
Thar Block II	2770	1.07	7.8	47.46	6.12
Gujarat, India	2600 - 3000	3.4 - 5.9	9 – 12	38.40	9 – 14
Hambach, Germany	1911- 2747	0.2 – 0.4	2 – 5	48.52	6.3
Maritza East – Bulgaria	1550	4.5	19-35	54	1.7

Source: PPIB.

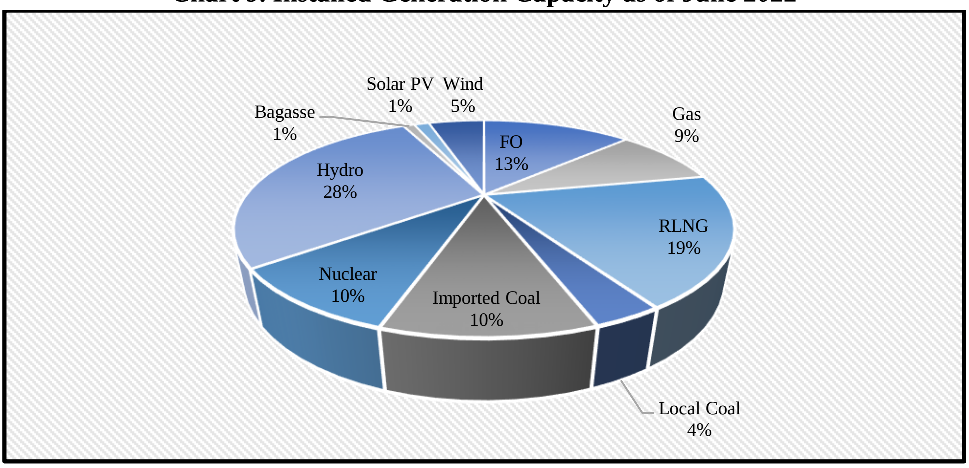
COAL-BASED POWER GENERATION IN PAKISTAN

In the electricity fuel mix of Pakistan in FY2021, coal share (both local and imported) was 18 percent. Much lower than many developed and developing countries (Chart 3). This share was reduced to 14 percent in FY 2022 (Chart 9). Because of the global coal price surge and shortage of foreign reserves, companies could not import coal.

Pakistan is seeking to expand the share of domestic coal in the electricity fuel mix. The objective is to save foreign exchange on import-base electricity generation, which stands at about 30 percent as of June 30, 2022. The government has developed policies and frameworks to enhance the local share. The share of local coal in the fuel mix for FY2024 is projected to be over 16 percent[160]. Unfortunately, due to the long-term agreements with commissioned and committed energy projects, the share of imported coal and RLNG would remain at 7 percent and 12 percent by FY2031 (Chart 10). It is challenging to convince power projects already commissioned on imported coal to switch to local coal[161].

Under the Power Generation Policy 2015, preference was given to RLNG and coal and not to reducing reliance on imported fuels. As a result, the new projects under this policy are becoming increasingly dependent on imported fuels. Utilising local resources has always been a priority in our planning strategies. Regrettably, we have not seen the desired level of effective implementation.

Chart 9. Installed Generation Capacity as of June 2022



Source: IGCEP 2023-31.

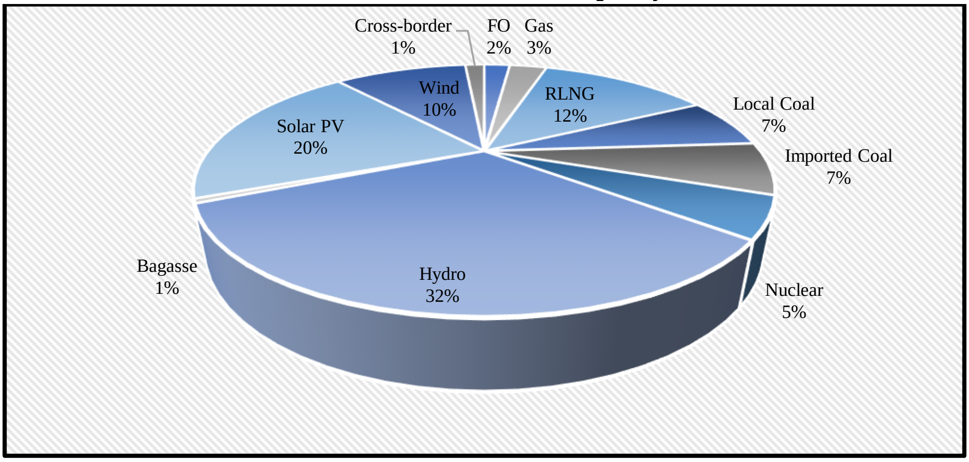
As of June 30, 2022, the installed capacity based on imported coal was 4620MW, higher than the capacity based on domestic coal (3600MW). Domestic coal-based power generation capacity has been delayed for more than three decades due to a lack of infrastructure, insufficient financing, and the absence of modern coal mining technical expertise (cited from Sheikh, 2022).

[160] NEPRA Tariff Determination for FY2024.

[161] The Government of Pakistan (GOP) had finalised a plan to shift CHIC Pak Power Company (Pvt.) in Gwadar from imported coal to Thar coal, but the Chinese government has refused this plan. During the PM's visit to China, he was required to modify the plan; the Chinese Foreign Ministry has sought written confirmation from the GOP (Ghumman, 2023).

Thar coal reserves were discovered in 1992 by the Geological Survey of Pakistan. Nevertheless, this cheap potential was not realised given our lack of long-term vision and planning capacity for two decades. The focus remained on imported fuels. The environment was not the reason for not realising this vast potential, but financing the mega project was. It was in 2012 when Sindh Engro Coal Mining Company (SECMC) launched coal mining as a joint venture between the Government of Sindh and Engro[162].

Chart 10. Installed Generation Capacity FY2031



Source: IGCEP 2023-31.

Under the 2015 generation policy, several coal-fired power plants entered the system. Though high returns on equity were offered to locally sourced power plants (Table 4), low global coal prices at that time and slow progress in Thar mining failed to attract much investment in plants using Thar coal. High moisture content in the local coal was regarded as not suitable for the technology to be used. Plus, given the great distance of the coal reserves from load centers, the government also promoted importing coal. At that time, policymakers assumed coal-based generation was the best option to scale up power generation in the country (Bhandary & Gallagher, 2022).

Despite the importance of the power plant's proximity to the mine, it was not given much consideration in Pakistan. Instead, the preference was given to imported coal without realising it would increase the burden on foreign exchange reserves.

The unit cost of imported coal-fired power plants is much higher than local coal-fired power plants (Table 4). Coal for power generation is mainly imported from South Africa and Indonesia. Coal prices have inflated tremendously. The global coal price index reached 483.84 index points in October 2022[163]. It was 119.18 index points in January

[162] Investing in coal-based projects in Pakistan was challenging as no Western bank was willing to finance the USD3 billion mega project. The Government of Sindh (GOS) recognised that developing Thar coal required a partnership between the Public and Private sectors and launched an International Competitive Bidding process for Thar Block II in 2008 to address this. As a result, a joint venture was formed between GOS and Engro, which led to the creation of SECMC in 2009. However, the joint venture came at the cost of a Sovereign Guarantee worth USD 700 Million (issued in 2012), which made the Thar coal project possible but also became a source of dollar capacity payment burden (details at https://www.brecorder.com/news/4392709).

[163] Source: www.tradingeconomics.com

2020. Although figures decreased compared to the previous month, net coal prices have significantly increased over the past two years. For instance, the South African coal export price increased from US$ 90.63 per metric ton in December 2020 to US$ 332.84 per ton in August 2022 (Chart 11). Consequently, the per unit cost of electricity generated from imported coal increased from Rs. 10.17/kWh to Rs. 29.12/kWh last year. As a result, these plants became lower on the Economic Merit Order (EMO), putting pressure on the capacity payment part of the tariff. In comparison, the per unit cost of electricity generated from Thar Coal during FY 2022 was around Rs. 7 / kWh to Rs. 9/kWh (NEPRA, 2022).

Table 4

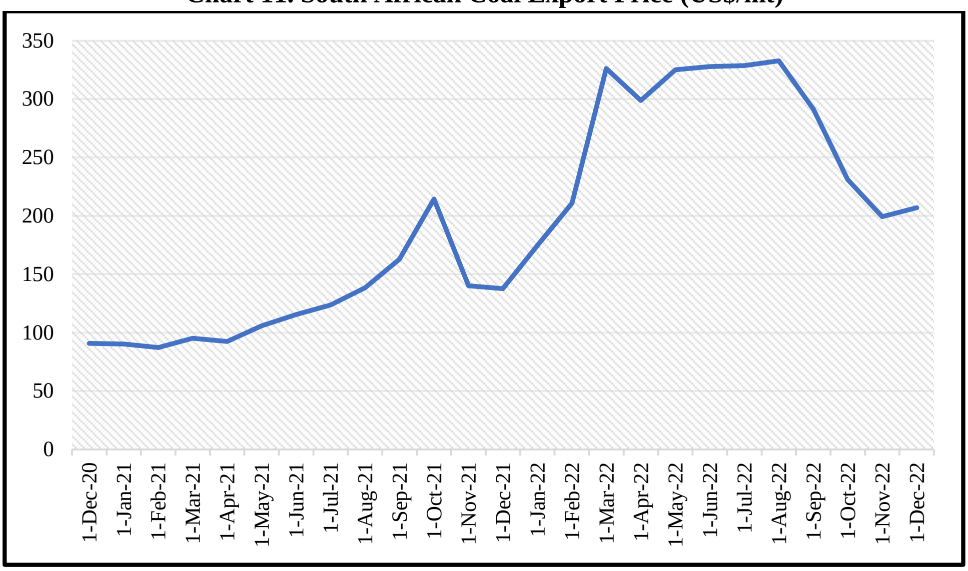
Coal-based Installed Capacity as of June 30, 2022

Plants_ Commissioned	Coal Type	Capacity MW	RoE %	Fixed O&M $/KW/Year	Variable O&M $/MWh	Fuel Cost $/GJ	Heat Rate GJ/MWh	Unit Cost $/MWh	Unit Cost Rs/KWh
Lucky*	Imported	660	27.2	25.39	2.94	0.95	9.23	11.71	2.08
Engro Thar	Local	660	30.65	338.96	6.21	1.47	9.66	20.37	3.62
Port Qasim	Imported	1320	27.2	28.07	1.24	14.15	9.01	128.71	22.90
Sahiwal	Imported	1320	27.2	24.87	1.22	17.50	8.51	150.09	26.71
China HUBCO	Imported	1320	27.2	26.64	3.02	17.39	8.95	158.73	28.25
Plants_ Committed	**Coal Type**	**Capacity MW**		**Fixed O&M $/KW/Year**	**Variable O&M $/MWh**	**Fuel Cost $/GJ**	**Heat Rate GJ/MWh**	**Unit Cost $/MWh**	**Unit Cost Rs/KWh**
Thar I	Local	1320	34.49	97.21	6.20	1.47	9.23	19.72	3.51
Thal Nova	Local	330	30.65	98.97	6.20	1.47	9.73	20.45	3.64
Thar Tel	Local	330	30.65	98.97	6.20	1.47	9.73	20.45	3.64
Gwadar	Imported	300	17	33.77	1.15	2.80	9.66	28.21	5.02
Jamshoro Coal U1	Imported	660	---	5.06	2.85	6.17	8.71	56.59	10.07

Source: IGCEP 2022-31 and NEPRA.

* Lucky Electric Power's 660MW is ultra-supercritical coal-fired plant started commercial operations on 21 March 2022. It is designed to burn a wide range of coal from diverse sources, including domestic coal.

Chart 11. South African Coal Export Price (US$/mt)



Source: https://ycharts.com/indicators/south_african_coal_export_price#:~:text=Basic%20Info,50.50%25%20from%20one%20year%20ago.

