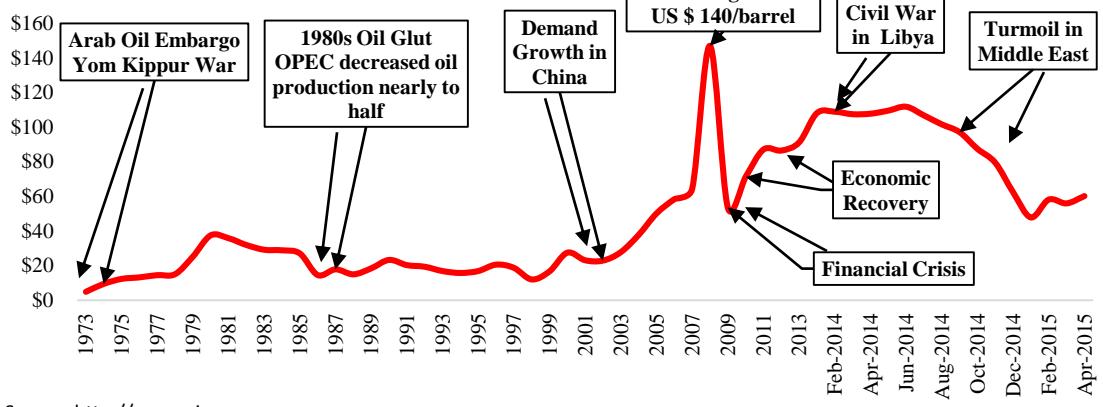


# Energy

The year 2014 can be marked as a turbulent year for the energy sector because of geopolitical crises, stagnating global economic growth, and slow progress in lowering greenhouse gas emissions to avoid global warming. Uncertainty existed in some producing regions, as tensions between the Russian Federation and Ukraine simmer, and the Islamic State of Iraq and Syria (ISIS) unleashed the turmoil in the Middle East. There is continuous rise in global energy

demand with oil and gas still having almost 60 percent in total world energy consumption. Moreover, China is becoming the largest oil-importing country. However, this year, oil prices have displayed significant volatility (Fig-1) and declined to the level last seen in 2010 with probable reason of higher supplies of oil from Middle East OPEC producers and a relentless build in US crude stocks.

**Fig-1: Crude Oil Prices (US\$ / Barrel)**



Source: <http://www.eia.gov>

The other interesting fact was that Saudi Arabia remained silent whereas the country could single-handedly reversed the price slide by cutting production as it has been done in the past. In 1980s, Saudi Arabia and its partner in OPEC decreased oil production nearly to half and also in 2010 after oil prices crashed due to financial crisis. On one side plunging oil prices are pressuring the American shale-oil and gas producers responsible for domestic energy boom which comes with its own ramifications for the economy as shale oil is relatively expensive to get out of the ground requiring prices of around \$ 70 a barrel to be economical, thus slashing the future shale-oil production. On the other hand, keeping prices low will give oil-importing countries a financial break especially Russia,

which is heavily dependent on its oil revenue and is already coping with Western sanctions over Ukraine.

Policy-makers and businesses are coming to terms with these new dynamics as they seek to adapt energy systems to meet the needs of today and tomorrow. Economic growth and development, sustainability and energy security, and access remain the key pillars of any energy system. Thus significant energy reforms with good intentions to fulfillment are required in response to these new imperatives and opportunities. Further decision-makers also require credible information to make complex decisions across these three dimensions.

Right from the beginning, the present government has attached high priority to energy sector. The government retired the circular debt (Rs 480 billion) immediately after taking oath which added 1752 MW of electricity into the system. In FY 15, the current level of circular debt is around Rs. 250 billion including Current Payable. Further a long awaited National Power Policy 2013 focused to support the current and future energy needs of the country and to set Pakistan on a trajectory of rapid economic growth and social development. The policy describes sustainability in the power sector as "the underpinning of long term transformation. The principle of sustainability will be grounded on three pillars: low cost energy, fair and level playing field, and demand management. Altering the fuel mix towards less expensive fuels will lead to low cost energy. Investments required for the low cost fuel mix will necessitate rationalization of the electricity tariff. Fairness will be ensured by protecting the poor and cross-subsidizing their consumption from the affluent. A level playing field will be created by providing power at comparable prices to all industrial users. Demand management will be introduced through novel policy, pricing and regulatory instruments." In December 2014, "Monitoring Report on Pakistan Energy Reform" was presented to the Economic Coordination Committee (ECC) of the Cabinet to analyze the progress and was subsequently released to the public as per ECC decision.

Lower tax to GDP ratio restricted the government in financing energy project solely thus private sector was also encouraged to play their role. Likewise energy sector always remained a key component of dialogue between the government and multilateral and bilateral development partners. During the recent visit of the Prime Minister to Turkmenistan, apart from mutual cooperation on various fields like trade, education, etc., the review of Turkmenistan-Afghanistan-Pakistan-India (TAPI) Pipeline and energy security remained main focus of the meeting. The project is expected to be materialized by end of 2017 will be providing the gas of 1.3 billion cubic feet to Pakistan. Turkmenistan, Afghanistan, India and Pakistan linked the Transaction Advisory Services Agreement (TASA) with Asian Development Bank (ADB) to find leading, technically and financially sound company that could form a

consortium to generate the finances for the project.

The government was keeping itself bound with its timelines related to energy projects, however undue sit-in by two political parties in August 2014 and disastrous flood witnessed by Kashmir region in September 2014 became significant hindrance. Flood delayed Neelum-Jhelum hydropower which is now expected to complete in 2016 and due to sit-in, many planned engagements with multilateral and bilateral donor was delayed, most importantly the due visit of President of China was rescheduled.

