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meetMED
Mitigation Enabling Energy Transition in the MEDiterranean region
Together We Switch to Clean Energy

State-of-the-art report on the water and water-related energy use in the building sector

Algeria

MED ENER

RCREEE
Regional Center for Renewable Energy and Energy Efficiency
المركز الإقليمي للطاقة المتجددة وكفاءة الطاقة

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About the project

The Mitigation Enabling Energy Transition in the Mediterranean region "meetMED" is an EU-funded project developed by the Mediterranean Association of the National Agencies for Energy Management (MEDENER) and the Regional Centre for Renewable Energy and Energy Efficiency (RCREEE).

With the objective of contributing to energy and climate transition Southern Mediterranean Neighbourhood through a multi-scale, multi-partner inclusive approach, meetMED II activities aim at developing a more stable, efficient, competitive, and climate-resilient socioeconomic environment in Southern Mediterranean countries, by fostering regional cooperation for Energy Efficiency measures and implementing demo actions.

Chapter 1: Water Management and Governance

Limited resources are under significant demand pressure. Algeria has limited, irregular, and highly unevenly distributed natural resources. Except for fossil waters in the Sahara, natural water resources are mainly located in the northern part of the country. 90% of total surface flows (estimated at 12.4 billion m^3/year) are found in the coastal region (7% of the land area), with the remaining 10% distributed between the High Plateaus and Saharan basins.

Algeria is among the countries with the lowest water potential, falling below the theoretical scarcity threshold set by the World Bank, which is 1,000 m^3 per capita per year. In 1962, per capita water availability was 1,500 m^3; it decreased to over 720 m^3 in 1990, 630 m^3 in 1998, and is only 430 m^3 in 2020. (Ministry of Hydraulic Algeria 2021)

Water resource potential is distributed as follows:

Global potential	18.5 billion m3
Surface water potential	11 billion m3
Groundwater potential (Northern region)	2, 5 billion m3
Groundwater potential (Northern Sahara)	5 billion m3
Unconventional resources (mobilizable by 2025)	
Seawater desalination	0,77 billion m3 /year
Reuse of treated wastewater	0,9 billion m3

Table 1: Water Resource Potential in Algeria (World Bank 2018)

This weakness in water resources has been exacerbated in recent years due to climate change:

From the supply side:

- Poor spatial distribution of this resource, and the mismatch between needs and availability, leading to significant transfers to meet the needs of less well-endowed regions.
- Seasonal and interannual variability in precipitation. Siltation of reservoirs.
- Significant water losses due to aging infrastructure and poor maintenance of networks.

From the demand side:

- Very low water prices that encourage wastage (€0.3/m^3, while the average price for a cubic meter of potable water in Europe is €4, which is 13 times more expensive than in Algeria).
- Wastage of this resource in all sectors of activity.
- Poor efficiency in the use of this resource, particularly in agriculture and industry.
- Low recycling of wastewater.

Among the most water-consuming sectors, some are well-known, particularly irrigated agriculture and domestic or recreational uses that are particularly water-intensive. The amount of water used in agricultural and industrial production is less apparent.

1.2. Distribution of Water Consumption in Algeria

The overall demand for water has significantly and rapidly increased. It has quadrupled over the past forty years and now exceeds more than half of the potentially mobilizable resources. At this rate, the maximum limit of hydraulic potential will be reached before 2050. In this context, strong competition is developing between major usage sectors, coupled with imbalances in resource availability between regions, making allocation decisions increasingly difficult. the share of potable water supply has significantly increased in both volume and proportion. From **16%** of total consumption in 1975, it has risen to **30%** currently. During the same period, the share of agricultural water has decreased from **80%** to **65%**, while the industrial share remains at **5%**. The supply of potable water has gained clear priority over other uses, a priority that has been enshrined in Algerian water legislation. (Ministry of Hydraulic of Algeria 2021)

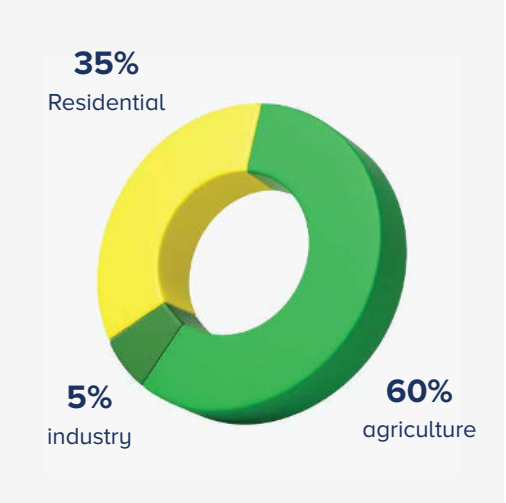


Figure 1: Distribution of Water Consumption in Algeria

1.3. Organization of Water Management in Algeria

Since the transfer of the irrigation sector, which was previously under the Ministry of Agriculture, to the Ministry of Water Resources (MRE) and currently to the Ministry of Hydraulic Resources, this sector is primarily responsible for water policy, including its development and implementation. Its responsibilities cover all activities related to research, exploitation, storage, distribution of water for all uses, and sanitation. It works with the ministries responsible for the Environment and Health to preserve water quality.

At the national level, the Ministry of Hydraulic Resources carries out its missions with the support of national public institutions responsible for hydraulic studies and resource evaluation (ANRH), water mobilization and transfers (ANBT), urban potable water supply (ADE), urban sanitation (ONA), and irrigation management (ONI). At the local level, in each wilaya, the MRE's functions are carried out by the wilaya's hydraulic department (DHW) under the administrative authority of the Wali. The Water Law (2005) established a National Advisory Council on Water Resources, which facilitates coordination and consultation with other administrations, economic sectors, and all users. The management of the water sector in Algeria is primarily organized under the Water Law (Law 05-12 of August 4, 2005), a legal instrument with dual purposes: normative and sectoral policy. This fundamental law takes into account the country's economic developments and sets out principles and rules for the use, management, and sustainable development of water resources as a national collective good.

