ANNEX 9

ARTICLES

Spain

Turkey

ARTICLE

SPAIN

BENEFITS AND CONCERNS ABOUT DAMS IN SPAIN

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ABSTRACT

In Spain, due to the high irregularity in the time of the flow of the rivers, and to the strong spatial unbalanced renewable water resources**,** it has been necessary to construct numerous large dams. The construction of dams in Spain began in Roman times, of which there still remain to date in operation the Cornalvo and Proserpina Dams. At the present time there are in Spain 1,200 large dams of which 21 are under construction, with a total reservoir capacity of some 56,500 Hm^3, which have made it possible to pass from a natural regulation of only 8% to a real regulation of more than 40% of the water resources, and thus situating the country in the setting of the mean natural regulation of the European countries.

In this paper the divers purposes of the dams in Spain are described, and a quantitative evaluation is made of the benefits which the dams represent in irrigation, water supply, water for industrial uses, hydropower and other applications, which in total suppose about 6% of the Gross Added Value (GAV). Likewise, the benefits of the dams in Flood Control are described.

On the other hand, diverse concerns with reference to dams are analysed, the most significant being that of Dam Safety and the Environmental aspects. The new legislations, guidelines and programmes on Dam Safety are described which are being complemented by non-structural measures, such as Dam Hazard classification and the Emergency Action Plans. Also the experiences of the studies of Environmental Impact Assessment (EIA) and the corrective measures are analysed.

1. INTRODUCTION

The peculiar location of the Iberian Peninsula, to the South West of Europe and to the North of Africa causes the climatology of Spain to present some very specific and varied characteristics with the influence of the Atlantic fronts, the Mediterranean storms, the hot air masses coming from the North of Africa, or the cold air coming from North and Central Europe. All this gives rise to a regime of rainfall and flows in the rivers with a very high irregularity in time and space. Time irregularity, with pronounced interannual variations which can give rise to long periods of drought, and also very important seasonal variations with considerable low-water during the summer months. Space irregularity: the northern half of the country having abundant water resources, as opposed to the scarcity of the greater part of the basins of the Mediterranean watershed.

The rainfall average in Spain is 685 mm/year, which gives rise to total renewable resources of some 112 Km^3/year. This represents some per capita resources of some 3,000 m^3/per person/year, a figure which is of the same order of magnitude as the average of the countries of the European Union (3,200m^3/per person/year). Nevertheless, the distribution of the per capita natural resources (Table Nº 1) show a great irregularity in space, which supposes that in the Spanish peninsula the Internal Basins of Catalonia are classified hydrologically as a zone of Absolute water Scarcity (with less than 500 m^3/ per person/ per year of renewable resources), the Basins of the Segura and Jucar classified as of water scarcity (with some renewable resources of between 500 and 1,000 m^3/per person/year), and the Basins of the South and Guadalquivir as of water stress (with values of between 1,000 and 1,700m^3/per person/year).

TABLE Nº 1. DISTRIBUTION OF THE RENEWABLE WATER RESOURCES PER CAPITA

	Renewable Resources		
Basin	Population (mill. inhabitants) (1996)	Totals (Hm^3/year)	Per Capita m^3/person/ year
North:	6.75	42,088	6,235
Duero:	2.25	15,168	6,741
Tagus:	6.36	12, 858	2,022
Guadiana:	1.66	6,165	3,714
Guadalquivir:	4.90	7,771	1,586
South:	2.07	2,418	1,168
Segura:	1.36	1,000	735
Jucar:	4.19	4,142	988
Ebro:	2.76	18,198	6,593
Interior Basins of Catalonia:	6.17	2,780	450
Total Peninsula	38.47	112,588	2,927

On the other hand, the flow regime of the rivers presents a high irregularity in time, which gives rise to reduced availabilities of resources in a natural regime, with a total of some 9,200 Hm^3/year (8.3% of the renewable resources) which would give rise to some mean per capita availabilities of only 240m^3/per person/year, as compared with the 1,000m^3/per person/year which is considered basic on a world level in order to cover the supply necessities. (1) (Table Nº. 2).

These basic data of the renewable resources together with the characteristic circumstances of the supply of water are clear indications of the Spanish situation, in which, in order to be able to attend the water demands, it has been necessary to carry out important hydraulic works and the construction of numerous large dams.

2. LARGE DAMS IN SPAIN

The construction of large dams began in Spain in the roman times, although in that period they were not placed in the main rivers, of which still remain the marvellous dams of Proserpina and Cornalvo. The Arabs followed with their systems of irrigation and their delightful dominating controls over the water and its distribution, from which afterwards much was learned during many years by the settlers of the south-eastern zones of the peninsula. Later, in the XVI and XVII centuries were developed the innovatory experiences of arch dams such as are the magnificent examples of the Tibi, Elche and Relleu Dams, which would be a world reference during more than 200 years. They also carried out daring technical works, the El Gasco and Puentes Dams, which with their failures gave rise to the need of basing the technique of the project and construction of dams on more scientific bases (2).

