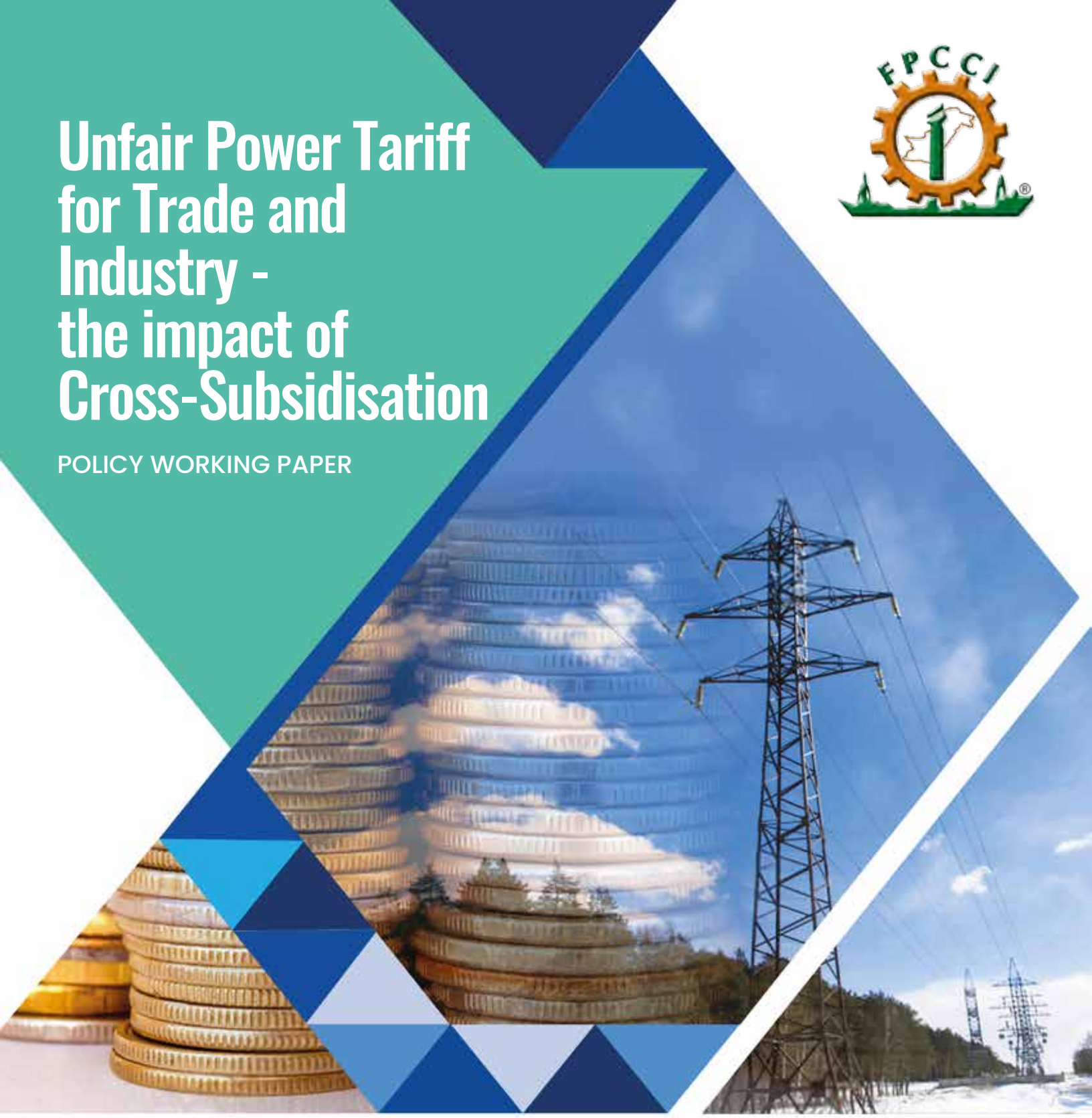
Unfair Power Tariff for Trade and Industry - the impact of Cross-Subsidisation

POLICY WORKING PAPER



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List of Figures

List of Tables

Contents

Executive Summary

Cross-subsidization is the practice of financing one sector of the economy at the expense of another sector which is quite evident in the power sector of Pakistan. Industrial and commercial sectors are charged higher than the residential and agriculture sector consumers. The shortfall for DISCOs, keeping the taxes and levies by NEPRA and GoP to zero, at the weighted average tariff (WAT), Rs.16.53/ unit, amounts to Rs. 269 billion. The major chunk in this loss is incurred by "Residential" and "Agriculture" sectors; loss from residential and agriculture sector is around Rs.303 billion and Rs.65 billion receptively; industrial, bulk supply and commercial sectors give a surplus of Rs.98 billion.

The residential and agriculture sector, on average, pay lower than recovery rate tariff (RRT), Rs. 18.32/ unit, whereas all other sectors and consumers pay much higher than these rates. Industrial and commercial sector consumers, on average, pay Rs. 4.06/unit and Rs. 11.5/unit more than RRT. The commercial and industrial sector consumers pay 63% and 22% more than the recovery rate, thus subsidizing the sectors where there is a shortfall.

The cross-subsidization of the residential and agriculture sectors by the industrial and commercial sectors is hampering the overall growth of the economy, because high electricity prices have a negative effect on power consumption and that eventually leads to less industrial growth and thus slows down economic growth.

Industrial and commercial tariffs are lower than residential tariffs in many developing countries, especially the countries that have prioritized their industrial growth i.e. Vietnam, South Africa, Morocco, Indonesia and Kenya. African countries like Mali, Uganda and Togo, which have lower nominal GDP/capita than Pakistan, prioritize their industries and charge lower business tariffs. As a semi-industrialized country, Pakistan's industrial and commercial sectors should be prioritized in order to boost economic activity. In the EU, industries pay almost 42% lower than the residential sector. Industrial electricity tariffs in Denmark, Germany, France and Spain are almost 50% lower than residential tariffs. In the case of the US, where there is retail power markets, the industries and commercial sector consumers are charged around 40% lower than the residential consumers in all states.

The price of electricity forms a major part of the total cost of production for industrial and commercial sectors; they should be charged at a price that allows electricity generation costs to be recovered, but in Pakistan, they are being excessively charged to cross-subsidize other sectors. The higher tariffs compromise the overall competitiveness of the industry and consequently, it is imperative to reduce the costs for these productive sectors in order to help our industry regain its competitiveness.

It is proposed to charge the commercial and the industrial sector at the weighted average rate (WAT), apart from the taxes and surcharges. If for the fiscal year 2020-2021, WAT would have been charged, industries and commercial sectors could have saved Rs.96 billion and Rs.85 billion respectively. The second solution is to charge the productive sectors at WAT and cross-subsidize the poor residential consumers with rich household consumers, a proposal of such tariff structure has been given in Section 6.2. Secondly, the low-income consumers may be paid subsidies directly through Ehsaas Program which will also help check the misuse of the present scheme of tariff concessions based on the quantum of consumption.

