PIDE Working Papers
No. 164

Welfare Analysis of Electricity Subsidies in Pakistan

Haroon S. Awan
Ghulam Samad
Naseem Faraz

PIDE Working Papers
No. 164

Welfare Analysis of Electricity Subsidies in Pakistan

Haroon S. Awan
Planning Commission, Islamabad

Ghulam Samad
Pakistan Institute of Development Economics, Islamabad

and

Naseem Faraz
Pakistan Institute of Development Economics, Islamabad

PAKISTAN INSTITUTE OF DEVELOPMENT ECONOMICS
ISLAMABAD
2019

Pakistan Institute of Development Economics
Islamabad, 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.

C O N T E N T S

List of Tables

List of Figures

List of Box

ABSTRACT

Pakistan has witnessed acute energy shortage over the past few years. One of the most important reasons for such routinized power outages is the competing use for resources. Moreover, energy mix for electricity generation and consequent circular debt issues are also aggravating the situation. The government of Pakistan has paid more than one trillion rupees as Tariff Differential Subsidy (TDS) to safeguard the masses against the increasing electricity generation cost. However, TDS, being an untargeted subsidy, is not only piling financial burdens but also resulting in welfare loss.

This study aims to develop different scenarios in order to assess the impact of direct transfer mechanism of TDS on social welfare. In doing so, for example, it compares the welfare of the poor households, which are given TDS directly, with that of the base scenario. Similarly, it assesses the impact on circular debt and the overall fiscal deficit situation of the country after targeting of subsidies. To quantify these impacts, we use the Social Accounting Matrix (SAM) 2010-11 and the Computable General Equilibrium (CGE) Model developed by International Food Policy Research Institute (IFPRI). This analysis, being in-line with the recommendations of New Growth framework, will not only help policy makers to devise a long term and sustainable solution to the problem of power outages but will also help mitigate its negative socioeconomic implications.

Results of our study reveal that Tariff Differential Subsidy is an untargeted subsidy, which instead of providing relief to the poor, largely benefits the urban rich segment of the society. Moreover, the removal of TDS results in high electricity prices and adversely affects the welfare of poor households, especially in rural areas. Thus, our analysis suggests that in order to reap its benefits, TDS needs to be phased out or be made more targeted. Furthermore, findings of our study suggest that reduction of TDS reduces fiscal deficit and, thus, eases out financial hardships of the government.

JEL Classifications: N7, Q4, Q42, Q43

Keywords: Electricity, Targeted Subsidies, Social Welfare, Macroeconomic System

1. INTRODUCTION

Electricity plays a vital role in fuelling economic activity and is considered among basic necessities of a society. According to the United Nations Foundation estimates, almost one quarter of the global population or 1.5 billion people have no access to electricity, whereas only 1 billion have intermittent access. The developing countries are affected largely by this unavailability of electricity. In Pakistan, the recent electricity crisis has severely affected the economy, especially the industrial sector. Siddiqui (2011) reveals that the total industrial output losses due to power outages vary from 12 percent to 37 percent in Punjab. Similarly, the cost to the industrial sector of load-shedding was estimated as Rs 210 billion or over 2 percent of GDP annually [Pasha (2008)]. This crisis has resulted in potential exports earning losses of over US$ 1 billion and 400,000 displacements of potential workers.[1] Large scale manufacturing industries that have their own alternative arrangements for electricity generation are comparatively performing well as compared to the small scale industries. In a nutshell, the situation in Pakistan is getting worse day by day and many industries are relocating to Bangladesh.[2]

In Pakistan, energy is generated from different sources including oil, LPG, gas, coal, hydro and nuclear. According to the energy year book (2015), the total electricity generated during the year was 106,966 GWh and the fuel mix was dominated by the oil based electricity generation (Figure 1). The company wise energy generation estimates during the year remained as follows: Water and Power Development Authority (WAPDA) about 42.3 percent, other Independent Power Producers (IPPs) 20 percent, Hub Power Company (HUBCO)[3] 6 percent, Karachi Electric Supply Company (KESC) 9 percent, Kot Adu Power Company (KAPCO) 7 percent, and others around 10 percent. The provincial consumption of electricity reveals that Punjab province is the largest consumer of electricity (61.3 percent), followed by Sindh (21.3 percent), KPK (11.1 percent), Baluchistan (5.3 percent) and AJK (1.1 percent) respectively.

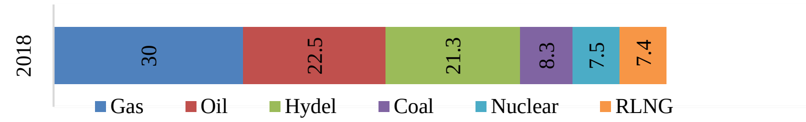
Acknowledgement: We acknowledge the technical contributions and support of the International Food Policy Research Institute (IFPRI) team Paul Dorosh, Sohail J Malik, Dario, Angga and Hamza.

[1]State of the Economy: Emerging from the Crises: 2nd Annual Report; 2009 : Institute of Public Policy, BNU

[2]According to Pakistan Readymade Garments Manufacturers and Exporters association (PRGMEA) over 40 percent of Pakistani textile units have relocated to Bangladesh due to load-shedding.

