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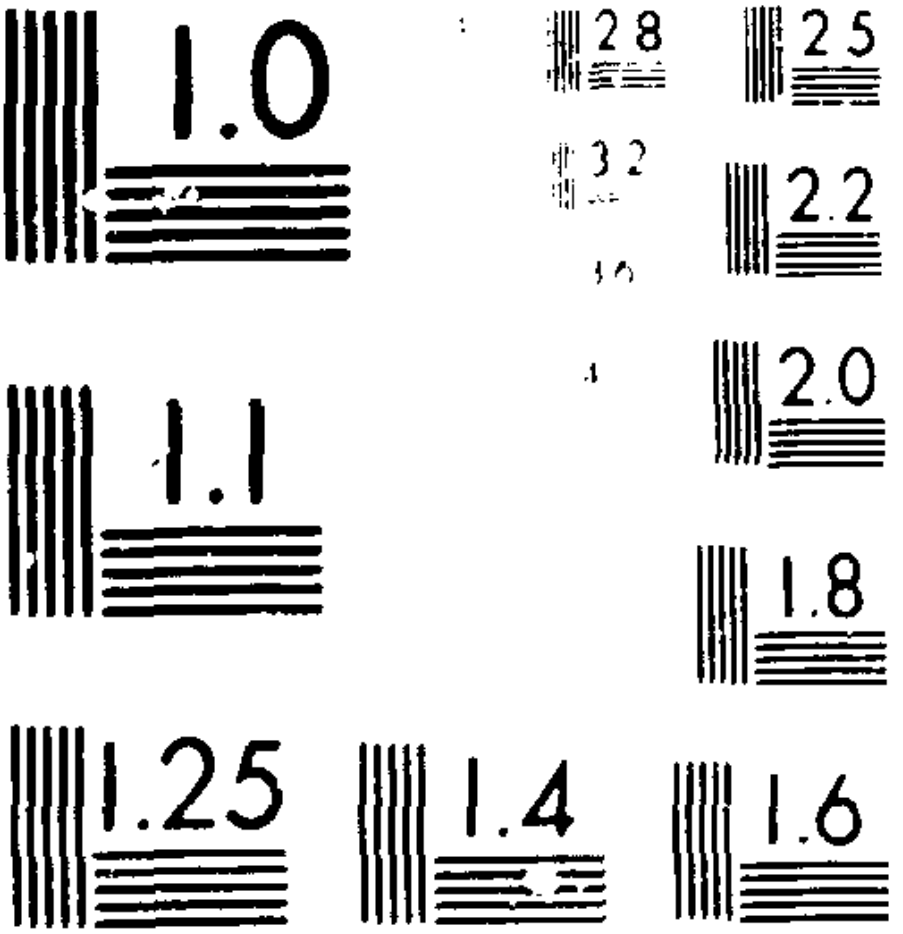
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POWER DEVELOPMENT IN PAKISTAN*

by

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1. ORGANIZATION SET UP:

The two main Organizations for supply of Electricity in Pakistan are Water and Power Development Authority (WAPDA) and Karachi Electric Supply Corporation (KESC).

WAPDA was created in 1958 as an autonomous body for unified and co-ordinated development of Water and Power resources of the country. The Organization of WAPDA consists of three Wings viz:

(i) Water Wing

This is concerned mainly with the development of water resources including construction of dams, canals and implementation of desalination schemes. It does not however, administer or operate completed projects.

(ii) Power Wing

This deals not only with the planning and development of power generation, transmission and distribution but also operates the power system from generation to the ultimate scale of energy to the consumers.

(iii) Finance Wing

This provides common resources to the water and power wings and is concerned with the finances of the Authority as a whole.

2. WAPDA's POWER SYSTEM

Generation

WAPDA's total installed generating capacity by the end of 1979 was 2685 MW. This consisted of 1567 MW of hydel and 1118 MW of thermal plant. The capability of hydel power stations varies due to seasonal variations in reservoir levels between 1720 MW during high level (July-November) period and 648 MW during low water (March to May) period. Due to derating of thermal plants, the total capability of thermal plants in 1979 was about 1008 MW. The combined peak recorded on WAPDA system was 2076 MW on 31.7.1979. A potential demand of about 200 MW existed during the year 1979. As the generation was lagging behind demand, load shedding was effected during low water period. The generating capacity is being further increased during the five year plan period (1978-83). The installed capacity is expected to increase from 2685 MW in 1979 to 4300 MW in 1983, consisting of 1330 MW hydel and 285 MW thermal.

The total hydel energy generated during 1978-79 was 8553 Mkwh or 78.8% of total energy provided during the year and the average energy consumed by station auxiliaries of all hydel stations was only 0.20% of the hydel generation.

