Journal of Engineering and Applied Sciences 12 (7): 1910-1913, 2017
ISSN: 1816-949X

The Price of Water in Industry; Benefits and Costs

Saeed Mehrjou, Sayed Sajad Bagheri Shakari, Abass Alipour and Mostafa Hashemi
Department of Agricultural Economics and Development, University of Tehran, Tehran, Iran

Abstract: The project of Persian Gulf water supply and transfer is completely agreed with water resources management policies and other important laws such as the law on encouragement of private sector investment in country water projects. To provide Eastern South industrial mineral complex water of country (Golgohar Sirjan, Mese Sarcheshmeh, Chadoramloo and Fooladsazi Yazd), it's essential to prepare equipment to transfer water from Bandar Abas desalination center to mentioned complexes. The results of economic evaluation of this project show the project of transferring water from Persian Gulf to place of mineral industries would be justifiable on basis of national economic policies. According to the calculation, every cubic meter of water in mentioned industries in average will have the final output value (economic price) about 4/117 thousand rials. While the average economic cost spent on this project is 8/62 thousand rials for each transferred cubic meter water (counting cost of buying water from desalination). Therefore for each provided cubic meter water for those industries, the net value (subtracting expenditures of desalination and water transfer) will be about 6/54 thousands rials. Economic return rate of this project is calculated about 34/22% that is considerably higher than basic rate 7% which normally is used in economic evaluation of national water projects. The project present net value shows that implementation of this project can totally bring a net value about 2/59127 billions for national economy as well as returning total investment expenditure use and maintenance of transferring lines and water desalination.

Key words: Water management, industry, production, evaluation, Iran

INTRODUCTION

Due to growing world population, living standards improvement, urbanization, increasing economic activities and industrial and agricultural development, demand for water is growing in the world. In addition, climate changes as a potential and effective threat on both supply and demand for water has caused a significant imbalance between water resources and consumption specially in arid and semi-arid countries. The result of this process will be more demand than supply, increasing social conflicts, instability and contamination of aquatic ecosystems and the environment. Due to this situation, today in all around the world this agreement has been achieved that other typical water resources are not enough and there must be a comprehensive plan to develop water resources including various ones not only one or two traditional water resources. Using new water resources is very important, it can reduce pressure on quality and quantity of typical water resources especially in dry ereas. Desalination is one of the unusual resources which is used in recent as an efficient resource to supply water in a lot of countries around the world. The water produced by desalination in the world (including sea water and brakish) in 2006 was about 48 million cubic meter a day (enough for 240 milion people). In addition the number of desalination units which were desalting water in the world was about 14500 and the number of desalination units under construction was more than 240 units in 2010. Due to growing rate of demands for water, there will be a remarkable raise in the number of desalination units in near future and it will increase to 140-160 milion cubic meter a day in 2025 (ONDC, 2009). The total water desalination capacity has increased consistently over the last twenty years in the world and this trend is not expected to be stopped in the future. It is expected to triple demand for water desalination during the next 6 years and its market value will be >30 bilion dollars until 2016 (Nellen, 2011). Abazza (2012) has evaluated the costs and benefits of water supply by desalination in South Mediterranean Countries (Abazza, 2012). Although, water produced by desalination compared to natural resources is more expensive but units of production during the past few decades due to technological progress has been decreasing. It is predicted that the unit cost of water supply drived from natural resources will increase in future. In contrast the unit cost of water desalination will decrease. Water

Correspondig Author: Abass Alipour, University Comprehensive Emamhussein, Tehran, Iran

desalination may soon compete with other resources. The newest methods named MSF was used in desalination unit in Abuduabi (United Arabic Emirates) and the method named RO used in desalination Unit Ashkloon in Israel. The cost of water desalination for each cubic meter in these centres is in order about 0/7 and 0/51 us dollars. This rapid decline in the costs is up to three factors; investment, energy and operation and maintenance costs which have been decreased because of technological progress, increasing production, lower costs of interest and energy and more competition between equipment suppliers used in above mentioned centers. Different factors including water featurs used as drinking water, produced water quality, unit desalination capacity, operation and maintainance costs, location and geographic features, type and the amount of energy consumption and its accessibility soon are efficient in determining the total costs of water production (Blank *et al*, 2007). Among these factors, the most important factor is the amount of energy consumption and its accessibility that is not only efficient in determining the total and final cost but also in selection of the type of technology used in desalination method. For example, with respect to more energy consumption in MSF method compared to RO and lower energy price in the Middle East, MSF method is a better method for countries located next to Persian Gulf, in contrast due to higher cost of energy, RO method is better to use in other countries in the world. In general, MSF technology for water desalination is a more expensive method than RO but with higher production capacity.

