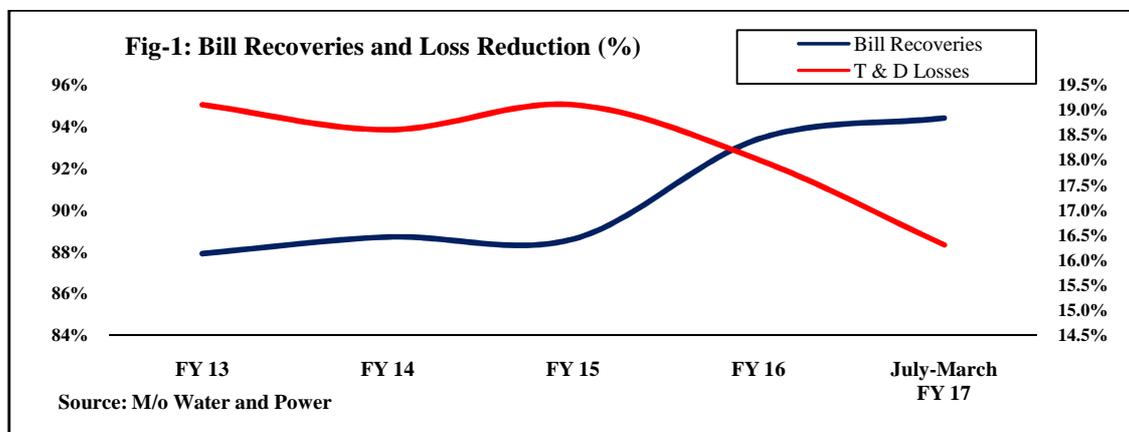


Energy

The energy sector saw major developments in its history since development of the first major power plant development. The energy crisis brewed in 2007 and was at peak during 2011-2012. Prior to the present government, circular debt, weak financial position of energy companies, liquidity crunch, falling gas production, low exploitation of indigenous coal and hydel resources, high dependence on oil/gas as power generation source and unutilized power generation capacity were some of the significant constraints which caused severe energy shortages. The present government from the very beginning, had given high priority to energy sector, thus making significant efforts on all fields ranging from immediate step to long-term plan. As immediate step, the government retired the circular debt in start of its administration. The government has also substantially brought down power subsidies and has significantly contained the accumulation of new payable arrears in the power sector by (i) improving Discos' performance, (ii) rationalizing tariffs, and (iii) reducing delays in tariff determination. The subsidy for power sector which were Rs. 464

billion (2.3 percent of GDP) in FY 2012 has been consistently reduced to Rs. 217 billion (0.7 percent of GDP) in FY 2016. All this was done while protecting the vulnerable consumer segments of the country. Further, Circular Debt Capping Plan is effectively managing the power sector financial flows, stocks and subsidy budget.

The “**National Power Policy 2013**” was approved by the CCI to address the key challenges of the power sector and to achieve the long-term vision of the power sector. The policy focused on short term, midterm and long term objectives to make the power sector sustainable. In short run, two critical issues were addressed on fast track. One issue was inefficient recovery system while the other was effective control of transmission and distribution losses. It is worth mentioning that Ministry of Water and Power has shown significant improvement in both issues. Recoveries from end consumers reached 94.40 percent during July-March FY-2017, being highest in past ten years while transmission and distribution losses declined to 16.3 percent during the period under discussion(Fig-1).



One other salient feature of the policy was creation of an energy market by moving from the single buyer model towards buyer plus and ultimately an energy exchange market. As first step of the transition an agent for the power sector entries and a clearing house was established by operationalization of Central Power Purchase Agency (CPPA-G). Thus under the executive direction from the ECC (April 30, 2015), NEPRA mandated the CPPA-G to propose the characteristics of a competitive trading bilateral contracts market (the CTBCM). As part of this assignment, the CPPA-G has reviewed several market models established in other countries, trying to extract from them the most important lessons and using this information to develop a customized model for the energy sector in the country. CPPA-G is working on development of self-sustainable power market with least intervention and subsidy support from the government of Pakistan. To increase transparency in the system, more dissemination of information is being done through public disclosure of major daily financial transactions in the power sector