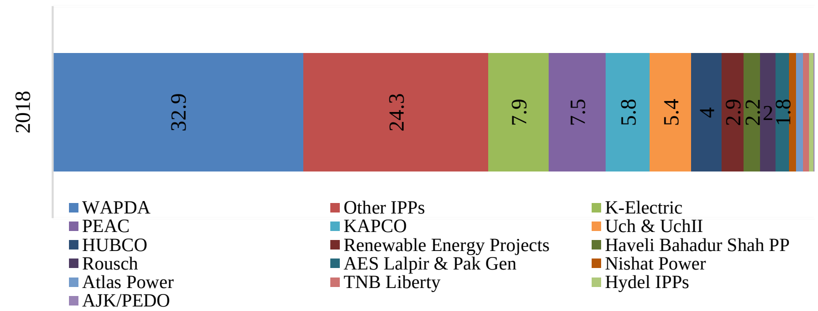
[3]One of the largest Independent Power Producer (IPPs).

Fig. 1. Fuel Mix of Electricity Generation: 2017-2018



Source: Energy Year Book, 2018.

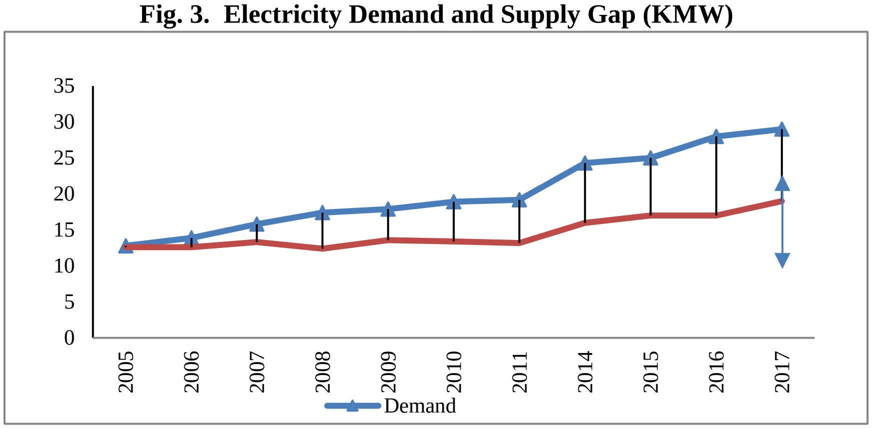
Fig. 2. Electricity Generation by Company: 2017-18



Source: Energy Year Book, 2018.

Pakistan suffers from a massive electricity shortage because the demand exceeds its supply, while this mismatch remains largely unresolved. In recent years, the electricity generation in Pakistan has shrunk by 50.0 percent, whereas, the shortage of electricity has touched 6000 megawatt mark and is further aggravating to an alarming level (see Figure 2). Furthermore, the failure to produce electricity to meet the increasing demand; due to population growth, industrial activity, and boom in consumer financing, has exacerbated the energy crisis. The government officials state that this situation necessitates breakdowns or load-shedding.

Fig. 3. Electricity Demand and Supply Gap (KMW)



Source: Planning Commission, 2018.

Electricity consumption in 2011-12[4] was 76,761 GWh[5] as compared to 77,099 GWh in 2010-11, registering a negative growth of 0.44 percent. Major decline in consumption was observed in the agriculture sector (4.7 percent) followed by bulk supply (4.5 percent), domestic sector (0.8 percent) and the commercial sector (0.4 percent). One of the main causes of electricity crises is the extremely high cost of generation. Currently, with 22,797 MW of total installed capacity, only 9000-10,000 MW is produced. As a result, the peak demand of 15000 MW results in 10-12 hours of load-shedding. An important contributing factor is also the transmission and distribution (T&D) losses of 17.4 percent from net supply.

An overview of the factors responsible for prolonged power outages in Pakistan is presented here for an in-depth understanding of the issue. First, electricity production from thermal resources is very expensive. Secondly, dependency on furnace oil makes it difficult for the government to purchase and provide oil at high and volatile prices. The price of furnace oil is rising very sharply and at present its price is almost 70,000 per ton. The cost of producing electricity from furnace oil is about Rs16 per Kwh. This is only the fuel cost not the fixed cost; transmission losses are not included in it.

Third responsible factor for prolonged power outage is circular debt i.e. the government's inability to pay fuel cost to the generating companies because consumers pay less for every unit while suppliers have to pay higher prices and this gap is filled by subsidies. Finally, increase in demand for energy is more expansionary than supply which poses a real challenge for the government to control the energy crisis for a longer period. This demand and supply mismatch is not only caused by poor governance but also due to natural factors like, population increase and resource depletion at a consistent rate.

In 2011, the government of Pakistan provided subsidies of Rs 285 billion for the power sector out of which Rs.750 million was spent on a daily basis. On average, the government pays at least Rs 3 for every Kwh used by domestic consumers in order to bridge the gap between the billed rate and the cost of production of electricity. 45 percent of the country's electricity is consumed by the residential users, who pay an average rate of Rs 7/Kwh. 75 percent of residential users consume less than 300 units of electricity, which is charged at the rate of 5.5/Kwh, while electricity generation costs more than Rs.9/Kwh[6]. This differential is covered by the subsidy. It is true that subsidies on power sector control inflation and benefit the poor. However, they ultimately translate into long hours of load-shedding because the demand exceeds the revenue which is required to sustain supply. If subsidies are reduced, the power sector will potentially improve. Money available from discounted subsidies can easily be transferred to oil and gas suppliers. As a result, smoother flow of finance can be assured and circular debt can be recharged.

---

[4]*Energy Year Book, 2012*.
[5]Giga watt hour.
[6]Sadia Zafar Baig, Published in *The Express Tribune*, April 30th, 2012.

To reduce the circular debt, the ministry of Water and Power had earlier requested the ministry of Finance to release Rs 10 billion but only Rs 6 billion was released. Despite the addition of Rs 136 billion by the government, the current circular debt stands at Rs 400 billion as of March 2012.