TABLE Nº 2. WATER RESOURCES IN NATURAL REGIME

Basin	Natural Regime (Hm^3 / year)	Population (mill. inhabitants) (1996)	Resources per capita m^3/person/year
North:	2,550	6.75	378
Duero:	840	2.25	373
Tagus:	360	6.36	57
Guadiana:	10	1.66	6
Guadalquivir:	920	4.90	188
South:	50	2.07	24
Segura:	130	1.36	96
Jucar:	710	4.19	169
Ebro:	3,460	2.76	1,254
Internal Basins Catalonia	160	6.17	26
TOTAL SPANISH PENINSULA	9,190	38.47	239

At the end of the XIXth. Century there existed in Spain references of some 90 dams (3) of which 58 dams are actually in operation. In general, they dealt with reservoirs of reduced dimensions, and only three dams (Puentes, Valdeinfierno and Villar)had a reservoir capacity superior to 10 Hm^3 . The capacity of the reservoirs created by these 58 dams was of 108 Hm^3.

The Fig. 1 shows the evolution of the number of large dams and of the capacity of their reservoirs during the XX^{th} century (1900-2000). During the first third of this century the construction of dams went following the ideas of the Hydraulic Policy of the regenerationists, who based themselves on the belief that the development of Spain should be based on an adequate farming with the carrying out of extensive irrigations for which it was necessary to regulate the water of the rivers, and which were expressed by Rafael Gasset and Joaquín Costa (4) and which culminated with the hydrological planification, in which the dams played a fundamental part. So was born, with the support and direction of Don Rafael Benjumea and Don Indalecio Prieto, the first National Hydrological Plan, drawn up in the year 1933 by Don Manuel Lorenzo Pardo (5). Afterwards, the Spanish Civil War and the post-war period supposed an important restraint for the construction of new works. In the year 1950 there existed 276 large dams which created 6,142 Hm^3 of capacity of reservoirs. With this in the first half of the century 218 dams had been constructed, which supposed a mean of 4 large dams per year, which had been maintained practically constant over the length of the 50 years, except for the interval of the years 1935-1940.The reservoir capacity had increased by 6,034Hm^3. which had supposed a mean of some 120 Hm^3 per year.

With the start of the second half of the century the construction of dams experienced a very spectacular advance, particularly from the years 1955 to 1970, and due fundamentally to the reservoirs with hydropower purposes, in which the number of dams was multiplied by 2.4, and the capacity of the reservoirs was multiplied sixfold (Table Nº3.). The mean increase of the number of dams per year, in this period, has been maintained practically constant and has been of some 18 dams per year.

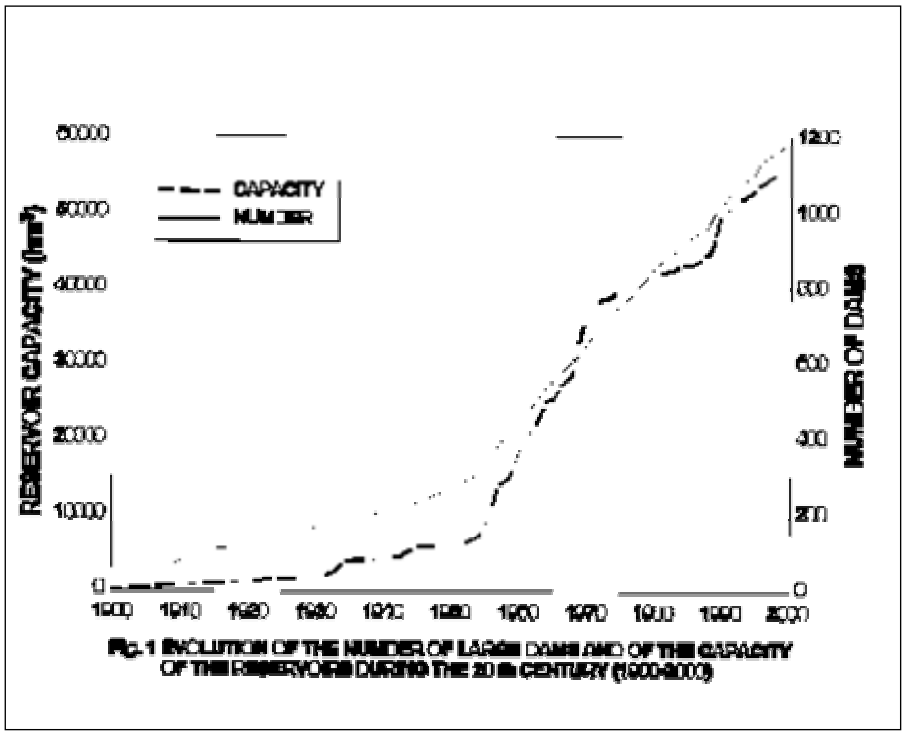

FIG. 1 EVOLUTION OF THE NUMBER OF LARGE DAMS AND OF THE CAPACITY OF THE RESERVOIRS DURING THE 20 th CENTURY (1900-2000)