In medium term, National Power Policy 2013 had also focused on reducing the basket price by introducing generation on cheaper fuels. 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. In this regard, both Private Power and Infrastructure Board (PPIB) and Alternative Energy Development Board (AEDB) are playing vital role on behalf of the Government of Pakistan in materializing government commitment of adding sustainable and affordable power generation to the national grid. Thus energy imports of liquefied natural gas (LNG) and coal along with utilization of domestic resources like construction of Thar coal mines, hydro power stations, nuclear power plants, as well as several solar and wind farms will significantly reduce the country's reliance on oil in the medium term and improve the energy mix. The list of Power Plants which started operation along with their respective fuel type is given below in Table-1:

Table-1: List of Power Plants Started Operation since 2015

2015			2016			2017		
Plant Names	Fuel Type	Installed Capacity (MW)	Plant Names	Fuel Type	Installed Capacity (MW)	Plant Names	Fuel Type	Installed Capacity (MW)
RYKML	Bagasse	30	APOLO SOLAR	Solar	100	Fatima	Coal/Bagasse	120
FWEL-I	Wind	50	Best Green Solar	Solar	100	Hamza	Bagasse	15
QUAID AZAM	Solar	100	Crest Energy Solar	Solar	100	Bhiki	Gas	760
NANDIPUR	Furnance Oil	425	Younus	Wind	50	Dawood Wind	Wind	50
SAPPHIRE	Wind	50	Metro	Wind	50	Sachal Wind	Wind	50
CHINIOT	Bagasse	62	Tapal	Wind	30	TOTAL		995
TOTAL		717	Master	Wind	50			
			Tenaga	Wind	50			
			Gul Ahmed	Wind	50			
			Chashnupp-III	Nuclear	340			
			TOTAL		919			

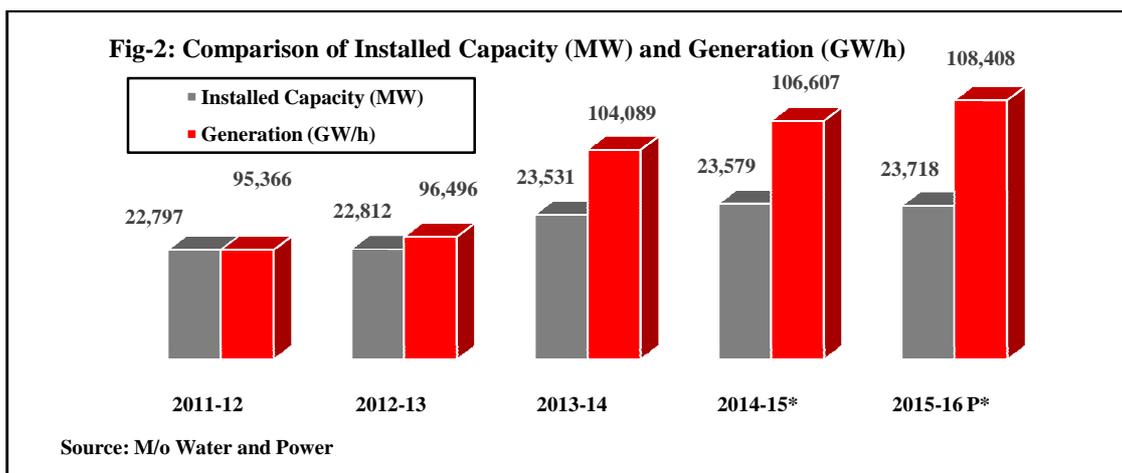
Source: Ministry of Water and Power

Various initiatives have also been started to ensure the sustainability of the reforms envisaged under the Power Policy of 2013

ranging from regulatory reforms to market development have been introduced. Another important and critical initiative is projects under