Apprehending the commitment of the present government, Asian Development Bank (ADB) has approved assistance packages to help Pakistan to undertake key reforms in the power sector. This included funding to ensure energy delivery to industrial and private consumers, and to build two vital power generation plants in Sindh Province. The Jamshoro Power Generation Project, which on completion in 2018, will add 1,300 megawatts (MW) to the country's electricity grid. Reliability of the power distribution network is also being enhanced through the investment of \$167.2 million to upgrade 284 grid stations. The World Bank also approved a financing package from the International Development Association (IDA) to help expand hydro-electricity generation in Pakistan through the development of the Dasu Hydropower Stage-I Project (DHP-I). The package consists of an IDA Credit of \$588.4 million and an IDA Partial Credit Guarantee (PCG) of \$460 million to help mobilize commercial financing for the project. DHP-I would have 2,160 megawatt (MW) hydropower plant on the main Indus River, which can be expanded to 4,320 MW in future with less additional cost.

During the recent visit of President of China, Pakistan and China signed 51 Memorandums of Understanding (MoUs) relating to diverse aspects of bilateral relations, including the Pakistan China Economic Corridor and series of energy projects. Thus almost \$15.5 billion worth of coal, wind, solar and hydro energy projects will come online by 2017 and when mature will add 10,400 megawatts of energy to Pakistan's national grid.

The government is encouraging domestic and international private investors in energy sectors giving them favorable opportunities and incentives especially in alternative sources of energy. As an example the present government has approved the use of grid-connected solar energy, rooftop solar installations and mortgage financing for home solar panels to boost clean energy in the country. Thus the government has reversed course and eliminated a 32.5 per cent tax imposed on imported solar equipment in the country's 2014-15 budget which was aimed to bring down the cost of installing solar panels. Investors from Germany, Qatar, Russia, etc., have shown there interest in investing in energy sector.

The Government of Pakistan also intended to diversify its energy mix so as to ensure energy Security. In this regard alternative and renewable energies is a strong contributor in the envisaged diversified energy mix. The investment portfolio in the Renewable Energy sector has increased by almost US\$ 1 billion in last year. Alternative Energy Development Board (AEDB) has undertaken a number of measures in order to promote Alternative and Renewable Energy (ARE) technologies to attract private sector investments.

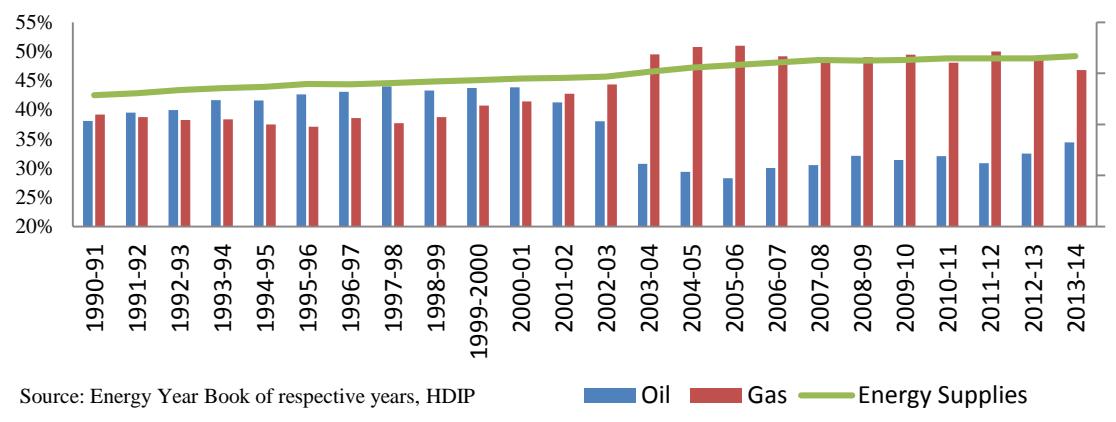
Recently a new investor friendly Power Generation Policy 2015 has been approved by the Council of Common Interest. The policy will facilitate in setting up of new plants as well

as in extending incentives - including fiscal, acceptance of bank guarantee, and issuance of corporate registered bonds - for generation from hydel, thermal as well as gas-based projects. The government is making efforts at all ends to get a sustainable resolution to the energy crisis that is not only hindering economic growth but also causing social disruption

### Pakistan Energy Sector:

Since 1991, the primary energy supplies had shown an annual compound growth rate of 3.6 percent and increased to 66.8 million TOE in 2014 compared to 28.5 million TOE in 1991. In 2014, per capita availability of primary energy supplies was estimated at 0.36 TOE. During July-March FY 2015, primary energy supplied increased to 50.9 million TOE compared to 48.8 million TOE showing a growth of 4.4 percent. Although there is no significant change in per capita availability, however there exist substitution in share of sources as share of gas dominated the share of oil in total energy supplies as gas being the cheaper source compared to oil especially after 2000-01 (Fig-2), beside Pakistan obtained Saudi oil facility from FY 1999 to FY 2004 and also subsidy given to oil sector by the government from FY 2002 to FY 2008 in order to give relief to consumer. However, the later step created fiscal burden to the exchequer. Oil and natural gas still continued to be the top two energy sources accounting for above 70 percent of energy demand.

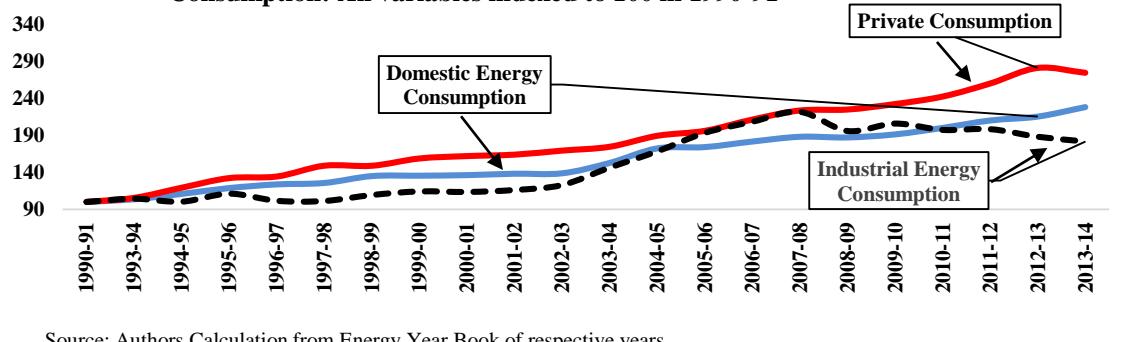
**Fig-2: Primary Energy Supplies By Major Sources**



The energy consumption has increased to 39.8 million TOE in 2014 compared to 17.0 million

TOE in 1991 with annual compound growth rate of 3.6 percent.

