KfW Development Bank

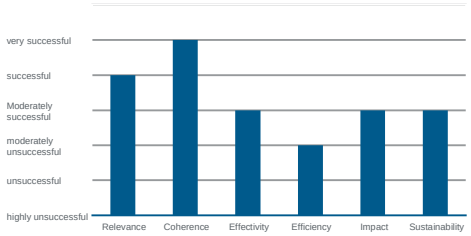
# Ex-post evaluation
# Improving the water supply in southeast Tunisia

| | | | |
|---|---|---|---|
| **Title** | Improving the water supply in southeast Tunisia | | |
| **Sector and CRS code** | 14030 Basic drinking water supply and basic sanitation 14030 | | |
| **Project number** | 2002 65 769 | | |
| **Commissioned by** | German Federal Ministry for Economic Cooperation and Development (BMZ) | | |
| **Recipient / Executing agency** | Société Nationale d´Exploitation et de Distribution des Eaux (SONEDE) | | |
| **Project volume / Financing instrument** | EUR 24.5 million, standard loan under Financial Cooperation | | |
| **Project duration** | 2004–2021 | | |
| **Reporting year** | 2023 | **Year of random sample** | 2023 |

## Objectives and project outline

The climatic and geological conditions in southern Tunisia are leading to supply bottlenecks and severe salinity of the limited ground water resources. As a result, ten decentralised plants for the demineralisation of saline ground water were built in disadvantaged areas of southern Tunisia as part of the project (and two existing plants were expanded). The objective at outcome level was to ensure that the population was sufficiently supplied all year round in order to sustainably improve their living conditions (impact objective).

Overall rating:
**moderately successful**




## Key findings

Despite obvious deficits, the objective is considered to be largely achieved. However, factors outside the project led to inefficiencies, both in terms of implementation and project impacts:

– The programme represents an approach to the core problem (and in fact is by and large the only possible solution) and takes into account the population's actual needs. At the same time, the project fits in very well with the overall involvement of German DC and other international donors.

– However, for technical reasons, desalination means that 20–25% of the desalinated water is not distributed as brine. With the usual mix of raw water and desalinated water, due to the increasing scarcity of raw water, a balance must be struck between achieving the desired water quality and the supply quantity targets. In many cases, this means that the built capacities are only partially used, and the desired water quality is not achieved.

– The efficiency of the project is limited by SONEDE's somewhat dilapidated distribution system. This means that a significant amount of the energy-intensively produced water is lost due to leaks. In addition, there are frequent supply interruptions, and dirt also finds its way into the supply, jeopardising its quality.

### Conclusions

– The rehabilitation of the SONEDE network continues to be a high priority in order to ensure that the population has access to sufficient clean, economically produced water with the appropriate quality.

– SONEDE is technically and organisationally capable of operating the plants professionally. The operating condition of the sites is rated as good to very good.

– In the long term, it will be necessary to make even greater use of (even more energy-intensive) seawater desalination processes. Potential ecological effects, as well as the efficiency of the distribution networks, will be important factors.

# Ex post evaluation – rating according to OECD-DAC criteria

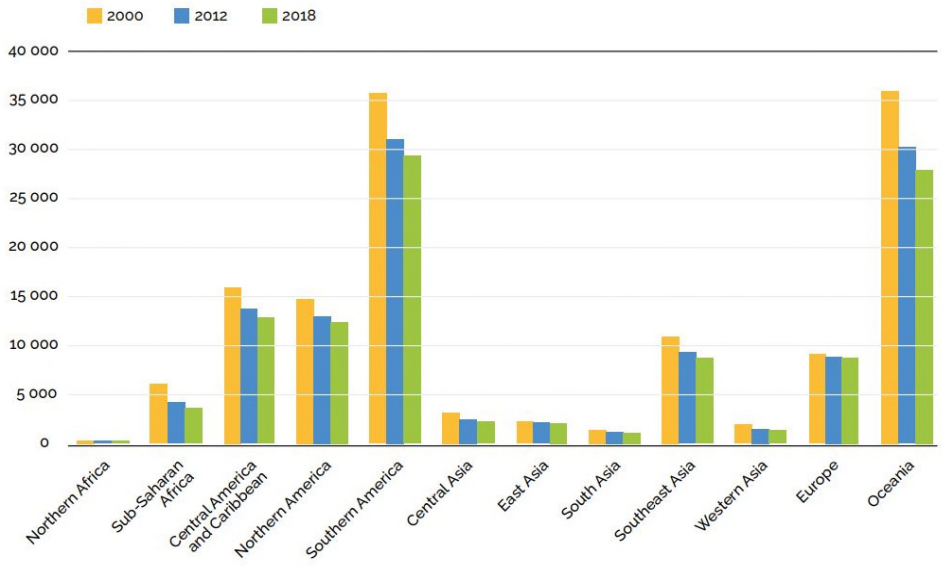
## Overview of partial evaluations:

| | |
|---|---|
| Relevance | 2 |
| Coherence | 1 |
| Effectiveness | 3 |
| Efficiency | 4 |
| Impact | 3 |
| Sustainability | 3 |
| **Overall rating:** | **3** |

## General conditions and classification of the project

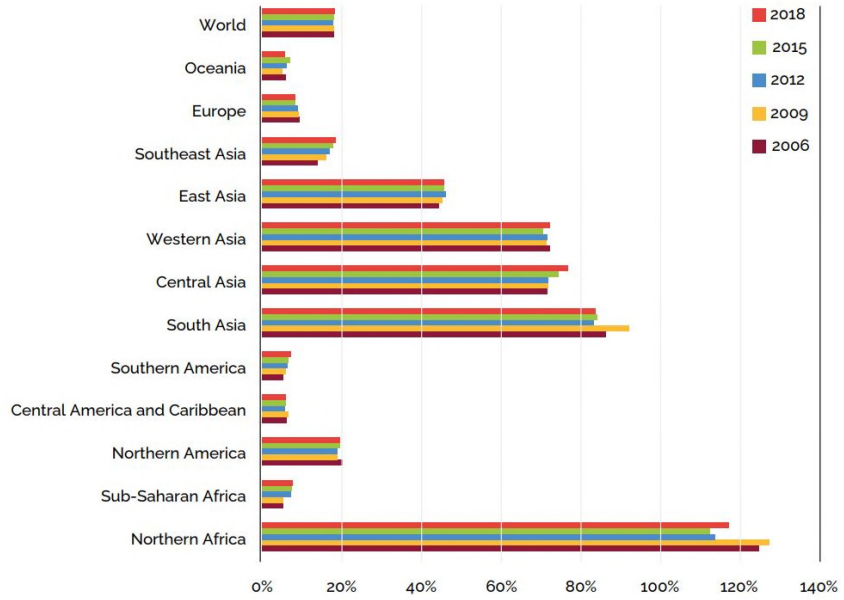
In order to better classify the project, the acute supply problems in the project region are illustrated here. It should be noted that North Africa is one of the world's regions most affected by water stress. The following two graphs illustrate the development and severity of the situation there:

**Total annual renewable water volume per capita in global comparison:**



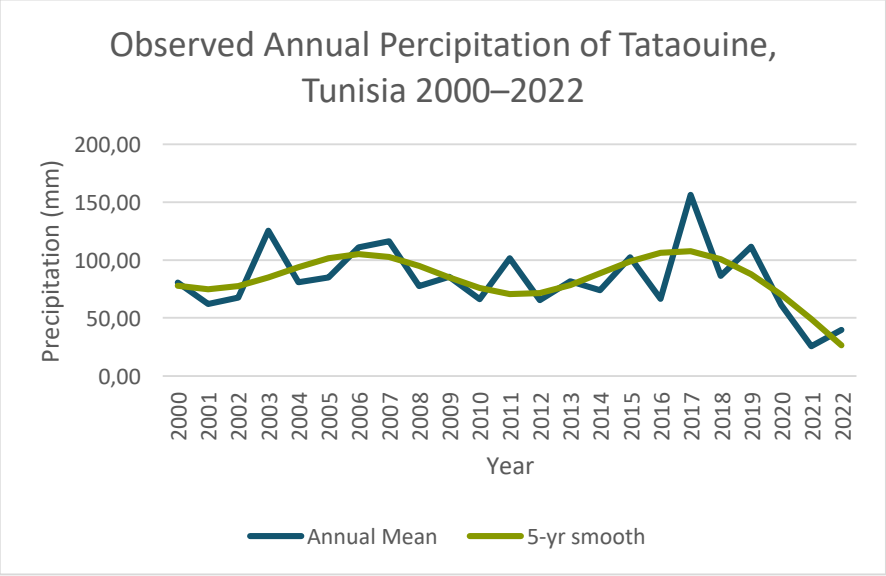

Source: FAO/Aquastat 2021

**Development of water stress in global comparison**[1]




Source: FAO/Aquastat 2021

Tunisia has a very low renewable specific water volume (345 m³/capita p.a.)[2] and is therefore in a state of ongoing water scarcity (absolute water scarcity, < 500 m³/capita p.a.). Ground water is in short supply and has been over-used for decades (often through illegal drilling for agricultural irrigation). At the same time, both ground water and agricultural land becomes salinated in many places. In addition to this long-term development, Tunisia has been experiencing a drought since 2017, which further delays the replenishment of ground water reserves. The declining precipitation volumes can be easily seen in the following diagramme:

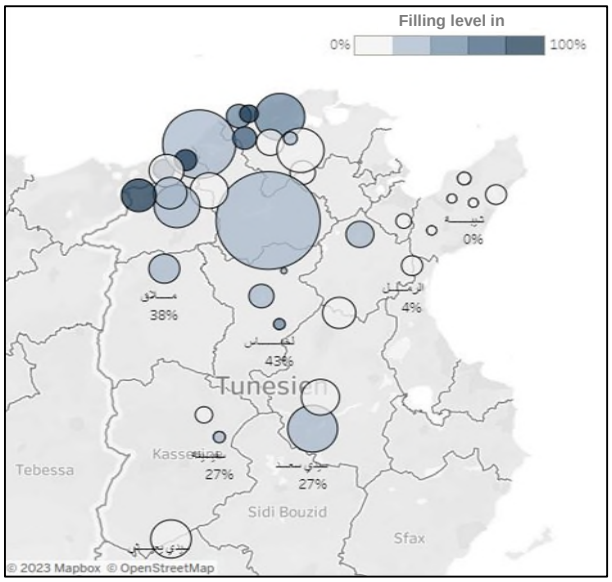



Source: World Bank Climate Change Knowledge Portal (CCKP 2020) Tunisia Climatology Historical Data. URL Tunisia – Climatology | Climate Change Knowledge Portal (worldbank.org)

[1] shows the percentage ratio of water withdrawal to water availability
[2] Source: World Data Bank (2020)

This creates further bottlenecks in the water supply. Despite emergency measures announced in April 2023 ranging from irrigation bans to night-time water shutoffs, even in the capital of Tunis, the population's water supply remains critical, which currently also manifests in the extremely low levels of the country's most important drinking water reservoirs (see figure, on average 32% as at 20 September 2023).

