PAKISTAN ENERGY ISSUES:
Government Policy and Foreign Assistance

April 1992

Pakistan Office
Japan International Cooperation Agency

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パキスタンのエネルギー問題
（政府の施策と外国援助）

はじめに

地球的課題として先進国と開発途上国が協調し、早急に解決を目指さねばならないものとして「貧困と人口」「婦人と開発（ＷＩＤ）」「環境とエネルギー」等が挙げられます。　これらの課題については、国際協力事業団は分野別援助研究会等も設定し、援助のあり方について活発な議論が重ね、数多くの具体的プロジェクトが進んでいます。

当パキスタン事務所としましても、これらの課題に積極的に取り組み、質の高い援助の実現へ向けて、パキスタン国政府並びに他援助機関との意見交換を踏まえ一層の優良案件を形成することが重要であることから、人口問題・ＷＩＤ・環境・エネルギーの４課題についてセクターレビュー的調査を実施しました。特に、環境とエネルギー問題については『国家環境保全戦略』が３月１日に国家承認を得、今後の具体化についても４月開催のパリ援助国会議（ＣＧ）でも論点の１つになったことからも、今後の環境ドナー会議をはじめ活発な議論が展開されると予想されます。

本報告書はパキスタン事務所が事業団内外の関係者の協力を得て、在外専門調整員制度を活用しエネルギー分野の基本情報についてとりまとめたものであり、別冊のパキスタンに於ける地球的課題報告書３種（人口・ＷＩＤ・環境）並びに社会セクター報告書２種（プライマリー・ヘルスケア分野及び初等教育分野報告書）とともに、内外の援助関係者に広く有効利用されることが望まれます。

１９９２年４月

国際協力事業団
パキスタン事務所
所長　御手洗　章弘

PAKISTAN ENERGY ISSUES

FOREWORD

As is widely known, the present-day world is confronted with numerous environmental issues, such as atmospheric pollution, soil erosion and flooding, salinity and waterlogging, air, water and marine pollution, sewerage, drainage and industrial effluent by uncontrolled discharge of toxic and harmful solid, liquid and gaseous waste substances into the environment, rapid population growth, and noise and vibration hazards. In order to check further deterioration in the global environment, the nations of the Earth, whether developed or developing, must make concerted efforts to solve the issues despite developmental and financial constraints. In this regard the Japan International Cooperation Agency (JICA) established a number of Study Groups, viz. "Poverty and Population", "Women's Role in Development Issues" and "Environment and Energy", etc. A series of discussions on the global issues took place to explore the ways and means for their solution. In fact JICA has made a lot of efforts towards this end and implemented quite a number of projects in these fields.

The Pakistan Office of JICA earnestly feels that we must struggle against the global environmental problems in an effective manner and it is, therefore, significant that we implement quality projects with close liaison and coordination of the Government of Pakistan and other donors. With this aim in view, we conducted some sort of sectoral reviews on Population, WID, and Environment and Energy. Special emphasis was laid on Environment and Energy since the National Conservation Strategy (NCS) was approved as a national policy in March 1992. Lively discussions were initiated for the realization of the NCS among the relevant organizations including donors of foreign aid.

This report was compiled on the basis of the fundamental information on Pakistan Energy Issues, by JICA Pakistan Office. I am confident that this report together with other three reports on the issues relating to Population, WID and Environment, and two reports on Social Sector comprising Primary Education and Primary Health Care, will prove to be of great benefit to all concerned with these activities in particular and to the people of Pakistan in general.

April 1992

Mr. Akihiro MITARAI
Representative of JICA
Pakistan Office

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List of Abbreviations

AGGR	Annual Compound Growth Rate
CNG	Compressed Natural Gas
DGNRER	Directorate General of New and Renewable Energy Resources
ENERCON	National Energy Conservation Center
F.O.	Furnace Oil
GOP	Government of Pakistan
GWH	Gega Watt-Hour
HDIP	Hydrocarbon Development Institute of Pakistan
HOBC	High Octane Blended Component
HSD	High Speed Diesel
JICA	Japan International Cooperation Agency
KWH	Kilo Watt-Hour
L.D.O	Light Diesel Oil
MMCFT	Million Cubic Feet
M.S.	Motor Spirit
MW	Mega Watt
NDFC	National Development Finance Corporation
NESPAK	National Energy Services of Pakistan
NGO	Non-Governmental Organization
NWFP	North-West Frontier Province
ODA	Overseas Development Agency
OGDC	Oil and Gas Development Corporation
PCSIR	Pakistan Council of Scientific and Industrial Research
PECC	Pakistan Energy Conservation Council
PMDC	Pakistan Mineral Development Corporation
PV	Photo-Voltaic
S.K.	Superior Kerosine
T/D	Transmission and Distribution
TOE	Tones of Oil Equivalent
UNDP	United Nations Development Program
USAID	United States Agency for International Development
WAPDA	Water and Power Development Authority

Executive Summary

Introduction and Background

Pakistan is a typical developing country with diverse culture, climatic, topography and socio-economic conditions.

Recently, the government has adopted a very liberal privatization and industrialization policy.

Shortage of energy is the main obstacle in the path of development in the country.

Energy Profile of Pakistan

High population growth, rapid urbanization and industrialization and rising standards of living are putting severe pressure on existing energy sources.

Fossil fuels (oil, gas and coal) provide upto two-third of country's energy, the rest is provided by non-commercial fuels (fuel-wood and bio-mass, etc.)

Petroleum products constitute 39% of the fossil fuel mix. More than half of petroleum is imported.

44.4% of all commercial energy is used in industry, 27.4% in transport, 18.6% in domestic and rest in other sectors, i.e., agriculture, commercial and government.

Frequent load-shedding is causing severe damage to the industrial sector.

Pakistan has 154 million barrels of known oil reserves with 33.4 billion barrels of potential reserves. Average daily oil production is 70,000 barrels.

Natural gas reserves are estimated to be 23.6 trillion cubic feet. Annual consumption is 455,482 MMCFT. These reserves may last another 15 years at present rote of consumption.

Pakistani coal is not high grade. Total reserves are estimated as 19,741 million metric tones. Current coal production is 2.64 million tones/years. At his rate, the reserves can last for 300 years.

Installed generation capacity is 8936 MW and annual electricity generation is estimated as being 40,700 GWh.

Rate of electricity demand growth is greatest in the domestic sector.

Transmission and distribution losses are estimated as more than 20%.

Renewable resources have not been effectively tapped in Pakistan.

Energy Conservation is a new field in Pakistan but is getting some attention from the Government.

Countermeasures to Face Issues

The Government has formed specialized institutions (Energy Wing and the National Energy Conservation Center (ENERCON) to solve country's energy problems.

The private sector is being inducted into power generation projects.

World Bank is funding the preparation of Pakistan's National Energy Conservation Plan, through a Japanese expert.

Shortcomings in GOP's Policies

Power project ar seriously behind schedule due to political, economic and technical reasons.

The GOP has a serious lack of local currency for investment in energy projects.

Electricity tariffs are distorted thus giving no incentives to conserve energy to such groups as tubewell owners.

Over-staffing , corruption and pilferage of electricity is rampant in WAPDA and KESC.

Local oil and gas exploration is proceeding at a slower pace compared to growth in demand.

Due emphasis is not being given to promote renewable sources and energy conservation.

Foreign Assistance Requirements of GOP

By 1993, Pakistan needs to invest more than US $ 4 billion to increase generation capacity by another 6000 MW to meet growing demand.

The GOP needs foreign assistance in the following areas:

manpower training;
oil and gas exploration;
end-use efficiency improvement; and
reduction in T/D losses.

Donor's Experience

A large number of donors, such as, USAID, UNDP and ODA are providing assistance in the energy sector.

All donors now demand stringent adherence to environmental protection as major problems while working with the GOP

Some donors have initiated coordination among themselves by developing a common Strategy for the Development of the Energy Sector.

NGO Perspective

Very few NGOs exist in the field of energy.

The ones which do exist, contribute towards only raising public awareness about energy issues.

Very little coordination exists between donors and NGOs - except in the field of rural fuels and technologies.

1

Introduction and Background

The rate of economic growth is both dependent upon and requires a corresponding growth in energy production and use. During the Sixth Plan period (1983-88), energy consumption grew at an average annual rate of 6.6% and it is projected to increase 2.5 times the 1987-88 level by the end of the century. The ratio of growth in energy use to the economic rate of growth has ranged between 1-1.5 for over the past decade and is forecasted to continue at an average of 1.25 during the Seventh Plan (1988-93). In contrast, newly industrialized countries such as South Korea and Taiwan, have energy/economic ratios of around 1.0, and developed countries have ratios around 0.5.

Thus, for the foreseeable future in Pakistan, as the economy grows, energy use will grow even faster and emissions due to usage of energy-mostly inefficiently -will grow accordingly. On the other hand, Pakistan is also facing a severe demand-supply gap in energy, as would be highlighted in this report.

1.1 Background Information on Pakistan

The Islamic Republic of Pakistan, situated between 24 and 37 degrees north latitude and between 61 and 78 degrees east longitude, is the second largest nation on the South Asian peninsula.

According to the Economic Survey of 1991-92, Pakistan had a population of 117.32 million people on January 1, 1992, spread over an area of 852,392 square kilometers.

The economy of Pakistan is predominantly based on agriculture with around 70 percent of the population living in rural areas. The provinces of Punjab and Sindh, in the Indus Basin, contain an enormous and sophisticated irrigation system, while the rest of the country depends on small-scale irrigation, rainfed farming or small percolation wells.

Pakistan is a federation of four provinces: Balochistan, Punjab, Sindh and North West Frontier Province (NWFP). In addition the Federal Government is responsible for the Federally Administered Tribal Areas adjoining NWFP, and the North Areas. The State of Azad Jammu and Kashmir is in administrative union with Pakistan and included in its planning process. The provinces are further administratively sub-divided into divisions, districts, tehsils (or taluqas) and markaz.

Broadly speaking, each of the four provinces is associated with a dominant ethnic group with its own language: the Balochis, Punjabis, Sindhis and the Pathans or Pakhtuns of NWFP. There are also many smaller ethnic groups, such as the Brahvis of Balochistan, the Seraiki-speakers of Punjab, and the Hindko-speakers and Chitralis of NWFP, as well as the Mohajirs, Urdu-speakers who came from India at partition, concentrated in the cities of Sindh. Azad Kashmir and the Northern Areas are also very ethnically diverse.

About ninety seven percent of the population is Muslim and the character of the country is strongly marked by religion of Islam. The most important religious minorities are the Christians, found mainly in Punjab - some are prosperous and some are ranked among the urban poor - while the Hindus, are settled mainly in Sindh.

After a chequered political history, Pakistan returned to multi-party parliamentary democracy in 1988. Under the Constitution of 1973, direct elections for 207 ordinary seats and 10 minority seats, reserved for non-muslims, in the National Assembly must be held every five years.

The Senate, or upper house, of 87 indirectly-elected members, also participates in the legislative process. Both houses jointly elect a President as head of state, and the leader of the National Assembly becomes Prime Minister and head of the government and forms a cabinet. In October 1990 the Islami Jamhuri Ittehad (IJI) or Islamic Democratic Alliance won the general elections with a large majority, and its leader Mian Nawaz Sharif was elected the Prime Minister.

At the federal level the administrative machinery of the government is made up of divisions with sectoral responsibilities such as Health, Education and Local Government and Rural Development. Each division is usually headed by a Secretary, and one or more divisions come under the responsibility of a single Minister. There are also certain departments attached directly to ministries, secretariats, and autonomous and semi-autonomous government bodies. The administrations of provincial governments and Azad Kashmir are headed by Chief Secretaries and divided into departments whereas Northern Areas is headed by the Chief Commissioner. According to the federal/provincial division of issues mentioned above, it is the provincial departments that have the primary responsibility for implementing most development activities, with the divisions of the federal government assuming a co-ordinating role.

