

Algerian Strategy for Water Security: Reality and Challenges.

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Abstract:

Water is the source of life and the foundation of development, impacting all aspects of life. With population growth and climate change, water resources are facing global deterioration, a concern for many countries, including Algeria. World Bank statistics indicate that water consumption has increased by 50% over the past 30 years . By 2035, freshwater availability is expected to fall to one-third of today's level, particularly in developing countries.

Algeria suffers from a shortage and pollution of water resources due to population growth and development requirements. There are also institutional and legal shortcomings, Therefore, Algeria must adopt a new national strategy based on unconventional methods to develop its water resources and achieve water security by 2030.

Keywords: Water Security, Seawater desalination, Wastewater Treatment, National Strategy.

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1. INTRODUCTION

Water is a basic requirement for sustainable development and a fundamental resource for all vital sectors. However, in recent years, it has become a threat to water security, particularly in light of climate change, which has negatively impacted water availability, and the failure of outdated water policies.

In recent years, water security has become a priority international concern. Many experts and organizations specializing in water resources predict that many countries .will face a severe water crisis, including Algeria

According to the National Statistics Office report of 2006, total water consumption reached 3.3 billion cubic meters in 2002, distributed as follows: 1.8 billion cubic meters for agriculture, 0.2 billion cubic meters for industry, and 1.3 billion cubic meters for domestic use. According to the aforementioned report, despite the reduction in water distribution, the agricultural sector remains the largest consumer of water in Algeria. There was also an increase in water consumption for domestic use between 1975 and 2002, which prompted the Algerian state to move towards involving the private sector in the management of the water service, with the aim of achieving water security, as well as searching for long-term strategic solutions, by adopting the National Water Strategy 2021-2030

This study attempts to gives answers to the following problematic:

What is the reality of Algeria's water strategy and what challenges does it face?

2.THE FIRST TOPIC: The Concept of Strategy and Water Security

2.1. First requirement: The Concept of Strategy

The word strategy is derived from the Greek word "strategos," meaning the art of leadership or the art of the general. It also denotes cunning in military maneuvers and warfare to mislead, surprise, or crush the enemy in order to achieve victory. Therefore, its initial association with military tasks was limited, but its scope of use later expanded to include other disciplines. (Abu Qahf, 1991).

2.1.1. First section:Definition of Strategy

Chandler defines it as: "It involves setting the long-term objectives of a particular project, determining the procedures and activities necessary to allocate the necessary resources or production units, and diversifying or creating new product lines to achieve a specific set of objectives". (Thaer Shaker Mohammed Al-Hayyi, 2014)

Abdul Qader Fahmy defines strategy as "the science and art of using available means and capabilities within the framework of an integrated, planned and prepared process, with the goal of creating a margin of freedom of action that helps decision-makers achieve their higher policy objectives in times of peace and war".

André Beaufre defines it in another definition: "It is the coordination and use of political, economic, social, psychological and military forces within an organized plan aimed at achieving the national interest".

It is noted in this last definition that Bouver was the first to take strategy out of its traditional military framework and into a comprehensive framework. The

comprehensive national strategy has all sectoral strategies in politics, economics, the military, and society branching out from it.

Accordingly, Khalil Hussein defines national strategy as “the rational mobilization of national resources based on the principles of scientific planning and the ability to predict, to assess national capabilities and choose appropriate means to achieve national goals at a specific time .(Saqr,2018)

The subject of strategy, with its various concepts, remains the subject of analysis and theorization in strategic thought. This is one of the most important concerns that monitor strategic challenges, diagnose their sources, distinguish between their many and varied types, and measure their severity. Innovation and creativity in crisis response methods are a difficult type to achieve, given the many challenges imposed by the economic, social, political, and even military situation. Predicting risks and emergency crises in the above areas is an area that requires any authority to take into consideration and provide insight to confront the disasters, floods, desertification and drought facing the water resources sector in Algeria. (Didouh, 2022)

2.1.2. Second section: Types of Strategy

The types of strategies can be identified as follows:

-Rational Strategy: This strategy relies on scientific study and assumes the willingness of the people to be persuaded of its requirements due to its objectivity and its reliance on sound, logical scientific thinking. This type of strategy relies on scientific research and a succession of scientific competencies to develop it, meet its requirements, and lead the desired change movement. It also relies on modern methods for its management and organization.