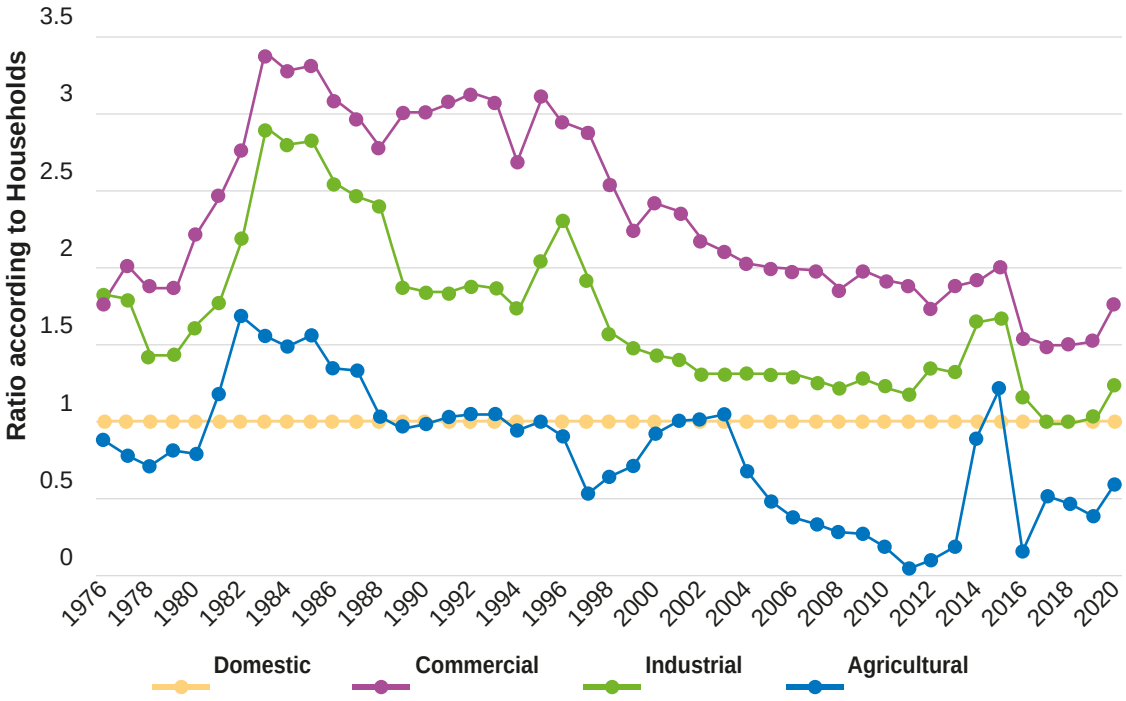
[1]The weighted average of the average tariffs written on the petitions given by DISCOs to NEPRA. The weightsare based on the consumption of the units in each DISCO and this rate is exclusive of any taxes and surchargeslevied by GoP and NEPRA and Fixed Rate. It is calculated to be Rs.16.53/unit
[2]The rate at which the total amount of units billed can be recovered completely. It is calculated to be Rs. 18.32kWh

1. Cross-subsidization

A cross-subsidy is the practice of financing one product with profits from another. The sum of the consumption of one customer group is being paid for by another. This situation arises in the case of public good where the purchasing capacity of one group of people is higher than the other group. As an example of cross-subsidization, consider health insurance, where rich individuals pay according to their incomes while poor individuals pay less since their prices are subsidized. Power sector cross-subsidies are particularly evident in Pakistan where agriculture is highly subsidized; the residential sector is another example of cross-subsidization since there are different tariff slabs based on usage, and people are charged differently.

The so-called energy policy "trilemma" requires policymakers to strike a balance between three goals: supplies need to be secure and sustainable while remaining affordable. However, in other countries, the productive sectors are charged less because they contribute to national growth and development. This is not the case in Pakistan, where heavy electricity tariffs are levied on industrial and commercial sectors. Figure 1 shows how the tariffs for different sectors have changed in reference to the residential (domestic) sector from 1978 to the year 2020. The tariffs reported in this graph are exclusive of any taxes and surcharges levied by NEPRA or the government.

Figure 1: Ratio of Sector-wise Tariffs according to Residential Tariff



It can be seen that industrial and commercial sector tariffs were always higher than the residential tariff. Whereas the agriculture sector has always been subsidized by the government except in the 1980s. Thus, it can be concluded that the industrial and commercial sectors are charged higher than the residential group despite having a huge part in the growth and development of the country. Our focus, in this paper, would be on the industrial and commercial electricity tariffs; how they plan an important part in the growth of the economy and how they are being charged heavily. Lastly, we will present alternative solutions to address the issue.

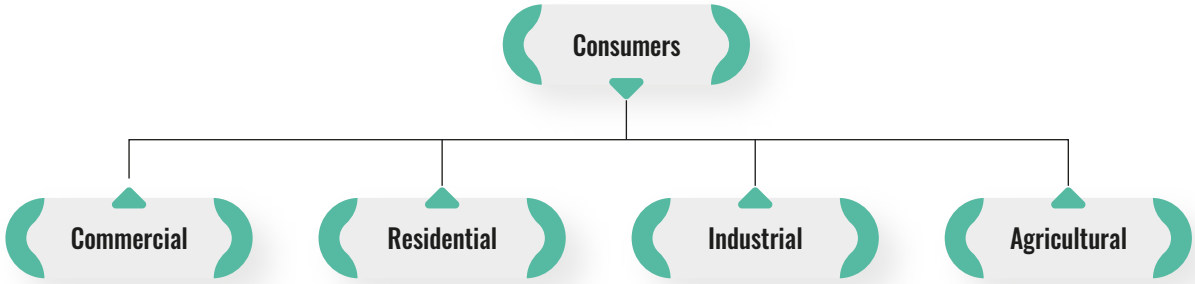
In section 2, we describe the types of cross-subsidies among customers based on consumption and power needs. The third section of the report explains DISCOs' profit/loss calculation by comparing different sectors and describing the idea of cross-subsidization. Section 4 explains how electricity prices correlate with industrial growth and how that impacts the nation's growth. In section 5, we examine energy and power prices in Pakistan and its neighbours, as well as developed countries, to figure out where our current path will take us. Last but not least, we offered two interim solutions to the high-tariff issue that industries and commercial sectors face, including how to minimize electricity costs so that consumers can afford products and achieve a competitive edge in the global market.

2. Types of cross-subsidization in Pakistan

In the power sector, there are different tariffs for different groups based on their usage, time of use, needs and function of that group in the economy. Since the cost of producing electricity is almost the same for all groups, it follows that some groups cross-subsidize the other groups. Below are the different ways in which different groups are being cross-subsidized by other groups based on their consumption patterns.

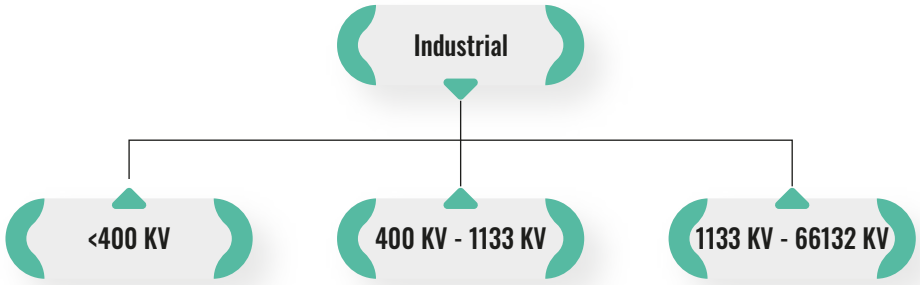
2.1 Cross-subsidy between different consumers

The four main economic groups according to the highest percentage of electricity consumption are Residential, Industrial, Commercial and Agricultural. The electricity tariffs for the commercial sectors are the highest followed by the industrial sector which also faces high tariffs, mainly due to its profitability and endurance, and cross-subsidizes the Residential sector of Pakistan. This is meant to provide accessible and cheaper energy to the average household which is an unproductive sector of the economy. They then, further subsidize the Agricultural sector, to benefit the farmers who otherwise won't be able to afford energy but it is used as a source of raw materials for the industrial and commercial sector. Subsidizing the Agriculture sector is crucial since the country is dependent on agricultural products for food security and its exports.



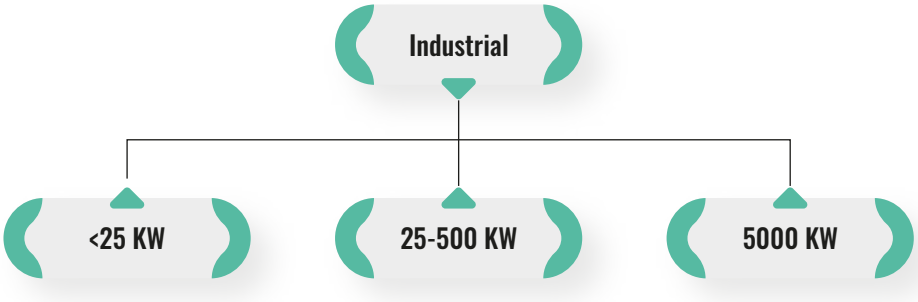
2.2 Cross-subsidy between users of different voltage grids (Supply)

The four main economic groups according to the highest percentage of electricity consumption are Residential, Industrial, Commercial and Agricultural. The electricity tariffs for the commercial sectors are the highest followed by the industrial sector which also faces high tariffs, mainly due to its profitability and endurance, and cross-subsidizes the Residential sector of Pakistan. This is meant to provide accessible and cheaper energy to the average household which is an unproductive sector of the economy. They then, further subsidize the Agricultural sector, to benefit the farmers who otherwise won't be able to afford energy but it is used as a source of raw materials for the industrial and commercial sector. Subsidizing the Agriculture sector is crucial since the country is dependent on agricultural products for food security and its exports.



