3 Energy

3.1 Introduction[1]

Pakistan's energy shortage has become the most pressing economic challenge. This is not to say the country's other structural deficiencies have been resolved, but simply that the scope of this problem is now so extensive that quick-fixes will no longer allow the economy to move forward.

Beyond the social disruption and the direct hit on the manufacturing sector (especially small and medium sized units), the energy shortage has created a recurring circular debt problem. This means the country is generating less power than it could otherwise be doing. Furthermore, the hemorrhaging in the power sector has also pushed the fiscal deficit to record highs, which in turn has forced the government to borrow large amounts from the banking system. The repercussions of the circular debt problem are far reaching: it has discouraged fresh investment (both private and public) in the power sector; it has squeezed out development spending; it has undermined government commitments to independent power producers (IPPs); and has become the primary driver for the sharp increase in domestic debt over the past 5 years (see **Chapter 6**).

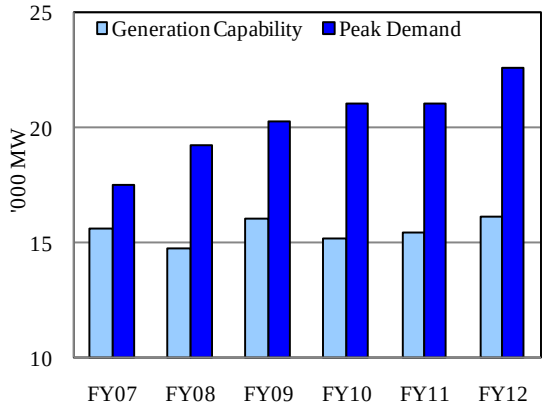
These interrelated problems will take many years to resolve, which mean Pakistan's economy faces an uphill task to achieve the sort of growth rates needed to absorb young job seekers, reduce poverty levels, and improve the country's social indicators. Unless it can achieve sustained growth rates of 7 percent as stated by the Planning Commission, Pakistan will continue to underperform in the global economy.

3.2 Assessment[2]

As things stand, the average Pakistani is increasingly concerned about two uncomfortable realities: there is insufficient power for households and other users; and two, the cost of this power (when available) is likely to continue rising.

The root of the problem can be traced to policy inaction, dating back to the early 2000s. Insufficient investment in generation capacity (especially hydel power) and growing demand, created a shortage that continues to grow (**Figure 3.1**). Facing this chronic shortage, users have been shifting to alternative sources of power to reduce their dependence on the erratic national grid.

Figure 3.1: Power Shortage



Source: State of Industry (SoI) Report ,Nepra

The increasing use of portable generators by household and shops, and investment in captive power by larger industrial units, is well known. The inefficiency of small generators, and their reliance on other fuels (gas, petrol, diesel), implies that this alternative does not reduce the overall burden on the country. While the inefficiency associated with portable generators is obvious, captive power units set-up by the industrial sector, also add to inefficiency at the country level.[3] In our view, by diverting

[1] This chapter will focus primarily on the power sector (electricity), but will also touch upon the role of gas allocations that has increased power generation costs.

[2] Unlike other chapters in this report, an annual performance assessment is not possible, as the industry reports on the energy sector for FY13 are not published. More specifically, the Energy Yearbook by Hydrocarbon Development Institute of Pakistan (HDIP) and the State of Industry Report by Nepra, were not available during the preparation of this Annual Report.

[3] Shifting gas from bulk power generation to captive power units follows the same *scale* argument – it would be more efficient for gas to be provided to Gencos, which could then provide this power to the industrial sector. On the flip side (that adds to the overall burden), SSGC's unaccounted for gas (UFG, which entails theft and line-losses), has increased from 6.6

gas from power generation to household usage (which has priority); the country has less available power than it would otherwise have. The increase in household consumption of gas and CNG use for transportation, in the face of stagnant total supply since 2008, is shown in **Figure 3.2a**. What should be noted in **Figure 3.2b**, is the sharp fall in gas usage for power generation, even though the country was experiencing a growing power shortage during this period. In our view, the challenges in the power sector can be traced to gas allocation decisions.

Figure 3.2(a): Gas Consumption

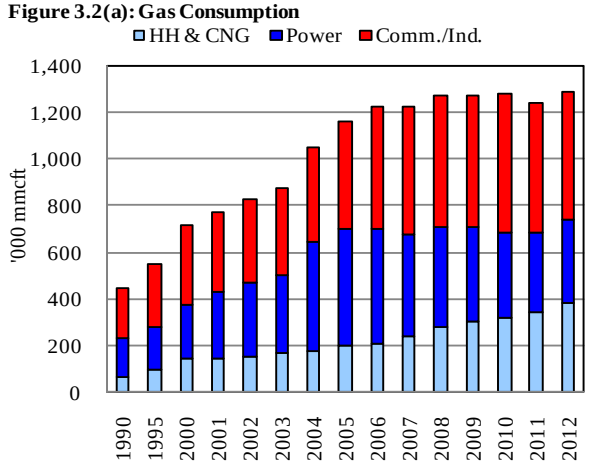
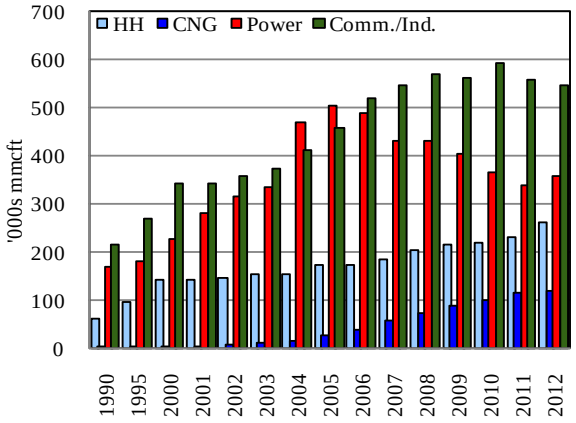


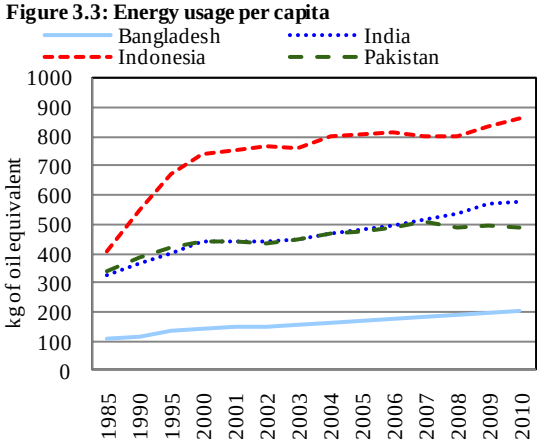
Figure 3.2(b): Gas Consumption



Source: Energy Year Book (EYB), Hydrocarbon Development Institute of Pakistan (HDIP)

The recent policy response to the power shortage is based on the reform agenda formulated over 10 years ago. The latter focused on the entire power supply chain, which was to be unbundled, restructured and eventually privatized. However, the unbundling exercise that started in 2002 was largely unsuccessful; it remains a planning exercise on paper with new companies that are manned by the same people operating with the same mindset. Only the privatization of Karachi Electric Supply Company (Kesc) went through, and after struggling for many years to reduce staff, tackle union issues, target theft, upgrade equipment, and improve customer service; Kesc was able to post its first profit in FY12.[4] The path forward for other power-related PSEs should be clear enough.

Figure 3.3: Energy usage per capita



Source: WDI, World Bank database

Inadequate power is a regional challenge

Many developing countries are challenged by inadequate and expensive power, but Pakistan still fares poorly in comparison. As shown in **Figures 3.3** and **3.4**, energy *and* power usage per capita in Pakistan, has stagnated from 2006 onward. The similarity in economic conditions and underlying infrastructure /institutions in Pakistan and India, could explain the incredible overlap in the two graphs till 2006; however, the recent divergence is a source of some concern.

Figure 3.5 is more insightful: it shows the relationship between energy usage and annual GDP, which could be interpreted as how productively a country uses its energy to translate into economic activity. As shown, the flat curve for Pakistan indicates that energy usage has not been able to generate

percent of total in 2008, to almost 11 percent in 2012. Shifting gas to CNG stations and from wholesale users (Gencos) to many more retail users (industrial units), could partially explain why SSGC's UFG has increased so much in recent years.

[4] An important part of this improvement can be traced to what Kesc calls the strategy of segmented load-shedding. This refers to the commercial decision to reward conscientious users (those who regularly pay their bills) with zero load-shedding, while localities with poor bill payments have to face the brunt of the load-shedding.

economic activity to the same extent as it has in India, Indonesia, and certainly China.[5] A simplistic assessment is that energy usage in Pakistan has focused on households, rather than the commercial/industrial sector. The latter directly generates economic activity as it uses energy as an *intermediate* good to create value; households, on the other hand, use power (electricity) as a *final* good to increase their utility (i.e. comfort or well-being).

