ASSESSMENT OF CHANGE FROM EXISTING IRRIGATION SYSTEM TO PRESSURE IRRIGATION SYSTEM IN GAP REGION IN THE FRAMEWORK OF VALUE ENGINEERING

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ABSTRACT

Agricultural irrigation is the mostprevalent area of the all sectorswhich are used water and 74% of water isconsumed on agricultural irrigation area in Turkey. In many parts of the our country, agricultural yieldlossesoccur in irrigation field and high irrigation costs are the top reasonswhichreducebenefitsexpectedfrom irrigation. Despiteefficiency of water use is as low as 40-50% rate in surface irrigation systems; water efficiencycanreach 90-95% with pressure irrigation systems. In thisstudy, acquisitions which are obtained by revision and changes in irrigation systems in Şanlıurfawhichpresents the most important region in GAP (SoutheastAnatolian Project) are discussed. In a state of conversion of areas which are irrigated by classical system to sprinkler irrigation system, 525 hm^3 amount of water from 1,500 hm^3 willbesaved on annual base while 900 hm^3 amount of water willbesaved for drip irrigation system. In case of transformation to sprinkler irrigation system, 283 GWhamount of energycanbesavedwhile 483 GWhamount of energycanbesavedwithdrip irrigation system. Energysavingscanbring a benefit 25.6 and 43.5 million euro in total on annual base respectivelywith 3 Dams and HEPPs in region.

Keywords: Pressure irrigation systems ; value engineering ; irrigation cost ; GAP; irrigation and energy

1. Introduction

Soil and water resources rank first among the most substantial natural wealth in communities and development of these resources besides wise use plays significant role in terms of social and economic progress. In this sense, increase of water demand due to increasing population and growing industry, deterioration of water based on quality and quantity and nature pollution necessitate correct use of water resources despite possible climate change. On the other hand, agricultural irrigation is the most prevalent area of the all sectors which are used water and 74% of water is consumed on agricultural irrigation area in Turkey. Considering this situation, development of agricultural irrigation systems in the perspective of value engineering become more of an issue based on economic, social and environmental sides. In many parts of the our country, agricultural yield losses occur in irrigation field and high irrigation costs are the top reasons which reduce benefits expected from irrigation. Excessive water use is the primary factor that lose agricultural yield. Surface irrigation systems are the practices lead to use of excessive water use and increase of unit water cost (Tekinel O., et all., 2001). Despite efficiency of water use is as low as 40-50% rate in surface irrigation systems; water efficiency can reach 90-95% with pressure irrigation systems. In this study, acquisitions which are obtained by revision and changes in irrigation systems in Şanlıurfa which presents the most important region in GAP (Southeast Anatolian Project) are discussed as part of value engineering. Even if transforming surface irrigation system to pressure irrigation system in field irrigation, water supply is needed in arid period will be possible in Şanlıurfa. Therefore, transformation to pressure irrigation system is key factor in terms of water, environment and food safety. Therefore, transformation to pressure irrigation system is key factor in terms of water, environment and food safety.

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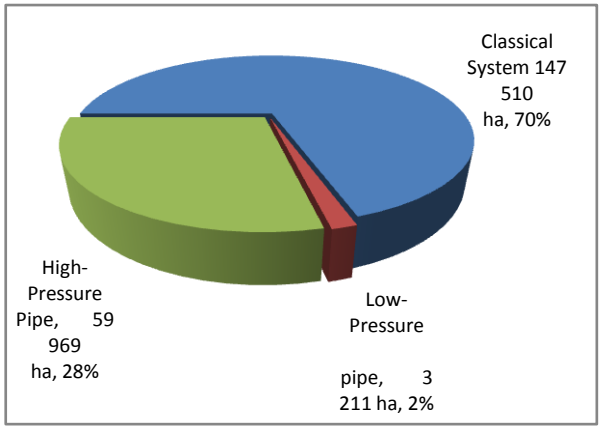
2. Study Area

