REPUBLIC OF TUNISIA
MINISTRY OF AGRICULTURE, WATER RESOURCES AND FISHERIES
Office of Planning and Hydraulic Balancing

NATIONAL REPORT OF THE WATER SECTOR

Year 2021

FOREWORD

In Tunisia, water is a scarce resource, with an unbalanced distribution between regions.

- *In relation to the Tunisian population, water resources per capita, with less than 430 m3/year per inhabitant, are below the threshold of scarcity;*
- *The North occupies 30% of the territory and produces 80% of surface water resources, hence the use of transfer infrastructures to fill the lack of resources in the deficit regions, which are increasingly in demand, so generates increasing subsidies to cover the costs of energy for water transport.*

Water stress has increased since the 2000s due to a combination of many factors and effects, including climate change, hydro-meteorological parameters, increased water demand, and inappropriate water resource management practices.

The year 2021 was deficient in terms of climate and hydrology, with:

- *Total rainfall for the whole country was largely deficient. The average rainfall for the whole country was 172 mm out of an interannual average of 232 mm. The stock in dams was impacted with a filling rate from 43% at the beginning of the year to 33% at the end.*
- *The summer was characterized by an exceptional increase in temperature across the country. Several regions have registered new records. The average temperature reached 30°C, a record difference of (+2.65°C) compared to the average reference.*

This situation already reveals a upset of the climatic system: irregularity of the seasons or tendency towards the disappearance of seasonality, changes in rainfall patterns, repeated temperature records, etc., which requires further strengthening of the coupling between climatological /meteorological data and the management of water resources, and the need to review the types of development..

Today, due to its scarcity and sensitivity to climate change, water is at the center of many strategic challenges; it is a fundamental issue for national food security and development. For this reason, the Ministry has undertaken several strategic and prospective studies, including the study "Water strategy 2050", "Reuse of treated wastewater 2050", "Study of transfer of surplus water North-Central", National Drought Plan (PNS), etc. ...

Currently, the socio-economic and environmental context of Tunisia requires a new, equitable, sustainable, and transparent management by public and private management services. This new management approach is oriented in terms of priority towards:

- *A new water governance framework;*
- *A national objective of stabilizing demand in the medium term;*
- *The improvement of groundwater recharge with the identification of potential recharge sites from riverbeds;*

- *The intensification of the desalination of brackish water and the continuation of the national program for seawater desalination, taking into account the environmental aspect while acquiring a greater mastery of new technologies;*
- *The valorization of treated wastewater, gray water and rainwater;*
- *Controlling the costs of production, transport and treatment of water, by using clean energy in the water sector (solar, wind and hydraulic);*
- *The development of management tools with:*
    - *Systems for producing, managing and sharing data for efficient, sustainable and transparent management of water resources,*
    - *A platform / decision support tool for the development of water resources especially in the agricultural field (agricultural map),*
- *The vulgarization and the awareness, with the implementation of a strategy of communication allowing to exceed the dispersed initiatives and to value the capacities and the competences of the civil society to make a strong advocacy and public mobilization on the need to preserve the resource in a sustainable way;*
- *Scientific research in the water sector, with the strengthening of processes for coordinating initiatives in the field and bringing together research and extension;*
- *The economic valuation of the water resource and the fight against waste by the implementation of control systems of audit and incentives of financial order;*

This report presents the current situation and highlights progress of the implementation of the national water policy during the year 2021 and highlights the orientations and the program for the following years. It is published annually by the Office of Planning and Hydraulic Balances within the Office of the Ministry of Agriculture, Water Resources and Fisheries as part of the sectoral review of water.

This report was presented at the annual coordination meeting that brings together all the stakeholders in the sector, technical and financial partners, professional organizations and representatives of civil society. This meeting is a space for dialogue and consultation on the problems facing the water sector, as well as on the priority actions planned.

Decision-makers, stakeholders, national and international partners, and the public, who are interested in the issue of water in its various aspects, will find in this document information and findings on the current performance and orientations of the water sector.

Abdelmonaam BELAATI

The Minister of Agriculture, Water Resources and Fisheries

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LIST OF ABBREVIATIONS AND ACRONYMS

ACC	Adaptation to Climate Change
ACTA	Agricultural Land Management and Conservation
AFD	French Development Agency
ANPE	National Agency for Environmental Protection
ARESET	Support to the Reforms of the Water Sector in Tunisia
ARP	Assembly of People's Representatives
AVFA	Agency for Agricultural Extension and Training
BAD	African Development Bank
BIRH	Bureau of Inventories and Hydraulic Researches
BPEH	Office of Planning and Hydraulic Balances
BV / SBV	Watershed / Sub-watershed
CC	Climate Change
CCNUCC	United Nations Framework Convention on Climate Change
CDN / NDC	National Determined Contribution (under the UNFCCC)
CDE	Water Code
CERTE	Water Research and Technology Center
CES	Water and Soil Conservation
CITET	International Center for Environmental Technologies of Tunis
COP	Conference of the Parties (UNFCCC)
CR	Regional Council
DGACTA	General Directorate of Agricultural Land Development and Conservation
DGBGTH	General Directorate of Dams and Large Hydraulic Works
DGEDA	General Directorate of Studies and Agricultural Development
DGEQV	General Directorate of Environment and Quality of Life
DGGREE	General Directorate of Rural Engineering and Water Exploitation
DGPA	General Directorate of Agricultural Production
DGRE	General Directorate of Water Resources
DHMPE	Direction of the Hygiene of the Environment and the Protection of the Environment
DHU	Direction of Urban Hydraulics
EUT	Treated Wastewater
FAO	Food and Agriculture Organization
FBG	Good Governance Fund
FVC	Green Climate Fund
GBO	Management of the Budget by Objectives
GIZ	Deutsche Gesellschaft für Internationale Zuzammenarbeit
GDA	Agricultural Development Group
GR	Rural Engineering
INAT	National Agronomic Institute of Tunisia
INGC	National Institute of Field Crops
INM	National Institute of Meteorology
INRAT	National Institute of Agronomic Research of Tunisia
INRGREF	National Institute of Research in Rural Engineering Water and Forestry
IRESA	Institute of Agricultural Research and Higher Education
JICA	Japan International Cooperation Agency
MAE	Ministry of Foreign Affairs
MARHP	Ministry of Agriculture, Water Resources and Fisheries
MESRS	Ministry of Higher Education and Scientific Research
ODD	Sustainable Development Goal
OMS	World Health Organization
ONAS	National Sanitation Office
OSS	Sahara and Sahel Observatory

PACTE	Program of Adaptation to Climate Change in Vulnerable Territories of Tunisia
PADIT	Integrated Territorial Planning and Development Plan
PAP	Annual Performance Program (MARHP) Performance Improvement Program (SONEDE)
PI	Irrigated Perimeters
PIP	Private Irrigated Perimeters
PNA	National Adaptation Plan
PNUD	United Nations Development Program
PPI	Public Irrigated Perimeters
PTF	Technical and Financial Partner
RAP	Performance Report
REUSE	Reuse of treated wastewater
RMTA	Agricultural Earthmoving Equipment Board
RNV	Voluntary National Report (SDG)
SAEP	Drinking Water Supply System
SDEM	Seawater Desalination Plant
SDES	Saltwater Desalination Plant
SECADENORD	Société d'Exploitation du Canal et des Adductions des Eaux du Nord
SNBC§RCC	Low Carbon and Climate Change Resilience Strategy
SONEDE	National Company of Exploitation and Distribution of Water
STEG	Tunisian Company of Electricity and Gas
STEP	Water Treatment and Purification Plant
UE	European Union
UTAP	Tunisian Union of Agriculture and Fishing
UTICA	Tunisian Union of Industry, Commerce and Handicrafts
WES	Water and Environment Support

GENERAL SUMMARY

THE SITUATION IN 2021

Persistence of drought:

The total volume of rains in the 2020-2021 hydrological year for the whole country is largely deficient. The average recorded over the whole country is 172 mm out of an inter-annual average of 232 mm. The year was deficient in terms of inflows to dams. They totaled 804 Mm3 out of an annual average estimated at 1888 Mm3. This has reduced the stock of dams whose filling rate went from 43% at the beginning of the year to 33% at end of the same year.

It is worth recalling that during the last five years, four years were in deficit.

Sector governance

Tunisia is facing water scarcity due to increasing demands combined with the effects of climate change. The establishment of a sustainable governance approach is one of the priorities that the country is called to implement. In fact, there is a weakness in the governance mechanisms that is in coordination with an institutional fragmentation and an outdated regulatory framework.

Water policies:

Today, the Vision and Strategy of water by 2050 for Tunisia is being developed. It aims to achieve a hydraulic balance between supply and demand in 2050 and asserts the need for a paradigm shift by proposing administrative and institutional reforms for a new mode of effective governance and decision-making.

Among its orientations: The strengthening of resources in a perspective of management of extremes and resilience to climate change a balance Drinking water supply / irrigation ensuring the security of drinking water and regulation of irrigated agricultural production, improving the efficiency and performance of water infrastructure, the development of non-conventional water for ecological and economic purposes, the revival of rain-fed agriculture, the fight against pollution and an approach "nexus water-supply-energy-ecology.

The reforms undertaken in 2021 were limited to the review process of the draft new Water Code. This has not yet been adopted due to issues related to the former assembly's freeze on activities.

Management by the agricultural development groups:

The agricultural development groups present a level of appropriation of the resource and hydraulic infrastructure in the rural environment and at the level of the irrigated perimeters based on collective action. Their performance is quite weak. They remain vulnerable and poorly integrated into water governance and need to review their status and prerogatives, taking into account the guidelines that will be given in the future Water Code.

Financing the sector

The costs under the Water program of the Management of the budget by objectives (program 3) during the year 2021 reached 471 million Dinars. They represent 101% of the budget. These expenses have decreased by 200 MD compared to 2020, due to the lack of payment credits. This difficult situation of public finances could cause increased difficulties for the sector for the implementation of reforms and its modernization which requires substantial financial resources, especially in the context of the implementation of action plans of Water 2050.

Performance indicators:

The objectives are achieved for the indicators concerning the rate of drinking water supply in rural areas and the rate of water saving equipment. The same is true for the participation of women in the management of drinking water systems in rural areas, but this target is very modest (5% of steering

committees). The rate of mobilization of surface water has not been reached due to the delay in the construction of new dams. The situation related to the non-achievement of the objectives of wastewater and groundwater exploitation rate is recurrent.

Mobilization and transfer of water resources:

The year 2020/2021 is characterized by hydrological drought with 43% of the average annual inflow to dams. The stock dropped from 1005 Mm3 at the beginning of the year to 763 Mm3 at its end. This situation is affecting the available resources and the increase in water stress experienced.

Considering the development of water demand and the interregional imbalance in terms of water resources availability, major projects are being carried out to strengthen the transfer capacity: The project of reinforcing the Canal Medjerda Cap Bon by a transfer complex Saida-Belli -Kalaa Kebira coupled with the realization of two reservoirs in Saida and Belli.

In addition, the feasibility study for the transfer of water from the North to the Center of Tunisia has reached its final phase to provide additional resources to the dams of Nebhana and Sidi Saad. This transfer could allow better management of surpluses and reduce discharges into the sea, especially from the dam of Sidi Barrak.

Groundwater Resources:

Groundwater resources continue to face increasing human pressures. The total exploitation reached a volume of about 2836 Mm^3 with an overall exploitation rate estimated at 129%.

The strengthening of the protection of groundwater resources has benefited from 2 institutional support projects in cooperation with technical and financial partners, the twinning project "Support for the protection of water resources and control of the public hydraulic domain" and Tunisia water sector reform project **-** A-RESET.

The results achieved consist essentially in the strengthening of inspection capacities, the setting up of pilot regional multi-stakeholder control commissions (Twinning), the initiation of the first steps for the establishment of water table management plans (A-Reset), the purchase of rolling equipment to fight against illicit drilling in the 4 pilot regions (A-RESET) the development of awareness on water preservation (awareness framework strategy at the central level for Twinning, citizen survey, media campaign targeting the general public and training in high level conflict communication for A-RESET).

However, these programs face difficulties in implementing the reforms they support, in particular the failure to promulgate the water code.

Unconventional resources:

Unconventional resources are an alternative that could fill the supply-demand gap in the future. The use of treated wastewater is still modest due to its poor quality. The direct use of treated wastewater only exceeds 21 Mm3/year out of a total volume of 288 Mm3, which is 7% of the treated wastewater; the reluctance to use this resource persists, especially if a nearby conventional resource is available.

The strategy for reusing treated wastewater will have to include an important awareness component.

As for desalination, the current capacity of SONEDE's plants is around 165,600 m3/d. This process will increase with the start-up of future SONEDE plants, starting with the Zarat plant scheduled for 2023. But the massive use of desalination remains dependent on technological advances allowing large-scale desalination systems with better energy efficiency and effective mitigation of environmental impacts.

Water uses

Securing the drinking water supply:

The overall service rate is 98.4% in 2021 resulting in a rate of 100% in urban areas and 95.0% in rural areas.

The analysis of SONEDE's indicators for 2021 confirms the trend of annual growth in demand of around 3.6%, the dilapidated state of the networks with a large number of breaks (22,753 per year) and a considerable loss rate of 32.5%, resulting from insufficient investment in rehabilitation and metering faults at subscribers. SONEDE is finding it increasingly difficult to carry out rehabilitation/maintenance work due to increases in the cost of labor, energy and chemicals. Under these conditions, SONEDE is facing increasing difficulties in meeting the ever-growing demand for water.

SONEDE plans to invest systematically in upgrading its network and in water saving techniques through major network renovation projects such as the pilot action program (PAP). This will be started in 2022.

SONEDE has revised its tariffs in order to approach financial balance. Thus, except for the social category for which consumption is less than 20m3, increases of 9 to 34% have been decided in 2021 for all categories. However, despite the two increases (2020, 2021), SONEDE ...in principle, the decision of the Restricted Ministerial Council of 2019 provides for 5 annual adjustments (2020 to 2024) to achieve financial stability of SONEDE, knowing that the current context of significant cost increases is added as an additional constraint to achieve this objective.

In the rural areas served by the GR, projects are carried out under the program (African Development Bank 2 ADB) started since 2017. Out of 268 programmed projects, 119 have become operational since the beginning of the program. However, the performance of the drinking water service is not satisfactory due to the governance problems of the Agricultural Development Groups (GDA) and the lack of local water resources.

The control of drinking water by the Directorate of Environmental Hygiene and Protection DHMPE shows that the quality continues to deteriorate. The national average rate of bacteriological non-compliance recorded in 2021 is 10.6% for the SONEDE water. For some governorates, and especially for the agricultural engineering GR, the analyses show results out of standards. Regarding the physico-chemical parameters, the rate of non-compliance is 5% and remains within the limits of the standards of the World Health Organization (WHO)

Accelerated development of bottled drinking water:

The consumption of bottled water continues its progression with an individual annual consumption that reached 247 liters in 2021. The evolution of this consumption has accelerated in recent years with the increase in the frequency of water cuts and the decline in water quality.

The irrigated sector:

Irrigated agriculture exerts a very strong pressure on resources with a total irrigable area of about 441,000 hectares of which 249,000 hectares are public irrigated perimeters. Several major projects for the rehabilitation and modernization of public irrigated perimeters are being carried out. They cover a total of 44,750 ha for a total cost of 887 million dinars. These projects are likely to increase demand.

The irrigated sector continues to suffer from the climatic hazards that have caused a considerable decline in dam stocks. The allocated quotas vary according to the dams; they have been served up to 87%, following the persistence of the drought. The public irrigated perimeters PPI fed by the Nebhana dam, have been the most affected with quotas in the order of 20 to 25% of the demand, which considerably increases the pressure on underground sources through the use of legal and illegal drilling.

The analysis of the irrigated sector shows that it is essential to ensure the economic and social viability of holdings, to orient the choices of intensification towards agro-ecology, to control the risks in order to secure the supply of water to the irrigated sector and to upgrade the infrastructures.

Water saving in irrigation:

Since its inception, the National Program for Water Saving in Irrigation has made it possible to equip 417,500 hectares with water saving equipment at the plot level, i.e. 94.7% of the irrigated perimeters. Localized irrigation is practiced on 208,000 hectares. The investments for the equipment in water saving have reached since 1995 until 2021 the amount of 1665 MDT among which 759 MDT are grants.

The energy bill increasingly heavy:

SONEDE is the largest consumer of electrical energy in Tunisia, with a constantly increasing consumption that has reached 525 Gwh, generating an expense of 137 million DT. The cost per m3 consumed is estimated at 0.267 D/m3. The total consumption of SECADENORD has reached 128 Gwh with an expenditure of 31.2 million dinars. About 60% of the energy consumption by SECADENORD, that is to say 77 Gwh, is generated by the transfer of water from the extreme North from the dams Sidi Barrak, Barbara and Ziatine.

In order to reduce its energy bill, SONEDE has implemented an energy efficiency plan, including the acquisition of pumping equipment with higher energy performance and the implementation of smart water networks allowing SONEDE to better control its infrastructure; it also plans to set up renewable energy capacities.

Climate, environment and health aspects

Adaptation to Climate Change:

The Ministry of Agriculture, Hydraulic Resources and Fisheries is closely involved in all the processes that Tunisia has set up to meet its commitments in terms of mitigation and adaptation to climate change.

The Nationally Determined Contribution (NDC) has been updated. Tunisia has raised the objective of reducing the national carbon intensity[1] from 40% to 45% by 2030[2], compared to its level in 2010; the objectives in terms of resilience of the water resources sector have been consolidated: no less than 29 measures have been retained to "Limit the impacts of climate change on water resources and maintain the storage capacity of surface water and the satisfaction of all water needs of users.

The Strategy for Low Carbon and Climate Change Resilience confirms an ambitious vision of Tunisia's commitments to achieve carbon neutrality by 2050. Water governance and its preservation are at the center of the strategic axes of the SNBCRCC which materialize the 2050 vision of the national determined contribution.

In addition, the second phase of the study "Contribution to the elements of the preparatory phase of the process of elaboration of the National Adaptation Plan to climate change", "food security" component was completed in 2021. The development phase of the national adaptation plan itself should be initiated in 2022.

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[1] Carbon intensity is the ratio of net greenhouse gas emissions (expressed in tonnes of CO2 equivalent) to GDP (expressed in this NDC at constant 2010 prices).

[2] Tunisia's first NDC targeted a 41% reduction in its carbon intensity between 2010 and 2030.

The updating of the National Action Plan to Combat Desertification also contributes to the strengthening of efforts to adapt to climate change. It is aligned with or takes into account the different fields of the national strategic framework (Sustainable Development Goal ODD, National Determined Contribution NDC, and Water Strategy 2050...)

Environmental protection and pollution control:

Tunisia presents an overall risk to water quality for the indicators nitrogen, electrical conductivity, and biological oxygen demand. The situation is complicated by a dispersed system of observation, the increase in treated wastewater "TWA" that does not comply with standards and industrial wastewater discharged into the environment without sufficient treatment.

In 2021, the National Environmental Protection Agency carried out 4,445 control operations, of which around 50% directly concern water pollution. This control resulted in 714 PV against the offenders. Most of the fines concerned offenses which consist particularly of non-compliant water discharges as well as the anarchic evacuation of the vegetable waters.

Sanitation:

The sanitation system has enabled about 7 million people to be connected to the public sewerage system, so that the connection rate has reached 76.8% in the areas covered and 63.2% throughout the country. Out of 350 municipalities, 157 are still not covered. This concerns small municipalities.

The year 2021 was marked mainly by the completion of sanitation work in 09 popular neighborhoods, completion of sanitation work in rural areas of Talmin in Kebili and Wergesh in Jendouba, as well as the strengthening of the wastewater treatment system by the commissioning of two new treatment plant and water purification "STEP" in Sidi Ali bin Aoun/Beer al-Hafi and Sabeikha.

The water treatment and purification plants "STEP" are not stable from the point of view of the quality of purified water. But several projects are underway to improve the quality of treated wastewater "EUT" the rehabilitation and extension of treatment plant and water treatment. The treatment of industrial discharges by appropriate water treatment and purification plants remains a component to be strengthened especially for large urban centers.

Communication and research, involvement of civil society

Communication, awareness:

In the extension of 2020, communication actions are expanding. They go beyond the simple advice to citizens for water saving to touch other aspects of resource management and the risks incurred with their degradation. The opinion polls of the project "A RESET" and the speeches at the political level show a higher level of awareness of the critical situation of water resources in Tunisia. The progress in terms of digitalization offers more opportunities to reach the targets (interactive platform, SMS system) for outreach and awareness.

Research:

Research focuses on the priority themes of sustainable water resources management. Solutions are ready to be multiplied on a large scale in areas that have not been developed to date, such as rural sanitation.

Civil society involvement:

Civil society remains strongly involved in the issue of overhauling the Water Code and defending the right to water for all citizens and shows a higher level of awareness of the critical situation of the resources, as perceived by more and more citizens. Its actions in the field touch on key aspects of sustainable management of the resource, such as the preservation of wetlands and the development of non-conventional waters.

Sustainable Development Goals " ODD " - Agenda 2030:

The year 2021, was marked by the submission of Tunisia's second Voluntary National Report (VNR) on the monitoring of the Sustainable Development Goals "ODDs" in 2021. It focused primarily on 9 sustainable development goals "ODDs" (1; 2; 3; 8; 10; 12; 13; 16 and 17).

With regard to Sustainable Development Goal 6, while some indicators related to targets 6.1 and 6.2 continue to gain ground (in connection with the extension of water supply and sanitation infrastructure), others, particularly those of 6.4 (6.4.1. and 6.4.2), are declining, reflecting, on the one hand, inefficient management of water resources and, on the other hand, a state of acute water stress that is constantly increasing.

Findings in brief:

The year 2021 has seen progress in the study of strategic scope "Water 2050" which has reached the construction phase of the vision and strategy, the revision of the national determined contribution "CDN" with reinforced ambitions, the progress in the field of the control of the direction of the Urban hydraulics "DPH" allowing a reinforcement of the capacities of intervention of the actors who have the responsibility of it, the tariff adjustment of the drinking water by the National water distribution utility "SONEDE" to decrease the deficit cost/tariff for the second consecutive year...

However, major problems persist:

- Weak governance mechanisms;
- Overexploitation of aquifers and non-compliance with regulations
- Insufficient performance of the agricultural development groups "GDA";
- Continuous decline in the quality of drinking water;
- Decrease in the efficiency of networks;
- Reuse of treated wastewater "EUT" is always very low;
- Delays in the implementation of projects;
- Recurrent environmental offences at the origin of pollution.

SHORT-TERM ORIENTATIONS

The 2021 sectoral report reflects an alarming situation for water resources, in a situation of water shortage that is becoming chronic.

In order to meet these challenges, the following measures should be highlighted or proposed:

1) Implementation of good water governance:

- Addressing regulatory aspects: Relaunch the process of adopting the "Water Code" by proceeding to its consolidation with all stakeholders and, pending its adoption, improving efforts to fight against violations on the Public Hydraulic Domain "DPH".
- Ensuring the sharing of roles and complementarity between the various stakeholders, with the accountability of all actors from the decision maker to the user level;
- Addressing the institutional and organizational aspects of MARHP and public enterprises;

2) Stabilizing demand:

- To Improve network efficiency to tolerable levels by reducing losses and leaks through the rehabilitation, maintenance, and improvement of "water accounting" metering systems;
- To adopt a pricing system that encourages water saving and penalizes waste;
- To Support the practice of speculations that use less water while ensuring a better valuation of the m3 of water;
- To normalize the recycling of water used in industry;

- To allocate a volume of water for ecological systems;

3) Systematically promote infiltration at the expense of surface runoff:

- To adopt appropriate water and soil conservation measures to clean up the water cycle for the benefit of the availability of water resources and take greater advantage of the "green water" resource;

4) Conduct a study of potential recharge sites from bed river:

- To make the recharge of the aquifers a strategic choice to be maximized and generalized;

5) Intensify the desalination of brackish water for all uses:

- To Maximize the valorization of the considerable brackish groundwater resources by taking measures such as encouraging operators to equip themselves with osmosis devices, while using clean and cheap energy;

6) Maximize treated wastewater, graywater and stormwater:

- To initiate the implementation of the strategy of the reuse of treated wastewater "REUSE" allowing the exploitation of the maximum of treated wastewater;
- Encourage the collection of rainwater while respecting the technical precautions, in order to be able to store the maximum of it;

7) Water prices:

- Control costs, especially through the use of clean energy in the water sector (solar, wind and hydraulic), while ensuring the efficient use of water resources;
- Ensure the recovery of operating and maintenance costs;

8) Information system:

- Revitalize the information system of data such as rainfall, piezometry, hydrometry, exploitation, the database of boreholes and that of irrigated perimeters, with their characteristics, while making them accessible to users;
- To publish informative data to raise the awareness of the general public.

9) Popularization and awareness:

- To go beyond the dispersed communication initiatives carried out in different projects and to include them in a common National Communication Plan (PNC) to raise awareness among users in the different economic sectors, within the framework of the actions of the Water 2050 strategy;
- To Valorize the capacities and skills of the civil society to make a "shock" plea on the need to preserve the resource sustainably and the risks incurred by its degradation for all categories of the population;
- Continue and intensify awareness campaigns to the general public, schools and universities.

10) Water Sector Research:

- Develop processes/activities to strengthen the coordination of research-extension initiatives (matching demands for innovations with offers of research results, promotion of extension research results);

11) Ensure the training of water professions and other profiles related to water use, :

- Develop and implement programs and fixed subjects in the educational cycles, from the beginning of elementary school to higher education, on water scarcity, its environmental dimension, the impacts of climate change "CC" and the necessary means of mitigation and adaptation;
- On the other hand, to strengthen the higher education of several specialties such as hydrogeology in the training of soil scientists, the use of innovative technologies for resource management, agroecology, water productivity, ...

SUMMARY OF DATA AND INDICATORS OF THE WATER SECTOR IN TUNISIA (2021)

	Descriptions	Unit	2015	2020	2021
I.1	Surface area of Tunisia	Km2	163 610	163 610	163 610
II.2	Urban population	1000 Inha	7622	8 044,4	8 058,7
II.3	Rural population	1000 Inha	3 612,3	3 740,6	3 744,9
II.4	Total population	1000 Inha	11234	11 785,0	11 803,6
	Rainfall average for the whole country	mm	234	218	172
II.1	Surface resources: inflows to dams	Mm3	2085	791	804
II.2	% of annual inflow to dams / average annual inflow	%	108	44	43
II.3	Underground resources	Mm3	2174	2201	2201
II.4	Surface water mobilization rate	%		92	92
III. 1	Number of dams	Unit	35	37	37
III. 2	Number of hill dams	Unit	253	258	258
III. 3	Number of hill lakes	Unit	902	918	922
III. 4	Total area of irrigated perimeters	1000 ha	425	440	441
III. 5	Surface area of private irrigated perimeters	1000 ha	227	248	249
III. 6	Percentage of irrigated perimeters equipped with water saving equipment	%		94,5	94,7
III. 7	Area developed in PI with treated wastewater	1000 ha	8,420	7,584	7,584
III. 8	Area actually irrigated from treated wastewater	1000 ha	2,134	2,450	2,425
IV.1	Agricultural withdrawal (Freshwater)	Mm3		2710	2780
IV.2	Water withdrawal for drinking water (Domestic)	Mm3		802	822,60
IV.3	Industrial water withdrawal	Mm3		61,9	60,62
IV.4	Withdrawal for tourism and others	Mm3		13,5	46,42
IV.5	Use of treated wastewater in irrigation (Agriculture)	Mm3		12,2	14,38
IV.6	% of treated wastewater in agriculture	%		5,1%	4,9
V.1	YEARBOOK 2015 — Number of equipped surface wells	Unit	111431	115001	115001
V.2	YEARBOOK 2015 — phreatic zone exploitation	Mm3	903	914	914
V.3	YEARBOOK 2015 — Phreatic zone exploitation rate	%	118	119	119
V.4	Total number of water points with deep aquifers	Unit	21675	34467	35428
V.5	Number of authorized drillings	Unit	10573	14117	14149
V.6	Number of unauthorized drillings	Unit	11102	20350	21279
V.7	Exploitation of deep aquifers	Mm3	1705	1904	1922
V.8	Exploitation rate of deep aquifers	%	119	133	134
V.9	Total exploitation of underground resources	Mm3	2608	2818	2836
V.10	Exploitation rate of groundwater resources	%	119	128	129
V.11	Volume of water artificially recharged	Mm3	30,9		41,74
VI.1	Number of agricultural development groups for drinking water supply	Unit	1364	1369	1330
VI.2	Number of agricultural development groups of irrigated perimeters	Unit	1243	1240	1229
VI.3	Number of mixed agricultural development groups	Unit	136	125	129
VI.4	Total number of agricultural development groups	Unit	2607	2734	2688

VII.1	Expenditures in Management of Budget by Objectives		1000 D	259,1	590,398	465,367
VII.2	Expenditures Achieved for Management of Budget by Objective		1000 D	270,2	672,835	470,995
VII.3	Expenditure Realization Rate of Management Budget by Objectives		%	104,3	114	101
	Target 6.4: Sustainable management of water resources					
VIII.1	Indicator 6.4.1: Change in the efficiency of the use of water resources		$US		11,33	7,94
VIII.2	Indicator 6.4.2: Level of water stress: Freshwater withdrawal as a proportion of available freshwater resources		%	92,02	112,67	119,3
	Supply of drinking water by national water distribution utility “SONEDE”					
IX.1		Total number of users	Unit	2720	3038	3121
IX.2		Urban population served with drinking water	1000 Inha	7622	8044,4	8058,7
IX.3		Urban water service rate	%	100	100	100
	Drinking water supply in rural zone ("SONEDE" national water distribution utility + rural engineering "GR")					
IX.4		Rural population served by national water distribution utility SONEDE	1000 Inha	1850,3	1997,7	2009,8
IX.5		Rate of service by national water distribution utility SONEDE in rural zone	%	51,2	53,4	53,7
IX.6		Rural population served by agricultural engineering "GR	1000 inha	1494,8	1546,5	1547,8
IX.7		Rate of service in rural zone by agricultural engineering "GR	%	41,4	41,3	41,3
IX.8		Rural service rate (agricultural + national water distribution utility SONEDE)	%	92,6	94,7	95
	Global drinking water supply (Urban + Rural)					
IX.9		Total population served with drinking water	1000 Inha	10967	11588,6	11616,3
IX.10		Overall service rate	%	97,6	98,3	98,4
	X. National water distribution utility (SONEDE)					
X.1		Number of treatment plants	Unit	19	19	19
X.2		Number of seawater desalination plants	Unit	0	1	1
X.3		Number of brackish water desalination plants	Unit	5	15	15
X.4		Length of the network	Km	51902	56561	57314
X.5		Water production total volume produced	Mm3	646,5	759,1	779,9
X.6		Brackish water and desalinated sea water	Mm3	18	42,7	42,4
X.7		Total volume consumed	Mm3	447,7	494,3	511,8
X.8		Volume consumed/inhabitant/day	l/inha/day	122,1	122,9	123,2
X.9		Average rate /m3 (with fixed charges)	D/m3	0,56	0,765	0.914
X.10		Average cost per m3	D/m3	0,82	1,224	1302
X.11		Overall network efficiency (supply and distribution)	%	70,7	67,7	67,5
X.12		Energy consumption	GWH	397	516	525
X.13		Specific production energy consumption	Kwh/ m^3		0,698	0,691
X.14		Energy cost	MDT		139,79	141,65
X.15		Specific production energy cost	millim / m^3		18,4	18,2

	X. SECADENORD « company of exploitation of the canal and the water supply north"					
X.13		Total volume billed	Mm3	460	478,5	467
X.14		Volume of water supplied to national water distribution utility SONEDE	Mm3	305	372	389,2
X.15		Volume of water supplied to the Regional Agricultural Development Commission "CRDA	Mm3	155	106,5	77,5
XI.16		Energy consumption	GWh	71,6	127,6	128
XI.17		Cost of energy consumption	MDT	13	31,1	31,2
	X. ONAS the national sanitation office					
X.18		Number of wastewater treatment plants	unit	113	123	124
X.19		Length of the network	Km	16063	17729	17877
X.20		Number of municipalities served	unit	173	193	193
X.21		Number of users	unit	1798	2125	2160
X.22		Rate of connection to the public sewerage system	%	61,9	63	63,2
X.23		Volume of wastewater (produced)_VWWP	Mm3		325	321
X.24		Volume of wastewater collected_VWWC	Mm3	249	289,4	289,4
X.25		Volume of wastewater treated_VWWT	Mm3	243	287	288,5
X.26		% of wastewater treated (VTW/ VWWP)	%		88,3	89,7
X.27		Volume of wastewater reused directly for any purpose	Mm3	12	20,9	21,74
X.28		Energy consumption for treatment and pumping	GWh	97,8	126	126
	Water pollution control (National Agency for Environmental Protection - ANPE)					
XI.1		Number of control points	Unit		340	390
XI.2		Number of water pollution control operations	Unit	5842	3 284	4445
XI.3		Number of non-conformity or infringement minutes	Unit		638	714
	Sanitary control of drinking water distributed by SONEDE (direction of hygiene and environmental protection (DHMPE)					
XI.4		Number of controls of free residual chlorine	Unit	269892	287797	253944
XI.5		Number of bacteriological analyses	Unit	28238	31579	31670
XI.6		Number of physico-chemical analyses	Unit	540	785	746
XI.7		Rate of physico-chemical non-compliance	%	34	5*	5
XI.8		Rate of bacteriological non-compliance	%	6	10,1	10,6

**Change in measurement method between 2015 and 2020*

in yellow, indicators with a negative trend

INTRODUCTION

The scarcity of water following the increase in water demand, increased by the effects of climate change, has prompted those responsible for managing the water system to rethink their modes of intervention.

Indeed, the weakness of coordination and consultation mechanisms between the various stakeholders is identified as a factor that contributes to the unsustainable governance of water resources.

Attempts to coordinate between the various actors and to involve the various levels of the decision-making process are carried out. These adaptations should ultimately lead to the establishment of a good water governance approach in Tunisia.

The sector review is one such attempt. This is a work process that should ensure dialogue with these parties on the monitoring of ongoing operations and the country's sector strategy.

The annual national report of the water sector constitutes the basic document of the sector review.

This report presents the progress of the implementation of reforms and strategies in the various sub-sectors and analyzes the current situation on the basis of the results and the various indicators.

It was established from the contributions of the various institutional actors involved in the sector within the Ministry of Agriculture, Water Resources and Fisheries "MARHP" and other Ministries including the Ministries of Environment and Health, consultations, and discussions with the community of researchers and with civil society (active associations in the sector).

As part of an interview process, interviews were held with the contributors to this report.

The draft report is being shared with contributors for comment, institutional partners in the sector, and technical and financial partners.

Meetings to discuss this version will be held before a new version is presented at the annual coordination meeting.

This annual meeting, bringing together all parties involved, is an important opportunity to discuss the challenges and priorities of the sector, to measure the progress made before proposing ways to improve in order to achieve the objectives set, and to consolidate the approaches, strategic choices and allocation of resources available from the state budget as well as technical and financial support from technical and financial partners "TFP".

FIRST PART

WATER SECTOR GOVERNANCE AND FINANCING

I. THE WATER SECTOR GOVERNANCE

I.1. POLICIES

I.1.1. Introduction

Tunisia has some important assets in the field of water management which have allowed it to avoid difficult situations and a large number of constraints such as the climate.

But the situation of the water field is characterized by the fact that the rationalization and regulation devices do not work at the optimum. This results in losses of efficiency at all levels, which are very difficult to reconcile with a water context marked by both scarcity and irregularity, which will become much worse with today's reality and the prospect of climate change.

Also, if there is no qualitative change in the way of thinking and conducting public water policy, serious consequences will affect the viability of the entire system, with ecological, social and economic effects.

I.1.2. Vision And Strategy Development of The Water Sector By 2050 In Tunisia

In order to improve the governance of water resources, based on a vision of achieving a hydraulic balance between demand and supply, the prospective study "the development of the vision and strategy of the water sector in Horizon 2050 for Tunisia" started in March 2019. It is divided into five (5) stages:

(1) Start-up: collection and preliminary analysis of existing data and previous strategies and studies.

(2) Diagnosis: inventory of the water sector; capitalized hydraulic assets, performance levels achieved, constraints of the current hydraulic system, its imbalances and malfunctions. He confirmed that the "water system" is operating more and more at the limits of its capacities and may be confronted with real risks of scarcity in quantity and quality, requiring a change of strategic paradigm.

(3) Foresight: establishment of projections according to different scenarios up to 2050. This step resulted in a "Water & Sustainable Development" scenario. The components of this scenario are part of an ecological and energy transition, and consist in optimizing supply and stabilizing demand, with: strong adaptation of the irrigated sector to climate change "CC", treatment of discharges at source, strong diversification in renewable energies, reinforcement of Public Private Partnership "PPP", and decentralized regional development. The scenario has been modelled in order to find the water balance and to design management rules to preserve this balance in normal situations, and finally, to detect imbalances in the future, especially in extreme situations.

(4) Vision and Strategy: carried out during the year 2021, it constitutes a "Key Stage", which confirms the paradigm change by:

- Administrative and institutional reforms for a new mode of effective and decision-making governance: to match the Missions of the Ministry of Agriculture, Water Resources and Fisheries "MARHP" with principles of "**Accountability**" for the achievement of Objectives of " **Food Security**" and "**Resilient Agriculture**"; creation of a specialized institution "Support for Private Perimeters"; acceleration of the Adoption of the New Water Code integrating these different options and based in particular on the adoption of the legal principle of "**Public Domain of Social, Environmental and Territorial Utility of Water**"; …
- 32 "tellian" dams to be built and 17 "southern Mediterranean hydro-climatic" regime dams to be upgraded: all of these reservoirs would make it possible to mobilize 1.5 billion m3 by 2050;

- Reinforcement of underground resources with a view to managing extremes and resilience to climate change: proactive management of floods at dam locks for assisted infiltration into groundwater;
- A balance of drinking water supply/irrigation in a 30/70 proportion by ensuring the safety of drinking water supply and the regulation of irrigated agricultural production, with:
  - A 100% secure and efficient drinking water supply system, meeting international standards: **stabilization of the consumption graph of the drinking water supply by 2050 (115l/day/inhabitant of specific consumption); total renovation of 73% of the network in 2050; overall efficiency of the networks to 80% by 2050;** installation of smart meters; a main hydraulic circuit ensuring the security of drinking water supply for 12 governorates from the waters of the far north; **a drinking water service in rural areas equivalent to that of the urban ;**
  - An irrigation guaranteed by the dual supply of surface water and / or groundwater: climate-smart and efficient to 83%: **doubling the supply of irrigated areas from surface water and groundwater, considerable improvement of efficiency and performance of irrigated areas at the level of networks and production** with the strengthening and modernization of techniques and technology in line with what is developing internationally, especially in the drylands;
- Water quality control and pollution control, **with closed cycle, constant level reservoir, wastewater, and reuse of treated wastewater**: collection and treatment of grey water and rainwater; **recovery of 85% of treated wastewater for ecological and economic purposes**; a desalination program, as carried out and planned by national water distribution utility SONEDE;
- A food security stabilized sustainably and resilient to climate: **financial balance green water** / **virtual water;** revival of **rainfed agriculture**, implementation of a conservation of water and soil of terroir, inclusive, productive, ecological and resilient to climate change with the integration of wetlands; a climate insurance and a socio-economic transition of rurality: polyculture, value chains;
- **An energy transition in support of the strategy WATER 2050**; a decoupling of economic growth from water and energy and through new technologies; a **nexus approach "Water, Energy, Food**" national and international;

(5) Action plans: to be developed in 2022.