The 2005 Water Law enshrines the right to access water and sanitation for all and defines the principles for the use, management, and sustainable development of water resources:

- The right to access water and sanitation for all.
- The right to use water resources for all within the limits of the general interest.
- Planning for allocation and management within natural hydrographic units.
- Consideration of the actual costs of domestic, agricultural, and industrial water supply services and sanitation services.
- Recovery of public intervention costs related to the quantitative and qualitative protection of water resources through water-saving and quality protection fee systems.
- Systematization of water-saving practices and the use of appropriate processes and equipment, as well as metering produced and consumed water to combat losses and wastage.
- Consultation and participation of all stakeholders.

Executive Decree No. 2000-324 of October 25, 2000 establishing the attributions of the Minister of Water Resources, National Agency of Hydraulic Resources (ANRH), National Agency of Dams and Transfers (ANBT), Algerian Water (ADE), National Office of Sanitation (ONA), National Office of Irrigation and Drainage (ONID)

This law introduced new and significant innovative provisions, including:

- The obligation to develop a National Water Plan and local management planning within hydrographic basins.
- Establishment of rules governing water pricing systems based on the actual costs of supply services.
- The possibility of concession or delegation of public water service to public legal entities

1.4. List of Dams in Algeria

As of the end of 2021, the water sector in Algeria has 80 dams and additional ones under construction, distributed across the entire national territory, under the Ministry of Water Resources and Environment (MRE). The sector's projections for 2030 include 139 dams. These dams are water reservoirs managed by the 48 Regional Water and Hydraulic Departments in Algeria and are overseen by the National Agency for Dams and Transfers (ANBT). The potable water extracted from these dams is managed by the Algerian Water Company (ADE).

The most important dams in Algeria:

Wilaya	Number of dams	Wilaya	Number of dams	Wilaya	Number of dams
Adrar	01	Tebessa	04	Annaba	05
Chlef	02	Tlemcen	05	Guelma	02
Laghouat	02	Tiaret	03	Constantine	01
Oum el bouaghi	01	Tizi ouzou	03	Medea	02
Batna	02	Alger	03	Mostaganem	03
Bejaia service	02	Djelfa	03	Msila	05
Biskra	02	Jijel	05	Mascara	05
Bechar	02	Sétif	02	Ouargla	01
Blida	01	Saida	03	Oran	02
Bouira	04	Skikda	04		
Tamenrasset	01	Sidi belabes	05		

1.5. Local Sources of Freshwater Supply

Local sources of freshwater supply come from desalination plants and groundwater. Algeria's coastline hosts 21 seawater desalination plants spread across 14 coastal wilayas, with 7 additional plants under construction, all under the Ministry of Water Resources (MRE). These plants provide 17% of the country's water consumption, serving 6 million people with a volume of 2.6 million m^3 per day.(Ministry of Water and Resources 2021)

The seawater desalination plant in El Hadjadj, formerly known as Port aux Pèlerins, has a daily production capacity of 550,000 m^3, making it the largest operational desalination plant in the world.A National Desalination Agency (ANDE) was established in March 2023 with the primary mission "to build, operate, and maintain desalination plants and their associated infrastructure and equipment."

Desalination Plants in Algeria

Wilaya	Desalination Plants
Wilaya of Chlef	1. Ténès Desalination Plant: 200,000 m^3/day of potable water. 2. Beni Haoua Desalination Plant (under construction): 5,000 m^3/day of potable water.
Wilaya of Béjaïa	1. Tighremt Desalination Plant in the commune of Toudja (under construction): Projected capacity of 300,000 m^3/day of potable water.
Wilaya of Tlemcen	1. Souk Tléta Desalination Plant: 200,000 m^3/day of potable water. 2. Honaïne Desalination Plant: 200,000 m^3/day of potable water
Wilaya of Tizi Ouzou	1. Tigzirt Desalination Plant: 2,500 m^3/day of potable water.
Wilaya of Algiers	1. Hamma Desalination Plant: 200,000 m^3/day of potable water. 2. Staoueli (Palm Beach) Desalination Plant, operational since August 19, 2021: 7,500 m^3/day of potable water. 3. Aïn Benian Desalination Plant, operational since September 18, 2021: 10,000 m^3/day of potable water. 4. Zeralda Desalination Plant, operational since October 27, 2021: 10,000 m^3/day of potable water. 5. Bordj El Kiffan (Bateau cassé) Desalination Plant, operational since April 2022: 10,150 m^3/day of potable water. 6. El-Marsa Desalination Plant, operational since July 2022: 60,000 m^3/day of potable water.
Wilaya of Jijel	1. Jijel Desalination Plant: 200,000 m^3/day of potable water.
Wilaya of Skikda	1. Skikda Desalination Plant: 100,000 m^3/day of potable water.
Wilaya of Annaba	(Information not provided.)

