Report on the current situation in the water sanitation sector and providing recommendations for an institutional and a legal framework for the future MRV system for the water sanitation sector

ICAT Initiative for Climate Action Transparency

Initiative for Climate Action Transparency - ICAT

Design of an MRV system for the reduction of emissions in the sanitation sector in Tunisia

Deliverable #3

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Summary

Abbreviation list

AFAT: Agriculture, Forêt et Autres utilisations des Terres
AFD: The French Development Agency
AfDB: African Development Bank Group
ANP: National Agency for Environmental Protection
BUR: Periodic Information Review
CADRIN: Industrial Waste Cadastre
CDM: Clean Development Mechanism
CO2: Carbon dioxide
COP: Conference of the Parties
EIA: Environmental Impact Assessment
ETF: Enhanced Transparency Framework
GGGI: Global Green Growth Institute
GHG: Greenhouse Gas
GIS: Geographic information systems
GIZ: The German Agency for International Cooperation
ICA: International consultation and analysis
ICAT: Initiative for Climate Action Transparency
ICTs: Information and communication technologies
IPCC: Intergovernmental Panel on Climate Change
ISO: International Organization for Standardization
IT: Information technology
KPIs: Key performance indicators
MPGs: Modalities, Procedures and Guidelines
MRV: Measurement, Reporting and Verification
NAMAs: Appropriate National Mitigation Measures (NAMAs)
NC: National Communication
NCs: National Communications
NDC: Nationally Determined Contribution
ONAS: Office National de l'assainissement (National Sanitation Office)
PNAEPA: Programme National d'Alimentation en Eau Potable et d'Assainissement 2011-2015 (PN-AEPA 2011-2015)
SDGs: Sustainable Development Goals
SONEDE: The National Water Exploitation and Distribution Company
TNA: Technology Needs Assessment
UGPO: Management by Objectives Unit
UN Water: United Nations Water
UNECE: United Nations Economic Commission for Europe
UNEP-CCC: United Nations Environment Programme Copenhagen Climate Centre
UNESCO: United Nations Educational, Scientific and Cultural Organization
UNFCCC: United Nations Framework Convention on Climate Change
UNICEF: The United Nations International Children's Emergency Fund

UNOPS: National Climate Change Coordination Unit-UGO-CC Tunisia
WHO: World Health Organization
WWTPs: Wastewater treatment plants

Introduction

Water sanitation is a major challenge for the public health of citizens and for the achievement of the Sustainable Development Goals in general. In Tunisia, as in many developing countries, the sanitation sector faces considerable challenges in terms of access, management and quality of services.

Since its independence, Tunisia has sought to invest in the provision of running water to its citizens and to build water sanitation networks according to international standards. The National Office for Water Sanitation was set up to support the country's growing urbanization and changing needs. ONAS was able to support the structural changes of the Tunisian economy and demographic needs until the early 2000s. But these developments have been interrupted for many reasons (political instability, budgetary crisis, public management...).

Nowadays, ONAS is faced with a triple constraint. First, while a very large proportion of the Tunisian population is connected to the ONAS sanitation network, a significant proportion of the population, particularly in rural areas, remains without access to these services. Universal coverage of this service poses a major challenge in a context of uncontrolled urbanization over the last decade. Secondly, the management of sewerage networks requires significant investments in order to upgrade them and adapt them to new realities (population density). The lack of network maintenance and resizing will have an impact on network quality. Finally, in the face of repeated droughts, ONAS waters are an important source for peri-urban agriculture. The need to use adequate treatments and to develop the resource requires ONAS to make heavy investments. At the same time, ONAS is faced with a pricing system, imposed by the legislator, which allows it to recover its costs weakly.

In addition, the recent international context has led to the consideration of the water purification sector as a priority sector in climate change adaptation and mitigation policies. Indeed, Tunisia has committed to reducing its carbon intensity by 45% by 2030 as part of its new Nationally Determined Contribution (NDC). This effort concerns the entire economy, including the sanitation sector, which is one of the key sectors. On the one hand, wastewater is considered to be of paramount importance in a country experiencing acute water stress and is threatened in its food self-sufficiency strategy. On the other hand, the sector is a net emitter of GHGs and it is necessary to know its emissions balance in order to reduce them or use them for energy purposes. The prerequisite for these changes is to set up a Measurement, Reporting and Verification (MRV) system in accordance with the Paris Agreement (Article 13).

The establishment of an effective MRV system is essential to monitor and evaluate progress in improving sanitation and reducing associated GHG emissions. In 2012, Tunisia launched consultations for the development of a national MRV system. The objective of the MRV is to set up an information system that ensures transparency in the monitoring and evaluation of GHG mitigation objectives and policies. Several sectoral MRVs have been set up in Tunisia, but a national MRV is not yet in place. The implementation of the MRV system in the energy sector has made significant progress.

Two other sectors that have already designed their MRV are construction and cement based on international methodological recommendations. Each MRV system has three components. First, MRV of national GHG emissions, which will be responsible for the development of GHG inventories, reporting and verification. Second, MRV mitigation measures, which will be responsible for monitoring, reporting and verifying the impacts of mitigation measures (emission reductions, co-benefits, etc.). Thirdly, MRV support, which will be responsible for monitoring, reporting and verifying actions carried out, and for which support has been received (funding, technology transfer and capacity building).

This report aims to take stock of the water sanitation sector in Tunisia, focusing on the challenges and opportunities related to the implementation of a MRV system. It is based on an analysis of the international context, including the Sustainable Development Goals (SDGs) and the Paris

Agreement, as well as national initiatives on water management and sanitation. The report makes recommendations to strengthen the institutional and legal framework and improve data for the future MRV system, with a view to facilitating the planning, implementation and monitoring of actions and projects related to sanitation and greenhouse gas emission reduction.

This report is produced with the support of the ICAT project. Within the framework of ICAT, UNEP-CCC and ISPRA with the Ministry of Environment (National Climate Change Coordination Unit-UGO-CC Tunisia) aims to support the development of an MRV system for the water and sanitation sector in Tunisia including institutional arrangements and a system for the collection, treatment and valorization of wastewater data as well as the monitoring of mitigation measures and capacity building of national and local actors.

The methodology used is a mixed approach, combining individual interviews with about thirty ONAS executives, field visits, focus groups and a full document review. Qualitative interviews were essential to gather relevant information for the drafting of the report**.** They were made over a period ranging from 5 April to 26 April. The names of the persons met as well as our sources of information are provided in Appendix 1.

The report is structured in six parts. In the first part, we will analyze international and national issues related to sanitation, current legislation and regulations, as well as challenges and opportunities for the establishment of an MRV system in Tunisia. We will also address key aspects of designing such a system, such as data collection and management, measurement methodology and data quality, and verification and monitoring of progress. Finally, we make recommendations to strengthen institutional capacity, improve the legal and regulatory framework, and optimize data management to establish an effective and sustainable MRV system in Tunisia's sanitation sector.

1. Background

Key points of this chapter

- The issue of water is an important concern on the international research agenda because of its crucial role in sustaining life, supporting ecosystems and driving economic development.
- The scarcity of water resources, marine intrusion and overexploitation of groundwater weigh on Tunisia's water balance and put it on an unsustainable trajectory.
- Tunisia faces major challenges in water management and sanitation, such as chronic water scarcity, unequal access to sanitation services, climate change, and the need for capacity building.
- Water management policies in Tunisia have enabled a mobilization rate of conventional water of more than 95%, to achieve a rate of supply of drinking water to the national population that is close to 98% and to increase the area of irrigated perimeters to more than 450,000 ha.
- The WATER 2050 strategy aims to keep Tunisia permanently above the coast of water stress, namely 500m3/year/inhabitant (+/- 10%), and ensure a balance in the distribution of national water resources between regions.

1.1. International context

The problem of water in the world is a crucial issue. Today, it occupies the top of the international sustainability agenda. This is particularly the case with regard to the 2030 Agenda - the Sustainable Development Goals (SDGs), specifically SDG6 named “Clean Water and Sanitation”, promoted by the United Nations, the UNECE Water Convention, the United Nations Convention on the Law of the Non-navigational Uses of International Watercourses (the United Nations Watercourses Convention) etc. The issue of water is an essential finite resource for various uses such as agriculture, industry, energy and domestic uses. However, water scarcity, pollution and inadequate access to safe drinking water pose significant global challenges.

Water scarcity has become one of the most pressing global challenges of the 21st century. With population growth, climate change and unsustainable water management practices, the availability of freshwater resources is rapidly declining. More and more people need water for drinking, sanitation and agriculture, increasing the pressure on available resources.

The global average of global warming has already reached 1.1°C, but the IPCC (2022) warns of dramatic global warming of +3.2°C if no significant action is taken. About 3.3 to 3.6 billion people live in contexts of very high vulnerability to climate change. The decline in biodiversity, the increase in the frequency and spread of diseases, heat waves and deadly droughts, as well as agricultural losses are all consequences of this global warming. In addition, the physical and mental health of populations will also be impacted. Vulnerability to climate change varies across regions of the world for socio-economic, historical or governance reasons.

Global warming is changing precipitation patterns, leading to increased rainfall variability and prolonged droughts in many regions. Changing climatic conditions affect water availability, making it a scarce resource in areas already prone to aridity.

Poor water management practices, including overuse, inefficient irrigation techniques and inadequate infrastructure, contribute significantly to water scarcity. These practices lead to waste, contamination and depletion of freshwater sources.