2.3 Cross-subsidy between different electric loads

According to the sanctioned load being used, users are divided into two levels; less than 5kW and 5kW & above. The higher load rate is priced higher than the first level. Generally, the higher the load rate of users, the lower the unit power costs. So, the higher load rate users are subsidizing the lower load rate of users in the sector or the cost of transmission/distribution of higher load is cheaper than the lowest loads. The tariffs for industrial sector has been divided into three different loads as follows,



In other sectors, the tariffs are higher if the load is lower, and lower if the load is higher. In this respect, it is possible to infer that the lower load consumers cross-subsidize the higher load consumers.

2.4 Cross-subsidy based on Time of Use

Besides the load, voltage and sector differences, the tariff structure differs by the time of usage of utilities; this was added at a time when the supply of electricity wasn't sufficient to meet the requirements of consumers. For the peak hours (4 hours) in the day, consumers are charged more to ensure there is enough electricity to meet all sectors' demands. It is, therefore, logical to infer that consumers of peak hours cross-subsidize consumers of off-peak hours; thus, they are given an incentive to use the utility in off-peak hours. In the current scenario of surplus power supplies, the differential in tariffs in peak and off-peak hours doesn't seem as reasonable.

3. Cross-Subsidization among Sectors

3.1 Calculation of Profit/Loss by DISCOs

It is imperative to understand the amount of cross-subsidies that every group is paying to other groups. For this, we got the data for usage of electricity by every group and calculated the bills at the current Applicable Tariff (A) and charges that should have been paid to cover the cost of production and transmission (B), (RRT), of electricity is also being calculated. Finally, the bills from cost-covering tariffs are subtracted from the bills of actual applicable bills to see the amount of money that is used to cross-subsidize other groups.

3.1.1 Residential Sector

In the residential sector, there are six slabs based on the number of units consumed; plus there are different tariffs for the time of usage of utility. As shown in the Table 1, the amount of money in excess or short of it is the difference between the cost of utility production and the amount needed to catch up with it. The column P/L against WAT also shows the excess/shortfall amount that DISCOs incurred in each group within a sector.

In the residential sector, the shortfall was almost 303 billion in 2021; consumers who consume less than 300 units of electricity contributed the most to this shortfall; they constitute almost 70% of the total consumers. Due to the overall high Loss against WAT, it can be inferred that the residential sector needs to be cross-subsidized by other sectors to cover the costs of production, transmission and distribution of power.

Table 1: Residential Sector–Excess/Shortfall

Description	Sales	%Share	Charges	WAT	Bill @ AT (A)	Bill @WAT (B)	Loss against WAT
	GWh		Rs./kWh	Rs./kWh	Rs. (Millions)	Rs. (Millions)	Rs. (Millions)
Up to 50 Units	10830	18.72%	4	16.53	43,319	179,015	(135,696)
01-100 Units	7259	12.55%	7.36	16.53	53,430	119,999	(66,569)
101-200 Units	13977	24.16%	9.68	16.53	135,300	231,045	(95,745)
201-300 Units	12532	21.66%	11.77	16.53	147,504	207,158	(59,653)
301-700 Units	6952	12.02%	20.82	16.53	144,745	114,920	29,825
Above 700 Units	2164	3.74%	23.92	16.53	51,763	35,771	15,992
For Peak Load Requirement Exceeding 5 kW							
TOU - Peak	725	1.25%	23.92	16.53	17,341	11,984	5,358
TOU - Off Peak	3411	5.90%	17.6	16.53	60,036	56,386	3,650
Temporary Supply	5	0.01%	25.11	16.53	122	80	42
Total Residential	57856				653,560	956,357	(302,797)

According to the Pakistani government, a group of consumers known as 'Life-line consumers' has been formed; these are people below the poverty line who are charged Rs.4/kWh, with the assumption that their usage of power shouldn't exceed 50 units/month. It can be seen from Table 1, that the users that consumed 0-50 units, consumed around 10830 GWh and they are 18.72% of the total household consumers that needs to be cross-subsidized by other sectors or the government.

Firstly, the residential consumers in Pakistan have the right to only benefit from one previous tariff slab, so it depends on the slab in which you fall into i.e. a consumer has been billed for 800 units, then he will be charged Rs.20.82/kWh for the first 700 units and then Rs.23.92/kWh for the next 100 units.

A second consequence is that the relaxed policies for solar panels and net-metering in residential areas have caused rich households to move towards solar energy, and they now fall into the lowest slab (1-100 units) in the tariff provided by DISCOs, which invalidates the whole subsidy system. So, in one way, it can be said that the rich households are the real beneficiary of the government subsidy system.

3.1.2 Commercial Sector

The DISCOs and NEPRA charge the most in the commercial sector as it is the one where all retail and wholesale operations take place. There is an over-payment of around Rs.38 billion by the commercial sector to cover the costs of power production and transmission. It is evident from Table 2 that all groups pay more than what they should cover the costs and thus cross-subsidizing other sectors.

Table 2: Commercial Sector – Excess/Shortfall

Description	Sales GWh	%Share	Charges Rs./kWh	WAT Rs./kWh	Bill @ AT (A) Rs. (Millions)	Bill @WAT (B) Rs. (Millions)	Loss against WAT Rs. (Millions)
For peak load <5 kw	3224	38%	20.66	16.53	66,598	53,285	13,313
For peak load >5 kw							
Regular	112	1%	24.14	16.53	2,704	1,852	852
TOU - Peak	933	11%	26.06	16.53	24,326	15,430	8,896
TOU - Off Peak	3977	47%	20.09	16.53	79,899	65,741	14,158
Temporary Supply	150	2%	22.85	16.53	3,439	2,487	951
Total Commercial	8397				176,966	138,795	38,171

3.1.3 Industrial Sector

Following the industrial revolution, the development and growth of any nation are based on industrial growth, so it is imperative for any country to implement policies that will save its industry costs. Electricity constitutes almost 5-10% of the production costs of industries; some industries are heavily dependent on power consumption, thus affordability is a big concern for the industries.

Table 3: Industrial Sector – Excess/Shortfall

Description	Sales	%Share	Charges	WAT	Bill @ AT (A)	Bill @WAT (B)	Loss against WAT
	GWh		Rs./kWh	Rs./kWh	Rs. (Millions)	Rs. (Millions)	Rs. (Millions)
B1	492	2%	19.74	16.53	9,717	8,136	1,580
B1 Peak	437	1%	20.3	16.53	8,866	7,220	1,647
B1 Off Peak	2378	8%	17.74	16.53	42,185	39,307	2,877
B2	266	1%	19.24	16.53	5,113	4,393	720
B2 - TOU (Peak)	1598	5%	20.24	16.53	32,344	26,415	5,929
B2 - TOU (Off-Peak)	8784	29%	17.53	16.53	153,980	145,196	8,784
B3 -TOU (Peak)	1202	4%	20.24	16.53	24,322	19,864	4,458
B3 - TOU (Off-Peak)	10420	35%	17.74	16.53	184,850	172,241	12,608
B4 -TOU (Peak)	564	2%	20.24	16.53	11,413	9,321	2,092
B4 - TOU (Off-Peak)	3729	12%	17.34	16.53	64,655	61,635	3,020
Temporary Supply	17	0%	20.82	16.53	361	286	74
Total Industrial	29886				537,804	494,015	43,789

Based on the Table 3 there is no doubt that industrial consumers pay Rs.43 billion more than what is needed to cover the cost of producing and distributing electricity. As a whole, groups within the industrial sector pay more than they should. This is because it is expected that industrial groups will cross-subsidize other sectors because they are the most productive part of the economy.

3.1.4 Agriculture Sector

The backbone of Pakistan's economy is the agriculture sector as it produces all the raw materials and food for all other sectors to use and change into finished goods. The agricultural sector all over the world is subsidized by the other sectors. It can be seen from Table 4 that DISCOs face almost Rs. 64 billion rupees shortfall from the agriculture sector.