Pakistan is still in the initial stages of developing Thar coal resources. The costs will be reduced even more with expansion and reaching the optimum level. As Rizvi (2021) mentioned, coal mining, like other mineral resources, is a 'game of economies of scale' globally.

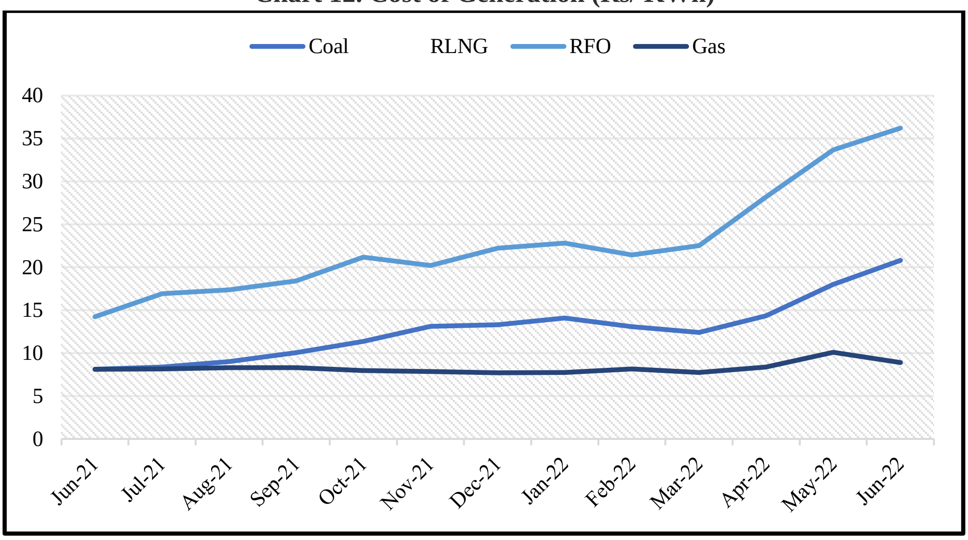
Compared to other fuels, coal-based generation costs in Pakistan remained low compared to RLNG and RFO (Chart 12) because of cheap domestic coal share. Coal-fired electricity tariff is lower than other fuels even though the upfront tariff determined by NEPRA was more than the average tariff levied in most South Asian Countries at that time (Abbasi, 2014). If the upfront tariff had been determined per the international rates, coal-based generation costs would have been lower.

Natural gas-based cost of generation is the lowest among fossil fuels. Nevertheless, its resources are depleting rapidly. Therefore, it is not dependable. Increasing the share of Thar coal via replacing/ substituting it with a portion or all of the imported coal can reduce the average cost of electricity generation and save foreign exchange reserves.

Despite being the cheapest, renewables in Pakistan cannot be adopted on a large scale. Pakistan is not ready yet. First, for solar PV, Pakistan heavily relies on imports from China for its equipment, and its domestic industry has yet to develop. Secondly, other costs, e.g., seasonality and lack of storage and transmission infrastructure, have made this a relatively expensive choice for Pakistan[164].

Local coal is Pakistan's reliable and inexpensive fossil fuel option for sustaining energy supply, especially given the country's growing population, increasing energy demand, and volatile global oil and LNG prices; *however, up to a specific acceptable limit* (Cheema et al., 2022).

Chart 12. Cost of Generation (Rs/ KWh)



Source: NEPRA State of Industry Reports (2021 & 2022).

[164] In FY2021, a verified amount of Rs. 3.94 billion was payable to the Wind Power Plants because of Non-Project Missed Volume (NPMV). The intermittent nature power plants (wind) enjoy the priority dispatch condition. Non-evacuation of available power due to transmission constraints from these plants makes them eligible for this payment.

BLENDING IMPORTED COAL WITH LOCAL COAL

Due to the rise in imported coal prices, the power plants have been exploring alternate cheaper coal sources on the advice of the GOP. Imports from Afghanistan are allowed provided its MMBTU price is lower than the international coal prices, and payments are permitted in Pakistan Rupees. As stated in the NEPRA State of Industry Report (2022), the existing capacity of Afghanistan coal is insufficient, and there is no published price index for Afghanistan coal, which is liquid, transparent, and reflective of the market. Therefore, the best would be to convert the existing capacity of imported coal power plants under long-term agreements of 30 years to Thar coal.

In Pakistan's coal power plants (Table 4), the Pulverised Coal Combustion (PCC) [165] System is used: subcritical (SUBC) and supercritical (SC) types. The SC boiler is used in the Sahiwal, Port Qasim, and China HUBCO power plants. According to the third modification in its license, Lucky Power Plant has upgraded its technology to ultra-supercritical (USC). These plants are designed to burn different coal types. The SUBC boilers are used in the remaining power plants. The Gwadar power plant has yet to start its operations. However, under the pressure of the Chinese government, the government is forced to allow imported coal. All other SUBC plants under operation in the country are using Thar coal.

Since the 3960 MW installed capacity is based on imported coal, a certain percentage of the blend can reduce the import burden significantly. Literature suggests that it is possible to replace a certain percentage of bituminous coal (imported in the case of Pakistan) with lignite coal (Thar coal) without any plant modification.

Box1. Appropriate Blending Ratio

- SC coal-fired power plants are designed to burn 100 percent sub-bituminous coal with vertical and roller-type pulverisers. Based on global experiences in boilers firing sub-bituminous coals, a moisture content of 30 percent is the maximum limit for such boilers to avoid any damage to the boiler.
- In SC plants in Pakistan, Thar coal can be mixed up to 20 percent. Mixing 20 percent Thar coal and 80 percent sub-bituminous coal in weight, the moisture content of uniformly mixed coals is calculated as follows:
- Moisture in normal design basis: (22.4 x 80+ 47.6 x 20)/100= 27.44 percent
- Taking account of a deviation of 10 percent on moisture contents, 20 percent would be an upper limit for the mixing lignite produced in Thar with the imported sub-bituminous.

Source: (JICA, 2016).

[165] PCC power technology with a stable operation record was developed long ago.

By replacing 20 percent of the imported coal used (Box 1) in power plants, Pakistan can save over US$ 147 million of the amount used for coal imports in 2021 (i.e., US$ 1466.4 million).

It is enormous, given the pressures on our foreign reserves. Jamshoro Coal Power Plant is planning to employ SC new boiler(s) to use imported sub-bituminous coal blended with local coal in a ratio of 80:20 as its fuel (ADB, 2022).

Coal blending is practiced worldwide to avoid disruption due to transportation problems or fuel costs. Globally, coal of various types is blended at different points, including the mine, preparation plant, trans-shipment point, plant site, or even at the boiler[166]. The method selected depends upon the site conditions, the level of blending required, the quantity to be stored and mixed, the accuracy required, and the end use of the blended coal. Large power plants treating coal in bulk prefer a mechanised stacking method (Sloss, 2014).

In PCC plants, the sub-bituminous (imported) coal is pulverised to a powder form, which is later fired from sideways. It does not require pre-drying as the coal used (sub-bituminous) is usually dry. With technology, it is possible to pulverise lignite coal. Thar coal's pre-drying process can be done through solar energy; Thar has plenty of sunshine. It can be dried at both mines and power plants. Exhaust steam is generally used in a reverse cycle for extra drying. This has already been done in Germany. Lucky Power reportedly uses almost the same approach in burning imported lignite and eventually plans to use local lignite (Ali, 2022).

COAL AND ENVIRONMENT

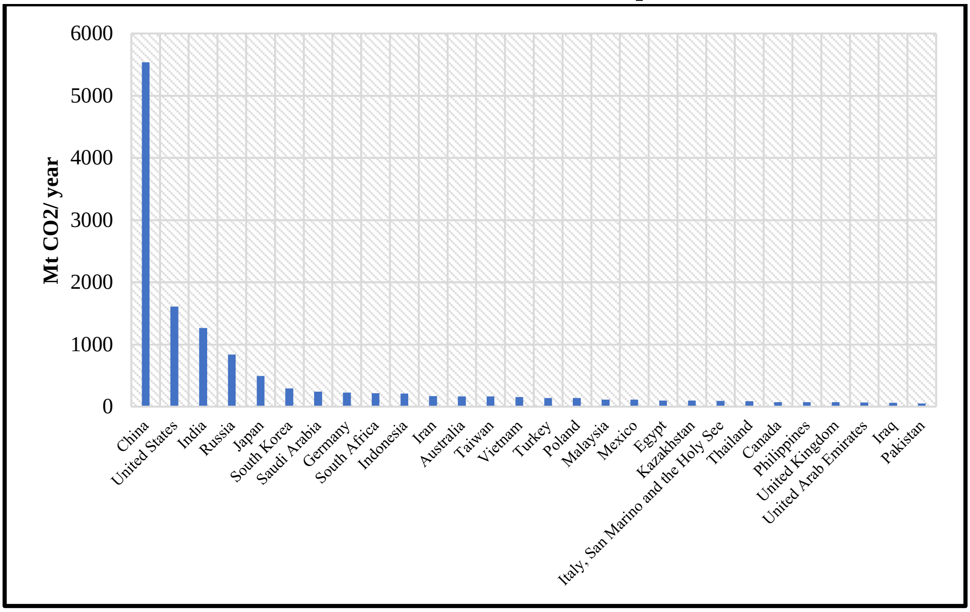
Despite being the cheapest fossil fuel, coal is the most environmentally detrimental energy source and is considered a significant contributor to climate change. The Paris Agreement calls for eliminating coal use in the power sector by 2050 (Sheikh, 2022). Nevertheless, its use is increasing globally.

Pakistan's power sector contribution to global power sector emissions is hardly 0.4 percent compared to over 38 percent by China, 11 percent by the US, 9 percent by India, and 6 percent by Russia in 2021. Still, as per the Global Climate Index 2021, Pakistan is the 8th most vulnerable country to climate change. *The technology used in coal-fired power plants is vital from an environmental perspective.*

Subcritical power plants (SUBC) achieve thermal efficiency in the range between 34 percent and 40 percent (based on coal heating value), with a global average efficiency of around 36 percent, whereas supercritical power plants (SC) reach efficiencies between 42 percent and 45 percent. Ultra-supercritical power plants (USC) employ advanced metal alloys to withstand extreme steam conditions and achieve even higher efficiencies. This is due to the elevated steam conditions: superheat and reheat steam temperatures of 600/620°C and steam pressures of up to 275 bar. Advanced ultra-supercritical power plants (A-USC) are expected to enter operation in the next decade, which will approach 50 percent net electricity generation efficiency with advanced metal alloys capable of withstanding steam temperatures and pressures over 700°C and 350 bar (Tramošljika et al., 2021).

[166] https://www.powermag.com/types-of-coal-and-fuel-blending-tips-for-coal-power-plants/

Chart 13. CO2 Emotions in the Power Sector: Top 28 Countries in 2021



Source: https://edgar.jrc.ec.europa.eu/report_2022

In Pakistan, SC boilers are used in more than half of coal-fired capacity (4680 MW: commissioned and committed), with a minimum net thermal efficiency of 39 percent and a maximum of 40.5 percent[167]*. SUBC boilers are used in the remaining power plants of Engro, Thar I, Thal Nova, Thar Tel and Gwadar with a minimum net thermal efficiency of 37 percent and a maximum of 38.5 percent (as per the license issued by NEPRA).*

SUBCs are less efficient, and countries are dumping these to reduce carbon footprints. Several countries across the world have moved towards USC (Box 2). Besides granting high upfront tariffs on coal-fired power plants, NEPRA failed to regulate heat rate, measuring the efficiency of power plants to convert a fuel (coal) into heat and electricity (Abbasi, 2014).

Higher efficiency translates into less coal consumption to generate a single unit of electricity while reducing CO2 emissions, mercury, and local air pollutants, releasing less local air pollutants, and leaving a smaller environmental footprint. Above all, it means lower consumer tariffs (Abbasi, 2014). Additionally, SC and USC require less water to generate electricity (per MW) than non-SC power stations (Alkon et al., 2019; Abbasi, 2014). However, generation capacity is the most crucial driver of cooling water demand magnitude.