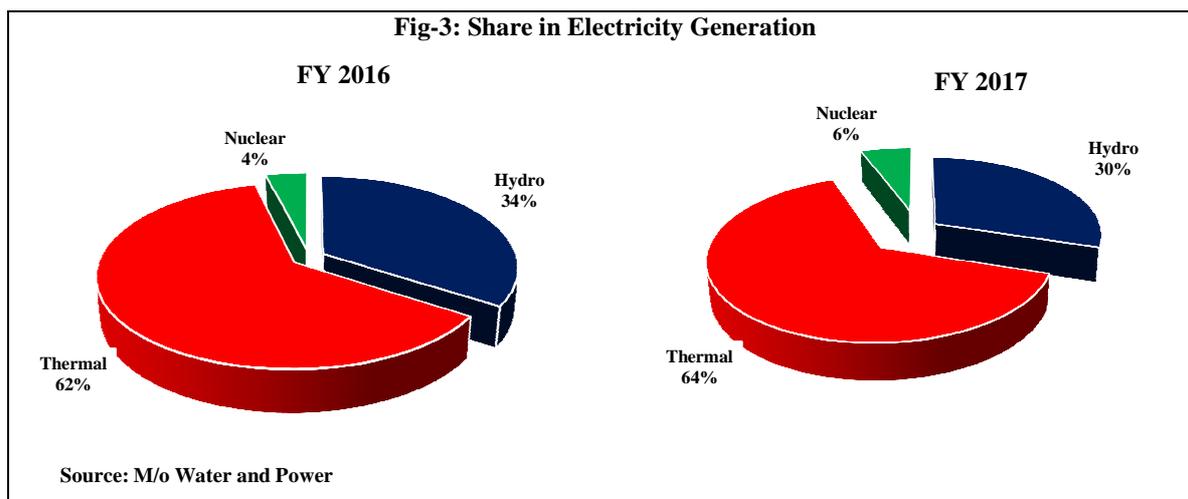
China-Pakistan Economic Corridor (CPEC). The CPEC envisages projects in energy and infrastructure, with a total financial outlay of around US\$ 46 billion. Financial outlay of Energy sector projects are estimated to be US \$ 34.74 billion while Infrastructure projects are estimated to be US \$ 13.217 billion. Energy sector projects includes power generation and transmission projects to be implemented in IPP mode while Infrastructure projects includes

projects for construction of roads, highways, railways, ports and telecommunications infrastructure, to be implemented as government to government loans/ grants. Till March 2017, twelve (12) projects have been signed in Energy Sectors with eight (8) projects in PPIB and four (4) projects in AEDB. The following figure (Fig-2) give the comparison of installed capacity (MW) and generation (GW/h):



During July-March FY 2017, although installed capacity increased to 25.1 million MW from 22.9 million MW during corresponding period last year, however there was decline in generation as it remained 85,206 GW/h during July-March

FY 2017 compared to 101,970 GW/h during July-March FY 2016. The decline in the share of hydro in electricity generation mainly occurred due to weather condition and less flow of water in rivers (Fig-3).



Regarding consumption pattern, there is no significant change in the consumption pattern

of electricity. However, during July-March FY 17, the share of household in electricity

consumption has been increased which is indicating that economy growth has switched general public to use advance technological products. The government has given priority to industrial sector thus there was uninterrupted power supply to industrial sector. However a little decline in share of industry in electricity consumption is due to the use of own captive power plants on LNG by large industrial units. The increase in share of agriculture in electricity consumption is positive sign that farmer are getting electricity for farm mechanization which will in turn have spill over effect on the economy as whole. The comparison between consumption patterns of electricity during July-March FY 2017 with corresponding period last year is shown below in Fig-4:

14.1: Performance of Pakistan Power Sector Players

14.1.1: Pakistan Atomic Energy Commission (PAEC)

Pakistan Atomic Energy Commission (PAEC) has been actively engaged in harnessing nuclear power technology. At present, four nuclear plant

i.e. Karachi Nuclear Power Plant (KANUPP) at Karachi, Chashma Nuclear Power Plant Unit-1, Unit-2 and Unit-3 (C-1, C-2 and C-3) at Chashma (Mianwali) are operating with gross capacity of 1,090 MW.