The energy generated from large hydel stations such as, Tarbela (700 MW), Mangla (600 MW) and Warsak (160 MW) during 1978-79 was 3746 Mkwh, 3583 Mkwh and 556 Mkwh respectively. This accounted for nearly 94.4% of the total hydel energy generated during 1978-79. In the case of small hydel stations aggregating 107 MW, the energy generated was 468 Mkwh or 5.6% of the total hydel energy generated.

In 1978-79, the energy generated from all the ten thermal power stations having an installed capacity of 1118 MW, was 2250 Mkwh or 21.2% of the total energy generated in WAPDA system. Thermal stations owned and operated by WAPDA can be classified in three categories:

(i) gas fired steam stations,
(ii) gas turbine stations and
(iii) coal fired steam stations at Quetta.

The energy consumed by auxiliaries of gas fired steam stations varied from 6% to 8% in the case of large plants whereas in the case of gas turbines, it varies from 0.5% to 2.0% of the energy generated. In the case of coal fired steam station it was more than 12.0%.

3. COST OF GENERATION

The average cost of hydel generation by taking into account all hydel stations big and small, averages at about 2.36 paisas per unit. As against this, the average cost of all thermal stations taken together 23.0 paisas.

In 1978-79, all the hydel power stations contributed 78% of the total energy generated and thermal power stations contributed only 21.2% of the energy generated.

4. TRANSMISSION SYSTEM

WAPDA's integrated transmission network extends from North to South and East to West of Pakistan excluding Karachi area. It consists 330 km of 500 KV EHV lines, 1219 km of 220 KV lines, 5885 km of 132 KV lines, 6217 km of 66 KV lines and 2106 km of 33 KV lines.

The total length of transmission system of different voltages aggregates 15,757 kilometers. The 500 KV line between Tarbela and Gatti (Faisalabad) was energised in June, 1979. This line was commissioned in September, 1977 on 220 KV pending completion of switchgear at the terminal ends. This line is being extended further from Faisalabad to Guddu via Multan (519 km) which is expected to be completed by 1983. The line is capable of transmitting 900 MW of power from Tarbela to different load centres and it is also expected to go a long way in reducing line losses on WAPDA's transmission system.

5. DISTRIBUTION SYSTEM

The distribution is carried out mainly through 11 KV lines. The total length of distribution lines up to end of June 1979 was 77,719 km consisting of 57,479 km in Punjab, 11,374 km, in Sindh, 6686 km, in NWFP and 2180 km in Baluchistan. The distribution wing is responsible for taking power/energy from grid stations to consumers premises. The distribution system inherited by WAPDA was in a dilapidated condition requiring immediate attention. As a result of rapid growth in demand for electric service connections, the distribution system is now generally loaded beyond normal limits. This has resulted in increased losses and excessive voltage drop during peak load hours.

A great deal of renovation and extension of distribution systems will be needed to meet the growing demand of power. Because of financial constraints and delays in the supply of construction materials, distribution system is under severe stress. The distribution system supplying most of the cities and its environs is by means of 11 KV feeders with 400 volts secondary circuits. The transformer primary connection is rated 11 KV is detz-star connected. The secondary is rated 400 volts and is four wire. WAPDA is using all aluminium cables steel re-inforced are used on all primary distribution lines.

The total number of consumers supplied by WAPDA is of the order of 2.53 million. The consumption by various categories of consumers is industrial (40%), agricultural (23%), commercial (64%), domestic (18%), public lighting (1%), bulk supply (12%) and traction (0.6%). The total number of pending applications during 1979 was estimated to be 1,81,000 consisting of industrial 88000), agricultural (7850) and general (1,65,200). The targets fixed for new connections during 1979-80 was 2,20,000 which includes 5000 industrial, 5000 agricultural, 1000 village electrification and 2,10,000 general connections.

KARACHI ELECTRIC SUPPLY CORPORATION (KESC)

Karachi Electric Supply Corporation (KESC) is the second largest power corporation in the country which supplies power not only to metropolitan city of Karachi and in environs but also to a part of Lasbella Districts of Baluchistan Province. In January, 1980 KESC had a total installed capacity of 573 MW and its derated capacity was 500 MW. KESC system is also connected with KANUPP through double circuit 132 KV lines.

The energy generated during the Fiscal year 1978-79 was 2370.868 Mkwh and the demand peak recorded was 519.9 MW in May 1980.

The fuel consumed during 1978 was equivalent to 25,484,986 Mcft of gas. The cost of fuel per unit sent out during 1978 was 7.80 paisas and during 1979 was 10.17 paisas.

