



Title: Techno-economic Evaluation of BWRO Systems for Brackish Water Desalination in the Jordan Valley

قليلة المياه لتحلية العكسي التناضح محطات تقييم واقتصاديا فنيا الأردن غور منطقة في الملوحة

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Abstract:

Due to the brackish water nature of ground and limited access to fresh water resources, few Brackish Water Reverse Osmosis (BWRO) desalination plants were constructed in the Jordan Valley. Two BWRO units, one in Marj Na'aja (1320 m³/d) and the second in Al-Zubeidat (10 m³/d) were taken as case studies. The aim of this study is to evaluate the techno-economic feasibility of these water treatment facilities, with focus on factors affecting the unit cost of desalinated water and coupling solar photovoltaic (PV) to BWRO desalination unit. The study also aimed to formulate guidelines for desalination in The Jordan Valley. For these purposes the Desalination Economic Evaluation Program (DEEP) was used to redesign and analyze the collected data.

The analysis results prevailed that the unit product cost (UPC) of Marj Na'aja BWRO unit is \$0.245 /m³ and is capable of producing water in the range of \$0.21-\$6.54 /m³, depending on the plant size, power source and cost. The cost breakdown results of Marj Na'aja unit showed that energy, material, labor, and capital costs account for 64%, 4%, 20% and 12% of the total costs, respectively.

Furthermore, the results analysis indicated a water production cost of \$0.423/m³ if Marj Na'aja unit was powered by solar PV cells instead of electricity. On the other hand, the economic analysis of the smaller BWRO unit of Al- Zubiedat powered by PV cells showed that the UPC is \$5.09/m³. This indicates that the UPC of the small scale BWRO desalination units are higher than the larger ones. In addition, the analysis results showed a higher cost factors for energy and labor costs of the electrically powered Marj Na'aja BWRO unit compared to the solar powered scenario. However, capital and labor costs were representing the highest two cost factors for Marj Na'aja unit when powered by PV cells. On the other hand, for Al- Zubiedat BWRO unit material and labor costs were forming the highest cost factors.

Finally, the outputs and the collected results from the economic analyses, costs breakdown and sensitivity analysis were employed to formulate guidelines for BWRO desalination in the Jordan

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valley. The suggested guidelines focused on the economics of BWRO desalination, and on the best practices to be applied in order to reduce the production costs of fresh water from desalination.