Wilaya of Mostaganem:	1. Mostaganem Desalination Plant: 200,000 m^3/day of potable water
Wilaya of Oran:	1. Arzew Desalination Plant: 90,000 m^3/day of potable water. 2. Bousfer Desalination Plant: 5,500 m^3/day of potable water. 3. Aïn Turck Desalination Plant: 5,000 m^3/day of potable water. 4. Mactaâ Desalination Plant: 500,000 m^3/day of potable water. 5. Cap Blanc (commune of Aïn El Kerma) Desalination Plant (under construction): Projected capacity of 300,000 m^3/day of potable water.
Wilaya of Boumerdès:	1. Djinet Desalination Plant, operational since 2012: 100,000 m^3/day of potable water. 2. Corso Desalination Plant, operational since September 2023: 80,000 m^3/day of potable water. 3. Cap Djinet Desalination Plant (under construction): Projected capacity of 300,000 m^3/day of potable water.
Wilaya of El Tarf:	1. El Tarf Desalination Plant: 50,000 m^3/day of potable water.Koudiet Eddraouche Desalination Plant, commune of Berrihane (under construction): Intended to supply El Tarf, Guelma, Souk Ahras, and Skikda wilayas, projected capacity of 300,000 m^3/day of potable water.
Wilaya of Tipaza:	1. Oued Sebt Desalination Plant: 100,000 m^3/day of potable water. 2. Douaouda (Fouka 1) Desalination Plant, operational since 2008: 120,000 m^3/day of potable water. 3. Fouka 2 Desalination Plant (under construction): Projected capacity of 300,000 m^3/day of potable water. 4. Bousmail Desalination Plant: 10,000 m^3/day of potable water.
Wilaya of Aïn Témouchent:	1. Béni Saf Desalination Plant: 200,000 m^3/day of potable water. 2. Chatt El Hilal Desalination Plant: 200,000 m^3/day of potable water.

1.6. Algerian Water Company (Algérienne des Eaux)

This organization encompasses fifteen (15) zones distributed across forty-four (44) wilaya units, responsible for the direct management of potable water supply (AEP) in 1,010 communes out of the 1,541 communes in the country.

The Algerian Water Company holds a majority stake in its three (03) subsidiaries structured as public limited companies (SPA) that manage 123 communes:

1

- Société des Eaux et de l'Assainissement de Constantine (SOACO): In the wilaya of Constantine, with ADE holding **64%** and ONA **36%.**

2

- Société des Eaux et de l'Assainissement d'Oran (SEOR): In the wilaya of Oran, with ADE holding **83%** and ONA **17%.**

3

- Société des Eaux et de l'Assainissement d'Alger (SEAAL): In the wilayas of Alger and Tipasa, with ADE holding **93%** and ONA **7%.**

The remaining 408 communes are managed by the local Assemblies of People's Communes (APC).

SPA ALGEAUX, a subsidiary of ADE, specializes in hydraulic studies and works, aiming to enhance ADE's technical intervention capabilities.

Water Treatment and Quality Control Over 900 specialists are involved in the treatment and control of all water produced and distributed by ADE. This is conducted through 86 process laboratories located at treatment stations, 44 laboratories in distribution units, and one central reference laboratory in Algiers.

ADE ensures high water quality by conducting extensive controls and analyses of all water produced at every stage, from production to the consumer's tap.

All produced water is rigorously monitored by 920 specialists across 131 analysis laboratories under ADE's oversight, from collection through treatment stations, storage in reservoirs, and up to the consumer's tap, throughout all wilayas in the country.

1.7. Algerian Water Company (ADE) – Water Control and Treatment

The ADE has a network of specialized laboratories to ensure water quality:

- **86** Process Laboratories located at water treatment stations, responsible for monitoring water quality at each stage of treatment.
- **44** Physico-Chemical and Bacteriological Analysis Laboratories for monitoring the parameters of distributed water quality and supporting disinfection operations for hydraulic works and distribution networks.
- **1** National Central Laboratory for specific controls such as quantification and identification of algae, trihalomethanes, hydrocarbons, pesticides, heavy metals, as well as for conducting contradictory analyses in case of non-compliance issues.

Control System in Place:

- Self-Monitoring and Surveillance: Water treatment, self-monitoring, and quality control are conducted at all levels of production and distribution networks managed by ADE, including at the consumer level.
- Water Quality Standards: The treatment and quality control of water intended for human consumption are regulated by six executive decrees. These decrees set the frequency, methods, and chemicals used for water treatment, as well as the conditions for sampling and analyzing groundwater and surface water. They also define quality objectives for water and conditions for supplying water for human consumption by mobile tankers.
- List of Chemicals: The list of chemicals usable for treating and correcting drinking water is determined by a ministerial decree. This system ensures rigorous control of water quality, ensuring its compliance with safety and hygiene standards.

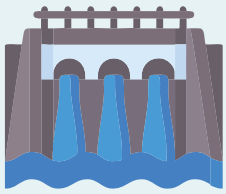
1.8. Fighting Waterborne Diseases (WBDs)

Waterborne Diseases (WBDs) refer to illnesses transmitted through contaminated water, such as cholera, dysentery, hepatitis A, and typhoid fever, which can lead to significant health risks and fatalities.

Impact on Public Health: WBDs pose a serious threat to public health, particularly during hot periods when their incidence tends to increase. This necessitates collaborative efforts from various ministries, local authorities, and civil society organizations to safeguard public health.

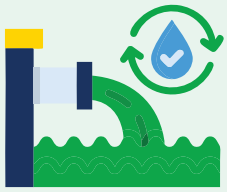
Financial Implications: The cost of treating a single case of a waterborne disease can reach 180,000 Dinars per day, highlighting the significant financial burden of these diseases.

Factors Contributing to WBDs: Several factors contribute to the spread of WBDs, including:



- Discharge of wastewater and industrial effluents directly into water sources (dams, rivers, etc.).
- Infiltration of wastewater into the drinking water network.
- Obsolescence of drinking water and sanitation networks.
- Illegal connections and thefts from water networks.
- Poor sanitation of water tanks and cisterns owned by individuals.

ADE's Measures to Combat WBDs: To effectively and sustainably combat WBDs, the Algerian Water Company (ADE) has implemented a rigorous system including:



- Cleaning and Disinfection: Regular cleaning and disinfection of all water storage facilities twice a year.
- Enhanced Water Quality Control: Increasing the frequency of water quality analyses, especially at critical points in the network (e.g., old networks, network extremities).
- Continuous Supply of Reagents: Ongoing provision of reagents, standards, culture media, and disinfection products to maintain high water quality standards.