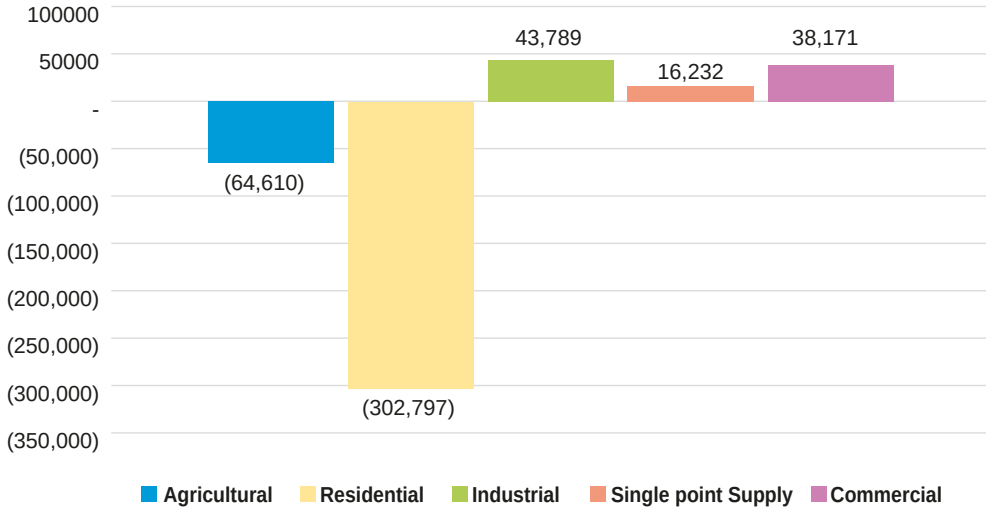
Table 4: Agriculture Sector -Excess/Shortfall

Description	Sales	%Share	Charges	WAT	Bill @ AT (A)	Bill @WAT (B)	Loss against WAT
	GWh		Rs./kWh	Rs./kWh	Rs. (Millions)	Rs. (Millions)	Rs. (Millions)
Scarp	364	4%	20.14	16.53	7,332	6,018	1,314
TOU Peak	72	1%	23.06	16.53	1,663	1,192	471
TOU -Off Peak	397	4%	15.81	16.53	6,276	6,562	(286)
Tube-Wells	3989	39%	9.5	16.53	37,891	65,930	(28,039)
TOU Peak	942	9%	9.5	16.53	8,946	15,567	(6,620)
TOU -Off Peak	4474	44%	9.5	16.53	42,500	73,949	(31,450)
Total Agricultural	10237				130,790	189,767	(64,610)

3.2 Snapshot of Cross-subsidization

Figure 2 gives a snapshot of the overall scenario of the excess tariffs paid by the industrial, single-point supply and commercial sectors. Furthermore, it also shows how the residential sector's shortfall is the highest despite being the non-productive part of the economy. It can be inferred from the figure below that the residential sector needs to cross-subside its own consumers; rich consumers of power cross-subsidize poor households. Whereas, the productive sectors should cross-subsidize themselves.

Figure 2: Excess or Shortfall from WAT



3.3 Shortfall/Excess Amount paid to DISCOs

For the fiscal year 2020-2021, the budgeted subsidy was around Rs.140 billion, whereas Rs.177 billion subsidies were required to keep the prices at the present level. The former subsidy was to provide relief to the "Life-line" consumers; they fall in the residential sector category '0- 50' units. The residential sector did not pay around Rs.29 billion in the fiscal year 2020-2021; whereas, at RRT, they owe DISCOs around Rs.244 billion. Even if we add the subsidy in the shortfall, the consumers still owe Rs. 77 billion to the DISCOs. Using Recovery rate tariffs, consumers in the industrial and commercial sectors paid Rs.95 billion and Rs.85 billion more than they should have as shown, despite having a realized shortfall of Rs. 8 billion and Rs. 14 billion respectively, in Table 5; even when they are charged higher tariffs, their recovery rates are above 95%.

Table 5: Scenario Analysis of Profit/Loss for DISCOs – sector wise (Rs. Millions)

Sectors	Billed Amount	Realized Amount	Amount @RRT	Realized Shortfall	Shortfall @RRT	Shortfall @ Realized
Domestic	845,568	816,330	1,060,093	(29,237)	(214,525)	(243,762)
Commercial	257,525	249,689	153,850	(7,835)	103,675	95,839
Industrial	647,006	633,227	547,600	(13,779)	99,406	85,627
Agricultural	136,920	77,794	187,573	(59,126)	(50,653)	(109,779)
Public Lighting	15,017	11,464	10,809	(3,553)	4,209	656
Bulk Supply	98,731	106,165	66,202	7,435	32,528	39,963
Others	114,474	155,818	89,106	41,343	25,369	66,712
	2,115,240	2,050,487	2,115,233	(64,753)	-	(64,746)

Bulk supply consumers paid almost Rs.39 billion in excess of what they should have and overall they paid Rs.5 billion in excess of what they were billed at. Overall, the DISCOs incurred a loss of Rs. 64 billion despite the excess payment by industrial, commercial and bulk supply. Agriculture and residential sectors gave the biggest losses of around Rs. 109 billion and Rs.243 billion respectively.

4. Electricity Prices and Industrial Growth

It has been argued extensively in the literature that electricity prices and consumption do play an important role in the growth of the economy as the cost of electricity industrial and commercial activities is considered pivotal in the overall growth of the economy. Pakistan was facing a problem of electricity shortage from its inception and the situation aggravated with time. In the 1990s, Pakistan was facing a problem of excess demand and shortage of electrical supply and that's why the Government of Pakistan tried to solve the problem by adding more companies on the supply side to cope up with the increasing demand of the country. Soon after that, the power sector decided to unbundle WAPDA; it used to be a vertically integrated energy utility provider before that.

To meet the demands of the country, the GoP attracted private investment in the sector through IPPs; but it's always difficult to invest in a country where there is ambivalent potential of growth. Though with time, the generation capability of Pakistan increased through private investment; every ease has its price; the curse was to ensure a Return of Equity (ROE) to private investors. This insurance increased the overall price for the end consumers; electric consumption is price elastic; thus growth of electric consumption didn't grow exponentially in response to it. Especially in the year 2019-2020, the industrial electric consumption decreased from 25% to 21%; partly it can be explained through the shifting of industrial customers towards 'Captive Power Plants', but majorly, the increase in prices could be a potential cause of decreased consumption. It is indispensable to gauge the relationship of electric prices on electric consumption and how it's impacting the GDP of the country.

Meta-Analysis

In Pakistan, electricity prices have increased significantly in the past three years, subsequently, electricity consumption in the industrial sectors has seen a downfall. Theoretically, prices do have a significant effect on the demand of the utility but we still need to ascertain if that is the case in Pakistan. There is a vast literature on the relationship between electricity consumption and GDP growth ranging from the most developed countries like Switzerland and US to the least developed countries like Ghana. The literature on the relationship between Electric Consumption (EC) and Gross Domestic Product (GDP) for various countries is summarized in Table 6.

In the case of Pakistan, a recent study (K. Abbasi, Lv, Nadeem, Khan, and Shaheen, 2020) has been done to analyze the relationship between Electricity Price, Electricity Consumption and GDP, for which VECM analysis is used. According to the paper, a 1% increase in electricity price decreases electricity consumption by 0.13%, and a 1% increase in GDP increases electricity consumption by 0.09%. Whereas a 1% increase in electricity consumption decreases electricity price by 0.19%. On the other hand, electricity price decreases by 0.16% if GDP increase by 1%. However, a 1% increase in electricity consumption increases GDP by 0.15% and electricity prices have an insignificant effect on GDP.

If we analyze the present situation of Pakistan with this analysis, we can observe that industrial electricity prices increased by 58.46%, industrial electricity consumption decreased by 11.51% and GDP Growth decreased by 0.47%. According to the paper mentioned above, if electricity prices in the industry increased by 58.46% in the year 2020, then electricity consumption should have decreased by 7.59% but it decreased by much more percentage (there are other factors plus Covid-19 effects). The electricity consumption decreased by 11.5% in the last year, which shows that GDP should have decreased by 1.75% but it only decreased by 0.47%. In the next year 2021, the expected GDP growth is almost 4%, then according to this analysis, the electricity consumption should increase by 0.36%, and electricity prices should decrease by 0.64%.

Table 6: Direction of Relationships

Author	Country (Period)	Variables	Methodology	Direction			
				→	←	↔	≠
9	China (1971–2001)	EC, GDP	Granger Causality	✓	✗	✗	✗
7	Switzerland (1950–2010)	EC, RGDP	ARDL, VECM	✗	✗	✓	✗
7	UK (1975–2010)	EC, RGDP	Panel bootstrap causality	✓	✗	✓	✗
7	OECD (1990–2008)	EC,	GDP Panel Granger causality	✓	✗	✓	✗
10	Pakistan (1972–2010)	EC, RGDP	Granger Causality	✓	✗	✗	✗
8	Poland (2000–2012)	EC, GDP	Granger causality	✗	✗	✓	✗
4	Turkey (1970–2011)	EC, GDP	Granger causality	✗	✗	✓	✗
5	Malaysia (2005–2010)	EC, RGDP	Multiplier Approach	✓	✗	✗	✗
6	U.S.(2005–2015)	EC, RGDP	Wavelet	✓	✗	✗	✗
3	Ghana (1971–2014)	EC, Growth	ARDL, ECM	✗	✓	✗	✗
1	Pakistan (1970–2018)	EC, EP, GDP	Granger causality VECM	✓	✗	✗	✗

Note: $\rightarrow$,$\leftarrow$,$\leftrightarrow$, and $\neq$ denotes unidirectional bidirectional and no causality, respectively.