-Directive strategy: This type of strategy depends on attracting the attention of those concerned, motivating them, and gaining their trust, while sharpening their will and modifying their attitudes, a modification that pushes them to carry out the desired actions, without neglecting the intelligence and rationality that humans possess.

-Political and Administrative Strategy: This strategy relies on the power emanating from political or administrative authority and assumes that the people concerned will comply with the demands and directions of the authority and follow its plans and directives. It also relies on government legislation and the resulting directives and instructions .(Fadil Dalyou, 2017)

2.2. Second requirement: The concept and Importance of Water Security

2.2.1. First section:The concept of water security

The issue of water security officially emerged in the declaration issued by the Second World Water Forum, held in The Hague in 2000, entitled "Water Security in the Twenty-First Century." This declaration constituted a high-level governmental statement on the concept of water security . (Nourhan Ben Jeddou,2023)

Water security means “providing sufficient water to citizens and their production requirements in time and space ”.(Tahtan Murad, 2017)

Munther Khaddam defines it as: “A stable state of water resources, in which water supply meets demand. When water supply cannot meet demand, a water deficit occurs, leading to a decline in water security”.

Water security also means “the state’s ability to provide clean, fresh water free from pollutants, both now and in the future, to its citizens, so that water resources must be

preserved for present and future generations without waste or failure to meet water needs ”.(Linda Sbach, 2015)

According to the 2006 Human Development Report, water security means “ensuring that every citizen has a reliable water resource to obtain safe water in sufficient quantity and at an appropriate price, so that he can live a healthy and dignified life and have the capacity to produce, while preserving the ecosystems that provide and depend on water. When access to water is not available, citizens will face significant risks related to human security, that is, the lack of human security, which leads to the disruption of means of life ”.(Ahmed Daas, 2019-2020)

2.2.2. Second section:The Importance of Water Security

Countries strive to achieve water security due to its importance, which includes the following:

- Water security reduces desertification and protects ecosystems and agricultural lands from erosion. This, in turn, protects biodiversity from degradation and extinction and reduces the migration of young people to cities and abroad .(Al-Yazid Bousaq M. M., 2022)

- Water is a natural resource and an important wealth in the process of economic and social development. It is a basic element of life, an important condition for investing in all other natural elements, and the foundation of urbanization and urban concentration that leads to the stability of the population in their cities and villages. Water also provides job opportunities and food and encourages investment in agricultural lands. It also helps in implementing development programs, increases the effectiveness of planning, and reduces the disparities between regions economically and socially . (Fadl, 2009)

- Water negatively impacts international relations by creating conflicts and tensions between countries, especially since most studies confirm that future wars will be wars over blue gold (water).

Water also has a positive impact on international relations, by strengthening cooperation between countries. It also plays an important role in achieving food security and self-sufficiency, and contributes to agricultural, industrial and service localization processes. (Al-Yazid Bousaq M. M., 2022)

3. THE SECOND TOPIC: the reality of water resources in Algeria

Algeria is among the poorest countries in the world in terms of water resources. This is due to the arid to semi-arid climatic characteristics that characterize the Algerian territory. Despite its vast area, Algeria is characterized by a scarcity of surface water, which is mainly confined to a portion of the northern slope of the Atlantic mountain range. Algeria's water potential is estimated at less than 20 billion m³, of which 75% is renewable. The following table illustrates the available water resources in Algeria. (Nabil Abu Teir, 2023)

Table No. 01: Available water resources in Algeria.

Region	North	South	Total
Water Potential			
Surface Water	10 billion m ³	0.5 billion m ³	10.5 billion m ³
Renewable and Non-Renewable Groundwater	2.5 billion m ³	5 billion m ³	7.5 billion m ³
Total	12.5 billion m ³	5.5 billion m ³	18 billion m ³

Source: Nabil Abu Teir and Abdel Wahab Shenekher, Water Resources Management Strategy in Algeria and Ways to Ensure Its Sustainability. Journal of Economic Studies, Volume 17, Issue 1, 2023, p. 866.

