International Journal of Sustainable Development and Planning
Vol. 19, No. 4, April, 2024, pp. 1281-1289
Journal homepage: http://iieta.org/journals/ijsdp

Reviewing Algeria's Energy and Environmental Landscape: Policy, Regulation, and Knowledge Needs

Belkacem Rabhi[1*], Hanane Maria Regue[1], Toufik Benchatti[2], Ahmed Benchatti[1]

[1] Laboratoire de mécanique, Université de Laghouat 03000, Algeria
[2] Laboratoire de méCanique, Université de Laghouat, ENS Laghouat 03000, Algeria

Corresponding Author Email: b.rabhi.mec@lagh-univ.dz

https://doi.org/10.18280/ijsdp.190406

Received: 4 January 2024
Revised: 18 February 2024
Accepted: 29 March 2024
Available online: 28 April 2024

Keywords:
Algeria, energy policy, environmental tax, sustainable planning, energy planning, renewable energy

ABSTRACT

Algeria faces a complex energy challenge: balancing rising domestic consumption with declining fossil fuel production and environmental concerns. Despite government efforts toward energy security and sustainability, progress has been slow. This review analyzes scholarly literature and existing regulations to identify knowledge gaps hindering a sustainable energy transition. The review identified existing policies targeting energy security and environmental sustainability. However, critical knowledge gaps remain in four key areas, The effectiveness of current policies for diversification, energy efficiency, and emission reduction needs further investigation. Research is needed on the effectiveness of existing regulations and the impact of potential subsidy reforms. Formulating regulations for a sustainable transport sector and addressing infrastructure challenges in unplanned urban areas are essential. Investigating domestic renewable energy manufacturing industries and grid integration of surplus renewable energy holds promise. Addressing these knowledge gaps is crucial for developing evidence-based solutions promoting a secure and sustainable energy future for Algeria.

1. INTRODUCTION

Algeria's energy sector faces an unprecedented challenge. According to Algeria's energy balance 2021, natural gas consumption surged by 10% in just one year, reaching 47% of total production [1] as highlighted by Aissaoui [2] and Ouki [3]. This rapid rise in domestic demand, coupled with a decline in hydrocarbon production, threatens Algeria's energy security, economic stability, and ability to address climate change.

To navigate this complex energy landscape, this paper delves into energy and environmental policy in Algeria. This review will conduct a comprehensive analysis of scholarly literature on energy policy, energy planning, and environmental sustainability approaches. The analysis will critically examine existing research to identify knowledge gaps related to the effectiveness of specific policies and key components that accelerate the implementation of renewable energy sources. By understanding the current regulatory framework and existing research landscape, this review aims to provide a foundation for proposing effective solutions in a subsequent paper.

2. LITERATURE REVIEW

Recent studies, delving into the complex intersection of environmental concerns and national policies, have cast a spotlight on the economic dimensions and instrumental approaches embraced by countries. Notably, within this expansive canvas of environmental discourse, the exploration of environmental taxes and related policy instruments emerges as a focal point of scholarly inquiry.

For instance, Olawuyi [4] explored the role of carbon taxation in mitigating climate change in the MENA region. The study examines the components and nature of carbon taxation, emphasizing its potential as a revenue-generating tool while reducing carbon footprints to align with the Paris Agreement commitments. The author suggests that MENA nations enact comprehensive carbon tax laws, incorporating empirical valuation of environmental costs and setting emissions limits, this idea is supported by the study of Omodero [5] who explored the impact of environmental taxes on public health in the case of Nigeria. Subsequently, some studies delved into the environmental tax framework in Africa with a more comprehensive understanding of the strategies and challenges faced across the continent for example. Mpofu [6] and Kerckhoven et al. [7] explored the landscape of environmental taxation in African countries, The studies discussed how African nations have implemented taxes to tackle climate change issues, promote sustainability, and generate revenue, thereby broadening their tax bases, the studies reveal that these taxes are predominantly introduced for revenue generation rather than stemming from genuine environmental concerns. Following this trend various studies have focused on Algeria's environmental policy as illustrated

by Dalila and Hamiti [8], Tidjane and Lounis [9], and Belfatmi and de Conférences [10] which focused on the role of taxes in environmental Policy implementation in Algeria, assessing their effectiveness. The studies reveal that the amount of taxes is not important to internalize the negative externalities nor incentivize the companies to adopt more environmentally friendly technologies. Furthermore, it showed that the allocation of funds from taxes is directed to budgetary purposes rather than promoting environmental issues, the studies emphasize the need for further research, particularly focusing on the implementation processes and their actual environmental impact. Additionally, it calls for an assessment of how these taxes affect income distribution, poverty levels, and the competitiveness of vulnerable industries. The limitation of assessing the environmental impact highlights the need for more comprehensive assessment methods. Consequential Life Cycle Assessment (CLCA) emerges as a promising alternative. Implementing CLCA in Algeria's energy policy assessments could provide a more holistic understanding of the environmental implications of proposed changes. This knowledge would be crucial for policymakers to make informed decisions that promote sustainable development. Luu et al. [11] examined (CLCA) studies applied to the power sector. The focus is on evaluating CLCA's effectiveness in modeling indirect environmental impacts, particularly in the context of current greenhouse gas (GHG) policies. The review reveals that implementing CLCA can lead to an increase in calculated GHG emissions and other environmental impacts within the power sector. This occurs because CLCA incorporates the indirect environmental burdens placed on other economic sectors throughout the power system's life cycle.

