**Journal of Renewable Energies**

*Revue des Energies Renouvelables*

*journal home page : https://revue.cder.dz/index.php/rer*

# Future Sustainable Water and Energy Policy for Algeria

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**Abstract**

This paper summarises the findings of many studies and surveys in the water and energy sectors in order to make recommendations for water and energy policies in Algeria. We provide an overview of current policy concerning water, energy, and climate change. We investigate the impact of the water-energy nexus on current policy developments. We made specific proposals to aid in the integration of water and energy policies in Algeria. This study demonstrates how, in the absence of integrated policies, the inextricable historical linkages between water and electricity have given rise to spurious trade-offs between water and energy. Drought and climate change are projected to increase demand for electricity, and water sector adaptation strategies have the potential to contribute to climate change by encouraging investment in energy-intensive technologies such as desalination and enhanced wastewater treatment. The findings indicate that demand management programmes and water pricing regulations that lower water and energy intensity in important industries are likely to benefit Algeria's whole economy and environment. The findings are equally applicable to other countries confronted with the burden of developing appropriate strategies to manage their water and energy issues.

**Keywords:** Algeria, policies, energy, water

## 1. Introduction

Water and energy are critical to humanity's survival. Throughout history, these two resources shaped the formation of societies. Water and electricity are inextricably linked in society. Water is required for the generation of energy, while electricity is required for the treatment and transportation of water. More than 41% of overall electricity production comes from large water-consuming coal power plants [1], and water transport uses around 7% of global energy

production [2]. The critical role of these two resources in social well-being and economic growth emphasises their importance and interconnectedness.

As humanity enters the twenty-first century, the connection between water and electricity - also known as the water-energy nexus - is becoming more obvious in Algeria and even globally, thanks to industry reforms prompted by drought and, more recently, climate change.

Algeria's water and energy industries have undergone major transformation during the last two decades, beginning with state-level reforms. In the early 2000s, the Algerian government overhauled its water and energy businesses. The first phase of the reform was on an economic scale, with the goal of increasing the competitiveness of the Algerian economy through increased productivity in infrastructure industries such as water and electricity. These reforms called for the separation of industry's fundamental roles, the introduction of competition rules, and the opening of monopoly parts to third-party access. To foster competition, the reforms resulted in the establishment of a national electricity market (NEM) and a water market (see figure 1).

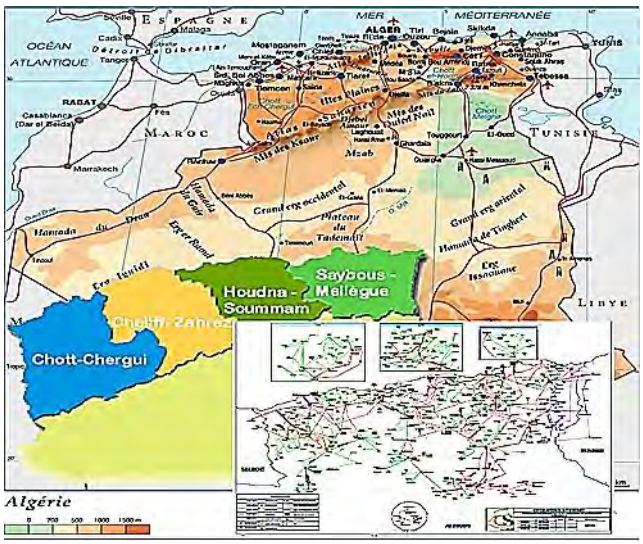


Fig 1. Maps of the hydro-geological basins and the Algerian electricity network.

The changes created independent regulatory provisions for the price and provision of services, environmental management, and water quality in the water sector.

Algeria estimated in the early 2000s that it needed more efficiency in the water and energy industries, and changes continue to this day. These improvements were followed by a greater awareness of environmental issues.