Table 1

Electricity Related Subsidies (Rs Million)

		2007-08	2008-09	2009-10	2010-11	2011-12	2015	2017
WAPDA	Budget	52,893	74,612	62,903	84,000	122,700	164,000	204,000
	Revised	113,658	92,840	147,005	295,827	–		
KESC	Budget	19,596	13,800	3,800	20,447	28,588	29,000	95,400
	Revised	19,596	18,800	32,521	64,447	–		
Oil Refineries/OMCs	Budget	15,000	140,000	15,000	10,807	7,921	7,000	22,600
	Revised	175,000	70,000	11,224	10,807			
Fertiliser	Budget	10,360	12,860	210	185	162		
Manufacturers	Revised	6,360	21,268	439	985	–	5,000	
Total	Budget	97,849	241,272	81,913	115,439	159,371	203,000	140,600
	Revised	314,614	202,908	191,189	372,066			

Source: Government of Pakistan various budget/economic survey documents

	0-50	50-100	101-200	201-300	301-700	>700
NEPRA Determined Tariff (PKR per unit)	4	11.8	14.39	14.39	16.25	17.85
GOP Notified Tariff (PKR per unit)	2	5.79	8.11	12.09	16	18
TDS (PKR per unit)	2	6.01	6.28	2.3	0.25	-0.15

Pakistan is facing acute energy shortage over the past few years. One of the most important reasons for these power outages is the competing use for resources. Moreover, energy mix for electricity generation and consequent circular debt issue are also aggravating the situation. The government of Pakistan has paid more than one trillion rupees as Tariff Differential Subsidy (TDS) to safeguard the masses against the increasing generation cost of electricity.[7] However, TDS, being an untargeted subsidy, is not only piling financial burdens but also resulting in welfare loss.

This study aims at developing scenarios such as paying TDS to the poor households through direct transfer mechanism only and assessing the impact on household welfare as compared with the base scenario. Similarly, assessing the impact on circular debt, and the overall fiscal deficit situation of the country after targeting the subsidies. To quantify these impacts, we use the Social Accounting Matrix (SAM) 2010-11 and IFPRI developed Computable General Equilibrium (CGE) Model. This analysis, being in-line with the recommendations of New Growth Framework will help policy makers devise a long term and sustainable solution to the problem of power outages and its negative social and economic impacts.

[7] Framework for Economic Growth Pakistan, Planning Commission of Pakistan.

Table 2

Electricity Tariff Structure for Residential Users

KWh/Month	Notified Consumer Tariffs (Rs/KWh) March-2008	March-2011	March, 2018	% Increase between 2008 and 2011	% Increase between 2011 and 2018
Up to 50	1.4	1.87	4	34	114
50 -100	3.08	4.45	9.17	44	106
101 -300	4.08	6.73	10.97	65	63
301 - 700	6.53	10.65	13.74	66	29
Above 700	7.79	13.29	15.67	74	18

Source: Pakistan Electric Power Company (PEPCO).

	0-50	50-100	101-200	201-300	301-700	>700
NEPRA Determined Tariff (PKR per unit)	4	11.8	14.39	14.39	16.25	17.85
GOP Notified Tariff (PKR per unit)	2	5.79	8.11	12.09	16	18
TDS (PKR per unit)	2	6.01	6.28	2.3	0.25	-0.15
Potential Payments (Rs. Billion)	8.9	176.4	165.6	148.5	93	31.8
Actual Payments (Rs. Billion)	4.5	86.5	93.3	124.8	91.6	32.1
Subsidy (Rs. Billion)	4.5	89.8	72.3	23.7	1.4	-0.3
Total Subsidy	191.5					
Subsidy (Rs. Billion)	4.5	94.3	162.1	96.0	25.2	1.2
Total Subsidy	383.2					
Units Used	2227	14946	11510	10319	5725	1783
User Shares	4.8	32.1	24.7	22.2	12.3	3.8

2. LITERATURE REVIEW

Electricity is one of the essential inputs for socio-economic development. The satisfactory provision of electricity contributes to poverty reduction by stimulating economic growth and enabling the attainment of basic human needs including health and education. Sustainability of electricity is thus crucial for improving living standards and fostering economic activity in a society.

Economic literature has discussed and analysed various aspects of electricity as well as energy issues in Pakistan. Siddiqui, *et al.* (2011) assessed the cost of unserved energy that is caused by electricity shortfall to the industrial sector of Pakistan. Their survey-based analysis indicates that labour hours have been decreased and the cost of production increased due to persistent electricity outages in Pakistan. Moreover, the electricity shortfall affected the ability of firms to meet the deadline to fulfil the domestic and foreign export orders that eventually affected the credibility of firms at international forums. They also estimated the output loss of the industrial sector, which is on average, a loss of 22.36 percent of value added due to shortage of electricity. Similarly, Abbasi (2011) estimated that power shortfall causes an approximately 2 percent of loss in GDP annually.

Besides the cost of electricity, the causes of crisis and constraints faced by power sector have thoroughly been discussed by Malik (2012). Her study explains that the power sector is affected by a number of institutional and organisational weaknesses including the inefficient power generation and distribution systems, dependence on expensive fuels, non-optimal tariffs, financial mismanagement and high level of corruption and incompetence. Overall, the study stressed that poor governance and wrong track of adopted policies are the prime reasons of power sector crisis in Pakistan.