TABLE Nº 3. EVOLUTION OF THE SPANISH LARGE DAMS. (1950-2000)

PERIOD	NUMBER OF LARGE DAMS	INCREASE Nº MEAN PER YEAR	RESERVOIR CAPACITY (Hm^3)	INCREASE MEAN CAPACITY PER YEAR (Hm^3)
BEFORE 1950	276	4	6.142	120
50-60	464	19	18.167	1.200
60-70	666	20	36.919	1.875
70-80	859	19	41.717	480
80-90	1.016	16	49.315	760
90-00	1.196	18	56.500	720
MEAN 50-00		18		1.000

The average increase in reservoir capacity has been of some 1,000 Hm^3 per year, with maximum values in the decade of the 1960's with some 1,875 Hm^3 per year. It should be pointed out that in the decade of the 1990's the number of dams in construction has diminished significantly, since while in the year 1991 there were 62 dams in construction, at the present time there are only 31 large dams.

At the present time there are some 1,200 large dams in Spain (1,175 dams in operation and 21 under construction), which create some reservoirs with a capacity of some 56,500 Hm^3. Their regulation capacity is of some 45,000 Hm^3/year - that is to say a 40% of the renewable water resources, although the rate of regulation is very varied in the different basins depending on its morphological and hydrological characteristics and on the determinants and incidents of the demands (Table Nº 4) (8).

With this, it has been possible to pass from a natural regulation of only 9% of the resources, which was totally insufficient, to some available resources of 40% of the mean annual run off, which has situated us in the setting of the mean availabilities of the European countries. The 98% of the total reservoir capacity is concentrated in the 300 reservoirs which have a capacity superior to 10 Hm^3. With this number of dams, Spain occupies the first place among the European countries, and the fourth in the world ranking, after the U.S.A., India and China. (6,7).

TABLE Nº 4. RESERVOIR CAPACITY AND REGULATED WATER RESOURCES AVAILABLE IN THE HYDROGRAPHIC BASINS

BASIN	RENEWABLE WATER RESOURCES (Hm^3/year)	RESERVOIR CAPACITY (Hm^3)	AVAILABLE RESOURCES (Hm^3/year)	REGULATION %
North	29.616	3.721	5.224	17
Duero	15.168	7.667	8.128	54
Tagus	12.230	11.135	7.071	57
Guadiana	6.168	9.619	2.975	48
Gadalquivir	7.978	8.867	3.632	46
South	2.483	1.319	504	20
Segura	1.000	1.223	725	72
Jucar	4.142	3.349	1.985	48
Ebro	18.217	7.702	12.998	71
Internal Basins of Catalonia	2.780	772	1.115	41
Galicia Coast	12.642	688	1.493	11
TOTAL	112.424	56.062	45.850	40.7

The greater part of the Spanish dams, the 72%, (64% gravity, 5% arch dams, 3% buttress) are of concrete or masonry, as opposed to 28% of embankment dams (17% earth, 11% rockfill). This is due to, in general, the characteristics of the foundations having been good, and that the dams of concrete are less vulnerable to the extreme floods so characteristic of the regime of the rivers. The 58% of the dams have a height of less than 30mts., and only 15% have a height superior to 60 Mts. There exist 40 large dams with a height greater than 100mts., the Almendra Dam, constructed in 1970, having the greatest height with 202mts. The reservoir of greatest capacity is that of La Serena, constructed in the year 1989, with 3,232 Hm^3. There are three reservoirs with capacities greater than 2,000Hm^3(La Serena 3,232 Hm^3, José Mª Oriol -Alcántara 3,162Hm^3 and Almendra 2,649 Hm^3), and six reservoirs with capacities between 1,000Hm^3 and 2,000Hm^3 (Buendia, Cíjara, Mequinenza, Valdecañas, Ricobayo and Alarcón). The population of Spanish

dams is growing old. At the present time 22% of the dams have more than 50 years old, and 55% more than 30 years. For this reason, in the future, greater efforts must be dedicated to the maintenance of the dams, to their rehabilitation, as also to the upgrading of dams and reservoirs to the new standards, more demanding every day.

The greater part of the dams and their reservoirs, 75% of the dams, some 900 dams, have a single purpose. This single purpose is in the first place that of irrigation (in 41% of the cases), followed by hydropower (28%), the water supply (26%), the flood control (2%) and others such as recreation, navigation, fisheries, etc., with 3%. The remaining 25% of dams correspond to reservoirs with multiple purposes, the mean being two objectives per dam. Among these, that of irrigation constitutes the first purpose (with 40%), followed by the water supply (29%), hydropower (21%), flood control (2%) and others. So then, considering all the purposes of the dams and their reservoirs, the first purpose of the Spanish dams is that of irrigation (with 40% of the cases), followed by that of water supply (27%), hydropower (25%) and flood control (2%).