I.2. THE LEGAL FRAMEWORK

Most of the hydraulic legislation of Tunisia is the subject of the Water Code (CDE) promulgated by Law No. 75-16 of 31 March 1975.

Over time, new challenges and threats are threatening water resources, such as overexploitation of resources, degradation of quality, an unsuitable governance framework, the impacts of climate change. A draft of a new Water Code (CDE) has therefore been developed for better consideration of these aspects. In December 2019, it was submitted to the former Assembly of Representatives of the People

The review process of this project in the parliamentary committee, began in December 2020.

Considering the importance of this law and its impact on all components of Tunisian society, a consultation process at the national and regional level has been established with listening sessions to national professional organizations (Tunisian Union of Agriculture and Fisheries, The Union of Farmers of Tunisia and Tunisian Union of Industry, Trade and Handicrafts), and also to some

components of civil society, including representatives of Agricultural Development Group and experts.

But the law was not voted before the freeze of the activities of the Parliament.

In summary

The modeling carried out in addition to the projections of scenarios to 2050 confirmed the hypothesis of a water crisis before 2030 if nothing was done in the short term in order to accelerate the commitment of strong measures to consolidate the efforts to achieve a balance between supply and demand.

The "Water 2050" strategy is now central, fully in line with the implementation of the Sustainable Development Goals " ODDs " in Tunisia and consistent with the substantive elements of the proposed new water code.

Without a clear perspective on the future of the proposed new water code, the rapid implementation of the "Water 2050" strategy, which brings together the most appropriate guidelines and measures to ensure sustainability with a supply-demand balance in the medium term, should be favored in order to anticipate a possible revision of the code and to begin its concrete application. However, in the current difficult context (political, socio-economic and environmental), the question of priorities, in relation to limited implementation capacities, will have to be rigorously evaluated in the framework of phase 5 of the study, which should develop the strategy's action plans/projects up to 2050.

I.3. INSTITUTIONAL ORGANIZATION

I.3.1. Organisation analysis

From an organizational point of view, there was nothing new during the year 2021. There are persistent weak points, including:

- **Not very active consultation mechanisms**: The consultation mechanisms between water administrators and users, such as the National Water Council (CNE), are not sufficiently operational. The last meeting of the National Water Council "CNE" was in March 2017, although it is supposed to meet at least twice per year;
- **Centralized water governance that is controlled by the State**. The current role of the regional "governorate level" needs to be consolidated. The real involvement of users in the decision-making process is not yet up to the level of the stated ambitions.

I.3.2. Management by Agricultural Development Groups

The Agricultural Development Groups (GDA) represent the main local institution for the participatory management of water systems (drinking water supply and irrigated perimeters). The participation of users is done through the Agricultural Development Groups.

In 2021, there were 2,688 Agricultural Development Groups (compared to 2,694 Agricultural Development Groups in 2020), including:

• 1 330 Agricultural Development Groups for rural drinking water supply;

• 1 229 Agricultural Development Groups of Private Irrigated Perimeters;

• 129 Mixed Agricultural Development Groups.

These Agricultural Development Groups supply 1.548 million inhabitants with drinking water and approximately 229,000 inhabitants of Private Irrigated Perimeters (i.e. more than 80% of the total surface area of Private Irrigated Perimeters).

Overall, the situation of Agricultural Development Groups has not improved, and these structures are unable to perform their tasks. Agricultural Development Groups still face many challenges, revealed, and exacerbated following the political upheavals experienced in Tunisia since 2011, such as in particular debt, crops abandoned due to lack of water, acts of vandalism on public infrastructure, the reluctance of beneficiaries towards voluntary work because of the complexity of the water systems, the almost total lack of financial control and weak management capacities.

Programs are carried out to support Agricultural Development Groups and revitalize them. The Good Management Fund (FBG) is one of them. It aims to guarantee the sustainability of hydraulic irrigation and drinking water supply systems through the upgrading of 110 Agricultural Development Groups in five governorates: Kairouan, Sidi Bouzid, Kasserine, Sfax and Mahdia.

The planned duration of the project is 5 years from 2018. Following the delays recorded in the technical assistance, the progress of the realization (end of 2021) is limited to the upgrading of 18 hydraulic systems. Most of the capacity building activities at the level of the Agricultural Development Groups and the districts in charge of their supervision are scheduled for 2022.

(See more details on the program and its progress in the attached project matrix).

The question of the future of Agricultural Development Groups should be central in the near future within the framework of the future Water Code, and be reformed in terms of status and prerogatives, in order to respond in a relevant way to the needs of users to water s in rural areas.

II. FINANCING AND COSTS FRAMEWORK

II.1. THE WATER PROGRAM BUDGET OF THE MANAGEMENT OF THE BUDGET BY OBJECTIVES AT THE MINISTRY OF AGRICULTURE, WATER RESOURCES AND FISHERIES

II.1.1. The budget by the nature of costs

Agricultural Development Groups (GDA) represent the financial forecasts and achievements of the Water program (P3) within the framework of the management of the budget by objective (Management of the Budget by Objective) are summarized in the following table:

Table n°1: The payment budget 2021 of the Water Program according to the nature of the expenditure (in millions of dinars)

Class	Achieved in 2020	Registered 2021*	Achieved in 2021
Remuneration	56,589	60,026	60,623
Management	78,506	1,360	16,316
Interventions	122,118	111,225	106,103
Investments	331,622	208,756	203,953
Financial operations	84,000	84,000	84,000
Total	672,835	465,367	470,995

Expenses are classified as follows:
Remuneration expenses: payment of personnel;
Management expenses: transfers to national water distribution utility and operating expenses of water management services at the ministry of agriculture, water resources and fisheries
Intervention expenditures: include incentives for investment in the water sector (water saving equipment, etc.) and the State's contribution to the financing of national water distribution utility 's projects;
Capital expenditures: project implementation
Financial operations expenditures: transfers to national water distribution utility
(1): budget entered after the supplementary finance law

It should be noted that:

- The payment budget registered in the finance law was 517 MD. This one was lowered to 465 MD by the complementary finance law. Consequently, some payments could not be made. This lack of payment credits has direct consequences for the organizations (among others, the National Office of Sanitation, the General Directorate of Dams and Large Hydraulic Works, the Regional Commissariat for Agricultural Development) which are no longer able to respect their counterparty on time, with as a corollary risk of important unpaid bills for the companies of the works and delays in the building sites, which can cause additional costs;
- The total expenses decreased by 202 MD compared to the year 2020; in particular the investment expenses which recorded a decrease of 127, 669 MD compared to 2020;
- The difference between the management expenses registered (1,360 MD) and realized (16,316 MD) comes from the fact that the forecasts had not considered the energy expenses for the transfer of the waters of the extreme North.

II.1.2. the budget by sub-program

The subprograms include:

- Sub-program 3-1: Agricultural engineering and water exploitation managed at the central level and state incentives;

- Sub-program 3-2: Water resources, dams and large hydraulic works;
- Regional programs. They mainly include private irrigated areas and the rural drinking water supply program with a multitude of costly projects (creation of irrigated private areas, modernization, equipment maintenance, operation of works, the rural drinking water supply program, etc.).

Table n°2: (Payement budget by sub-program (in millions of dinars - Source: performance report 2021 by the ministry of agriculture, water resources and fisheries)

N°	**Sub-Program**	**Achieved in 2020**	**Registered 2021**	**Achieved in 2021**
3-1	Agricultural engineering and water exploitation (at the central level)	89,648	48,654	*45,248*
3-2	Dams, major hydraulic works and water resources	225,561	94,787	*107,360*
Regional Programs		176,991	154,850	*156,302*
Public operators: Financing of National water distribution utility SONEDE's drinking water supply in rural areas projects		95,000	83,085	*78,085*
Public operators: SONEDE: national water distribution utility		84,000	84,000	*84,000*
Public operators: Drilling board		1,170	0	*0*
	Total	**672,835**	**465,367**	***470,995***

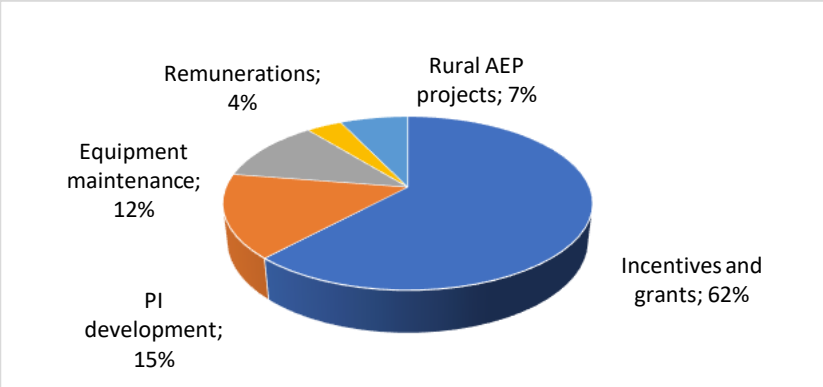

Figure n°1: Distribution of the achievements of the Agricultural Engineering and Water exploitation program

The achievements during 2021 of the Agricultural Engineering and Water Exploitation program at the central level are mainly devoted to incentives and grants for water saving and exploitation of irrigated areas.

In summary:

The public financing of water remains governed by a persistent paradoxical effect, consisting in the fact that the extreme reduction in the means of financing generates each day less capacity for maintenance and upgrading of infrastructure and equipment, thereby aggravating the reduction in financial availability required by the activity (Indicator Intensity of water consumption "CF" and the achievements in Agricultural Engineering and Water Exploitation).

And thus, generating more and more constraints, up to the survival limit of the whole "water system" and the threat of its blockage. Whereas, with a view to optimal management of the water system, in-depth actions to modernize/adapt/optimize the system will have to be undertaken quickly, with a significant financial cost, at a time when public finances in the short and medium terms are going through a rough patch.

II.2. INDICATORS OF THE BUDGET MANAGEMENT BY OBJECTIVE

For program 3 - Water, the budget management by objective has retained 3 objectives and 6 indicators. The target to be achieved is scalable and must demonstrate progress.

The following table gives the indicators and targets of the 2021 RAP for the P3 Water program.

Table n°3: The objectives and indicators of program 3 (Source: Performance Report 2021 of the ministry of agriculture, water resources and fisheries)

N°	**Indicator**	**Achieved 2020**	**Targeted 2021**	**Achieved 2021**
Objective 3-1: Managing water demand				
3-1-1	Rate of irrigated area equipped with water saving equipment (Regional indicator)	94,5%	95,5%	95,7%
3-1-2	Volume of treated wastewater reused in agriculture (regional indicator)	12,2 Mm^3	13 Mm^3	12 Mm^3
3-1-3	Groundwater exploitation rate without taking into account illicit drilling (Regional indicator)	104 %	100 %	*Not done*
Objective 3-2: Meeting rural drinking water needs				
3-2-1	Coverage rate for rural drinking water supply (Regional indicator)	94,7%	95,0%	95,0%
Objective 3-3: Mobilization of surface water resources				
3-3-1	Rate of mobilization of surface water resources (central)	92%	93%	92%
Objective: Improving the role of women in rural water management				
	Rate of women's participation in the Boards of Directors of agricultural development groups for rural drinking water supply and as technical directors	4%	5%	5%

Indicator Analysis:

Achievements are below target for at least 3 out of 6 indicators.

Water saving in the irrigated areas: The indicator relating to the equipment of the irrigated areas through water saving is achieved. However, the method of calculation of this indicator does not consider the state of the water saving systems in place, which have become obsolete or degraded and are no longer functional.

Reuse of treated wastewater in irrigation: This has been a recurring observation for several years. The target has not been reached although it is very low compared to the availability of treated wastewater and the surface of public irrigated areas with treated wastewater.

Groundwater exploitation rate: the rate for the reference year (2021) is not yet available. The rate for the year 2020 exceeds the target of 4% without taking into account illicit drilling.

The mobilization of surface water resources: the delay in the completion of the Douimis dam is largely responsible for the stagnation of the rate at 92% instead of the target of 93%.

Women's participation in the management of rural water supply systems: the target of 5% has been reached. However, women's participation in the management of water systems remains low given the social specificities of rural areas, and the mode of governance in agricultural development groups, which is more easily controlled by men.

SECOND PART

WATER RESOURCES: AVAILABILITY, MOBILIZATION AND CONSERVATION

I. WATER RESOURCES MOBILIZATION

I.1. GROUNDWATER

The non-rational exploitation of groundwater reaches an alarming stage far beyond the renewal rate of the resource. This may result, in the absence of a solution, in a deterioration of water quality following the increase of its salinity in situ or by sea water intrusion.

The state of groundwater overexploitation is illustrated by two indicators: the rate of exploitation and the number of illicit drillings.

I.1.1. The phreatic zones

The estimate of the volumes of water exploited from the aquifers is based essentially on the average continuous fictitious flows of the surface wells, the frequency of irrigation and the types of crops practiced by region. The volumes of water withdrawn from these aquifers in 2020 are estimated at 914 Mm3 /year, i.e. an exploitation rate of 119% compared to annual renewable resources estimated at 767 Mm³/year (compared to 118% in 2015).

This exploitation is done through 115001 equipped wells (among 153347 wells in total) against 111431 in 2015 or an evolution of 3570 wells compared to 2015. It is noted that the water tables of Central Tunisia are the most requested with a withdrawal rate of 139% in 2020.

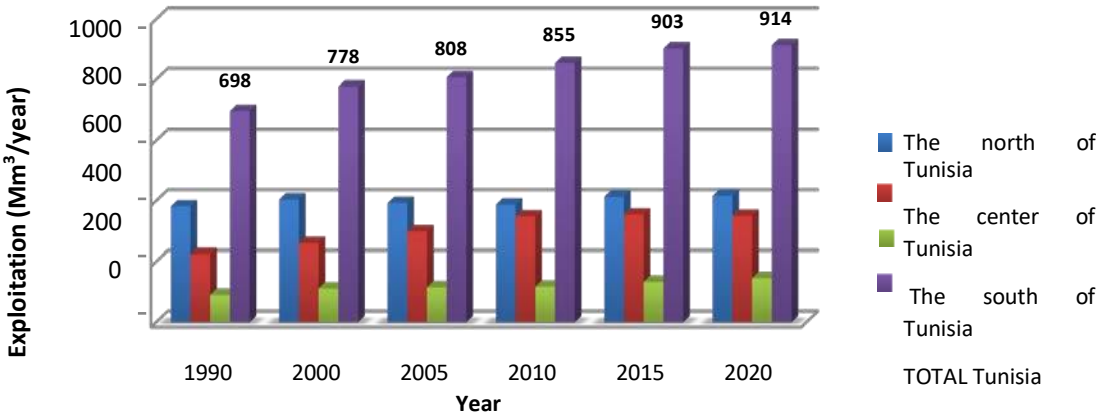

Figure n°2: Evolution of phreatic zones exploitation in Tunisia 1990-2020 (Source: DGRE 2022)

I.1.2. The deep aquifers

The overall exploitation of the deep aquifers of Tunisia in 2020, reached a volume of about 1922 Mm³ in 2020 against a volume of 1844 Mm³ in 2019. The overall exploitation rate is estimated at 134% compared to annual renewable resources estimated at 1431 Mm³/year.

The exploitation of the deep aquifers is done through 35,428 water points.

Among the water points, we estimate:

- 14149 authorized water points that withdraw about 1381 Mm³ of which 800 created in 2021;
- 21279 illicit boreholes that withdraw about 541 Mm³; 9252 are in Kebili, 4700 in Sidi Bouzid, 2430 in Kasserine and 1796 in Nabeul.

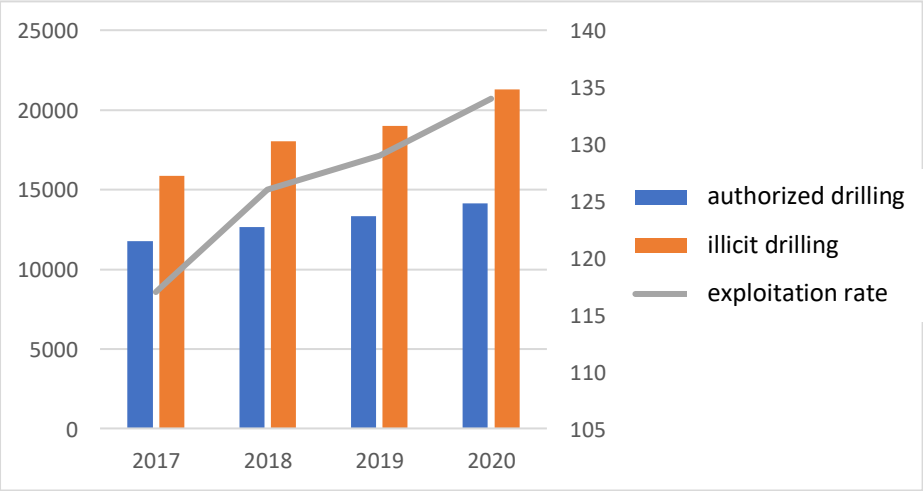

Figure n°3: Evolution of the exploitation of the deep aquifers

Overexploitation continues at a steady pace. It is estimated that illicit drilling now accounts for 60% of all drilling.

I.2. SURFACE WATER MOBILIZATION

Most of the surface water potential is in the North.

Tunisia has developed for decades a strategy of mobilization of its water resources initiating significant investments. The first objective of this hydraulic infrastructure has been the collection of water in addition to the protection against floods.

The planning and construction of dams continues to this day, following master plans, although suitable sites for a dam are becoming increasingly difficult to identify. In the near future, the priority will be the sustainability of these large infrastructures, which are exposed to degradation.

The mobilization of surface water faces two essential problems:

- The irregularity of supplies with fairly long drought cycles which result in the decline of stocks. Of the 2700 Mm3/year of average potential surface water resources, 1800 Mm3/year, on average, are irregular flood waters;
- The siltation of dams, which has become an acute problem as it drastically reduces the useful volume of dams and thus hinders their function of mobilizing and regulating water. As of August 31, 2021, the siltation of large dams is estimated at 675 million m3 out of an initial capacity of 2,988 million m3, i.e. an average siltation rate of 23%. For all capacities combined, dams lose 22 Mm3 each year. Bathymetric measurements are irregular and insufficient, especially for dams that provide drinking water supply, such as Sidi Barrack.

In addition, large quantities of water have been discharged into the sea without this being the result of an explicit policy of discharge such as for ecological reasons, but only by an effect of exceptional floods not controlled by the water system as a whole. This characteristic is specific to the country with an arid climate, with a precipitation regime of irregularity and intensity that favors too much runoff and too little infiltration. This hydric characteristic is going to be more predominant and accentuated with the climate change and this irrecoverable discharge affects the water balance and deprives the country of a scarce resource, being at the origin of the damages due to the floods.

I.2.1. Mobilization infrastructure

The country's surface water mobilization infrastructure now includes:

- 37 large dams of which 36 are in operation with a current total storage capacity of 2,313 Mm3. The Serrat dam is not yet included in the situation of the exploitation of dams until August 31, 2021;
- 258 hill dams and 922 hill lakes, with a total capacity of about 360 Mm³ that can be mobilized for local use for irrigation;
- 4 infrastructures in progress: dams of Mellègue upstream (Kef), Douimis (Bizerte), the reservoir of Kalaat Kébira and the reservoir of Saida.

The Annual Performance Report for the year 2021 indicates that the surface water mobilization rate is 92%.

I.2.2. The hydraulic situation of the dams during the year 2020/2021

The year 2020/2021 is characterized by the hydrological drought experienced following the low inflows in the dams. In fact, the year was largely in deficit with 43% of the average annual contributions. The stock of dams fell from 1005 Mm3 at the beginning of the year to 763 Mm3 at the end.

Table n°4: Inputs and releases from the 36 dams in operation (in millions of m3 - Source: DGBGTH)

Regions	**Storage on 1/9/2020**	**Contribution 2020/2021(1)**	**Average annual contribution (2)**	**(1)/(2) %**	**Releases**	**Storage on 31/8/2021**
Dams in the North	888	736	1630	45	983	686
Dams of the Center	91	58	213	27	33	65
Dams in Cap Bon	26	9	45	20	17	12
Total	**1005**	**804**	**1888**	**43**	**1033**	**763**

The filling rate of the dams has dropped from 43% on September 1, 2020, to 33% on August 31, 2021.

Analysis of inflows over the last five years shows a significant deficit in inflows. In fact, during this period, four out of five years have been in deficit. Only the year 2018/2019 recorded a surplus. This situation affects the available resources and the increase in water stress experienced by the country.

The irrigated areas from Nebhana and Sidi Salem have seen their quota significantly reduced.

Table n°5: The contribution evolution over the last 5 years

Year /contribution	**2016/2017**	**2017/2018**	**2018/2019**	**2019/2020**	**2020/2021**	**Average 5 years**
Contribution Mm3	835	1078	2563	790	804	1214
% to average	41	65	144	43	44	67

I.2.3 The sedimentation risk mitigation activity within the framework of the "Water and Environment Support (WES)" project:

The regional technical support project financed by the European Neighborhood Instrument South, includes an activity **concerning the mitigation of sedimentation risks for the sustainability of water resources in Tunisia: study of the siltation of two Tunisian dams, Siliana and Lebna.**

The main objectives of the activity are:

- Better understand the causes of reservoir sedimentation and the origin of eroded sediments in the watersheds assessed;
- Evaluate the actual rate of sedimentation and loss of useful storage in the two dams concerned and their correspondence with the rates of erosion and the yield of sedimentation;
- Assess current practices for controlling sedimentation and erosion processes in Tunisia by studying these two dams/reservoirs as pilot case studies;
- Assess the applicability of measures that could be implemented to control the accumulation of sediments in the reservoirs.

The progress of the project consists in the collection and processing of data.

I.3. Surface Water Transfer

I.3.1. Inter-Regional Transfers in Tunisia

To face the inter-regional variability of water resources, Tunisia has large transfer systems from surplus to deficit areas.

The drinking water supply of the large urban areas of the coast is ensured by the transfer of water from the Medjerda and the extreme North. The Medjerda Cap Bon Canal and the adductions of the Extreme North (Sidi Barrak, Sejnane, Joumine, Medjerda) ensure this transfer. From these systems, canal exploitation and north water abductions company has supplied its customers with a volume of about 434 Mm3 during 2021, against 428 Mm3 in 2020.

Given the evolution of the demand for drinking water, it increasingly exceeds the capacity of the Medjerda Cap Bon canal at peak consumption periods. Major projects are underway to reinforce the transfer capacity. These projects aim to ensure the security of drinking water for the large urban agglomerations, notably the Sahel and Sfax: The project to reinforce the Medjerda Cap Bon Canal (CMCB) by a transfer complex Saida-Belli -Kalaa Kebira (a 112 km long line and pumping stations) and the modernization of the Medjerda Cap Bon Canal itself (a project in progress) with the increase of its transfer capacity in its central section from 8,8 m^3/s to 12 m^3/s.

I.3.2. Feasibility Study of water transfer from the north to the center of Tunisia

The feasibility study for the transfer of water from the North to the Centre of Tunisia is a pillar among the sixteen action blocks of the strategic study of WATER 2050.

This transfer could allow better management of surpluses and reduce discharges into the sea, particularly from Sidi Barrak when it is full and from the Zarga, Moula and Kebir dams which are connected to it, and to bring additional resources to the Nebhana and Sidi Saad dams

The study includes the following phases:

Phase 1: preliminary study of the project focusing on hydrological aspects with a water balance study for the current situation and for the year 2050;

Sub-Phase 2a - Preliminary design study: Establishment and evaluation of four transfer variants from the North to the Centre, Simulation for the different scenarios;

Sub-Phase 2b - Final Preliminary Design Study: Detailed study of the transfer variant.

Several transfer variants were studied in sub-phase 2a. A multi-criteria analysis was carried out. It took into account the investment costs per m^3 transferred, the volume of water transferred, the environmental impacts and the energy balance.

Following this analysis, it was decided to continue the study in its final phase 2b by studying a transfer project from the North to the Centre with a capacity of 10 m^3/s from Sidi Barrak to Bejaoua and 4 m^3/s from Bejaoua to Sidi Saad for the two variants of the EAST corridor 1.2 and 1.0, taking

into consideration the Melah Upstream dam: Sidi El Barrak dam - Sejnene dam - Medjerda/Cap Bon Canal (CMCB) - Nebhana / Sidi Saad dams.

The additional volume to be supplied by this transfer is estimated at 82 Mm³/year. This volume is higher than the average annual inflow of the two dams Sidi Saad (49 Mm3) and Nebhana (23 Mm3), i.e. this transfer would double the surface water resources mobilised by these two dams.

This variant consists of the following components:

- Component 1: Rehabilitation measures of existing works (Sidi Barrak - Bejaoua);
- Component 2: Construction of Melah dam upstream and gravity transfer to Sejnane canal;
- Component 3: Increase of the transfer capacities of Sidi Barrak - Sejnane by 4 m3/s and Sejnane - Bejaoua by 10 m3/s;
- Component 4: Transfer from Bejaoua to Nebhana dam with a capacity of 4 m3/s;
- Component 5: Transfer from Nebhana dam to Sidi Saad dam with a capacity of 4 m3/s.

The total cost of these components is 2 529 million dinars (excluding taxes). The financing is not yet finalised. However, there are possibilities to prioritise certain components. At present, according to the results of the study and given the available funding, it is probably only possible in the short/medium term to transfer to the Nebhana Dam.

Figure n°4: Layout of the selected scenario (Source: DGBGTH, feasibility study of water transfer from the north to the centre of Tunisia, June 2022)

I.4. THE CONTROL OF THE PUBLIC HYDRAULIC DOMAIN

The national guidelines remind us of the urgent need to act to preserve water resources, in particular by reinforcing the application of regulations through effective control of urban water management.

The Ministry of Agriculture, Hydraulic Resources and Fisheries is responsible under the Water Code for protecting the public hydraulic domain, enforcing the law and preventing infringements. The decree n° 98-1707 of August 31, 1998 (Official Gazette of the Republic of Tunisia N°72 of the year 1998) charged the sworn agents of the Regional Commissary of Agricultural Development, national water distribution utility, Canal exploitation and north water Abductions Company with the control of the public hydraulic domain and the water police. These agents are equipped with professional cards and are empowered to note infractions as well as to draw up reports and initiate public action.

Nevertheless, there are many blockages in the control of the Public Water Domain and the infringement procedure:

- **Lack of dedicated staff:** The control of the Public Hydraulic Domain is not exercised in some Regional Commissariats for Agricultural Development due to the lack of staff to carry out the controls. Their main tasks are focused on rural development;
- **Inadequate status of the agents** does not allow them to have any real power of judicial police, for example to compel someone to give their identity or confiscate illicit material; they must then be accompanied by a representative of the police;
- **Lack of legal skills of sworn agents** including their attributions in this area; ignorance of the procedures relating to the water police; ignorance of the legal aspects;
- **Non-dissuasive penalties**, the amount of penalties has not been updated since 1975;
- **Absence of a procedure** for following up on offences, leading to the abandonment of prosecutions and very frequent impunity;
- **Weak participation and involvement of non-state actors** (civil society, citizens, elected officials, farmers, etc.) whereas it should be encouraged because it constitutes one of the essential components for enforcing the decisions taken and facilitating the missions of control of the public domain. Hydraulic;
- The absence of several implementing texts for the Water Code affects the legal qualification of certain offenses such as the lack of delimitation of public water areas which causes problems of legal qualification in offenses involving damage to public water areas;
- The unjustified delay in the swearing-in procedure for administrative officers in the regions flagrantly hinders the task assigned to these officers to control and record breaches of public water resources;
- The lack of contact between sworn officers and the territorially competent public prosecutor, while the code of criminal procedure expressly provides that they must work under his authority; they must maintain a direct relationship with the prosecutor and his deputies;
- The difficulty of executing the decisions of the administration and seizing the tools and materials used in the offense due to a lack of cooperation from police officers and the national guard in several regions.

Two projects are underway for the protection and reinforcement of the control of the Public Hydraulic Domain: the Tunisia water sector reform project and Twinning projects, with the following fields of action:

- Allocation of the inspectorate and improvement of the administrative procedures needed to deal with infringements and influence the legal process;
- Simplification and digitalisation of operations at different levels (permit applications, monitoring of fees, concession management system, etc.);
- Development of a communication strategy and integration of a multi-target awareness (local authorities, magistrates, general public, media...) on the necessary protection of the Public Hydraulic Domain[3];
- Support to analysis and decision making at regional/local level for grassroots management of the resource...

Nevertheless, the efforts made within the framework of these projects should be more coordinated, in terms of interaction between their respective project leaders (the General Directorate of Water Resources for the Twinning project and the Office of Planning and Hydraulic Balances for the Support to Reforms in the Water Sector in Tunisia). The Twinning project is due to end its activities in

[3] For the A Reset project see also the chapter "communication".

November 2022, the Tunisia water sector reform project has a horizon until January 2025; 2022 could thus be advantageously devoted by the partners to harmonize the results obtained in a coherent framework of management of the control of the public hydraulic domain.

I.4.1. Progress of the twining Project "Support to the protection of water resources and the control the public hydraulic domain"

Its main objective is to strengthen the human, institutional, organizational, and operational capacities of the actors involved in the management of the DPH and the water police for the control of the use of water resources and the application of a new water code.
The results achieved consist essentially of:

- The development of a cooperation strategy between all the parties involved in the monitoring, control and surveillance of the Public Hydraulic Domain;
- Strengthening inspection capacities (CRDA, SECADENORD, ANPE...): training of 14 inspector trainers; on-the-job training of 30 Public Hydraulic Domain inspectors; roadmap for the professionalization of the inspectors' corps;
- Pilot implementation of regional multi-stakeholder control commissions (CRC) in Zaghouan, Sidi Bouzid and Nabeul;
- In the development of a communication and awareness strategy for the preservation of water; awareness of 21 magistrates; awareness via the CRC of local public and private authorities and actors (governorate, delegates, officials of the national brigade, municipalities, technical services – CRDA, ONAS, SONEDE, STEG, ANPE -, representatives of the Regional Union of Agriculture and and Fisheries (URAP), the Tunisian Union of Industry, Commerce and Handicrafts (UTICA);
- The establishment of a national and regional control plan in the pilot areas of Sidi Bouzid Zaghouan and Nabeul, with the start of interdepartmental and interministerial control missions in the field in the pilot areas (during November 2021), which led to decisions (partly to be followed up and concretised) in terms of delimitation of the Public Hydraulic Domain, the setting up of water table contracts, accelerating certain projects (ex: STEP), regularizing the situation of exploitation by concession, and recommendations for the protection of sworn agents against the frequent aggressions they suffer, the establishment of action plans for the collection of fees, the introduction of new technologies for control, or the reinforcement of material means for the districts of the regional commissary for agriculture development s in charge of control...

In addition, the Twinning project is working on several projects: (1) the simplification of procedures for authorization requests and the drafting of specifications for a digital solution for online requests (2) a digital solution for the drafting and follow-up of penalty notices and (3) the development of a Geographic Information System for activities to map sources of pollution in collaboration with the National Agency for Environmental Protection and a Geographic Information System for infractions. However, the project does not have sufficient resources for the operational development of these information systems and will be content with the design and drafting of specifications. The financing of their implementation remains to be defined, in particular with the actors directly in charge of the digitalization of operations.

I.4.2. Progress of the project "Support to the reform of the water sector "A-RESET

The objective of the project is to further support reforms in the water sector for sustainable management of groundwater resources.

The specific objective of Component 1, entitled "Advisory support for the application of water regulations", is to ensure that the competent authorities have the tools and capacities to apply the regulations in force and that they are directly concerned with the control of the DPH.

The activities carried out in 2021 consisted mainly of:

- The organisation of conferences in the regions to discuss the new draft of the water code;

- Judicial review of the clauses of the authorizations for research and exploitation of groundwater: A series of meetings was held in the presence of the BPEH, BIRH, DGRE and General Directorate of Legal and Land Affairs (DG/AJF), to make proposals for revisions to the " Decree of 1978 which sets the conditions for research and exploitation of groundwater " in order to strengthen the protection of groundwater against all types of infringements (exceeding authorized volumes, exploitation of groundwater without exploitation authorization, non-payment of fees...);
- The improvement of the functioning of the office of inventories and hydraulic researches (BIRH): generalization (in progress) of the seizure of the data bases of the authorizations of occupation of the DPH, support and improvement of the structural and institutional organization of the office of inventories and hydraulic researches;
- The installation of piezometers in the governorates of Zaghouan and Mahdia as part of an upgrade of groundwater resources monitoring structures in the 4 governorates targeted by the project;
- Elaboration of a manual of procedures on infringements of the DPH in two languages, Arabic and French;
- Preparation of a national strategy to reduce the number of illicit drillings, based on a socio-economic typology of illicit drillings (e.g. difference between small operator and large investor) to allow a differentiated treatment of the offence.

It should be noted that other activities of this project related to regulation have been postponed because they are dependent on the adoption of the new water code: support for the implementation of the new water code, support for the creation of the regulatory body, support for the creation of the national agency for the protection of the public hydraulic domain, support for the creation of Regional Water Councils.

In summary:

Groundwater resources, both surface and groundwater, are facing increasing human pressure and numerous socio-economic challenges. Great vigilance is therefore required to preserve the sustainability of groundwater and to maintain/increase the supply of surface water in hydraulic infrastructures.

The main orientations to remedy this situation include:

- **Improving knowledge of underground aquifers;**
- **Raising users' awareness of the impact of illicit drilling and overexploitation of groundwater;**
- **Institutional reinforcement and rigorous application of regulations, particularly in terms of control of illicit drilling (dissuasive sanctions, drawing up of statements of offence, seizure of equipment and plugging), by making the most of the institutional support projects currently underway for the preservation of groundwater and the control of the DPH; The adoption of a national control plan would engage all actors (MARHP and ANPE) accountable for the use of the means at their disposal for the protection and control of the DPH;**
- **Artificial recharge of water tables and optimisation of the management of surface water reservoirs;**
- **Strengthening the mobilisation infrastructure over the next few decades and identifying sites of lesser capacity on the major tributaries of the main oueds;**
- **The development of the upper basins, through the creation of additional hill dams, upstream of the main works, as an interesting alternative, on the one hand to reduce solid inputs to the latter and on the other hand to reserve part of the resource for local development needs;**

- **Given that the desilting of dams is not a technically feasible option, the construction of new replacement dams or the raising of dams to compensate for losses of useful volume;**
- **The reinforcement of the transfer networks, including the transfer of surplus water from the north to the central regions, with an average of 82 Mm³ that could be transferred annually. However, it should be noted that some of this "additional" water will eventually be used in Greater Tunis in the future - especially in summer during the peak periods that have become increasingly frequent in recent years. Moreover, the time needed to complete this project, given that the feasibility studies began in 2015, remains a challenge given the urgency of the situation in these regions;**
- **Strengthening measures to maintain the quality of water resources in the face of the aggressions generated by multiple socio-economic activities (agriculture, industry, sanitation, etc.) through better organisation/coordination of those responsible for quality control.**

I.5. UNCONVENTIONAL WATER RESOURCES

Non-conventional waters constitute important water resources from a quantitative point of view. They consist of wastewater treated by the national sanitation office and desalinated water by the national water distribution utility. For treated wastewater, it is imperative to overcome the problems of quality that often do not conform. As for desalinated water, it represents in Tunisia a reliable non-conventional resource for increasing the supply of fresh water in the long term. However, the desalination of brackish water comes up against the environmental problem linked to brine and the problem of energy cost and the corresponding emission of CO2. Regarding the energy issue, the combination of desalination projects with a renewable energy component will only increase in the future.

I.5.1. Treated wastewater

The ONAS operates in 193 municipalities and runs 123 wastewater treatment plants.

In the current situation (2020 figures), treated wastewater constitutes a potential of 300 Mm^3 per year on the scale of Tunisia. These 300 Mm^3 of treated wastewater produced represent 6% of the country's overall resources in an average year. By 2050, the production of treated wastewater could reach 640 Mm^3 per year, i.e. an increase of +106% compared to the current situation. In practice, the situation varies from one region of the country to another, in several respects.

Table n°6: Regional distribution of treated wastewater potential (Source: DGGREE/BRL Elaboration of the National Master Plan for the Reuse of Treated Wastewater in Tunisia - WATER REUSE 2050 phase 2 - Prospective of the sector by 20250)

Region	**%**
Grand Tunis and Zaghouan	45
Cap Bon	9
North-West and Bizerte	8
Sahel and Sfax	25
Center	4
South	9

The quality of treated wastewater is very frequently questioned by users.

Currently, almost half of the treatment plants and the volume treated do not meet the requirements of the standard for the COD parameter (125 mg/l)[4]. For the other two parameters (Ntot and faecal coliforms) the excess is 80% compared to the treated volume[5], making it impossible to guarantee a safe use of the treated wastewater.

The problems have multiple origins:

- Insufficient treatment performance due to the operating conditions of the treatment plants;
- Hydraulic and biological overloading of some water treatment plants, which currently concerns about 30% of water treatment plants;
- Poor quality of raw water, especially if some of the water comes from polluting industries;
- Salinity of treated wastewater;
- Discharge of wastewater by industrialists, which often contains heavy metals and other dangerous ingredients, into conventional wastewater treatment plants that cannot eliminate them.

Prospects:
The compliance of treated wastewater is a prerequisite for an economic reuse of this resource, which the "Water 2050" study aims to increase to 80% reuse rate.
In order to achieve the objective of compliance, the following provisions should be applied:

- **Planned and rigorous management of sanitation infrastructure (timely implementation of infrastructure rehabilitation and extension programmes / regular maintenance and upkeep with sufficient coverage, optimisation of the operating conditions of water treatment and purification plants, etc.);**
- **Adaptation of discharge standards to the sensitivity of the receiving environment and use;**
- **Pushing treatment to the tertiary level aiming at disinfection of treated effluents with the use of treatment processes adapted to the quality of the wastewater, to the size of the plant and to the dedicated use;**
- **Separation of industrial wastewater from domestic wastewater when the fraction of the volume or the industrial pollution load exceeds 20% and/or when it concerns industries generating specific pollution (heavy metals, cyanides, margines, etc.);**
- **Implementation of pre-treatment at the level of industrialists so that their discharge does not present a nuisance at the level of the treatment stages within the municipal water treatment and purification plants.**

I.5.2. Desalinated water

Desalination is practised in the South of the country to meet the inadequacy between the growing needs and the insufficiency of conventional local resources; the objective being to improve the quality of the service and to secure the supply of drinking water. The objective was to improve the quality of the service and to secure the supply of drinking water. The national water distribution utility thus had to resort progressively to the desalination of brackish underground water, then to the desalination of sea water.

The most affected priority regions are in the south-east of the country, where demographic and economic pressure is high and groundwater salinity varies from 3 to 6.5 g/l.

[4] *Tunisian discharge standard NT106.002 for the 3 pollution parameters: COD for organic pollution, total nitrogen (Ntot) for nutrients and faecal coliforms for bacteriological pollution*
[5] *Source: STUDI 2022, Elaboration of the vision and strategy of the water sector by 2050 for Tunisia EAU 2050, Phase 04: Vision & Strategy*

The SONEDE currently operates:

- The Djerba seawater desalination plant with a potential of 50,000 m^3/d.
- 15 brackish water desalination stations with a total capacity of 115 600 m^3/d.