MATERIALS AND METHODS

Depending on the actual use of industries which are using transferred water, digit codes data (ISIC) related to industries that were most consistent with the activity of the mentioned industries (2710 code related to Iron and steel products and 2721 related to basic copper products) is extracted in the period of time between 1380-1389 and used in estimating production function. Then production functions method of ordinary Least Squares Dummy Variables (LSDV) or panel fixed effects pattern. In specification of production functions of each of the industries studied, the dependent variables is selected according to the total value of annual production (according to thousand) and independent variables are selected as follows; variable production inputs such as the amount of annual water consumption (according to cubic meter), the number of productive labor force (according to people), the value of row material (according to million rials), the amount of electricity consumption (according to 1000 kW/h) and the amount of fuel consumption (a thousand liters). With respect to that, dependent variable (annual production) and one of independent variables (the amount of primary and raw material) of pattern is according to dominal production values and raw materials and other variables are according to quantitative data. It was necessary to change the series of these two variables to the real and actul value before estimating the model. This was done by adjusting the nominal values using price index and basic metal price index published by the central bank . For forms of linear function, second grade, Cubb-Dugloss and translog are specified for estimating each of these production variables and are estimated in Shazam Softwere Package. After estimating mentioned patterns, co-linearity tests, hetroskedactisity, autocorrelation and normality of error terms test for study of violation of classical assumptions were done.

RESULTS AND DISCUSSION

The results of the model tests showed that second grade production function is better than other functions for both iron and steel and copper industries. Therefore, the results of this fitting functional form set as the basis for calculating the final output value of water (theeconomic value ofwater) in each of these industries. The results of estimating second grade production functions of basic Iron and steel products and copper products are mentioned in the following Table 1-6. These estimates are the basis for calculating the value of the final water production. It means this estimate is determined by differentiation of the above stated functions of water input. The value of the final production or economic value of water is determined according to national economic policies. High statistic for both patterns shows that the explanatory variables explain changes in the dependent variables. Dorbin-Watson (DW) statistic also shows that disturbing elements of estimated patterns don't have any serial correlation and coefficient of most of variables are meaningful and their signs are consistent with the theory. Therefore, its use is reliable in determining the economic value of water. With respect to this fact that dependet variables in these patterns are specified as production value (according to constant price in 1383) by direct differentiation of them, the ratio of water input, the value of final water production (economic value of each cubic meter) is obtained according to the fixed price (base year 1383). To convert this value to the price of the base year of studies (1392), price index of basic metal product is used. The value of final water production represents the production value wich is achieved for every additional water consumption unit of water and shows the maximum trend of consumers to pay for each unit (cubic meter) of water input.

Table 1: The estimate results of production functions of basical iron, steel and copper production functions