Water scarcity poses a significant threat to human well-being, environmental sustainability and economic development worldwide. Addressing this crisis requires collective efforts, both locally and globally, to implement sustainable water management practices, promote water conservation and invest in infrastructure development. By recognizing the importance of water as a finite resource and taking proactive action, we can ensure a water-secure future for generations to come.

1.1.1. The Sustainable Development Goals (SDGs) and sanitation challenges

Globally, 2.2 billion people lack access to safe drinking water and 4.2 billion do not have access to safely managed sanitation (UNICEF, 2019). Lack of access to safe drinking water and sanitation has adverse consequences for public health, the environment and socio-economic development. Every year, about 297 000 children under the age of 5 die from diarrhoeal diseases due to lack of access to safe drinking water, sanitation and hygiene (WHO, 2023).

Progress towards SDG 6 named "Clean Water and Sanitation" is uneven, and the most vulnerable populations are often the most affected (UN Water, 2020). People living in rural areas, internally displaced persons and populations living in conflict-affected areas often face challenges in accessing quality water and sanitation services. Gender, income and ethnic inequalities can also affect access to water and sanitation (UNICEF, 2019).

Partnerships between governments, the private sector and civil society are essential to mobilize the resources needed to achieve SDG 6 (AFD, 2022). Investments in sanitation infrastructure would need to reach $114 billion per year to achieve SDG 6 by 2030 (World Bank, 2019). Partnerships can also facilitate knowledge exchange, implementation of innovative technologies and capacity building in the sanitation sector (GIZ, 2023).

Efforts to improve sanitation are essential to protect human health, preserve the environment and build resilience to climate change. Sustainable sanitation systems can contribute to reducing greenhouse gas (GHG) emissions, protecting water resources and preventing pollution (SFM, 2022). Investments in sanitation can also have multiplier effects on other sectors, such as education, gender equality and poverty reduction.

Technological innovations and integrated approaches are key to improving access to sanitation and achieving SDG 6. Decentralized sanitation systems, wastewater treatment technologies, and the reuse of treated wastewater for agricultural irrigation are examples of promising innovations (World Bank, 2017). The implementation of these technologies can help reduce pressures on water resources, improve water quality and support food security.

Awareness raising and community engagement are key to ensuring the sustainability of sanitation interventions. Hygiene promotion programmes, awareness-raising campaigns and education initiatives can help strengthen sanitation behaviours and practices. Involving local communities in the planning, implementation and management of sanitation systems can also improve the sustainability and effectiveness of interventions (UNESCO, 2019).

1.2.2. The Paris Agreement and the United Nations Framework Convention on

Climate Change (UNFCCC)

The emergence of the term "MRV" (Measurement, Reporting and Verification) took place at COP13 in Bali in 2007. This concept was introduced to ensure that developed countries' climate change mitigation commitments are credible, coherent and embedded in an integrated approach to sustainable development (COP13, 2007). The MRV aims to support these commitments with support measures in terms of funding or capacity building.

COP16, held in 2010 in Cancún of Mexico, clarified the nature of the reporting required and the data verification processes. Developed countries should formulate their mitigation commitments in a biennial report and support developing countries financially and technologically. Capacity building and skills transfer have also taken on an important dimension in the international consultation and analysis (ICA) process (COP16, 2010).

At COP21, held in 2015 in Paris of France, an Enhanced Transparency Framework (ETF) was created, representing the backbone of the Paris Agreement. The ETF aims to ensure greater transparency and accountability in the implementation of countries' climate commitments (COP21, 2015). The Modalities, Procedures and Guidelines (MPGs) were adopted at COP24 in 2018 to support the implementation of Article 13 of the Paris Agreement, thereby strengthening the enhanced transparency framework (COP24, 2018).

COP27, held in 2022 in Sharm El Sheikh of Egypt, highlighted the importance of water in climate policy negotiations. Participants discussed the challenges of water management and sanitation infrastructure in the face of climate change and advocated for better integration of water issues into climate policies and strategies. The World Water Council also stressed the need to integrate water management and climate issues, especially at COP21.

1.2. The Tunisian context

Because of its scarcity, water is a fundamental issue for the future and current development of Tunisia. The country is arid for most of its territory, being among the group of countries with the least water resources on the planet. Therefore, in recent decades, drinking water has occupied an important place in Tunisia's economic and social development plans. The efforts made have made it possible to improve the conditions of drinking water supply in terms of quality and quantity in both rural and urban areas.

The scarcity of water resources, marine intrusion and overexploitation of groundwater weigh on Tunisia's water balance and put it on an unsustainable trajectory. Water management policies in Tunisia have enabled a mobilization rate of conventional water of more than 95%, to achieve a rate of supply of drinking water to the national population that is close to 98% and to increase the area of irrigated perimeters to more than 450,000 ha. The rate of groundwater exploitation nationwide is consistently above 100%.

The sanitation sector in Tunisia is an essential support to the development effort and a main factor for the preservation of the health of the citizens and the sustainability of the environment. The sanitation infrastructure has until the end of 2019 about 17188 km of pipeline against 7700 km twenty years before. The number of wastewater treatment plants - WWTP is 122 units at the end of 2019. The rate of access to adequate sanitation covers 61.5% of housing in 2014 against 53.4% in 2004 and 20.7% in 1975. For the sanitation network (ONAS), it covers a fairly high proportion of housing of around 86.1% (2019) in communal areas and a low proportion of dwellings not exceeding 10.2% in non-communal areas. In areas supported by ONAS, the grid connection rate

is 90.3%, while the national rate is only 56% (2019).

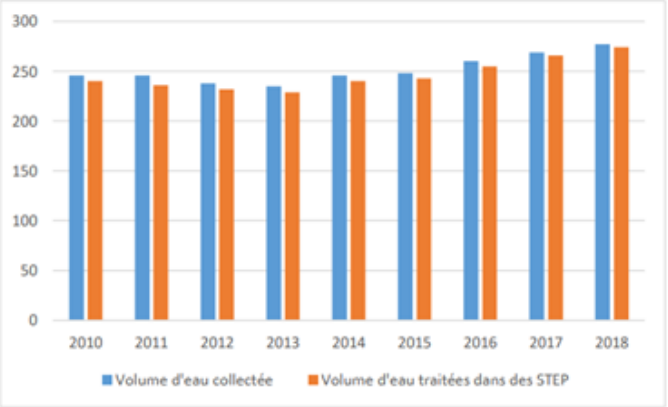

Figure 1. Evolution of the quantities of wastewater collected and those treated

The mobilization of surface water remains limited because of low rainfall, between 500 and 1000 mm in the North, between 200 and 500 mm in the Center and less than 100 mm in the South, and because of drought periods that bring only 11 billion m3/year compared to years of heavy rainfall with 90 billion m3/year. In addition, the siltation of dams and the reduction of their storage volume constitute a significant loss for the availability of surface water resources.

In this sense, the 2030 water strategy and the 2016-2020 five-year development plan for the agricultural sector have provided for the use of new approaches to the mobilization of non-conventional waters, mainly seawater desalination and the reuse of treated wastewater, which would alleviate the pressures currently exerted on conventional waters and contribute to the achievement of the objectives of the envisaged 2050 water strategy. In this respect, it should be mentioned that a Tunisian has on average only 400 m3 / year of water mobilized for all uses, a volume below the water stress threshold of 500 m3 / year accepted internationally. This average is likely to decrease significantly in the coming years as a result of climate change.

One of the expected results of the EAU 2050 strategy is to keep Tunisia permanently above the coast of water stress, namely 500m3/year/inhabitant (+/- 10%), and to ensure a balance in the distribution of national water resources between regions. This situation will be achieved by improving the rate of mobilization of floodwaters and groundwater recharge, increasing the storage capacity of dams and desalination.

ONAS, which is responsible for urban wastewater management, provides services at the level of municipalities (communes) located in its service area, while providing sanitation services in some more densely populated rural areas (above 3000 eq.hab), in accordance with a 2016 ministerial decision whose implementation is considered slow. The sanitation network (ONAS) covers, in 2019, a fairly high proportion of connected housing of around 90.3% in urban areas in the areas of its intervention (communal), which represents an intervention in 184 municipalities and a small proportion of housing not exceeding 10.2% in rural (non-communal) areas. The connection rate of collected wastewater to the entire WWTP fleet (122 WWTPs) is 88%. Two (2) % of the collected wastewater is not transferred to a WWTP and is therefore discharged without any treatment into the receiving environment.

The obsolescence of the ONAS network and the need to replace pipes that are more than 20 years old complicate the situation today. Indeed, the current networks seem to be no longer in

line with demographic changes and the uses of city dwellers. The renewal of pipelines faces the problem of its financing. In the absence of oversizing of pipes, storms quite often produce flooding and especially an interconnection between rainwater and wastewater.

1.2.1. Specific challenges in terms of access to drinking water and sanitation in Tunisia

Tunisia faces major challenges in water management and sanitation, such as chronic water scarcity, unequal access to sanitation services, climate change, and the need for capacity building, financing and skills transfer.

Chronic water scarcity: Water scarcity in Tunisia is a structural problem, exacerbated by climate change. Water resources are limited and demand continues to increase due to population growth, economic development and urbanization. According to the World Bank (2023), per capita water availability is estimated at about 450 m^3 per year, which is well below the water scarcity threshold of 1,000 m^3.

Unequal access to sanitation services: many Tunisian households do not have access to adequate sanitation services, especially in rural areas. According to UNICEF (2022), although 96% of the population has access to safe drinking water, only 86% have basic sanitation. The rate of access to sanitation in rural areas is even lower, at 73%, compared to 95% in urban areas.

