Key Issues:
12- Benefits due to Dam Function

Climatic Zone:
Df : Humid continental

Subjects:
- Large Scale Multipurpose Development

Effects:
- Fisheries in Reservoir
- Increase of Agricultural Production
- Hydropower Generation
- Navigation
- Increase of Employment Opportunities
- National and Regional Economic Growth


Ataturk Dam

Project Name: Ataturk Dam and Hydroelectric Power Plant (H.E.P.P.)
Country: Turkey

Implementing Party & Period
- Project:. State Hydraulic Works (DSI)
1992 (Completion of construction) -
- Good Practice: State Hydraulic Works (DSI)
1992 (Commencement of operation) -

Key words:
Hydropower, Irrigation, Fishery, Multipurpose Development

Abstract:
Ataturk Dam and H.E.P.P was constructed on the Euphrates River in 1992 as the key structure of the Southeastern Anatolian Project (GAP in Turkish acronym). In addition to hydroelectric power production, this large scale multipurpose project has increased agricultural production due to irrigation and has provided an abundant fisheries and recreation in the reservoir. The benefits including creation of employment opportunities accrue to not only the region but also the whole country.

1. Outline of the Project

Ataturk Dam and H.E.P.P, which is in the Lower Euphrates projects, is the most important and key structure of both this project and Southeastern Anatolian Project. It is located at 24 kilometers to Bozova town of Sanliurfa. Ataturk Dam has been listed in international construction publications as the world's largest construction site. It was planned and implemented by the State Hydraulic Works (DSI) and constructed by ATA Joint Group consisting of three prominent Turkish contractors. The construction began in 1983 and completed in 1992.

Figure 1: Location of Ataturk Dam

The rock formations at the construction site show mainly a cretaceous and tertiary age. The oldest rock formation is the dolomitic limestone of Upper Cretaceous. The lower part of the rock sequence is intercalated by cherty layers while the upper levels locally contain marly and even chalky layers.

The main dam is rockfill type with a volume of 84.5 million m^3 composed essentially of the following zones:

- A central core of impervious clay. At the top the core has a width of about 10 meters; the upstream and downstream core boundaries are sloped 1 vertical 0.4 horizontal and 1 vertical 0.1 horizontal respectively.
- The downstream shell consists of basalt rockfill and inner zone of platy limestone.
- Between the core and downstream shell transition materials are placed. (Figure 2)