Generating Stations Under Execution/Planned:

Sind Industrial and Trading Enterprises (SITE)

This station was commissioned in March 1980 to meet the shortfall due to non-availability of Karachi Nuclear Power Plant (KANUPP). It has 5 units of 25/20 MW each.

In accordance with the long term feasibility already carried out, KESC generating capacity is expected to be further augmented as under:

Pipri Power Station:

Unit	Size	Year
1	200 MW	1984
2	200 MW	1986
3	200 MW	1988
4	200 MW	1990

The average load growth of KESC adopted for the 6th Plan Period is 10.4%. Accordingly, the demand of power and energy for the period 1981-85 works out to be as under:

Year	System demand (MW)	% increase over previous years	Sale of energy (Mkwh)	% increase over previous years
1981	614	13.9%	2,763,000	14.6%
1982	684	11.4%	3,097,000	12.1%
1983	749	9.5%	3,411,000	10.1%
1984	813	8.5%	3,702,000	8.5%
1985	882	8.5%	4,015,000	8.4%

Rawalpindi Electric Power Company (REPCO)

1. The Rawalpindi Electric Power Company (REPCO) generates and supplies power to parts of Rawalpindi.

2. In order to improve the conditions of supply and provide better facilities to consumers, REPCO was taken over by the Federal Government in 1972. Its management was placed under the control of a Managing Director appointed by the Government of Pakistan and is resporsible to the Ministry of Water and Power.

3. The Company has its own generation, which only meets parts of the demand, the rated output being 5500 KW. About 85% of the power distributed by REPCO is imported from WAPDA.

4. The primary distribution consists of 11 KV and 3.3 KV overhead and underground lines. The total length of 11 KV lines is 220 km of which 60 km is underground. The low voltage system consists of overhead lines. The total route mileage is 350 km. Almost the entire primary network has been constructed on the basis of radial system without interlinking of various legs. Therefore, duplicate feed to most of the consumers is not available and in the event of a fault load transfers are not possible. In most parts of the city, the circuits are overloaded and complete renovation of the network is necessary.

5. In order to improve the supply conditions and to meet the additional requirements, REPCO has formulated plans for the future. This includes conversion of existing 3.3 KV circuits to 11 KV, replacement of small section copper conductors, standardizing equipment used in distribution lines and substations, interconnection of the primary network to facilitate transfer of power during faults, carrying out studies to determine fault levels and better voltage regulation.

Multan Electric Supply Company (MESCO)

1. The Multan Electric Supply Company (MESCO) generates and supplies power in the municipal limits of Multan. At present the installed capacity of the system is 23 MW and the firm capacity is 10 MW. The maximum peak load recorded is about 20 MW. MESCO is also interlinked with the WAPDA system, and imports about 10 MW of power. The length of 3.3 KV, 11 KV and 400 volts feeders is approximately 32 km, 18 km and 180 km respectively. The existing transmission and high voltage distribution facilities are not capable of taking more than 16 MW of load. The line losses (27%) are very high considering the compact size of the system. The management of MESCO was taken over by the Government in January 1972 and to meet the growing

demand, adequate planning is being done to renovate the existing high voltage and low voltage lines and to extend the distribution facilities to new consumers with a view to improve power supply position.

SMALL HYDEL STATIONS

In April, 1974 Government decided to install isolated Small Hydel Stations in inaccessable mountenous areas of Northern Areas, NWFP and Azad Kashmir which were outside of limits of National Power Grid. Accordingly orders were made for the purchase of 100 Small Hydro-electric Plants considering of 50 units of 50 KW and 50 units of 100 KW. Out of the 100 units, 60 units were to be installed in Northern areas: 30 in NWFP and 10 in Azad Kashmir. At present however, 17 units have been installed in 10 different stations in Northern areas, NWFP and Azad Kashmir. The stations completed are:

Northern areas:

Minapin	1 x 100 KW
Singal	2 x 50 KW
Kachura	2 x 100 KW
Sirmik	1 x 100 KW

NWFP

Garam Chashma	1 x 100 KW
Shishigol (Chitral)	3 x 100 KW

Azad Kashmir

Pattika	1 x 100 KW
Chinari	2 x 50 KW

The purpose of this project is to electrify the village in the inaccessable mountainous areas where plenty hydro potential is available and where presently no electric power exists or planned by any other sources. The objective of the project is in consistency with the overall development effort of water and power development resources in the country.

The project is being implemented by the Ministry of Water and Power and Engineering Adviser (Power) is designated as Employer's Representative for the execution of this project.

Feasibility study of 82 prospective sites in Northern areas, NWFP and Azad Kashmir was carried out to determine the location of power houses. The project is being financed by the Federal Government out of its own cash resources.