**Levels in drinking water reservoirs/dams as at 20 September 2023**




Source: Observatoire National de l´Agriculture

## Brief description of the project

The project to be evaluated is a module within the open DC programme "Integrated Water Resource Management (IWRM)". To desalinate mineral-heavy ground water, the project financed the construction of ten decentralised brackish water desalination plants with a total capacity of 36,200 m³/day and their integration into the supply network, the capacity expansion of two existing plants in Djerba and Gabès by a further 12,500 m³/day, as well as measures to improve the network infrastructure at the Sidi Makhlouf, Dkhilet/Toujane and Halg Jmal sites to desalinate mineral-rich ground water.

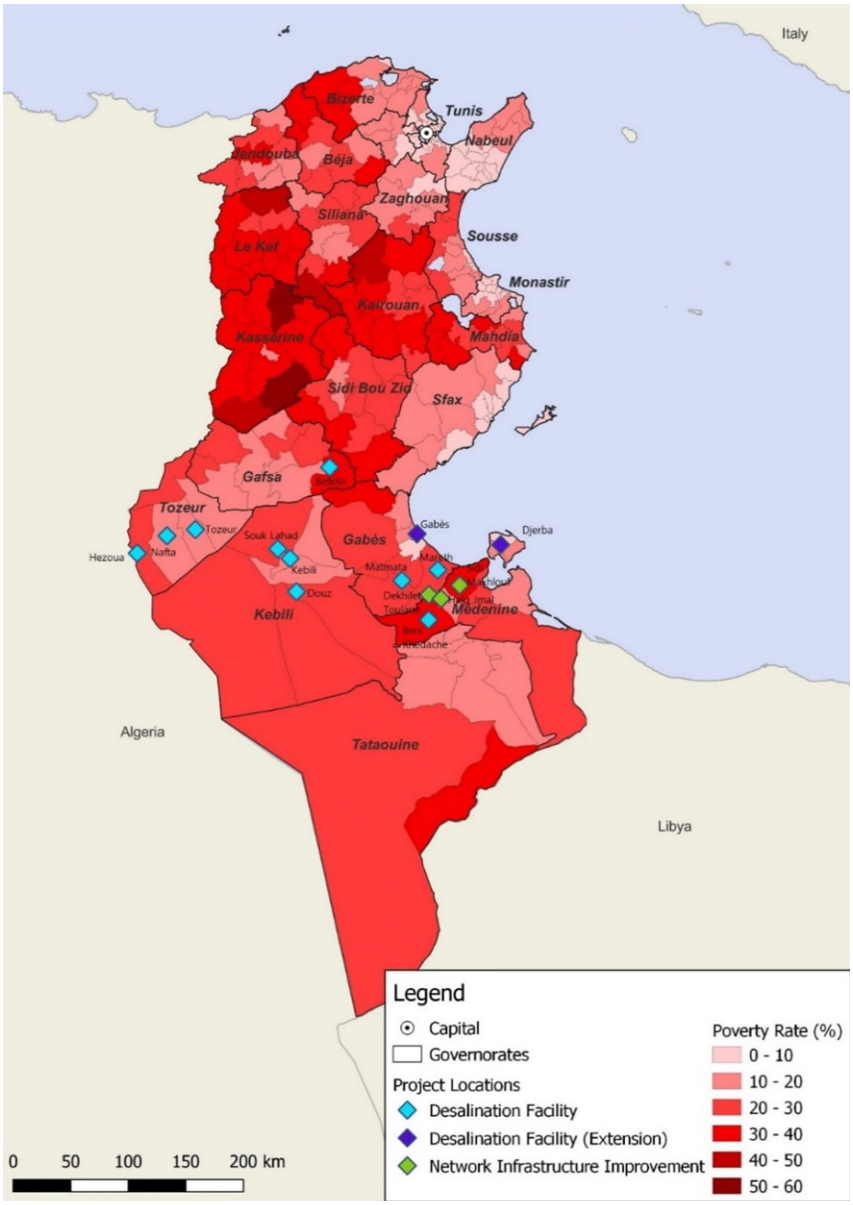
At the time of the programme appraisal, the target group comprised around 550,000 inhabitants distributed over the supply area of the project's planned plant sites in the governorates of Kebili, Tozeur, Gabès and Médenine. The population development was estimated at 840,000 residents for the 2020 design year, which nearly corresponds to the actual development until 2022 (829,000 residents).

The construction or expansion of the desalination plants accounts for more than 90% of the total investment volume. These are therefore at the heart of the ex post evaluation's thematic interest.

## Breakdown of total costs

| In EUR million | Inv. (planned) | Inv. (actual) |
|---|---|---|
| **Investment costs (total)** | **41.6** | **60.7** |
| Counterpart contribution | 16.6 | 36.2 |
| Debt financing | 25.0 | 24.5 |
| *of which BMZ budget funds* | *25.0* | *24.5* |

## Map/satellite image of the project country including project areas



## Evaluation according to OECD-DAC criteria

## Relevance

### *1. Policy and priority focus*

At the time of project design (2002), the project fully complied with the requirements of the Tunisian National Development Plan (2002–2006) and the Contrat programme of SONEDE (Société Nationale d'Exploitation et de Distribution des Eaux, state-owned water utility)[3] that focused on these. One strategic objective is the improvement of the water supply. This is set to be achieved on the one hand by improving the supply of drinking water in the districts and on the other hand by improving the quality of the drinking water, which often has high salinity, especially in the south of the country. At the same time, the project also contributes to implementing the right to drinking water, which has been enshrined in constitutional law since 2014. In addition, the Tunisian development strategy is increasingly aiming to support the population in disadvantaged regions. Due to its focus on the disadvantaged south of the country, the project to be evaluated also fits well into this strategy from today's perspective.

At the same time, the programme was in line with the German Federal Ministry for Economic Cooperation and Development (BMZ) sector concept of "water and sanitation" during project planning. From today's perspective, the project is also consistent with the German Federal Ministry for Economic Cooperation and Development's (BMZ) country strategy for Tunisia. The protection of natural resources is also anchored among the four core themes. In the Tunisian context, this particularly concerns the drinking water problem. German DC is advising Tunisia on making more efficient and sustainable use of its water resources, which are becoming increasingly scarce. These include the reform of water law, but also investment in water infrastructure and the sustainable use of resources, with the aim of stabilising the water supply, reducing poverty and preventing conflicts.

The quality characteristics for German DC can be found in the project to be evaluated, in particular in connection with the human right to water and the fight against inequalities, especially as the project sites focus on the poorer, disadvantaged population of southern Tunisia. Within the regional target group, the programme also has the potential to provide the poorest parts of the population (who cannot access bottled drinking water) with drinking water of good quality.

The project works well in the light of Tunisia's political and institutional framework conditions. SONEDE is the obvious project-executing agency for the planned measures with regard to organisational responsibility and technical competence. In fact, there are no other alternatives.

### *2. Focus on needs and capacities of participants and stakeholders*

At the time of the project appraisal, the availability of drinking water in Tunisia was the decisive prerequisite for the socio-economic development of entire regions, and this remains the case today. This applies in particular to agriculture, which uses around 80% of water resources with its large irrigation areas in northern and central Tunisia, but also increasingly applies to industrial development.

In contrast to the north of Tunisia, the south of Tunisia does not have significant quantities of surface water and almost exclusively mobilises ground water to meet the water needs of the various users. The core problem relates to securing an adequate drinking water supply for the population with the scarce resources available. However, at the time of the project appraisal, there were significant deficits in the context of southern Tunisia's water supply at all levels, which still exist today. On the one hand, as previously shown, water resources are very scarce and in some cases have qualitative deficits (e.g. salinity). On the other hand, there is not enough capacity available to treat the water. Finally, large parts of the SONEDE distribution network are dilapidated, leading to frequent supply interruptions and quality impairments. This project – as part of German DC's comprehensive involvement in the Tunisian drinking water sector – focuses on the lack of treatment capacities. From the perspective of the evaluation, part of the core problem was therefore correctly identified. However, other factors (raw water availability, distribution) outside the planned project's sphere of influence are decisive for ensuring the drinking water supply.

[3] Multi-year contractual agreement between the Tunisian government and SONEDE

The project addresses the needs of particularly vulnerable parts of the target group. Tunisia is one of the countries in the world with the highest consumption of bottled drinking water (225 l/capita p.a., compared to France 160 l/capita p.a.)[4]. Large parts of the population do not wish to drink mains water and prefer to buy water in bottles. On the one hand, this would reduce the relevance of the project, because improved water quality mainly has a positive effect when consumed directly. On the other hand, the programme therefore benefits primarily the poorer sections of the population, which are usually connected to the mains network (provided they live in locations with a central water supply). They are often not able to afford bottled water regularly (costs: around 1 dinar for 1.5 l, equates to approximately EUR 0.30) and use either (precipitation-dependent) cistern water[5](which is also often contaminated with pathogens) or mains water from SONEDE. This part of the target group therefore benefits the most from the quality of the drinking water provided by SONEDE due to a lack of alternatives.

Discrimination between parts of the target group when accessing the project capacities is implausible at the locations, as the entire population is connected to the mains network. At the most, discrimination in the context of location selection would be conceivable. However, there are no corresponding indications that the choice of location might have led to discrimination against ethnic minorities (i.e. Berbers).

***3. Appropriateness of design***

The project design envisaged desalination of the saline ground water reserves following their extraction through deep wells and pretreatment with sand filters. The reverse osmosis procedure was used at all sites (with the exception of the Belkhir site; see section on Efficiency). This is a widespread and easily controlled procedure for brackish and seawater desalination. For the financial suitability of the concept, the question of cheaper alternatives arises (see section on Allocation efficiency). Desalination results in costs for the energy used, which were however able to be covered by appropriate tariff increases that were considered plausible at the time of the project appraisal.

The results chain can be described as follows: The construction of the desalination plants creates capacities for the project-executing agency to treat saline ground water (output). At the plants, the salinity of the treated water can be reduced to comply with Tunisian drinking water standards, and the treated ground water can be safely offered as drinking water and fed into SONEDE's distribution networks, as well as being used by the local target group (outcome). The improved water quality should result in an improvement in the health situation of the population accessing this water (impact). The measure should also help to conserve water resources.