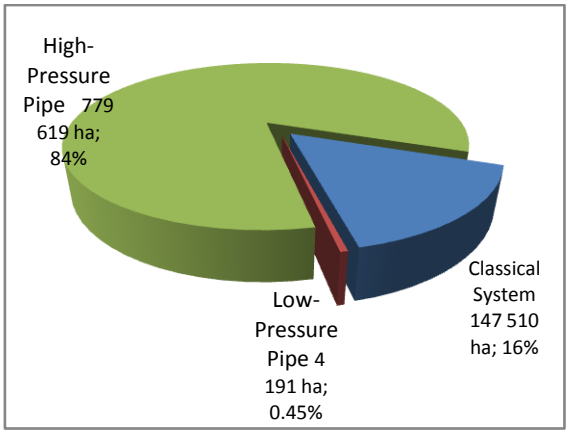
The importance of the study is to be considered in the region where GAP project covers which is the largest integrated development project in Turkish Republic history. Because, the GAP project is a regional development project that includes many industries such as irrigation, energy, transportation, tourism and so on. It is reported that irrigation investments in GAP is the most important component of the project and both welfare and socio-economic development of the region will be improved along with the increase in national income (Gülağacı, 2011).When the projects within GAP are completed, approximately 1,822,000 ha area in total of 9 provinces will be irrigated. Şanlıurfa approximately generates 50 percent of GAP project with 932,250 ha irrigation area and land resources. Irrigated areas and their irrigation systems is given Table 1.1 Also, Picture 1.1 showsdistribution of irrigation projects in operation in DSI 15.Regional Directorate according to irrigation systems. Picture 1.2 shows distribution of irrigation projects in case of complement of all projects according to irrigation systems.

Table 1.1: Irrigation Areas and Irrigation Projects

Project Name	**Area (ha)**	**Irrigation System**
Harran-Şanlıurfa Plains Irrigation Project	133235	Classical System
Yaylak Irrigation Project	18322	HighPressurizedPipe
Bozova 1. Part Pumping Irrigation Project	8669	HighPressurizedPipe
Yukarı Harran Irrigation Project	13455	HighPressurizedPipe +California



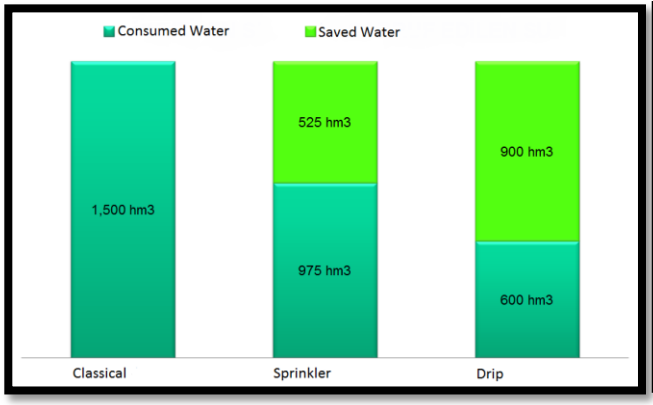
Picture 1.1: Distribution of irrigation projects in operation according to irrigation systems

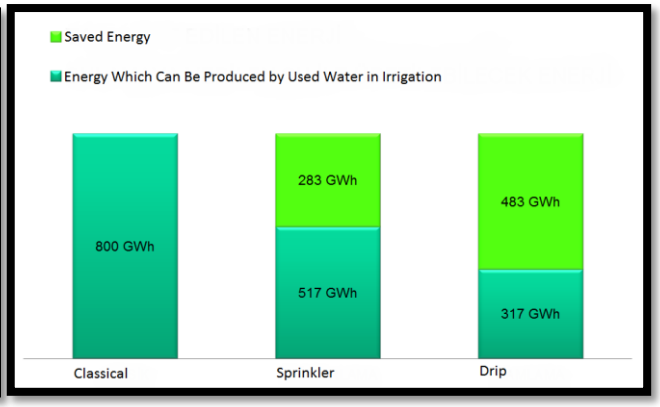


Picture 1.2: Distribution of irrigation projects in case of complement of all projects according to irrigation systems.

Classical system is mainly used for areas was built by DSI 15.Regional Directorate and in operation now. Water which is one the most natural resources of our world can be saved by transformation to sprinkler and drip irrigation system. Irrigation area which is irrigated by classical system is 133235 ha as part of Harran-Şanlıurfa Plains Irrigation Project. Water amount consumed by classical system in operation areas is 1500 hm3.

Water amount consumed by classical system is calculated for sprinkler and drip irrigation systems considering consumed water amount (m3) on annual base per 1 ha area. Average water amounts consumed by irrigation systems on annual base are as 10 000 m3 /ha / year for classical irrigation system, 6 500 m3 /ha / year for sprinkler irrigation system and 4000 m3 /ha / year for drip irrigation system. In case of transformation from classical system to sprinkler and drip irrigation systems, energy amounts which can be produced by Dam and HEPPs in region with saved water because of transformation and financial gains are presented in tables.





Picture 2.1: Water amounts which can be saved by transformation to sprinkler and drip irrigation system from classical system

Picture 2.2: Energy amounts which can be produced by savedwater with transformation to drip and sprinkler irrigation system.