Climate change: climate change is exacerbating water scarcity and sanitation problems in Tunisia. The impacts of climate change, such as rising temperatures, reduced rainfall and increased evaporation, reduce water availability and exacerbate scarcity. In addition, extreme weather events, such as floods and droughts, strain existing water and sanitation infrastructure.

Capacity building, financing and skills transfer: to overcome these challenges and achieve the Sustainable Development Goals on water and sanitation, Tunisia needs to strengthen the capacities of its institutions, mobilize adequate financing and ensure effective skills transfer. Tunisia's commitment to the global process to combat climate change and the update of its Nationally Determined Contribution (NDC) in 2021 demonstrate its commitment to promoting a sustainable and resilient economic development model.

1.2.2. National initiatives to improve water management and strengthen the sanitation sector

Tunisia has put in place several national initiatives to improve water management and strengthen the sanitation sector.

The wastewater treatment project in the Greater Tunis region: this €98 million project aims to improve the water quality of the Bay of Tunis and reduce pollution by building a new wastewater treatment plant. The project is scheduled for completion in 2026 and will benefit approximately 1.5 million people, which covers around 12% of the population of Tunisia (SUEZ, 2023).

The Climate Change Adaptation in the Water Sector Project in Tunisia: This project, funded by the German Agency for International Cooperation (GIZ), aims to strengthen the resilience of the water sector to climate change. It includes the modernization of water infrastructure, the training of local actors and the establishment of an integrated water resources management system.

The National Programme for Access to Drinking Water and Sanitation in Rural Areas (PNAEPA): this programme, funded by the French Development Agency (AFD), aims to improve access to drinking water and sanitation for nearly 400,000 people living in rural areas. The program provides for the construction and rehabilitation of drinking water and sanitation infrastructure, as

well as capacity building for local and national actors (AFD, 2022).

The 2030 Resilience Building Project: this project aims to strengthen Tunisia's resilience to climate change by improving water management and sanitation. It includes setting up monitoring and early warning systems, training local and national actors, and integrating climate risk management into development policies and plans (Ministry of Environment, 2022).

Rural Solid and Liquid Sanitation Project: this project, funded by the World Bank, aims to improve access to solid and liquid sanitation for approximately 250,000 people living in rural areas. It includes the construction and rehabilitation of sanitation infrastructure, as well as capacity building for local and national actors (World Bank, 2023).

United Nations Environment Programme: this programme aims to support the implementation of the national water strategy in Tunisia. It includes the establishment of an integrated water resources management system, capacity-building of local and national actors and the promotion of energy-efficient and environmentally friendly water technologies.

These initiatives demonstrate Tunisia's commitment to improving water management and sanitation to achieve the Sustainable Development Goals (SDGs) and meet its commitments under the Paris Agreement and the United Nations Framework Convention on Climate Change (UNFCCC).

2. Introduction to MRV: Concept, benefits, key elements, and application to the sanitation sector in Tunisia

Key points of this part

- The MRV system aims to ensure transparency and accountability in the management of greenhouse gas (GHG) emissions by measuring their impacts and assessing efforts to implement GHG mitigation projects.
- The MRV system is based on three key elements: measurement (Measurement - M), reporting (Reporting - R) and verification (Verification - V).
- The establishment of a robust MRV system is essential to ensure transparency, accuracy and comparability of information on GHG emissions and mitigation measures in the sanitation sector in Tunisia.
- The Tunisian national MRV is composed of several subsystems, such as the MRV AFAT (NAMA forest), MRV processes (MRV cement), MRV energy (NAMA buildings, NAMA Tunisian solar plan, NAMA transport) and MRV waste (NAMA sanitation).
- The Tunisian national MRV has made significant progress in measuring, reporting and verifying greenhouse gas emissions.

2.1. The MRV concept

The Measurement, Reporting and Verification (MRV) system is an international requirement set out in the Paris Agreement, and is a key element for accessing climate-related finance, such as carbon finance (UNFCCC, 2014). The MRV system aims to ensure transparency and accountability in the management of greenhouse gas (GHG) emissions by measuring their impacts and assessing efforts to implement GHG mitigation projects. In addition, it makes it possible to monitor, report and verify the progress made against the objectives set, the expected impacts and the supports mobilized to achieve these objectives (UNFCCC, 2011).

2.2. Benefits of MRV

Implementing an MRV system offers many benefits to countries, including the following points.

Improved transparency and trust: MRV contributes to enhancing transparency and trust between countries in the context of international climate agreements, in particular the Paris Agreement (UNFCCC, 2014). It ensures that countries' mitigation and adaptation commitments are

rigorously and transparently monitored and verified.

National capacity building: the implementation of a MRV system strengthens national capacities for the collection, analysis and management of data on GHG emissions and mitigation actions (GIZ, 2021). This helps to improve decision-making on climate-related policies and projects, as well as to facilitate coordination and collaboration between the different institutions involved.

Identification of areas for improvement: MRV helps countries identify areas where further efforts are needed to meet national and international GHG emission reduction targets (World Bank, 2019). By monitoring progress, actions and investments for climate change mitigation and adaptation can be better targeted.

Facilitating access to international finance: having a robust MRV system facilitates access to international finance, such as carbon finance, for the implementation of mitigation and adaptation projects (AfDB, 2018). A well-designed and functional MRV system demonstrates to donors a country's ability to implement and manage climate-related projects effectively and transparently.

Support for companies for better environmental management: MRV allows companies to better understand and manage their GHG emissions, identify opportunities to improve their environmental performance and adopt more sustainable practices (GIZ, 2021). By integrating MRV requirements into their business processes, companies can also gain a competitive advantage and a better image with their customers and partners.

2.3. Key elements of the MRV system

The MRV system is based on three key elements.

Measurement (M): Measurement includes the collection and evaluation of data on greenhouse gas (GHG) emissions, their impacts and the effectiveness of the mitigation measures implemented. This makes it possible to monitor environmental performance and assess progress in combating climate change (UNFCCC, 2007).

Reporting (R): Notification consists of documenting the actions taken, the progress made and the support mobilized to achieve the objectives set. This is mainly done through National Communications (NCs) and Biennial Update Reports (BURs), which inform stakeholders and international bodies about each country's efforts to combat climate change (UNFCCC, 2011).

Verification (V): Verification includes International Consultation and Evaluation (ICA), which controls the quality of the information provided and verifies compliance with international obligations. ICAs ensure rigorous assessment of country reporting, including compliance with the provisions of the Paris Agreement and other international climate change commitments (UNFCCC, 2014).

2.4. The application of MRV to the sanitation sector in Tunisia

The establishment of an MRV system in the sanitation sector in Tunisia is crucial to ensure sustainable water management and fight climate change. The application of MRV in this sector involves several key steps and areas of action.

The establishment of an inventory of GHG emissions. The first step is to establish a complete and detailed inventory of GHG emissions from the sanitation sector. This includes processes for collection, transport, wastewater treatment and sludge management. Accurate and up-to-date emissions data is crucial to assess the effectiveness of mitigation policies and measures in place in the sector.

Implementation of mitigation measures. Following the establishment of the emissions inventory, Tunisia must implement appropriate mitigation measures to reduce GHG emissions in the sanitation sector. These measures may include: promoting low-GHG wastewater treatment technologies, such as Anaerobic sludge digestor and biogas recovery; improving the energy efficiency of wastewater treatment plants and the recovery of sewage sludge, for example through its use as fertiliser or for energy production.

Monitoring and evaluation of progress. Monitoring and evaluating progress in reducing GHG emissions in the sanitation sector is essential to ensure the effectiveness of mitigation measures and the achievement of national and international emission reduction targets. This involves setting up a system for monitoring emissions and mitigation actions, as well as regular reporting on progress.

Institutional and technical capacity-building. The establishment and management of a MRV system in the sanitation sector in Tunisia requires institutional and technical capacity building. This may include training staff responsible for collecting and analyzing GHG emissions data, as well as developing tools and methodologies to facilitate the implementation and evaluation of mitigation measures.

Mobilization of funding. The application of the MRV system in the sanitation sector in Tunisia also promotes access to international finance, such as carbon finance, to support mitigation and adaptation projects. This funding can help accelerate the transition to more sustainable and climate-resilient sanitation systems.

2.5. Setting up an MRV system: methodology and tools

The establishment of a robust MRV system is essential to ensure transparency, accuracy and comparability of information on GHG emissions and mitigation measures in the sanitation sector in Tunisia. An effective MRV system promotes learning, allows for international comparisons, facilitates access to finance, and encourages other countries to adopt best practices.

The institutional and legal framework. A strong institutional framework, with clearly defined roles and responsibilities for the different stakeholders, is essential to ensure the smooth flow of information and the quality of the data collected. Appropriate legal agreements should govern the execution of responsibilities related to the MRV of emissions (UNFCCC, 2021).

Methodology for measuring GHG emissions. The measurement process should cover overall emissions and GHG emission reductions. A methodology based on IPCC guidelines and adapted to the specificities of the sanitation sector in Tunisia needs to be developed (GIZ, 2021). The quality of the information depends on detailed and consistent monitoring, based on plausible methods of systematic and comprehensive recording of emission data (GGGI, 2021).

Data Collection and Reporting. The collection and reporting of quality information depends on the quality of communication between all the institutions involved. A data collection and management system should be in place to facilitate the collection, validation, analysis and storage of data on GHG emissions and mitigation measures (ICAT, 2021).

Training and capacity building. Training and capacity building are essential to ensure the effective implementation of the MRV system. Trainings and workshops should be organized for actors involved in the collection, analysis and reporting of data on GHG emissions and mitigation measures (AfDB, 2021).

