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Analysis of tariff equity between GDA and SONEDE water users

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Introduction

The goal of the analysis is to assess the financial consequences of achieving tariff equity between water users served by SONEDE and water users served by GDAs. At present the tariffs paid by many GDA water users are above the tariff level charged by SONEDE. At the same time, the quality of GDA water services often lags behind the service quality provided by SONEDE.

The Ministry of Agriculture, Hydraulic Resources and Fishing shared its database on GDAs. The database made it possible to estimate the current consumption, costs and tariff payments at individual GDAs in 15 governorates. Based on the data it was also possible to estimate the same variables under a reformed system which includes SONEDE tariffs and changed operational practices.

Below the process of the analysis and the main conclusions are summarized.

1. The analyzed data

The database received from the Ministry contained data for 733 GDAs from 15 governorates. Standard data validation techniques were applied to screen for wrong data and outliers. In particular, the following steps were executed:

- Orders of magnitudes and units were checked for each variable (e.g. millim vs. TND, m^3 vs. 1000 m^3, TND/m^3 vs. TND/month). Discovered errors were corrected when possible.
- Specific variables were compared to each other to identify unreasonable deviations. For example, volume of pumped water was compared to volume of distributed water and the cost level was compared to prices.
- Indicators were calculated to screen for outliers. Indicators included network loss, consumption per user, consumption per connection, revenue per user, connections per km of network…etc.

When the data of a GDA was clearly wrong and could not be corrected then the GDA in question was deleted from the database. When a piece of data was wrong, but could be corrected (e.g. obvious mistake with units) then the correction was made.

In order not to lose too many GDAs from the database, some of the missing data was estimated based on the average of the GDAs that had data for the particular variables. For instance, when all data was available and only the volume of water was missing, then the latter was estimated based on the number of water users, also considering that small, medium sized and large GDAs had different average water consumption per user.

When volume of pumped water was missing, but volume of distributed water was available (or vice versa), then the average network loss figure was applied to estimate the missing variable. When monthly water price (e.g. 10 TND/month/subscriber) was available, but unit price per cubic meter was absent, then we estimated the unit price based on total revenues and total consumption.

Following the above data validation procedure and after getting rid of GDAs with suspicious or missing data, 681 GDAs were left in the database, ready to be analyzed. The 52 discarded GDAs represent 7% of the original dataset. Based on available data we concluded that these GDAs were on average somewhat smaller than the GDAs left in the database.

Some of the key data of the analyzed GDAs is included in the tables below, broken down to governorates. The network loss in Tataouine and Zaghouan are much below the average figures of all other governorates, suggesting that there may be a data problem here.

Table 1 Volume of water and network loss of the analyzed GDAs

Governorate	Number of GDAs	Volume of water pumped or bought (m^3/year)	Volume of water distributed (m^3/year)	Network loss (m^3/year)	Network loss (%)
Ariana	16	25,000	20,600	4,400	17.60%
Beja	87	1,680,676	1,328,230	352,446	20.97%
Ben Arous	20	439,881	338,770	101,111	22.99%
Bizerte	72	1,213,187	851,755	361,432	29.79%
Jendouba	20	450,196	299,095	151,101	33.56%
Le Kef	88	1,597,097	992,570	604,527	37.85%
Mahdia	31	2,123,865	1,746,181	377,684	17.78%
Manouba	37	718,216	501,327	216,889	30.20%
Medenine	58	807,396	651,541	155,854	19.30%
Nabeul	37	3,820,012	2,156,784	1,663,228	43.54%
Seliana	26	548,799	428,064	120,736	22.00%
Sfax	90	3,356,165	2,561,778	794,387	23.67%
Sousse	32	611,830	396,802	215,028	35.15%
Tataouine	24	275,776	265,008	10,769	3.90%
Zaghouan	43	1,196,575	1,146,946	49,629	4.15%
Total	**681**	**18,864,672**	**13,685,451**	**5,179,221**	**27.45%**

Compared to the SONEDE's supply network performance in 2015 and 2016 evaluated to 76.7%, the GDAs losses are not excessively higher.

The average variable tariff (cubic meter price) substantially varies across governorates, as evident in Table 2 below, from 0.23 TND/m^3 in Ariana to 0.92 TND/m^3 in Manouba. The weighted average price of all 681 GDAs is 0.71 TND/m^3, while the average consumption per user is 41 m^3/year, equivalent to about 10 m^3/quarter, which falls into the lowest tariff block employed by SONEDE, with a price of 0.2 TND/m^3. These figures highlight that on average GDA water users pay much more for water than SONEDE customers with a similar consumption profile.

As a comparison, based on the information included in the SONEDE's annual statistic report of 2016, the average domestic subscribers' consumption is evaluated to 31.9

m^3/quarter. It was around 32.1 m^3/quarter in 2015. In addition, 68.5% of SONEDE's domestic subscribers consume a volume of water less than 40 m^3/quarter and pay a quarterly bill of less than 27.8 TND/quarter (including the drinking water, the sanitation fees and the value added tax (VAT)).

Table 2 Consumption, revenue and price at the analyzed GDAs

Governorate	Number of users / beneficiaries	Average consumption per user (m^3/year)	Total revenue from variable tariff (TND/year)	Average variable tariff (TND/m^3)
Ariana	2,855	7.2	4,738	0.23
Beja	15,315	86.7	1,213,500	0.91
Ben Arous	12,689	26.7	212,939	0.63
Bizerte	64,212	13.3	658,613	0.77
Jendouba	3,872	77.2	210,001	0.70
Le Kef	13,647	72.7	816,327	0.82
Mahdia	12,475	140.0	1,027,414	0.59
Manouba	18,949	26.5	461,811	0.92
Medenine	30,921	21.1	414,411	0.64
Nabeul	76,465	28.2	1,578,135	0.73
Seliana	18,203	23.5	380,052	0.89
Sfax	26,049	98.3	1,586,279	0.62
Sousse	2,567	154.6	290,453	0.73
Tataouine	1,843	143.8	132,504	0.50
Zaghouan	33,582	34.2	681,816	0.59
Total	**333,644**	**41.0**	**9,668,992**	**0.71**

2. Analyzing the financial consequences of tariff equalization

2.1. The applied methodology

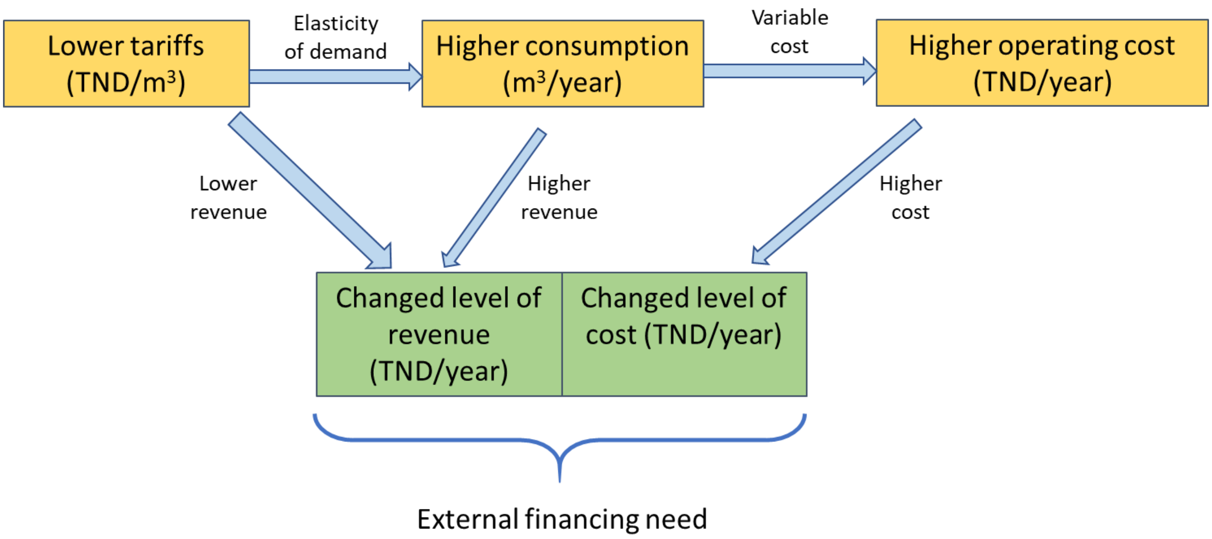
With the cleaned GDA database it becomes possible to analyze the impact of introducing SONEDE tariffs for GDA water users. SONEDE tariffs are generally lower than GDA tariffs (though not everywhere) which delivers three interrelated impacts:

- Lower tariffs result in lower revenues at the same level of consumption.
- Consumption, at the same time, increases as customers react to lower prices. This impact can be measured through the "elasticity of demand".Higher consumption generates more revenues. This impact, will, however not fully balance the decline of revenues due to lower tariffs.
- Higher consumption, in turn, has an impact on costs, as "variable costs" (costs that are proportional to the volume of delivered water, especially electricity cost and water purchase cost) will increase.

Assuming that a GDA is in financial balance with its current tariffs, the introduction of SONEDE tariffs will erode this financial balance and require external financing.

This relationship is described by the figure below. This is the interrelationship that we employ when analyzing the GDA database.

Figure 1 The impact of lower water tariffs on the financial balance



We need to make a few supplementary remarks about our assumptions:

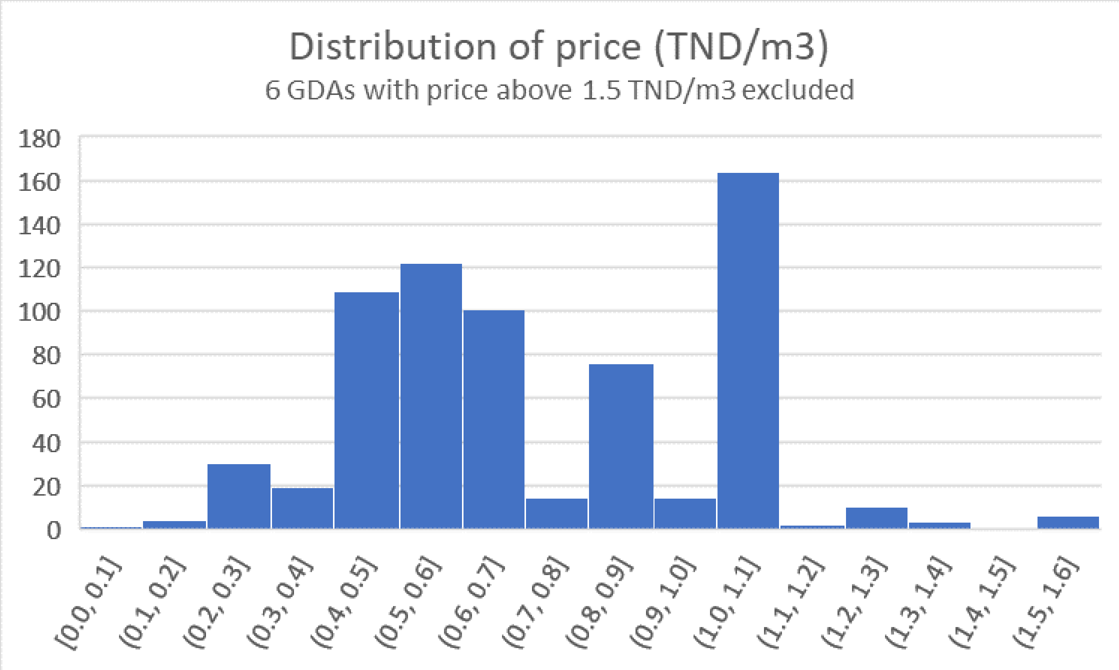
- As indicated, lower water tariffs would result in higher consumption. This is especially true for subscribers that use water for non-household purposes as well, for example animal husbandry. Many GDAs, however, even today face the threat of water shortage, especially in the summer. It is not at all certain that higher demand for water can be satisfied. Nevertheless, for modelling purposes we assume that higher water needs can be satisfied.
- Some GDAs currently employ lower tariffs than the tariffs paid by SONEDE customers for the same level of consumption. In such a situation the above interrelations would work in the opposite direction. However, we don't think it is reasonable to expect that SONEDE tariffs can be introduced in these locations. Therefore, we simply leave these GDA tariffs unchanged.
- SONEDE customers have to pay a quarterly fixed tariff based on the diameter of the water meter. For the smallest meters with a diameter of 15 mm, typical for households, this tariff is 5.050 TND/connection/quarter. We are aware that many GDA water users also pay a fixed tariff (1 to 2 DT per month), and some of them also pay a modest annual subscription or membership fee. Since we do not have detailed data on the current fixed tariffs paid by GDA water users, but we know that they are on average about the same as the SONEDE quarterly fixed tariffs, we just assume that introduction of SONEDE fixed tariffs to replace GDA fixed tariffs would not materially influence the financial balance of GDAs. This topic, however, is to be further investigated in the future.

2.2. Current water prices at GDAs

The cleaned GDA database contains price information for 681 GDAs. As it was learned through personal interviews, some GDAs employ block tariffs and for some GDAs tariffs have been increased recently. Therefore, we can conclude that the available price information is not fully reflective of the present situation, prevailing prices are probably slightly underestimated on average. Nevertheless, this is the best available information for the moment, therefore this is what we use.

Figure 2 shows the distribution of variable prices across the inspected GDAs. The vertical axis represents the number of GDAs with a price falling in specific ranges. For example, there is only one GDA with price between 0 and 0.1 TND/m^3, there are 4 GDAs with prices between 0.1 and 0.2 TND/m^3 etc. The majority of GDAs have prices between 0.4 and 0.7 TND/m^3, between 0.8 and 0.9 TND/m^3 and between 1 and 1.1 TND/m^3. These are the starting price levels of our analysis, and they are not subject to value added tax. Compared to this, most households served by SONEDE pay less than 0.325 TND/m^3. With VAT, this tariff becomes 0.387 TND/m^3, still much below the average GDA tariff level.

Figure 2 Distribution of the variable water price across GDAs



2.3. Elasticity of demand

Both international and domestic experience confirms that water users react to changes in price. Higher prices imply lower consumption and vice versa. This relationship is described as the elasticity of demand: the percentage change in consumption as a result of a 1 percent increase of price. For most products, including drinking water, the value of the elasticity of demand is negative. An elasticity of demand of -0.1 means that a 1% increase in the price of water triggers a 0.1% decline in consumption[4].

