

Chapter 8

The Atatürk Dam in the Context of the Southeastern Anatolia (GAP) Project

Dogan Altinbilek and Cecilia Tortajada

8.1 Introduction

The Southeastern Anatolia Region of Turkey has historically been a plateau with low productivity. Although rich in water, land and human resources, the region has lagged behind the rest of the country in terms of development. The development potential of both the Euphrates and Tigris Rivers was recognised in the 1960s, and the idea of harnessing their waters for irrigation and hydropower generation emerged. Towards the end of the 1970s, the General Directorate of State Hydraulic Works¹ (DSI) planned the ‘Southeastern Anatolia Project’—a series of land and water resources development projects on the two rivers. Through a Master Plan in 1989, and a significant revision in 2002, the Southeastern Anatolia Project, or Güneydogu Anadolu Projesi (GAP), was transformed from a land and water resources development project into a large-scale, multi-sectoral regional development project to be implemented in nine of Turkey’s provinces that came to be known as the Southeastern Anatolia (GAP) Region.

The GAP Project thus came to focus not only on economic growth based on water infrastructural development but also on regional development as a whole, taking into

¹The DSI is responsible for planning, design, construction, operation and maintenance of dams, pumping stations and canals for water supply of large cities, large-scale irrigation systems and hydropower production in Turkey. It is headquartered in Ankara and has several regional directorates in the rest of the country.

D. Altinbilek (✉)

Civil Engineering Department, Middle East Technical University, Ankara, Turkey

C. Tortajada

International Centre for Water and Environment, Zaragoza, Spain

Lee Kuan Yew School of Public Policy, Singapore

Third World Centre for Water Management, Atizapan, Mexico

account industry, transportation, urban and rural infrastructure, environmental protection and social sectors such as employment generation, health, education, capacity building and gender equity. The main objective of the GAP Project was to strengthen social, economic, institutional and technical aspects of human development in an economically disadvantaged region by significantly increasing the living standards of its people (GAP Administration 1999; Altinbilek 1997).

A designated Project Management Unit at the State Planning Organisation (SPO) initiated the Master Plan for the GAP Region. Phase I of the Master Plan Study Completion Report was submitted in July 1988 and it presented a proposal for a suitable project management system to implement activities in the region. The proposal was elaborated further in Phase II of the Completion Report submitted in November 1988. Also in November 1988, an Interim Macroeconomic Plan was submitted that examined alternative development scenarios and frameworks consistent with socio-economic and resource allocation policies at the national level.² The Turkish government's increasing emphasis on reducing socio-economic disparity across regions, evident in the GAP Project, was a reflection not only of concern for equitable development but also of the recognition that the realisation of development potentials in less-developed regions would contribute to the national objectives of sustainable economic growth, export promotion and social stability. It was thus acknowledged that, alongside economic growth, provision of social services would have to be improved (Hashimoto 2010,³ personal communication). The Master Plan was finally completed in April 1989. In November of the same year, Law no. 388 was enacted to establish the Southeastern Anatolia Project Regional Development Administration (also known as the GAP Administration), which largely followed the proposal in the Master Plan⁴ (Nippon Koei Co. Ltd., and Yuksel Project A.S., 1990; Hashimoto 2010, personal communication).

The GAP Administration was established in 1989. Its key purpose was to plan and coordinate development efforts in the GAP Region, mostly by integrating multi-sectoral projects.⁵ Attached to the Prime Minister's Office, the GAP Administration would approve land use plans and would coordinate the various agencies responsible for implementing development activities in the region. The Administration was initially

²The Plan incorporated numerous comments that were received during Phase I of the Completion Report.

³T. Hashimoto, Director General of Nippon Koei, was a key figure during the preparation of the GAP Master Plan.

⁴Article 1 of Law no. 388 of 6 November 1989 stated that the Southeastern Anatolia Project Regional Development Administration was a juridical entity, affiliated to the Prime Minister's Office and had a duration of 15 years. The Administration would provide, or would organise the provision of, services related to planning, infrastructure, licenses, housing, industry, mining, energy and transport, in order to ensure a rapid development of the region under the Southeastern Anatolia Project. It would take actions, or would organise that actions were taken, to improve the educational level of the local population, and would ensure coordination among the relevant agencies and organisations.

⁵The Southeastern Anatolia Project Regional Development Administration has its headquarters in Ankara and a Regional Directorate in Sanliurfa.

established for a period of 15 years (GAP Administration 1999, 1998). However, this was later modified and the institution is still functional.

The GAP Project became one of the most ambitious regional development projects in the country by encompassing not only hydropower and irrigation infrastructure development as originally planned, but also all related sectors including industry, transportation, rural and urban infrastructure, environmental protection and social sectors in the region. Since GAP was planned as a multi-sectoral integrated regional development project, an integrated approach was essential to achieve its targets and objectives. It was thus understood that construction of energy and irrigation infrastructure, past and future, would contribute to economic growth, social development and environmental change. All these changes would, in turn, have discernible impacts on different parts of the region and would need to be managed with a view to achieving the sustainability of the GAP Project and improving the quality of life for the local population.

Some 20 years on, the progress achieved in the GAP Region is indisputable: per capita income had increased from 47% of average national income in 1985 to 55% by 2001. By the end of 2005, eight hydropower plants had been completed, representing 74% of all energy projects at the national level. In that year alone, the electricity generated in the region was to the order of 253 billion kWh, equivalent to \$15.1 billion (1 kWh = 6 cents) and accounting for 47.2% or \$1.1 billion of total production at the national level. In addition, seven industrial centres had been completed by the end of 2005 (GAP Administration 2006), and 286,502 ha of land in the Euphrates and Tigris river basins were under irrigation at the end of 2010. In terms of investment, some \$19.6 billion (TL 25.6 billion) of public funds had been spent in the region at the close of 2007, representing 62.2% of the total calculated expenditure for the GAP Project as originally projected (Government of Turkey 2008).

In spite of this progress, implementation of the GAP Project as an integrated regional development project is still well behind the targets set out in the Master Plan. Low annual average growth; unemployment; insufficient qualified labour force; inappropriate infrastructure for industry, education, health, drinking water, wastewater and solid waste; low levels of education and low level of regional capital accumulation continue to plague the region. These issues have been further aggravated due to high population growth and environmental problems that have resulted from intensive agricultural practices, excessive and uncontrolled irrigation, insufficient drainage in agricultural areas, and poor water, wastewater and solid waste management in the growing urban centres.

Insufficient funding has been a key issue for the lack of implementation of the project. An example is the investment of DSI in the agricultural sector in the GAP Region, which has always been considered of utmost importance because of its expected positive impacts in the income level of the overall population. In 1998, as requested by the national government, DSI revised its construction programme and annual budget estimates for the 1999–2010 period and submitted them to SPO for their consideration. Nonetheless, the funds allocated by the government to the GAP Project were not enough to implement it by 2010 (DSI 2008).

In order to address the delay in the implementation of the GAP Project, the Government of Turkey has developed the GAP Action Plan for the GAP Region for the period 2008–2012 (Government of Turkey 2008). The objective of this plan is

to ensure economic growth, social development and employment creation. Its focus is on meeting basic infrastructure needs, mainly in terms of irrigation, and accelerating economic and social development in the region with the aim to contribute to the national targets of economic growth and development as well as social stability and capacity building. Total expenditures foreseen for the Action Plan 2008–2012 are \$20.54 billion of which \$20 billion will be spent in infrastructure development mainly for irrigation, energy, transportation and social issues.

This analysis will not attempt an overall evaluation of the socio-economic impacts of the GAP Project. As mentioned by Beleli (2005), the lack of a systematic monitoring and evaluation system of such a complex project makes an assessment of that nature quite impossible. Rather, the objective is to analyse the main impacts of the Atatürk Dam—one of the largest and most relevant water projects in the GAP Region and also one of the most important in Turkey—not only in terms of energy generation and irrigation-related activities, but as part of an overall strategy which aims to achieve energy security for the country. The analysis and discussion are based largely on personal experience as well as on previous studies carried out by the authors in the region.

8.2 The GAP Region

The GAP Region spreads along 75,000 km² and includes the Provinces of Adiyaman, Batman, Diyarbakir, Gaziantep, Kilis, Mardin, Siirt, Sanliurfa and Sirnak. The region covers approximately 10% of the country's area and has correspondingly about 10% of the total population.⁶ It is estimated that approximately 20% of total irrigable land and 28% of the country's energy potential are in this region.

In 1985, the GAP Region accounted for 4% of the GNP, per capita income of the region was 47% of the national average, the literacy rate was about 55%, and medical facilities and personnel in the region were inadequate with 1,391 doctors and 1,630 nurses per 10,000 population at the regional level compared to 3,631 doctors and 2,758 nurses at the national level for the same number of population. Some 22% of the rural population (living in 3,500 rural settlements) did not have access to clean drinking water, 29% of the villages had telephone access, 66.8% had electricity and 90% were linked to the road networks. Almost 70% of the economically active population was engaged in agriculture, but was generating only 44% of the total value added (Unver 1997).