In the US (Ben-Salha et al., 2018) and China (Shiu and Lam, 2004), an increase in electric consumption causes the GDP growth to increase too, this study is consistent with the metrics shown for Pakistan. The result can also be compared with Turkey's relationship between electricity consumption and GDP Growth, where it gives similar results (Bayar et al., 2014).

5. Comparative Analysis

To understand the power market in Pakistan, it is imperative to understand the power markets around the world especially the power markets of regional neighbours. Though currently, Pakistan has a single buyer market, in the near future, it is shifting towards a competitive market step-by-step in phases. Firstly, it will shift towards a wholesale market in which the GENCOs will operate competitively, later a retail market will be introduced in which the DISCOs will start operating competitively with a single market operator. According to microeconomic theory, market systems give rise to efficient and lower tariffs as more degree of competition is introduced. European and American power markets mostly follow a retail market design, therefore their tariffs structure pursue a cost-effective trajectory. In India, different market structures can be seen depending on the state; whereas, in Bangladesh, the power sector has moved towards a wholesale market. Nevertheless, the tariffs for industrial and commercial sectors have high tax percentages all over the world.

5.1 South Asia

The industrial and service sectors are the largest users of electricity in India, accounting for 74% of total final consumption (TFC) together, roughly half each; whereas in Pakistan, it accounts for only 28.37%. The service sector includes agriculture (demand for water pumping) and forestry, which account for half of the sector's demand. The residential sector, on the other hand, is the third largest electricity consumer in India, at 24% of total consumption; whereas in Pakistan it accounts for almost 48.72%. The figures mentioned above are reflections of how the industrial and commercial sector in Pakistan isn't growing at the same rate as its neighbors. The hurdles, it is facing in its growth, can be attributed to the long hours load shedding in 1990s, when Pakistan was facing a shortage of supply, and the high electricity prices. According to the new Open Access Policy in India, the industrial sector can consolidate power supply to plants at various locations and build captive power plant to achieve economies of scale, whereas in Pakistan, such facilities are available but with inflated energy costs.

5.1.1 Fuel Prices

The most important component of any electricity cost is fuel price that has to be paid by GENCOs and eventually the end consumers. The comparison of energy prices across the region and US are shown in Table 7 below,

Table 7: Gas and Diesel Prices, in USD per liter

Country	Gasoline Price	Diesel Price
Pakistan	0.731	0.712
United States	0.936	0.873
Bangladesh	1.045	0.763
India	1.388	1.255
Sri Lanka	0.922	0.556

Source: GlobalPetrolPrices.com

Pakistan's gasoline and diesel prices collectively are the lowest out of the five countries listed. India's gasoline and diesel prices are 89.9% and 76.2% higher respectively, while Bangladesh's 42.9% and 7.2% higher, while the US has 28.0% and 22.6% higher prices. Sri Lanka has 26% higher prices for gasoline but 21.9% lower for diesel. After analyzing the Table 7, it is expected that electricity prices (part of the Energy Charge Component of Power Purchase Price), would be lowest in the region.

5.1.2 Electricity Prices

If one important component i.e. fuel price of the cost of electricity is cheapest as compared to neighbours, then one can expect the total price to be the lowest too, but that is not the case in Pakistan. Though the electricity prices for the residential sector (that ought to be a non- productive sector) are the lowest in Pakistan. The household prices in the US, Bangladesh, India, Sri Lanka are higher by 174%, 22%, 44.4% and 37.0%, respectively. The business sector, on the other hand, observes lower prices in the US, Bangladesh, Sri Lanka by 27.0%, 28.4% and 56.1%, relative to Pakistan's, but is 19.6% higher only in India.

Table 8: Electricity Prices, in USD per kWh

Country	Household	Business
Pakistan	0.054	0.148
United States	0.148	0.108
Bangladesh	0.066	0.106
India	0.078	0.177
Sri Lanka	0.074	0.065

Source: GlobalPetrolPrices.com

Looking at the countries individually, Pakistan's business sector pays 2.7 times higher its own household sector, compared to Bangladesh's businesses who pay 1.6 times, India's 2.3 times. Whereas in the US and Sri Lanka, businesses pay 0.8 and 0.9 times less than their households. Comparing Pakistan's low fuel costs, it has relatively higher electricity prices on average, especially for the business sector.

5.1.3 Tariff Comparisons

The residential and industrial tariffs for the three neighbours, Pakistan, Indian and Bangladesh are given in Table 9. In the case of Pakistan, the uniform tariff is given; the tariffs of Maharashtra, Uttar Pradesh and Tamil Nadu are given in the case of India; for Bangladesh, the average tariff by the regulatory authority is given.

Table 9: Tariff Structures, in USD per kWh

Consumer Class		Bangladesh		Pakistan		India	
		Variable Charges	Fixed Charges	Variable Charges	Fixed Charges	Variable Charges	Fixed Charges
Residential	0-50	0.045	0.360	0.024	0.440	0.016	0.247
	0-100	0.055	0.360	0.082	0.440	0.014	0.004
	101-200	0.069	0.360	0.094	0.440	0.045	0.468
	201-300	0.072	0.360	0.099	0.880	0.037	0.735
	301-500	0.090	0.360	0.109	0.880	0.070	0.632
	>500 Units	0.138	0.360	0.124	0.880	0.086	0.491
Industrial	<11kV	0.102	0.360	0.099	2.596	0.094	2.345
	11 to 66	0.103	0.720	0.103	2.478	0.092	4.480
	66 to 132	0.101	0.720	0.100	2.360	0.090	3.780
	>132kV	0.100	0.720	0.094	2.360	0.085	3.780

Source: DPDC, NEPRA, TANGEDCO, MSEDCL, UPPCL

The actual tariff structure for the three countries shows that all three have similar pricing structures for the residential and industrial sectors. The residential sector is broken into slabs, depending on the number of units used. All three have lower prices to benefit lifeline users and increasingly higher prices for each increasing slab. The industrial sector is split into the voltage levels required, with variable charges decreasing as the level increases. Bangladesh's residential tariffs for lifeline users, and for the highest slabs, are the highest in the region. India's tariffs, on the other hand, are relatively the lowest. Bangladesh's lifeline users pay 87.5% higher than Pakistan's and 184% higher than India's. In Bangladesh, the charges for the highest units are 3 times the charges for the lifeline users. In Pakistan, the figure is 5.2 times, and in India, it is 5.4 times.

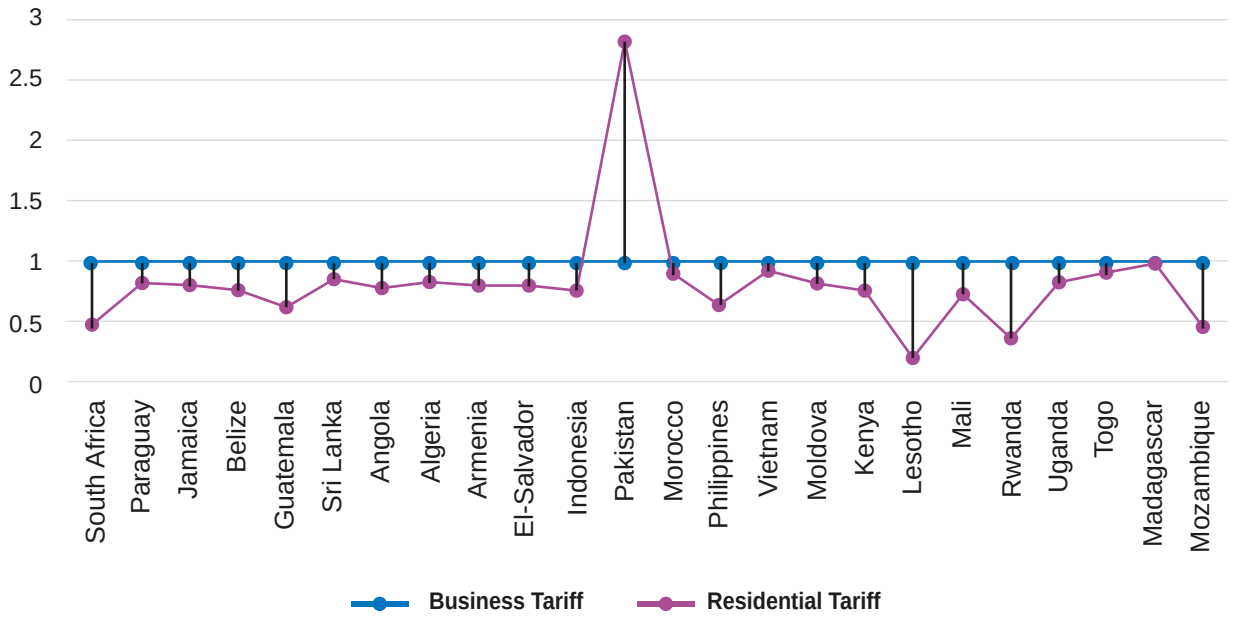
The Industrial prices in Pakistan and Bangladesh are identical for the variable costs, but Pakistan has significantly higher fixed costs, about 74% higher than Bangladesh's costs. India has the lowest variable costs in the region, but the highest fixed costs, which is 31.9% higher than Pakistan's.