Under efficiency-linked improvements in coal-power technology, SC and USC coal power generation technologies operate at higher temperatures and pressures than conventional (SUBC) pulverised coal combustion (PCC) plants, achieving high efficiencies. SC technology is considered clean coal technology as CO2 emissions are less than for older plants. Therefore, the environmental impact of such technologies would be less[168]**.**

[167] Although the technology used in the Lucky power plant is now USC, the reported efficiency is 39 percent.

[168] A 1 percent gain in efficiency for a typical 700MW plant reduces 30-year lifetime emissions by 2,000t NOx, 2,000t SO_2, 500t particulates and 2.5 million tons of CO_2 (https://www.power-technology.com/projects/yuhuancoal/)

Replacing an old SUBC power plant with SC parallels a 10 percent efficiency gain and a CO_2 emission reduction of more than 20 percent. For example, a conventional SUBC generates electricity at 36 percent thermal efficiency with around 1000 $kgCO_2/MWh$ emissions. In comparison, a USC unit with 46 percent thermal efficiency generates 28 percent (0.46/0.36 = 1.28) more electricity per unit of fuel heat input with emissions of 781 $kgCO_2/MWh$ (1000/1.28 = 781), about 22 percent reduction. USC plants could achieve up to 700 kg/MWh with post-combustion carbon capture (Tramošljika et al., 2021).

Box 2. Technology Modernisation for Efficiency—Global Practices

- In Japan and Korea, supercritical technology was adopted before 2000. These countries now have high-performance coal plants with average efficiencies above 40 percent. These countries have now adopted USC technology. Yokosuka (Japan) is one of the 22 new coal-fired power plants planned to be built in Japan by 2025, equipped with two USC coal-fired units of 650MW capacity each.
- Germany's RWE power, a lignite-fired power plant, uses USC technology with an efficiency of 43.2 percent. A record-high net efficiency of 47.5 percent was achieved by the RDK Block 8 USC unit in Germany.
- NTPC, India's leading power generator, has commissioned the country's first USC unit having a capacity of 660 MW at Khargone in Madhya Pradesh, with operational efficiency of 41.5 percent, 3.3 percent higher than the conventional SC ones. The high efficiency will result in less coal consumption for generating the same amount of electricity vis-à-vis SC plants and will reduce 3.3 percent CO_2 emissions.
- Bangladesh commissioned a 1,320 MW USC coal-fired power plant in a joint venture with China in 2022.
- China's share of SC and USC is increasing rapidly. For instance, China's Huaneng Yuhuan power plant (recently commissioned) is equipped with four USC coal-fired power generating units of 1,000MW capacity each. New units also incorporate high-efficiency dust removal and desulphurisation.

Sources: (Tramošljika et al., 2021), IEA (2012), and
https://www.nsenergybusiness.com/projects/yokosuka-coal-fired-power-plant/
https://www.rwe.com/en/the-group/countries-and-locations/neurath-power-plant/#:~:text=Most%20modern%20power%20plant%20of%20its%20type&text=Like%20the%20BoA%20unit%20K,to%20cleaning%20the%20flue%20gas.
https://www.ntpc.co.in/en/media/press-releases/details/ntpc-commissions-india%E2%80%99s-first-ultra-super-critical-plant-0
https://www.aa.com.tr/en/asia-pacific/bangladesh-launches-its-largest-thermal-power-plant/2541508
https://www.power-technology.com/projects/yuhuancoal/

Indeed, the environment is of concern for Pakistan, as it is already among the world's most vulnerable countries. The only thing that needs to be done is to focus on the most efficient technologies. In Pakistan, it is expected that even after developing Thar coal at full scale, carbon emissions will be twenty times lower than the fast-growing and developed economies on an absolute basis and five times lower than the global average per capita basis (Rizvi, 2022). With high-efficiency and low-emission technologies, the emissions from coal-fired power generation would be reduced even more.

The technology used in coal plants is one part of the equation. Transporting Thar coal to a power plant is also significant. Although, there is no railway link with the Thar coal site. The coal plant in Sahiwal should have been avoided due to the high cost of electricity generation and the negative environmental impact caused by the 1200 km rail journey required to transfer imported coal from the port to the plant site (Cheema et al., 2022). It has been determined that the Sahiwal coal power plant has caused damage to fertile agricultural land, contaminated canal water, and polluted the air[169]. The plant's location is significant not only in terms of cost-effectiveness but also for its environmental implications.

Box 3. Mitigating the Environmental Impact of Coal Power Plants

- Efficient technology that conserves energy and resources is crucial. When constructing a new coal-fired power plant, it is essential to prioritise high efficiency and ensure that it can be easily retrofitted for CO_2 capture and storage.
- Dry handling methods for coal combustion wastes, such as fly ash, eliminate the ecological risks associated with surface impoundments, such as metal contamination of wildlife.
- Recycling of coal combustion waste for use in cement, concrete products, and construction fills.
- Reusing wastewater in coal-fired plants through recycling.
- Ensuring that ash disposal and reclamation are managed in accordance with internationally recognised standards.
- Construction of plants near coal mines to avoid transport-related environmental impact.
- Relocating nearby communities.
- To establish stronger operational and maintenance protocols and better-coordinated land use planning.

Source: Coutinho, M. and Butt, H. K. (2014)

KEY TAKEAWAYS

Pakistan faces a significant challenge with its energy imports, which strains its energy security. Tapping into the country's energy resources is essential to address this issue. However, it is also crucial to consider the environmental impact of using local coal. When deciding on the best fuel mix for generating electricity in the future, it is critical to strike a balance between energy and capacity costs while prioritising environmental protection.

- Due to long-term agreements, immediately decommissioning the existing plants with outdated technology is impossible. Commissioned SUBC power plants or pipeline technology must be upgraded or retrofitted to more efficient USC.

[169] https://dailytimes.com.pk/300805/environmental-impact-of-the-sahiwal-coal-power-plant/

Additionally,

- A 20 percent blending of Thar coal in commissioned SC plants can be done to save foreign exchange reserves.
- Future commissioning of the power plants based on Thar Coal must not ignore power plant technology, its efficiency, and its location. *All new power plants must be USC or even A-USC with higher efficiency to reduce future carbon and other pollutant emissions.*
- It is crucial to adhere to all environmental safety protocols when operating a power plant that runs on coal.

REFERENCES

Abbasi, A. H. (2014). Coal-Fired Power Generation in Pakistan Technology, Efficiency and Pollution. Centre for Research and Security studies. https://crss.pk/coal-fired-power-generation-in-pakistan-technology-efficiency-and-pollution/

ADB (2022). Pakistan: Jamshoro Power Generation Project, Environmental Monitoring Report. Available at https://www.adb.org/sites/default/files/project-documents/47094/47094-001-emr-en_26.pdf

Ali, S. (2022). Solving the Energy Crisis is a “Now or Never” for Pakistan: The Future is Thar! Daily Pakistan, April 22. Accessed at https://en.dailypakistan.com.pk/22-Apr-2022/solving-the-energy-crisis-is-a-now-or-never-for-pakistan-the-future-is-thar

Ali, S. A. (2022). Local But Complicated. The News, July 30. Accessed at https://www.thenews.com.pk/print/978135-local-but-complicated

Alkon, M., Heb, X., Parisc, A. R., Liaod, W., Hodsone, T., Wandersf, N., and Wangg, Y. (2019) Water security implications of coal-fired power plants financed through China’s Belt and Road Initiative. Energy Policy, 132, https://doi.org/10.1016/j.enpol.2019.06.044.

Bhandary, R. R. & Gallagher, K. S. (2022). What drives Pakistan’s coal-fired power plant construction boom? Understanding the China-Pakistan Economic Corridor’s energy portfolio. World Development Perspectives, 25, https://doi.org/10.1016/j.wdp.2022.100396

Cheema, T.B, Haque, N. U. and Malik, A. (2022). Power Sector: An Enigma with No Easy Solution. PIDE-RASTA.

Coutinho, M. and Butt, H. K. (2014). Environmental Impact Assessment Guidance for Coal Fired Power Plants in Pakistan. Islamabad: IUCN Pakistan.

Ghumman, M. (2023). “Gwadar Plants on Thar Coal: Two Chinese Loans to be Confirmed Soon.” Business Recorder, January 19. Accessed at https://www.brecorder.com/news/40221115

IEA (2012). Technology Roadmap: High-Efficiency, Low-Emissions Coal-Fired Power Generation. International Energy Agency, OECD.

JICA (2013) Data Collection Survey on Thar Coal Field in Pakistan. https://openjicareport.jica.go.jp/pdf/12113221_01.pdf

JICA (2016) Preparatory Survey on Lakhra Coal Fired Thermal Power Plant Construction Project in Pakistan. https://openjicareport.jica.go.jp/pdf/12267449_01.pdf

JICA (2016). https://openjicareport.jica.go.jp/pdf/12267431_02.pdf

Kumar, G. N. and Gundabattini, E. (2022). Investigation of Supercritical Power Plant Boiler Combustion Process Optimisation through CFD and Genetic Algorithm Methods. Energies, 15, 9076. https://doi.org/10.3390/en15239076

Larson, A. (2021). Types of Coal and Fuel Blending Tips for Coal Power Plants

NEPRA (2022). State of Industry Report, National Electric Power Regulatory Authority, Islamabad.

PACRA (2020) Coal Mining and Trading: Sector Overview. https://www.pacra.com/sector_research/Sector%20Presentation%20-%20Coal%20July%202020_ 594463009.pdf

Rizvi, S. A. F. (2021). The Case of Thar Coal for Pakistan. Available at https://macropakistani.com/thar-coal/

Sheikh, H. (2022). Transition to Clean Energy: How is power, capitalism and politics perpetuating coal use in Pakistan? Pakistan's Growth Story, November 16. Available at https://devpakblog.com/2022/11/16/transition-to-clean-energy-how-is-power-capitlaism-and-politics-perpetuating-coal-use-in-pakistan/

Sloss, L. L. (2014) Blending of coals to meet power station requirements. IEA Clean Coal Center. Accessed https://usea.org/sites/default/files/072014_Blending%20of%20coals%20to%20meet%20power%20station%20requirements_ccc238.pdf

Tramošljika, B., Blecich, P., Bonefačić, I., and Glažar, V. (2021). Advanced Ultra-Supercritical Coal-Fired Power Plant with Post-Combustion Carbon Capture: Analysis of Electricity Penalty and CO2 Emission Reduction. Sustainability 2021, 13, 801. https://doi.org/10.3390/su13020801.

Pakistan's Nuclear Energy Outlook*

Afia Malik

INTRODUCTION

Due to concerns over carbon emissions and volatility in fossil fuel prices, there has been a renewed interest in nuclear energy worldwide as a solution to growing energy demands (Vegel and Quinn, 2017). Currently, fossil fuels comprise 63% of Pakistan's commercial energy supplies, while the remaining 37 percent is derived from renewables (including hydro)(28 percent) and nuclear power(9 percent) (GOP, 2023).

GLOBAL NUCLEAR ENERGY EXPANSION

For centuries, fossil fuels remained the dominant source of energy globally. It was in the 1950s that commercial nuclear power stations started operations. With this, an avenue for nuclear energy opens, reducing oil and gas import dependency in many countries. Several countries embarked on nuclear power programs after the 1970s energy crisis (dramatic surge in global oil prices). Most Nuclear Power Reactors (NPRs) were constructed from 1970 to 1985.