There are several sources of water resources in Algeria, which can be divided into the following:

3.1. First requirement: Natural Water Resources:

The total volume of water resources in Algeria is estimated at approximately 19.2 billion m³/ year, of which 13 billion m³ are in the north and 5.2 billion m³ in the south. These resources are distributed between groundwater and surface water. Furthermore, Algeria's renewable water potential is 75%, of which 60% is from surface water and 15% from groundwater .(Linda Sbache, Water Security and its Relationship to Agricultural Development in Algeria, 2016).

3.1.1. First section: Rainfall

Algeria has a vast area of 2,381,741 km², of which more than 85% is desert, with virtually no rainfall. The average annual rainfall is estimated at 12.4 billion m³ (Issa Zararka, 2021). It also has a diverse climate, with hot summers and mild to cold winters. Rainfall is rare in the summer, with very high evaporation rates. Rainfall occurs over approximately 100 days a year at most, and sometimes more than 100 mm can fall in less than a single day. Most of the year's rainfall may be concentrated over a few days, with occasional snowfall on the mountain peaks. Annual rainfall in the north of the country may exceed 500 mm, and can sometimes reach 1,500 or 2,000 mm. As we move south, rainfall gradually decreases, reaching less than 100 mm / year in areas bordering the Sahara and almost nonexistent in the desert regions.(Nabil Abu Teir, 2023)

Table No. 02: Annual rainfall rate in Algeria (mm).

Region	West	Central	East
Sahel	400 mm	700 mm	900 mm
Tell Atlas	600 mm	700-1000 mm	800-1400 mm
High Plateaus	250 mm	250 mm	400 mm
Saharan Atlas	150 mm	200 mm	300-400 mm
Sahara	20-150 mm	20-150 mm	20-150 mm

Source: Umm Sheikh Gharbi, Future Prospects for Water in Algeria. A thesis submitted as part of the requirements for a Master's degree in Law, Ibn Khaldoun University, Tiaret, 2015-2016, p. 3.

We notice from the table above that the amount of rainfall varies from one region to another. In the eastern regions, rainfall falls in significant quantities, and the rainfall gradually decreases as we move towards the western regions. The coastal regions and the Tell Atlas region are considered to be the regions with the most rainfall, and the rainfall decreases as we move towards the desert, where the amount of rainfall ranges between 20-150 mm.

3.1.2. Second section: Surface water

Despite Algeria's vast area, surface water is scarce, confined mainly to the northern slope of the Atlantic mountain range. Algeria's water potential is estimated at less than 20 billion m³, of which 75% is renewable. This includes non-renewable water resources in the aquifers north of the Sahara. Algeria has an estimated 30 surface watercourses, most of which are in the hills. They flow into the Mediterranean Sea and are characterized by irregular water levels. Their capacity is estimated at 12.4 billion m³ (Reem Gharib, 2021-2022) .

Algeria's surface water resources are estimated to range between 9.8 billion m³ and 13.5 billion m³ / year, distributed geographically from north to south and from east to west. The Mediterranean basins (north) contain 11.1 billion m³, the basins of the High Plateaus contain 0.7 billion m³ (5.7%), and the desert basins contain 0.6 billion m³ (48%). There are 112 dams in Algeria, 50 of which have a capacity exceeding 10 million m³, with a total storage capacity estimated at 5 billion m³. Through the emergency program at the dam level, projects have been planned that allow for a total filling estimated at 11 billion m³ and a total regular volume estimated at 6 billion m³.

These are as follows:

- 50 dams in operation (with an estimated capacity of 7.5 billion m³).
- 12 dams under construction (with an estimated capacity of 70.1 billion m³).
- 8 dams and their launch network (with an estimated capacity of 70.1 billion m³).
- 30 in-depth studies, nine of which are ready (with an estimated capacity of 40.2 billion m³).
- 27 preliminary studies are feasible (with an estimated capacity of 150 million m³). (Issa Zararka, 2021)

Table No. 03: Distribution of surface water resources in Algeria according to hydrographic regions.