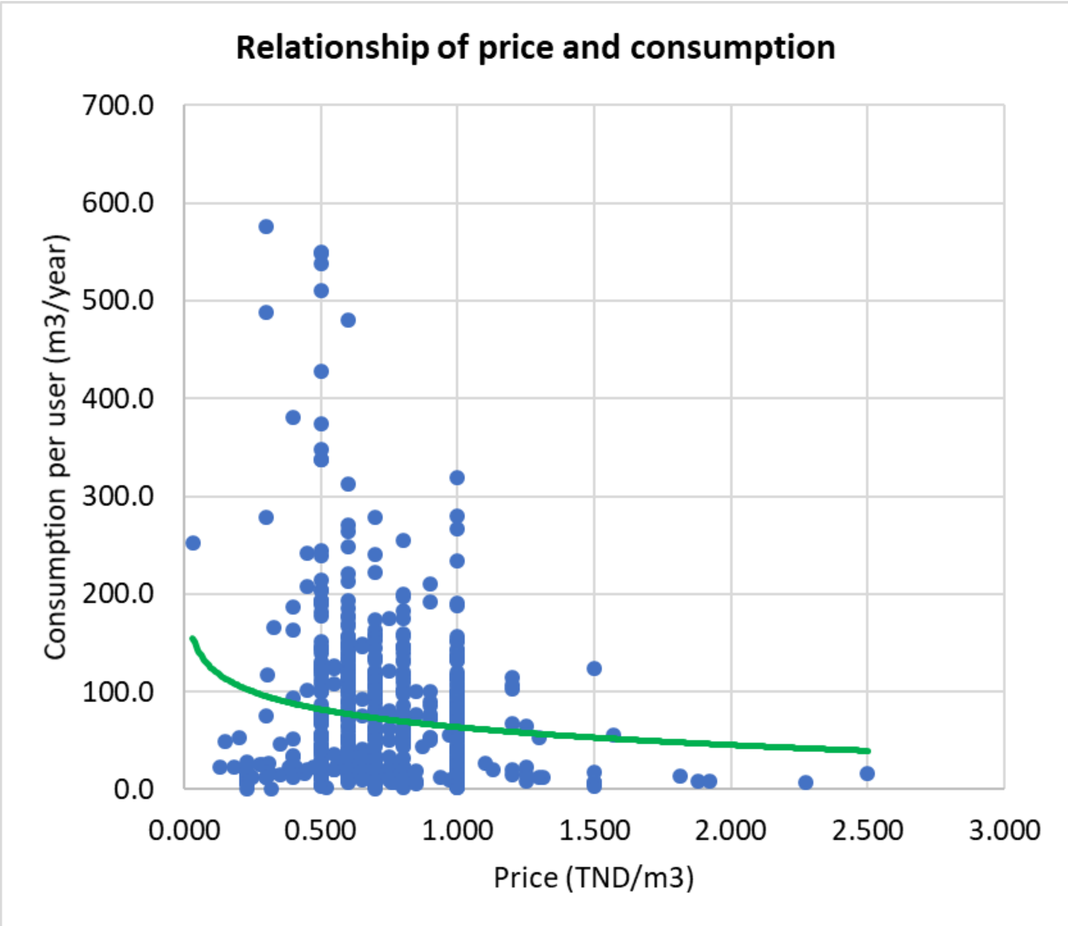
We decided to test two elasticity values in our analysis. The range of elasticities to be used was estimated based on 1) international literature and 2) notes from the World Bank report including a summary of the elasticity related conclusions of a 2004 study by IdeaConsult[5]. In general, we can say that the short-term response of customers to changes in price is generally quite inflexible, as they need time to make adjustments, especially adjustment of a technical nature (e.g. installation of new appliances such as taps and shower heads). The long-term elasticity reflecting response to tariffs on a multi-year time horizon can be notably higher than the short-term value. The short to

[4] The price of water stands for a) water only (without the price of sewage) and b) the variable price of water, since the fixed tariff is independent of consumption and therefore its payment cannot be influenced through altered consumption, customers only react to a change of the cubic meter price.
[5] SONEDE (2004) : Etude de tarification de l'eau potable. Mission 2 : Structures et réajustements tarifaires. Rapport de Synthèse, IdeaConsult, mars 2004.

medium term elasticity for water in the case of GDA water users is likely to be between -0.1 and -0.3. We test both values within our analysis.

The GDA dataset also provides some confirmation that across all GDAs there is a moderate interrelation between price and consumption. Figure 3 includes individual GDA data points depicting the variable tariff (TND/m^3) and the annual consumption per user (m^3/year). The green line indicates the relationship between the two variables. The figure serves as a good illustration of the fact that higher prices generally correspond to lower consumption per user.

Figure 3 Relationship between price and consumption at GDAs

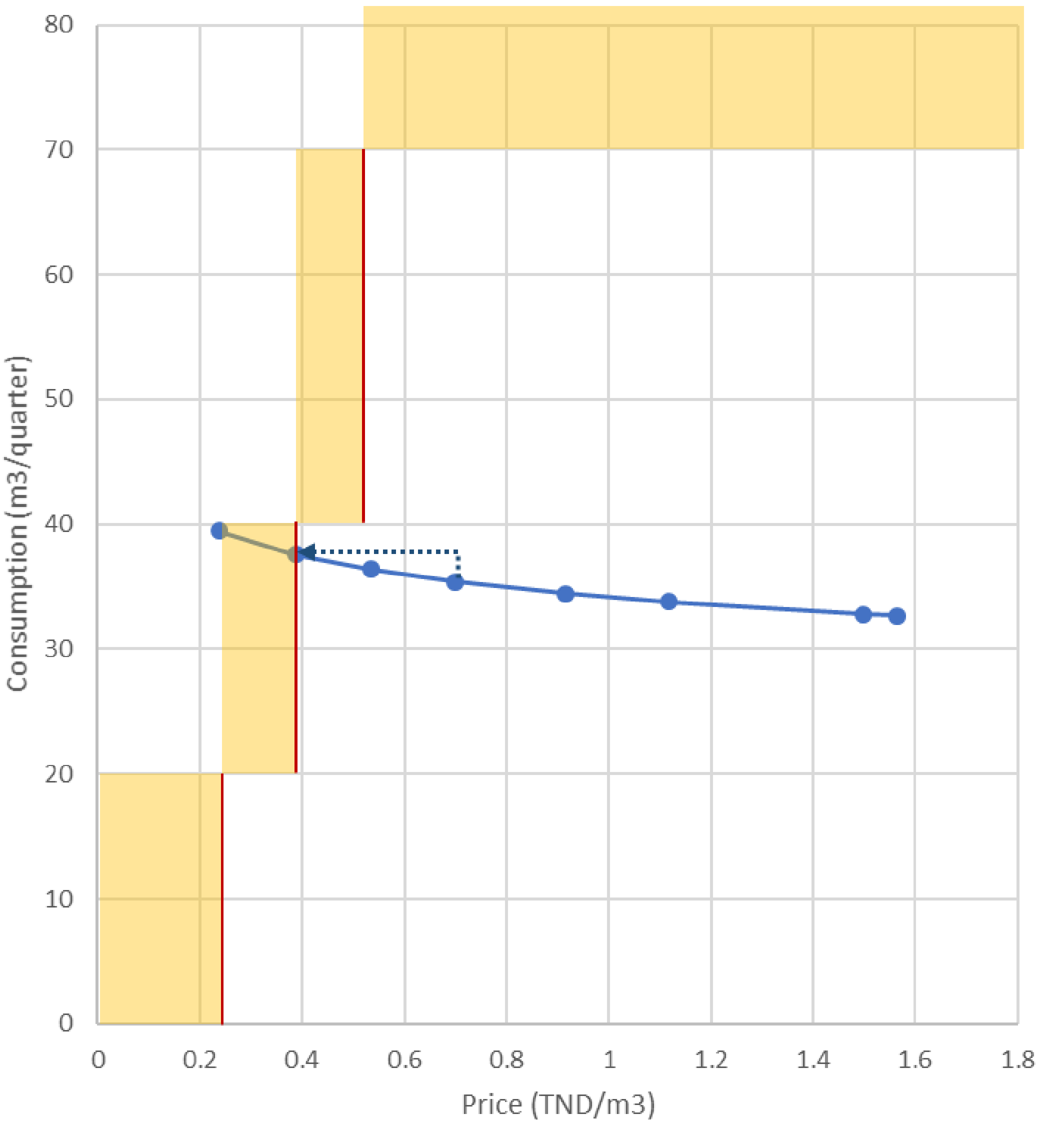


2.4. Calculating the new level of consumption

The following algorithm has been applied to calculate the new level of consumption at individual GDAs after switching to SONEDE tariffs. Figure 4 provides an illustration for the calculation.

