

15

Energy

The global economic recovery from a downturn raised important question in many parts of the world regarding energy security including diversification, generation and its efficient allocation. The future of economic development hinges upon energy security and reframing of public policy for effective policy interventions will set the standard for shaping out the future of energy demand.

The global demand for different fuel sources is changing the overall energy mix to support cost effective support to economic growth. Notwithstanding falling share, oil is likely to remain the dominant fuel source in primary energy mix till 2035. It will remain sensitive to public policy actions to curb rising demand and emissions standards. The natural gas will play instrumental role in meeting the world energy needs for at least next two and half decades. The demand for energy put pressure on people around the world to explore new vistas for energy and think beyond the available sources of energy. Exploring new renewable energy sources has become more important to lead the world towards a more secure, reliable and sustainable energy path.

Energy is the key determinant of economic development and prosperity of society. It also provides an impetus for keeping sustainability in economic growth. Pakistan, which falls in the middle income group, has been facing an unprecedented energy crisis for past few years as the demand and supply gap widens. Its current energy demand far exceeds its indigenous supplies fostering dependency on the imported oil that put substantial burdens on the economy. Recent unrests in Middle East and North Africa (MENA) and political turmoil put up an upward pressure on the international oil prices with implications for

Pakistan's burgeoning oil import bill, and boosting cost structure in power generation sector leading to severe domestic shortage of electricity and gas.

The energy availability has remained main impediment to economic growth. The growth prospects of the economy in 2010-11 were constrained by the availability of energy. In order to ensure energy supply, government is pursuing policies of increasing domestic energy supplies by attracting foreign investment, diversifying imports to include natural gas, coal and electricity. It encourages attainment of optimal energy mix through fuel substitution by promoting energy efficiency and renewable energy and interregional co-operation.

The circular debt represents inefficiency in electricity sector and has increased to 1.5 times as compare to last year. Due to high energy prices, shift from expensive imported fuel (oil) to indigenously available alternative fuel (gas) has been seen, creating huge gap between demand and supply and has compelled government to tackle this with load management strategy along with increase in the prices.

Pakistan's Energy Sector

15.1 Energy Consumption

Pakistan's total energy consumption stood at 63.1 million tons of oil equivalent in 2009-10. The energy mix comprised of gas, oil, electricity, coal and Liquid Petroleum Gas (LPG) with different levels of shares. The share of gas consumption stood at 43.9 percent in total energy mix of country followed by oil (27.9 percent), electricity (15.6 percent), coal (11 percent) and LPG (1.5 percent). Furthermore, this energy consumption mix has witnessed significant transformation since

2004-05 [See Fig-15.1]. As a result, the major consumption source of natural gas witnessed an increase of 7.7 percentage points during 2009-10 compared to 2004-05 while share of oil consumption declined by 8.6 percentage points during the period under review. These changes in consumption of gas and oil mainly owed to shift from imported expensive fuel (oil) to relatively cheaper source of gas. Furthermore, the share of coal and LNG consumption increased slightly and that of electricity remains the same as it was in 2004-05. The shift of energy consumption towards indigenous resources saved the considerable amount of foreign reserve during the period.

During the period 2001-02 to 2009-10, the consumption of petroleum products has increased by an average of 1.3 percent per annum. The consumption of gas, electricity and coal has increased at an average of 6 percent, 4.9 percent and 9.1 percent per annum (see Table 15.1). This long term trend suggests that composition of

annual energy consumption is shifting from petroleum products to other energy sources. Energy consumption of petroleum and gas has witnessed a negative growth during July-March 2010-11, while electricity consumption increased by 2.8 percent and that of coal increased substantially by 10.29 percent during the period under review.

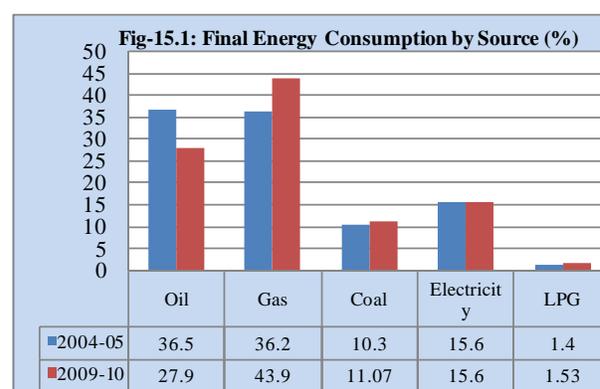


Table 15.1: Annual Energy Consumption

Fiscal Year	Petroleum Products		Gas		Electricity		Coal	
	Tones (000)	Change (%)	(mmcft)	Change (%)	(Gwh)	Change (%)	M.T* (000)	Change (%)
2001-02	16,960	-3.9	824,604	7.4	50,622	4.2	4,408.60	9.0
2002-03	16,452	-3.0	872,264	5.8	52,656	4.0	4,889.90	10.9
2003-04	13,421	-18.4	1,051,418	20.5	57,491	9.2	6,064.50	24.0
2004-05	14,671	9.3	1,161,043	10.4	61,327	6.7	7,893.80	30.2
2005-06	14,627	-0.3	1,223,385	5.4	67,603	10.2	7,714.00	-2.3
2006-07	16,847	15.2	1,221,994	-0.1	72,712	7.6	7,894.10	2.3
2007-08	18,080	7.3	1,275,212	4.4	73,400	0.9	10,110.60	28.1
2008-09	17,911	-0.9	1,269,433	-0.5	70,371	-4.1	8,390	-17.0
2009-10	19,132	6.8	1,277,821	0.66	74,348	5.65	8,139	-2.99
Avg. 9 years		1.3		6.0		4.9		9.1
July-March								
2009-10	13,937	-	959,475	-	54,653	-	5,304	-
2010-11 (e)	13,802	-0.97	939,960	-2.03	56,194	2.8	5,850	10.29

e: estimated for coal

*Million Ton

Source: Hydrocarbon Development Institute of Pakistan

15.2 Component Wise Performance of Energy

15.2-a Petroleum Product

During the first three quarters of current fiscal year i.e. July-March 2010-11, the overall consumption of petroleum products decreased by

0.97 percent against the same period last year. The consumption of petroleum products declined in household, agriculture and power sectors by 1.5, 18.2 and 5.7 percent, respectively (see Table 15.2). The consumption of petroleum products in industrial and government sectors have increased by 22.5 and 19.7 percent, respectively.