As originally conceived, the land and water resources programme of the GAP Project included the construction of 22 dams and 19 hydropower plants on the Euphrates and Tigris rivers and their tributaries, as well as very extensive irrigation networks. By the year 2010, the GAP Project was expected to have increased per capita income in the region by 209%, approximately 3.8 million people would have been provided employment opportunities, 1.7 million ha of land would be under

⁶According to Aksit and Akcay (1997), the GAP Region does not necessarily denote a uniform and distinct social structure nor does it display a cultural uniformity. It simply refers to a group of provinces included in the area of the Southeastern Anatolia Project.

irrigation and 27 billion kWh of hydroelectric energy would be produced annually (GAP Administration 2006). The situation, however, is quite different. The analysis will explain the reasons thereof.

8.2.1 Development Plans and the GAP Region

The main development instruments used for planning purposes in Turkey are National Five-Year Development plans, Medium Term programmes and annual programmes. All of these plans are prepared by the SPO, Prime Minister's Office.

The National Five-Year Development plans set macroeconomic targets, sectoral and regional objectives and policies, and the overall direction for the country's social development (Say and Yucel 2006; SPO 2008a). The Medium Term programmes are policy documents with a 3-year perspective, which analyse the current status of the country and determine modifications for the macroeconomic, sectoral and regional policies, goals, targets and priorities, and also set the budgets. The SPO is responsible for monitoring their implementation (SPO 2008b).

All the plans and programmes throughout the years have been very ambitious regarding regional development. As is normally the case, the objectives of both development plans and programmes have changed with time, but regional development has always been identified as an important means to ensure the highest economic and social benefits for the country as a whole. Within these varying objectives, land and water resources have been consistently identified as a priority.

The several plans and programmes recognise that imbalances in socio-economic structure and income level across rural and urban settlements, as well as across regions in Turkey, continue to be a major constraint. So far, infrastructure for the provision of services and employment opportunities in most cities remains inadequate for responding to population pressure resulting from both population growth and migration. This requires implementing integrated regional development policies that consider measures which are specific to the problems and potentials of the area, and which focus on strengthening local institutions, developing qualified labour, promoting employment, building social infrastructure and increasing the contribution of the private sector to regional development.

It is also widely acknowledged that institutional arrangements have to be more agreeable for the implementation of national regional policies. For this purpose, in 2002, SPO defined the Nomenclature of Territorial Units for Statistics (NUTS) levels in Turkey and organised the 81 provinces of the country into 26 so-called 'statistical regions' at the NUTS II level⁷ (Table 8.1). It was planned that regional development agencies would be established in the NUTS II regions. They were expected to play a

⁷NUTS is the name of the statistical region classification used in the European Union. NUTS classification, developed by Eurostat, establishes the framework for regional development policies, collection of regional data, and creation of a comparable statistical database harmonised with the European Union regional statistics system. Regions are classified as NUTS I, II and III depending on their population. Turkey aligned itself with the NUTS classification system in 2002. The country has 12 NUTS I, 26 NUTS II, and 81 NUTS III regions.

Table 8.1 Selected indicators for the first and last five NUTS II regions, ranked according to the Socioeconomic Development Index (SEDI)

Regions	SEDI rank (2003, within 26 regions)	GDP per capita (2001, TR = 100)	Sectoral employment (2005)			Urbanisation rate (%) (2000)	Net migration rate (per thousand) (2000)
			Share of agricultural sector (%)	Share of industrial sector (%)	Share of services sector (%)		
TR10 (Istanbul)	1	143	0.7	37.0	62.4	90.7	46.1
TR51 (Ankara)	2	128	7.3	16.0	76.6	88.3	25.6
TR31 (Izmir)	3	150	18.1	27.7	54.2	81.1	39.9
TR41 (Bilecik, Bursa, Eskişehir)	4	117	18.3	37.8	43.8	76.4	38.7
TR42 (Bolu, Düzce, Kocaeli, Sakarya, Yalova)	5	191	20.4	26.8	52.8	57.2	-9.5
Turkey	-	100	29.5	19.4	51.1	64.9	-
TR41 (Bayburt, Erzurum)	22	50	62.0	3.5	34.5	57.3	-43.5
TRC2 (Diyarbakir)	23	54	38.1	5.7	56.1	59.1	-39.5
TRC3 (Batman, Mardin, Simak, Siirt)	24	46	29.3	10.0	60.8	59.6	-46.8
TRA2 (Agri, Ardahan, Iğdir, Kars)	25	34	61.8	3.1	35.1	44.6	-57.3
TRB2 (Bitlis, Hakkari, Mus, Van)	26	35	48.0	6.3	45.8	49.3	-39.5

TR, TRA, TRB, TRC refer to NUTS codes. For more information see SPO (2006b)

major role in managing regional policies, achieving regional development, and mobilising support and funding for regional development projects, while integrating the public and private sectors with non-governmental organisations (NGOs) working towards regional development (Kayasü 2008).

Six of the nine provinces of the GAP Region are among those considered less developed in the country, in terms of socio-economic development and structure of employment for the agricultural, industrial and services sectors. They are all targeted as priority areas for investment (Table 8.1).

In terms of levels of investment, the 2007–2013 Ninth Development Plan (SPO 2006b) stated that a main constraint in achieving substantial implementation progress in the different regional development plans has been that, except for GAP, plans have been considered only within the scope of sectoral allocation rather than a more integrated point of view, in addition to have been provided with limited funding. Among those plans are the Zonguldak-Bartın-Karabük Regional Development Project (ZBK), the Eastern Black Sea Regional Development Plan (DOKAP), the Eastern Anatolia Project (DAP) and the Yeşilirmak Basin Development Project (YHGP) (SPO 2008a).

However, while the GAP Project has been provided with more funding than other projects, it still needs to be considered as an integrated regional development programme which promotes local initiatives and collaboration among development agencies, rather than a purely infrastructure-based project with investments in energy and irrigation development. Additionally, policies that promote market opportunities and institutional capacity at the local level, and that develop a qualified cadre of human resources, still need to be strengthened (SPO 2006b).

The Long-Term Strategy and Eighth Five-Year Development Plan for 2001–2005 (SPO 2001) consider the reduction of inter-regional imbalances as one of its main objectives and, therefore, list among its priorities the implementation of regional development policies, inter-regional integration and social and economic equity. The plan acknowledges serious disparities between regions in spite of the progress achieved with regard to regional development. Some of the reasons identified are high population growth, low levels of education, insufficient qualified labour and lack of timely fund allocation for development of infrastructure. High inter-regional migration, as well as continuous migration from rural to urban areas, have also been recognised as serious issues since they exacerbate socio-economic problems because of unemployment, lack of urban infrastructure and lack of access to housing, education and health services. In the case of the GAP Region, the adverse impacts of migration have been noted in several provinces: Adiyaman, Gaziantep, Diyarbakir, Batman and Sanliurfa (SPO 2001, 2007a). Nonetheless, these provinces have also been identified as centres for urban growth that could prevent out-migration from the region, and for this reason it is fundamental to promote development of urban infrastructure and services for the increasing population (SPO 2007a, 2008b, 2010).

In 2000, the Long-Term Strategy identified 49 provinces and two administrative regions, including the GAP Region, as First Degree Priority areas (SPO 2001). These areas represent 55% of the country's area and 36% of its population, which indicates the extent of sustained effort that is necessary in order to achieve desired development targets in the country.

Within the frameworks established by Turkey's development and strategy plans, reduction of regional disparities (SPO 2005, 2006a) and fulfilment of regional development (SPO 2007b, 2008a, b, 2009) are also identified as important means to achieve the objectives of the Medium Term Programmes. As before, land and water resources have been acknowledged as priorities, with specific reference to the GAP Project. These plans also emphasise the importance of transforming integrated regional development plans, primarily the GAP Project, into implementable programmes, of ensuring that the allocation of resources is consistent with those programmes, and of setting up monitoring and evaluation mechanisms in order to achieve the targets that have been defined (SPO 2008a, b).

In terms of investment for the GAP Project, the funds needed to finance its implementation during the 2008–2012 period alone are estimated to be approximately \$20.54 billion, most of which is expected from the budget of the central government (SPO 2008b). It is also expected that resources from the Unemployment Insurance and Privatisation funds will continue to be transferred to the central government for use within the GAP Action Plan as well as for other investments towards economic and social development (Government of Turkey 2008). It is worth noting that the projected total capital expenditure for the GAP Action Plan for the year 2010 alone would be TL 5.4 billion, or 1.8% of the national GDP (SPO 2010).

The Social Support Programme (SODES) has been developed within the scope of the GAP Action Plan to ensure a focus on social development. Through SODES, 398 projects were financed in 2008 with a total investment of TL 42 million for employment, social integration, and culture, arts and sports purposes. In the following year, TL 92 million was invested in 778 projects (SPO 2010).

The end objectives of the implementation of the development and action plans in the GAP Region are to improve the quality of life of people living in the region by mobilising local resources, eliminating development disparities among the regions, and also by contributing to national targets of economic growth and social stability. Of course, sustained progress in the region cannot be achieved through planning alone—proper implementation is essential.