Most government revenues, including income tax, sales tax and duties on imports and exports, accrues to the federal government, although the provincial governments can raise some of their own revenues, notably land taxes. All government expenditure is structured according to a strict separation between development expenditure and current expenditure. Recurrent expenditures entailed by development projects after their lifetime are included in the latter.

Out of the total expenditure on development programs implemented by the federal government, around 72 percent of development expenditure is paid for from federal government funds.

Federal government also transfers funds to the provincial governments for the entire funding of their development programs. Provincial government revenues are used towards their recurrent expenditure (including their general administration) but are insufficient for these purposes. As a result, more grants are made by federal government, which cover around 75 percent of provincial recurrent expenditure. There has been a long history of attempts to place these transfers on a systematic footing. According to an award announced by the National Finance Commission in April 1991, the provinces will receive 80 percent of an expanded pool made up of net receipts of export duty on cotton, income tax, sales tax, and excise duty on sugar and tobacco. This will be divided between them in accordance with the population. Various discretionary grants, either for specific purposes or to reduce provincial deficits, have been made by federal government, but the 1991 award will regulate and simplify this procedure, as well as allocate certain additional revenues directly to the provinces. Overall, the award represents an increased allocation of resources to the provinces, with the likelihood that they will be expected to take greater responsibility for the use of those resources.

Development policy at the highest level is made by the National Economic Council, chaired by the Prime Minister and attended by the Chief Ministers of the provinces and their Planning and Finance Ministers, and certain key federal ministers. This body approves the five year development plans, which have been made since 1955, with a non-plan period in the seventies. Implementation of the Seventh Five Year Plan started in 1988.

The plan is drawn by the Federal Division of Planning and Development on the basis of proposals from other federal ministries, provinces, AJK and Northern Areas. The sectoral ministries are supposed to formulate their plans in consultation with local levels of government, in order to incorporate local priorities and a realistic view of implementation capacity.

Each province has a Planning and Development Department, which also serves as a link between the Federal Planning Division and the provincial line departments, co-ordinating and transmitting the provincial sectoral objectives to the center. In practice, however, the planning process is highly centralized in the higher echelons of government, and particularly in the Federal Planning Division. As a result, realistic targets which represent considered priorities are not set.

In the light of the overall medium-term objectives, and budgetary constraints, Annual Development Programs are drawn up at federal and provincial level. These include the annual budget allocation for new and ongoing projects. Approval and implementation of these are subject to the submission of plans known as PC-Is. There are prescribed powers held by Central, Provincial and Departmental Working Parties and individual officials, to authorize different levels of development expenditure. In addition, the federal government can also finance development through the Special Development Program, which gives it additional control. Planning of recurrent expenditure is based primarily on part expenditure plus annual increments, rather than on assessment of requirements.

The present government under Nawaz Sharif has launched an ambitious program of privatization and industrialization. Government controls on economic activity are being eliminated. For example, the government has lifted foreign exchange controls to boost foreign investment in the country. However, given the severe energy shortage in the country, the ambitious industrialization program may remain a dream.

2

Energy Profile of Pakistan

2.1 Commercial Energy Supply

Modern forms of energy (fossil fuels) provide two-thirds of the energy used in Pakistan. In 1990-91 petroleum (57% imported) met 39% of this amount, natural gas 36.9%, coal 10.2%, hydroelectric 13.6% and nuclear energy 0.4% (Table-1).

Table 1. Commercial Energy Supplies

(million TOE)

Energy Source	Supply in 1990-91	% Share
Oil (imported Crude/POL)	8.74	28.6
Indigenous Crude	3.15	10.3
Natural Gas	11.27	36.9
Coal (imported)	0.59	2.0
Coal (domestic)	2.52	8.2
Hydel	4.14	13.6
Nuclear	0.13	0.4
Total:	30.54	100.0

Source: Report of the Working Group on Energy Sector (for 8th 5-Year Plan) - 1992

As can be seen from Table-1, oil and gas account for about 75% of the total commercial energy supplied during 1990-91. Out of this natural gas is an indigenous product thus providing a major relief to the national exchequer. However, the imported oil component has a big impact of draining precious foreign exchange.

2.2 Commercial Energy Consumption

44% of the commercial energy went to meet the needs of industry (including power, fertilizer and agro-industry), 27% for transport and the rest of the 29% for other sectors of the economy, as shown in Table-2.

Table 2. Sector-Wise Commercial Energy Consumption

(million TOE)

Sector	Consumption in 1990-91	% Share
Industrial (includes power and fertilizer)	8.24	44.4
Transport	5.09	27.4
Residential	3.45	18.6
Agriculture	0.75	4.1
Government	0.54	2.9
Commercial	0.46	2.6
Total	18.53	100.0

Source: Report of the Working Group on Energy Sector (for 8th 5-Year Plan) - 1992.

It can be seen from Table-2 that the industrial and transport sectors are the biggest consumers of energy followed by residential sector, which accounts for more than 18% share. As industrialization is expedited and more rural electrification is pursued, the burden on energy resources would further increase thus necessitating an increase in energy supplies.

2.3 Current Energy Issues in Pakistan

The energy sector is unable to provide reliable supplies of energy to meet the existing demand of industrial, agricultural and other consumers, let alone connect new consumers. Power load-shedding has reached one-third the system's capacity and gas load-shedding one-fourth. Some major issues are:

(i) Continuing Power/Gas Shortage: The existing problems of electric power and natural gas shortages have been the most serious problems facing the industry for the last ten years - the annual amount of value added in manufacturing lost due to load shedding is estimated at $500 million. Shortage of electricity/gas reduces new investment by almost 35%. On the other hand, the present government is giving liberal concessions to investors to boost the industrialization process. This process cannot take-off unless energy shortage is taken care of.

(ii) Lethargic Performance of Utility Services: Thousands of customers in all sectors of the economy await gas connections, hundreds of thousand of customers have applied for over a year for power connections and literally tens of millions await rural electrification. However, due to complex procedures involved in applying for connections and the processes employed by the authorities, it is quite difficult to get connections. In case these services are given to the private sector the performance may improve considerably.

(iii) Inefficient End-Use in Agriculture: The cost of energy embedded in nitrogenous fertilizers, diesel fuel and electricity to operate tubewells is probably the most critical factor in determining growth in the output of agriculture production. Proper usage of energy for these end-uses would mean a better input-output ratio thus making agriculture an even more profitable sector of our economy.

(iv) Cost of Imported Oil: Though oil imports are not rising much due to local extraction, the nation still has to pay heavy foreign exchange for import of oil. This takes away development funds from a very large number of other social sector projects designed to meet basic human needs.

(v) Gas Load Shedding: The impact of gas load-shedding on Pakistan's economy is also very serious. In 1985-86, gas load shedding amounted to 24% of the gas grid. This had grave consequences for industries like fertilizer which depend mainly on gas. The GOP has even converted some gas-fired cement plants to oil-thus increasing the oil import bill.

(vi) Inefficient Public Sector Companies: Added to these problems, the energy sector in Pakistan is dominated by a small number of large but inefficient public sector companies. First of all, WAPDA, the electric power authority which blankets the country, except Karachi, is the largest employer in country. It suffers from major institutional weaknesses in: planning, maintenance, generating; and distribution efficiency; project implementation; and customer service. Similarly, corporations like Pakistan Steel, most of the state-owned industries and the oil and mineral development corporations such as a Pakistan Mineral Development Corporation and OGDC have been working in a lethargic manner, thus failing to bridge the gap between supply and demand for energy. It is due to these bottlenecks and snags present in these institutions that the present government has decided to privatize most of them to ensure a more professional style of management, coupled with better service to the end-users. A commission will soon be set-up to privatize WAPDA, while studies are underway to privatize other public sector institutions.

In order to further elaborate specific issues in the energy sector, a detailed discussion is given below.

2.3.1 Oil

Oil is used to fulfil 39% of energy requirements in Pakistan. Most of the oil needs are met through imports. That is why a major portion of Pakistan's scarce foreign exchange reserves are spent on oil imports (Table-3). Added to this, Pakistan's dependence on imported oil makes its economy highly vulnerable to price fluctuations in the international oil market, since a sudden rise in oil price would put tremendous pressure on the constrained foreign exchange reserves.

As can be seen from Table-3, the import of petroleum products only has been increasing. But import of lubes is now discontinued. When we look at total POL products only, the net import bill has risen appreciably between 1987-89. This phenomenon is due to an increase in public transport system which uses diesel as primary fuel. On the other hand, local extraction has also been expedited to meet some of the demand for oil. From the same table, it is also evident that the import of crude oil has decreased considerably on account of local extraction. Thus the grand total for POL products and crude oil shows a decrease in net payments. Even then, the sum is very high for a country like Pakistan which needs to spend a lot of precious foreign exchange on a very large number of social development projects.

Table 3. Import of Petroleum Products

(TOE and million US$)

Product	1987-88		1988-89	
	Quantity	Value	Quantity	Value
Aviation Fuel	1,540	0.6	3,288	1.3
High Octane (HOBC)	132,021	19.4	165,234	24.0
Kerosine (S.K)	594,658	95.4	629,308	96.6
Diesel (HSD)	2,449,235	341.8	2,881,978	387.9
Furnace Oil (F.O)	707,466	63.3	769,377	59.8
Crude Oil	3,801,929	460.2	3,607,650	391.1
Lubes	0	0.0	0	0.0
Total	7,686,849	980.7	8,056,835	960.7

Source: Energy Year Book - 1989

Pakistan's has proven remaining recoverable oil resources of 154 million barrels (as of 1st March 1991), and potential resources of 33.4 billion barrels, out of which probable (recoverable) reserves could be as much as 13.2 billion barrels. These details can be seen in table-4.

Table 4. Oil Reserves

(billion barrels)

Basin	Potential Reserves	Probable Reserves	Proven Reserves +
Upper Indus (North)	2.4	2.2	0.232
Middle Indus	11.0	Condensate	0.015
Lower Indus	13.2	11.0	0.140
Makran/Balochistan	4.3	-	-
Off-Shore	2.5	-	0.0
Total	33.4	13.2	0.387

Source: Report of Hydrocarbon Development Institute of Pakistan - 1991.

(+: These figures do not include production todate. Remaining reserves = 0.154 billion barrels)

The average per day oil production is currently estimated at about 70,000 barrels. If the entire domestic market demand is met through oil, these reserve would last only 2 years. The total refining capacity in the year 1988-89 was estimated at 5,667,322 metric tons, which included 3,607,650 tones of imported crude oil. Local exploration of oil is controlled by the Oil and Gas Development Corporation (OGDC). However, its performance is also coming under question since it has yet to the meet various drilling targets it sets for itself each year. For example, in 1990-91 it could only drill 28 wells against a target of 44 wells by end March 1991.

While the annual compound growth rate of local crude oil production works out to be 28.44%, it is far from satisfactory since we still have to import more than half of our oil requirements.

As far as sectoral consumption of petroleum products is concerned the historic trend is shown in Table-5 below.

Table 5. Historical Demand of Oil/Petroleum

					Oil/Petroleum (tones)	
Year	Household	Industry	Agricultural	Transport	Power	Other Govt.
1982-83	593,887	391,652	161,324	2,890,159	754,177	723,219
1983-84	678,897	689,038	173,254	3,066,952	766,274	725,780
1984-85	748,426	814,713	218,887	3,240,202	944,468	649,047
1985-86	800,449	945,977	242,599	3,410,276	1,003,928	653,553
1986-87	860,498	1,228,063	240,328	3,922,526	1,180,874	295,902
1987-88	859,415	1,224,939	330,407	4,185,965	1,598,749	329,902
1988-89	971,037	1,290,943	293,703	4,352,677	1,822,002	328,953
1989-90	1,116,896	1,297,018	286,921	4,683,595	2,188,552	399,475
1990-91	944,256	1,147,698	265,229	4,841,362	2,434,136	328,592

Source: Statistical Supplement, Economic Survey 1990-91

(HSD consumption in agricultural sector in not available separately and is included under transport sector. Agricultural sector represents LDO only).