These measures aim to prevent the spread of waterborne diseases and ensure safe, clean drinking water for the population

1.9. AGIRE: National Agency for Integrated Water Resources Management

AGIRE, established by Executive Decree No. 11-262 on July 30, 2011, operates under the Ministry of Water Resources and is responsible for the integrated management of water resources in Algeria.

Its main missions include:

Conducting Research and Studies: Performing investigations, studies, and research related to the development of integrated water resources management.

- Developing and Coordinating Information Systems: Building and coordinating national water information management systems.
- Planning and Evaluation: Contributing to the development, evaluation, and updating of medium and sectoral plans.
- Promoting Water Conservation: Supporting initiatives to encourage water conservation and preserve water quality.

In addition, AGIRE performs public service obligations on behalf of the state, in collaboration with river basin agencies. These include:

- Data Collection and Processing: Gathering and analyzing data and indicators related to water resources, natural environments, and their uses.
- Delimitation of Public Hydraulic Domain: Conducting technical operations to define the boundaries of natural hydraulic public domains, such as rivers and natural water bodies.
- Information and Awareness Campaigns: Creating documents and carrying out actions to inform and educate various user groups on water conservation and quality preservation.

AGIRE plays a crucial role in managing and protecting Algeria's water resources through its comprehensive approach and coordination with other agencies.

Chapter 2:

Standard Water Equipment Installed in Residential and Public Administrative Buildings

This chapter describes the standard hydraulic equipment installed in residential and administrative buildings.

Generally, the specifications set forth in the Public Procurement Guidelines represent the minimum requirements for residential equipment. The sanitary equipment to be provided in the dwelling must be designed and exec

2.1 RESIDENTIAL BUILDING (Large Complex)

In Algeria, the installation of water equipment in households varies widely depending on region, socioeconomic factors, and infrastructure development. In urban areas, most households have access to modern water-saving devices, such as low-flow faucets, dual-flush toilets, and efficient water heaters. However, in some rural and underserved areas, access to reliable water infrastructure is more limited, and traditional water use methods are still prevalent. Moreover, the country faces increasing water scarcity due to climate change and growing demand, pushing for more efforts to promote water conservation technologies.

Government initiatives and programs like the integration of water meters and the development of greywater recycling systems are gradually being introduced. but adoption of behaviors that limit water waste remains slow due to limited awareness and relatively low water bills.

While Algeria is making strides in encouraging the adoption of water-efficient technology, significant challenges remain, particularly around affordability, awareness, and access to modern infrastructure in underserved areas In Algeria, water from the public networks is distributed through underground networks, solely during planned hours. For this reason, it is common that buildings have storage water tanks (usually installed on the buildings' roofs) to meet the occupants' water needs. Pumps are used to pump the water to the main storage water tanks.

Water Storage (Water Tank)	- Concrete reserve (based on capacity, intended use, and user needs)
Associated Treatment Equipment	- Sand, cartridge, or activated carbon filters to remove particles - UV treatment or chlorination system to ensure water potability - Drain valves for regular cleaning of the tank
Elevator or Recirculation Pumps:	- Submersible or surface pumps for water supply - Booster pumps to ensure adequate pressure in the distribution network - Float switches or level sensors to monitor water level - Automatic valves for managing water entry and exit - Programmable controllers for pump and valve management
Elevator or Recirculation Pumps:	- Submersible or surface pumps for water supply - Booster pumps to ensure adequate pressure in the distribution network - Float switches or level sensors to monitor water level - Automatic valves for managing water entry and exit - Programmable controllers for pump and valve management
Bathroom (Faucets, Showers, and Bathtub):	- Thermostatic mixer for the washbasin - Faucets for washing machines - Thermostatic mixer for the shower - Thermostatic mixer for the bathtub

Sanitary Equipment

Toilet Flush Systems	- Faucet for WC - Flush supply faucet - Stopcock
Kitchen (Sinks)	Mixer for the sink
Bathroom Equipment	Mixer for the washbasin and shower

To ensure safety, the following are needed:

1
- Check valves to prevent backflow of contaminated water

2
- Pressure relief valves to protect against overpressure

3
- Low and high-level alarms to alert of anomalies

Sanitary Hot Water Production Equipment and Other Relevant Heating Equipment:

- Electric or gas water heaters
- Hot water storage tanks
- Boilers and radiators
- Gas radiators
- Rainwater recovery and reuse systems

Irrigation Equipment (Rainwater Harvesting):

Rainwater Collection Systems	- Gutters and Downspouts: Installed on roofs to direct rainwater into storage tanks. - Screens and Filter Grids: Placed on gutters to trap debris and leaves.
Storage Tanks	- Aboveground or Underground Tanks: Made of PVC, concrete, or galvanized steel, with capacities suited to needs (typically 1,000 to 10,000 liters for residential applications or more for administrative buildings). - Secure Covers: To prevent contamination and evaporation.

Filtration Systems	- Primary Filtration: Fine mesh filters to remove large debris before water enters the tank. - Secondary Filtration: Sand or cartridge filters to eliminate finer particles. - Fine Filtration: Activated carbon filters to remove organic contaminants and improve water quality
Pumping Systems	- Submersible or Surface Pumps: To transport water from the tank to the irrigation system. - Booster Pumps: To maintain consistent water pressure for supply or irrigation.
Distribution Systems	- Pipes and Fittings: Made of PVC or HDPE, durable and weather-resistant. - Safety Fittings: To prevent leaks and ensure secure connections. Control and Management Systems: - Level Sensors: To monitor water levels in tanks. - Controllers and Timers: To automate irrigation according to needs and times of the day. - Bypass Systems: To allow the use of potable water in case of rainwater shortage.
Treatment Systems (Optional)	- UV Treatment: To disinfect water and remove pathogens if rainwater is used for purposes other than irrigation. - Chlorination: For chemical disinfection if needed.
Safety Systems:	- Firefighting Network: Comprising a water tank, steel piping, pumps or booster pumps, and valves at each level.