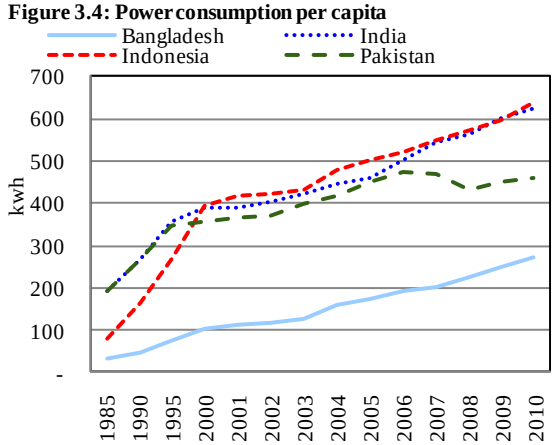
3.3 The role of CNG

The growing popularity of CNG powered vehicles, as shown by the CNG pumps that have opened up across the country, has played a critical role (at the margin) in shifting natural gas to unproductive uses (see **Figure 3.2b**).[6] What is somewhat disappointing is the sharp divergence between *projected* CNG usage and the actual amounts consumed. **Figure 3.6** shows how projections made in FY04, assumed a gradual increase in CNG demand; however by FY06, projected demand was only half of what was *actually* being consumed – yet the only policy solution to discourage consumption, was to close CNG stations for a few days every week. While this may have reduced CNG sales at the margin, artificially restricting supply does little to tackle the root cause of the problem – the subsidized cost of CNG. In fact, more gas was made available to CNG stations to meet public demand. In our view, the economic cost of diverting this marginal gas away from more productive uses like power generation, was not given adequate policy attention.

Clearly, this *status quo* could not be sustained: the current rationing of CNG is causing public discontent in terms of the increase in CNG prices (to reduce the gap between CNG and retail petrol prices), and the long queues at CNG stations in the larger cities of Pakistan.

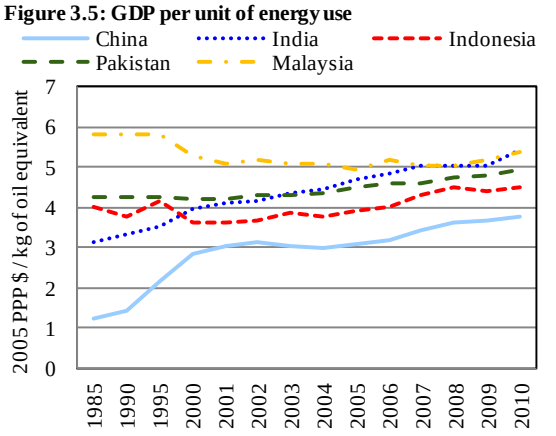
This additional demand should be viewed within context of the overall usage of gas in Pakistan. As a global norm, countries ensure that their base-load power requirement is met by indigenous sources (as in China and India that rely on coal). In the case of Pakistan, the indigenous energy source is hydel and natural gas. However, despite the fact that the production of gas has leveled off since 2008 (**Figure 3.2a**), the authorities allowed for increasing

Figure 3.4: Power consumption per capita



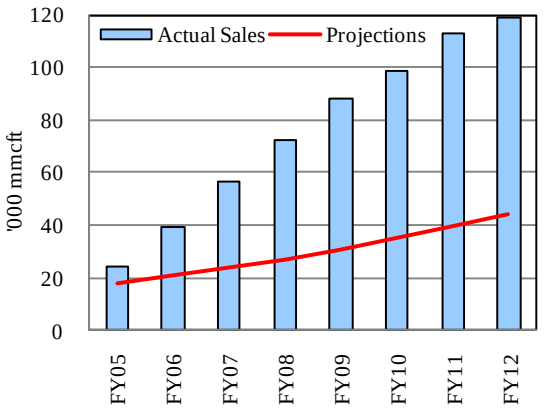
Source: WDI, World Bank database

Figure 3.5: GDP per unit of energy use



Source: WDI, World Bank database

Figure 3.6: Demand Projections vs Actual Sales (CNG)



Source: EYB, HDIP; Annual Report FY04, Ogra

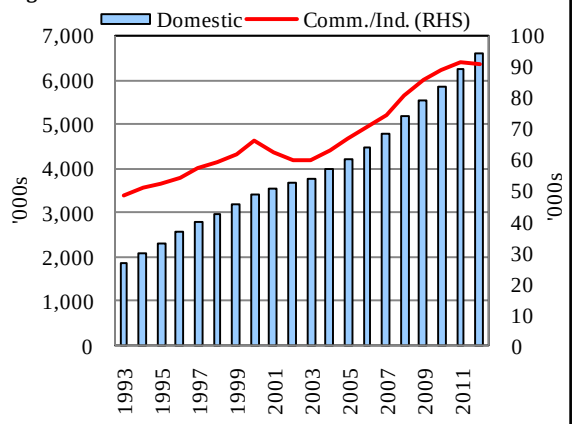
[5] At the earlier stages of industrial development, power is often scarce and additional supply directed to productive use, creates higher economic growth. At the later stages of development when households have sufficient purchasing power, non-productive usage becomes more common. In Pakistan's case, the ample availability of hydel and gas-generated power did not directly constrain economic development. In our view, it was the lack of an Industrial Policy that did not enhance the productive use of power in Pakistan.

6 We use a rigid definition of *unproductive* to include CNG, as these vehicles were originally fueled by petroleum products. In terms of productivity, we are only focusing on usage that directly increases economic activity.

usage by households and as CNG, which reduced what is available for industry, commerce, and most importantly, power generation. [7]

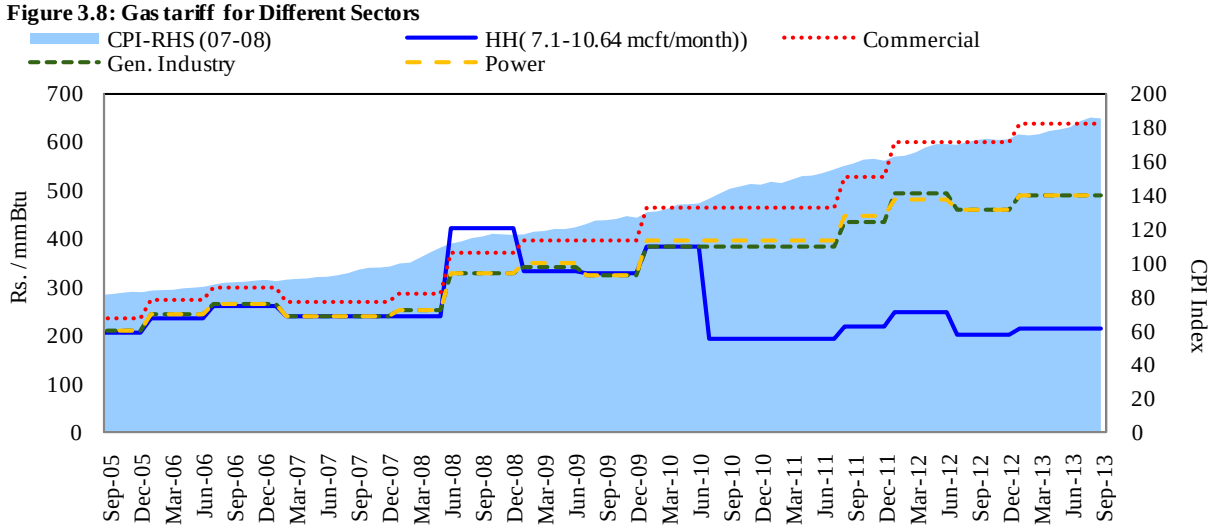
Heavy usage by household can also be traced to the current tariff structure, and the fact that new connections have increased quite rapidly in the past 5-6 years (**Figure 3.7**). As shown in **Figure 3.8**, gas tariffs for the majority of household consumers, is almost at the same level as it was in mid-2005 – during this same period, the CPI index has increased by over 220 percent. This anomaly was primarily due to a very sharp reduction in household tariff in mid-2010. Furthermore, the tariff differential between households and what industrial, commercial and power generators have to pay has been increasing. Focusing on those households that use gas to generate power, the sheer efficiency loss in shifting from large-scale power generation to household generation, *cannot* be understated.[8] This is only possible because of the gross under-pricing of household gas, which has resulted in the suboptimal allocation of this scarce resource in the country.

Figure 3.7: Number of Gas Consumers



Source: EYB,HDIP

Figure 3.8: Gas tariff for Different Sectors



Source: EYB-2012, HDIP; PBS

3.4 Power generation costs

The decision to shift natural gas to CNG stations is not only squeezing out more productive usage of gas, it is directly impacting the cost of generating power (electricity) in the country. As shown in **Figure 3.9**, different sources of generating power have very different costs of production. Hydel is the cheapest, as the marginal cost of generation only entails maintenance, since the fixed-capital cost falls to inconsequential levels over time. For the purpose of our analysis however, hydel and nuclear are not viable options to generate additional power, as the set-up costs and time required, imply these medium-to-long term propositions. The only options (if gas is not supplied for power generation) is residual furnace oil (RFO) and high speed diesel (HSD), which entail far higher costs as they are

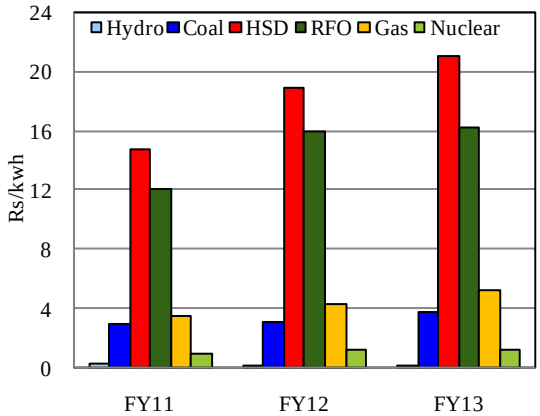
7 There is increasing anecdotal evidence that more affluent households are using piped gas to run generators to compensate for extended hours of load-shedding. We have also heard that gas tariffs are low enough that some households have come to rely on gas generators to meet their daily peak demand for power in the evenings. The inefficiency of doing this is discussed later in the Chapter.

