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Evaluation of Run-Off Supply Projects in Hamadan Province (Iran)

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ABSTRACT: Water resources project is for the control or use of water. Where utilization is proposed, the first question is usually how much water is needed .This is probably the most difficult of all the design problems to answer accurately because it involves social and economic aspect as well as engineering. In order to meet the various demands and of water requirements in Hamadan province which is situated in west of Iran, more than 28 projects were defined and studied, but only few of them were adopted. This paper presents a criteria based on the ratio of reservoir capacity to volume of earthen dam named as feasibility factor (F) for exact evaluation of different alternatives to assure the designer, so that, to obtain sufficient quantity of water in a form which can be easily and cheaply made fit for various uses.

Keywords: Water Requirement, Reservoir Capacity, Volume of Earthen Dam, Evaluation of Run-Off Supply, Economic Analysis

1. INTRODUCTION

Hamadan province is located in the western part of Iran with an area of more than 19000 square kilometers. Hamadan is a beautiful highland covered with huge mountains and green slopes, farmlands, pastures, snowcapped peaks , anti fertile valleys under a blue sky.
Annual precipitation is 6822 million cubic meters and 4000 million cubic meters evaporate. Annual water consumption in Hamadan is 2900 million cubic meters in which ground water possess 81 percent of the demand and 19 percent is supplied through surface run-off. Reference [6] shows that, 93 percent of the total Water consumption is reserved for agricultural activities, 5 percent for urban use and 2 percent in industrial sector. It may be seen that there is severe shortages of water supply through-out the year. In the other words, it is necessary to provide such a large volume of water scarcity especially in drought periods [4].
In the two recent decades, in order to overcome water shortages, 28 reservoir dam projects were proposed in Hamadan province. Two projects completed, four projects put under construction, 11 projects were in the feasibility studies and 11 projects rejected.

2. OBJECTIVES AND SCOPE

In order to meet various demands and water requirements in Hamadan province, more than 28 projects were proposed and studied, but few of them were adopted. There is always an essential question whether these projects are economically feasible and could be able to provide water shortages or not? Therefore, the main objective of this research is to present criteria for selecting those projects so that decision makers could be assure of water supply with maximum net benefits.

3. METHODOLOGY

In order to provide agricultural water requirements, few parameters such as water quantity, agricultural pattern, irrigation method, irrigation efficiency, water conveying systems and benefit cost ratio are to be considered. Usually, achievement of objective of water resources projects is ambiguous. In this research, economic evaluation based on the existing approaches such as supply cost and reservoir storage planning along with suggested criteria, “physical characteristics of the project”, have been used for estimating run-off supply projects in Hamadan Province .These methods could be used in screening phase to assure adequate supply and economic justification.
According to Rogers [5], the real value of water, depends upon the user view with respect to quantity and quality and water use to which it is put. The exact value is the summation of intrinsic and economic value. In the other words, full cost of water use, includes investment costs, operational and maintenance costs, a water scarcity rent and the cost of negative externalities of water use [8].
For economic equilibrium, the value of water should equal the full cost of water. However, in practice, the value of water in use is typically expected to be higher than the estimated full cost. This is often because of difficulties in estimating the externalities in the full cost calculations. More ever, in many cases, it may be lower than full cost, since political and social obligations override the economic issues. Full supply cost or average value per cubic meters of water which has been used in this research, includes the cost associated with the supply of water to consumer without consideration of externalities and alternate use of the water.

4. ANALYSIS

4.1 Evaluation on the Basis of Physical Characteristics of Projects

Whenever, a water-resources project is planned, it must be ensured that the proposed proposal is the best, and any other possible alternative will not be better than purposed one. To obtain such a criteria for selecting optimum proposal, the ratio of reservoir capacity to volume of earth fill dam named as feasibility factor (F=C/V) was studied and noticed that whenever the actual ratio estimated, is equal or greater than F, the scheme is considered to be successful. The average value of F for existing large dams in Iran is "20"and"9" for Hamadan. This parameter could be used as a primary evaluation and project selection. The actual ratio for two proposed projects in Hamadan, namely "Yengjeh" and "Shirin sou" dams equaled to 8 and 30 respectively. From the above discussion, it is clear that, Shrin sou dam is only feasible in comparison with suggested criteria.