8.3 GAP Project

The GAP Project is a major attempt to reduce inter- and intra-regional development disparities and accelerate improvements in quality of life for the region's population. In terms of resources allocated primarily for investment in energy and irrigation, it is considered to be the most comprehensive project in Turkey. However, the GAP Project has not been the only regional project of the country. There have been many regional development plans along the years, including the Antalya Project (1959), Eastern Marmara Planning Project (1960–1964), Zonguldak Project (1961–1963), Cukurova Regional Project (1962–1963), Zonguldak-Bartın-Karabük (ZBK) Regional Development Project (1995–1996), Eastern Anatolia Project (DAP) (1999–2000), Eastern Black Sea Regional Development Plan (DOKAP)(1999–2000), Yeşilirmak

Basin Development Project (YHGP) (2005–07) and Konya Plains Project (KOP) (Government of Turkey 2008; SPO 2008a).

The initial aim of the GAP Project was to achieve economic and social development in the region through the implementation of land and water resources projects that involved the construction of 22 dams, 19 hydropower plants with a total installed capacity of 7,500 MW and extensive irrigation and drainage networks. The project was expected to nearly double the area under artificial lakes to 228,136 ha in the country; irrigated land was to increase from 2.9% to 22.8% of the region's total area; and rain-fed agriculture to decrease from 34.3% to 10.7% (Biswas and Tortajada 1999; Unver 1997). So far, its implementation as an integrated regional development project is well behind the targets of the Master Plan. Nevertheless, significant progress has been achieved in terms of the water and land resources programme under which several dams and related projects have been developed and the benefits of which are, for the most part, already tangible in terms of electricity generation and irrigated agriculture. Even though the target of around 1.7 million ha under irrigation is still rather far off, the newly irrigated acreage has transformed the GAP Region into a major producer of cotton contributing nearly 50% of the national output.

The following is an analysis of the land and water resources programme of the GAP Programme, with an emphasis on the main water project for the local area and the region, as well as one of the most important for the country—the Atatürk Dam.

8.4 Land and Water Resources Programme

The GAP Project has multiple programmes for different sectors. The land and water resources programme includes 13 main irrigation and energy projects, seven of which were planned for the Euphrates River and six for the Tigris River. Before discussing the infrastructure development made possible by the project, it is useful to delineate the characteristics of both rivers.

8.4.1 *Euphrates and Tigris Rivers*

The mean annual flow of the Euphrates (Firat) River is estimated to be 33.6 BCM, and that of the Tigris (Dicle) River is estimated to be 50.9 BCM (excluding the flow of Karun River from Iran). Some 98% of the Euphrates River runoff originates in the highlands of Turkey, while the rest of its catchment in lower arid regions makes little contribution to the river (Altinbilek 2004). The main features that distinguish the hydrologic regime of the Euphrates-Tigris River system are their annual and seasonal fluctuations, with large floods originating from the snow-melt in spring.

The Euphrates River has a catchment area of 127,304 km² and a mean catchment elevation of 1,383 m. Its main tributaries, the Karasu and Murat Rivers, flow towards the west along intra-mountain valleys and join the Euphrates River around the

Table 8.2 Characteristics of the Euphrates and Tigris Rivers

	Tigris ^a	Euphrates ^a
Mean catchment elevation (m)	1,451	1,383
Catchment area (km ²)	57,614	127,304
Mean annual discharge (km ³)	21.33	31.61
Mean annual precipitation (cm)	65.8	55.9
Mean air temperature (°C)	12.6	11.0
Number of ecological regions	4	7
<i>Land use (% of catchment)</i>		
Urban	0.0	0.1
Arable	37.7	30.6
Pasture	26.7	31.4
Forest	21.5	17.8
Natural grassland	12.8	18.6
Sparse vegetation	0.0	0.0
Wetland	0.1	0.1
Freshwater bodies	1.2	1.4
<i>Protected area (% of catchment)</i>		
Water stress (1–3)		
1995	3.0	3.0
2070 (estimated)	3.0	3.0
Fragmentation (1–3)	3	3
Number of large dams (>15 m)	11	49
Native fish species	46	42
Non-native fish species	2	1
Large cities (>100,000 people)	2	6
Human population density (people/km ²)	65	57
Annual gross domestic product (\$ per person)	1,311	1,535

^aOnly within Turkey

Source: Adapted from Akbulut et al. (2009)

Keban Dam, where they flow first towards the southeast and then the southwest before entering Syria. The Euphrates is 3,000 km long, with 1,230 km in Turkey, 710 km in Syria and 1,060 km in Iraq. Turkey contributes 89% of the river's annual flow and Syria 11%. The Tigris River is 1,850 km long and represents a natural border between Turkey and Syria, later crossing into Iraq. In terms of its annual flow, Turkey contributes 51%, Iraq 39%, and Iran 10% (Altinbilek 2004). It has a catchment area of 57,614 km² and a mean catchment elevation of 1,451 m. Its main tributaries within Turkey are the Batman, Garzan, Botan and Hezil Rivers. The Tigris enters Iraq at 300 m mean sea level (msl) and joins the Euphrates to form the Shatt-el-Arab in southern Iraq before discharging into the Persian Gulf (Akbulut et al. 2009) (Table 8.2).

The main difference between the Euphrates and Tigris Rivers is in terms of their discharge: the Tigris receives water from several major tributaries in the middle portion of its course, while all the major tributaries of the Euphrates are in the extreme upper end of the basin. This distinction has a significant effect on the regulation of

both rivers. For the Euphrates, a single dam (in this case the Atatürk Dam) in the upper part of the catchment is able to regulate a very large proportion of the flow of the river. Since the Tigris receives water from the Greater Zab, the Lesser Zab, the Adhaim and the Diyala Rivers, its overall water management is more complex than is the case with the Euphrates, requiring the construction of a series of major dams on individual tributaries to provide a control of flow comparable with that of the Euphrates (Altinbilek 2004).

With regard to their river basins, that of the Euphrates is shared by Turkey, Syria, Iraq and Saudi Arabia, while the Tigris Basin is shared by Turkey, Syria, Iraq and Iran. Turkey contributes approximately 98% to the total discharge of the Euphrates River at its mouth, and 53% to the discharge of the Tigris.

8.4.2 *Infrastructural Development*

Details of infrastructure development under the land and water resources programme as of 2005 are provided in Table 8.3, while the historical development of the GAP Project is traced in Table 8.4.

The first dam to be constructed on the Euphrates River, in what would later become the GAP Region, was the Keban Dam (675 km²)⁸. Operational since 1974, this dam has great importance for the region because it is able to store 70% of the river's flow within Turkey. Downstream Keban, there are the Karakaya (268 km²), Atatürk (817 km²), Karkamis (28.4 km²) and Birecik (56.25 km²) dams constructed in 1987, 1992, 1999 and 2000, respectively.

Atatürk Dam, functional since 1992, is widely considered to be not only the largest dam in Turkey, but also one of the largest in the world. The dam generates 8,900 GWh of electric power per year, followed by Karakaya and Keban, with 7,300 GWh and 6,000 GWh respectively. In 1994, water was delivered from the Atatürk Dam to the Harran Plains, an area that has since become the country's major producer of cotton (DSI 2009).

Dams constructed on the Tigris River include the Kralkizi, Dicle and Batman. The main dam, however, will be the Ilisu Dam due to its importance in regulating the river. The construction of this project has been delayed for many years due to strong differences of opinion between the developers and the affected population, as well as credit agencies. The credit agencies set a number of conditions regarding resettlement of affected people, possible pollution of the future reservoir due to discharge of untreated wastewater by various cities upstream, as well as protection of the cultural heritage of Hasankeyf, an ancient town with numerous archaeological sites that was declared a natural conservation area in 1981. When adequate measures were not implemented within the given timeline, the credit agencies decided to cancel their loans. At present, the Turkish government has decided to continue

⁸All figures in brackets refer to the reservoir area.

Table 8.3 Status of the GAP Project as of 2005

Project status	The Euphrates Projects	The Tigris Projects	Total
<i>Total</i>			
Installed capacity (MW)	5,318	2,172	7,490
Energy production (GWh)	20,140	7,247	27,387
Irrigated land (ha)	1,188,135	632,913	1,821,048
Number of dams	14	8	22
Number of HEPP	11	8	19
<i>In operation</i>			
Installed capacity (MW)	5,066	402	5,468
Energy production (GWh)	19,464	927	20,391
Irrigated land (ha)	175,571	38,353	213,924
Number of dams	6	3	9
Numbers of HEPP	4	3	7
<i>Under construction</i>			
Installed capacity (MW)	50	0	50
Energy production (GWh)	124	0	124
Irrigated land (ha)	103,246	57,014	160,260
Number of dams	1	0	1
Numbers of HEPP	1	0	1
<i>Completed design</i>			
Installed capacity (MW)	202	1,770	1,972
Energy production (GWh)	552	6,320	6,872
Irrigated land (ha)	909,318	537,546	1,446,864
Number of dams	7	5	12
Numbers of HEPP	6	5	11

Source: Akyürek (2005)

the project with funds from international commercial loans secured by local contractors without guarantee from the treasury. The government will pay only the value-added-tax portion of the expenditures. Some 48 houses that were built within the construction site by the government for the affected people of Ilisu village were distributed to owners during October 2010. A new town will be built to resettle Hasankeyf village in the upstream area. Sites of cultural heritage that will be flooded due to the dam will be relocated above the level of the future lake (535 m). A new museum will be built to exhibit the findings of salvage excavations which took place over a decade. Construction is now progressing with a deadline to withhold water in 2014 and to produce energy in 2015.