Thus, the total current potential is 165 600 m^3/d, i.e. an annual potential of desalinated water of 58.6 million m^3.

On the other hand, the phosphate industry sector operates a seawater desalination plant and a brackish water desalination plant in Skhira with a capacity of 22.000 m^3/d ha, i.e. 8 million m^3 per year.

The national water distribution utility's desalination activity is in the process of significant evolution since several projects for the creation of a seawater desalination plant and a brackish water desalination plant are underway or planned.

These are:

- Four new seawater desalination plants (Zarat, Sousse, Sfax and Kerkennah) with a total capacity of 206 000 m^3/d ha by 2025;
- Six new plants with a total capacity of 31 000 m^3/d ha;

The potential volumes to be desalinated by the national water distribution utility will thus increase from 58.6 Mm^3/year in 2021 to 145 Mm^3/year in 2025.

It should be noted that on the basis of seawater desalination projects, the National Company for Water Exploitation and Distribution has acquired know-how in terms of project management. However, desalination projects are delayed in relation to their deadline. The explanations given refer to the limited human resource capacities, in relation to the volume of missions, as well as to the complexity of the "context" of project execution, in connection with land, social, and resource confirmation and appropriation problems for the supply of raw water to these stations.

Prospects:

Although desalination remains expensive compared to conventional water costs, cost reductions are likely to close the gap in the future.

The trend towards environmentally friendly and sustainable desalination projects will be facilitated by emerging technologies, particularly for desalination, primarily reverse osmosis, pre-treatment, brine management, energy efficiency and supply, allowing for lower energy consumption and less costly means of mitigating the environmental impacts of brine and associated desalination waste.

As emerging technologies evolve into optimised and reliable large-scale desalination systems over the next two decades, desalination will experience a significant drop in cost, with improved environmental "sustainability".

Projet de la station de dessalement des eaux de mer Zarat (Source SONEDE)

II. WATER AND SOIL CONSERVATION

II.1. ACHIEVEMENTS IN THE YEAR 2021 OF THE WATER AND SOIL CONSERVATION PROGRAM AND PLANS FOR 2022

The intensity of rainfall and the more or less permeable nature of the soil as well as the steepness of the slope of the land condition water erosion. On the basis of the physical criteria adopted to assess the risk of water erosion, it appears that soils with medium to very high sensitivity to water erosion occupy 7,558,809 ha and cover 48.9% of the territory, and 34% of the agricultural areas used are of medium to very high sensitivity to water erosion, i.e. 1.8 million ha.

Water and soil conservation works have had very positive direct economic impacts for the farmers in the areas where they are located, but also indirectly through the safeguarding of agricultural land and the rehabilitation or restoration of degraded land. They can reduce the vulnerability of the territories by improving their resilience in case of exceptional rainfall, and in periods of prolonged drought. Actions should be targeted according to levels of physical vulnerability (prioritisation according to the urgency of intervention in the face of erosive processes for example) and the social vulnerability of rural populations.

These water and soil conservation works require permanent rehabilitation actions, at a time when the dynamics of land degradation are still very active.

For watershed development and maintenance of works, the achievements reached in 2021 respectively **67% and 80%** of the forecasts. For gully correction works, the completion rate reached 216% and for groundwater recharge works, the completion rate reached **47%.**

Table n°7: The physical achievements of the national soil and water conservation program for 2021 and plan for 2022

Nature of the work	**Unit**	**Plans 2021***	**Achievement 2021**	**Plans 2022**
Watershed management	Ha	23457	15771	18242
Maintenance and conservation	Ha	38439	30724	34958
Soft techniques	Ha	8950	3252	0
Ravine adjustment	Unit	291	716	108
Spreading works	Unit	14	3	3
Groundwater recharge works	Unit	73	34	34
Hillside lakes	Unit	5	1	-

**= Forecast 2020 + remainder 2019*

Concerning the financial achievements of the programme, the amount committed on the State budget in 2021 reached 49 269 MTD out of a budget of 48 000 MTD.

II.2. THE IMPLEMENTATION OF THE 3RD WATER AND SOIL CONSERVATION STRATEGY

The implementation of the new strategy is based mainly on regional strategic planning studies that make it possible to identify priority areas for intervention according to the new strategic guidelines (priorities for land with agronomic potential, socio-economic vulnerability and taking into account ongoing or planned development measures). Integrated territorial development plans (PADITs) are programmed and implemented in these priority areas.

The PADITs represent a radical change in the modes of intervention and a break with the technical approach sometimes adopted (from the design to the implementation of water and soil conservation

projects). They are the result of a work of animation with the population but also of mobilization/coordination/responsibility of the partners around the integrated territorial planning and development plans to contribute to their implementation for activities outside the planning and conservation of agricultural land, falling within their respective mandates.

The main part of 2021 saw the continuation of actions undertaken in 2020, mainly:

- The elaboration of regional strategic planning studies for agricultural land conservation schemes, underway for Gabes, Tozeur and Siliana;
- The launching of calls for tender for the elaboration of 33 PADITs in various governorates;
- The implementation of the works included in the framework agreement with the Agricultural Earth Moving Equipment Company - RMTA (2019-2021) for the execution of water and soil conservation works in 17 governorates;
- The continuation of the training of the executives of the DGACTA on various topics within the framework of the various projects (participative approach, rural animation, techniques of communication, management of the projects, geographic information system);
- The acquisition of environmental scientific equipment for the establishment of a territorial observatory for the management of natural resources in the governorate of Zaghouan as a pilot site and this within the framework of the research convention with the national institute of research in rural engineering, water and forests INRGREF;
- Formulation of requests for the financing of rural development and climate change adaptation projects...

In parallel, the DGACTA continues to work on consolidating its implementation approach for priority aspects of the strategy:

- Increasing the number and "autonomy" of the integrated territorial development plans process: not only by strengthening the capacities of the people in charge of animation and rural development in the water and soil conservation districts (stopping the use of consultancy firms) but also by involving partners such as municipalities, agricultural development groups, potential carriers of integrated territorial development plans in their territory (elaboration of integrated territorial development plans on demand);
- Relaunching rainfed agriculture, a pillar of national food security: capitalisation of good practices (including in terms of costs), implementation of components dedicated to agro-ecology within the framework of projects, bringing together the Agency for the Promotion of Agricultural Investments to argue on these bases for an adaptation of the investment code in favour of rainfed agriculture, support for the anchoring of rainfed agriculture in the various strategies that affect it, Water 2050, low-carbon strategy and resilience to climate change;
- Strengthening data production, particularly in terms of anthropogenic and climate change impacts but also water and soil conservation interventions, in the context of linking with research (observatory) to facilitate decision-making on priorities.

The DGACTA is considering requesting support for the implementation of the Agricultural Land Development and Conservation strategy from the "Dispoflex" technical support mechanism, which was established in December 2021, as part of the GIZ "Recap" project with the Ministry of Economy and Planning.

In summary:

A fundamental re-examination of the water and soil conservation policy is one of the factors for the valorization of green water and the re-foundation of rainfed agriculture taking advantage of water and soil opportunities. This is a crucial point in the Tunisian agricultural model, particularly in relation to the constraints of water potential, as rainfed agriculture has a much lower cost of intervention, particularly through water and soil conservation, than irrigated agriculture, while ensuring complementarity between irrigated and rainfed agriculture. In fact, there is room for rainfed agriculture to improve its efficiency and achieve at least two-thirds of production.

The soil and water conservation strategy is therefore relevantly oriented towards inclusive, productive, ecological and climate change resilient terroir-based soil and water conservation

Several traditional rainwater harvesting techniques have been used in central and southern Tunisia (meskats, jessours, flood irrigation, etc.). Other "modern" techniques have been used in all regions of the country, within the framework of successive water and soil conservation programmes, including hillside reservoirs. At present, this network of collective works can be better exploited through more targeted water and soil conservation actions through integrated territorial development plans: on the scale of plots and farms, with techniques for improving water infiltration conditions in the catchment area (e.g. filtering strips) and on the plot or for reducing evapotranspiration that are better developed: tillage practices, organic matter inputs, etc…

III. DEVELOPMENT MEASURES FOR DISASTER RESILIENCE

III.1. THE ISSUE POSITION

Stormy and intense rains, very localized, caused flooding in different regions, cities and neighborhoods. These frequent floods in recent years are a reflection of climate change.

Reducing the vulnerabilities of territories to the risk of flooding, through runoff control and floodwater storage facilities, could both slow down land degradation processes, mobilize more water resources and protect populations.

However, flood risk management is complex and brings together many institutional players who are divided into three major entities: the Ministry of Agriculture and Hydraulic Resources, the Ministry of Equipment, Housing and Infrastructure and local communities. It is imperative to define the role of all stakeholders precisely, assign a single institutional structure to coordinate between all parties to implement this flood protection program.

A great deal of effort has been undertaken with numerous projects implemented over several decades. However, it is observed that flood management is organized most of the time in response to an event, following a crisis.

And if the forecast is very often lacking, the lack of human and financial resources is also a major challenge.

III.2. THE INTEGRATED PROGRAM FOR RESILIENCE TO DISASTERS AND CLIMATE CHANGE IN TUNISIA (2021 – 2026)

The Tunisian government concluded a financing agreement with the French Development Agency (AFD) and the World Bank on 3 June 2021 in Tunis for the implementation of the Integrated Disaster Resilience Programme (IDRP).

This is a results-based programme whose development objectives are to strengthen disaster risk management and financing and to improve the protection of exposed populations and assets against disasters and climate change induced events.

The total amount of the programme is 102 M€, of which 81.3 M€ are loans.

The programme is composed of four pillars:

Column 1: Improving flood risk reduction activities in urban areas:

- Six projects of physical investments in flood risk reduction (112 MDT) in the Governorates of Bizerte (2), Nabeul (2) and Monastir (2) and this in addition to the 19 pre-programmed projects (136 MDT); three projects will be launched in 2022 and the rest of the projects in 2023 in priority areas;
- Strengthening the capacities of the "Urban Hydraulics Directorate", based on a diagnosis of needs.

Column 2: Improving disaster preparedness:

- Institutional and capacity building of National Meteorological and Hydrological Services;
- Modernization of weather and flood monitoring, modeling and forecasting systems;
- Improved hydro-meteorological services, Impact-based Multi-Hazard Forecasting and Early Warning Systems for better preparedness and response planning at national and regional levels.

Column 3: Strengthening Financial Protection:

- Definition, adoption and implementation of a national disaster risk financing strategy that combines public financial instruments and solutions proposed by the insurance sector;

- Establishing the basis for the sustainable development of national insurance markets with the aim of taking advantage of them to transfer the risks that threaten the most vulnerable populations and businesses and facilitating the establishment of a more comprehensive financial response framework.

Column 4: Promoting institutional coordination and creating an enabling regulatory environment for disaster and climate risk management:

- Establishment of coordination mechanisms for disaster risk management, including the creation of a permanent unit in charge of resilience and the establishment of a national platform dedicated to disaster risk management;
- Adoption of a regulation that organizes the decentralization of responsibilities;
- Development of an Action Plan: comprehensive regulatory and institutional reform to strengthen resilience to disasters and climate change.

III.3. THE MASTER PLAN FOR THE REGULATION OF FLOODS IN THE BASIN DRAINAGE MEDJERDA

In Tunisia, the Oued Medjerda remains the most vulnerable river because of its morphology which favors overflows in the part downstream of Ghardimaou and at the approach of the cities crossed by the river.

The Master Plan for Flood Control in the Medjerdaa River Basin retained a subdivision of the Medjerda River Basin into four zones, two zones upstream of the Sidi Salem dam and two downstream.

The project consists in the development of the wadi and the improvement of the role of the dams.

The table below shows the physical progress of the flood control projects in the Medjerda watershed carried out by the Ministry of Agriculture, Hydraulic Resources and Fisheries through the General Directorate of Dams and Large Hydraulic Works

Tablen°8: Physical progress of flood control projects in the Medjerda watershed

Project area	***Donor of funds***	***Progress***
Zone D2 from the entrance to the dam of Laroussia	JICA	In progress
Zone D1 between the dam of Laroussia and the dam of Sidi Salem and study of protection against the silting of the dam of Sidi Salem	JICA	Feasibility study
Zone U1+M from the confluence between the Medjerda and Mellègue Oueds to the Algerian border	KfW	Preliminary and final project studies
Zone U2 between the upstream of the Sidi Salem dam and the confluence between the Medjerda and Mellègue Oueds	KfW	preliminary and final project studies

In summary

The management of extremes and the reduction of risks is an essential challenge for the water sector, in order to ensure the security of supplies, the stabilization of economic activity and the improvement of the living comfort of households.

In addition to the traditional flood protection measures and facilities, the concept of integrated surface water/groundwater management is an orientation to face this challenge. The process consists of slowing down runoff and promoting infiltration.

This principle should not hide the complexity of its implementation at the level of the:

- **The identification and characterization of aquifers intended for the progressive absorption of collected water and dedicated to infiltration;**
- **The necessary soil studies in terms of infiltration aptitude and retention capacities;**
- **Development choices for both increasing storage capacity and improving infiltration.**

Cleaning of waterways, Medjerda flood protection project
(Source: general direction of dams and large hydraulic works))

THIRD PART

USE/ EXPLOITATION

I. DRINKING WATER SUPPLY

I.1. GENERAL OVERVIEW

Drinking water in Tunisia is a human and social right. It is an obligation that is part of the basic missions of the State and has priority over other water uses.

The National Company for the Exploitation and Distribution of Water (SONEDE) ensures the supply of drinking water to the urban environment and part of the rural environment. The overall service rate is 98.4% in 2021 (98.3% in 2020), resulting in a rate of 100% in urban areas and 95.0% in rural areas (53.7% Société Nationale d'Exploitation et de Distribution des Eaux and 41.3% rural engineering).

The achievement of the objective of satisfying drinking water needs comes up against the constraint of limited resources, especially with climatic hazards and overexploitation. The situation is further complicated by the trend of increasing demand of about 3 to 4% annually.

In this situation, it is necessary to act in two areas:

- Demand Management: reduction of specific consumption and improvement of network efficiency;
- Optimization of supply: through transfer and desalination.

I.2. DRINKING WATER IN URBAN AREAS

I.2.1. Drinking water indicators by the national water distribution utility

The network of the National Water Distribution utility is made up of 57314 km, 47219 of which are for distribution. The renewal of lines is done at a rate of: 200 km/year or less than 0.4% of the park, far from the standard of 2 - 2.5%.

Tableau n°9: Indicators of drinking water supply by SONEDE in 2021 (Source: SONEDE)

Indicators		**Unit**	**2020**	**2021**	**Progress**
Volume produced (Treated volume + untreated groundwater volume)	**Total**	**Mm^3**	**759,1**	**779,9**	**+ 2,8 %**
	Surface water	Mm^3	431,2	446,8	+ 3,6 %
	Groundwater	Mm^3	279,1	283,5	+ 1,6 %
	Desalinated brackish water	Mm^3	30,7	29,5	- 3,9 %
	Desalinated sea water	Mm^3	12,0	12,9	+ 8,2 %
	Iron-free water	Mm^3	6,1	7,3	+ 18,9 %
Volume consumed		Mm^3	494,3	511,8	+ 3,6 %
Performance of water supply systems		%	88,4	88,5	+ 0,08
Distribution system performance		%	76,3	76,3	+ 0,07
Specific consumption for all uses		l/inha/day	122,9	123,2	+ 0,2 %
Total number of subscribers		Million	3,038	3,121	+ 2,7 %
Number of new connections		Unit	61 071	64 632	+ 5,8 %
Extension of networks		Km	745	753	+ 0,01 %
Number of breaks		Unit	19 990	22 753	+ 13,87 %

From these indicators for the year 2021, we can see:

- The increasing demand with an increase in the number of subscribers of 2.7% and consumption of about 3.6%;
- The dilapidated state of the networks with a significant number of breakages which is 22 753 per year;
- A volume of lost water increased by 2% compared to 2020 on the distribution networks (160.9 Mm3 in 2021 against 157.8 Mm3 in 2020)

In order to meet the high demand for water, to ensure the continuity of its service and thus satisfy the needs of its customers, the national water distribution utility has carried out in recent decades a large number of major infrastructure projects to mobilize non-conventional water resources. This increase in supply has been successful since Tunisia has a drinking water supply rate of almost 98% of the population.

Nevertheless, this effort focused on supply has not been accompanied by sufficient measures in the management/control of demand and efficient distribution of drinking water in Tunisia. Today, the national water distribution utility is no longer able to respond satisfactorily to this growth in water demand. Indeed, on the one hand, the available resources are limited; and on the other hand, the water distribution network is partially obsolete (about 20% of the national water distribution utility's network is more than 46 years old).

The national water distribution utility's efforts should focus more on water conservation, efficiency and network effectiveness. Water cuts are becoming more and more frequent and longer. They regularly trigger social movements in the summer that express the dissatisfaction of the population.

In this context, water losses in the national water distribution utility network are difficult to tolerate. They amounted on average nationally to 32.5% in 2021 with much lower results in rural areas of central and southern Tunisia.

I.2.2. SONEDE's demand management Programs: Example for the performance improvement plan (PAP):

The SONEDE plans to invest systematically in upgrading its network and in appropriate technologies that will enable it to manage demand and save water, a priority of the SONEDE and of the MARHP.

Through the renovation of about 15% of the network in the 7 selected governorates, the annual performance program aims to:

- Significantly reduce water losses in order to protect the scarce and overexploited resource;
- Strengthen the continuity and quality of the drinking water service provided to the population;
- Increase the resilience of the water sector in the program's governorates to the negative impacts of climate change (more efficient use of an increasingly scarce resource) and reduce pumping which implies the reduction of CO2 emissions.

The planned investment is about 82.2 million €. It aims at renewing 1500 km of network, 65,000 connections, 130,000 meters and creating water saving services.

The financing will be provided by KFW, the EU and the state budget. The action will take place in 3 governorates in the center (Kairouan, Kasserine and Sidi Bouzid) and 4 governorates in the south (Gafsa, Gabes, Medenine and Tataouine), particularly affected by the difficulties of drinking water supply. The period of completion of the work is estimated at 5 years (2022-2026).

I.3. DRINKING WATER IN RURAL AREAS

The operators in charge of supplying drinking water to rural areas are the national water distribution utility for agglomerated localities, the services of the agricultural Rural (GR) of the regional agricultural development commission and the agricultural development groups for low-density or dispersed localities.

Table n°10: Indicators of drinking water supply in rural areas in 2021 (Source: DGGREE)

Total rural population	**Population served by national water distribution utility**	**Population served by agricultural engineering**	**Total population served**	**Rate of service**
3 744 900	2 009 800	1 547 800	3 557 600	95,00

The rural coverage rate has increased from 94.7 in 2020 to 95.1 in 2021. This rate differs from one region to another. The West Center, this rate is well below the national average, including the governorate of Kairouan (84.5%) and Sidi Bouzid (90.6%).

Table n°11: Drinking water supply rate in rural areas (Source: DGGREE)

Region	**Rate of service 2020 (%)**	**Rate of service2021 (%)**
Grand Tunis	99,8	99,8
North-East	95,0	95,1
Northwest	95,0	95,9
Center - West	89,3	89,3
Central East	97,0	97,7
South - West	99,8	99,8
National rate	**94,7**	**95,0**

Water tower: drinking water supply project in rural areas (Source: MARHP)

However, despite these high rates, the quality of the drinking water service is inadequate, particularly in rural areas, due to the limited capacity of the agricultural development groups. This makes the issue all the more acute in areas that lack local resources.

The projects are carried out under the rural water supply program (African Development Bank 2) started since 2017. Out of 268 programmed projects, 119 have started operating since the beginning of the program. Some delays are due to problems encountered during the studies: impossibility of connection from the SONEDE networks due to insufficient flow, non-compliant water quality of the boreholes, refusal of the beneficiaries to be supplied by the agricultural engineering, exceeding the maximum cost of the project...

I.4. DRINKING WATER PRICING

Based on the study "Study on the financial balance of SONEDE" conducted in 2016, and after the adjustment made during 2020, the rate of drinking water was readjusted again in 2021 by decision of the MARHP of 19 May 2021 (Official gazette No. 43 of 21/05/2021).

Table n°12: Pricing by SONEDE (en D/m³, consumption in a quarter)

Consumption during a quarter	**Price before 2020 Without VAT**	**Price 2020 Without VAT**	**Price 2021 Without VAT**	**Evolution 2020/2021 %**
Consumption ≤ 20	0,200	0,200	0,200	0
20< consumption ≤40	0,325	0,495	0,665	34
40< consumption ≤70	0,450	0,620	0,810	31
70< consumption ≤100	0,770	0,940	1,120	19
100< consumptionn≤150	0,940	1,110	1,290	16
150< consumption ≤500	1,260	1,430	1,620	13
Consumption >500	1,315	1,490	1,620	9
Touristic Use	1,315	1,490	1,620	9

This adjustment did not concern the social bracket for which consumption is less than 20m3. On the other hand, for the other brackets, the evolution 2021/2022 from 9 to 34%. The 20-40 and 40-70 bands have been subject to the most significant increases. The tariff for the 20-40 bracket is doubled compared to the pre-2020 tariff. However, the tariff for the largest consumers (>500) has undergone the least significant increase.

With this second increase, SONEDE is still far from its financial equilibrium objectives; in 2021 the average price per m3, i.e. 0.914 D, will only cover 70% of the cost price of 1.304 D / m3.

As a reminder, the decision of the Ministerial Council of 2019 provides for **5 annual adjustments** (2020 to 2024) to achieve this balance.

Regarding the pricing of drinking water served by agricultural development groups, it varies from one agricultural development group to another, but in all cases, it exceeds the 1D / m3.

I.5. BOTTLED WATER

The consumption of bottled water continues its progression with an individual annual consumption of 247 liters in 2021, placing Tunisia in 3rd place internationally. This development has accelerated over the past three years, which have seen water stress set in with the succession of 3 dry years, and their corollary of cuts and decline in water quality.

Water sales have increased threefold over the past 10 years, to reach nearly 3 thousand million liters in 2021 and the sector currently has 31 active water conditioning units. However, the quantity of bottled water remains insignificant compared to other water uses. A competition in the medium term with groundwater withdrawals for drinking water is not to be excluded, in the perspective of an increasing lack of availability of resource of satisfactory quality (cf. salinization by overexploitation and the continuous degradation of the quality of drinking water).

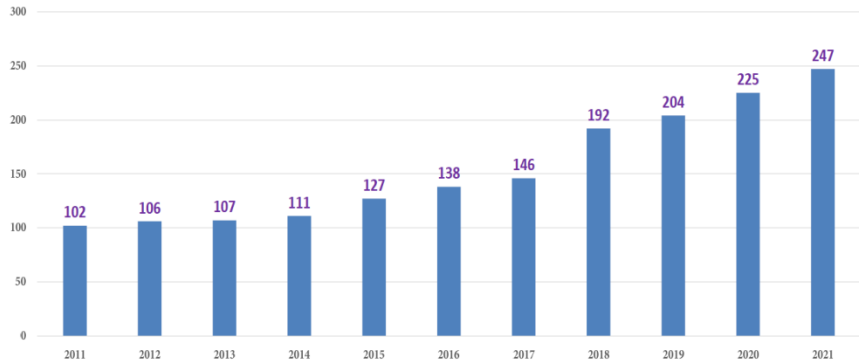

Figure n°5: Evolution of the annual consumption of bottled water (in liters / inhabitant)

In summary

Today, the national water distribution utility is finding it increasingly difficult to meet the ever-growing demand for water. The available resources have reached their limits and are facing multiple pressures (water theft, detour for agricultural purposes, etc.) and, on the other hand, the aging of the network is causing more and more breakdowns, leading to repeated or prolonged water cuts in many areas or regions, causing citizen discontent and social unrest. The constant increase in the consumption of bottled water could soon cause a conflict of use between the operating companies and the drinking water supply, due to the lack of vision and control of this sector.

The issue of drinking water has thus become of great importance for the political and social stability of the country.

It is necessary to implement strong measures to support the sustainability of the drinking water supply for all citizens. They aim at a drinking water supply system that meets international standards and is economical, effective and efficient; with a drinking water service in rural areas equivalent to that of urban areas (according to constitutional law). This requires from now on a drastic effort to stabilize the consumption curve of the drinking water supply with:

- **A specific national and regional program for responsible governance of rural drinking water supply.**
- **The control of the specific consumption;**
- **Renewal of the networks up to the required level;**
- **The installation of smart meters to make consumers more responsible and improve customer service;**
- **The reinforcement of the skills of the National water distribution utility in the field of water saving;**
- **The conduct of a prospective estimate of water resources that can be mobilized for conditioning purposes and the establishment of a master plan of operation, including the establishment of regulations necessary to avoid encroachment on the exploitation for drinking water supply, respect the environment, as part of the sustainable management of resources;**
- **Repeated campaigns to raise awareness among consumers, but also among all the actors in the political and economic sphere, on the efficient use and reduction of wastage of drinking water.**

II. THE IRRIGATED SECTOR

II.1. OVERVIEW OF THE IRRIGATION SYSTEM IN TUNISIA

Irrigation in Tunisia is the most water-consuming activity, accounting for 75% (according to the latest estimates for the year 2021) of the volume exploited. The irrigated sector covers nearly 441,000 ha in 2021, divided into public irrigated perimeters on an area of nearly 249,000 ha (56%) and private perimeters covering 192,000 ha private irrigated perimeters.
The current irrigated area represents more than seven times the area of land irrigated in the 1960s.

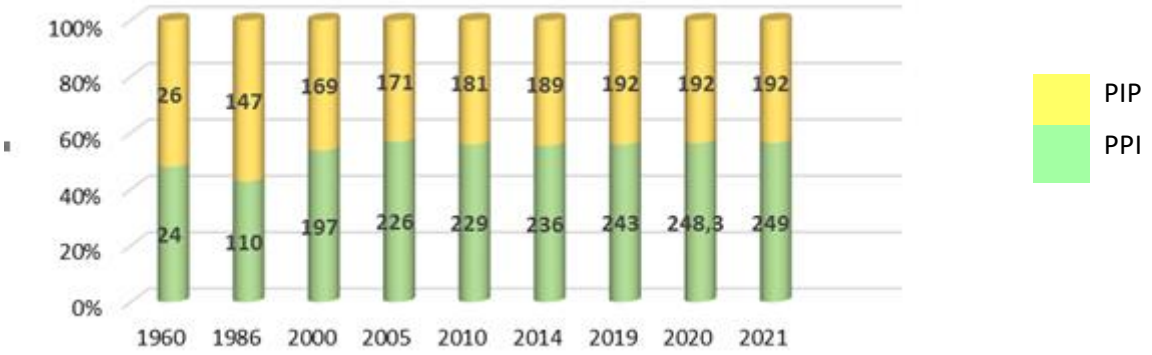

Figure n°6: Evolution of the surface area of irrigated areas (Source: DGGREE 2022)

The overall intensification rate is estimated at 87%. It is often reduced because of the areas actually allocated to irrigation. Thus, it happens that land developed for irrigation is maintained under rain-fed agriculture, thus representing a significant loss of agricultural and food income. These situations are frequent in the large public perimeters of the center and north of the country.

Irrigation of tree crops and market gardening with high remuneration by production prices are the main speculations in irrigated agriculture.
The determination of consumption over a number of years classified as dry throughout the country shows that the consumption of irrigated areas is around 2.5 billion m3. Irrigation water comes for 75% from groundwater, for 23% from surface water, and for 2% from the reuse of treated wastewater.
The irrigation system is not lacking in assets that deserve to be consolidated and developed for the future. Indeed, despite its small relative area (8% of the agricultural area used), the system has a strategic character in terms of its impact on food security and its place on the economic and social plan:

- Economic impact: the sector accounts for 35-40% of the value of the country's agricultural production, with a potential of up to 50%, including: 95% of market garden production, 70% of tree production and 30% of milk production. The irrigated sector also contributes to 20% of agricultural exports (citrus fruits, dates, early fruits, etc.);
- Social impact: the sector employs 20% of the agricultural workforce and its impact on employment positively affects all the upstream and downstream sectors (supply, food companies, services ...), in addition to a favorable impact on the rural development of the regions concerned.

II.2. THE IRRIGATION WATER QUOTA SYSTEM

From the year 2016-2017, until 2020-2021, the irrigated sector has been impacted by the lack of available water resources to ensure both the supply of drinking water and the needs of irrigated

agriculture. A quota system has been put in place, reducing the quantities allocated to irrigation. The perimeters irrigated from the dams of Sidi Salem and Nebhana were the most affected. Users have been called upon to reserve the small quotas for the safeguarding of perennial crops, particularly arboriculture and to refrain from the establishment of new summer vegetable crops.
Initially annual, with quotas representing 20-30% of demand, quotas became multi-year for the Sidi Salem system (7 years) starting in 2018-2019. The improvement of the reserve has made it possible to reach quotas representing 60 to 70% of the demand from this year.

For the year 2020/2021, we note the weakness of the quotas of the system Nebhana (Sousse, Monastir and Mahdia) that can be described as minimal because they represent only 20 to 25% of applications.
As for the system Sidi Salem (Beja, Manouba, Ariana, Bizerte, Ben Arous, Tunis and Nabeul), the quotas were about 70% of the needs.

The total quota allocated for irrigation from dams is 235 million m3, consumption is 205 million m3.

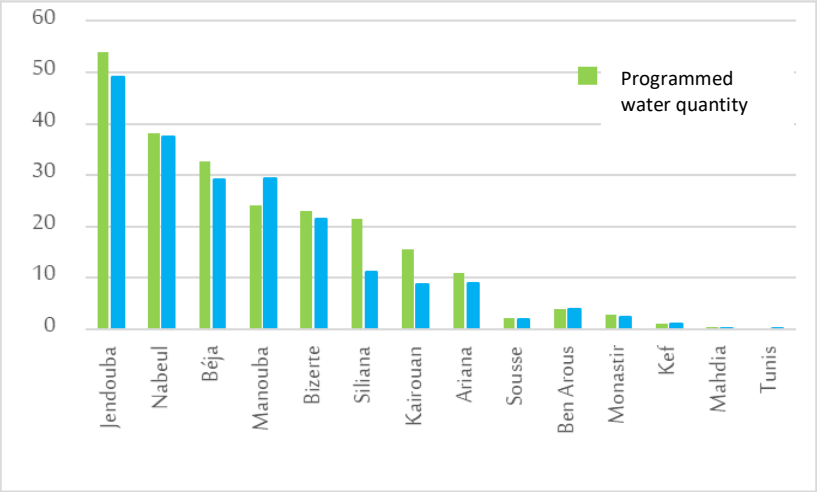

Figure n°7: Distribution of irrigation quotas and quantities consumed by governorate for the period from October 1 to August 31, 2021 (in millions of m3 - Source: BPEH 2022)

The consumption rate is 87%. The differences between the programmed quotas and consumption are attributed to the weakness of the inflows. On the other hand, in this context of shortage, some difficulties have been encountered for the perimeters located downstream of the water system therefore being further from the water source, like the public irrigated perimeters of Bizerte served by the Sidi Salem dam. Finally, the infringements on the public hydraulic domain which consist in unauthorized pumping on the Medjerda river disrupts the functioning of the system.

II.3 Achievements during the year 2021

The Public Irrigated Areas in operation during 2021

The year 2021 saw the entry into operation of 16 new public irrigated areas, on an area of 638 ha. These areas are located in the governorates of Tataouine, Gabes, Sidi Bouzid, Mahdia and Kasserine. They are located around the drillings. These are regional projects programmed and started a few years ago.

The major development projects of the Public Irrigated Areas in progress

Several major projects of rehabilitation of Public Irrigated Perimeters are underway during the year 2021 covering a total of 44 750 ha for a total cost of 887 million dinars, including:

- **The Project of Intensification of Irrigated Agriculture in the Northern Governorates of Tunisia (PIAIT):** which concerns 23 000 ha of Public Irrigated Perimeters in the governorates of Siliana, Beja, Jendouba, Bizerte and Nabeul;
- **The project of Valorization of the public irrigated perimeters of the Central** governorates (Project of Valorization of the irrigated perimeters through the development of the value chains): 9 000 hectares of Public Irrigated Perimeters in the governorates of Kairouan, Kasserine and Sidi Bouzid;
- **The project of Modernization of the Irrigated Perimeters of the Lower Medjerda Valley**: 5950 ha in the governorates of Manouba and Ariana;
- **The project of the Integrated Management of Water Resources in Mornag**: 6800 ha;
- **The project of rehabilitation of the Laaroussia Canal** in the governorate of Manouba;
- **The maintenance and improvement of the operating conditions of the hydraulic systems**: involving all the governorates.

These major projects address the following aspects:

- The institutional aspect allowing a sustainable management of the Public Irrigated Perimeters through the creation of a public company of management of the concerned Public Irrigated Perimeters (The Project of Intensification of the Irrigated Agriculture of Tunisia) or the support to the groups of agricultural development, the pricing of water (application of the binomial tariff for the modernized Public Irrigated Perimeters)..;
- Hydraulic infrastructure through rehabilitation with the objective of reaching an efficiency of 80% (instead of nearly 50% currently);
- Agricultural development, marketing of products, and water valuation.

Project of modernization of the Public Irrigated Perimeters of the Watershed BVM, Complex of pumping Chouigui (Source: CRDA Mnouba)

II.4. THE IRRIGATION WATER SAVING

The National Irrigation Water Saving Program has enabled 417,500 ha to be equipped with water saving equipment at the plot level, i.e. 94.7% of the irrigated areas. 208.000 ha of land is irrigated using localized irrigation and 114,000 ha using sprinklers. Improved gravity-fed irrigation is applied to 95.000 ha.

The investments for the equipment in water saving have reached since the beginning of the National Program of water saving in irrigation in 1995 until 2021 the amount of 1665 MDT including 759 MDT of subsidies.

The activity of improving water use efficiency in agriculture under the Water and Environment Support (WES) project:

This regional technical support project financed by the European Neighborhood Instrument South, started in November 2020. The specific objective of the activity "Improvement of water use efficiency in agriculture" is to increase the level of knowledge of the technicians of the regional commissary for agricultural development and agricultural development groups on the practices of increasing water use efficiency at the plot and in collective networks.

It focuses on "capacity building / training of a pilot Agricultural Development Group (Zaouit-Jedidi in the governorate of Nabeul). The program also includes awareness raising on water saving and modern irrigation technologies and the development of a new guide based on new technologies such as smart irrigation.

The activities carried out started with the development of awareness materials and technical guides to be distributed to the concerned people. However, due to restrictions related to COVID-19, the training scheduled for late September 2021 in Tunisia has been postponed.

In summary

Today, for farmers who have access to irrigation water, the income per hectare from the irrigated system is not only much higher than that from rainfed farming, but also has the immense advantage of being, a priori, exempt from climatic hazards.

With irrigation water that is almost free (see, for example, the development of photovoltaic pumping on authorized and illicit wells in the south, which leads to a significant waste of water) or highly subsidized, irrigated agriculture is too attractive beyond the limit of exploitation of resources, despite the national effort to save water that has been implemented over the last 20 years.

The system of management by surface water quota for an arbitration favourable to the priority given to drinking water requires difficult decisions to be taken with risks to be managed accordingly such as the illicit recourse to more exploited underground resources or the dysfunction of the Agricultural Development Groups whose financial resources will be further reduced with less water sold and difficulties in recovering the arrears of the users.

As with drinking water supply, agricultural water use requires further reform as part of a more advanced sustainability and demand management policy.

The satisfaction of the demand for irrigation water is posed in terms of great complexity:

- **Controlling the hazards to be able to secure the water supply of the irrigated sector, by adapting to the available quotas, including through the adaptation of crops;**
- **To upgrade the infrastructures and collective equipment and improve their efficiency;**
- **To support the choices and the methods of agricultural intensification, by directing them towards agroecology;**
- **Intensively develop irrigation using TMEs (see next paragraph);**
- **Strengthen the capacities of public structures (Regional Commissariat for Agricultural Development) and associative institutions (Agricultural Development Group) in order to improve water management;**
- **Ensuring the economic and social viability of farms; in particular with the implementation of a real policy of orientation and support for farmers' crop choices towards crop rotation compatible with adaptation to climate change and the national objectives of food security.**

A reorganization of the agricultural sector in a sustainable vision of natural resource management, combining rain-fed and irrigated agriculture in a complementary way and protecting ecosystems, can generate significant water savings with, in perspective, more performance and efficiency thanks to both a lower demand for water and higher agricultural revenues.

III. REUSE OF TREATED WASTEWATER

III.1. OVERVIEW OF THE REUSE

REUSE is one of the essential elements to achieve the Sustainable Development Goals, in particular Sustainable Development Goal 6: Ensure the availability and sustainable management of water and sanitation for all, Sustainable Development Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable, and Sustainable Development Goal 12: Establish sustainable consumption and production patterns.

In Tunisia, at present, the use of treated wastewater is practically restricted to irrigation of irrigated areas and landscape irrigation (golf courses, hotel gardens, forestry plantations, green spaces). Recharge of aquifers with treated wastewater is not well developed.

During the 2020-2021 campaign, the number of public perimeters irrigated from TMEs reached 33 perimeters, with a developed area of about 7584 ha, and an effectively irrigated area of 2364 ha, i.e. an average intensification rate of 31% in relation to the total developed area. The volume of treated wastewater consumed in the irrigated perimeters is around 14 Mm3.

The total area planted in the season 2020-2021 is approximately 2425 ha.
The reuse rate is low (< 10%) given:

- The non-compliance of the quality of treated wastewater;
- The distance of potential reuse areas from the production poles of treated wastewater;
- The reluctance of potential beneficiaries towards REUSE.

III.2. ACHIEVEMENTS IN THE YEAR 2021

Apart from the development projects of irrigated perimeters / Treated wastewater executed at the regional level by the regional commission for agricultural development, since the year 2019 the Minister of Agriculture, Hydraulic Resources and Fisheries via the General Directorate of Rural Engineering of Water exploitation has established an annual program of urgent interventions in order to develop the reuse of treated wastewater in the agricultural field with an average cost of 2 million dinars per year on the Tunisian budget

The interventions of this program include the following:

- Extension of irrigated perimeters by extending the pipes outside the existing irrigated perimeters, considering the availability of demand from farmers, with revision of the decrees of creation and delimitation of these perimeters;
- Improving the quality of treated wastewater by installing additional treatment equipment and using tertiary treatment in some treatment plants;
- Intervention at the level of pumping stations, irrigation, and water storage networks (maintenance, drainage, cleaning of works, ...): Bordj Touil station (Ariana), Dissa pumping station (Gabes).

III.3. THE DEVELOPMENT OF THE NATIONAL MASTER PLAN FOR THE REUSE OF TREATED WASTEWATER IN TUNISIA "WATER REUSE 2050"

This study is carried out within the framework of the Adapt'Action facility, which is itself part of the Paris Climate Agreement and Tunisia's commitment to integrate the Sustainable Development Goals by 2030 in its development plans. The development of a National Master Plan "Water REUSE 2050" will establish the foundations for improving the Reuse of Treated Wastewater in Tunisia.

The process of developing this study is divided into three major phases:

- Phase 1: Diagnosis of the sector;
- Phase 2: Assessment of the future of treated wastewater reuse and definition of a strategy for the sector;
- Phase 3: Drafting of the "Water REUSE 2050" Master Plan.

In the framework of phase n°2 carried out in 2021, sectoral assessments were carried out for each region. Scenarios for the development of Treated Wastewater Reuse have been elaborated. The scenarios combine several treated wastewaters uses that are coherent in terms of land use planning and water policy and give possible pictures of treated wastewater reuse in the regions by 2050.

