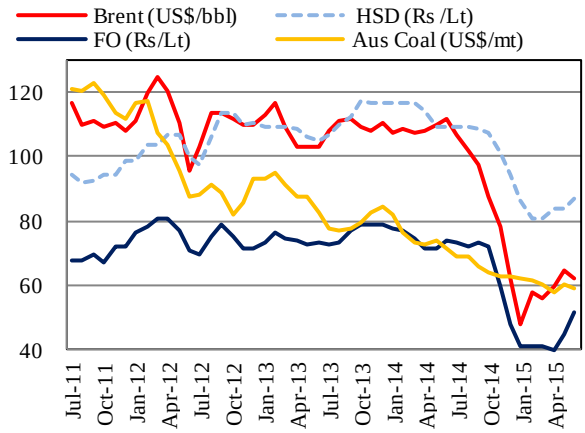
3 Energy

3.1 Overview

The hallmark for FY15 was the sharp decline in global crude oil prices: the price of Brent crude – the benchmark used by OPEC – fell by over 55 percent between July 2014 and January 2015 (**Figure 3.1**). While the plummeting oil prices had positive impact on Pakistan (an oil importing country), its impacts on the energy sector varied across different segments:

Figure 3.1: Prices of Key Fuels



Source: Haver, PSO

- The consumers benefited the most, as the government passed-on the benefit of such low prices to domestic fuels (e.g., high speed diesel, the motor spirit, furnace oil). In fact, Pakistan has gone beyond many regional countries in passing-on the relief to domestic consumers.[1]

- In the power sector, the local price of furnace oil – the key fuel used in power generation – declined by around 30 percent during FY15. However, despite the resulting fall in the cost of generation, the power supply could improve only marginally from last year; this was even less than the estimated increase in demand.[2] Therefore, load management continued during FY15, reflecting the below par performance of the power sector.

- Although renewable energy (e.g., solar and wind) is not directly linked with global oil prices, the lower cost of power generation on fossil fuels has made alternative energy less appealing (despite a significant decline in their cost due to technological innovation). Having said this, the renewable energy can still play an important role in achieving a sustainable power generation mix in Pakistan in medium and longer term (**Section 3.3**).

- The falling crude oil prices have also lowered the wellhead prices of oil and gas, thereby made future exploration and production in Pakistan less attractive for foreign investors (**Section 3.4**); local players on the other hand remained active.

3.2 Power Sector

As mentioned earlier, with the decline in domestic fuel prices (in line with international trends), the variable cost of power generation fell from Rs 8.02 per kilowatt hour in FY14 to Rs 6.08 in FY15 (**Table 3.1**). The government passed on the benefit of declining generation cost to consumers through frequent downward revisions in the fuel adjustment surcharge. As a result, the liquidity constraints stemming from circular debt continued to hamper the power generation, despite a considerable fall in the cost of furnace oil.[3] Specifically, the growing receivables from downstream firms in the energy

[1] See **Box 1.1** on 'Decline in Crude oil Prices and Pass through to Domestic Gasoline Prices', in SBP Second Quarterly Report for FY15. Also see **Figure 1.2** in **Chapter 1**, Section 1.2 for the comparison of pass through of the international oil prices among regional countries between October 2014 and August 2015.
[2] NTDC generally assumes 4.5 percent average annual increase in demand for electricity.
[3] Furnace oil, the largest source of power generation, contributed 33.2 percent of the total electricity produced in the country during FY15.

supply chain, affected the furnace oil imports, particularly in the first half of FY15.[4]

At the same time, the private power producers were also reluctant to increase generation due to financial constraints, despite a steep decline in their input cost (furnace oil price). These constraints became more pronounced in November/December 2014, when a number of Independent Power Producers (IPPs) threatened to invoke sovereign guarantees on non payments of their past dues by the government. In the meanwhile, government also decided to reduce country's dependence on furnace oil. As a result, share of furnace oil in total power generation fell from 38.5 percent in FY14 to 33.2 in FY15 (**Table 3.1**).