This table shows that:

- the household sector has been gradually using more and more petroleum products, except very recently when the demand has been less than the preceding year;

- in the industrial sector, there has been a sudden increase in demand during the last 10 years due to rapid industrialization;

- demand in the agriculture sector has not increased much, rather remained steady, perhaps due to more reliance on electricity for tubewells. Also, the government data includes HSD usage in the agriculture sector under transport - thus giving constant demand figures in this sector while the number of tractors and other diesel-run equipment has certainly increased over the years.

  the transport sector is the biggest user of petroleum products and its share has been rising gradually;

- in the power sector too, demand is constantly rising and it is the second largest user of petroleum products; and

- other uses have actually reduced over the years.

A more recent breakdown of sectoral consumption of petroleum products by product-types is given in Table-6.

This table explains that diesel and furnace oil are being used most, with the transport sector accounting for almost all of the diesel and the industry and power sectors accounting for furnace oil.

Table 6. Petroleum Products Consumption by Sector

Products	Domestic	Industry	Agriculture	Transport	Power	Other Govt.	Total
Aviation Fuels	00	00	00	212,062	00	145,824	357,886
Motor Spirit	00	00	00	789,528	00	25,982	815,510
High Octane (HOBC)	00	00	00	233,205	00	6,982	240,187
Kerosine	1,001,722	00	00	1,076	00	15,271	1,018,069
Diesel (H.S.D)	00	67,773	00	3,234,027	764,962	123,146	4,189,908
Light Diesel Oil	00	455	306,039	819	2,954	797	311,074
Furnace Oil	00	1,193,768	00	100,647	1,062,623	17,123	2,374,161
Total	1,007,722	1,262,006	306,039	4,571,364	1,830,539	335,125	9,306,795

Source: Energy Year book, 1989

From the data given above, it is evident that:

- the transport, industry and power sectors consume most of the petroleum products. Hence, effective energy management programs are needed in these sectors to lessen energy demand; and

- high demand for kerosine in the household sector should be curbed by employing fuel-efficient cooking technologies.

In order to cope with the demand for oil, and to streamline various procedures, the Government of Pakistan has taken various steps, which are as under:

(i) Petroleum Policy: The new Petroleum Policy announced in November 1991, has the following salient features

Produce and procure enough oil and gas to sustain the planned economic rate of growth.

Step up exploration and development of indigenous oil and gas resources.

Mobilize domestic and external financial and technical resources from private and public sectors, especially the former, for the development of petroleum exploration, refining, import, export, storage, distribution and marketing.

Replace oil even by bulk import of gas but to so fix the quantity imported as not to dampen the indigenous exploration efforts.

Strengthen the research, technical and administrative capabilities of the government agencies responsible for making policies and their effective implementation.

Progressively free the petroleum industry and trade from government controls.

Create a competitive environment for giving the best deal to the consumer in price and quality.

Promote measures for protection of the environment especially by reduction of lead in motor spirit and use of CNG in vehicles.

(ii) Upstream Activities: Following upstream activities are scheduled during the 8th 5-year Plan period (1993-98):

Exploration of 142 wells and development of 208 wells by OGDC and private sector.

Increasing oil production to 123,317 barrels/day by 1998.

An investment of US$ 1,557 million in the oil sector.

(iii) Downstream Activities: The following downstream activities are scheduled during the 8th 5-year Plan period (1993-98).

An ambitious plan has been prepared to increase refining capacity of Pak Refineries by 0.66 million tones/annum and that of Attock Refineries by 0.85 tones/annum.

The following new refineries are coming-up:

Dhodak Topping Plant	0.1 million tones/annum
Hydrocracker	1.6 million tones/annum
Iran-Pak Refinery	5.8 million tones/annum
Multan Refinery	4.5 million tones/annum

Various new pipelines are proposed to be built, if finances could become available. The government is especially keen on these projects as both railways and road transport seem to be getting worse as far as bulk oil movement is concerned.

2.3.2 Gas

Recoverable gas reserves are estimated to be 23.6 trillion cubic feet (TCF) and annual consumption is estimated at 455,482 MMCFT. The existing gas reserves may last another 15 years if the present rate of consumption continues.

Natural gas meets 36.9% of Pakistan's energy requirements. Power sector claims the largest share i.e 39% of gas consumption, followed by fertilizer industry (20.4%); general industry (23.8%) and domestic (14.29%) as shown in Table-7.

Table 7. Sector-Wise Consumption of Gas

Sector Compound	Million TOE (1990-91)	% Share	Annual Growth Rate (1988-91)
Power	3.98	38.73	9.47
General Industry	2.45	23.87	7.63
Fertilizer	2.09	20.43	1.80
Residential	1.46	14.29	9.75
Commercial	0.27	2.68	4.60
Total	10.25	100.00	--

Source: Report of the Working Group on the Energy Sector (for the 8th 5-year Plan) - 1992.

As can be seen in Table-7, the domestic and power sectors have the highest annual compound growth rates of gas consumption. This is attributable to rising population and government's plans for increasing thermal power generation.

Table-8 shows the historical trend of gas demand by various sectors.

Table 8. Historical Demand of Gas by Sector

Gas (MMCFT)

Year	Household	Commercial	Cement	Fertilizer	Power	Industry
1980-81	17,738	7,540	26,085	65,920	84,743	62,748
1981-82	24,037	8,337	26,319	77,273	82,087	67,471
1982-83	28,357	8,905	21,222	97,308	74,205	70,522
1983-84	32.246	9,122	10,305	98,335	77,927	73,159
1984-85	37,372	9,838	8,300	100,083	88,906	74,629
1985-86	42,512	9,923	7,283	99,788	103,252	74,852
1986-87	45,761	9,878	5,496	103,131	118,098	75,305
1987-88	47,443	10,282	5,262	102,853	142,750	78,741
1988-89	51,278	10,829	5,255	104,394	142,064	81,421
1989-90	60,140	11,154	7,988	108,582	169,089	86,368
1990-91	57,450	10,873	10,770	98,889	160,889	81,039

Source: Statistical Supplement, Economic Survey 1990-91

This table shows that:

- The demand in the household sector has been rising at a higher pace from 1980-81 onwards due to rise in foreign exchange remittances by Pakistanis working abroad. Thus, their families have started using more locally made gas-consuming appliances such as gas heaters and geysers. But locally manufactured appliances are inefficient compared to foreign-made ones, and consume too much gas and are prone to gas leakages.

- The commercial sector demand has been increasing gradually.

- The cement sector demand has been declining rapidly from 1982-83 onwards due to shift to other fuels.

- Gas demand in other sectors (power, fertilizer and industry) has been increasing gradually.

This shows that there is a great potential to conserve gas in the domestic sector by using more efficient appliances. Also, in the power sector, efficient generation techniques need to be adopted to use gas in a cost-effective manner.

As far as the transmission and distribution of gas is concerned, it is divided into 2 systems:

- Sui Southern Gas System
- Sui Northern Gas System

The Sui Southern Gas System commenced in 1955 and now supplies gas to towns on the Indus Right Bank and Left Bank, as well as upto Quetta. It supplies gas to 36 towns with 1,351 industrial, 12,370 commercial and 722,407 domestic consumers. Its current capacity is 380 MMCFT.

The Sui Northern System commenced in 1956 and supplies gas to 63 towns with 2,591 industrial, 25,349 commercial and 665,629 domestic consumers. Its current capacity is 447 MMCFT.

In order to enhance the gas sector the government has chalked-out the following projects in the 8th 5-year Plan period (1993-98):

S.No.	Project	Commissioning Date	Pipeline Capacity (MMCFT)
1.	Sui Northern - VI Phase - II	October 1996	680
2.	Gas Utilization (ex-Qadirpur)	June 1993	200
3.	Gas Purification Facility	December 1993	120
4.	Gas Purification Facility	May 1995	120
5.	Up-gradation of Compression and Installation of Additional Compressor at Dadu	July 1994	N.A

The government has also decided to launch a massive program to convert petrol vehicles to compressed natural gas (CNG). A pilot project is also being considered to test the feasibility of running tubewells on gas.

2.3.3 Coal

Pakistan does not have high grade coal in abundance. The total coal reserves in Pakistan have been estimated as 19,741 million tones which include 6,712 million tones as "Inferred" reserves (Table-9).

Table 9. Summary of Coal Resources Estimates for Known Coal Fields

(million tones)

Province	Identified			Hypothetical	Total Resources	Total Recoverable Demonstrated Reserves
	Demonstrated		Inferred			
	Measured	Indicated				
Sindh	422.0	2060.0	6571.0	10228.0	19281.0	1489.2
Balochistan	52.5	12.5	129.0	0.0	194.0	39.0
Punjab	48.0	21.0	9.0	178.0	256.0	41.4
NWFP	0.0	0.0	3.0	7.0	10.0	0.0
Total	522.5	2093.5	6712.0	10413.0	19741.0	1569.6

Source: Geological Survey of Pakistan - 1990.

The total production of local coal is currently recorded as 2.64 million metric tones (Table-10). Even at 10 million metric tones annual recovery, existing coal reserves would last for another 100 years.

Table 10. Field-Wise Production of Coal

Fields	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	A.C.G.R. 1983-84 to 1988-89 Percentage
Sor Range	193,605	207,010	172,222	162,765	187,021	195,501	0.19
Degari	116,621	147,459	183,241	152,120	165,177	158,134	6.28
Sharigh	43,765	59,026	42,213	59,807	69,158	81,550	13.26
Sinjidi	179,943	204,160	202,344	185,293	215,957	215,872	3.71
Mach	81,017	92,580	65,297	109,343	224,253	205,988	17.75
Harnai Khost	18,459	42,614	60,268	40,767	35,061	128,004	47.30
Duki	201,688	218,697	224,908	232,314	293,896	303,496	8.52
Pir Ismail Ziarat	84,702	163,082	201,845	144,352	194,339	187,923	17.28
Abegum	36,809	34,279	16,880	27,058	56,374	52,050	7.17
Makerwal Salt Range	473,452	471,223	425,572	485,126	595,761	456,784	-0.71
Lakhra	366,011	533,462	543,975	585,361	652,332	609,036	10.72
Jhimpir	31,119	30,321	26,874	59,683	17,471	14,624	-14.02
Makerwal/Gula-Khel/Kohat	31,707	33,805	36,168	36,569	43,175	34,064	1.45
Total	1,868,898	2,237,738	2,201,807	2,260,558	2,749,975	2,643,028	7.18
A.G.R. (%)	0.00	19.74	-1.61	2.68	21.65	-3.89	

Source: Data Provincial Directorates of Mineral Development - 1991

It can be seen from Table-10 that while some fields are being utilized in an effective manner, the utilization of other fields is either increasing very slowly or even declining. This needs the attention of the government since it is more feasible to abandon uneconomical fields than to continue spending money on their upkeep.

Current use of coal is restricted to brick-kiln industry which accounts for more than 98% of the total production. The rest is used for domestic purposes and power generation (Table-11).

Table 11. Coal Consumption by Sector

(Metric Tones)

Sector	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	A.C.G.R. 1983-84 to 1988-89 Percentage
Power	23,544	32,114	25,569	18,992	21,288	18,176	-5.04
Brick-Kiln Industry	1,610,740	2,174,427	2,148,187	2,220,751	2,704,811	2,608,490	7.57
Domestic	21,607	16,035	14,398	5,627	20,255	14,875	-7.19
Other Govt.	13,007	15,162	13,453	15,188	3,623	1,485	-35.20
Total	1,668,898	2,237,738	2,201,607	2,260,558	2,749,975	2,643,026	7.18
A.G.R. (%)		19.74	-1.61	2.68	21.65	-3.89	

Source: Data by P.M.D.C. - 1991

It can be seen from Table-11 that except for the brick-kiln industry, the use of coal is declining in all other sectors. This could be due to the environmental hazards associated with using local coal.

