التعاون الألماني
DEUTSCHE ZUSAMMENARBEIT

Implemented by:

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In cooperation with:

Ministry of Water & Irrigation
وزارة المياه والري

WATER AUTHORITY

Desalination of Sea and Brackish Water

Improve planning and operational performance of desalination plants

The challenge

Jordan is suffering from a decline in natural water resources (-39%). This is caused by climate change (~ -15% by 2040) and by the overexploitation of groundwater. At the same time, water demand is steadily increasing (+31% by 2040). According to current estimations, Jordan will have a demand-supply gap of 65% in the municipal water supply in 2040 (531 Mm^3 per year).

Desalination is the only long-term option to increase water supply. Brackish water resources are available near the main supply centers and production costs could be relatively low. However, there is currently no adequate planning for their use. Water supply from seawater desalination is much more costly, mainly because the resource is more than 300 km away from the supply centers. However, with limited brackish water resources available, Jordan needs both brackish and seawater desalination.

Since 2002, about 30 mainly small desalination facilities have been established. However, actual production is far below what was originally planned, while operating costs are significantly higher. There are many reasons for this: planning was not optimal in most cases, and responsibilities for site management and supervision are fragmented. In addition, the human capacity in the field of desalination is insufficient.

Desalination plant operators currently do not require specific qualifications, and management contracts often do not cover all relevant components.

Project name	Desalination of Sea and Brackish Water
Commisioned by	German Federal Ministry for Economic Cooperation and Development (BMZ)
Project region	Jordan
Partner	Ministry of Water and Irrigation (MWI), Water Authority of Jordan (WAJ)
Duration	07/2020 – 07/2024

Our approach

Based on a situation analysis carried out at the beginning, four fields of action were defined:

- Planning for new desalination plants needs to be improved. This requires first determining the future needs and exploitation potential of brackish water resources. A comprehensive site searching is critical to capital and long-term operating costs. A *planning guideline* will assist in finding the right solutions, and a *roadmap for developing desalination schemes* (based on brackish and seawater) will support the planning of individual facilities. The project is working closely together with KfW Development Bank, which is planning its investments based on the project's recommendations.
- The human capacities of the organisational units responsible for desalination at the Ministry of Water and Irrigation (MWI) and the Jordan Water Authority (WAJ) are to be strengthened. This requires a *human resources development concept* and agreements on roles and responsibilities. Tailor-made *training courses* and on-the-job training developed the competencies of the staff. A *Best Management Practice Guideline for Desalination Facilities* were developed to improve plant operation and management.
- A regulatory framework will be introduced to better control the work of desalination plant operators. The project supports the establishment of a licensing system and the development of an Environmental and Social Impact Assessment (ESIA) guideline specific to desalination plants, with the aim of reducing environmental damage. The performance and costs of existing desalination plants are evaluated.
- Operators and water utilities are involved in all the measures described. Based on the evaluation of the plants, measures are also implemented to reduce environmental impact or to improve operational performance.

Left: The project will support improving the KEMAPCO desalination plant operated by AquaTreat for water supply to Aqaba.

Right: Abu Zighan desalination plant owned by WAJ for water supply to Deir Allah.

Contact person

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Left: Newly established desalination plant at Qatar/Wadi Araba operated by Aqaba Water Company.

Right: Newly established desalination plant at Bir Mathkor/Wadi Araba operated by Aqaba Water Company using photovoltaic energy.

Impact in Figures

A study on the exploitation potential of brackish water resources in Jordan was conducted. The study comprised a screening of 19 sites and a pre-feasability level in-depth description for five of them. A roadmap recommends the best option for each of these five sites. In total, the selected sites have the capacity to supply 38 million cubic metres of drinking water.

By strengthening human capacity, operators will be supervised more closely, which will contribute to reduced operational costs. So far, 110 water sector staff have been trained. Guidelines and best practices developed by the project help them to optimise processes in the areas of operation and maintenance, energy optimisation, contract management and finances.

Negative environmental impacts will be reduced through the introduction of an improved regulatory framework on licensing and environmental and social sustainability. The participation of operating companies in the project measures enables better plant management, and the implementation of measures to correct operational mistakes will help to reduce operating costs and increase plant efficiency.

Between the planning of desalination facilities and their implementation, many years will pass. It is important to involve donors and inform them about results or potential constraints. The project will therefore be implemented in close collaboration with KfW Development Bank, which has committed to support Jordan in the building of brackish water desalination facilities in the Jordan Valley. The project helps to prepare this investment.

To achieve all the above, a collaborative environment across all involved actors is required. Introducing changes in the licensing and environmental regulations will not be easy but is in the best interest of the country. It is necessary to create awareness about the consequences if such changes would not happen.

Impact in Faces

Looking at the operational performance of sites helps to identify mistakes. Therefore, the project has started to identify typical mistakes together with WAJ, the water utilities and operators (contractors). Related proposals were drafted and submitted to the owners and operators. Implementing the proposed operational changes will directly reduce costs. Where maintenance is required, either the project itself, the owners, or the operators can implement the related measures.

Examples of the performance evaluation studies are the Ghor Safi and Ghor Mazra desalination plants, located in the Governorate of Karak, serving a population of approximately 53,000. The water is desalinated via reverse osmosis and blended with well water prior to being conveyed to the demand centre.

Site visits revealed typical issues that can also be observed in other desalination plants in Jordan: The amount of water abstracted from the well reduced after a while, leading to an increase in salinity, which threatens the sustainable operation and maintenance of the plant.

The performance analysis showed a significant difference between expected and actual operating values. Even small changes in these values can significantly alter the operating costs as well as the quantity and quality of the treated water. Together with the partners, the project has developed a proposal to rehabilitate the desalination plant and thereby restore supply security and performance.

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