التعاون الألماني
DEUTSCHE ZUSAMMENARBEIT

Implemented by:

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

In cooperation with:

Ministry of Water & Irrigation
وزارة المياه والري

WATER AUTHORITY

Desalination of Sea and Brackish Water

The challenge

Jordan is faced with a rapid conventional water resources decline, which is not considered in planning (-39%) and caused by climate change (~ -15% until 2040) and groundwater overabstraction. At the same time, water demand continues to increase (+31% until 2040). Based on current estimations, Jordan will have a demand-supply gap in municipal water supply of 65% (531 MCM/yr) in 2040.

The only long-term solution for augmentation of supply is desalination. Brackish water resources are available close to the main demand centers and production costs could in general be relatively low, however, there is no adequate planning for their exploitation yet. Providing desalinated water from seawater will be much more expensive, chiefly because of the long distances of more than 300 km to the demand centers. As there is not enough brackish water, Jordan will need both in the future, seawater, and brackish water desalination.

Since 2002, some 30 largely small-scale desalination facilities have been established but production from these is far less than design capacity and costs are much higher than anticipated. The reasons are manyfold. Planning of desalination facilities has in most cases been weak. There is a fragmented responsibility for sites management and supervision, paired with insufficient human capacity development in the field of desalination. A comprehensive regulatory framework for licensing of sites and environmental impact is missing. Companies operating desalination plants do not require a specific qualification and management contracts often do not cover all critical 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 – 07/2023

Our approach

Four main outputs have been defined, based on the situation analysis conducted in the beginning:

- Planning for new desalination facilities needs to improve. This requires first a proper determination of the future water demand and the exploitation potential of brackish water resources. A thorough site searching process is decisive for the overall capital and long-term operational costs. A *planning guideline* will assist in finding the right solutions. A *roadmap for the development of desalination schemes* (brackish/seawater) will help in the planning of individual sites. As most of the brackish water resources are found in the Jordan Valley, a *General Plan for Development of Brackish Water Resources in Southern Jordan Valley* will be prepared. The project is in cooperation with KfW Development Bank, which plans to implement the investments that will be proposed.
- Human capacity of the Desalination Units at the Ministry of Water and Irrigation (MWI) and the Water Authority of Jordan (WAJ) shall be strengthened. This requires a *human resources development concept* and agreements on roles and responsibilities. Tailored *training courses* and on-the-job training will be provided so that these units can fulfil their tasks. *A Best Management Practice Guideline for Desalination Facilities* will be established, so that operation and management of sites can improve.
- A regulatory framework to control activities of desalination plant operators shall be introduced. The project will support establishment of a licensing system and prepare an Environmental and Social Impact Assessment (ESIA) guideline, that is specific for desalination facilities. This will help to reduce environmental damages. A performance and cost evaluation of existing desalination facilities will be conducted.
- Operators will be included in the above activities and, based on the above evaluation of sites, measures for mitigation of environmental impact of desalination facilities or improving operational performance will be implemented.

Left: Poorly maintained 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.

The benefits

The improved planning of desalination sites will contribute to better investment planning and ultimately water supply augmentation and more supply security. Strengthening the human resource capacity will lead to better supervision of site management and thus reduce operational costs. Having better regulatory instruments at hand concerning licensing and ESIA, will result in less environmental damage as currently is the case. Including the operators in the project allows them to gain more experience in management of sites. Implementing measures to correct operational mistakes will reduce operational costs and increase the amount of water provided by desalination plants.

Success factors

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 GIZ 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.

An example from the field

Looking at the operational performance of sites helps to identify mistakes. Therefore, the project has started to identify problematic elements together with WAJ, Water Utilities and operators (contractors). Related proposals were drafted and submitted to the owners/operators. Following the proposed operational changes will directly reduce costs. If maintenance is required, either the project itself or the owners/operators can implement the related measures.

An example of the exploratory phase conducted as part of the project occurred at the Znayah desalination plant, located in the Governorate of Mafraq, serving a population of approximately 40,000.

A portion of the water is desalinated via reverse osmosis and blended with well water prior to being discharged into the network.

Site visits showed what is anticipated to be a common theme in the poorly performing desalination plants in Jordan. In addition to depletion in the well water resources and the resulting increase in salinity, the plant sustainability is challenged by poor operation and maintenance.

The performance analysis reveals a difference between design and actual values and even small changes in performance can affect the overall operational costs of the plant and cause a reduction in the amount and deterioration in quality of water delivered to the public.

Together with the partner GIZ has proposed a plan to refurbishing this plant and thereby increase the on-line availability and plant performance.

Published by
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices Bonn and Eschborn, Germany

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As at
July 2021

Design
GIZ

Credits
Photos: © GIZ/Armin Margane

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GIZ is responsible for the content of this publication.

On behalf of
Federal Ministry for Economic
Cooperation and Development (BMZ)

In cooperation with
Ministry of Water and Irrigation (MWI), Water Authority of
Jordan (WAJ)