It must be mentioned here that the Energy Wing of the Ministry of Planning and Development has estimated that in 1991-92 the demand for coal would increase to 6.4 million tones, and upto 10.5 million tones by 1998.

Coal is imported only for Pakistan Steel which uses it as metallurgical coal (Table-12).

Table 12. Historical Import of Metallurgical Coal

Unit	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	A.C.G.R. 1983-84 to 1988-89 Percentage
Metric Tonne	491,079.00	715,578.00	852,318.00	918,639.00	852,945.00	895,939.00	12.78
A.G.R. (%)		45.72	19.11	7.78	-7.15	5.04	

Source: Data by Pakistan Steel Mills Corporation - 1991

The government had solicited the help of JICA to conduct a feasibility study on the production of coal briquettes from Lakhra coal mines, for domestic heating. However, this project has not been able to make further headway due to lack of commitment on part of the government to develop coal as a cheap energy source.

Since coal can be easily used for power-generation (if the environmental hazards are controlled) the government has chalked-out a US $ 43 million project to develop mechanized coal mines at Lakhra to run three 50-MW power plants through WAPDA. Besides this, the Sindh Coal Development Authority is being established to work in collaboration with the GSP to develop coal fields in Sindh.

The help of the private sector is also being sought for exploratory work all over the country. The Government is also setting-up a "Coal Appraisal Wing" in the GSP for close spaced drilling to farm-out large blocks for public bidding by concerned provinces. Donor assistance is needed by the government to initiate this activity.

In order to increase demand for coal, WAPDA has been asked to prepare specific coal-fired power projects based on local coal. These projects would be given preference even if generation cost is somewhat higher.

All of these steps would greatly help in increasing demand for coal which still remains an untapped source of energy.

2.3.4 Electricity

The current installed power generating capacity is recorded at 8936 MW. Total generation of electricity by all means is recorded at 40,700 GWH. WAPDA claims the biggest share in electricity generation (83.4%) followed by KESC (16.5%) and KANUPP (0.1%). Table-13 shows breakdown of electricity generation by source over the last 20 years.

Table 13. Historical Generation of Electricity

	Hydroelectric (Hydel)		Thermal		Nuclear	
Year	Installed Capacity (MW)	Generation (Gwh)	Installed Capacity (MW)	Generation (Gwh)	Installed Capacity	Generation (Gwh)
1980-81	1,847	9,043	2,121	6,869	137	150
1981-82	2,547	9,522	2,121	7,983	137	183
1982-83	2,357	11,365	2,114	8,104	137	228
1983-84	2,548	12,826	2,325	8,723	137	324
1984-85	2,898	12,241	2,580	10,416	137	346
1985-86	2,898	13,804	3,263	11,355	137	430
1986-87	2,901	15,250	3,615	12,951	137	502
1987-88	2,898	16,690	3,776	16,147	137	254
1988-89	2,898	16,670	4,069	17,562	137	30
1989-90	2,898	16,650	4,739	20,238	137	292
1990-91	2,898	18,245	5,901	22,455	137	..

Source: Economic Survey 1990-91

It can be seen from table 13 that thermal power generation capacity has been increasing at a much faster pace compared to hydel generation capacity, while nuclear generation capacity has been at a standstill. Pakistan has abundant sites and potential for hydel power generation, but political problems with the North-West Frontier Province (NWFP) have made it almost impossible to tap this source. This is evident from the fact that the proposed Kalabagh dam project has not even been okayed by all concerned parties inspite of the lapse of many precious years.

In 1989, there were about 7.3 million electricity consumers in Pakistan (Table-14). This figure is increasing every day. The massive urbanization coupled with the present government's emphasis on industrialization and rural electrification would put tremendous pressure on existing generation capacity.

Table 14. Electricity Consumers and Average Consumption in 1988

Consumer Category	WAPDA		KESC		Country Wide	
	Consumers (Million)	Average Yearly Consumption Per Consumer (KWH)	Consumers (Million)	Average Yearly Consumption Per Consumper (KWH)	Consumers (Million)	Average Yearly Consumption Per Consumer (KWH)
Domestic	5.08	1352	0.700	2641	5.78	1508
Commercial	1.04	1026	0.210	4193	1.25	1558
Agricultural	0.14	31114	0.001	22533	0.141	31056
Industrial	0.15	50527	0.021	88763	0.171	55222
Bulk	0.06	34033	0.010	42232	0.07	35204
Total	6.42	3413	0.942	5323	7.362	3658

Source: Tanveer Azhar, NESPAK - 1989.

The domestic sector demand for electricity is rising much faster than the demand in the industrial sector (Table-15). This could have serious implication as the domestic sector pays a subsidized tariff and this could further diminish cash flow to the utilities.

Table 15. Historical Demand of Electricity

(GWh)

Year	Traction	Household	Commercial	Industrial	Agricultural	Street Light	Other Govt.	Total
1980-81	44	2,696	954	4,520	2,135	137	893	11,384
1981-82	42	3,223	1,047	5,002	2,369	105	910	12,698
1982-83	44	3,752	1,049	5,572	2,559	109	1,065	14,150
1983-84	38	4,535	1,287	5,884	2,673	101	1,212	15,730
1984-85	37	5,076	1,413	6,249	2,798	105	1,906	17,584
1985-86	36	5,845	1,526	7,288	2,900	131	1,939	19,665
1986-87	38	6,806	1,713	8,012	3,471	146	1,511	21,697
1987-88	40	7,900	1,868	8,973	4,415	167	1,712	25,075
1988-89	35	8,660	1,921	9,416	4,379	187	2,189	26,787
1989-90	36	9,500	2,000	10,100	5,300	200	2,000	29,136

Source: Economic Survey 1990-91

Transmission and distribution losses also account for heavy system loss, as can be seem at Table-16.

Table 16. Power System Losses as % of WAPDA Generation

Year	Auxiliaries Consumption	Transmission Losses	Distribution Losses	Overall System Losses
1983-84	2.2	9.9	17.2	29.3
1984-85	2.1	9.4	15.2	26.7
1985-86	1.9	9.1	15.4	26.4
1986-87	1.7	8.7	14.5	24.9
1987-88	1.6	8.5	14.5	24.6
1988-89	1.7	8.3	13.9	23.9
1989-90	3.0	6.8	12.7	22.5
1990-91	3.0	6.6	12.4	22.0

Source: Energy Year Book 1989

Note: (Data for 1988 onwards is based on estimation)

These losses coupled with increasing urbanization, industrialization and rising standard of living put so much pressure on the national grid that the utilities have to resort to large-scale load-shedding (Table-17).

Table 17. Targeted and Actual Load-Shedding

(MW)

	Load Shedding 1988-89 (target)		Actual Maximum Load Shedding in 1988-89	
	WAPDA	KESC	WAPDA	KESC
July	- 432	- 38	- 380	- 36
August	- 108	- 23	- 584	- 77
September	- 353	- 16	- 947	- 149
October	- 456	- 05	- 276	- 144
November	- 485	- 53	- 242	- 24
December	- 780	- 95	- 700	- 158
January	- 701	- 14	- 550	- 34
February	- 728	- 83	- 761	0
March	- 699	- 28	- 1101	- 7
April	- 785	- 40	- 1350	- 134
May	- 798	- 52	- 2103	- 113
June	- 806	- 84	- 1800	- 96

Source: Energy Year Book 1989

Note: (Data for 1988 onwards is based on estimation)

As can be seen from Table-17, actual load-shedding was much more than estimated load-shedding targets. This was due to variability of hydel power, rapid growth of demand, slippage in commissioning schedule and unforeseen breakdowns. It has been estimated that annually US $ 500 million of value added in manufacturing is lost due to this load shedding.

The whole system of power generation, distribution and sales is under state control. Only recently, the private sector is being encouraged to produce power - though to see a project on ground is still to become a reality.

As far as future power development project are concerned, the following are noteworthy:

1. Installation of combined cycle power plant units (300 MW) at Kot Addu.

2. Chashma low-head project (270 MW).

3. Completion of the 2400-MW Kalabagh Dam by 1998 (although this project may not even be initiated for quite some time due to political problems).

4. Construction of a 1200-MW power plant at Ghazi-Ghariala (feasibility study being conducted by a joint venture of local, UK and USA consultants).

Since the government has embarked upon a massive rural electrification and industrialization program, the demand for electricity will increase rapidly during the next few years. To cope with this situation, the following steps are envisaged in the 8th 5-Year Plan:

- Highest priority will be accorded to tap the vast, but still unutilized hydropower potential.

- A large number of transmission projects will be executed to ensure proper transmission of electricity to load centers.

- For secondary transmission/distribution programs, WAPDA has been allocated US$ 492 million while KESC has been allocated US$ 248 million by the Government.

- Both WAPDA and KESC will give a total of 4.0 million new connections.

- WAPDA would reduce line losses to 18.5% by 1998, through retrofit, stoppage of theft of electricity and through better management.

However, all of these efforts are not enough to cope with the rising demand for electricity without resorting to import of more oil and coal, since locally these two energy sources are not being explored at the desired pace. (Hence, the issue of enough supply of electricity at desired rate and cost may remain the major topic of concern for the government.

2.3.5 Renewable Sources

Given the widening gap between energy demand and supply and the fluctuating oil market, it is imperative for the Pakistani government to search for alternative and renewable sources of energy.

At present the sales and distribution network for solar, wind and biogas technology in Pakistan is almost non-existent. However, Directorate General of New and Renewable Energy Resources (DGNRER) has completed the following projects at a very small scale:

(i) 18 Solar stations with a capacity in the range of 5-57 kwp totalling 434 kwp have been installed all over the country to demonstrate the supply of electric power through solar technology;

(ii) 4137 Bio-gas units have been installed in various parts of the country;

(iii) 100 Solar water heaters and 60 solar cookers have been installed to demonstrate solar thermal technology; and

(iv) 4 wind pumps and 2 wind power systems have been installed for water supply. While there is a good potential to tap renewable sources of energy, very little work has been done in this area in Pakistan.

Considering the fact that 70% of our population lives in rural areas, some of which is not even connected to the national grid, it is essential that non-conventional/renewable sources of energy are used to fulfill their basic needs for energy. The following projects could be effectively launched in the rural areas of Pakistan, through the employment of non-conventional sources:

a) Lighting and vaccine refrigeration in rural health clinics and power supplies for education and communities social functions in rural and remote areas.

b) Water pumping system using solar as a source of energy for domestic and photovoltics.

c) Power supplies to remote villages and isolated houses through solar photovoltics.

d) Battery charging through solar system.

e) Mechanical power supplies for water pumping system for domestic and irrigation, using wind mills as a source of energy.

f) Bio-gasification (Bioconversion processes and system design for methane production).

g) Solar thermal for water heating.

Photovoltaic (PV) can also be used for the following applications on commercial basis, if we consider life cycle cost and socio-economic benefits:

a) **Lighting, sterilization, and vaccine refrigeration in rural dispensaries**

The power requirement for each dispensary is about 50 KWH/month. The estimated market for this sector could be over 10,000 KW over next 10 years.

b) **Water pumping for irrigation, drainage and village water supply**

This sector has not been studied properly. However, estimated market for 10 years could be about 12000 KW.

c) **Remote telecommunications facilities, cathodic protection and Navigation aids**

This market segment includes applications such as microwave repeater stations, radio repeater, corrosion protection for pipeline and bridges, navigation aid, railroad crossing signals, highway signs and lights. The estimated market for these purposes is 1,200 KW for next ten years.

d) **Remote village electric power supply**

The power for a rural village having 50 house holds with no access to electric grid require about 1000 KWh/month. The total addressable market in this sector alone could be over 30,000 KW during next 10 years.