Below are some outputs of this phase:

Inventory of the potential valorization of Treated Wastewater: The potential of valorization has been studied for a wide range of uses, including agricultural irrigation (trees, olives, vines, fodder, cereals, etc.), watering of golf courses and green spaces, industrial supply, and groundwater recharge;

Total volume of treated wastewater produced projected to 2050: It is estimated that this volume will reach nearly 640 Mm3 by 2050, more than double the current production. The Greater Tunis will remain the major purification pole with nearly 38% of the treated wastewater produced in 2050. The Sahel and Sfax region will continue to produce 27% of the country's treated wastewater. The largest increase in flow will be for the Grand Sud, which will see its production of treated wastewater more than triple between 2020 and 2050. Indeed, the National Office of Sanitation plans to increase the number of treatment plants and water treatment in rural areas of the region in these master plans of sanitation for the governorates of Gabes, Gafsa and Medenine and to develop the treatment poles of Gabes and Zarzis;

Possible technological developments for the sanitation and reuse of treated wastewater: multiple opportunities exist in terms of energy saving or even energy production at the level of wastewater treatment plants. Several valuations can be set up, allowing the recovery of energy or the reduction of the energy consumption of the wastewater treatment plants and offer an important potential in terms of reduction of the operating costs and the carbon footprint of the plants;

Regulatory proposals: The regulation should define a minimum quality level of treated wastewater used for each authorized use; define a number of barriers, expressed in the form of a sanitary objective (pathogen reduction); establish procedures for control, self-monitoring, monitoring and evaluation of the system; define the institutional responsibilities and the scope of intervention of each institution, the control tools and sanctions in case of non-compliance with the regulation;

Institutional proposals: The permanence and the operationality of the national commission (National Congress of Research of the University Institute of Technologies) and the regional commissions (Regional Congress of the reuse of treated wastewater) are necessary, reinforcement of the sensitization, reflection on the bearing of the field and on the possibility of placing the field of the reuse of treated wastewater under an organization responsible for the Planning and/or Integrated Management of Water Resources, Stronger involvement of the national sanitation office, particularly in the emergence of projects, to synchronize the reflections on the construction/rehabilitation of water treatment plants with the reflections on the possible uses of the resource that is treated wastewater, to clearly define the responsibilities of the different structures that have a role in the reuse of treated wastewater and the coordination mechanisms between these structures, to avoid the dilution of responsibilities and to promote an efficient approach.

In summary

The valorization of treated wastewater could play an important role in the conservation of threatened irrigated areas (such as the peri-urban areas of Greater Tunis and Cap Bon). This implies the possibility of substituting them for conventional water, particularly to safeguard threatened crops (citrus and wine-growing areas in Cap Bon, olive growing in the Sahel). In case of water stress, encountered during dry years, supplemental irrigation with treated wastewater is an opportunity.

The availability of treated wastewater is also an opportunity to develop sectors whose production does not meet the needs of the population for basic foodstuffs, such as cereal by-products, forage crops and industrial crops.

The interest of the reuse of treated wastewater can also intervene in the protection of resources from overexploitation, by recharging the aquifers. This concerns first of all the coastal water tables by creating a hydraulic barrier against the intrusion of the sea water (case of the water table of Korba, Oued Souhil).

Treated wastewater can partially fill the ecological water needs of lakes and lagoons at risk (Ichkeul). This is an effective means for additional treatment of these waters before their dilution in natural water courses.

The recovery of treated wastewater also helps to protect areas with high tourist and industrial stakes such as the Center-East and to limit environmental problems on the coast (Cap-Bon, Gulf of Tunis, Gulf of Hammamet) by reducing the volumes of treated wastewater discharged.

The following actions should be undertaken to promote the valorisation of treated wastewater:

- **Modernization and upgrading of water treatment and purification plants to provide treated water suitable for dedicated use;**
- **Identification and classification of potential reuse areas based on water demand, availability of conventional resources, acceptance of the population and beneficiaries, with a priority focus on peri-urban areas;**
- **Encouraging the recycling of industrial water;**
- **The use of groundwater recharge, especially those of the coast, subject to heavy exploitation and infiltration of sea water;**
- **The implementation of a beautification program for urban centers: "Irrigate all green spaces with treated wastewater".**

From an institutional point of view, it is suggested that an Adapted and Evolving Institutional Framework be put in place to

- **Strengthen the capacities of the decentralized structures called upon to participate in the promotion and development of the Reuse of treated wastewater;**
- **Put in place mechanisms to regulate and control the activity: monitoring devices to ensure compliance with upstream and downstream standards, requirements for discharge according to the receiving environment;**
- **Support the development of local strategies for the Reuse of treated wastewater.**

IV. THE WATER –ENERGY NEXUS

IV.1. Overview of the energy sector in Tunisia

The energy situation in Tunisia is marked by limited energy resources, a decline in energy production and a strong increase in demand. This gap between energy production and national demand for hydrocarbons has resulted in a deficit in the primary energy balance which reached 4.6 Mtep in 2020.

This situation of energy dependence imposes on Tunisia major challenges related to the security of its energy supply and the competitiveness of its economy. The electric fleet, mainly composed of thermal power plants, is the largest consumer of natural gas; the power generation sector alone accounts for about 75% of the country's consumption. In view of the decline in natural gas production, the heavy dependence on this fuel now poses a serious problem for the security of electricity production: 97% of electricity is produced from natural gas, and the share of renewable energy has not exceeded 3%.

IV.2. Energy consumption by SONEDE

The national water distribution Utility is the largest consumer of electrical energy in Tunisia, with a consumption that reaches for the year 2021, 525 Gwh against 515 in 2020, or 3% of national consumption, generating an expenditure of 137 million DT.

Table n°13: SONEDE's energy consumption (Source: SONEDE, annual energy management report 2021)

Indicators	**2020**	**2021**	**Evolution**
Total medium voltage consumption (Gwh)	515,72	525,13	+ 1,8 %
Total cost (MDT)	135,17	136,87	+ 1,3 %
Energy consumption per m3 produced (Kwh/m3)	0,679	0,673	- 0,8 %
Cost of energy/m3 produced (Mil/m3)	178	175	- 1,7 %
Cost of energy/m3 consumed (Mil/m3)	273	267	- 2,2 %

Total medium voltage consumption is constantly increasing.

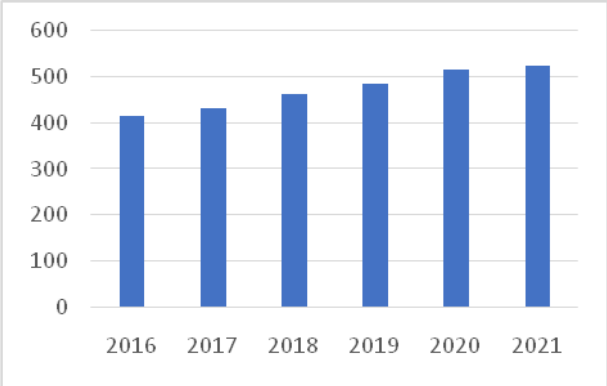

Figure n°8: Evolution of total medium voltage consumption (Source: annual reviews of previous years)

The number of contracts of the National water distribution utility with the Tunisian Company of electricity and gas for medium voltage increased from 1093 in 2020 to 1114 in 2021.

The most important energy consumption takes place at the pumping and treatment stations.

Desalination represents 11% of energy consumption, with a specific consumption of 2.4 kWh/m^3 for seawater (31.2 gwh for 12.9 Mm^3 produced).

Table n°14: Distribution of electrical energy consumption by structure

Structure	**consumption Gwh**	**% Total consumption**
Desalination plants	56,450	10,74 %
Treatment and pumping stations	316,249	60,22 %
Drilling	149,418	28,45 %
Administrative use	3,013	0,59 %
Total	525,13	100

It should be remembered that electrical energy is subsidized in Tunisia, the production cost is 285 mills / kwh, while the average selling price is 251 mills / kwh.

To reduce its energy bill SONEDE is moving towards the choice "renewable energy", with a first experience of setting up, in 2013, a photovoltaic plant of 212 kWc installed on the ground at the level of the desalination plant of Ben Guerdane.

It is also the implementation of an energy efficiency plan, including particularly:

- The use of the best technologies of desalination of sea water such as reverse osmosis;
- The installation of electronic speed variators to improve the energy efficiency of pumping stations;
- The acquisition of pumping equipment with higher energy performance;
- The installation of intelligent water networks allowing the national water distribution utility to better control its infrastructures in order to monitor and diagnose problems.

IV.3. ENERGY CONSUMPTION BY SECADENORD

The SECADENORD operates several hydraulic works to serve the national water distribution utility and regional commissary for agriculture development.

The SECADENORD's total consumption reached 128 Gwh in 2021, the same amount as in 2020. The energy expenses reached 31.2 million dinars in 2021, against 31 million dinars in 2020.

Table n°15: Evolution of the indicators of electrical energy consumption by SECADENORD (Source: SECADENORD 2022)

Indicators	**2020**	**2021**
Total consumption (Gwh)	128	128
Total Cost (MDT)	31	31,2

About 60% of the energy consumption by SECADENORD, that is to say 77 Gwh, is generated by the transfer of water from the extreme North from the dams Sid Barrak, Barbara and Ziatine. The volume transferred by pumping from these dams reached 175 Mm3 generating an energy cost of 17.3 MD in 2021. These expenses are covered by the State Budget.

The energy cost per m3 transferred by pumping is 100 millimes.

Table n°16: Energy consumption for the transfer from the dams of Sidi Barrak, Ziatine and Barbara (Source : SECADENORD)

Indicators	**2020**	**2021**
Volume transferred Mm3	147	175
Energy consumed for the transfer Gwh	63	77
Energy cost of transfer complexes (millions of dinars)	15,1	17,3
Specific cost mil/m3 transferred	102	99

IV.4. ENERGY CONSUMPTION IN IRRIGATION

The CRDAs /GDAs have an estimated annual consumption of 100 GWh (Source: STUDI, 2022, Elaboration of the vision and strategy of the water sector by 2050 for Tunisia, phase 4).

The application of Photo voltaic not connected to the electricity network for the agricultural sector is essentially at the level of the equipment of surface wells and boreholes that are far from the network of the Tunisian Company of Electricity and Gas, or illicit boreholes not authorized to benefit from the tariff advantage related to agricultural use.

IV.5. ENERGY CONSUMPTION BY ONAS

The amount of water treated by the National Office of Sanitation is 290 million m3, the energy consumed is estimated at 126 Gwh, for an energy bill of about 30 million DT.

The National Office of Sanitation has developed an **energy efficiency** program is the optimization of energy consumption in the treatment plants (treatment plant and water treatment) through the use of technology and innovative equipment for energy optimization.

Investment measures include:

- Reduction of energy consumption through the installation of energy-saving aeration systems and rehabilitation of water treatment plants;
- Energy production from biogas (digestion/cogeneration) or from photovoltaic installations;

The first part of the program concerns 8 water treatment plants.

In summary
Whether for drinking water, transfers, irrigation or sanitation, the issue of the water-energy nexus is becoming increasingly acute. The current surge in the cost of energy at the global level will aggravate this situation, with no prospect of a return to lower costs in the coming years.

The SONEDE and the SECADENORD should better use renewable energy by the realization of one or more photovoltaic power plants, in a sunny site (Sidi Barrak, Sfax, Zarat, Djerba, Sousse and Gabes).
The expected effect is a reduction in the cost of drinking water by reducing the energy bill of these two public companies. The solution "Renewable Energy" is all the more timely as the energy consumption of the National Company of exploitation and distribution of water will increase with the entry into operation of new desalination plants of sea water, as well as the canal exploitation

and north water Abductions Company after the completion of projects to strengthen the capacity of transfer.

In irrigated agriculture, the anarchic development of illicit drilling, the increase in the depth of wells and boreholes and in some cases the loss of artesianism for the oases of the South, will generate a high energy demand; the improvement of agricultural intensification risks increasing the demand for water if it is not rationalized and included in an agricultural policy clearly in favor of the sustainability of the sector.
The use of alternative energies currently being developed must be strengthened while being well thought out and supervised, in order to avoid drifts in use, as currently observed with photovoltaic pumping; in the long term, the use of brackish water desalination solutions for agricultural purposes should be considered, subject to the management of brine discharges, especially in inland regions close to the wadis or groundwater, or certain ecosystems.

For the ONAS, the solution of "elimination of sewage sludge" is both an ecological opportunity and energy saving. The valorization of sludge at the level of water treatment plants by anaerobic digestion constitutes a means of valorization.
The biogas produced can be transformed into electrical energy through gas engines. The electricity produced should allow covering a part of the global consumption of the water treatment plant.

FOURTH PART

CLIMATIC, ENVIRONMENTAL AND HEALTH ASPECTS

I. WATER AND CLIMATE CHANGE

I.1. FUTURE CLIMATE CHANGE AND CONSEQUENCES FOR THE WATER SECTOR IN TUNISIA

Scientific forecasts at the international level, relayed for the Tunisian context by the National Institute of Meteorology, report a vertical shift in the south-north direction of bioclimatic stages, with a more moderating effect from the coast (east) towards the continent (west), and an extension of the Saharan stage. According to this spatial logic it is the northwest, water tower of Tunisia, which will be most affected. The most tangible manifestation of climate change is manifested through the rise in temperature (between +1.5 ° C and +1.9 ° C by 2050), the reduction in rainfall (between -6% and -9% in 2050 compared to the reference period) and the rise in sea level. The consequences of this warming, which affect ecosystems, include:

- More disturbances in the climate system: increased frequency and intensity of heat waves, heavy precipitation, more pronounced and recurrent droughts, causing an intensification of changes in the water cycle (interannual variability and worsening of extreme events, droughts and floods, reduced runoff and increased evapotranspiration) resulting in a less favorable water balance ;
- The increase in the rate of CO_2 growth in the atmosphere, as oceanic and terrestrial carbon sinks become less efficient.

The decrease in water resources is taking place in a limnological and sedimentological context of marine water intrusion, salinization of the water tables, increase in the pollutant load and rapid sedimentation of the dams' reservoirs. These factors, combined with the continued increase in demand, complicate the resource management equation from year to year, and expose it to water crash in case of drought, with the main consequences:

- Supply-demand imbalances, leading to tense management of water resources;
- Dysfunctions in the management of hydraulic works (dams, boreholes, etc.);
- Dysfunctions in the management of drinking water, industrial and tourist zones;
- Dysfunctions in the management of irrigated areas;
- Risks of conflicts and tensions of a territorial nature.

Thus, hydraulics, although in a position of "weak influence on the climate" compared to other socio-economic fields, is highly dependent on climate change.

I.2. CLIMATOLOGICALLY SUMMARY OF THE YEAR 2021 IN TUNISIA

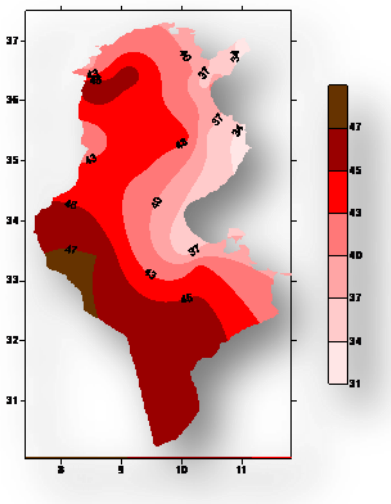

Figure n°9 : Temperature records for August TXM 7-9/08/21

Temperature: The year 2021 in Tunisia was the year of temperature records: 51 new monthly records were recorded regionally, plus an absolute national record of **50.3°C** recorded in Kairouan August 11, 2021, the former national record was **50.1°C**, July 26, 2005 in El-Borma.

The overall average temperature in 2021 reached **20.8°C** with a record anomaly of **+1.5°C**, ranking the year in **the first rank** of the hottest years.

The August heat wave mainly affected the northern and central regions of the country with record anomalies of up to +10°C during the days of 7 to 13 of the month, **15** records of maximum daily temperature were recorded.

Evaporation: The reference evapotranspiration ET0 was marked by a slight increase over the whole country. The cumulative annual ET0 for the year 2021 is between 1136 mm in Tabarka about 3.2 mm / day and 2700 mm in Tozeur about 7.4 mm / day.

Precipitation: According to the drought index "Standardized Precipitation Index" 12 months, the year 2021 was marked by a drought situation throughout the country and it was more severe in the central and southern regions due to the decrease in rainfall, which has negatively affected the water stock. The drought index ranged from 0 in Tabarka to -3.2 in Kasserine and Medenine. More than two thirds of the country recorded **less than 50%** of their annual average rainfall.

During the year 2021, the cumulative annual rainfall was between 10 mm in the extreme south and 1015 mm in Tabarka . This cumulative annual rainfall was below the reference rates in most regions except for the regions of Tabarka and Haouaria where a surplus of 7% was recorded, while the deficit is included in the rest of the country between 10% in Kelibia and 95% in the extreme south.

During 2021, total cumulative rainfall (24 major plants) was 5,224.9 millimeters, which was well below the baseline cumulative rainfall (8,234.9 millimeters), and the deficit was 36% relative to the baseline annual normal for the same stations, **ranking 2021 as the driest year since 1990**.

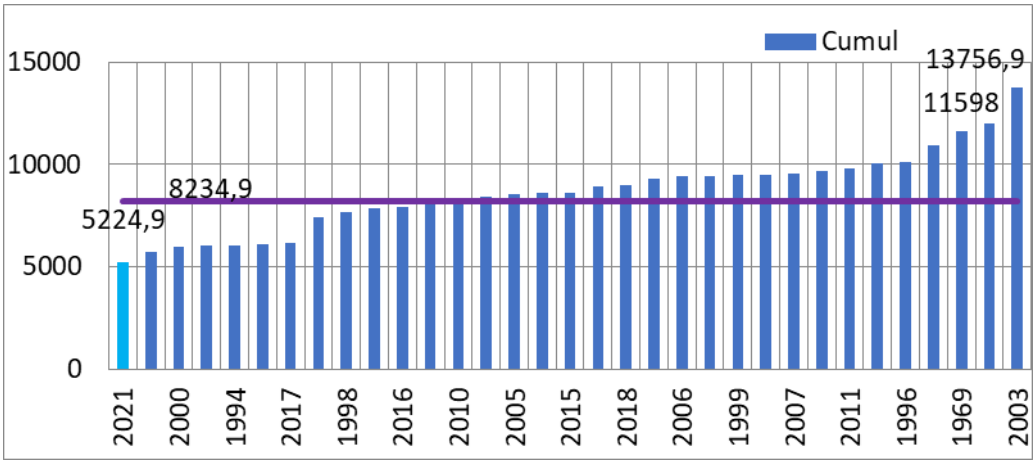

Figure n°10: Annual Precipitation Ranking (National Institute of Meteorology, July 2022))

The meteorological phenomena recorded during the year 2021

Heat wave and exceptional temperatures recorded:

The summer of 2021 was characterized by an exceptional increase in temperature across the country. Several regions set new records. The average temperatures were higher than normal on all stations. They ranged from 26.68 ° C in Tabarka, and 35.06 ° C in El Borma. The average temperature for this summer reached 29.95 ° C, it was higher than the average reference for the same stations (27.30 ° C) with a record deviation of (+2.65 ° C). This difference ranks the summer of 2021 as the .hottest summer ever
The overall average maximum temperature reached 36.8°C for the first time, exceeding the reference average (34.0°C) with a record deviation of (+2.8°C).

Snowfall:

The days of March 21 and 06 December 2021, the country has experienced the arrival of cold air masses of polar origin, which have contributed to a remarkable drop in temperatures in most regions, especially in the north and center, where the maximums were between 8 and 13 degrees

and close to 4 ° C on the heights, while the minimums are between 0 and 4 degrees in the western regions and between 4 and 8 degrees on the rest of the territory, with a slight fall of snow on the western heights and especially those whose height exceeds 800 meters, as Ain Draham, GharDimaou and Ain Sultana, Sakiet Sidi Youssef, Makthar and Kesra.

Intense rainfall recorded in 2021:

During the day of October 23, 2021, the country experienced an unstable weather situation and was characterized by a low concentration of atmospheric pressure over the eastern Algerian areas, which led to the formation of storm clouds more active in the northern coastal areas with strong winds and wet in the lower layers of the atmosphere and was also accompanied by heavy rain. We recorded 41mm in Tunis, Carthage, 106 in Kalâat El Andalous, 100 in Mornaguia, 166 in Rass Jebel and 108 millimeters in Bizerte, then the depression moved eastward on October 24, 2021, to be stationed off the eastern coast of Tunisia and contributed to a return of East especially over the northwestern regions, where the amounts reached 139 in Ain Dirham, 102 in Beni Metir and 80 mm in Nefza

Finally, it should be noted that there is a difficulty in predicting the events of torrential rains because on small areas, hence the need to use a fine mesh model to better predict.

I.3. PROACTIVE CLIMATE RESILIENCE

Tunisia has been committed since the first conference of the parties in 1992 to deal with climate change. It regularly establishes and implements the reference planning frameworks required or recommended by the first successive conference of the parties, in particular those recommended by the Paris Agreements:

- National reports such as the 3rd national communication (2017), the determined expected contribution of Tunisia (2015, updated in 2021);
- National Adaptation Plan (NAP) to climate change (in progress for the food security component 2021);
- National Low Carbon and Climate Change Resilience Strategy (SNBSRCC - 2021);
- Study of climate trends and projections in Tunisia with the National Institute of Meteorology, and creation of the climate change portal of the National Institute of Meteorology;
- Initiation of the process of establishing the national transparency system (in accordance with Article 13 of the Paris Agreements[6]) to ensure monitoring and evaluation on 3 components: the inventory of greenhouse gas emissions (GHG), mitigation actions and implementation of the nationally determined contribution, national and international support (required, provided and mobilized) at all levels.

I.4. CONTRIBUTION DETERMINED AT THE NATIONAL LEVEL

Launched at the end of 2020, the process of updating the nationally determined contribution concluded in September 2021, with the challenge of strengthening Tunisia's commitments in the implementation of the Paris agreements, in terms of mitigation and adaptation.

Objectives and approaches

In terms of mitigation

[6] It is a "uniform" transparency framework, which all countries must put in place by 2024, in order to establish mutual trust between parties to the Agreement, to raise climate ambition and to rigorously monitor public policies in this field. The national system is being developed with the support of the GIZ-supported "Institutional Capacity Building for the Implementation of the NDC in Tunisia".

The updated Nationally Determined Contribution raises Tunisia's greenhouse gas mitigation ambitions, in line with Article 4.3 of the Paris Agreement, through an increase of the national carbon intensity reduction target[7] to 45% by 2030[8], compared to its 2010 level.

This upward revision of the Tunisian ambition will also be accompanied by:

- The increase in the scope of the target (in accordance with the recommendations of article 4.13 of the Paris Agreement), which now exhaustively includes all sources of emissions[9];
- The low-carbon scenario (LCP) will impose a downward trajectory, leaving behind the peak of net emissions, which occurred well before 2020;
- The net emissions decline trajectory will continue after 2030, putting Tunisia definitively in the launching pad of the long-term objectives pursued by the Paris Agreement.

In terms of adaptation

The general adaptation objective of the updated nationally determined contribution aims to "**promote a Tunisia that is resilient to climate change, that has significantly reduced the vulnerabilities and strengthened the adaptive capacities of its ecosystems, its population, its economy and its territories, and that has resolutely carried out the necessary transformations**, capable of ensuring an inclusive and sustainable socio-economic development model that can participate in the construction of a more resilient world.

In order to strengthen its food, water, ecological, social, economic, territorial, health and also natural disaster resilience, the adaptation component of the nationally determined contribution is based on a new way of acting within a more global and cross-cutting/intersectoral adaptation framework of action that concerns all parts of the nation and its development, with the implementation of a prioritized action plan, encompassing vertical actions that respond to the specific sectoral issues and cross-cutting actions to better address the intersectoral challenges. To this end, the actions affect the six most vulnerable sectors: water resources, agriculture and forestry (Agriculture, forestry and other land uses), ecosystems, the coastline, health, and tourism.

Water Resilience

The climate change resilience objectives for the water resources sector in the updated Nationally Determined Contribution take into consideration all projected impacts and possible and feasible solutions within an incremental trajectory where the goal is to "**Limit the impacts of climate change on water resources and maintain surface water storage capacity and meet all water needs of users**" by 2030.

No less than 29 measures have been selected, divided into 3 priorities:

- Priority 1: Improve water governance and quantitative and qualitative management of conventional water resources in the face of the impacts of climate change;
- Priority 2: To massify the controlled use of non-conventional water to face the scarcity of the resource under the effect of climate change;
- Priority 3: Strengthen the technical, scientific and institutional capacities of water stakeholders to adapt to climate change.

To which are added a series of 7 measures in the social resilience component, under priority 3: "Ensuring a gender justice-based water resilience policy.

[7] Carbon intensity is the ratio of net greenhouse gas emissions (expressed in tonnes of CO2 equivalent) to GDP (expressed in this NDC at constant 2010 prices).

[8] Tunisia's first NDC targeted a 41% reduction in its carbon intensity between 2010 and 2030.

[9] Including those not covered by the target of the first nationally determined contribution.

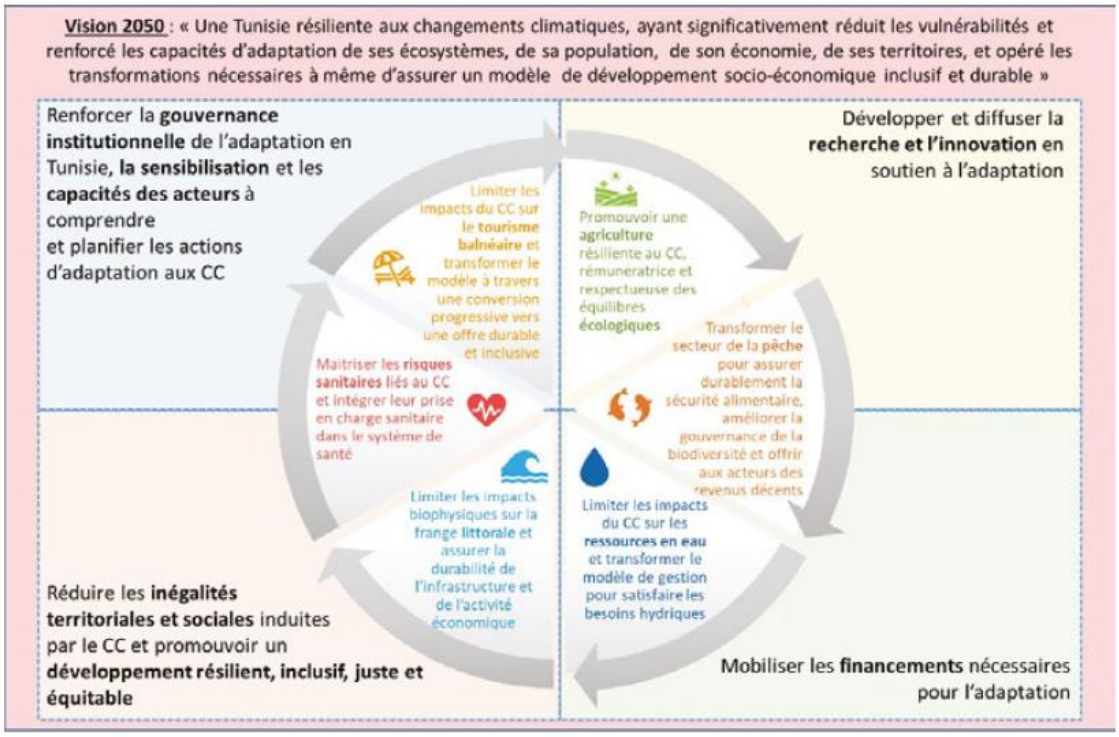

Figure n°11: Elements of the Vision 2050 of the Nationally Determined Contribution (CDN)

I.5. LOW CARBON AND CLIMATE CHANGE RESILIENCE STRATEGY (SNBCRCC)

Also, a key link in the implementation of the Paris Agreements, the SNBCRCC is an extension of the nationally determined contribution to better guide progress towards the country's long-term goal and better anchor the ambitions of the nationally determined contribution in the country's development priorities. Unlike the Nationally Determined Contribution, the development of a low-carbon and climate change resilience strategy is not mandatory. However, Tunisia has seized the opportunity to conduct this exercise with the support of German cooperation.[10].

This strategy confirms an ambitious vision of Tunisia's commitments to achieve carbon neutrality by 2050. The scenarios of vulnerability BAU established within the framework of the study, demonstrates once again how much these resources are exposed to the water crash, which points the strategy Water 2050 if no binding measures are taken by 2030.

Water governance and resource preservation are thus at the center of the concerns of the strategic axes of the SNBCRCC that materialize the 2050 vision of the Nationally Determined Contribution (figure n°11), whether they are sectoral or transversal.

[10] «Project "Institutional capacity building for the implementation of the National Determined Contribution of Tunisia" funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the project "Capacity building and support to the implementation of the national policy of adaptation to climate change in Tunisia" Adapt-Climate Change funded by the German Federal Ministry for Economic Cooperation and Development (BMZ) in partnership with the Ministry of Local Affairs and the Environment in Tunisia

I.6. PROGRESS OF THE PROCESS OF ELABORATION OF THE NATIONAL ADAPTATION PLAN

The second phase of the study "Contribution to the elements of the preparatory phase of the process of elaboration of the National Plan of Adaptation to Climate Change" was completed in February 2021.

Its objective was to highlight the "Impacts of climate change on food security". The analysis of the impacts of climate change by 2050 and 2100 highlights the prospect of increasing water stress with a rise in aridity towards the north of Tunisia, leading to a decrease in cultivable areas and a risk of considerable decline (about 1/3 in 2050 and 2/3 in 2100) of yields and national production of cereals, olive and rangeland.

The development phase of the National Adaptation Plan itself should be initiated during 2022. A fund of one million dollars (Green Climate Fund) is available for the "food security" component, supported by the Food and Agriculture Organization.

I.7. UPDATE OF THE NATIONAL ACTION PROGRAMME TO COMBAT DESERTIFICATION (PLAN-LCD)

The three Rio Conventions of 1992 (climate change, desertification, and biodiversity) form a systemic whole to work for sustainable development.

The instruments developed and implemented therefore interact closely.

Tunisia has updated its National Action Program - Combating Desertification in 2020 - 2021, for the period 2018 - 2030, as part of its commitments with the United Nations Convention to Combat Desertification, paying particular attention to its alignment with national and sectoral strategies being implemented or developed (nationally determined contributions, land use planning and conservation and Water 2050) and the orientation of the Sustainable Development Goals. The focus is on Sustainable Development Goal15 and its target 15.3 on Land Degradation Neutrality (LDN), which requires drastic measures to be taken against erosion and soil salinization, consequences of anthropic pressure and the effects of climate change.

The National Action Program to Combat Desertification also integrates the improvement of the resilience of ecosystems and agrosystems to climate change; with proposals for measures in favor of rain-fed agriculture, governance of water saving, particularly in the oasis environment, and the preservation of wetland ecosystems (ecological waters). Axis P2.2 advocates an effective policy of strategic drought management based on strengthening water security for all sectors. It takes up some of the axes of Water 2050, such as the mobilization of EC and ENC (with the fight against silting of dams, the strengthening of groundwater recharge, the Reuse of treated wastewater / master plan,...), the promotion of a new governance of the management of water resources (amendments of the water code in particular for the protection of groundwater and the management of drought, strengthening the coordination between the water authorities, proposal for the creation of a National Agency for Integrated Water Management - following the example of the National Agency for Energy Management - whose vocation is to coordinate and promote technologies and processes for saving drinking water for domestic, tourist and industrial uses, and improving the efficiency of these uses,...).

I.8. MAPPING OF BANKABLE PROJECTS FOR THE DUTCH FUND FOR CLIMATE AND DEVELOPMENT

The mapping was developed within the framework of the project "Integrated Water Resources Management in the Medjerda transboundary watershed" MedGIRE[11]. This project aims to contribute

[11] *Project carried on by WWF (https://www.wwf.tn/nos_projets/medgire_2022/)*

significantly to the conservation, restoration and regeneration of wetlands and water-related natural ecosystems in the Medjerda watershed.

The study is based on interviews conducted mainly with private companies carrying green economy projects but also potential donors capable of financing this type of project. These companies cover the sectors (industry, agriculture, etc.) that have the greatest environmental impact on the ecosystems of the targeted geographical area.

This action has resulted in a portfolio of bankable green economy projects with significant impact potential, including the following examples:

- **Implementation of an adapted process of depollution for the industrial discharges of the factory of the Tunisian Sugar Company;**
- **Implementation of a new wastewater treatment station (water treatment and purification station) autonomous in Energy**
- **Implementation of water saving systems through the use of intelligent agriculture (SMART agriculture) for cooperatives;**
- **Implementation of a project for the valorization of waste for the water treatment plant of the dairy company of the North (la Compagnie Laitière du Nord)**

Several support and financing actors have shown great interest in supporting the development of the Dutch Fund for Climate and Development's activity in Tunisia and have expressed their willingness to support the realization of the projects identified, by identifying avenues for collaboration with the Dutch Fund for Climate and Development. One of the tracks would be to see the possibility of working concretely with the banks to finance projects in their portfolios especially that some of the lines of financing which they have expired.

It is also essential for the Dutch Fund for Climate and Development to ensure a certain fluidity, reactivity, and transparency in the evaluation of financing possibilities to avoid having the same reputation as other climate funds characterized today as being inaccessible because of their rather complex procedures.

In summary

Tunisia is committed to a paradigm shift by addressing the challenges of climate change adaptation and mitigation in the agricultural sector in a multisectoral, participatory and integrated manner (through its commitments materialized by the Nationally Determined Contribution and the National Adaptation Plan for Food Security process). This transition to climate-resilient agricultural/food production systems must also be:

- **Promoted by the development of synergies between food production and the sustainable use of natural resources "water and soil" as well as "available, efficient and renewable" energy in the country, by gradually integrating new concepts (still approached in a pilot and fragmentary way within the framework of projects), of "water footprint", "water-energy decoupling", "water-food-energy nexus", "systematization of the consideration of the value chains" and "economic diplomacy" etc...**
- **Oriented towards conservation agriculture and organic farming, with scientific and experimental research on climate adaptation of resilient species, as well as natural resource protection systems, a digital transition for "smart" agriculture, the development of climate finance and insurance, technical and financial support to rural communities....**

On the national strategies and operational level:

The set of measures proposed for water resilience aligns with national priorities, also developed in the upcoming "Water 2050" strategy. The measures of "gender justice, water and climate change" shed additional light that could be pertinently considered in the elaboration of the action plans of "Water 2050" being developed during 2022.

The regular coordination between the actors of the Water cluster and the Project Management Unit in charge of Climate Change at the Ministry of the Environment and Sustainable Development has made it possible to support the strategic place of water management in the various national processes (Nationally Determined Contribution, National Adaptation Plan, low-carbon strategy and resilience to climate change) carried out within the framework of the United Nations Framework Convention on Climate Change / Paris Agreements This coordination is imperative in the long term to :

- **Detailing the measures included in the National Determined Contribution / low carbon and climate change resilience strategy / National Adaptation Plan, in order to make them effective and sustainable, in particular for some of the measures that may have counterproductive effects (for example, regarding water saving measures in agriculture - see the evaluation of the national water saving program in the framework of the support program for public policies on water resources management, or desalination, which generates over-salted and polluting discharges) and to include sensitive points such as the control of the public hydraulic domain.**
- **Facilitate the transition to the operational phase, so that each of the players can control their contributions to the projects selected and be able to ensure their implementation.**

However, in accordance with the recommended intersectoral approach, this coordination must be part of an even broader framework, by linking up with other national development planning processes, in particular with the economic and social development plans, and in the short term with the plan for the period 2023-2025.

II. ENVIRONMENTAL PROTECTION AND POLLUTION CONTROL

II.1. BASIC DATA ABOUT WATER QUALITY

The quality of water resources is a decisive issue for their mobilization. If for some resources of lower quality their use would require, depending on the use, a prior treatment, it would be appropriate for those of good quality to safeguard and protect against the degradation of this quality following the anthropogenic activity (agriculture, industry, liquid and solid sanitation, etc.) and climate change.
According to the World Bank report (Unknown Quality: The Invisible Water Crisis; 2019), Tunisia shows a high level (red) of global risk for water quality for the three main water quality indicators of Sustainable Development Goal 6.3.2:

- Nitrogen (nitrate-nitrite), an outlier in terms of scale, scope, trends and impacts;
- Electrical conductivity, a measure of water salinity; and
- Biological oxygen demand (BOD), a widely used generic indicator of water quality.

The water quality challenges and issues are as follows:

- The monitoring of water quality is marked by a fragmented system of observation and monitoring and by the absence of an integrated and reliable operational mechanism in the matter; two groups of operators ensure the monitoring of water quality: the first for the monitoring and management of the resource and works: the services of the Minister of Agriculture, water Resources and Fisheries , the second for the control and monitoring of water pollution: the National Agency for Environmental Protection;
- Wastewater continues to increase and to be insufficiently treated;
- Industrial wastewater is, in many cases, discharged into nature with a more or less important load of harmful agents;
- Intensive cultivation and the multiplication of irrigated areas involving massive use of fertilizers and pesticides with inadequate drainage and leaching systems are one of the causes of the accentuation of water quality problems in Tunisia;
- The overexploitation of groundwater reaches an alarming stage largely exceeding the renewal rate of the resource. The continuous lowering of the piezometric level of the water tables results in a deterioration of water quality following the increase of its salinity in situ or by sea water intrusion;
- The wetlands are currently subject to strong pressures related to the lack of fresh water supply (especially through the construction of dams), pollution and climatic hazards. These wetlands have a priori the function to act as natural buffers, which absorb excess nutrients and toxic substances;
- Climate change, with rising temperatures, more droughts and floods, will affect water quality and increase pollution from sediment, nutrients, dissolved organic carbon, pathogens, pesticides and salt;
- The national water system is naturally connected to the systems of neighboring countries. These transboundary waters concern several wadis whose watersheds are shared with Algeria as well as the Saharan aquifers whose exploitation is common to Tunisia, Algeria and Libya. The management of these transboundary waters is not very transparent. Only Tunisia respects the self-limitation of withdrawals. The management and governance of these transboundary waters deserves not only a quantitative but also qualitative monitoring, because pollution related to industrial and urban activities in neighboring countries remains a potential threat in the absence of treaties and system of conventions between the three neighboring countries governing the control of water quality.

II.2. WATER POLLUTION CONTROL BY NATIONAL AGENCY FOR ENVIRONMENTAL PROTECTION "ANPE"

The national agency for environmental protection continues to carry out its campaigns of monitoring of the quality of water whose objectives are essentially summarized in the:

- Diagnosis of the environmental state of the hydrous environments in Tunisia;
- The establishment of the sources of pollution that can lead to a deterioration of water resources, the creation of an information bank on the environmental status of natural waters.

The number of points monitored in 2021 by the monitoring service of water environments at the National Agency for Environmental Protection; and as shown in the figures below, reached 390 distributed in wadis, dams, sebkha, groundwater, ... The number of analyses has reached 4560 in 2021. In fact, there is a resumption of activities after the COVID period (the year 2020 and a good part of 2021).