KANUPP has now completed forty five years of safe and successful operation. C-1 and C-2 are amongst the best performing power stations in the country. C-3 was formally inaugurated by the Prime Minister on December 28, 2016. Some performance parameters of these operating plants is given in the following Table-2:

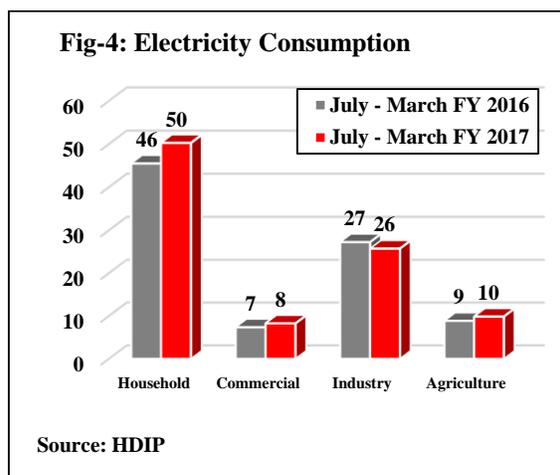


Table 2: Performance of the Operating Nuclear Power Plants in Pakistan

Plants	Capacity (MW)		Grid Connection Date	Electricity sent to Grid (million KWh)	
	Gross	Net		July 1, 2016 to March 31, 2017	Lifetime upto March 31, 2017
KANUPP	100	90	18-Oct-71	293	14,026
C-1	325	300	13-Jun-00	1,808	32,885
C-2	325	300	14-Mar-11	1,654	13,000
C-3	340	315	15-Oct-16	966	966

Source: Pakistan Atomic Energy Commission

The construction of fifth nuclear plants, Chashma Nuclear Power Plant unit-4 (C-4) at Chashma site is underway. It is expected that C-4 will be connected to the national grid in May 2017. Sixth and Seventh Nuclear Power Plants Unit-2 and Unit-3 (K-2 and K-3) are under construction near Karachi. The first concrete pours of K-2 and K-3 were performed on Aug 20, 2015 and May 31, 2016 respectively.

Pakistan Atomic Energy Commission (PAEC) is planning to intensify its activities to amplify its role towards meeting the electricity

requirements of the country. Construction of K-2/K-3 is the first major step to achieve the target of 8,800 MW nuclear capacity by 2030. PAEC is actively planning to develop additional sites to install future nuclear power plants. Sites have been identified throughout the country that are being investigated and acquired for development.

14.1.2: National Electric Power Regulatory Authority (NEPRA)

The National Electric Power Regulatory Authority (NEPRA) is responsible for

Note: Following may be read in published copies:
Date instead of Data
15-Oct-16 instead of 15-Oct-15
Unit-2 and Unit-3 instead of Unit-2 and Unit-2

regulating electric power services and safeguarding the interests of investor and consumers. The main functions of NEPRA are:

- It grants licenses for generation, transmission and distribution of electric power
- It determines tariff rates, charges and other terms and condition for supply of electric power
- Prescribes and enforces performances standard
- Addresses complaints of electricity consumers
- Give advice/recommendations to the concerned entities including the government on various power sector issues

License

During July-March FY 2017 one Distribution License and twenty three Generation Licenses with installed capacity of 6,269 MW were issued. Also six generation licenses were cancelled and two licenses were revoked during the period under consideration.

Tariff

During July-March FY 2017, NEPRA granted licenses for generation, transmission and distribution of electric power for coal, solar, LNG, small Hydropower and Bagasse based power projects. Three companies namely Dating Pakistan Karachi Power Generation (Private) Limited (imported coal), Thal Nova Power Thar (Private) Limited (local coal) and Thar Energy Limited (local coal) unconditionally accepted the Upfront Coal Tariff and the decisions in the matter were issued on Aug 11, 2016, Oct 18, 2016 and Oct 18, 2016 respectively. Two companies namely Lucky Electric Power Company and Siddiqsons Energy have shifted from imported coal to local coal. Decisions in the matter were issued on Oct 20, 2016 and Dec 1, 2016 respectively. Tariff were also issued on Aug 9, 2016 to National Power Parks Management Company for its two LNG projects located at Balloki and Haveli Bahadur Shah of 1,223 MW and 1,230 MW respectively.