In addition, the project intended to contribute to the conservation of natural water resources. As the project-executing agency confirms, improved water quality goes hand in hand with an immediate increase in water demand (all the more so as SONEDE's largely dilapidated distribution networks experience high technical losses). Along with the unavoidable process-related unaccounted for water (approx. 20–25% as concentrated retentate) in the course of desalination, it becomes clear that the operation of the plants will ultimately always adversely impact ground water resources. However, this is unavoidable in order to supply the population. In addition, any lower-lying, shallower freshwater resources could also benefit, as these would be protected by the use of the lower-lying saline water.

Therefore, the results chain also appears valid from today's perspective. However, as already explained under Question 2, there are prerequisites for validity that lie outside the project's impact scope. In particular, sufficient availability of raw water (which is regarded in the log frame matrix as a prerequisite for the health effects of the project (impact target), but in fact is a prerequisite for ensuring that the population has access to water supply (outcome target)), but also ensuring the quantitatively and qualitatively appropriate distribution of water in the SONEDE mains network, are decisive factors for objective achievement. In addition, a health effect can be expected in particular if large parts of the population consume mains water directly. This was still assumed at the time of the appraisal; from today's perspective, the context must be viewed critically. Since 2010 alone, the consumption of bottled water has almost tripled from 80 litres per capita per year to 225 litres. It can therefore be assumed that health effects can only be achieved in the poor parts of the population, which usually consume mains water directly.

[4] Source: Tunisian Forum for Economic and Social Rights (FTDES)
[5] Ministère de l'Agriculture, des Ressources Hydrauliques et de la Pêche, Rapport National du secteur de l´eau, Année 2020

The design of the project is considered to be sufficiently precise. The indicators for supply performance are sufficiently verifiable, and corresponding data was provided by SONEDE, but the targets at the overall objective level are not measurable (health effects) or achievable (protection of water resources). In principle, the project addresses holistic and sustainable development of the target region, with water supply as a basic condition for all social and ecological development. However, sufficient availability of water resources is a prerequisite. This is not something that the project is able to influence.

The project was audited as part of the open DC programme “Integrated Water Resource Management”. In addition to reducing losses in the SONEDE networks and improving the collection rate of the rural water supply, its indicators in the drinking water supply subsector are also aimed at creating capacities for desalination of brackish and sea water. In this respect, the project is consistent with the objectives of the DC programme.

***4. Response to changes/adaptability***

There were no significant deviations from the project planning during its implementation. However, the framework conditions changed compared to the parameters expected during project planning.

The population figures at the 12 locations ultimately approximated the planned figures assumed at the time of the appraisal. A census in 2004 (after the project appraisal) showed that the initial figures were somewhat too high. Nevertheless, the forecast values had been more or less reached as at 2022 (plan: 840,000 inhabitants, actual: 829,000).

However, no overdimensioning of the plants could be identified in relation to the number of inhabitants supplied with water, so no adjustment of the design was necessary (however, overdimensioning could be identified in relation to ground water availability; see section on Efficiency).

The development of ground water availability in recent years since commissioning of the plants has proved to be unexpectedly problematic. The project no longer had any influence on this, but the project-executing agency carried out additional drilling on its own initiative to ensure the usability of the FC-financed facilities.

***Summary of the rating***

In view of the urgency of the supply situation in southern Tunisia and the potential contribution of the measures to adequate supply of the population in the project area, the relevance of the programme is evaluated as good. The overarching objectives formulated as part of the project appraisal that go beyond the provision of services to the population (health situation and resource protection) are assessed as too ambitious in view of the low number or complete lack of possibilities for the project to have an influence and should be addressed by other measures.

**Relevance: 2**

## Coherence

***5. Internal coherence***

The project is part of German DC’s comprehensive involvement in the drinking water supply in rural and suburban areas of Tunisia. It is also part of the open DC programme “Integrated Water Resource Management”. FC and TC work in a largely complementary manner in this regard, with regular coordination meetings taking place on the most important issues. These regular coordination meetings also include donors from other countries in the sector (see Question 6). Cooperation between FC and TC in the implementation of the IWRM approach will be further expanded in the coming years. The institutional strengthening of the Bureau de Planification et des Equilibres Hydrauliques (“Planning Office for Water Balance”) by TC is additionally important in this regard.

Tunisia’s sectoral policy has been guided by IWRM guidelines for some time, although in recent years the use of unconventional water resources, including saline ground water, has also inevitably become more important.

The various German DC elements and actors interact in a meaningful way. TC also promotes the regional, sustainable use of water resources. Together with public, private and civil society organisations, solutions for resource-conserving agriculture and rural development are developed, which result in drinking water being valued

and used economically. FC finances investments in drinking water infrastructure (including capacity building in the area of brackish and sea water desalination). This involves not only building up and expanding capacities, but also addressing urgently required rehabilitation measures for the Tunisian distribution network (e.g. as part of the programme "Improving efficiency in the networks of SONEDE / Programme d'Amélioration des Performances de la SONEDE (PNAQ)", the second phase of which is currently being prepared). Investments in the drinking water sector are complemented by FC's widespread involvement in the Tunisian waste water sector.

The programme is consistent with the norms and standards of German DC and is part of efforts to ensure that the population is able to exercise its human right to drinking water. The project is in line with Sustainable Development Goal (SDG) 6 "Clean Water and Sanitation". There are no discernible inconsistencies between the project and international norms and standards.

***6. External coherence***

The measures complement the own efforts of SONEDE, which fulfils its tasks at other locations in the country without external development financing and has financed certain components within the project itself (e.g. laboratory facilities). Overall, the majority of the financing for the project to be evaluated was contributed directly by the Tunisian side (planned 40%, actual 60%); the FC contribution granted as a development loan is properly repaid.

German DC is one of the most important donors to the Tunisian drinking water sector. Other important donors are the AFD, EIB, IDB, JICA, ADB, IBRD (World Bank) and EBRD. Cooperation with these donors is constructive and characterised by regular coordination meetings among the international partners active in the Tunisian water sector, known as PTF rounds (Partenaires Techniques et Financiers). There is therefore successful donor coordination in the water sector, in which German DC plays a leading role.

Implementation and operation of the project build on SONEDE's existing role in water supply. This is supported/expanded by the use of treatment-intensive water resources – or the improvement of low quality resources.

***Summary of the rating:***

From today's perspective, the programme's coherence can be evaluated as very good.

**Coherence: 1**

## Effectiveness

***7. Achievement of (intended) targets***

The objective of the project at outcome level was to ensure an adequate supply of hygienically sound drinking water to the population of selected locations in south Tunisia all year round. The achievement of the project objectives defined at the project appraisal can be summarised as follows:

**Outcome target achievement table:**

| Indicator | Status during PA | Target value PA/EPE | Actual value at final inspection (optional) | Actual value at EPE |
|---|---|---|---|---|
| Indicator 1 (PA) Annual utilisation rate (peak demand) of the installed demineralisation plants (incl. expansions) | n/a | >75% | 7–98% | 7–82% predominantly not achieved |
| Indicator 2 (PA) Total number of the population who are direct | n/a | >90% | N/A | >99%<br><br>achieved |

| | | | | |
|---|---|---|---|---|
| beneficiaries of the programme reaches 90% of the forecast values | | | | |
| Indicator 3 (PA) Drinking water complies with Tunisian standards (RS< 2.0 g/l) | Average: 2.4 g/l | < 1.5 g/l | 1.0–2.3 g/l | 1.0–3.0 g/l partially achieved |
| Indicator 4 (PA) Average desalinated water volume reaches 5.3 million m³/year | n/a | 5.3 million m³ | 6.7 million m³ | 4.2 million m³ not achieved |
| Indicator 5 (PA) Average amount of drinking water provided reaches 11.1 million m³/year | n/a | 11.1 million m³ | N/A | 20.4 million m³ achieved |
| Indicator 6 (PA) Utilisation rate of transfer lines reaches an annual average of 70% | n/a | >75% | N/A | 98% |

After commissioning of the plants, operation was restricted at some sites, as the constructed evaporation ponds into which the brine is discharged were not large enough and the water evaporated more slowly than calculated in the project planning. In order to prevent the brine from leaking into the surrounding landscape, some plants had to be temporarily shut down or their operation had to be restricted depending on weather conditions (wind, insufficient evaporation). This shortcoming has now been rectified, as SONEDE has acquired additional land in the meantime and significantly increased the size of the affected evaporation ponds.

Indicator 1: The capacity utilisation of the desalination plants varied between 7% and 22% of the total capacity of the plants in 2022. The average was only 36%, and only one plant (Hezoua) achieved the target of 75%. The low capacity utilisation is generally not due to technical reasons, but to the scarcity of available ground water resources, which were not sufficient for a higher capacity utilisation of the plants, as the desalination process additionally reduces the available quantity of retentate[6] that arises (see evaluation question 3). SONEDE responds to this (preliminary) stress situation by reaching or exceeding the limits for permissible salinity in the treated water. These limits are reached or exceeded when feeding into the desalination system is minimised and mixing with non-desalinated ground water is maximised.

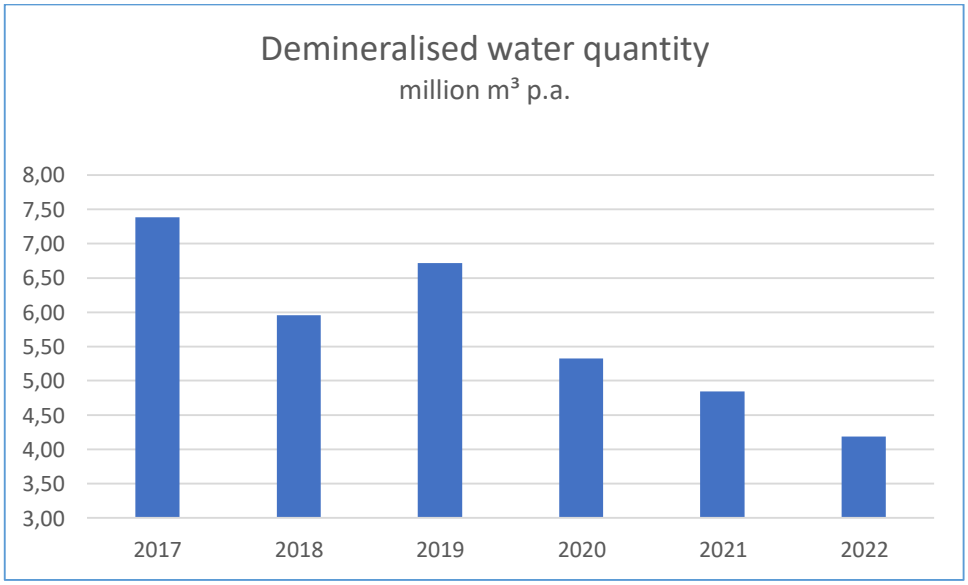
Indicator 2: The percentage of the population that is reached is taken into account. From the perspective of the evaluation, it does not seem expedient to establish this on the basis of the population development forecast at the PA. A possible overdimensioning of the created plants could be measured this way – but Indicator 1 (capacity utilisation) can already be used for this. Instead, the proportion of the population within the project locations that actually benefits from the programme is measured for the EPE. Since almost the entire population in the project locations is connected, this figure is close to 100%.