The richness and abundance of natural resources both fossil and renewable resources of Algeria is an area of growing research interest. This interest revolves around the evaluation of existing energy policies, planning, and management, shaping a discourse critical to understanding and optimizing Algeria's energy trajectory. For instance, Himri et al. [12], Abada and Bouharkat [13] highlighted their concerns about Algeria's ability to meet its domestic consumption for the next decade due to the decline in conventional resources. Despite the potential of fossil resources and renewable sources, the studies revealed that Algeria's abundant fossil and renewable resources position it to bolster Europe's energy security and recommend for enhancing clean energy adoption and sustainable development in Algeria.

The findings underscore the importance of strategic foresight in managing energy resources to sustain Algeria's economic growth and energy security. Similarly, Aissaoui [2], Ouki [3] delved into the Algerian gas scene by analyzing the essential elements and options of Algeria’s natural gas balance and evaluating potential future gas developments in conjunction with Algeria’s position as a major gas exporter over the period until 2030, it highlights the different factors that stimulate the fast growth in domestic gas demand by investigating on several constraints on natural gas supply and demand, their findings reveal that energy efficiency measures and other reforms in energy policy will be ineffective alongside low energy prices and government subsidy policy, casting doubts on capability of the country to diversify its energy mix until the next decade due to slow progress in the implementation of renewable energies. And recommend to address these challenges, with more efforts on implementation of RE the urgent abandonment of energy price and subsidy policy and the need for development of realistic renewable energy program, they advocate more institutional reforms. Meanwhile, some studies opine that the energy transition is a matter of fact subject to conviction of policy-makers to adopt cleaner energy through increasing pressure from public opinion awareness [14].

As the country witnessed noticeable leaps in regulations and energy policies, similar studies have been conducted in other regions, for example, Karaeva et al. [15] conducted a review by performing a comparative analysis of energy policies for three regions by assessing their energy sectors, the study reveals that significant disparities between regions are observed in terms of key targets and achievements with EU being the leader followed by the United States, however, Russia remains lagging in terms of progression in RES, despite the availability of regulations and measures for all three regions, this is due to availability and cheapness of natural resources for both Russia and United States. Subsequently, Falconi [16] assessed the effectiveness of energy efficiency policy measures in Italy, the study suggests that a combination of fiscal incentives, economic support mechanisms, and well-structured voluntary initiatives can effectively promote energy efficiency in the building sector.

Conversely, although fossil resources remain a dominant form of energy in Algeria's energy landscape there is a growing interest in renewable resources as an alternative in this regard [17-20] which evaluates the solar and wind energy potential in Algeria, and suggests reforms that focus on enhancing conditions for program implementation, aiding authorities in crafting supportive regulatory frameworks, encouraging private investment in the sector, and highlight the importance of the financial and socio- cultural factors that prevent the transition towards renewable energies.

The power industry sector in Algeria is the largest primary energy consuming and is the foremost contributor to pollution in the country, the surge in electricity consumption in the last decade applied a significant constraint on the power infrastructure and poses a serious concern for the energy sector in Algeria. A lot of studies have addressed this area of research, in particular, Bouznit et al. [21] and Benasla et al. [22] addressed challenges and opportunities to meet domestic needs and the potential to export electricity generated from renewable resources to Europe, studies reveal that the applied measures aren't meeting set objectives emphasizing the need for Algeria to accelerate its renewable energy programs to meet its growing domestic demand while also enhancing its position in the European energy market as a reliable supplier.

In the midst of the debate on re-evaluating energy policies in Algeria and the urging need to shift to a more sustainable energy solution, and revitalizing its economy in light of the deterioration of hydrocarbon exports to foreign markets and rising internal demand, environmental concerns appear as the consequence of irrational exploitation of fossil resources, specifically in light of Algeria’s global commitments to reduce its GHG emission, addressing this aspect becomes the focus of many studies, for example, the studies of Boudalia et al. [23], Chekouri et al. [24], Abdelli and Shahbaz [25], Bergougui [26] show the need for a reevaluation of Algerian policies regarding natural resource management to strike a balance between resource extraction and its environmental impact. They propose a focus on promoting renewable energies, reducing reliance on hydrocarbons, diversifying the economy, and exerting control over unplanned urbanization expansion. Additionally, it emphasizes the need to allocate more funds to

research development, appreciate the positive aspects of TI (Technology Innovation) and raise awareness initiatives.

Other studies on Algeria highlight the unique challenges and strategies associated with the country's approach to sustainability, as illustrated by, Sakhraoui et al. [27], who examined Algeria's sustainable energy transformation, and its ambitious objectives to mitigate GHG emissions, by assessing different key factors that drive to its transformation to green sources and the barriers and challenges, The study underscores the importance of comprehensive planning aligned with Algeria's socioeconomic structure, advocating for gradual implementation to mitigate potential impacts on the overall economic sustainability during the transition to a sustainable energy system.