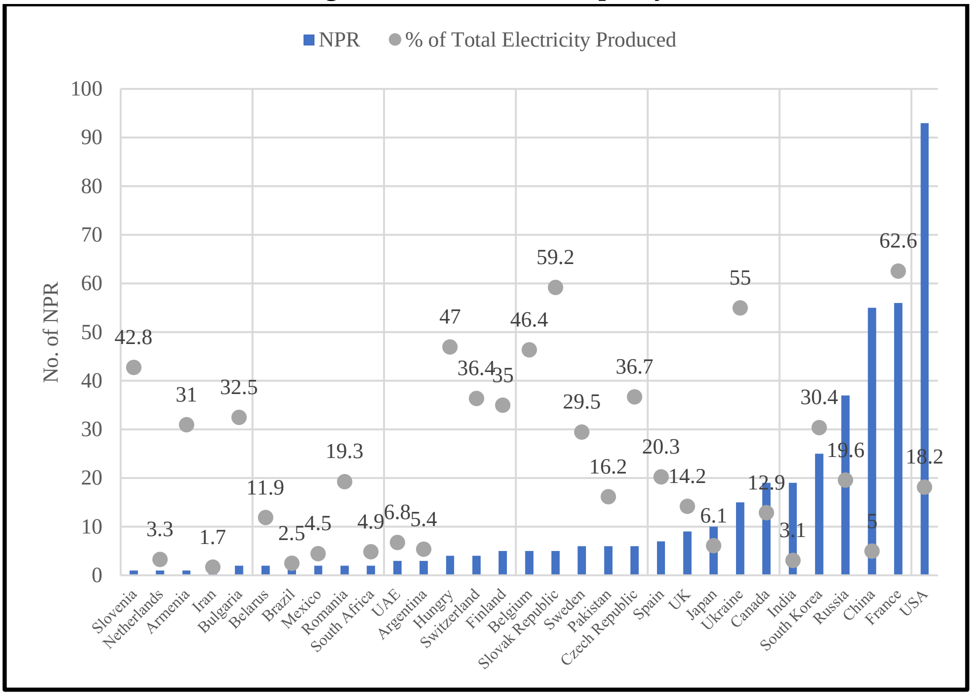
As of August 16, 2023, nuclear energy meets around 10 percent of global energy demand, with 408 currently operational NPRs with a capacity of 366736 MW in 31 countries (Figure 1). In addition, 57 new NPRs are under construction (IAEA, 2023).

France stands out among 31 countries, generating 63 percent of its electricity through nuclear power. It began expanding its nuclear power industry in the 1970s to reduce dependence on foreign oil and lower emissions[170]. Ukraine and the Slovak Republic follow France for depending on NPRs for more than 50 percent of electricity generation (Figure 1).

* It was published as PIDE Knowledge Brief 2023:103.

[170] By increasing its reliance on nuclear power, France reduced its fossil-based CO2 from the power industry from 112 MtCO2/year in 1980 to 34.7 Mt CO2/ year in 2021 (Crippa et al., 2022).

Fig. 1. Global Nuclear Capacity



Source: IAEA Power Reactor Information System.

SALIENT FEATURES OF NUCLEAR POWER REACTORS

Dependability

Nuclear power plants can operate for up to 18 months without refueling. Additionally, they can store fuel on-site for an additional 18 months without incurring extra costs (GOP, 2023). Due to this, nuclear power plants are less susceptible to price fluctuations and supply chain disruptions. Furthermore, they minimise the risks of grid disruptions caused by weather events. Nuclear power also has the highest reliability or capacity factor. For example, in 2021, nuclear power in the US had a capacity factor of over 92 percent, compared to coal (49.3 percent), natural gas (54.4 percent), wind (34.6 percent), and solar (24.6 percent)[171].

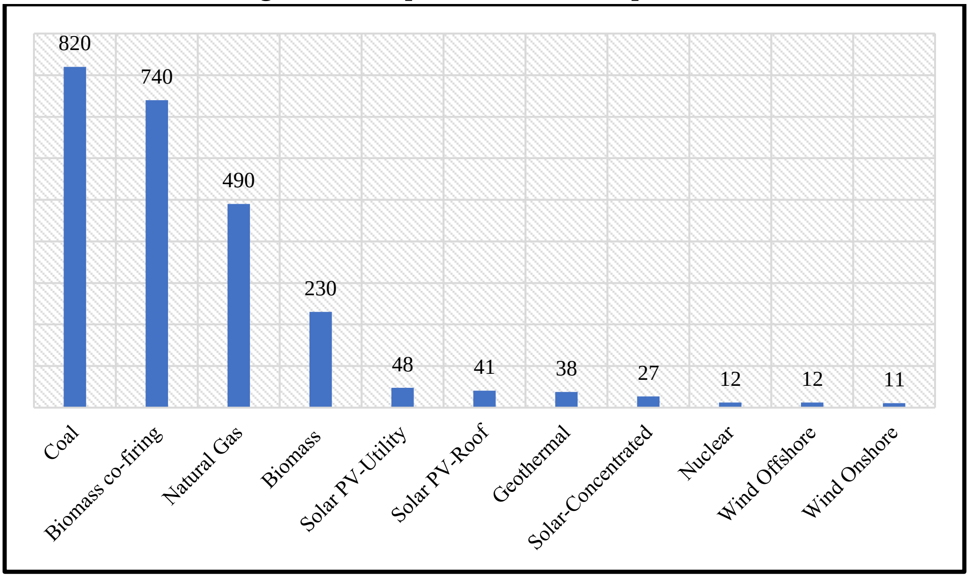
Eco-Friendly

It is not a renewable energy source because of its dependence on a chemical - uranium. While uranium can be found in rocks worldwide, power plants need a specific type, uranium-235, which has limited supplies (Patapati, 2022). However, it is a clean energy source with negligible greenhouse gas emissions. Its CO2 equivalent emissions are even less than some renewable energy sources (Figure 2).

---

[171] https://www.energy.gov/ne/articles/what-generation-capacity#:~:text=The%20Capacity%20Factor&text=It%20basically%20measures%20how%20often,of%20the%20time%20in%202021.

Fig. 2. CO2 Equivalent Emissions per kWh



Source: https://world-nuclear.org/nuclear-essentials/how-can-nuclear-combat-climate-change.aspx#:~:text=Nuclear%20power%20plants%20produce%20no,electricity%20when%20compared%20with%20solar.

A primary environmental concern regarding nuclear power is creating radioactive waste, including uranium mill tailings, used reactor fuel, and other radioactive materials. However, the radioactivity of nuclear waste decreases over time through a process called radioactive decay. Radioactive waste with a short half-life[172] is often temporarily stored before disposal to decrease potential radiation doses to personnel handling and transporting the waste while reducing radiation levels at disposal sites[173].

Additionally, although nuclear plants produce toxic nuclear waste, the amount produced is negligible. The amount of nuclear waste produced in 70 years equals what coal plants produce in an hour. Nuclear fuel is highly dense and contains enormous energy in a small amount (Perch Energy, 2022).

Compared to solar and wind, nuclear power plants require significantly less land. One estimate suggests that a wind farm needs 360 times more land to generate the same energy as a nuclear power plant, while solar requires 75 times more land area (cited from Perch Energy, 2022).

Economics of Nuclear Power Plant

Nuclear power plants are expensive to build (CAPEX) but cheap to run. Safety costs, including waste disposal and decommissioning costs, are included in their operating costs[174]. Nuclear energy is even more economical than fossil fuels when considering social,

---

[172] The time duration for the radioactivity of radioactive material to reduce to half its original level is referred to as the radioactive half-life.

[173] https://www.eia.gov/energyexplained/nuclear/nuclear-power-and-the-environment.php

[174] Nuclear power expenses consist of capital and operating costs. Capital expenses comprise site preparation, engineering, manufacturing, construction, commissioning, and financing while operating expenses include fuel costs (from uranium mining to fuel fabrication), maintenance, decommissioning, and waste disposal.

health, and environmental costs. System costs for nuclear power are much lower than for intermittent renewables[175].

Repaying the initial investment each year is more expensive due to the technical complexity of these plants and the strict licensing and design requirements they must meet. Building a new nuclear power plant involves hiring highly qualified specialists, which can take many years and add to financing costs. Delays caused by design changes or lawsuits can further increase financing charges, which may even exceed the actual construction costs in some cases.

Over the past few decades, the costs of nuclear plants have increased. Many of these costs result from the indirect expenses of constructing plants, such as engineering, management, and supervision. In addition, these costs have risen due to increased safety regulations. However, the cost constraints have been reduced through the small modular nuclear reactors (SMRs) ((Box 1).

Box 1. Small Modular Reactors (SMRs)

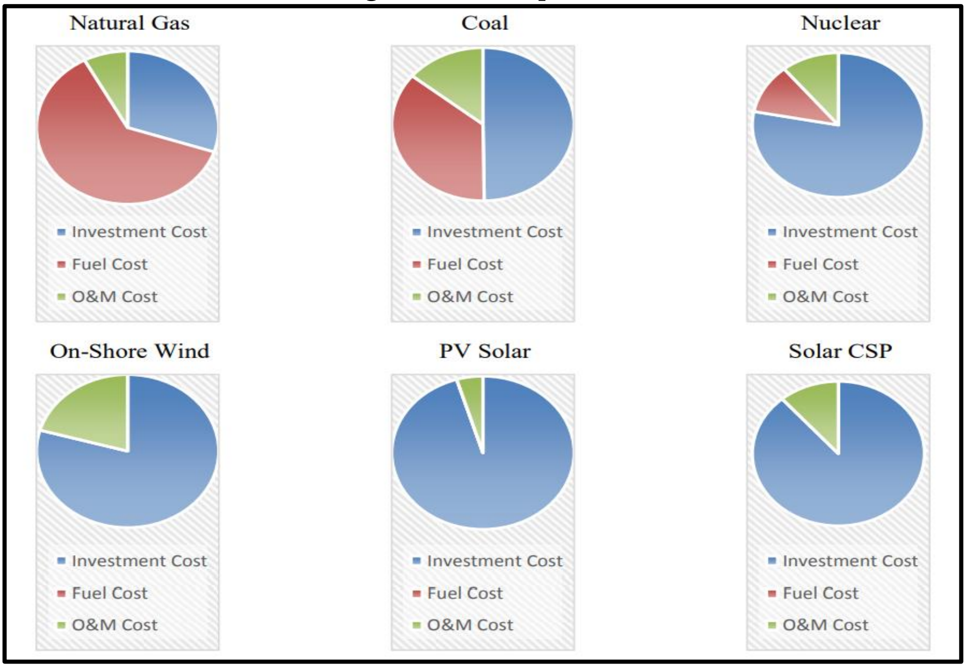
- SMRs can produce up to 300 MW of electric power.
- Cost-effective for smaller electricity grids.
- Easy to transport and install to meet demand in the market at any remote or distant location; specific SMR designs can replace diesel generators in small islands or remote regions.
- It can be deployed as a single or multi-module plant with advanced safety measures.
- Provides flexible power generation for a broader range of users and applications (even for non-electrical use, providing heat for industrial processes, hydrogen production, or seawater desalination).
- Can be replaced with aging fossil-fired units.
- Has improved safety performance.
- Moderate financial commitment compared to large nuclear power reactors.
- Can achieve improved thermal efficiencies through cogeneration, resulting in better returns on investment.
- SMRs have lower fuel requirements. Unlike traditional plants that require refueling every 1 to 2 years, SMRs may only need to be refueled every 3 to 7 years. Some SMRs are designed to operate for up to 30 years without refueling.

While SMRs have lower upfront capital cost per unit, their economic competitiveness is yet to be proven.

Source: IAEA, 2020.
https://www.iaea.org/newscenter/news/what-are-small-modular-reactors-smrs

175 Source: World Nuclear Association

Fig. 3. Cost Comparison



Source: Cited from https://progress.institute/nuclear-power-plant-construction-costs/

Despite having large capital investment, the levelised cost of electricity generated through nuclear power plants is less than coal or gas power plants.