Indicator 3: At the time of the EPE, the quality of the drinking water, measured by the dry matter content (résidu sec/RS) of the produced water, only reached the target value (<1.5 g/l) outlined at the PA at three locations (Hezoua, Nafta, Djerba). However, the indicator defined during the PA aimed at compliance with the Tunisian drinking water standards, which stipulate a dry substance content of 2.0 g/l, which – depending on the season – is only achieved at around half of the locations. This is directly related to the failure to achieve the target values for Indicator 1. In the FI (2019), the values were even lower, but with the ongoing drought and increasing water

[6] I.e. substance retained by the membranes

shortage, SONEDE had to prioritise quantitative supply performance over water quality at most locations and was only able to desalinate to a correspondingly lower extent. According to SONEDE, these problems can be felt particularly during periods of high demand (i.e. summer months). In addition, the salinity of the raw water at some sites has deteriorated significantly since the PA (e.g. from 2.1 to 2.8 g/l at the Douz site).

Indicators 4 and 5: The quantitative targets – which are only evaluated here on the basis of the newly built desalination plants (without expansion investments) for reasons of data consistency – must be viewed in a differentiated manner. The quantity of desalinated water ultimately corresponds to the capacity utilisation considered for Indicator 1. With a calculated full utilisation of the plants, a total quantity of 13.2 million m³ of desalinated water could be obtained; the planned value at the PA was 7.3 million m³ for 2020. In fact, only 4.1 million m³ of water was desalinated. Since the capacity utilisation aspect is already included in the evaluation with Indicator 1, it is not re-evaluated with Indicator 4. However, it should be noted that the volume of desalinated water was significantly higher in previous years and, with volumes between 5.3 and 7.4 million m³, the target volume defined in the PA (5.3 million m³) was clearly achieved in the years 2017–2020. The clear downwards trend in recent years can be seen in the following diagramme. At the same time, the total volume of produced (mixed) drinking water increased slightly in the period under review.




Source: own data

Indicator 5 addresses the quantitative supply target and, with 20.4 million m³ of water produced per year (desalinated water mixed with raw water), significantly exceeds the planned quantities calculated at the PA (15.8 million m³) and the target value of the indicator (11.1 million m³). The quantitative supply target is therefore considered to have been achieved.

Indicator 6: The installed transfer lines are almost fully utilised at 98%.

***8. Contribution to achieving targets***

The outputs of the programme were delivered in accordance with the design planning at PA: the desalination capacities have been built and are available to date. However, the declining use of desalination capacities due to the framework conditions limits the impact of the programme at outcome level. Nevertheless, from the perspective of the EPE – in view of the necessary quantitative minimum supply for the population – the resulting quality losses are still considered to be justifiable (and without alternatives), which relativises the failure to achieve the indicator target values (Question 7).

The noticeable improvements in water quality despite the aforementioned restrictions benefit the entire population – almost the entirety of which is connected to the mains network at the project sites – without discrimination. The very low water tariffs are also affordable for the poorest parts of the population. The project therefore made a clear contribution to achieving the formulated module objective – especially at population level. The selection of

the project locations (south Tunisia) addressed a region that can be regarded as disadvantaged and vulnerable, not least due to the precarious water supply.

The project was not able to meaningfully address gender impact potential at target group level. However, it became clear during the course of the mission that many management positions at the executing agency SONEDE are occupied by female staff (e.g. Djerba District Manager, Manager of the Kebili/Douz sites as well as Gabès and the Gabès Laboratory Manager).

Project-external factors are decisive for the limitation with regard to the outcome of the project, primarily the increasingly critical ground water availability. From today's perspective, it is not possible to estimate whether climatic conditions in the region will continue to deteriorate in the coming years. In this case, the need for limited desalination would also have a long term effect.

***9. Quality of implementation***

The quality of the infrastructure visited as part of the EPE is evaluated positively. In detail, conceptual improvements would be possible (e.g. enclosure of the sand filter systems to protect the UV-sensitive plastic parts). In several cases, the size of the evaporation ponds for the separated brine did not meet the actual requirements, so that subsequent, in some cases significant expansions had to be undertaken by SONEDE to prevent regular overfilling of the ponds (Matmata and Belkhir sites).

The project was only initially managed with the help of an international consultant and suffered many considerable delays (see Efficiency section / Question 11). As already stated in the report, it is recommended that SONEDE be supported by an international consultant in large and complex investment programmes.

***10. Unintended consequences (positive or negative)***

With the exception of some complaints (e.g. an inoperative emergency shower), there were no indications of deficiencies in occupational safety or cleanliness / environmental impacts at the visited locations. The project had unintended negative effects for a period, as the underdimensioned evaporation ponds occasionally overflowed and brackish water flowed into the natural environment. These effects have now been eliminated following expansion of the ponds by SONEDE. No further unintended effects were observed.

***Summary of the rating***

The project met the key objectives with regard to securing the population's water supply. However, a quantitatively sufficient supply could only be achieved with limited desalination. Accordingly, the target indicators relating to water quality and capacity utilisation have largely not been achieved in recent years. Nevertheless, the project is still regarded as moderately successful.

**Effectiveness: 3**

## Efficiency

***11. Production efficiency***

Converted to the number of people reached, the specific costs of the desalination plants (new buildings and expansions) including further investments at the sites are EUR 80/inhabitant. However, this value is not very meaningful, as in this case only a certain part of the supply service (processing/desalination) was the focus. Existing elements of the supply system continued to be used, resulting in a lack of comparability with other projects. From today's perspective, the funds used appear to be appropriate for the project output; a more favourable approach is not apparent. The construction contracts were tendered nationally or internationally (desalination plants), depending on the requirements. The implementation of the project was occasionally supported by an international consultant. The share of consulting costs in the total costs of the project was very low at around 1% (see next paragraph).

Project implementation suffered many significant delays. The project appraisal assumed full completion in 2008 (project duration 44 months). In fact, only the expansion measures at the Gabès and Djerba sites were

completed by this time. Due to problems in the tendering procedure, the other installations could only be put into operation successively from October 2015. Further approvals were made until 2019 (project duration: 176 months). According to project reporting, this is not only due to bureaucratic obstacles with regard to the competent Tunisian authorities, but also to the low involvement of the international implementation consultant. On the one hand, the consultant's involvement was limited to intermittent assignments, and on the other hand, the consulting contract expired in mid-2013, six years before the end of the last construction measures. According to project reporting, this was a deficit in implementation. Closer support of SONEDE by an international consultant has already been recommended for future complex investment projects in the course of ongoing project reporting in order to ensure timely implementation. The events of the Arab Spring from 2010 onwards and the associated uncertainties also contributed to the delay in the project.

Another important factor for the efficiency of the project is the distribution of the treated water. Given the extremely scarce water resources, pipeline losses are particularly important in this case. Extraction of the drinking water including the desalination process is a lengthy process, and treatment is energy intensive. It is then fed into the SONEDE pipeline network, where it is susceptible to loss and contamination. According to official data from SONEDE, all distribution networks in the southern regions have higher losses than the national average (23.7%). In the Gafsa and Gabès pipeline networks, which receive desalinated water from the project plants, the losses are estimated at 40% and 44% respectively[7]. Although the rehabilitation of the SONEDE distribution network is addressed by other projects (including as part of FC), distribution efficiency remains a limiting factor for the efficiency of the evaluated project. Added to this is the very high specific consumption for a water-poor region. With regard to the locations of the newly installed desalination plants, consumption for 2022 has been calculated to stand at around 170 litres per capita per day, including pipeline losses.

***12. Allocation efficiency***

There are general alternatives to the project approach with regard to the choice of water origin in particular. In addition to treating ground water, desalination of sea water is also a good option. This method is being used more and more in southern Tunisia, even though it is even more energy intensive[8].

Ultimately, sea water desalination and brackish water treatment are complementary approaches. While limited ground water resources in turn limits the scope for desalination of brackish water, it offers the advantage of significantly lower energy and overall producing costs compared to sea water desalination.

In addition, there was also the option of securing the supply of southern parts of the country by creating long-distance water pipes that start in the wetter areas in the north. Independent of economic considerations, it can be seen today that water scarcity – and ultimately the distribution battle for the scarce resource – has increased significantly at national level. In particular, the drought that has continued since 2016 has also led to supply bottlenecks in what has so far been the relatively "water-rich" north of the country and significant restrictions (e.g. on agricultural irrigation) have come into force. Therefore, a supra-regional water transfer would meanwhile be associated with a considerable potential for usage conflicts.

The project also attempted to identify optimisation potential when selecting the technology to be used for the desalination plants. A study carried out before the project's implementation had shown that, under certain framework conditions (dimensioning of the plant, salinity of the raw water), an alternative technology (electrodialysis) has efficiency advantages. Almost all the installed desalination plants utilise the widely used reverse osmosis process. However, the Belkhir plant is an exception here; this plant uses the electrodialysis process as a consequence of the study results. However, with regard to its technology, this plant is an isolated case, as it is the only facility in Tunisia that is using this process. In the operator's point of view, this choice of technology entails considerable problems in the procurement of spare parts (e.g. electrodes, dialysis membranes), as there are no suitable suppliers in Tunisia due to a lack of demand. This means that for very small order quantities, complex procurement processes must be carried out in order to make purchases from suppliers abroad. From today's perspective, the comparison of alternatives was expedient in the PA: in the end, however, it would have been advantageous to standardise the technology of the plants throughout.

[7] Source: SONEDE, Rapport des statistiques année 2021

[8] Sea water desalination plants in south Tunisia: Djerba (50,000 m³/day, in operation since 2018, FC-financed), Zarat (50,000 m³/day, almost completed, FC-financed), Sfax (100,000 m³/day, under construction), Sousse (100,000 m³/day, under construction), further plants currently in the planning process.