- There is a starting level of price and average consumption for the water users of the selected GDA. In the figure this is 0.7 TND/m^3 and 35.4 m^3/quarter of consumption.
- From this point we can generate a demand curve with the use of the elasticity of demand. The demand curve is illustrated with the blue dots connected by blue line. Depending on the actual level of the elasticity, the demand curve can be steeper or flatter. The curve in the figure is based on demand elasticity of -0.1.
- The progressive blocks of the SONEDE tariff schedule are depicted by yellow. E.g. the first 20 m^3/quarter of consumption takes place at the price of 0.238 TND/m^3, consumption between 21 and 40 m^3/quarter is charged at a price of 0.387 TND/m^3 etc. These SONEDE prices already include the 19% VAT.
- Wherever the demand curve of the GDA arrives into a block of SONEDE, the new price and consumption evolves. In this example, the new price would be 0.387 TND/m^3, as opposed to the original price of 0.7 TND/m^3, and a consumption of 37.6 m^3/quarter belongs to the new price. The consumption thus increased by 6%, due to a price decline of 45%.
- A similar exercise is carried out for all GDAs.

Figure 4 Example for calculating the new level of consumption based on SONEDE tariffs

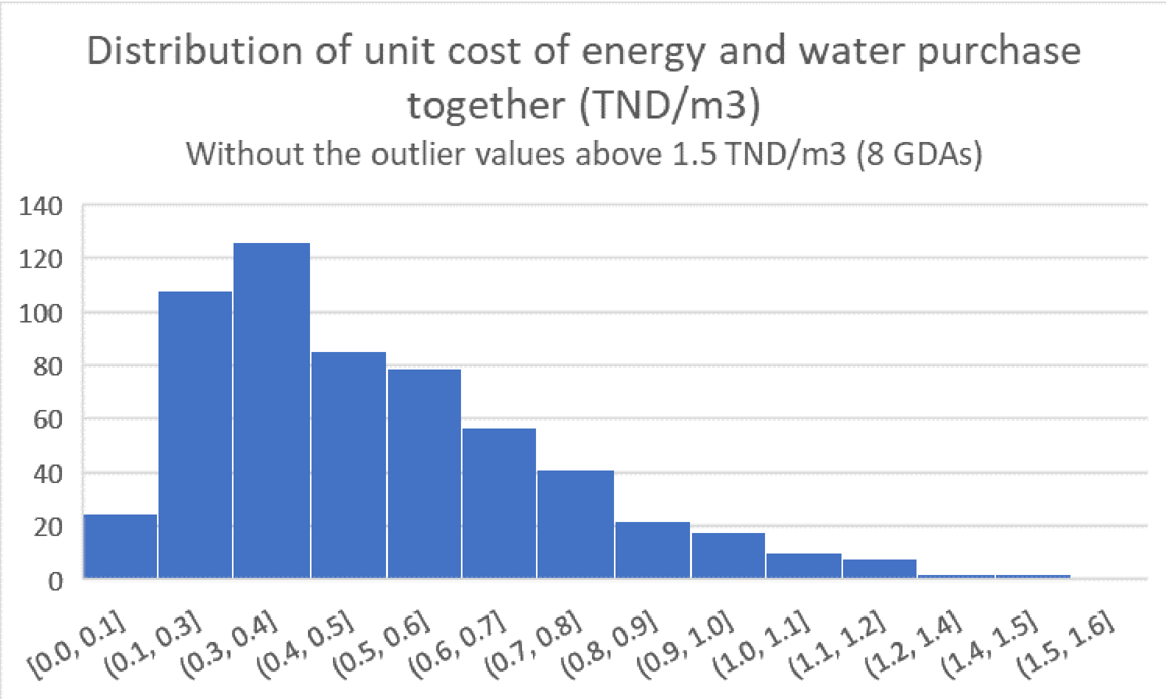


2.5. Operating costs

The change in the volume of consumed water implies a change in operating costs. Higher volumes of water require more energy for pumping and/or higher purchase cost in case of water bought from SONEDE or another water system (substantial increase in volume could even result in a need to recalibrate some water systems). The GDA database contains a lot of information about different types of operating costs. Out of the 681 GDAs, 607 had data on either energy costs or water purchase costs or both. As opposed to salary, maintenance and other charges, energy and water purchase costs can be considered as variable items, changing more or less in proportion with the volume of supplied water. Some GDAs only had energy cost without water purchase cost – these are mostly pumping from own water sources. Other GDAs had only water purchase cost, without energy cost – these are probably purchasing already pressurized water from SONEDE, therefore they do not have to spend considerable energy on pumping. Still other GDAs had both energy and water purchase costs.

Our calculations show that the sum of the energy and water purchase cost per cubic meter of delivered water is about 0.39 TND/m^3 on average. This is the value that we use during our analysis. If the volume of delivered water changes, we assume that the cost level is also changing by 0.39 TND/m^3. The actual distribution of GDA specific variable unit costs is depicted by Figure 5, where the vertical axis shows the number of GDAs with values falling into the cost range on the horizontal axis.

Figure 5 Distribution of unit variable costs among GDAs



3. Results of the analysis

Following the steps outlined in the previous chapter, we created a model based on the GDA database to estimate the impact of switching to SONEDE tariffs. The results are applicable to the 681 GDAs, not the full circle of GDAs in Tunisia.

We applied two different elasticities: -0.1 and -0.3.Results are presented for each governorate. Individual, GDA specific results are not shared, because verifying individual data through a large number of site visits was beyond the scope of the project. However, the results for the whole sample together are likely to be quite reliable, as deviations usually cancel each other out.

Depending on the elasticity, water consumption at the analyzed GDAs would increase from the current level of 13.7 million m^3/year to 14.3-15.5 million m^3/year, the average price would decline from 0.71 TND/m^3 to between 0.45 and 0.47 TND/m^3. Due to the combined effect of lower prices and higher consumption, revenues from variable tariffs would decline considerably, from about 9.7 million TND/year to 6.4-7.2 million TND/year, creating a financial deficit that needs to be covered. In addition, operating costs would rise by about 0.2-0.7 million TND/year due to higher volumes of distributed water. The total financing need would fall between 3.1 and 3.5 million TND/year.[6]

At the same time, as GDA water users under the SONEDE tariff scheme are subject to VAT payment, 0.39-0.51 million TND/year of additional VAT revenue would arrive to the central budget. Therefore, in case the government decides to finance the deficit at GDAs, the actual burden would have to be adjusted with the VAT flows, and it would be about 2.7-3.0 million TND/year.

[6] Substantially higher consumption could require a water system recalibration in some locations (e.g. wider pipes and reservoirs...etc), resulting in additional costs which are difficult to estimate.