2.2 ADMINISTRATIVE / PUBLIC BUILDINGS

Water Storage	- Tanks: Made of PVC, stainless steel, or concrete (depending on capacity and intended use based on user needs).
Associated Treatment Equipment	- Filters: Sand, cartridge, or activated carbon filters to remove particles. - Treatment: UV treatment or simple chlorination to ensure water potability. - Drain Valves: For regular cleaning of the tank.
Pumping Systems:	- Primary Filtration: Fine mesh filters to remove large debris before water enters the tank. - Secondary Filtration: Sand or cartridge filters to eliminate finer particles. - Fine Filtration: Activated carbon filters to remove organic contaminants and improve water quality

Faucets and Showers	- Pumps: Submersible or surface pumps for water supply. - Booster Pumps: To ensure adequate pressure in the distribution network. - Float Switches or Level Sensors: To monitor water levels. - Automatic Valves: For managing water entry and exit. - Programmable Controllers: For managing pumps and valves.
Faucets and Showers	- Push-button Faucets: To save water for sinks. - Mixer: For showers (e.g., in sports facilities).

Water Treatment Equipment (optional / special cases only)

(only for hospitals, hotels, or high-end housing projects, not standard social housing in Algeria)

- Water softeners
- Filters / Reverse osmosis units
- Disinfection systems

Water Network:

- Pipes: Made of PVC, HDPE, or galvanized steel for water transport.
- Fittings, Elbows, Check Valves, and Joints: To ensure network sealing and flexibility.

To ensure safety:

- Check Valves: To prevent backflow of contaminated water.
- Relief Valves: To protect against overpressure.
- Low and High-Level Alarms: To alert of anomalies.

Sanitary Hot Water Production Equipment and Other Relevant Equipment:

- Centralized Water Heaters
- Instantaneous Hot Water Production Systems
- Pressure Reducers
- Rainwater Recovery and Reuse Systems

Irrigation Equipment (Rainwater Harvesting):

Rainwater Collection Systems:	- Gutters and Downspouts: Installed on roofs to direct rainwater to storage tanks. - Screens and Filter Grids: Placed on gutters to trap debris and leaves.
Storage Tanks:	- Aboveground or Underground Tanks: Made of plastic, concrete, or steel, with capacities suited to needs (more than 10,000 liters for administrative buildings). - Secure Covers: To prevent contamination and evaporation.
Filtration Systems:	- Primary Filtration: Fine mesh filters to remove large debris before water enters the tank. - Secondary Filtration: Sand or cartridge filters to eliminate finer particles. - Fine Filtration: Activated carbon filters to remove organic contaminants and improve water quality.
Pumping Systems:	- Submersible or Surface Pumps: To transport water from the tank to the irrigation system. - Booster Pumps: To maintain constant water pressure for irrigation. Distribution Systems: - Pipes and Fittings: Made of PVC or HDPE, resistant to wear and weather. - Safety Fittings: To prevent leaks and ensure secure connections.
Control and Management Systems:	- Level Sensors: To monitor water levels in the tanks. - Controllers and Timers: To automate irrigation based on needs and times of the day. - Bypass Systems: To allow the use of potable water in case of rainwater shortage.
Treatment Systems (Optional):	- UV Treatment: To disinfect the water and remove pathogens if rainwater is used for purposes other than irrigation. - Chlorination: For chemical disinfection if necessary
Security Systems:	- Firefighting Network: Comprising a water tank, steel piping, pumps or booster pumps, and valves at each level.

Chapter 3:

Installation and Operating Conditions Affecting the Water-Energy Nexus of Buildings

This chapter should provide information on relevant installation and operational conditions that affect the water-energy nexus of buildings:

- Typical Operational Water Pressure at Building Inlets

- Typical Hot Water Temperature Set Points

- Implementation of Water Efficiency Standards for Faucets and Showers, or Other Restrictive Standards for Maximum Water Flow

The installation and operation of water and energy systems in residential and public administrative buildings are impacted by several key parameters. These parameters directly affect the efficiency, sustainability, and operational costs of the systems. The following section provides an overview of the main, non-exhaustive conditions to consider, which will enable optimization in the use of water and energy resources, leading to reduced operational costs, a decreased ecological footprint, and improved overall sustainability.

The electricity sector in Algeria is heavily reliant on fossil fuels, with “natural gas” being the dominant source, accounting for approximately 99% of electricity generation. The country has vast natural gas reserves, which are central to both its domestic energy production and exports. In recent years, there has been a push towards diversifying the energy mix by integrating “renewable sources” such as solar and wind power, but these still account for a small percentage of the overall energy production.

When examining the “nexus of water and energy”, one of the significant intersections is the energy-intensive process of “desalination”. Given Algeria’s growing water scarcity issues, desalination plants have become critical for supplying fresh water, particularly in coastal cities. However, this

process requires a considerable amount of energy, primarily sourced from natural gas despite the introduction of energy recovery systems that improve the energy efficiency of the system. As of recent reports, around 3-4% of Algeria's total energy consumption is dedicated to desalination. This fi gure is expected to grow as more desalination plants come online to meet the increasing demand for potable water, further stressing the country's energy resources. Addressing this challenge will require enhancing energy effi ciency and expanding renewable energy integration, particularly in sectors like desalination that are crucial for water security.

3.1 Installation Conditions in Algeria (Author's Assessment)

1- Design and Planning:

- Assessment of Water and Energy Needs: Determine the expected consumption to size the systems correctly and reduce waste.
- Equipment Selection: Choose energy- and water-efficient equipment (booster pumps, low-flow faucets, efficient appliances, etc.).
- Initial Pressure Evaluation: Use pressure gauges to measure the available water pressure at the building's inlet. Typically, the optimal pressure ranges between 3 and 5 bars for residential and administrative buildings.
- Pressure Regulation: Install regulators at building inlets to maintain a constant pressure, avoid fluctuations, and keep it within the optimal range considering the specific needs of internal systems (appliances, heating system, etc.).