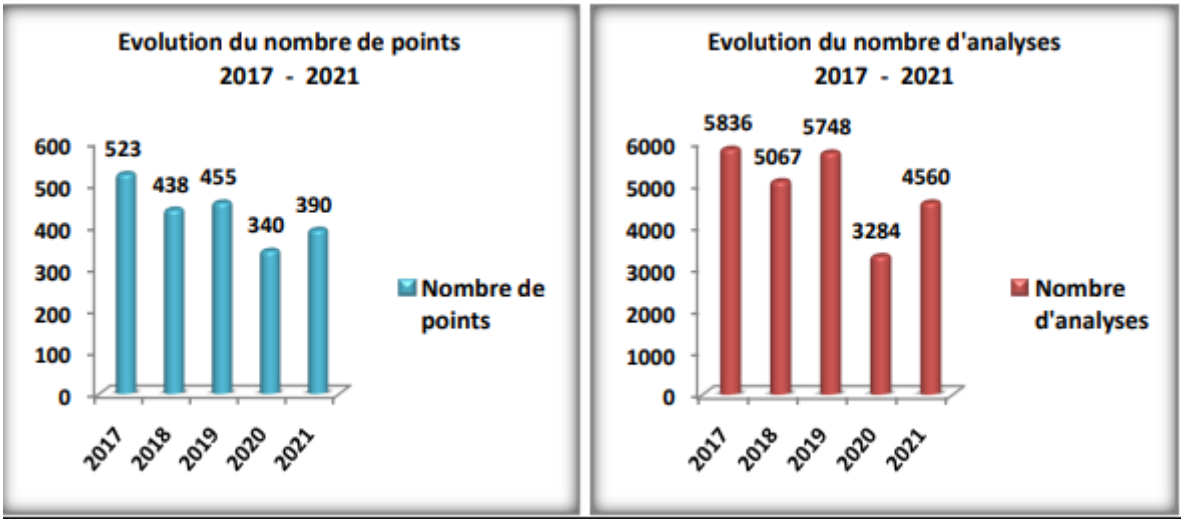

Figure n°12: Evolution of the number of points monitored and analyzed by the National Agency for Environmental Protection (Source: ANPE 2022)

In 2021, the ANPE has carried out 4445 control operations of which about 50% directly concern water pollution. This control has resulted in 714 reports against the offenders and this after confirmation of their infringement to the environment justified by the laboratory analysis of legal samples, carried out by the National Agency for Environmental Protection at its expense.

The most targeted sectors are the service activities and landfills with 53% of control operations followed by the food sector and agriculture by 20% of control operations.

The majority of the reports concerned infringements which consist particularly in non-conforming water discharges as well as the anarchic evacuation of margins. The highest rate of infringement (77.4%) was recorded at the level of sanitation infrastructures.

II.3. PROGRESS OF NATIONAL AGENCY FOR ENVIRONMENTAL PROTECTION'S PROGRAM IN 2021

Integrated program for the depollution of the region of the lake of Bizerte (for more details on the whole of this program cf the matrix of the projects in appendix): The ANPE is charged of the supervision of the execution of a mission of environmental follow-up of the Lake of Bizerte for a duration of three years. In addition to the monitoring, the program includes:

- The design of an alert system for water quality monitoring;
- The design and implementation of an environmental monitoring program in the medium and long term;

- The monitoring of the performance of the rehabilitated water treatment and purification station (water treatment and purification station of Bizerte, Menzel Bourguiba and Mateur).

Actions completed during the year 2021: A consultant has been selected.

Bilateral cooperation project with Wallonia: Expansion of the multi-stakeholder platform to support the governance of water resources in the Medjerda watershed / Implementation of an integrative methodology for the evaluation of surface water quality based on biological indicators (2019 - 2023)

The project aims to:

- To strengthen the ANPE in its missions of monitoring and physico-chemical modeling of surface waters through continued training, including the use of PegOpera software;
- To integrate the use of bioindicators (aquatic macro-invertebrates, diatoms, macrophytes) in this process of environmental monitoring in order to reinforce the knowledge and the monitoring of the aquatic ecosystems, in perfect adequacy with the missions of the ANPE;
- Strengthen the multi-stakeholder platform for information and discussion.

The actions completed during the year 2021: start of the implementation of the laboratory of biomonitoring of the ANPE (equipment to be acquired, training), installation of the new laboratory for biological monitoring of water quality in El Mourouj (work and reception of equipment and materials).

Co-evolution of Mediterranean coastal human activities and natural systems for sustainable tourism and blue growth in the Mediterranean (Co-Evolve4BG)/ 2019 - 2023:

The Co-Evolve4BG project aims to analyze and promote the co-evolution of human activities and natural ecosystems in coastal tourist areas, towards a sustainable blue development.

The analysis and actions planned by the project will limit the impacts of discharges, especially water in coastal tourist areas and improve the sustainable development of coastal and marine tourism by fully exploiting the potential of the blue economy, promoting the creation of businesses and jobs in the field of ecosystem services, coastal and marine tourism, coastal management and adaptation to climate change.

Actions completed during the year 2021: Choice of pilot sites: Sousse and Monastir, publication on the website of the National Agency for Environmental Protection, sharing of a survey on social networks and the website of the National Agency for Environmental Protection to identify the main issues to be resolved to ensure sustainable coastal/maritime tourism in Sousse and Monastir.

II.4. ECOLOGICAL WATERS

II.4.1. Elaboration of the sustainable management Plan of Garâat Sejnen and its adjacent areas [12]

Garâat Sejnen is the largest natural freshwater wetland in the country. Since February 2021 this site is listed as a RAMSAR wetland of international importance.

The study area includes a number of water bodies (dam, hill dam, hill lake, Ramsar zone, ..), forest and pastoral ecosystems, a complex hydrographic network, a mosaic of agricultural landscapes (irrigated and dry). It has a natural and cultural heritage quite important. The presence of a wealth of

[12] *: Source: Ministry of Environment, THTIS Office, 2022, Sustainable Management Plan of Garâat Sejnen and its adjacent areas (Sejnen and Ichkeul watersheds), Report phase1 : Global diagnosis of the Garâat Sejnen watershed and its adjacent areas*

flora and fauna, the presence of rare and endemic species prove that the area has an invaluable potential. Nevertheless, these resources are vulnerable and undergo continuous pressure.

The Ministry of the Environment has carried out Phase 1 of the sustainable management plan of Garâat Sejnen and its adjacent (Sejnen and Ichkeul watersheds), which aims to contribute to the conservation and sustainable management of ecological waters and ecological recovery of ecosystems in this area. This phase concerns the global diagnosis.

Development issues and challenges:

The lack of a strategy to develop the natural and heritage potential of the Sejnen region only serves to worsen the socio-economic indicators in the area, which are already flashing red (poverty, unemployment, disparity, and imbalance with other regions, etc.). All this will make it difficult to reconcile man and his natural environment in this area with all the negative consequences on biodiversity and ecosystems that are unique.

Factors that may influence management:

Desertification and land degradation: The Wadi Sejnen watershed is affected by erosion that results in the stripping of the soil surface, leading to the humus-rich organic matter horizon, leaving a stony surface.

Climate change, mainly related to climatic extremes: prolonged drought and intense rainfall, which can have more marked effects on the territory, and impact on the productivity of rain-fed and irrigated agricultural land, grasslands, scrubland, and forests in the near and medium term.

Anthropogenic constraints: the natural resources of GarâatSejnen have also been subjected for decades to human pressure due either to the needs of the local population (grazing, land cultivation ...) or due to the mobilization of water resources for regional and national needs.

In addition, there is the impact of solid and liquid waste and water pollution from the towns along the rivers and water bodies and the sometimes-excessive use of agricultural pesticides.

Recommendations:

Phase 1 concerning the diagnosis presented the following recommendations:

- The establishment of a common vision for the development of the Garâat Sejnen area (watershed and adjacent areas);
- The strengthening of the heritage character of Garâat Sejnen and to ensure that its need for water, in quantity and quality, is not neglected, but on the contrary that the development is beneficial to it, see that it contributes to new forms of economic and social rural innovation to fight against the effects of global warming and especially the scarcity and mismanagement of water;
- The development of a management plan in line with the requirements of biosphere reserves: management body, equipped and trained, preservation of landscapes, restoration of the environment, monitoring of the components of the natural environment, agro-pastoral development plan, environmental education, local and national governance, ... ;
- The promotion of economic activities. This will involve activities (micro-projects or micro/small businesses) that can be initiated and developed by local communities and the private sector, particularly income-generating activities;
- The identification and proposal of relevant financing measures, incentives and incentives that would be able to encourage the support and participation of local communities in the maintenance and sustainable management/enhancement of biodiversity;
- Awareness raising and capacity building of actors, targeting in a differentiated way the different stakeholders and beneficiaries at different levels.

II.4.2. Sustainable management of the lagoon of Ghar el Melh

The lagoon of Ghar El Melh provides valuable services to the local community of the adjacent city. The ecological and historical assets of the lagoon of Ghar El Melh earned it its classification as a Wetland of International Importance under the Ramsar Convention in 2007. But due to the increasing pressure of human activities on the lagoon, exacerbated by climate change, urgent actions are needed to limit the degradation of this fragile ecosystem.

The GemWeta project aims to create a model for integrated management of coastal areas and wetlands in North Africa. It specifically aims to protect, sustainably manage and restore the lagoon of Ghar el Melahen Tunisia.

During Phase I of the Gemwet Project[13], to maintain the lagoon in a stable ecological state was organized.

The second phase (ongoing) has the following components:

- To improve knowledge and information on biodiversity, hydrology, marine resources and the socio-economic aspect of Ghar el Melh;
- Build capacity and awareness at all levels;
- Lobbying and policy work with decision makers to implement measures to restore water quality in the lagoon;
- Demonstrate best practices on tourism, agriculture, water use and fisheries;
- Implement lagoon management planning combining integrated coastal zone management and integrated water resources management.

In this context, a study to improve the flow and water quality of the Sebkha Sidi Ali El Mekki has been carried out; it has allowed identifying options for the regeneration of the hydraulic system and increasing the flow of exchanges between the lagoon and the freshwater tributaries.

II.5. IMPLEMENTATION OF THE INTEGRATED PROGRAM FOR THE REMEDIATION OF THE REGION OF THE BIZERTE LAKE - ECOPACT

The Program, whose cost amounts to more than 80 million €, envisages a set of integrated actions linked by a common objective to depollute the catchment area (BV) of the lake of Bizerte, to improve the quality of the waters of the lake and the state of its ecosystems. In order to achieve this objective, it is essential that all the potential sources of pollution are taken in charge by the program to be eliminated or reduced to the level considered acceptable by the standards in force.

It includes 4 investment elements:

- Reduction of industrial pollution (atmospheric emissions, liquid effluents, solid waste) aimed mainly at three state-owned factories: the El Fouledh iron and steel industry, the Bizerte cement factory SCB and the Tunisian Company of Refining Industries STIR;
- Extension and improvement of the sanitation of urban and rural settlements around the lake so that the collection and treatment of wastewater reach Tunisian standards, which are in line with EU standards, or even stricter on some parameters. The program also includes a pilot individual sanitation system for scattered dwellings in rural areas;
- Management of industrial solid waste through the rehabilitation and development of the anarchic landfill of Menzel Bourguiba, in the south-western area of the lake;
- Development of the banks of the north-eastern zone of the Lake with the creation of a cornice in front of the city of Menzel Abderrahmane and the extension of its fishing port.

This program is marked by the strong involvement of the civil society in the follow-up of its execution and the contribution to its realization through a dozen projects that actors of the civil society carry

[13] *GEMWET Project "Conservation and Sustainable Development of Coastal Wetlands with High Ecological Value" July 2018 - October 2022, Donor: MAVA Foundation for Nature; Implementing Agency: Worldwide Fund for Nature - North Africa*

out to contribute to the perpetuation and the sustainability of the results of the program by reinforcing the level of citizens' environmental sensibility and by reinforcing the dialogue for the implementation of a strategy of sustainable development of the lake region.

In 2021:

The program has signed 12 agreements with non-governmental and civil society actors: the World Wide Fund for Nature (WWWF) in Tunisia, the Strategic Center for the Protection of Sustainable Development, the Ichkeul Association for Strategic Watch, the Youth Association for Active Citizenship and Democracy and also with the Menzel Jemil Association, the Association for the Protection and Safeguarding of the Bizerte Coastline, the Tunisian Association of Environmental Agriculture, the Association Friends of CAPTE Tunisia.

The environmental and social impact assessment of the project to extend and rehabilitate the artisanal fishing port of Menzel Abderrahmane, was conducted and validated with local stakeholders (municipality, civil society associations, local population and particularly the fishermen of the region);

The rehabilitation of the sewage network in the region of Lake Bizerte carried by the National Sanitation Office are finalized on several areas such as Menzel Abderrahmane, Menzel Bourguiba, Mateur, Tinja, Jarzouna and Avenue Othmane Allouche in Bizerte;

Two environmental projects, benefiting from funds under the implementation of the EcoPact program, have been launched:

- The Waterpact project carried by World Wildlife Fund Tunisia, the Chamber of Commerce and Industry of the north-east of Bizerte and the Association of Protection and Safeguarding of the coast of Bizerte; it intervenes to reduce pollution through awareness and support of industries in the region;
- The AGIR AGRI project carried by the Tunisian Association of Environmental Agriculture - AAG and the association Les amis de Capte Tunisia with the objective of establishing models of good agricultural practices contributing to the reduction of pollution of agricultural origin.

In summary

The quality of water resources is deteriorating due to several impacts, the most important of which are from water and solid waste, whether urban, industrial or tourist.

Currently, industrial discharges pollute large areas, and their effects often reach rivers and in some cases groundwater. On the other hand, the burial of solid waste in controlled landfills as a treatment method has reached its limits and their impacts are increasingly visible and uncontrollable on the quality of water resources.

To contribute in a very important way to the improvement of the quality of the water resources, the orientations, largely exceed the operations / devices of control, and consist in fighting against the pollution by the domestic and especially industrial wastewater and by the solid waste through measures often of great extent, integrated and multi-actors as:

- **The treatment of industrial discharges according to Tunisian standards, the realization of grappled stations for industrial areas, the depollution of industrial hot spots, monitoring and control of the quality of industrial discharges and encouraging industries to opt for clean technologies and treatment of their discharges;**
- **The fight against solid waste pollution by maximizing waste recovery (circular economy) and the implementation of projects to build treatment and recovery units (UTV);**
- **Improving the regulatory framework: despite the policies and objectives put in place in terms of water quality and environmental protection, there are deviations from the planned provisions, due to an insufficient level of compliance and a non-rigorous application of regulations, particularly in terms of control and dissuasive measures in this area (establishment of statements of offence, dissuasive penalties, etc.);**

- **The implementation of regulatory provisions based on clear, transparent and proportionate rules, procedures, sanctions, incentives and tools;**
- **Taking into account the sources of diffuse pollution due to agriculture: particular attention should be paid to the problem of nutrient overload due to fertilizers and effluents from livestock activities, leading to eutrophication and algal blooms in agriculture;**
- **The strengthening of measures for the preservation of ecological waters and wetlands;**
- **At the level of control operators: the establishment of an operational mechanism for quality control and environmental protection integrating the services of the National Agency for Environmental Protection and those of the Ministry of Agriculture, Water Resources and Fisheries in charge of controlling the Public Hydraulic Domain to avoid the dispersion of actors.**

III. WATER SANITARY CONTROL

III.1. SANITARY CONTROL OF DRINKING WATER DISTRIBUTED BY SONEDE

The Ministry of Health's Department of Environmental Health and Protection (DHMPE) conducts sanitary inspections of the drinking water supply systems distributed by SONEDE. The number of operations carried out in 2020 is comparable to previous years and is as follows:

- Control of free residual chlorine: 253944
- Bacteriological analyses: 31670
- Physico-chemical analyses: 746

The national average rate of bacteriological non-compliance recorded in 2021 is 10.6% compared to 10.1% in 2020.

High rates of bacteriological non-compliance were recorded in the regions of Tataouine (35%), La Manouba (30%), Ben Arous (20%), Jendouba and Beja (14%). These rates are attributed to the absence or ineffectiveness of disinfection operations knowing that the rates of absence of free chlorine residual are high in Tataouine (33%), Bizerte (12%), Gafsa (11%), Kasserine and Medenine (10%), Ben Arous (8%), La Manouba (7%) and Sfax (6%), compared to the national average rate of absence of free chlorine residual of 5.3%.

It should be noted that the services of SONEDE indicate that they have conducted, as part of their self-monitoring operations, analysis of 53,901 samples of which 3% are bacteriologically unsuitable, which is very far from the results provided by the DHMPE (10.6% of bacteriological non-compliance).

The national average rate of physico-chemical non-compliance in 2021 is 5%, the same rate as in 2020.

The results of physico-chemical analyses carried out in 2021 on samples of water distributed by SONEDE have shown high rates of non-compliance with quality limits in the case of the regions of Beja (22%), Monastir (14%), Nabeul (12%), Ben Arous and Zaghouan (11%), Jendouba and Kasserine (10%). The exceedances recorded concern the parameters: pH, turbidity, electrical conductivity, salinity, total hardness, sulfates, chlorides and nitrates.

III.2. SANITARY CONTROL OF DRINKING WATER DISTRIBUTED BY RURAL ENGINEERING

III.2.1. Sanitary control of networks and reservoirs

- Free chlorine residual control: 33165
- Bacteriological analysis: 7804
- Physico-chemical analyses: 388

High rates of bacteriological non-compliance were recorded in the regions of Ben Arous (59%), Gabes (45%), Jendouba (35%), Bizerte (32%), Beja (30%), Kairouan (23%), Kasserine and Gafsa (18%), compared to a national average rate of (13%) as in 2020. The absence of free chlorine residual recorded are very high in Gafsa (85%), Zaghouan (84%), Bizerte (78%), Kasserine (77%), Kairouan (65%), Beja (44%), Siliana (36%), Jendouba (22%) Ben Arous (21%) and this compared to the national average rate of (29%) against 34% in 2020.

The results of physico-chemical analysis conducted in 2021 showed high rates of non-compliance with quality limits in the regions of Manouba (24%), Jendouba (18%), Nabeul (15%), Beja (14%) and Kasserine (13%). The average national rate recorded is (9%) against 10% in 2020.

III.2.2. Equipped public water points

- Disinfection operations: 940
- Bacteriological analyses: 3869
- National rate of bacteriological non-compliance: 47% compared to 32% in 2020.

The sanitary control of public water points in rural areas concerns the disinfection of wells and cisterns, the bacteriological control, and the sanitary state of these water points. High rates of bacteriological non-compliance are recorded, particularly for:

- Wells: Sousse (61%), Tataouine and Beja (59%), Jendouba (58%) and Kairouan (50%)
- Tanks: Kébili (100%), Gabès (69%), Kasserine (37%) and Gafsa (35%)
- The sources: Gabes (89%), Jendouba and Kasserine (48%), Beja (42%), Tozeur (40%), Sidi Bouzid (38%).

III.3. Sanitary control of water in border Areas

On a total of 1208 bacteriological analyses conducted on drinking water taken in the border areas, a bacteriological non-compliance rate of about 28% is recorded against 21% in 2020. The rates of non-compliance were very high for the regions of Jendouba (48%) Tozeur (20%) and Gafsa (18%).

Similarly, a total of 310 bacteriological analyses have been conducted on wadi water in border areas that have not revealed the presence of pathogens such as vibrio cholerae and salmonella in these waters.

III.4. Sanitary control of treated wastewater reused in irrigation

During 2021, laboratory analyses revealed high non-compliance of the organic disturbance indicator parameters, namely COD (67%), BOD_5 (62%) and TSS (48%). The results of analysis of heavy metals such as lead, and cadmium showed their compliance with the current standard NT 106.03.

As for the microbiological quality and if the compliance is total for cholera vibrio and salmonella, a case of presence of helminth eggs was isolated in the treated wastewater of a treatment plant.

III.5. Other activities in water sector:

Microbiological analyses were conducted on:

- Raw and treated wastewater (not reused in agriculture): 4364
- Swimming pool water: 310
- Sea swimming waters: 6127
- Thermal and thalassotherapy waters: 114
- Conditioned water: 772

In summary

The situation tends to continue to deteriorate, with non-compliance rates that increasingly exceed the World Health Organization

The situation tends to continue to deteriorate, with non-compliance rates that exceed more and more significantly the standards of the World Health Organization, despite functional control devices, and a sufficiently representative number of analyses. From one year to another, several governorates show high percentages of control out of standards. In addition, the disparity between urban and rural areas remains marked and the corrective measures undertaken by the Directorate of Environmental Health and Protection still seem insufficient. These measures consist of technical assistance to the members of the Agricultural Development Groups and health education for the beneficiaries.

This situation partly explains the growing consumption of bottled water and encourages the development of the parallel market for the sale of water from areas where the water is known for its quality, at the expense of the populations of these areas, who will find themselves in the short term in difficulty in covering their needs.

The Directorate of Environmental Health and Protection has repeatedly recommended that water suppliers develop and implement sanitary safety management plans. This provision is included in an article of the new water code; however, no progress has been made in this direction.

Currently and soon, the issue of water quality degradation will become even more acute. The measures can no longer be simply punctual corrective but also preventive and this within the framework of concerted action plans of management of the sanitary safety of water, between the suppliers of water (in the first place the SONEDE) and the services of sanitary control (Direction of Hygiene of the Environment and Protection of the Environment). This imposes a clear distribution of roles: the suppliers being in the front line to control the installations, to bring and follow up corrective measures, to monitor closely the sensitive points in the network (areas exposed to pollution risks for example...), the health control services to carry out external analyses in significant quantities on all the networks or conditioning points, to ensure the supervision of the services of the water suppliers in charge of the control of the installations, to rule on the sanitary risks for the population in the event of exceeding the standards, to make the diffusion of the assessments of the analyses near the actors concerned (suppliers but also municipalities, services of the environment….) etc. The plans should also be backed up by a spatialized database of the analyses carried out and the measures taken, making it possible to monitor the effectiveness of interventions and to determine priorities for action.

IV. SANITATION

IV.1. SYNTHESIS OF THE SANITATION SITUATION

As part of the State's strategy to preserve the environment and water resources of the country, and to fulfill its international commitments to the Paris Climate Agreement (Nationally Determined Contribution 2021) and the achievement of the Sustainable Development Goals 2030, in particular Goal VI aimed at ensuring access to water and sanitation for all, the National Sanitation Office continued in 2021 its efforts to implement various programs and projects. These projects aim at developing the sanitation infrastructure by extending and rehabilitating the sewerage networks for the cities taken in charge, sanitation of popular districts and some areas that were rural, thus contributing to the generalization of sanitation services throughout the Tunisian territory.

The total investments since the creation of the national office of sanitation in 1974 amounted to about 3610 million TND, including 258.2 million TND in 2021.all these investments have allowed the development of the sanitation system of the country, which now includes about 17,877 km of pipes and 124 treatment plants.

This sanitation system has allowed benefiting about 7 million inhabitants to the public sewerage network so that the connection rate has reached 76.8% in the areas taken care of and 63.2% on the whole national territory.

The volume of treated water reached 288 million m3 in 2021.

The sanitation indicators for the year 2021 are summarized as follows:

Table n°17: the sanitation indicators

Indicator	**Unit**	**2020**	**2021**
Number of municipalities covered* (%)	municipalities	193	**193**
Rate of connection to the public network	%	63,0	63,2
Rate of connection to the public network in the intervention areas of the National Sanitation Office	%	76,63	76,8
Number of users	1000 users	2125	2160
Number of pumping plant	Plant	810	830
Number of treatment plant	Plant	123	124
Volume of water treated	Millions m^3	287	288,5
Linear of the network	Km	17729	17 877

There are still 157 communes that are not yet covered by the national sanitation office. These are small communes, but they require large investments due, among other things, to the type of housing, which is often scattered.

IV.2. ACHIEVEMENTS IN 2021

The year 2021 was marked primarily by:

- **Sanitation of popular neighborhoods:** the completion of sanitation work in 09 popular neighborhoods, bringing the number of sanitized neighborhoods to 1,126 for the benefit of approximately 1.386 million inhabitants;

- **Intervention in the regions that were rural**: completion of the sanitation work in the areas of Talmin in Kebeli and Wergesh in Jendouba. The number of areas that were rural and sanitized since the launch of the program is 34 areas for the benefit of 117 thousand inhabitants;
- **Strengthening the wastewater treatment system**: 2 treatment plants (Sidi Ali Ben Aoun/Beer al-Hafi and Sabeikha) are commissioned respectively on 04/10/2021 and 17/04/2021;
- **Improvement of the quality of treated wastewater**: Continuation of works for the extension and rehabilitation of wastewater treatment plants: Mahdia, Ouardanine, El Jem, Sidi Bouali and Al-Mahres.Work has started for the STEP Moknine for the treatment of industrial wastewater;
- **Progress of the DEPOLMED Program**: This is a sanitation program contributing to the de-pollution of the Mediterranean and its protection against water pollution (for details refer to the annex matrix of projects).

The year 2021 has been devoted mainly to:

- The procedures for awarding the study contracts for the South Melian Water Treatment Plant;
- Procurement procedures for the works (Hamdoun Sousse 2 Water Treatment Plant, Djedeida WWTP);
- The continuation of the project execution study (a water treatment and purification station Kélibia);
- The start and continuation of the extension and rehabilitation works of the sewerage networks and pumping stations committed in 2020 and 2021;
- The preparation and launching of the DAO for the extension and rehabilitation works of the sewerage networks and pumping plants scheduled in 2022.

IV.3. Private sector participation in sanitation infrastructure opeation

In order to improve efficiency and services at a lower cost, the National Sanitation Office has called on private partners through subcontracting contracts for the operation of sanitation infrastructure throughout the country. The sanitation infrastructure operated by the private sector in 2021: 3600 km of sewerage network; 209 pumping stations and 15 treatment plants.

For the Concession, the financial evaluation report has been approved for the project to operate some of the sanitation infrastructures in Tunis North and South of Tunisia through concession contracts. The required contracts are expected to be completed in 2022.

The main problems raised are the limited number of National Companies specialized in the exploitation of sanitation infrastructures, despite the measures taken by the National Sanitation Office, in particular at the level of the specifications in order to motivate and encourage new companies to specialize in this field.

IV.4. Management and recovery of Sludge

With the increase in the production of wastewater and the extension of sanitation to the whole territory, the management and recovery of residual sludge is positioned in addition to the Reuse of treated wastewater given the significant risks that generates their accumulation without appropriate treatment in the natural environment.

In addition, reuse for agricultural purposes makes it possible to enrich the soil without resorting to chemical fertilizers, and, in terms of energy (biogas), they can reduce dependence on fossil fuels to meet the energy needs of the Stations. water treatment and purification (eg cogeneration).

In 2015, the National Sanitation Office adopted 4 regional master plans for the management of sludge from wastewater treatment plants.

IV.4.1. Sludge management

In 2021, the water treatment and purification stations in operation produced approximately 174,000 m3 of dry sludge with a drying rate varying between 18 and 70% depending on the drying method.

The Sludge Management and Investment Program includes a number of projects resulting from regional sludge management master plans. Projects adopting technologies that do not require international expertise have already begun:

- Improvement of the water and sludge treatment system for 19 water treatment and purification stations: Works were completed for 6 northern water treatment and purification stations and 6 treatment and purification stations. 'Purification of Southern Waters;
- Completion of rehabilitation works and extension of drying ponds for 8 water treatment and purification stations.

IV.4.2. Sludge recovery

In 2021, approximately 5,600 tonnes of sludge were spread from 09 water treatment and purification stations over an estimated area of 815 hectares spread over 05 Governorates.

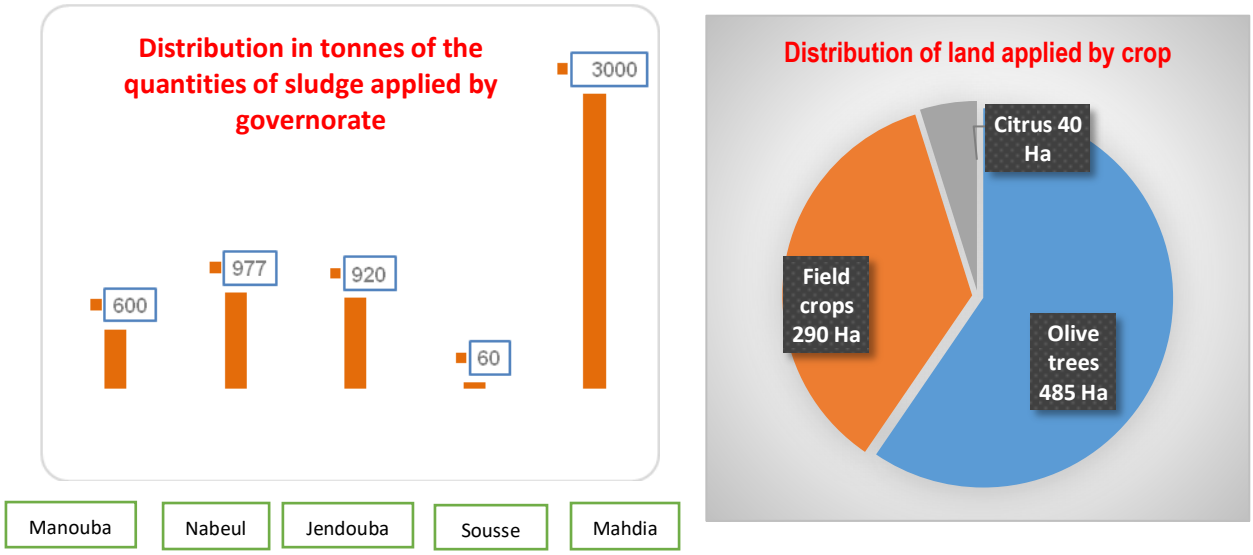

Figure n°13: Breakdown of areas spread by governorate and by crop (Source: National Sanitation Office 2022)

The use of sludge as fertilizer therefore remains on a modest scale, as does the reuse of treated wastewater in irrigated areas.

IV.5. Sanitation in Rural areas

Sanitation in rural areas in Tunisia has not yet benefited from a clear institutional and regulatory framework. Several studies and initiatives on rural sanitation have been carried out by the Ministry in charge of the environment, the National Sanitation Office and the General Directorate of Rural Engineering and Water Exploitation. All these initiatives did not lead to a clear strategy and remained dispersed between the different departments.

The Restricted Ministerial Council held in June 2016, distributed the roles between the National Sanitation Office, the General Directorate of Rural Engineering and Water Exploitation and the Regional Councils. This decision did not solve the problem and was not followed by a strategy and

the necessary means. The Regional Councils do not currently have the necessary skills or the means to take charge of rural sanitation. The distribution of roles and responsibilities according to the thresholds of the number of inhabitants is not adapted to the reality on the ground, which remains very heterogeneous.

Drinking water supply projects in rural areas allow more and more households to be connected to the National Water Supply and Distribution Company network or to the Rural Engineering network. This would imply the growth of the quantities of wastewater and will cause serious problems for the disposal of domestic wastewater. Therefore, proper sanitation is required.

The project "Improvement of the rate of drinking water supply in the rural areas of the governorate of Béja (Beja drinking water supply) will allow the connection of households to the network of the National Company for the exploitation and distribution of water in three delegations, namely: Amdoun, Nefza and North Beja.

As part of this project, a mission was hired to develop an overall sanitation concept adapted to the needs of the beneficiaries in the project region. This is a support measure for the project.

The study elaborated the configurations and combination of the proposed solutions, adapted to very rural areas. This involves individual sanitation: septic tanks, filtering wells, or sanitation for grouped houses: collection network, planted vertical flow basin, planted horizontal flow basin. Operation and maintenance are inexpensive. However, faced with the investment cost to implement a sustainable individual sanitation system in rural areas, the study recommended establishing aid mechanisms to encourage owners. A subsidy system such as for drip irrigation could be instituted (installation cost subsidy).

The Beja drinking water supply project does not plan to set up a sanitation infrastructure but to raise awareness and support households on these autonomous/individual sanitation solutions while respecting hygiene.

In summary

Sanitation is a priority public service, and the State must ensure service coverage in urban and rural areas. To achieve this objective, the following measures can be implemented:

- **Densification of the connection coverage in the areas already equipped;**
- **The coverage of all the communes and the development of the infrastructure in the areas not yet equipped;**
- **Covering the rural world with collective sanitation systems in densely populated areas and with individual systems in scattered areas;**
- **Use of innovative treatment technologies (fully mixed aerated lagoons, reed filters, etc., see the "research" section of the review) that are suitable for small towns and rural areas.**
- **Consider that drinking water supply and sanitation are closely linked, as wastewater is a consequence of domestic use of drinking water. It is therefore important to consider sanitation as an accompanying measure in any rural water supply project.**

The following provisions should be taken or reinforced to improve the quality of treated wastewater:

- **Planned and rigorous infrastructure management (timely completion of infrastructure rehabilitation and extension programs / regular maintenance and upkeep);**
- **Adaptation of discharge standards to the sensitivity of the receiving environment and to the use;**
- **Optimization of conventional treatment processes (activated sludge, bacterial beds, ...) and use of treatment processes adapted to the quality of the wastewater, to the size of the plant and to the dedicated use;**

- **Implementation of pre-treatment at the industrial level and separation of industrial wastewater from domestic wastewater;**
- **Acting on the quality of raw wastewater with upstream monitoring devices at the level of the connected municipalities (connection of rainwater, etc.);**
- **Involvement of the private sector given the capacity constraints of public operators.**

These measures must be supported by a targeted tariff policy, based on the periodic revision of the tariff with a view to achieving billing close to the real cost, the application and reinforcement of the polluter pays principle that ensures tariff equity.

- **It should be recalled that the ONAS continues its efforts in this direction, to ensure the quality and sustainability of services, and this through the upgrade and maintenance of existing facilities. In parallel, it multiplies the operations of reinforcement and extension of sanitation infrastructure through the implementation of major programs and projects to improve its services:**
- **Project for the extension and rehabilitation of 19 water treatment and purification plants and 130 pumping stations;**
- **Project for the improvement of purified wastewater with the rehabilitation of 17 water treatment and purification plants;**
- **Program of sanitation and wastewater treatment of industrial areas by equipping 9 industrial areas with grappled wastewater treatment plants.**

A consistent support is brought to the ONAS to reinforce its capacities and give it adequate means for the implementation of these orientations.

FIFTH PART

COMMUNICATION AND AWARENESS, RESEARCH, INVOLVEMENT OF CIVIL SOCIETY

I. COMMUNICATION, AWARENESS, EXTENSION, AND AGRICULTURAL TRAINING IN THE SECTOR OF WATER

The year 2021 has seen an increase in communication and training activities around the issue of water in the context of the drought that has prevailed in the country since 2020.

The public operator in charge of these activities is the Agricultural Extension and Training Agency, but alongside this institution, many other actors are involved in awareness / capacity building on water issues in other technical departments, particularly the Water Pole (General Directorate of Water Resources, General Directorate of Rural Engineering and Water Management, Office of Planning and Hydraulic Balances) and at the level of the Ministry of the Environment and Sustainable Development, and its agencies under the supervision of the National Environmental Protection Agency, the Agency for the Protection and Development of the Coastline.

These activities are mainly carried out within the framework of projects that support the sector, directly for the management of water resources, or indirectly via their support to environmental protection or sustainable agriculture.

I.1. THE THEME OF WATER AT THE AGRICULTURAL EXTENSION & TRAINING AGENCY « AVFA » IN 2021

The Agency for Agricultural Extension and Training is gradually developing its activities around sustainable water management in agriculture. The theme is taking an increasing place in the continuity of the program of support to public policies of water resources management (closed in 2019) which devoted a large component to communication on this theme with the agency.
2021 saw, among other things:

- The cooperation between the office of planning and hydraulic balances and the agency of agricultural extension and training for the conduct of a summer awareness campaign on water saving (with the national radio, the realization of online days with extension workers, ...), initiative that would be renewed annually;
- The start of the dissemination of SMS advice to extension workers, agricultural advisers, farmers; part of the SMS has concerned the situation / water saving. The departments of the water sector (office of planning and hydraulic balances, general direction of rural engineering and water exploitation) are involved in the commission that decides on the content of these messages, alongside the other directions concerned with agricultural development and are therefore able to propose and frame the formulation of these SMS in the themes that concern them;
- The launch of the renovated version of the agricultural extension and training agency's website platform, enriched with new features. It is dedicated to the learning and extension of good agricultural practices, reconciling productivity and protection of natural resources, for the benefit of farmers and fishermen. Its interactive format allows farmers to exchange with extension workers, and extension workers to consult and share information with subject matter experts and access the results of scientific research;
- Capacity building actions for trainers in horticultural techniques adapted to climate change, smart agriculture and "smart irrigation", hydroponics and soilless crops, maintenance of motor pumps, as well as the development of continuous training modules for the benefit of trainees from training centers and/or professionals on these topics, within the framework of various projects (program Training and Professional Integration financed by the Swiss cooperation, project "Strenthening agricultural education in Tunisia by teachingtrainers on climate smart horticulture &entrepreneurship", Farmer project, BIWAC project / Germany...) ;

- The development of school fields for producers, within the framework of the project « Improvement of water efficiency and productivity and its sustainability in the NENA region »[14] for olive trees in the regions of Jendouba and Kairouan;
- Initiatives of rapprochement between research and extension / agricultural training, with a first call for projects, within the framework of the FARMER project, to institutions to identify and carry out a cooperative action to enhance pedagogically a research result; the selection resulted in working on a theme in the field of livestock for this first experience.

I.2. THE INTERVENTION S OF THE PROJECT TUNISIA WATER SECTOR REFORM PROJECT « ARESET »

Component 2 of the project "Awareness and inter-societal dialogue" has the objective: "The understanding by the main actors of the water sector in Tunisia improved the understanding of the sustainable and rational use of water".
It has seen intense activity in 2021, with:

- The realization of a large public awareness campaign on the situation of water resources and the importance of saving them.
  - The preparation of this campaign was based on a large-scale operation of opinion polling among citizens on various problems related to water consumption in Tunisia (the situation of natural resources, regulatory aspects - legislation, water code ..., strategies and orientations of the State, the different uses/users of water as well as the managers of water resources), which will serve as a baseline to assess the impacts of the campaign;

This survey has highlighted contrasting positions in the knowledge and appreciation of the situation in public opinion. The majority of respondents consider that the situation of water resources is bad in the country (83%) and that it is experiencing a water crisis (75%) and know the causes that affect the availability / uses of water (drying, pollution, salinization) but 79% consider that the country is not going in the right direction in the way of managing its water resources, including 31% blame the poor governance of the State.

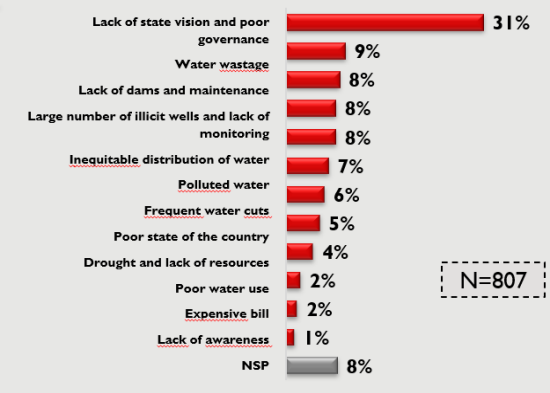

Figure n°14: Causes of water shortage according to the survey

  - The campaign was carried out in part through urban posters, production and broadcasting of spots, radio and television programs, holding a Water Resources pavilion during the International Exhibition of Agriculture, Agricultural Machinery and Fishing 2021 ...; the campaign was suspended at the request of partners within the MARHP, on consideration that the branding used (Maya and the word "water") was difficult to assimilate by the public in its own socio-cultural context.

