

Chapter
10**Energy****Overview**

Access to modern commercial energy is fundamental to civilization, and economic and social development is fuelling a growing demand for reliable, affordable and clean energy. Most of the population, today lack access to modern energy services whereas country's energy resources are abundant.

The ongoing privatization and market liberalization processes and the evolving energy regulation and environmental legislation, are creating more uncertainties in the market. This calls for a balanced approach to the planning of the energy mix and for a maximum deployment of domestic energy resources. Local resources and renewable energies, together with improved efficiency throughout the whole production, supply and use chain will contribute to improving energy security.

The country historically has been subjected to energy demand suppression due to limited supplies and lack of adequate infrastructure development for provision of energy to the economy. The lack of sustained and affordable energy to economy has restrained economic and social growth and created declining tendency for investment in the country

Long-term strategic decision for development of energy sector that carries long lead times, spanning decades, requires careful due diligence and reliable data. Accordingly a long term integrated National Energy Security Plan; covering the period up to 2030 approved by the Government in 2005, is aimed at (i) enhanced exploitation of indigenous resources including hydropower, oil, gas and coal, and to increase the share of coal and alternative energy in the overall energy mix, (ii) optimum utilization of the country's resource base to reduce dependence on imported energy through an institutionalized strategy, (iii) creating an environment conducive to the participation of the private sector, and (iv) developing the local energy scenario in the context of regional perspective.

To meet future energy requirements through indigenous sources domestic exploration and development would be intensified. Simultaneously, the energy supply options would be diversified, with import of gas and LNG. In the Power Sector, additional generation capacity would be developed with extensive private sector participation system losses would be reduced. In the oil and gas sector, the number of oil and gas wells to be drilled will be more than double from current level. Significant improvements will also be made in oil transportation, storages and refining operations.

The strategic direction for development of the energy sector and sustainable supply of energy at competitive price to all sectors of the economy include: (i) supply to be based on an optimum energy mix;(ii)maximum utilization of the indigenous resources to meet the increasing energy demand with a major emphasis on increasing the coal share in the energy mix by developing indigenous coal resources, and setting up integrated coal mining and power generation, petro-chemical plants and coal

gasification; development of hydropower increasing local oil and gas production by enhancing drilling activities particularly in off-shore areas and promotion of accelerated nuclear and renewable/alternative energy sources (wind, solar) in overall energy mix; (iii) enhancing private sector participation, including manufacturing of plants and equipment by strengthening regulatory frameworks and related institutions and development of infrastructure, and (iv) development of human resources with emphasis on technical skills and expertise. The strategy also includes extension of LPG supply to commercial and domestic sector, encouragement of CNG utilization in the transport sector and import of LNG to meet short-term gas requirements.

Power Supply

To meet the electricity demand over the Energy Security Action Plan (ESAP) (2005-30) an extensive expansion of installed generating capacity will be required. It is estimated that installed electricity generating capacity will grow from 19,540 MW in 2005 to 162,590 MW in 2030 (average annual growth rate of 8.2 percent). The fuels used in the additional generating capacity vary, as a function of available natural resources, energy security concerns, and market competition among fuel choices, as well as other factors. In the ESAP envisaged additional power generation capacity through each technology as indicated in the Table: 10.1

**Table: 10.1 Power Generation Plan
2005-2030**

	Nuclear	Hydel	Coal	Renewable	Gas	Oil	Total	Cumulative
Existing (2005)	400	6460	160	180	6400	5940	19540	
Addition	0	0	0	0	0	0	7880	
2010	0	1260	900	700	160	4860	7880	27420
2015	900	7570	3000	800	300	7550	20120	47540
2020	1500	4700	4200	1470	300	12560	24730	72270
2025	2000	5600	5400	2700	300	22490	38490	110760
2030	4000	7070	6250	3850	300	30360	51830	162590
Total	8800	32660	19910	9700	7760	83760	162591	
Share	5.4%	20.1%	12.2%	6.0%	4.8%	51.5%	100.0%	

Source: Medium Term Development Framework 2005-10 Planning Commission

Fuel

Exploration of oil and gas resources and exploitation of coal resources has given high priority, therefore target of exploratory and development wells have been increased to 100 wells per year during the period of MTDf 2005-2010. It also envisages to accelerate the exploitation of indigenous coal. The imported coal is encouraged in the short term for use along with local coal for industrial purposes and

for power generation. Based on energy demand supply gap, import options have also been envisaged.