In case of transformation from classical system tosprinkler irrigation system 525 hm3 water will be saved using 975 hm3 in annual. In addition, in case of transformation from classical system to drip irrigation system 900 hm3 water will be saved using 600 hm3 in annual. In view of these values, amount of consumed water using classical system is more 2,5 times than amount of water consumed with drip irrigation system. Water amounts which can be saved by transformation to sprinkler and drip irrigation system are shown in Picture 2.1.
800 GWh amount of energy can be obtained with total amount of consumed water (1500hm3) inirrigated areas by classical system. In case of transformation to sprinkler irrigation system, 283GWh amount of energy can be saved while 483GWh amount of energy can be saved with dripirrigation system. Picture 2.2 shows energy amounts which can be produced by saved waterwith transformation from classical system todrip andsprinkler irrigation systems.

Dam and HEPP Name	Energy Amounts can be produced by 525 hm^3 Saved Water on Annual (Sprinkler) GWH	Financial Gain Million Euro €
Atatürk Dam and HEPP	205	18.5
Birecik Dam and HEPP	62	5.6
Karkamış Dam and HEPP	16	1.5
TOTAL	283	25.6

Picture 2.3: Energy amounts can be produced with saved water (525 hm3) for Atatürk, Birecik and Karkamış Dams and HEPPs.

In case of transformation from classical system tosprinkler irrigation system 525 hm3 water will besaved using 975 hm3 in annual. 205 GWhamountof energy from AtatürK Dam and HEPP (1 kwhenergy is produced by 3m3 water), 62 GWh amountof energy from Birecik Dam and HEPP (1 kwhenergy is produced by 2m3 water), and 16 GWhamount of energy from Karkamış Dam and HEPPcan be produced with amount of saved water. Income from energy production with these savings is18.5, 5.6 and 1.5 millioneuro recently. Also, it means 25.6 million euro income in annual for 3 dams. Picture 2.3shows energy amounts can be produced with savedwater (525 hm3) for Atatürk, Birecik and KarkamışDams and HEPPs.

Dam and HEPP Name	Energy Amounts can be produced by 900 hm^3 Saved Water on Annual (Drip) GWH	Financial Gain Million Euro €
Atatürk Dam and HEPP	350	31.5
Birecik Dam and HEPP	105	9.5
Karkamış Dam and HEPP	28	2.5
TOTAL	483	43.5

In case of transformation from classical system to drip irrigation system 900 hm3 water will be saved in annual. 350 GWh amount of energy from Atatürk Dam and HEPP, 105 GWh amount of energy from Birecik Dam and HEPP, and 28 rom Karkamış Dam and HEPP can be produced with this saved water. Income from energy production with these savings is 31.5, 9,5 and 2.5 million euro recently.

income in annual for 3 dams. When these values are taken into account, in drip irrigation system both agricultural irrigation and energy can be provided using consumed water in classical systems. Picture 2.4 shows produced with saved water (900 hm3) for Atatürk, Birecik and Karkamış Dams and HEPPs.

Picture 2.4: Energy amounts can be produced with saved water (900 hm3) for Atatürk, Birecik and Karkamış Dams and HEPPs

3. RESULTS AND SUGGESTIONS

In case of transformation from classical system to sprinkler irrigation system and drip irrigation system many gains will be provided in region. We can order these gains as; energy, water and land gain, prevention of salinity and easy terms of management. Water and land loss come about in classical irrigation systems because farmers use their all water to area. This loss can be minimized by transformation to modern irrigation systems. It will be easy to irrigate huge and rugged areas so erosion will be prevented depending on surface irrigation. Desertification of land also will be prevented as a result of sufficient water for product. Furthermore, high and quality yield will be obtained per unit area. Product cost will be fallen its minimum values by providing savings from fertilizer and labour. In addition, spread of plant diseases will be reduced and usage of chemical medication will be reduced to the minimum.

Modern irrigation systems bring many benefits in terms of water management and controlling.For example, personal water use can be detected nettably inserting counter and so usage fee can be received according to amount of use.This also makes easier to control and monitor the facility. Moreover, this type of facilities is open to modern usage methods.Modern irrigation systems will be adopted in circumstances where a clear financial incentives to farmers.Irrigation fees, government supporting and price policies are main factors affect farmers' attitudes and behaviors.Discount for energy costs as an important input in transformation to pressurised irrigation will be a significant support for farmers and irrigation organizations.Modern irrigation systems make a big contribution in the sense of sustainability of irrigation projects.Efficient water use and irrigation system modernization is mandatory to overcome water scarcity problems which will reach serious aspects due to climate change.Other important issue is the role of irrigation on food safety.Being limited of water resources and arable soil and falls in yields per unit area creates problems in terms of food security (Buhr and Sinclair, 1998).Modern irrigation techniques are begun to implement in new projects in our region because they can minimize possible difficulties in future within the frame of food security and climate change. Also, necessary planning studies for transformation from classical system to sprinkler and drip irrigation systems have been begun.Therefore, modern irrigation systems make a big contribution to farmers' and national economy and these systems will contribute high standards as technical and economical in irrigation projects.

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