4.2 Evaluation on the Basis of Primary Investment

As already discussed earlier, the cost of one cubic meter of water is a function of investment costs, operational and maintenance costs. According to [1], average value (base value) per cubic meter of water estimated on the basis of 2001's tariff given by ministry of energy is equal to 520 Rials (0.065$) and in accordance with shadow price in agricultural sector, is equal to 420 Rials (0.052$) [2].

"References [3]-[7] show that the cost of water per cubic meter with interest rate of 7 to 14 percent for Yengjeh and Shirin sou dams in Hamadan is estimated to be 650(0.082$) to 1300 Rials (0.16$) and 307(0.040$) to 717 Rials (0.090$) respectively. Comparison of the estimated water cost with the water base value reveals that the average cost of water per cubic meter for Shirin sou dams equals the base value given by ministry of energy. Therefore, it may be concluded that on the basis of primary investment, only Shirin sou dam is economically feasible.

4.3 Evaluation on the Basis of Reservoir Storage Planning

The storage, capacity of a reservoir is to be planned keeping in view the overall objective of the water resources development. The policies and guide lines of the government in a relation to water resources development of the region are to be adhered too. Therefore, the determination of storage capacity needs detailed and careful study as the same is depending on a number of factors. Some of the important factors are inflow, desired annual demand and its distribution over time, operating policy and losses through evaporation and seepage. If the planned storage capacity is small, it may not serve the purpose for which it has been designed. On the other hand, over estimation of the storage capacity will result in considerably high cost of the project rendering the project to be uneconomical. Hence, it is necessary to make a very judicious estimate of the storage capacity.

Reservoir storage planning for Shirin sou and Yengjeh dam have been worked out and the results for Yengjeh with a volume equal to 570 thousand cubic meters is shown in "tab."1. It may be seen that during the months of April to October, inflow (108000 cubic meters) into the reservoir goes down but demand for irrigation (2232000 cubic meters) is high. In the other word, out flow decreases and cannot meet the demand. Moreover, water scarcity ranges from 26 to 100 percent throughout the year. During monsoon months (November to March), irrigation requirements is small, and reservoir volume rises to 248 thousand cubic meter which is only 43.50 percent of the designed capacity of the reservoir. It may be concluded that planned storage capacity of Yengjeh dam is small and cannot meet the demand.

Table 1- Reservoir Storage Planning for Yengjeh Dam
(Units in thousand cubic meters)

Month	In flow	Demand	Out flow	Reservoir Volume		Over flow	Water Scarcity		Remarks
				Beginning	End		Volume	Percentage	
September	1	120	1	0	0	0	119	99	Scarcity
October	16	24	16	0	0	0	8	8	Scarcity
November	39	0	0	0	39	0	0	0	Normal
December	50	0	0	39	89	0	0	0	Normal
January	61	0	0	89	150	0	0	0	Normal
February	98	0	0	150	248	0	0	0	Normal
March	145	168	168	248	225	0	0	0	Normal
April	78	408	303	225	0	0	105	26	Scarcity
May	12	672	12	0	0	0	660	98	Scarcity
June	1	480	1	0	0	0	479	99	Scarcity
July	0	288	0	0	0	0	288	100	Scarcity
August	0	240	0	0	0	0	240	100	Scarcity

5. CONCLUSIONS

This study has been mainly directed towards suggesting a suitable criteria for evaluation of run-off supply projects in Hamadan province and the data of Yengjeh and Shirin sou dams have been used to present the suggested approach. It may be noted that, the existing methods (primary investment and reservoir storage planning) take into account the various aspects which are required for economical evaluation of different alternatives.

As discussed earlier, the existing methods, envisage that, Shirin sou dams is only economically feasible. Furthermore, in this particular case, suggested criteria (physical characteristics of the project) proposes that, selection of Yengjeh dam is not a proper decision but, Shirin sou project is economically feasible as well as there is no water scarcity during the reservoir operation.

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