Table 3 Additional financing need with demand elasticity of -0.1

Governorate	Number of GDAs	Current tariff level			SONEDE tariffs			Additional financing need on top of current revenues		
		Average price (TND/m3)	Volume of water distributed (m3/year)	Total revenue from variable price (TND/year)	Average price (TND/m3)	Volume of water distributed (m3/year)	Total revenue from variable price (TND/year)	Revenue deficit compared to current revenues (TND/year)	Additional operating cost (TND/year)	Total financing need (TND/year)
Ariana	16	0.23	20,600	4,738	0.23	20,600	4,738	0	0	0
Beja	87	0.91	1,328,230	1,213,500	0.46	1,427,176	658,907	554,592	38,318	592,910
Ben Arous	20	0.63	338,770	212,939	0.42	353,004	149,317	63,622	5,512	69,134
Bizerte	72	0.77	851,755	658,613	0.34	918,504	315,144	343,469	25,849	369,318
Jendouba	20	0.70	299,095	210,001	0.36	317,066	115,279	94,723	6,959	101,682
Le Kef	88	0.82	992,570	816,327	0.42	1,064,032	451,755	364,572	27,675	392,247
Mahdia	31	0.59	1,746,181	1,027,414	0.49	1,778,230	874,781	152,633	12,411	165,044
Manouba	37	0.92	501,327	461,811	0.44	541,780	236,467	225,344	15,666	241,010
Medenine	58	0.64	651,541	414,411	0.39	686,097	264,453	149,957	13,382	163,340
Nabeul	37	0.73	2,156,784	1,578,135	0.43	2,274,635	979,155	598,980	45,639	644,619
Seliana	26	0.89	428,064	380,052	0.55	454,057	251,833	128,219	10,066	138,285
Sfax	90	0.62	2,561,778	1,586,279	0.48	2,630,491	1,270,642	315,637	26,610	342,247
Sousse	32	0.73	396,802	290,453	0.44	416,277	181,166	109,287	7,542	116,830
Tataouine	24	0.50	265,008	132,504	0.43	269,533	116,774	15,729	1,753	17,482
Zaghouan	43	0.59	1,146,946	681,816	0.48	1,168,311	564,371	117,445	8,274	125,719
Total	**681**	**0.71**	**13,685,451**	**9,668,992**	**0.45**	**14,319,793**	**6,434,783**	**3,234,209**	**245,658**	**3,479,867**

Table 4 Additional financing need with demand elasticity of -0.3

Governorate	Number of GDAs	Current tariff level			SONEDE tariffs			Additional financing need on top of current revenues		
		Average price (TND/m3)	Volume of water distributed (m3/year)	Total revenue from variable price (TND/year)	Average price (TND/m3)	Volume of water distributed (m3/year)	Total revenue from variable price (TND/year)	Revenue deficit compared to current revenues (TND/year)	Additional operating cost (TND/year)	Total financing need (TND/year)
Ariana	16	0.23	20,600	4,738	0.23	20,600	4,738	0	0	0
Beja	87	0.91	1,328,230	1,213,500	0.48	1,616,222	782,305	431,194	111,529	542,723
Ben Arous	20	0.63	338,770	212,939	0.44	377,253	166,221	46,718	14,903	61,621
Bizerte	72	0.77	851,755	658,613	0.37	1,046,946	388,165	270,448	75,590	346,038
Jendouba	20	0.70	299,095	210,001	0.40	348,724	138,727	71,275	19,220	90,494
Le Kef	88	0.82	992,570	816,327	0.47	1,184,377	553,042	263,286	74,280	337,566
Mahdia	31	0.59	1,746,181	1,027,414	0.49	1,843,117	907,633	119,781	37,540	157,321
Manouba	37	0.92	501,327	461,811	0.49	608,768	297,635	164,176	41,608	205,784
Medenine	58	0.64	651,541	414,411	0.41	744,909	304,442	109,969	36,158	146,127
Nabeul	37	0.73	2,156,784	1,578,135	0.45	2,486,583	1,128,771	449,365	127,719	577,084
Seliana	26	0.89	428,064	380,052	0.55	507,871	277,195	102,857	30,907	133,764
Sfax	90	0.62	2,561,778	1,586,279	0.50	2,739,108	1,370,036	216,243	68,673	284,917
Sousse	32	0.73	396,802	290,453	0.50	439,896	220,720	69,733	16,689	86,422
Tataouine	24	0.50	265,008	132,504	0.44	276,906	121,420	11,084	4,608	15,691
Zaghouan	43	0.59	1,146,946	681,816	0.48	1,212,408	586,640	95,176	25,351	120,527
Total	**681**	**0.71**	**13,685,451**	**9,668,992**	**0.47**	**15,453,689**	**7,247,688**	**2,421,304**	**684,774**	**3,106,078**

The actual impact on tariffs and revenues may be slightly underestimated for a particular reason. At around 10% of the GDAs the quarterly consumption per connection exceeds 70 m^3, for some of them it is above 100 or even 200 m^3. It can be assumed that these connections serve numerous households. A connection based block tariff scheme is disadvantageous for them, thus once SONEDE compatible tariffs are introduced, these current joint connections would likely split to household based connections, reducing the consumption per connection or find some other solution like a pro-rate system based on the number of households.

4. International practice of financing rural water services

In this chapter selected examples are provided from four countries on how different approaches can help to enhance rural water services and/or make them more affordable.

4.1. Morocco: Supporting and outsourcing auxiliary water activities to micro-entreprises

In Morocco, according to article 31st of the constitution adopted in 2011, the State, public institutions and local authorities shall mobilize all the means available to facilitate equal access to water for all citizens.

ONEE, the national office for water and electricity, a public enterprise created in 1972 is officially entitled of sanitation and drinking water supply. The office activities are covering more than 400 municipalities and the number of its subscribers is exceeding 2 millions.

In the nineties of the last century, the ONEE mission was extended to the rural areas, where the rate of drinking water supply was around 30%. In order to improve drinking water accessibility and to secure water supply in those areas, ONEE-Water branch has developed amongst other solutions, a support system to the creation of a network of private micro-enterprises in order to allow the operator to have a local and competitive outsourcing offer.

This program was launched in 1996 and since then, 800 companies were created employing on average 5 people per company, 85% of them specialized in water supply and 15% in sanitation and other activities.

Their activities cover different areas such as:

- Drinking water networks maintenance works,
- Management and monitoring of pumping and sanitation stations,
- Monitoring and maintenance of water plants and systems,
- Water leakages detection and repair,
- Electromechanical maintenance,
- Water sampling.

The main advantage for ONEE through the implementation of such a mechanism was bridging the disinvestment of large and medium-sized companies for services considered unprofitable. Actually, the creation and support of such micro-enterprises is justified by the need for the implementation of a rapid intervention system at the lowest cost. The dispersion of the operations generating a low return level would have involved considerable additional costs if they were made by ONEE itself.

There was an additional benefit relating to the optimization of the ONEE human resources management, by favoring outsourcing rather than direct recruiting and saving on payroll. On the other hand, ONEE had the obligation to provide free training to the selected micro-enterprises. Indeed, selected candidates graduated from vocational training centers may, after a training period of 3 to 5 weeks, benefit from a guarantee of a volume of activity over a minimum period of 12 months. Added to this, is the provision of work equipment (repayable loan), as well as the supervision and assistance of the local services of ONEE during the first months of activity.

Nowadays, the drinking water supply rate in rural areas jumped to 96% with more than 17,000 villages covered, achieving a better equity between urban and rural water users in terms of supply accessibility.

In addition to micro-enterprises, the Moroccan water operator has also supported the involvement of SMEs to manage the supply of drinking water in rural areas.

ONEE-Water branch has signed seven contracts with local SMEs for periods of five to ten years (one with commercial risk transfer on SMEs) and it's too early to draw final conclusions regarding the success of such an experience.

4.2. France: Public subsidy system to the most vulnerable users

In France, the right to water for basic needs is legally recognized and the most vulnerable households are entitled to receive public subsidies to cover their drinking water expenses under specific conditions. Nevertheless, this subsidy system has witnessed a certain evolution.

Indeed, law n ° 2006-1772 of December 30th, 2006 on the water and the aquatic environments provides that: "Everyone has the right to access drinking water for food and hygiene under economically acceptable conditions".

In addition, the social action and families Act (article L115-3) states that: "Anyone or any family who is in financial difficulty is entitled to help from the community to access the water supply...

In the case of non-payment of bills, the supply of water is maintained until assistance is obtained.

Water suppliers cannot interrupt or terminate the contract for non-payment of invoices all year long".