5.2 Developing Countries

In Pakistan, the industries and commercial sectors are charged 31% and 63% more than the residential sector but if we compare the average tariffs for the residential and business sector, then the latter pay almost 2.7 times what he is being paid by the former. It would be rational to compare the tariff structure of Pakistan with developing countries where the power market is still in the development phase. Most of the countries shown in Figure 3 don't have retail power markets and rely on single buyer markets. The production of electricity in Africa is mostly coal based and power utility operations are run by the government. Countries like Mali and Uganda which have lower nominal GDPs/capita than Pakistan, prioritize their industrial sector and charge lower business tariffs. While other African developing countries like South Africa, Morocco and Kenya, where there is high industrial growth, give subsided tariffs to their business sector.

Highly industrialized countries like Vietnam and Indonesia, despite having developing country status, charge their business sector way lower than the residential sector. As a semi-industrialized country, Pakistan's industrial and commercial sectors should be prioritized in order to boost economic activity, and utility prices for the business sector should be lower than those for the residential sector.

Figure 3: Comparison of Residential and Business Tariffs in Developing countries



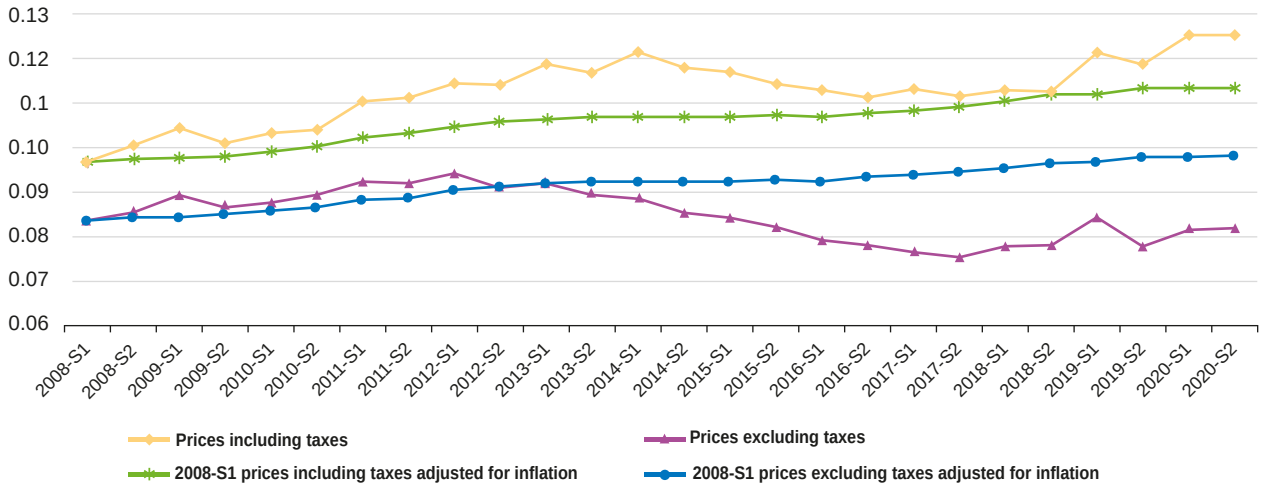
5.3 European Union

The power sector in Europe is diverse in its market design; ranging from vertical integration to retail market structure. The tariff structure varies with every country; with high tariffs for the industrial and commercial sectors in less developed countries and lower tariffs for these sectors in most developed countries. US and European market structures differ in that the market operator in the US acts both as a market operator and a technical operator, while in Europe, Independent Market Operators operate independently of Technical Market Operators.

5.3.1 Electricity Prices in EU

Europe is making towards an efficient energy mix where they are moving in the direction of green energy; better energy mix combined with efficient power infrastructure. The electricity prices in the EU are shown in Figure 4; average prices have been quite stable since 2008, but the amount of taxes have increased. But if we look at the prices adjusted for inflation, then the picture becomes clearer as the prices also incorporate the inflation. On the other hand, taxes have increased in the past year because of the introduction of Carbon taxes as instituted in the Paris Climate Agreement because of global warming.

Figure 4: Electricity Prices for non-household consumers, EU-27, 2008-2020 (EUR/kWh)



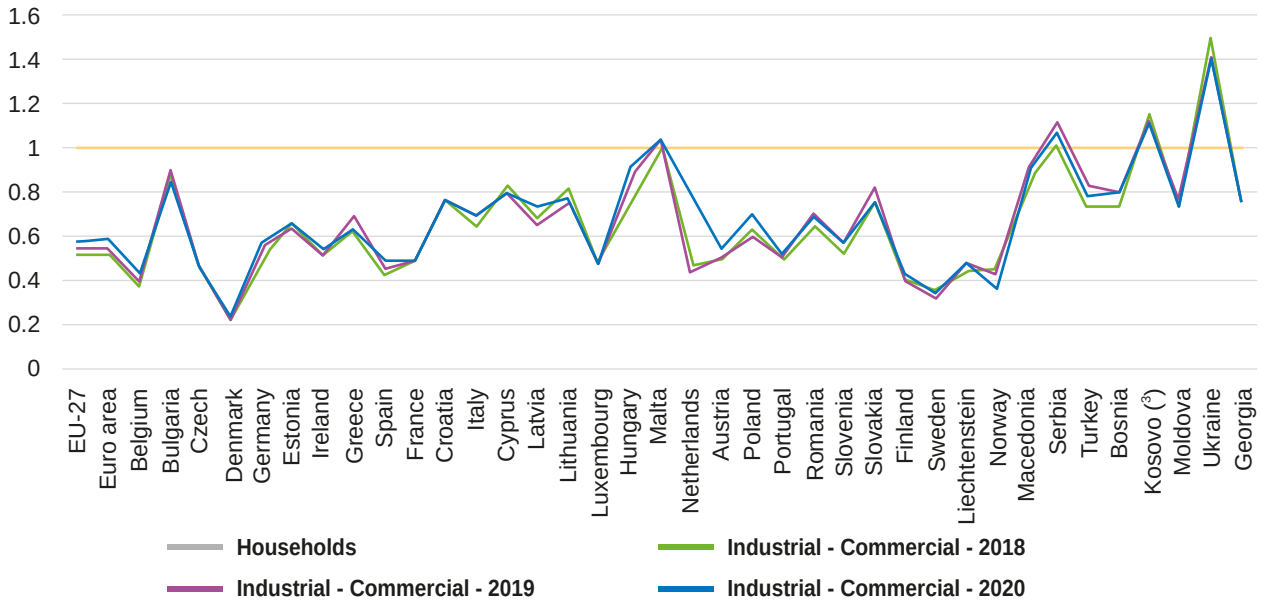
Source: Eurostat (online data codes: nrg-pc-205)

Non-households includes industrial and commercial usage of electricity. Businesses around the world are looking for stability in policies regarding their utility costs so that they can predict accurate demand for their products and Europe is successful in providing this stability to business as can be shown from Figure 4.