3. BENEFITS OF DAMS AND RESERVOIRS

In Spain the construction of large dams has been one of the characteristics and topics that has marked the Spanish hydraulic tradition, strongly conditioned by the great space and time irregularity of the natural flow regime of the rivers. The existing dams produce important benefits in the economy of the country, and have been a determining factor in the grade of development obtained during the last decades. In the analysis of economic viability of each dam the specific studies are developed in which are shown the benefits that are going to be obtained with the regulation of the waters. Nevertheless, we are not going to refer here to the presentation of the various most significant cases, but in a general manner we are going to present an economic evaluation of a global nature, quantifying the economic benefits which the regulated water in the reservoirs produces in the diverse sectors of the Spanish economy, such as the irrigation, water supply, water for industrial uses, hydropower, and the uses for refrigeration, recreational purposes and other applications. For this, the aspects relative to the regulated water as a productive economic factor are going to be analysed, quantifying its contribution to the GROSS ADDED VALUE at the market value (GAV). Also the benefits of the dams in flood control are going to be described. The present situation of the water demands in the diverse sectors is as follows (8):

SECTOR	WATER DEMAND (1998) (Hm^3/year)
Irrigation	24,094
Water Supply	4,667
Water for industrial uses	1,647
Hydropower (flexible)	16,000
Other uses (refrigeration, etc.)	4,915

The most important demand is that for irrigation, which represents almost 80% of the demands for consumptive uses, and of the order of 47% of the total of the consumptive and non-consumptive demands, excluding the environmental demands.

The economic studies detailed sector by sector which have been carried out in Spain, based on the productivity of the water stored in the reservoirs (9), can be synthesized in the values which are shown in the Table nº 5.

TABLE Nº 5. ECONOMIC VALUE OF THE REGULATED WATER FOR THE RESERVOIRS

SECTOR	M YEAR	VALUE m^3	GAV (%)
IRRIGATION	5,000	0.26	1.06
WATER SUPPLY	5,225	1.4	1.10
WATER FOR INDUSTRIAL USES	11,529	7.0	2.40
HYDROPOWER	3,290	0.21	0.70
REFRIGERATION AND OTHER USES	2,949	0.6	0.63
TOTAL	27,993	MEAN 0.55 m^3	5.89%

So then, the economic value of the water regulated by the reservoirs can be estimated in some 28 B year, which represents nearly 6 % of the GAV. That signifies a mean value of the regulated water for the different uses of 0.55 m^3.

Apart from the benefits of the water regulated by the reservoirs that can be quantified economically, the benefits that the dams and the reservoirs produce in the flood control can also be cited. In Spain the floods constitute the most important natural disaster and represent a grave economic and social problem. There references of more than 2,400 floods occurred in the last five hundred years, which signifies an average of five important floods per year. The floods produce a mean loss of life of 30 persons per year, together with material damages of 500 M year.

Among the diverse measures for reducing the damages produced by the floods, the dams and reservoirs constitute a very efficient structural action, as they are the only measure that can store water in a very significant manner, modifying the hydrographs and reducing the peak flows. In Spain there exist numerous real cases of beneficial effects of the reservoirs in the reduction of the damages produced by the floods (10). One very significant case was constituted by the flood of the 7^{th} and 8^{th} of November of 1982 in the basin of the Ebro and the Internal Basins of Catalonia which produced 14 deaths and damages superior to 300MThe study on the effect of the reservoirs in the flood routing in the most eastern rivers of the left bank of the Ebro river (Gallego, Cinca, Noguera Ribagorzana, Noguera Pallaresa and Segre rivers) and on the axis of the river Ebro itself up to the reservoir of Ribarroja, shows that in general the reservoirs were very efficient in their zone close downstream with reductions of peak flows of up to 80%. In the middle zones of the basin, already with ample zones not regulated, the routing effect of the reservoirs in the higher zones of the basin was close to 30%. On the other hand, the global effect of the reservoirs on the mouth of the River Ebro was 57% of reduction, with a peak flow in the last dam of Ribarroja of 3,200 m^3/sec. (close to the limit of the capacity of the river in order not to produce important damages in the townships downstream of the dam) as contrasted with the 7,400 m^3/sec. which were estimated without the existence of the dams in the basin. In the Internal Basins of Catalonia the routing effect of the reservoirs, supposed a reduction of 80% in the River Ter in Gerona, a real peak flow of 300 m^3/sec. as contrasted with a natural volume of flow without reservoirs of 1,500 m^3/sec., and a reduction of 27% in the River Llobregat in Martorell, real peak flow of 1,600 m^3/sec. as contrasted with a natural flow without reservoirs of 2,200 m^3/sec. These figures show in this case, as in many others (11), the very important real reduction in damages in flood situations and the important benefit which supposes for the country the flood control produced by the reservoirs.

At the present time there exist 30 reservoirs the main objective of which is that of flood control, which represents about 2.5% of the existing reservoirs. Of these, there are two flood control dams under construction, the dams of Puentes II and that of Charcos, both in the Basin of the Segura.