Table 15.2: Consumption of Petroleum Products (000 tones) (Percentage Change)

Year	House holds	Change (%)	Industry	Change (%)	Agriculture	Change (%)	Transport	Change (%)	Power	Change (%)	Other Govt.	Change (%)	Total
2001-02	335	-25.7	1,612	-16.2	226	-11.4	8,019	-1.7	6,305	-2.8	464	24.7	16,960
2002-03	283	-15.5	1,604	-0.5	197	-12.8	8,082	0.8	6,020	-4.5	266	-42.7	16,452
2003-04	231	-18.4	1,493	-6.9	184	-6.6	8,464	4.7	2,740	-54.5	309	16.2	13,421
2004-05	193	-16.5	1,542	3.3	142	-22.8	9,025	6.6	3,452	26.0	317	2.6	14,671
2005-06	129	-33.2	1,682	9.1	82	-42.3	8,157	-9.6	4,219	22.2	359	13.2	14,627
2006-07	106	-17.8	1,596	-5.1	97	18.3	7,982	-2.1	6,741	59.8	325	-9.5	16,847
2007-08	121	14.1	1,071	-32.9	109	12.7	9,384	17.6	7,084	5.1	311	-4.5	18,080
2008-09	97	-19.5	9,69	-9.5	70	-36.2	8,837	-5.8	7,750	6.9	367	18.2	17,911
2009-10	90	-7.5	985	1.6	58	-16.9	8,861	0.3	8,814	16.4	323	-12.0	19,131
July-March													
2009-10	68	-	750	-	44	-	6,580	-	6,271	-	223	-	13,936
2010-11	67	-1.5	919	22.5	36	-18.2	6,599	0.3	5,913	-5.7	267	19.7	13,801

Source: Hydrocarbon Development Institute of Pakistan

15.2-b Natural Gas

Consumption pattern of gas by different users since 2001-02 is presented in Table 15.3. The sectoral consumption of gas indicates that the commercial, cement, fertilizer, power and industrial sectors have experienced decline in consumption of gas during July-March 2010-11 against the same period of last year. Only two sectors, household and transport have posted positive growth in gas consumption. Gas consumption in the transport sector has increased by 14.3 percent, mainly due to a shift from imported fuel oil to relatively cheaper source of

gas during July-March 2010-11 followed by the household sector with almost negligible growth rate of 0.75 percent. The cement sector has shown major decline of 64.7 percent mainly because of the fact that the cement sector has almost switched over to coal fire system for its production activities. Gas consumption in industrial, commercial and fertilizer sectors have declined by 9.2, 5.0 and 2.7 percent, respectively during first nine months of the current fiscal year. Whereas, the power sector consumption decreased marginally by 0.2 percent during the period under review.

Table 15.3: Consumption of Gas (Billion cft) (Percent change)

Year	House hold	Change (%)	Commercial	Change (%)	Cement	Change (%)	Fertilizer	Change (%)	Power	Change (%)	Industrial	Change (%)	Transport (CNG) mmcft	Change (%)
2001-02	144	2.1	22	4.8	7	0	178	1.7	315	12.1	151	8.6	7,369	66.6
2002-03	154	6.9	23	4.5	3	-57.1	181	1.7	336	6.7	165	9.3	11,320	53.6
2003-04	155	0.6	24	4.3	8	166.7	185	2.2	470	39.9	193	17.0	15,858	40.1
2004-05	172	11.0	27	12.5	13	62.5	190	2.7	507	7.9	226	17.1	24,443	54.1
2005-06	171	-0.6	29	7.4	15	15.4	198	4.2	492	-3.0	279	23.5	38,885	59.1
2006-07	186	8.8	31	6.9	15	0.0	194	-2.0	434	-11.8	307	10.0	56,446	45.2
2007-08	204	9.7	34	9.4	13	-15.1	200	3.1	430	-1.0	323	5.1	72,018	27.6
2008-09	214.1	4.9	35.5	4.8	7.3	-42.6	201.1	0.5	404.1	-6.0	319.0	-1.1	88,236	22.5
2009-10	219.3	2.4	36.95	4.1	1.94	-73.4	220.1	9.4	366.9	-9.2	333.5	4.5	99,002	12.2
July-March														
2009-10	184.5	-	28.6	-	1.7	-	162.5	-	264.8	-	246.1	-	71,225	-
2010-11(p)	185.9	0.75	27.2	-5.0	0.6	-64.7	166.9	-2.7	264.3	-0.2	223.6	-9.2	81,400	14.3

P: Provisional

Source: Hydrocarbon Development Institute of Pakistan

15.2-c Electricity

On average, electricity consumption increased at the rate of 5.2 percent per annum during the period 2001-02 to 2009-10. Overall the electricity consumption increased by 2.8 percent during July-March 2010-11 against the comparable period last year. The reason for the modest increase in the

consumption of electricity indicates some revival in economic activities as can be seen in Table 15.4 that the increase mainly emanates from industrial sector where an increase of 7.3 percent, has been witnessed. With the exception of agriculture and street lighting sectors, all remaining sectors witnessed a positive growth during July-March 2010-11.

Table 15.4: Consumption of Electricity by Sectors (Percentage Change)

Year	Trac-tion	House hold		Commercial		Industrial		Agriculture		Street Light		Other Govt.		Total
		GWH House hold	Chang e (%)	GWH (000)	Chang e (%)	GWH (000)	Chang e (%)	GWH (000)	Chang e (%)	Gwh	Chang e (%)	GWH (000)	Chang e (%)	
2001-02	11	23.2	1.8	3	7.1	15.1	5.6	5.6	14.3	212	-0.5	3.5	0	50,622
2002-03	10	23.7	2.2	3.2	6.7	16.2	7.3	6	7.1	244	15.1	3.4	-2.9	52,656
2003-04	9	25.8	8.9	3.7	15.6	17.4	7.4	6.7	11.7	262	7.4	3.7	8.8	57,491
2004-05	12	27.6	7.0	4.1	10.8	18.6	6.9	7	4.5	305	16.4	3.8	2.7	61,327
2005-06	13	30.7	11.2	4.7	14.6	19.8	6.5	7.9	12.9	353	15.7	4	5.3	67,603
2006-07	12	33.3	8.5	5.4	14.9	21.1	6.6	8.2	3.8	387	9.6	4.4	10.0	72,712
2007-08	8	33.7	1.2	5.6	3.7	20.7	-1.9	8.5	3.7	415	7.2	4.5	2.3	73,400
2008-09	5	32.3	-4.2	5.3	-6.2	19.3	-6.6	8.8	3.5	430	3.6	4.3	-5.0	70,371
2009-10	2	34.2	5.9	5.6	5.7	19.8	2.6	9.7	10.2	458	6.51	4.5	4.7	74,348
July-March														
2009-10	2	24.9	-	4.1	-	14.7	-	7.2	-	364	-	3.3	-	54,653
2010-11	-	25.8	3.8	4.2	1.9	15.8	7.3	6.6	-9.0	321	-11.8	3.5	4.1	56,194

Source: Hydrocarbon Development Institute of Pakistan

The electricity sector remained plagued with inter-corporate circular debt which constricted growth in the power sector as a whole and impacted oil and gas sector to some extent. Various organizations in the energy sector had Rs.258.5 billion stuck up in inter-corporate circular debt till April-2011 compared to Rs 103.9 billion in April 2009 indicating an increase of almost 147 percent. Receivables amounted to Rs.775.2 billion and payables stood at Rs 516.7 billion.

Out of Rs. 258.5 billion, net receivables of PSO stood at Rs51.0 billion, SSGCL Rs.7.1 billion, PEPCO Rs.2.7 billion, OGDCL Rs.115.5 billion, PARCO Rs. 37.5 billion, KESC Rs.27.5 billion, GHPL Rs. 9.6 billion and PPL Rs 22.2 billion. On the other hand, SNGPL and KW&SB have net payables of Rs 13.4 billion and Rs 1.2 billion, respectively. The position of different organizations regarding circular debt is shown in Table 15.5.