The past drilling status and future targets, and supply demand position of gas, oil and coal is given in Tables 2,3, 4 and 5 respectively.

Table 10.2 Drilling Targets/Investment

Period	Exploratory Wells	Appraisal / Development- Wells	Total - Wells	Investment (Million US \$)
1999-2006 Achievements	109	149	258	1548
2007-2015 Targets	630	420	1050	6300

Table 10.3 Natural Gas Demand Supply

(MTOEs)

	Demand	Indigenous	Supply Pipeline Import	LNG Import
Existing	28.0	28.0	0.0	0.0
2015	52.9	26.9	22.5	3.5

Table 10.4 Oil Demand Supply

(MTOEs)

	Demand	Indigenous	Import
Existing	18.3	3.21	15.09
2015	32.15	2.18	30.33

Table 10.5 Coal Demand Supply Position

(MTOEs)

	Demand	Indigenous	Import
Existing	4.0	2.3	1.7
2015	14.5	12.5	2.3

Serious efforts are underway for enhancing regional cooperation with China and USA and accordingly, Energy Cooperation Forums have been established with these countries. The avenues for import of electricity from Central Asian Republics are

being explored. An energy corridor is also envisaged under the planned National Trade Corridor, with Gwadar as a hub for energy storages and transportation to regional countries.

Evaluation of Policies Programs and Projects

As far as power sector is concerned there was partial success in the policies and program. Major achievement was the privatization of Karachi electric supply corporation in 2005 besides import of power from Iran to meet the power requirement of coastal area of Balochistan. Power policy 2002 received an enthusiastic response from the private sector and a total of forty nine (49) projects having a cumulative generation capacity of about 12000 MW and estimated cost of over US\$ 11 Billion are at various stages of processing. However no power plant could be commissioned during this period due to long processing time of projects in private sector besides some regulatory issues. The same is the case for development of other renewable resources (wind and solar). The President of Pakistan has announced the construction of five major dams on priority basis and inaugurated the Diamer-Bhasha Dam project, having an installed capacity of 4500 MW and water storage capacity of 7.4 MAF.

In fuel sector mostly major targets have been achieved or work has been started and is underway to achieve. The import of gas from Iran is at the highest level of its history to ensure that the first pipeline gas volume will be available by 2011-12. Similarly to introduce LNG business in Pakistan, LNG-Policy-2006 have already been implemented and first LNG project in public sector is also close to its maturity. A pilot project of blending 5-10% ethanol with motor gas line is operational to obtain the data for evaluation and its final execution. Drilling of 80 wells as against the target of 100 wells has been accomplished. The establishment of National Drilling Company is underway to overcome the shortages of drilling rigs. New state of art refinery is being set up at Khalifa Point and setting up of second hand refineries are allowed without delay but guarantees to enhance the availability of products in the country. To increase the share of coal in the energy mix Thar Coal Mining company (TCMC) has been established and prime objective of the company is to develop 5-6 million tones per annum coal mine at Thar Coal Field.

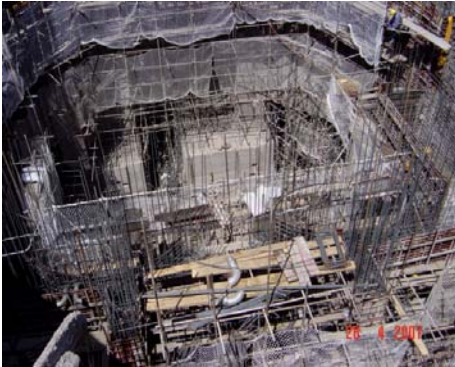
Review of 2006-07

Power

For the year 2006-07, an allocation of Rs 60,572 million (including foreign aid of Rs 13,075 million) was made for the power sub-sector, including budgetary allocations for corporations. Against the above allocations, the revised estimates are Rs 53,089 million (including foreign aid of Rs 13,174 million) or 81 percent of the allocation. The main reason of low utilization of fund is non-availability of local as well as foreign aid for some of the projects of WAPDA.