Verification process. A verification process must be in place to ensure the quality and accuracy of

GHG emissions and mitigation measures. This process may include internal reviews and external audits by independent verification bodies, based on recognized standards and protocols, such as ISO 14064-3 (ISO, 2023).

Reporting of results. Communicating MRV results is critical to ensuring transparency and accountability in GHG emission reduction efforts in the wastewater sanitation sector. Regular reports should be prepared to present mitigation progress and audit results. These reports must be submitted to relevant national and international bodies, such as the Ministry of Environment and the UNFCCC (Ministry of Environment, 2022). By following these steps and using the appropriate tools, Tunisia will be able to set up a robust and effective MRV system for the sanitation sector, thus contributing to the achievement of the Sustainable Development Goals and the fight against climate change.

2.6. Evaluation of the Tunisian national MRV system

In this section, we analyse the main components of the Tunisian national MRV system (see Figure 2), which will serve as a reference for the evaluation and subsequent improvement of the regional MRV. The Tunisian national MRV is composed of several subsystems, such as the MRV AFAT (NAMA forest), MRV processes (MRV cement), MRV energy (NAMA buildings, NAMA Tunisian solar plan, NAMA transport) and MRV waste (NAMA sanitation) (GIZ, 2021; UNFCCC, 2022).

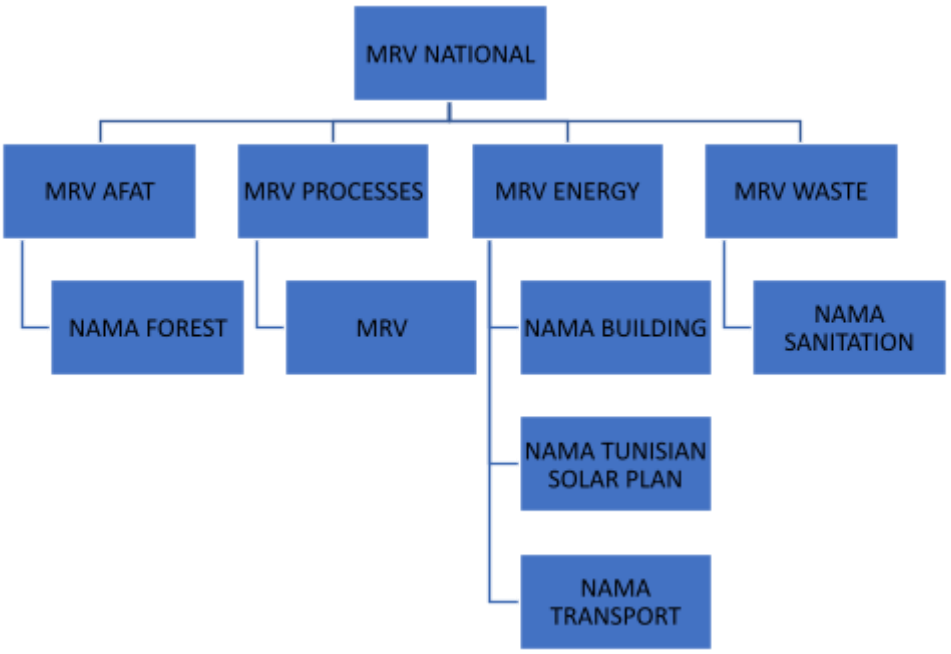

Figure 2. Tunisian national MRV

The experience and achievements of the national MRV in Tunisia. The national MRV of Tunisia has acquired a solid experience in the implementation of measurement and reporting methods, particularly within the framework of the UNFCCC, with the preparation of National Communications (NC) and the Updated Biennial Report (BUR) (UNFCCC, 2021). Tunisia has also participated in the Clean Development Mechanism (CDM) and Appropriate National Mitigation Measures (NAMAs) projects (OECC, 2021).

Strengthening the regulatory and institutional framework. The Ministry of the Environment has undertaken actions to strengthen the regulatory and institutional framework of the national

MRV. Among these actions, the creation of a Management Unit by Objective (UGPO-CC) makes it possible to coordinate and monitor activities related to climate change at the national level (GIZ, 2021; ICAT, 2021).

Cooperation and coordination between institutions. The establishment of the UGPO-CC has improved cooperation and coordination between the different institutions involved in the national MRV. However, challenges remain to ensure effective communication between all relevant institutions, particularly with regard to the collection and reporting of quality data (GIZ, 2021; ICAT, 2021).

Training and capacity building. Training and capacity building are key elements for the success of the Tunisian national MRV. Efforts have been made to train actors involved in the collection, analysis and reporting of GHG emissions and mitigation measures, but additional training and technical support needs remain (AfDB, 2021).

Verification process. The verification process of the Tunisian national MRV has improved over time, thanks to the adoption of recognized standards and protocols, such as ISO 14064-3 (ISO, 2023). However, further efforts are needed to ensure the quality and accuracy of GHG emissions and mitigation measures.

Reporting and reporting of results. Reporting the results of Tunisia's national MRV system is crucial to ensure transparency and accountability in efforts to reduce GHG emissions. Reports are regularly prepared and submitted to relevant national and international bodies, such as the Ministry of Environment and the UNFCCC (Ministry of Environment, 2022). Nevertheless, improving the quality and frequency of reporting is necessary for a better assessment of progress.

2.6.1. National MRV subsystems

MRV AFAT (NAMA forest). The MRV AFAT is a forest and biodiversity monitoring system for reducing greenhouse gas emissions in the forest sector. It is designed to support the implementation of policies and measures to reduce emissions and improve carbon sinks in the forest sector (TNA, 2016). Efforts to build capacity and improve measurement methodologies are needed to ensure the accuracy and effectiveness of the AFAT MRV.

MRV processes (MRV cement). The MRV processes is a system for measuring, reporting and verifying greenhouse gas emissions in the cement sector. It is designed to support the implementation of policies and measures to reduce emissions in the cement sector (GIZ, 2021). Improved verification processes and the adoption of international best practices are necessary to enhance the credibility and effectiveness of MRV processes.

MRV energy (NAMA buildings, NAMA Tunisian solar plan, NAMA transport). The energy MRV is a system for measuring, reporting and verifying greenhouse gas emissions in the energy sector. It is designed to support the implementation of policies and measures to reduce emissions in the construction, solar and transport sectors (GGGI, 2021; TNA, 2016 ;). The establishment of harmonised data collection protocols and the promotion of a culture of transparency and accountability are essential to improve the efficiency of the energy MRV.

MRV waste (NAMA sanitation). The MRV waste is a system for measuring, reporting and verifying greenhouse gas emissions in the waste management sector. It is designed to support the implementation of policies and measures to reduce emissions in the sanitation sector (WHO, 2023). The integration of the latest measurement technologies and the strengthening of cooperation between the different institutions involved are necessary to improve the efficiency of waste MRV.

The Tunisian national MRV has made significant progress in measuring, reporting and verifying greenhouse gas emissions. However, further efforts are needed to improve

coordination and communication between the different institutions involved and to ensure the collection and reporting of quality data. The exchange of knowledge and experience between the different subsystems of the national MRV can also contribute to the overall improvement of the MRV system in Tunisia.

3. The Clean Water Sector and GHG Management

Key points of this chapter

- The main missions of ONAS include the fight against water pollution, the management of sanitation works, the planning and implementation of projects for the State and local authorities, as well as the valorization of products from wastewater treatment plants.
- ONAS had 125 treatment plants, of which 114 treated urban wastewater, one treated industrial wastewater and eight treated mixed wastewater (as of 2021).
- Tunisia is a leader in wastewater reuse in the Mediterranean basin. In 2021, 21.2 Mm3 of treated wastewater was reused, including 14 Mm3 for irrigation.
- ONAS focuses on several axes to achieve sustainable sanitation, including strengthening the institutional and legal framework, improving data and integrating MRV systems, investing in infrastructure, promoting wastewater reuse and collaborating with international partners.
- Efforts are being made to strengthen cooperation, coordination and information-sharing among the different entities, and to promote the participation and engagement of all relevant actors, including the public and private sectors, civil society and international organisations.

3.1. Presentation of the National Sanitation Office (ONAS)

Created in 1974 under Law No. 74/73, the National Sanitation Office (ONAS) is a Tunisian public company of an industrial and commercial nature and the only public wastewater manager in Tunisia. Its mission was revised in 1993 by Law 93/41, positioning ONAS as a major player in the protection of the water environment in Tunisia. ONAS is governed by commercial legislation and placed under the supervision of the Ministry of the Environment. It is administered by a Board of Directors headed by a Chairman and Chief Executive Officer, and meets at least once every three months, in accordance with Decree No. 2198 of 2002.

The Tunisian State exercises periodic control over ONAS through the Ministry of Sectoral Supervision, in accordance with the provisions of Articles 5, 6, 12 and 23 of Decree No. 2198 of 2002. These provisions make it possible to ensure that the management of ONAS is consistent with the general orientations of the State in the sector of activity to which it belongs. The main missions of ONAS include the fight against water pollution, the management of sanitation works, the planning and implementation of projects for the State and local authorities, as well as the valorization of products from wastewater treatment plants. The ONAS Board of Directors is composed of representatives of various ministries, local authorities, the National Water Exploitation and Distribution Company (SONEDE) and the National Agency for Environmental Protection (ANPE).

In 2021, ONAS had 125 treatment plants, of which 114 treated urban wastewater, one treated industrial wastewater and eight treated mixed wastewater. The total wastewater treatment

capacity reached 286,000 m3/day, with an annual production of 104,000 tonnes of sludge.