4. MAIN CONCERNS ABOUT DAMS

The main concerns about dams in Spain refer to the dam safety and to the environmental aspects.

In relation to the dam safety it must be pointed out that, as it has already been mentioned, Spain figures in fourth place at a world level in relation to the number of dams constructed with a total number of close to 1,200 large dams, in accordance with the classification of ICOLD. This important number of large dams, a consequence of the great climatic irregularity, has obliged since many years ago that a very singular attention be paid to their safety. As a country of relevant activity in the dam construction, Spain has suffered some important failures and various incidents. Our statistics, in this sense, do not differ much from those carried out by ICOLD at a world level (12, 13, 14). Also, these failures have activated the social conscience demanding the adoption of greater measures of security. The two last failures, the Vega de Tera Dam in 1959 and the Tous Dam in 1982, have promoted the development of regulations more and more demanding in the matter of dam safety.

The new Technical Regulation on safety of dams and reservoirs of 1996 (15) is of application to all the new dams and to those existing the owner of which is the Administration, whilst for the existing dams of private ownership the Instruction of 1967 continues to be valid. The principal safety criteria of the Regulation is the classification of the dams in three categories in function of the potential hazard, A high hazard dams, B significant hazard dams and D low hazard dams, applying more safety demands according to the potential hazard. Moreover to the contrary of the Instruction of 1967, the new regulation has a more general and open character which contains organizational and administrative safety criteria, instead of concrete technical solutions, which should be taken into account in order to foresee and limit the social an environmental hazards that the dams could represent. In order to complete the application of the technical safety criteria which remain indefinite in a norm of general character, the Spanish Committee on Large Dams is publishing several Guidelines on the diverse themes relative to the safety (structural, hydrological, etc.). Other relevant aspects which distinguish the actual Regulation are the great emphasis which it places on the safety, the great attention which it pays to the correct dam operation demanding periodic revisions of preventive character by independent experts, insisting on Emergency Action Plans for the dams of high and significant hazard, and demanding that the Technical Archives of the dam be maintained update (16).

At the present time more than two thirds of the Spanish large dams have been classified in accordance with the potential hazard in case of failure, and the redaction of the Emergency Action Plans is advancing. Nevertheless, the application of the new Regulation poses some problems. On the one part ,on its application coexisting with an old norm, which is applied to some dams, an undesirable heterogeneity is produced in the application of criteria of safety which must be solved. On the other hand the application of a new norm requires an important financing which, to date, has resulted insufficient for the needs established, and significant delays start to be produced in the space of time foreseen. Finally, the Regulation has a low legal status and a generalized consensus exist among the dam engineers in the sense that it would be convenient to put into operation a dam safety law which would resolve the existing competence voids.

In relation to the environmental concerns it should be indicated that the dam construction produces, inevitably, some environmental impacts of a very varied nature, some of a temporary character: excavations, noises, dusts, residues, etc. and others of permanent character such as the flooding of the reservoir, the barrier effect for certain species and, definitively, a variation of the flow regime of the river which produces several variations of the ecosystems .

The alteration of the regime of flow which produces any exploitation of the waters and the environmental effects which it involves should be limited by way of the establishment of minimum volumes of flow and reserving storage in the reservoirs for this purpose. The Hydrological Plans of the basin, actually in force in Spain, fix in the majority of the cases minimum flows, which usually is about the 10% of the mean annual inflow. Furthermore, in all of them the necessity is raised of carrying out specific studies on stretches of river in order to determine exactly these minimum flows.

In relation to the dam construction and operation, and the environmental effects which they can produce, we will mention the existing legislative framework in order to minimize them and the problems which create their application (17).

The fundamental legislative regulations existing in Spain in order to evaluate the effect on the environment of the large dams are the Royal Legislative Decree 1,302/1986, of the 28th of June, of Environmental Impact Assessing which is a transposition on the Spanish legislation of the Directive 85/337/CEE of the European Community and the Royal Decree 1,131/1988, of the 30th. of September, which is the development of the anterior. Recently the Royal Decree- Law 9/2000 of the 6th of October, and the Law 6/2001 of the 8th of May of the Environmental Impact Assessing have been approved, which incorporates fully in the Spanish law the Directive 97/11CE of the European Union.

These regulations establish the obligation to formulate the Declaration of Environmental Impact with prior status to the administrative resolution which is mandatory for the construction of large dams. Furthermore, the Law 4/89 of Conservation of the Natural Spaces and of the Flora and Fauna, and of all the European directives protective of the environment must be well accomplished. Completing this legal framework, there are i force a set of dispositions of the Autonomous Communities (the Spanish State is composed of 17 Autonomous Regions) which are obligatory within its territorial limits and which also condition the negotiation of the projects of large dams. The Autonomous Communities on legislating, in use of its responsibilities, in matters of the environment, have declared protected zones with its territory, with which, on many occasions, totally or partially interfere with the dams planed.