The hydropower plants in the GAP Region are of great importance at the national level from the viewpoint of energy, since they produce half of Turkey's hydroelectric energy as well as very significant revenues for the country (DSI 2009). In fact, the main impact of the GAP Project so far is considered to be the production of energy, the market value of which is calculated to be more than the total investment for energy purposes in the region. Table 8.5 shows the total energy generation in the GAP Region, and its monetary equivalent from the time the different dams became functional and until the end of 2004.

Table 8.4 Historical development of the GAP Project

Year	Event
1936	Research on the Fırat River was initiated under directives from President Atatürk
1938	Geological and topographical studies were begun and flow stations were established in Keban
1954	The General Directorate of State Hydraulic Works (DSI) was established
1961–1971	The Fırat Planning Authority, established in 1961, published the Fırat Basin Reconnaissance Report in 1964. The Lower Fırat Feasibility Report was prepared in 1970 and the Dicle Basin Reconnaissance Report was published in 1971
1966	Foundation work for the Keban Dam was started
1974	The Keban Dam started operations with the great benefit that a regular flow of water would be supplied to any dam downstream
1976	Construction of the Karakaya Dam was begun
1980	The Lower Fırat and Dicle Projects were combined, and named the GAP Project
1981	Construction of the Atatürk Dam's diversion tunnels as well as the Sanlıurfa tunnels was initiated
1987	The Karakaya Dam began to produce electricity
1990	Water was stored in the Atatürk Dam
1992	The Atatürk Dam started to produce electricity
1994	Water reached the Harran Plains via the Sanlıurfa tunnels
1997	Water was stored in the Kralkızı and Dicle dams
1998	Water was stored in the Batman Dam
1999	The Karkamis Dam and HEPP were completed
2000	The Birecik Dam and HEPP were completed

Source: DSI (2009)

Table 8.5 Hydropower energy production and revenues in the GAP Region until the end of 2004

Dam and HEPP	Year of operation	Installed capacity (MW)	Total energy production (billion kWh)	Monetary equivalent (million \$)
<i>The Euphrates River</i>				
Karakaya	1987	1,800	127.83	7669.80
Atatürk	1992	2,450	94.10	5,646
Karkamis	2000	189	1.67	100.20
Birecik	2001	672	7.96	477.60
Total		5,111	231.56	13893.60
<i>The Tigris River</i>				
Kralkızı	1999	94	0.58	34.80
Dicle	2000	110	0.96	57.60
Batman	2003	198	0.59	35.40
Total		402	2.13	127.8

1 kWh = 6 US cent

Source: Akyürek (2005)

Investments in the energy sector of the region have more than paid off. The total value of energy generated in the region has been higher than the total investments made in the energy sector within the framework of the GAP Project which, up to 2002, were \$4.17 billion (Ercin 2006).

8.5 Atatürk Dam

The Lower Euphrates Project, one of the 13 main irrigation and energy projects in the GAP Region, is the largest and the most comprehensive one. It includes the Atatürk Dam and Hydroelectric Power Plant (HEPP), Birecik Dam and HEPP, Sanliurfa tunnels, Sanliurfa-Harran irrigation, Mardin-Ceylanpinar irrigation, Siverek-Hilvan pumped irrigation and Bozova pumped irrigation (DSI 2009, 2000; Unver 1997).

The Atatürk Dam is considered to be the main undertaking within the GAP Project. The dam is a multi-purpose project for both hydropower generation and irrigation. It is a rock-fill dam with clay core. It has a crest length of 1,664 m, a crest width of 15 m and a crest elevation of 549 m. Its height from the foundation is 169 m, and the maximum water elevation is 542 msl. The volume of the reservoir is 48,700 hm³ and it has a reservoir area of 817 km². The volume of embankment is 84.5 million m³ (MCM), the spillway capacity is 16,800 m³/s and it generates 8,900 GWh per year.⁹

The dam consists of eight Francis-type turbine and generator groups of 300 MW each, supplied by Sulzer Escher Wyss and ABB (Asea Brown Boveri), respectively. The turbines have a rated discharge of 8×300 m³/s and a head of 151 m (Table 8.6).

With the completion of the Atatürk Dam, some 81,700 ha of land were inundated (GAP Administration 1999).

Water reaches the Sanliurfa-Harran Plains, the largest irrigation area in the GAP Region, through the Sanliurfa twin tunnels system. The Sanliurfa tunnels are concrete-lined, each 7.62 m in diameter and 26.4 km long (DSI 2000). There are 52 connection tunnels and 23 ventilation shafts, with one shaft every 1,500 m and depths which vary between 65.24 and 207.95 m, which facilitate excavation and concreting activities. The T1 (left-side tunnel, in terms of direction of water flow) has been used since May 1997, while T2 (the right-side tunnel) was finalised later. (Yesilnacar 2003).

8.5.1 Irrigated Agriculture

One of the main goals of the GAP Project has been to transform the region into a base for agricultural exports. Irrigation is expected to increase crop yields and promote diversification, thus contributing to increased economic activities and development of agro-industries and other agricultural services.

⁹Pöyry Energy Ltd, www.poyry.com, accessed on 30 March 2010, and General Directorate of State Hydraulic Works, DSI, www.dsi.gov.tr/baraj/, accessed on 30 March 2010.

Table 8.6 Atatürk Dam and hydropower scheme

Key data	
<i>Hydrology</i>	
Catchment area	92,240 km ²
Annual inflow	26,585 MCM
<i>Reservoir</i>	
Retention water level	EL 542.0 m
Minimum operating level	EL 526.0 m
Maximum water level	EL 544.15 m
Active storage	12,700 MCM
Reservoir capacity	48,700 MCM
Reservoir area	817 km ²
<i>Diversion structures</i>	
Number of tunnels, concrete-lined	3
Length	4,100 m
Diameter	8.0 m
Discharge capacity	3,900 m ³ /s
<i>Dam</i>	
Type	Rock-fill with central core
Height above lowest foundation	169 m
Crest length	1,664 m
Elevation of top of dam	EL 549.0 m
Volume of dam	84.5 MCM
<i>Spillway</i>	
Type	Controlled overflow spillway
Type of gates	6 radial gates
Size of gates	16 m × 18 m
Discharge capacity	16,800 m ³ /s
<i>Power intake</i>	
Type	Concrete gravity dam, 8 blocks
Type of gates	8 roller gates
Size of gates	7.5 m × 7.5 m
<i>Penstocks</i>	
Number of penstocks	8
Length	Between 515 and 640 m
Diameter	7.25 m
<i>Powerhouse</i>	
Location	Adjacent to the dam toe
Size (l × w × h)	257 m × 53 m × 49 m
Net head	151 m
Valves	8 Butterfly
Turbines	8 Francis
Rated speed	150 rpm
Turbine discharge	1,748 m ³ /s
Installed capacity	8 × 300 = 2,400 MW
Annual energy total	8,900 GWh

Source: Adapted from Pöyry Energy Ltd (no date)

Most of the irrigated agriculture in the GAP Region is being developed in Sanliurfa Province, which has 11 districts and 1,080 villages and settlements. The districts include Akcakale, Birecik, Bozova, Ceylanpinar, Halfeti, Harran, Hilvan, Sanliurfa City, Siverek, Suruc and Viransehir. The Province of Sanliurfa ranks ninth in terms of population at the national level. It is the most populated area in the region, with 21.8% of the region's total; within the Province Sanliurfa City has the highest population, of approximately 37%.

The GDP of Sanliurfa is the second highest in the region. In the period 1990–2001, it increased from TL 597 billion to TL 1,236 billion (at 1987 prices) (Ercin, 2006). This rise is directly attributed to economic activities resulting from irrigation.

8.5.1.1 Sanliurfa-Harran Plains

Irrigation of the Sanliurfa-Harran Plains was the first project to become operational among several such projects in the GAP Region in 1995. Irrigation of the plains has resulted in numerous social, economic and environmental impacts throughout the years, both positive and negative. While the impacts are manifold, the main ones are mentioned below:

- Overall improvement in the welfare of the population, although health and education services still need to be significantly enhanced.
- Change in crop patterns to an emphasis on cotton, following the introduction of irrigation. This change has reversed the patterns of out-migration from the region since farmers do not have to go to other provinces for seasonal work.
- Land consolidation, which has improved the systems of land tenure and increased the value of land.
- Negative environmental impacts in some areas of the Harran Plains, mainly in terms of salinity.

Sanliurfa is the province with the highest agricultural output in the region (mostly in Harran), with the Atatürk Dam and irrigation projects playing a major role. Agricultural yield increased from 2 million tons in 1994 to 3 million tons in 2003. This improvement in the quantity of agricultural production is also evident in its market value, which rose from \$459 million in 1994 to \$1 billion in 2003. Although cereals have a low market value, the total cereal production in the GAP Region increased by nearly one million ton between 1994 and 2003, from 3.5 to 4.5 million tons. The market value of cereal output also increased from \$404 million before irrigation in 1994 to \$902 million in 2003 (Ercin 2006).