2- Location and Climate:

- Access to Natural Resources: The availability of rainwater, groundwater, or renewable energy sources (solar, wind).
- Climate Conditions: Heating or cooling needs influence energy consumption.

3- Infrastructure:

- Distribution Network: The quality and capacity of existing water and energy networks using PVC, HDPE, copper, or galvanized steel pipes depending on local standards and building characteristics.
- Tank and Pump Installation: For rainwater harvesting systems or greywater treatment.

4- Standards and Regulations:

- Local Regulations: Compliance with building codes, safety standards, and environmental regulations that define adequate water pressure for different types of buildings.
- Subsidies and Incentives: Government programs to encourage the use of energy- and water-efficient technologies.

3.2 Functioning Conditions:

1. Pressure Control and Monitoring:

- Install Pressure Gauges: At key points in the water distribution system to monitor pressure in real-time.
- Use Water Management Systems: To control and regulate pressure automatically.

2. Preventive Maintenance:

- Check Pressure Regulators, Pumps, and Valves: To ensure they are functioning correctly.
- Perform Cleaning and Descaling Operations: On pipes and equipment to prevent obstructions that can affect pressure.

3. Managing Consumption Peaks:

- Use Buffer Storage Tanks: To smooth out consumption variations and maintain stable pressure.
- Schedule High-Usage Activities: Outside peak water consumption hours to avoid pressure drops (such as filling tanks).

3.3 Operating Conditions

Consumption Management:

- Usage Control: Monitoring systems to track and control water and energy consumption in real-time.

- Schedule Optimization: Use of devices and systems outside peak hours to reduce load on networks.

Maintenance and Upkeep:

- Regular Maintenance: Cleaning filters, inspecting pipes, and heating systems to ensure maximum efficiency.

- Proactive Repairs: Rapid intervention in case of leaks or malfunctions to prevent water and energy losses.

Education and Awareness:

- Occupant Training: Raising awareness among residents and employees about water and energy conservation practices.

- Incentive Programs: Encouraging the adoption of eco-friendly behaviors.

Management Technologies:

- Energy Management Systems (EMS): Automation and optimization of energy consumption.

- Water Management Systems (WMS): Monitoring and managing water flows to minimize waste.

Impact on the Water-Energy Nexus:

Energy Efficiency:

- Efficiency of Heating and Cooling Systems: Use of solar thermal systems or heat pumps to reduce energy consumption related to heating and hot water production.
- Stable Pressure Maintenance: Allows various systems to operate more efficiently, reducing energy consumption.
- Solar Water Heaters (Solar Thermal): Use of solar thermal water heaters.
- Insulation of Tanks: To minimize thermal losses.
- Insulated Pipes: To reduce heat loss during hot water transport.
- Hot Water Recirculation: Installing a system that keeps hot water close to the outlets, reducing water waste while waiting for it to heat up.

Note: currently, households are almost systematically equipped with a water tank and booster pump. even if the booster pump is almost effective (often not)

Lighting and Appliances:

- Adopt LED Solutions: For lighting and low-water, energy-efficient appliances.
- Prefer Low-Temperature Washing Machines: For laundry or dishwashing, or use existing hot water networks.

Water and Energy Conservation:

- Reducing Leaks: Addressing leaks caused by excessive water pressures, which lead to water loss and increased energy costs associated with pumping and treating water.
- Flow Reduction Devices: Installing devices that operate efficiently (optimized) such as water-saving faucets and showers, which work with stable pressure. This reduces wear and tear, lowering maintenance or replacement costs.
- Greywater Recovery and Reuse: For non-potable uses such as irrigation and toilet flushing.

Integration of Renewable Energy Sources:

- Photovoltaic Solar Panels: Generating renewable electricity to reduce dependence on conventional energy sources.
- Rainwater Collection and Storage Systems: Reducing demand on public water networks.

User Safety and Comfort:

- Setting Water Heater Temperature: Adjusting to the sanitary reference temperature of 55°C to 60°C to prevent bacterial growth like Legionella and avoid burn risks.
- Adjusting Faucet and Shower Temperatures: To prevent burns, especially in buildings with children and elderly people.
- Installing Thermostats on Radiators: To regulate room temperatures based on occupancy.

Implementation of Water Efficiency Standards:

Conducting Water Consumption Audits: To identify reduction opportunities.

- Evaluating Equipment: To determine efficiency and compliance with current standards.
- Setting Reduction Targets: Establish specific goals over a given period.
- Adopting Maximum Flow Standards: For faucets, showers, etc. (e.g., limiting sink faucets to 6 liter per minute and showers to 8 LPM) .
- Selecting Equipment Based On:
    - Certified Low-Flow Faucets: 1.5 GPM (USA standard).
    - Showerheads with Maximum Flow Rate: 2.0 GPM.
    - Complementary Technologies: Such as thermostatic valves to stabilize temperatures.
- Establishing Professional Installation Procedures.
- Documenting Installations: (e.g., tracking sheets, displays).
- Training Installers and Raising User Awareness.
- Offering Incentives or Rewards: For individual and collective efforts.
- Ensuring Feedback:Regular reporting and monitoring.

Water Sobriety:

- Voluntary reduction of water consumption to what is truly necessary, achieved by changing habits and behaviours.

Chapter 4:

Cold and Hot Water Use in Residential and Administrative Buildings

Main Distribution of Water Consumption: Understanding the allocation of hot and cold water for various uses.

By understanding the distribution of hot and cold-water consumption and implementing effective management strategies, residential and administrative buildings can reduce their water usage, improve energy efficiency, and promote sustainable practices.