Tunisia is a leader in wastewater reuse in the Mediterranean basin. In 2021, 21.2 Mm3 of treated wastewater was reused, including 14 Mm3 for irrigation. The total area developed for irrigation from treated wastewater was 8,530 hectares, supplied by 32 treatment plants. However, the actual irrigated area was limited to 2,685 hectares.

ONAS continues its efforts to improve the coverage of sanitation services in Tunisia, particularly through programs and projects to extend and modernize its infrastructure. The objectives include increasing wastewater treatment capacity, protecting the water environment and promoting the reuse of treated water in different sectors, such as agriculture and industry.

3.2. ONAS organisational structure

The National Sanitation Office (ONAS) is a Tunisian public institution whose mission is to manage and implement sanitation policies and programs in the country. In order to ensure optimal functioning and effective management of its responsibilities, ONAS is structured around several directorates, departments and units.

In total, ONAS has 3,241 staff, divided between 480 managers, 659 supervisors and 2,102 executive staff. The organization is composed of four regional poles and 24 regional directorates, corresponding to the Tunisian governorates. The regional hubs have financial and administrative autonomy, which allows for operational decentralization and more efficient management. The four regional poles are as follows: Regional Pole North, Regional Pole of the Centre, Regional Pole of the South and Regional Pole of Greater Tunis. Each regional directorate is responsible for the management of wastewater treatment and pumping plants in its area of competence, and coordinates activities with other ONAS units and external partners.

ONAS is administered by a Board of Directors headed by a Chief Executive Officer, appointed by decree. The Board of Directors also includes representatives of various ministerial departments related to ONAS activities, as well as a representative of large municipalities. The organization chart of ONAS is characterized by a decentralized structuring including central directorates and regional departments. This organisation allows for an efficient distribution of tasks and responsibilities and ensures optimal management of the Office.

At central level, ONAS is composed of control structures (audit, inspection and expense control):

- **Management structures** (planning, budget preparation, management control, organization, IT and quality)
- **Financial management structures** (finance, accounting, human resources management, legal affairs, procurement, warehousing, training, asset management and international cooperation)
- **Technical structures** (major sanitation studies, studies of wastewater treatment plants, Planning of projects for delegation of operating services, monitoring and assistance of the operational units, research and development, valorization of products from wastewater treatment plants, planning of interventions on rainwater structures).

At the regional level, ONAS is structured into different management, enforcement and inspection entities. Regional management structures include human resources management, acquisition and warehousing, contract management, customer management and collections, budget monitoring, finance, accounting, legal affairs, information technology, archives, studies, and

project work and control.

The implementing structures at regional level are responsible for the operation of the public sewerage network and treatment plants, the control of industrial pollution, the monitoring of the quality of treated water, the maintenance of rolling stock and equipment, and the monitoring of subcontracts. These structures ensure that sanitation operations are carried out efficiently and in accordance with environmental and health standards.

Finally, regional inspection structures include administrative, financial and technical inspection. They ensure that NANOS' activities comply with internal regulations and procedures and guarantee good governance and optimal functioning of the organization.

3.3. ONAS's commitments to sustainable sanitation

The National Sanitation Office (ONAS) is committed to continuously improving its sanitation practices in Tunisia. It focuses on several axes to achieve sustainable sanitation, including strengthening the institutional and legal framework, improving data and integrating MRV systems, investing in infrastructure, promoting wastewater reuse and collaborating with international partners.

Strengthening the institutional and legal framework. ONAS works to consolidate the institutional and legal framework for sanitation in Tunisia, in accordance with national and international objectives for water management. This involves establishing regulations and standards for the treatment, reuse and quality of wastewater.

Data improvement for the future MRV system. To monitor progress in wastewater sanitation and reuse, ONAS is committed to improving data quality for the future MRV (Measurement, Notification, Verification) system. This includes implementing regular monitoring and reporting systems to ensure transparency and effectiveness of projects.

Investment in infrastructure. ONAS is committed to investing in sanitation infrastructure, including wastewater treatment plants and collection networks, to improve wastewater quality and capacity. This involves the construction of new wastewater treatment plants and the rehabilitation of existing ones, ensuring that they are adapted to current and future needs.

Promotion of wastewater reuse. ONAS promotes the reuse of treated wastewater, particularly in agriculture and industry. This includes setting up pilot projects for wastewater reuse and promoting the use of innovative technologies to reduce water consumption and promote sustainable management of water resources.

International cooperation. ONAS collaborates with various international partners, such as the World Bank, the French Development Agency (AFD) and GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit), to strengthen national capacities in wastewater treatment and reuse. These partnerships allow ONAS to benefit from technical expertise, funding and support for the implementation of projects aimed at improving the sustainability of sanitation in Tunisia.

ONAS is also committed to continuously improving its sanitation practices in Tunisia, in accordance with the general orientations of the national policy aimed at improving the living environment of citizens, protecting the environment and preserving water resources. The future strategy of ONAS for the medium and long term focuses on the following themes.

Scaling up sanitation services and improving living conditions: ONAS is continuing the national effort to expand sanitation services in urban areas, particularly in governorates with connection

rates below the national average. This also includes improving the living conditions of low-income citizens, extending sanitation services to small towns and rural areas with clustered settlements, and continuing the national sanitation programme for working-class neighbourhoods.

Development of treatment capacities and improvement of the quality of treated water: ONAS aims to develop treatment capacities to treat all collected wastewater, especially in regions experiencing a high rate of development. This includes improving the quality of treated water through the extension and upgrading of obsolete wastewater treatment plants, and sustainable management of industrial water by cleaning up polluting industrial areas.

Sustainable sludge management and promotion of wastewater reuse: ONAS is implementing a programme to improve sludge treatment systems and their sustainable management. It also promotes the reuse of treated wastewater in various areas of development, moving towards new sanitation technologies and modernizing treatment systems and processes.

Rehabilitation of sewerage networks and use of modern technologies: ONAS works to rehabilitate and renovate sewerage networks to control operating costs and improve the quality of services provided to customers. It also relies on the use of modern information and communication technologies for continuous monitoring and control of the quality of wastewater and treatment.

Communication, modernization and participation of the private sector: ONAS develops and implements a communication plan with the target audience and continues the effort to modernize managerial and technical management methods. It integrates information and communication technologies (ICTs) into all its activities and promotes private sector participation in sanitation infrastructure management to optimize the distribution of roles between the private and public sectors and provide quality and affordable service.

4. Strengthened institutional and regulatory framework

Key points of this chapter

- ONAS is the key actor in charge of the implementation of sanitation policies and programs in Tunisia, working in collaboration with other organizations such as SONEDE for water management and billing for sanitation services.
- ONAS operates mainly in urban and rural areas for groups of more than 3000 inhabitants. Some parts of the territory are not covered by sewerage networks.
- Strengthening the institutional and regulatory framework will ensure better coordination between the various actors involved in water management, environmental protection and the fight against climate change.
- Tunisia's institutional framework for climate change and environmental management includes several entities working in coordination to achieve the objectives set. These entities include the Management by Objectives Unit (UGPO), the National Environmental Protection Agency (ANPE), the National Sanitation Office (ONAS) and the National Water Exploitation and Distribution Company (SONEDE).

4.1. National context and policies relating to ONAS activities

Tunisia attaches particular importance to the sustainable management of natural resources because of climate variability, resource scarcity and vulnerability. ONAS is the key actor in charge of the implementation of sanitation policies and programs in Tunisia, working in collaboration with other organizations such as SONEDE for water management and billing for sanitation services.

4.2. Legal and regulatory framework governing ONAS activities

ONAS activities in Tunisia are governed by various laws and regulations relating to sanitation, water management, protection of agricultural land and the environment. The main laws and regulations include, among others, the Law on the Simplification of Administrative Procedures, the Decree on Environmental Impact Assessment (EIA), the Water Code, the Law on Standardization, and the Law on the Protection of Agricultural Land.

The laws and regulations governing ONAS activities in Tunisia cover various aspects of sanitation, water management, protection of agricultural land and the environment. Currently, Tunisia does not have specific national legal texts on climate governance and climate transparency.

Among the main legislative and regulatory texts are:

- Law No. 2001-14 of 30 January 2001, simplifying administrative procedures relating to permits issued by the Ministry of the Environment and Regional Planning;
- Decree No. 2005-1991 of 11 July 2005 repealing the 1991 Decree on Environmental Impact Assessment (EIA);
- Water Code n°76-75;
- Law 82-66 of 6 August 1982 on standardization;
- Law No. 83-87 on the protection of agricultural land amended by Law No. 96-104 of 1996;
- Law No. 95-70 of 17 July 1995 on Water and Soil Conservation;
- Decree No. 85-56 of 2 January 1985 on the regulation of discharges into the receiving environment:
- Decree No. 75-492 of 26 July 1975 which entrusts SONEDE with the invoicing of sanitation and the collection of fees on behalf of ONAS;
- Decree No. 94-2050 of 3 October 1994 which sets the conditions for connection to public sewerage networks in ONAS intervention areas;
- Decree No. 95-1139 of 28 June 1995 on the administrative and financial organization of ONAS;
- Decree No. 2001-2001 of 27 August 2001 on the sanitation fees that ONAS is authorized to collect in its intervention districts;
- Decree No. 2006 – 395 of 3 February 2006 which establishes the organizational chart of ONAS;
- Decree No. 2008 – 2268 of 9 June 2008 which establishes the services falling within the missions of ONAS that may be granted;
- Decree No. 79-768 of 8 September 1979 regulating the conditions for connecting and discharging wastewater into the public sewerage network, supplemented by Decree No. 94-1885 of 12 September 1994 laying down the conditions for the discharge of non-domestic waste water into sewerage networks;
- Law No. 30 of 6 March 2000 on the development of agricultural land in irrigated public areas;
- Law No. 96-41 of 10 June 1996 on waste and the control of its management and disposal;
- Order of the Minister of Local Affairs and the Environment and the Minister of Industry and Small and Medium-sized Enterprises of 26 March 2018, setting limit values for effluent discharges into the receiving environment.