Table 15.5 Inter Corporate Circular Debt as on 30th April 2011 (Rs. Billion)

Organization	Receivables	Payables	Net Position July-April 2010-11	Net Position July-April 2009-10
PSO	149.4	98.4	51.0	30.4
SSGCL	50.6	43.5	7.1	(1.0)
SNGPL	11.4	24.8	(13.4)	(8.5)
PEPCO	304.2	301.5	2.7	(39.7)
OGDCL	115.6	0.1	115.5	79.7
PARCO	37.5	0	37.5	29.9
KESC	67.6	40.1	27.5	(23.6)
GHPL	9.6	0	9.6	10.6
PPL	22.2	0	22.2	25.9
KW&SB	7.0	8.2	(1.2)	0.2
GRAND TOTAL	775.2	516.7	258.5	103.9

Source: CF Wing, Finance Division

15.2-d Coal

Pakistan has huge coal resources estimated at over 185 billion tones, including 175 billion tones, identified at Thar coal fields in Sindh province. Pakistan's coal generally ranks from lignite to sub-bituminous. About 56.5 percent of total coal in the country has been consumed by the brick

kilns industry whereas 42.7 percent by cement industry during the period July-March 2010-11. The coal consumption shares of brick kilns decreased by 2.4 percent and that of cement industry increased by 3.1 percent. The percentage share of power sector declines by 1.24 percent during July-March 2010-11 compared against the same period last year (see Table 15.6).

Table 15.6: Consumption of Coal (Percentage Share)

Year	Household	Power	Brick Kilns	Cement
2001-02	0	5.7	58.5	35.9
2002-03	0	4.2	53.3	42.5
2003-04	0	3	42.7	54.2
2004-05	-	2.3	49.5	48.2
2005-06	-	1.9	54.7	43.3
2006-07	0	2.1	41.5	56.4
2007-08	0	1.6	37.2	61.2
2008-09	0	1.3	39.0	45.3
2009-10	0	1.54	36.9	61.5
Jul-March				
2009-10(e)	0.0	2.0	58.9	39.6
2010-11(e)	0.0	0.76	56.5	42.7

- not available
e: Estimated

Source: Ministry of Petroleum Natural Resource
Hydrocarbon Development Institute of Pakistan

15.3 Supply of Energy

The primary energy supply has increased by 1.9 percent during July-March 2010-11 as compared

to corresponding period last year. The per capita availability of energy remained the same during the period under review (see Table 15.7).

Table 15.7: Primary Energy Supply and Per Capita Availability

Year	Energy Supply		Per Capita	
	Million TOE	Change (%)	Availability (TOE)	Change (%)
2001-02	45.07	1.5	0.32	-1.25
2002-03	47.06	4.41	0.32	2.86
2003-04	50.85	8.06	0.34	5.25
2004-05	55.58	9.26	0.36	6.45
2005-06	58.06	4.18	0.37	2.48
2006-07	60.62	4.33	0.38	2.61
2007-08	62.92	3.78	0.39	2.86
2008-09	62.55	-0.58	0.38	-2.27
2009-10	63.09	0.86	0.36	-5.26
Jul-Mar				
2009-10	47.10	-	0.271	-
2010-11(e)	48.01(e)	1.93	0.271	0.00

e : estimated

Source: Hydrocarbon Development Institute of Pakistan.

TOE- Tons of Oil Equivalent

Analysis of the composition of final energy supplies to the country suggests that supply of coal during 2001-02 to 2009-10 grew by an average rate of 9.3 percent per annum followed by gas, electricity, crude oil and petroleum products with per annum growth rates of 6.3 percent, 3.5 percent, 2.9 percent and 1.1 percent, respectively.

Supplies of coal and electricity increased by 11.3 and 8.3 percent, respectively, whereas, the supply of gas showed a slight increase of 0.1 percent during the period under review. The remaining components experienced decline in their supplies during July-March 2010-11 over the corresponding period last year (see Table 15.8)

Table 15.8: Composition of Final Energy Supplies

Year	Crude Oil		Gas		Petroleum Products		Coal		Electricity	
	Million Barrels	Change (%)	(bcf)*	Change (%)	(Mln.T.)	Change (%)	(Mln.T)	Change (%)	(000Gwh)(a)	Change (%)
2001-02	75.1	2.1	923.8	7.7	18.7	1.6	4.4	7.3	72.4	6.3
2002-03	76	1.2	992.6	7.4	18	-3.7	4.9	11.4	75.7	4.6
2003-04	80.3	5.7	1,202.70	21.2	15.4	-14.4	6	22.4	80.9	6.9
2004-05	85.3	6.2	1,344.90	11.8	16.8	9.1	7.9	31.7	85.7	5.9
2005-06	87.5	2.6	1,400.00	4.1	17	1.2	7.7	-2.5	93.8	9.5
2006-07	85.3	-2.5	1413.6	1.0	18.6	9.7	7.9	2.5	98.4	4.9
2007-08	90.5	6.1	1454.2	2.9	19.8	6.1	10.1	28.1	95.9	-2.6
2008-09	86.1	4.9	1460.7	0.44	19.8	0	8.4	-16.8	91.8	-4.3
2009-10	86.1	0	1460.7	0	19.8	0	8.4	0	95.6	0
Avg. 9 Year Jul-March		2.9		6.3		1.1		9.3		3.5
2009-10(e)	38.8	-	1109.3	-	16.3	-	5.3(e)	-	63.7(p)	-
2010-11(e)	35.6	-8.2	1109.9	0.1	15.8	-3.1	5.9(e)	11.32	69.0	8.32

e: Estimated and p:provisional

a: Giga Watt hour

**: Billion cubic feet*

Source: Hydrocarbon Development Institute of Pakistan

15.3-a Crude Oil

The balance recoverable reserves of crude oil in the country have been estimated at 280.647 million barrels. The average crude oil production per day has increased to 65,996.50 barrels during July-March 2010-11 from 65245.69 barrels per day during the same period last year. The overall production has increased to 18.08 million barrels during July-March 2010-11 from 17.88 million barrels during the corresponding period last year showing an increase of 1.15 percent. During the period under review, 34,762 (53 percent) barrels per day were produced in northern region and

31,234 (47 percent) barrels per day in southern region, as against 27,659 (42 percent) barrels and 37,586 (58 percent) barrels produced per day in North and South region respectively compared against the same period last year. During July-March 2010-11, production of crude oil has increased by 25.68 percent from northern region whereas production decreased in southern region by 16.90 percent, as compared to same period last year. The company wise production of crude oil during July-March 2010-11 and corresponding period of the last fiscal year is given in Table 15.9.