In Algeria, the production of domestic hot water (DHW) in residential and public buildings largely depends on traditional energy sources, with a gradual shift toward more sustainable solutions. The most common domestic hot water systems include:

1. Gas Water Heaters

Gas-powered water heaters are the most widespread solution in Algerian homes, particularly in urban areas. These systems are preferred due to the abundance and low cost of natural gas in the country. They typically use instantaneous gas heaters, where water is heated on demand. This type of system is also commonly used in public buildings.

2. Electric Water Heaters

Electric water heaters are also widely used, especially in areas without access to natural gas. These systems are simple to install and can be used with existing electricity infrastructure. However, they are less energy-efficient compared to gas heaters and are associated with higher energy costs for households. Electric heaters are commonly found in apartments and smaller homes, as well as public institutions like schools and office buildings.

3. Solar Water Heaters

Solar water heating systems are becoming more popular in Algeria, particularly in newer, eco-friendly residential and public buildings. These systems use solar collectors (typically placed on rooftops) to capture the sun's energy and heat water, which is then stored in insulated tanks. While solar water heaters have a higher initial installation cost, they offer significant savings over time by reducing dependence on fossil fuels. They are also a key component of Algeria's strategy to promote renewable energy and energy efficiency in households and public facilities.

4. Hybrid Systems (Solar + Electric or Gas Backup)

In some cases, hybrid systems are used, which combine solar water heaters with an electric or gas backup system to ensure a constant supply of hot water, particularly during cloudy or rainy periods when solar heating is insufficient. These systems are more efficient and sustainable, providing hot water with minimal environmental impact.

5. Centralized Hot Water Systems in Public Buildings

In larger public buildings, such as hospitals, hotels, and schools, centralized hot water systems are often used. These systems are powered by either natural gas or electricity and deliver hot water to multiple points within the building through a network of insulated pipes. Some newer public buildings also integrate solar water heating as part of centralized systems to reduce energy costs.

6. Heat Pump Water Heaters

In larger public buildings, such as hospitals, hotels, and schools, centralized hot water systems are often used. These systems are powered by either natural gas or electricity and deliver hot water to multiple points within the building through a network of insulated pipes. Some newer public buildings also integrate solar water heating as part of centralized systems to reduce energy costs.

Though still rare, heat pump are gradually being introduced in some high-end residential developments and public buildings. These systems extract heat from the air or ground to heat water and are much more energy-effi cient than traditional electric or gas heaters.

Overall, while gas and electric water heaters dominate the market, the use of solar water heaters is gaining momentum, especially in the context of Algeria's efforts to increase energy efficiency and reduce dependence on fossil fuels. Solar heating systems, in particular, are seen as a sustainable solution, especially in the country's sunny climate.

Usage	Residential building		Public building	
	Cold water	Hot water	Cold water	Hot water
Kitchen / cafeteria	Domestic use 10-15% of the Total consumption	10-15 %	10-20 %	20-30 %
	Lave-vaisselle	5-10 %	/	/
Bathroom	Toilet : 25-30 %	/	30-40 %	/
	Lavabos : 5-10 %	10-15%	10-15%	depending on the case
	Bath : 10-20 %	20-30 %	depending on the case	depending on the case
Washing machine	15-20%	10-15%	/	/
Exterior watering and cleaning	20-30%	/	15-25 %	/
Miscellaneous Drinking water Filling of tanks	5-10 %	/	10-20 %	/
Cooling/heating system (if applicable)	/	/	10-15 %	10-15 %

Source : world bank study 2018

Approach for Efficient Water Management:

1. **Installation of Efficient Meters:** Install meters to measure both cold and hot water consumption, and to detect anomalies or leaks.
2. **Identification of Potential Reduction Areas:** Identify areas where water use can be reduced.
3. **Installation of Low-Flow Fixtures:** Install low-flow faucets and showers. For imported fixtures, require a water efficiency label as a primary action.
4. **Encourage Greywater Recycling:** Promote systems for recycling greywater for toilets and outdoor cleaning.
5. **Education and Awareness:** Educate and raise awareness among users about water conservation through training programs with local communities.
6. **Awareness Campaigns:** Organize campaigns to promote best practices for water consumption.
7. **Regular Maintenance:** Conduct regular maintenance of plumbing systems and appliances.

Adjusting the water management strategy based on needs and progress is crucial.

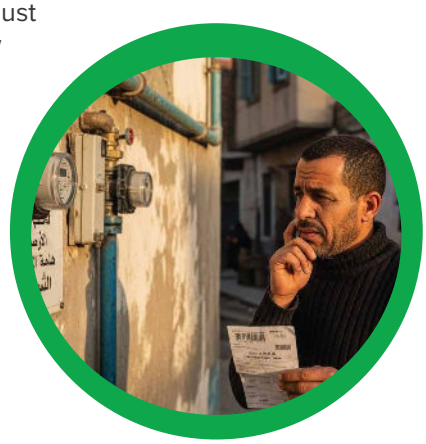
(Source : Ministry of water and resources)

Chapter 5:

Water and Energy Pricing

The implementation of awareness programs and resource pricing has gradually shifted towards integrated water resource management in the 2000s. The role of Basin Agencies (ABHs) has been reinforced, and they are responsible for “information and awareness actions for domestic, industrial, and agricultural users to promote rational use and protection of water resources.” Educational events and publications are focused on younger generations. The role of ABHs should be strengthened with clear and strong mandates.

Fair water pricing is seen as an effective way to encourage users to adjust their consumption. Decrees from 2005 and 2007 emphasize that new water pricing should cover the actual cost of the service through user fees. However, this requirement is challenging to implement, and the Ministry of Water Resources has yet to adjust pricing bases for domestic, industrial, and agricultural uses. Social resistance to water price increases partly explains the delay. Many experts agree that water priced at 10% of its cost does not promote rational use. While water is often considered a “gift from the sky,” significant financial commitments are needed for mobilization, storage, transfer, production, and distribution.



Algerian national law defines water as a “collective national asset,” and its management is a public service regulated by law, regardless of exploitation or governance strategies. The desire for a progressive and unified tariff system across the country raises questions about financing, which has been avoided due to revenues from hydrocarbon exports.