4.3. Strengthening the institutional framework

Strengthening the institutional and regulatory framework will ensure better coordination between the various actors involved in water management, environmental protection and the fight against climate change. It also promotes a better integration of policies and actions in these areas, thus contributing to a more efficient and sustainable management of natural resources in Tunisia.

Tunisia's institutional framework for climate change and environmental management includes several entities working in coordination to achieve the objectives set. These entities

include the Management by Objectives Unit (UGPO), the National Environmental Protection Agency (ANPE), the National Sanitation Office (ONAS) and the National Water Exploitation and Distribution Company (SONEDE).

National Agency for Environmental Protection (ANPE): the ANPE is a public institution of a non-administrative nature, placed under the supervision of the Ministry of the Environment. The ANPE is responsible for environmental protection and pollution control, and contributes to the implementation of national policies and programmes relating to climate change. ANPE is also responsible for environmental monitoring, control and information and the promotion of clean technologies and the circular economy.

National Office of Sanitation (ONAS): ONAS is a public institution of an industrial and commercial nature, responsible for the management of the sanitation sector in Tunisia. It is responsible for the planning, construction, operation and maintenance of wastewater systems, as well as promoting the circular economy and wastewater reuse. Despite the efforts made, the sanitation sector is still ranked last in the country's inventory in terms of GHG emissions, highlighting the need to strengthen actions and investments in this area.

National Water Exploitation and Distribution Company (SONEDE): SONEDE is a public industrial and commercial institution, responsible for the management of the drinking water sector in Tunisia. It ensures the production, transport, distribution and marketing of drinking water, and contributes to the implementation of national policies and programmes relating to integrated water resources management and adaptation to climate change.

Management by Objectives Unit (UGPO): the Management by Objectives Unit (UGPO) is an entity created by Government Decree No. 2018-263 of 12 March 2018 within the Ministry of Environment in Tunisia to manage, coordinate and monitor the implementation of activities related to the Paris Climate Agreement and the United Nations Framework Convention on Climate Change. This unit plays a central role in the management of climate change in Tunisia, implementing strategies and action plans to achieve the objectives set out in the Nationally Determined Contributions (NDCs). The UGPO represents the heart of the national inventory system and is placed under the responsibility of the national focal point, supported by several sectoral focal points. It plays a key role in the coordination, planning and monitoring of actions to combat climate change in Tunisia.

Figure 3. Management Unit by Objectives (UGPO)

These entities are working together to implement an integrated and coordinated approach to climate change and environmental management in Tunisia. Efforts are being made to strengthen cooperation, coordination and information-sharing among the different entities, and to promote the participation and engagement of all relevant actors, including the public and private sectors, civil society and international organisations.

The responsibilities of the UGPO (see Figure 3) are as follows:

- **Coordination between different stakeholders in the field of climate change: The UGPO ensures the coherence of actions and initiatives in the field of climate change by facilitating communication, collaboration and information sharing between different national and international actors.**
- **Development of a portfolio of priority projects and action plans:** The UGPO is responsible for identifying and prioritizing projects and actions in the areas of emissions mitigation, climate change adaptation and financing. It develops plans such as the National Adaptation Plan and the Investment Plan for the implementation of NDCs.
- **Support for the establishment of a transparency**, reporting and verification mechanism: The UGPO is coordinating with all relevant sectors to establish a national climate change measurement, reporting and verification (MRV) mechanism. This mechanism makes it possible to monitor progress and evaluate the effectiveness of the actions taken.
- **Continued support to all stakeholders for access to financial mechanisms:** The UGPO accompanies and supports national actors in accessing the financing mechanisms available under the United Nations Framework Convention on Climate Change and other support and international cooperation mechanisms.

- **Effective involvement of key stakeholders in identifying priorities and monitoring progress:** The UGPO seeks to involve all relevant actors, including the public and private sectors, civil society and international organizations, in setting priorities and monitoring progress in the implementation of NDCs.
- **Assistance for mainstreaming climate change** into development policies: The UGPO supports the integration of climate issues into national development policies and programmes, by collecting the necessary data and information, and developing a national low-emission and climate-resilient development strategy.
- **Capacity building of stakeholders at the national level:** The UGPO develops and implements programmes to support and build the capacity of national actors, particularly in the area of international climate change negotiations. It also encourages cooperation and partnership with public and private bodies, national and international, to achieve the objectives of the NDCs.
- **Monitoring the implementation of Nationally Determined Contributions:** The UGPO supports the establishment of a national measurement, reporting and verification (MRV) mechanism to monitor progress in the implementation of NDCs. It also prepares periodic reports required by the United Nations Framework Convention on Climate Change, including national communications and greenhouse gas and emissions inventory reports.

5. Analysis of the current sanitation management in Tunisia

Key points of this chapter

- In Tunisia, in theory, sanitation data is rigorously collected and documented on a daily, monthly and annual basis.
- ONAS collects data from a variety of sources, such as water quality monitoring networks, wastewater treatment facilities, inspection reports, wastewater treatment plant data, meter readings and user surveys and many others, etc.
- However, ONAS faces the problem of missing data for various reasons.
- The inventory of sanitation services and GHG emissions is developed by the National Sanitation Emissions Coordinator (which is part of ONAS). The data is then verified by independent projects led by ONAS.
- The adoption of renewable energy generation technologies in the sanitation sector would not only reduce GHG emissions, but also promote energy efficiency, reduce reliance on fossil fuels and increase environmental sustainability.

5.1. Data collection, monitoring and analysis procedures

Data collection methodology. In Tunisia, sanitation data is rigorously collected and documented on a daily, monthly and annual basis. These procedures are formalized by manuals developed by the National Sanitation Office (ONAS), which ensure that these processes are continuously updated according to the evolution of commitments and objectives. The data collected comes from a variety of sources, including inspection reports, wastewater treatment plants, meter readings and user surveys.

Ensure data quality and reliability. To ensure the reliability and transparency of the data collected, a threefold level of revision of activity reports is put in place. The managers of the sanitation plants ensure the technical and organizational aspect of the activities, thus ensuring the quality of the data collected.

5.2. The ONAS information system: architecture and functionalities

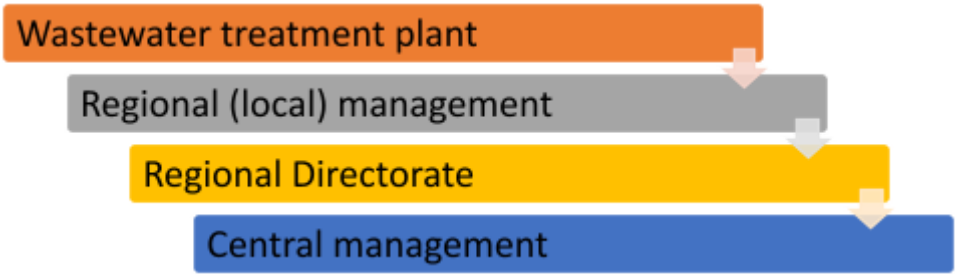

Figure 4. The ONAS information system: data collection

Data collection. ONAS collects data from a variety of sources, such as water quality monitoring networks, wastewater treatment facilities, inspection reports, wastewater treatment plant data, meter readings and user surveys and many others, etc. (see Figure 4). This data is digitalised and can be stored in centralized databases.

Data storage. The collected data is stored in centralized databases for later use. ONAS uses database management systems to store and manage this data, ensuring that it is accurate, secure and easily accessible.

Data analysis and processing. The collected data is analyzed and processed using various tools, such as modeling software, spreadsheets, geographic information systems (GIS), etc. Data analysis can generate information relevant to sanitation management, such as performance indicators, spatial analysis maps, demand forecasts, etc.

Dissemination and sharing of information. The information produced is disseminated to ONAS stakeholders, such as decision-makers, managers, operators, customers, etc. ONAS uses various communication channels to disseminate this information, such as printed reports, online dashboards, mobile applications, etc.

Security and data protection. Data security is a major concern for ONAS, given the sensitive nature of the information collected and managed. ONAS implements technical and organizational security measures to protect data against unauthorized access, data loss, unwanted changes, etc. These measures include data encryption, firewalls, user authentication, and regular data backup.

5.3. Specific applications of the ONAS information system

Wastewater treatment management application. ONAS' wastewater treatment management application enables comprehensive and efficient monitoring of wastewater treatment activities from collection to landfill. It controls wastewater treatment and manages the chemicals used in the process.

Industrial wastewater treatment management application: Industrial Waste Cadastre (CADRIN). CADRIN is a key IT tool developed by the National Sanitation Office (ONAS) to manage and monitor industrial wastewater discharges in intervention areas in Tunisia. It was created in 1996, improved in 2000, and a web version was launched in 2010, providing access via the ONAS intranet. The data are entered by the Industrial Waste Service at the level of the regional directorates. Thus, CADRIN is an essential management tool for ONAS in the control of industrial wastewater discharges in Tunisia. It makes it possible to better monitor companies, ensure effective management of industrial wastewater and contribute to the monitoring and control of industrial pollution.

