ROLE OF DAMS IN THE ECONOMIC GROWTH OF PAKISTAN

Engr. Zahid Majeed
Pakistan Water and Power Development Authority

Dr. Awais Piracha
University of Western Sydney Australia

OBJECTIVES

To evaluate the impact of dam operation on availability of water in the canal of Indus Basin Irrigation System (IBIS).

To assess power generation impacts and other addition benefits of these multi-purpose reservoirs.

METHODOLOGY OF RESEARCH

Firstly impact of Mangla and Tarbela dam reservoir operation on the canal head diversion of Indus Basin Irrigation System has been analyzed for the post-dam period of 1967-2006 (about 40 yrs) and compared with the pre-reservoirs period of 1960-67 by using historic discharge data.

Flow measurements are taken at the rim-stations of Indus Basin Rivers at points where these enter the plains or at key locations such as storage sites. The record at rim-stations does not account for the run-off generated from local tributaries below these stations.

Secondly power benefits from Mangla and Tarbela dam has been calculated over the last 4 decades using real time data.

Finally impact on the economic growth of the country due to failure to construct the mega multipurpose dam since 1976 is explored.

ISLAMIC REPUBLIC OF PAKISTAN

Area	= 796095 sq. km
Population	= 170 million
Per Capita Income	= 800 US $ per Annum
Per Capita Electricity	= 600 kWh per Annum

CAPITAL Islamabad

FOUR PROVINCES

BALUCHISTAN:	Area 347,200 sq. km	Population 7.5 million
NWFP:	Area 74,521 sq. km	Population 24.9 million
PUNJAB:	Area 205,344 sq. km	Population 82.7million
SINDH:	Area 140,900 sq. km	Population 34.5 million

Pakistan is located in arid and semi arid region

In most plain area rainfall less than 500mm and non uniform over the year.

Total Cultivable area 31.2 Million Hectares.

Flows are uneven in the rivers and variation in high to low flow is 100 times.

More than 88% of flows are during 70 to 100 days between April to September.

High Flow variation dictates Mega Storage Dams to use the water through out the year optimally

AGRICULTURE SECTOR OF PAKISTAN

Agriculture sector is the largest source of foreign exchange earnings and yet one of the largest contributor to GDP (25%).

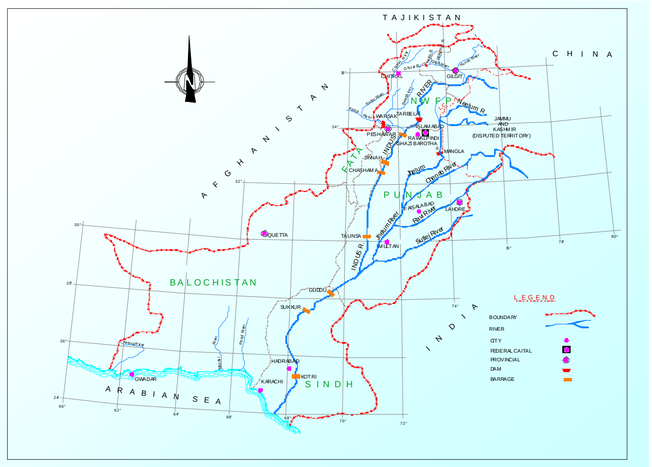
It accounts for 40% of total employed Labour Force.

Almost agriculture of the country is dependent on Indus River System (IRS).

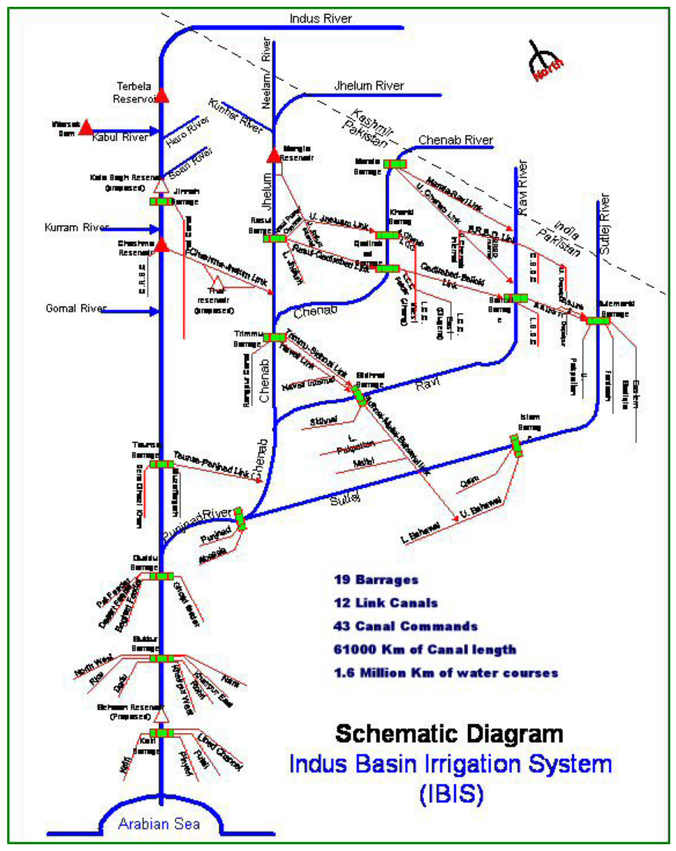
Indus Basin Treaty (IBT)