8 In the Annual Report FY12, we had discussed in some detail the wastage of gas from the improper use household geysers.

dependent on more expensive oil. In effect, by diverting gas away from the power sector, generation in the country has shifted quite sharply towards oil (**Figure 3.10**), and as a result, generation costs have soared.

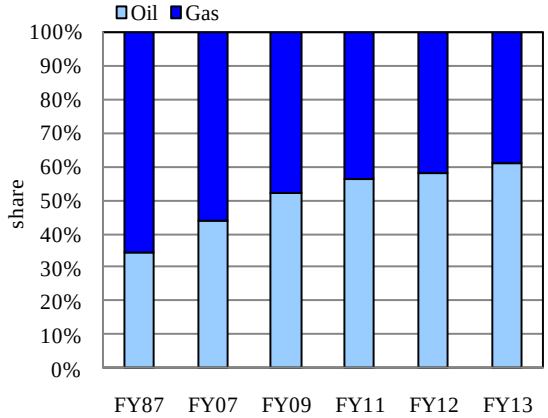
How this shift has increased the cost of power generation, gains support from **Table 3.1** *(at the end of chapter).* This shows the Merit Order compiled by Nepra, which ranks power generation units by cost efficiency.[9] As shown, gas-powered plants are the most efficient, followed by mix-fuel units (which can use either gas or oil-based products like RFO and HSD), and then those that are only oil based. With less gas available for power generation, the cost of power generation in Pakistan has risen sharply. Looking at past Merit Orders published by Nepra, gas-powered IPPs are consistently at the top of the list, while government-owned Gencos (that have larger generation capacities) are at the bottom.[10] The latter are not just old, but inadequate maintenance has further eroded their operating efficiency.

Figure 3.9: Cost of Generation on Different Fuels



Source: EYB, HDIP; SoI Report, Nepra

Figure 3.10: Thermal Generation Fuel Mix



Source: EYB, HDIP; SoI Report, Nepra

There are also some other points that could be made:

- Operating and maintenance (O&M) costs are correlated with the fuel used. So gas-powered units post lower O&M costs than generating units that depend on oil products;
- Broadly speaking, for each fuel source (note the bold lines in **Table 3.1**), IPPs are more efficient than state-owned Gencos;
- Even for those generating units that operate on different fuels, IPPs maintain their efficiency advantage over Gencos (compare Kapco-1 that is ranked 11, 40 & 59, with Jamshoro 2-4, which shows up at 28, 38 & 68 in **Table 3.1**); &
- This Merit List is prepared to assist Pepco in terms of how it should prioritize its power purchases (starting with the cheapest generators). However, non-availability of gas has forced Nepra to purchase power from increasingly inefficient units.

Beyond the inefficiency at the generation stage, the main Discos do not fare too well in terms of transmission & distribution (T&D) losses (**Figure 3.11**). The T&D losses in Pakistan's main power distribution centers varies from 9.5 to 35.1 percent; in overall terms, Pakistan's T&D losses are well above the global average, even for developing countries. High T&D losses in Pesco can be explained by the fact that this Disco also supplies power to the FATA region, where theft is high because the distributor is unable to monitor and charge individual users.[11] On the other hand, Iesco that serves Islamabad and Rawalpindi, posts the smallest T&D losses.

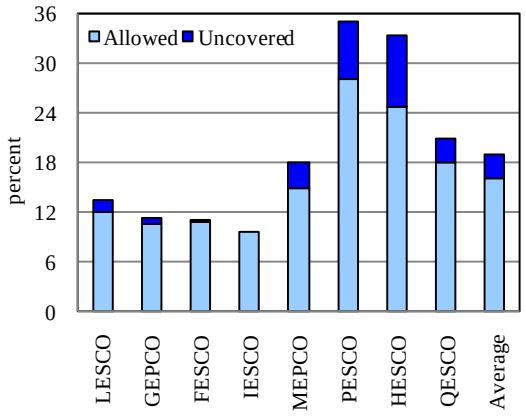
[9] Efficiency entails the conversion of caloric content of fuel to power in a well-maintained unit; the level of maintenance (IPPs score better than government-owned Gencos); the cost of raw material; and the cost of maintenance. Efficiency can be mapped to lower cost of generation (total cost).

[10] The Merit Order only covers units that fall under the Pepco system; it does not include any generating units that supply Kesc, as the latter is a vertically integrated utility.

[11] Historically, the FATA region has been provided with bulk electricity by Wapda at a low standardized rate.

Another point to flag in **Figure 3.11** is that Nepra recommends a tariff structure that rewards efficient Discos and punishes more inefficient distributors, to incentivize the latter to reduce their T&D losses. As shown, while the entire T&D loss is covered by Nepra allowed tariffs in Iesco and Fesco, this is not the case with the others – the more inefficient the distributor, the larger the loss it is forced to carry on its books. However, the unified tariff structure notified by the government disallows this incentive; as a result, the combined losses of the inefficient Discos have to be borne by the federal government.

Figure 3.11: T&D Losses (Nepra Allowed and Uncovered)



Source: Planning Commission and USAID Report (March -13)

3.5 Circular Debt

Table 3.2 spells out the root causes for the recurring circular debt in the power sector. It shows how the volume of receivables has grown in the past seven years from Rs 84.1 billion in end-FY05, to Rs 872.4 billion as of end-FY12. It is noteworthy that unpaid subsidies have started to dominate the circulate debt issue since FY10; before that, unpaid bills were the main drivers. Furthermore, just the delay in notifying the Nepra tariff in FY12, created a hole of Rs 72.2 billion, while the loss on account of inadequate or delayed fuel adjustments, have also added to the burden in FY11 and FY12. However, the crux of the problem remains the difference between what the Disco *claims* from the government as subsidies (i.e., the difference between the tariff determined by Nepra and the tariff the government approves) and what they actually receive from the government.

Table 3.2: Build-up of Circular Debt (Rs. billion)

Primary Causes	FY06	FY07	FY08	FY09	FY10	FY11	FY12
A. Stock of Debt - Start of fiscal year	**84.07**	**111.26**	**144.99**	**161.21**	**235.65**	**365.66**	**537.53**
B. Non Collection:							
Receivables from:							
- Federal govt.	0.22	0.35	0.08	0.15	1.79	1.57	0.19
- FATA	10.87	6.36	9.43	10.24	(78.34)	4.30	13.42
- Provincial govt.	2.25	0.75	5.09	7.17	16.72	36.07	15.84
- AJK Government	0.54	0.27	0.46	1.18	2.00	5.50	6.05
- Agri-Tubewells	0.42	1.28	1.07	3.01	3.46	(3.68)	(3.12)
- Private Consumers	9.08	7.96	9.64	19.88	25.59	39.29	54.55
Sub-total	**23.38**	**16.97**	**25.77**	**41.63**	**(28.78)**	**83.05**	**86.93**
CPPA receivables from Kesc	3.81	16.76	26.74	(11.87)	4.04	(1.79)	13.78
Total non-collections (B)	**27.19**	**33.73**	**52.51**	**29.76**	**(24.74)**	**81.26**	**100.71**
C. Tariff & Subsidy Issues:							
Tariff determination & notification delay	N/A	N/A	N/A	N/A	N/A	N/A	72.19
Fuel Price Adjustments	N/A	N/A	N/A	N/A	N/A	20.10	33.19
Gap between Disco subsidy claim vs. actual disbursed	N/A	N/A	(36.29)	39.66	134.84	48.68	106.02
Gap between Nepra allowed vs. actual T&D losses	N/A	N/A	N/A	5.02	19.91	21.84	22.78
Sub-total (C)	**N/A**	**N/A**	**(36.29)**	**44.68**	**154.75**	**90.62**	**234.18**
Circular Debt- End of year (A+B+C)	**111.26**	**144.99**	**161.21**	**235.65**	**365.66**	**537.53**	**872.41**

Source: "The Causes and Impacts of Power Sector Circular Debt in Pakistan", USAID (March 2013)

Unpaid bills over the period FY06-FY12 add up to Rs 248.9 billion, which is significant. While the popular view is to place the blame on government agencies, till June 2012, private consumers were the main culprit (**Table 3.2** for the sharp increase in private unpaid bills in recent years). Furthermore, whereas many would expect FATA to be a key source of unpaid bills, the growing burden of provincial governments (and AJK), is surprising and needs to be addressed.[12]

[12] As shown in **Table 3.2**, the federal government paid off FATA's outstanding bills in FY10, which is why it is not the main culprit in unpaid bills. Having said this, many government agencies have an incentive not to pay their electricity bills – they

Looking specifically at private consumers that include households, commercial and industrial users, **Table 3.3** reveals that the incidence of unpaid electricity bills varies across the country. Since Nepra does not include data for Kesc, we are unable to show how this privatized utility compares to the other Discos. From the Table, it is clear that Peshawar, the FATA region, Hyderabad, Sukkur and Quetta account for the bulk of unpaid bills. On the other hand, private consumers in Lahore, Multan, Faisalabad, Islamabad, Rawalpindi and Gujranwala, are relatively more conscientious about paying their bills. This means different Discos will have to customize their restructuring agendas to improve their respective operations.