Cotton has become the dominant crop in the area, accounting for over 85% of all summer-irrigated crops. Its production has increased from 160,000 tons before irrigation to 1,135,886 tons in 2003. The net result has been that the GAP Region has become the main producer of cotton in Turkey with almost 50% of the country's cotton production. In 2003 alone, the region produced 1.13 million of tons with a total value of \$582.6 million. Within the region, the Province of Sanliurfa (Harran Plains)

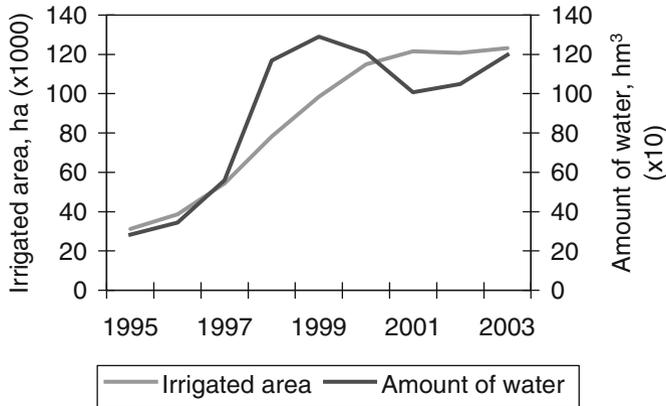


Fig. 8.1 Distribution of irrigated area and water carried to the Harran Plains, 1995–2003. *Source:* Yesilnacar and Uyanik (2005)

has become the largest producer of cotton (51.1% of the region's total), followed by Diyarbakir (18.6%) and the rest of the provinces (Ercin 2006).

In 2000, the gross agricultural output value (GAOV) in the GAP Region was approximately \$262 million, representing \$2,347 per ha and \$2,547 per capita.

The change from rain-fed to irrigated agriculture has meant that water requirements for cotton in the Harran Plains have also increased agricultural water use from about 370 MCM in 1993 to over 1 BCM in 2002. The expansion of irrigated land also seems to have resulted in a steady decrease in potential evaporation due to increased roughness and decreased humidity deficit in the Harran Plains. If changes in future evaporation conditions are of a similar nature, it is possible that demand for irrigation water will decrease by more than 40% in future (Ozdogan et al. 2006). The decrease in the use of water for irrigation in the Harran Plains despite the increase in irrigated area is also mentioned by Yesilnacar and Uyanik (2005) (Fig. 8.1). These are important findings when planning for water use in future irrigated areas.

The socio-economic benefits of irrigation in the Harran Plains have also been studied over the years (Harris 2008; Miyata and Fujii 2007; Akyürek 2005; Kundat and Bayram 2000; Oklahoma State University et al. 1999). While assessment of the impact of irrigation, and of related opportunities, has varied by economic activity, age, gender and marital status of persons interviewed, there seems to be general agreement that the overall quality of life in the villages has improved significantly. However, the interviewees also appear to agree that irrigation schemes should be organised more effectively and efficiently, that the performance of water users associations should be improved, and that the problems related to salinity in the area should be addressed and solved in a targeted way.

Transformations in the area are said to have had positive impacts not only for farmers working on their own land, but also for the landless workers whose conditions and returns were reported as having improved over what they were before. The

assessments also indicate the importance of supporting small farmers' organisations and of enhancing the access of small producers to technical information, credit and technology. There was much room for improvement in the provision of overall services to the population as well as in the cooperation and coordination of organisations and agencies in the region (Oklahoma State University et al. 1999).

Studies indicate that the Adiyaman Province has lost a great portion of its agricultural land because of the Atatürk Dam's construction. Nonetheless, the share of agricultural product has increased, mainly due to irrigation. For instance, in 1994 the output and value of crop production were 568,821 tons and \$166 million respectively; this increased to 614,350 tons and \$201 million in 2003 (Ercin 2006).

On the whole, a major constraint for agricultural development in the overall GAP Region has been the lack of investment. So far, most of it has been channelled to the Harran Plains without much consideration of the agricultural potential of other provinces in the region.

In terms of environmental consequences, there are serious problems in the area because of increasing water logging and salinity, largely due to unsustainable irrigation methods, insufficient drainage and poor land management. Salinity distribution studies for 1987, 1997 and 2000 show that salinity has increased significantly in some parts of the plains, mainly in Akcakale which is located in the lower level in the plain. The total area in the plains affected by salinity was 5,500 ha in 1987, 7,498 ha in 1997 and 11,403 in 2000 (Çullu et al. 2002) (Fig. 8.2). Salinity problems in the Harran Plains are also confirmed by other studies (see Kapur et al. 2009; Yesilnacar and Gulluoglu 2007; Kendirli et al. 2005; Çullu 2003).

8.5.1.2 Assessment of Economic and Social Impacts

In order to understand and appreciate the changes that the construction and operation of the Atatürk Dam have brought about through economic and social development, for the people living in the project area as well as in the region, a study was carried out to determine the extent and magnitude of the actual social, economic and environmental impacts of the dam and the reservoir some 8 years after their construction. The emphasis of the study was on economic, social and environmental issues, both direct and indirect, over the short- to medium-terms, which could be objectively estimated and evaluated with reasonable accuracy. It included an evaluation of the direct impacts (positive and negative) on people living in the two provinces most directly affected, Adiyaman and Sanliurfa, as well as on the region as a whole. The analysis did not include an evaluation of impacts at the national level. The detailed findings of the study have been published elsewhere (see Biswas and Tortajada 1999; Tortajada 2000, 2004).

The assessment of the economic and social impacts included fieldwork and discussions, both in Ankara and the project area. There were interviews with senior members of national and international institutions within the region and beyond (GAP Administration and other planning and implementing institutions, especially

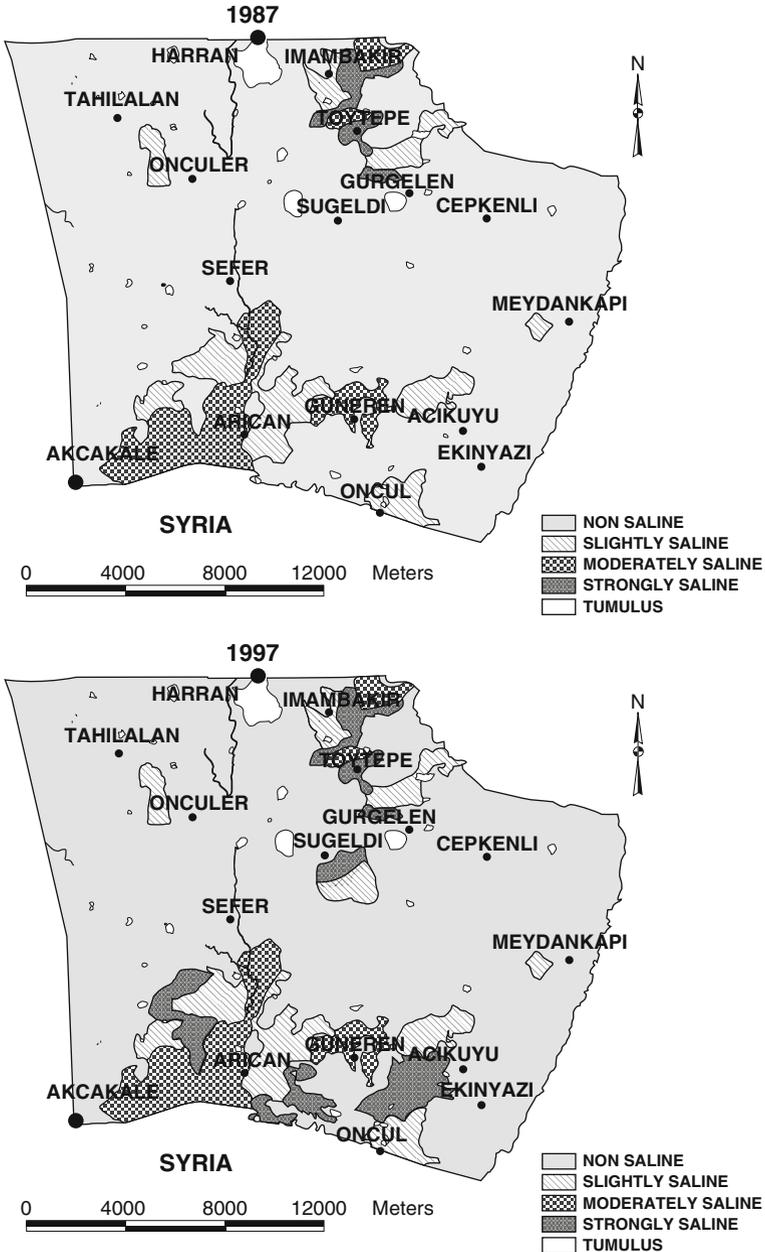


Fig. 8.2 Salinity distribution of the study area for three different years (1987, 1997 and 2000).
Source: Çullu et al. (2002)

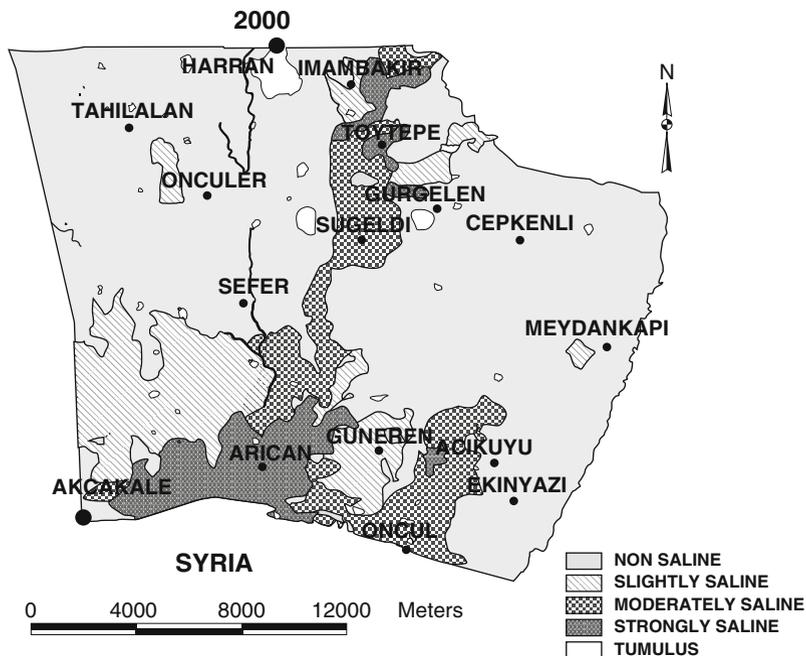


Fig. 8.2 (continued)

the DSI, SPO, General Directorate of Rural Affairs, Middle East Technical University etc.), concerned private sector institutions and NGOs, as well as representatives of the affected population at different locations.