**Fig-3: Relation between Private Consumption, Domestic and Industrial Energy Consumption: All variables indexed to 100 in 1990-91**



Source: Authors Calculation from Energy Year Book of respective years

There is consistent rise in domestic energy consumption compared to industrial energy consumption (Fig-3), firstly, representing normal behavior on account of increase in economic welfare, secondly, technical innovations introducing more energy-using appliances to households and energy-saving techniques to industry. During July-March FY 2015, energy consumption increased to 25.1 million TOE compared to 24.6 million TOE in same period last year showing a growth of 2.0 percent

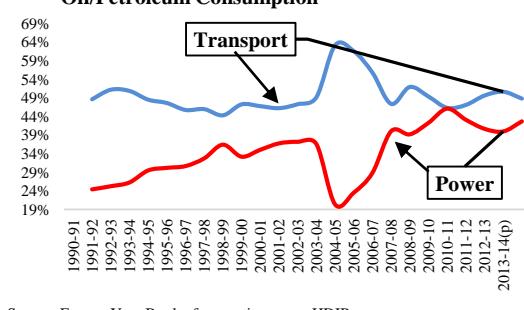
### Pakistan Energy Sources:

#### 14.1 Oil (Petroleum Product)

In early 1990s, transport and power sector were the main consumers of oil/petroleum having share of 50 percent and 25 percent, respectively in its total consumption. The consumption of oil/petroleum has shown a significant decline in period between 2000-01 and 2005-06 (Figure 4). The reason was rise in the price of crude oil since 2001. From an average price of US \$22.99/barrel in 2001, it was increased to US \$ 50.04 /barrel which was 118 percent higher than 2001. Realizing the fact, the government has initiated an ambitious pro-market reform program in the sector. The objective behind these market base policies was to limit the

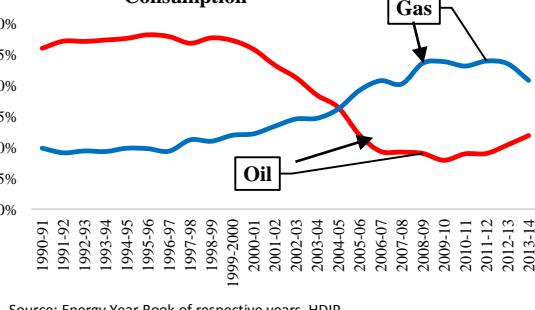
government role to only policy related issues and pricing and regulatory responsibilities to pass on to an independent regulatory authority. The government also changed the guaranteed return formula of the refineries to an Import Parity Price (IPP) formula. Previously, the refineries were working under a fixed return formula where the return was capped in the range of 10-40 percent of their equity. Thus government was liable to meet any loss in the profitability of the refineries. Under the new formula, an import tariff is applied to the FOB price of the petroleum product to determine the ex-refinery prices. Further to attract on the exploitation of indigenous resources, the government announced policy for Power Generation Projects 2002 in which one Window facility was provided by Private Power and Infrastructure Board (PPIB) for all projects above 50 MW Capacity. Thus oil became expensive source for the power sector was substituted by gas (Fig-8) as electricity was generated by consuming almost 50 percent fuel (Furnace Oil and Diesel Oil). It again started rising because of subsidy given by the government. During the period 2003-04 and 2005-06, the rise of share of transport in oil consumption was mainly due to fast growing transport sector while shift toward CNG was not fully matured.

**Fig-4: Share of Transport and Power in Oil/Petroleum Consumption**



Source: Energy Year Book of respective years, HDIP

**Fig-5: Share of Oil and Gas in Energy Consumption**

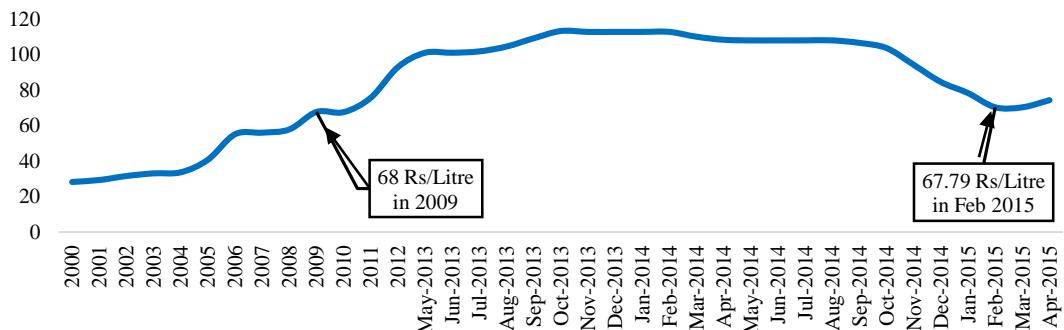


Source: Energy Year Book of respective years, HDIP

The longer term trend suggests that composition of energy consumption, the composition is changing by substituting the gas as cheaper source compared to oil being expensive (Fig- 5). However due to gas load management, share of oil has again started rising. But still oil remained

expensive prior to July 2014, as the government immediately responded to falling international oil prices and brought the domestic oil prices to Rs67.79/liter less than the levels last seen in 2009 (Fig-6).