The government is pursuing a policy to enhance the power generation by harnessing more indigenous resource such as hydro, coal and gas. In order to improve the hydro-thermal mix towards hydropower as well as to augment the existing water storage facilities, the optimal utilization of hydroelectric potential is being accorded priority in the power development program. In the public sector, construction of the seven medium hydro-electric projects (Malakand-III 81 MW, Khan Khwar 72 MW,

Allai Khwar 121 MW, Duber Khwar 130 MW, Kayal Khwar 130 MW, Golan Gol 106 MW and Jinnah Low Head Hydel 96 MW) is underway.



Construction of Khan Khwar Hydropower project

Pakistan's first nuclear power plant, KANUPP, refurbished for life extension of 15 years. The plant is operating at around 100 MW capability. Feasibility studies for two nuclear power plants at Karachi (KANUPP-2 & 3) are completed. Similarly a site selection study of six other sites for nuclear power generation is also underway.

The work on up gradation of transmission facility for import of 100 MW power from Iran to supply electricity to costal area of Balochistan near the Iranian border is also being taken up by WAPDA/NTDC. In addition, in order to ensure uninterrupted and stable power supply to the consumers, the augmentation and rehabilitation of transmission network was undertaken. As part of this effort, besides addition to the ongoing secondary transmission and grid program, construction of several new 500 kV & 220 KV primary transmission lines and grid stations has also been intimated.

The Power Policy 2002 received encouraging response from private investors. The investors were attracted due to growing demand for electricity, competitive fiscal incentives and improved macro-economic conditions. Consequently, a number of proposals from international as well as local investors for establishment of multi-fuel power projects at various locations of the county have been received by the Private Power & Infrastructure Board (PPIB). The PPIB is currently processing forty nine (49) projects having a combined generation capacity of about 12000 MW and estimated cost over US\$ 11 Billion. Out of these projects, Letters of Interest (LOI) for 28 projects with cumulative capacity and 7630 MW have been issued which include ten (10) gas based / dual fired projects, mine (9) hydro, five (5) coal based projects whereas four (4) project are based on oil. Of these Letter for Support (LOS) to seven project have been issued. In addition the government has initiated a fast track process for processing of new power generation proposal form private sector, that includes used / refurbished equipment. Sponsor of 6 projects with a cumulative capacity of 919 MW have been advised to approach NEPRA for acceptance of up-front tariff. Three companies, after having their tariffs determined by NEPRA, submitted Performance Guarantee (PG) for issuance of Letter of Support (LOS). Two of these companies have already been issued LOS.

The option of imported coal based power project has also been given serious considerations. Consequently PPIB initiated two 1000-1200 MW Imported Coal based Integrated Power Projects near Karachi. Nine Cos submitted Statements of Qualifications (SOQ).

During the year, installed generating capacity was increased marginally 19,550 MW in 2005-06 to 19846 MW 2006-07 as rental plant of 150 MW at Lahore, 136 MW at Bhikki and 10 MW in KESC system is expected to be commissioned from Anode. However, the peak demand of the national grid system increased from 15,282 MW in 2005-06 to 16,200 MW in 2006-07 and the total energy generation is expected to have increased from 92,892 GWh in 2005-06 to 99,116 GWh in 2006-07. It is also estimated that the losses in both WAPDA and KESC would system decrease from 27.9 percent in the year 2005-06 to 25.6 percent by the end of 2006-07.

During the year, 965,000 new connections are estimated to be provided by WAPDA and KESC. It is also estimated that WAPDA would have electrified about 15,000 villages/ abadies during the year.

Physical achievements of power sector for the years 2005-06 and 2006-07 are presented in Annex 10.1.

Fuel

An allocation of Rs 931 million was made for Fuel Sector during 2006-07 excluding non-budgetary corporation program. Against the above allocation, the revised estimates are Rs 823 million, showing 88 percent utilization. The reason of shortfall was the law and order situation in Balochistan, which slowed down implementation of projects, especially the project namely "Oil and Gas Exploration in Balochistan-Opening of activities in Tribal Areas" being undertaken in the Kohlu Agency have commenced in the last quarter of fiscal year 2006-07.