When considering whether efficient supply is provided in the sense of cost-covering tariffs, the question arises as to whether an isolated analysis of the project sites is an expedient approach. On the one hand, the production costs due to desalination are higher than at other Tunisian sites where desalination is not necessary. On the other hand, there is a uniform tariff system throughout the country, which implicitly goes hand in hand with imputed cross-subsidisation of sites with higher production costs. A cost-covering, site-specific tariff increase – measured against the local production costs of the project sites – would therefore not be effective. The relevant question of covering of the costs therefore lies at the level of the entire company SONEDE.

The comparison of SONEDE's operating income and expenditure shows a continuous deficit for recent years, with the lowest value registered in 2019 with a cost coverage of 71% – this value increased to 97% at the end of 2022. Since 2016, the shortfalls have resulted in consistent net losses amounting to TND 203 million (EUR 67 million at the exchange rate at the time) for 2019. For 2022, SONEDE still reported losses of TND 20 million (EUR 6 million). Further tariff increases are envisaged (at the time of the EPE, a corresponding application has been made to the responsible ministry for approval).

***Summary of the rating***

The project did not aim to improve losses in the SONEDE distribution network. Nevertheless, these losses play a significant role in whether the project achieves its objectives efficiently. This is all the more true because desalination means that the costs of drinking water that is fed into the pipeline network are relatively high. SONEDE's improved operating cost coverage must also be put into perspective, as the operating costs are far from sufficient to adequately maintain or rehabilitate the existing distribution networks. According to SONEDE, across a period of several years, only a fraction[9] of the necessary network rehabilitations have been carried out, so the problem will continue to intensify. Against this background, the efficiency of the project can no longer be evaluated as successful.

**Efficiency: 4**

## Impact

***13. Overarching developmental changes (intended)***

In light of the events of the Arab Spring, Tunisian society has been undergoing profound change since 2011, in which greater political participation and constitutional societal objectives (such as gender equality) face high political and economic risks. Terrorist threats from home and abroad add to these risks, and also pose a threat to the country's economic and political stability. Against this backdrop, too, the poor economic situation (e.g. due to the slump in tourism revenues after several terrorist attacks and during the COVID-19 pandemic) can be seen. This leads to radicalisation, especially of younger people, who lack future prospects due to inadequate opportunities for employment[10] and no improvement in their living conditions. Water plays an important role at various levels, as sufficient water availability is essential for the economic development of tourism, agriculture and industry. At the same time, the population's fragile situation hampers unpopular political decisions (e.g. tariff increases, restrictions on ground water withdrawal, legal prosecution of the construction of illegal wells). Against the backdrop of overutilised ground water reserves and supply bottlenecks, the drinking water sector is characterised by both heavy pressure to act and strong sensitivities. Therefore, an improved supply is regarded as having a high potential influence. Despite the improvements achieved as part of the project, climate change and the recent drought have had a negative impact on the reliability of the water supply for the entire southern Tunisia region. The availability of ground water is in an increasingly critical state. SONEDE is trying to counteract this – partly with FCs support and partly with aid from other donors – by utilising more cost-intensive alternative water resources (particularly sea water desalination). In addition to the existing sea water desalination plant on Djerba, three plants (Gabès, Sfax and Sousse) are currently under construction. Additional plants are in the planning stage.

[9] According to SONEDE, approximately 1,000km of lines require rehabilitation each year. However, rehabilitation is in fact only carried out on around 100km of these.
[10] Unemployment rate among 15–24-year-olds: 38% as at June 2023 (source: Institut National de la Statistique Tunisie)

*14. Contribution to overarching developmental changes (intended)*

The project was designed to improve the population's living conditions while taking ecological concerns into account. Insofar as this is understood to be an improvement of the environmental situation, these objectives appear to be only partially compatible with each other. Reliable supply for the population in these regions is to a certain extent linked to overutilisation of water reserves or energy-intensive treatment of drinking water.

However, it should be noted that the provision of treated drinking water makes a direct contribution to improving the living conditions of the population and to their subjective satisfaction. The rural exodus as well as national and international migration are taking place due to a variety of factors. Nevertheless, it can be safely assumed that the project will have positive and lasting effects for the population residing in the programme region. At least at the project sites, the quality of drinking water has improved, which makes a positive contribution to the living conditions of the population.

However, the health effects associated with quality improvement are likely to be limited. Only a very small proportion of the population consumes mains water from the SONEDE distribution network for drinking; most people prefer to consume bottled water. The low level of confidence in the quality of the mains water is underpinned by corresponding official research. According to a report by the Direction de l'Hygiène du Milieu et de la Protection de l'Environnement (agency for hygiene and environmental protection), 10.6% of water samples in 2021 were bacteriologically contaminated according to applicable standards[11]. The dilapidated mains network and the resulting frequent supply interruptions are also likely to play a role in this aspect.

FC's long-standing partnership with SONEDE is to be evaluated as positive. Today, the FC enjoys a high level of trust from Tunisian partners in the sector.

*15. Contribution to (unintended) overarching developmental changes*

It is estimated that across the globe, around 95 million m³ of drinking water is extracted through desalination of sea and brackish water each day; around half of this takes place in the MENA region. The desalination of sea water and brackish water produces around 140 million m³ brine per day worldwide, of which approximately 100 million m³ is produced in the MENA region[12]. Brine and possibly chemical residues spread into the sea (such as is the case at the Gabès, Djerba and Matmata sites), which may have negative environmental impacts. The concrete effects of this fundamental problem cannot be adequately investigated as part of the EPE. However, appropriate studies[13] should be consulted before designing corresponding plants, and alternative disposal options for the produced brine should be examined if necessary.

*Summary of the rating*

Despite the critical situation of the drinking water supply in southern Tunisia overall, the project's contribution is viewed as positive. The project's impact is therefore evaluated as successful.

**Impact: 3**

## Sustainability

*16. Capacities of participants and stakeholders*

The technical condition of the inspected plants can be described as good to very good. The qualifications of the SONEDE employees on site, including laboratory staff, are also to be evaluated positively. Two other factors are

[11] Ministère de l'Agriculture, des Ressources Hydrauliques et de la Pêche : Rapport National de l´Eau 2021

[12] Edward Jones, Manzoor Qadir, Michelle T.H. van Vliet, Vladimir Smakhtin, Seong-mu Kang, The state of desalination and brine production: A global outlook, Science of The Total Environment, Volume 657, 2019, Pages 1343–1356, ISSN 0048-9697, https://doi.org/10.1016/j.scitotenv.2018.12.076.

[13] E.g. Mariam N. Soliman, Fatima Z. Guen, Somaya A. Ahmed, Haleema Saleem, Mohd Junaid Khalil, Syed Javaid Zaidi, Energy consumption and environmental impact assessment of desalination plants and brine disposal strategies, Process Safety and Environmental Protection, 2021

decisive for the future operation of the plants: SONEDE's financial situation on the one hand, and the availability of ground water on the other.

As already shown in the Efficiency section (Question 12), SONEDE has recently approached imputed operating cost coverage again after several years of sometimes high losses. This was achieved by imposing significant restrictions on maintenance and rehabilitation expenditure (e.g. mains network). Overdue rehabilitation tasks are addressed – in part through FC projects (e.g. National d'amélioration de la qualité programmes). The existing deficits, in particular the largely dilapidated distribution network, will also significantly affect the efficiency of SONEDE's water supply in the coming years.

The Tunisian state holds all of SONEDE's capital. Although SONEDE does not receive regular subsidies, due to the fundamental importance of SONEDE's water supply, sufficient support from government budgets will be available to ensure operations, even in the event of negative financial developments. This has also been demonstrated with recent negative developments. In 2019, a comprehensive recapitalisation programme totalling TND 253 million (approx. EUR 76 million) was agreed upon for SONEDE. This is meant to compensate for the losses incurred in the years 2008–2017, which also came about due to suspended tariff increases.

The future availability of ground water appears to be in a much more critical state. This depends on further meteorological and climatic developments and can therefore not be comprehensively predicted. Declining ground water tables already mean that new boreholes must be made to enable the plants to operate and to safeguard supply for the population (see also Question 18).

***17. Contribution to supporting sustainable capacities***

From a strictly business perspective, it can be assumed that, instead of strengthening SONEDE's financial situation, the project will place an additional financial burden on it. The energy-intensive treatment of the water in the desalination plants leads to comparatively high production costs. However, these are unavoidable due to a lack of alternative water resources. At the same time, the political and socio-economic objectives (ensuring the provision of the basic infrastructure, improving living conditions in disadvantaged areas, avoiding social unrest and mitigating migration movements) require safeguarding of natural resources for the rural population living in the central and southern hinterland of Tunisia.

***18. Durability of impacts over time***

The stability of the project context can be assessed as fragile – also see Question 13 – and the quality of the water supply remains a decisive factor for the stability of the region. In addition to the political and socio-economic framework conditions, the sustainability of the project effects is also impaired by the (over)use of fossil ground water sources, which only renew over a very long period. Since there are not enough fresh water resources available in the southern parts of the country, new ways must be found in the long term to ensure continued drinking water supply in the programme locations. Sea water desalination is particularly important here. Transfers of raw water from other regions with a surplus of water that were planned a few years ago are now looking more unrealistic. The acute water scarcity has now also spread to the northern parts of Tunisia and there are no more "excess" quantities of water available. The Tunisian government is aware of this problem and is working to counteract it in cooperation with international donors, including German DC, as part of the implementation of the Integrated Water Resource Management (IWRM) concept.

***Summary of the rating***

The project appears to be sustainable in technical, staffing and financial terms. However, this is all dependent on the utilisation of ever deeper ground water reserves and further climatic development. The region's future water supply is not expected to be guaranteed if cost-intensive resources are not utilised. These include the Mediterranean Sea with desalination of sea water and even more economical use of the resource. Sustainability of the impacts is therefore evaluated as moderately successful.

**Sustainability: 3**

## Overall rating: 3

Overall, the project is rated as moderately successful from the point of view of the ex post evaluation.

## Contributions to the 2030 Agenda

By improving the water supply in southern Tunisia, the project sites are making a positive contribution to the living conditions of all residents. This goes hand in hand with safeguarding the region's economic basis, where long-term development is not possible without significant investments in a reliable water supply. The project makes a direct contribution to SDG 6 (Clean Water and Sanitation). In addition, involvement in a disadvantaged region contributes to reducing inequalities (SDG 10). At the same time, the already visible effects of climate change are also mitigated (SDG 13). To this end, the existing national water supply capacities are being exploited and expanded. The project is part of a comprehensive coordinated commitment by German DC and other international donors in the sector.