Standard

The Key Performance Indicators for previous years as per the requirements of Performance Standard Generation Rules (PSGR) 2009, Performance Standard Transmission Rules (PSTR) 2005 and Performance Standard Distribution Rules (PSDR) 2005 were evaluated and comprehensive Performance Evaluation Reports of the Public Sector GENCOs, TRANSCO, DISCOs and K-Electric were uploaded on the website of NEPRA.

Efforts are being made to make amendments NEPRA Act. These amendments will

- Enhance powers of NEPRA
- Provide competitive Market Transactions,
- Provide Efficiency, Transparency and Accountability
- Clarify Policy and Regulation

141.3: Private Power and Infrastructure Board (PPIB)

The Private Power and Infrastructure Board (PPIB) is a 'One Window' facilitator to the private investors in the field of power generation on behalf of the Government of Pakistan (GOP). The main achievements are:

- Successfully managed to induct 31 independent private power projects totaling about 9071 MW.
- Attracted an investment of around US\$ 9.4 billion.
- IPPs are around 50% of the country's present installed generation capacity.
- Attracted leading international / local investors and lenders to the Pakistan Power Sector.
- Contributed in development of domestic capital markets.
- Supported economic growth and enhanced power supply.
- 84 MW New Bong Hydropower Project, the first hydro IPP in Pakistan/AJK Commissioned.

- 870 MW Suki Kinari, Financing Agreements with the Lenders Signed.
- 1320 MW PQEPCL started construction activities.
- 1320 MW Sahiwal Power Project started construction activities at site from its equity.
- 102 MW Gulpur Hydropower Project, Ground Breaking Ceremony held on 15-October-2015.
- 660 MW Engro Powergen Thar Limited started construction activities.

141.4: Alternative Energy Development Board (AEDB)

To diversify energy mix and ensure energy security, the Government of Pakistan has mandated Alternative Energy Development Board (AEDB) to act as a central agency for development and promotion of Alternative & Renewable Energy (ARE) technologies in the country and to facilitate the private sector investment in this sector. The current and expected status of Renewable Energy power generation projects are as under:

Wind Power Projects

Twenty Four (28) wind power projects having a cumulative capacity of 1397.6 MW are at different stages of development / operation. In 2016, five wind power projects by Yunus Energy Ltd (50 MW), Metro Power Company Ltd (50 MW), Tapal Wind Energy Private Ltd (30 MW), Master Wind Energy Private Ltd (528 MW) and Gul Wind Energy Ltd (50 MW) are situated at Jhampir while Tenaga Generasi Ltd (49.5 MW) is situated at Gharo. Till now, twelve wind power projects of 590.5 MW cumulative capacity have achieved commercial operation and are supplying electricity to National Grid. Eight (08) projects with a cumulative capacity of 445 MW have achieved financial close and are under construction and expected to be completed within 2018. These are Hydro China Dawood Power Private Ltd (49.5 MW), Sachal Energy Development Private Ltd (49.5 MW), United Energy Pakistan Private Ltd (99 MW), Jhampir Wind Power

Limited (49.6 MW), Hawa Energy Pvt. Limited (50 MW), Hartford Alternative Energy Private Limited (49.3 MW), Three Gorges Second Wind Farm Private Ltd (49.5 MW), Three Gorges Third Wind Farm Private Ltd (49.5 MW). Further, four (04) wind power projects with a cumulative capacity of **197.1 MW** have been issued LOS and are expected to achieve Financial Closing during 2017.