Region	Area (km ²)	Average Annual Flow (hkm ³ /year)	Percentage %
Algiers-Hadhna-Soummam Basin	47588	958	7.19
Chlef-Zahrz Basin	56000	1974	14.81
Constantine-Seybous-Mellague Basin	44348	4300	32.27
Oran-Chatt-Ech-Chef Basin	77251	5595	41.98
Sahara Basin	2078251	500	3.75
Total	2303438	13327	100

Source: Amin Kaouach, "Practicing Governance Principles in Water Resources Management in Algeria: A Case Study of Jijel Province." A thesis submitted for a PhD in Management Sciences, Mohamed Khider University, Biskra, 2020-2021, p. 171.

From the table, we note that surface water resources in Algeria are decreasing from north to south, and they are heterogeneous and unbalanced, as a large part of them is located in the east and center of the hilly region (Constantine region, Algiers region), while the Oran and Chlef regions only account for a small amount of the total surface water flows, while the desert region receives only very small amounts of surface water levels. This large volume of runoff to the east and center of the hilly region is due to the density and concentration of precipitation there, which reaches 90%, while the sloping basins in the high plateaus receive only 10% of the water generated by rain, while only very small amounts return to the desert regions .(Amin Kaouach, 2020-2021)

3.1.3. Third section: Groundwater

The amount of exploitable groundwater in Algeria is estimated at approximately 7 billion m³, with approximately 1.5 billion m³ located in the north of the country. According to estimates from the technical departments of the National Water Resources Agency and the Directorate of Major Facilities, exploitable groundwater in the north is estimated at 90%, with 12,000 deep wells, 900 springs, and 100,000 wells. Approximately 5 billion m³ are located in the south, of which only 1.7 billion m³ are currently exploited, equivalent to 34%. Studies have confirmed that this percentage could be increased to 5 billion cubic meters annually. (Tayeb Qassas, 2015-2016)

Table No. 04: Distribution of groundwater resources in Algeria according to hydrographic zones.

Region	Exploitable groundwater (km³/year)	Exploited groundwater (km³/year)	Percentage %
Algiers-Hadhna-Soummam Basin	400	375	5.6
Chlef-Zahrz Basin	245	230	0.35
Constantine-Seybous-Mellague Basin	775	745	11.07
Oran-Chatt-Ech-Chef Basin	580	550	0.83
Sahara Basin	5000	1700	71.4
Total	7000	3600	100

Source: Aisha Ben Nouy, Water Governance – A Case Study of Algeria. Journal of Governance, Social Responsibility and Sustainable Development, Volume 2, Issue 2, 2020, p. 77.

From the table above, we note that groundwater resources are increasing as we move from north to south. We find that the high plateaus and desert regions lack surface water, while they have an abundance of groundwater. The largest volume of it is found in the desert region, where it represents 71.4% of the total exploitable water. This water is found in deep aquifers with complex flow and poor renewal .(Aicha Bennoui, 2020)

3.2. Second requirement: Non-natural water resources

The increasing demand for water resources in Algeria, in light of rapid demographic growth and industrial development, coupled with scarce rainfall and drought, along with the difficult terrain and high financial costs of investing in and exploiting natural resources, has led the Algerian state to quickly seek alternatives and methods to diversify and develop water resources, foremost among which are seawater desalination and wastewater treatment.

3.2.1 First section: Seawater desalination

Algeria's experience in this field continued until the early 1960s, primarily in three industrial zones: Arzew, Skikda, and Annaba. However, these plants only allow, in extreme cases, the production of 18 million m³ / year to meet the need for industrial and drinking water. With the worsening water crisis in Algiers and the western provinces, public authorities announced a program that includes a general study on seawater desalination in Algeria. This study will enable the development and definition of a general strategy for the development of this technology. (Mohamed Belghali, 2009)

Algeria has implemented a project to provide potable water through seawater desalination, as part of the national recovery plan, which has allocated a budget of 7 billion dinars. The program includes the establishment of 43 desalination plants by 2019. Since adopting the seawater desalination option at the beginning of the third millennium, Algeria has been able to reduce the pressure on groundwater and surface water, as desalinated water contributed to the water balance to reach 14% in 2015 . (Ahmed Tarbash, 2016)

The following table shows the most important seawater desalination plants.