Table 15.9: Production of Crude Oil (BPOD)

Region	2009-10	July-March 2009-10	July-March 2010-11	Change (%)
Northern Region	28,471.29	27,659.17	34,762.28	25.68
Dewan	112.52	102.02	211.21	107.02
OGDCL	15,327.11	15,095.17	18,236.27	20.81
OPII	591.55	532.93	658.18	23.50
POL	3,999.66	4,079.64	3,401.00	-16.63
PPL	4,748.64	4,635.96	4,925.16	6.24
MOL	3,691.81	3,213.47	7,330.47	128.12

Region	2009-10	July-March 2009-10	July-March 2010-11	Change (%)
Southern Region	36,477.06	37,586.52	31,234.22	-16.90
OGDCL	21,029.06	21,683.20	18,615.34	-14.15
BP (Pakistan)	11,487.48	12,001.83	8,625.29	-28.13
PPL	584.94	411.86	1,233.66	199.53
BHP	2,841.99	2,949.74	2,228.26	24.46
OMV	63.33	70.05	54.28	-22.51
ENI	340.63	340.87	355.34	4.25
MGCL	2.19	2.28	7.30	220.16
Petronas	127.43	126.68	114.15	-9.89
Total:	64,948.35	65,245.69	65,996.50	1.15

Source: Ministry of Petroleum & Natural Resources

15.3-b Natural Gas

The importance of natural gas to the country has been increasing rapidly. Government is making efforts towards enhancing gas production in order to meet the increasing demand of energy in the country. The balance recoverable natural gas reserves have been estimated at 26.62 Trillion Cubic Feet. The average production of natural gas per day stood at 4050.84 million cubic feet during July-March 2010-11, as compared to 4,048.76 million cubic feet over the same period last year. The overall production of gas has increased to 1,109,930.16 million cubic feet during July-March

2010-11 as compared to 1,109,360.24 million cubic feet in the same period last year, showing an increase of 0.05 percent. Natural gas is used in general industry to prepare consumer items, to produce cement and to generate electricity. In the form of compressed natural gas (CNG), it is used in transport sector and most importantly to manufacture fertilizer to boost the agriculture sector. Currently twenty eight (28) private and public sector companies are engaged in oil and gas exploration & production activities. Company wise total natural gas production is given in Table 15.10.

Table- 15.10: Production of Natural Gas (mmcf/d)

Company	2009-10	July-March	July-March	Change (%)
		(2009-10)	(2010-11)	
BHP	506.98	524.11	399.77	-23.72
ENI	441.37	434.11	486.89	12.16
Dewan	17.56	16.12	28.88	79.13
MGCL	495.05	494.32	502.02	1.56
OGDCL	860.77	872.10	853.74	-2.11
OMV	441.33	439.13	446.43	1.66
OPII	9.60	7.54	13.01	72.48
POL	24.37	24.55	21.46	-12.57
PPL	792.90	794.99	765.58	-3.70
Tullow	1.53	1.61	0.50	-68.88
PEL	28.74	28.19	27.57	-2.19
BP	247.28	246.53	189.61	-23.09
Petronas	16.06	16.26	13.52	-16.88
MOL	179.04	149.20	301.85	102.31
Total:	4,062.60	4,048.76	4,050.84	0.05

Source: Ministry of Petroleum & Natural Resources

(i). Liquefied Petroleum Gas (LPG):

Liquefied Petroleum Gas (LPG) contributes about 0.6 percent of the country's total primary energy supply mix. The main objective to enhance the use of LPG is to stop deforestation in the areas where the supply of natural gas is technically not viable. As a result of the government's policies, LPG supplies have been increasing over the past few years. The LPG marketing companies have imported around 55826.4 MT of LPG during July-March 2010-11 against 406975 MT of LPG during July-March 2009-10

(ii). Compressed Natural Gas (CNG):

In an effort to reduce dependency on expensive imported fuels as well as to improve the environment the use of CNG in vehicles has been encouraged. Currently Pakistan is the largest CNG using country. Due to existing price differential between CNG and petrol, consumers prefer to convert their petrol vehicles to CNG. Presently, there are 3,329 CNG stations operating throughout the country. By March 2011 about 2.5 million vehicles have been converted to CNG. In addition, the governments' policy of de-dieselization is being actively pursued with the provincial governments, as this policy is being implemented by them to achieve import substitution. For instance, the diesel operated intra-city urban public transport is being phased out in Karachi, Hyderabad, Lahore Faisalabad, Peshawar, Quetta and Islamabad/ Rawalpindi.

(iii). Liquefied Natural Gas (LNG):

The government is encouraging LNG import by

the private sector. Accordingly, Pakistan Mashal LNG Project (PMLP) was conceived to cater for the energy need of the country as envisioned in the 25 year National Energy Security Plan. PMLP is to be set-up on integrated basis whereby a private sector project developer will manage the entire supply chain including procurement and shipping of 3.5 million tons per annum LNG, construction and operation of an onshore LNG receiving terminal, and delivery of 500 mcmfd re-gasified LNG to the SSGC's system in Karachi. The process for appointment of Consultant for re-tendering of the Mashal Project would be initiated shortly through open international tendering and the process may take up to 6 months. Project's Schedule and other details would be finalized after appointment of consultant and decisions regarding commercial structure of the project, terminal type, terminal location and SSGC's role will be finalized soon.

c) Drilling Activities

During July-March 2010-11, a total of 30 wells were drilled, including 13 wells in the public sector and 17 in the private sector. Exploratory wells witnessed a negative growth, whereas the development wells posted a positive growth in the public sector during period under consideration. Total investment of \$ 810 million has been made during July-March 2010-11 in the upstream petroleum sector. Table below provides the details of drilling activities of the public and private sector companies engaged in the exploration and development of wells.

Table 15.11: Drilling Activities (Achievements)*(No. of Wells)*

Sector	2009-10	July-March	July-March	Change (%)
		2009-10	2010-11	
Public Sector	26	16	13	-18.75
i) Exploratory	13	8	1	-87.50
ii) Appraisal/Dev	13	8	12	50.00
Private Sector	42	34	17	-50.00
iii) Exploratory	13	10	6	-40.00
iv) Appraisal/Dev.	29	24	11	-54.17
Total:	68	50	30	-40.00

Source: Ministry of Petroleum & Natural Resources

15.4 Performance of Major Oil and Gas Companies

15.4-a Oil and Gas Development Company Limited (OGDCL):

The company has studded 20 wells showing an increase of 33 percent in the drilling activities as compared to the corresponding period last year. The production activities of OGDCL consist of oil, gas, LPG and sulphur. Average oil production during the period July-March 2010-11 was 36,852 barrels per day as compared to 36,312 barrels per day during corresponding period last year while the average gas production during July-March

2010-11 stood at 854 Mmcf as compared to 868 Mmcf. During July-March 2010-11, the production of LPG came down to 122 metric tons per day compared to 124 metric tons per day. Average sulphur production during the period was 71 metric tons per day whereas it was 68 metric tons per day during the same period last year (see Table- 15.12).

During July-March 2010-11, the company made two successful gas discoveries one in Sindh and the other in Khyber Pakhtunkhwa. The company continued its offshore activities at three different blocks and has also engaged in joint ventures too.