Table 4

Normalised Levelised Cost of Energy

	Nuclear	Coal		Natural Gas	
	LCOE	LCOE	LCOE with carbon cost	LCOE	LCOE with carbon cost
US	1	0.88	1.21	0.67	0.85
South Korea	1	1.40	1.99	1.54-2.69	1.78-2.93
Japan	1	0.94	1.23	0.92-1.46	1.05-1.58
China	1	1.03	1.63	0.74-1.72	0.97-1.95
France	1	–	–	0.58-1.05	0.71-1.18
Pakistan	1	1.09	–	–	–

Source: Faizi (2020) and MIT (2018)

Note: Cost values are normalised to a value of 1 for nuclear power reactors; if the normalised value is less than 1, that energy option is more competitive than nuclear, and if it is greater than 1, nuclear is more competitive.

PAKISTAN NUCLEAR POWER CAPACITY

Pakistan has six nuclear power reactors (NRPs) with a capacity of 3,530 MW, contributing about 27 percent of the total electricity generation in the national grid in December 2022. All these plants are pressurised water reactors (PWR), the technology mainly used worldwide. China has assisted Pakistan's civil nuclear energy program since the late 1970s by helping construct nuclear power plants (Khalid, 2020).

Box 2. History of Pakistan's Nuclear Power Industry

- 1955: The Pakistan Atomic Energy Committee was established.
- 1956: To develop nuclear technology and regulate the use of radioactive substances, the Atomic Energy Council was established. It was tasked with procuring, supplying, manufacturing, and disposing of radioactive materials. The Council also conducted surveys for radioactive minerals. They created comprehensive plans to explore and mine uranium, construct nuclear research, and power reactors, and utilise other applications of nuclear technology.
- Pakistan started its nuclear program in 1965 with a 5 MW research reactor at the Pakistan Institute of Nuclear Sciences and Technology (PINSTECH). The construction of this research complex was initiated in 1961. The project was designed by Edward D. Stone and won the 1966 American Society of Landscape Architects (ASLA) Professional Award for design excellence.
- In 1961, the Pakistan Atomic Energy Commission (PAEC) created a nuclear minerals division to aid in Pakistan's geological surveys. During that same year, the search for uranium began. This search was for nuclear minerals and to establish milling processing facilities. The survey concluded that the Siwaliks of Suleiman Range (Dera Ghazi Khan)_ *uranium favourable*.
- 1964, aerodynamic surveys were conducted.
- 1965, the Pakistan Atomic Energy Commission (PAEC) was given a legal cover by promulgating the PAEC Ordinance.
- Pakistan established a nuclear safety division within PAEC, which became the Directorate of Nuclear Safety and Radiation Protection after the Pakistan Nuclear Safety and Radiation Protection Ordinance 1984. The Pakistan Nuclear Regulatory Authority was created to oversee regulatory affairs and separate promotion and regulatory functions by promulgating the Pakistan Nuclear Regulatory Authority Ordinance in 2001.

Source: Sultan et al. (2015); https://inis.iaea.org/collection/NCLCollectionStore/_Public/21/020/21020770.pdf#page=11; and https://www.pnra.org/history.html

Pakistan constructed its first nuclear power plant, KANUPP, in Karachi in 1972[176]. After its shutdown in August 2021, KANUPP's infrastructure and knowledge supported the development of reliable nuclear power reactors in Pakistan. KANUPP, a Pressurised Heavy Water Reactor (PHWR), was built with Canada's assistance. However, all six new generations of nuclear plants in Pakistan are Pressurised Water Reactors (PWR) designed and constructed with the help of China (Government of Pakistan, 2023).

[176] In 1959, Canada and Pakistan signed an agreement for nuclear cooperation that included the installation of a 137 MW CANDU-style power reactor named KANUPP. Later, in 1969, a deal was struck between Canada, Pakistan, and the IAEA, with the IAEA being responsible for safeguarding the KANUPP reactor. The reactor commenced commercial operations in 1972 (Sultan et al., 2015).

Table 5a

Pakistan Nuclear Power Plants

Name	Capacity MW (Gross)	Capacity MW (Net)	Connected to Grid	Gross Electricity sent to grid up to March 31, 2023 (Million kWh)	Plant Factor % FY2022
Chashma Nuclear Power Plant – 1 (C-1)	325	300	Jun-2000	46225	89
Chashma Nuclear Power Plant – 2 (C-2)	325	300	Mar-2011	27294	86.3
Chashma Nuclear Power Plant – 3 (C-3)	340	315	Oct-2016	15311	78.3
Chashma Nuclear Power Plant – 4 (C-4)	340	315	Jun-2017	13013	73.5
Karachi Nuclear Power Plant-2 (K-2)	1100	1017	Mar-2021	14052	68.1
Karachi Nuclear Power Plant-3 (K-3)	1100	1017	Mar-2022	7853	19.6
Chashma Nuclear power Plant – 5 (C-5)	1200		Expected in 2029	–	–

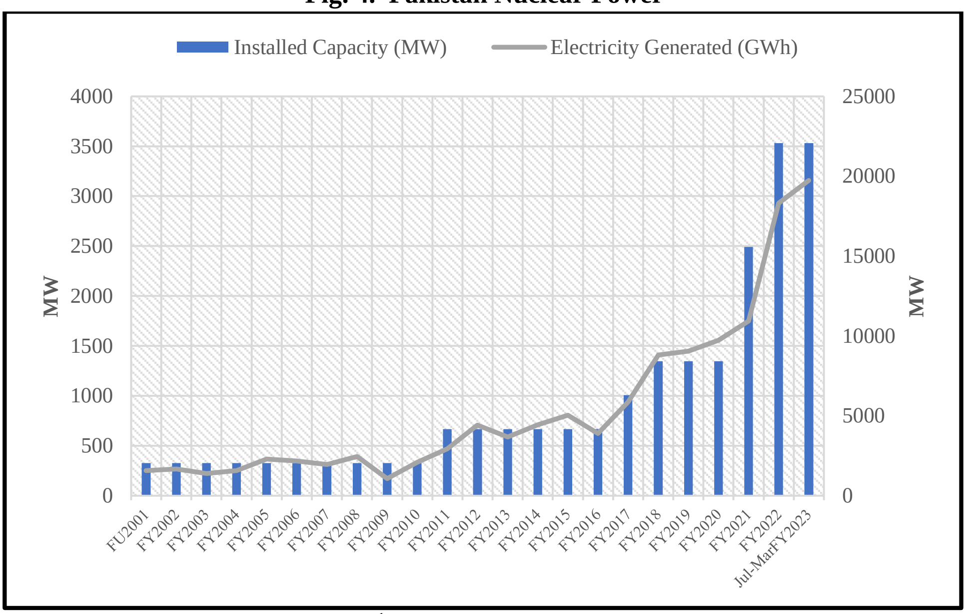
Source: Pakistan Atomic Energy Commission.

Table 2b.

Name	Fixed O&M	Var. O&M	Fuel Cost US$/GJ	Heat Rate GJ/MWh	Cost US$/MW	Cost Rs/kWh
C-1	135.48	0	0.50	10.91	5.47	0.97
C-2	124.60	0	0.58	10.91	6.33	1.13
C-3	99.91	0	0.49	10.91	5.35	0.95
C-4	99.08	0	0.61	10.91	6.65	1.18
K-2	52.28	0	0.47	10	4.77	0.85
K-3	52.20	0	0.47	10	4.70	0.84
C-5	73.89	0	0.47	9.57	4.50	0.80

Source: IGCEP 2022-31.

Fig. 4. Pakistan Nuclear Power



Source: NTDC Power System Statistics, 47th Edition, 2022 and GOP, 2023.

NPRs accounted for only 8.6 percent of Pakistan's installed generation capacity from July to March FY2023. However, due to the high-capacity factor of NRPs, they generated 21 percent of the country's electricity in the same period (Figure 4). In December 2022, nuclear was the leading source of electricity generation, with a share of 27 percent, followed by hydro (20.4 percent) and coal (18.1 percent) (Table 3). Nuclear has the highest capacity utilisation rate. In FY2021, the average capacity utilisation rate of nuclear energy was at 72 percent, followed by hydro (45 percent), thermal (38 percent), wind (27 percent), solar (19 percent), and Bagasse (15 percent) (PBS, 2022).

Nuclear energy is significant in Pakistan's electricity generation mix due to its dependable nature and consistently low energy costs (Table 3a). Most of the cost of nuclear power comes from capital costs, which are fixed, so nuclear plants are usually operated continuously to supply baseload power, as was the case in Pakistan in December 2022. No doubt, the capacity costs of nuclear plants are higher than those of local coal and gas power plants (Table 3b), but they have much lower energy costs and a much larger operating life.

Over the decades, the nuclear power industry has significantly improved its performance and operational safety worldwide. In addition to developing reactor technology in Pakistan, the nuclear power industry is also focused on improving regulations and learning from past events. The Pakistan Nuclear Regulatory Authority (PNRA) is an independent national regulator responsible for implementing these regulations. The Pakistan Atomic Energy Commission (PAEC)[177] conducts Periodic Safety Reviews with the help of experts from the nuclear industry and international peers. Furthermore, the PAEC regularly organises courses to promote and ensure a safety culture at all levels[178].

Table 3a

Generation Mix with Energy Costs (Monthly Comparison)

	% Share in Total Generation		Energy Cost (Rs/kWh)	
	Dec. 2022	Jun. 2023	Dec. 2022	Jun. 2023
Hydro	20.44	30.14	–	–
Coal	18.07	17.75	11.5	14.05
HSD	–	0.07	–	30.45
RFO	0.46	5.43	25.8	26.1
Gas	15.13	8.54	10.5	11.74
RLNG	13.71	18.55	20.2	24.07
Nuclear	27.15	13.54	1.07	1.07
Import	0.47	0.18	21.5	23.63
Mix	0.03	0.20	3.3	6.29
Wind	2.51	4.36	–	–
Bagasse	1.20	0.48	5.97	5.98
Solar	0.83	0.77	2.8	–
Units Generated (GWh)	8417	13715		

Source: NEPRA.

[177] The Pakistan Atomic Energy Commission was established in March 1956 to develop nuclear technology, regulate, procure, supply, and manufacture all radioactive substances, and conduct surveys for radioactive minerals. It became a lawful entity following an act of parliament in 1965.

[178] https://paec.gov.pk/Parameters/Safe/

Table 3b

Generation Mix with Power Purchase Price

Generation Mix	FY2023 Projected Generation (GWh)	FY2023 Energy Price (Rs/KWh)	FY2023 Capacity Price (Rs/KWh)	FY2024 Projected Generation (GWh)	FY2024 Energy Price (Rs/KWh)	FY2024 Capacity Price (Rs/KWh)
Hydro	44859	0.12	5.19	41226	0.09	6.84
Imported Coal*	39202	19.25	9.22	16552	17.18	23.36
Local Coal				22696	10.55	13.42
Gas	12685	8.44	4.52	14312	8.57	4.45
RLNG	15036	22.36	8.16	6639	23.56	27.86
Bagasse	1012	7.14	8.69	1136	6.06	8.77
Wind	5611	-	20.69	5212	-	33.64
Solar	1163	-	21.22	2563	-	15.04
Nuclear	22281	0.95	13.65	25566	1.04	17.34

Source: NEPRA Tariff Determinations.

Pakistan Trade Potential in Nuclear Energy

Pakistan has developed its civil nuclear fuel cycle with the support of China, independent of its nuclear weapons. Due to its weapons program, Pakistan is not a member of the Nuclear Non-Proliferation Treaty[179], limiting its potential to trade or access nuclear materials (uranium) and hindering indigenous development of civil nuclear energy[180].

Over the past three decades, China has installed four nuclear power generation units in Chashma, with a net generation capacity of 1230MW, and began the construction of a fifth one with a capacity of 1200MW (Table 1). C-5 will be Pakistan's largest generation-III plus nuclear power project (Box 3).

Despite not being a significant player in the global uranium market, Pakistan has plans to increase the use of nuclear energy in power generation significantly; the availability of uranium will play a key role in Pakistan's nuclear future (Sultan et al., 2015).