Table 3.3: Receivables from Private Consumers (Rs. millions)

	FY09	FY10	FY11	FY12	Share
PESCO + TESCO	26,809	32,902	41,282	51,360	26%
HESCO + SEPCO	18,856	25,454	33,344	44,237	22%
QESCO	4,297	5,238	24,780	48,193	24%
LESCO	10,957	15,968	17,081	23,080	12%
GEPCO	3,585	5,322	5,631	5,912	3%
FESCO	3,719	5,676	5,866	7,068	4%
IESCO	2,287	2,286	2,762	2,703	1%
MEPCO	7,252	10,505	11,900	14,638	7%
All Discos	**77,762**	**103,351**	**142,646**	**197,191**	**100%**

Source: "The Causes and Impacts of Power Sector Circular Debt in Pakistan", USAID (March 2013)

In some ways, the challenges in the energy sector appear to be following the same pattern as the country's fiscal problem. More simply, while the underlying cause for the fiscal deficit has not been adequately addressed, the manifestations (i.e., how to manage the growing financing gaps) appear to have monopolized policy attention. Similarly, the power shortage in the country has not resulted in any significant increase in generation capacity, but as the cost of generation has eclipsed revenues accruing to Discos, the significantly higher subsidy payments have to be balanced against the government's other spending needs. This explains why the circular debt is allowed to balloon, before it is paid off.[13]

Although the government has taken urgent steps to pay off the circular debt in late June 2013 (which has helped unchoke the energy supply chain), this itself has done little to resolve the underlying problem – producers and distributors are simply unable to cover their costs. Having said this, commercial and industrial tariffs were increased in August 2013, and an upward adjustment in household tariffs was announced in November. This should help contain the hemorrhaging in power-related PSEs, but it will also stoke inflation (see **Chapter 4**). Having said this, more concrete steps are required to improve bill collections.

3.6 Demand side

Although analysts and the media have focused increasingly on Pakistan's energy shortage, we are of the view that the picture is incomplete. For the most part, the lack of power and the rising cost of generation have been viewed primarily through the lens of the supply side. For example, policies to address the power shortage have focused on generation capacity (via IPP supplied power), and more recently, the government's intervention to pay off the circular debt. What is missing in the overall picture is the steady growth in demand for power, especially from households where wastage is more pronounced.

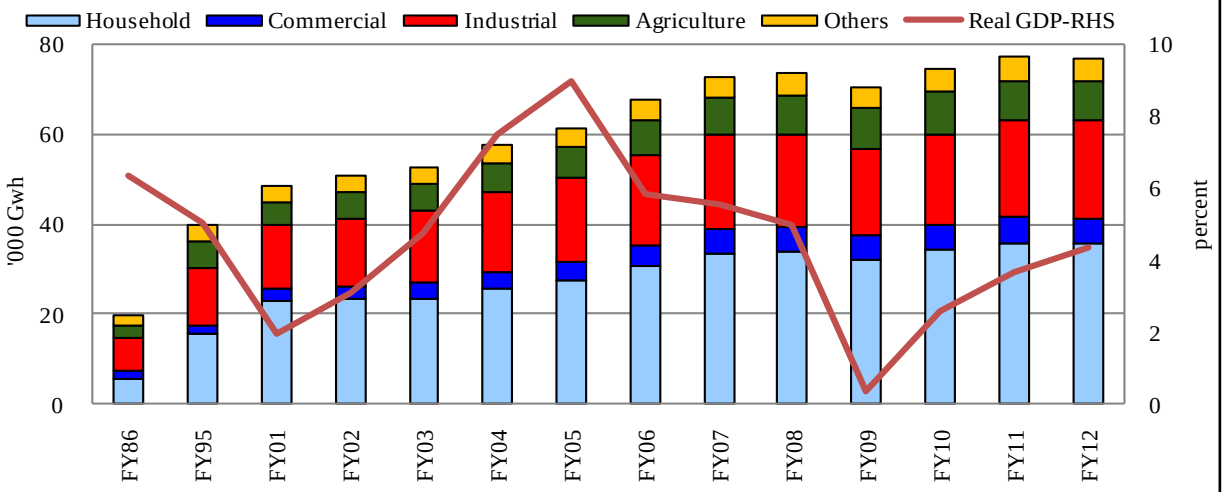
As shown in **Figure 3.12**, power consumption reveals some correlation with economic growth. The consumer-led boom that started in 2003 and ended by 2007, witnessed a corresponding increase in power consumption, especially by household and commercial users. Although subsequent years have shown some tapering, what is interesting to note is household consumption continues to remain

reason that their role is so critical to the government machinery and the public at large, that an interruption in their services would not be tolerated. They assume that if power is cut off for non-payment, the government would be forced to step in.

[13] Commercial banks have been unable to lend further because of the rapid increase in their exposure to the energy sector, which has increased from 7.8 percent in FY09, to 12.3 percent as of March 2013. This exposure is only second to textiles, and is much larger than the entire banking sector portfolio of consumer lending and loans to bank employees. The resulting cash flow problems along the *entire* energy supply chain have reduced generation and also undermined the level of maintenance required to operate generating units at maximum efficiency.

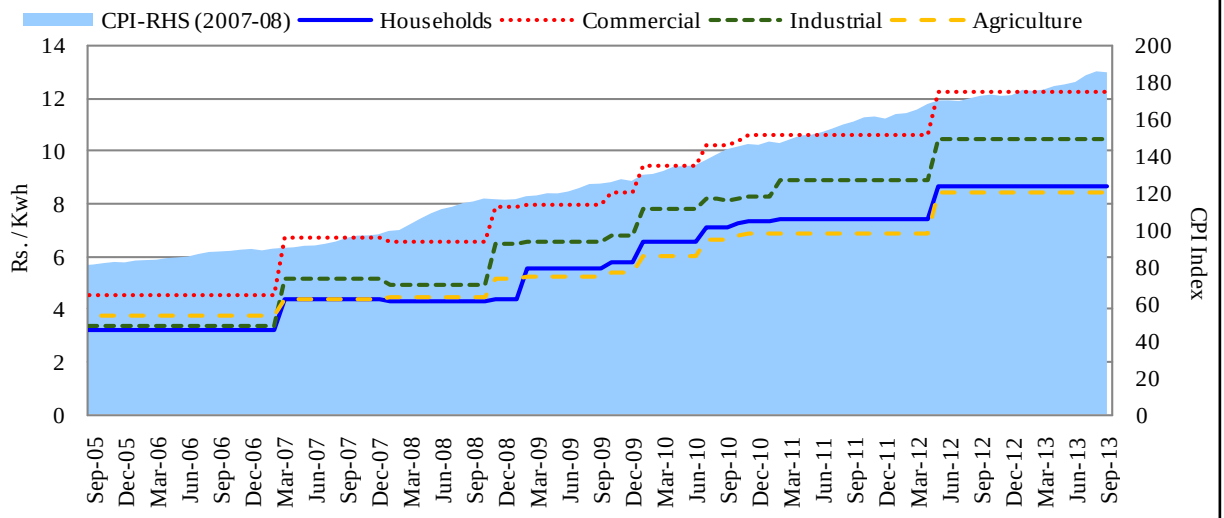
robust. Compared to the mid-1980s, when household consumption only accounted for 31 percent of total usage, the most recent data (for FY12) shows that households now consume over 47 percent.

Figure 3.12: Power usage vs Real GDP Growth



Source: EYB,HDIP; Pakistan Bureau of Statistics

Figure 3.13: Average Power Tariff by Sectors



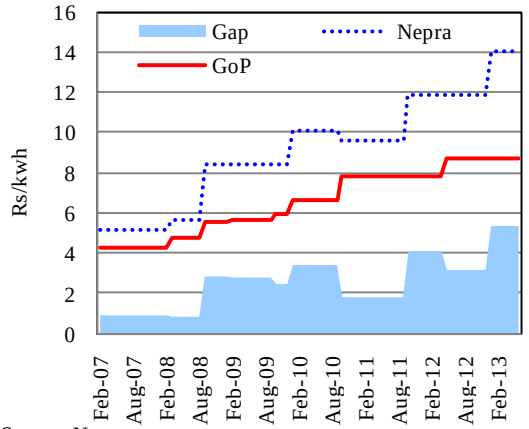
Source: SoI Report 2011-12,Nepra; PBS

The underlying reason for this shift in power consumption is the tariffs charged to end-users.[14] As shown in **Figure 3.13**, household tariffs (for the average slab of 101-300 KWh/month, which accounts for the bulk of users), has not increased as sharply as industrial and commercial tariffs. Since the number of households is far higher than industrial and commercial users, this hints at the political dimension in tariff formulation. It would appear that required increases in household tariffs were soft-pedaled, in the sense that the government was willing to subsidize households at the direct cost of increasing its own debt burden.