In the 2000s, the company questioned the environmental impact of development projects such as water and electrical infrastructure (air pollution and water salinity). Environmental challenges, such as the world's water resources, the ozone layer, and global warming, grow

more worldwide throughout this time period. In the wider discourse, these concerns gained special emphasis. They believe that the Earth cannot continue on its current path of growth. The shift in mentality resulted in the creation of the notion of sustainable development, which equalises social, environmental, and economic issues. These ideals have pervaded reforms, particularly during the 2000s.

## 2. Overview of current policy

Table 1 covers the most recent projects as well as the ministries in charge of their implementation.

Table 1 provides a more complete summary of the Water for the Future effort and the carbon emission reduction plan.

Table 1. Summary of current policies

| **Institutions** | **Measures** |
|---|---|
| Council of the Algerian government | climate change and water Energy Council of Ministers<br>- The National Framework on Energy Efficiency |
| National Agency for Climate Change | Plan to reduce Carbon Emissions<br>Plan for climate action |
| The Ministry of Water Resources | The Water for the Future Initiative of the National Water Commission<br>The Desalination Program<br>Sustainable use of water in rural areas Infrastructure program<br>New dam program<br>Transfer program Water efficiency program<br>Information quality program |
| The Ministry of Energy | State plans (Electricity supply)<br>- The implementation of electricity reforms and development<br>Electricity plans from clean and renewable sources<br>Energy efficiency action plan |
| Ministry of Planning, Environment and the City | National Action Plan for the Environment and Sustainable Development (PNAE-DD);<br>-Waste recovery<br>- Afforestation and reforestation |

**Notes:** The table only includes government initiatives chosen in accordance with the suggestions given at the end of the article. As a result, it is not a comprehensive list of all government policies concerning climate change, water, and energy. Because climate change, water, and energy policy are all scalable, this list is susceptible to change [5].

## 3. The water-energy nexus implications

This section examines the impact of the nexus on Algeria's present energy and water policy. The analysis is organised around the following major themes:

- Price regulation and the market;
- Decoupling economy, energy and the water;
- Reinforcement of technology;
- Alternative to technology (Social change)
- Social participation

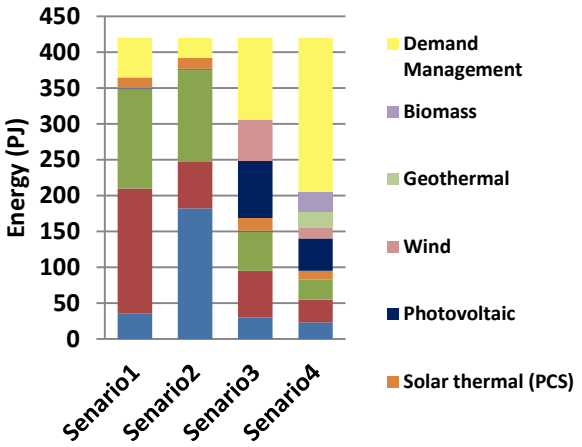


Figure .1 The electricity production mix in 2030 in the four scenarios for Algeria [21, 22]

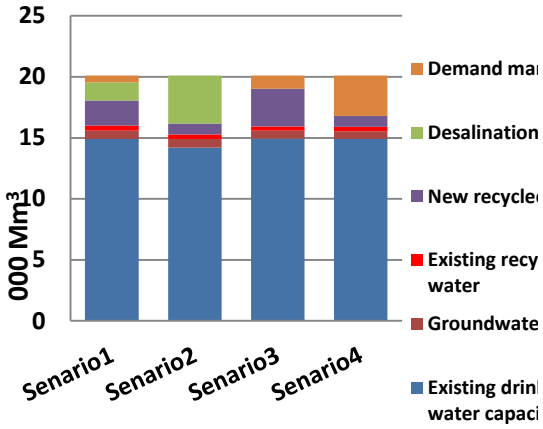


Figure 2 Water demand and supply mix in 2030 in the four scenarios for Algeria

## 4. Policy recommendations

Despite climate change, which has led the formation of many current policies that can only deepen the relevance of the ties between water and electricity, the water and energy policies mentioned in section 2 fail to explain in depth the importance of the links between the two. The inconsistent precipitation and lengthy spells of dryness that are already a feature of Algeria's climate are projected to worsen in the coming years as a result of climate change. It is therefore critical that policymakers take action to correct the current trend of failing to integrate water and energy policies before it becomes an emergency issue that will cost even more money.