Between 1993 and 2005, the production of weapons-grade uranium (enriched to 90 percent uranium-235 or greater) in Pakistan increased (Akhtar et al., 2015). However, despite this increase and ongoing efforts, the evidence suggests Pakistan is experiencing a uranium shortage. Based on assessments of only Khushab reactors in Pakistan, four reactors operating at about 70 percent efficiency may need 70 tU per year. Hanhum et al. (2018) cited that Pakistan only mines about 45 tU annually. It means Pakistan already uses more uranium than it produces to operate its four Khushab reactors. Adding Chashma nuclear reactors means Pakistan's demand for uranium is much more. Enriched fuel for the power reactors is currently imported from China[181].

The shortage of uranium has prompted the Pakistan Atomic Energy Commission (PAEC) to initiate costly exploration drilling projects in the Kirthar mountain range, the Kohat plateau, and the Potwar plateau. To aid in this effort, the PAEC signed a technical cooperation contract with the China National Nuclear Corporation (CNNC) in July 2017 for uranium resource exploration and development (Hanhum et al., 2018).

[179] The Treaty aims to facilitate the use of nuclear technology for peaceful purposes by constraining the development and production of nuclear weaponry.

[180] https://world-nuclear.org/information-library/country-profiles/countries-o-s/pakistan.aspx#ECSArticleLink1

[181] https://world-nuclear.org/information-library/country-profiles/countries-o-s/pakistan.aspx

Box 3. Evolution of C-5 and its Challenge

- In April 2015, the Strategic Plans Division signed a framework agreement for C-5.
- PAEC and their Chinese counterparts signed a commercial agreement in November 2017.
- Due to the strategic nature of the project, the C-5 was included in the committed projects in IGCEP 2019 and 2022.
- The IGCEP (2022-31) was primarily based on the least cost principle. Therefore, C-5 was labeled a candidate project because of its high upfront cost. The plan did not fully consider other factors, such as the lower operational costs and longer lifespan, to support the baseload.
- In June 2023, China began its construction with advanced safety and foolproof security features.
- It is estimated to cost a minimum of US$ 3.7 billion, with roughly 85% Chinese credit. Cost has escalated by more than 50 percent since its planning. China's Import and Export Bank is expected to provide a major part of the financing.
- The location of C-5 is strategically important due to its proximity to load centers; its transmission costs are lower than other baseload options, such as Thar coal plants or large hydro projects (with similar CAPEX) (Dasu and Diamer Bhasha).
- Being eco-friendly, it is a better baseload option.
- However, the only challenge is that the system's existing capacity is surplus. If the existing capacity remains underutilised, it escalates the capacity cost component in the consumer-end tariff. For FY2024, these costs will be around Rs 2 trillion. C-5 addition may offset plans to include renewable power plants in the system to keep the capacity burden under control. By the time C-5 is completed and added, with all other factors constant, this will further increase the capacity challenge.

Source: IGCEP 2022, Ghumman (2023), and NEA (2023).
Note: Tariff details are not publicly available.

KEY TAKEAWAYS

- Pakistan desires to join the Nuclear Supplies Group (Khalid, 2020). After completing this task, harnessing the potential for nuclear energy trade will be easier. Pakistan has developed significant expertise in building, operating, and designing nuclear reactors, resulting in a safe and reliable nuclear power industry that meets global standards. However, diplomatic efforts are needed to join the Nuclear Supplies Group.
- In Pakistan, 25 percent of the population still has no access to electricity, and more than 90 percent of the rural population relies on non-commercial energy sources. Per capita energy consumption is one of the lowest in the world, at only 17.1 gigajoules per capita, higher than only Bangladesh and some African countries. The biggest challenge in improving access to energy is the need for more infrastructure, particularly in rural areas where grid coverage is limited and

connecting to the grid can be expensive. In locations where transmission lines and grid capacity are inadequate or without access to the grid, SMRs can be a good option for providing reliable baseload support to renewable energy resources.

Microreactors are more efficient, cost-effective, safer, and offer greater process control than traditional reactors. They also produce reactions more quickly and with better yields. In addition, SMRs can be produced on-site and on-demand, making them an ideal solution for delivering clean electricity to industry or other economic activities and the population in remote areas.

- Constructing large nuclear plants can be costly despite their dependability, safety, and low energy costs. Even if energy prices remain low, the capacity purchase price will rise with any new addition, such as C-5. However, notwithstanding the high capacity costs, nuclear plants have an operation life of almost 60 years, longer than fossil fuel and other renewable power plants, except for hydro plants. At the same time, it is crucial to be transparent when finalising any new power purchase agreement by clearly defining the tariffs or incentives provided. This will allow for an independent assessment to be conducted beforehand.
- Pakistan currently has sufficient electricity generation capacity, but the costs of generating electricity have increased due to a reliance on imported fuels, dollar-denominated payments, rising interest rates, and financial difficulties. This has led to higher consumer tariffs, frequent power outages, and mounting circular debt. Boosting energy use in productive activities is crucial to alleviate the burden of capacity payment challenges in the coming years.
- In the future, Pakistan can augment its nuclear energy production while concurrently integrating renewable sources to promote a greener future.

REFERENCES

Akhtar, S., Yong, Y. X., and Yue, W. F. (2015). Uranium Deposits and Resources Potential in Pakistan: A Review. Sci. Int. Lahore, 27(2), 1293-1296.

Crippa, M. et al. (2022). CO2 emissions of all world countries - 2022 Report, EUR 31182 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-55802-6, doi: 10.2760/07904, JRC130363.

Ghumman, M. (2023). $5bn Chasma-5 N-plant to produce power at Rs 20 per unit: Country has swallowed a bitter pill? https://www.brecorder.com/news/40252138.

GOP (2023). Pakistan Economic Survey 2022-23, Finance Division, Government of Pakistan.

Hanham, M., Liu, G., Rodgers, J., McIntosh, B., Rowlan, M., Best, M., Milne, S., and Lepinard, O. (2018). Monitoring Uranium Mining and Milling in India and Pakistan through Remote Sensing Imagery. CNS Occasional Paper No. 41. James's Martin Center for Nonproliferation Studies.

IAEA (2020). Advances in Small Modular Reactor Technology Developments. IAEA Advanced Reactors Information System (ARIS) http://aris.iaea.org.

IAEA (2023). Power Reactor Information System (PRIS). www.iaea.org.

Igini, M. (2023). The Advantages and Disadvantages of Nuclear Energy. https://earth.org/the-advantages-and-disadvantages-of-nuclear-energy/#:~:text=While%20nuclear%20energy%20may%20be,tens%20of%20thousands%20of%20years.

Khalid, A. (2020). China-Pakistan Nuclear Energy Cooperation: History and Key Debates. https://southasianvoices.org/china-pakistan-nuclear-energy-cooperation/

MIT (2018). The Future of Nuclear Energy in a Carbon-Constrained World. MIT Energy Initiative.

Moghal, M. Y. (n.d.). Current Uranium Activities in Pakistan. https://inis.iaea.org/collection/NCLCollectionStore/_Public/33/003/33003346.pdf?r=1&r=1

NEA (2023). Uranium 2022: Resources, Production and Demand. No. 7634, a joint report by Nuclear Energy Association in collaboration with International Atomic Energy Agency, OECD.

Patapati, S. (2022). Is Nuclear Energy A Renewable Resource? http://large.stanford.edu/courses/2022/ph241/patapati1/

PBS (2022). Trends in Electricity Generation. Pakistan Bureau of Statistics, Ministry of Planning, Development, and Special Initiatives, Government of Pakistan.

Perch (2022). Is Nuclear Energy Renewable Or Sustainable? Pros & Cons. Perch Energy. Can be accessed at https://www.perchenergy.com/blog/energy/is-nuclear-energy-renewable-sustainable.

Sultan, M., Jaspal, Z.N., Riaz. M., Hashmi, J., Hashmi, J., and Hassan, . (2015). DIIS Report 2015:08.

Vegel, B. and Quinn, J. C. (2017). Economic Evaluation of Small Modular Nuclear Reactors and the Complications of Regulatory Fee Structures. Energy Policy, 104, 395-403.

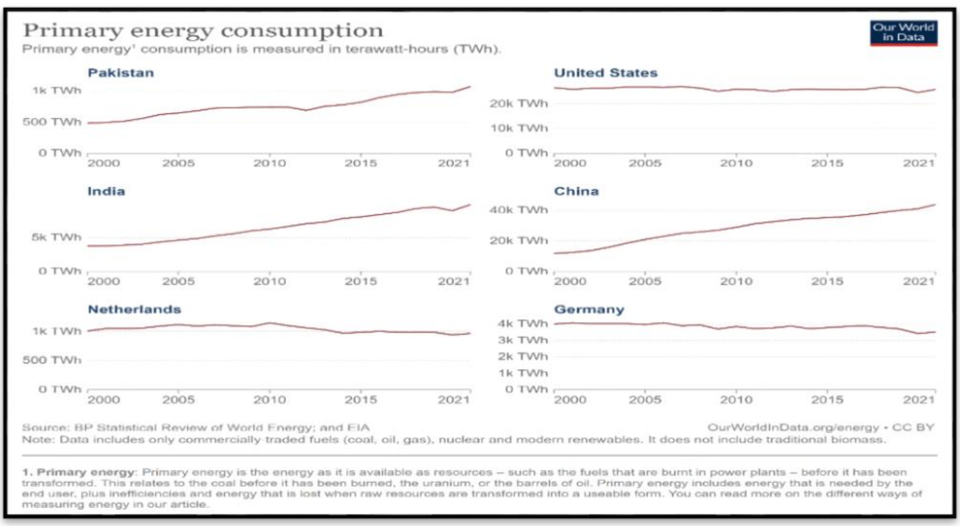
Energy Efficient Buildings to Save Energy in Pakistan*

ANJEELA KHURRAM and TEHMINA ASAD

INTRODUCTION

Global energy consumption is increasing rapidly. Pakistan is also facing a severe energy crisis. A glimpse of energy consumption patterns in developing countries compared to those in developed countries depicts that energy consumption in developing countries, including Pakistan, has been rising (Figure 1).

Figure 1. Primary Energy Consumption since 2000



Source: https://ourworldindata.org/energy/country/pakistan?country=IND~CHN~USA~DEU~NLD~PAK#how-much-energy-does-the-country-consume-each-year

Since 2002, Primary Energy Consumption in Pakistan has increased from 484 terawatt-hours (TWh) in 2000 to 1071TWh in 2021[182]. However, the decline in energy consumption in developed countries like the United States, Germany, and the Netherlands manifests that these countries are becoming more energy efficient with time. By 2022, the Netherlands and Germany became the top energy-efficient countries in the world, with

* This chapter is completed in 2023.

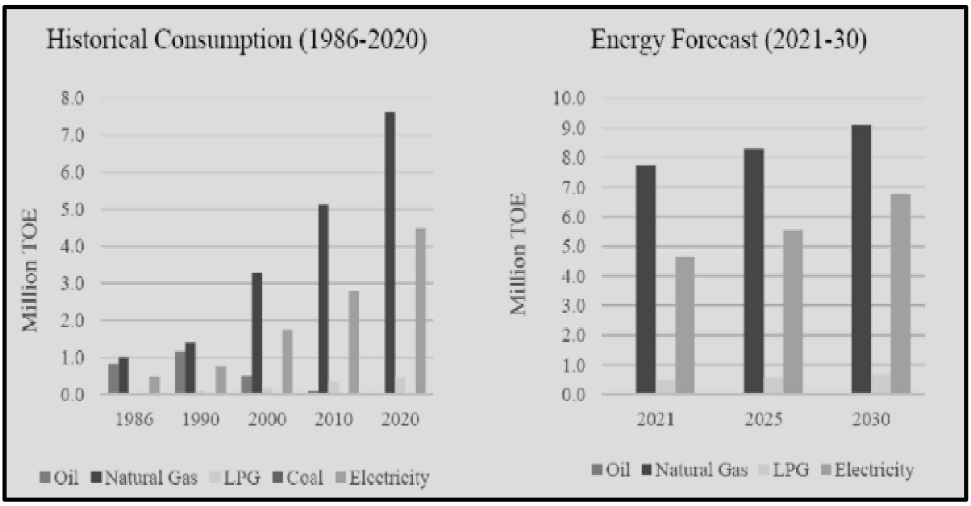
182 https://ourworldindata.org/energy/country/pakistan?country=IND~CHN~USA~DEU~NLD~PAK#how-much-energy-does-the-country-consume-each-year

China and India in 9th and 16th positions, respectively[183], showing their efforts to be energy efficient. This knowledge brief offers a solution for sustainably managing the increasing energy demand in Pakistan's building sector.