TABLE 15.12: Physical Performance of OGDCL

S. #	Name of Activity	July-March	July-March	Change (%)
		2009-10	2010-11	
1	Total	16	13	-18.75
	i Exploratory Wells	8	1	-87.50
	ii Development/Appraisal Wells	8	12	50.00
2	Production			
	i Oil (Barrels/Day)	36,312	36,852	1.5
	ii Gas (MMcft/Day)	868	854	-1.61
	iii LPG (MT/Day)	124	122	-1.61
	iv Sulphur (MT/Day)	68	71	4.41

Source: MP&NR, OGDCL

15.4-b Sui Northern Gas Pipelines Limited (SNGPL):

During the first nine months of the current fiscal year 2010-11, the Company connected 203 industrial, 2,309 commercial and 182,679 domestic consumers. SNGPL carried out development work for extension of the gas network to the tune of Rs. 1,607 million on transmission projects, Rs. 5,162 million on distribution projects and Rs. 391 million on other projects (see Table15.13). The domestic sector is the largest consumer of gas provided by SNGPL with share of 27.9 percent followed by the general industry and power sector with shares of 19.5 and 19.0 percent, respectively. The Domestic consumers accounted for 98.6 percent of new connections provided. Most of the investments made by the SNGPL are in distribution projects. During the next fiscal year 2011-12 the company

has projected to invest Rs. 18,457 million in transmission, distribution and other projects.

15.4-c Sui Southern Gas Company Limited: (SSGC)

By the end of March 2011, Sui Southern Gas Company Limited was supplying a total of 268,019 mmcf of gas to Sindh and Balochistan. During the period under review, SSGC provided new connections to 176 industrial, 1,429 commercial and 79,955 domestic consumers bringing the total consumers to 2,368,732. During July-March 2010-11 the company carried out development work for extension of the gas network to the tune of Rs.90 million on transmission projects, Rs.5,863 million on distribution projects and Rs.996 million on other projects. Industrial and domestic sector remained major consumers of the gas provided to all sectors and accounted for around 60 percent share

followed by the power sector with a share of 22.8 percent. The domestic consumers accounted for 98 percent of new connections issued. Furthermore, most of the investments made by the SSGC are in distribution projects. The details are given in Table 15.13.

15.5 Power Sector

15.5-a National Electric Power Regulatory Authority (NEPRA)

The National Electric Power Regulatory Authority is exclusively responsible for regulating the provision of electric power services. NEPRA grants licenses for generation, transmission and

distribution of electric power, determines tariff, rates, charges and other terms and conditions for the supply of electric power services by generation, transmission and distribution companies, addresses complaints of electricity consumers, prescribes procedures and enforces performance standards, etc.

NEPRA announced a multi-stage tariff mechanism for hydropower project which provides an opportunity of multi-stage tariff for hydro power project, namely, the feasibility stage tariff, the EPC stage tariff and final adjustment in tariff at Commercial Operation Date (COD).

Table 15.13: Physical Performance of SNGPL & SSGC

S. No	Name of Activity	July-March 2010-11 SNGPL	July-March 2010-11 SSGCL
1	<u>Sector-Wise Gas Consumption (mmcf)</u>		
	Power	83,451	61,048
	Fertilizer	31,209	17,529
	Cement	-	579
	CNG/Transport	60,581	20,482
	General Industry	85,754	97,393
	Commercial	19,280	7,838
	Domestic	122,730	63,150
	Total	440,191	268,019
2	<u>New Connections (Nos.)</u>		
	Domestic	182,679	79,955
	Industrial	203	176
	Commercial	2,309	1,429
	Total	185,191	81,560
3	<u>Addition in Distribution Network (KMs)</u>		
	Mains	2,615	1,555
	Services	800	291
	Total	3,415	1,846
4	<u>Investment in Gas Sector (Rs. Million)</u>		
	Transmission Projects	1,607	90
	Distribution Projects	5,162	5,863
	Others	391	996
	Total	6,620	6,949

Source: SNGPL, SSGC

During 2009-10, to encourage the hydel and coal based power projects in the country, the authority allowed 17 percent Internal Rate of Return (IRR) to hydel and indigenous coal and 16 percent to imported coal power projects as against the 15 percent IRR for oil and gas based thermal power projects. As a result during the period July-March 2010-11, NEPRA processed twenty three

applications for the grant of Generation licenses, including thermal and hydel power plants with a cumulative capacity of 932.2 MW as compared to ten applications processed against the same period last year.

Furthermore, during the period July-March 2010-11, NEPRA issued thirty six (36) tariff

determinations and 132 tariff adjustments in respect of generation and distribution companies. The keystones of NEPRA regulatory process are transparency in operation through Public Participation, to adopt consultative approach mainly through advertising of application & soliciting comments and holding public hearings in which all stakeholders are invited to participate. During the period July-March 2010-11 a total of fifty five (55) hearings have been conducted in various cities of the country.

In order to seek compliance of the various authority decisions and fulfill the requirements of different Articles of the granted Licenses, NEPRA has set up a Monitoring & Enforcement Division to gauge the performance of the Licensees.

15.5-b Oil & Gas Regulatory Authority (OGRA)

Oil and Gas Regulatory Authority (OGRA) was mandated to regulate the oil and gas sector to promote competition and promote investment in the sector. It was also given mandate to rationalize prices of petroleum products in March 2006. Furthermore, OGRA is determining and announce ex-depot sale prices of regulated products as per approved formula without seeking governments' approval. OGRA is required to compute and notify the ex-depot sale prices of regulated petroleum products in accordance with the prescribed formula which is also published on the website of the OGRA for making it transparent.

Government in pursuance of its deregulation policy has decided to deregulate petroleum prices and IFEM (Equalization of POL prices). The implementation will be done at an appropriate time. As a first step, Oil Marketing Companies (OMCs) and dealers margins for high speed diesel (HSD) have been fixed in absolute terms with effect from December 01, 2010 as Rs.1.35/Liter and Rs.1.50/Liter, respectively.

The local prices have been linked with the developments in the international oil market. Accordingly, local ex-depot prices vary in line with the international prices. Moreover, cost of gas is linked with international prices of crude/fuel oil per Gas Pricing Agreements (GPAs) executed between the gas producer companies and Government of Pakistan.

15.6 Supply Sources of Electricity:

15.6-a. WAPDA

The total installed capacity of PEPCO system is 20,681 MW as of March 2010, compared to 20,190 MW in first nine months of the last fiscal year. Out of 20,681 MW, the hydro production is 6,555 MW and the thermal production is 14,126 MW. The hydropower capacity accounts for 31.7 percent and thermal 68.3 percent. During July to March 2010-11, the total installed capacity of WAPDA stood at 11,439 MW. Out of 14,126 MW of thermal power, 4829 MW is owned by ex-WAPDA GENCOs, 323 MW by rental, 665 MW by PAEC and rest by IPPs. During the first nine month of current fiscal year 66,928 GWh of electricity has been generated as against 64,935 GWh in the same period last year showing an increase of 3.07 percent.

i). Power Development Programme

To meet the current and future energy demands, the government is working on different power generation projects. During 2009-10, an addition of 1298 MW was added to the system and by the end of June 2011 further addition of 1871 MW shall be added to the existing system of PEPCO. Thus the expected capacity by the end of June 2011 will be 21117 MW and by 2029-30 expected cumulative capacity will be 106,656 MW. This has been planned according to current demand and the future requirements.

Table 15.14: Power Development Programme

Year	Expected Capacity to be Installed (MW)	Expected Cumulative Capacity(MW)
2010-15	14,022	33,268
2015-20	23,271	56,539
2020-25	16,077	72,616
2025-30	34,040	106,656

Source: WAPDA

ii). Electricity Generation & Power Transmission

The energy consumption pattern exhibited a similar picture with the same mix of hydro-thermal in total energy consumption. The share of thermal generation remained higher than that of hydro generation which shows that hydro potential has not been fully utilized. The hydro potential which is located in the north is still largely untapped. During the fiscal year July-

March 2010-11, the electricity generation from hydro has increased by 14.4 percent and that of thermal decreased by 2.4 percent as compared to the same period last year. Furthermore, the share in total energy generation by hydro generation remained at 36.0 percent while thermal generation stood at 64.0 percent during the period under review (see Table 15.15).