In 2012, the average water bill in an Algerian household was about 1% of its total income. Authorities face the challenge of balancing social data, consumption control, and environmental protection. This explains the reluctance to increase domestic and

agricultural water prices to match mobilization costs and internalize costs related to resource depletion (pollution, excessive pumping, depletion of fossil water, etc.).

Hydraulic officials believe that users will only pay the true price of water once services are qualitatively and quantitatively satisfactory.

Category	Slices of consumption	Drinking water (Unit Price DA)	Sanitation (Unit Price DA*)
Category 01: individuals	T-1 : 0 to 25 m3	6,3	2,35
	T-2 : 26 to 55 m3	20,48	7,64
	T-3 : 56 to 82 m3	34,65	12,93
	T-4 : more than 82 m3	40,95	15,28
Category 02: Public buildings	Single Slice	34,65	12,93
Category 03: industrial and touristic sector	Single Slice	40,95	15,28

Source : water in Algeria 2021 / Ministry of water resources

Carburants, le prix par litre	Date	DZD	USD
Gasoline price	02.10.2023	45.97	0.333
Diesel prices	02.10.2023	29.01	0.21
Price of LPG c	02.10.2023	9	0.065

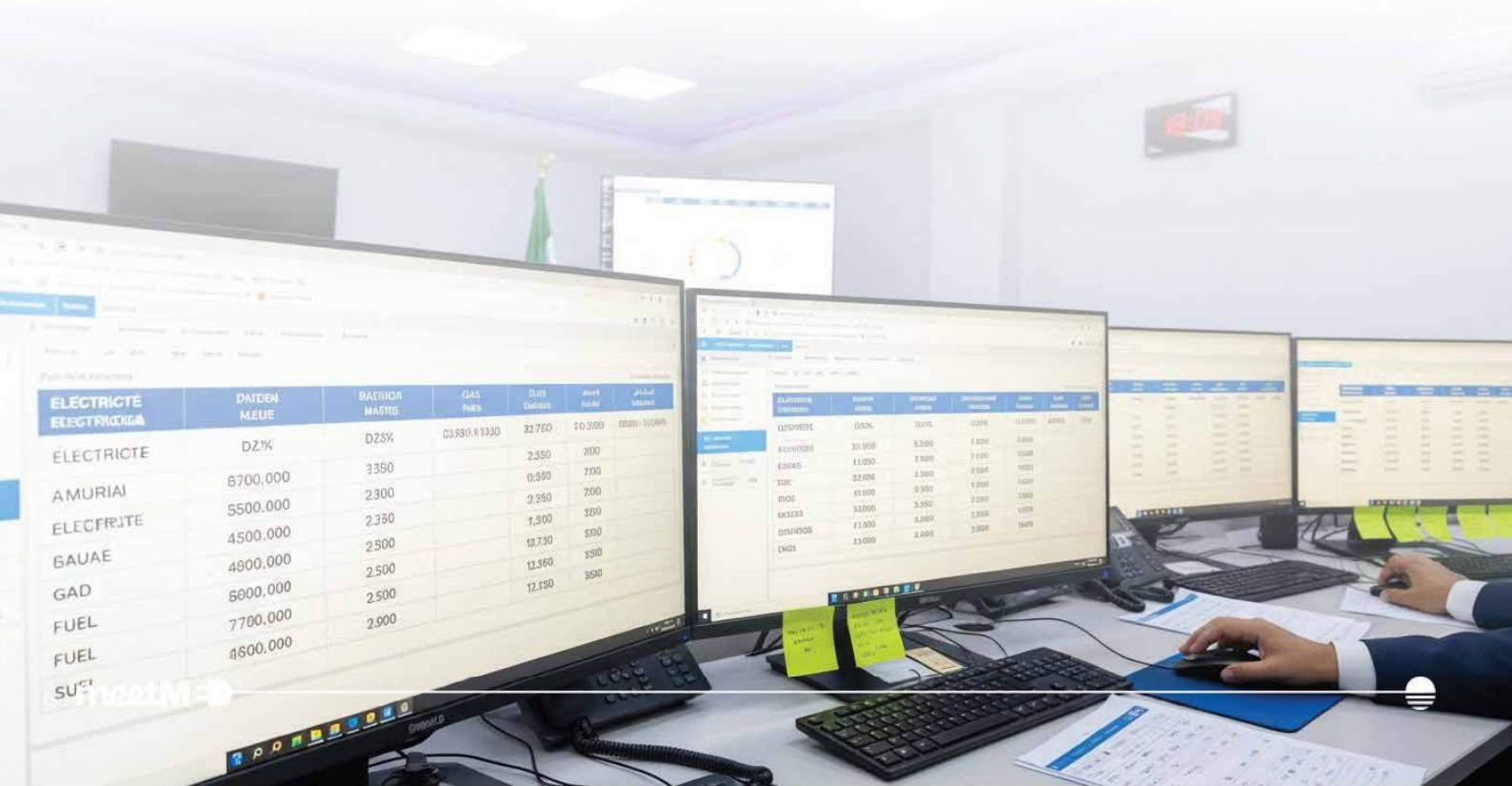
Source : energy balance Algeria 2021

Electricity and Gas Tariffs:

(Defined according to customer type [LV: households and non-households; MV: tertiary sector and small industries; HV: large industries] and by consumption brackets, as set by CREG Decision D/22-15/CD of 29 December 2015 on electricity and gas tariffs.)

Notes:

- BT (basse tension) ⟶ LV (Low Voltage) = households & small non-households
- HTA (haute tension A) ⟶ MV (Medium Voltage) = tertiary & small industrial
- HTB (haute tension B) ⟶ HV (High Voltage) = large industrial
- CREG = Commission de Régulation de l'Électricité et du Gaz (Algeria)



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