Practically, a public fund (the solidarity fund for housing) was created in 1990 at the regional level (in each department), to provide financial assistance to households in difficulty.

The solidarity fund for housing grants financial assistance to people who encounter difficulties to ensure the expenses of their housing (bills, rents ...).

This financial assistance is characterized by the assumption of all or part of the unpaid water bills.

The persons who could benefit from this measure, are:

- The tenant and sub-tenant,
- The occupying owner,
- The person accommodated free of charge,
- The shelter-housing resident.

In addition, in 7 February 2011, a new Act on solidarity in the fields of water supply and sanitation entered into force stating that public water utilities can allocate a subsidy to the fund, in order to increase households support.

Recently, this legal framework has been consolidated by the promulgation of the law No. 2013-312 of April 15, 2013 on preparing the transition to a sober energy system, including various provisions on water pricing and the decree n ° 2015-416 of April 14th, 2015 fixing the list of the local authorities chosen to implement a social water pricing.

As a consequence of this legal reform, an experimentation was put in place for a period of 5 years to implement a social water pricing. This experimentation is undertaken in some local authorities under different forms: a preventative aid by paying for example, a "water-check" to reduce the amount of the household's water bills, or a progressive water tariff including a 1st block of free consumption modulated according to the income of the beneficiaries.

This aid is intended for owners, co-owners or tenants whose resources are considered as insufficient according to the criteria set and it is the local authority who identifies the beneficiaries.

During the processing of the request for payment of the water bill, no water cut can be made.

Once allocated, the aid for the payment of the water bill is accompanied by several protective measures: The debt corresponding to the provision of water and sanitation is erased, potential collection fees and late fees are not claimed, no cuts in water may be imposed on a family caring for an infant or elderly person who is reported to be in difficulty by an organization able to receive applications for financial assistance, water cannot be cut after midday on Fridays, Saturdays, Sundays, days and eve of feast and no cuts will be made within 12 months of the allocation of the payment aid for water bills.

4.3. Hungary: state subsidy system to lower rural water tariffs

Providing drinking water and sanitation services in small, remote settlements is generally more costly than providing such services in densely populated cities. This phenomenon has been observed and tested many times within the water utility industry.

Hungary has about 3,000 settlements, and a third of these are villages with population below 500. Some of them face high unit water service costs not only because of their small size, but also due to other circumstances, e.g. mountain region that requires much pumping of water or access to raw water that needs advanced treatment. In addition, the average income in most remote villages is significantly lower than the national average, therefore the water bill can represent a disproportionately high burden.

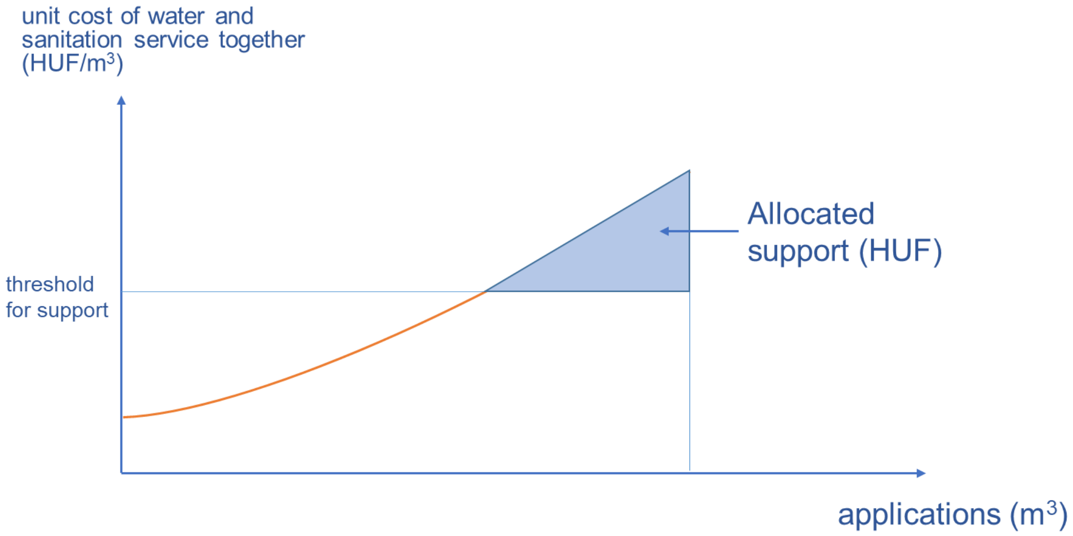
To help these disadvantageous settlements, during the 1990's the Government of Hungary established a dedicated fund that serves to cover part of the operating costs of eligible settlements. The Fund is part of the central government budget and it is refilled annually with HUF 4.5 billion (about 15 million EUR).

Local governments that would like to receive assistance from the Fund, have to submit an application each year, including the volume of sold water and collected sewage, past and forecasted water utility expenditures, number of household consumers in their settlement. Based on these figures the average cost level of water utility services is calculated.

Once the deadline for applications has passed, the responsible Ministry makes a calculation of all the requested assistance and decides on the threshold cost level for support. All costs above this threshold level are covered by the government, but municipalities where the unit cost falls below the threshold are not supported at all. In other words, a ceiling is set for the unit cost level. This ceiling is set separately for each year, depending on the submitted applications, always ensuring that the full Fund is utilized. The algorithm for setting the support level is illustrated by Figure 6. The most expensive settlement is supported first (starting from the right of the diagram), then the second most expensive, the third most expensive etc., until the full budget is exhausted, represented by the blue area.

The municipalities lower the water and sanitation bills of household customers with the assistance of the funds that they receive. Commercial water users cannot be supported, their water bill is not lowered.

Figure 6 The impact of lower water tariffs on the financial balance



The experience with this support scheme is generally positive, but there is a notable drawback. The settlements do not have any incentive to improve their operations to lower the cost of water and sanitation services. They submit their applications based on actual costs of service, and the Ministry does not inspect if the level of the cost is justified, or it is high because of negligence or other reasons that could be mitigated. As a result, each year the threshold cost level is increasing.

4.4. India: private sector involvement

The Indian case is from Mamdapur multi-village system in Karnataka, located in the South West of India. In Mamdapur 9 villages decided to cooperate to establish a common bulk water supply system, as their ground water well had become polluted and water supply had been unreliable, with intermittent water supply from existing wells. The villages established an agency, the Karnataka Rural Water Supply and Sanitation Agency (KRWSSA) to build a water abstraction facility at the nearby Ghataprabha River, and to transfer the acquired water to the local storage tanks in the 9 villages. The responsibility of KRWSSA extends until the local storage tanks, from where independent in-village networks are used to further deliver the water. These local networks are operated by village committees. Households access drinking water either through private household connections or street standposts. The system altogether serves 39 thousand people and the average water consumption is 70 liters per person per day.

In 2009 KRWSSA invited bids from private firms to operate the common system. Niketan Engineering was selected as the winner, and an operating contract was signed for 3 years. The company started with assessing key engineering challenges and addressed them first. They then hired local staff and did an extensive training program. Altogether a staff of 12 was established: 1 manager, 1 engineer, 1 supervisor, 3 pump operators, 5 valvemen, 1 mechanic. In the beginning of its contracted period Niketan Engineering held „Inception meetings" in all 9 villages to learn about problems of operation, to share its plans with its customers, and to establish a relationship of mutual trust. Later on regular stakeholder consultations were also held.