5.3.2 Comparison of Households vs. Non-Households

Figure 5, shows the comparison of households' vs. non-households (Industrial and Commercial) tariff prices in Europe. The prices are normalized to households' prices for ease of comparison. The Figure 5 shows a stark difference between the tariffs that are charged to the households as compared to the tariffs charged to the industrial and commercial sectors.

Figure 5: Electricity Tariffs in EU – Comparison



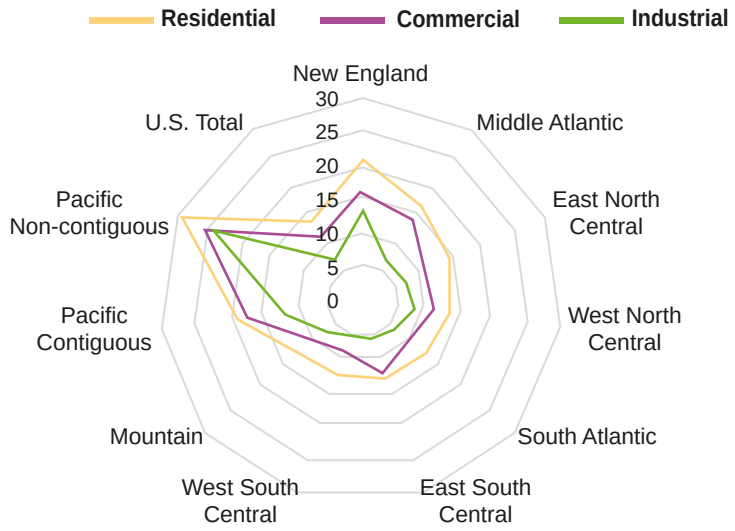
Source: Eurostat (online data codes: nrg-pc-205)

It can be deduced from the Figure 5 that countries that are more developed tend to have lower tariffs for the industrial and commercial sectors; Denmark, Norway, Sweden, Germany and Belgium charge less tariff to their productive sectors. On the other hand, the countries that are less developed like Ukraine, Kosovo, Serbia charge the industrial and commercial sector expensive power as compared to the households. It can be observed that developed nations provide cheap utility services to their industrial and commercial sectors because they attribute it as the productive part of their economy.

5.4 Electricity Markets in US

The electricity market in the US is considered highly efficient and prices are based on the principle of marginal cost. It transformed from a natural monopoly to a wholesale market and now retail market. Still, there are many states in which there is vertical integration of power providers. The question of whether a country should open up its market to competition is mainly based on circumstances and consumer behavior.

Figure 6: Comparison of US electricity prices - sector-wise



The electricity market of the US can be divided into 10 distinct regions on the basis of market set-ups. It can be seen from Figure 8 that residential prices in all the regions are greater than the electricity prices for the industrial and commercial sectors. Some areas like Pacific Contiguous, where there are the highest prices for the residential sector, still provide electricity to commercial and industrial sectors at a lower rate. The US electricity tariffs show similar trends as can be seen in the EU market, cheaper rates for the productive sector (industrial and commercial) of the economy.

6. Interim Solutions

Although the commercial, industrial and agricultural sectors are more productive, Pakistan's commercial and industrial sectors pay significantly more in electricity bills than the residential sector. When production and trade costs are high, industrial production would be low and eventually, it would be detrimental to the development of Pakistan. Therefore, it is imperative to recommend solutions and alternatives to the current tariff structure of electricity. Table 10 shows the average rate in Rs/kWh for different sectors and at what average rate the DISCOs recovered from each of the sectors.

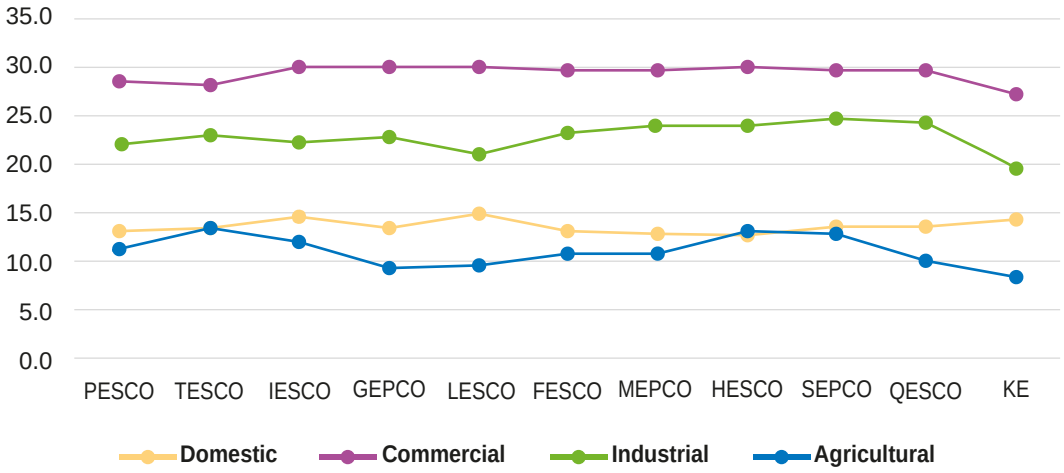
Table 10: Billed and Recovery Rate of Electricity Bill

Sectors	Billed Rate	Recovery Rate	%Recovery
Domestic	14.27	14.11	97%
Commercial	29.82	29.74	97%
Industrial	22.38	21.19	98%
Agricultural	12.77	7.60	57%
Public Lighting	24.11	19.43	76%
Bulk Supply	26.10	29.38	108%
Others	25.07	32.04	136%

Billed rate is the average rate at which all the different consumers were billed for the units used. We can observe from the figure that the agricultural sector enjoy the lowest average tariffs at 11.1 Rs/kWh but it is a productive sector. Despite the fact that residential consumers aren't productive, residential rates are still low at 14.1 kWh. The average cost of producing electricity is 16.53 Rs/kWh, but the residential sector pays less than that; this results in a loss of 4.2 Rs/kWh for the power sector. Tariffs for commercial and industrial supplies, as well as bulk supplies, are the highest.

On the other hand, Recovery Rate Tariff is the average rate at which the units that were billed got recovered by DISCOs. The last column in the Table 10 is % recovery, it shows the percentage at which the amount billed was recovered by the DISCOs. We can observe that the recovery rates for the commercial and industrial sector, despite being billed heavily, are considerably high; whereas it can be observed that the % recovery for the domestic sector is quite low. It can also be seen from Figure 7 that industrial and commercial sectors are charged higher than domestic by all DISCOs, which is contrary to what we have seen earlier for the European and US markets.

Figure 7: Average Electricity Tariffs for DISCOs by sectors



Burdening the industrial and commercial sector to subsidize the residential sector is unfair, as industries and commercial and agricultural activities are the productive parts of the economy. As the agricultural sector is subsidized all over the world, we assume that it should be subsidized in Pakistan too as it produces the raw materials for the industries and markets for commercial activity to take place. The residential sector, on the other hand, is heavily subsidized, even the rich households are cross-subsidized by the productive sectors, which is quite unreasonable.

6.1 Weighted Average prices

The best-case scenario for finding the best solution to this problem is to charge a tariff that covers the cost of power production. To recover the total cost of energy generation in Pakistan, we propose the same prices for all consumers/sectors, i.e. Weighted Average Tariff (WAT).

According to the "Draft NEPRA Guidelines for determination of consumer end tariff", the DISCOs are subject to submit a petition stating their average tariff and then NEPRA decides for a uniform tariff before any taxes and surcharges. The WAT is the weighted average of the Average tariff, reported by DISCOs to NEPRA for the calculation of consumer-end tariffs, on the basis of the consumption weight of every DISCO. It can be seen in Table 11.

The average tariff reported by DISCOs is listed in the Table 11 by the name Average Tariff (A). Later, the share of each DISCO, based on consumption, is listed under the heading % Share Consumption in the Table 11. Finally, we took the weighted average of the average tariff per DISCO, with respect to their distribution share in total electricity consumption, we reach a value of 16.53 Rs/Unit (kWh); whereas the average of the average tariffs is 17.28 Rs/kWh.

Table 11: Average Tariff Calculation

DISCOs	%Share Consumption (B)	Average Tariff (A)*	A*B
FESCO	12%	16.26	1.99
GEPCO	9%	16.69	1.55
HESCO	5%	22.43	1.1215
IESCO	1%	14.29	1.39
LESCO	19%	15.99	3.08
MEPCO	15%	16.88	2.58
PESCO	8%	16.85	1.42
QESCO	5%	18.34	0.83
SEPCO	3%	21.58	0.55
TESCO	2%	14.91	0.25
K-Electric	13%	15.89	2.07
		17.28	16.53
* in Rs./kWh			

The total units billed and the amount of units bills are shown in Table 12. The total units consumed this year are 115441 Gwh and Rs. 2115240 Million were billed to the consumers.