After initial discussions, it was determined that the assessment would focus on issues such as new economic activity and employment generation during construction of the dam, reservoir and associated infrastructure; changes in the agricultural yields and incomes of farms using pumped irrigation directly from the reservoir; a review of the resettlement process due to inundation caused by the reservoir; impacts on health and education; and overall changes in quality of life for those living in the project area.

During the study, it was clear that the lifestyle and working conditions of the local population had improved, employment opportunities had significantly increased, and expanded economic activities had in many cases encouraged migration from rural to urban areas of the region. New urban growth poles were developing, as in Sanliurfa, which helped somewhat in evening out the urbanisation process. The areas around the dam were primarily rural, with limited infrastructural facilities. Before the dam was constructed, transportation and communication networks between the various population centres in the vicinity of the site were inadequate. When construction began a good road network was built, which considerably improved communications in the area. The movement of people and goods from one place to another became much easier and less time consuming. Commercial activities also increased.

In general, the magnitude and extent of the social and economic impacts generated by the Atatürk Dam and its reservoir have been positive not only for the project area but for the country as a whole. The benefits accruing to the country through the increase in electricity generation alone are substantial. Equally, there has been a marked improvement in lifestyle for those living in the project area, and especially for the majority of people living near and around the reservoir. In retrospect, on the basis of currently available data, it is clear that construction of the Atatürk Dam, which is the main infrastructural project in the GAP area, has acted as an engine for economic growth and development in a historically underdeveloped area. The dam has enhanced the quality of life and working conditions of local people, and significantly increased employment opportunities for communities. Expanded economic activities have encouraged migration from rural to urban areas. The region's semi-urban and urban areas are now facing a surge in population, with the attendant need for more and more housing, water, education, health services, employment opportunities, and efficient and reliable transportation and communication systems.

The area has flourished and employment has been generated during both the construction and the subsequent operation of the dam. Many of the labourers, who were initially unskilled, were trained during dam construction and acquired skill through the process. Many of them have since been employed in the construction of dams all over the country resulting in an increase in income for the region, since the labourers remit their incomes to their families.

The benefits of irrigation are visible mainly in Sanliurfa Province, where both formal and informal jobs have increased exponentially. However, the benefits of dam construction were not limited to employment. The daily exposure of the villagers to the different traditions and practices of 'outsiders' over more than a decade of construction resulted in noticeable social changes, evident in new ambitions for better and more housing and transportation, altered food and health habits, a desire for higher education, the decision of some of the local population to send their children (including girls) to school, a demand for information and communication, etc. The lifestyles of the area's population have thus begun to change, which will likely lead to a better quality of life for many people.

Construction of this dam and its associated hydraulic structures has also had adverse direct and indirect social and environmental impacts, for example, resettlement of a large number of people from the inundated area, impoverishment of those who did not manage their expropriation funds properly, loss of productive agricultural land, and increase in environmental contamination due to higher levels of economic activity. The affected population has, however, generally been fairly compensated for their losses.

Regarding resettlement and rehabilitation, information was collected from DSI (central office and regional office in Sanliurfa) and from the General Directorate of Rural Affairs. The Regional Directorate of DSI in Sanliurfa Province provided information on the status of urban and rural resettlement as of 1993, and also the status of expropriation as of 1996. DSI data did not include information on resettlement after 1993. On the basis of the information collected from DSI and the General Directorate of Rural Affairs, the expropriation of properties up to the height of 542 m had been

completed by 15 September 1997. The total cost was TL 13,057 trillion (at 1995 prices). By the end of 1995, TL 2,979 trillion (at 1995 prices) had been paid to settle disputes with the resettled population through the decisions of the courts. The General Directorate of Rural Affairs estimated that 1,129 families had to be displaced due to the Atatürk Dam from 1988 to 1997. Of these displaced families, 44% were to be resettled in rural areas and the balance 56% in urban areas. By 1998, only 30% of the population had been resettled (344 families), and 70% were yet to be resettled (369 families in rural areas, and 416 families in urban areas) (Tortajada 2004). By 1999, 375 families affected by the dam were still living in rented houses waiting to be resettled in rural areas (Altinbilek et al. 1999a, b).

According to Bayram (2000, personal communication), by July 2000 an additional 36 families had been resettled in Ayrancilar village and six other families had decided not to wait any longer to receive the support of the government. For the most part, the main problem in relocating the population was scarcity of land rather than a lack of funds for compensation.

In order to obtain a clearer picture of the efficacy of the resettlement process from the perspective of the affected population, extensive discussions were conducted with project-affected people in several villages in Adiyaman and Sanliurfa Provinces. Collective meetings with resettled communities were organised in a few villages. All the meetings included the Mukhtar (village head) and every head of household (men) in that town. At least 50% of the heads of the households were interviewed in detail.

The main issues discussed during the interviews and meetings were the effectiveness of the resettlement process, status and level of paid compensation, quality of housing and services provided, as well as the impacts of the construction of the Atatürk Dam on the lives of the men, their families and their villages. The three villages studied in detail were New Samsat, Akpinar and Kizilcapinar. (A detailed analysis of the resettlement process from the perspective of the resettlers is available in Tortajada 2004.)

The overall benefits and costs of the dam were viewed differently at the local level depending upon whether the people were from Sanliurfa or Adiyaman and whether or not they had access to irrigation. In all cases, however, people confirmed that their quality of life in the new settlements was better than what they had before. However, the vast majority of them were not aware of the resettlement process as a whole, nor did they have much knowledge of the relevant resettlement or expropriation laws and their entitlements under these laws.

Properly planned and implemented, resettlement programmes can become part of an overarching national strategy for poverty reduction. Well-planned investments in new infrastructure and services (water, electricity, schools, hospitals, roads, etc.) represent an opportunity to improve the standard of life of populations directly affected by development projects. Since it is unrealistic to avoid or reject involuntary resettlement altogether, it is essential to improve the knowledge base for the planning and implementation of projects, with a view to protecting the entitlements and livelihoods of those affected. Resettlement should be approached as part of a development process and not as the neglected stage of an infrastructure construction project.

8.6 The Impact of the GAP Project on the GAP Region

As mentioned above, the GAP Project was planned as a large-scale, multi-sector, integrated regional development project aimed at economic growth and regional development of the GAP Region, through a focus on industry, transportation, urban and rural infrastructure, environmental protection and social sectors such as employment generation, health, education, capacity building and gender equity. While important progress has been achieved, it has mostly been limited to electricity generation and irrigated agriculture. The project still lags behind the targets of the Master Plan in terms of its objective of integrated regional development. Issues such as low annual average growth; unemployment; insufficient qualified labour force; inadequate infrastructure for industry, education, health, drinking water, wastewater and solid waste services; and low level of regional capital accumulation continue to be major concerns in the region. These problems have been further aggravated by high demographic growth. Environmental problems have also resulted from intensive agricultural practices, excessive and uncontrolled irrigation, insufficient drainage in agricultural areas, and poor water and solid waste management in growing urban centres (Government of Turkey 2008). Thus, as an integrated regional development project, the GAP Project still has a long way to go.

According to the socio-economic development ranking of Turkey's provinces carried out in 1996 and 2003 (Dincer 1996; Dincer et al. 2003), the GAP Region is still the least developed area in the country in spite of many local efforts and achievements.

In an extensive analysis of the social and economic impacts on the GAP Region, Ercin (2006) has shown the progress, or lack thereof, in terms of socio-economic, agricultural, industrial and energy development in the region's nine provinces. The overall findings reveal that the GAP Project has fallen behind the targets of the Master Plan mainly in terms of public and private investments and in the quality of the projects implemented, mostly in the social sector, which are considered to be very poor. The main factors are considered below, with the exception of agricultural development which was discussed earlier in the chapter.