**Fig-6: Domestic Petrol Prices (Rs / Litre)**



Source: Pakistan Economic Survey, Ministry of Petroleum & Natural Resources

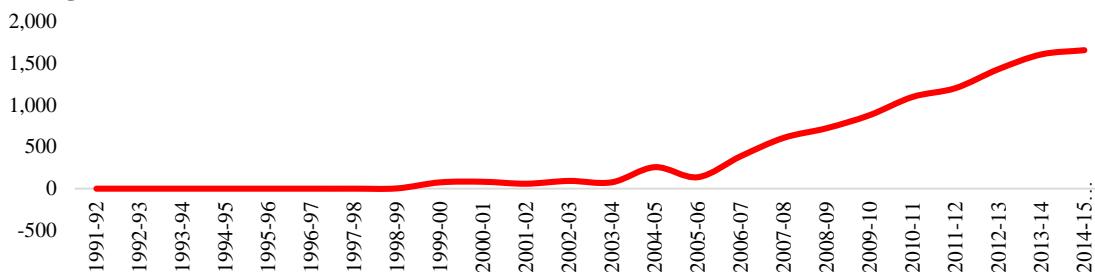
The falling of international oil prices saved foreign exchange due to lower import bill (an amount of \$ 3 billion approximately will be saved) while reduction in domestic petrol prices decreased the private consumption expenditure on oil thus money saved could be spent on other goods and services. Due to substantial decrease in retail prices on December 1, 2014 and afterwards on January 1, 2015, sales of petrol witnessed unprecedented increase. However, unfortunately, Pakistan—Arab Refinery Ltd (PARCO) the largest producer of petrol experienced a shutdown due to tripping of 11KV lines in Muzaffargarh area while National Refinery Limited (NRL) also experienced shutdown due to leakage of Distillation Tower. The short supplies aggravated the problems for Oil Marketing Companies (OMCs). On the other hand as required by the provisions of OGRA Ordinance, 2002 and license condition, OMCs had to maintain 20 days storage/stocks which OMCs could not fulfilled. Moreover in the first

half of January 2015, two vessels of OMCs were delayed. By the time daily sales reached the level of 15,000 metric tonnes per day (an addition of 3,000 metric tonnes per day against projected demand of 12,000 metric tonnes) thus 45,000 metric tonnes more than the normal demand during first fortnight of January 2015, lead to severe pressure on reserve level. An unfortunate coincidence of all these factors contributed to the petrol crisis. However, once the shortages were observed, the government efficiently tackled the crisis which was over within few days which might have gone longer otherwise.

#### 14.2 Natural Gas

With respect to gas, Pakistan has one of the most developed gas transmission and distribution network in the region but on account of its increased share in energy consumption, the gap between its demand and supply is widening steeply as shown in Fig-7:

**Fig-7: Natural Gas Shortfall Data**

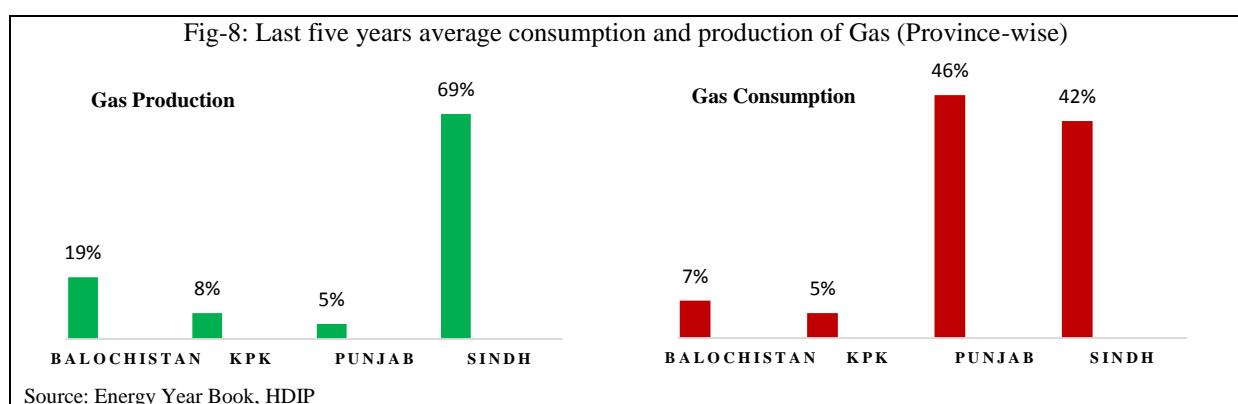


Source: Directorate General of Gas, Ministry of Petroleum & Natural Resources

The gap started when gas being cheaper was substituted for oil and political will of adding new consumers on account of annual development schemes. During July 2014 to February 2015, the two Gas utility companies (SNGPL & SSGCL) have laid 72 km gas transmission network, 1,040 km distribution and 758 km services lines and connected 59 villages/towns to gas network. Thus 206,473 additional gas connections including 206,127 domestic, 249 commercial and 97 industrial were provided across the country. It is expected that gas will be supplied to approximately 419,445 new consumers during the fiscal year 2015-16. Pakistan's natural gas production has been stagnant at the 4,000 Million Cubic Feet per Day (MMCFD). Thus there exist constrained demand for natural gas of 6,000 MMCFD against a supply of 4,000 MMCFD while the unconstrained demand for gas is estimated to be 8,000 MMCFD or more than double the current domestic production. One risk associated with this sector is that there is continuous depletion of existing natural gas fields while the pace of new gas discoveries is little slow.

Historically, gas demand during winter increases due to manifold increase in

consumption of domestic sector consumers, in almost all areas on SNGPL's system and in some areas of SSGCL's system. The gas shortage is now being faced in summer months as well due to worsening demand-supply gap owing to increase in its demand as well as depletion of existing sources. Government of Pakistan is pursuing its policies of enhancing gas production to meet the increasing, demand of energy in the country. Still for supply of gas, the government has given priority to domestic and commercial sectors followed by power sector while general industry, fertilizer and captive power is on third priority. Cement and CNG sector are respectively on fourth and fifth priority of the government for supply of gas. There is no gas load shedding in domestic and commercial sectors in the country. However, the Honorable Sindh and Peshawar High Courts have directed the federal government to adhere the provision of Article 158 of the Constitution therefore the gas load management is mostly restricted to Punjab Province as its share in gas supply is about 5 percent while it has a share of almost 46 percent of national gas consumption. An average of last five year province-wise gas production and consumption is given in Fig-8.