The production of green hydrogen remains one of the promising paths toward sustainable energy solutions, specifically in the transportation sector given its status as one of the most polluter sectors. As an illustration, Messaoudi et al. [28] and Pedrzzi et al. [29] suggested the production of electricity from renewable energies aimed at supplying electrolysis process for green hydrogen production. The studies offer a great opportunity to decarbonize the transport sector and other related sectors, in light of this, Chettah and Nait Amar [30] underscore the urgent need to transition road transport toward cleaner energy sources. Recommending implementing additional levies on the vehicle market and establishing effective monitoring and reporting systems for GHG emissions. However, some studies argue that green hydrogen may not be a sufficient solution for all sectors due to economic considerations. For example, Baker [31] emphasizes limitations associated with green hydrogen that could hinder its widespread adoption.

3. REGULATORY AND PROCEDURES RELATED TO ALGERIA'S ENVIRONMENTAL POLICY

3.1 Overview of different ecological taxes in Algeria

Algeria approved several international conventions and agreements with respect to environment and protection of ecological systems. As environment concerns rise, the country acknowledged the need for institutional frameworks and policy reforms to protect the environment. One of the approaches employed is the implementation of green taxation, which encompasses the application of various taxes, fees, and economic instruments with the intention of protecting the environment.

Ecological taxation appears for the first time in the Algerian regulations in the finance law of 1992 [32], more precisely, this endeavor is pursued through the provisions outlined in Article 117 [32]. This marked the beginning of the government's efforts to implement policies aimed at protecting the environment through economic measures (Table 1).

The environmental taxation framework was revised and updated through the Finance Laws of 2000 and 2001 [33, 34], along with the Complementary Finance Law of 2001 [35]. These modifications entailed amendments to Article 189 of the law governing the special allocation account n°302-065 [35]. Furthermore, the name of the fund was changed from the National Fund for the Environment (Fonds National de l'Environnement) to the Fund for the Environment and Industrial Depollution (Fonds pour l'Environnement et la Dépollution Industrielle) [36].

Table 1. Environmental taxes

Taxes	Year	Allocation
The tax on polluting and hazardous activities for the environment	1992	50% state budget, 50% National Environment and Coastal Fund
The tax on fuels	2002	50% national road and highway fund, 50% National Environment and Coastal Fund
The tax on petroleum products	2007	100% stat budget
The complementary tax on industrial air pollution	2007	25% National Fund For municipalities, 75% Environment and Coastal
Tax on Oils, lubricants and lubricant preparations	2006	50% National Fund For municipalities, 50% Environment and Coastal
Tax on Plastic bags	2004	27% National Environment and Coastal Fund, 73% state budget
Tax on Imported new tires	2006	35% for municipalities, 33% for national fund for solidarity, 35% state budget
Tax Incentive for the destocking of waste	2002	25% National Fund For municipalities, 75% Environment and Coastal
Tax Incentive for the destocking of waste related to healthcare	2002	25% for municipalities, 75% national fund for the environment and depollution
The complementary tax on industrial wastewater	2007	50% National Fund For municipalities, 50% Environment and Coastal
The household waste removal tax	2002	100% for municipalities
Flaring taxes	2005	50% state budget, 50% Solidarity and Guarantee Fund for Local Authorities

In 2002, the Finance Law [37] enhanced the ecological taxation system by implementing a variety of taxes. These included tax incentives for the proper disposal of industrial waste and hospital care activities, as well as additional taxes aimed at mitigating air pollution (Table 1).

The implementation of the polluter-pays principle was further solidified by adjusting the multiplier coefficient index of the tax on polluting activities, taking into account the type, significance, and extent of pollution generated. Ongoing modifications to environmental-related articles persisted until the 2018 Finance Law [38], which encompassed several revisions and renamed the special account "FEDEP" as the National Fund for the Environment and the Coastline. Furthermore, in 2009, Executive Decree No. 09-336 [39] redefined the activities subject to the tax on polluting or environmentally hazardous activities.

As part of the environmental taxation policy, the implementation of an efficient tax system, guided by the "polluter pays" principle, has specifically focused on regulating and addressing highly polluting activities.

3.2 The tax on polluting and hazardous activities for the environment

Algeria imposed a tax on polluting or dangerous activities for the environment through an executive decree N°09-336 [39] on October 20, 2009, the tax introduced the multiplier coefficient. The decree classified activities into three categories: those necessitating authorization from the local municipality, those requiring authorization from the governor

of the province, and those mandating approval from the minister overseeing the environment.

3.3 The tax on fuels

This tax is imposed on fuels whether leaded super/normal gasoline and diesel, it is collected and distributed in the same way as the tax on petroleum products. The generated revenue of this tax is allocated equity between the national road and highway fund and the National Fund for the Environment and the Coastline [40].

3.4 The tax on petroleum products

The TPP (Tax on Petroleum Products) is imposed to adjust the fuel prices in terms of expected socio-economic and budgetary impacts, imposed on all petroleum products or their equivalent, regardless of imported or domestically produced, and for all types of factories exploiting it [41].

3.5 The complementary tax on industrial air pollution

The excess emissions beyond the limit values are subject to this tax. The amount of the tax is calculated based on the annual base amount set by regulations and a multiplier coefficient ranging from 1 to 5, depending on the extent of the excess emissions [42].

