Paper No. 166

SOCIO ECONOMIC IMPERATIVES OF HYDRO ELEECTRIC DEVELOPMENT IN PAKISTAN

BY

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World's half of the hydro power potential is estimated totalling around 1200 gWS & relates to developing countries. Of this hardly ten percent is tapped. High costs of Thermal Generation effecting the general price structures of economies have necessitated increased exploitation of hydel resources of energy to stabilise price networks & national economies. Hydro power costing between 3000 to 3500 US $ per KW of installed capacity yields average generation cost of 40-50 paisas per unit.

Tables I & II & III show the comparative figures of different types of Generation & Production of Electricity in developing countries and also the investments in Power Sector.

Table-I
DEVELOPING COUNTRIES: POWER GENERATING CAPACITY
1980-90

	1980		1985		1990	
	Gigawatts	Percent	Gigawatts	Percent	Gigawatts	Percent
Thermal /a						
Oil	90.3	37.4	112.2	31.3	129.1	24.7
Gas	12.5	5.2	29.9	8.3	60.7	11.6
Coal/Lignite	35.1	14.5	58.2	16.2	92.2	17.6
Subtotal	137.9	57.1	200.3	55.8	282.0	53.9
Hydro	99.6	41.3	147.0	41.0	201.3	38.4
Nuclear	3.4	1.4	10.2	2.8	38.1	7.3
Geothermal	0.4	0.2	1.4	0.4	2.3	0.4
Total	241.3	100.0	358.9	100.0	523.7	100.0

/a Estimated fuel breakdown based on primary fuel (some stations are dual fueled).

Source: World Bank staff estimates.

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Table-II
ELECTRICITY PRODUCTION IN DEVELOPING COUNTRIES, 1980-90

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ELECTRICITY PRODUCTION IN DEVELOPING COUNTRIES, 1980-90

	1980		1985		1990	
	Terawatt Hours	Percent	Terawatt Hours	Percent	Terawatt Hours	Percent
Thermal						
Oil	272	30.5	346	25.0	388	19.2
Gas	55	6.2	131	9.5	213	10.5
Coal/Lignite	154	17.2	255	18.4	404	20.0
Subtotal	481	53.9	732	52.9	1,005	49.7
Hydro	394	44.2	592	42.7	777	38.4
Nuclear	15	1.7	51	3.7	225	11.1
Geothermal	2	0.2	10	0.7	15	0.8
Total	892	100.0	1,385	100.0	2,022	100.0

Source: World Bank staff estimates.

Table-III
DEVELOPING COUNTRIES: ELECTRIC POWER INVESTMENT, 1981-90

	Unit Cost S/KW /a	1981-85		1986-90		1981-90	
		Giga-watts	Billion US Dollars	Giga-watts	Billion US Dollars	Giga-watts	Billion US Dollars
Thermal	1,160	62.4	72	81.7	95	144.1	167
Hydro	1,730	47.4	82	54.3	94	101.7	176
Nuclear	1,920	6.8	13	27.9	54	34.7	67
Geothermal	2,100	1.0	2	0.9	2	1.9	4
Total		117.6	169	164.8	245	282.4	414

/a Unit costs also include amounts for transmission and distribution facilities.

Source: World Bank staff estimates.

In democratic countries where general price structure is of vital significance, adoption of cheaper methods of producing electricity becomes more and more of a necessity.

Table-IV

Data regarding WAPDA's Power Generation System comprising 12 Hydel and 11 Thermal Power stations is given below:

Hydel Stations	Year of Commissioning	Installed Capacity(MW)
Mangla	1967-81 (8x100 MW)	800
Tarbela	1977-85 (10x175 MW)	1750
Warsak	1960-81 (6x40 MW)	240
Dargai	1954 (4x5 MW)	20
Malakand	1938-51 (3x3.3 MW 2x5 MW)	20
Rasul	1951 (2x11 MW)	22
Chichoki Mallian	1959 (3x4.4 MW)	13
Shadiwal	1961 (2x6.75 MW)	13
Nadipur	1963 (3x4.6 MW)	14
Karrum Garhi	1958 (4x1 MW)	4
Renala	1925 (5x0.22 MW)	1
Chitral	1984	1
Sub-Total		2898