Objectives of CADRIN

- Monitor and control companies that discharge effluent into wastewater collection systems managed by ONAS.
- Collect and store data on industrial releases for more efficient management.
- Identify companies that do not comply with environmental standards and take the necessary measures to bring them into compliance.
- Ensure better coordination between ONAS and companies to improve water quality and protect the environment.

Features of CADRIN

- Registration and updating of information on companies and their industrial discharges.
- Data analysis and assessment of the compliance of industrial discharges with environmental standards.
- Generate customized reports to facilitate decision-making and corrective action planning.
- Data visualization in the form of maps to identify risk areas and non-compliant businesses.
- Follow-up of corrective actions taken to improve the quality of industrial discharges and compliance with environmental standards.

5.4. Monitoring greenhouse gas (GHG) emissions and mitigation measures: National Communications

Tunisia's National Communications play a crucial role in providing detailed information on the country's GHG emissions and the measures taken to mitigate and adapt to the impacts of climate change. They not only track progress, but also highlight areas where improvements are needed, thereby promoting more effective climate action.

5.4.1. Detailed inventories and assessment of sanitation infrastructure and services

The inventory of sanitation infrastructure in Tunisia provides comprehensive information on the systems in place for wastewater management and treatment. This includes wastewater treatment plants (WWTPs), pumping systems, and sewerage system management and maintenance mechanisms. ONAS is responsible for the supervision and management of these infrastructures, as well as the valorization of by-products from WWTPs.

The inventory of sanitation services and GHG emissions is developed by the National Sanitation Emissions Coordinator. The data is then verified by independent projects led by ONAS. The ONAS activities subject to this monitoring include the purification, pumping, management and maintenance of the sewerage network, as well as the recovery of products from WWTPs.

5.4.2. Strengthening the system for measuring, reporting and verifying (MRV) mitigation actions in the sanitation sector

The study conducted to assess the state of play of MRV mitigation actions in the sanitation sector involved a survey of key stakeholders, consultation of secondary sources of information and visits to different WWTPs. Several criteria were used to assess the effectiveness

of the actions, including the analysis of existing institutional arrangements and recommendations to improve the MRV system.

The results of the study show that there is currently no concrete structure for MRV of mitigation and adaptation actions. Stakeholders are often asked on an ad hoc basis to provide information on their actions, particularly in the context of the National Communication (NC), Periodic Information Review (BUR) and Nationally Determined Contributions (NDC) processes.

To strengthen the MRV system of mitigation actions in the sanitation sector, it is necessary to establish mechanisms for coordination and cooperation among different stakeholders, such as government agencies, non-governmental organizations and the private sector. An effective MRV system will accurately and transparently track GHG emissions and mitigation measures, facilitating the implementation of appropriate policies and regulations to improve the sector's environmental performance.

5.4.3. Exploring energy generation potential in the sanitation sector

The sanitation sector has considerable potential to generate renewable energy and thus contribute to the country's energy transition. ONAS plans to install anaerobic sludge digestion systems with cogeneration in 22 of its wastewater treatment plants (WWTPs). These facilities could generate up to 15 GWh of electricity per year, meeting about 13% of ONAS's energy needs.

Harnessing this potential could significantly reduce greenhouse gas (GHG) emissions by reducing reliance on electricity from fossil energy sources and reducing emissions from sludge sanitation and management processes. GHG emission reductions could thus reach more than 45,000 tonnes of CO2 equivalent per year.

The adoption of renewable energy generation technologies in the sanitation sector would not only reduce GHG emissions, but also promote energy efficiency, reduce reliance on fossil fuels and increase environmental sustainability. In addition, it could stimulate technological innovation and create economic opportunities in the renewable energy and clean technology sector.

5.4.4. Deployment and development of anaerobic digestion and biogas recovery systems

Five wastewater treatment plants – Attar, Sousse Hamdoun, Gafsa, Moknine and Mahdia – are being planned for the installation of anaerobic digestion and biogas upgrading systems. A sixth station, Nabeul SE4, recently benefited from a complete renovation of its biogas system. These projects aim to improve sludge management and develop the energy potential of the biogas produced during the anaerobic digestion process.

To ensure the success of these projects, a training and support programme is being set up. This program aims to strengthen the skills of ONAS employees in the design, construction and operation of anaerobic sludge digestion and biogas recovery facilities by cogeneration. Through this initiative, ONAS will be able to ensure the efficient and sustainable use of these innovative technologies, while helping to reduce greenhouse gas emissions and promoting the production of renewable energy.

The implementation and expansion of these anaerobic digestion and biogas upgrading systems will not only reduce GHG emissions and fossil energy consumption, but also create opportunities for economic and technological development in the renewable energy and clean technology sector.

6. Recommendations for the establishment of a sectoral MRV system in water sanitation

Key points of this chapter

- The analysis of the current functioning of the water sanitation sector and the analysis of the data necessary for the development of a MRV system in this sector shows the need to undertake many multi-stakeholder and multi-level actions to achieve this end.
- Strengthening the institutional capacities of the water sanitation ecosystem in Tunisia is essential to improve the institutional and legal framework for effective implementation of the MRV system.
- The current legal framework does not allow for the deployment of a comprehensive MRV system.
- Improving data quality and establishing an effective MRV system are key elements for monitoring, assessing and mitigating GHG emissions and emission reduction efforts in the sanitation sector.
- Measurement methodology and data quality are essential aspects to ensure reliable and accurate results in any data-based study or analysis.

The analysis of the current functioning of the water purification sector and the circulation of data necessary for the development of a MRV system in this sector shows the need to undertake many multi-stakeholder and multi-level actions to achieve this end. Many public institutions must be involved in these circuits in order to ensure effective implementation of this system.

Seven priority actions should be taken to address this challenge.

1) **Access to quality data is a crucial step in setting up an MRV system.** Our study suggests that as of today there is a need to improve data collection, validation and management processes. Indeed, it is essential to fill gaps in missing or non-existent data to put in place strategies to ensure the implementation of an effective MRV system. However, to date, such a strategy is absent.
2) **Existing human resources require capacity building in order to be operational for this project.** At the moment, the project team around climate change is small and needs to be upgraded in terms of skills. Indeed, it is crucial to strengthen institutional and human capacities, including through staff training, improvement of infrastructure and equipment, and the establishment of adequate information management systems to fully build an MRV system.
3) **A project of great awareness of the challenges of implementing an MRV system must be carried out internally and externally.** Conducting awareness-raising and training

campaigns for relevant stakeholders, including policymakers, financial partners and stakeholders, is important to address the lack of awareness of MRV and climate change adaptation issues. This strategy can provide expertise and missing information at this stage.

4) **The MRV project requires to elaborate monitoring and evaluation systems for the adaptation actions carried out in the field.** There is a need to develop robust monitoring and evaluation mechanisms to measure the progress and impacts of adaptation actions and to enable institutions to take effective ownership of these actions and their effects.
5) **Ensuring the sustainability and commitment of stakeholders in the MRV system should be ensured by increasing the visibility of results.** To facilitate political decision-making, it is essential to strengthen communication and reporting mechanisms so that policymakers have up-to-date and relevant information to guide their actions. The visibility of the results allows a process of self-reinforcement to take place.
6) **The establishment of an MRV system will require financial resources that public institutions will not be able to mobilize on their own and from their own resources.** The mobilization of domestic and international funding is crucial to support MRV-related activities, given the financial constraints resulting from donor dependence and insufficient domestic budget support. The activities to be carried out are numerous and require specific technical expertise with a significant cost.
7) **The institutionalization of the MRV process must be a priority to avoid internal hierarchical constraints and facilitate the role of focal points.** The role of the focal points is essential to ensure good coordination between the different institutions involved in the MRV system and to ensure the coherence of the actions carried out.

6.1. Improving the institutional and legal framework

6.1.1. Institutional capacity building

In order to improve the institutional framework for effective implementation of the MRV system, it is essential to strengthen the institutional capacities of the water sanitation ecosystem in Tunisia. We hereby present ten recommendations for enhancing future reports.

1) **Infrastructure and equipment for data collection and processing will need to be improved.** Improving infrastructure and equipment to enable efficient data collection and analysis is a key step in the process. This includes modernizing information management systems, creating data centres, and acquiring appropriate hardware and software. The current state of the equipment does not allow us to have adequate information.
2) **It is important to ensure effective coordination and follow-up by establishing a clear decision-making circuit.** Establish coordination and monitoring mechanisms within institutions to ensure effective implementation of the MRV. These mechanisms will monitor progress, identify obstacles and challenges, and take corrective action if necessary.
3) **Committed focal points should be designated.** Indeed, designating focal points within each institution concerned is a prerequisite for clarifying roles. These focal points should have the necessary resources and support to coordinate MRV-related activities.
4) **Optimize the use of existing skills and implement tailor-made staff training.** Optimize the use of expertise by leveraging existing human and institutional resources, and facilitate coordination and collaboration among the different institutions involved. Provide appropriate training to employees of relevant institutions to improve data collection, analysis and management, as well as monitoring and evaluation mechanisms. This will increase understanding of MRV issues and ensure data quality for decision-making. Training

must take into account the skills gaps between staff and adapt to their constraints.