From the Table-1, it can be concluded that the gas load management is mostly restricted to Punjab Province:

Priority-wise Sector	July-March FY 14					July-March FY 15				
	Punjab	Khyber Pakhtunkhwa	Sindh	Balochistan	Total	Punjab	Khyber Pakhtunkhwa	Sindh	Balochistan	Total
Domestic	474	81	213	29	797	448 <span style="color:red">↓</span>	96 <span style="color:green">↑</span>	207 <span style="color:red">↓</span>	27 <span style="color:red">↓</span>	778 <span style="color:red">↓</span>
Power	151		468	225	844	123 <span style="color:red">↓</span>		477 <span style="color:green">↑</span>	302 <span style="color:green">↑</span>	902 <span style="color:green">↑</span>
Commercial	69	7	26	2	104	60 <span style="color:red">↓</span>	7 <span style="color:green">↑</span>	26 <span style="color:green">↑</span>	2 <span style="color:green">↑</span>	95 <span style="color:red">↓</span>
General Industry										
Pak Steel			24		24			21 <span style="color:red">↓</span>		21 <span style="color:red">↓</span>
Captive Power	83	18	207		308	83 <span style="color:orange">⇒</span>	21 <span style="color:green">↑</span>	207 <span style="color:red">↓</span>		311 <span style="color:green">↑</span>
Other Industry including Textile	179	20	175	1	375	102 <span style="color:red">↓</span>	19 <span style="color:red">↓</span>	170 <span style="color:red">↓</span>	1 <span style="color:orange">⇒</span>	292 <span style="color:red">↓</span>
Fertilizer (Feed)	230		225		456	223 <span style="color:red">↓</span>		233 <span style="color:green">↑</span>		456 <span style="color:green">↑</span>
Fertilizer (Fuel)	63		83		146	58 <span style="color:red">↓</span>		90 <span style="color:green">↑</span>		148 <span style="color:green">↑</span>
Transport (CNG)	87	67	76	3	233	37 <span style="color:red">↓</span>	74 <span style="color:green">↑</span>	78 <span style="color:green">↑</span>	4 <span style="color:green">↑</span>	193 <span style="color:red">↓</span>
Cement				1	1			1 <span style="color:green">↑</span>	2 <span style="color:green">↑</span>	
<b>Sub Total</b>	<b>1,336</b>	<b>193</b>	<b>1,499</b>	<b>260</b>	<b>3,288</b>	<b>1,134 <span style="color:red">↓</span></b>	<b>218 <span style="color:green">↑</span></b>	<b>1,511 <span style="color:green">↑</span></b>	<b>336 <span style="color:green">↑</span></b>	<b>3,199 <span style="color:red">↓</span></b>

Source: Directorate General of Gas, Ministry of Petroleum and Natural Resources

SNGPL is meeting the requirement of more than 4.8 million consumers of domestic, commercial, CNG and industrial categories through its distribution network. All categories of consumers are fed through a common distribution network. There is a continuous extension in SNGPL's network. On an average, there has been an increase in gas demand by 40-50 MMCFD (based on average consumption during summer months) and 80-100 MMCFD (based on average consumption during winter months) each year. On the other hand there is no considerable increase in inputs. Small fields

which have been connected to the system, hardly compensate the reduction of supply due to depletion of major gas fields supplying gas to SNGPL's system. Thus low pressure issues are faced by the consumers especially those which are situated at the tail-end of our distribution network, mainly during winter.

Keeping in view the demand and supply position of natural gas, SSGCL has also started gas load management on "as and when ever required basis". The comparison of gas curtailment in the two gas companies is given below

**Table 2: Comparison of Gas Curtailment**

Sectors	SNGPL	SSGCL
CNG	7 holidays / week	3 holidays / week (on alternate days)
Industry	5 holidays / week (Only captive power of textile sector is given 6 hours / day while textile processing units are provided gas against 25 percent of their allocation on daily basis)	1 holiday / week
Fertilizer	Reduced quantities	Reduced quantities

Source: Directorate General of Gas, Ministry of Petroleum & Natural Resources

Government of Pakistan is taking following steps to overcome the shortage of natural gas in the country:

- i) Contain the natural gas demand at current level
- ii) Increase indigenous gas supplies
- iii) Promotion of LPG air mix
- iv) Import of LNG
- v) Import of Gas from Iran
- vi) Import of Gas from Turkmenistan

#### **14.2.1 Compressed Natural Gas (CNG):**

The government was promoting the use of CNG to reduce pollution and to improve the ambient air quality. During past few years CNG industry has observed a tremendous growth. Today Pakistan is the world leading CNG user country with more than 3 million NGVs (Natural Gas Vehicles) plying on the roads. The choice of conversion is mainly due to the fact that prices of CNG is significantly less than petrol price. Currently there are more than 3,414 CNG stations in the country fulfilling the fuel need of the NGVs. However realizing the situation of gas, it is pertinent to mention that there is ban imposed by federal government on the issuance of CNG Provisional Licenses for establishment of new CNG Stations across the country.

#### **14.2.2 Liquefied Petroleum Gas (LPG):**

OGRA is empowered to regulate the LPG sector under OGRA Ordinance, 2002 and LPG (Production & Distribution) Rules, 2001 w.e.f 15th March, 2003. LPG plays an important role in the energy mix of Pakistan as it provides a cleaner alternative to biomass based sources, especially in locations where natural gas is not available or unable to reach due to low pressure especially in winter. The total supply of LPG during July-March, 2014-15 was 494,763 tones, accounted for about 0.5 percent of the total primary energy supplies in the country. Gas producing fields contributed 53 percent followed by refineries and imports with share of 26 percent and 21 percent respectively. Currently there are 12 LPG producers and 97 LPG marketing companies operating in the country having more than 4,482 authorized distributors.