Table 15.15: Electricity Generation by WAPDA (GWh)

Year	Hydro	Share (%)	Thermal	Share (%)	Total
2001-02	19,056	31.3	41,804	68.7	60,860
2002-03	22,350	34.9	41,690	65.1	64,040
2003-04	27,477	39.8	41,617	60.2	69,094
2004-05	25,671	34.9	47,849	65	73,520
2005-06	30,855	37.5	51,370	62.5	82,225
2006-07	31,942	36.4	55,895	63.6	87,837
2007-08	28,667	33.23	57,602	66.77	86,269
2008-09	27,763	32.90	56,614	67.10	84,377
2009-10	28,492	31.90	60,746	68.10	89,238
July-March					
2009-10	21,072	32.45	43,862	67.55	64,935
2010-11	24,105	36.02	42,823	63.90	66,928

Total generation includes purchase from IPPs and imports

Source PEPCO,NTDC

By the end of June 2010, the total length of transmission line was 12,445 ckM compared to 12,405ckM, at the end of June 2009. The length of transmission lines included 500-KV, 220-KV, 132-KV and 66-KV during the period under consideration (end June, 2009). In order to ensure uninterrupted and stable power supply to the consumers as well as integrity of the grid supply system, the augmentation of the transmission network is a continuous process. In addition to the various on-going secondary transmission lines and grid-stations programme, new transmission lines and substations are being envisaged. The transformation capacity of 500kV substations at the end of June 2009 was 13800MVA whereas it was increased to 14850 MVA by the end of June 2010 showing an increase of 1050MVA. The

transformation capacity of 220 kV substations at the end of June 2009 was 14069 MVA whereas it was 15014 MVA at the end of June 2010 showing an increase of 945 MVA.

iii). Growth in Consumers.

With the expansion of the electricity network, the number of consumers has also increased by 7,445 thousands since 2001-02. During July-March 2010-11, the growth of consumers stood at 4.3 percent as it reached 20.1 million consumers as compared to 19.3 million in same period last year. The share of domestic consumers remained 85.3 percent followed by the commercial and agricultural sectors having 11.9 and 1.4 percent share, respectively (see Table 15.16).

Table 15.16: Consumers by Economic Groups (Thousands)

Year	Domestic	Commercial	Industrial	Agriculture	Others	Total
2001-02	10,483	1,803	200	184	8	12,678
2002-03	11,044	1,867	206	192	9	13,318
2003-04	11,737	1,935	210	199	10	14,092
2004-05	12,490	1,983	212	201	10	14,896
2005-06	13,390	2,068	222	220	10	15,911
2006-07	14,354	2,152	233	236	11	16,987

Year	Domestic	Commercial	Industrial	Agriculture	Others	Total
2007-08	15,226	2,229	242	245	11	17,955
2008-09	15,481	2,256	250	254	11	18,255
2009-10	16,673	2,362	263	271	12	19,582
July-March						
2009-10	16,416	2,342	260	269	12	19,300
2010-11	17,157	2,404	270	279	12	20,123

Source: NTDC, WAPDA

iv). Village Electrification.

Being an agro-based economy almost 67 percent of the population of the country resides in rural areas. Keeping this fact in view and in order to increase the productivity of a majority of the population, the village electrification program is being highlighted as a central component of the

total power sector development programme. The numbers of villages that have been provided with the electricity have reached 160,110. Furthermore, the village electrification facility has increased by 8.9 percent during the period of July-March 2010-11 as compared to same period last year. The detailed trend of village electrification is given in Table 15.17

Table 15.17: Village Electrification (In Number)

Year	Addition During the Year	Progressive Total	Growth (%)
2006-07	14,203	117,506	-
2007-08	10,441	127,897	8.84
2008-09	9,868	137,765	7.72
2009-10	15,062	152,827	10.93
July-March			
2009-10	9,273	147,038	-
2010-11	7,283	160,110	8.89

*Including FATA

Source: Water and Power Development Authority

v). Electricity Consumption by Economic Group

The sectoral consumption of electricity by economic group identifies the domestic sector as the largest consumer of electricity for the past many years. During the current year (July-March

2010-11), the consumption pattern followed the same historic pattern with a domestic share of 42.9 percent, industrial share of 25.1 percent and agricultural share of 12.3 percent. Table 15.18 shows detailed electricity consumption by different economic groups.

Table 15.18: Electricity Consumption by Economic Groups (% Share)

Year	Domestic	Comm- ercial	Industrial	Agri- culture	Public Lighting	Bulk Supply	Traction	Supply to KESC
2001-02	45.5	5.1	28.0	12.3	0.33	5.89	0.03	2.94
2002-03	44.0	5.3	28.4	12.6	0.35	5.54	0.02	3.8
2003-04	44.0	5.6	28.1	12.9	0.37	5.43	0.02	3.58
2004-05	43.5	5.8	28.1	12.5	0.41	5.17	0.02	4.54
2005-06	43.3	6.0	26.6	12.6	0.45	4.86	0.02	6.15
2006-07	43.0	6.0	26.1	12.0	0.47	4.84	0.02	7.27
2007-08	43.2	6.5	26.0	12.6	0.51	5.01	0.01	6.12
2008-09	42.6	6.4	24.6	13.3	0.53	4.90	0.01	7.68
2009-10	42.8	6.5	23.8	13.9	0.54	4.89	0.00	7.56
July-March								
2009-10	42.2	6.5	23.9	14.0	0.57	4.92	0.01	7.94
2010-11	42.9	6.5	25.1	12.3	0.49	5.11	0.01	7.53

Source: NTDC, WAPDA

vi). Power Losses.

The transmission and distribution losses increased by 0.2 percent during July-March 2010-11 as compared to corresponding period of last year. NTDC and DISCOs have started a range of technical and administrative measures to enhance operational and managerial efficiency to reduce power losses. These measures have showed positive signs resulting in the reduction of power losses and leading to an increase in revenue over the past few years. Along with these, other measures which involve continuous processes like renovation, rehabilitation, capacitor installation and strengthening the distribution system network are being carried out to control the wastage of power. The Transmission and Distribution losses since 2001-02 are given in Table 15.19.

15.6-b Karachi Electric Supply Company Limited (KESC)

During July-March 2010-11, the company's own generation stood at 5,469.8 Million units (kWh), only 0.6 percent less than the previous year generation of 5503.7 million units (KWh) owing to reduced availability of fuel gas. The supply of KESC was supplemented by imports from WAPDA, IPPs' and Rentals which totaled 5,664.7 million units (kWh) during July-March 2010-11 compared to 5,852.1 million units (kWh) in the same period last year. The installed capacity of various generating stations stood at 1,821 MW against 1946 MW during the period under review (see Table 15.20). The reduction was the direct result of KESC's endeavor to replace old inefficient generation capacity with the new state of the art power generating station. Consequently an old power station of 125 MW was decommissioned in July 2010.