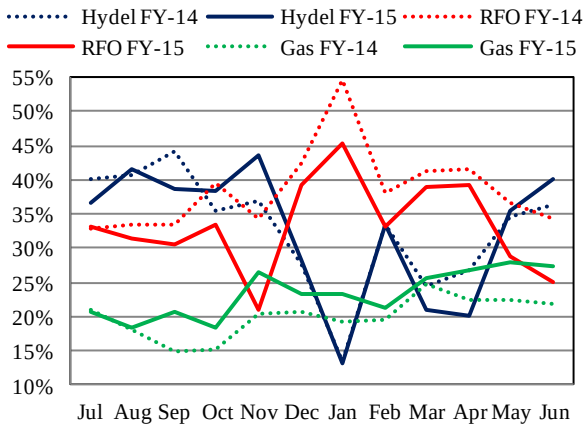
Table 3.1: Power Generation by Source and Its Costs

	Ave Cost of Generation (Rs/kwh)		Total Generation (in 000 Gwh)		%age Share in Generation	
	FY14	FY15	FY14	FY15	FY14	FY15
Hydel			32.2	32.6	32.9	32.5
RFO	16.0	12.4	36.0	31.7	38.5	33.2
Gas	4.8	4.7	19.0	22.5	20.1	23.3
HSD	22.2	17.4	1.6	2.9	1.7	3.1
Coal	4.0	4.5	0.1	0.1	0.1	0.1
Nuclear	1.3	1.2	4.4	5.0	4.8	5.4
Import Iran	10.2	10.1	0.4	0.5	0.4	0.5
Mixed	9.3	8.2	1.1	1.3	1.2	1.5
Wind			0.3	0.5	0.3	0.5
(Avg/Total)	7.7	5.9	95.2	96.7	100	100
Transmission losses	0.2	0.1	-2.3	-2.1		
Net delivered	8.0	6.1	92.8	94.9		
FPA Variation (Rs/Kwh)	2.8	-1.8				

FPA= Average Fuel Price Adjustment; RFO= Residual Fuel Oil or Furnace Oil; HSD= High Speed Diesel
Source: NEPRA

Additional drag on power generation came from below normal water availability during the winter, particularly for the period Mar-Apr 2015 (**Figure 3.2**).[5,6] However, better gas supplies to the power sector (due to substitution of CNG with petrol in the transport sector), provided some comfort. Later on, hydel generation recovered strongly in May- June 2015 following the improvement in river flows.[7]

Figure 3.2: Sourcewise Generation (Percent)



Source: NEPRA

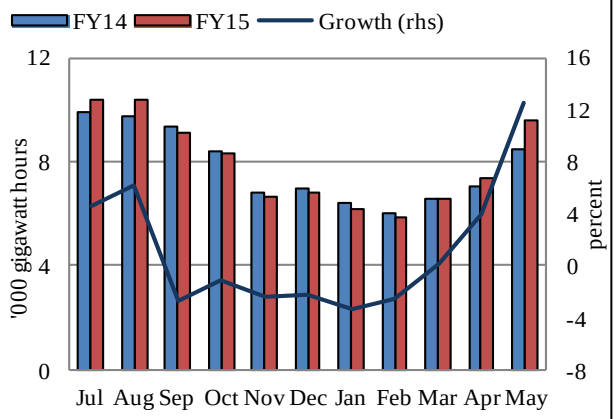
Broadly speaking, power supply did not show any major improvement through most of the fiscal year (**Figure 3.3**). The total power generation for FY15 increased by only 1.6 percent, considerably lower than the demand. While we do not have precise estimate on the demand for electricity, the empirical evidence suggests that the demand for power rises more than proportionally to changes in per capita income.[8,9]

Hence, not surprisingly, the power outages remained persistent in FY15. Specifically, the distributional constraints continue to act as the key bottleneck in the improving the load management.