Due to lack of reliable data on renewable sources of energy, other than hydel, the government has not been able to evolve an effective strategy to use these resources. However, the Energy Wing of the Ministry of Planning and Development will complete a UNDP/World Bank funded study by end 1992, giving detailed information on energy usage, mostly renewable and non-commercial, in urban and rural households.

2.3.6 Energy Conservation

Traditionally, the energy demand has been met through an expansion in the generation capacity. However, this approach is not only time-consuming but requires heavy investments. On the other hand, demand-side management (DSM) and energy conservation can improve end-use efficiency to release additional capacity in the system at fractional costs (see Table-18 for comparative costs of energy).

Table 18. Comparative Costs of Energy

Source		Cost (Rs./mm Btu)
Conventional		
Natural Gas		48.50
Oil		48.10
Diesel		106.62
Kerosine		105.46
Electricity		266.71
Conservation		
Thermal	Boiler Tuning	1.12
	Boiler Upgrade	11.64
	Stream System Upgrade	11.64
	Waste Heat Recovery	23.28
Electricity	Lighting Upgrade	76.01
	Replacement of Inefficient Motors	152.01
	Motor Speed Controls	125.81

Source: ENERCON, 1989

It can be seen from Table-18 that simple measures such as boiler tuning and steam system upgrade cost just a fraction of the cost involved in using fossil fuels to obtain same level of efficiency.

Energy demand has been outstripping available supply for many years in Pakistan, and thereby retarding economic growth. The federal government in 1984, formed a select Working Group on Energy Conservation to formulate a plan to develop energy conservation as an additional means of meeting the country's pressing energy needs. With assistance from the United States Agency for International Development (USAID), the Working Group completed preparation of a plan for a National Energy Conservation Program in April 1985.

The focal point of the National Program was the creation of an autonomous federal agency solely dedicated to promoting improved energy efficiency throughout the country. The agency was to be called ENERCON. Several key concepts were incorporated into the design of ENERCON. These included:

Comprehensiveness - ENERCON needed to possess the capability to carry out all functions necessary to promote energy conservation including planning, policy development, training, information development and dissemination, investment promotion, monitoring and evaluation, and perhaps most importantly, design and implementation of large conservation programs.

Autonomy - ENERCON was designed to be free standing in order to gain increased public visibility, to be unencumbered with other responsibilities, and to be able to exercise independent judgment in policies and programs.

High Level - In order to have sufficient authority within the government, ENERCON needed to be placed at a high level. Thus, the Prime Minister is the Patron-in-Chief of ENERCON. A high level council, the Pakistan Energy Conservation Council, governs ENERCON's activities.

ENERCON was formally established by resolution of the Prime Minister on December 23, 1986; with funding and technical assistance from the USAID. ENERCON was established as an autonomous body under the Ministry of Planning and Development.

ENERCON is governed by the Pakistan Energy Conservation Council (PECC), which functions under the patronage of the Prime Minister. The Minister for Water and Power is the Chairman of the Council, and the Deputy Chairman, Planning Commission acts as the Chairman in his absence. Other members of the Council are

Chairman of the Advisory Committee of ENERCON

Secretaries of the Ministries of Agriculture, Communications, Finance, Industries, Housing, Petroleum and Natural Resources, Planning, Production, Railways, Science and Technology, and Water and Power.

Chief Secretaries of the Provincial Governments

Managing Director, ENERCON as Member Secretary

The Council is provided with an Advisory Committee whose Chairman is selected from the private sector.

It is responsibility of the PECC to:

Administer ENERCON and render policy guidance on the formulation and implementation of National Energy Conservation Plans and Programs".
In addition, the Council is to:

- Recommend incentives and provide technical assistance to other Ministries
- Establish, approve and monitor energy efficiency standards for equipment
- Direct ENERCON in the development of manpower, information and outreach programs, and other functional areas
- Evaluate the progress of ENERCON and the National Program

ENERCON functions as the executive arm of the Council. It is to carry out the following responsibilities:

- Prepare a comprehensive National Energy Conservation Plan
- Develop data bases and serve as a clearinghouse for information on energy conservation
- Provide training opportunities
- Develop and monitor efficiency standards
- Undertake demonstration programs
- Draft appropriate legislation for energy conservation
- Procure funds to undertake energy conservation activities

During the 7th Five-Year Plan period (1988-93) various key energy saving targets have been set by ENERCON which are given in Tables 19-21.

These tables detail the targets of energy conservation that have to be met by 1993. However, lack of funds, lack of interest by consumers and low-priced energy have been the main obstacles in achieving these targets.

Table 19. Key Energy Conservation Targets for 7th 5-Year Plan (1988-93)

Targets	High Scenario	Low Scenario
Cumulative Energy Savings to be Achieved	5.5 million TOE	2.96 Million TOE
Cumulative Energy Cost Saving to be Achieved	Rs. 23.1 billion	Rs. 12.0 billion
Number of Energy Surveys to be Performed		
Public Sector Industry	70	30
Private Sector Industry	330	200
Public Buildings	50	30
Private Buildings	40	25
Demonstration Projects to be Implemented		
Industry	15	10
Buildings	10	6
Transport	5	3
Agriculture	4	3
Feasibility Studies to be Conducted	20	10
Number of Persons to be Trained		
Graduating Engineers	9,000	4,500
Thesis Projects	100	50
Continuing and Professional	10,000	5,000

Source: ENERCON, 1987

Table 20. Cumulative Energy Savings Over 7th 5-Year Plan Period

(000 TOE)

	Electricity		Petroleum Products		Natural Gas		Coal		Total	
Sector	High	Low	High	Low	High	Low	High	Low	High	Low
Industry	169	76	801	346	1969	861	760	345	3699	1628
Transport	0	0	1028	772	0	0	0	0	1028	722
Buildings	194	175	0	0	339	304	0	0	533	479
Agriculture	69	19	200	64	0	0	0	0	269	83
Total	432	270	2029	1182	2308	1165	760	345	5529	2962

Source: ENERCON, 1987

Table 21. Annual Energy Savings as % of Annual Sectoral Energy Demand over 7th 5-Year Plan Period

Sector	1988-89		1989-90		1990-91		1991-92		1992-93	
Sector	High	Low	High	Low	High	Low	High	Low	High	Low
Industry	3.8	1.7	5.5	2.4	6.8	3.0	7.3	3.2	7.6	3.3
Transport	3.9	2.9	4.9	3.3	5.0	3.7	5.6	4.2	6.2	4.6
Buildings	0.1	0.1	0.3	0.3	0.5	0.5	0.9	0.8	1.3	1.1
Agriculture	0.6	0.2	1.4	0.5	2.4	0.8	3.6	1.1	4.9	1.4

Source: ENERCON, 1987

The major issue in this area is government's commitment to energy conservation. More funds are needed to conserve energy, but these are being provided to large and extremely expensive power generation projects. ENERCON has recently started negotiations with a number of donors (such as, UNDP, GTZ, World Bank, Swedish Government, ODA, etc.) to launch a full-scale Energy Conservation Program. Also, ENERCON will soon initiate the preparation of the National Energy Conservation Plan through World Bank/UNDP assistance, employing a leading Japanese expert, Mr. Hidetoshi Nakagami of the Tokyo-based Jyukankyo Research Institute.

In order to promote the cause of energy conservation in Pakistan, the following steps are beings taken:

- ENERCON is implementing a US$ 5.0 million Power Factor Improvement Project through Asian Development Bank assistance.

- ENERCON has developed packages for the following 3 projects for funding by foreign donors:

(i) Energy Efficient Lighting
(ii) Tubewell Efficiency Improvement
(iii) Industrial Boiler Replacement

- Taxes and duties on energy efficient equipment are being abolished.

- Incentives will be given to promote energy conservation, besides using legislative measures.

ENRECON is also holding a Donor's Conference in August 1992 to unveil its programs requiring foreign assistance.

3

Countermeasures to Face the Issues

The energy situation in Pakistan is really serious and explosive. Various short term as well as long term policies are needed to check the problem. Moreover, the problem has to be tackled at various levels, ranging from creating awareness among people to save energy to investing in oil exploration.

3.1 Countermeasures for the Issues

i. Petroleum experts believe that upto 50% more oil can be extracted in Pakistan from existing resources through fracturing and other tertiary recovery techniques, during the eighth five year plan, and that more gas can be developed and transmitted than is presently the case - especially if given to the private sector.

ii. Coal remains as yet a marginally-tapped energy resource for Pakistan. There are great prospects for coal-fired power-generation especially in Sindh and Balochistan.

iii. Hydro-electric potential is similar to coal in that only about 10% of the existing potential has been tapped even though the approximately 2500+ MW from Tarbela, Mangla and Warsak and others represent upto 50% of total national electric power supply. Decisive action of proceeding with Kalabagh Dam is fundamentally important to make Pakistan's power generation plans possible.

iv. Pakistan is considered as a country which does not easily "sell itself" to international petroleum companies despite its improving investment and repatriation codes. For this more aggressive concessions, acreage, leasing and promotion to private sector is needed. In this regard, strengthening Pakistan's own private petroleum companies is required to encourage more gas exploration and development.

v. Except for metallurgical coal (coke) Pakistan does not import any coal. Yet this may be an important option for supply which would minimize dependence on imported oil and free up indigenous gas and oil for higher value uses in industry, transport and fertilizers. Also, there is need to involve the private sector in power generation projects.

vi. There is a pressing need to take concrete steps for the conservation and efficient use of the energy. While energy conservation involved many technical components, the greatest challenge is to create awareness about it among the energy-users and policy-planners. Furthermore, government institutions involved in energy production or management have to be streamlined and restructured.

vii. Reduction in the projected quantum of load shedding in the future and continued financial and economic viability of power generation can only be achieved through the enforcement of a well devised demand regulation policy. Basically, there are two sets of tools available today which when used effectively in conjunction with each other, can help to overcome the steepness of demand growth profile. The first is demand tariff which exerts control through financial incentives and penalties while the other is a peak limiting breaker, which exerts technical control over excessive levels of consumption.

viii. Rural electrification may be slowed down and renewable resources introduced to lesson the burden on the national grid.

3.2 GOP's Policies and Activities for Countermeasures

Since early 1980s, the government has been taking steps to enhance energy planning, conservation and resource assessment capabilities. Although there is no Central Ministry of Energy, the Energy Wing of the Planning and Development Division coordinates all activities related to energy. The following major energy organizations exist under various ministries:

Ministry of Water & Power

(a) WAPDA: The Water and Power Development Authority (WAPDA) came into being in the 60s and controls generation and distribution of electricity all over the country except Karachi. It is fully autonomous and enjoys vast powers. Recently, its performance is being questioned seriously due to rising cases of load-shedding.

(b) KESC: The Karachi Electric Supply Corporation (KESC) produces and distributes thermal power in Karachi. Its performance has been fairly better due to very rare cases of load-shedding.

(c) Private Power Cell: This Cell has been created very recently by the present government to induce the private sector into power generation and distribution. It has yet to make a major headway.

Ministry of Petroleum & Natural Resources

(a) OGDC: The Oil and Gas Development Corporation (OGDC) is responsible for controlling the oil and gas sectors. It gives concessions to foreign companies for oil and gas exploration in the country.

(b) DGNRER: The Directorate General of New and Renewable Energy Resources (DGNRER) is responsible for popularizing renewable energy resources. However, its performance has gradually decreased over the past few years.

(c) HDIP: The Hydrocarbon Development Institute of Pakistan (HDIP) is involved with research and technical services in the oil and gas sectors. It has also been promoting the use of compressed natural gas (CNG) in automobiles.

Ministry of Planning and Development

(a) Energy Wing: This Section of the Ministry coordinates all energy-related activities in the country.

(b ENERCON: The National Energy Conservation Center (ENERCON) is based in Islamabad and is responsible for coordinating all energy conservation activities in Pakistan.