The process of environmental evaluation starts with the dispatch by the promoter to the competent environmental organization of the Report-Summary of the project to evaluate. It consists in general, of a synthetic document in which are described the objectives to be achieved, the various alternatives studied, the most important characteristics of the solution proposed, and the foreseeable environmental impacts that will be derived, both in the phase of construction as also during dam operation. With the Report- Summary the environmental organization will establish a period of consultations with the people, Institutions and Administrations foreseeable affected by the construction of the project. With the replies received, the promoter will have available the basic data and significant aspects to be taken into account in the formulation of the project and with this information he will proceed to draw up the study of the Environmental Impact Assessment. Once completed the project, with the Study of the Environmental Impact, will be submitted to Public Information process and, before definite approval, the General Direction of Quality and Environmental Evaluation should emit the obligatory Declaration of Impact. This qualifies the work as environmentally viable or no. In the first case it could include several conditions which would make it viable.

The procedure foreseen in the legislation is complicated to apply, which has given rise to important delays**,** but which assures an ample public participation of all population and organizations potentially affected. Up to the present time (July 2001)of a total of 180 procedures of large dams initiated, 73 (41%) have concluded in a Declaration of Impact, of which 4 were negative; the mean duration of the process is of three and a half years.

For example, in some of the dams in which the Declaration of Environmental Impact has been negative, the following impacts have been considered:

A. Omaña Dam (Province of León). Its purpose: Irrigation. The most significant environmental effects taken into consideration are:

- Flooding of valuable fauna habitats.
- The change in flows regimes downstream of the dam with the modification of biotic, physical and chemical factors of the river and the resultant effect on the aquatic and bank ecosystems.
- Effects on large mammals in danger of extinction, such as the brown bear.
- Socio-economic implications due to the resettlement of people expropriated.
- Effects on the historical, artistic and anthropological heritage caused by the total or partial flooding of inhabited centres.

B. Vidrieros Dam (Palencia). Purpose: to reduce water deficits in irrigation. Both the area where the dam is going to be built and the valley to be flooded represent a valuable enclave in Europe with a high level of development. The biological indicator of this well-conserved enclave is the presence of population of brown bears whose prowling area lies in the valley that was going to be flooded.
The types of impact that would be produced by this project similar to those of the previous case.

C. Cerros Verde Dam (Badajoz). A dam for the water storage and flood control, preventing the flood damages in the farming areas downstream. Environmental rejection is based on, amongst others, the following considerations:

- The effect it may have on the Cornalbo Nature Park.
- Various impacts on the valuable wildlife in the area, which includes the presence of more than 30 threatened species, some in danger of extinction, like the imperial eagle and black stork.
- The barrier effect of the reservoir on the ecosystems, interrupting the flow of populations between the valley and the mountains. This would also affect aquatic wildlife.

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ARTICLE

TURKEY

TURKISH POSITION ON DAMS

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Chairman of TRCOLD

Turkey is not a water or energy resources rich country. It is estimated that there will be only 1 100 m^3 available water per capita annually in the future. Therefore it is imperative for Turkey that all technically and economically feasible dams should be constructed even to achieve the minimum standards of living for its people. The negative approach of WCD against dams and the deficiencies of their report have also been commented in this article.

1. INTRODUCTION

At the first glance, Turkey seems water rich but in truth it doesn't have much water. Its total run-off is estimated about 186 km^3 annually. As being a country in a semi-arid climate, most of this resource is not easily exploitable. In practice, the water resources engineers assess the country's available water at 110 km^3 annually. One should keep in mind that even this figure can only be obtained after the full development of water resources by building dams and other facilities. At present, Turkey's population is about 65 million and the demographers estimate that the population will stabilize around 95 to 100 million at the year 2050. Therefore, the available water per capita will only be around 1100 m^3 annually and this figure indeed indicates that Turkey will be a poor country of water in the future, despite the full development of its water resources.

Turkey is not also a rich country from the point of energy sources. It has very limited oil. Available coal is not abundant and its quality is generally low. So every year Turkey is obliged to import most of its oil and coal needs. From the electricity usage point of view, the level of the consumption per capita in a community indicates the level of prosperity. Annually the consumption per capita in Turkey is around 1500 kWh and this is even well below the World average. On top of this, the demand of the country is growing with a rate of 7 to 8% every year. This situation also forces Turkey to develop fully its hydropower potential rapidly.

Consequently, it is indispensable for Turkey to build dams to develop its water resources for the prosperity of its people by caring also its environment and cultural heritage.

2. WATER RESOURCES OF TURKEY

Turkey extends from Europe to Asia over the straits of Istanbul and Çanakkale and borders Greece, Bulgaria, Romania, Ukraine, Russia, Georgia, Armenia, Azerbaijan, Iran, Iraq and Syria. Its total area is about 779 500 km^2, about 97% of which is situated in Asia and 3% in Europe. Turkey is surrounded by four seas, the Marmara, the Aegean, the Mediterranean and the Black Sea. Total cost lines amount to about 8300 km.