	Production functions			
	Copper basical production		Iron basical production	
Variable explanation	Coefficient	t-stat.	Coefficient	Coefficient
Early raw material	1201/3	24/81*	0/85	19/86*
Consumed water	-	-	438/97	22/59*
Consumed electricity	807/95	3/54*	-	-
Consumed fuel type 1 (white oil, gas oil)	1806/8	3/12*	-	-
Square of water	-0/201	1/21*	1/147	12/15*
Square of early raw materils	0/00023	9/37*	0/00000008	5/85*
Square of consumed fuel type 1	0/00069	3/12*	-0/056	-14/73*
Square of consumed fuel type 2	4/51	9/05*	-	-
Square of consumed electricity	0021/0	5/74*	-	-
Early material×consumed water	0/044	4/97*	-0/0014	-37/57*
Early material×consumed electricity	-0/0016	9/16*	-	-
Early material×consumed fuel type1	0/00012	0/82*	0/000086	10/3*
Early material×of consumed fuel type 2	-0/071	-10/40*	0/00076	13/57*
Consumed water×labor	16/01	5/64*	-	-
Consumed water×consumed electricity	-0/192	-5/14*	-	-
Consumed water×square of consumed fuel type 2	-2/85	-2/8**	-	-
Laber×consumed electricity	0/22	7/84*	-	-
Consumed water×consumed electricity	-0/99	-8/20*	-	-
Consumed fule type 1×labor	-16/7	-4/86*	-	-
Consumed fule type 1×consumed electricity	0/0013	4/02*	-	-
Consumed fule type 2×consumed electricity	0/13	8/16*	-0/049	-23/93*
Consumed fule type 1×consumed fule type 2	-0/11	5/91*	0/056	24/28*
Dummy variable 1	19518000000	11/16*	85563	3/37**
Dummy variable 2	112490000	2/05**	70299	4/21**
Dummy variable 3	152220000	2/37**	-	-
Dummy variable 4	818420000	5/89*	-	-
R^2	0/99		0/97	
Dourbin- Watson test	1/98		1/77	

Table 2: Total estimate of yearly impure economical materials resulting of securing and transferring persian gulf

			Gross benefit of water	
Raws	Consumption	The amount of water allocation (million square meter)	Instead of each square 100 rials yearly)	Total benefit yearly
1	Golgoharesirjan	40	107/3	4292
2	Mesesarcheshmeh	30	135/03	4050/9
3	Fouladsazi Yazd	25	107/3	2682/5
4	Other consumptions	15	107/3	1609/5
Total	-	110	117/4	12634/9

Table 3: Economical and organic company of golgoharsarcheshmeh copper center

	Economical Evaluation indexes of water transfer		
Change factors/Senario	Net Present Value (NPV)	Benefit to Cost ratio (B/C)	Interal Rate of cost Return (IRR%)
Rate of discount			
5	83773/4	2/00	
7	59127/2	1/86	
10	35175/3	1/65	
12	24701/2	1/52	22/34
15	13862/3	1/34	
0	3178/8	1/10	
22/34	0/0	1/00	
Change in project incomes			
+20	84724/2	23/2	27/2
+10	71925/7	2/04	24/8
-10	46328/7	1/67	19/65
-20	33530/2	1/49	16/7
Change in project costs			
+20	45355/6	1/55	17/7
+10	52241/4	1/69	19/9
-10	66013/0	2/07	25/1
-20	78407/3	2/58	31/3

Table 4: Finished price (economical) each square of water in part 1

Cost types	Finished price of water transfer in part 1	The price of each square of water desalination outpot	Finished price of water of golgohar company
Finished price of water (square/rials)	23745	18700	42445

Table 5: Finished price (economical) each square of water in part 2

Cost types	Finished priceof water in part 1 (with respect to price of buying water)	Finished price of transferring water in part 2	Finished price of water for copper campany of sarcheshmeh
Finished price of water (square/rials)	42445	15187	57632

Table 6: Finished price (economical) each square of water in part 3

Cost types	Finished price of water at the end of part 2	Finished price transferring of water at end of part 3	Finished price of water for chadrmelo and steel companies
Finished price of water (square/rials)	57632	13694	71326

CONCLUSION

According to the results of production functions, the final production value (economic value) of each cubic meter of water for basic iron and steel products is equaled to 107/3 thousand rials and for basic copper product is equaled to 135/03 thousand rials.

REFERENCES

Abazza, H., 2012. Economic considerations for supplying water through desalination in south Mediterranean countries. MSc Thesis, Sustainable Water Integrated Management-Support Mechanism (SWIM-SM), European Union.

Blank, J.E., G.F. Tusel and S. Nisanc, 2007. The real cost of desalted water and how to reduce it further. Desalin., 205: 298-311.

Nellen, A., 2011. Desalination: A viable answer to deal with water crises. Global Food and Water Crises Research Programme, Australia. http://futuredirections.org.au/wp-content/uploads/2011/07/FDI%20Strategic%20Analysis%20Paper%2028%20July%202011(1).pdf

ONDC., 2009. [Spanish association of desalination and reuse (AEDyR)]. Official Notes of Desalination Course, Madrid, Spain. (In Spanish).