Due to augmented investment and future expansion plans of the LPG marketing companies, significant investment in LPG supply and distribution infrastructure has been witnessed. OGRA has made noteworthy contribution in national economic progress and created an environment for additional investment especially in auto sector which will not only result in creation of infrastructure in

LPG sector all over the country but will also provide jobs to hundreds of unemployed people. There are six (6) LPG auto refueling stations, twenty four (24) are under construction and almost hundred (100) applications are under process. OGRA is playing its vital regulatory role to increase private investment in midstream and downstream petroleum industry. During July-March, 2014-15 an investment of approximately Rs. 1.5 billion has been made in LPG infrastructure.

#### **14.2.3 Liquefied Natural Gas (LNG):**

The two transnational gas pipelines that Pakistan has pursued for over two decades have been delayed due to reasons beyond control. The 750 MMCFD Iran-Pakistan (IP) gas pipeline has been delayed due to international sanctions (although there is now hope for removal of the sanctions) and the 1,325 MMCFD Turkmenistan-Afghanistan-Pakistan-India (TAPI) gas pipeline has been delayed due to the security situation in Afghanistan and structural issues with the project transaction.

The Government of Pakistan is now successful to import 500 million cubic feet per day (mmcfd) of LNG from Qatar. As per LNG Policy in 2006/2011 the project structures can be (i) integrated, in which the terminal developer arranges LNG imports as well as its buyers and (ii) unbundled, in which the terminal developer, LNG importer and LNG buyers are different. In 2014, the Government of Pakistan called bids through Inter State Gas Systems (ISGS), for construction of LNG regasification terminal by private companies. Engro Elengy Terminal Limited (EETL), formerly Elengy Terminal Pakistan Limited (ETPL), a subsidiary of Engro Corporation Limited was selected as the 'Technically' and 'Financially' qualified bidder for construction of LNG regasification terminal at Port Qasim Karachi. EETL has signed an LNG Service Agreement (LSA) with a government's designated entity i.e. SSGC for handling 400 MMCFD of Re-gasified Liquefied Natural Gas (RLNG) to be injected into national grid. The LNG shall be imported by the Government of Pakistan and EETL shall provide the regasification services at a tolling tariff. Moreover M/s Bahria Foundation on 22nd September 2014 applied for grant of 'Provisional License' under OGRA (LNG) Rules, 2007. After scrutiny of the application,

the company was granted 'Provisional License' on 17th March 2015 for a period of 12 months. During this period the company is required to complete all formalities as per requisite rules to apply for a license for construction of LNG terminal.

The current 400 MMCFD of Regasified LNG (RLNG) will be provided to the power sector including Nine (9) gas-based Independent Power Plants (IPP) - KAPCO, FaujiKabirwala, Rouche, Halmore, Orient, Saif Energy, Sapphire, Altern Energy, and Davis Energen for replacement of Diesel or LSFO consumption. This RLNG will allow these power plants to generate an additional 9 Billion KWh per annum, equivalent to an additional 10 percent of total current annual power generation, without investment in any new generation capacity.

Energy cost calculations clearly prove that RLNG is cheaper than ALL other imported fuels for power generation in Pakistan. On April 27, 2015, the delivered price for fuel to power plants in Northern Pakistan on equivalent basis was \$11.5/MMBTU for LNG, \$ 12.6/MMBTU for HSFO, \$ 13.8/MMBTU for LSFO, and \$ 22.8/MMBTU for Diesel. In this context, LNG with a notional Brent linkage of 14.5 percent is 10 percent cheaper than High Sulphur Furnace Oil (HSFO), 20 percent cheaper than Low Sulphur Furnace Oil (LSFO), and half the price of Diesel. In addition, as a fuel for power generation, LNG as compared to liquid fuels provides (i) substantially greater efficiency (ii) lower maintenance costs (iii) no storage costs (iv) ease of transportation and (v) no pilferage or adulteration issues.

Thus it is expected that import of LNG will help to overcome the shortage of gas as by providing LNG to power sector will give space in availability of gas for other sectors. The government is also making efforts to attract private investor for exploring new gas discoveries.

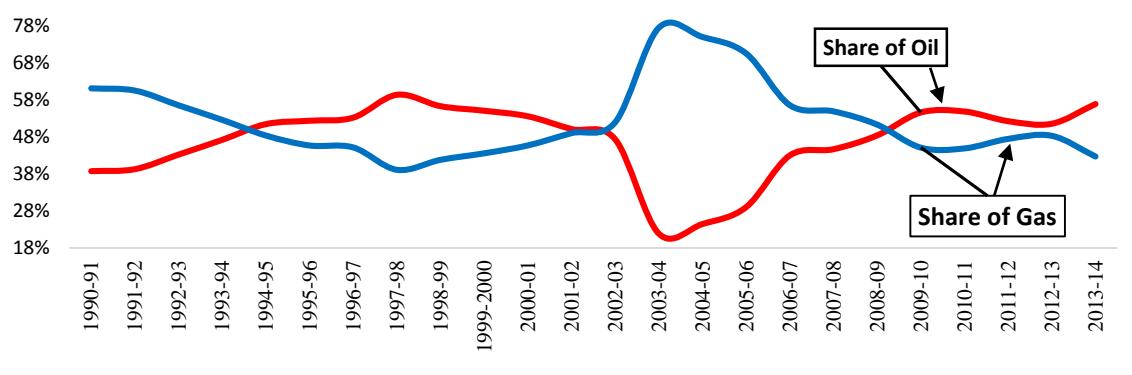
#### **14.3 Electricity**

Electricity although the secondary source of energy has become indispensable not only for household but for all other sphere like industry, transport etc. Power shortages has become the most influential economic challenge not only causing social disruption but also hitting the real

GDP growth rate. In NEPRA State of Industry Report 2013, NEPRA estimated, "the power sector is responsible for 2 to 3 percent reduction in the annual GDP of the country." However, exact cost including direct and indirect cost of power shortage and its directional relationship with growth is still unfold for developing economies especially for Pakistan. In this era of modernization, there is continuous increase in consumption of electricity within household as innovation has introduced more electrical-usage appliances to household. With respect to

industry, the behavior is little bit different as due to power shortage the large manufacturers have got their own captive plants to generate electricity and thus became Independent Power Producers (IPPs) under the Power Policy 2002. Nishat, Gul Ahmed, Orient, etc are some of the examples. All IPPs under the 1994 policy were thermal power plants often using furnace oil as a fuel. Thus the share of oil in thermal power generation remained high which also created a heavy dependence on oil prices.

