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.

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