8.6.1 High Population Growth

High population growth has made it more difficult to achieve the targets of the GAP Project, and the general infrastructure in place has proved to be inadequate for the provision of services to people in the region. The annual growth rate in the region's urban areas is the highest in the country, with the population having increased 36.8% from 1990 to 2003. This high rate of urbanisation is caused by employment opportunities, industrial development and better health and education facilities in urban areas, which are insufficient in themselves but superior when compared to conditions in the region's rural areas. This has encouraged people from both within and outside the region to move to urban areas within the GAP. Security concerns in the

rural areas and resettlement in urban areas after the construction of dams have also contributed to the high urbanisation rate.

8.6.2 Economic Development

Economic development in the GAP Region is based mostly on agriculture, industry and service-related activities. Agriculture, which is the main economic activity in the region, accounted for 26.6% of the region's economy in 1987 but fell to 24.6% in 2000. Similarly, the share of industrial activities declined to 17.9% in 2000 from 21.1% in 1987, with the electricity, gas and water sub-sectors increasing during this period. Finally, only the services sector in the region grew between 1987 and 2000, from 52.4% to 57.5%, mainly in terms of transportation, communication and government services (Table 8.7).

The GDP resulting from services between 1987 and 2000 was TL 2 billion, agriculture was TL 1,773 billion, and industry was TL 1,189 billion (all at 1987 prices) in the region. The values of both imports and exports have increased in the region from the start of the GAP Project. Exports have increased by \$1 billion between 1989 and 2005, and imports have increased from \$100 million in 1989 to \$600 million in 2004.

Public and private investments, or lack of them, have been a major problem in achieving the objectives of the GAP Project. In the case of public investments, there has been a decrease from 6% of the total investment in the country in 1990, to 2% in 2001. Within the region, Sanliurfa Province has benefited the most, since 50% of the investments have been directed to this province for infrastructural development.

Despite new economic activities in the region, unemployment has increased: it was at 12.13% in 2000, four times the national average, from 4.32% in 1980, which was close to the national average. Only the agricultural sector in Sanliurfa and Adiyaman Provinces and the industrial sector in Gaziantep Province have seen some improvement. Stagnation in the Turkish economy is one of the main reasons for this, but population growth is also a factor.

8.6.3 Industrial Development

Industrial development, which was intended to develop the region into an agriculture-based export centre, has been slow and has depended mostly on public investment with almost no participation from the private sector. According to SPO, the GAP Region has not shown a significant improvement from 1996 to 2003 (Dincer et al. 2003; Dincer 1996) even though the number of factories and plants (mostly small to medium-size) has almost doubled. The manufacturing sector, which was already strong in Gaziantep Province before the project began, does not appear to have benefited from the GAP Project.

Table 8.7 Economic structure and change in GAP and Turkey^a

	GAP region		Turkey		Change (%)	
	1987	2000	1987	2000	GAP	Turkey
<i>Agriculture</i>	26.5	24.5	18.2	14.0	-2.0	-4.2
Agriculture and livestock production	25.9	24.4	16.7	13.3	-1.5	-3.4
Forestry	0.6	0.1	1.1	0.3	-0.5	-0.8
Fishing	0.0	0.0	0.4	0.4	0.0	0.0
<i>Industry</i>	21.0	17.9	26.3	24.0	-3.1	-2.3
Mining and quarrying	8.7	4.4	2.0	1.1	-4.3	-0.9
Manufacturing	9.5	9.1	22.3	19.9	-0.4	-2.4
Electricity, gas and water	2.8	4.4	2.0	3.0	1.6	1.0
<i>Services</i>	52.5	57.6	55.5	62.0	5.1	6.5
Construction	7.7	5.2	7.4	5.2	-2.5	-2.2
Trade, wholesale and retail trade	16.1	13.9	17.5	16.5	-2.2	-1.0
Hotels, restaurants services	1.1	1.2	2.7	3.5	0.1	0.8
Transportation and communication	8.8	13.5	11.7	14.2	4.7	2.5
Financial institutions	1.3	1.5	3.1	3.8	0.2	0.7
Business and personal services	1.3	1.7	2.4	3.9	0.4	1.5
Government services	6.9	16.8	5.1	10.1	9.9	5.0
Ownership of dwelling	9.3	3.8	5.6	4.8	-5.5	-0.8
GDP	100.0	100.0	100.0	100.0		

^aThe figures represent the percentage share of each sector in the economies of GAP Region and Turkey
Source: Ercin (2006)

8.6.4 Energy Development

The development of the energy sector has been most relevant. Investments for energy development in the region have more than paid off, since the total value of the energy generated from investments in the GAP Region is higher than the total investments into the energy sector in the GAP Project.

To take just one example of the scale of the project's potential in terms of energy production, in 2002 alone a total of 7.06 billion kWh of energy were produced by three of the dams in the region (Atatürk, Birecik and Karkamis), with a monetary value of almost \$424 million. Also, by 2002, the Atatürk Dam alone had produced a total of approximately 80 billion kWh worth \$4.7 billion. This figure is higher than the total investments made in the energy sector in the GAP Region up to 2002, which is \$4.17 billion (Ercin 2006). This achievement is very important not only in terms of electricity generation, but also in terms of a broader strategy of energy security for the country.

8.6.5 Health Services

In terms of health, the SPO considered the GAP Region to be the least developed in the country in 1996 (Dincer 1996). In 2003, even though all relevant indicators had improved, all provinces of the region were still below the national averages. In

2003, the region was ranked sixth (out of seven) in overall health at the national level; sixth in infant mortality and number of pharmacies (1.85) per 10,000 people; and last in terms of number of doctors (5.49), dentists (0.52) and hospital beds (13.26) per 10,000 people (Dincer et al. 2003).

8.6.6 Education and Training Activities

The literacy ratio in the GAP Region in 2000 was the lowest in Turkey at 72.2%, compared to the national average of 87.32%. However, literacy of women in the region has increased from 29% in 1985, to 38% in 1990 and 52% in 2000, representing a significant improvement.

Training programmes have been implemented for years for disadvantaged population living in poor urban neighbourhoods and in rural communities. The most successful example in the region so far has been the Multi-purpose Community Centres, known as CATOMs. These centres have focused mainly on women development with modular programmes on literacy, hygiene, nutrition, access to public services, income and employment generation activities (handicrafts, rug weaving, knitting, embroidery, silver works, stone working, computer skills, and so on), micro-credits, management skills for them to start their own businesses, etc. (Tigret and Altinbilek 2003). According to Unver and Gupta (2004), in 2001 alone, 4,512 people in the region benefitted directly from the training programmes implemented at CATOMs.

8.7 Conclusions

The GAP Project was established as an initiative to improve one of the less developed regions in Turkey. Initially conceived as a series of land and water resources development projects on the Euphrates and Tigris Rivers, it was later transformed into a water- and land-based large-scale, multi-sectoral regional development project. The objectives of the project were manifold, complex and very ambitious, and attempted to influence the social, economic, institutional and technical aspects of human development in a large area of the country. However, the implementation of the project as an integrated regional development project is well behind targets established in the Master Plan of the Region in 1989, and in 2002 when it was reviewed.

The project faces many challenges if it is to be implemented by 2012 as laid down in the GAP Project Action Plan 2008–2012. As mentioned by Kayasü (2008) and Beleli (2005), some of the major constraints in the implementation of the project have been a highly centralised system which is reflected in regional policies and projects as well as in the institutional arrangements for their execution; a sectoral focus on public investment planning; limited public investments in less-developed areas; vaguely defined division of tasks and responsibilities between planning, implementing and coordinating institutions; non-institutionalised coordination efforts; and inadequate administrative capacity of local and regional planning and implementing institutions.

These issues are only mentioned here and not analysed in detail because they are not within the scope of this chapter. They are included, however, because it is important to be aware of the reasons why the GAP Project may not have reached its planned goals both in the initial and the revised Master Plans, and in order to understand the limitations that surround its implementation.

In spite of these shortcomings, there has been significant progress in some sectors of the GAP Region as a direct result of the project. These are the energy and the agricultural sector. The development of the energy sector has transformed the region into a fundamental component in an overall strategy for the country's energy security. In terms of agricultural development, the region has become the main producer of cotton at the national level, with the related positive and negative impacts of extensive irrigation practices.

Within the water projects, the Atatürk Dam has resulted in multiple benefits for people living in the project area as well as for the country as a whole. Its direct benefits have been in terms of energy generation and irrigated agriculture, with indirect benefits through the promotion of urban, industrial, agricultural and commercial activities, mostly in Sanliurfa Province.

The social and economic impacts of the construction of the Atatürk Dam and its reservoir have been substantial through a variety of pathways. As mentioned earlier, both the dam and the reservoir have acted as an engine for economic growth and development in a historically underdeveloped area that has flourished since the construction of the dam. In addition, the daily exposure of the villagers to the traditions of 'outsiders' over more than a decade of construction, resulted in social and cultural changes evident in new ambitions for better and more housing and transportation, altered food and health habits, a desire for higher education, the decision of some of the local population to send their children (including girls) to school, a demand for information and communication, etc. The lifestyles of the area's population have thus begun to change, which will likely lead to a better quality of life for many people.