Table 12: Units and Amount Billed

DISCOs	Units Billed (GwH)	Amount of Units Billed (Rs. Millions)
PESCO	9608	176716
TESCO	2013	30625
IESCO	10944	220542
GEPCO	10922	192389
LESCO	22352	431602
FESCO	14501	258995
MEPCO	17466	280491
HESCO	4014	72027
SEPCO	2778	50300
QESCO	4775	85679
KE	16069	315873
Total	115441	2115240

The average tariffs are exclusive of Electricity Duty, tax on the sale of electricity, taxes and other charges levied by the Government or other competent authorities from time to time which is payable by the consumers, in addition to the charges levied as per the tariff. Therefore, we assume that the government and NEPRA levies a tax or surcharge in the bill of around 0.83 Rs./kWh. Without any of these assumptions, the total recovery of the bill can be made at the rate of 18.32 Rs./Unit.

$$\text{Recovery Rate} = \frac{\text{Total Billed Amount (Rs. Millions)}}{\text{Units Billed (GwH)}} = \frac{2115240}{115441.4} = 18.32 \text{ Rs./Unit}$$

If we take our assumption of taxes and surcharges by NEPRA and government and Fixed Tariff for all consumers to be Rs.2/kWh, then the total amount can be recovered at the rate of 16.53 Rs./Unit (WAT).

On average, the residential sector will pay 22% more than the average unit price they currently pay as shown in Table 13. On the brighter side, the industry and commercial sector would get the electricity at far less prices i.e. 27% and 44% fewer prices and this would reduce the cost of production of the goods and services of these sectors.

Because agriculture provides food and raw materials to residential, industrial, and commercial sectors, agriculture is subsidized by the government in all industrialized nations; therefore, government subsidization is proposed for the agriculture sector. In contrast, residential consumers should have their electricity rates raised to recover all production costs. The government's narrative of subsidizing Lifeline users necessitates different tariffs based on slabs and different classes of consumers. Thus, the residential sector tariff should be divided into two classes based on tariff for

- Life-line Users - 0-100 unit usage

- All other users - greater than 100 units usage

We can combine the Lifeline users with the agriculture sector users and use social subsidy programs to ensure that poor families, small farmers, and small and medium businesses receive financial assistance according to their needs.

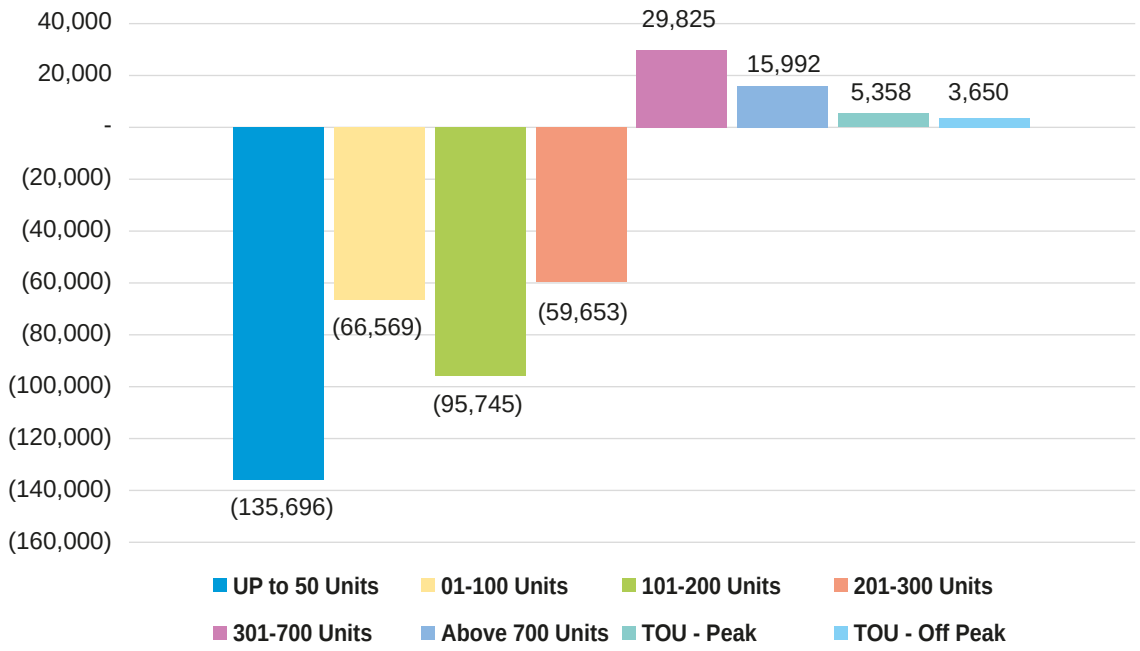
Table 13: Difference of prices between RRT and Applicable Rates

Sectors	Average Tariff*	Recovery Rate Tariff*	Diff with RRT*	%Diff with RRT
Domestic	14.27	18.32	-4.05	-22%
Commercial	29.82	18.32	11.50	63%
Industrial	22.38	18.32	4.06	22%
Agricultural	12.77	18.32	-5.55	-30%
Public Lighting	24.11	18.32	5.79	32%
Bulk Supply	26.10	18.32	7.78	42%
Others	25.07	18.32	6.75	37%
* in Rs./kWh				

6.2 Cross-Subsidization among households

With the current tariff system, where residential consumption is considered in “slabs” of monthly consumption, and despite the government’s measures in trying to make the tariff system less regressive, the richest 20 % of households still receive 40 % more in subsidies than the poorest 20 percent of households. Additionally, the seasonality of electricity consumption, where less electricity is consumed in winter months than in the summer, the richer households fall into the lower, more subsidized slabs. Similarly, in the summer, the poorer households are made to use more electricity and end up at a higher slab level (World Bank, 2017). The profit and loss against WAT can be seen in the Figure 8

Figure 8: Residential Sector – Profit/Loss againstWAT – "Slab"-wise



The system was designed to benefit the poor, on the grounds that low-income groups must use less electricity, but according to a World Bank study, the correlation between measured electricity consumption and household welfare in Pakistan was proved to be relatively weak, rendering the current system useless in truly providing help to the poor. The consumers are charged in such a way that Households with high incomes tend to take advantage of the tariff structure that is in place in order to benefit the overall housing market for various reasons. On one hand, rich customers avoid paying the higher rates through net metering or solar panels, thereby reducing their consumption of electricity from the grid. Increased use of net metering has its benefits, but it also means less contribution to fixed costs for utilities and higher rates for customers without net meters. Some customers own two or more meters, which reduces their overall bills and others resort to illegal methods to avoid falling into the higher slabs.

One solution could be to reduce the subsidies on the household sector altogether, to reflect the actual cost of energy. This would reduce the fiscal deficit as well as the burden on the industrial sector. Fiscal resources would be free to engage in an alternative policy instrument, for example, a conditional cash transfer program, which could prove to be more efficient in protecting the poor. Another potential option could be to end the cross-subsidization from the Industrial sector and impose higher tariffs on the rich households based on their consumption, with the lower levels receiving the same low tariffs. This would mean that the richer households would be cross-subsidizing the poor at a larger scale than before, and without the Industrial sector. A proposal for such arrangement can be seen in the Figure 14

Table 14: Case of Cross-subsidization among residential consumers

Description	Sales	%Share	Charges	New Charges	%Change	Diff withWAT	New Diff withWAT
	GWh		Rs./kWh	Rs./kWh		Rs. (Millions)	Rs. (Millions)
< 50	10830	18.72%	4	4	0%	(135,696)	(135,696)
01-100	7259	12.55%	7.36	8	9%	(66,569)	(61,923)
101-200	13977	24.16%	9.68	13	34%	(95,745)	(49,340)
201-300	12532	21.66%	11.77	17.2	46%	(59,653)	8,397
301-700	6952	12.02%	20.82	33	59%	29,825	114,503
>700	2164	3.74%	23.92	43.74	83%	15,992	58,882
For Peak Load requirement exceeding 5kw							
TOU - Peak	725	1.25%	23.92	43	80%	5,358	19,190
TOU - Off Peak	3411	5.90%	17.6	30	70%	3,650	45,948
Temporary Supply	5	0.01%	25.11	26	4%	42	46
Total Residential	57856					(302,797)	0

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