ENERGY CONSUMPTION IN PAKISTAN

In Pakistan, electricity consumption in the domestic sector has risen continuously since 1986 due to rural electrification and urbanisation. Pakistan's total energy consumption is 60.21 MTOE[184]. By 2030[185], a spike in energy consumption is expected, such that natural gas consumption will be 55 percent, followed by electricity (40 percent) in the energy mix for the domestic sector (IEP, 2021) (Figure 2).

Fig. 2. Historical Energy Consumption & Energy Forecast in Domestic Sector in Pakistan



Source: IEP, 2021.

There are over 29 million households in the residential sector of Pakistan, consuming about 20.98 percent of the country's total energy consumption. The electricity consumption pattern in Pakistan is in stark contrast with the global trend: 48.5 percent of the total electricity consumption is in the domestic sector, followed by industry, which consumes 27.2 percent of the total electricity[186]. On the contrary, globally, more electricity is consumed in the industrial sector (41.9 percent) as compared to the domestic sector (26.6 percent)[187]. Even in India, industry consumes 41 percent of total electricity, while the domestic sector consumes only 26 percent[188].

[183] https://www.aceee.org/international-scorecard
[184] Pakistan Energy Yearbook 2021
[185] https://www.pc.gov.pk/uploads/report/IEP_Report_FINAL.pdf
[186] NEPRA State of Industry Report, 2022.
[187] https://www.iea.org/data-and-statistics/charts/world-electricity-final-consumption-by-sector-1974-2019
[188] https://www.statista.com/statistics/1130112/india-electricity-consumption-share-by-sector/

ENERGY CONSUMPTION IN BUILDINGS IN PAKISTAN

A major portion of energy is consumed to condition the buildings (residential, commercial, public, and private) during extreme weather conditions. One reason for high energy consumption in the buildings can be attributed to the construction materials and designs.

Looking deeper highlights that buildings have been constructed using thermally conductive materials without having the insulation capacity, making buildings warmer in the summers and cooler in the winters, leading to high energy usage for regulating the temperature.

For example, the energy demand in Pakistan fluctuates significantly between winters (12 KMW) and summers (32 KMW), with the high cooling load being the primary contributing factor. Domestic cooling accounts for nearly 37.10 percent of the total capacity, while commercial cooling contributes to approximately 65 percent of the total energy demand. The difference is around 20 KMW. Electricity has to be generated at high rates to meet this additional demand, resulting in high tariffs and capacity.

By 2025, the peak electricity demand in Pakistan is expected to increase by an additional 4000 MW. This gap is anticipated to widen due to various factors, including the growing electricity consumption in the building sector.

The buildings sector consumes more electricity than any other sector for space heating and cooling, refrigeration, cooking, lighting, etc. Effective Energy Efficiency and Conservation (EE&C) measures could save Pakistan up to 2.63 MTOE in energy in these areas[189]. Globally, in 2020, the building sector consumes 35 percent of the world's energy, with residential buildings accounting for 22 percent of that consumption (Abergel, 2020). Efficiently managing energy demand can reduce peak load during extreme seasons in the building sector.

ENERGY CONSERVATION BUILDING CODES FOR ENERGY EFFICIENT BUILDINGS

The demand for new construction in Pakistan is increasing. This presents a great opportunity to use energy-efficient equipment, materials, and practices to develop an improved building envelope to reduce energy wastage. For instance, due to high population growth and rapid urbanisation in Pakistan, there is a 5.3 percent annual demand for new construction. By 2023, over 40 million people will live in urban areas, requiring new buildings and accelerating energy demand[190]. There is a need to enforce the Energy Conservation Building Code (ECBC) in the building sector.

The improved building envelope efficiency can reduce the electricity demand for air conditioning by 20 percent[191]. One potential solution is to introduce energy-efficient measures in new construction using sustainable materials, technologies, and design strategies such as Building Information Modeling (BIM) (Box 1). In other words, implementing building codes in Pakistan's buildings is a promising path to reaching energy efficiency goals amidst the energy crisis.

---

[189] https://neeca.gov.pk/SiteImage/Downloads/DRAFT%20NEEC%20ACTION%20PLAN%202023-2030.pdf

[190] https://neeca.gov.pk/SiteImage/Downloads/DRAFT%20NEEC%20ACTION%20PLAN%202023-2030.pdf

[191] Sustainable Energy Efficiency Program, ADB (2009)

Box 1: Building Information Modeling (BIM)

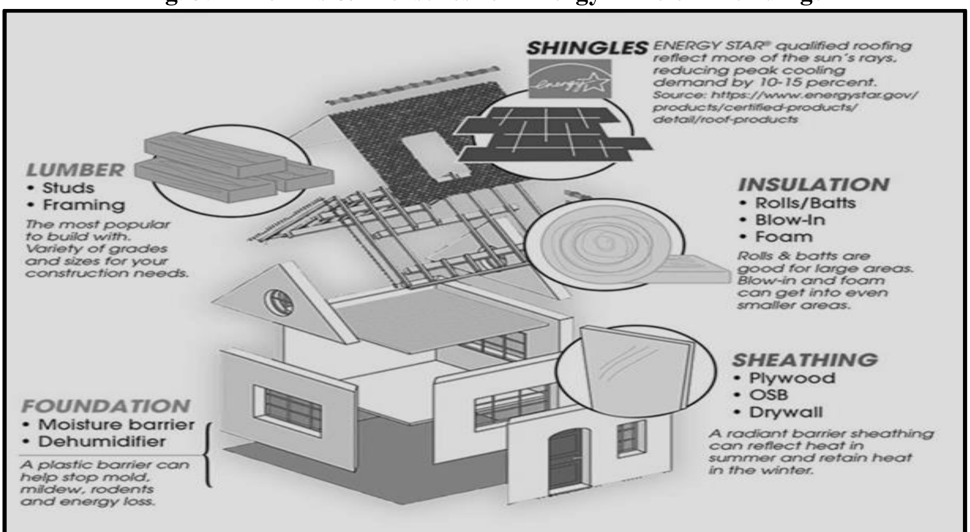
Building Information Modeling (BIM) can decrease the expenses of constructing energy-efficient structures. Using BIM software from companies like Autodesk (San Rafael, CA, USA), EnergyPlus (Orlando, FL, USA), EnergySoft (Novato, CA, USA), and Trimble (Sunnyvale, CA, USA) can help architects, engineers, and construction workers integrate suggestions for more convenient, reliable, and cost-efficient energy-efficient buildings. Combined with energy-efficient tools, BIM can perform a life-cycle cost analysis (LCCA) of a building over its lifetime.

The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) has developed guides and codes that are now the industry standards for energy-efficient green buildings. The United States has also established programs such as Leadership in Energy and Environmental Design (LEED) to certify green buildings and verify their design.

Source: Abbas et al., 2022.

The energy efficiency of a building is determined by how its energy consumption per square meter of floor area compares to established energy consumption benchmarks (Abergel, 2020). Following the ECBC guidelines can help determine appropriate material usage (as shown in Figure 3) and appliance standards. Regulatory regimes, where present, can improve efficiency in building construction and appliances. To achieve energy efficiency, certain measures can be adopted for heating, cooling, air-conditioning, ventilation, lighting, fans, pumps and controls, office or other electrical equipment, and electricity consumption for external lighting, depending on the country and types of building. One potential measure to achieve energy-efficient buildings is to adopt Phase Change Material (PCM) in new buildings or make changes in the existing buildings by retrofitting (Abergel, 2020).

Fig. 3. Materials & Measures for Energy-Efficient Buildings



PROSPECTS OF ENERGY CONSERVATION BUILDING CODE (ECBC) IN PAKISTAN

Research indicates that BIM software can improve energy efficiency in smaller residential buildings to address Pakistan's energy crisis and environmental impact (Arif et al., 2021). Innovations in building design, energy-efficient materials, appliances and ECBC implementation can reduce energy burden.

Pakistan has a sunny and hot climate in most areas due to its geographical location. However, some regions experience extreme weather conditions, resulting in high energy demand for cooling, thus increasing energy consumption. Research shows that incorporating energy conservation measures (ECMs) can improve building energy efficiency, achieving a 40 percent increase in sustainability and cost-effectiveness and saving PKR 113K/year. An energy-efficient house can save up to 65 percent of the annual energy consumption by insulating building materials and solar panels. Though the initial investment cost increases by PKR 1.1 million, it saves PKR 76K/year (Shakoor et al., 2023). Long-run energy savings can offset the upfront incremental construction cost (Chen et al., 2013).

Smart buildings use various technologies to increase efficiency in design, construction, and operation for energy savings[192]. Similarly, Zero-energy buildings (ZEBs) use minimal external energy and have zero carbon emissions. They achieve this through on-site renewable energy sources (Figure 4). On-site renewable energy sources power them to meet energy requirements (Kylili, 2015). Energy-efficient buildings and intelligently designed zero-energy buildings (ZEBs) have the potential to create smarter cities through efficient energy management. Building envelopes alone can save up to 40 percent of the energy consumed by a building and implementing the ECBC can achieve up to half of the energy-saving potential.

There are two strategies[193] to make the existing buildings energy efficient. *Active strategies* consist of heating and cooling systems. *Passive strategies* include building orientation, envelope, air sealing, continuous insulation, daylighting, and natural ventilation opportunities. Passive strategies normally add much front cost and can even reduce the cost of active design strategies by reducing heating and cooling loads (Box 2).

Box 2. Five building Principles behind Passive Building

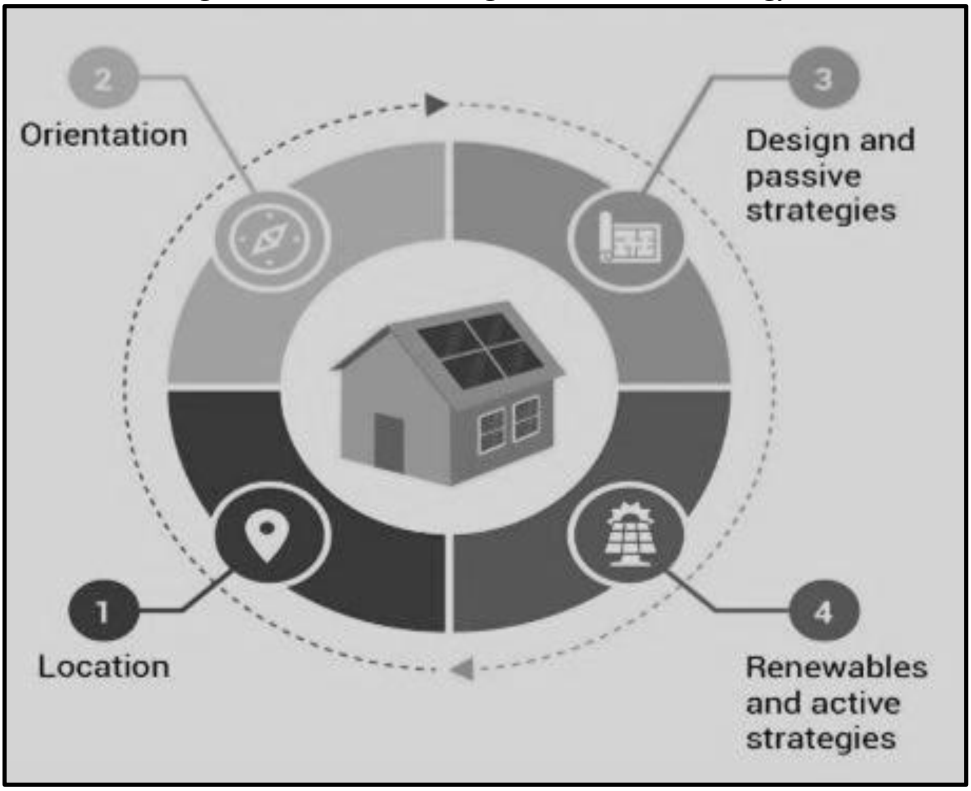
- Continuous insulation breaks thermal bridges between the inside and out,
- Airtight construction stops heat and moisture,
- Optimised windows keep heat in and out,
- Balanced ventilation ensures fresh air & controls moisture, and
- Minimal mechanical is all a super tight building need.