[4] These receivables accumulated due to nonpayment of dues by government enterprises (e.g., public sector power companies and the gas utilities), and became part of the circular debt.
[5] Water is the second largest source of power generation, contributing 32.8 percent to the available electricity during FY15.
[6] Importantly, the hydel power, the cheapest source of power generation, could not get traction due to political complexity.
[7] The hydel generation increased sharply by more than 15 percent in May - June 2015 due to better water availability. As a result, the total hydel generation in FY15 was 32,562 Gwh, slightly higher than 32,239 Gwh recorded in FY14. In the absence of May-Jun 2015 increase, the aggregate power generation would have been lower than the FY14 level.
[8] According to literature on electricity demand in Pakistan, the increase in income results in more than proportional rise in the power consumption (References: (1) Iqbal, Nasir., Saima Nawaz., and Saba Anwar. (2014). *'Electricity Demand in Pakistan: A Nonlinear Estimation'* 29th Annual General Meeting Proceedings, PIDE, Islamabad. (2) Tariq, M. Salman., M. Nasir., and Ankasha Arif. (2013). '*Residential demand for electricity in Pakistan'.* Pakistan Development Review, 52(4), 479–492).
[9] The per capita income for Pakistan has risen by 7.5 percent (in nominal terms) during FY15.

Interestingly, even if existing generating units are geared up to operate three-fourth of their capacity, the country simply does not have the infrastructure to distribute this power to end-users. Unfortunately, the policy focus in energy sector is oriented towards enhancement of generation capacity, instead of the transmission and distribution capacity.

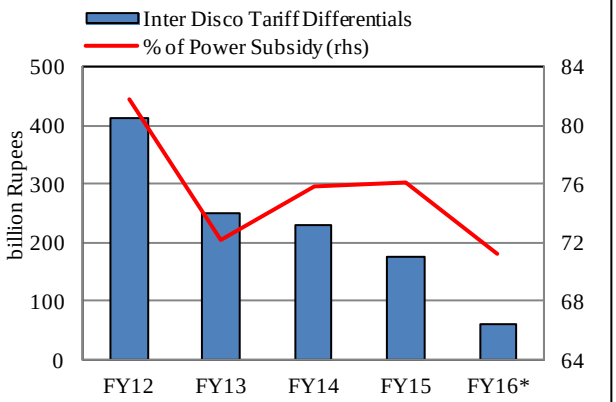
Figure 3.3: Monthwise Power Generation (Gwh)



Source: NEPRA

The steep decline in the oil prices also allowed the government to bring down the total power sector subsidies from Rs 309 billion in FY14 to Rs 292.3 billion in FY15.[10,11] Furthermore, the lower cost of generation also slows down the pace of buildup in circular debt – the most binding constraint faced by the power sector. Interestingly, the government could have gained more in terms of reduced volume of circular debt, had Nepra not revised the fuel adjustment surcharge downward. The resulting ease in financial constraints would have even allowed government to boost power generation and reduce load management.

Figure 3.4: Inter Disco Tariff Differentials



*Budgeted
Source: Federal Budget Documents

Focusing on the circular debt, the outstanding volume at end-June 2015 was Rs 648 billion (this included Rs 335 billion of arrears and Rs 313 billion of fresh buildup between June 2013 and June 2015).[12] This debt is sourced back to payables from power vendors and suppliers; overdue bills from public and private consumers; line losses that are not recognized in the tariff; delays in the refund of excess GST collected by the FBR; delays in tariff determinations; and accrued interest on past arrears. Taking benefit from lower oil prices, and to address the circular debt issue, the government has introduced a new tariff structure that includes following three different surcharges:

- Tariff Rationalization Surcharge @ Rs1.54 per kwh, exclusively for recovering the determined cost of power producers. This surcharge aims to cover the (a) line losses and non-collection of revenues; (b) financing costs due to delays in tariff determination; and (c) eliminating subsidies on non-residential consumers, and equalizing tariffs across Discos.[13]
- Debt Servicing Surcharge @ Rs 0.43 per kwh, exclusively for discharging the financing cost of various power sector loans obtained under Power Holding Company (PHCL) debt.
- Neelam-Jhelum Surcharge @ Rs 0.1per kwh for exclusive use for Neelam-Jhelum Hydro

[10] Government provides power sector subsidies for (i) inter-discos tariff differential; (ii) tariff differentials for agri-tube wells in Balochistan; (iii) pick up of WAPDA/PEPCO receivables from FATA and AJK; (iv) exchange rate differential for USAID's grants to GENCO's; (v) subsidy to WAPDA/PEPCO on account of arrears on inter-disco tariff differential; and (vi) pick up of KE tariff differential.

[11] Government intends to further cut this subsidy to Rs 87 billion in FY16 (Source: Ministry of Finance and Pakistan IMF Country Report No. 15/162, June 2015).

[12] Source: Pakistan IMF Country Report No. 15/278, October 2015.

[13] Source: Nepra notification of 12th June 2015 on new tariffs and Pakistan IMF Country Report 15/162, June 2015.

Power Project.[14]

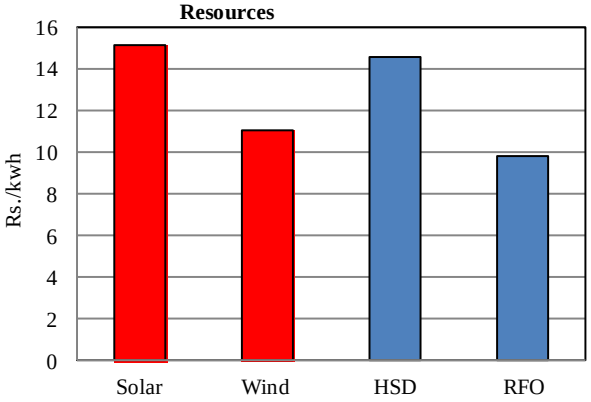
One of the key outcomes of the Tariff Rationalization Surcharge is the decline on dependence on power sector subsidy, specifically the subsidy provided for the equalization of inter-disco tariff differentials. The government has already reduced subsidy under this head to Rs 174 billion in FY15 from Rs 225 billion in FY14 (**Figure 3.4**).

The new tariff structure will address the circular debt issue by transferring the entire cost of poor governance and inefficiencies in the power sector to end-users.[15] In fact, any increase in the power theft (or upsurge in unpaid bills) due to higher tariff, will also be paid by consumers who are already paying their bills. The transmission and distribution companies, on the other hand, have no incentive to improve their operations.

3.3 Renewable Energy Resources

The sharp decline in global oil prices has drastically changed the dynamics for renewable energy sources. Specifically, low oil prices have rendered alternate energy resources less appealing, even with significant fall in their fixed costs due to technological innovations. For example, the power generation based on furnace oil, costs less than Rs 10 per kwh on average between January-June 2015, which is far less compared to upfront tariff of Rs 15.13 per kwh for Solar energy (**Figure 3.5**).[16]

Figure 3.5: Generation Cost of Fossil & Alternate Resources



NEPRA's upfront tariff for Wind and Solar Energy
Jan-Jun 2015 average of generation costfrom HSD & RFO

Nonetheless, the alternate energy projects still remain viable for producers as the government guarantees the purchase of power – though these may slip in their standing in the power generation merit order. Furthermore, looking from long term perspective, there is a need to reduce country's heavy reliance on volatile fossil fuel in the power generation mix. This will lessen dependence on import and help achieve cleaner environment (**Box 3.1** Feed in tariff and promotion of solar energy Among Households in Pakistan).