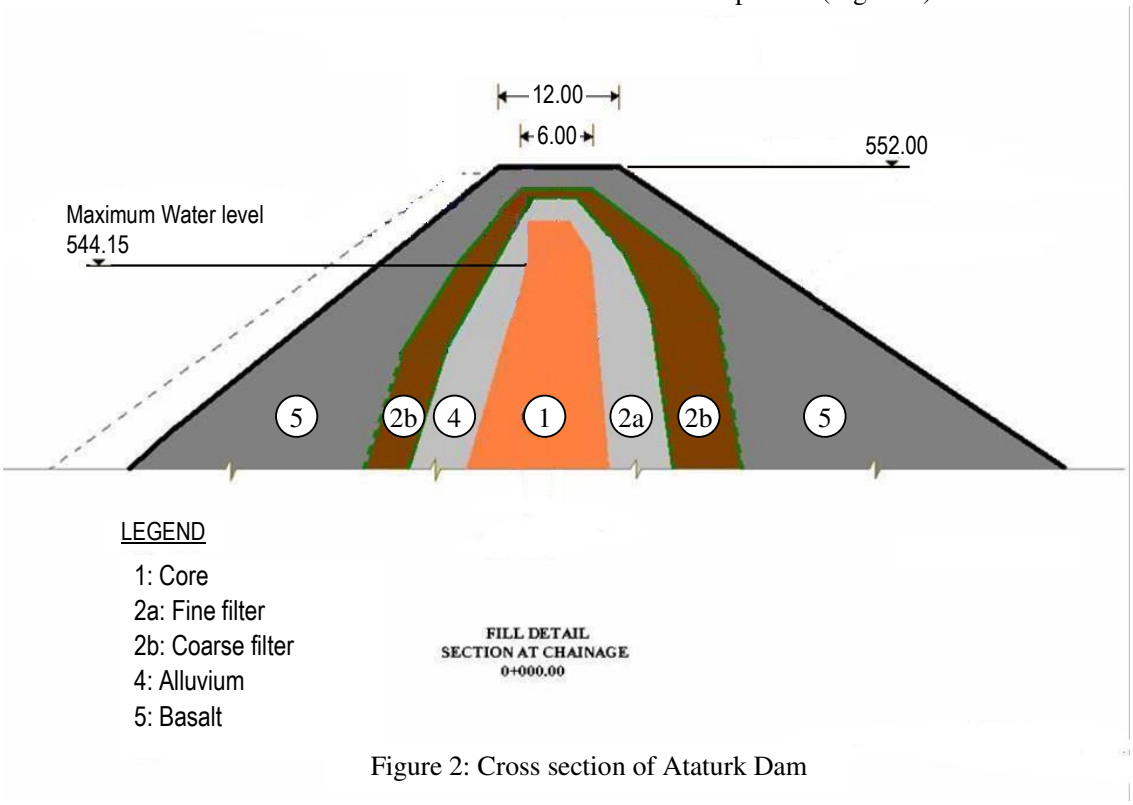

Figure 2: Cross section of Ataturk Dam

The spillway structure has an ogee type with six bays, each one controlled by a 16.0 m x 17.0 m radial gate. Its maximum discharge capacity is of 16,800 m^3/sec with the water level in the reservoir at elevation 544.15. Three diversion tunnels lie on the left bank with parallel longitudinal centerlines spaced at 30.0 m each. The typical cross-section is horse-shoe shaped with an inside diameter of 8.0 m. The maximum discharge capacity of each tunnel is 850 m^3/sec. Total irrigation area of the Ataturk Dam is 872,385 ha.

Ataturk Hydroelectric Power Plant is equipped with 8 units, each of units has 300 MW installed capacity. It began generating power in 1992 and has produced almost 93.4 billion kWh until now. Specifications and overview of Ataturk Dam and HEPP are shown in Table 1 and Figure 3 respectively.

Figure 3: Overview of Ataturk Dam

Table 1: Specifications of Ataturk Dam and H.E.P.P

Item		Specification
River		Euphrates
Power Plant	Start of Operation	July 1992
	Ave. Annual Generation	8,900 GWh
	Max. Output	2,400 MW
	Max. Power Discharge	241 m^3/sec
	Max. Effective Head	151.2 m
Dam	Name	Ataturk
	Type	Centralized Clay Rockfill
	Crest Length	1,670 m
	Max. Height	170 m
	Volume	84,500,000 m^3
	Design Flood Discharge	16,800 m^3/sec
Reservoir	Catchments Area	92,240 km^2
	Impounding Area	817 km^2
	Max. Capacity	48.7 billion m^3
	Max. Water Level	544.15
	Minimum Water Level	526.00

2. Features of the Project Area

The climate in Ataturk area is that prevailing in South-East Anatolia, namely cool and moderately wet winters, mild springs and dry hot summers. The mean annual temperature in the basin ranges from 17 to 19 C. The mean annual precipitation in the region is 473 mm. The average annual humidity is 48 % for periods of up to 50 years.

Precipitation increases with altitude, the annual total varying from 300-1000 mm in the Ataturk Dam basin. The average annual precipitation observed in Dutluca was 700 mm.

The greater part of precipitation occurs between November and May. From beginning of December it generally falls as snow in the higher areas. This snow accumulates during the winter and melts in April and May.

The largest flood occurs by a combination of snow melting and rainfalls. The Euphrates (Firat) has a relatively regular regime. High average flows from November to May and minimal flow from July to September, during the months. The hydrological studies defined an annual average inflow at Ataturk of 843 m^3/sec.

Upon the completion of irrigation projects supplying water from Ataturk Dam, there will be naturally significant changes in agricultural output and crop design in the region and consequently in the life standards of people living there. Such irrigation-led crops like vegetables, soybean, groundnut, sunflower, cotton, corn, lentil and chickpea, almond, pistachio and fodder crops will be the basis of flourishing agro-industries. The main fields of activity include the production of agricultural products, operation of relevant industrial facilities and marketing of the final products in the national platforms and particularly the international platforms. In the Organized Industrial Districts of Sanliurfa, Adiyaman and Gaziantep will be established processing and packaging plants for agricultural production. For the time being the procedures for the realization of technological production with high productivity rate will be executed uninterruptedly. With parallel to agricultural and industrial development, job opportunities also will increase.

3. Benefits

3.1 Fishery

Dam reservoirs are artificial lakes where fishlife should be able to develop as in natural lakes and provide an abundant source of food for lakeside populations as well as opportunities for recreational fishing. Ataturk Dam Lake like some other reservoirs has even become well-known in this respect. By commercially fishing in the reservoir it has been gained 1.26 million USD per year with a catch of approx. 1,000 tons of some fish species. In addition to commercial fishing it has a potential of 7,000 tons/year cage culture and may offer a market value of 14 million USD.