## Project-specific strengths and weaknesses as well as cross-project conclusions and lessons learned

The project had the following strengths and weaknesses in particular

- Experienced and technically competent project-executing agency with state financial support
- Use of appropriate technology for desalination plants
- Distribution of drinking water via dilapidated SONEDE network: as a result, there were frequent supply interruptions and also the potential for pathogens to get into the water supply
- Limited financial capacity of the project-executing agency due to tariffs that are too low
- Due to cumbersome procurement procedures at national level, implementation was significantly delayed

Conclusions and lessons learned:

- As part of the project reporting, it was already recognised that large and complex investment programmes should also be supported by an internationally experienced implementation consultant, if possible, even for high-performance executing agencies such as SONEDE, in order to ensure faster implementation. Local consulting skills and the executing agencies' human resources are not sufficient for this in many partner countries.
- Especially in the case of cost-intensive drinking water production and scarce water resources, efficient water distribution should be given particularly high priority. If applicable, network rehabilitation projects or locations with already rehabilitated networks can be prioritised.
- The use of mains water as drinking water is unusual in large parts of Tunisian society. This results in high consumption of water from plastic bottles. Establishing confidence in the safety of drinking water is a long-term process that requires significant improvements in the quality of drinking water in distribution networks and then measures to raise awareness.

## Evaluation approach and methods

### Methodology of the ex post evaluation

The ex post evaluation follows the methodology of a rapid appraisal, which is a data-supported qualitative contribution analysis and constitutes an expert judgement. This approach ascribes impacts to the project through plausibility considerations which are based on a careful analysis of documents, data, facts and impressions. This also includes – when possible – the use of digital data sources and the use of modern technologies (e.g. satellite data, online surveys, geocoding). The reasons for any contradicting information are investigated and attempts are made to clarify such issues and base the evaluation on statements that can be confirmed by several sources of information wherever possible (triangulation).

Documents:
Internal and external project documentation, studies on desalination issues, country/sector analyses, media reports

Data sources and analysis tools:
Available executing agency data, publicly available data relating to the drinking water situation

Interview partners:
SONEDE employees at management level in Tunis and at the sites, randomly selected users of the water supply in the project area, representatives of the local authorities visited

The analysis of impacts is based on assumed causal relationships, documented in the results matrix developed during the project appraisal and, if necessary, updated during the ex post evaluation. The evaluation report sets out arguments as to why the influencing factors in question were identified for the experienced effects and why the project under investigation was likely to make the contribution that it did (contribution analysis). The context of the development measure and its influence on results is taken into account. The conclusions are reported in relation to the availability and quality of the data. An evaluation concept is the frame of reference for the evaluation.

On average, the methods offer a balanced cost-benefit ratio for project evaluations that maintains a balance between the knowledge gained and the evaluation costs, and allows an assessment of the effectiveness of FC projects across all project evaluations. The individual ex post evaluation therefore does not meet the requirements of a scientific assessment in line with a clear causal analysis.

The following aspects limit the evaluation:
Due to the significant geographical expansion of the project area, only a sample of seven of the total of 12 desalination sites could be visited within the available time window.

## Methods used to evaluate project success

A six-point scale is used to evaluate the project according to OECD DAC criteria. The scale is as follows:

**Level 1** very successful: result that clearly exceeds expectations

**Level 2** successful: fully in line with expectations and without any significant shortcomings

**Level 3** moderately successful: project falls short of expectations but the positive results dominate

**Level 4** moderately unsuccessful: significantly below expectations, with negative results dominating despite discernible positive results

**Level 5** unsuccessful: despite some positive partial results, the negative results clearly dominate

**Level 6** highly unsuccessful: the project has no impact or the situation has actually deteriorated

The overall rating on the six-point scale is compiled from a weighting of all six individual criteria as appropriate to the project in question. Rating levels 1-3 of the overall rating denote a “successful” project while rating levels 4-6 denote an “unsuccessful” project. It should be noted that a project can generally be considered developmentally

“successful” only if the achievement of the project objective (“effectiveness”), the impact on the overall objective (“impact”) and the sustainability are rated at least “moderately successful” (level 3).

## List of abbreviations:

| | |
|---|---|
| AFD | Agence Française de Développement |
| ADB | African Development Bank |
| FI | Final inspection |
| GDP | Gross domestic product |
| BMZ | German Federal Ministry for Economic Cooperation and Development |
| DAC | Development Assistance Committee |
| EBRD | European Bank for Reconstruction and Development |
| EIB | European Development Bank |
| EUR | Euro |
| FC | Financial cooperation |
| FC E | FC evaluation |
| HDI | Human Development Index |
| IBRD | International Bank for Reconstruction and Development (World Bank Group) |
| JICA | Japan International Cooperation Agency |
| PA | Project appraisal |
| PAR | Project appraisal report |
| PNAQ | Programme National d’Amélioration de la qualité (FC-financed project) |
| PP/PA | Project proposal / project appraisal |
| RS | Résidu sec (dry matter content) |
| SONEDE | Société Nationale d’Exploitation et de Distribution des Eaux, state water supplier |
| TND | Tunisian Dinar |
| TC | Technical cooperation |
| USD | US Dollar |

## Publication details

**Responsible**
FC E
Evaluation department of KfW Development Bank
FZ-Evaluierung@kfw.de



KfW Group
Palmengartenstrasse 5–9
60325 Frankfurt am Main, Germany

## List of annexes:

Target system and indicators annex

Risk analysis annex

Project measures and results annex

Recommendations for operation annex

Evaluation questions in line with OECD DAC criteria/ex post evaluation matrix annex

## Target system and indicators annex

| Project objective at outcome level | Rating of appropriateness (former and current view) |
|---|---|
| During project appraisal: Ensuring that the population of selected locations in southern Tunisia is supplied with hygienically sound drinking water in accordance with WHO guidelines and Tunisian standards all year round. | Appropriate, although checking all WHO parameters is not realistic. The focus here is on compliance with the parameter for salinity (<1.5 g/l) |
| During EPE (if target modified) | |

| Indicator | Rating of appropriateness (appropriate; partially appropriate; not appropriate) | Rationale of appropriateness (for example, regarding impact level, accuracy of fit, target level, smart criteria) | PA target level<br>Optional: EPE target level | PA status (year) | Status at final inspection (year) | Optional: EPE status (year) |
|---|---|---|---|---|---|---|
| Indicator 1 (PA) Annual utilisation rate (peak demand) of the installed demineralisation systems | Appropriate | Dimensioning of the plants | >75% | | 7–98% | 7–82%<br>predominantly not achieved |
| Indicator 2 (PA) Total number of the population who are direct beneficiaries of the programme reaches 90% of the forecast values | Appropriate<br>Note: the actual population development is used as the basis. This deviates downwards from the forecast at the PA (90% – value is therefore 280,000 instead of 432,000 PE.) | Range of supply | >90% | | N/A | >99%<br>achieved |
| Indicator 3 (PA) Drinking water complies with Tunisian standards (RS< 1.5 g/l) | Appropriate | Quality of supply, assuming that SONEDE also monitors other water quality parameters. | < 1.5 g/l | | 1.0–2.3 g/l | 1.0–3.0 g/l<br>predominantly not achieved |

| | | | | | | |
|---|---|---|---|---|---|---|
| Indicator 4 (PA) Average desalinated water volume reaches 5.3 million m³/year (= 75% of the annual volume) | Partially appropriate | Ultimately redundant with Indicator 1 (capacity utilisation/dimensioning of the systems) – is considered, but is not additionally included in the evaluation. | 5.3 million m³ | | 6.7 million m³ | 4.2 million m³ not achieved |
| Indicator 5 (PA) Average quantity of drinking water provided reaches 11.1 million m³/year (= 75% of annual quantity) | Appropriate | Scope of supply. Clarification of "provided quantity": the amount of drinking water provided in terms of utilisation of the supply capacities (mixture of desalinated water and raw water) is considered. However, it is not clear which locations are considered here – for the purposes of the EPE, the ten locations with newly built desalination plants are considered and set in relation to the specific planned quantities at PA | 11.1 million m³ | | N/A | 20.4 million m³ achieved |
| Indicator 6 (PA) Utilisation rate of transfer lines reaches an annual average of 70% | Appropriate | Use of transfer pipelines | >75% | | N/A | 98% |

| **Project objective at impact level** |
|---|
| During project appraisal: sustainable improvement of the living conditions of the population in disadvantaged urban and rural regions of Tunisia on the basis of a balanced water inventory and taking ecological concerns into account. This project contributes both to improving drinking water quality and to security of supply. |
| During EPE (if target modified): |

## Risk analysis annex

| Risk | Relevant OECD-DAC criterion |
|---|---|
| Achievement of objectives at outcome level (occurred in particular for capacity utilisation targets) | Effectiveness, efficiency |
| Non-compliance with project schedule | Efficiency |
| Insufficient tariff income, e.g. to cover maintenance costs and replacement investments: did not occur at the level of the investments considered, but downstream (distribution network) | Sustainability, impact |
| Insufficient availability of raw water, difficult to foresee in the future | Effectiveness, efficiency, sustainability |

## Project measures and their results annex

| | Envisaged measure | | Implemented measure | |
|---|---|---|---|---|
| | Number | Capacity | Number | Capacity |
| Desalination plant, New building | 10 | 35.200m$^3$/day | 10 | 36.350m$^3$/day |
| Desalination plant, expansion | 2 | 13.500m$^3$/day | 2 | 12.500m$^3$/day |
| Well | 8 | 311 l/s | 7 | 485 l/s |
| Cistern | 6 | 10.000m$^3$ | 7 | 11.000m$^3$ |
| Conveyor pipeline | 239km | n.a. | 222km | n.a. |

## Recommendations for operation annex

Construction defects were found at the time of the final inspection (2019), and not all structures had yet been accepted. A number of smaller recommendations, which have now been implemented, relate to the rectification of the deficiencies and the pending acceptances.

In addition, there were a number of recommendations to improve occupational safety. These appear to be largely implemented at the time of the evaluation mission. In isolated cases, however, deficiencies (e.g. non-functional emergency showers) were still observed in this area.

One recommendation referred to fixing leaks within the desalination plants. These fixes have now been carried out; there were no corresponding complaints by the operating units visited as part of the EPE.

From the perspective of the evaluation, the staffing of the production facilities appears to be sufficient, and the corresponding recommendation has therefore also been implemented. This applies not only to the quantitative human resources, but also to the level of training of the staff spoken to.

The planned implementation of remote data transmission of operating data from the desalination plants is still pending

.