3.6 Other taxes [36]

- The tax on oils, lubricants and lubricant preparations
- The specific tax on plastic bags
- The tax on imported new tires
- Tax incentive for the destocking of waste
- The tax incentive for the destocking of waste related to healthcare activities in hospitals and clinics
- The complementary tax on industrial wastewater
- The taxes on tobacco products
- The household waste removal tax.

3.7 Flaring taxes in Algeria

Algeria is a major producer of natural gas and oil, consequently, the upstream and downstream operations generate significant quantities of GHG, in order to reduce its carbon foot print and its negative effects on humans during these operations the country set a regulation to limit the volume of flared gas.

The Decree outlined in Article 1 of the law n°19-13 [43] of December 19th, 2019 provides the framework for the granting of exceptional authorizations for gas flaring by the National Agency for the Valorization of Hydrocarbon Resources (ALNAFT) and the Hydrocarbon Regulation Authority (ARH). Article 2 of the Decree specifies that requests for such authorizations must be submitted by the national enterprise or contract parties for upstream activities to ALNAFT, and by downstream operators or pipeline concessionaires to ARH. These regulations indicate the commitment of the Algerian government to reduce gas flaring and to promote the efficient use of hydrocarbon resources.

3.7.1 Upstream operations

The conditions for obtaining exceptional authorization for gas flaring during upstream activities in Algeria involve submitting a request to the National Agency for the Valorization of Hydrocarbon Resources (ALNAFT) for a limited duration. The authorization is granted for specific operations, such as exploration well tests, startup of new facilities, and maintenance operations, among others. The company or contracting parties must take measures to recover and evacuate liquid hydrocarbons safely to the nearest production center. However, the authorization is subject to strict conditions and thresholds set by ALNAFT. During the operating period, the national company or contracting parties must submit a monthly global request for gas flaring authorization. Operations that require gas flaring for safety reasons are not subject to prior authorization for gas flaring. The Algerian National Agency for the Valorization of Hydrocarbon Resources (ALNAFT) has set strict thresholds and conditions for flaring during upstream activities [43].

3.7.2 Downstream operations

The downstream operator or concessionaire must submit a request for exceptional authorization for gas flaring to the Hydrocarbon Regulation Authority ARH beforehand for various reasons such as maintaining torches and pressure of gas collectors, starting new installations, or complying with regulatory requirements. The request must be accompanied by a report on the quantities of gas flared during the previous month and an explanation of the contributing events. Gas flaring required for safety reasons does not require prior authorization, but a report detailing the circumstances leading to the flaring, the volume of gas flared, and the duration of flaring must be submitted to the ARH for regularization.

The permissible thresholds for gas flaring are expressed as a percentage based on the amount of gas flared relative to the quantity of hydrocarbons processed. During normal operation, gas flaring should be minimized to the volume required for maintaining lit torches and pressure in gas collectors. In the case of new installations or delays in startup, the operator must submit a request for authorization of gas flaring, which will be evaluated by the ARH. The operator must also provide an annual report on the amounts of gas flared and vented. For activities involving transport by pipelines, a request for authorization of venting must be submitted to the ARH, which includes a description of the work to be carried out and the measures to be implemented for safety and environmental protection [43].

4. REGULATORY AND PROCEDURE FRAMEWORK RELATED TO ALGERIA'S ENERGY POLICY

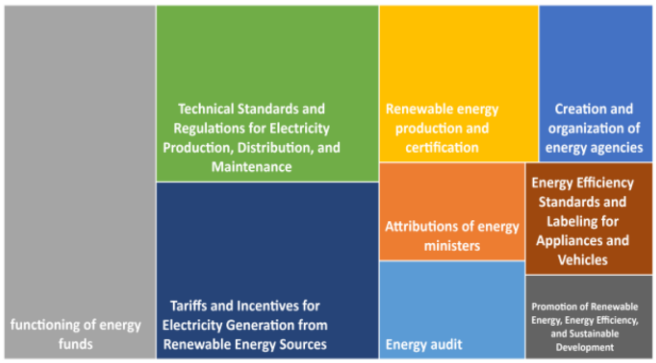
In accordance with its commitments to sustainable development, the Algerian government adopted several regulations and measures to promote energy efficiency and renewable energy sources, the reduction of reliance on fossil fuels, mitigation of GHG and diversification of the country's energy mix are the main endeavors of these regulations (Figure 1 (a)), the government acknowledges the valorization of energy conservation, renewable energy generation and cogeneration to achieve its energy security and alleviate GHG.

4.1 Laws

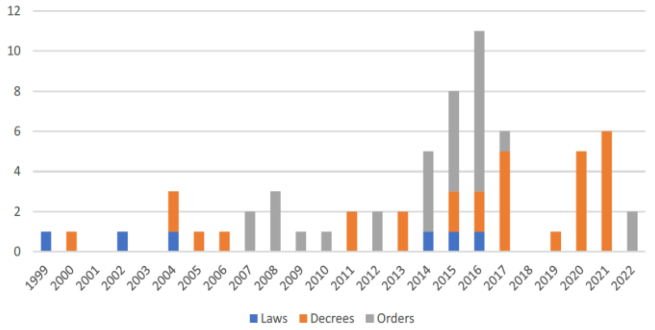
Algeria has recognized the importance of establishing a legal framework for the planning and development of its

policy for transitioning to renewable energies by founding legislative tools for the organization and control of its new energy policy to achieve its objectives, this legal framework came from a long process of progression and optimization in order to keep up and update its policy In light of local and international economic and ecological changes (Figure 1 (b)).