[14] Although Pakistan's population growth could explain part of the increase in household consumption, the growing share is more likely to be linked to new connections and the priority given to household consumption. In our view, there has been an appreciable increase in the use of electrical appliances in the main urban and peri-urban centers.

Given the large number of generating units in the country, and their varying costs of production, the best proxy for the average generation cost is the tariff rates recommended by Nepra.[15] However, what Nepra recommends and what the Ministry of Water and Power (MoWP) actually notifies are quite different. As shown in **Figure 3.14**, the gap between these two tariffs has been increasing since late 2011; it also shows how notification by MoWP is sometimes delayed significantly, which directly adds to the circular debt (**Table 3.2**). As things stand, the average cost of generation is above Rs 14/KWh, but the average tariffs realized from end-users is only Rs 8.5/KWh. As a result, power subsidy payments due from the government, have not only been far higher than budget, but are also delayed.

Figure 3.14: Nepra and GoP Notified Tariff (subsidy/unit)



Source: Nepra

Micro Analysis

Another dimension of this problem, are the actual recipients of the power subsidy. Using household data on power consumption for the city of Karachi, we have traced the various monthly tariff slabs with the types of electrical appliances that an average household would use in each slab. There are several points that need to be highlighted from **Table 3.4**:[16]

Table 3.4: Appliances used by average Household

Appliances	Rating (Watts)	1-50	1-100	100-300	301-700	700+
Fan	80	✓	✓	✓	✓	✓
Bulb	100	✓	✓	✓	✓	✓
Energy Saver	24		✓	✓	✓	✓
Tube	40		✓	✓	✓	✓
Iron	1000		✓	✓	✓	✓
A/C - Split	1400-2000				✓	✓
Fridge	300-500			✓	✓	✓
Deep Freezer	300-500				✓	✓
Washing Machine	373			✓	✓	✓
Water pump	746					✓
Television	120			✓	✓	✓
Microwave Oven	1200					✓
Computer	200				✓	✓
Electric Kettle						✓
Toaster						✓
Vacuum Cleaner						✓
Hair dryer						✓
Food factory						✓

Source: Kesc

- Lifeline users (0-50 KWh/month) have very basic usage, which entails conservative use of a couple of bulbs and one ceiling fan. More frequent use of these appliances, and perhaps a TV, would push the household into the next slab (51-100 KWh/month), which suggests that additional use by lifeline consumers, would have to be done via illegal connections (kunda);
- By energy requirement, air-conditioners, microwaves, water-pumps, fridges and deep-freezers, are *heavy* appliances as they entail the use of a motor. As shown in **Table 3.4**, there is a clear sequencing of the range of appliances a household will use as its disposable income increases. For the majority of users (101-300 KWh/month), most of these heavy appliances are not used;
- In terms of heavier users, fourth slab households (301-700 KWh/month) have only one air-conditioner. Multiple A/C households would also operate a host of luxury appliances, which means users in the 700+ slab are likely to post a significant spread of monthly usage. In our view, there is ample room for further bifurcations within households in the upper slab.

[15] Nepra has a pricing formula where it analyzes each power producer owned by the government (the Gencos), and then takes the cost of production of the most efficient Genco as the benchmark. Although there are issues with the formula, it does seek to average out the more efficient producers (the IPPs) against the least efficient Gencos.

[16] **Table 3.5** gives a stylized assessment of the electrical appliances used by an average household that falls into the various power slabs. This is based on the power rating of each appliance and the average number of hours (per month) of usage. For a proper comparison across slabs, we have focused on summer usage, when small users have to be cautious about use to stay within their respective slabs.

Table 3.5 shows the number of consumers (more accurately, meters) in each slab, and how much power is consumed in each slab.[17] The normal distribution across slabs is to be expected, and so does the fact that heavier users (6 percent of households) consume about one-third of total household consumption. What is more interesting is how the power subsidy is actually distributed amongst the various slabs.

To get a proper handle on the incidence of subsidies, we focus separately on the economic costs and the more binding fiscal burden. Focusing on the economic costs, we use the difference between the tariff announced by the government and the average cost of production and distribution for the year (**Table 3.6**). The subsidy per KWh is computed by taking into account that heavy users benefit from the cheaper rates attached to lower slabs (**Table 3.6** adds up the staggered pricing for power consumed).

Given the quantum of power consumed by heavier users, over 51 percent of the subsidy is realized by users who average more than 301 KWh/month – these are the households that use air-conditioners and a number of luxury appliances (**Table 3.4**).[18] Lifeline users, on the other hand, only get 1.6 percent of total household subsidies. If tariffs were rationalized to channel the subsidy to the most needy, only the first two slabs (i.e. up to 100 KWh/month) would get the bulk of the subsidy – as things stand, they only realize 6.7 percent of household subsidies. Also, for the average household in each slab, the heaviest users are subsidized by Rs 6,631 per month, while lifeline users only get Rs 420.[19] The fact that *all* households are subsidized, is alarming, and must be rectified immediately.

Table 3.5: Household Consumers and Units Consumed

	Slabs (units)	*Total consumers	% of total Cons.	Units Billed (GWh / month	% of total billing
FY13					
i	1 – 50	141,083	9%	4	1%
ii	51 – 100	207,663	13%	17	3%
iii	101-300	793,326	50%	158	32%
iv	301 – 700	356,609	22%	156	31%
v	700+	97,233	6%	162	33%
	Total	**1,595,914**	**100%**	**496**	**100%**
FY12					
	Slabs (units)	***Total consumers**	**% of total Cons.**	**Units Billed (GWh / month)**	**% of total billing**
i	1 – 50	123,869	8%	3	1%
ii	51 – 100	222,211	14%	18	4%
iii	101-300	796,914	51%	151	33%
iv	301 – 700	325,481	21%	141	31%
v	700+	96,241	6%	148	31%
	Total	**1,564,716**	**100%**	**461**	**100%**
FY11					
	Slabs (units)	***Total consumers**	**% of total Cons.**	**Units Billed (GWh / month**	**% of total billing**
i	1 – 50	137,557	9%	4	1%
ii	51 – 100	238,145	16%	18	5%
iii	101-300	718,387	49%	133	33%
iv	301 – 700	292,356	20%	126	31%
v	700+	88,155	6%	119	30%
	Total	**1,474,600**	**100%**	**400**	**100%**

* Total consumers = Active consumers less disconnected or dismantled service cable.
Note: Consumption is based on a typical summer month - peak demand. The data presented in the above table is based on meters (i.e. there might be multiple meters in a single premise. The use of multiple meters was revoked in FY13).

Source: Kesc

In terms of the fiscal burden, one must realize that current tariffs are already rationalized. Nepra sets tariffs so that heavier (more affluent) users subsidize the poorer households (**Table 3.6** shows the very low tariff for lifeline users). Since the government generally opts for lower tariffs than what Nepra recommends, it must account for the difference as a subsidy in the federal budget.

Given the importance of Kesc in the national network, and the fact that it operates as a private entity, power subsidies allocated by the federal government are disaggregated by Pepco and Kesc. As shown

[17] Kesc data covers meters and not households. This supports the observation that some large household users have installed multiple meters to benefit from the lower tariffs for smaller users. Although Kesc has imposed a policy in FY13 that each household (apartment or house) will only get one meter, they estimate that perhaps 20-25 percent of affluent households have multiple meters.
[18] The misdirected subsidy becomes more lopsided when one considers that about 20 to 25 percent of the heaviest users have multiple meters in their homes, which means they are billed as 301-700 KwH/month customers.
[19] One must realize that although the highest tariff rate is above the average cost of generation, when one account for the built-in subsidies in the lower slabs, even affluent households are subsidized by the government.

in **Table 3.7**, federal budgets have consistently underestimated the actual subsidy payments to the power sector. Although the difference between actual payments and what had been projected has narrowed in FY13, the quantum continues to threaten the country's macro stability. As a percentage of GDP, this burden on the fiscal side is the main reason that the fiscal gap has been above 8 percent of GDP in the past two years. Furthermore, the significant difference between allocations and payments during FY10-FY12 shows that projected tariffs (at the start of the year) did not account for the increase in generation costs, and the fact that the government was unwilling to pass this onto end-consumers.

Table 3.6 : Distribution of Economic Subsidy to Kesc Households in each Slab

Residential Slabs	NEPRA Determined tariff (Rs./KWh)	Applicable Tariff approved by GoP (Rs./KWh)	Tariff Difference	Subsidy /unit [1]	Unit consumed[2]	Economic Subsidy per Average consumer (Rs)	No. of Consumers	Total Economic Subsidy/ Slab (Million Rs.)	Share (%)
	(1)	(2)	(3=1-2)	Rs. 17.0 - (2)					
1- 50 units	2	2	0	15.0	28	420	141,083	59.3	1.6%
01-100 units	14.89	5.79	9.1	11.21	82	919	207,663	190.9	5.1%
101-300 units	16.39	8.11	8.28	8.89	199	2,001	793,326	1,587.5	42.4%
301-700 units	18.59	12.33	6.26	4.67	437	3,539	356,609	1,262.0	33.7%
700 + units	20.19	15.07	5.12	1.93	1,666	6,631	97,233	644.8	17.2%
							1,595,914	**3,744**	**100%**

1 Difference between the average cost of distribution (Rs. 17.0 / KWh) and the GoP applicable tariff at each slab.

2 Average units consumed in a typical summer month by a KESC consumer each slab.

Source: SBP Calculations based on Kesc data for slab-wise consumers and consumption in a typical Summer month for FY13.