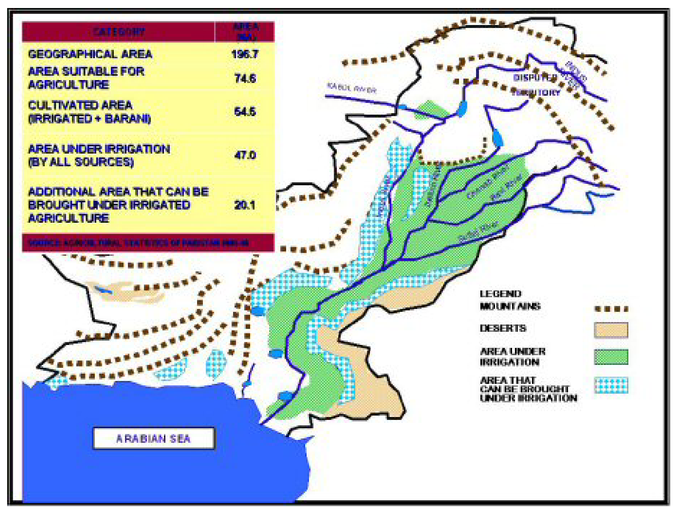
Indus Basin Project (IBP)

Indus Basin Irrigation System (IBIS)



Water Resources - Pakistan





INDUS RIVER SYSTEM (IRS)

INDUS RIVER SYSTEM (IRS) stretches from Karakorum and Himalayan mountains in North to dry plains of Sindh in South and empties in to Arabian Sea.

IRS comprises of five main rivers which join Indus are Jhelum, Chenab, Ravi, Bias and Sutlej and Northern and Western tributaries.

IRS has

a. Hydropower Potential	= 54000 MW
b. Mean Annual Flows	= 169 Billion cubic meter

Present

Hydropower Development	= 6538 MW
Live Storage Capacity	= 22 Billion cubic meter

12 % of Total Hydropower Potential and Flows available in country

INDUS BASIN IRRIGATION SYSTEM (IBIS)

Historically IBIS had been fed through run of river supplies from Indus and its five major tributaries.

After Independence of Pakistan had a water dispute with India because she cut off its river flows.

The dispute was resolved through Indus Basin Treaty (IBT) in 1960 under aegis of World Bank.

The IBT provided eastern rivers Sutlej, Beas and Ravi to India western rivers Chenab, Jhelum and Ravi to Pakistan.

For supplying water to Pakistan's irrigation network (the largest man made canal system in the world) the IBP was designed and constructed to replace the waters of eastern rivers.

The network which regulates IBIS has three major reservoirs: Tarbela, Mangla and Chashma. It also includes

–19 barrages

–12 inter river link canals

–43 canal systems

More than 107,000 water courses. The aggregate length of the canals is 60,376 km. In addition, the watercourses, farm channels and field ditches cover another 1.6 million km.

MANGLA DAM

Earthfill Dam Built across River Jhelum (12th Biggest of its type in World).

Height of Dam	= 116 m
Length	= 3.15 km
Lake Area	= 256 sq. km
Live Storage	= 6.52 cu. km (Presently 5.5 cu. km)
Main Spillway Capacity	= 28612 cubic meter per second
Emergency Spillway	= 6500 cubic meter per second
Installed Capacity	= 1000 MW
Annual Generation	= 5 Billion units (KWh)

TARBELA DAM

Earth and Rockfill Dam Built across River Indus
(Largest of its type in World).

Height of Dam	= 148 m
Length	= 2.75 km
Lake Area	= 256 sq. km
Live Storage	= 14.20 cu. km (Presently 11.90 cu. km)
Main Spillway Capacity	= 18413 cubic meter per second
Auxiliary Spillway	= 23796 cubic meter per second
Installed Capacity	= 3478 MW
Annual Generation	= 14 Billion units (kWh)

CONCLUSIONS

The operation of Mangla and Tarbela dams from their commissioning to 2006, as compared to pre-reservoirs period of 1960-67, reveals:

Cumulative incremental irrigation water benefits over the period of 1967-2006 were 2.6 billion US$ due to regulation of these big storage dams.

Withdrawals of IBIS increased by about 20 percent in the low-flow periods of early Kharif i-e April and May in Rabi from October to March and late Kharif i-e September, which ensuring regular water supply throughout the year in this semi arid, agriculture based economy.

Hydropower contribution from these dams from 1967 to 2006 aggregated to 478 billion KWh. Correspondingly estimated benefits were 6.8 billion US$ which saved 119 million tons of furnace oil resulting in saving of foreign exchange of 13.5 billion US$.

Electricity benefit, which is by product of dam operations, is 3 times the direct irrigation benefits and in present era plays a vital role when the furnace oil prices are at their peak i-e 120 US$ a barrel.

Combined impact of above two factors was a substantial contribution to sustainable economic growth of Pakistan.

These dams regulation ensures minimum flows as and when required necessary to avoid saltwater intrusion from the sea in low line areas during low flow season.