Mismanagement of energy resources and inefficient investment activities in Pakistan's economy is highlighted by Pasha (2010). The author argues that the growth in demand in this decade was not fully anticipated by the authorities and sufficient investments were not made to tackle the increased demand for electricity. Moreover, presence of surplus power in the first half of this decade and unanticipated demand measures made the previous government unworried, rather than taking serious policy measures to avoid this electricity crisis. The increasing population and demand for electricity caused slow growth in the new capacity. Due to low growth of new capacity and lack of upgrading of power plants, the share of power sector in the public sector development programs fell to less than 3 percent of GDP in this decade, which was relatively higher in earlier years.

The power sector has also been seriously affected by the circular debt problem, called the inter-corporate. This problem hurts the capacity utilisation of power sector. It forced the thermal power plant to operate at a very low 'capacity factor', thereby causing massive increase in power outages. ADB (2010) and Bhutta (2011) explained that the non-availability of fuel supply potentially reduced the capacity of power generation companies by 2000 MW to 2500 MW, which increased with the passage of time.

In addition to the inefficient and below cost recovery tariffs, Trimble, *et al*. (2011) looked at the system of electricity subsidies as a major source of the inter-corporate circular debt issue. There is on the one hand, the inability of the distribution companies to pass on the cost of electricity to customers, on the other hand the inability of the government to pay the tariff differential subsidy in time. In other words, both the government's inability to finance its commitment to fund subsidies and inefficiencies of the power sector including low collections, delays in determination and notifications, and increased cost of fuel imports is aggravating the circular debt problem.

Several studies have provided empirical evidence on relationship between energy and economic development in Pakistan. Jamil and Ahmad (2010) studied the linkage between electricity consumption, prices and economic growth. At disaggregate and sector level evidence, they found a long run relationship and unidirectional causality from economic growth and electricity prices to electricity consumption. Siddiqui and Haq (1999, 2004) analysed the disaggregated demand for energy and provided evidence that the general demand for energy is price elastic, and the changes in income also affect the demand pattern significantly. They viewed that own price and prices of other components of energy including electricity has limited impact on revenue generation due to their impact on inflation, income distribution and political and social conditions of the country.

Aqeel and Butt (2001) explained the relationship of economic growth and total energy consumption at aggregate level. At disaggregate level, they stressed that economic growth causes increased electricity consumption. Similarly, Khan, *et al*. (2009) provided estimates that electricity consumption responds positively to changes in real income per capita and negatively to changes in domestic price level in case of Pakistan.

The dynamic relationship between electricity consumption and economic growth in Pakistan is investigated by incorporating the effects of the capital and labour factors by Shahbaz and HooiHooi (2011). They argue that adoption of electricity conservation policies to conserve energy resources may unwittingly decline growth and this lower growth rate will in turn decrease the demand for electricity. Shahbaz and Feridun (2011) also stressed that policymakers should devise proactive policies to be well-prepared to satisfy a likely increase in demand for energy through making the necessary investments to expand energy generation capacity and fostering economic development in the economy.

We took an overview of the literature on electricity issues in Pakistan. We observed that, so far, a range of literature is available that discusses the electricity crisis factors, constraints, circular debt issues, electricity linkages with economic growth, etc. However, our objective is to study the mechanism of direct subsidies to electricity sector and its impacts on household welfare. To our best knowledge, we have been unable to find empirical evidence on direct and indirect subsidies to electricity sector and their implications for household welfare and circular debt issues. This study could add to the empirical literature on the scenarios of direct and indirect subsidies and their economic implications in case of Pakistan.

Even though, no evidence was found on the mechanism of subsidies and its welfare impacts in Pakistan, but Gassmann and Klytchnikova (2005) evaluated the impact of increasing electricity prices on household welfare in Tajikistan. They discussed the alternative subsidies mechanisms and their impacts on the poorest households. They argued the lifeline tariffs, even if targeted, is not a very effective way of protecting the poor since they result in substantial leakage of benefits to higher income households. A more effective way of protecting the poor would be to use a comprehensive safety net system, which explicitly targets poor households.

Besides the transfer mechanism, several studies support the electricity subsidies as an instrument of social protection. Komives, *et al*. (2005) looked at the utility subsidies including the electricity subsidies as an instrument of social protection, for transferring resources to the poor where weak administrative structures make cash transfers infeasible or costly. Freund and Wallich (1995) examined the welfare effects of increasing energy prices. The main findings of their study indicated that the policy of subsidising energy prices, common in the transition economies of Eastern Europe and in former Soviet Union, helped the poor in providing them with low cost energy. Davidson and Mwakasonda (2006) viewed that electricity subsidy programs in South Africa directly benefitted the poor. They had some positive impact on poverty alleviation as they reduced electricity expenditure. However, they argue that this is short term outcome of subsidies and if it is not done with proper transfer mechanism, it could cause high cost and potentially cause adverse impacts on government's coffers.

3. DATA AND METHODOLOGICAL SPECIFICATION

The Computable General Equilibrium (CGE) model is based on Walras' Law stating that if a particular commodity is in equilibrium at particular prices then all other quantity demanded in the market must be equal to quantity supplied in the market. If the analytical analysis is deemed to accommodate the economic problem, the quantitative approach like Computable General Equilibrium (CGE) model helps in evaluating the economic problems. The international organisations like IMF, World Bank, and other donor organisations are widely using the CGE techniques for sectoral and macroeconomic level research. Bohringer (2003) pointed out that CGE has very comprehensive adjustment effects induced by exogenous policy interference and very micro consistent representation of price dependent market interactions. However, without a detailed programming knowledge, CGE would remain a "black box" for non-modelers.