Oil and Gas Exploration/Production

Crude oil production during 2006-07 is expected to be about 66487 BPD against the target of 74,753 BPD showing an achievement of 89 percent and gas production is expected to be 3886 MMCFD against the target of 4,279 MMCFD, showing 91 percent achievement. A total of 80 wells both in public and private sector (52 exploratory and 28 development/appraisal wells) are expected to be drilled against the target of 100 wells showing 80 percent achievement. Eight oil and gas discoveries, four in public and four in private sector have been made.

Policy

To enhance domestic production, the Government is striving hard to accelerate the exploration and production activities in Pakistan by encouraging foreign investment through its attractive policies. Therefore, Petroleum Policy-2001 is being revised. The revised "Petroleum Policy-2007" to be finalized within next couple weeks, will cover broadly the aspects such as pre-qualification of applicants, a systematic route/proviso for new entrants, a more detailed bid evaluation system to ensure transparency and a mechanism for new proposed gas prices for different zones to provide more incentives to investors, windfall levy on crude oil/condensate natural gas/LPG to the government, upward adjustment in social welfare rates for social development of the local people of the area besides, formulation of a committee to address the issues of the implementation of the policy, overcoming difficulties and anomalies encountered. .

LPG

The Liquefied Petroleum Gas (LPG) production is expected to be 1,670 tonnes per day against the target of 1,600 tonnes per day showing 104 percent achievement. About 15 Liquefied Petroleum Gas (LPG) stations would also be installed.

CNG

Pakistan has become the leading country in Asia and the third largest user of CNG in the world, after Argentina and Brazil. The CNG market currently is about 100 MMCFD, accounts for about 3 percent of the total natural gas market. There will be 1465 CNG stations servicing more than 1.45 million vehicles (motorcars, vans and taxi-cabs) operating on roads till 30th June, 2007 as compared to 1.2 million vehicles serviced by 965 CNG stations during previous year.

LNG

In order to meet the fuel requirements, the import of LNG was also envisaged and for this purpose LNG Policy-2006 was formulated to attract the investment in public and or in private sector. In this regard SSGCL is finalizing to bring integrated LNG project in public sector with a capacity of 500 million cubic feet per day (MMCFD) which can further be increased to 1000 MMCFD.

Supply of Gas to New Towns/Areas

The gas is expected to be supplied to 250 villages/abadies by the gas utilities. About 0.271 million consumers are expected to be added to the system during the year. About 445 Km of transmission pipelines and 5386 Km of distribution pipelines would be completed.

Oil Refinery

The existing refinery capacity of the country is 12.87 million tones per year. Further, setting up of new state of art refinery at Khalifa Point is underway and an offer letter was issued to International Petroleum Investment Company (IPIC) of Abu Dhabi/PARCO. The implementation agreement is being finalized. It is also planning to relocate the second hand oil refineries in the country with no through put guarantee by the government which will also enhance the availability of petroleum products in the country.

Ethanol Blending

In the light of decision of Energy Security Action Plan, a pilot project on ethanol blending at the rate of 10 percent with motor gasoline is operational. After evaluation and analysis of data obtained during for the pilot project further strategy will be developed.

Coal

Estimated production of coal during 2006-07 is 5.1 million tonnes per annum as compared to target of 5.2 million tonnes per annum showing 98 percent achievement. In addition, the feasibility study being undertaken by Sui Northern Gas Pipeline Limited (SNGPL) for setting up a pilot coal gasification plant at Bhakkar would be completed. The project "Feasibility Study on Gasification of Thar Coal

District Tharparkar, Sindh” is under execution to ascertain viability of gasification of Thar Coal. The report of Phase I-A has been completed. The laboratory study has shown that Thar Coal is feasible for gasification. The next phase 1-B is expected to be completed in the first quarter of 2007-08. The current coal mining techniques in the country are rudimentary; not even a single coalmine is mechanized. To enhance the share of coal in primary energy mix, Thar Coal Mining Company (TCMC) has been established. The prime objective of the company is to develop 5-6 million tone per annum coal mine at Thar Coal Field with the help of international well reputed firms/consultants.

Physical achievements of the fuel subsector for the year 2006-07 may be seen at Annex 10.3.