The Government has also taken steps to bring the private sector into the oil and gas exploration sector. In this respect, a very liberal Petroleum Policy has been recently announced.

Under this policy, foreign firms have been offered lucrative terms to initiate large-scale oil and gas explorations in the country. However, recently some foreign firms have had to close their offices in Pakistan due to security problems around drilling sites-especially in the Sindh province.

Since the present government is giving extreme importance to industrialization, self-employment and privatization, it is natural that the demand for energy would increase manifolds. In order to cope with this situation no immediate plans are

evident. Thus, a major issue for the current government is to bridge the gap between demand and supply of energy.

3.3 Shortcomings in GOP's Policies

While the GOP is trying its level best to cope with the energy crisis, there are still many shortcomings in its policies which may be classified as under:

i. Power project are seriously behind schedule due to political, economic and technical reasons. The Kalabagh Dam is a classic example where millions of dollars have been spent without making any progress on ground.

ii. The GOP has a serious lack of local currency for investment in energy projects.

iii. Electricity tariffs are seriously distorted thus giving no incentives to conserve energy to such groups as tubewell owners. This can be proved by looking at tariffs for various consumers given below:

Domestic (upto 50 units)	-	Rs. 0.54/kwh
Office/Commercial (first 100 units)	-	Rs. 2.17/kwh
Industrial (single phase)	-	Rs. 1.19/kwh
Industrial (3-phase)	-	Rs. 2.19/kwh
Agricultural Tubewells	-	Rs. 0.49/kwh + Rs. 41.0/kw/month

(Source: Statistical Supplement, Economic Survey, 1990-91).

As can be seen, domestic and agricultural consumers pay very little for energy and thus use it in inefficient manner since there is not much saving even if they invest in energy conservation.

iv. Overstaffing, corruption and pilferage of electricity is rampant in WAPDA and KESC, though OGDC and other energy-related organizations are also plagued to some extent by these problems;

v. Local oil and gas exploration is proceeding at a slower pace compared to the growth in demand. This is due to the fact that security problems arise near drilling sites. This is a specially disturbing feature for foreigners.

vi. Due emphasis is not being given to promote renewable sources and energy conservation. The government should encourage these two sectors as much as possible.

4

Foreign Assistance Requirements of GOP

By 1993 Pakistan will need at least 6000 MW more, an almost doubling of capacity to meet demand, which will require additional investments in excess of US $ 4 billion. These figures include the necessary initial investment for projects coming on line after 1993, but excludes an additional US $ 2 billion needed for Kalabagh Dam. At current rates of cost recovery, WAPDA will be able to finance only 40% although even that will require a doubling of rates by 1993. Thus for such a major investment plan, GOP needs extensive financial assistance from foreign donors. A list og government departments dealing with the energy is given at Annex-A.

4.1 Priority Issues for the GOP

Besides expansion in generation capacity, the GOP considers the following to be priority issues:

i. Training / Human Resource Development

Since energy is a very vast subject and is experiencing changes due to advents in technology and operational techniques, it is necessary that professional working in this area acquire most modern knowledge. The government has been giving due emphasis to training and its officials have been receiving foreign training in various technical areas. Yet, there are many areas where sufficient expertise is still scarce. These include: energy planning; energy conservation in industry, transport, buildings and agriculture; renewable resources; and environmental impact assessment.

ii. Oil and Gas Exploration

While a number of foreign firms are working in the field of oil and gas exploration, local expertise must be upgraded substantially to come to their level. Thus, acquiring expertise in oil and gas exploration is extremely important from the government's point of view.

iii. End-Use Energy Efficiency Improvement

While ENERCON exists to improve end-use energy efficiency in all sectors of the economy, there is very little expertise available in the country to undertake tasks such as energy audits, thermal insulation, power-factor correction, etc. Hence, the government is keen to acquire any possible help in this vital area.

iv. Reduction in T/D Losses

WAPDA's transmission and distribution (T/D) losses are quite high compared to international standards. However, a massive program to reduce these losses can only be undertaken through foreign assistance due to scarcity of local funds and expertise.

4.2 Foreign Assistance Requirements

The magnitude of foreign assistance required to undertake the projects mentioned above is colossal. Only in the power sector, an investment of US $ 4.0 billion is required to add enough generation capacity to meet the growing need for power. Similarly, billions of dollars worth of investments are needed by the oil, gas and coal sectors to be able to become self-reliant in bridging the gap between supply

A complete list of such projects is usually provided by the government to its aid-giving consortium each year. The same can be referred to for further details.

5

Donors Experience

5.1 Profile of Donors

The international donors like UNDP, USAID, ODA and Swedish Government have played a significant role in the development of the energy sector in Pakistan. These donor agencies have been instrumental in providing technical assistance, financial assistance and training of technical personnel. A list of major donors is given at Annex-B.

All the gigantic hydro-electric projects and most of the oil and gas exploration ventures have been partly or wholly financed by these donors. These include Mangle and Terbela Dams as well as thermal power stations of Jamshoro and Karachi.

The foreign donors continue to provide assistance to GOP in the development of energy resources. But there is a growing shift in the policy of the donors agencies. Now a major area of concern for the donor agencies is environment. All the energy projects have to be environmentally feasible. Secondly, the donor agencies are also stressing on alternative sources of energy. In fact, very tough negotiations are now being held between many foreign donors and Government of Pakistan on account of the environmental hazards associated with some projects.

A survey of foreign donors has revealed the following facts:

Most Crucial Issues Facing Pakistan

The donors have pointed-out the following issues as being most crucial as far as the energy sector in Pakistan is concerned.

i. Rising Population

With a population growth rate of 3.1% per annum, the pressure on existing resources is increasing at a very fast pace. All efforts to check this growth rate have been almost futile since the decrease in population growth rate has not been as much as would have been desired. Rapid urbanization and government's plans to provide rural electricity are two factors which increase demand for conventional power in such a manner that the gap between the demand and supply will keep on increasing unless some drastic steps are initiated.

Hence, though not directly related to the power sector, there is an urgent need to check the rate of population growth.

ii. Subsidized Energy Pricing

As was shown in section 3.3, the price of electricity is heavily subsidized for domestic and agricultural consumers. This gives no incentives to them to conserve energy since potential savings would be too low in monetary terms. This issue has to be resolved by having a more rational pricing structure.

iii. Political Problems

Most of the energy-sector projects have to be planned under severe political constraints. For example:

Kalabagh Dam is making no headway as the politicians of two provinces consider it as a threat to their people.

- Oil and gas exploration work is not being carried-out at full pace since the local inhabitants of some sensitive areas create disturbances for the local and international firms working in those areas.

- International political pressures on Pakistan also cause delays in initialing some projects in time.

The only solution to these problems is to have a very strong government at the center with the provinces getting due share in the energy royalties.

(iv) Heavy T/D Losses

While WAPDA has initiated various measures to curb transmission and distribution losses in the national grid, pilferage of electricity is rampant and usually added to T/D losses. Anti-pilferage measures have to be adopted to control the T/D losses.

Most Implementable Programs

The donors have highlighted the following as being most implementable programs in Pakistan's energy sector.

i. Technical Training

The needs of training are quite diverse and urgent since modern technology is introducing latest techniques and equipment to the energy sector. Training can either be imparted locally (as USAID has constructed a Distribution Training Institute for WAPDA at Islamabad and JICA has established the High Voltage Testing Labs in Rawat) or abroad (as a large number of energy sector professionals go abroad through JICA, ODA and USAID).

ii. Commodity Supply

Most of the energy sector donors have been supplying commodities under their aid projects. These commodities range from turbines to simple measuring equipment.

iii. Energy Conservation

Recently, a large number of donors have started taking interest in demand-side management (DSM) which implies improving end-use energy efficiency. Due to environmental concerns, it is considered that improving energy efficiency costs much less to not only save energy, for other uses, but also to improve the environment.

Most Difficult to Implement Programs

The donors considered that although it is a very general question, the following may be termed as difficult to implement programs:

i. Large Power Projects

It was felt that large power projects, such as Kalabagh Dam, require a lot of initial work and a possibility that they may run into political problems causing unneccessary delays with the result that some donors see no point in pursuing these projects.

ii. Projects With Many Counterpart Agencies

In some projects, the number of counterpart or reporting agencies can become large. This causes further delays and at times abandonment of these projects.

iii. Projects Involving Policy Changes at Government Level

In some cases, like private power generation, the government has to take policy-level decisions to change its procedures. This could entail lot of resistance from various agencies which may consider such projects as a threat to their existence.

Strengths of Counterpart Agencies

The donors were of the opinion that counterpart agencies had a number of strong points, such as the following:

i. Large, Organized Set-ups

Government agencies and departments are generally large and spread all our the country. They also enjoy authority. This is more true of execution agencies such as WAPDA, OGDC, etc.

ii. Highly-trained Professionals

In most of the execution agencies, highly-trained professionals exist thus making it easier for the donor agencies to work with them.

iii. Decision Making Authority

Governments have lot of decision-making authority and it is used at times to expedite matters related to aid projects.

Weaknesses of Counterpart Agencies

While there are strong points in counterpart agencies, some weaknesses also exist side by side. The donors termed the following as being some major weaknesses:

i. **Lengthy Procedures**

Since the execution agencies work under various ministries, lengthy procedures are involved in obtaining approvals for various decisions. At times, it takes longer-than-usual and causes unnecessary delays.

ii. **Delay in Response**

Most of the foreign assistance projects do not take-off because relevant government departments do not respond in time to various queries. This also causes lot of delays even in case of on-going projects.

iii. **Dissatisfied Staff**

In many cases, highly-qualified staff feels dissatisfied due to lack of monetary or professional rewards. This can cause problems in dealing with departments with such staff.

(iv) **Transfer of Key Personnel**

In some cases, the donors deal with one or two key personnel in a particular department. However, these key personnel can be suddenly transferred without suitable replacements being made. This is another cause of delays in aid project implementation.

5.2 Achievements of Donors

Donors like USAID, UNDP and ODA have been providing much-needed help to the energy sector. They have also been coordinating with each other for policy reforms, commodity procurement, technical assistance and other matters influencing better performance of Pakistan's energy sector. In fact, the donors have developed a common Strategy for the Development of the Energy Sector.

Some of the major donor achievements are given below:

- initiation of the Energy Planning and Development Project in the Planning and Development Division;
- establishment of ENERCON in the Planning and Development Division;
- establishment of the Private Power Cell in the Ministry of Water and Power;
- co-financing of the Guddu Power Project;
- co-financing of WAPDA's Energy Loss Reduction Program;
- institutional and management reform assessment for OGDC; and
- preparation of feasibility studies/program designs for the 1000 MW Jamshoro oil-fired power station.

5.3 Common Problems of Donors

The most common problem described by the donors was the sometimes slow attitude of counterpart agencies alongwith lack of local matching funds. More details are given under "Weaknesses of Counterpart Agencies".

6

NGO Perspective

6.1 Profile of Energy NGOs

Their are no such NGOs which can be called energy NGOs. However, a very few NGOs do exist which describe energy as being one of their fields of work. Their list is given at Annex - C.

6.2 Achievements of NGOs

The role of NGO's in energy generation or conservation is very marginal. Much remains to be done vis-a-vis activating the NGOs. The NGOs can play an effective role in search for alternative and renewable forms of energy as well as creating an awareness among the people to save energy. However, their activities may not be enough to help solve the major energy problems facing Pakistan in the fossil fuel area. They have only been able to raise some awareness about energy issues in Pakistan.

6.3 NGO and Donor Agencies Coordination

Most of the donors in the energy field have coordination among each other rather than with NGOs. Some coordination does exist when it comes to rural fuels and technologies - it also being insignificant compared to the magnitude of Pakistan's energy problems.