Solar Power Projects

Four solar projects (100 MW each) named Quaid-e-Azam Solar Park, Bahawalpur with different IPPs with cumulative capacity of 400 MW are operational. Out of four, three were completed in Aug 2016. Seven IPPs with a cumulative capacity of 72.52 MW have obtained Letter of Support (LOS) from AEDB and are in the process of achieving Financial Closing of their projects while seventeen solar power projects of 484 MW cumulative capacity have obtained Letter of Intent (LOI) from AEDB and are at different stages of project development and will be completed during 2018-19.

Biomass / Waste-To-Energy

In order to tap the potential of electricity generation from the sugar mills in Pakistan, the Government of Pakistan on recommendation of AEDB announced the Framework for Power Co-Generation 2013 (Baggase/Biomass) in 2013. Twenty Four (24) companies / sugar mills of 817.5 MW cumulative capacity have been issued Letter of Intent (LOI) from AEDB and are at different stages of project development and will be completed during 2018-19.

14.2: Oil (Petroleum Product)

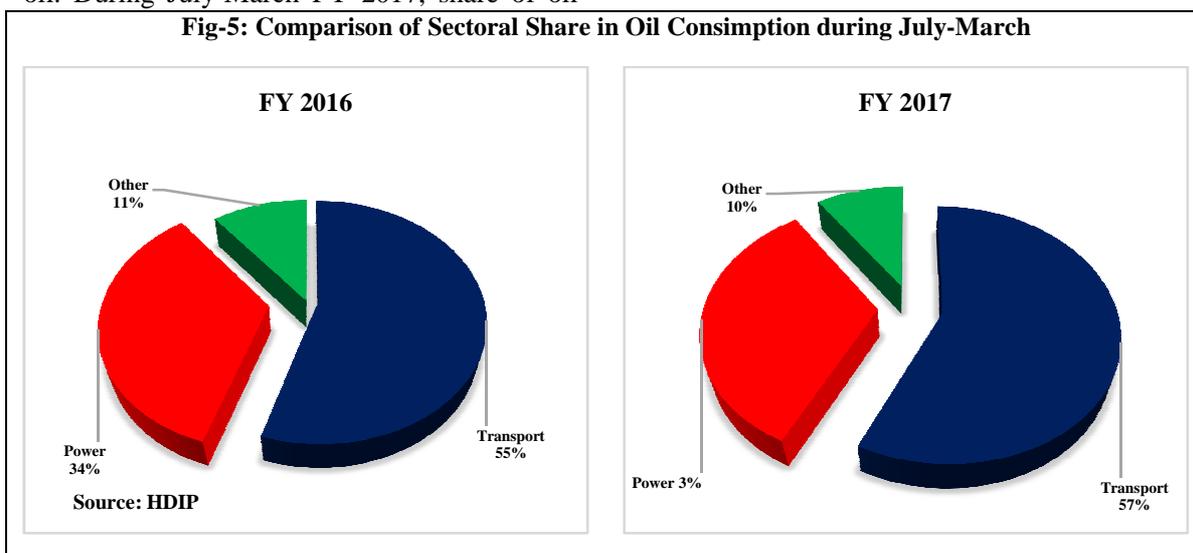
Pakistan mainly depends upon oil and gas resources to fulfil energy requirements. The domestic production of crude oil remained 24.2 million barrels during July-March FY 2017 compared to 24.0 million barrels during the corresponding period last year. Indigenous resources of oil are not enough to quench energy thirst of a growing economy. As a result Pakistan has to import large quantity of oil and

oil based products from Middle East countries especially from Saudi Arabia. The quantity of crude oil imported remained 5.9 million tones with value of US \$ 1.84 billion during July-March FY 2017 compared to the quantity 4.2 million tones with value US \$ 183 billion during the same period last year. Thus the low international prices of oil helped in saving foreign exchange due to lower import bill.

consumption in transport increased to 57 from 55 percent during the same period last year while share of oil consumption in power remained 33 percent during July-March FY 2017 which was 34 percent during the same period last year mainly because some of inefficient thermal plants remained closed due to overhauling during the period under discussion. Also gas being the cheaper source, there is continuous shift of power sector from oil to gas as shown in Fig-5.

