Country Report

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Development of Eco-Efficient Water Infrastructure In Iran

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Introduction

The current system of water resource development began more than 70 years ago and has been evolving in relation to the specific historical and social conditions of the country.

While in 1956 only three cities existed in Iran with a population over 250,000 in 2000 seven cities had developed with a population over 1 million people. Considering the current population of the country around 70 million, where as it was 7.7 million in 120 years back, the direct impact of population growth on water resource management of the country increased the need for portable water in populated areas. The impact is included an increase demand for agricultural products,

development of irrigation lands and the need for the creation of job opportunities and more income, especially in the agriculture sector.

In the light of population increased in urban and rural areas and to protect population centers and farmers from flood and drought from one side, and to better exploit of water resource with respect to both the qualitative and quantitative limitations of these resources and the need to economize and optimize the use of these resource, the water development and management have gained an importance in recent decades.

In the same context in last three decades due to significant reform in the country structure, the participation of public and private sector in developing better planning and budgeting have significantly improved, resulted in initiating several new projects on water resources development either completed or would be constructed in the near future .

Current Investment

The Islamic Republic of Iran with GDP of 115 billion US$ considers the second populated country and second economy in the region, provided opportunity to invest hugely on developing water resources. The budget since last ten years has increased five times to improve water resources mainly through constructing new dams and irrigation system. Currently more than 172 new dams are under studied for future construction.

Water Potential in the Country

Iran is a vast country with an area exceeding 106 MKm^2 with two major Zagross and Alborz mountain ranges. According to the latest figures related to the main characteristics of annual precipitation and its processes of transformations into water resources, the information are:

Annual average precipitation	417 bcm
Average annual evaporation	2 99 bcm
Surface water	92 bcm
Seepage to alluvial aquifers	26 bcm

Further about 72 percent of precipitation is not accessible due to evaporation and transpiration and about 22 percent of precipitation flows on surface water resources and nearly 6 percent of precipitation that falls within the limits of the country in used for direct recharge of alluvial aquifers. Based on the mean annual precipitation of the country about 250 mm which is equal to one third of world mean average and 13 bcm surface flows enter into the country from across its borders. The total water resources potential is 130 bcm of water that available for various usage such as the per capita water consumption is 480 litters/day

(domestic 6 percent), agricultural (92 percent) including 50% underground water and 50% from surface and industrial (2 percent) including 54 percent from ground water and remaining from surface water

Current position of Wtaer Structure

In Iran most of the dams are built in remote areas which has become one of the major economic factors for industrial improvement, creates job for the people, crop and electricity production. The current position of water structure in Iran are;

Dam Position	Number	Type of Dam	Concrete	Embankment	Water Potential 10^9 m^3
Build	310	Large	42	268	32.9
Under Construction	81 At least 60 m	large	-	-	-
Under Study	172	-	-	-	-

The following large dams entered service in 2007 are:

Name	Height (m)	Usage
Ekbatan Dam	71	Irrigation
Races Ali Delvari Dam	115	Irrigation & Power (19.4 MW)
Molla sadra Dam	75	Irrigation & Power (100 MW)
Danaalov Dam	37	Irrigation
Kohrra Dam	26	Irrigation
Shiyaan Dam	25	Irrigation
Shahid Ghanbari Dam	24	Irrigation
Faryaab e Roodaam Dam	22	Irrigation

The comparative study of dam built in Iran in last one decade to earlier three past decade indicated of increasing (56.6 %) of developing new water structure activities and increasing of (73.6%) of completed new dams through today, total gross investment on water resource development based on the fixed prices of the year 2000, is estimated at US$ (125 billion) of which about 40 percent in private sector investment. Gross capital investments represent about 1.2 percent of GDP and 5.8 percent of gross national investment.

Eco-efficient of Water Infrastructures

The eco-efficient of water infrastructure has been focused for developing new projects, considering how to increase the economy value of water. The situation of eco-efficient use of water based on following realities;

1- Iran is mostly considered as an arid country and except in very Limited regions, this required water to be provided for irrigation. Referring to eight climate zones in Iran, the per capita water need to obtain self-sufficiency is estimated as 1180 m^3/year.

As per comprehensive water study for Iran in year 1996 with proven sources of water which can be extracted by the country's present technology in the main water basins, it is estimated that an amount of 121km^3 /year of water can be supplied by the year 2021 of this, 46.5 km^3 / year will consist of ground water and remaining 74.5 km^3 /year of surface water. This forms 88 percent of the total renewable water resources of these resources. However, due to enormous investments required by the government, this goal can hardly be achieved. At an optimistic scale,(85%) of this figure i.e 102 km^3 / year would be accessible in the year 2021. The share of Agriculture from accessible water resources will reduce from 93.6 % in year 1998 to 87.2 5 in the year 2021 and 81.2 % in the year 2060. As a result, the amount of allocated water to Agriculture sector would be almost constant i.e, 82 km^3 / year (1998), 88.9 km^3 / year (2021) and 89.3 km^3 / year (2060). Therefore in general with current trend of water utilization by various sectors, the country need to follow new approach, firstly to reduce water use by various users, secondly generate new funding to apply the new technology and infrastructure application to improve eco-efficient system at large.

2- Fortunately the country has achieved the good level of engineering to Plan , design and implement the various eco-efficient water structure and the country can claim that, the expertise is good enough to implement large projects in this respect, considering 30 large companies are now working in important city and in addition, about 124 consulting firms and 216 construction companies support the water resource development in the country. The same firma are currently working in several countries especially in the Central Asia to improve the water structures system.

Recommendations and Conclusions

As it is indicated that, there will be water shortage sooner or later in many regions in Asia Specific including Iran and the best possible approach is to curtail the various demands and to improve eco-efficient water utilization. Therefore the followings steps are recommended;

1- Charging for irrigation water

Inadequate funding for maintenance of irrigation works and emerging shortages of water are prevalent. The use of water charges to generate resources for maintenance and to reduce demand is widely advocated. Examples from other utilities, and from the domestic/industrial sectors of water supply suggest the approach could be effective.

In developing countries, the facilities required for measured and controlled delivery of irrigation structure are rarely in place, and would require a massive investment in physical, legal and administrative infrastructure.

To be effective in curtailing demand, the marginal price of water must be significant. The price levels required to cover operation and maintenance

(O&M) costs are too low to have a substantial impact on demand, much less to actually bring supply and demand into balance. On the other hand, the prices required to control demand are unlikely to be within the politically feasible range.

Furthermore, water *supplied* is a proper measure of service in domestic and industrial uses. But in irrigation, and especially as the water resource itself becomes constrained, water *consumption* is the appropriate unit for water accounting. This is exceptionally difficult to measure.

An alternative approach to cope with shortage would focus on assigning volumes to specific uses—effectively rationing water where demand exceeds supply. This approach has a number of potential benefits including simplicity, transparency, and the potential to tailor allocations specifically to hydrological situations, particularly where salinity is a problem.

2- Improving Integration of Water Resources System

The country at large has developed complex water resource system successfully, however it needs to put all units together to see them as one comprehensive system, enabling the engineers to find where the improvement is required and how economically the water can be taken from this system / or tapping water i.e running water to the oceans across the boarder (currently is hugged) to improve irrigation capacity in the number of regions that can produce food and industrial productions which at the moment are completely dried.