References

- Akbulut N, Bayar S, Akbulut A (2009) Rivers of Turkey. In: Klement T, Urs U, Christopher TR (eds) *Rivers of Europe*. Academic Press, London, pp 643–672
- Aksit B, Akcay AA (1997) Sociocultural aspects of irrigation practices in Southeastern Turkey. *Int J Water Resour Dev* 13(4):523–540
- Akyürek G (2005) Impact of Atatürk Dam on social and environmental aspects of the Southeastern Anatolia Project. Master dissertation, Graduate School of Natural and Applied Sciences, Middle East Technical University, Ankara
- Altınbilek D (1997) Water and land resources development in Southeastern Turkey. *Int J Water Resour Dev* 13(3):311–332
- Altınbilek D (2004) Development and management of the Euphrates and Tigris Basin. *Int J Water Resour Dev* 20(1):15–33
- Altınbilek D, Bayram M, Hazar T (1999a) The new approach to development project-induced resettlement in Turkey. *Int J Water Resour Dev* 15(3):291–300
- Altınbilek D, Bayram M, Hazar T (1999b) The new approach to reservoir-induced resettlement and expropriation in Turkey. In: Turfan M (ed) *Benefits of and concerns about dams*. Case

- Studies, 67th Annual Meeting of the International Commission of Large Dams (ICOLD), Antalya
- Beleli O (2005) Regional policy and EU accession: learning from the GAP experience. *Turkish Policy Q* 4(3):87–96
- Biswas A, Tortajada C (1999) Rapid appraisal of social, economic and environmental impacts of the Ataturk Dam. GAP Regional Administration and UNEP, Ankara
- Çullu MA (2003) Estimation of the effect of soil salinity on crop yield using remote sensing and geographic information system. *Turkish J Agric Forestry* 27:23–28
- Çullu MA, Almaca A, Sahin Y, Aydemir S (2002) Application of GIS for monitoring soil salinisation in the Harran Plain, Turkey. *Proceeding of the international conference on sustainable land use and management, Çanakkale, Turkey*, pp 326–332
- Dincer B (1996) Socio-economic development index ranking of the provinces-1996. State Planning Organization, Ankara
- Dincer B, Ozaslan M, Kavasoğlu T (2003) Socio-economic development index ranking of the provinces-2003. State Planning Organization, Ankara
- DSI (General Directorate of State Hydraulic Works) (2000) DSI in brief. General Directorate of State Hydraulic Works, Ministry of Energy and Natural Resources, Republic of Turkey, Ankara
- DSI (General Directorate of State Hydraulic Works) (2008) DSI in brief, 1954–2007. Ministry of Energy and Natural Resources, Republic of Turkey, Ankara
- DSI (General Directorate of State Hydraulic Works) (2009) GAP 2008, Dicle-Firat Basins and the Southeastern Anatolia Project. General Directorate of State Hydraulic Works, Ministry of Environment and Forestry, Republic of Turkey, Ankara
- DSI (General Directorate of State Hydraulic Works). Available at www.dsi.gov.tr/baraj/. Accessed 30 Mar 2010
- Ercin AE (2006) Social and economic impacts of the Southeastern Anatolia Project. Master dissertation, Graduate School of Natural and Applied Sciences, Middle East Technical University, Ankara
- GAP Administration (1998) Law no. 388 concerning the establishment and duties of the Southeastern Anatolia Project Regional Development Administration, 6 November 1989, and Amending Law 4314 on the Decree in force of Law on the Institutions and Duties of the Southeastern Anatolia Project Regional Development Administration, 14 December 1997. Prime Minister's Office, Ankara
- GAP Administration (1999) Latest status in Southeastern Anatolia Project. GAP Regional Development Administration, Prime Minister's Office, Ankara
- GAP Administration (2006) Latest situation on Southeastern Anatolia Project: activities of the GAP Administration. Prime Minister's Office, Ankara
- Government of Turkey (2008) Southeastern Anatolia Project Action Plan 2008–2012, Ankara
- Harris LM (2008) Water rich, resource poor: intersections of gender, poverty, and vulnerability in newly irrigated areas of Southeastern Turkey. *World Dev* 36(12):2643–2662
- Kapur S, Kapur B, Akca E, Eswaran H, Aydin M (2009) A research strategy to secure energy, water, and food via developing sustainable land and water management in Turkey. In: Brauch HG, Oswald SU, Mesjasz C, Grin J, Behera NC, Chourou B, Kameri-Mbote P, Liotta PH (eds) *Facing global environmental change: environmental, human, energy, food, health and water security concepts*. Springer, Berlin, pp 509–518
- Kayasü S (2008) Institutional implications of regional development agencies in Turkey: an evaluation of the integrative forces of legal and institutional frameworks. 42nd ISO-CARP (International Society of City and Regional Planners) Congress, 14–18 September, Istanbul
- Kendirli B, Cakmak B, Ucar Y (2005) Salinity in the Southeastern Anatolia Project (GAP). *Issues Options Irrigation Drainage* 54(1):115–122
- Kundat A, Bayram M (2000) Sanliurfa-Harran Plains On-farm and Village Development Project. In: Kundat A, Peabody S, Keyder C (eds) *Social assessment and agricultural reform in Central Asia and Turkey*. World Bank Technical Paper No. 461, The World Bank, Washington, pp 255–302
- Miyata S, Fujii T (2007) Examining the socioeconomic impacts of irrigation in the Southeast Anatolia Region of Turkey. *Agric Water Manage* 88:247–252

- Nippon Koei Co Ltd and Yuksel Project AS (1990) The Southeastern Anatolia Project Master Plan Study. Final Master Plan Report, Volume 1. GAP Administration, Prime Minister's Office, Ankara
- Oklahoma State University, SU-YAPI Engineering, Consulting Company and KKGV Foundation for Rural and Urban Development (1999) Sanliurfa-Harran plains On-farm and Village Development Project: a social evaluation. GAP Regional Development Administration, Ankara
- Ozdogan M, Woodcock CE, Salvucci GD, Demir H (2006) Changes in summer irrigated crop area and water use in Southeastern Turkey from 1993 to 2002: implications for current and future water resources. *Water Resour Manage* 20:467–488
- Pöyry Energy Ltd (no date). Available at: www.pyry.com. Accessed 30 Mar 2010
- Say NP, Yucel M (2006) Strategic environmental assessment and national development plans in Turkey: towards legal framework and operational procedure. *Environ Impact Assess Rev* 26:301–316
- SPO (2001) Long-term strategy and Eight Five-Year Development Plan 2001–2005. Prime Minister's Office, Government of Turkey, Ankara
- SPO (2005) Medium Term Programme (2006–2008), Accepted by the decision of Council of Ministers No. 2005/8873 on 23 May 2005. Official Gazette (2nd repeated) on 31 May 2005, No. 25831, Ankara
- SPO (2006a) Medium Term Programme (2007–2009), Cabinet Decree No. 2006/10508, 30.05.2006. Official Gazette No. 26197, 13.06.2006, Ankara
- SPO (2006b) Ninth Development Plan (2007–2013). Prime Minister's Office, Government of Turkey, Ankara
- SPO (2007a) 2007 Annual Programme, Ninth Development Plan (2007–2013). T.R. Prime Minister's Office, Republic of Turkey, Ankara
- SPO (2007b) Medium Term Programme (2008–2010), Cabinet Decree No. 2007/12300, 28.05.2007. Official Gazette No. 26559, 21.06.2007, Ankara
- SPO (2008a) 2009 Annual Programme, Ninth Development Plan (2007–2013). T. R. Prime Ministry, Republic of Turkey, Ankara
- SPO (2008b) Medium Term Programme (2009–2011), Cabinet Decree No. 2008/13834, 28.06.2008. Official Gazette No. 26920, 28.06.2008, Ankara
- SPO (2009) Medium Term Programme (2010–2012), Cabinet Decree No. 2009/15430, 14.07.2009. Official Gazette No. 27351, 16.09.2009, Ankara
- SPO (2010) 2010 Annual Programme, Ninth Development Plan (2007–2013). T. R. Prime Ministry, Republic of Turkey, Ankara
- Tigret S, Altinbilek D (2003) Sustainable human development in the Southeastern Anatolia Project. Middle East Technical University, Ankara
- Tortajada C (2000) Evaluation of actual impacts of the Atatürk Dam. *Int J Water Resour Dev* 16(4):453–464
- Tortajada C (2004) South-Eastern Anatolia Project: impacts of the Atatürk Dam. In: Biswas AK, Ünver O, Tortajada C (eds) *Water as a focus for regional development*. Oxford University Press, Delhi, pp 190–250
- Unver O (1997) South-Eastern Anatolia Integrated Development Project (GAP), Turkey; an overview of issues of sustainability. *Int J Water Resour Dev* 13(2):187–207
- Unver O, Gupta R (2004) Participative water-based regional development in the South-Eastern Anatolia Project (GAP): a pioneering model. In: Biswas AK, Ünver O, Tortajada C (eds) *Water as a focus for regional development*. Oxford University Press, New Delhi, pp 154–189
- Yesilnacar MI (2003) Grouting applications in the Sanliurfa Tunnels of GAP, Turkey, *Tunnelling Underground Space Technol* 18:321–330
- Yesilnacar MI, Gulluoglu SM (2007) The effects of the largest irrigation of GAP Project on groundwater quality, Şanlıurfa – Harran Plain, Turkey. *Fresenius Environ Bull* 16(2):206–211
- Yesilnacar MI, Uyanik S (2005) Investigation of water quality of the world's largest irrigation tunnel system, The Sanliurfa Tunnels in Turkey. *Fresenius Environ Bull* 14(4):300–306