Source: https://commercial.phius.org/service-category/5-principles-drive-phius

[192] SMART2020: Enabling the low carbon economy in the information age," (The Climate Group.2008):3/41.

[193] https://commercial.phius.org/service-category/5-principles-drive-phius

Fig. 4. How Does a Building Achieve Net Zero Energy



Existing buildings can be made energy efficient by retrofitting. An energy audit suggests that the annual energy usage and annual energy cost can be reduced up to 2.33 percent & 4.54 percent respectively, by improving the window-to-wall ratio. Almost 7.62 percent of energy cost can be reduced by modifications in lighting fixtures. Changing the HVAC type can save an additional 14.8 percent of energy costs. Moreover, installing solar photovoltaic panels can save up to PKR 1 million, and natural ventilation can save more than PKR 0.2 million/annum & solar PV panels installation can save up to PKR 1 million annually (Arif et al., 2021). At the national level, NEECA has mandated compliance of ECBC for all new buildings by the end of 2024[194] to achieve energy efficiency targets in the building sector.

NATIONAL ENERGY EFFICIENCY & CONSERVATION AUTHORITY (NEECA)

NEECA, established under the Ministry of Energy (Power Division), is mandated to promote all energy conservation activities across different sectors of economy at the Federal level. It aims to improve energy intensity across sectors through cost-effective measures in cooperation with provincial authorities to achieve sustainable development (Box 3).

[194] https://neeca.gov.pk/SiteImage/Misc/files/NEEC%20Policy%202023-1.pdf

Box 3. NEECA's Initiatives to Ensure EE&C

- In new buildings, mandatory compliance of ECBC by the end of 2024.
- In old buildings, mandatory energy audits of designated consumers with five-year energy saving plan by 2025.
- Compliance with minimum energy performance standards (MEPS) & labelling regimes for electric & gas appliances, & equipment by July 2023.
- Issuance of guidelines by PPRA to ensure procurement of Pakistan energy label appliances in the country.
- Placement of energy managers at designated consumers of the building sector for verifiable energy management system deployment vis-à-vis regular reporting.
- Mandatory energy audits pre- and post-solarisation initiatives in the public buildings.
- The deployment of solar or other distributed energy resources in collaboration with Provincial Designated Agencies.

The energy efficiency potential of Pakistan is estimated to be around 15-20 percent of primary energy use[195]. Funneling the focus to building sector, the NEECA Policy 2023 aims to save 2.2 MTOE of energy with an emission reduction of 8.29 MTCo2 by 2030[196] by taking specific measures (Box 2). For instance, retrofitting existing residential buildings with EE&C measures can reduce final energy consumption by up to 22.2 percent and GHG emissions by 24.87 million tons.

Extant research supports the use of BIM and building performance simulation to investigate energy-efficient measures by analysing the effectiveness of various construction and material alternatives (Bughio et al., 2021). NEECA has approved the revised Energy Conservation Building Codes (ECBC) 2023 to improve energy efficiency in buildings.

ENERGY CONSERVATION BUILDING CODES (ECBC) 2023

ECBC 2023 sets minimum requirements for energy-efficient design and construction of new and renovated buildings, focusing on building envelope, equipment, and systems. The ECBC-2023 covers optimising building envelopes, passive building design, insulation, retrofitting existing buildings for energy efficiency, energy analysis monitoring devices, renewable and geothermal energy potential, and energy management systems.

With the annual rate of construction of new buildings in Pakistan reaching 5.3 percent, implementing ECBC during the early phases of construction can ensure energy efficiency by limiting heat loss/gain with effective building envelope techniques. Effective implementation of ECBC 2023 can reduce the overall energy demand of the building sector, saving millions in public funds. This code will encourage eco-friendly structures that produce fewer GHG emissions and possess resilient features for adapting to climate changes.

NEECA has drafted an action plan demonstrating that implementing EE&C measures in domestic and government buildings can save around 2.63 MTOE energy[197].

[195] https://www.adb.org/projects/42051-023/main#project-pds Access Date: August 02, 2023
[196] https://neeca.gov.pk/SiteImage/Misc/files/NEEC%20Policy%202023-1.pdf
[197] https://neeca.gov.pk/SiteImage/Downloads/DRAFT%20NEEC%20ACTION%20PLAN%202023-2030.pdf

Various measures will be taken to promote energy efficiency nationwide, including mandatory energy audits, appliance testing, and fiscal incentives. In terms of achieving its targets, NEECA's success in EE&C institutionalisation has been acknowledged internationally. Pakistan scored 36 in 2021 compared to 28 in 2019 on the Regulatory Indicators for Sustainable Energy (RISE) metric developed periodically by the World Bank[198]. For example, in Financing Mechanisms for Efficiency, Building Energy Codes, Energy Labelling Systems, and Minimum Energy Efficiency Performance Standards, Pakistan has demonstrated improvement from 0, 10, 0, and 22 to 8, 25, 13, and 32 respectively.

Table 1

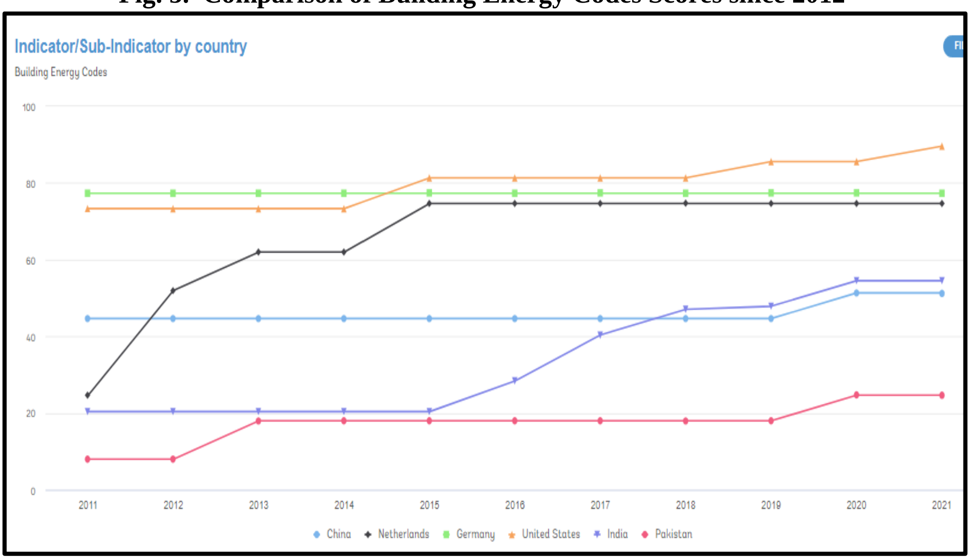
Comparison of Countries in Terms of Scores of Sub-Indicators of Building Energy Codes RISE

Sub-Indicators	USA	Germany	Netherland	China	India	Pakistan
New residential & commercial buildings	88	60	80	60	76	40
Compliance system	100	100	66.87	33.33	53.33	4.93
Renovated buildings	100	100	100	50	40	50
Building energy information	100	66.67	66.67	33.33	53.33	33.33
Green Buildings	60	60	60	80	50	4.93

Source: World Bank.

Despite improved Building Energy Codes since 2012 (Figure 5), Pakistan's compliance system and Green Buildings concept still lag behind many (Table 1). Developing a sustainable culture is vital to reducing energy consumption and carbon emissions.

Fig. 5. Comparison of Building Energy Codes Scores since 2012



Source: https://rise.esmap.org/analytics.

[198] www.esmap.rise.org

KEY TAKEAWAYS

The building sector accounts for one-third of total energy consumption (IEA, 2013). Pakistan has one of the highest domestic energy consumption rates. Effective EE&C measures can save up to 2.63 MTOE in Pakistan's building sector, but implementing them requires proper national, provincial, and local institutional setup. This can help address Pakistan's energy crisis and environmental impacts.

The government should facilitate, making it easier for buildings to be retrofitted for energy efficiency. Creating an energy conservation culture is essential to raise awareness through social and electronic media. Regular audits should be conducted for existing buildings; new ones should be required to obtain a compliance certificate. This can be achieved by implementing ECBC.

REFERENCES

Abbas, S., Saleem, O., Rizvi, M. A., Kazmi, S. M. S., Munir, M. J., & Ali, S. (2022). Investigating the Energy-Efficient Structures Using Building Energy Performance Simulations: A Case Study. *Applied Sciences*, *12*(18), 9386.

Abergel, T. (2020). Global status report for buildings and construction-towards a zero-emissions, efficient and resilient buildings executive summary construction and construction sector. United Nations Environment Programme.

Kylili, P. A. Fokaides. (2015). "European SmartCities: The Role of Zero Energy Buildings."Sustainable Cities and Society.

Sohail, M. Qureshi, "Energy-efficient buildings in Pakistan" A scientific journal of COMSATS – SCIENCE VISION, vol. 17, pp. 27-37, December 2011.

Arif, F., Khalid, R., & Azhar, N. (2021). Identification of Energy Efficiency Improvement Measures of an Existing Residential Building Using Audit-Assisted Energy Simulation and Analysis. *Engineering Proceedings*, *12*(1), 18.

Bughio, M., Khan, M. S., Mahar, W. A., & Schuetze, T. (2021). Impact of passive energy efficiency measures on cooling energy demand in an architectural campus building in Karachi, Pakistan. *Sustainability*, *13*(13), 7251.

IEA. *Transition to Sustainable Buildings: Strategies and Opportunities to 2050*; OECD/IEA: Paris, France, 2013

J. Chang, Y. Chang, "Research on green building materials evaluation system," in 2017 6th International Conference on Industrial Technology and Management (ICITM), Cambridge, UK, pp. 134-138.

Marro, M. Passive Design Strategies. 2018. Available online: https://www.metalarchitecture.com/articles/passive-design-strategies

P. Chen, L. Chan, and Y. Chen, "A BIM-based framework for selection of cost-effective green building," Proceedings of the Thirteenth East Asia-Pacific Conference on Structural Engineering and Construction (EASEC-13), September 2013.

PEC (Pakistan Engineering Council). *Building Codes of Pakistan: Energy Provisions-2011*; Pakistan Engineering Council: Islamabad, Pakistan, 2011.

Shakoor, T., Ahmad, B., Arif, M., & Younas, T. (2023). Sustainability in Building Design: A Comparative Study of Conventional and Energy Efficient Designs using BIM in Lahore, Pakistan. In *International Conference on Trends in Advanced Research* (Vol. 1, pp. 246-254)

https://www.youtube.com/watch?v=l0z35vxUdJQ&t=917s&ab_channel=PIDEOfficial

www.pide.org.pk

Pakistan Institute of Development Economics
P. O. Box 1091, Islamabad-44000, Pakistan
Tel: (92) 51-9248137, Fax: (92) 51-9248065 Email: publications@pide.org.pk