**Fig-9: Share of Oil and Gas in Thermal Power Generation**



Source: Energy Year Book, HDIP

The Power Policy 2002 encouraged the use of indigenous fuel (gas) and hydel power projects. Thus the share of gas in thermal power generation started rising after 2002-03. Hydel plants with their low variable costs may be cheaper but WAPDA carried the risk of water availability for plants with a capacity bigger than 50 MW. Under Natural Gas Load Management Program in November 2011, Economic Coordination Committee of the Cabinet (ECC) decided to give first priority to domestic consumers, then commercial consumers, power generation units and fertilizer industry. Thus the share of gas and oil started reversing after the decision (Figure 8). Then under Gas Allocation and Management Policy 2013, first priority was given to domestic and commercial users followed by power. National Power Policy 2013 emphasized on by using indigenous resources such as coal (Thar coal) and hydel for the generation of inexpensive and affordable electricity for domestic, commercial, and industrial use. Recently, as per the decisions of Economic Coordination Committee of the Cabinet and Cabinet Committee on Energy, a new investor friendly Power Generation Policy

2015 was prepared and has also been approved by the Council of Common Interests. The policy accommodates new fuel provisions like Coal and R-LNG for power generation. Major improvements in Power Generation Policy 2015 are:

- For Projects under Government to Government Agreement, terms and conditions of such Agreement shall be applicable accordingly
- Payment of Capacity Purchase Price (CPP) with reduced Return on Equity (ROE) to Independent Power Producers (IPPs) in case plant is not available for dispatch due to non-availability of fuel solely caused by delayed payments by the Power Purchaser
- Minimum Take or Pay Provision to be included in the Power Purchase Agreement (PPA) as agreed by Power Purchaser / NEPRA
- Performance Guarantees (PGs) payable in equivalent Pak Rupees at the prevailing exchange rates at time of encashment

- For any specific fuel, Government of Pakistan may provide Guarantee for obligation of the fuel supplier
- Laws of England will be allowed for the foreign lenders participating in the projects as the governing law for the Direct Agreements (Implementation Agreement (IA) & Power Purchase Agreement (PPA)
- LOI Bank Guarantee extended till issuance of LOS instead of completion of Feasibility Study
- LOS Bank Guarantee to secure Financial Close only instead of FC and COD under 2010 Guidelines
- International Competitive Bidding (ICB) on Tariff for Hydropower projects will be carried out where Feasibility and Detailed Engineering Design is available
- PPIB will issue Tripartite LOS for projects initiated by the Provinces/AJK/GB, execute IA and issue Government of Pakistan Guarantee
- For R-LNG based projects, Standby Letter of Credit (SBLC) and/or Revolving L/C in favor of R-LNG Supplier to be established by the Sponsor

Thus the need for cheaper hydro power has gained more importance. Unfortunately the composition of electricity generation shows that hydro potential has not been fully utilized. The hydro potential which is located in the north requires long transmission lines to transport power to the load centers. During July-March FY 15, the hydro generation accounted for 31.47 percent of the total generation almost at similar level that was in same period last fiscal year.

The installed capacity of PEPCO system was 20,850 MW at the end of June 2013 which has gone up to 22,104 MW by the end of June 2014 with hydro and thermal capacities occupying 7,097 MW and 15,007 MW respectively. Out of aforementioned thermal capacity, 5,458 MW is owned by ex-WAPDA GENCOs, 650 by PAEC and rest by IPPs/Rentals. There is also 55 MW of isolated generation capacity at Pasni & Punjgoor areas in Baluchistan. The installed capacity of PEPCO system has gone up to 22,577 MW by the end of March 2015 with hydro and thermal capacities occupying 7,097 MW and 15,480 MW respectively. It is also

mentionable that the village electrification program is still an integral part of the total power sector development program. It is important for not only to raise the productivity but also to raise socio-economic standards of the population living in rural areas. The progressive number of villages electrified has increased from 1, 89,018 on 30th June 2014 to 1, 93,511 at the end of March 2015 while As of March 2015, the number of consumers has risen to 23.258 million.

To mitigate the impact of rising cost of thermal power and narrow down the demand-supply gap, the work on mega projects like Neelam-Jhelum (969 MW) and Diamir-Basha (4500 MW) hydropower projects is under way.

#### **14.4 Coal**

The Government considers Thar coal development as a flagship project and believes in it as a means to Energy Security. Thar Coal Projects have been enlisted as early harvest projects by the CPEC (China-Pakistan Economic Corridor), Sindh Engro Coal Mining Company (SECMS) and Sino Sindh Resources (Pvt.) Limited (SSRL) have been prioritized as top priority projects to be financed by Chinese institutions. There is a complete synergy between the Federal and the Provincial Government of Sindh. Total power generation anticipated from these three projects is 2400 MW by 2018.

In addition to Thar Coal resources, the Energy Department has worked on other sources of energy and established two special purpose companies namely M/s Sindh Nooriabad Power Company Private Ltd (SNPCL) and Sindh Nooriabad Power Company Private Limited Phase-II with a lead partner M/s Technomen Kinetics Private Limited for installation of 100 MW Gas power generation facility. It is in very advance stage and commissioning is expected in early of 2016.