Box 3.1: Feed in Tariff and Promotion of Solar Energy Among Households in Pakistan

In Pakistan, the use of solar energy is still in its evolutionary stage. Despite having enormous potential for solar power, generation capacity in Pakistan is almost non-existent. Germany, which receives almost one-third less sun shine in a given year compared to Pakistan, generated almost 37,780 Gwh using solar power in 2013, which was equivalent to 43 percent of total power produced in Pakistan in FY15 (**Figure 3.1.1**).[17]

Looking at EU experience, it was their political will that led to the adoption of the climate and the energy agenda in 2008, thus paving way for supportive policies for increasing the household and industrial investments in the renewable energy. As a result, most of the European countries witnessed a rapid increase in the renewable energy production, with Germany climbing to the top of the ladder to become global leader in the solar power generation (**Figure 3.1.1**).

Pakistan has announced various policy initiatives, in line with the Independent Power Producers (IPPs), to

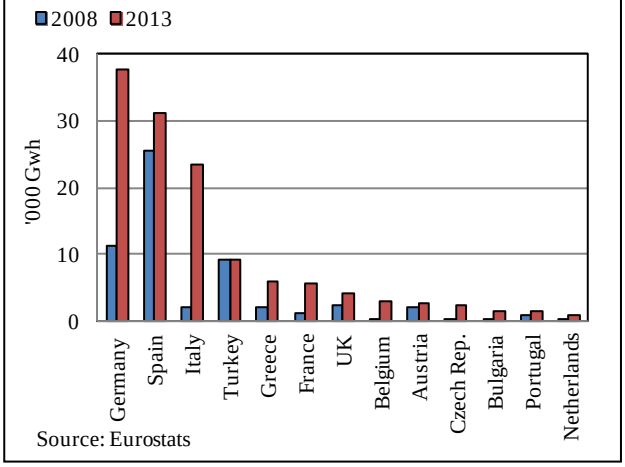
[14] In addition, Gas Infrastructure Development Cess (GIDC) is also re-imposed through fuel price adjustment (**Section 3.4.1**).
[15] However, life-line electricity consumers remain protected in this tariff structure.
[16] NEPRA announced levelized Solar PV Upfront Tariff on May 25, 2015 as; Rs15.13, Rs 15.0 and Rs 14.86 for maximum of 20MW, 50MW and 100MW generations.
[17] Updated information on solar power generation in European Union is currently available till 2013.

attract investments in the renewable energy sectors.[18] However, there is almost no effort to attract residential investors, who have a potential to change the energy landscape of this country.

It is easier to encourage household to invest in solar energy. Not only that the installation and maintenance of residential solar panels involve low cost, the Solar Photovoltaic (PV) technology mostly used by households for generation of solar energy, is more efficient in utilizing space.

One disadvantage with solar panels is that they are only effective during daylight hours, as storing electricity is not an efficient process.[19] In fact, adding batteries for storage not only increases the overall installation and the maintenance costs, it also makes power management cumbersome for household, as this may require frequent switching between solar and conventional power supply. Instead of managing two different power circuits, it is efficient for a photovoltaic panel user to be coupled with the grid. This would allow users to supply the excess power to the main grid during the day, and switch to grid source at night when the solar output is not available.

Figure 3.1.1: Top Solar Electricity Generating EU Countries



Source: Eurostats

Most of the advanced economies, where solar energy witnessed a rapid growth in recent years, incentivized households through 'feed in tariff'. Under this tariff structure, anyone who installs an eligible solar system will receive a guaranteed fixed payment for all the electricity they generate (including what they use) for a certain period. Besides, these small producers also receive an additional payment for any surplus electricity that they feed back into the power grid. This tariff incentive attracted residential investment in the solar power and provided a boost to the economy.