We will present in the following section the main laws related to energy management, EE (energy efficiency) and incarnation of RE (renewable energies) in the Algerian energy policy.



(a) Regulation by category in EE and RE (1999-2022)



(b) Published regulations (1999-2022)

Figure 1. Regulation related to EE and RE

4.1.1 Law No. 99-09 of July 28, 1999, relating to energy management

It is considered the first comprehensive legislative text in the country that addressed energy efficiency, appeared on July 28, 1999, this leading law underlined the importance of energy conservation, sustainable resource utilization, and set limits on the impact of energy systems on environment, it holds various set of provisions, measures and initiatives toward promoting energy efficiency practices for many sectors, additionally, it emphasizes the development and utilization of renewable energies as a way to achieve energy security and environmental sustainability, the law is cornerstone for legal framework to adopt energy efficiency program, technologies and fostering energy awareness and education [44].

4.1.2 Law No. 02-01 of February 5, 2002

Established the rules related to production, transmission, distribution and marketing of electricity and gas including access to networks, tariffs, regulation and sanctions, this law also promotes the use of renewable energies and energy efficiency. Moreover, it includes orientation regarding limitations on GHG emissions and constraints on environmental impact [21, 45].

4.1.3 Law No. 04-09 of August 14, 2004, on the promotion of renewable energies in the framework of sustainable development

This law defines the measures for promoting renewable energies with respect to sustainable development objectives, highlighting the importance of environmental protection, climate change, and the valorization of utilization of fossil fuels, it describes renewable energies widely, whether it is from solar, wind, geothermal, biomass and hydropower sources. The law comprises a national program for renewable energy promotion, fostering awareness, training and incentives for research and development of renewable energies which is funded from the state budget, it includes the instruments for certifying the origin of energy from renewable energy, it addresses biogas valorization from various waste sources and establishes a National Observatory for the Promotion of Renewable Energies to support their development [46].

4.1.4 Law No. 05-07 on hydrocarbons modified by the 2016 finance law

A set of measures that encompass several amendments and modifications to the tax and fiscal regulations in the country are represented by this law, the aim of these changes is to align with sector specific laws, promote renewable energies, reduce flaring, and ensure financial sustainability. It incorporates the notion of "funding allocation," allowing the fund to allocate financial resources for specific activities to promote energy efficiency, renewable energies and cogeneration [47].

4.1.5 Law No. 15-18 of December 30, 2015

Amends the previous finance law to establish the "National Fund for Energy Management and Renewable Energies and Cogeneration." It combines two special accounts: one for renewable energies and cogeneration and the other for energy management. The fund receives revenue from oil royalties, taxes, and other sources. It allocates funds for promoting renewable energies, pre-financing projects, energy management programs, interest-free loans, and equipment acquisition for energy efficiency [47].

4.2 Decrees and ministerial orders

Algeria has experienced a major leap in terms of regulations and policy since the early 2000's (Figure 1) this can be noticed by the quantity and quality of its decrees that deal with energy management energy efficiency and diversification of energy sources, after establishing its first laws relating to energy management, the government expanded its regulatory scope by identifying new areas of application. It initially focused on the residential sector, which experienced rapid growth. In this regard, the government introduced a decree n°2000-90 [48] on April 24th, 2000, with the objective of reducing energy consumption in this sector. This decree introduced thermal regulations for new buildings to minimize energy usage.

The government introduced other regulations about renewable energies by a decree [49] on March 25th, 2004 aiming to define the costs of diversification of electricity produced from renewable energies and/or cogeneration, under the special regime as well as the conditions of production, transport and connection to the networks of the electricity produced.

The government again intended to target industries energy-intensive actors by settings a decree [50] on the energy audit

of high-energy-consuming establishments for the purpose of defining the energy consumption thresholds determining the criteria for subjecting establishments to the audit, the frequency of the audit and the conditions and procedures for implementing the energy audit the same decree again modified and completed by another decree on December 18th, 2013 [50], on November 26th, 2006 the government introduce a decree [51] for establishment of the specifications regarding the rights and obligations of the electricity producer. In light of significant economic growth and its recovery, and with the high rate of consumption among the people the government headed towards minimizing energy consumption in residential sector again by setting a list of domestic appliances and their categories that are subject to specific energy efficiency regulations and operate using electrical energy, additionally to this setting an energy labeling of refrigerators, freezers, and combined domestic appliances subject to specific energy efficiency regulations and operating on electrical energy by establishment of Interministerial Orders [52] on November 03rd, 2008 and February 21st, 2009. The automobile market was also a target for the government in order to reduce the emission and appraisal of domestique fossil sources by another interministerial order [52] on June 2nd, 2014 for the purpose of establishing quotas for vehicles running on LPG (liquefied petroleum gas).