When a reservoir can provide sufficient food for fish but the conditions are not conducive to reproduction, fish stocking or restocking can be considered. Young fish (“fingerlings”) can be propagated in special hatcheries and introduced into the reservoir once a year. In this context, approximately 33 million fingerlings propagated in DSI Ataturk Fish Hatchery have been stocked into the reservoir since 1992. In the initial year, 200 000 fingerlings were released to reservoir. Considering all aspects of fishery activities in the reservoir, Ataturk Dam Reservoir may contribute totally 15 million USD to GNP and provides an employment of 1,600 people.

Furthermore, international water sports festival is organized annually at Ataturk Dam and athletes competes in sailing, SCUBA and swimming categories.

For transportation purposes, several ferries are operated in the reservoir.

Figure 4: Fish production meets the protein needs of people

3.2 Irrigation

Sanliurfa-Harran irrigation scheme began operation in 1995. Irrigation water has been supplied from Ataturk Dam. Gross irrigation area of the project was 31,285 hectares in 1995. Irrigation area has been increased in the following years and reached to 121,138 hectares in 2003. When the construction of whole irrigation facilities of the project will be completed, the irrigation area would be 872,385 hectares. Main crops in irrigated area are cotton and grains. Variations in cultivated areas of these crops are shown in the following table and chart.

Table 2: Cultivated Areas of Main Crops in Irrigation Area

Years	Area (ha)			
	Net Irrigated	Cotton	Cotton Rate (%)	Grains
1995	21,603	20,613	95	345
1997	46,097	37,925	82	5,051
1999	79,649	62,518	79	15,932
2001	99,046	89,872	91	9,865
2003	98,837	75,427	76	20,008

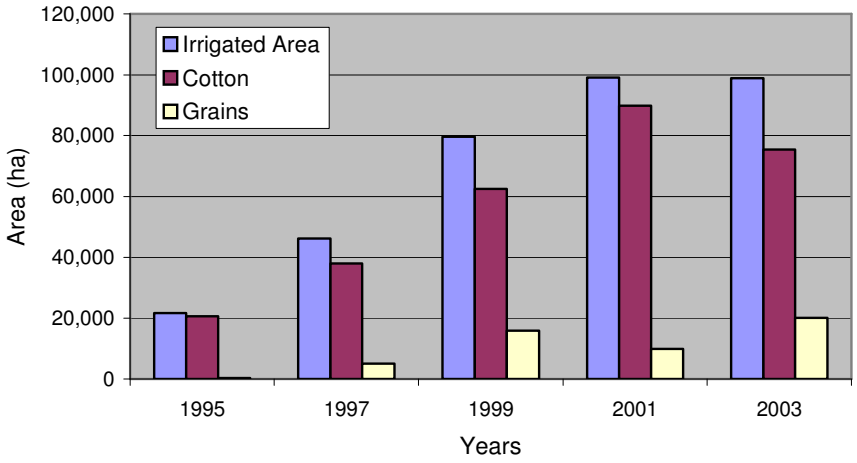

Figure 5: Ratio of cultivated areas of main crops in irrigation area

Irrigation ratio was 82% in DSI developed irrigation areas in this project including second crop areas and irrigated areas outside of the command area.

Yield increase in a unit area provided by irrigation is a unique element for increasing agricultural production value and added value. Yield increases in Sanliurfa-Harran irrigation scheme compared to without project situation are as follows: 111% grains, 54% legumes, and 69% cotton.

The increases in production value and Gross National Agricultural Product (GNAP) obtained from the irrigation area have great importance for farmers. Increasing figures of these indicators for past 4 years can be seen in Table 3. According to 2003 crop yields and prices, production value of 213, 6 YTL (New Turkish Lira) increase has been obtained per declare irrigated area. GNAP has also increased compared to without project situation, and GNAP of 1,054 USD increase has been provided per hectare irrigated area.

Contribution of irrigation schemes to employment is also significant for regional and national economy. One hectare developed irrigation area provides additional employment for 2 people. Thus, irrigation area of this scheme would ensure employment opportunities for about 250,000 people.

Benefit/cost ratio is an indicator, which shows the effectiveness of irrigation scheme. According to most recent data, benefit/cost ratio of this scheme is 2.52.