Table No. 05: The most important seawater desalination plants and their water production capacity.

Location	Province	Installed capacity m ³ /d	Commission Date	Actual annual production
Arzew/Kahramaa	Oran	90.000	August 2005	226.303.773
Hamma	Algeria	200.000	March 2008	390.230.784
Skikda	Skikda	100.000	March 2009	170.420.990
Chatt El Hilal (Beni Saf)	Ain Temouchent	200.000	October 2009	290.061.910
Souk El-Thalatha	Tlemcen	200.000	April 2011	192.244.454
Cap Djenet	Boumerdes	100.000	July 2011	71.710.941
Fouka	Tipaza	120.000	July 2011	124.375.818
Henin	Tlemcen	200.000	August 2011	75.595.874
Mostaganem	Mostaganem	200.000	September 2011	174.034.660
Ténès	Chlef	200.000	June 2015	/
Total				1.714.979.204

Source: Ahmed Daas, Water Governance as a Mechanism for Achieving Sustainable Development in Algeria: A Case Study of the Beni Haroun Dam in Mila Province. A thesis submitted for a PhD in Political Science, University of Constantine 3, 2019-2020, p. 102.

To achieve water security, an urgent plan has been developed to complete five desalination plants as part of the complementary program to complete desalination

plants in the period between 2022 and 2024, due to the lack of rainfall. These plants are located in: Boumerdes (Cap Djenet), Tipaza (Fouka 2), Oran (Ras El Abiad), El Tarf (Kedia Draouch), and Bejaia (Timghramt Toudja .) (Amina Ghani, 2024)

3.2.2 Second section: Wastewater Treatment

Wastewater treatment and reuse are among the priorities outlined in Algeria's water policy. A set of regulatory laws has been enacted to this end, the most important of which is Article 2 of Law No. 05-12 of August 4, 2005, relating to water. Article 2 and Article 3 of Law No. 05-12 of August 4, 2005, stipulate that the objective of wastewater treatment is to protect human health and the environment from pollution, while also enhancing its use as a non-conventional resource for improving water supplies . (Amin Kaouach, 2020-2021)

Wastewater in Algeria is treated through treatment plants. There are 170 plants operated by the National Sanitation Office, 11 plants operated by operators such as: SIAL, SIEO and SIACO, in addition to 30 plants operated by municipalities and various water resources.(Amina Ghani, 2024)

By the end of 2019, Algeria had 200 wastewater treatment plants in operation, and 75 under construction, with an installed treatment capacity of more than 1,800 million cubic meters / year. Utilizing 25% of this capacity over the next fifteen years will make it possible to irrigate more than 45,000 hectares, or irrigate 3,000 hectares annually . (Nabil Abu Teir, 2023)

.Table No. 06: Wastewater treatment in Algeria from 2000 to 2020.

Data	2000	2017	2020
Number of treatment plants	28	186	270
Production capacity of treatment plants (million m³/year)	90	860	1300
Volume of wastewater produced (million m³/year)	500	1500	1800
Volume of wastewater treated (million m³/year)	90	400	/
Volume of wastewater treated to volume produced	18	26.66	/

Source: Amin Kawash, "Practicing Governance Principles in Water Resources Management in Algeria: A Case Study of Jijel Province." A thesis submitted for a PhD in Management Sciences, Mohamed Khider University, Biskra, 2020-2021, p. 183.

We note from the table above that the number of wastewater treatment plants in Algeria has increased from 28 in 2000 to 186 in 2017, and is expected to reach 270 by the end of 2020. This means that the production capacity of treatment plants will increase by more than 10 times, as it is expected to reach 1,300 million m³ / year in 2020, after it was around 90 million m³ / year in 2000. We also note that the volume of wastewater in Algeria has increased threefold during the period from 2000 to 2017, and is expected to reach 1,800 million m³ / year in 2020. This is due to the accelerating pace of urbanization driven by population growth.(Amin Kaouach, 2020-2021).