Table 3.7: Power Sector Subsidies Rupees in *million*

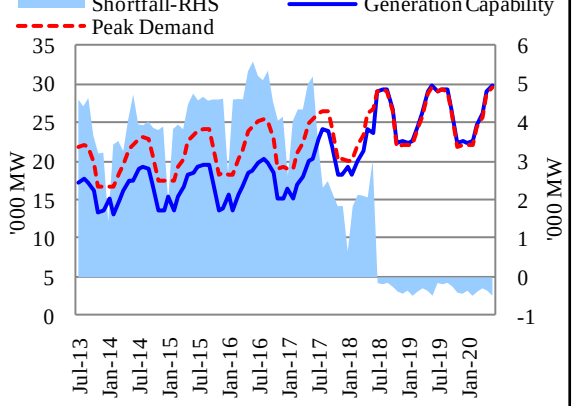
	FY09		FY10		FY11		FY12		FY13	
	Allocated	**Released**	**Allocated**	**Released**	**Allocated**	**Released**	**Allocated**	**Released**	**Allocated**	**Released**
A. Pepco										
Tariff differential	65,000	82,000	10,000	93,487	30,000	284,780	50,000	412,018	120,000	250,261
Others	9,612	8,454	52,903	53,103	54,000	14,000	72,700	7,000	14,970	10,000
Sub-total (A)	**74,612**	**90,454**	**62,903**	**146,590**	**84,000**	**298,780**	**122,700**	**419,018**	**134,970**	**260,261**
B. Kesc										
Tariff differential	12,000	17,000	2,000	31,714	2,000	46,000	24,000	45,000	50,000	84,000
Others	1,800	1,720	1,800	537	1,317	1,317	588	-	317	-
Sub-total (A)	**13,800**	**18,720**	**3,800**	**32,251**	**3,317**	**47,317**	**24,588**	**45,000**	**50,317**	**84,000**
Grand Total (A+B)	**88,412**	**109,174**	**66,703**	**178,841**	**87,317**	**346,097**	**147,288**	**464,018**	**185,287**	**344,261**
Tariff differential	77,000	99,000	12,000	125,201	32,000	330,780	74,000	457,018	170,000	334,261
Power subsidy as a % of GDP*	**0.7%**	**0.8%**	**0.5%**	**1.2%**	**0.5%**	**1.9%**	**0.7%**	**2.3%**	**0.8%**	**1.5%**

* *Allocated* amount is taken as a % of *targeted* GDP, while *released* amount as a % of *actual* GDP.

Source: Budget Documents, several issues

In terms of what to expect, **Figure 3.15** shows Nepra's projections for peak demand and generation capacity in the country. Both are seasonal, as power demand peaks in the summer season, just when maximum hydel power becomes available. Irrespective, this shows that the power shortfall in Pakistan will not be eliminated till mid-2018.

Figure 3.15 Projected Generation Capability & Peak Demand



Source: SoI Report, Nepra

3.7 Solving the problem

With power subsidies driving the circular debt and fiscal deficit in FY13, there is an urgent need to increase tariffs. However, this itself will not resolve the problem, as rising tariffs could incentivize theft

and bill manipulation – it will also reduce consumption as conservation measures are adopted more widely. These factors could undermine revenue generation, which means the expected increase in revenues accruing to Discos, may be less than anticipated.

Other than tariff increases, there is a corresponding need to reduce generation costs and slash T&D losses. In terms of implementation, there is a required sequencing where gas allocation should first prioritize power generation to reduce generation costs, and new captive power units should be disallowed; T&D losses, on the other hand, are only likely to be addressed when the Gencos and Discos are restructured by professional management. Although T&D losses are very high in some Discos (**Figure 3.11**), bringing these down will require heavy capital investment to upgrade infrastructure at the transmission and distribution stages. As things stand, the government simply does not have the fiscal space to carry out this investment.

Tariff rationalization would also impact the demand side, as conservation measures are likely to be adopted to manage electricity bills. In discussions with energy experts, there are several avenues end-users could pursue to reduce consumption:

1. Audits by energy experts. All users can have their power consumption audited to flag inefficient appliances[20]; ensure the load supplied is consistent with the user's requirement; and additional advice to make existing premises more energy efficient;
2. Discos like Kesc, are actively working with appliance manufacturers to create awareness and promote energy efficient household appliances;
3. Building codes should be formulated to make new residential, office, commercial and industrial spaces more energy efficient;
4. Minimum standards for power distribution networks in newly developed areas, will not only generate long-term efficiencies, but also reduce the incidence of theft;
5. For low income households, the Asian Development Bank has launched a scheme to replace inefficient bulbs with energy savers; and
6. Media and advertizing campaigns to create awareness of the above avenues by the government.

In most of these conservation measures, the government will have to take an active role. Although some positive steps were taken by past governments, they lacked policy commitment and longevity to have a meaningful impact. Worse still, fundamental policy decisions on gas allocation, pricing of oil & gas exploration (see **Special Section 3.1**), and end-user tariffs (both gas and power); have been working at cross purposes. For example, gas allocation and pricing decisions are done by the Ministry of Petroleum and Natural Resources (and OGRA), while power generation and tariffs decisions are made by the Ministry of Water & Power (and Nepra). In effect, decisions about how best to allocate scarce natural gas and its implications on required oil imports, are done by different players, often operating under different compulsions.

Accordingly, we agree with an earlier policy recommendation that there should be a single Ministry of Energy.[21] This would allow for a more holistic approach to policymaking, to ensure that longer term planning is enforced in the energy sector, and gas allocation decisions are not just populist in nature. **Figure 3.16** shows how the unified Energy Ministry would incentivize gas allocation decisions to account for power generation (which currently is done by a separate Ministry); it would also force the unified regulator to price fuels and energy in such a manner that all end-users account for the opportunity cost of what they are consuming. We also think final tariff notifications must be left to the unified regulator, so that the government Ministry does not compromise on required tariff increases because of political considerations.

Finally, we also think concrete policy steps are required to expedite the approval and implementation of alternative energy projects, and to encourage smaller hydel units. Since these entail smaller

[20] Old appliances like fridges, water-pumps and air-conditioners become extremely inefficient as they age. With higher tariffs, households would rationally decide to shift to newer, more efficient heavy appliances.
[21] This was one of the recommendations of the PM Task Force on Energy (2008).