Transport and power are the two major users of oil. During July-March FY 2017, share of oil

Fig-5: Comparison of Sectoral Share in Oil Consumption during July-March



To enhance oil and gas reserves, the government is trying to attract companies to undertake new exploration and production activities. Thus, it is expected the domestic production of oil will improve by new wells and also with exploration of unconventional oil and gas resource.

14.3: Natural Gas

Natural Gas is a clean, safe, efficient and environment friendly fuel. It contributes about 46% of the total primary energy supply mix in the country. Pakistan has an extensive gas network of over 12,202 Km Transmission 119,736 KM Distribution and 32,823 Services gas pipelines to cater the requirement of more than 8.4 Million consumers across the country by providing about 4 Billion Cubic Feet per day natural gas. Government of Pakistan is pursuing its policies for enhancing indigenous gas production as well as imported gas to meet the

increasing demand of energy in the country. During July – March FY 2017 the LNG imported remained 129,092,714 mmbtu compared to 62,373,272 mmbtu during same period last year. The average natural gas consumption was about 3,654 Million Cubic Feet per day (MMCFD) including 410 MMCFD volume of RLNG during July 2016 to February. During July 2016 to February 2017, the two Gas utility companies (SNGPL & SSGCL) have laid 814 Km Gas Transmission network, 4,153 Km Distribution and 1,162 Km Services lines and connected 104 villages/towns to gas network. During this period, the gas utility companies have invested Rs. 17,925 Million on Transmission Projects, Rs. 11,183 Million on Distribution Projects and Rs. 14,925 Million on other projects bringing total investment to about Rs. 44,033 Million. During this period, 360,824 additional gas connections including 360,465 Domestic, 339 Commercial

and 20 Industrial were provided across the country. It is expected that Gas will be supplied to approximately 414,723 new consumers during the fiscal year 2017-18. Gas utility companies have planned to invest Rs. 12,702 Million on Transmission Projects, Rs 43,045 Million on Distribution Projects and Rs. 8,462 Million on other projects bringing the total investment of Rs. 64,209 Million during the fiscal year 2017-18.

14.3.1: Compressed Natural Gas (CNG)

Government of Pakistan initially encouraged use of Compressed Natural Gas (CNG) as an alternate fuel for auto-motives in order to control environmental degradation, reduce foreign exchange expenditure on import of liquid fuel and generate employment. Pursuant to government’s investor friendly initiatives, Pakistan has become the world leading CNG user country with more than 3 Million NGVs (Natural Gas Vehicles) plying on the roads. Currently more than 3,416 CNG stations have the CNG marketing licenses in the country. However, keeping in view the mushroom growth of CNG stations in the country vis-à-vis depletion of natural gas reserves, Government has imposed a ban on establishment of new CNG stations in the country w.e.f. 07.02.2008. For sustainable growth of this sector,

Government has approved provision of RLNG to this sector with fiscal incentives of GIDC at the rate of zero and Sales Tax at the rate of five percent.

14.3.2: Liquefied Natural Gas

The first LNG re-gasification Terminal was commissioned on 27th March 2015 in a record time of less than 11 months. Since March 2015, 83 LNG Cargoes have been handled at the LNG Terminal. The Terminal has re-gasification capacity of 600 MMCFD. Moreover, 2nd LNG Terminal has also been awarded to Pakistan Gas Port Company Limited (PGPCL) by the Government Company i.e. Pakistan LNG Terminal Limited (PLTL). The Terminal is expected to be completed by 3rd quarter, 2017. For this purpose Pakistan LNG Limited (PLL) is in a process to arrange 4.5 MTPA for said terminal.