7

Survey of Foreign - Assisted Energy Projects

7.1 Inventory of Major On-going, Past and Proposed Projects

A list of some of the above projects is given in the following pages. An effort has been made to enlist latest projects only. As can be seen from this list USAID and ODA are major donors in the field of energy.

No	Donor	Project	Region(s)	Agency(s)	Start	End	Cost Million $	Sum. Page
1	USAID	Energy Planning & Development Project	Pakistan	ENERCON, Energy Wing, etc.	July 83	July 93	105.00	58
2	USAID	Rural Electrification	Pakistan	WAPDA	Sep 82	Dec 94	181.30	59
3	USAID	Private Sector Power	Pakistan	Min. of Water & Power, WAPDA, NDFC	Sep 88	Sep 94	76.40	60
4	USAID	Energy Commodities & Equipment Program	Pakistan	OGDC, PCSIR, KESC, HDIP, etc.	Aug 84	Mar 92	99.00	61
5	USAID	Forestry Planning and Development	Pakistan	Fed. & Prov. Forest Depts.	Aug 83	Aug 93	27.50	62
6	Sweden (BITS)	Energy Conservation in Industrial Sector	Pakistan	ENERCON	Feb 92	Feb 94	0.40	63
7	UNDP	Energy Conservation in the Public Sector	Pakistan	ENERCON	1992	1994	0.68	64
8	To be Decided	Energy Efficient Lighting in Comm. Buildings.	Pakistan	ENERCON	1993	1996	24.00	65
9	To be Decided	Industrial Boiler Replacement	Pakistan	ENERCON	1993	1994	150.00	66
10	USAID	Additional 33-MW Combined Cycle Power Unit	Guddu, Sindh	WAPDA	1991	1992	104.00	67
11	USAID	Development of Lakra Coal Mines for 3x50 MW Power Plant	Sindh	WAPDA	1989	1992	43.00	68
12	ODA	WAPDA Power Plant Efficiency Improvement Project	Pakistan	WAPDA	1987	1992	12.00	69
13	ODA	WAPDA Maintenance Management Systems	Pakistan	WAPDA	1992	1999	3.80	70

7.2 Summaries of Selected On-going and Proposed Projects

One-page summaries of some current and planned projects are given in the following pages for review by JICA.

1.	***Title:*** ENERGY PLANNING AND DEVELOPMENT PROJECT	2.	***Region(s):*** Whole of Pakistan
3	***Donor:*** USAID	4.	***Implementing Agency:*** - Ministries of Planning & Development - Water & Power - Petroleum & Natural Resources - Science & Technology
5.	***Cost:*** US $ 105 million	6.	***Period:*** July 1983 - July 1993
7.	***Goal:*** To increase Pakistan's energy self-sufficiency	8.	***Purpose:*** To transfer relevant expertise to GOP officials to enable them to plan for future energy demands.
9.	***Project Components:*** - Establishment of Energy Wing and ENERCON in the Planning & Development Division - Training of 36 long-term and 150 short-term officials in USA - Establishment of National Geodata Centre - Preparation of draft Energy Conservation Law	10.	***Expected Outputs:*** - Establish National Energy Analysis group - Establish National Energy Conservation Program - Implement Building Energy Code - Improve coal analysis facilities - Complete management assessment of OGDC - Complete 18 energy studies
11.	***Beneficiaries:***	Government of Pakistan	
12.	***Current Status:***	Nearing completion	
13.	***Implementation Issues:***		

1.	***Title:*** RURAL ELECTRIFICATION	2.	***Region(s):*** Whole of Pakistan
3.	***Donor:*** USAID	4.	***Implementing Agency(s):*** WAPDA
5.	***Cost:*** US $ 181.3 million	6.	***Period:*** September 1982-December 1994
7.	***Goal:*** To strengthen the organization capabilities of WAPDA to provide electric services in rural areas.	8.	***Purpose:*** To provide electricity to the rural areas for their development.
9	***Project Components:*** - Construction of combined-cycle power plant at Guddu - Cathodic protection of all underground piping of the Guddu plant. - Construction of the Distribution Training Institute. - Procurement of computer hardware and software. - Mapping and surveying of distribution feeders.	10.	***Expected Outputs:*** - Connect 185,000 residential, 17,000 commercial, 7,700 tubewell, 4,500 community and 1,500 industrial customers. - Train 28,638 individuals. - Construct 1 training institute. - Develop National Rural Electrification Plan. - Construct 600 MW and 300 MW power plants at Guddu.
11.	***Beneficiaries:*** Rural areas of Pakistan; WAPDA		
12.	***Current Status:*** Operational		
13.	***Implementation Issues:***		

1.	***Title:*** PRIVATE SECTOR POWER	2.	***Region (s):*** Whole of Pakistan
3.	***Donor:*** USAID	4.	***Implementing Agency(s):*** - Ministry of Water and Power - WAPDA - National Development Finance Corporation (NDFC)
6.	***Cost:*** US $ 76.4 million	6.	***Period:*** September 1988-September 1994
7.	***Goal:*** To promote socio-economic development by mobilizing private sector resources for power supply.	8.	***Purpose:*** To increase electricity generation and operating efficiency.
9.	***Project Components:*** - Hub River Private Power Project - 100 MW Nandipur Power Project - Privatization of a WAPDA power plant.	10.	***Expected Outputs:*** - US $ 85 million loans to GOP - Production of 430 MW of power - Establishment of a Private Energy Division in NDFC - Training of 30 Pakistani professionals in management of private power projects.
11.	***Beneficiaries***: Government of Pakistan		
12.	***Current Status***: Operational		
13.	***Implementation Issues:***		

1.	***Title:*** ENERGY COMMODITIES AND EQUIPMENT PROGRAMME	2.	***Region(s):*** Whole of Pakistan
3.	***Donor:*** USAID	4.	***Implementing Agency:*** Planning and Development Division; OGDC; PCSIR; KESC; GSP; HDIP; DGNRER
5.	***Cost:*** US $ 99 million	6.	***Period:*** August 1984-March 1992
7.	***Goal:*** To promote energy conservation, training and technology transfer	8.	***Purpose:*** To provide balance of payment support for energy production from indigenous sources
9.	***Project Components:*** - Purchase of electric power equipment. - Purchase of computers - Purchase of laboratory equipment	10.	***Expected Outputs:*** - Reduce energy waste in the private and public sectors. - To mitigate balance of payments problem in energy sector.
11.	***Beneficiaries:***	Government of Pakistan	
12.	***Current Status:***	Near completion	
13.	**Implementing Issues:**		

1.	***Title:*** FORESTRY PLANNING AND DEVELOPMENT	2.	***Region(s):*** Whole of Pakistan
3.	***Donor:*** USAID	4.	***Implementing Agency(s):*** -Inspector General of Forests -Pakistan Forest Institute -Provincial Forestry Departments
5.	***Cost:*** US $ 27.5 million	6.	***Period:*** August 1983-August 1993
7.	***Goal:*** To help increase energy supplies, reverse deforestation and encourage agro-forestry.	8.	***Purpose:*** To foster self-sufficiency in wood products and to provide fuelwood to village people.
9.	***Project Components:*** - Establishment of 1,600 private nurseries. - Procurement of machinery and computers - Training for GOP officials - Village-level NGO activities. - Paper production from euclyptus to be demonstrated.	10.	***Expected Outputs:*** - Demonstrate crop-management techniques. - Train over 400 professional and 60,000 farm families. - Develop 5,000 acres of government forests. - Involve NGOs in forestry and environmental activities.
11.	***Beneficiaries:***	Federal and provincial forest departments; GOP.	
12.	***Current Status:***	Operational	
13.	***Implementation Issues:***		

1.	***Title:*** ENERGY CONSERVATION IN INDUSTRIAL SECTOR	2.	***Region(s):*** Whole of Pakistan
3.	***Donor:*** Swedish Agency for International Technical and Economic Cooperation (BITS)	4.	***Implementing Agency(s):*** ENERCON
5.	***Cost:*** US $ 0. 4 million	6.	***Period:*** February 1992-February 1994
7.	***Goal:*** To survey and retrofit selected fertilizer, sugar and textile units.	8.	***Purpose:*** To promote energy efficiency and environmental improvement in Pakistan's industries.
9.	***Project Components:*** - Assessment of assistance needs - Energy audits. - Identification of incentives for companies to implement energy conservation programmes.	10.	***Expected Outputs:*** - Energy audits of 15-20 plants. - ENERCON staff trained in environmental analysis. - Six plants retrofitted for demonstration of modern energy conservation technologies.
11.	***Beneficiaries:*** Public and Private sector Industries		
12.	***Current Status:*** Operational		
13.	***Implementation Issues:***		

1.	***Title:*** ENERGY CONSERVATION PROGRAMME IN THE PUBLIC SECTOR	2.	***Region (s):*** Whole of Pakistan
3.	***Donor:*** UNDP	4.	***Implementing Agency (s):*** ENERCON
5.	***Cost:*** US $ 0.68 million	6.	***Period:*** 1992-1994
7.	***Goal:*** Demonstrate efficacy of energy efficiency improvement in the industrial and buildings sector.	8.	***Purpose:*** To promote energy conservation activities in the country
9.	***Project Components:*** - Updating industrial energy demand data-base through surveys. - Design of energy-efficient houses. - Study of coal substituation for oil in cement plant. - Training of ENERCON staff.	10.	***Expected Outputs:*** - An updated energy demand data base for public sector industries - A manual of energy efficient house designs - A study on the feasibility of converting an existing cement plant from oil to coal. - International training for 6 ENERCON staff.
11.	***Beneficiaries:***	ENERCON, public sector industries, architects and builders.	
12.	***Current Status:***	To be operational very soon.	
13.	***Implementation Issues:***		

1.	***Title:*** ENERGY EFFICIENT LIGHTING IN COMMERCIAL BUILDINGS	2.	***Region (s):*** Whole of Pakistan
3.	***Donor:*** To be determined	4.	***Implementing Agency (s):*** ENERCON
5.	***Cost:*** US $ 24 million	6.	***Period:*** 1993 - 1996
7.	***Goal:*** To demonstrate the energy saving potential of modern energy-efficient lamps and fixtures.	8.	***Purpose:*** To improve energy efficiency of lighting systems in commercial buildings
9.	***Project Components:*** - Selection of target buildings. - Local consultants trained in lighting Energy Audits. - Audits of buildings - Monitoring and evaluation	10.	***Expected Outputs:*** - Preliminary and detailed lighting audits of 300-500 commercial buildings - Lamp replacement (about 1.0 million lamps to be replaced) - Capacity saving = 52 MW - Annual energy savings = 109 GWh
11.	***Beneficiaries:*** Utilities; owners of commercial buildings		
12.	***Current Status:*** Donor is to be identified		
13.	***Implementation Issues:***		

1.	***Title:*** INDUSTRIAL BOILER REPLACEMENT	2.	***Region(s):*** Whole of Pakistan
3.	***Donor:*** To be determined	4.	***Implementing Agency(s):*** - Chief Inspector of Boilers - ENERCON
5.	***Cost:*** US $ 150 million	6.	***Period:*** 1993-94
7.	***Goal:*** To replace 50% of the existing 3,000 boilers with energy-efficient boilers.	8.	***Purpose:*** To improve efficiency of boilers by 10-15 %.
9.	***Project Components:*** - Survey of boilers - Recommendations for replacement - Boiler replacement - Post-replacement monitoring	10.	***Expected Outputs:*** - 1500 boilers replaced. - 34 million gegajoules of fuel saved in 20 years. - Reduce CO2 emissions by 7,000 tonnes per annum.
11.	***Beneficiaries:***	Public and private sector industries	
12.	***Current Status:***	Donor is to be identified	
13.	***Implementation Issues:***		