This section contains proposals for improving the coordination and integration of Algeria's water and energy policy. The recommendations are based on the previous sections of this paper. The recommendations refer to the methods indicated in Table 1 in order to make targeted political contributions to decision-makers in both industries.

4.1 Institutional organizations

Water and energy policy reforms are now being pushed by national reform plans and executed by the government. This study advises that these policies be integrated, whether at the government or service level.

Recommendations to help with policy integration include:

The portfolios of climate change, water, and energy are controlled by many ministries, including the Ministry of Land Management and Environment, the Ministry of Water Resources, the Ministry of Energy, and the Ministry of Agriculture and Rural Development. While no ministry is in charge of the portfolios of climate change, water, and energy, the prevailing institutional structure makes integration efforts between the four portfolios difficult. A recommendation is therefore to establish a climate-water-energy dialogue under the auspices of the Algerian Government Council (CGA), potentially within the framework of the Working Group on Climate Change and Water, to help the coordination of the policies of water and energy. One possible activity within the framework of this dialogue would be to ensure that the General Direction of Strategy and Prospective (GDSP) of the Sonelgaz holding responsible for the elaboration of the rules and the development of the national electricity market (MNE) [28] coordinates with the National Agency for Hydraulic Resources (ANRH), to develop regulatory provisions which ensure the negotiation on the electricity market and compromise in the short and long term on the health of water resources, in particular those under stress.

Similar coordination is also recommended at the state level. As the name suggest, the department of Legislative and Executive decrees of Water and Energy in government which is responsible for implementing the water and energy reform program.

Unexpected consequences of the electricity market on the distribution of water can be one disadvantage of markets. Alternative approaches, such as regulation can ensure that social and environmental values are protected. It would also require a deep personal change in our individual beliefs, so we decide beyond our individual interests, to realize a more sustainability path to the future.

4.2 Government recommendations

The important water and energy policies pertinent to the water-energy nexus are summarised in Table 1. This section makes recommendations to improve the consideration of the water-energy relationship in existing policies and recommends new policies [29].

The government could consider developing a "national plan to reduce the need for water for energy" that compares power plants and sets targets for water reduction in the national

electricity market as part of the climate-water-energy dialogue recommended under the heading "institutional organisations" (NEM). Subsidies for water efficiency could be targeted at power plants. This approach may also aid in the reduction of conflicts between power producers and other water users, such as populations, irrigators, and the environment [30, 31].

The government has committed substantial resources to the development of alternative energy technology. As shown in Table 1, the Ministry of Energy is in charge of the renewable energy programme (1312 billion DA). The Department should consider implementing water eligibility criteria to guarantee that only innovations with a positive or neutral impact on water resources are supported. This can be calculated by comparing total water intensities for various production technologies. Because of the comparatively low water requirements, investments in wind energy projects should be given special consideration, according to the findings.

Grant submissions for the geothermal drilling programme may be subject to "water impact studies" to guarantee that grants are not allocated to drilling projects in locations where water is scarce. water, or, in this example, that there are sufficient subsurface water reserves to enable the growth of geothermal power plants without jeopardising the surrounding ecosystem's health. The proposal is based on the high water intensities projected by this study for geothermal energy, which is proposed as a future basic technology due to its low carbon emissions. The findings indicate that there are trade-offs between reducing carbon emissions and increasing water use. In July 2006, the operator of the Algerian electricity system (OS “subsidiary of the Sonelgaz holding”) took on the role of the national production planner. The planner will study the most efficient combination of production options. This research recommends that the efficient use of water forms part of planning criteria.

Climate change is likely to reduce the availability of water in many regions of the NEM; the IPCC predicts 20% more drought over most of the country in 2030.

Likewise, the Ministry of Energy is currently preparing the national energy security assessment. This assessment identifies strategic energy security problems in key electricity sectors and those likely to affect the security level in 5 years (2025) and 10 years (2030).