At present one LNG Terminal is in operation and is handling 4.5 MTPA of LNG which equals 600 MMCFD of RLNG. With the establishment of 2nd LNG Terminal LNG import volumes may reach 9 MTPA i.e. 1200 MMCFD of RLNG. The Average Sector-wise Natural Gas Consumption in Million Cubic Feet per Day (MMCFD) is given in Table-3

Table-3: The Average Sector-wise Natural Gas Consumption in Million Cubic Feet per Day (MMCFD)

Sector	For the Period July 1, 2015 To Feb 29, 2016			For the Period July 1, 2016 To Feb 28, 2017		
	Gas Consumption in MMCFD	RLNG	Total	Gas Consumption in MMCFD	RLNG	Total
Power	961	143	1,104	980	116	1,096
Domestic	777	0	777	801	-	801
Commercial	92	0	92	89	-	89
Transport (CNG)	155	17	172	150	43	193
Fertilizer	633	0	633	611	64	675
General Industry	594	15	609	613	187	800
Total	3,212	175	3,387	3,244	410	3,654

Source: Ministry of Petroleum and Natural Resources

14.4: Coal

Constitutionally, minerals other than mineral oil, natural gas & nuclear minerals are Provincial subject. Executive authority for coal exploration and development and regulation of coal sector rests with the Provinces. Federal Government is mandated with geological surveys (that help

identification of potential mineral bearing areas), national policies/plans formulation and coordination at national and international levels. Federal Government has been playing facilitation role for development of coal sector as per its mandate. Since its inception, Geological Survey of Pakistan (GSP) [attached department of Ministry of Petroleum & Natural Resources] has

been working for exploration of mineral resources including coal as a routine job on regular basis. So far, nineteen coalfields have been discovered in the country with total coal resource potential estimated to exceed 186 billion tons; of which more than 185 billion tons are located in Sindh Province and over 175 billion tons in Thar Coal-field alone.

Provincial Governments have granted more than 1,100 coal mining concessions to public and private sector companies, who carry out exploration and mining operations in the licensed/leased area. Two federally controlled organizations; Pakistan Mineral Development Corporation (PMDC) and Lakhra Coal Development Company [joint venture of PMDC, WAPDA & Government of Sindh] are engaged in extraction of coal in Sindh and Balochistan Provinces, producing about 558,000 tons and 235,000 tons of coal per annum (for 2015-16), respectively. These two companies also supply coal to Lakhra Power Plant of WAPDA.

Annual domestic coal production is around 3.5 million tons. About 4-5 million tons of coal is imported per annum to meet the supply and demand gap of coal. Coal is imported mainly from Afghanistan, Australia, Canada, Indonesia, South Africa & U.S.A. and consumed in steel and cement manufacturing and power generation units.

Thar Coal development is accorded strategic importance by the Federal & Provincial Governments, which are working together to provide enabling environment and robust infrastructure required for Thar Coal development; roads, water supply, waste water drainage channel, airport and transmission line etc. Government of Sindh has established a one-stop organization/dedicated decision making body

namely “Thar Coal & Energy Board (TCEB)” under the Chief Executive of the Province with representation from Federal & Provincial Governments to facilitate fast track development of Thar coal. Government of Sindh encourages projects of open-pit mining, coal based power generation, underground coal gasification, surface gasification, coal-to-liquid, briquetting etc. Many blocks of Thar Coal-field have already been allotted/offered to foreign/local investors for integrated mining & power generation projects. Some of Thar Coal Mining and Power Projects are enlisted for China-Pakistan Economic Corridor. The commissioning of Thar projects will usher into a new era of energy security for the country and prosperity for the people of Pakistan.

All power generation projects including those based on coal (indigenous or imported) are dealt by the Ministry of Water & Power and Private Power & Infrastructure Board (PPIB). As per PPIB six power generation projects based on indigenous coal with cumulative capacity of 4,290 MW and seven power projects based on imported coal with cumulative capacity of 5,201 MW are presently under process at various stages to be completed between 2017 - 2021.

Conclusion

The government is making all efforts to increase and diversify its energy supply with long-term vision of the power sector to meet Pakistan’s energy needs in a sustainable manner. Pakistan has embarked on a wide-ranging initiatives. Till now government remained successful in attracting foreign companies to undertake new exploration and production activities. The China-Pakistan Economic Corridor (CPEC) will also become a source of coordination for developing energy related projects through indigenous energy resources such as coal, hydro and renewable sources.