In order to organize and take control of its energy policy, Algeria has implemented a mechanism aimed at ensuring that energy is sourced from renewable energy or cogeneration systems. This mechanism defines various energy sources such as Solar photovoltaic and thermal, Wind turbine, Geothermal, Waste valorization, Small-scale hydropower, and Biomass. It was established through an executive decree [53] on February 15th, 2015.

Subsequently, a series of ministerial orders were issued in 2014 and 2016 [52] to guarantee purchase prices and establish the conditions for their implementation for electricity generated from installations utilizing the aforementioned technologies. In 2015 the government decided to set the specifications and technical procedures related to the design, construction, operation, and maintenance of electricity transport and distribution infrastructure by many ministerial orders [52].

The government also acknowledged the importance of investment and attracting capital, diverse expertise, and partnerships for the renewable energy sector. Furthermore, they have established an executive decree [54] outlining the tendering procedure for the production of renewable energies or cogeneration and their integration into the national electricity supply system. To promote the use of renewable energies and to raise aware of energy efficiency and energy management Algeria creates various institutions, agencies and academic institutions to strengthen its awareness in the field of energy and technical knowledge among the professional environment and society through the establishment of the Agency for the promotion and rationalization of energy (Agence pour la promotion et la rationalisation de l'utilisation de l'énergie APRUE) [55] in 1985 which marked the initial step towards implementing a national energy management policy and promoting energy efficiency. The agency operates under the supervision of the Minister responsible for energy. The primary mission of the agency is to implement energy consumption patterns in accordance with established orientations, decisions, and priorities. Its objectives include meeting basic energy needs, expanding energy utilization, promoting the use of available energy sources, encouraging energy conservation and efficiency, and developing renewable energy sources.

Another public institution was created on October 20th, 2019 [56] The Renewable Energies and Energy Efficiency Commission (CEREFE). The Commission (CEREFE) is responsible for contributing to the national and sectoral development of renewable energies and energy efficiency. is also responsible for evaluating the national policy in this field, the tools used for its implementation, as well as their impact, and preparing the related annual evaluation reports.

Some other agencies and institutions that are created and existing also [52]:

- Renewable Energy Development Center (CDER) conducts research and development programs, scientific and technological in the field of renewable energies;
- Electricity and Gas Regulatory Commission (CREG) February 5th, 2002 to ensure the competitive and transparent functioning of the electricity and the national gas market, in the interest of consumers and operators;
- The National Center for Cleaner Production Technologies august 17th, 2002 (CNTP) Environmental protection, reduction of pollution and industrial nuisances at the source, and the ecologically rational use of natural resources;
- National Agency for Climate Change (ANCC) 2005;
- National Higher School of Renewable Energies, Environment, and Sustainable Development June 08th, 2020.

In its pursuit to promote energy efficiency and conservation across several sectors namely, industrial, transportation, buildings and agricultural, the government founded the National Energy Efficiency Program (PNME) by a decree [57] on May 19th, 2004. The program underlines the application of measures and strategies to optimize energy consumption, and mitigate GHG emissions, the program covers various activities, such as energy audits, awareness campaigns, and the development of energy efficiency standards and regulations.

In order to support and provide funding for projects related to energy efficiency, renewable energies and cogeneration, the government established a financial institution [58], known as the National Fund for Energy Efficiency, Renewable Energy, and Cogeneration. The fund is financed from various sources, including the national energy consumption tax, taxes on energy-intensive appliances, contributions from energy sector stakeholders, and fines stipulated within the framework of the energy management law.

5. CONCLUSIONS

Algeria faces multifaceted challenges surging domestic energy consumption, declining fossil fuel production, and rising environmental concerns. This review through a comprehensive analysis of scholarly literature and existing regulations related to environment and energy identified existing policies and regulations targeting energy security and environmental sustainability, critical knowledge gaps remain.

5.1 Policy and planning

The effectiveness of existing energy policies in achieving diversification, efficiency improvement, and emission reduction needs further investigation. Additionally, robust

implementation mechanisms for successful policy execution and the integration of environmental goals with energy strategies require in-depth analysis.

5.2 Regulations and practices

The review identified regulations for energy efficiency and environmental externalities. However, the effectiveness of these regulations and the potential impacts of subsidy reform remain unclear further research is required to address the impact of potential reforms on the effectiveness of energy efficiency measures and design effective tools to address environmental externalities to shift behavioral.

5.3 Sectoral analyses

Gaps exist regarding regulations for a sustainable transport sector and solutions for infrastructure challenges in unplanned urban areas.

5.4 Emerging opportunities

This review identified the potential for domestic renewable energy manufacturing industry and grid integration of surplus renewable energy from the auto producing sector. These areas warrant further research.

5.5 Significance for future research

These knowledge gaps provide a valuable foundation for future research endeavors. By rectifying these deficiencies, researchers have the opportunity to devise solutions grounded in evidence that advance energy security, ecological sustainability, fair social practices, and economic progress in Algeria. Future investigations can capitalize on these discoveries to offer a more thorough understanding of Algeria's energy framework, paving the way for a more secure and sustainable energy future. Future research can then delve deeper into specific areas identified in this review for a more granular understanding of the challenges and opportunities.

REFERENCES

[1] Anon. (2022). Bilan énergetique national 2021. https://www.energy.gov.dz/Media/galerie/bilan_energetique_2021_63df78f2b775e.pdf.