1.	***Title:*** ADDITIONAL 300 MW COMBINED CYCLE POWER PLANT AT GUDDU	2.	***Region(s):*** Sindh
3.	***Donor:*** USAID	4.	***Implementing Agency(s):*** WAPDA
5.	***Cost:*** US $ 104 million	6.	***Period:*** 1991 - 1992
7.	***Goal:*** To overcome the shortage of electrical power in the country.	8.	***Purpose:*** Provision of electrical power in the surrounding areas.
9.	***Project Components:*** - Installation of two combustion turbines. - Installation of a steam unit	10.	***Expected Outputs:*** - 200 MW generating capacity from two combustion turbines - 100 MW generation capacity from a steam unit.
11.	***Beneficiaries:*** Government of Pakistan; electricity consumers		
12.	***Current Status:*** Near completion		
13.	***Implementation Issues:***		

1.	***Title:*** DEVELOPMENT OF LAKHRA COAL MINES FOR 3X50 MW COAL-BASED POWER PLANT	2.	***Region(s):*** Punjab
3.	***Donor:*** USAID	4.	***Implementing Agency (s):*** WAPDA
5.	***Cost:*** US $ 43 million	6.	***Period:*** 1989 - 1992
7.	***Goal:*** To overcome energy shortage in the country.	8.	***Purpose:*** To utilize the local coal reserves for power generation.
9.	***Project Components:*** - Study on using coal for power generation	10.	***Expected Outputs:*** - Mine development works - Annual supply of 750,000 tonnes of coal for the power plant.
11.	***Beneficiaries:*** Government of Pakistan		
12.	***Current Status:*** Almost complete.		
13.	***Implementation Issues:***		

1. ***Title:*** WAPDA POWER PLANT EFFICIENCY IMPROVEMENT PROJECT	2. ***Region(s):*** Pakistan
3. ***Donor:*** ODA	4. ***Implementing Agency(s):*** WAPDA
5. ***Cost:*** US $ 12 million	6. ***Period:*** 1987-92
7. ***Goal:*** To Improve the existing thermal power system	8. ***Purpose:*** Rehabilitation of steam units & combustion turbines at Sukkur, Guddu, Faisalabad, Quetta, Multan, Kotri and Shahdina.
9. ***Project Components:*** - Training of Staff - System rehabilitation	10. ***Expected Outputs:*** - Conserving 250 MW of electricity - Better-trained staff.
11. ***Beneficiaries:*** Government of Pakistan	
12. ***Current Status:*** Completed recently	
13. ***Implementation Issues:***	

1. ***Title:*** WAPDA MAINTENANCE MANAGEMENT SYSTEM	2. ***Region (s):*** Pakistan
3. ***Donor:*** ODA	4. ***Implementing Agency(s):*** WAPDA
5. ***Cost:*** US $ 3.8 million	6. ***Period:*** 1992-1999
7. ***Goal:*** To maintain & sustain the benefits of Wapda's Power Plant Efficiency Improvement Project.	8. ***Purpose:*** To introduce structured computer based maintenance management system is WAPDA.
9. ***Project Components:*** - Strategic planning - Outage planning and control - Work control - Stocks management and maintenance	10. ***Expected Outputs:*** - Better management maintenance system in WAPDA
11. ***Beneficiaries:*** WAPDA	
12. ***Current Issues:*** Ongoing	

Annex - A

List of Government Departments Dealing with Energy

No	Department	Name & Designation	Telephone No
1.	Ministry of Water & Power Block-A, Pak. Secretariat Islamabad.	Mr. Daud Beg Additional Secretary (Power)	823153
2.	Energy Wing Ministry of Planning & Development Buland Markaz, Blue Area, Islamabad.	Mr. Ashfaq Mehmood Senior Chief	811175
3.	Ministry of Petroleum & Natural Resources Pak. Secretariat, Islamabad.	Mr. Jehangir Bashar Joint Secretary (Development)	824819
4.	Oil & Gas Development Corporation, Markaz F-8, Islamabad.	Dr. Gulfraz Ahmed Chairman	853974
5.	WAPDA WAPDA House, The Mall, Lahore.	Mr. Mumtaz Hameed Chairman	

6.	ENERCON Buland Markaz, Blue Area, Islamabad.	Mr. Arif Alauddin Managing Director	815614
7.	Sui Northern Gas Pipelines Limited Plot 28-30, I-9, Islamabad.	Mr. Abdul Wahid Regional Manager	410525
8.	National Institute of Silicon Technology, Plot No 25, H-9, Islamabad.	Mr. Mohammad Ishaq Director General	851987
9.	Pakistan Council of Appropriate Technology, 1-B, St. 41. F,7/2, Islamabad.	Dr. A.R. Junejo Chairman	824483
10.	Directorate General of New & Renewable Energy Resources, 14-Z, Markaz F-8, Islamabad.	Mr. A.P.R. Memon Director General	857536

Annex - B

List of Major Donors Dealing with Energy

No	Donor	Name & Designation	Telephone No
1.	Canadian International Development Agency (CIDA) c/o Canadian High Commission Diplomatic Enclave, Islamabad.	Ms. Lois Marsha First Secretary (Development)	211101
2.	United Nations Development Programme (UNDP) Diplomatic Enclave, Islamabad.	Mr. Neil Buhne Asst. Resident Representative	212071
3.	GTZ 31 Circular Road, Peshawar.	Mr. Atif Masroor Program Officer	
4.	World Bank 20-A, Shahrah-e-Jamhuriat Ramna 5/1, P.O. Box 1025 Islamabad.	Mr. Petros Aklilu Senior Project Officer	819781-6

5.	United States Agency for International Development (USAID) 18, 6th Avenue, G-5, Islamabad.	Mr. Anjum Ahmad Chief EPPR Division, Office of Private Enterpise & Energy	824071
6.	Delegation of the Commission of the European Communities, H-No 8, Margalla Road, F-6/3, Islamabad.	Mr. T.C. O'Sullivan Head of Delegation	821828
7.	Asian Development Bank 38-Khayaban-e-Iqbal F-6/3, Islamabad.	Mr. Jahed-ur-Rehman Sr. Project Implementation Officer	818791-4
8.	JICA Pakistan Office 1, St. 61, F-6/3, Islamabad.	Mr. K. Iwasaki Asst. Resident Representative	217404-7

Annex - C

List of Major NGOs Dealing with Energy

No	NGO	Name & Designation	Telephone No
1.	Family Planning Association of Pakistan (PASBAN) 3-A, Temple Road, Lahore	Ms. Yasmin Shahid Senior Director (Women, Youth and Environment)	61482 213099
2.	International Union for Conservation of Nature & Natural Resources (IUCN) 1, Bath Island Road, Karachi-75530	Mr. Nasir M. Dogar Programme Administrator	573082 573046 573079
3.	Energy and Environment Society of Pakistan 123-J, Model Town, Lahore.	Mr. Mohammad Nazim President	851583
4.	Foundation for Integrated Development (Find) 21-B, St. 21, F-7/2, Islamabad.	Mr. Gul Najam Jamy Executive Director	824456

Selected Bibliography on Energy Publications

Following is a selected bibliography of publications, including books journal articles, seminar/conference proceedings and data sources on energy-related issues in Pakistan

A - Government Publications

1. Directorate General of New and Renewable Energy Resources (DGN&RER) Energy Year Book 1989, Islamabad : 1989.
2. Environment and Urban Affairs Division, Government of Pakistan: National Report Submitted to the UNCED, Islamabad : March 1992.
3. Planning Commission, Government of Pakistan : 7th Five Year Plan and Perspective Plan 1988 - 2003, Islamabad : 1988
4. Private Energy Division, National Development Finanace Corporation : Performance Review Report for 1991, Karachi : 1992.
5. ENERCON : Energy Conservation - Working Together for an Energy Efficient Future, Proceedings of the Ist Energy - Conservation Symposium, Islamabad : October 30 - 31, 1988.

B - Donor Publications

1. UN/ESCAP : Sectoral Energy Demand Studies : Application of the End - Use Approach to Asian Countries, Energy Resource Development Series (No. 33), Bangkok : 1991

2. UNDTCD : Energy and Environment : Impacts and Controls, Publication No. TVD/NRED/E.16, New York : October 1990.

C - NGO Publications

1. World Resource Institute, USA : World Resources 1990-91, Jointly producd by WRI, UNEP and UNDP, New York : 1990.

D - Other Publications

1. Arshad M. Khan and A.I. Jalal (Pakistan Atomic Energy Comission) : Oppurtunities for Energy Efficiency Improving in Electric Appliances, Paper presented at APENPLAN Regional conference on an Asian - Pacific Energy Efficiency Initiative, Kuala Lampur, Malaysia : August 1991

2. Arshad M. Khan, A.I. Jalal, A.Mumtaz and F. Bashir (Pakistan Atomic Energy Commission) : Long - Term Planning for Energy in Pakistan with Particular Emphasis on Environmental Aspects, undated paper.

Terms of Reference of Survey

1. Objectives of the Study and Proposed Methodology

This study purports to study and analyze the overall energy picture in Pakistan. Towards achieving its aims, the study covers a broad spectrum of issues like: current energy issues in Pakistan; countermeasures adopted by the Government of Pakistan (GOP) to deal with the problem; foreign assistance requirement of GOP; and donor's experience, etc.

The study follows a three-step methodology: collection and organization of data; analysis of the major energy issues in the light of the data; and finally in the light of the preceeding analysis provides policy guidelines for JICA for its contribution to the development of the energy sector in Pakistan.

2. Data Collection

The first and most important step consists of gathering all the information related to energy demand and its determinants. This includes data on energy utilization as well as data on all factors necessary to interpret the energy trends.

Data collection follows a two-pronged strategy. In the first phase, Primary Data was collected, followed by the collection of Secondarty Data.

Primary Data Collection

For the purpose of this particular study, primary data consisted of government documents, reports by various international organizations, personal interviews and questionnaire surveys.

The primary data collected fundementally dealt with the following subjects:

i Current Energy Issues in Pakistan

This primarilly dealt with the nature as well as the magnitude of energy issues in Pakistan. The data collected pertained to:

- energy profile of Pakistan; and
- current status of major energy sources (Oil, Gas, Coal etc):

ii Countrermeasures for Dealing with the Energy Issues Facing Pakistan

Various countermeasures and GOP's policy/activities in this area were collected and analyzed. Secondly, the shortcomings in the GOP's eneregy policies have been highlighted.

iii Foreign Assistance Requirements of the GOP

The GOP's agencies involved in the economic planning; energy management and regulation were visited so as to ascertain their real needs in terms of foreign assistance.

iv Donor's Experience

The foreign donor agencies operational in Pakistan, in the field of energy, were contacted to extract the following information:

- crucial energy issues confronting Pakistan;
- most implementable programmes;
- strength/weakness of counterpart agencies;
- common problems faced by the donor;
- suggestions for improvements; and
- concrete results/achievements by the donors.

v The NGO Experience

A very small number of local and foreign NGOs are working in the field of energy in Pakistan. Opinion of some of them were also obtained.

Secondary Data Collection

The primary data provides a general picture of the energy sector and was augmented by secondary data collection. Secondary data collection proceeded on the following lines:

i Selected Bibliograpgy in the Energy Sector in Pakistan

Under this heading a bibloliography of all reports publications, papers, books and articles relevant to this study have been compiled.

ii Inventory of Major On-going, Past and Proposed Foreign Assisted Projects in the Energy Sector

Under this heading a survey of all the major onging, past and proposed energy sector projects was compiled.

This survey essentially provides the following information about such projects:

- title;
- donor;
- amount (including utlization status);
- start/end dates;
- region; and
- counterpart government agency.

Summaries of important on-going and pipeline projects have also been provided.

3. Data Analysis Procedure

The primary and secondary data was throughly cross-referred and checked to rule-out any discrepancies. Moreover, an analytical cum descriptive approach was adopted to substantiate the data which have appeared more than once in the responses obtained.

Data quality has been maintained meticulously and every effort has been made to provide only that information which can be backed by the solid data.