Other mentionable progress in coal sectors are:

- China Machinery Engineering Corporation (CMEC) submitted to PPIB a formal proposal on 27th October 2014 for the development of a 300 MW indigenous coal fired power plant at Pind-Dadan Khan, Salt Range, Punjab (the ‘Proposal’) under the

ECC approved ‘Guidelines for Setting up of Private Power Projects under Short Term Capacity Addition Initiative - August 2010’ (the ‘Guidelines’).

- Lucky Electric Power Company Limited submitted its proposal to PPIB for development of 660 MW imported coal based private power project at Port Qasim Karachi. After successful evaluation of the proposal by PPIB’s consultant, PPIB on 15th January 2015 issued Notice to Proceed (NTP) to the Sponsors. Upon fulfillment of all requirements according to the Guidelines, including the submission of site confirmation letter from the Power Purchaser, PPIB on 11th February 2015 issued Letter of Intent (LOI) to the Sponsors. Lucky Electric Power Company Limited is now required to approach NEPRA for grant of Generation License and Tariff Determination.
- Siddiq-sons Limited submitted a formal proposal for the development of 350 MW

imported coal based private power project at Port Qasim Karachi. The Proposal was forwarded to PPIB’s consultant for evaluation. After necessary evaluation, the consultant declared the proposal responsive as per the criteria prescribed down in the Guidelines. Accordingly on 19<sup>th</sup> January 2015, Notice to Proceed (NTP) was issued to the Sponsors. Issuance of Letter of Intent (LOI) to the Sponsors is expected soon

#### **14.5 Nuclear Power:**

Pakistan Atomic Energy Commission (PAEC) is operating three nuclear power plants. The first nuclear power plant, Karachi Nuclear Power Plan (KANUPP), completed its 30 year design life in 2002, continues to provide electricity after necessary refurbishments and safety retrofits. Two nuclear power plants, Chashma Nuclear Power Plant unit-I & unit-2 (C-1 & C-2) are operating very well and setting high standards in the power industry of the country. Some performance parameters of these operating plants are highlighted in the following Table;

**Table 3: Performance Parameters of Nuclear Plants**

Plant	Gross Capacity (MW)	Grid Connection Date	Electricity sent to Grid (million kWh)	
			1 <sup>st</sup> July 2014 to 31 <sup>st</sup> March 2015	Lifetime upto 31 <sup>st</sup> March, 2015
KANUPP	100	18 October 1971	246	13,259
C-1	325	13 June 2000	1,809	28,944
C-2	330	14 March 2011	1,879	8,316

Source: Pakistan Atomic Energy Commission (PAEC)

Work on the construction of the fourth and fifth nuclear power plants, Chashma Nuclear Power Plants unit-3 & unit-4 (C-3- & C-4) at Chashma site continues ahead of the schedule. These two units are 340 MW each and are scheduled to be connected to the National grid in 2016, one in April and the other in December. Sixth and Seventh nuclear power plants, Karachi Coastal Power Plants (K-2 and K-3) are also under construction near KANUPP.

#### **14.6 Alternative Energy Sources**

Pakistan has abundant resources of shale gas, hydel and coal etc. Thus it has potential to utilize these cheaper resources to diversify its energy mix. Pakistan Council of Renewable Energy Technologies (PCRET) and Alternative Energy Development Board (AEDB) are consistently taking a number of measures in order to promote Alternative Energy (ARE)

technologies and to attract private sector investments.

#### **Progress in Alternative Energy (ARE) technologies**

##### **i. Wind**

There are almost thirty one (31) wind power IPPs (1810 MW) holding LOIs issued by AEDB are at various stages of project development while following projects are under construction:

- 50 MW Three Gorges First Wind Farm Pakistan (Pvt.) Ltd., Jhampir Sindh
- 50 MW Foundation Wind Power-I Ltd. Khuttikun, Gharo, Sindh
- 50 MW Foundation Wind Power-II (Pvt.) Ltd., Khuttikun, Gharo, Sindh

## **ii. Solar**

On May 5, 2015, the Prime Minister inaugurated 100MW solar energy project which will generate 100 MW electricity. In Solar Energy, 33 LOIs for cumulative capacity of approximately 888.1 MW On-Grid Solar PV power plants have been issued. Four (4) companies have submitted the feasibility studies of their projects and one feasibility study is approved by AEDB. Other sponsors are at the stage of preparation of feasibility studies. Also NEPRA announced upfront tariff for solar power projects for a total of 50 MW capacity on 21st January 2014. The upfront tariff is as follows:

- North Region: 17.006 cents/kWh
- South Region: 16.306 cents/kWh

The upfront tariff has been awarded to 05 IPPs by NEPRA.

## **iii. Biomass/ Waste-to-Energy**

Following Biomass/Waste-to-Energy projects are in various stages of implementation under IPP mode:

- M/s SSJD (12 MW) Sindh
- M/s Lumen Energia (12 MW Shahkot) Punjab

- M/s Biomass Power Generation Limited (12 MW), Faisalabad
- M/s Green Sure Environmental Solutions (12 MW), Mardan, KPK

Also framework for power Co-generation 2013 (Biomass/Bagasse) was approved by Economic Coordination Committee (ECC) for bagasse/biomass based sugar industry projects. 1500-2000 MW of power is expected to be generated in next 2-3 years.

## **Conclusion**

The energy issue is still top priority of the government. The government is intended to fulfill its commitments realizing the fact that good governance and regulation will contribute to a sustainable, affordable and reliable energy system. The government is sincerely committed to add electricity generation of 10,400 megawatts to Pakistan's national grid by 2017-18 along with reduction in the cost of generation and transmission losses. Under the plan vision 2025, the government is committed in power generation to 45,000 MW with provision of uninterrupted, affordable and clean 'energy for all'. Thus the government is encouraging private investment to achieve power generation mix through development of indigenous energy resources particularly hydel, coal, shale gas, etc. to achieve zero load-shedding along with the reduction in average electricity rates.

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