[2] Aissaoui, A. (2016). Algerian gas: Troubling trends, troubled policies. Oxford Institute for Energy Studies. https://doi.org/10.26889/9781784670580

[3] Ouki, M. (2019). Algerian gas in transition: Domestic transformation and changing gas export potential. Oxford Institute for Energy Studies. https://doi.org/10.26889/9781784671457

[4] Olawuyi, D.S. (2021). Climate Change Law and Policy in the Middle East and North Africa Region (1st ed). London: Routledge. https://doi.org/10.4324/9781003044109

[5] Omodero, C.O. (2022). Environmental taxation and public health issues. International Journal of Digital Networks and Economics, 17(1): 131-136. https://doi.org/10.18280/ijdne.170117

[6] Mpofu, F.Y. (2022). Green taxes in Africa: Opportunities and challenges for environmental protection, sustainability, and the attainment of sustainable development goals. Sustainability, 14(16): 10239. https://doi.org/10.3390/su141610239

[7] Kerckhoven, S.V., Bécault, E., Marx, A. (2015). Ecological tax reform initiatives in Africa. International Journal of Green Economics, 9(1): 58. https://doi.org/10.1504/IJGE.2015.067885

[8] Dalila, H. (2022). La fiscalité environnementale comme outil de protection de l'environnement en Algérie. Journal of Law and Economics, 11(2): 504-523.

[9] Tidjane, N., Lounis, A. (2022). La fiscalité environnementale entre l'approche économique et les textes juridiques: Cas de l'Algérie. Journal of Law and Economic Studies, 1(1): 80-88.

[10] Belfatmi, S., de Conférences, M. (2019). Calcul des taxes liées aux émissions de gaz à effet de serre en Algérie: Cas des gaz torchés par les complexes de GNL. Algerian Journal of Economics and Management, 13(1): 55-76.

[11] Luu, L.Q., Longo, S., Cellura, M., Sanseverino, E.R. (2020). A review on consequential life cycle assessment in the power sector. International Journal of Sustainable Development and Planning, 15(8): 1157-1168. https://doi.org/10.18280/ijsdp.150802

[12] Himri, Y., Bouziane, M.T., Draoui, B. (2018). Overview of the role of energy resources in Algeria's energy transition. Energies, 11(10): 2523. https://doi.org/10.3390/en11102523

[13] Abada, Z., Bouharkat, M. (2018). Study of management strategy of energy resources in Algeria. Energy Reports, 4: 1-7. https://doi.org/10.1016/j.egyr.2017.09.004

[14] Polonara, F. (2020). The future of energy. International Journal of Energy Sector Management, 64(1): 7-10. https://doi.org/10.18280/ti-ijes.640102

[15] Karaeva, A., Magaril, E., Al-Kayiem, H.H. (2023). Review and comparative analysis of renewable energy policies in the European Union, Russia and the United States. International Journal of Energy Production and Management, 8(1): 11-19. https://doi.org/10.18280/ijepm.080102

[16] Falconi, P. (2021). The evaluation of energy efficiency policies in the building sector: A regional analysis based on the stochastic frontier approach and on the energy environmental Kuznets curve (EKC) and policy implications. Techno-Industrial Engineering, 65(2-4): 422-432. https://doi.org/10.18280/ti-ijes.652-441

[17] Bouraiou, A., Necaibia, A., Boutasseta, N., Mekhilef, S., Dabou, R., Sahouane, Z.N., Attoui, I., Mostefaoui, M., Touaba, O. (2020). Status of renewable energy potential and utilization in Algeria. Journal of Cleaner Production, 246: 119011. https://doi.org/10.1016/j.jclepro.2019.119011

[18] Zahraoui, Y., Basir Khan, M.R., AlHamrouni, I., Mekhilef, S., Ahmed, M. (2021). Current status, scenario, and prospective of renewable energy in Algeria: A review. Energies, 14(9): 2354. https://doi.org/10.3390/en14092354

[19] Díaz-Cuevas, P., Haddad, B., Fernandez-Nunez, M. (2021). Energy for the future: Planning and mapping renewable energy. The case of Algeria. Sustainable Energy Technologies and Assessments, 47: 101445. https://doi.org/10.1016/j.seta.2021.101445

[20] Boukli Hacene, M.E.A., Lucache, D., Rozale, H., Chahed, A. (2020). Renewable energy in Algeria: Desire and possibilities. Journal of Asian and African Studies,