This research strongly recommends taking into consideration the impact of extreme events such as drought and floods. Energy security will be more dependent on water security and must therefore be taken into account in all strategic assessments.

Government policies must encourage power stations in inland regions to use recycled water, to reduce dependence on the drinking water sector. This is important if additional combined cycle gas turbines will be integrated into the electricity distribution grid. The basis of this recommendation is the dissatisfaction of the citizens of the neighboring towns with combined

cycle power plants, following frequent water cuts, which are triggered by the water levels in the dams.

Unless new thermal power plant proposals show a negligible impact on the region's water resources, it is advised that new thermal power plants be located in coastal locations to reduce future demand on inland water resources. Recycled water and air cooling technologies are two technologies that could help achieve this. This suggestion might be put into action through governmental planning rules.

This study strongly proposes that steps to support rainwater tanks, which are the equivalent of solar panels at the household level, be implemented to relieve pressure on drinking water networks. Climate change money from the government can be utilised to install rainwater tanks at the household level.

The widespread installation of rainwater tanks will signal a shift in public understanding of water as a precious resource that may be captured locally, which will certainly result in a slew of legislation mandating their installation in new homes. Some citizens may be motivated by a desire to reduce their household's environmental effect.

Water and energy efficiency, as noted in this study, provide large benefits and can easily offset the need for greater supply capacity in the future. As a result, it is critical that the policies target the industries with the highest water and energy intensities, as well as those that are strongly linked to other sectors of the economy. According to the findings, the following industries would gain the most from direct water conservation measures: agriculture, services and civil engineering, oil, mining, and quarrying. Direct energy efficiency techniques would assist the following industries the most: building materials manufacturing, food industries, (WPC) wood, paper, and cork, and (TC) transportation and communications. The improvements should also help reduce water and energy consumption in other industries that rely heavily on these sectors' outputs and are energy and water intensive.

Aside from efficiency measures, the government might consider educational awareness initiatives for schoolchildren that emphasise the need of efficient water and energy use, as well as resource conservation as a way of environmental care. Such initiatives could also be incorporated into school curricula. This would significantly aid in changing people's attitudes on water and long-term energy consumption. This proposal is based on Algeria's historically low water and energy costs in comparison to other countries across the world. Restriction and demand management initiatives in both industries will raise the perceived worth of both resources. The recommendation will have long-term benefits by instilling this new attitude in young children, who will be society's future decision-makers. Fuel switching has been

highlighted as a significant approach for reducing demand for power and, as a result, carbon emissions. Based on the findings, this study advises that projects involving the transition from electricity to gas or from diesel to gas be prioritised due to the lower water intensities offered by the gas industry.

4.3 Water and electricity industries measures

Water and electricity services play a critical role in lowering energy and water use. Strategies for reducing energy consumption in the water sector could be tailored to the type of energy source used and the pattern of consumption. This advice is based on the idea that energy-saving methods could reduce the cost of water in the future. It would also increase the social responsibilities of public-sector organisations.

Another major finding from this study is the significance of exact data. It is strongly advised that future water accounts give more precise data in keeping with previous publications. This, in conjunction with a regular collecting cycle, would aid time series comparisons useful for policy modelling [32, 3].

## 5. Conclusion and policy implications

The analysis also revealed that measures for reducing water and energy consumption in Algeria's production sectors are dependent on how these sectors are integrated into the economy in terms of contribution to economic production, income generation, and employment growth. Demand management programmes and water pricing strategies that lower water and energy intensity in important industries are anticipated to help Algeria's overall economy and environment.

The future implications of the energy-water nexus are investigated using a medium-term scenario for Algeria in 2030. The analysis demonstrates how political decisions affect the circumstances in order to make philosophical choices in terms of balancing alternative technologies and demand management, with varying ramifications for water and power use.

Based on these findings, the study proposed a set of recommendations aimed primarily at redirecting existing institutional organisations, government policies, and industry actions to foster integration of water and energy policies.

Although the backdrop for this study is Algeria, the findings are equally applicable to other countries confronted with the issue of developing appropriate policies to handle their water and energy concerns.

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