Niketan Engineering, relying on its experience from elsewhere, introduced a number of operational changes to improve the quality of service. These included, for instance:

- The quality of water was tested on a daily basis. As a result, sick days associated with water pollution declined.
- All important data of operation, such as maintenance, quality tests, were recorded
- The company started to store spare parts at the water treatment plant to be able to carry out quick repair. As a result, the reliability of service delivery improved - supply hours increased from 1-2 hours/day to 2-3 hours/day -, therefore women and children had more time for their activities, they did not have to spend time carrying water from distant locations.
- Customer complaints were addressed through regular meetings. As a result, the company learned about the problems and was able to address them, while the population grew an appreciation of the attention of the company.
- As service quality improvements required some additional costs, price was also raised, but the population was nevertheless more satisfied with the service, and was willing to pay higher prices.
- The success of the scheme is indicated by the fact that the share of households with water connection increased from 16.6% in 2010 to 30.4% in 2013.

5. Financing mechanism

It is clear that creating equity between rural and urban water users requires additional financial resources. There could be various sources for these funds, below we simply assume that the Government decides to fill the financing gap from the State Budget Other alternatives could be:

- Increased tariffs for all water users, although the details would need to be finetunded, since SONEDE's budget is independent from the State budget, so even if there's a substantive tariff increase, the additional revenue would not directly be available to support rural water tariffs.
- A special tax on bottled drinks. The settlement and revenue of such a tax would be included in State budget through the creation and the management of a

"treasure special fund", from where it could be used to finance rural water services.
- Temporarily even donor funding is an option.

Investigating the above options was beyond the scope of the current project. Moreover, the below proposal reflects our current understanding of GDA operations, their efficiency and financial status, and also builds on international good practices of financing rural water services. With additional research and analysis, this proposal could be further elaborated and amended.

The financing mechanism needs to serve three goals: 1) lower, more affordable tariffs to GDA water users by introducing SONEDE household drinking water tariffs, 2) increasing the operating efficiency of GDAs so that the financing need can be controlled and 3) ensuring that despite lower water tariffs the water consumption at GDAs does not increase significantly.

First, joining the scheme should be optional for the GDAs, not obligatory. There are many properly functioning GDAs that may not need external financial assistance, and/or they wish to retain their current autonomy. These GDAs should be allowed to continue operations as they wish.

The GDAs that decide to take part in the financing mechanism, should be assisted through the following principles:

- GDAs need to be operated by "licensed operators" that qualify to specific standards. These standards need to be set by the Ministry of Agriculture, Hydraulic Resources and Fishing, they may include e.g. technical staff, invoicing software, financial audits, bank account, certain technical procedures, code of conduct etc. Some of these requirements are already in force, others would need to be specified. It is important to help GDAs through sharing of best practices, procedure manuals, certification systems. The requirements together can ensure adequate quality of services and offer the prospect of improved operating efficiency.
- If a GDA complies with the standards, it can receive a license, i.e. it becomes its own licensed operator. Those that cannot comply or do not wish to carry on operations themselves, will have to contract with external licensed operators.
    - One possibility is SONEDE, especially for those GDAs the prime water source of which is a SONEDE connection or those that are technically more complex. Technically, such GDAs can also be transferred to SONEDE, instead of simply contracting with it (obviously, the additional financial burden falling on SONEDE would have to be compensated, any social impacts managed etc.).

  - Another option is micro enterprises that identify GDA operation as a business opportunity. GDAs that qualify as licensed operators can also agree with other GDAs to act as their operator, merge or create a federation, where they can share some costs and means and ensure economies of scale.
- The financing gap of each GDA should be calculated based on the new (SONEDE) tariffs, consumption and eligible (allowable) costs. Eligible costs are to be determined separately for each GDA by a qualified unit within the Ministry. Eligible costs include all reasonable costs of operation and maintenance, applicable taxes and a proportionate management fee for the licensed operator. Eligible costs, however, exclude costs related to investments, as investments are separately financed by the government. The financing gap needs to be set in advance for a period of 5 years. Based on the calculated financing gap the Ministry regularly (e.g. quarterly) transfers a sum of money to the bank account of the licensed operator.
- If a licensed operator can reduce costs by introducing cost saving measures or through the extension of the service area (via contracting with more GDAs, and therefore achieving higher economies of scale), it can retain the difference as profit. However, it is also responsible to cover any cost in excess of the eligible cost level. Therefore, it has an incentive to 1) achieve cost efficiency during the 5-year period and 2) introduce incentives for water users to reduce consumption, since higher consumption also implies higher operating costs.
- After the 5-year period has passed, eligible costs are to be newly calculated by the Ministry unit, considering any changes in operations (reduced cost level, change in subscriber numbers etc.).
- If major changes take place within the 5-year period (e.g. many new customers) then the licensed operator can apply for a recalculation of its financing gap.
- The licensed operators should receive advice and technical assistance on the financing mechanism, on how to reduce costs and also on water demand management measures that they can apply (e.g. improved metering of water consumption, leakage detection, helping their own customers with advice on water use, detecting illegal connections). For this purpose, the Ministry should facilitate the creation of regional service centers that can help the licensed operators in these activities.
- As a supplementary option, a special Fund could also be created on the initiative and managed by the Ministry of Agriculture to finance measures of cost reduction and water demand management. The licensed operators can submit proposals to this fund for measures such as leakage reduction, energy efficient or solar energy operated pumps, purchase or refurbishment of water meters etc. As a result, the cost level of operation should decline, implying lower level of eligible costs to be financed in the future.

- Donor funds and donor financed expertise should be channeled to support this Fund as well as to activate technical assistance.

6. Further research need

Our analysis on financing GDAs should be considered as preliminary. The available time and resources made it possible to do a first analysis, but policy decisions require a deeper analysis. The following measures could be considered:

- Expanding the existing GDA database to become as comprehensive as possible with respect to governorates, GDAs and multi-year data.
- Improving the data within the database through statistical techniques, interviews at CRDAs and GDAs, and other methods.
- Conducting regional workshops with the participation of GDA representatives to better understand their operations, challenges, the room for efficiency improvement. Field visits to individual GDAs (from other governorates: South, Center, Northwest) with the same purpose.
- In-depth analysis of the database.
- Further elaboration of financing mechanisms.
- Pilot application building on the results of the above analysis
- Enhancing the exchange of experience among GDAs (through regional best practice workshops, website etc.)
- Developing a system for the calculation of eligible costs and related capacity building at the Ministry
- Developing a data management and benchmarking system for GDAs.
- Analyzing the costs and impact of transferring some GDAs management to SONEDE.

7. Conclusions

The key conclusions of the project are listed below:

- The analysis relied on GDA data from 15 governorates, covering most, but not all GDAs in these governorates. Therefore the results only refer to this set of rural water associations, not all GDAs of Tunisia.

- Only drinking water services were inspected, agricultural water serivces are excluded from the analysis.
- The data clearly supports the notion that there is a significant difference between the average tariffs paid by water users served by GDAs and SONEDE.
- Switching to SONEDE tariffs at GDA customers would in most locations result in much lower tariffs, which generates higher consumption. However, due to physical constraints (capacity of infrastructure, availability of water) this higher demand would not be possible to satisfy in all locations, therefore demand management measures would need to be applied to keep a balance between supply and demand.
- The financing need / gap arising from the application of lower water tariffs for the analysed sample of GDAs is about 3-3.5 million TND/year.
- This gap, however, is partly counterbalanced by Value Added Tax revenues of about 0.4-0.5 million TND/year.
- Furthermore, there is room for efficiency improvement of operations and revenue collection at many GDAs, which could further reduce the gap.
- There are various alternatives for mechanisms that would transfer GDAs from their current state to a new position of lower tariffs and improved operating efficiency. These mechanisms fall outside the scope of the project, therefore only some of their main aspects have been described so far, they should be further scrutinised in the future, as the success of a GDA tariff reform may depend on them.
- Lastly, further data collection, verification and analysis is needed to arrive to a more complete dataset to support analysis

8. References

SONEDE (2004) : Etude de tarification de l'eau potable. Mission 2 : Structures et réajustements tarifaires. Rapport de Synthèse, IdeaConsult, mars 2004

SONEDE: 2016 annual statistic report.