To quantify the electricity subsidies impacts, we have used the International Food Policy Research Institute (IFPRI) 2010-11 Social Accounting Matrix (SAM) and IFPRI the Computable General Equilibrium (CGE) Model developed by IFPRI. To build an updated SAM for 2010-11, IFPRI used the base year SAM of 2001-02 developed by Dorosh, Niazi and Nazli[8]. This base year SAM is based on input-output table of 1990-91. "In preparing the 2007-08, Pakistan SAM it was necessary to construct a consistent set of accounts for production and value added, by sector, based on the updated information and also on the 1991 input-output table. These accounts then formed the base upon which factor and household accounts were disaggregated". The structure of the Pakistan SAM 2010-11 is given at Box-1.

[8]Dorosh, Paul A., Muhammad Khan Niazi and Hina Nazli (2006). A Social Accounting Matrix for Pakistan, 2001-02: Methodology and Results. (PIDE Working Paper 2006:5) Islamabad: Pakistan Institute of Development Economics. See also Dorosh, Paul A., Muhammad Khan Niazi and Hina Nazli (2003). "Distributional Impacts of Agricultural Growth in Pakistan: A Multiplier Analysis". *The Pakistan Development Review* 42:3, 249–275.

Box 1: Structure of the 2011Pakistan SAM

Activities(52)

Agriculture(12): Wheat irrigated, Wheat non-irrigated, Rice-IRRI (irrigated), Rice-basmati (irrigated), Cotton (irrigated), Sugarcane (irrigated), Other field crops, Fruits/vegetables, Livestock (cattle, milk), Livestock (poultry), Forestry, Fishing.

Industry(23): Mining, Vegetable oils, Wheat milling, Rice milling (irri), Rice milling (basmati), Sugar, Other food, Cotton gin (lint), Cotton spin (yarn), Cotton weave (cloth), Knitwear, Garments, Other textile, Leather, Wood, Chemicals, Fertilisers, Cement and bricks, Petroleum refining, Other manufacturing, Energy, Construction

Services(17): Trade-wholesale, Trade-retail, Trade-other, Transport-rail, Transport-road, Transport-water, Transport-air, Transport-other, Housing, Imputed rent, Business services, Health care, Education, Personal services, Other private services, Public services, Finance and insurance

Commodities (51)

Same as activities except Wheat irrigated and Wheat non-irrigated activities aggregated as one commodity (Wheat).

Factors (27)

Labour (10): Own-farm (Large farm, Medium farm Sindh, Medium farm Punjab, Medium farm Other Pakistan, Small farm Sindh, Small farm Punjab, Small farm Other Pakistan), Agricultural waged, Non-agricultural unskilled, Non-agricultural skilled

Land (12): Large farm (Sindh, Punjab, Other Pakistan), Irrigated medium farm (Sindh, Punjab, Other Pakistan), Irrigated small farm (Sindh, Punjab, Other Pakistan), Non-irrigated small farm (Sindh, Punjab, Other Pakistan)

Other factors (5): Water, Capital livestock, Capital other-agriculture, Capital formal, Capital informal

Households (18)

Rural (15): Large/medium farm (Sindh, Punjab, Other Pakistan), Small farm (Sindh, Punjab, Other Pakistan), Landless unwaged farmer (Sindh, Punjab, Other Pakistan), Landless waged farmer (Sindh, Punjab, Other Pakistan), Rural non-farm per capita expenditure quintile 1, quintile 2, and rest

Urban (3): per capita expenditure quintile 1, quintile 2 and rest.

Other Institutional Accounts (4)

Government, Rest of world, Saving-Investment, Change in stocks. The government includes separate taxes for import taxes, direct taxes and sales taxes.

Source: Dario, *et al.* (2012), IFPRI, Washington, DC.

3.1. Model Closure

In this analysis, we set specific closure to the model, which determines how the market reached the macro-equilibrium. There are mainly three macro-closures that need to be set before running the model, which are government balance, saving-investment balance and finally rest of the world balance. While for the micro-closure, we need to only set the factor closure to determine how flexible all the factors are utilised in the economy.

For government balance, we fixed the government share spending and let loose the government savings account. In this way, we could know how much government savings/deficit would change due to particular shock on the economy. For saving-investment balance, we fixed the share of propensity to save and allowed investment to adjust the total savings. This type of closure is usually known as savings driven investment. For the rest of the world, we set fixed foreign savings account and let the exchange rate to adjust. Finally for the factor closure, we assume full employment with flexible wage rate.

3.2. Model Simulations

In order to assess the impact of electricity subsidy cut and its alternative policy, we run three different simulations. First, we examine solely the impact of subsidy cut by 50 percent of the ongoing spending. Second, we complement the subsidy cut with direct transfer from government to the affected poor households as a compensation of income loss based on the findings in the first simulation. Lastly, we assume that the electricity sector could gain higher productivity in the long run. Therefore, in the last simulation, we try to examine the impact of higher productivity of electricity sector (by 20 percent) on the economy whilst the subsidy cut.

4. RESULTS AND DISCUSSION

4.1. Macro-Level Behaviour

The general equilibrium analysis depicted that reduction in tariff differential subsidy by 50 percent does not have any significant impact on GDP and overall demand, but it negatively affects private and public consumption. Moreover, slashing government expenditures on subsidy by 50 percent, reduces government spending, and affects private consumption due to the high cost of electricity which elevates prices of almost all the commodities (Table 3).

Table 3

Impact on Macro Variables (in Real Terms)

Variable	BASE	TDS_Cut	GOV_TRNSFR	Prod_UP
GDP	17,806.1	0.0	0.0	0.1
Absorption	19,230.1	0.0	0.0	0.1
Private Consumption	15,483.1	-0.4	-0.4	0.1
Investment	1,983.5	3.8	3.6	0.6
Government spending	1,481.0	-0.2	-0.2	-0.4
Exports	2,149.0	0.1	0.1	0.4
Imports	-3,573.0	0.0	0.0	0.2
Govt. Savings/Deficit	-683	-20.1	-19.0	-6.8

Source: Model Simulations.