Table 3: Benefit of the Irrigation in Sanliurfa-Harrran

Years	Revenue	Without Project USD/ha	With Project USD/ha	Revenue Increase USD/ha
2000	*Production Value**	148	793	645
	*GNAP***	107	571	464
2001	*Production Value*	274	1,712	1,438
	GNAP	197	1,233	1,035
2002	*Production Value*	400	1,501	1,101
	GNAP	288	1,081	793
2003	*Production Value*	455	1,919	1,464
	GNAP	327	1,381	1,054

*Production Value means that multiplication of crop yields obtained yearly in a unit agricultural area with the market prices of the crops.

**GNAP means that family labor force, taxes, amortization and operation costs per unit agricultural area are included in the production value.

4. Effects of the Benefits

The GAP region was in a disadvantaged position compared with other regions in the country from a socioeconomic point of view and its relative economic importance had decreased continuously over the last half century. The inter-regional disparities and rural-urban differences were hindrances to development. The GAP project aims to reverse this situation by using geographical and local advantages of the region to alter the natural course of socioeconomic change and expedite development efforts. Ataturk Dam will provide irrigation water to an area of 900,000 hectares, which is larger than the half of the area to be irrigated within GAP Project. At present, although only 200,000 hectares are being irrigated from Ataturk Dam, it can be said that irrigation has brought the

spread of commercial crops and modernization of agricultural production in the region. On the other hand hydroelectric power production of Ataturk Dam has become about 93.4 billion kWh since 1992, which is a quite important figure in the electric production of Turkey. Ataturk Dam also provides drinking water for the city of Şanliurfa and some other smaller cities. During the construction of Ataturk Dam and afterwards the irrigation schemes, employment opportunities and training possibilities for the local people have arisen. Ataturk Dam Reservoir also provides fishery facilities.

5. Reasons for Success

As stated above, being the largest dam on the Euphrates River, Ataturk Dam provides water for irrigation, hydroelectric power production and drinking water supply, and provides flood control, recreational opportunities etc.. The benefits obtained are both for the region and the whole country. The main reason for the success is the public acceptance and support and political determination.

The "official" developmental goals of this project that took its final shape as the process of building it got under way are as follows:

1. To improve the economic structure of Southeastern Anatolia and raise its income level.
2. To increase production, productivity, and employment opportunities in agriculture.
3. To improve the ability of big cities to absorb the population moving from rural to urban areas by stopping migration.
4. To increase exports by mobilizing the resources of the region and by well-targeted and sustainable economic activity.

Figure 6 Harran Farmers met with irrigation water

Water security for irrigation, food, and domestic needs of people has been assured after completion of the Ataturk Dam. People living in the region have waited impenitently for a long time when the irrigation water will meet and wet their dry but fertile agricultural lands. Crop production and so income has increased 5 to 6 folds after irrigation.

6. Outside Comments

Ataturk Dam & HEPP has been taking a great attraction and interest in the local, national and also international media. Each year, more than 25,000 people are visiting the Ataturk Dam and thousands of articles on newspaper, magazines are being published.

It can be stated some of specific outside comments on the GP made by newspapers and magazines, as follows:

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Publisher: Springer Science+Business Media B.V., Formerly Kluwer Academic Publishers B.V.
ISSN: 0049-6979 (Paper) 1573-2932 (Online)
DOI: 10.1023/A:1005229419209
Issue: Volume 123, Numbers 1-4
Date: October 2000
Pages: 565 - 579
"Unlike most Middle East countries which are highly dependent on water from sources originating in other countries or on desalination, Turkey is naturally endowed with relatively abundant water resources. The Turkish government has assigned the highest priority to completing its massive $32 billion Southeastern Anatolia Project (GAP), consisting of 22 dams and 19 hydroelectric power plants on the Euphrates and Tigris rivers. Scheduled for completion in 2005, GAP will generate 27 billion kilowatt hours of hydroelectric power and will divert water from the Atatürk Dam reservoir through the two giant Şanliurfa Tunnels into a canal system to irrigate 1.7 million hectares in south-eastern Anatolia just north of the Syrian border. For Turkey, GAP will not only provide food and energy for a growing population, but is the crux of a comprehensive and sustainable economic development plan designed to end instability and reduce out-migration by radically transforming the feudal economic and social structure of this poor region of the country."

International Journal of Water Resources Development
Special Issue
Editor: Asit K. Biswas
December 1997, Volume 13, Number 4
"The largest dams are on Fırat River. Atatürk Dam is the eight largest in the world by structural volume (84.5 hm^3) and Keban Dam is the third largest by height (207 m) among the composite dams of the world."

7. Further Information

7.1 References

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