Program for 2007-08

Power

An allocation of Rs 107,396 million (including Foreign aid of Rs 13,578 million) has been made for the power sub-sector during 2007-08, including budgetary corporations. This represents an increase of 77.3 percent over the allocation for 2006-07. The agency wise details are at Annex 10.2.

The maximum power demand of the country is expected to increase from 16,200 MW in 2006-07 to 17,468 MW in 2007-08. An additional capacity of 421 MW is expected to become available during the next year. This includes the Wind Mill Project (150 MW), Power from additional Gas Turbine (80 MW), Malakand-III hydropower project (81 MW). The KESC system will get power from DHA Co-gen (combined cycle) (80 MW), Anode Power (30 MW) and from their own overhauled gas turbines (194 MW). The target set for the total energy generation (including private sector) is 106,015 GWh in 2007-08, an increase of 7.7 percent over the energy generated in 2006-07. During the year, 975,000 new electric connections would be provided by WAPDA and KESC besides electrification of 15,000 new villages/abadies under the Khushal Pakistan Program. In addition 26,800 homes will be provided lighting in the remote locations during next year with the use of solar and micro wind turbines under the program of Alternative Energy Development Board (AEDB). Physical targets of the power sector for the year 2007-08 are presented at Annex 10.1.

Fuel

An allocation of Rs 1233.7 million has been proposed during 2007-08 for the Fuel Sector, excluding the non-budgetary corporations program.

Oil and Gas

During 2007-08, the crude oil production is planned to be 72000 BPD against estimated production of 66487 BPD in 2006-07 showing 8.3 percent increase over the previous year. The gas production is planned to be 4200 MMCFD against the estimated production of 3886 MMCFD in 2006-07 showing an increase of 8.1 percent over the previous year. It also includes Gas/Condensate discovery in the TAL Block which was made at Manzalai in the end 2002 and is currently producing around 50 MMSCFD gas and 500 barrels of condensate. The appraisal of field is completed in early 2006 and a full field development activity is planned during 2007-2008 period with drilling of 3-4 additional development wells and installation of hydrocarbon processing facilities. The full field development envisages around 250 MMSCFD gas and 2000 barrels condensate in early 2009.



Drilling in Progress –Tal Block



Hydrocarbon Processing Facilities Tal Block

The total of 100 wells both in public and private sector are planned to be drilled. The LPG production is planned to increase to 1730 tonnes per day from 1670 tonnes per day showing an increase of 4 percent over the previous year. It is also planned that gas would be supplied to 353 villages/abadies during the year by the gas utilities. About 0.313 million consumers are planned to be added to the system during the year. About 204 Km of transmission pipelines and 6422 Km of distribution pipelines are planned to be completed. It is planned that about 250,000 vehicles are converted through CNG. Moreover, 500 CNG stations are expected to be installed besides about 25 Liquefied Petroleum Gas (LPG) stations.

Coal

The coal production is planned to increase to 5.2 million tones per annum from 5.10 million tones during 2006-07 showing 2 percent increase over the pervious year. The feasibility study being undertaken by Ministry of Petroleum and Natural Resources to ascertain techno-economic viability of Thar Coal gasification and extraction of chemicals is expected to be completed. It is expected that work to develop a mine of 6 million tones per annum will also be started.

Physical targets for the year 2007-08 are given in Annex 10.3.

At present country is facing shortage of about 1000 MW power which is expected to increase to about 1500-2000 MW up to June 2007. The Ministry of Water and Power has announced load shedding and load management program to save power during peak hours. The load management program includes offering incentive to agriculture tube-well to operate from 10 pm to 6 am during nighttime, closure of business activities by commercial sector by 9 pm etc. These measures will reduce the peak demand by 500 MW and rest will be managed by load shedding.