In Pakistan, though Nepra has announced 'Net Metering Regime' to encourage the alternate energy generation at smaller level, and allowed consumers to sell surplus electricity (maximum of 1 MW) to discos, other institutional settings are lacking.[20] The absence of financing scheme for household's investment in solar panel;[21] and the lack of standards for solar instruments, are a few examples. Furthermore, despite Nepra advice, discos have not taken any initiative to encourage the household's participation in solar power generation.

In sum, households' investment in the solar power is one of the solutions to address power shortage in the country as it will release power units for the industrial sector from household consumption.

3.4 Natural gas

The decline in global prices of crude oil also dragged down gas wellhead prices in Pakistan, making future exploration and production in Pakistan less attractive. The average Brent crude oil price of US$111.87/bbl in June 2014 yielded wellhead gas price of US$ 6.3 per mmBtu (**Figure 3.6**). As the crude oil prices came down to US$ 62.35/bbl in June 2015, the wellhead gas price also dropped to US$ 5.1 per mmBtu.

[18] For example in solar energy generation, government guaranteed electricity purchase; announced attractive upfront tariff; provided protection against the political risk and change in law; allowed various tax exemption; undertook resource risk; and allowed full capital convertibility for foreign investors.

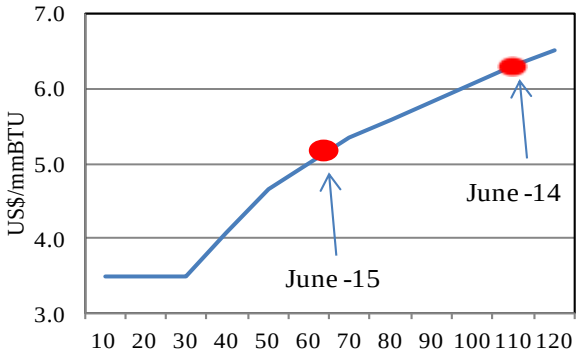
[19] Solar thermals technology can store energy in form of thermal energy. It uses mirrors to concentrate sunlight which is then used directly as a source of heat for water heating or driving heat cycles in some form of engines. Thermal energy thus stored, can be used for almost 24 hours. However, solar thermals are costly and feasible only for large scale solar power production.

[20] See Net Metering Rules (2014) available at http://www.nepra.org.pk.

[21] SBP allows refinancing facility to power plant units using renewable energy (see IH&SMEFD Circular No 03, January 01 2013, available at: http://www.sbp.org.pk/smefd/circulars/2013/C3.htm)

This raises concerns as the proven gas reserves and annual average gas production are already on a decline in Pakistan, and the oil & gas sector has failed to attract sufficient foreign investments.[22] The energy experts identify difficult security situation, and policy delays as major obstacles to foreign investment in this sector. In addition, as the reserves are small, only mid-sized companies show their interest in Pakistan. In this perspective, the decline in wellhead price would further discourage foreign investors from undertaking exploration and production activities in Pakistan.[23]

Figure 3.6: Relationship between Crude Oil Vs. Gas Wellhead Prices



Source: Petroleum Policy 2012

Furthermore, low wellhead gas prices are likely to push down the prescribed price for consumers of two gas utilities (SNGPL and SSGCL). The expected downward revision in prescribed price (which is due in January 2016) will further reduce the fuel prices for the power sector.

3.4.1 Gas Infrastructure Development Cess

To manage the ever increasing gas consumption demand and dwindling gas reserves, government imposed Gas Infrastructure Development Cess (GIDC) in 2011 on non-domestic sector gas consumers. This cess was designed to finance large infrastructure projects for importing natural gas, e.g., Iran-Pakistan (IP) pipeline project, Turkmenistan-Afghanistan-Pakistan-India (TAPI) pipeline project, LNG and other ancillary projects. However, this levy drew wide criticism and litigation on its method of imposition, non-transparency in the use of fund, and on the jurisdiction of the federal government to impose this levy.