- Actions aimed at reaching other targets in society, including:
  - The realization of a first "Get together" session in June 2021 in order to improve the dialogue Decision-makers - Entities of the society with high impact factor; it supported an exchange of knowledge and contributions between decision-makers/institutional partners and selected journalists during a field visit ;

[14] *With the support of the Food and Agriculture Organization of the United Nations and funding from the Swedish International Development Cooperation Agency.*

- The start of a study on the profitability of good water-saving practices in the governorates concerned by the project, within the framework of cooperation (office of planning and hydraulic balances - Tunisian Union of Agriculture and Fishing - GIZ. This study will be developed for the benefit of trainers who will be provided with an educational kit on this topic for farmers;
- The organization of an information day on the state of water resources in Tunisia for the benefit of parliamentarians;
- The realization of a competition for farmers: "Valuation of good practices of Tunisian agriculture" and a competition in schools in the project regions: Zaghouan - Nabeul - Mahdia and Kebili on water saving, on the occasion of the World Water Day 2021;
- The holding of a national workshop and 6 information workshops in 6 governorates organized by the Tunisian Union of Agriculture and Fisheries among farmers, with the aim of informing about the training sessions that the Tunisian Union of Agriculture and Fisheries will organize on water saving for 300 farmers.

I.3. PROPOSAL FOR A SINGLE COMMUNICATION STRATEGY FRAMEWORK FOR THE WATER SECTOR

Within the framework of the Twinning project "Support to the protection of water resources and the control of the Public Hydraulic Domain", at the initiative of the General Directorate of Water Resources E, the various Tunisian Ministries and Administrations of the sector have agreed to establish a communication strategy, defining a common framework in which all the actions and communication supports should be carried out in the coming years for the water sector: the objectives pursued, the organization of implementation, the target audiences, the partners, the potential influencers to be involved as well as the type of communication channels preferred.

The ambition is to have a unique tool for communication oriented towards a common vision for sustainable water resources management, which would be a reference for all actors in the sector, including donors.

On the operational level:

- A communication campaign on Water Conservation was carried out at the level of the governorate of Sidi Bouzid by the British cooperation in collaboration with the twinning on the basis of the communication strategy;
- Within the framework of the Twinning project interventions, a series of communication and awareness measures also accompanied the first field control program at the level of the pilot area of Zaghouan (November 2021).

This strategy was to be signed by the stakeholders in the fall of 2021.

Synthetic

Communication/awareness, popularization, and training in the field of sustainable water management (GDRE) are taking on more and more consistency, not only in the projects but also within the regular activities implemented by the public operator mandated in this field, the Agency for Agricultural Extension and Training (AVFA).

The actions and initiatives are however too dispersed due to the diversity of the actors involved and the difficulties of coordination, the initiative of the DGRE to set up interministerial and multi-actor cooperation in this field not having been able to be maintained over time.

Decompartmentalising communication is nevertheless a necessity. The Hydraulic Planning and Balance Office has taken the initiative to have a common communication plan for all the actors of the Ministry's Water division, which is a first step to be reinforced. The Twinning project provided

with the communication strategy a framework of approach broad enough to integrate the diversity of communication activities. The A Reset project has developed an interesting diversity of awareness-raising methods (get together, master class, contests, etc.) with various target groups, in addition to mass campaigns...Establish a functional inter-departmental commission within the Minister of Agriculture , Hydraulic Resources and Fisheries coordinated by the Office of Planning and Hydraulic Balances for the themes and the Agency for Agricultural Extension and Training for the questions of methods and supports, and thus ensure better coherence and consistency communication/awareness actions would certainly be the next step to be taken in the short term.

At the level of the AVFA, the progress made in terms of digitization and use of new technologies offers new opportunities to deal with the theme with greater scope and visibility[15]:

- **The AVFA platform should be fully operational by 2022. It will not only be able to make available resources concerning the GDRE, but also to offer remote support to extension workers and farmers on this topic by specialists from the departments of the Water cluster. The cooperation modalities between the different structures still need to be consolidated (to be seen in the framework of the inter-departmental commission set up for the SMS);**
- **The SMS broadcasting system should expand in 2022 and beyond with a larger budget and a capacity of approximately 60,000 SMS/year, which leaves good possibilities for including messages on sustainable water management.**

AVFA is also considering the development of simple digital applications to address topics such as water conservation.

In addition, the focus is on the extension of more resilient and therefore water-efficient agriculture:

- **Reinforcement and extension of the training through practice on the school-fields[16], which target small farmers, on the theme of water saving;**
- **Continuation of the experience of valorization of research achievements, either on the initiative of AVFA, or at the request of projects, in strategic sectors, water, rain-fed agriculture, olive growing (particularly in the framework of the extension of the FARMER project), through the financing of the action (proposal to be negotiated with the departments of the water cluster);**
- **Establishment of a project proposal in consultation with IRESA on the development of agroecology.**

The awareness actions are beginning to make a shift towards a more "shock" and provocative communication (see the videos being developed with UTAP on the situation of groundwater and video testimonies on the drying up of water tables in the framework of the A Reset project); the "soft" actions calling on images involving children or promoting eco-actions for example having shown their limits. The current crisis also allows us to dare to hit the spirits hard and to make all segments of Tunisian society aware of their responsibilities, in the face of the many violations of water resources (illegal drilling and pumping, various types of pollution, waste...).

[15] *The means of popularization on the ground being more and more limited; the current number of extension workers is 307…; they were 414 in 2016; other modes are therefore necessary.*

[16] *As part of the project "Improving water efficiency and productivity and its sustainability in the NENA region" with the support of FAO and funding from the Swedish Development and Cooperation Agency*

II. RESEARCH IN WATER SECTOR

Research in the water sector is developing with an increasingly marked orientation towards themes such as NCTs, adaptation to climate change, control of water pollution, given the persistent context of water stress but also the accentuated problems of loss of water quality under the effect of increasing urbanization and the development of polluting economic activities.

In addition to specialized institutions, such as the Center for Research and Water Technology (CERTE) and the National Institute for Research in Rural Engineering (INRGREF), many other research institutions and higher education establishments are devoting work or teaching modules to the various facets of the issue of sustainable water management[17].

The main themes and research activities conducted by the CERTE and the INRGREF are summarized below, illustrated by research results that have already been tested or that have a high potential for popularization. For the whole of the research institute and higher agricultural education system, a list of research themes ready to be disseminated / valorized and in progress is included in *Annex 2*, as well as for the national and international cooperation projects of the research center and water technologies.

II.1. Activities of the Water Research and Technology Center (CERTE)

The Water Research and Technology Centre is currently conducting a self-evaluation of its ongoing programs over the past 4 years. Its work covers the entire water cycle, with more than 50 projects conducted by its 5 laboratories[18] and mainly targeting:

- The development of knowledge and innovative solutions in hydro geosciences (groundwater and surface water);
- The improvement of water quality, in particular the optimization of water desalination processes, in relation to the management of discharges from desalination plants of brackish water or sea, which will pose with increasing acuity whether on the coast or inland;
- The impacts of climate change (development of scenarios, modeling) on resources and their exploitation;
- Innovative management of wastewater and its recovery: development of bioprocesses for efficient treatment of wastewater and industrial discharges, innovations in sanitation, especially in rural areas;
- Local management of rainwater for use in urban areas (watering of recreational areas, urban vegetable gardens, etc.);
- The agricultural valorization of raw and treated organic waste products and their medium and long-term impacts on the quality of soils and agricultural products...

Some examples of CERTE's research and development activities

Focus: Groundwater management

The InTheMED project[19], funded by the EU under the PRIMA 2019 program: The Research Center and Water Technologies pilot, in cooperation with the Regional Commissioner for Agricultural Development of Nabeul and the national agency for environmental protection, the establishment of management tools and innovative and sustainable remediation strategies for the management of the water table of Grombalia (Nabeul).

[17] *See the 2020 Water Sector Review for more details*
[18] *For more information see the centre's website: www.certe.rnrt.tn*
[19] *Innovative and Sustainable Groundwater Management in the Mediterranean: www.inthemedprima.com*

In addition to an in-depth prospective diagnosis (SWOT, governance analysis, modeling of the evolution of the water table ...), new management methods are being implemented to optimize the prospects for sustainability of the resource (quantitatively and qualitatively).

High resolution data collection sensors (HRMS monitoring[20]) remotely connected to an interactive platform have been installed in the Grombalia aquifer site. These specific sensors, combined with the results of modeling, will strengthen the early warning and ensure the real-time characterization of groundwater for optimal decision-making.

On the other hand, remediation strategies and solutions have been developed and evaluated, based on cost-benefit analyses for the treatment and reuse of treated wastewater in industries, whose discharges affect (may affect) the quality of groundwater.

A detailed communication and dissemination plan has been developed.

Focus: rural sanitation

The CERTE has the necessary expertise to implement sanitation concepts in rural areas. Many experiences and pilot stations have been implemented in Tunisia. The first experiences date back to 2008 with:

- The installation of a local water management system, combining water saving measures (rainwater collection tank for toilet supply, push-button equipment for sinks, and toilets...) and a pilot sanitation system, consisting of a septic tank followed by a planted wetland (filtering basin) with horizontal subsurface flow at the elementary school of Chorfech 24 in Ariana. The evaluation of the system combined 3 years after its implementation has demonstrated its relevance in terms of water saving (reduction of more than 50% of water consumption / student) and quality of treated wastewater that complies with the regulations in force, allowing it to be reused locally to irrigate trees and ornamental plants.

The experience was later extended to 3 other schools as part of the Water-Kasserine project.

A guide was published by the Water Research and Technology Center in 2019 for the implementation of a local water management system in rural primary schools and similar institutions.

It presents the criteria for designing such a system and the steps for its installation.

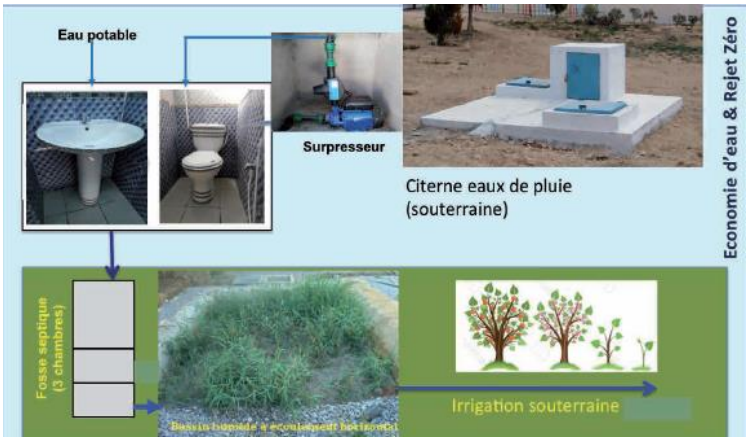

Figure n°15: Sanitation system at the elementary school

The guide also discusses the necessary conducts to the operation of the works and their maintenance, as well as the measures to be taken in case of malfunction.

II.2. Activities of the National Agronomic Institute of Tunisia

At INAT, several research structures work directly or indirectly on water resources. Those whose central theme is water are the LR GREEN-TEAM laboratory and the L-STE laboratory. Others work indirectly, such as the genetic improvement of cereals for the selection of water stress tolerant varieties.

[20] *HRMS: High Resolution Mass Spectrometry*

INAT's Lr GREEN-TEAM (LR17AGR01), with its fifteen international projects (H2020 RISE ACCWA, PRIMA ALTOS, ERANETMed CHAAMS, ERANETMED OPTIMED WATER, ARMNET VIANA, PHC, PEER, IN WOP...) all directly or indirectly related to the characterization and management of water resources, particularly in agriculture, through the use of multi-source remote sensing data, in situ measurements and observations and modelling for :

- Multi-objective water resource management;
- Characterize agricultural soils given their importance in agricultural water management;
- Identify irrigated areas and particularly those conducted on illicit wells;
- To evaluate water consumption and needs in agriculture and to spatialize them;
- Analyse spatially and temporally the drought and its impact on cereal yields;
- Produce maps of seasonal agricultural occupations that are very useful in agricultural water management;
- Evaluate the impact of agricultural activities on the diffuse pollution of surface water by eco-hydrological modelling and propose development scenarios to reduce diffuse pollution of water courses, etc…

The IN WOP (**Mind the Water Cycle Gap: Innovating Water Management Optimisation Practice** – **IN-WOP**) project, for example, aims to study the contribution of optimisation to several objectives of integrated water resources management (IWRM). To this end, three case studies are used in a comparative assessment in various hydrological and cultural contexts, one of which is in central Tunisia "the Merguellil watershed".

II.3. Activities of the National Research Institute for Rural Engineering Water and Forests - INRGREF)

The National Institute for Research in Rural Water and Forest Engineering, more focused on water and agriculture, integrates a variety of research themes, in particular in relation to the management of water resources, the valorization of water in agriculture, technologies irrigation and the use of ENCs, water and adaptation to climate change.

The Institute works in particular on the introduction of innovative technologies at the farm level in a participatory framework researcher – operators / farmers, around subjects such as:

- The development and testing of low-cost natural treatment systems allowing the sustainable management of treated wastewater and residual sludge for the reduction of environmental and health risks for agricultural use. The pilot system is installed in the PI of Oued Souhil (Nabeul) with a series of cascading basins with planted filters for the Reuse of treated wastewater in agriculture (as part of the TRESOR project funded by the European Union (Treatment of wastewater and sludge through planted filters) and in cooperation with the Water Research and Technology Center;
- Development and capacity building by integrating the results of good agricultural water management practices, obtained at the level of experimental plots, into training programs for farmers and extension technicians. These programs include crop rotation, irrigation water management, rationalization of mineral fertilization, integration of livestock and adoption of conservation agriculture (SUPROMED project "Sustainable Production in water limit of environments of Mediterranean agro-ecosystem");
- Co-construction, by crossing the needs of the actors (farmers, technicians, extension workers, etc.) and the research products that can be mobilized, and the transfer in terms of decision-making tools for the benefit of the capacities of the stakeholders (LMI NAILA 2 Laboratoire Mixte International – 2020 / 2025, Management of water resources in Tunisian rural areas). Focus-

groups on the ground are thus organized as in the public irrigated perimeters PPI Chraf (Hubis) on the use of connected humidity sensors which has largely attracted the interest of farmers;

The INRGREF is also engaged in innovative research work, to:

- Reducing water and energy consumption in irrigated agriculture. In greenhouse agriculture, maintaining and controlling precisely the humidity and temperature conditions involves a significant energy consumption. The Institute is currently testing innovative processes based, on the one hand, on absorption processes using the hygroscopic properties of a saline fluid solution that has the capacity to ensure heating, cooling and dehumidification in a single device, and on the other hand, on a prototype of a rainwater harvesting system using a natural cold-hot mechanism for use in irrigation; the savings would be close to 50% (TheGreefa project with the cooperation) ;

The experimental greenhouse of the national institute of research in rural engineering water and forests with the new device of thermal dissipation next to the absorption system

- The improvement of wastewater treated by electromagnetic treatment for a better valorization in agriculture. The first results of the experiments have shown that irrigation with electromagnetically treated wastewater causes an improvement in the bacteriological quality and a significant increase in the volume and salinity of the drainage water compared to the drainage water from soils irrigated with untreated water. At the level of a barley crop, TE water produces an improvement in growth parameters and an increase in major and trace metal elements in the different plant organs. These changes are associated with soil reorganizations that improve soil porosity and water holding capacity.

In summary

Exchanges with research institutions have once again confirmed the importance and diversity of research topics in the water sector, topics that are fully in line with the needs and priorities of the sector (water saving and energy, water quality, enhancement of ENCs, sanitation for all, etc.).

Within the framework of several cooperation projects, the emphasis is placed on this response to the needs of actors in the field by favoring the involvement of beneficiaries (case of sanitation in primary schools, management of the Grombalia , activities of the Naila laboratory, etc.).

Key research results are available for enhancement. However, the appropriation of innovations still remains a challenge, which, if it is no longer quite at the level of the popularization of research results, persists with regard to the large-scale implementation of innovation on programming plans (and approach), supervision and financial resources. For example, suitable solutions for rural sanitation exist and are tested, but their installation, although inexpensive, remains out of reach

for low-income rural populations. A subsidy system should be put in place (like those practiced for drip systems, rain cisterns), backed by a large-scale awareness/information campaign, to facilitate ownership, this which, obviously, requires very significant planning, management, financing and regulatory framework efforts for the State.

Moreover, the channels for communicating the needs of development to research are poorly structured. Everything happens within the framework of projects, such as those mentioned above (see also the initiative of the Agency for Agricultural Extension and Training within the framework of the FARMER project in the communication / training part), and these initiatives are therefore dispersed.

The Center for Research and Water Technologies, in cooperation with development partners, participates in the design of a technological platform in order in particular to establish links with partners so that they submit the issues for which they have needs. in innovation; this would make it possible in a certain way to partially centralize the needs.

For successful innovations ready for "upscaling", making them visible and demonstrating their usefulness, grouping them together in the same demonstration space would also be an effective way to initiate their development / dissemination, both at the private and corporate level. development projects and organizations. The CERTE participated for the first time in the "Water-Expo" fair organized by the Tunisian Union of Industry, Commerce and Crafts to publicize its themes and research results in the area; The CERTE would be interested in expanding this experience by establishing cooperation with other research institutions to organize a joint innovation fair.

III. INVOLVEMENT OF CIVIL SOCIETY IN WATER MANAGEMENT

The consultation meeting with the associations for their contribution to the 2020 review took place on October 20, 2022, with the participation of only 5 associations, however, strongly involved in issues related to sustainable water resources management.

Exchanges with the associations focused on the essential axes of their intervention in this field, the projects and activities they carry out and their recommendations targeting the priorities for sustainable water management.

III.1. ACTIVITIES OF ASSOCIATIONS IN THE WATER SECTOR IN 2021

III.1.1. Contributions to amendments to the new water code

The associations have actively participated in parliamentary days and in the process of regional consultation on the CdE led by the commission dedicated to the assembly of people's representatives in line with the efforts they have devoted since 2019[21] to protect / guarantee the rights of citizens and preserve the environment in the formulation of the various articles of the code.

Many actions related to the advocacy for the right to water have been conducted, in particular by the Tunisian Water Observatory, among others: Petition to request the revision of the draft law on the water code, which was signed by 91 active civil society associations, organization of a workshop in collaboration with the Tunisian Observatory of the Economy for activists and representatives of national organizations and associations to propose adjustments to the water code, press conference at the headquarters of the SNJT, participation in media broadcasts, submission of an action plan (October 2021) to guarantee the right to water to the President of the Republic, the Prime Minister and the Minister of Agriculture...

III.1.2. Some examples of association activities in 2021

Here are some examples of the activities of the associations met during the October 2021 meeting, which provided their 2021 activity reports as reference.

Several associations, interested in water issues, such as Solidar Tunisia, Nakhla, MawtiniBiyati, the Tunisian Water Observatory..., have established collaborations between them or are members of networks / coalitions such as "Dynamique Eau" or "Collectif Eau"... in order to expand their awareness initiatives, increase the opportunities for projects with the PTfs and implement coordinated actions in the framework of projects.

For example, as part of the project "Citizen and fair governance of natural resources", the associations Solidar Tunisia, Nakhla, Friguia for strategies and OTE, have collaborated during the year 2021, conducting workshops in Douz and Jendouba, to develop, in consultation with technical services / administrations (Municipalities, CRDAs, ONAS, STEG), project sheets to be proposed by civil society to be integrated into the projects of the economic and social development plan 2021-2025 of the governorates of Kebili and Jendouba. For the governorate of Kebili, the projects identified fall within the guideline's nexus "water, oasis, renewable energy".

The basic data on these associations and their projects are available on their website or Facebook page.

[21] *See 2020 Water Sector Review*

Association Nakhla

https://www.facebook.com/nakhla.tn

The association's mission is to "contribute to the improvement of the living conditions of the Tunisian oasis population through support for capacity building, the development of economic activities, the conservation of natural resources and respect for the biodiversity.

In the field of water, the association's main areas of interest are:

the fight against drilling and the extension of illicit palm groves, which are multiplying rapidly in the governorate of Kebili, and the development of non-conventional water, particularly drainage water from agriculture.

Focus " Recovery of drainage water from palm farms

The oasis region of Kebili records the highest rates of overexploitation of southern Tunisia for the CT (Terminal Complex) and CI (Continental Intercalary) aquifers. However, the oases of Kebili have significant unconventional water resources mainly drainage water of oases. These resources are estimated at about 185l/s in summer and 800l/s in winter (between 20 and 40 million m3 annually) which represents a large water potential lost in the chotts (source: Regional Commissioner for Agricultural Development Kebili 2017).

As part of the project "Strengthening the resilience of oasis ecosystems to climate change", in partnership with the WWF, a rush nursery was installed to enhance the drainage water of the palm grove, at the edge of the oasis of Douz. This production is used by the craftswomen of the area who produce articles in rushes.

The association then repeated this action with the installation of 2 nurseries of pollinating palm trees, irrigated with drainage water and 4 with geothermal water.

The experiments should be continued within the framework of the project A Reset in 2022: awareness of farmers, field schools on the valorization of non-conventional waters (drainage water, cooled hot water ...), creation of at least 05 mini nurseries for the production of local oasis plants adapted to oases where drainage water is in abundance.

Nomad08

(https://nomad08.org/)

Since 2016, the association manages the Tunisian Water Observatory (OTE) and in particular the alert platform www.watchwater.tn which allows citizens to report their problems related to water to officials (The National water distribution utility , Ministries, Local Authorities, etc.), alerting on cuts or others and requesting the intervention of the observatory.

The association is in close contact with the populations of the center and south of the country, which they meet during frequent visits or field days, such as those organized in the governorates of Kebili, Gabes and Tozeur on "water and agro-ecology in the oasis spaces.

For the year 2021, the Tunisian Water Observatory has noted an increased number of disturbances, with 2633 alerts particularly in the governorates of Gafsa and Sfax but also in the greater Tunis, especially concerning water cuts, but also water quality (double compared to 2020). These findings overlap pertinently the deterioration of the current situation, relayed through the indicators of the sector.

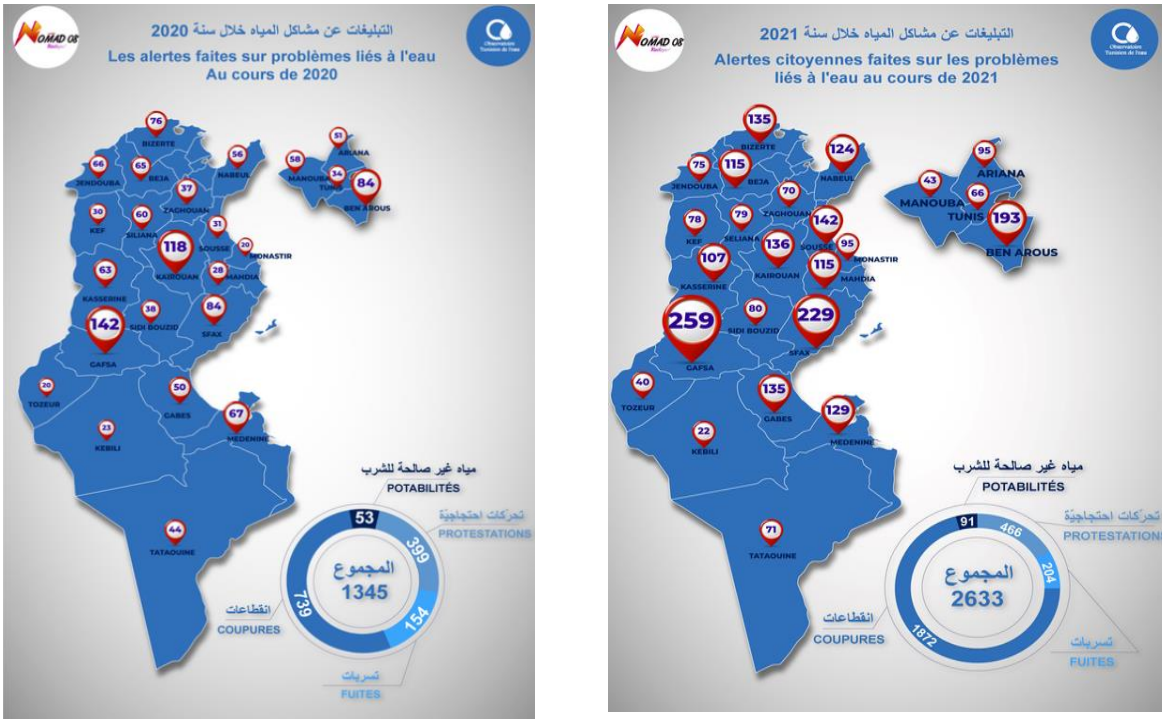

Figure n°16: Mapping of citizen alerts on drinking water issues; 2020 and 2021 comparison

During 2021, in addition to an intense advocacy activity for the CDE (see previous paragraph), it has:

- Organized regular workshops and webinars on water issues/themes: elaboration of a "roadmap for the right to water", analysis of the legal framework of the water sector, concept of water footprint, application of the "polluter pays" principle in the water sector, food sovereignty and the human right to water.
- Conducted and disseminated several studies on:
  The issue of virtual export of water: "The export of dates and the water cost of foreign exchange: agricultural policies that doom the region of Kebili to shortage,
The issue of dependence on cereal imports: "The limits of a food security policy: the case of the cereal sector".
  The explosion of the consumption of bottled water "Consumption of mineral water in Tunisia: reality and issues
- With International Alert Tunisia, the Tunisian Water Observatory has launched a new project to strengthen the participatory democratic governance of water in the governorate of Kasserine, which includes the organization of workshops and advocacy campaigns in the field of defense of the right to water, for the benefit of civil society activists and representatives of Agricultural Development Groups and local authorities de Kasserine.

The Tunisian Association for the Protection of Nature and Environment (ATPNE) of Korba (https://www.facebook.com/ATPNEdeKorba/)

الجمعية التونسية لحماية الطبيعة و البيئة بقربة Atpne Korba
@ATPNEdeKorba · Organisation non gouvernementale (ONG)

As a reminder, the objectives of the association are essentially focused on environmental issues at the local level, in particular the contribution to the preservation of natural ecosystems and the development of eco-citizen behavior among youth and the local population.

The association has progressively developed and diversified its activities around a central theme: the sustainable protection of the Korba lagoon, classified as a RAMSAR site.

It has established a long-term cooperation with the National Office for Sanitation which has made it possible to set up the supply of treated wastewater (4000 m3 / day) to the lagoon to restore and maintain its ecological functions as a wetland.

The successive projects around treated wastewater and the lagoon environment have affected different aspects of water management and valuation, with the creation of a first irrigated perimeter using treated wastewater the development of ecotourism activities (Eductour, birdwatching, etc.), prevention of pollution of the site by waste from the neighboring residential area ("eco-district" project, awareness of waste sorting, etc., biological control of mosquitoes, collaboration with educational establishments superior for the conduct of PFE on the site of the lagoon (study of the physico-chemical properties, biodiversity and micro-fauna ..). The question of the quality of wastewater is a central concern of the association, it is currently committed to trying to multiply the installation of PIs with the EUTs, as part of the next upgrade of the water treatment and purification stations in the area.

Association water and development

https://aed.org.tn/; https://www.facebook.com/eauetdev

جمعية المياه والتنمية
Association Eau et Développement

Created in 2012, the association has a scientific vocation; it brings together experts and researchers from the water sector, and intends to contribute to the sustainable preservation of water resources, through the organization of days, workshops, scientific outings, etc.

In 2021, the association participated, among other things, in workshops on current topics such as groundwater management and the issue of ecological water.

She organized:

- A day on the water code and drinking water supply in rural areas on the sidelines of the association's elective assembly (April 2021). The topics discussed were: (i) Governance in the draft Water Code (CDE), (ii) remarks on the draft water code and the Roadmap of Civil Society action (work of the Water Collective) , (iii) health aspects in the CoE and (iv) the strategic study of drinking water supply in rural areas (AEPR);
- Co-organized a virtual conference on the issues and challenges around water management in North Africa in collaboration with ATUGE and Hum'am (April 2021);
- Similarly, with LMHE/ENIT a conference ""Reconstruction of the natural climate over the last 6 M years (6M-1850 BC) from stable isotopic tools and other analysis techniques" (November 2021).

III.2. MAIN RECOMMENDATIONS OF ASSOCIATIONS INVOLVED IN THE SECTOR OF WATER

The SC representatives made recommendations on the management of the sector in its various aspects, which should be reflected in the contents of the Review, summarized below:

The need to find a way out of the process, currently suspended, of approving the new water code as an essential instrument for framing sustainable water management at the national and regional levels. The alternatives are to be defined within the framework of a re-launch of the reflection between the actors of the water sector including the civil society.

The degradation of the quality of drinking water is a reality more or less serious depending on the region and more particularly in rural areas. The causes of this degradation must be investigated more precisely, in particular by having more accurate data on the situation in the regions. The causes can be various: insufficient water treatment (chlorination in particular), influence of repeated breaks and cuts, clogging of pipes and oxidation, etc...

Pumping report is currently having increasingly negative repercussions on water consumption for irrigation, particularly in the south with the continued extension of palm groves and illicit drilling. A regulatory framework should be established to set the conditions for installation and monitoring of withdrawals by the administration.

In summary

Although the exchanges with the civil society have mobilized only 5 associations, they have highlighted once again the dynamics of these associations, in particular those acting directly with the citizens.

They do not hesitate to work together to be a force of proposals at the political level (cf. the CDE project) but also to have more possibilities and impacts on the field. They regularly collaborate with local administrations and technical services and have easy access to the mass media.

However, the capacity of the associations remains dependent on the projects, and this is the main constraint to the development of their activities and to develop their membership.

The policy of water resources management in relation to the revision of the CoE (in its version submitted to the ARP) remains at the center of the interest of associations, which wish to resume this file and maintain their position to make substantive changes to strengthen the social component of the human right to water in the new code.

But they are also interested in and act on issues that have become priorities today in the context of climate change: overexploitation of groundwater, development of non-conventional water, protection of ecosystems, preservation of drinking water quality ...

SIXTH PART

SUPPORT POLICY, ALIGNMENT ANS STATE OF THE TARGETS AND INDICATORS OF THE SUSTAINABLE DEVELOMENT GOAL 6

I. BACK IN HISTORY AND INTERNATIONAL CONTEXT

I.1. INTRODUCTION

For more than a decade, international mobilization has increased in the search for sustainable development, including the social dimension. The objective is to engage all countries in an integrated approach making the 17 sustainable development goals inseparable. The 2030 Agenda thus considers the environmental dimension, emphasizing the links between the fight against poverty and the preservation of the planet in the face of climate change. It identifies five pillars of sustainable development: planet, population, prosperity, peace and partnerships.

The countries adhering to this program and in cooperation with the United Nations Development Program are working to improve the relevant indicators by setting practical targets. Reports have been presented to this effect (Voluntary National Report RNV) during the High-Level Policy Fora (HLPF).

I.2. IMPACT OF THE PANDEMIC (COVID -19): GRIM REALITIES

The United Nations Report on the Sustainable Development Goals 2021 summarizes the impacts of COVID-19 on the status of the Sustainable Development Goal indicators:

- **Years or even decades of progress have been slowed or reversed. For example, the global extreme poverty rate has increased for the first time in over 20 years, etc. ;**
- **The pandemic has highlighted and intensified inequalities within and between countries. The crisis threatens the livelihoods of 1.6 billion workers in the informal economy;**
- **The climate crisis, the biodiversity crisis and the pollution crisis persist despite the pandemic. The world is woefully behind in meeting the goals of the Paris Agreement;**
- **The COVID-19 pandemic is a mirror for the world. Inadequate social protection, fragile public health systems and inadequate health coverage, structural inequalities, environmental degradation, and climate change;**
- **Resilience, adaptability, and innovation give us optimism. Many governments, the private sector, academia, and communities have responded with rapid interventions, remarkable creativity, and new forms of collaboration;**
- **Fundamental change is needed, and the Sustainable Development Goals are the roadmap. Governments and the international community should make structural transformations and develop common solutions guided by the Sustainable Development Goals;**
- **Investment in data and information infrastructure is essential. Policies, programs, and resources to protect people in these challenging times will inevitably fall short without the information needed to target and refine interventions.**

I.3. GENERAL PRESENTATION OF THE STATE OF THE TARGETS AND INDICATORS OF THE SUSTAINABLE DEVELOPMENT GOAL 6:

According to the UN's SDG Report 2021:

- 129 countries are not on track to have sustainably managed water resources by 2030: **Current rate of progress must double;**
- 2.3 billion people live in countries at risk of water stress;
- 26% still lack safely managed drinking water;

- 46% still lack safely managed sanitation services;
- 29% lack basic hygiene services.

II. SUPPORT AND POLITICAL APROPRIATION OF THE SUSTAINABLE DEVELOPMENT OBJECTIVES

II.1. SUPPORT POLICY AND COMMITMENT

After finalizing its first Voluntary National Report on the monitoring of the SDGs in 2019, Tunisia has developed its 2nd Voluntary National Report in 2021 with the support of the United Nations System in Tunisia. This report:

(i) Reported on the status of implementation of the SDGs, including measures taken to ensure the integration of the SDGs into the national development framework;

(ii) Also outlined the steps taken to contextualize and adapt the SDGs and their targets to the national context; and

(iii) the efforts made with a view to promoting their implementation, particularly in terms of the evidence reported and the challenges to be met.

II.2. KEY FACTS IN THE VOLUNTARY NATIONAL REPORT 2021

- **Goal: Reduction of death and disease due to unsafe water and poor sanitation and hygiene**

Control of the environment to prevent the negative impact of pollution on the health of the child "environmental health program":

Outdoor and indoor air pollution, water contamination, lack of sanitation, toxic substances and ecosystem degradation are complex phenomena that constitute environmental risk factors for populations. Their effects on health vary according to the type of product, the dose, the age, the sex and the frequency or duration of exposure.

Children are a particularly sensitive and fragile population when faced with environmental pollution. For their better protection against environmental risks, environmental health has represented a main axis of the national programs of prevention and health promotion.

In this framework, the following measures have been taken:

- Reactivation of the national health-environment plan developed in 2011;
- Strengthening of water supply and sanitation projects;
- Strengthening national capacities for environmental risk assessment as well as monitoring and alerting of these risks;
- Informing the population about possible sources of pollution including indoor air pollution and their impact on health, especially that of children;
- Stimulating children's interest in maintaining a balanced environment and instilling in them a sense of ownership of their environment;
- Mobilization of local and regional authorities to better protect children's environments and to better solve the problem of pollution;
- Training professionals on environmental risks and how to manage them.

- **Goal: To improve agricultural productivity and incomes of small-scale food producers, particularly women, indigenous people, family farmers, pastoralists and fishermen**

Food security has always been a major objective in the design and implementation of agricultural development policy.

In this context, the agricultural sector has continued its efforts to ensure a supply of food products to meet local consumption needs but also to develop exports to balance the food trade balance.
The lack of achievements is due to:

- Unfavorable weather conditions (cereals);
- The delay in the implementation of a number of projects programmed for the modernization of the sector and the improvement of agricultural and rural infrastructure under the 2016-2020 Plan;
- The negative impact of COVID 19 on the progress of agricultural campaigns and fishing activities.

However, it should be noted that this agricultural production has overall allowed a regular supply of food products to the local market even during the containment period.
During 2016-2020, particular interest was given to the diversification of agricultural products, the development of sustainable modes of production such as organic farming and conservation agriculture, the encouragement of the introduction of soil enriching crops in the crop rotation (beans) as well as the promotion of products that value local natural specificities through labeling.

III. THE STATE OF THE TARGETS AND INDICATORS OF THE SUSTAINABLE DEVELOPMENT GOAL 6 FOR 2021

III.1. POSITIONING OF TUNISIA ON THE CONTINENTAL SCALE

Tunisia occupies the first step in Africa.

According to the latest report published by the Center for Sustainable Development Goals for Africa, under the year 2020, Tunisia is ranked first in Africa, for the first time, out of 52 countries in the field of achievement of sustainable development goals (SDGs).

The report states that the rate of achievement of Tunisia of the goals of sustainable development has reached 67.1%, ahead of Mauritius (66.8%), Morocco (66.3%), and Algeria (65.9%).

III.2. STATE OF THE TARGETS OF THE SUSTAINABLE DEVELOPMENT GOAL

III.2.1. Target 6.1: by 2030, ensure universal and equitable access to drinking water at an affordable cost

The indicator used for this target is the drinking water coverage rate. In 2015 this rate was 97.5% and increased to 98.4% in 2021 nationwide. Progress has been made in rural areas (33% of the population), this rate has increased from 92.2% in 2015 to 95% in 2021, since this rate is 100% in urban areas.

43 small drinking water supply system projects have been put into service for the benefit of 43 thousand inhabitants in rural areas.

Regarding the price of 1 m^3 consumed drinking water, it has not changed for the social bracket that consumes less than 20 m^3 per quarter, it has remained at 0.2 DT/m^3, while the other brackets that consume more have undergone three price increases for 1 m^3 consumed in 2016, 2020 and in 2021.

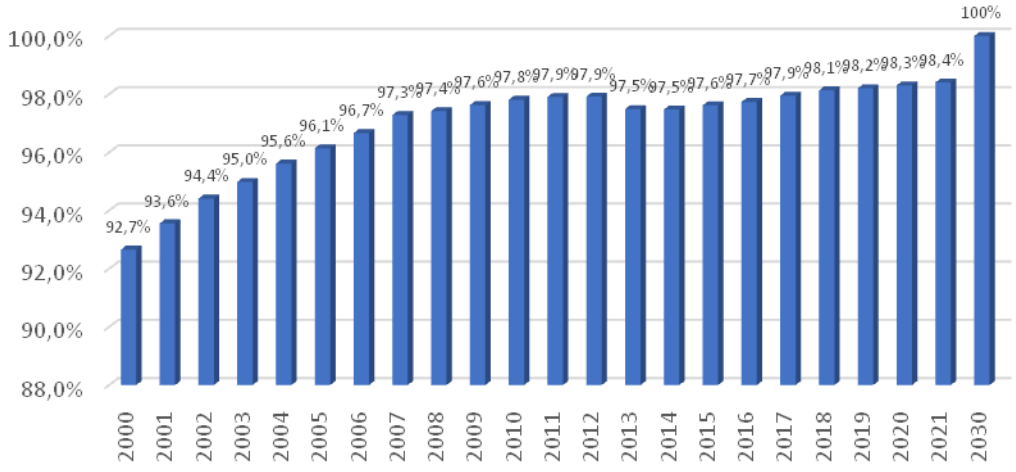

Figure n°17: Indicator 6.1.1 % of population using safe drinking water services in Tunisia (Source: SONEDE)

In general, progress on this goal is considered good, but challenges remain regarding the quality and sustainability of access with limited water resources and impacted by climate change.

III.2.2. Target 6.2: by 2030, ensure access for all under equitable conditions to adequate sanitation and hygiene services

Currently, the national sanitation office covers 193 communes (9.07 million inhabitants) out of 350 communes.

Despite the difficulties in implementing some projects (delays in execution, etc.) and the institutional vacuum in rural areas, the number of inhabitants connected to the public sewerage system is 7 million out of a population of about 9.071 million in the communes covered by the National Sanitation Office. Thus, the rate of connection to the public sewerage system in the areas of intervention of the National Sanitation Office is 76.8%.