## Evaluation questions in line with OECD-DAC criteria/ex post evaluation matrix annex

# Relevance

| Evaluation question | Specification of the question for the present project | Data source (or rationale if the question is not relevant/applicable) | Rating | Weighting ( - / o / + ) | Rationale for weighting |
|---|---|---|---|---|---|
| Evaluation dimension 1: Policy and priority focus | | | 2 | o | |
| 1.1 Are the programme's objectives aligned with the (global, regional and country-specific) policies and priorities, in particular those of the (development policy) partners involved and affected and of the BMZ? | Did the objective correspond to the specifications and priorities of the Tunisian government and DC in the Tunisian context? | Progress review 2013<br><br>German Federal Ministry for Economic Cooperation and Development (BMZ) country strategy for Tunisia, August 2022<br><br>Source: Resolution adopted by the General Assembly on 28 July 2010<br>[without reference to a Main Committee (A/64/L.63/Rev.1 and Add.1)]<br>64/292. The human right to water and sanitation<br><br>Discussion with SONEDE: are there comparable locations without desalination? How does the drinking water supply work there?<br><br>PA | | | |
| 1.2 Do the programme's objectives take into account the relevant political and institutional framework conditions (e.g. legislation, administrative capacity, actual power structures (including those related to ethnicity, gender, etc.))? | Did the objective correspond to the specifications and priorities of the Tunisian government and DC in the Tunisian context? | PA | | | |

| | | | | | |
|---|---|---|---|---|---|
| Evaluation dimension 2: Focus on needs and capacities of participants and stakeholders | | | 2 | o | |
| 2.1 Are the programme objectives focused on the target group's developmental needs and capacities? Was the core problem identified correctly? | Was improving the drinking water supply in the project area a relevant need in the target region?<br><br>Is it applied in the right area? Is the use of water not included in Tunisia (80% goes to agriculture, export of virtual water) | | | | |
| 2.2 Were the needs and capacities of particularly disadvantaged or vulnerable parts of the target group taken into account (possible differentiation according to age, income, gender, ethnicity, etc.)? How was the target group selected? | Were there any criteria in the location selection that could have led to disadvantages? | | | | |
| 2.3 Would the programme (from an ex post perspective) have had other significant gender impact potentials if it had been designed differently? (FC-E-specific question) | No specification required | Question not relevant as no additional gender impact was expected. | | | |
| Evaluation dimension 3: Appropriateness of design | | | 1 | o | |
| 3.1 Was the programme's design appropriate and realistic (technically, organisationally and financially) and in principle suitable for contributing to solving the core problem? | Would a parallel reduction in mains losses have been expedient in view of the scarce resources (and the energy-intensive desalination)? | SONEDE: current amount of unaccounted for water<br><br>According to the PA, the losses at the time were 15%, i.e. completely acceptable. | | | |
| 3.2 Is the programme design sufficiently precise and plausible (transparency and verifiability of the target system and the underlying impact assumptions)? | No specification required | Reporting | | | |

| | | | | | |
|---|---|---|---|---|---|
| 3.3 Were the selected indicators and their value allocation appropriate in their entirety (select one of the following to answer: indicators and values were appropriate / partially appropriate / not appropriate)? The rationale is differentiated according to indicators in Appendix 1. (FC-E-specific question) | No specification required | See above | | | |
| 3.4 Please describe the results chain, incl. complementary measures, in the form of a graphical representation if applicable. Is this plausible? As well as specifying the original and, if necessary, adjusted target system, taking into account the impact levels (outcome and impact). The (adjusted) target system can also be displayed graphically. (FC-E-specific question) | | PA / impact matrix | | | |
| 3.5 To what extent is the programme's design based on a holistic approach to sustainable development (interplay of the social, environmental and economic dimensions of sustainability)? | Were social, environmental and economic aspects taken into account in the design? | PA | | | |
| 3.6 For projects within the scope of DC programmes: is the programme, based on its design, suitable for achieving the objectives of the DC programme? To what extent is the impact level of the FC module meaningfully linked to the DC programme (e.g. outcome impact or output outcome)? (FC-E-specific question) | Does the programme contribute to improving the living conditions of the population in disadvantaged urban and rural regions<br>of Tunisia based on a balanced water inventory and environmental sustainability? | PA | | | |
| Evaluation dimension 4: Response to changes/adaptability | | | 2 | o | |

| | | |
|---|---|---|
| 4.1 Has the programme been adapted in the course of its implementation due to changed framework conditions (risks and potential)? | Have external developments (declining water availability, lower population growth) led to adjustments to the project? | PCR |

## Coherence

| Evaluation question | Specification of the question for the present project | Data source (or rationale if the question is not relevant/applicable) | Rating | Weighting ( - / o / + ) | Rationale for weighting |
|---|---|---|---|---|---|
| Evaluation dimension 5: Internal coherence (division of tasks and synergies within German development cooperation): | | | 1 | o | |
| 5.1 To what extent is the programme designed in a complementary and collaborative manner within German DC (e.g. integration into DC programme, country/sector strategy)? | No specification required | PCR/PP<br>Progress review February 2017<br>Progress review March 2018 | | | |
| 5.2 Do German DC's instruments dovetail in a conceptually meaningful way within the scope of the programme, and are synergies put to use? | Were there also TC measures for SONEDE (or at ministerial level) and, if so, were they synergistic with FC? | Discussions with SONEDE | | | |
| 5.3 Is the programme consistent with international norms and standards to which<br>German development cooperation is committed (e.g. human rights, Paris Climate Agreement, etc.)? | No specification required | PA/<br>Reporting | | | |
| Evaluation dimension 6: External coherence (complementarity and coordination with actors external to German DC): | | | 1 | o | |

| | | |
|---|---|---|
| 6.1 To what extent does the programme complement and support the partner's own efforts (subsidiarity principle)? | | Check on site: are the laboratories available and functional? |
| 6.2 Is the programme's design and implementation coordinated with the activities of other donors? | | Reporting<br><br>German Federal Ministry for Economic Cooperation and Development (BMZ) country strategy Tunisia August 2022 |
| 6.3 Was the programme designed to use the existing systems and structures (of partners / other donors / international organisations) for the implementation of its activities and to what extent are these used? | | Reporting and discussions with SONEDE |
| 6.4 Are common systems (of partners / other donors / international organisations) used for follow-up / evaluation, learning and accountability? | Not relevant, no such systems known. | |

## Effectiveness

| Evaluation question | Specification of the question for the present project | Data source (or rationale if the question is not relevant/applicable) | Rating | Weighting ( - / o / + ) | Rationale for weighting |
|---|---|---|---|---|---|
| Evaluation dimension 7: Achievement of (intended) targets | | | 3 | o | |
| 7.1 Were the (if necessary, adjusted) programme objectives (incl. capacity development measures) achieved? Table of indicators: Comparison of actual/target | See indicators | Questionnaire and discussions SONEDE and PCR | | | |

| | | | | | |
|---|---|---|---|---|---|
| Evaluation dimension 8: Contribution to achieving objectives: | | | 3 | o | |
| 8.1 To what extent were the programme's outputs delivered as planned (or adapted to new developments)? *(Learning/help question)* | No specification required | Project completion report section 2.02 | | | |
| 8.2 Are the outputs delivered and the capacities created used? | - Table analogous to PCR section 4.08<br>- Unclear: what does capacity utilisation "during peak periods" mean ? What period is considered there, one day? If a sufficiently small period under review is selected, 100% capacity utilisation will always be reached (if the system was switched on at some point)<br>- Also: do the desalination plants cover all the raw water used in the locations? | Questionnaire and discussions SONEDE | | | |
| 8.3 To what extent is equal access to the outputs delivered and the capacities created guaranteed (e.g. non-discriminatory, physically accessible, financially affordable, qualitatively, socially and culturally acceptable)? | Is the entire area of the town covered by the supply? Or are there still unsupplied areas of the town? Were these already unsupplied at PA?<br><br>Comparison of income/tariffs | Questionnaire and discussions SONEDE.<br><br>Research on the income situation in Tunisia | | | |
| 8.4 To what extent did the programme contribute to achieving the objectives? | No specification required | Project documentation | | | |
| 8.5 To what extent did the programme contribute to achieving the objectives at the level of the intended beneficiaries? | Has the salinity of the drinking water improved?<br>Is the water used by consumers? | Project documentation, PCR, SONEDE questionnaire (Important: for questionnaires, make sure that mains losses are not included in consumption! (see PCR 4.06.) | | | |
| 8.6 Did the programme contribute to the achievement of objectives at the | Do all residents of the locations benefit equally? With a 100% connection rate, | Income research Tunisia<br>Relationship to water prices | | | |

| | | | | | |
|---|---|---|---|---|---|
| level of particularly disadvantaged or vulnerable groups involved and affected (potential differentiation according to age, income, gender, ethnicity, etc.)? | this would be the case, but are there any unconnected quarters/households that do not benefit from the measures? How can the affordability of water be seen? | Table with tariffs for SONEDE water prices | | | |
| 8.7 Were there measures that specifically addressed gender impact potential (e.g. through the involvement of women in project committees, water committees, use of social workers for women, etc.)? (FC-E-specific question) | Not relevant, as effects are not gender-specific | | | | |
| 8.8 Which project-internal factors (technical, organisational or financial) were decisive for the achievement or non-achievement of the programme's intended objectives? *(Learning/help question)* | Why does salinity in many cases continue to exceed the limit values despite treatment? (internal project factors) | Discussions with SONEDE, questionnaire | | | |
| 8.9 Which external factors were decisive for the achievement or non-achievement of the programme's intended objectives (also taking into account the risks anticipated beforehand)? *(Learning/help question)* | Why does salinity in many cases continue to exceed the limit values despite treatment? (external project factors) | Discussions with SONEDE, questionnaire | | | |
| Evaluation dimension 9: Quality of implementation | | | 3 | o | |
| 9.1 How is the quality of the management and implementation of the programme to be evaluated with regard to the achievement of objectives? | No specification required | Questionnaire/discussion with SONEDE | | | |
| 9.2 How is the quality of the management, implementation and participation in the programme by the partners/sponsors evaluated? | No specification required | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 9.3 Were gender results and relevant risks in/through the project (gender-based violence, e.g. in the context of infrastructure or empowerment projects) regularly monitored or otherwise taken into account during implementation? Have corresponding measures (e.g. as part of a CM) been implemented in a timely manner? (FC-E-specific question) | Not relevant, as effects are not gender-specific | | | | |
| Evaluation dimension 10: Unintended effects (positive or negative) | Note: if there are **no** unintended effects:<br>➔ No weighting<br>➔ No evaluation | | | | |
| 10.1 Can unintended positive/negative direct impacts (social, economic, environmental and, if applicable, those affecting vulnerable groups) be seen (or are they foreseeable)? | What is the background of vandalism at the supply facilities (progress review 2012)?<br>Are there any environmental problems resulting from the operation of the desalination plants? | Discussions with SONEDE<br>Discussions with community representatives | | | |
| 10.2 What potential/risks arise from the positive/negative unintended effects and how should they be evaluated? | To be considered depending on the actual unintended effects that have occurred | | | | |
| 10.3 How did the programme respond to the potential/risks of the positive/negative unintended effects? | To be considered depending on the actual unintended effects that have occurred | | | | |