Specifically, in June 2013, Pakistan's court declared GIDC a fee which could not be imposed through finance bill. Moreover, though the cess was meant for gas infrastructure development project, the budget documents from FY15 onwards treat this as 'other tax revenue' under budgetary finance.[24] The GIDC Act 2011(and subsequent Acts) required government to present annual report before the parliament on utilization of this cess after three months at the end of every fiscal year; no such report was presented by the government till date. Furthermore, provinces see natural gas a provincial subject after the 18th Constitutional Amendment, and often demand their share in the revenue collected under GIDC.

Although the government has strengthened the legal cover to this levy through introduction of GIDC Act in June 2015, many stakeholders have sought court intervention against this cess. Furthermore, collection of arrears for the period July 2013 to May 2015, specifically from power and the fertilizer sectors, remains a major issue.[25] In the power sector, these arrears would be recovered through monthly Fuel Price Adjustment (FPA).[26]

[22] Annual average gas production declined in FY14 to 1,493.5 trillion Cft from 1,505.8 trillion Cft in FY13.
[23] On the other hand, local players (largely public sector firms) which dominate the exploration and the production activity in Pakistan, have capacity issues.
[24] However, proceeds from GIDC are being kept in a separate account and used for development of the gas infrastructure.
[25] Gas utilities will collect Rs 11.1 billion of GIDC collected by the CPPA on behalf of the IPPs.
[26] These arrears will be adjusted against negative adjustment in Fuel Price Adjustment, i.e., any benefit of lower fuel prices will be adjusted against these arrears, instead of passing on that to consumers.

3.4.2 Provincial gas consumption dynamics

Both southern provinces, Sindh and Balochistan, contributed almost 87 percent of the total gas produced in Pakistan in FY14. However, the consumption and distribution of the natural gas has become a provincial subject after the 18th constitutional amendment.[27] A review of province-wise gas consumption reveals some interesting insights (**Table 3.2**).

Table 3.2: Provincial Gas Consumption and Production Pattern

Use in billion CFt; share in percent

	Punjab		KPK		Sindh		Balochistan		Total	
	Use	**Share**	**Use**	**Share**	**Use**	**Share**	**Use**	**Share**	**Use**	**Share**
Consumption										
Domestic	159.3	31.3	28.4	40.2	72.1	13.4	9.3	9	269.1	22.1
Commercial	25.3	5	2.6	3.6	9.5	1.8	0.7	0.7	38.1	3.1
Industry	229.7	45.2	14.5	20.5	225.6	41.9	6.2	6	476.1	39
Power	61.6	12.1	0	0	202.4	37.6	85.5	82.9	349.5	28.6
Transport	32.5	6.4	25.3	35.7	28.5	5.3	1.3	1.3	87.6	7.2
Total	**508.3**	**100**	**70.8**	**100**	**538.2**	**100**	**103.1**	**100**	**1220.5**	**100**
Production	**63.3**	**4.2**	**135.1**	**9.0**	**1,018.00**	**68.2**	**277.1**	**18.6**	**1,493.5**	

Source: Energy Year Book 2014

For example, in Sindh (the largest gas producer), industry and power sectors together consume more than 79 percent of the available gas. In comparison, Balochistan (the second largest gas producer) allocates around 83 percent of its gas supply to power. This is understandable as the industrial base in this province is almost nonexistent.

In KPK, households and transport sector receive greater gas allocation. Demand from power sector is nil, as electricity generation is based on hydel sources (KPK produces more than half of the total hydel electricity produced in Pakistan).

Finally, Punjab's industrial sector is the largest consumer of gas (45.2 percent), followed by households (31.3 percent). More than two third of the total provincial gas consumption is used by these two sectors. Moreover, household gas consumption in Punjab makes around 60 percent of the total household consumption in Pakistan.

[27] Article 158 of the Constitution, which stipulates that the province in which a wellhead of natural gas is situated, shall have precedence over other parts of Pakistan in meeting requirements from that wellhead.