The total units available to the company's system posted a decline of 2.1 percent by reaching 10,714.71 million kWh during July-March 2010-11 compared to 10,942.64 Million kWh in the corresponding period of last year. Transmission and Distribution losses have reduced to 31.2 percent in July-March 2010-11 from 34.5 percent.

Power purchase by KESC has decreased by 3.2 percent during the period under review. The setback in power purchase was due to the unavailability of DHA COGEN 80MW Power Station which was significantly balanced by supply from Al-Abbas power plant. In terms of additional generation capacity, KESC has made significant progress. The rental power agreement with Aggreko concluded in March 2011. The 560 MW combined cycle power plant project at the existing Bin Qasim site is being developed as per schedule. Civil, mechanical and electrical works are progressing at a rapid pace. The first unit of 116 MW is expected to be commissioned in July 2011

Table 15.19: WAPDA Power Losses

Year	T&D Losses (%)*
2001-02	23.6
2002-03	23.9
2003-04	23.5
2004-05	22.3
2005-06	21.9
2006-07	21.5
2007-08	21.3
2008-09	21.1
2009-10	20.9
July-March	
2009-10	19.6
2010-11	19.8

* T&D = Transmission and Distribution

Source: NTDC, WAPDA

15.6-c Nuclear Energy

Pakistan Atomic Energy Commission (PAEC) is responsible for planning, construction and operation of nuclear power plants. Presently, two nuclear power plants; Karachi Nuclear Power Plant (K-1) and Chashma Nuclear Power Plant Unit-1 & 2 (C-1 and C-2) are in operation.

K-1, a Pressurized Heavy Water Reactor (PHWR), commissioned at Karachi in 1972 has completed its design life of 30 years in 2002. After necessary refurbishments and up-gradations undertaken by PAEC, K-1 is now operating on 15-years extended life at a power level of 90 MWe. K-1 generated 196.0 million kWh of electricity during the period July-March 2010-11, raising its lifetime generation to 13.2 billion kWh. C-1, a Pressurized Light Water Reactor (PWR)

located in Chashma, with a gross capacity of 325 MW, has completed ten years of its safe commercial operation in September 2010. C-1 generated 2063.5 million KWh of electricity during July- March 2010-11, raising its lifetime

generation to 21.7 billion kWh. The construction work on the third nuclear power plant C-2 of 340 MW capacity has been completed. C-2 was connected to the national grid for trial operation on 14th March 2011.

Table 15.20: KESC Operating Results**(Units in Million kWh)**

S. No	Description	July-March (2009-10)	July-March (2010-11)	Change (%)
1	<u>POWER PURCHASE</u>			
	KANUPP	413.19	177.3	-57.1
	PASMIC	71.94	59.6	-17.2
	TAPAL	410.28	586.0	42.8
	GULAHMED	384.39	538.2	40.0
	WAPDA	4044.15	3962.0	-2.0
	ANOUD POWER	18.92	57.5	204.1
	DHA COGEN	115.74	0.0	-100
	INTL. INDUS. LTD	95.11	81.2	-14.6
	AGGREKO	253.36	158.2	-37.6
	Engro	45.02	1.52	-96.6
	Al Abbas	-	43.1	-
	Total	5851.1	5664.7	-3.2
2	<u>Units Available for Distribution (Million kWh)</u>	10942.6	10714.7	-2.1
3	<u>Unit Sold (Million kWh)</u>	7163.3	7372.0	2.9
4	<u>Trans. & Dist. Losses</u>	3779.3	3342.8	-11.6
5	<u>Installed Capacity (MW)</u>	1946.0	1821.0	-6.4

Source: KESC

The government has mandated PAEC for installation of 8,800 MWe nuclear power capacities by the year 2030. Technical and engineering infrastructure is in place to provide technical support to existing, under construction and future nuclear power plants. Institutes are being upgraded and expanded for enhancement of indigenization in nuclear power technology. The construction work has been started on the fourth nuclear power plant of the country, Chashma Nuclear Power Plant unit-3 (C-3), which is also a 340 MWe PWR type plant.

Besides, facilitating the energy needs, PAEC is playing a vital role in the health sector. The Commission is pioneer in using the nuclear and other advanced techniques for diagnosis and treatment of cancerous and allied diseases and is actively involved in the national cancer awareness, prevention, diagnosis and treatment program.

15.6-d Coal

The supply of coal during July-March 2010-11, increased by 10.3 percent compared to

corresponding period of last fiscal year. Operational coal mines increased production from 1.704 million tonnes to 2.350 million tones during July-March 2010-11 against the same period (see Table 15.21). Over the past few years almost the whole cement industry has switched over to coal from furnace oil which has enhanced utilization of indigenous coal along with imported coal. Utilization of indigenous coal in cement manufacturing plants has saved considerable foreign exchange.

To harness the huge coal reserves of Thar by utilizing it as a source of energy for power generation through international investment federal and provincial governments are taking prudential steps. Government of Sindh has leased out a coal block for an integrated mining project and a 400 MW coal based power plant to M/s China National Chemical Engineering Group Corporation in Sonda Jherrick coalfield. M/s Cougar Energy UK has been allocated Block-III in Thar coalfields for extraction of coal and establishment of a 400 MW power plant. M/s Bin Daen Group of UAE has been allocated Block-IV for developing coal mine and installing 1000 MW

power plant. One block has been allocated to Planning Commission of Pakistan for Pilot Project of 50 MW plant based on underground coal gasification. M/s Oracle Coalfield Plc. UK has been allocated Block-VI for developing a coal mine and installing power plant of 300 MW extendable up to 1000 MW. The Sindh Government entered into a joint venture with M/s Engro Powergen (Pvt.) Ltd for coal mining and installing 600-1000 MW power plant in Block-II. Sindh Government is entering to another joint

venture with M/s Al-Abbas Group Company and allocated area in Badin coalfield for developing Coal Mine and a Coal-fired power plant of 300-600 MW. The federal government has developed the infrastructure of Thar coal field (i.e. roads, water supply, communication network, airstrip & railway track). The establishment of experimental small scale open-pit mining is also under consideration to collect data for large-scale mining, as a guideline for investors.

Table 15.21: Consumption of Coal**(Percentage Share)**

Year	Imports	Production	Total
2001-02	1,081	3,328	4,409
2002-03	1,578	3,312	4,890
2003-04	2,789	3,275	6,064
2004-05	3,307	4,587	7,894
2005-06	2,843	4,871	7,714
2006-07	4,251	3,643	7,894
2007-08	5,987	4,124	10,111
2008-09	4,652	3,738	8,390
2009-10	4,652	3,738	8,390
Jul-March			
2009-10(e)	3,600	1,704	5,304
2010-11(e)	3,500	2,350	5,850

- not available

e: Estimated

Source: Ministry of Petroleum Natural Resource
Hydrocarbon Development Institute of Pakistan

15.6-e Private Power and Infrastructure Board (PPIB)

Private sector projects in the power sector are processed by the Private Power and Infrastructure Board. The potential of hydropower in Pakistan is around 50,000 MW, while total coal reserves in Pakistan are estimated to be around 185 Billion tones. PPIB is currently processing forty multiple fuel (Oil, Coal, Gas and Hydrel) power projects with a cumulative capacity of 10399 MW. Out of these forty projects, a total of nine new IPPs having a cumulative capacity of over 1,800 MW have been commissioned since March 2009, while other companies are aggressively working to achieve the financial close and commissioning of their respective projects.