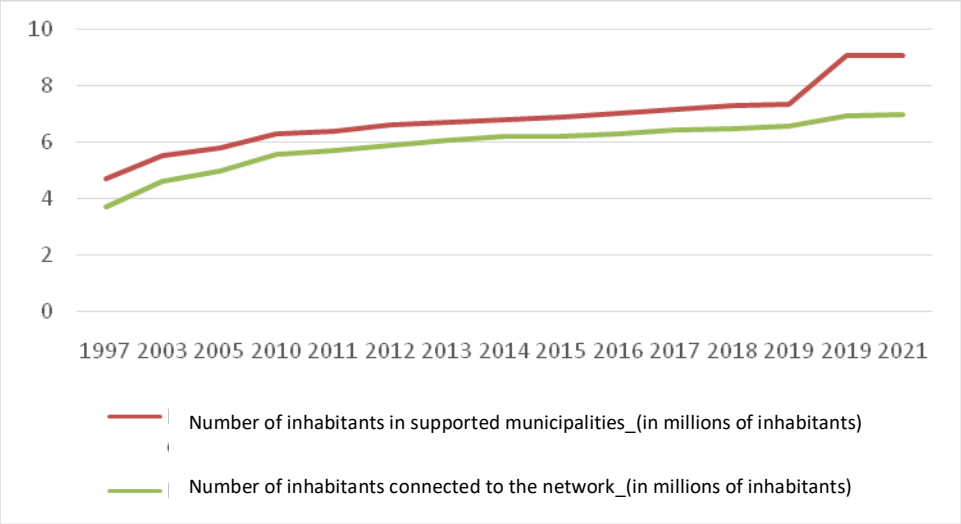

Figure n°18: Percentage of the population with access to sanitation (Source: National Sanitation Office, 2021)

It should be recalled that following the communalization of the entire national territory, 187 municipalities have experienced an expansion in their communal perimeters, which has resulted in an increase in population in the municipalities supported by the National Sanitation Office, and consequently a decrease in the rate of connection.

III.2.3. Target 6.3: By 2030, improve water quality by reducing pollution, eliminating waste dumping and minimizing emissions of chemicals and hazardous materials, halving the proportion of untreated wastewater, and significantly increasing the safe recycling and reuse of water globally.

Indicator 6.3.1: Proportion of wastewater treated safely

Currently, there are 124 treatment plants (there were only 52 in 1997); 114 plants spread over the major cities, 1 industrial wastewater treatment plant and 9 plants in rural areas.

The volume of treated wastewater is about 288 million m3/year on 291 million wastewaters collected by the network of ONAS, a treatment rate equivalent to 98.9%. With the consideration that

ONAS covers only 193 communes out of 350 in total which consume about 493 million m3 of drinking water in 2020, the rate of treatment of wastewater is estimated at 70%

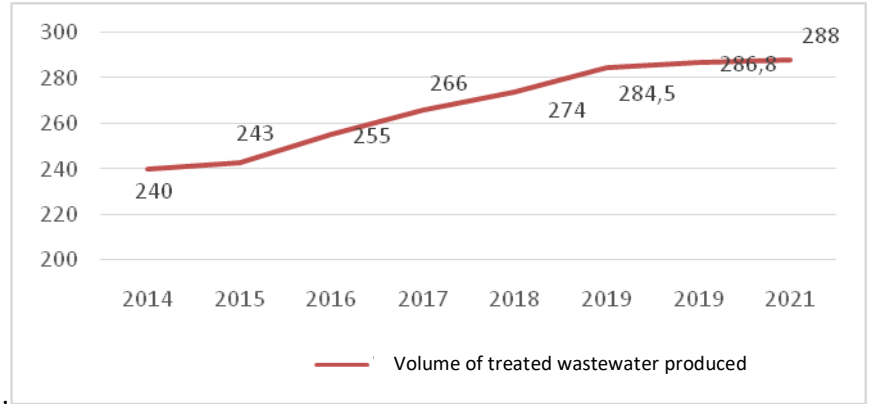

Figure n°19: Evolution of the volume of treated wastewater (Mm^3)

Indicator 6.3.2: Proportion of water bodies with good ambient water quality

- For surface waters: 70% of the potential with a salinity lower than 1.5 g/l
- For groundwater: 15% of the potential with a salinity of 1.5 g/l

The total proportion of waters with a salinity lower than 1.5 g/l (acceptable quality) is about 45%.

III.2.4. Target 6.4: By 2030, significantly increase the efficiency of water use in all sectors and ensure the sustainability of freshwater withdrawals and supplies to address water scarcity and significantly reduce the number of people who lack water.

Indicator 6.4.1: Progress in water use efficiency

Indicator 6.4.1 measures changes and evolution in the level of water use efficiency over time and was designed to address and track the economic component of SDG target 6.4.

It corresponds to the total efficiency of the main economic sectors, which is the sum of the efficiency gains in the main economic sectors, weighted by the proportion of water withdrawn by each sector out of the total withdrawals.

Table n°18: Added value and water use efficiency by sector

Sector	Withdrawal (Mm^3)	Added value (in billions of constant 2010 US dollars)	Efficiency ($/$m^3$)	Efficiency ($/$m^3$) in 2020
	2021			
Agriculture (irrigated sector)	2780	1,582	0,569	0,65
Industry	60,62	10,79	177,994	173,60
Service	868,93	28,08	32,316	34,69
Global	3709,55		**7,939**	11,33

- In terms of evolution, water use efficiency has varied as a result of a number of influencing factors, including weather/hydrological conditions, water resource management, economic conditions.

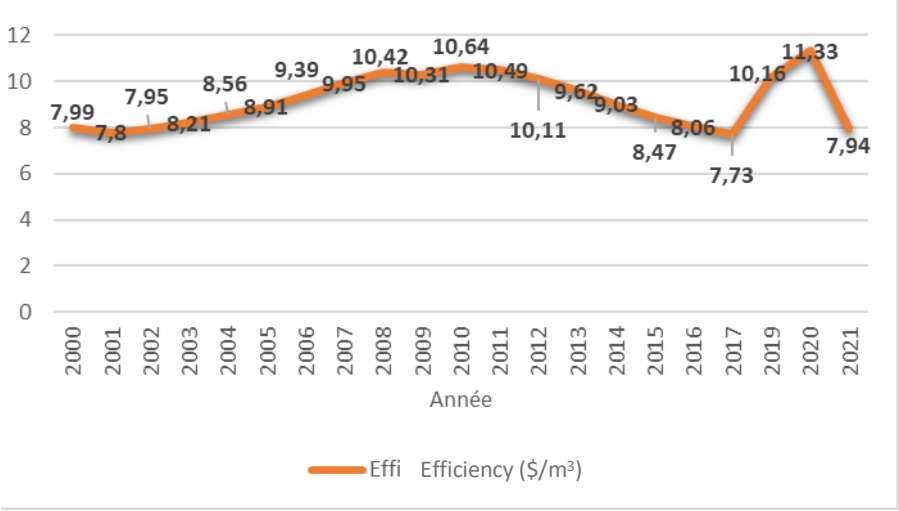

Figure n°20: Evolution of water use efficiency (in $/m3)

- However, there is a regression of efficiency in the irrigated sector in 2021; explained in particular by the deterioration of hydrometeorological and agrometeorological conditions with records that have been recorded at the level of temperatures and periods of drought that exceed half the year without rainfall especially in the central and southern regions.

Progress on Indicator 6.4.2 - Level of water stress: freshwater withdrawals as a proportion of available freshwater resources

The level of water stress corresponds to freshwater withdrawals as a proportion of available freshwater resources, i.e. the ratio of the total amount of freshwater withdrawn by the main economic sectors to the total amount of renewable water resources. (FAO-http://www.fao.org/sustainable-development-goals/indicators/642/fr/)

This indicator involves:

- ❑ Total renewable water resources (long term average -Ref.: FAO: surface water + groundwater): 3,758 billion m^3
  - Groundwater: 2201-330 = 1871 Mm^3 ;
    - Ground water: 770 Mm^3 (DGRE);
    - Deep aquifers: 1431 Mm^3 of which 330 Mm^3 nonrenewable (DGRE);
  - Surface water:
    - Average Regulated Inputs to Dams (DGBGTH): 1887 Mm^3;
- ❑ Non-renewable underground resources (fossil): 330 Mm^3 (DGRE);
- ❑ Withdrawals (freshwater): 3,675 billion m^3
  - ∇ Withdrawal by source:
    - ❖ Groundwater abstraction: 2,836 billion m^3;
      - Groundwater: 914 million m3; Exploitation rate: 118.7%;
      - Deep aquifers: 1922 million m3; Exploitation rate: 134.3%;
      - Groundwater exploitation rate (ground water + deep aquifers): 128.9%;
    - ❖ Surface water withdrawal (dams + hillside dams): 839 Mm^3 (DGBGTH, SECADENORD+SONEDE);
    - ❖ Desalination (seawater): 12.9 Mm^3;
    - ❖ Treated wastewater (all uses combined, direct and indirect): 63.49 Mm^3
    - ❖ Treated wastewater (direct uses): 21.75 Mm^3
  - ∇ Withdrawal by use:
    - ❖ Withdrawals for agriculture (irrigation): 2780 Mm^3;
      - Groundwater: 2456 Mm^3 (DGRE)
      - Surface water: 302 Mm^3 (BPEH/DGGREE)
      - Treated wastewater: 21.75 Mm^3 (ONAS)

- ❖ Withdrawals for industries: 60.62 Mm^3 (DGRE);
  - By direct pumping: 38.12 Mm^3 (DGRE)
  - from the SONEDE network: 22.5 Mm^3 (SONEDE)
- ❖ Withdrawals for Drinking water supply (Municipal/Domestic water + tourism + Miscellaneous): 869 Mm^3
  - For drinking water supply (domestic): 822.6 Mm^3
  - Tourism 46,42 Mm^3 (38.12 by direct pumping + 8,3 from the SONEDE network)
- ❖ Treated wastewater withdrawals for green spaces: 0.87 Mm^3 (Annual report ONAS 2021)
- ❖ Treated wastewater samples for Espace T Golf: 6.5 Mm^3 (Annual report ONAS 2021)
- ❖ Treated wastewater withdrawals for recharge and wetlands: 41.74 Mm^3 (ONAS 2021 annual report)
- ❖ Withdrawal non-conventional resources: 12.9 (seawater desalination) + 21.75 (treated wastewater, direct use) = 34.65 Mm^3
- ❖ Fresh water withdrawal (without desalination and treated wastewater): 3675 Mm^3
- ❖ Total withdrawals = 3675+34,65 ≈ 3709.7 Mm^3

Referring to the AQUASTAT – FAO database, with the updated data of 2020 relating to the calculation parameters adopted by the FAO (listed above), the value of Indicator 6.4.2 relating to Water Stress" is the order of:

Indicator 6.4.2 "Water Stress" = **119,3 %, i.e. 120 %**

Water stress has changed since 2000 under the effect of a set of factors linked in particular to the hydro-meteorological characteristics of the hydrological year, irrigated and cultivated areas (change in water consumption for irrigated agriculture), and the mode of water resources management adopted.

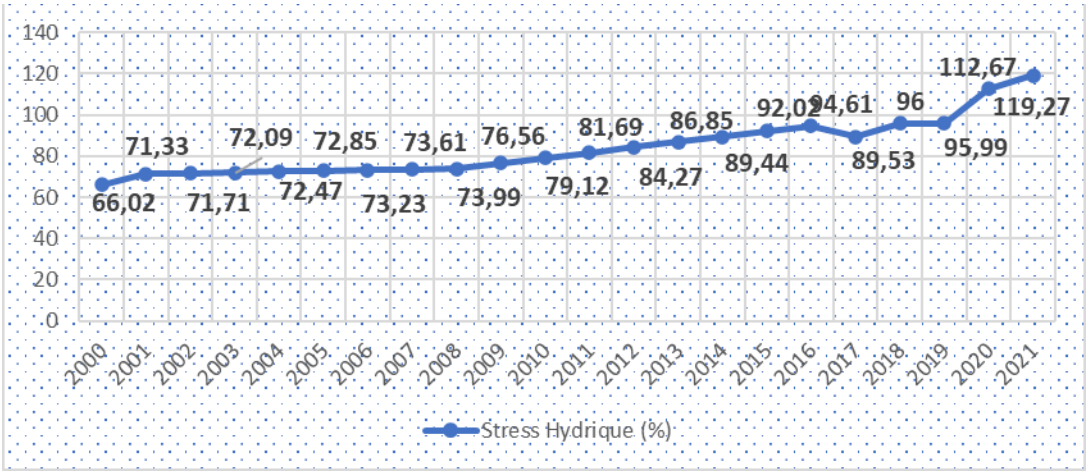

Figure n°21: Evolution du stress hydrique 2020-2021

The year 2021 was characterized by extreme events in both temperature and precipitation: it is the sixth year of drought in the last 7 years.

The 2018/2019 hydrological year was a relatively rainy year, with inputs to the hydrological regions of 4.765 billion m3. Exceptional rainfall was recorded in some regions: catastrophic flooding of Nabeul in September 2018.

It should be noted that the calculation of the water stress indicator is made from estimates based on concessions and not on the counting of consumption and does not take into account illicit drilling. As a result, its value is underestimated.

III.2.5. Target 6.5: By 2030, achieve integrated water resources management at all levels, including through transboundary cooperation as appropriate.

Target 6.5 aims to support the equitable and efficient use of water resources as a key factor in socio-economic development and environmental sustainability. Indicator 6.5.1 measures progress by scoring from 0 to 100 on the following criteria: Enabling environment, 2 Institutions and participation, 3 Management instruments, and Financing.

Table n°19: Scoring to establish the indicator according to the thematic sections

Section	**Average note (%)**
Section 1 Enabling Environment	59
Section 2 Institutions and Participation	62
Section 3 Management Instruments	60
Section 4 Financement	60
Score for indicator 6.5.1 = Degree of IWRM implementation (0 - 100)	**60**

ANNEXE 1

MATRICE DES PROJETS

TABLEAU : AVANCEMENT ET PROGRAMME DES PROJETS DES GRANDS TRAVAUX HYDRAULIQUES

Maitre d'œuvre : DGBGTH

Objectifs	Durée	Composantes	coût	Financement	Avancement 2020	Avancement physique 2021
Intitulé du projet : Réalisation de Barrages						
Mobilisation des eaux de surface de l'extrême Nord	2002-2015	Réalisation du Barrage Douimis (Bizerte)	60 MD	FADES	65 %	70%
Mobilisation des eaux du Nord	2015-2020	Réalisation du Barrage Mellègue amont (Jendouba)	277 MD	FADES	35 %	35%
Intitule du projet : Connexion des barrages et mobilisation des ressources en eau au Centre de la Tunisie						
Connexion des barrages Houareb-Sidi Saad	2014-2017	Connexion barrages Houareb-Sidi Saad	31,2 MD	BID	- Fourniture des conduites : 97% - Travaux de pose des conduites : 47% - Acquisition et montage pièces hydromécaniques et électriques - Acquisition pièces hydromécaniques de protection de la conduite : 93%	100% 47% 93% 100%

Objectifs	Durée	Composantes	coût	Financement	Avancement 2020	Avancement 2020
Intitulé du projet : Renforcement et la sécurisation de l'eau potable au Cap Bon, Sahel et Sfax						
Mobilisation des ressources en eau pour sécurisation de l'eau potable	2016-2019	Barrage Kalaa Kébira 33 Mm^3	110 MD	FADES	Avancement global de 60%	Continuité des travaux, avancement global 85%
		Barrages Saida 45 Mm^3	166 MD	FADES	Avancement global de 15%	Avancement global de 35%
		Complexe de transfert Saida-Belli-Kalaa Kbira / Renforcement du canal Medjerda-CapBon Réalisation d'une conduite : DN 1800 mm et 1400 mm + 5 stations de pompage + 3 bassins de mise en charge	435 MD	FADES-BID	Avancement global 20%	Avancement global 30%
Intitulé du projet : Création de barrages collinaires						
Mobilisation des eaux de surface, création des périmètres irrigués et recharge de la nappe	2018-2021	Exécution des travaux de Barrage collinaire Dmayem		FAD-Budget national		95%
	2018-2021	Exécution des travaux de Barrage collinaire Seguifa		FAD-Budget national		Projet de résiliation du marché
	2018-2021	Exécution des travaux de Barrage collinaire Khol		FAD-Budget national		Projet de résiliation du marché
	2019-2022	Exécution des travaux de Barrage collinaire Hanita		FAD-Budget national		45%

Objectifs	Durée	Composantes	Coût	Financement	Avancement 2020	Avancement 2021
Intitulé du projet : Projet de contrôle des inondations de la Medjerda)						
Protection contre les inondations de la Medjerda. Tronçon du barrage Laroussia à la mer (zone D2)	2014-2023	Aménagements	252,7 MD	JICA	Conclusion du marché et démarrage des travaux	20%
Protection contre les inondations de la Medjerda tronçon U1 + M	2018-2023	Aménagements	153 MD	KFW	- En cours de l'APD	En cours de l'APD
Protection contre les inondations de la Medjerda, tronçon U2	2019-2025	Aménagements	280 MD	KFW	- En cours de l'APD	En cours de l'APD
Intitulé du projet : Programme de Gestion Intégrée des Ressources En Eau						
Augmentation de la capacité de stockage du barrage Bouhertma	2017-2020	Surélévation du barrage Bouhertma de 33 Mm^3 (Jendouba)	210 MD	KFW	42%	77%
Modernisation du canal Medjerda Cap-bon -		Système de dégrillage ; Réhabilitation du Barrage Laroussia ; Augmentation de la capacité de la station de Fondouk Jedid ;		KFW	60% Démarrage de réalisation 40%	100% 20% 60%

TABLEAU : AVANCEMENT ET PROGRAMME DES PROJETS DE CONSERVATION DE L'EAU ET DU SOL

Maitre d'œuvre : DGACTA

Intitulé du projet : Développement Agricole Rural autour des lacs collinaires (DARAL)						
Objectifs	**Durée**	**Composantes**	**Coût**	**Finance-ment**	**Avancement 2020**	**Avancement 2021**
Une meilleure gestion des ressources en eau et en sol dans la zone d'intervention **Régions concernées : les gouvernorats de Kasserine, Kairouan et Sidi Bouzid.** **Objectifs spécifiques :** **- Valorisation des aménagements existants ;** **- Amélioration des revenus des exploitants ;** **- Protection des ressources naturelles**	2014-2018	Travaux de CES ; Aménagements ou réhabilitation des lacs collinaires ; Mesures complémentaires pour le développement socio-économique dans la communauté.	17 M€	KFW	- Réalisation des travaux de forage. (2 forages à Thala et Al Ayoun du gouvernorat de Kasserine) ; - Réalisation des travaux d'alimentation en eau potable ; - Acquisition des engins (citernes tractées, pelle chargeuse) ; - Extension du réseau d'eau potable dans la zone Zaafria du gouvernorat de Sidi Bouzid - Travaux de CES dans les 6 sites du projet ; Formation des GDAs et des bénéficiaires ; Acquisition du cheptel, des ovins et des ruches pour les AGR individuelles	- Lancement de l'appel d'offre de 52 km de pistes dans les 3 gouvernorats ; - Lancement de l'appel d'offre de réhabilitation de l'extension du réseau d'épandage des périmètres irrigués de 300 ha de la localité de Zaafria à Sidi Bouzid ; - Lancement des appels d'offre des réseaux d'irrigation à partir des lacs collinaires ; - Lancement de l'appel d'offre de l'acquisition des engins agricoles ; - Consultation pour la réalisation de 3 forages à Kasserine et Kairouan ; - Lancement des appels d'offre de l'alimentation en eau potable El Khol ; - Lancement des appels d'offre relatifs aux citernes enterrées. - Extension du projet DARAL (cofinancement UE – KfW) signée en 2021, dans les gouvernorats de Jendouba, Siliana et Kasserine avec des enjeux de développement intégré territorial autour de la gestion des bassins versants et de la valorisation de l'eau

Objectifs	Durée	Composantes	Coût	Finance-ment	Avancement 2020	Avancement 2021
Intitulé du projet : Programme d'adaptation aux changements climatiques dans les territoires ruraux vulnérables (PACTE)						
Contribuer au développement durable et à l'adaptation aux changements climatiques des territoires ruraux vulnérables en Tunisie. Le projet a pour objectif de définir et mettre en œuvre des politiques, stratégies et projets structurants de gestion intégrée des ressources naturelles dans les zones prioritaires d'intervention par les acteurs locaux et nationaux. (Gouvernorats : Bizerte, Kef, Kairouan, Siliana, Sidi Bouzid), autour de : **- La gestion rationnelle durable des ressources naturelles durables** **- Le développement économique des territoires ruraux** **- L'amélioration de la gouvernance du développement territorial**	2017-2022	Composante 1 : Planification concertée des actions de GRN, Composante 2 : Investissement de mise en œuvre des plans d'aménagement Composante 3 : Coordination, dialogue politique GRN, appuis institutionnels et formation	56 M€	AFD	- Signature d'une convention avec l'AVFA - Signature d'une convention avec l'OEP - Signature des conventions avec 07 municipalités sur la décentralisation de la gouvernance locale - Réalisation d'un plan spécial COVID19 pour le soutien des agriculteurs et de la population rurale - Constitution des comités de territoire	- Démarrage des réunions de concertation entre les services techniques du comité du territoire pour élaborer le plan d'intention et des PADITS - Formation – Action des CADR par les CIRAD sur les techniques de planification concertée - Clôture de premier cycle de formation des CADR et des formateurs de Sidi Thabet et préparation du démarrage d'un 2ème cycle - Opérationnalisation du Système du suivi systématique du PACTE

Objectifs	Durée	Composantes	Coût	Finance-ment	Avancement 2020	Avancement 2021
Intitulé du projet : « Promotion d'une agriculture résiliente au climat et amélioration des moyens de subsistance des petits agriculteurs dans le Sud Tunisien »)						
Atténuation de la vulnérabilité au changement climatique dans le Sud Tunisien à travers l'amélioration de la capacité d'adaptation de la population, des écosystèmes, des ressources naturelles et des moyens de subsistance grâce à un ensemble de techniques et d'approche intégrées dans la perspective de réduire leur exposition, leur sensibilité et leur vulnérabilité aux aléas climatiques et aux phénomènes extrêmes dans trois types de territoires représentatifs du sud: oasis, montagne et plaine. Le projet ciblera des régions vulnérables des six gouverneurs du sud : Gabès, Gafsa, Kébili, Médenine, Tataouine et Tozeur représentant 1,6 million d'habitants et 82 000 bénéficiaires directs du projet.	6 ans	**Composante 1 :** Préservation des écosystèmes des zones arides tunisiennes en tant que modèle de résilience au changement climatique par la restauration des terres et la gestion de l'eau **Composante 2 :** Investir dans la diversification des moyens de subsistance des petits exploitants pour promouvoir l'adaptation au changement climatique. **Composante 3 :** Renforcement de la gouvernance, de la planification et de la capacité institutionnelle en matière d'adaptation au CC à long terme.	60 M$	30 M$ AFD 25 M$ Don FVC	- Achèvement d'une étude préliminaire pour la note conceptuelle de projet financée par la FAO (2017-2018), maintenant dans la phase de finalisation de la préparation de l'étude de faisabilité du projet. Cette étude est réalisée dans le cadre de l'initiative Adapt'Action Le projet est en cours d'instruction	- Finalisation de l'étude de faisabilité du projet du Sud financée par l'initiative Adapt'Action Le projet a été initialement approuvé pour le financement de la partie prêt AFD. En attente de soumission du funding proposal au FVC pour demande de financement de la partie don

TABLEAU : AVANCEMENT ET PROGRAMME DES PROJETS DES PERIMETRES IRRIGUES

Maitre d'œuvre : DGGREE

Objectifs	Durée	Composantes	Coût	Finance-Ment	Avancement 2020	Avancement 2021
Intitulé du projet : La modernisation et la réhabilitation des grands périmètres irrigués de la Basse Vallée de la Medjerdah						
Modernisation des périmètres irrigués de la basse vallée de la Medjerda	2012-2020	Remplacement des systèmes d'irrigation de la basse vallée de la Medjerda au gouvernorat de Manouba : 2750 ha	91 MD	KFW	- Lot 1 (1125 ha) : Irrigation : 98% Assainissement et pistes : 75% - Lot 2 (1625 ha) : Acquisition de conduites : 70% Pose : 20%	- Lot 1 : irrigation : 100% Assainissement et pistes : 85% marché résilié - Lot 2 : Electrification : 65% Acquisition conduites réseau : 91% Acquisition de conduites de refoulement : 50% Pose de conduites réseau : 82% Construction et équipement station de pompage et réservoirs : 52%
Modernisation des périmètres irrigués de la basse vallée de la Medjerda	2012-2021	Remplacement des systèmes d'irrigation des PI de la basse vallée de la Medjerda au gouvernorat de l'Ariana sur une surface de 3200 ha Réalisation d'un réseau de drainage (1700 ha)	70 MD	KFW	- Acquisition des conduites : 100% - Construction de 2 réservoirs et équipement station de pompage : 100% - Acquisition et pose de conduites : 65% - Drainage : réalisation physique 100%	- Acquisition des conduites : 100% - Construction de 2 réservoirs et équipement station de pompage: 100% - Acquisition et pose de conduites : 80% Drainage : 100%
Réhabilitation Canal Laaroussia	2017-2027	Travaux de réhabilitation du Grand Canal de Laaroussia : génie civil, régulation	60 MD	KFW	70%	90%

Objectifs	Durée	Composantes	Coût	Finance-Ment	Avancement 2020	Avancement 2021
Intitulé du projet : Gestion intégrée des ressources en eau du périmètre irrigué de Mornag						
Gestion intégrée des ressources en eau du périmètre irrigué de Mornag	2012-2021	Réhabilitation des systèmes d'irrigation des PI de la plaine de Mornag : 6800 ha Recharge artificielle de la nappe	65,8 MD	KFW	- Etude de recharge : APD en cours - Pose des conduites : 15 % - Stations de pompage et réservoirs : conclusion du marché	-Etude de recharge : achevée -Acquisition de conduites fretté béton : 85% -Pose des du réseau d'irrigation conduites : 85 % -Pose de conduites frettées béton et réservoirs : démarrage -Stations de pompage : 20%
Intitulé du projet : Programme annuel de maintenance des équipements hydrauliques						
Maintenance des équipements hydrauliques	2021	Maintenance des stations de pompage, réseaux d'irrigation, réseaux d'assainissement et drainage, remplacement des équipements des forages refroidisseurs	19,21 MD	Budget de l'Etat		- Réseaux d'irrigation : 21% des marchés achevés, 29 % en cours de réalisation, 4% en cours d'engagement des marchés, 14% marchés reportés, 32% en cours de procédures de passation des marchés - Stations de pompage : 30% des marchés achevés, 33 % en cours de réalisation, 9% en cours d'engagement des marchés, 27% marchés reportés - Equipement des forages : 13 % en cours de réalisation, 13% en cours d'engagement des marchés, 73% marchés reportés
Amélioration des conditions d'exploitation des systèmes hydrauliques	2021	Acquisition de compteurs d'eau, électrification des stations, aménagement des pistes agricoles, équipement des forages, curage d'oueds, ...	16,12 MD	Budget de l'Etat		- Curage des oueds : 20% marchés achevés, 13% marchés en cours de réalisation, 67% marchés reportés Pistes agricoles : 11% en cours de réalisation, 89 % reportés pour insuffisance des crédits

Objectifs	Durée	Composantes	Coût	Finance-ment	Avancement 2020	Réalisation 2021
Intitulé du projet : Projet d'Intensification de l'Agriculture Irriguée aux gouvernorats du Nord de la Tunisie (PIAIT)						
Valorisation des grands périmètres irrigués du Nord : gouvernorats de Jendouba, Siliana, Béja, Bizerte, Nabeul, et Sfax	2019-2024	Composante 1 : aspect institutionnel, création d'une entreprise publique de gestion des PPI concernés par le projet Composante 2 : Réhabilitation de 23000 ha Composante 3 : développement agricole et commercialisation des produits, valorisation :agricole et appui aux investissements Composante 4 : appui à l'unité de gestion du projet Composante 5 : appui à la lutte contre la pandémie COVID 19	430 MD	Banque Mondiale	**CRDA Nabeul :** - Procédures de passation des marchés du bureau de contrôle et de drainage **CRDA Bizerte :** - Procédures de passation du marché du bureau de contrôle et d'acquisition et de pose de conduites en béton **CRDA Jendouba :** - Procédures de passation du marché du bureau de contrôle et du marché d'acquisition de conduites en béton **CRDA Béja :** - Procédures de passation du marché du bureau de contrôle et du marché d'acquisition de conduites en béton **CRDA Siliana :** - Procédures de passation du marché de recrutement du bureau de contrôle	**A l'échelle centrale :** - Assistance technique : 35% - Bureau de contrôle : 45% **CRDA Nabeul :** marché du bureau de contrôle : 25% travaux de drainage : 90% **CRDA Bizerte** : marché du bureau de contrôle : 25% acquisition de conduites en béton : 40% pose de conduites en béton : 20% **CRDA Jendouba : m**arché du bureau de contrôle : 20% ; acquisition de conduites en béton : 30% ; procédures de passation du marché de pose des conduites **CRDA Béja :** marché du bureau de contrôle 30% ; acquisition de conduites: 20% ; procédures de passation du marché de pose des conduites **CRDA Siliana :** marché du bureau de contrôle : 30%, acquisition de conduites en béton : procédures de passation pose des conduites : procédures de passation du marché

Objectifs	Durée	Composantes	Coût	Finance-ment	Avancement 2020	Avancement 2021
Intitulé du projet : Valorisation des périmètres publics irrigués des gouvernorats du centre						
Valorisation des périmètres irrigués du Centre : Kairouan, Kasserine et Sidi Bouzid à travers le développement des chaines de valeur	2018-2022	Réhabilitation et modernisation de 17 PPI de 9 000 ha de PPI	60 M€	BAD	**Kairouan :** réhabilitation achevée d'1 PPI de 110 ha en cours de réhabilitation : 1 PPI de 480 ha : 35% **Kasserine :** réhabilitation en cours de 3 PPI de : 190 ha : 15% ; 69 ha : 65% ; 713 ha : 20%, **Sidi Bouzid :** 2 PPI de 236 ha en cours de procédures de passation des marchés	**Kairouan :** réhabilitation achevée d'1 PPI de 110 ha réhabilitation en cours de 2 PPI de 480 ha et 460 ha : 55% **Kasserine :** réhabilitation de 3 PPI de : 190 ha : 45% ; 69 ha : achevés ; 713 ha : 30% **Sidi Bouzid :** Réhabilitation achevée de 2 PPI de 145 ha et 91 ha ; Réhabilitation en cours de 3 PPI de 406 ha
Intitulé du projet : Projet de l'appui de la gestion durable de l'irrigation par les eaux non conventionnelles dans la région méditerranéenne PROSIM						
Projet de l'appui de la gestion durable de l'irrigation par les eaux non conventionnelles dans la région méditerranéenne PROSIM	2019-2021	Réalisation d'une station de dessalement des eaux saumâtres avec photovoltaïque pour le PPI Bir Ben Kamla à Mahdia ; Réalisation de 2 systèmes de pilotage de l'irrigation ; 1parcelle pilote	0,523 M€	UE	Recrutement d'un auditeur de comptes Appel d'offres de la station photovoltaïque	Appels d'offres de la station photovoltaïque, station de dessalement Bir Ben Kamla, 374 serres ; Réalisation de 2 systèmes de pilotage d'irrigation ; Réalisation d'une parcelle pilote de 1 ha
Intitulé du projet : Le projet « Water and Environment Support (WES) »						
Composante1 : amélioration de l'efficacité de l'utilisation de l'eau en agriculture, Augmenter le niveau de connaissance des techniciens du CRDA et des GDA Composante 2 : atténuation des risques de sédimentation pour la durabilité des ressources en eau en Tunisie	2019-2023	Composante 1 : Renforcement des capacités d'un GDA (Zaouit Jedidi, gouvernorat de Nabeul), sensibilisation sur l'économie d'eau et les technologies modernes d'irrigation Elaboration d'un nouveau guide sur la base des nouvelles technologies Composante 2 : Etude d'envasement des barrages de Siliana et Lebna		UE	Démarrage des activités fin 2020	Composante 1 : - Réalisation des enquêtes auprès des agriculteurs et des acteurs, organisation de 2 sessions de formation - Développement de matériel de sensibilisation et de guides techniques à distribuer aux personnes concernées Composante 2 : collecte et traitement des données

TABLEAU : AVANCEMENT ET PROGRAMMES DE L'ALIMENTATION EN EAU POTABLE

Maitre d'œuvre : SONEDE

Objectifs	Durée	Composantes	Coût	Finance-Ment	Avancement 2020	Avancement 2021
Intitulé : Renforcement et sécurisation de l'alimentation en eau potable						
Renforcement du système d'alimentation en eau potable pour les régions du Grand Tunis, Cap-Bon, Sahel et Sfax	2018-2024	Renforcement des infrastructures pour le transfert des eaux brutes et traitées du complexe Belli vers le Sahel : 28 km de conduites en FD et BP 2 réservoirs de 10000m3, 2 réservoirs de 5000m3, … Exécution du pôle de traitement 4 m3/s à Kalaa Kébira, 2 stations de pompage de 4,8 et 4 m3/s	60 M€	AFD	- Fourniture des tuyaux en fonte : livrés (100 %) - Fourniture des tuyaux en BP : marchés conclus - Travaux de pose de conduites et de génie civil : AO en cours de lancement - Acquisition du terrain de la station de traitement achevée - Construction de la station de traitement : en cours d'appel d'offres	17%
Réduire la salinité à 1,5 g/l pour 585 000 habitants aux gouvernorats de Gafsa, Tozeur, Kebili, Sidi Bouzid et Médenine	2017-2025	2ème PHASE (PNAQ2) : 6 SD de capacité totale 31000 m^3/j	55 M€ 25 M€	KFW SONEDE	15%	17%
Sécurisation de la desserte des centres urbains	2012-2022	AEP de 33 centres urbains dans 19 gouvernorats : réalisation de 7 forages, 400 km de conduites, 40 réservoirs, 20 stations de pompage	103 MD	JICA	82%	87%

Objectifs	Durée	Composantes	Coût	Finance ment	Avancement 2020	Avancement 2021
Intitulé : Mobilisation des ressources en eau non conventionnelles saumâtres et eau de mer						
Dessalement d'eau de mer	2017-2023	Station de dessalement d'eau de mer de Sfax 100000 m^3/j extensible à 200000 m^3/j : Phase 1 = 100000 m^3/j	810 MD 130 MD	JICA Budget	-Travaux de pose de conduites : en cours - Station de dessalement : en phase de passation du marché	10% -Travaux de pose de conduites : en cours - Station de dessalement : en phase de passation du marché
	2017-2022	Station de dessalement d'eau de mer de Zarat 50000 m3/j extensible à 100000 m3/j : Phase 1 = 50000 m3/j	315 MD	KFW	- 65% - Travaux en cours	75% - Travaux en cours.
Intitulé : Programme exceptionnel de renforcement des ressources en eau						
Projets urgents pour le renforcement des ressources en eau pour les zones affectées par le manque de ressources lors de l'été 2016	2017-2022	Station de traitement des eaux de mer de Sousse	237 MD	Etat	- 40%	60%
		Station de traitement à partir du barrage Lebna de capacité 25 000 m^3/j			- En phase de passation du marché	
		Renforcement des ressources en eau au Sud du gouvernorat de Kairouan, pose de 73 km de conduites			- 10% - Travaux en cours	
		Exécution, équipement et raccordement de 44 forages répartis sur différents gouvernorats			- 34 forages réceptionnés, - 2 forages en cours. - 08 marchés conclus	

Objectifs	Durée	Composantes	Coût	Finance-Ment	Avancement 2020	Avancement 2021
Réhabilitation des adductions	2017-2022	Réhabilitation des adductions du Grand Tunis (1ère phase) 20 km DN 1400 mm à 400 mm	200 MD	FKDEA	- Travaux en cours	40%
	2017-2022	Réalisation des adductions Sud parallèles à l'aqueduc romain (entre Zaghouan et Jebel Ouest) le long de 50 km DN 500 mm en fonte			- Passation du marché	
	2017-2022	Réhabilitation des adductions du Nord-Ouest 16 km DN 1200 mm			- Conduites livrées. En phase de passation du marché des travaux.	
	2017-2022	Réhabilitation des adductions du sud-est de 83 km DN 600 et réalisation de 3 stations de pompage			- Travaux en cours AO de fourniture de tuyaux en fonte : Adjugé.	
Réhabilitation des adductions	2017-2022	Renforcement des infrastructures dans le Grand Sousse 43 km DN 800 mm à 200 mm + 1 SP + 3 RSE 10000 m3 + 1 RST 250 m3			- AO Travaux : en cours d'élaboration.	
	2017-2022	Station de dessalement Kerkennah : 1 SD 6000 m^3/j extensible à 9000 m^3/j			- Exécution de deux forages profonds : Travaux en cours	
Le projet d'amélioration du taux de desserte en milieu rural de Bizerte de **87,3% à 95,0%**	2017-2024	AEP de 675 groupements ruraux (500 km de conduites + une station de traitement 500 l/s + 58 Ouvrages hydrauliques)	299 MD	FSD	- Appel d'offres	5%
Amélioration du taux de desserte en milieu rural dans le gouvernorat de Béja de 90,4% à 96,9%	2017-2022	AEP de 385 groupements ruraux (Fourniture et pose de 441 km de conduites + construction d'une station de traitement 300 l/s + 94 ouvrages hydrauliques : réservoirs, stations de pompage, brises-charge)	36,2 M€	KFW	- En continuation	68%

Objectifs	Durée	Composantes	Coût	Finance-Ment	Avancement 2020	Avancement 2021
Intitulé : Alimentation des centres ruraux en eau potable						
Alimentation des centres ruraux tranche 3	2010-2021	49 projets AEP pour 137 centres ruraux et 54000 bénéficiaires + Projet SIG + Projets maîtrise d'énergie + Economie d'eau	21,5 M€ +3,8 M€	AFD Budget de l'Etat	95 %	99%
Alimentation des centres ruraux tranche 4	2014-2023	36 projets AEP pour 102 centres ruraux dans 13 gouvernorats et 58000 bénéficiaires	20 M€ 3,85 M€	AFD Budget de l'Etat	89 %	93,6%
Projet de construction d'une station de traitement des eaux à Béjaoua pour le renforcement des ressources en eau pour le Grand Tunis et l'AEP du port financier.	2021-2025	Construction d'une station de traitement des eaux d'une capacité de production de 4 m3/s à Béjaoua + construction d'une station de pompage + Fourniture et pose de 55 km de conduites + construction de 4 réservoirs)	76 M€ 3 M€	BEI & AFD SONEDE	- En phase de préparation des dossiers d'appels d'offres.	- En phase de préparation des dossiers d'appels d'offres.
Projet de sécurisation et de renforcement de l'AEP des centres urbains	2021-2025	35 projets urbains dans 17 gouvernorats.	315 MD	FKDEA	- En phase de préparation des dossiers d'appels d'offres.	- En phase de préparation des dossiers d'appels d'offres.