## Efficiency

| Evaluation question | Specification of the question for the present project | Data source (or rationale if the question is not relevant/applicable) | Rating | Weighting ( - / o / + ) | Rationale for weighting |
|---|---|---|---|---|---|
| Evaluation dimension 11: Production efficiency | | | 4 | o | |

| | | | | | |
|---|---|---|---|---|---|
| 11.1 How are the programme's inputs (financial and material resources) distributed (e.g. by instruments, sectors, sub-measures, also taking into account the cost contributions of the partners / executing agency / other participants and affected parties, etc.)? (Learning and help question) | Cost & Financing Table | PCR 2021 | | | |
| 11.2 To what extent were the programme's inputs used sparingly in relation to the outputs produced (products, capital goods and services; if possible in a comparison with data from other evaluations of a region, sector, etc.)? For example, comparison of specific costs. | What are the specific costs per resident supplied? | Project documentation / PCR | | | |
| 11.3 If necessary, as a complementary perspective: To what extent could the outputs of the programme have been increased by an alternative use of inputs (if possible in a comparison with data from other evaluations of a region, sector, etc.)? | Considered under allocation efficiency, see below. | | | | |
| 11.4 Were the outputs produced on time and within the planned period? | Were cost and time schedules adhered to? | Project documentation, discussions with SONEDE | | | |
| 11.5 Were the coordination and management costs reasonable (e.g. implementation consultant's cost component)? (FC-E-specific question) | No specification required | | | | |
| Evaluation dimension 12: Allocation efficiency | | | 4 | + | The significant underutilisation of the plants represents a significant lack of efficiency, although this is |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | caused by external factors |
| 12.1 In what other ways and at what costs could the effects achieved (outcome/impact) have been attained? *(Learning/help question)* | Has the alternative provision of drinking water via long distance pipelines been considered? Is this realistic? And where should the water come from? | Discussions with SONEDE | | | |
| 12.2 To what extent could the results achieved have been attained in a more cost-effective manner, compared with an alternatively designed programme? | Question can only be specified if alternative project approach is possible – is considered in previous question. | | | | |
| 12.3 If necessary, as a complementary perspective: To what extent could the positive effects have been increased with the resources available, compared to an alternatively designed programme? | See above | | | | |
| Note: If the internal identifier PSP (Private Sector Participation; see Inpro under 1.11) was issued for the project or there is generally cooperation with private actors (commercial banks, companies, professional NGOs) in the implementation of FC (private sector as an instrument), the following evaluation question must be taken into account: | | | | | |
| 12.4 In what respect was the use of public funds financially complementary? | No specification necessary | | | | |

## Impact

| Evaluation question | Specification of the question for the present project | Data source (or rationale if the question is not relevant/applicable) | Rating | Weighting ( - / o / + ) | Rationale for weighting |
|---|---|---|---|---|---|
| Evaluation dimension 13: Overarching developmental changes (intended) | | | 3 | o | |
| 13.1 Is it possible to identify overarching developmental changes to which the programme should contribute? (Or if such changes are foreseeable for the future, please be as specific as possible in terms of time.) | The aim was to improve the supply based on a balanced water inventory (was this a realistic goal at all?) | Discussions with communities | | | |
| 13.2 Is it possible to identify overarching developmental changes (social, economic, environmental and their interactions) at the level of the intended beneficiaries? (Or if such changes are foreseeable for the future, please be as specific as possible in terms of time) | Have the target group's living conditions improved? | Data on supply and water quality (SONEDE)<br><br>Is there specific health data? (but impact probably more long term)<br><br>Discussions with communities | | | |
| 13.3 To what extent can overarching developmental changes be identified at the level of particularly disadvantaged or vulnerable parts of the target group to which the programme was intended to contribute? (Or, if such changes are foreseeable for the future, please be as specific as possible in terms of time) | Have living conditions among poorer parts of the population developed in the same way? | Discussions with communities<br><br>(also see connection rate: with connection rates close to 100%, it can be assumed that all parts of the population are connected) | | | |
| Evaluation dimension 14: Contribution to overarching developmental changes (intended) | | | 3 | o | |
| 14.1 To what extent did the programme actually contribute to the identified or | To what extent did the project affect the balance of the water inventory? | | | | |

| | | |
|---|---|---|
| foreseeable overarching developmental changes (also taking into account the political stability) to which the programme was intended to contribute? | | |
| 14.2 To what extent did the programme achieve its intended (possibly adjusted) developmental objectives? In other words, are the project impacts sufficiently tangible not only at outcome level, but at impact level? (e.g. drinking water supply/health effects) | Has the programme contributed to an improved health situation? | Studies on the health implications of drinking water salinity (e.g. Health Implications of Drinking Water Salinity in Coastal Areas of Bangladesh – PMC (nih.gov)) |
| 14.3 Did the programme contribute to achieving its (possibly adjusted) developmental objectives at the level of the intended beneficiaries? | Covered by previous question | |
| 14.4 Did the programme contribute to overarching developmental changes or changes in life situations at the level of particularly disadvantaged or vulnerable parts of the target group (potential differentiation according to age, income, gender, ethnicity, etc.) to which the programme was intended to contribute? | Has the improved supply situation had a particularly strong impact on the poorer parts of the population (possibly because they presumably drink mains water)? | Discussions with communities |
| 14.5 Which project-internal factors (technical, organisational or financial) were decisive for the achievement or non-achievement of the programme's intended developmental objectives? *(Learning/help question)* | | |
| 14.6 Which external factors were decisive for the achievement or non-achievement of the programme's intended developmental objectives? *(Learning/help question)* | | |

| | | | | | |
|---|---|---|---|---|---|
| 14.7 Does the project have a broad-based impact?<br>- To what extent has the programme led to structural or institutional changes (e.g.in organisations, systems and regulations)? (Structure formation)<br>- Was the programme exemplary and/or broadly effective and is it reproducible? (Model character) | How big is the salinity problem at national level? Can/should the project be replicated at other locations? | Discussions with SONEDE | | | |
| 14.8 How would development have gone without the programme (developmental additionality)? | | Discussions with SONEDE<br>Discussions with communities | | | |
| Evaluation dimension 15: Contribution to (unintended) overarching developmental changes | Note: if there are **no** unintended effects:<br>➔ No weighting<br>➔ No evaluation | | 3 | o | |
| 15.1 To what extent can unintended overarching developmental changes (also taking into account political stability) be identified (or, if such changes are foreseeable for the future, please be as specific as possible in terms of time)? | How is the (increasing?) extraction of ground water in the project area to be interpreted in the long term? Does the situation regarding water supply at all allow for sustainable settlement within the current scope? | | | | |
| 15.2 Did the programme noticeably contribute to unintended (positive and/or negative) overarching developmental impacts, or are such impacts foreseeable for the future? | Were there any negative environmental impacts as a consequence of the measures? | On-site visits<br>Discussions with communities<br>Discussions with SONEDE | | | |
| 15.3 Did the programme noticeably contribute to unintended (positive or negative) overarching developmental changes at the level of particularly disadvantaged or vulnerable groups | Were there any negative effects at target group level?<br>For example, negative impacts on poorer parts of the population when water prices need to be increased | Discussions with communities. | | | |

| | | |
|---|---|---|
| (within or outside the target group; do no harm, e.g. no strengthening of inequality (gender/ethnicity)), or are such changes foreseeable for the future? | | |

## Sustainability

| Evaluation question | Specification of the question for the present project | Data source (or rationale if the question is not relevant/applicable) | Rating | Weighting ( - / o / + ) | Rationale for weighting |
|---|---|---|---|---|---|
| Evaluation dimension 16: Capacities of participants and stakeholders | | | 3 | o | |
| 16.1 Are the target group, executing agencies and partners institutionally, personally and financially able and willing (ownership) to ensure that the programme's positive effects continue over time (after the end of the promotion)? | On a financial and staffing level, is SONEDE able to sustain the supply? | Annual financial statements SONEDE<br><br>SONEDE questionnaire (also inquire about the subsidy requirements) | | | |
| 16.2 To what extent do the target group, executing agencies and partners demonstrate resilience to future risks that could jeopardise the impact of the programme? | How is the resilience to further ground water scarcity or soil salinity to be assessed?<br>Resilience to rising energy costs?<br>What happens in the event of a (not groundless) state bankruptcy? | Discussions with SONEDE | | | |
| Evaluation dimension 17: Contribution to supporting sustainable capacities: | | | 3 | o | |
| 17.1 Did the programme contribute to the target group, executing agencies and partners being willing (ownership) on an institutional, staffing and financial level to ensure that the programme's positive effects continue over time and, | In addition to the desalination systems, have measures also been taken to reduce consumption/losses? Would this have been indicated? | Project documentation<br><br>SONEDE questionnaire | | | |

| | | | | | |
|---|---|---|---|---|---|
| where necessary, to curb negative effects? | | | | | |
| 17.2 Did the programme contribute to strengthening the resilience of the target group, executing agency and partners to risks that could jeopardise the effects of the programme? | No specification required | | | | |
| 17.3 Did the programme contribute to strengthening the resilience of particularly disadvantaged groups to risks that could jeopardise the effects of the programme? | No specification required | | | | |
| Evaluation dimension 18: Durability of impacts over time | | | 4 | o | |
| 18.1 How stable is the programme's context (e.g. social justice, economic performance, political stability, environmental balance)? *(Learning/help question*) | How can the ecological balance – especially a balanced water inventory – be evaluated? | | | | |
| 18.2 To what extent is the durability of the programme's positive effects influenced by the context? *(Learning/help question)* | Are there any relevant migration movements?<br>How is the real income of the population developing (and the "affordability" of drinking water)? | Discussions with communities<br><br>Development of payments received in recent years (receivables, invoicing efficiency): SONEDE questionnaire | | | |
| 18.3 To what extent are the positive and, where applicable, the negative effects of the programme likely to be long-lasting? | Conclusion from the previous questions | | | | |
| 18.4 To what extent can the programme's gender results be considered permanent (ownership, capacities, etc.)? (FC-E-specific question | Are there specific gender results? | Discussions with communities | | | |