All water resources in Turkey are thoroughly observed and evaluated through the hydrological and meteorological network extended all over the country. With a mean annual precipitation of 643 mm, it is assumed that yearly precipitations bring 501 km^3 of water, while 274 km^3 of this quantity return to the atmosphere through evapotranspiration from ground and water surfaces as well as from plants. 69 km^3 feed the underground water reserves through infiltration from the surface, therefore a total of 186 km^3 of which 158 km^3 from the precipitation and 28 km^3 from the underground water reserves flow into the sea and into the lakes through rivers and creeks of various sizes. Furthermore, based on flow observations it is determined that 7 km^3 water flow into Turkey every year through the rivers from neighboring countries. Accordingly, Turkey's surface flow potential is calculated as 193 (158+28+7) km^3 keeping in mind that significant changes may occur every year depending on meteorological conditions. On the other hand, consumable water

potential on the basis of current technology and economics is 110 km^3 including the ground water resources.

Streams of Turkey do not have naturally regulated flows. They have generally wild flows varying considerable throughout the year as well as in the course of years. Droughts and floods are quite common in Turkey. This situation exists on many countries in the World such as Chine, India and South American Countries. Dams are the sole structures to tame the rivers so to hardness their water and energy.

Owing to considerable variations observed in the run-offs in terms of seasons and year, it is absolutely necessary in Turkey to have water storages in order to ensure the use of the water, when it is necessary. Consequently first priority has always been given to the construction of water storage facilities.

3. THE NEED FOR DAMS

With the exclusion of small pondage dams for irrigation, there are 241 dams in operation and 112 under construction. The total number of dams built for energy production or for multi-purposes including energy production is 63.

Among the most important hydraulic structures are the dams. The main function of the dams are to store water when it is in excess and to use it at times when it is scarce but we need most. With this starting point, dams are the most important means helping to supply water for domestic, industrial and agricultural use. Additionally, dams have considerable contribution for flood and erosion protection, navigation and power generation.

Turkey has approximately 28 million ha of arable land. 26 million ha of this are irrigable. With the existing technology and economics 8.5 million ha of irrigable land is feasible to irrigate. Until now Turkey could manage to develop only half of this to be irrigated through water resources projects, mainly dams. Not only to feed its rapidly increasing population but also to contribute worlds food supply Turkey must continue its water resources development program.

To maintain an adequate standard of living about 1000 m^3 of water per capita annually is necessary. It is a well-known fact that most of this amount is needed for irrigation that is food production. Remaining amount from irrigation is for drinking and commercial and industrial activities. As one of Turkish businessman stated, "Millions have lived without love. No one has lived without water".

If one recalls the fact each person in the industrialized counties today consumes 4000 to 5000 m^3 of water every year, it become very evident that it is essential for Turkey to construct its storage facilities at least to be able to reach its 1100 m^3/year per capita capacity in the year 2050 in order to give an appropriate living standard for its people.

Otherwise, undernourishment, famine and as a result of these, severe social problems will be unavoidable.

To achieve efficiency in water supply, the creation of reservoirs and the construction of hydraulic structures, such as dams, waterways and transfer systems are absolutely necessary.

Today, Turkey is producing approximately one third of its electricity from hydropower plants. The rest comes almost from thermal sources, which are oil, coal and natural gas mostly imported goods. Up to now Turkey could develop only one third of exploitable hydroelectric energy potential of 123 TWh/year. The need for energy and especially electricity as key form of energy is

increasing very rapidly in developing countries. As being a developing country, the demand for electricity in Turkey, with the existing annual rate of increase will reach in the year 2020 to 547 TWh from 130 TWh of today.

If Turkey do not make necessary investments to develop its hydropower potential, it will mean more overburden on World's fossil fuels and emissions of gases causing green house effects.

Hydropower is not only a clean and sustainable power resource, but also it has great advantage in the electric network regulation. So in many countries with inadequate hydropower resource, pumped storage power plants have to be built to solve this problem. Hence it will be very likely for Turkey to built some pump storage facilities in the future besides the full development of its hydropower potential.

European countries and North America, those are rich countries, have already developed most of their technically feasible water resources potential through dams. The rest of the World, mostly developing countries representing the majority of World's population, is using less than the one fifth of their potential.

Developing countries are the ones having the highest rate of population growth. The only way to feed their people is to increase the agricultural production. The most important key to achieve this goal is to irrigate the arable land through dams. Supply of drinking water and sufficient food for people is a vital issue. For example if Turkey did not build its existing dams 22 million out of present 65 million would possibly be in starvation and absolute poverty.

The countries aware of absolute necessity of dams such as Chine, India, Turkey, Iran, Algeria and many other are very keen to develop their water resources and most of the dams under construction are in these countries.