The reduction of TDS has also augmented the investment levels in the economy. Higher investment (3.8 percent) comes mainly from higher public savings or less deficit. This condition follows the closure, where investment follows the changes on total savings.

The second simulation of equivalent direct transfers to affected households (Gov_Transfr) indicates that due to these transfers at macro level, no significant change appeared. With the increase in productivity in electricity sector (Prod_Up) all the macro variables have been positively affected, except government spending, which declines by 0.4 percent. Higher electricity productivity increases real GDP. This positive impact mainly comes from higher investment level. In addition, private consumption is slightly better when productivity increases. This is also reflected by higher absorption level, where more goods are consumed domestically.

If we analyse the government savings/deficit, the subsidy cut automatically reduces government spending, which translates into lower deficit, and this pattern prevails in the last simulation as well because improved efficiency in electricity sector also contributes towards reducing the fiscal deficit problem.

4.2. Output, Price and Consumption of Electricity

Increase in price of electricity, due to TDS cut, resulted in escalation in electricity prices, which translated into decreased demand for electricity. This reduction in demand is translated into a fall in electricity output. With the official transfers in second simulation, no significant impact has been noticed, however, increasing productivity has a favourable impact on both output (16.6 percent increase) and price of electricity (37.4 percent decrease). This may become the rationale for improving productivity of electricity sector in a more competitive way (see Table 4).

Table 4

Electricity Output and Prices

Sector	Variable	BASE	TDS_Cut	GOV_TRNSFR	Prod_UP
Electricity	Output (%)	321.4	–1.5	–1.5	16.6
	Price (%)	1.0	5.4	5.4	–37.4

Source: Model Simulations.

The analysis of electricity consumption under these three cases is very revealing and indicates that with reduction of subsidy, the electricity usage of all types of households has gone down. This further depicts a major policy lapse on the part of planners and policy formulators because the purpose of tariff differential subsidy is to safeguard poor households against high-energy prices, while this analysis depicts that untargeted subsidy is benefiting 'Urban Rich' households the most.

With the government transfers to affected household, the level of consumption is not restored to the extent of consumption loss, which indicates that affected households are not spending all of the compensation money for electricity; rather they are spending this money to meet other needs. Third simulation indicates that with improvements in productivity of the sector, electricity consumption in different segments of society augment to the tone of 40 to 49.7 percent (Table 5). This may be due to the increased supply and low price achieved due to improved productivity. An important outcome of this development is that the poor households are the prime beneficiaries of this development.

Table 5

Electricity Consumption

Household	BASE	TDS_Cut	GOV_TRNSFR	Prod_UP
Med/Large Farm Sindh	1.4	-7.0	-7.0	43.3
Med/Large Farm Punjab	8.2	-6.4	-6.4	40.8
Med/Large Farm Other	0.9	-6.7	-6.6	42.0
Small Farm Sindh	0.8	-7.7	-7.4	49.7
Small Farm Punjab	8.1	-7.0	-6.7	45.1
Small Farm OthPak	2.0	-7.0	-6.9	47.0
Landless Farmer Sindh	0.5	-7.7	-7.4	50.1
Landless Farmer Punjab	1.1	-7.3	-6.9	46.2
Landless Farmer OthPak.	0.4	-7.2	-7.1	47.7
Waged Rural Landless Farmers Sindh	0.9	-7.1	-7.1	48.0
Waged Rural Landless Farmers Punjab	0.9	-6.9	-6.9	46.8
Waged Rural Landless Farmers OthPak.	0.1	-7.1	-7.1	48.0
Rural Non-farm Quintile 1	2.5	-6.4	-6.4	45.5
Rural Non-farm Quintile 2	2.5	-6.4	-6.5	46.0
Rural Non-farm Other	14.6	-6.1	-6.2	44.3
Urban Quintile 1	2.4	-6.2	-6.2	46.1
Urban Quintile 2	3.7	-6.0	-6.1	45.3
Urban Other	18.0	-8.4	-8.4	38.4

Source: Model Simulations.

4.3. Value Added Prices of Major Sectors

Before discussing the impact on wages and income due to TDS cut on electricity sector, we need to first look at the value added price of all sectors because this is how the wages and household incomes are finally determined. Based on the table above, we found that the average value added price in agricultural sector goes down and the magnitude is much higher as compared to the service sector. However, the industrial sector experiences higher prices. This condition is mainly influenced by higher investment in the economy as discussed earlier, where the flow mostly accrues to industrial sector especially on cement and construction sectors as shown in the Table 6.

Table 6

Average Value Added Price

Sectors	TDS_Cut	GOV_TRNSFR	Prod_UP
Agriculture	–0.51	–0.48	0.43
Industry	0.66	0.60	1.27
Cement, bricks	6.00	5.57	1.80
Construction	5.50	5.11	1.72
Services	–1.93	–1.96	–2.34

Source: Model Simulations.

4.4. Real Wages

Based on the previous discussion, we can now understand clearly why all farm labours are paid lower after the alleviation of subsidy. Similarly for land, water and capital, all show lower returns in real wages ranging from 0.5 percent to 2.5 percent in the agriculture sector (Annex–1). On the other hand, the skilled and unskilled workers of non-agriculture sector get better payment due to their large involvement as factors in the industrial sector. For the formal capital, it shows lower return due to its high contribution in the service sector, which gives lower value added price. However, when productivity of electricity goes up, only agriculture waged labour experience a lower payment while the other types of labour show a slightly higher wage, which again follows the value added price changes.