The Ministry of Water and power through these measures can manage the problem temporarily but the demand and supply gap is going to be wider during next couple of year, if serious efforts are not made to bring additional capacity in the system. The issue arose due to the reason that 2002 power policy was primarily based on thermal power generation through gas. However, the enough gas was not available therefore, off late the government decided to encourage thermal power generation on RFO. In addition there are a lot of issues being faced by IPP with respect to tariff and other technical matters included in the tariff administration. This has resulted that IPPs are not achieving financial close. In order to make sure that additional capacity is brought on line as soon as possible, all the irritants needs to be addressed on war footing basis

Exploration of Oil and Gas

Pakistan is endowed with two major sedimentary basins, namely Indus and Balochistan with 830,000 sq.km. area. Despite this vast sedimentary cover, the exploration activities have been restricted to the selected areas, leaving large areas of the country grossly under-explored. The well density per exploratory well is 1537 sq.km compared to around one well per 80 sq.km. in other parts of the world with similar geological environments. As a result, only 620 exploratory wells were drilled in various sedimentary zones of Indus and Balochistan basins. The drilling targets for exploratory and appraisal wells were envisages to 100 wells per year but the achievement remained behind target. The main causes for not meeting the drilling targets are shortages of drilling rigs and law and order situation. In principle it was agreed to form a National Drilling Company to overcome shortage of drilling rigs. The formation of company should be expected.

Installation of Gas Pipelines for Import of Gas

The Gas Demand and Supply Projections indicate a widening gap in gas supply, starting from 2009-10 as there is declining trend in gas production. Any commitment of additional gas supplies to various sector of economy i.e. industries, power or fertilizer plants on sustainable basis will be met through imported gas. The Iran – Pakistan-India pipeline is being finalized with the expectation that first imported volume would be available by the year 2012. Import of gas from Iran having initial capacity for Pakistan is 1.5 billion cubic feet per day (BCFD), which will be increased to 2.1 BCFD subsequently. Any further delay in import of gas would be a serious repercussion on energy sector especially on economic growth of the country.

Chemical Complex based on Gas

In case of availability-imported gas, value addition of natural gas is necessary by establishing petro-chemical complex on gas. Therefore, necessary study to examine the viability of petro-chemical complex is essential.

Physical Targets : Power Sector

S. No.	Items	Units	2005-06 (Actual)	2006-07 (Estimates)	2007-08 (Targets)
1	Additional installed Capacity *	MW	0	296	421
2	Installed Capacity (Total)	MW	19550	19846	20267
	Growth Rate		0	1.51%	2.12%
3	Maximum Demand	MW	15282	16200	17468
	Growth Rate	(%)	4.85%	6.00%	7.83%
4	Energy Generation	GWH	92892	99116	106015
	Growth Rate		9.66%	6.70%	7.77%
5	Energy Sale	GWH			
	Annual Energy Sale	GWH	66988	73196	80202
	Growth Rate	(%)	9.18%	9.27%	9.57%
6	System Losses	(%)	27.9%	25.60%	24.35%
7	Consumers Cumulative	Million	17.793	18.758	19.733
	Consumers Added	Million	1.079	0.965	0.975
8	Electrification of Villages/Abadies	Nos.	103263	118263	133263
	Addition	Nos.	12764	15000	15000

2006-07		2007-08	
Rental Plant at Lahore	150	Additional GT	80
Bhikki	136	Malakand-III	81
Anode	10	Wind Mill	150
		DHA	80
Total	296	Anode	30
		Total	421

Annex 10.2

**Investment Program: Power Sector
2007-08**

Rs Million

S. No.	Name of Agency	Investment for FY 2007-08	
		Total	Foreign Aid
1	Water Power Development Authority (WAPDA)	91570	9308
2	Pakistan Atomic Energy Commission (PAEC)	11186	4270
3	Pakistan Nuclear Regulatory Authority (PNRA)	421	0
4	Consultancy Services of Pakistan Engineering Council	10	0
5	Karachi Electric Supply Corporation (KESC)	4180	0
6	Alternative Energy Development Board (AEDB)	29	0
	Total	107396	13578

**Physical Achievements and Targets: Fuel Sector
2006-07 and 2007-08**

Sr. No.	Items	Unit	Estimated Achievements 2006-07	Targets 2007-08
	Fuel Sector			
1	Crude Oil Production	BPD	66487	72000
2	Gas Production	MMCFD	3886	4200
3	Wells drilled	Nos	80	100
	- Exploratory	Nos	52	46
	OGDCL		31	25
	Private		21	21
	- Appraisal/ Development	Nos	28	54
	OGDCL		10	26
	Private		18	28
4	LPG Production	Tonnes/day	1670	1730
5	Coal Production	Million Tonnes Per Annum	5.10	5.20