Interviews with the DGGREE officials in 30 January and 2 February 2018.

Interview with Nabeul's CRDA officials in 31 January.

Interviews with the GDA's El Hayet, Boushem, Garsouline and Boulidine representatives in 31 January and 1st February 2018.

The GDA's El Hayet, Boushem, Garsouline and Boulidine budgets and balances sheets.

DGGREE statistics on the GDAs.

9. Annex: Field visits in Nabeul Governorate on 31 January and 1 February 2018

In this annex the most important observations and data from the field visits to 4 GDAs in Nabeul Governorate are summarised. The field visits have been extremely helpful in better understanding the situation, trends and challenges faced by GDAs.

9.1. GDA El hayet (Delegation of Hammamet)

Reference documents: Annual Budget 2018

The GDA has a technical director since 2008, has been beneficial for operations. CRDA is also helping to reform operations. The regulation itself requires some development and the GDA has additional plans. The system has been split to 2 after the revolution, but now plans for integration again. Network loss gradually reduced, from 60% originally to below 50% now.

Trying to establish electronic billing system.

Purchased water arrives from 4 connection points to SONEDE. During the summer SONEDE cannot supply all the needed water, this is when the wells are needed. For water from the wells only the pumping cost needs to be covered, no additional charge to be paid to anyone. The quality of drinking water from the wells is adequate. The final delivered water is a blend of the two sources (SONEDE and the wells).

The supplied water is for domestic purposes only, not for irrigation.

The biggest challenge is financial + maintenance of assets.

Non-payment of bills has been modest, but it has started to increase lately. They are fighting it with a campaign and the threat of disconnection.

All households are metered.

Due to urban expansion the number of connected households keeps growing, at an annual rate of about 8%. Since homes are built a little unsystematically (scattered over large area), it is not possible to supply all of them. Some households are suspected to have illegal wells. Some have pools. In the summer the households rely more on the GDA delivery of water than during other seasons, as there is less water in the wells.

Connection of new households: if the household is within 20 meters of the network, the GDA can connect and a connection fee is charged. If the household is more than 20 meters away from the network, the CRDA can establish the connection and charge the households the corresponding cost.

1- Sector: Besbasia/Munchar/Bir ben Zahra

Families: 1800

Connections: 1494 + 4 public utilities

Loss rate: 20%

Water price: 0.679 TND/m3 in 2018, 0.600 in 2017

Flat rate monthly: 1.5 TND

Subscription fee: 2 TND

Volume of water purchased (projected): 330.000 m3

Volume of water distributed (projected): 264.000 m3

Staff:

- 5 workers

2- Sector: Sidi Hamed

Families: 1500

Connections: 843 + 4 public utilities

Loss rate: 40%

Water price: 1.002 TND/ m3 in 2018, 0.760 TND in 2017

Flat rate monthly: 1.5 TND

Subscription fee: 2 TND

Volume of water purchased (projected): 215.000 m3

Volume of water distributed (projected): 129.000 m3

Staff:

- 3 workers

Water system: Connection on SONEDE's network +Military borehole + 3 pumping stations

9.2. GDA Boushem (Delegation of Bou Argoub)

Reference documents: Annual report 2016

The ground water level at their well is dropping due to less precipitation and more water abstraction.

The consumer base is increasing due to urban expansion. Sometimes the GDA has to refuse new connections.

Another problem related to their ground water well is the power needed to operate the pumps. The electricity company is not always able to provide the necessary performance due to their own electricity network problems. This problem is especially acute during the summer. As a result, they cannot meet all demand, there are service interruptions, service available only for 2 days a week. Households store water in storage tanks, but that results in lower quality of drinking water.

Water quality on the network is tested by the public health authorities on a weekly basis.

Irrigation use of drinking water is not allowed, but some people may still use it for this purpose. The price of certain crops (e.g. fruit of cactus) can be high enough to justify the use of expensive drinking water for irrigation.

Enterprises and hotels pay double price.

Some illegal connections probably exist. GDAs do not really have the capacity to control illegal connections.

Even increased tariffs cannot cover all the costs. They try to keep a balance by charging for new subscriptions (150 TND/connection), and an annual membership fee. One reason for high costs is that the GDA has to pay the commercial electricity tariff, which is higher than the electricity tariff paid by irrigators.

Year of establishment: 1996

Families: 5600

Connections: 1120

Public utilities: 3 schools, 2 medical dispensaries, 3 mosques

Network length: 310 Km

Loss rate: 32% in 2017 (62% in 2013) – decline due to network renewal and trying to fight illegal consumption

Water price:

From 0 to 40 m3: 0.690 TND

Over 40m3: 1.300 TND

Monthly flat rate: 1 TND

Yearly subscription fee: 1 TND

Water system: - Borehole: 230m deep, 9 to 12 l/s flow + 3 water reservoirs (100 m3/50 m3/15m3)

- SONEDE's network connection

Staff:

- Technical director

- 3 workers

- 1 Trainee

9.3. GDA Boulidine (Delegation of Korba)

Reference document: Annual budget 2017

Only drinking water service, no irrigation water supply. Usually 7/24 service, but during the summer service interruptions may occur when SONEDE is unable to supply the needed water. All connections are metered. Losses amount to 9-10% as this is a new network (14 km length). The GDA itself was established 3 years ago. They do not have any engineer staff, but they can call one when needed.

Beneficiary families: 150

Connections: 113

Public utilities connected: 0

Loss rate: 15%

Volume of water purchased (projected): 20000 m3

Volume of water distributed (projected): 17000 m3

Water price: 0.410 TND/m3

Flat rate monthly: 1.5 TND

Subscription fee: 1 TND

Salaries (monthly): 150 TND (one employee in charge in meter reading, invoicing)

Water purchase cost: 0.250 TND/m3

Water system: 2 connections to SONEDE's network (gravity system)

9.4. GDA Garsouline/Dar Mhanna (Delegation of Menzel Temime)

Reference document: Balance sheet 2017 (10 months)

The water is taken over from SONEDE and pressure reduction is applied, because the original pressure is too high, creating technical problems and increasing the level of water loss. The consumption of households is metered. Water is not used for irrigation, only for domestic consumption and animal husbandry. Bills are paid on a two-monthly basis. Between 2011-2016 water was not supplied, as SONEDE did not have enough water. During this period water was purchased by households from private water vendors for a cost sometimes reaching 15 TND/m3. Compared to this, current costs are much lower and the service is greatly appreciated by the residents.

They reactivated the GDA in 2016, without a permanent committee so far, as the subscribers have not elected one yet.

Some public institutions cannot pay the water bills (e.g. school, mosque), outstanding revenue of about 7000 TND has accumulated.

The high network loss (63%) is due to several issues: high pressure on the network (now more or less managed), old network with absence of service for 5 years, and part of the pipelines are under the road difficult to access for repair.

There is a connection fee of 50 TND for new connections.

The GDA has a debt to SONEDE, slowly repaying it based on a special agreement (deferred payment).

Average consumption of households is about 30-50 m3/2 month/connection.

In case a household cannot pay the bill, first they try to find some arrangement, and disconnect only if this fails.

Meters are not in compliance with standards, therefore actual consumption may be higher or lower than the metered figure. This also impacts network loss.

Beneficiaries: 500 families

Connections: 400 + 4 public institutions

Loss rate: 63%

Volume of water purchased: 55.307 m3

Volume of water distributed: 33.735 m3

Price: 0.830 TND/m3

Flat rate monthly: 1 TND

Water system:

Connection to SONEDE’s network + breakwater