Out of the aforesaid nine commissioned projects, the following three new IPPs have been commissioned during the fiscal year 2010-11 and other projects are under construction and will soon be delivering the much needed megawatts to the national grid to minimize the demand supply

gap. The annual expected capacities of private power generation up to the year 2013 are given in Table 15.22

Private sector projects in the power sector are processed by the Private Power and Infrastructure Board. The potential of hydropower in Pakistan is around 50,000 MW, while total coal reserves in Pakistan are estimated to be around 185 Billion tones. PPIB is currently processing thirty three multiple fuel (Oil, Coal, Gas and Hydrel) power projects with a cumulative capacity of 8,145 MW which are expected to be commissioned from year 2009 to 2013

Table 15.22: Annual Expected Capacity (IPPs)

Year	(MW)
Projects already Commissioned	1806
2011	600
2012-13	459
2013-14	652
2014-15	642
2015-16	2,779
2016-17	3,461
Total	8145

Source: PPIB

15.6-f Alternative Sources of Energy

To meet the growing demand of energy and to achieve the target of 9700 MW generation by the year 2030, the AEDB has taken various initiatives. Under the remote village electrification program; AEDB is to electrify 7874 remote off-grid villages in the Sindh and Baluchistan provinces. AEDB under its mandate serves as a One-window facility to process all Alternative and Renewable Energy (ARE) projects both in Public and the Private Sectors. It assists and facilitates development and generation of ARE, encourages transfer to technology, helps develop indigenous manufacturing base for ARE equipment; promotes provision of ARE based energy services etc. Under AEDB Act, enacted on May 2010, AEDB now has the mandate to implement projects in addition to its authorizations under the AEDB Ordinance.

(i) Mega Wind Power Projects

AEDB issued seven (7) letters of Intent (LOI) for wind power projects; one for 50 MW project, two (2) for 10 MW projects each, three (3) for 5 MW projects each and one (1) LOI for 2.4 MW wind power project in Gharo area. AEDB is currently facilitating twenty one (21) projects having capacity of 50 MW each, which are at different stages of development. One IPP has signed a contract with international turbine manufacturer, Nordic for the supply of equipment for their project. One company has installed 6 MW in the first phase of their 56.4 MW project.

Feasibility studies for 50 MW wind power projects each have been completed by seven (7) IPPs taking the total to seventeen (17) completed feasibility studies. NEPRA has determined tariff for two (2) more IPPs. The Energy Purchase Agreement (EPA) and Implementation Agreement (IA) have been negotiated by two IPPs with NTDC and AEDB respectively. One IPP has signed the IA with AEDB. In order to mitigate country risk associated with the project financing AEDB has arranged Asian Development Bank's Political Risk Guarantee facility for the wind power project developers.

(ii) Biodiesel

The government has given a target for replacement of 5 percent of total annual petroleum diesel consumption with Biodiesel by the year 2015 and 10 percent by 2025. AEDB has engaged Pakistan State Oil (PSO) for furthering the National Biodiesel Programme and provided a production plant of biodiesel to PSO for the optimization of processing techniques for Biodiesel. The cultivation has now risen from around two acres in 2005 to more than 650 acres. Pakistan's first ever commercial Biodiesel production facility with the capacity of producing 18,000 tons of Biodiesel per annum has been setup in Karachi by the private sector.

(iii) Bio Gas Projects

New Zealand based firm has completed the pilot phase of the biogas project at Landi Cattle Colony, Karachi where waste from 400,000 cattle in the area would be utilized to generate electricity and high grade organic fertilizer. The full scale plant is estimated to generate up to 50 MW of electricity and 1500 tons of organic fertilizer per day. A Waste to Energy Study is being carried out for Karachi to generate 10 MW power.

(iv) Small Hydro

AEDB is actively working with several national and international agencies for the development ARE potential in the country, and supporting provinces in tapping the potential in their respective jurisdictions. AEDB is actively working to install 103 hydro power plants in Khyber Pakhtunkhwa (KPK) and Gilgit-Baltistan (GB), with the total cost of US\$ 19.5 Million. Another project for 250 plants is under preparation for the same areas.

Eight small/mini/micro hydro projects have been initiated under the Renewable Energy Development Sector Investment Programme (REDSIP) with the support of Asian Development Bank (ADB). AEDB is serving as the executing agency at the federal level to consolidate the project proposals from federal, provincial and other public entities for submission to ADB for subsequent loan tranches. These projects are being implemented at the following sites in KPK and

Punjab with an estimated cost of US\$ 139.5 Million

Table 15.23: Small Hydro Projects

Year	MW
Ronoli , KPK	11.5
Dral Khwar, KPK	35
Manchal, KPK	3.5
UCC Main Lower (Gujranwala), Punjab	4.8
Deg Fall Sheikhpura, Punjab	8.0
LBDC Okara, Punjab	5.0
UCCM Marala, Punjab	11.5
Shegherthan Skardu	26.0
Chilas	4.0
Total	110.1

Source: AEDB

AEDB initiated a program with the GTZ support to assist the provinces solicit private investments in small hydro sector; under this program Feasibility Studies for top 25 hydro sites in AJ&K, Sindh, Punjab and KPK with the cumulative capacity of 284.14 MW has been completed.

(v) Solar

Pakistan is blessed with a huge solar potential of more than 5-6 KWH/m²/day of irradiation in many areas. The potential is feasible for both Solar PV and Solar Thermal application. The area with highest solar potential is the province of Baluchistan followed by Eastern Sindh and Southern Punjab promising technical and financially viable solar energy projects. These projects can be On-Grid or Off-Grid. Some areas in Eastern Sindh and Southern Punjab also have potential for such interventions. As a first phase, AEDB plans to electrify 400 villages, 100 in Sindh and 400 in Baluchistan. 49 villages in Sindh

have already been electrified where 3000 Solar Home Systems are installed.

Street lights and billboards consume around 400 MW of power which can be taken off from the grid by converting these loads to solar. The duration of use and the amount of power requirement make these two interventions technically viable financially attractive with very small payback periods. This intervention is ready to do in the country and AEDB has prepared a PC-I and submitted for approval for a demonstration project.

AEDB has also initiated pilot program under World Bank assistance to study the technical, financial and social viability for replacement of conventional water heaters with Solar Water Heaters. This pilot designed to trigger the market forces under different financial mechanisms and incentives.

Solar PV Parks of small to medium capacity (1-10 MWs) in dispersed locations will ensure reliability and efficiency of the national grid. High solar potential increases the affordability factor on one hand and sustainability on the other. AEDB has issued 5 LoIs of cumulative capacity of 113 MW for installation of Solar PV parks in Sindh and Southern Punjab.

Solar Thermal Power Generation using concentrated solar power technology (CSP) is a viable option because of its promising potential. These power plants of medium to large capacities (10-50 MW) can be installed in Southern Punjab and Eastern Sindh and Baluchistan because of the availability of water in these areas. A LoI request for installation of 500 MW of CSP power plants is under review with the panel of experts.