4.5. Household Incomes

As we observed earlier, farm workers receive lower wages due to electricity subsidy cut, which is translated into lower income on most farm households. While the non-farm households, who mostly generate their income from non-agriculture labour, experience slightly higher income. However, the rich urban households (urban other), who generally own majority of formal capital, have lower income due to lower return of this type of capital.

In the second simulation (TDS_CUT), we found no change in income for farms households. This is due to the direct transfer from government that matches their loss of income. Lower income was only observed in rich urban households, since the government provides support/transfer to poor households only. The household income table further authenticates these results. (Annex-2). Finally, when productivity of electricity goes up, almost all households have higher income level as the return on factor has increased as discussed earlier.

4.6. Welfare Impact of Policy Intervention

To assess the welfare changes after the policy, we use equivalent variation. Positive numbers mean welfare increase while negative number means the opposite. When subsidy is cut, total welfare decreased by 69.6 billion, where the rich urban are the most affected. However, we also find mild welfare reduction on all farm households who are relatively poor than urban rich (Annex-3). After the transfer is introduced, we observed the welfare changes are close to zero percent which means that the transfer may compensate the loss incurred by farm households. Total welfare also shows better results but with worsening situation of rich urban. Lastly, when the productivity goes up, all households have better welfare except for the rich urban. This is mainly due to their lower income level even though the productivity has increased.

5. CONCLUSION

The study reveals that Tariff Differential Subsidy is an untargeted subsidy and the urban rich segments of society are the largest beneficiaries of this subsidy. Moreover, removal of TDS results in high electricity prices and poor households especially the rural poor are hit hard by this policy intervention. The analysis provides the insight that TDS, which is meant for providing relief to the poor, is benefiting rich class the most and thus may be phased out or be made more targeted to reap its benefits. Reduction of TDS also reduces fiscal deficit significantly and thus eases out financial hardships for the government.

Another important outcome of the analysis is that the amount paid to the poor households in lieu of TDS is not fully spent for purchasing electricity, rather it is directed towards other needs as well, which restricts unnecessary use of electricity. Improvement in productivity of electricity sector has tremendous implications for the economy and the welfare of poor households. Improved productivity augments electricity consumption, reduces electricity prices, generates employment opportunities, results in better wage levels and thus contributes towards improved household welfare.

If subsidies are reduced, the power sector will potentially improve. Money available from discounted subsidies can easily be transferred to oil and gas suppliers. In this way, the smoother flow of finance can be ensured and circular debt can be recharged.

In a nutshell, the time is ripe for introducing productivity boosting measures in electricity system (both in production and transmission). In this regard, the experience of private sector for using pre-paid meters and better transmission lines should be replicated at national level. Moreover, governance system and financial management of GENCOs and DISCOs should be improved. Some serious steps with reference to better generation mix; such as improving coal mines and gas fields are also required to get rid of circular debt and to eliminate load-shedding.

ANNEXURE

Annex-1: Real Wages

Variables	BASE	TDS_Cut	GOV_TRNSFR	Prod_UP
Labour - agric (own)-large	1.0	-0.5	-0.5	0.6
Labour - agric (own)-med Sindh	1.0	-0.5	-0.5	0.6
Labour - agric (own)-med Punjab	1.0	-0.5	-0.4	0.7
Labour - agric (own)-med OPak	1.0	-0.5	-0.4	0.6
Labour - agric (own)-sm Sindh	1.0	-0.5	-0.5	0.7
Labour - agric (own)-sm Punjab	1.0	-0.5	-0.4	0.6
Labour - agric (own)-smOPak	1.0	-0.5	-0.5	0.5
Labour - agric (wage)	1.0	-0.6	-0.5	0.0
Labour - non-ag (unsk)	1.0	0.5	0.4	0.9
Labour - non-ag (skilled)	1.0	0.8	0.7	1.0
Land - large- Sindh	1.0	-0.5	-0.5	0.6
Land - large- Punjab	1.0	-0.5	-0.5	0.6
Land - large - OthPak	1.0	-0.6	-0.5	0.6
Land - irrigated - med Sindh	1.0	-0.5	-0.5	0.6
Land - irrigated - med Punjab	1.0	-0.5	-0.5	0.6
Land - irrigated - med OthPak	1.0	-0.5	-0.5	0.6
Land - irrigated - sm Sindh	1.0	-0.5	-0.5	0.6
Land - irrigated - sm Punjab	1.0	-0.5	-0.5	0.6
Land - irrigated - smOthPak	1.0	-0.5	-0.5	0.5
Land non-irrig - sm/m Sindh	1.0	-0.6	-0.6	0.9
Land non-irrig - sm/m Punjab	1.0	-0.5	-0.5	0.4
Land non-irrig - sm/m OthPak	1.0	-0.6	-0.5	0.6
Water	1.0	-0.5	-0.5	0.6
Capital livestock	0.2	-0.6	-0.6	-0.6
Capital other agric	0.2	-0.5	-0.5	0.7
Capital formal	0.2	-2.5	-2.5	-2.9
Capital informal	0.2	0.0	0.0	0.9

Source: Model Simulations.