4. THE THIRD TOPIC: Algeria's National Water Strategy 2021-2030.

The National Water Strategy in Algeria is implemented through Law No. 05-12 of August 4, 2005, relating to water. This law defines the legal framework for the use and management of water resources development. The law was amended and supplemented by Law No. 08-03 of January 23, 2008, and was subsequently amended and supplemented by Decree No. 09-02 of July 22, 2009, relating to water.

Algeria's traditional water resources are expected to continue declining, posing a significant challenge for the country. Current water resources are estimated at 5 billion cubic meters / year, while demand is expected to reach 12.9 billion cubic meters by 2030. To address this challenge, Algeria has adopted a comprehensive national program aimed at enhancing water security in Algeria, through the establishment of desalination plants, the construction of dams, and the implementation of water transfer and well-drilling projects.

By the end of 2021, Algeria had successfully operated 14 desalination plants, with a production capacity exceeding 2.1 million cubic meters of potable water / day, representing approximately 17% of the country's total available water resources.

4.1. First requirement :Pillars and Axes of the National Water Strategy

This strategy is based on three pillars:

- Seawater Desalination:** To meet the population's drinking water needs, with a focus on coastal and inland areas near desalination plants.

- Wastewater Treatment:** Allocating 2 billion cubic meters annually for irrigating agricultural lands, with a particular focus on fruit trees, thus reducing pressure on groundwater and surface water.

- Water Rationalization:** A central pillar aimed at raising awareness of the importance of water and preserving this vital resource . (tunisie-telegraph, 2025)

4.2. Second requirement: Objectives of the National Water Strategy:

This strategy aims to achieve comprehensive national objectives to ensure the sustainability of water resources and meet the needs of various sectors. These objectives include:

- Mitigating Water Stress:** By reducing excessive groundwater depletion and ensuring its long-term sustainability.

- Meeting the growing demand:** by providing the water needed for drinking, agriculture, and industry, with a focus on increasing the contribution of desalinated water within the 2021-2030 strategy, which aims to increase it from 17% to 60% by 2030. The southern states will also benefit from a groundwater desalination program, which will secure water supplies for the residents of the south, in accordance with the government's pledges.

- Securing the needs of coastal cities:** by meeting the needs of 80% of the population living in coastal cities.

-Use of modern technologies: Adopting advanced technologies to improve the quality and efficiency of desalinated water production, while reducing production costs to achieve economic and environmental sustainability . (Manal Sakhri, 2024)

Sofiane Zeghmich, head of the Algerian Energy Company, revealed in its latest report in May 2023 that the number of seawater desalination plants will increase to 19 by 2024. Under the first program, 11 plants were built along the coast with a production capacity of 2.11 million cubic meters / day.

The government also completed, within the framework of the emergency plan, three (03) other stations with a capacity of 70 thousand cubic meters / day, in parallel with the completion of five (05) additional stations under the supplementary program, which will provide 1.5 million cubic meters / day in five (05) governorates by the year 2024.(Kenza Ben Ghalia, 2024)

4.3. Thrid requirement: Projects and measures supporting the National Water Strategy

- **Construction of desalination plants and dams:** Desalination plants have been put into operation, and construction of additional dams and water barriers will continue as part of improving water resource management.

Algeria has made significant progress in the field of water desalination. It is considered one of the leading countries in the region in the use of seawater desalination technologies. Numerous desalination plants have been built along its coastline, helping to provide potable water to a large number of areas suffering from severe water shortages. These projects have supplied major cities such as Algiers, Oran, and Annaba with desalinated water, significantly increasing their capacity to meet the needs of the growing population.

The number of dams in Algeria has reached more than 80, giving it a developed dam network. These dams have contributed to providing irrigation water for vast agricultural areas, in addition to securing water for domestic and industrial uses. Among the most prominent dams in Algeria are the Beni Haroun Dam and the Chlef Dam, which have played a major role in strengthening the country's water reserves. (boukhari Rouida, 2025)

- **Water transfer projects:** Implementing water transfer projects to connect dams and water resources to areas suffering from water scarcity.