Figure 3.16 (a): Existing Structure of the Energy Sector

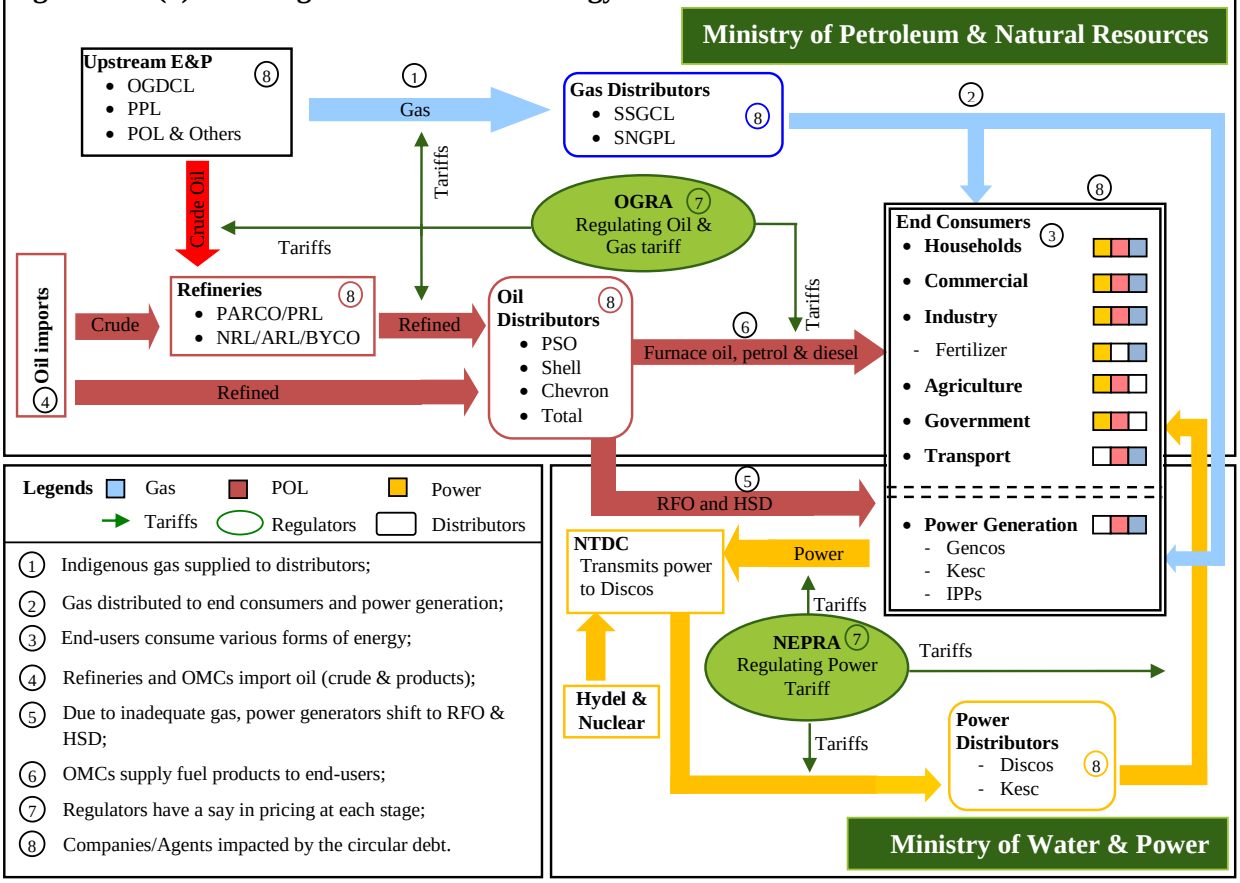
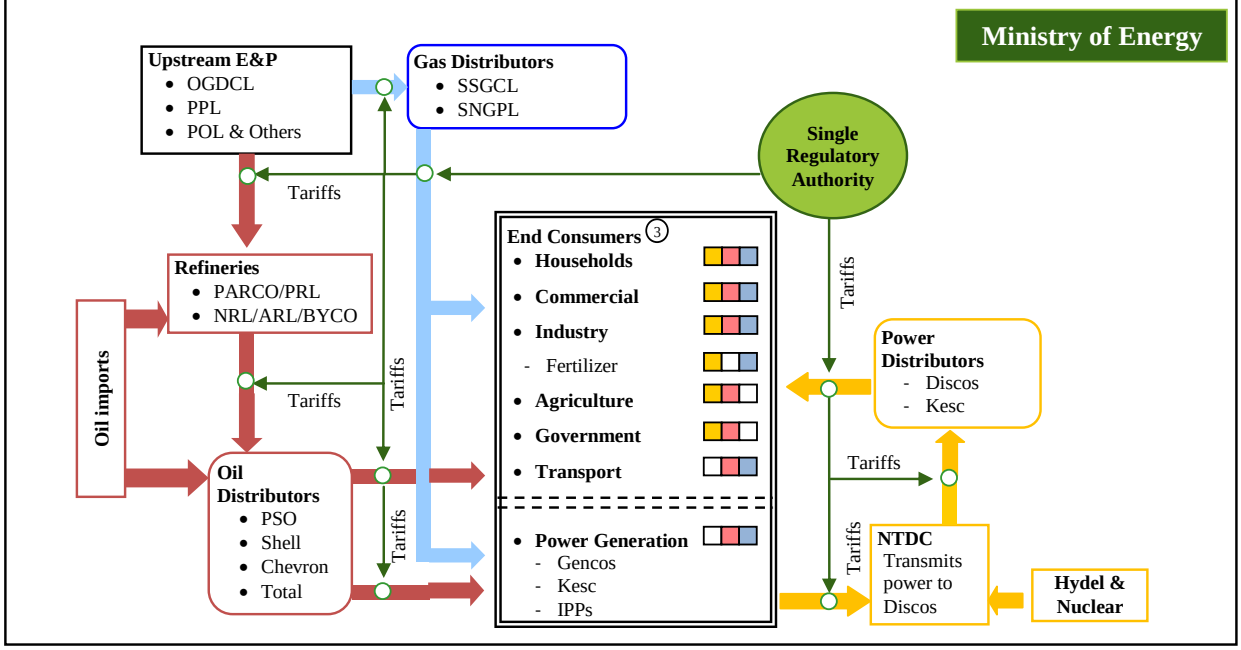


Figure 3.16 (b): Proposed Structure of the Energy Sector



generation capacities that may not be inducted into the national grid, provincial government must take the lead in soliciting interest in this area.

3.8 Conclusion

The most pressing impediment in the energy sector has been resolved in June 2013 – the government paid Rs 322 billion to settle the circular debt.[22] To address the underlying problem, commercial and industrial power tariffs were increased in August 2013, and household tariffs in November. However, unpaid bills by private consumers and provincial governments must also be addressed, as part of the larger reform agenda for the entire energy supply chain. As discussed earlier, policymakers must not just deal with the financing issue (i.e., paying off the circular debt or financing the huge power subsidy), but also push hard to bring in professional management to restructure the energy sector. As Pakistan's case clearly shows, short-term policy expediency creates medium-to-long term structural problems.

As in the case of fiscal reforms to increase tax revenues, raising power tariffs and reversing the ill-advised cut in gas tariffs in 2010, will not be palatable for existing users. However, with a gap of Rs 5.5 /KWh between the average cost of generation and distribution, and what Discos are able to recover from customers, a sharp increase in tariffs is unavoidable. In the case of piped gas, tariffs should be increased not just to reduce the sharp differential that currently exists between household and industrial/commercial users, but to discourage over-use by households (especially for power generation). This tariff rationalization will stoke inflation, which partially explains why SBP projected inflation for FY14 in the range of 10.5 - 11.5 percent.

With the power shortage likely to persist for many years, multi-dimensional steps are required to increase the production of domestic oil and gas; disallow inefficient use of natural gas (i.e. CNG[23], households and captive power units in the industrial sector); rationalize end-user tariffs in both the power and gas sectors; prioritize allocation of gas for power generation; and move aggressively to restructure and privatize state-owned Gencos and Discos.

[22] While the overall settlement was for over Rs 500 bln, the cash impact was limited to Rs 322.2 billion.

[23] As in the case in India, CNG for privately owned cars should be disallowed, only allowing public buses and three-wheel rickshaws to avail CNG.

Table 3.1: Merit Order of Power Plants (Pepco System) based on Net Heat Rate at 100% Plant factor (June 2012)

Merit Order	Name	Type	Fuel	Fuel Cost (Rs./KWh)	O&M Cost (Rs./KWh)	Specific Cost (Rs./KWh)
1	Uch (upto 152.375 GWh)	IPP	Gas	0.29480	0.17573	0.50913
2	Uch (+ 152.375 GWh)	IPP	Gas	1.30510	0.17573	1.51943
3	Liberty (upto 61.904 GWh)	IPP	Gas	1.78975	0.26167	2.05142
4	Lakhra	Genco	Coal	2.86770	0.19540	3.06310
5	Fauji Kabirwala POWER CO. Ltd.	IPP	Gas	3.24234	0.56964	3.81198
6	Orient Power	IPP	Gas	3.74960	0.17590	3.92550
7	Sapphire Electric	IPP	Gas	3.74950	0.29600	4.04550
8	Saif Power	IPP	Gas	3.74960	0.29930	4.04890
9	Halmore power	IPP	Gas	3.74970	0.30110	4.05080
10	Foundation Power	IPP	Gas	3.92880	0.30250	4.23130
11	KAPCO-I	IPP	Gas	4.03475	0.20946	4.24421
12	GTPS Faisalabad 5-9	Genco	Gas	4.36440	0.02500	4.38940
13	Guddo 11-13	Genco	Gas	4.33350	0.06890	4.40240
14	Rousch	IPP	Gas	4.25470	0.20535	4.46005
15	Engro Energy	IPP	Gas	4.22200	0.26350	4.48550
16	Habibullah Coastal Power Plant		Gas	4.13784	0.40081	4.53865
17	Altern(phase-II)	IPP	Gas	4.12524	0.51976	4.64500
18	KAPCO-II	IPP	Gas	4.42544	0.24501	4.67045
19	Guddo 5-10	Genco	Gas	4.81490	0.06890	4.88380
20	KAPCO-III	IPP	Gas	4.57701	0.47227	5.04928
21	GTPS Kotri 3-7	Genco	Gas	5.19900	0.08990	5.28890
22	Muzaffargarh 4	Genco	Gas	5.43000	0.02500	5.45500
23	Muzaffargarh 1-3	Genco	Gas	5.47870	0.02500	5.50370
24	Altern(phase-I)	IPP	Gas	5.30052	0.51976	5.82028
25	Guddu 3-4	Genco	Gas	5.77780	0.06890	5.84670
26	Muzaffargarh 5-6	Genco	Gas	6.17440	0.02500	6.19940
27	Guddo 1-2	Genco	Gas	6.19030	0.06890	6.25920
28	Jamshoro 2-4	Genco	Gas	6.23220	0.11130	6.34350
29	NGPS Multan 1-4	Genco	Gas	7.16790	0.02500	7.19290
30	SPS Faisalabad 1-2	Genco	Gas	7.29670	0.02500	7.32170
31	GTPS Faisalabad 1-4	Genco	Gas	7.80370	0.02500	7.82870
32	Liberty (+ 61.904 GWh)	IPP	Gas	8.94873	0.26167	9.21040
33	GTPS Kotri 1-2	Genco	Gas	10.56450	0.08990	10.65440
34	Muzaffargarh 4	Genco	Mix	11.82370	0.02500	11.84870
35	Muzaffargarh 1-3	Genco	Mix	11.93005	0.02500	11.95505
36	Engro Power Gen.	IPP	Mix	11.71920	0.26720	11.98640
37	Guddo 3-4	Genco	Mix	12.39695	0.06890	12.46585
38	Jamshoro 2-4	Genco	Mix	13.21315	0.11130	13.32445
39	Muzaffargarh 5-6	Genco	Mix	13.44495	0.02500	13.46995
40	KAPCO-I	IPP	RFO	13.24213	0.36334	13.60547
41	Nishat Power	IPP	RFO	13.39010	0.73770	14.12780
42	Nishat Chunian	IPP	RFO	13.44930	0.73590	14.18520
43	Attock Gen.	IPP	RFO	13.48180	0.74910	14.23090
44	Liberty Power Tech.	IPP	RFO	13.44000	0.81830	14.25830
45	Atlas Power	IPP	RFO	13.68610	0.73770	14.42380
46	KEL	IPP	RFO	14.29075	0.45320	14.74395
47	KAPCO-II	IPP	RFO	14.53346	0.51145	15.04491
48	Japan Power	IPP	RFO	14.61336	0.43274	15.04610
49	SEPCOL	IPP	RFO	14.48184	0.75477	15.23661