TABLEAU : AVANCEMENT ET PROGRAMMES DES PROJETS D'AEP EN MILIEU RURAL

Maitre d'œuvre : DGGREE

Projet	Durée	Composante	Coût MD	Finance-ment	Avancement 2020	Avancement 2021
Projets d'alimentation en eau potable en milieu rural pour 372 000 habitants	2016-2023	268 projets pour 372 000 bénéficiaires dont 88 nouveaux projets et 180 projets de réhabilitation 32 forages profonds Mesures d'accompagnement : stratégie de communication, intégration du genre, sensibilisation sur les aspects sanitaires, étude de faisabilité d'équipement de 20 stations par le photovoltaique, assistance technique des GDA,	405	BAD	- 83 projets sont achevés pour la desserte de 73000 habitants. - 105 projets sont en cours d'exécution pour 144000 habitants. - 41 forages d'AEP sont achevés et 8 sont en cours	- 113 projets sont achevés pour la desserte de 109 000 habitants. - 91 projets sont en cours d'exécution pour 132 000 habitants. - 50 forages d'AEP sont achevés et 12 en cours parmi 83 forages programmés pour l'année 2017,2018, 2019, 2020 et 2021
AEP rural autour des axes de transfert de Sejnane pour 35000 bénéficiaires	2012-2020	Une station de traitement des eaux du barrage Zyatine, conduite de refoulement, 4 axes de transfert, réservoir de 2500 m3, 6 stations de pompage	70	BAD	- Réalisation d'une station de traitement, d'un réservoir, et de 4 axes (Sejnane, Tamra, Kef Abada, et Syria). - Le projet est entré en exploitation pour les deux axes Sejnane et Tamra - Réalisation du 5ème axe (Sidi Mechreg) à 92%.	- Achèvement de réalisation du 5ème axe (Sidi Mechreg) - Réalisation de 3 projets liés aux axes
Alimentation en eau potable des écoles en zones rurales.	2015-2019	Alimentation en eau potable de 880 écoles	29,5	Budget	- Achèvement de travaux de desserte de 737 écoles et 122 écoles en cours	- Achèvement de travaux de desserte de 814 écoles et 45 écoles en cours

Projet	Durée	Composante	Coût	Finance-ment	Avancement 2020	Avancement 2021
Assainissement sanitaire des écoles en zones rurales	2016-2018	Assainissement de 843 écoles en zones rurales.	16,5 MD	Budget	- Assainissement de 659 écoles achevés ; 50 écoles en cours d'exécution	- Les travaux d'assainissement de 712 écoles sont achevés ; - 16 écoles en cours d'exécution
Remplacement des forages pour l'AEP	2021	Remplacement des forages d'exploitation	9,8 MD	Budget	- Remplacement au cours de 2020 de 30 forages d'exploitation et intervention sur 17 autres	- Remplacement au cours de 2021 de 24 forages d'exploitation et intervention sur 17 autres
Remplacement des forages très profonds destinés à l'irrigation et à l'AEP au Sud : L'intervention au niveau de 37 oasis de 3640 ha et 22 PI sur des systèmes de refroidissement aux gouvernorats de Kebili, Tozeur, Gabes et Gafsa		Remplacement de 22 forages sur le système continental intercalaire Réaménagement de 17 têtes de forages Remplacement de 19 ouvrages de refroidissement Réhabilitation des réseaux d'irrigation de 2289 serres Réhabilitation des systèmes de drainage et d'assainissement pour 2 491 ha Mesures d'accompagnement	190 MD	BERD et Budget	- Discussion de l'accord de prêt	- Conclusion de l'accord de prêt - Elaboration des TDR des mesures d'accompagnement : renforcement des capacités, réformes institutionnelles,
Pérennisation des systèmes d'AEP et des périmètres PMH en milieu rural dans cinq gouvernorats : Kairouan, Sidi Bouzid, Kasserine, Mahdia et Sfax	2018-2023	Réhabilitation de 60 systèmes d'AEP et de 50 systèmes d'irrigation et amélioration de leur gouvernance au lieu de 107 et 56 programmés au démarrage (110 GDA au lieu de 163) Assistance technique AT-FBG des GDA concernés et des arrondissements de gestion des systèmes hydrauliques AGSH	16,8 M€	KFW	- Mise à niveau de 15 GDA Pas d'avancement important suite à la démission du chef de la mission d'assistance technique à deux reprises en plus de la pandémie COVID 19	- Identification de 41 GDA éligibles sur les 110 GDA - 19 GDA déclarés éligibles et préparation des DAO de mise à niveau des systèmes y afférents - 31 Diagnostics Techniques réalisés - 14 DAO lancés - 6 systèmes en cours de travaux (5 AEP et 1 PMH) dont 1 a été achevé et réceptionné à Sfax

TABLEAU : AVANCEMENT ET PROGRAMME DE L'ASSAINISSEMENT

Maitre d'œuvre : ONAS

Projet	Durée	Composante	Coût	Finance-ment	Avancement 2020	Avancement 2021
Assainissement de Sousse II	2008-2023	Construction de la STEP de Sousse Hamdoun et réhabilitation de STEP de Sousse Sud et système d'interconnexion ; Réhabilitation et extension des réseaux d'assainissement dans le gouvernorat de Sousse.	143 MD	KFW	**Pôle d'épuration Sousse Hamdoun** -- Sous lot A1: Fourniture et transport de conduites et pièces spéciales: fournitures livrées et réceptionnées - Sous lot A2: Fourniture et transport de conduites et pièces spéciales : fournitures livrées et réceptionnées - Fourniture et transport de conduites et génie civil et équipement de SP Akouda et pose de conduites pour le système de Transfert des Eaux Usées Brutes de Akouda vers STEP Sousse Sud et de Sousse Sud vers Hamdoun : travaux en cours de démarrage - Travaux en cours de démarrage de la STEP de Sousse Hamdoun : mise en eau, reste travaux de cogénération **Réhabilitation et extension des réseaux d'assainissement dans le gouvernorat de Sousse :** - Renforcement du réseau de Kalâa Kébira et Akouda ; DAO prêt - Réhabilitation du réseau secondaire de Sousse : 3 ème tranche : 90%. - Assainissement des cités El Jorf et Chargui à Kalaa Sghira : achevés - Traitement complémentaire- Filtres à sable et désinfection UV (y compris GC et Equipement) STEP Sousse Hamdoun : marché conclu le 28/10/2020	**Pôle d'épuration Sousse Hamdoun** -- - Sous lot A1: Fourniture et transport de conduites et pièces spéciales: fournitures livrées et réceptionnées - Sous lot A2: Fourniture et transport de conduites et pièces spéciales : fournitures livrées et réceptionnées - Fourniture et transport de conduites et génie civil et équipement de SP Akouda et pose de conduites pour le système de - Transfert des Eaux Usées Brutes de Akouda vers STEP Sousse Sud et de Sousse Sud vers Hamdoun : travaux en cours 68% - STEP de Sousse Hamdoun : STEP mise en eau, reste travaux de cogénération **Réhabilitation et extension des réseaux d'assainissement dans le gouvernorat de Sousse :** - Réhabilitation du réseau secondaire de Sousse : 3 ème tranche : travaux achevés. - Assainissement des cités El Jorf et Chargui à Kalaa Sghira : travaux achevés Traitement complémentaire- Filtres à sable et désinfection UV (y compris GC et Equipement) STEP Sousse Hamdoun : les travaux sont en cours d'achèvement

Projet	Durée	Composante	Coût	Finance-ment	Avancement 2020	Avancement 2021
Assainissement des petites et moyennes villes II (6 villes)	2008-2019	Réalisation de 6 STEP et réseaux d'assainissement de 7 villes : Mornaguia, Sers, Bouarada, Makther, Jerissa, et Meknassy Assainissement de Bordj El Amri	91 MD	KFW	- Makthar : STEP achevée et réseau complémentaire en cours (85%) - Bordj El Amri Tranche 1 : 1er marché résilié (suite à un avancement de 60%), un nouveau marché a été conclu Tranche 2 : travaux de pose achevés, reste les travaux de branchement et de la station de pompage (problème foncier en cours de résolution)	- Makthar : STEP et réseau complémentaire Travaux achevés - Bordj El Amri Tranche 1 : 1er marché résilié, 2ème marché travaux en cours 75% Tranche 2 : avancement global des travaux 75%, l'achèvement est tributaire de l'achèvement du réseau primaire de la tranche 1
Extension et réhabilitation des STEP et des stations de pompage (TR I et II)	2009-2021	Extension et réhabilitation de 19 STEP et 130 stations de pompage	413 MD	KFW-AFD-UE	- 5 STEP achevées - 4 STEP en cours de réalisation (Sidi Bouali, Ouadanine, El Jem, Ksour Essaf) - 38 stations de pompage achevées - 2 stations de pompage en cours -12 stations de pompage : en phase de passation de marchés - 10 stations de pompage : marché conclu	- 5 STEP mises en eau - 5 STEP en cours de réalisation (Sidi Bouali, Ouadanine, El Jem, Mahdia et Mahres) -2 STEP en phase de passation de marchés -1 STEP en phase d'études - 40 stations de pompage achevées - 12 Stations de pompage : Marché conclu ; 10 stations de pompage : Travaux en cours 30%
Assainissement de 9 zones industrielles par des STEP spécifiques (Tr 1 et Tr 2)	2014-2024	Equipement des zones industrielles par des stations grappées, - La première phase comprend Moknine industrielle, Bir El Kassaa et les études de Sfax, Utique et Oued El Bey	140 MD	KFW	- STEP Moknine industrielle : en phase de signature du marché - Branchement provisoire du pôle technologique Enfidha : marché signé le 23/12/2020 - Transfert des eaux usées de Moknine : appel d'offres lancé, - STEP Ben Arous et système de transfert : en phase d'études - Utique, Sfax et Oued El Bey : en phase d'études	- STEP Moknine industrielle : avancement travaux 15% - Branchement provisoire du pôle technologique Enfidha : avancement global 55% - Transfert des eaux usées de Moknine : travaux en cours 10%, - STEP Ben Arous et système de transfert : préparation du dossier de prequalification - Utique, Sfax et Oued El Bey : en phase d'études (APS)

Projet	Durée	Composante	Coût	Finance-ment	Avancement 2020	Avancement 2021
Assainissement de Tunis Nord : réduction des quantités des EUT rejetées au Golfe de Tunis ; Amélioration de la réutilisation des EUT en agriculture ; Amélioration de la qualité des EUT du pôle de traitement de Chotrana	2012-2019	Réalisation d'une station de pompage de 2,7 m^3/s Réalisation d'un système de transfert des eaux épurées depuis le point actuel de décharge vers un bassin de stockage pour leurs réutilisations en agriculture ; Evacuation des eaux épurées non réutilisées ; Réalisation d'un émissaire des eaux épurées.	146,8 MD	BIRD	Lot1 : - Fourniture et transport de conduites et accessoires en Béton armé : achevé - Fourniture et transport de conduites et accessoires en PEHD : achevé Lot2 : - Travaux de pose de conduite DN 1800 en béton armé : achevé - Travaux de GC et d'EQ du bassin de régulation et d'irrigation - Travaux de pose de conduites terrestres (GC et EQ de la station de pompage) : achevé Lot3 : - Fourniture, Transport et pose de 6,3 Km de conduites DN 1600 en PEHD (émissaire en mer) : achevé	Lot1 : - Fourniture et transport de conduites et accessoires en Béton armé : achevé - Fourniture et transport de conduites et accessoires en PEHD : achevé Lot2 : - Travaux de pose de conduite DN 1800 en béton armé : achevé - Travaux de GC et d'EQ du bassin de régulation et d'irrigation - Travaux de pose de conduites terrestres (GC et EQ de la station de pompage) : achevé Lot3 : - Fourniture, Transport et pose de 6,3 Km de conduites DN 1600 en PEHD (émissaire en mer) : achevé
Amélioration des eaux usées épurées	2012-2019	Réhabilitation du système de traitement des eaux usées et des systèmes de transfert des eaux traitées Réhabilitation de de 17 STEP (Charguia, Sud Meliane1, Chotrana, …)	102 MD	BAD	- Achèvement de la réhabilitation de 10 STEP, - Réhabilitation de 2 STEP en cours, Transfert des eaux épurées de la station de la côtière Nord : achevé	- Achèvement de la réhabilitation de 22 STEP, - Réhabilitation de 2 STEP en cours, - - Transfert des eaux épurées de la station de la côtière Nord : achevé

Projet	Durée	Composante	Coût	Finance-ment	Avancement 2020	Avancement 2021
Assainissement des villes de Ben Guerdane, El Guetar, Foussana et Regueb	2012-2021	Pose d'environ 200 km de conduites ; Raccordement de près de 13 000 logements ; Construction de 4 stations d'épuration.	87 MD	Recyclage de la dette Allemande	- STEP Ben Guerdane : 60% - STEP El Guetar : 30% - Réseau d'assainissement El Guetar : 100% - Réalisation du réseau de Ben Guerdane : 95% - STEP Regueb et STEP Foussana : en cours d'expropriation du terrain	- STEP Ben Guerdane : les travaux de génie civil et équipement sont achevés, la mise en service de la STEP est tributaire du raccordement électrique - STEP El Guetar : les travaux de génie civil et d'équipement sont achevés, les travaux de raccordement électrique sont en phase d'achèvement - Réseau d'assainissement El Guetar : 100% - Réalisation du réseau de Ben Guerdane : les travaux sont achevés à 100% et la mise en service de la SP est tributaire du raccordement électrique - STEP Regueb et STEP Foussana : procédures d'acquisition de terrain en cours
5ème Projet d'assainissement des quartiers populaires (Tranche 2) et Projet d'assainissement rural TR3	2016-2020	Assainissement de 116 quartiers populaires, au bénéfice d'environ 122 mille habitants Pose d'environ 467 km de conduites, raccordement de 22 300 logements ; Construction de 26 stations de pompage. Construction de 3 STEP et acquisition de matériel d'exploitation.	30,5 M€	AFD	- 87 quartiers assainis - 293 km de réseau posés - 12 stations de pompage réalisées - 15 011 boites de branchement installées	- 96 quartiers assainis - 340 km de réseau posés - 18 stations de pompage réalisées - 16 711 boites de branchement installées

Projet	Durée	Composante	Coût	Finance-ment	Avancement 2020	Avancement 2021
Amélioration de l'environnement des eaux dans les villes locales : de Bizerte, Zaghouan, Béja, Siliana, Le Kef, Jendouba, Kasserine, Sidi Bouzid, Sfax et Kebili	2013-2024	Réhabilitations de 05 STEP ; Extension et la réhabilitation de 662 km de réseaux et 43 stations de pompage dans les 10 gouvernorats.	279 MD	JICA	- Travaux de réhabilitations urgentes de 5 STEP à Beja, Medjez el Bab, Jendouba, Tabarka et Siliana : 15% Lot N°1 : étude en cours Lancement des appels d'offres Lot N°2 : Consultant assistance au contrôle des travaux des 5 STEP : procédures de passation des marchés Lot n°3 : Consultant : Etudes de réhabilitation et d'extension des réseaux et des stations de pompage de 10 gouvernorats : études en cours Tranche prioritaire : travaux achevés à Jendouba et travaux en cours à Kasserine, Sfax Kebili , Sfax Nord	- Travaux de réhabilitations urgentes de 5 STEP à Beja, Medjez el Bab, Jendouba, Tabarka et Siliana : marché résilié à 15% Lot N°1 : Pour STEP Siliana travaux en cours 42%, Medjez el bab : Marché en cours de signature, Jendouba AO en cours de lancement et pour Béja et Tabarka : DAO en cours d'achèvement. Lot N°2 : Consultant assistance au contrôle des travaux des 5 STEP : Pour le lot 2-1 marché en cours de signature pour le lot 2-2 rapport de dépouillement est en cours d'approbation. Lot n°3 Consultant : Etudes de réhabilitation et d'extension des réseaux et des stations de pompage de 10 gouvernorats : études en cours de finalisation Tranche prioritaire : travaux achevés à Jendouba à Kasserine, à Sfax et à Kebili.

Projet	Durée	Composante	Coût	Finance-ment	Avancement 2020	Avancement 2021
Programme d'assainissement contribuant à la dépollution de la Méditerranée "DEPOLMED" : protection de la mer méditerranéenne contre la pollution hydrique ; mise à niveau des réseaux vétustes ; extension du réseau et généralisation des services d'assainissement dans les nouveaux noyaux urbains. (Tranche prioritaire)	2018-2026	1. Composante investissements Extension et réhabilitation de 4 stations d'épuration côtières : Sud Méliane, Sousse Nord/Sousse Hamdoun 2, Kélibia et Jédaida Extension et réhabilitation de réseaux et stations de pompage dans les régions Grand Tunis, Nord, Centre et Sud 2. Composante renforcement des capacités de l'ONAS et du CITET	140 M€	AFD-BEI-UE	L'année 2020 a été consacrée essentiellement à/au : - Lancement des travaux d'extension et de réhabilitation de la STEP Sud Méliane; - Démarrage et la poursuite des travaux d'extension et de réhabilitation des réseaux d'assainissement et des stations de pompage engagés en 2019 et 2020; - La préparation et le lancement des DAO pour les travaux d'extension et de réhabilitation des réseaux d'assainissement et des stations de pompage programmés en 2020 ; - La préparation des dossiers pour les autres marchés à lancer en 2021.	L'année 2021 a été consacrée essentiellement à/au : - **STEP Sud méliane** : la suspension des délais du projet d'extension et de réhabilitation de la STEP Sud Méliane à partir du 17 mars 2021 (retard au niveau de l'engagement du bureau d'études chargé de l'ACTE) ; - **STEP Sousse Hamdoun 2** : l'approbation par la HAICOP du rapport d'évaluation des offres de préqualification des entreprises pour le projet de Sousse Hamdoun 2 ; - **STEP Jediada** : l'établissement du rapport d'évaluation des offres de préqualification des entreprises et sa transmission à la HAICOP pour avis ; - **STEP Kélibia** : la continuation de l'étude d'exécution du projet (Phase APD) ; - Le Démarrage et la poursuite des travaux d'extension et de réhabilitation des réseaux d'assainissement et des stations de pompage engagés en 2020 et 2021; - La préparation et le lancement des DAO pour les travaux d'extension et de réhabilitation des réseaux d'assainissement et des stations de pompage programmés en 2022 ; - La préparation des dossiers pour les autres marchés à lancer en 2022.

ANNEXE 2a : Liste des Projets et des Résultats de recherche dans le domaine de l'Eau dans les établissements relevant de l'IRESA

1. Projets achevés

Intitulé du projet	Etablissement	Période de réalisation	bjectifs
Adoption de la stratégie de l'irrigation déficitaire pour une meilleure efficience de l'utilisation de l'eau en cultures légumières sous serres	**CRRHAB Chott Mariem**	Septembre 2017 – Août 2019	**Objectifs Globaux** Appui scientifique et technique en matière d'économie en eau et de maitrise des besoins hydriques des cultures légumières sous serres mono-tunnel plastique au Sahel Tunisien
Eau virtuelle et sécurité alimentaire en Tunisie: du constat à l'appui au développement (EVSAT/CAD)	**ESA Mograne**	2012-2015	Evaluer le potentiel et les enjeux de l'eau virtuelle de la stratégie de sécurité alimentaire en Tunisie
Impact des changements climatiques sur le rendement des cultures en Tunisie en utilisant un modèle agrohydrologique	**ESA Mograne**	2019	Planification d'une stratégie d'adaptation des grandes cultures aux changements climatiques
ERANET-MED « Global CHanges: Assessment and Adaptation for Mediterranean Region Water Scarcity» / CHAAMS	**INAT**	Octobre 2019 – Septembre 2022	**Objectifs Globaux** Développer des méthodes combinant données, enquêtes et outils de modélisation pour établir les trajectoires possibles d'évolution des ressources et proposer des outils d'aide à la gestion de l'eau agricole
E-NUNDATION- Pour une gestion opérationnelle des inondations– Déploiement à Bou Salem (Tunisie)	**INAT**	Juin 2021 – Octobre 2022	**Objectifs Globaux** Le présent projet vise à améliorer les dispositifs de gestion de crise et implanter E NUNDATION, un outil d'aide à la décision pour la gestion des inondations, sur l'oued Medjerda dans le secteur de Bou Salem.

Optimizing Water Management for Cultivated Lands through Remote Sensing Analyses and Climate Change Scenarios (OptiMED-Water)	**IRA Medenine**	Septembre 2018-Août 2021	**Objectifs Globaux** - Utilization of remote sensing data for use in water management - Climate and crop modeling for water management scenarios
Bringing Innovation and Sustainability Along the Whole Value Chain in the MEDIterranean TOMATO Industry, MEDITOMATO	**INRGREF**	1er Juin 2019 – 30 Novembre 2022	**Objectifs Globaux** L'objectif principal de MEDITOMATO est (i) d'offrir des solutions technologiques innovantes couvrant la chaîne de valeur de la tomate permettant à ce secteur de progresser à différents niveaux (environnement, qualité et sécurité alimentaire, durabilité, traçabilité, efficacité et gestion de l'eau).
Etude des besoins en eau d'irrigation pour différents types d'oasis et son impact sur la qualité des dattes	**CRRAO** Degueche	2014-2017	**Objectifs globaux** L'amélioration de la qualité des dattes à travers l'économie et la valorisation de l'eau.

2. Projets de recherche en cours

Intitulé du projet	Etablissement	Période de réalisation	Objectifs
Adoption de l'irrigation déficitaire comme stratégie d'économie en eau et d'amélioration de la qualité des fruits du Grenadier	**CRRHAB** Chott Mariem	Septembre 2020 – Août 2022	**Objectifs Globaux** Economie de l'eau d'irrigation et amélioration de l'efficience de l'utilisation de l'eau (EUE) et de la qualité des fruits chez le grenadier.
Managing water resources within Mediterranean agrosystems by accounting for spatial structures and connectivities (ALTOS)	**INAT / CERTE / INRGREF / SUPCOM**	Février 20220 – Juin 2024	**Objectifs Globaux** Le projet ALTOS a comme objectif, l'amélioration des modèles de gestion et d'aménagement des ressources en eau en agriculture pluviale et irriguée en considérant la structure spatiale et la connectivité des infrastructures hydro-agricole et des pratiques.
E-NUNDATION- Pour une gestion opérationnelle des inondations– Déploiement à Bou Salem (Tunisie)	**INAT**	Juin 2021 – Octobre 2022	**Objectifs Globaux** Le présent projet vise à améliorer les dispositifs de gestion de crise et implanter E NUNDATION, un outil d'aide à la décision pour la gestion des inondations, sur l'oued Medjerda dans le secteur de Bou Salem. L'application du modèle hydraulique HECRAS2D ainsi que le traitement d'une image Satellitaire Sentinel 1 band Radar pour la cartographie du risque inondation.

ERANET MED OPTIMED WATER	**INAT**	mai-23	**Objectifs Globaux** Optimed Water porte sur l'Optimisation de la gestion des ressources hydrauliques en agriculture irriguée grâce à une analyse spatiale et temporelle des données de télédétection, des observations sur terrain et des scénarios de changement climatique.
Innovation et développement économique, social et solidaire pour une oasis durable / IDES	**INAT**	Octobre 2020 – Septembre 2024	**Objectifs Globaux** Le projet IDES va construire, en concertation avec les acteurs de l'oasis de Jemna, une réponse au triple défi d'une gestion durable d'un point de vue environnemental, d'une bonne valorisation économique et de la constitution d'un cadre de gouvernance efficient mettant la population locale au centre.
Mind the Water Cycle Gap: Innovating Water Management Optimisation Practice (IN WOP)	**INAT**	1er juillet 2019 - 30 Juin 2023	**Objectifs Globaux** Etudier la contribution de l'optimisation à plusieurs objectifs à la gestion intégrée des ressources en eau (GIRE), sur trois cas d'étude dans une évaluation comparative dans divers contextes hydrologiques et culturels, en Tunisie, Italie et France
PHC UTIQUE IPASS	**INAT**	mai-23	**Objectifs Globaux** Le projet PHC Utique IPASS vise, en s'appuyant sur des données de proxi et de télédétection, à caractériser les productions agricoles et plus précisément à étudier leur impact sur les propriétés fonctionnelles et les services écosystémiques des sols. Ainsi, en ciblant de multiples phases clés des cycles agricoles dans deux contextes pédoclimatiques très contrastés.
Approche Biotechnologique intégrée pour améliorer le rendement des cultures, la biodiversité et la résilience des agroécosystèmes méditerranéens Acronyme : ReCROP	**INAT**	01/06/2021 – 31/05/2024	**Objectifs Globaux** Identification des agrosystèmes en intercalaire efficients pour améliorer les rendements tout en utilisant moins de ressources. Fournir aux agriculteurs et à l'écosystème des preuves soutenant qu'un système de production bien géré conduit à une durabilité accrue du système agricole en améliorant les efficiences de l'utilisation des ressources naturelles et principalement la ressource en eau
TALANOA WATER - Talanoa Water Dialogue for Transformational Adaptation to Water Scarcity Under Climate Change	**INAT**	Juin 2021 à Mai 2025	**Objectifs Globaux** Le projet TALANOA-WATER se base sur l'information et l'adoption de stratégies d'adaptation transformationnelles robustes vis à vis la rareté de l'eau et face au changement climatique qui contribuent aux objectifs de la gestion intégrée des ressources en eau (GIRE).
TRUST – Management of industrial Treated wastewater ReUse as mitigation measures to water Scarcity in xxvlimate change context in two Mediterranean regions	**INAT**	Juin 2021 à Mai 2024	**Objectifs Globaux** Contribuer à réduire la pénurie d'eau dans les régions méditerranéennes. Le projet envisage une des mesures d'atténuation potentielles qui est la réutilisation des eaux usées industrielles traitées, soit dans les processus industriels, l'irrigation ou dans la recharge d'aquifères.

A novel Condensation Supported Greenhouse Irrigation System (CONSIRS)	**INRGREF**	01 février 2020 – 31 Juillet 2023	**Objectifs Globaux** La mise en place d'un système innovant de récupération de l'eau et d'irrigation des serres agricoles basé sur le principe de l'évapo-condensation combinée en circuit fermé. Le système sera intégré dans des serres à climat contrôlé utilisant les techniques de climatisation passive.
Traitement des Eaux uSées et des bOues Résiduaires par filtres plantés et usage agricole durable – TRESOR	**INRGREF / CERTE**	01/07/2019 – 31/09/2023	**Objectifs Globaux** Conservation et utilisation durable des ressources naturelles Diffuser les traitements naturels des eaux usées traitées et des boues résiduaires Valoriser les eaux usées traitées et les boues résiduaires en agriculture
SUSTAINABLE PRODUCTION IN WATER LIMITED ENVIRONMENTS OF MEDITERRANEAN AGRO-ECOSYSTEM-SUPROMED.	**INRGREF**	1er Octobre 2019 – 31 Décembre 2022	**Objectifs Globaux** SUPROMED fournira un système holistique de gestion de l'eau pour l'agriculture et l'élevage résilient au changement climatique. En détail, une plate-forme informatique (technologie de l'information) spécialement conçue pour conseiller intelligemment les agriculteurs dans la gestion efficace de l'eau des systèmes de culture et d'élevage méditerranéens sera livrée. Via l'application de la gestion innovante de l'eau d'irrigation, SUPROMED prévoit une augmentation de 10-20% de la production, avec un impact général sur le revenu des agriculteurs et sur l'utilisation des ressources : eau et énergie.
Programme d'Encouragement des Jeunes Chercheurs PEJC, 3ème Edition (2020) : « Etude à long terme de la contribution et de la dynamique de l'érosion ravinaire dans les flux de sédiments à l'exutoire de deux bassins versants semi-forestiers de la Dorsale Tunisienne et du Cap Bon ».	INRGREF	Juin 2021-Juin 2023	**Objectifs Globaux** Evaluer à long terme l'origine des sédiments et la dynamique du ravinement à l'échelle de deux bassins versants semi-forestiers de la Dorsale Tunisienne et du Cap Bon par une approche combinant le suivi de terrain pour la décennie 2010-2022 et de la photo-interprétation sur la période 1960-2022.
WISPER_ Water-efficient Innovative Solutions Portfolio for Enhancing Resilience	INRGREF	16/10/2020 _15/10/2023	**Objectifs Globaux** Contribuer à la promotion d'une utilisation efficace de l'eau dans les zones rurales en Tunisie et en Jordanie afin de s'adapter et de renforcer la résilience aux impacts du changement climatique sur l'eau.
Precision Irrigation with Cost-effective and Autonomic IoT Devices using Artificial Intelligence at the Edge (OSIRRIS)	INRGREF	12/2021-12/2024	**Objectifs Globaux** : Pilotage de l'irrigation en temps réel. Conception d'un outil d'aide à la gestion de l'eau à l'échelle de la parcelle. Amélioration des efficiences de l'irrigation et de l'utilisation de l'eau.
Mediterranean wAter management solutions for a sustainable aGriculture supplied by an Online collaborative platform (MAGO)	INRGREF	3 ans (2021-2024)	**Objectifs Globaux** Le projet MAGO se veut une contribution à la démonstration/présentation des solutions innovantes pour améliorer la gestion intégrée des ressources en eau (GIRE) pour une agriculture durable dans la région méditerranéenne. Ces solutions renfonceront l'efficacité de l'utilisation de l'eau dans l'agriculture, l'utilisation de ressources en eau alternatives et l'adaptation aux changements climatiques.

Boosting Nexus Framework Implementation in the Mediterranean Acronym: BONEX	BIOAZUL SL	3 années (mai 2022-avril 2025)	**Objectifs Globaux** Produce a novel, robust, transdisciplinary, and diagnostic WEFe Bridging Framework (named WEFeF) to serve the production of context-specific Nexus Bridging Plans (NBPs) tailored to different innovative technologies and its combination (e.g. solar powered water reuse, agrivoltaics, and solar irrigation) and socioeconomic contexts across the MedRegion. The WEFeF combines methods in a context-specific manner, mobilizing transdisciplinary collaboration to go beyond disciplinary silos and integrate system, practice, and transformation knowledge.
PAIRWISE- Dispersal of antibiotic resistance and antibiotics in water ecosystems and influence on livestock and aquatic wildlife	INRGREF	_____	**Objectifs Globaux** Etudier la dispersion de la résistance aux antibiotiques et des antibiotiques dans les écosystèmes aquatiques et leurs influences sur le bétail et la faune aquatique.
Open innovation Hub for Irrigation Systems in Mediterranean agriculture	INRGREF	01/10/2020 to 30/09/2024	**Objectifs Globaux** The main objective is to favour the emergence, evaluate and boost innovations aiming at reducing the performance gap and thus improve the sustainability of irrigation systems in the Mediterranean region. These innovations comprise new tools and services for farmers and water users associations (WUA), designed to increase water, nutrient and energy use efficiency. Innovation development leading to adoption of new standards will rely on bottom-up processes, understanding of governance settings and implementation of sharing procedures, through innovation hubs developed by the project.
Gestion du phénomène d'envasement et du risque d'érosion des bassins versants des grands barrages de la nature	ISP Tabarka	2021-2023	**Objectifs Globaux** Analyser les risques d'érosion Gérer convenablement les aménagements GES
Effets du biochar sur la rétention en eau, biofertilité des sols et culture du blé sous stress hydrique et salin (EBI REB SHS)	CRRGC Béja	Juillet 2020-Février 2023	**Objectifs Globaux** L'objectif général du projet est l'étude de l'effet du biochar sur l'amélioration des paramètres physico-chimiques et biologiques des sols ainsi que les performances agronomiques de la culture du blé dans un contexte de déficit hydrique et de changement climatique / dégradation des ressources en eau et sols
Caractérisation de l'apport des eaux usées traitées en microparticules de plastique et impact sur la biofertilité des sols agricoles	CRRGC Béja	Juin 2021- Juin 2023	**Objectifs Globaux** Ce travail a comme objectifs de : *Identifier et caractériser la présence des particules de plastiques dans les eaux usées traitées. *Evaluer l'effet de ces particules apportées par les Eaux Usées Traités sur la biofertilité des sols agricoles.
Capacity enforcement of agricultural research for climate change response (CCA)	CRRGC Béja	2022-2024	Obj1- Rendre l'information scientifique sur le changement climatique disponible dans une plateforme destinée aux chercheurs et décideurs travaillant dans une politique scientifique régionale pour l'évaluation du changement climatique et ses effets agronomiques dans le nord-ouest de la Tunisie. Obj2- Évaluer une synthèse complète des connaissances sur le changement climatique mondial en

			modélisant sa variabilité et son évolution sur plusieurs échelles de temps et selon plusieurs modèles de réduction d'échelle et scénarios d'émissions. Obj3- Concevoir le système de polyculture-élevage aux impacts potentiels du changement climatique par des pratiques durables Obj4- Sensibiliser les agriculteurs aux bonnes pratiques tout en préservant et valorisant les ressources et l'environnement Obj5- Développer une stratégie de gestion des sols adaptée pour renforcer la résilience climatique des petites exploitations céréalières du Nord de la Tunisie et développer des pratiques agroécologiques ciblant les microbiomes du sol pour favoriser la biodiversité souterraine. Obj6- Garantir des systèmes de production alimentaire durables et mettre en œuvre des pratiques agricoles résilientes qui augmentent la productivité et la production, qui aident à maintenir les écosystèmes, qui renforcent la capacité d'adaptation au changement climatique, aux conditions météorologiques extrêmes, à la sécheresse, aux inondations et autres catastrophes et qui améliorent progressivement la qualité des terres et des sols Obj7- Renforcement des capacités en facilitant le développement, la diffusion et le déploiement des technologies et en développant les aspects pertinents de l'éducation, de la formation et de la sensibilisation du public
Gestion de l'eau et du sol pour une agriculture durable	ESA Mograne	2014-2019 et 2019-2022	Gestion de l'irrigation, érosion, salinisation des sols, surexploitation

ANNEXE 2b : Liste des Projets en cours au CERTE

1. Projets en cours dans le cadre de la coopération nationale

Nom de Projet	Laboratoire/unité	Partenaires
PRF---Eau 2019---D1P6 : Approche Systémique de la gestion des ressources en eau et employabilité des compétences vertes, AS---HYDRO	LR15CERTE01 Laboratoire de Géoressources	CERTE / INGREF / FSSfax
EJC : Développement d'un capteur Raman pour la détection et la quantification des microplastiques dans les Eaux conditionnées	LR15CERTE02 Laboratoire Dessalement et Valorisation des Eaux Naturelles	
VRR : Procédé de prévention de l'entartrage des eaux potables		SONEDE / CRDA
PRF---Eau : Nanomatériaux appliqués à l'environnement	LR15CERTE03 Laboratoire Eaux Usées et Environnement	CERTE, FST, FSG, CITET Politech---Gabes
EJC : Dépollution des eaux naturelles chargées en minéraux par absorption en vue de sa potabilisation	LR15CERTE04 Laboratoire Eau, Membranes et Biotechnologie de l'Environnement	
EJC : Application du procédé électrochimique de d'ionisation capacitive avec des électrodes à base de nanomatériaux de carbone pour le dessalement des eaux salines et l'élimination des métaux lourds		
VRR : Valorisation des rejets des industries des boissons sucrées par production de microorganismes et de métabolites d'intérêt	LR15CERTE05 Laboratoire Traitement & Valorisation des Rejets Hydriques	Société Tunisienne des Boissons Gazeuses
VRR : La mise en place d'un système nationale de surveillance de la qualité virologique des eaux usées traitées en Tunisie		

2. Projets en cours dans le cadre de la coopération internationale[22]

Nom de Projet	Laboratoire/unité	Partenaires
PRIMA (INWAT): Quality and management of intermittent river and groundwater in the Mediterranean basins (http://inwatproject.eu/partners)	LR15CERTE01	CSIC, Spain ICRA, Spain Univ---Jijel, Algeria UDE, Germany UM, France UNIBA, Italy,
TUNISO---ALGERIE : Modélisation de l'interaction Hydro---Agro- Climatique pour la gestion conservatoire des ressources en Eaux et en sol au profit du développement durable des bassins Sud---méditerranéens		
Tuniso---Portugais : Aléa minier : Paysage et mobilisation des éléments traces métalliques(ETM) dans le milieu naturel, Exemple de l'ancienne mine de Hammam Zriba (NE de la Tunisie)		
PRIMA (HaloFarsMs): Development and Optimization of Halophyte based Farming systems in salt-affected Mediterranean Soils.	LR15CERTE02	CBC, Tunisia INRA, France Université Bretagne, France Université Pisa, Italie SCIC, Spain LUISA, Portugal DRC, Egypt

[22] *Les projets en coopération avec des établissements relevant de l'IRESA ne sont pas repris ici (ct 1ère partie de l'annexe)*

TUNGER 2+2---WaterReTUNe, Desalination, nutrient recovery and diversified valorization techniques of nature based recycled wastewater.		FiW, Germany TERRA, Germany ONAS INAT GDA Sidi Amor Art des Jardins, Tunisie
France (projet REUSE---INTAE): Integrated VAlorization of liquid and Solid Waste		
PHC--- UTIQUE : Procédé continu d'électrocoagulation pour la potabilisation des eaux naturelles Tunisiennes.		
PRIMA, Sustain---Coast: Sustainable coastal groundwater management and pollution reduction through innovative governance in a changing climate. https://www.sustain-coast.tuc.gr/en/home	LR15CERTE03	
PHC ---UTIQUE Traitement électrochimique des eaux usées chargées en polluant émergeant utilisant des anodes innovatrices et à coût maitrisé		
PRIMA: Smart irrigation cube for sustainable agriculture in the Mediterranean region		
PHC--- MAGHREB : Matériaux Carbonés Biosourcés pour des applications énergétiques, environnementales et agronomiques.		
TUNISO---ALGERIE : Conception optimisation d'un procédé Eco---innovant et parfaitement rentables basé sur la technologie membrane pour le traitement des Effluents issus d'une savonnerie pour une réutilisation durable Gestion innovante de déchets d'industries agro---alimentaire. Valorisation énergétique, environnementale et agronomique		
ENI_CBCMED---MEDWAYCAP: The MEDiterranean PATHWAY for innovation CAPitalisation toward an urban---rural integrated development of non---conventional water resources (MEDWAYCAP)		
ERANETMED---FRAME: Development of the frame conditions for the establishment of an innovative water technology which couple's anaerobic wastewater treatment and biomass production in a bioreactor in the Mediterranean region		
ERANETMED 2---FERTICHARD: Recovery of olive oil by---products through bio---hydrochars for agricultural soil fertilization and environment preservation https://fertichar.net/index.php/en/omada---ergou		
PRIMA---InTheMed: Innovative and Sustainable Groundwater Management in the Mediterranean. https://www.inthemedprima.com		
TUN---GER 2+2--- SUSPIRE: Sustainable Decentralized industrial wastewater recycling in rural areas- poultry slaughterhouse as example,		
ENI_CBCMED---NAWAMED: Nature Based Solutions for DomesticWater Reuse in Mediterranean Countries. www.enicbcmed.eu/projects/nawamed		
TN--- Maghreb : Mise au point d'un procédé innovant de traitement des effluents fromagers et étude de leur valorisation en agriculture	LR15CERTE05	
ENI_CBCMED---AQUACYCLE: Towards Sustainable Treatment and Reuse of Wastewater in the Mediterranean Region, http://www.enicbcmed.eu/fr/projets/aquacycle		

Prima: Initiative de **P**artenariat pour la **R**echerche et l'**I**nnovation dans la **R**égion **M**éditerranéenne « **PRIMA** » dans le cadre du programme européen Horizon 2020

ENI_CBCMED est la plus grande initiative de coopération transfrontalière (CTF) mise en œuvre par l'UE dans le cadre de l'instrument européen de voisinage (IEV).

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