Annex-2: Household income

Households	BASE	TDS_Cut	GOV_TRNSFR	Prod_UP
Med/Large farm Sindh	293.0	-0.4	-0.4	0.5
Med/Large farm Punjab	1,229.2	-0.3	-0.3	0.5
Med/Large farm Other	165.1	-0.4	-0.3	0.6
Small farm Sindh	363.6	-0.2	0.0	0.4
Small farm Punjab	2,252.6	-0.2	0.0	0.4
Small farm OthPak	678.9	-0.1	0.0	0.6
Landless Farmer Sindh	276.5	-0.2	0.0	0.4
Landless Farmer Punjab	365.4	-0.3	0.0	0.2
Landless Farmer OthPak	156.1	-0.1	0.0	0.5
Waged rural landless farmers Sindh	310.6	0.0	0.0	0.6
Waged rural landless farmers Punjab	294.5	0.0	0.0	0.6
Waged rural landless farmers OthPak	38.2	0.0	0.0	0.6
Rural non-farm quintile 1	600.0	0.2	0.2	0.7
Rural non-farm quintile 2	705.5	0.2	0.2	0.7
Rural non-farm other	3,520.2	0.3	0.2	0.7
Urban quintile 1	575.9	0.4	0.3	0.8
Urban quintile 2	749.8	0.4	0.4	0.8
Urban other	6,388.1	-1.6	-1.6	-1.8

Source: Model Simulations.

Annex-3: Equivalent Variation %

	Welfare Measures		
Households	TDS_Cut	GOV_TRNSFR	Prod_UP
Med/Large farm Sindh	-1.3	-1.2	1.7
Med/Large farm Punjab	-5.0	-4.7	8.0
Med/Large farm Other	-0.7	-0.6	1.1
Small farm Sindh	-0.5	0.2	1.4
Small farm Punjab	-3.9	0.0	8.5
Small farm OthPak	-0.2	0.2	3.8
Landless Farmer Sindh	-0.3	0.1	1.0
Landless Farmer Punjab	-0.8	0.1	0.6
Landless Farmer OthPak	-0.1	0.0	0.7
Waged rural landless farmers Sindh	-0.1	0.0	1.7
Waged rural landless farmers Punjab	-0.1	0.0	1.6
Waged rural landless farmers OthPak	0.0	0.0	0.2
Rural non-farm quintile 1	1.0	0.9	4.7
Rural non-farm quintile 2	1.4	1.3	4.9
Rural non-farm other	7.6	6.8	25.3
Urban quintile 1	2.1	1.9	4.8
Urban quintile 2	2.9	2.6	6.5
Urban other	-71.6	-72.7	-75.0
TOTAL	-69.6	-65.2	1.5

Source: Model Simulations.

REFERENCES

Abbasi, Z. (2011) Energy Crisis Costs 2 Percent of GDP Annually. *Business Recorder*, July 07.

ADB (2010) Islamic Republic of Pakistan: Rental Power Review. Report Prepared by Asian Development Bank.

Aqeel, A. and M. S. Butt (2001) The Relationship between Energy Consumption and Economic Growth in Pakistan. *Asia-Pacific Development Journal* 8:2, 101–109.

Bhutta, Z. (2011) Power Tariffs to Go Up by 16.5 Percent. *The Express Tribune*, August 03.

Bohringer, C., T. F. Rutherford, and W. Weigard (2003) Computable General Equilibrium Analysis: Opening a Black Box. (ZEW Discussion Paper No. 03-56).

Coady, D., F. Gassmann, and I. Klytchnikova (2005) Electricity Tariff Reforms and Alternative Compensation Mechanisms in Tajikistan. Maastricht Graduate School of Governance. ((Working Paper GSoG/2006/WP2005/ 001).

Davidson, O. and A. Mwakasonda (2006) Electricity Access to the Poor: A study of South Africa and Zimbabwe. *Energy for Sustainable Development* 8:4, 26–40.

Jamil, F. and E. Ahmad (2010) The Relationship between Electricity Consumption, Electricity Prices and GDP in Pakistan. *Energy Policy* 38:10, 6016–6025.

Khan, A. and U. Ahmad (2009) Energy Demand in Pakistan: A Disaggregate Analysis. http://mpra.ub.uni-muenchen.de/15056/ MPRA Paper No. 15056.

Komives, K., J. Halpern, and Q. Wodon (2005) *Water, Electricity, and Poor. Who benefits from the Utility Subsidies*? Washington, DC: The World Bank.

Malik, A. (2012) Effectiveness of Regulatory Structure in the Power Sector of Pakistan. Pakistan Institute of Development Economics, Islamabad. (Working Paper No. 25).

Pakistan Energy Year Book (2011) *Hydrocarbon Development Institute of Pakistan.* Ministry of Petroleum and Natural Resources.

Pasha, A. (2010) Economic Cost of Power Outages. http://ippbnu.org/files/CostofPowerOutages.pdf.

Pasha, A. G. (2008) Economic Cost of Power Outages. http://ippbnu.org/RR/Cost%20of%20Power%20Outages.pdf

Shahbaz, M. and M. Feridun (2012) Electricity Consumption and Economic Growth Empirical Evidence from Pakistan. *Quality and Quantity* 46:5, 1583–1599.

Shahbaz, M., and L. HooiHooi (2011) The Dynamics of Electricity Consumption and Economic Growth: A Revisit Study of Their Causality in Pakistan. *Energy* 39:1, 146–153.

Siddiqui, R. and R. Haq (1999) Demand for Energy and the Revenue Impact of Changes in Energy Prices. Pakistan Institute of Development Economics, Islamabad. (Research Report No. 174).

Siddiqui, R., J. Hanzla, N. Muhammad, and W. S. Malik (2011) The Cost of Unserved Energy: Evidence from Selected Industrial Cities of Pakistan. Pakistan Institute of Development Economics, Islamabad. (Working Paper No. 75).

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

Wallich, I., and C. Freund (1995) Rising Household Energy Prices in Poland. Who gains? Who Loses? World Bank. (Policy Research Paper 1495).