5) **Establish inter-institutional partnerships to better coordinate activities.** Encouraging collaboration between different institutions to ensure the coherence of MRV actions is a success factor. Partnerships will facilitate the sharing of resources, skills and knowledge and ensure better coordination of MRV activities.
6) **Establish and consolidate the legal and regulatory framework.** Consolidate the legal and regulatory framework to support MRV-related actions. This involves reviewing and revising existing laws and regulations, adopting new provisions – if necessary – and ensuring their adequacy with effective implementation of the MRV.
7) **Improve climate change governance within Tunisian public institutions and provide them with guidance for climate change response measures.** Align the MRV framework with existing climate change governance mechanisms to ensure a coherent and integrated approach to addressing climate challenges. Provide clear guidance to relevant institutions, such as ONAS, on the implementation of policies, projects and programmes to combat climate change and promote adaptation.
8) **Facilitate international reporting and reporting.** Facilitate the collection, analysis and reporting of information required for ONAS to meet its reporting obligations to international for a, such as the UNFCCC.
9) **Best prepare public institutions for climate finance and establish a platform to attract international climate finance flows.** Enable ONAS to demonstrate its ability to effectively use climate finance funds by highlighting the quality of its project planning, management and monitoring. A well-designed and effective MRV framework can serve as a basis for attracting investment and finance from multilateral and bilateral development partners, demonstrating the country's capacity to manage and implement climate-related projects in a transparent and accountable manner.
10) **Mobilize additional financial resources.** Ensure sufficient financial resources for training, infrastructure improvement and equipment purchases, by mobilizing national and international funding.

6.1.2. Legal and regulatory reforms

Legal and regulatory reforms are essential to support and facilitate the effective implementation of an MRV system. It must be noted that the current legal framework does not allow the deployment of a complete MRV system. Several measures could contribute to strengthening the legal and regulatory framework for MRV.

1) **Offer a critical reading of existing laws and regulations.** The existing arsenal of regulatory laws is binding for the deployment of an effective MRV system. There is a need to review existing laws and regulations to identify gaps and barriers to the establishment and operation of an effective MRV system. This analysis will also help identify areas requiring priority legislative or regulatory interventions.
2) **Develop new laws and regulations.** Develop new legal and regulatory provisions to address identified gaps and facilitate the implementation of the MRV system, based on the analysis of existing laws and regulations. These new provisions should cover aspects such as data collection, management, sharing and reporting, as well as the responsibilities and obligations of the different institutions and actors involved in the MRV.
3) **Harmonising legal and regulatory provisions.** Ensure consistency between different laws and regulations related to MRV and climate change, harmonizing provisions and avoiding overlaps or contradictions. This will facilitate the implementation and monitoring of MRV

and climate change actions.

4) **Consult with stakeholders.** Involve relevant stakeholders, such as government institutions, non-governmental organizations, the private sector and local communities, in the development and revision of MRV-related laws and regulations. This will ensure that legal and regulatory provisions meet the needs and concerns of different stakeholders and facilitate the implementation of the MRV.
5) **Strengthen existing legislative and regulatory capacities.** Train MRV stakeholders, including policy makers, legislators, regulators and implementers, on MRV-related legal and regulatory provisions. This will contribute to a better understanding and enforcement of MRV laws and regulations.
6) **Monitor and evaluate laws and regulations on a regular basis.** Establish mechanisms to monitor and evaluate the impact of MRV-related laws and regulations on the implementation of climate change actions. This assessment will identify areas requiring adjustments or revisions and ensure that the legal and regulatory framework remains appropriate and effective.
7) **Promote awareness and understanding of MRV-related laws and regulations among different stakeholders and the general public.** This will contribute to increased engagement and compliance with MRV legal and regulatory requirements.

6.2. Improving data and setting up an effective MRV system

Improving data and establishing an effective MRV system are key elements for monitoring, assessing and mitigating GHG emissions and emission reduction efforts. To do this, we propose four key actions.

1) **Establishing data collection protocols.** Develop clear and standardized protocols for data collection, taking into account the specific needs of the different sectors and sub-sectors involved in MRV. This will ensure consistency and comparability of the data collected.
2) **Improved information management systems.** Implement or improve information management systems to facilitate data collection, storage, analysis and reporting. This may include the use of digital technologies and online platforms to improve the efficiency and transparency of data management processes.
3) **Training and capacity-building.** Train data collection and management staff in the techniques and tools needed to ensure the quality and accuracy of the data collected. This may include training on data collection protocols, information management systems, and data analysis software.
4) **Data sharing and reporting.** Establish mechanisms to facilitate data sharing and communication between the different institutions and stakeholders involved in MRV. This may include the establishment of online platforms and data exchange systems to facilitate access to information and promote transparency.

6.3. Measurement methodology and data quality

Measurement methodology and data quality are essential aspects to ensure reliable and accurate results in any data-based study or analysis. Before starting any data collection, it is important to clearly define the measurement objectives and research questions. This will help guide data collection and analysis in a meaningful way. Three key elements need to be considered.

1) **Develop robust measurement methodologies adapted to the different sectors and sub-sectors concerned by the MRV.** These methodologies should be based on

international standards and best practices to ensure comparability of data and credibility of results.

2) **Establish quality assurance and quality control mechanisms to ensure the accuracy, precision and reliability of the data collected under the MRV.** This may include conducting internal and external audits, validating data by independent experts, and implementing procedures to correct errors and inaccuracies
3) **Regularly review and adjust measurement methodologies and data collection protocols to take into account new knowledge, technological advances and feedback.** This will continuously improve the quality and relevance of the data used for MRV.

6.4. Verification and monitoring of progress

Verification and tracking help protect data integrity. It ensures that the data has not been tampered with, manipulated or corrupted during the collection process. This is especially important when it comes to sensitive or confidential data where the integrity of the information is crucial. Four key elements must be taken into consideration.

1) **Put in place mechanisms to verify the compliance of actions and projects with MRV requirements and to evaluate the effectiveness of implemented measures**. This may include internal and external audits, on-site inspections and assessments by independent experts.
2) **Regularly monitor progress in the implementation of MRV-related actions and projects.** This may include setting up key performance indicators (KPIs), reporting regularly on progress and results, and conducting periodic evaluations to measure the effectiveness of actions and projects.
3) **Use the information gathered during progress monitoring and evaluation of results to identify areas for improvement and adjust actions and projects accordingly.** This will optimize the effectiveness of interventions and ensure better use of available resources.
4) **Share the results of monitoring and evaluation with different stakeholders, including policy makers, funding partners and civil society.** This promotes transparency, accountability and mutual learning, and will contribute to a better understanding of the challenges and opportunities related to MRV implementation.

Conclusions

Key points of this part

- Tunisia has undertaken important national initiatives to improve water management and strengthen the sanitation sector.
- It is essential to maintain a constructive dialogue with all stakeholders concerned with the issue of sanitation.
- The recommendations could greatly contribute to improving the performance of Tunisia's sanitation sector, reducing GHG emissions and meeting Tunisia's climate change targets.

This report provided an overview of the water sanitation sector in Tunisia, highlighting its strengths and challenges, while placing itself in the broader context of the Sustainable Development Goals (SDGs) and commitments under the Paris Agreement. With the support of the project ICAT, the UNEP Copenhagen Climate Centre and ISPRA with the Ministry of Environment Tunisia aims to support the development of a MRV system for the water and sanitation sector in Tunisia that includes institutional arrangements and a system for the collection, treatment and valorization of wastewater data, as well as the monitoring of mitigation measures and capacity building of national and local actors.

In a national context marked by specific challenges in terms of access to drinking water and sanitation, Tunisia has undertaken important national initiatives to improve water management and strengthen the sanitation sector. However, this report highlights the importance of having a strengthened institutional and legal framework and a significant improvement in data for the establishment of an effective future MRV system.

The recommendations in this report are intended to support these efforts. They include legal and regulatory reform, improving data collection and processing, establishing an effective MRV system, implementing an appropriate measurement methodology and data quality controls, and verifying and monitoring progress.

These recommendations, if implemented effectively and coherently, could greatly contribute to improving the performance of Tunisia's sanitation sector, reducing GHG emissions and achieving Tunisia's climate change targets. The analysis of the current functioning of the water purification sector and the circulation of data necessary for the development of an MRV system in this sector shows the need to undertake many multi-stakeholder and multi-level actions to achieve this end.

It is essential to maintain a constructive dialogue with all relevant stakeholders throughout this process, including governmental institutions, non-governmental organizations, the private sector and local communities. Their commitment and active participation will be crucial to ensure the success of these efforts.

Finally, this report should be seen as a starting point for continuous and evolving work, requiring regular revisions and adjustments based on progress, new knowledge and feedback. The future of Tunisia's sanitation sector will depend on the country's ability to adapt and innovate to the challenges of climate change.

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Appendix 1. List of interviews

Interview schedule		
Direction	**Date**	**Place**
Department of purification - Central department of purification and recovery	14/04/2023	ONAS
Metrology and Industrial Waste Department - Central Department for Purification and Recovery	06/04/2023	ONAS
Development Department - Central Technical Department	07/04/2023	ONAS
Department of Training, Documentation and Archives - Central Department of Management	10/04/2023	ONAS
IT Department-Central Department of Management	11/04/2023	ONAS
Organization Directorate - Central Department of Management	12/04/2023	ONAS
Maintenance Department - Central Department of Means and Equipment	13/04/2023	ONAS
Energy Management Project Manager - Chief Executive Officer / Board of Directors	05/04/2023	ONAS
Ms Hajer GHARBI, Inventory Preparation Officer	16/04/2023	ONAS
Schedule of visits to wastewater treatment plants		
Wastewater treatment plant	**Date**	**Place**
Rural WWTP Bin Ayeche -Nabeul	18/04/2023	Bni Ayeche Nabeul
SE4 Dar chaabene El fehri- Nabeul	20/04/2023	Dar chaabene Fehri Nabeul
STEP Mornaguia	24/04/2023	Mornaguia
STEP Metouia Gabes	25/04/2023	Gabes
STEP Aguila- Gafsa	26/04/2023	Gafsa