4. COMMENTS ON WCD REPORT

The report "Dam and Development: A New Framework for Decision- Making", prepared by the World Commission on Dams (WCD), by using the results obtained from analysis of case studies, countries' reviews and cross-check survey of 125 existing dams all around the world, recognizes that the benefit of dams are "considerable". However, it highlights the need to reconsider the management of freshwater resources in the context of developmental objectives. It calls for "cooperation in reconciling competing needs", and urges dam developers, governments, non-governmental organizations, and affected people to find ways of sharing the benefits of water resources equitably and sustainably.

Although the report gives a new framework for decision-making, it is worried that there were some prejudices in the preparation process. Considering the whole content of the report in general, we would find out the following impressions for the report due to its unbalanced approach to the benefits and adverse aspects of the dams:

- It is clear that overall approach is negative concerning the role of dams, mainly generalizing adverse aspects, unsatisfactory social and economic benefits by ignoring or under-estimating the benefits especially for power generation and irrigation.

- The conclusive points of the report were drawn by basing on the analysis of 125 dams. These dams only constitute about 0.28% of the total completed ones of 45 000. Hence the report makes a wild generalizations about problems or deficiencies of dams. That is to say some findings of the report have been based on inadequately researched data.

- Concerning affected people, it is true sometimes it is necessary to resettle the people in the project area, but there is nothing in the report about the people whose lives are stabilized by providing them water and power.

- Alternatives to large dams recommended by the Report as 'near-term solutions' are qualitatively interesting, but are not realistic on an adequate scale to meet the needs of an extra 3 billion people by the year 2050. In addition to this, the social and ecological impacts of these suggested alternatives are not discussed for comparison.

- The report unnecessarily is trying to discuss the matters related to Transboundary Rivers. In addition to this, it was another issue of the critique that, while the countries being in the leading positions of the process have developed their water resources with about the level of 100%, the prejudiced findings of the report may probably prevent the water resources development project planned by the developing countries, such as India, Turkey, with the development level of 30%, and China.

- It seems that WCD has forgotten the fundamental purpose of dams, which is to enhance the prosperity of nations. Dams are absolutely necessary to store water, which is not evenly distributed in space and time.

- 40 to 80 million, this exaggerated or unconsciously extrapolated figure about the number of people displaced by the dam projects cannot be a base for the conclusions of the report. Even if it is a solid fact, it cannot still hinder to see the billions benefiting from dams with water and power supply.

- To create a forum of local stakeholders for the development of a project continuously is not feasible. The counterpart to governments or investing institutions is the whole nation. Because certain needs arises at national level such as to feed the population. Additionally most of the countries willing to develop its water resources have democracy allowing the related groups of population to represent their interests.

5. CONCLUSION

In Turkey dam construction is a vital and unavoidable program for the country. It is supported by all the political parties represented in the parliament. The dams and hydroelectric power plants are producing roughly 25 billion US and 39 billion US value into GNP each year. The total amount is corresponding to 39,1% of GNP. This program has improved living standards of all the population especially villagers.

Southeastern Anatolia Project (GAP) of Turkey, an example for the socio-economic development, is a human centered and integrated regional development project carried out along with the principle of sustainable human development. The development envisaged under the GAP has the goal of creating opportunities for the people of the region fully materialize their preferences and economic potentials.

The ultimate aim of GAP is to ensure sustainable human development in the region. Therefore it is a human centered development process. Physical structures which are now being built will be the basis of human development. The aim of sustainable development will be achieved by eliminating disparities, spreading welfare, ensuring community participation and developing human resources. the combination of economic growth targets with a human development perspective envisages the transformation of the projected social change into participatory solutions specific to the eco-system and cultural make-up of the region.

GAP has been an example of good water resources management. The components of the Project have being realized by implementing modern concepts of water management, environmental conservation and women participation. This is sincerely appreciated by various Government and UN related organizations.

The following message of Secretary General of United Nations – Kofi Annan on World Water Day summaries very well the reasons why developing countries are obliged to develop their water resources:

> "Access to safe water is a fundamental human need and, therefore, a basic human right. Contaminated water jeopardizes both the physical and social health of all people. It is an affront to human dignity.
>
> Yet even today, clean water is a luxury that remains out of the reach of many. Worldwide, more than a billion people have no access to improved water sources, while nearly two and a half billion live without basic sanitation. These people rank among the poorest in the world – as well as the least healthy. In fact, the absence of a safe water supply contributes to an estimated 80 per cent of disease and death in the developing world.
>
> In this new century, water, its sanitation, and its equitable distribution pose great social challenges for our world. We need to safeguard the global supply of healthy water and to ensure that everyone has access to it. Please joint me in celebrating World Water Day, and let us renew our commitment to clean, safe, and healthy water for all people."

As the last word, the suggested guidelines of WCD for the development of water resources and dams do not fit the needs and interests of Turkish people. Additionally, it is imperative for Turkey to carry out its programme for dam construction to be able to fully develop its water resources so to ensure self-sufficiency to feed its people and to supply drinking water and energy to enhance their standard of living.

(Source :httpt://www.talsperrenkomitee.de/symposium/index.cgi/page/turfan)