- **Drilling wells:** Continue drilling wells to support drinking water supplies and provide water for agricultural irrigation.

- **Modernizing drainage systems:** Rehabilitating and modernizing wastewater and sanitation systems to facilitate efficient reuse.

- **Dealing with drought and climate change:** The strategy is in line with efforts to address water scarcity resulting from climate change and mitigate its effects. (Mustafa Ben Mira, 2025)

4.4. Fourth requirement: Objectives of the National Water Strategy

Algeria aims to achieve the following by adopting the National Strategy:

Enhancing water security: by ensuring the provision of sufficient quantities of fresh water for the population and the national economy in all circumstances.

Supporting economic development: by providing the necessary water for the agricultural and industrial sectors and contributing to achieving food security.

Confronting climate change: by mitigating the effects of drought and lack of rainfall, by diversifying water sources and increasing the efficiency of their use. (Hadhaqa, 2023).

5. THE FOURTH TOPIC : Challenges of the Water Security Strategy in Algeria

Algeria faces a number of challenges that hinder the implementation of the national water strategy, which can be summarized as follows:

- **Scarcity of water resources**, especially given the low rainfall rates. The problem is exacerbated in the short term and intensified in the long term, particularly with the worsening phenomenon of global warming and the lack of green spaces that help moderate the climate. Algeria has experienced long periods of drought, which affected the entire national territory, especially the west of the country. The National Meteorological Office indicated that the western region is one of the regions with the lowest rainfall. This had a negative impact on the flow of rivers and valleys, most of which have dried up. It also led to a decline in water levels in dams to low levels, in addition to serious disruptions to water supply programs for the population. Rainfall during the last fifteen years was less than 20% for the eastern region and 30% for the western region. This led to a reduction in the storage rate in existing dams by 80% of their total capacity and the depletion of groundwater resources during that period . (Ismail Boukenour, 2021)

- **Algeria's decades-long overuse of water resources**, in order to achieve self-sufficiency and food security, has led to a decline in non-renewable groundwater levels, which constitute a strategic water reserve.

- **Large amounts of water leak into the sewage channels** due to the wear and tear of the water channels, which leads to the waste of huge sums of money every year .(Kenza Ben Ghalia, 2024)

- **The rapid increase in population** has become a challenge for the Algerian government in meeting the growing demand for water resources, especially in the fields of drinking, industry and agriculture. The domestic demand for water in Algeria was estimated at 1,900 million m³ in 2010, and will be estimated at 2,400 million m³ in 2025. According to a study conducted by the National Institute of Water Drainage and Irrigation, there is an increase in the demand for water to increase irrigated areas by an estimated 5.8%. (Nourhan Ben Jeddou)

- **Dam siltation:** Algeria has built 57 dams, but most of these dams are currently experiencing dangerous levels of siltation. The reasons for this situation are due to the phenomenon of water erosion, which particularly affects sloping basins, and the loss of large areas of forests due to fires, in addition to the failure to undertake the cleaning and removal of silt operations, due to their huge cost .(Reem Gharib, 2021-2022)

- **The shortcomings in scientific research**, the lack of specialized personnel, and the low efficiency of water use, in addition to the presence of unstable, ineffective, and uncoordinated institutions, as well as the presence of irrational projects and achievements (where many structures were completed with significant sums of money to develop the water sector, but not all of them have begun to operate yet). (Ismail Boukenour, 2021).

6. Conclusion:

Despite the significant steps Algeria has taken to strengthen its water infrastructure and develop strategies to adapt to a changing climate, challenges remain and require further concerted efforts. Climate change, with its devastating impact on water resources, has made it imperative for Algeria to continually update and develop its strategies. Solutions go beyond expanding infrastructure or desalination technologies, but also include improving comprehensive water resource management and activating water governance mechanisms to ensure equitable and sustainable water distribution.

To achieve long-term water security, it is necessary to enhance coordination between local and sectoral policies, and activate institutional legal frameworks that ensure the sustainability of water resources in the face of climate change.

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