50	HUBCO Narowal	IPP	RFO	14.60500	0.68800	15.29300
51	NGPS Multan 1-4	Genco	Mix	15.66275	0.02500	15.68775
52	Lal Pir Power	IPP	RFO	15.58806	0.12982	15.71788
53	Pak Gen. Power	IPP	RFO	15.58806	0.12982	15.71788
54	HUBCO	IPP	RFO	15.60725	0.15942	15.76667
55	Saba Power	IPP	RFO	15.76947	0.13534	15.90481
56	SPS Faisalabad 1-2	Genco	Mix	15.99675	0.02500	16.02175
57	Jamshoro-1	Genco	RFO	17.53560	0.11130	17.64690
58	Orient Power	IPP	HSD	17.92820	0.28850	18.21670
59	KAPCO-I	IPP	HSD	18.02173	0.21063	18.23236
60	Muzaffargarh 4	Genco	RFO	18.21740	0.02500	18.24240
61	Sapphire Electric	IPP	HSD	17.83500	0.42720	18.26220
62	Hamlore Power	IPP	HSD	17.84940	0.43450	18.28390
63	Muzaffargarh 1-3	Genco	RFO	18.38140	0.02500	18.40640
64	Saif Power	IPP	HSD	18.03060	0.43200	18.46260
65	Guddo 3-4	Genco	RFO	19.01610	0.06890	19.08500
66	Engro Power Gen.	IPP	HSD	19.21640	0.27090	19.48730
67	KAPCO-II	IPP	HSD	19.77906	0.28318	20.06224
68	Jamshoro 2-4	Genco	RFO	20.19410	0.11130	20.30540
69	Muzaffargarh 5-6	Genco	RFO	20.71550	0.02500	20.74050
70	GTPS Faisalabad 5-9	Genco	HSD	21.13620	0.02500	21.16120
71	KAPCO-III	IPP	HSD	20.45576	0.71511	21.17087
72	NGPS Multan 1-4	Genco	RFO	24.15760	0.02500	24.18260
73	SPS Faisalabad 1-2	Genco	RFO	24.69680	0.02500	24.72180
74	GTPS Kotri 3-7	Genco	HSD	24.77840	0.08990	24.86830
75	NGPS Multan 1-4	Genco	HSD	37.79140	0.02500	37.81640
76	GTPS Kotri 1-2	Genco	HSD	50.35030	0.08990	50.44020

Source: State of Industry Report-2011-12, Nepra

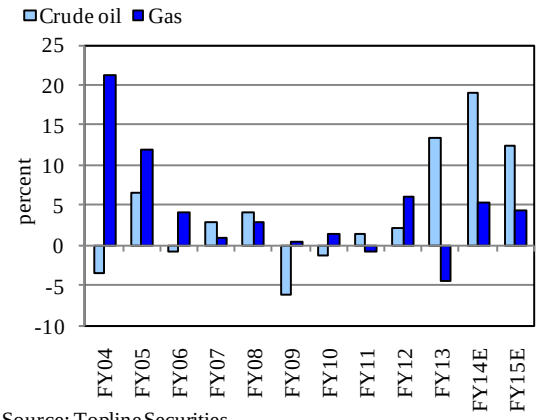
Special Section 3.1: Enhancing gas production via competitive pricing.[24]

Given Pakistan's natural endowments, it is clear that natural gas should be the source that sustains the country's base-load energy requirements. However, as shown in **Figure 3.2(a)**, Pakistan's production of natural gas has plateaued since 2008. Add to this the additional demand created by the growing popularity of CNG and the increase in household connections, and the gap between demand and available supply has been growing. This in turn complicates gas allocation decisions, as competing users have started publically petitioning the government. What is required is to grow the pie, not give users time-bound slices.

As shown in **Figure SS 3.1.1**, the projected YoY growth in domestic oil production is much higher than for gas, despite the fact that this oil only caters to a small fraction of the country's total need.[25] It is surprising that natural gas production has not shown any upward trend, particularly given Pakistan's somewhat unique position: it has a large domestic consumer base (which makes exploration attractive), and proven gas fields that implies further exploration is likely to be successful.

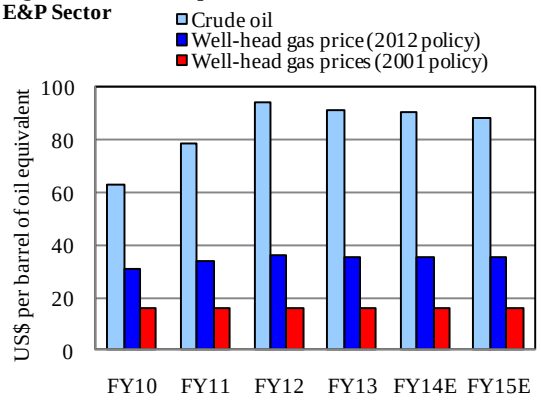
Market sources claim that according to the 2001 Petroleum Policy, the net realized price for a unit of oil extracted is almost six times higher than the equivalent amount of gas (see **Figure SS 3.1.2**). Furthermore, prices offered for oil are more transparent as they are directly benchmarked to international prices (this is not the case for gas), while the exploration costs for natural gas also includes delivery to end-users, which is not the case for oil. In effect, exploration and production (E&P) companies are more interested in oil.

Figure SS 3.1.1: Growth in Crude Oil and Gas Production



Source: Topline Securities

Figure SS 3.1.2: Comparison of Realized Prices in Pakistan's E&P Sector



Source: Topline Securities

Announcing a competitive well-head gas price is critical in the E&P sector, as the investment required must be commercially viable before any exploration activity begins. In terms of simple economics, a higher price for the commodity will increase supply – or the supply curve would be upward sloping. In the case of Pakistan, a low well-head gas price is constraining supply, while the low price charged to end-users in fueling demand.

The series of Petroleum Policies issued in the past decade reveals a reactive and piecemeal approach to gas exploration. The most recent 2012 Policy, effectively doubled well-head gas prices, but these are significantly below what it would cost to import gas into Pakistan. This policy allowed the possibility of switching, which means that new exploratory efforts made after the effective date of 2012 Policy, i.e. 30 August 2012, would be able to avail prices stated in the 2012 Policy. E&P experts believe the series of Petroleum Policies has incentivized some E&P companies to hold back commercial production, in anticipation they would secure higher well-head prices in future policies.

In our view, these piecemeal adjustments in well-head prices and the actual implementation of this pricing, has not allowed the government to reduce

[24] This special section was written by Dr Mushtaq Khan.
[25] One must realize that current investment in the oil and gas sector will determine production 2 to 3 years into the future.

the growing demand-supply gap. What is required is a bold and decisive policy, whereby E&P companies (both local and foreign) realize that subsequent policy changes are unlikely, and therefore begin to operate more effectively.

As we have discussed in this chapter, we feel the pricing of natural gas is not reflective of the energy content. As a simple proxy, natural gas should be priced against LNG, as the latter is only a processed form of natural gas – yet the price differential is significant. We also think the operating model used in Pakistan's gas transmission and distribution network (i.e., SSGC and SNGPL) does not incentivize proper economic pricing for natural gas.

If gas well-head prices were properly formulated, and these companies were run strictly on a commercial basis, the pricing of gas to end-consumers would be more efficient. This in turn would have the following implications:

1. Existing gas fields that are commercial unviable would automatically come on-line, which could increase Pakistan's gas production quite significantly;
2. Competitive well-head gas prices would also encourage fresh exploration, which could increase total gas reserves in the country; and
3. Although the cost of gas production would automatically increase, we think more reflective pricing would incentivize more efficient usage.

We realize a decisive move on well-head prices will not be easy for consumers, but it needs to be clearly communicated that natural gas is grossly underpriced in Pakistan. Furthermore, after the one-off inflationary impact washes away a year later, the availability of more gas *coupled* with more efficient usage (i.e., prioritize power and industrial users over households and CNG stations) should place Pakistan on a far more sustainable energy footing.