Thermal Stations	Years of Commissioning	Installed Capacity (MW)
Multan Steam	1960-63 (4x65 MW, 1x5.7 MW)	266
Faisalabad Steam Power Station	1967 (2x66 MW)	132
Faisalabad Gas Turbine Power Station	1975 (8x25 MW)	200
Shahdara Gas Turbines	1966-69 (2x13.25 MW, 4x14.75 MW)	85
Gudhu	1974-86 (2x110 MW, 2x210 MW, Steam, 4x100 MW, 1x9 MW Gas Turbines)	1049
Hyderabad	1960-65 (2x7.5 MW, 1x8 MW, 1x15 MW, Steam, 1x5.7 MW Gas Turbines)	43
Sukkur	1965-67	50
Kotri Gas Turbines	1970-81 (2x15 MW, 4x25 MW)	130
Quetta	1964-84 (2x7.5 MW Steam, 1x5.7 MW, 1x12.25 MW, 1x25 MW, 1x35 MW Gas Turbines, 1x7.5 MW)	95
REPCO	1981 (1x1.5 MW, 1x2 MW, 1x2.28 MW, 1x3.3 MW)	9
MESCO	1981 (2x10 MW)	20
Thermal		2079
Grand Total		4977

Table-V

Table-V

Power Station	Installed capacity (MW)	Actual Generation (MKWH)/(GWH) 1985-86	1986-87	%increase (+) decrease (-) over 1985-86 MKWH	Percent
Tarbela units 1 -10	1,750	7,993.66	8,121.17	+ 127.51	+ 1.59
Mangla units 1 -8	800	4,637.65	5,937.22	+1,299.57	+28.02
Warsak units 1 -6	240	680.96	678.96	- 2.00	- 0.29
Small Hydel Stations	108	492.01	513.34	+ 21.33	+ 4.34
Total	2,898	13,804.28	15,250.69	+1,453.41	+10.48

AN OVERVIEW OF THE EXISTING HYDEL POTENTIAL

The existing power generation capabilities in Pakistan and the schemes planned are given in Table IV & V. We are experiencing a power shortage to the extents of 400 to 600 MWs which compels WAPDA to carry out load shedding. With an annual growth rate of about 20-25% in power development, the power requirement in Pakistan is likely to reach 15000 MWs by the year 2000. It therefore calls for massive power generation development programmes. The hydel component of the power development has to be sizeable portion in view of the overall socio-economic advantages in hydro-electric projects. The estimated hydel potential for future power development whih is yet untapped is estimated around 30000 MWs.

Hydel generation in our country has the following extra-ordinary socio economic benefits apart from direct contribution to energy development.

1. Impact on Unemployment

2. Price Structure Effects.

3. Local Resources Utilisation.

We would discuss these factors in some details.

1. IMPACT ON UNEMPLOYMENT

Hydel projects normally involve construction of Dams as distinct from thermal plants where

only construction of a few buildings is involved. Dams Construction additionally involve huge civil works & therefore local manpower is used to a greater extent. In case of large Dams, the extent of use of local personnel is further enhanced. This is therefore an added positive factor. Hydel Plants are the following

1. Run of the River Plant.

2. Storage Plants on large reservoirs.

3. Plants based on Day to Day storage/pondage.

The former two types are used as base load stations & the last category is employed for peaking purposes.

In Pakistan, it is desirable, in view of water shortages in drought conditions, that the future hydel stations have pumped storage facilities as well to maintain water reservoirs levels all the year. This would enable the plants to act as base load stations even in drought conditions.

2. LOCAL RESOURCES UTILISATION

Hydel Projects Technology is relatively less sophisticated than that of thermal plants. Hydel civil works can mostly be handled by local construction resources. For small hydel stations, the water turbines can also be developed locally in Pakistan with a little R & D input and mobilisation of local manufacturing potential. These elements would form almost 60-70% of the capital costs of a hydel project.

Thus with hydel projects our local resources can be utilised to a great extent than the thermal plants. Apart from this, the operational inputs do not involve any fuel but mainly involve water & therefore percentage of utilisation of local resources in the operation of Hydel Plants goes to almost 95% except for minor spares.

3. PRICE STRUCTURE

It is estimated that the generation cost of hydel stations is almost 40-50% of the Gas or oil fired thermal plants. Owing to the higher operational costs, the tariffs are going to be on the increase. Electricity being the basic primemover of industry & agriculture, the prices of goods/services therefore are bound to spiral up & thus it sets a chain reaction of rising prices in the country.

It is therefore impeative to utilise the hydel potential in the country to the maximum to balance the general price structure for the overall welfare of the common man and economic development. Economists are of the considered view that the health of any economy is well gauged by the general price structure prevailing there.