55(7): 947-964. https://doi.org/10.1177/0021909619900202
[21] Bouznit, M., Pablo-Romero, M.D.P., Sánchez-Braza, A. (2020). Measures to promote renewable energy for electricity generation in Algeria. Sustainability, 12(4): 1468. https://doi.org/10.3390/su12041468
[22] Benasla, M., Boukhatem, I., Allaoui, T., Berkani, A., Korba, P., Sevilla, F.R.S., Belfedel, M. (2024). Algeria's potential to supply Europe with dispatchable solar electricity via HVDC links: Assessment and proposal of scenarios. Energy Reports, 11: 39-54. https://doi.org/10.1016/j.egyr.2023.11.039
[23] Boudalia, S., Okoth, S.A., Zebsa, R. (2022). The exploration and exploitation of shale gas in Algeria: Surveying key developments in the context of climate uncertainty. The Extractive Industries and Society, 11: 101115. https://doi.org/10.1016/j.exis.2022.101115
[24] Chekouri, S.M., Chibi, A., Benbouziane, M. (2023). The impact of natural resource abundance on ecological footprint: Evidence from Algeria. Environmental Science and Pollution Research, 30(26): 69289-69306. https://doi.org/10.1007/s11356-023-26720-z
[25] Abdelli, M.E.A., Shahbaz, M. (2023). Digital economy, energy and sustainability: Opportunities and challenges. In Green Energy and Technology. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-031-22382-2
[26] Bergougui, B. (2024). Moving toward environmental mitigation in Algeria: Asymmetric impact of fossil fuel energy, renewable energy, and technological innovation on CO2 emissions. Energy Strategy Reviews, 51: 101281. https://doi.org/10.1016/j.esr.2023.101281
[27] Sakhraoui, K., Awopone, A.K., Von Hirschhausen, C., Kebir, N., Agadi, R. (2023). Toward a systemic approach to energy transformation in Algeria. Euro-Mediterranean Journal of Environmental Integration, 8(2): 365-379. https://doi.org/10.1007/s41207-023-00367-1
[28] Messaoudi, D., Settou, N., Allouhi, A. (2024). Geographical, technical, economic, and environmental potential for wind to hydrogen production in Algeria: GIS-based approach. International Journal of Hydrogen Energy, 50: 142-160. https://doi.org/10.1016/j.ijhydene.2023.07.263
[29] Pedrazzi, S., Morini, E., Nasti, M., Pizzileo, S., Allesina, G. (2022). Green hydrogen powered forklifts in industrial transport: Case study of an Italian fruit and vegetable market. International Journal of Heat and Technology, 40(1): 145-150. https://doi.org/10.18280/ijht.400117
[30] Chettah, S.E., Nait Amar, N. (2021). Towards a sustainable transport in Algeria: The requisite of energy transition in the road transport sector. Serbian Journal of Science and Technology, 112: 33-49. https://doi.org/10.20858/sjsutst.2021.112.3
[31] Baker, D.F. (2022). Is the United Kingdom's hydrogen strategy an effective low carbon strategy? International Journal of Environmental Quality, 7(2): 164-175. https://doi.org/10.2495/EQ-V7-N2-164-175
[32] JOURNAL OFFICIEL DE LA REPUBLIQUE ALGERIENNE Secrétariat Général du Gouvernement. (1991). Loi N° 91-25_loi_de_finance_1992. N°65, December 1991.
[33] JOURNAL OFFICIEL DE LA REPUBLIQUE ALGERIENNE Secrétariat Général du Gouvernement. (1999). Loi_n_99-11 loi de finance 2000.pdf. N°92, December 1999.
[34] JOURNAL OFFICIEL DE LA REPUBLIQUE ALGERIENNE Secrétariat Général du Gouvernement. (2000). Loi n 2000-06 portant loi de finance 2001. N°80: December 2000.
[35] JOURNAL OFFICIEL DE LA REPUBLIQUE ALGERIENNE Secrétariat Général du Gouvernement. (2001). Loi 01-12 de 19 juillet 2001 portant loi de finances complémentaire. N°38: July 2001.
[36] D. G. des I. Ministère des Finances. (2018). La fiscalité ecologique. Bulletin d'information de la Direction Générale des Impôts, N°87.
[37] JOURNAL OFFICIEL DE LA REPUBLIQUE ALGERIENNE Secrétariat Général du Gouvernement. (2001). Loi n 01-21 du Chaoual 1422 correspondant au 22 décembre 2001 portant loi de finance 2002. N°79: December 2001.
[38] JOURNAL OFFICIEL DE LA REPUBLIQUE ALGERIENNE Secrétariat Général du Gouvernement. (2017). Loi n 17-11 du 8 Rabie Ethani 1439 correspondant au 27 décembre 2017 portant loi de finances pour 2018. N°76: December 2017.
[39] JOURNAL OFFICIEL DE LA REPUBLIQUE ALGERIENNE Secrétariat Général du Gouvernement. (2009). Décret exécutif 09-336 du 20 octobre 2009 relatif à la taxe sur les activités polluantes ou dangereuses pour l'environnement. N°63: April 2009.
[40] JOURNAL OFFICIEL ALGERIE. (2006). The tax on fuels [Article 55 de la loi n 06-24 du 26 décembre 2006]. N°85: December 2006.
[41] JOURNAL OFFICIEL DE LA REPUBLIQUE ALGERIENNE Secrétariat Général du Gouvernement. (2006). Loi n 06-24 du 26 décembre 2006 portant loi de finances pour 2007. N°85: December 2006.
[42] JOURNAL OFFICIEL DE LA REPUBLIQUE ALGERIENNE Secrétariat Général du Gouvernement. (2019). Loi n° 19-14 du 11 décembre 2019 portant loi de finances pour 2020. N°81: December 2019.
[43] JOURNAL OFFICIEL DE LA REPUBLIQUE ALGERIENNE Secrétariat Général du Gouvernement. (2021). Décret exécutif n° 21-330 du 25 août 2021 fixant les conditions d'octroi de l'autorisation exceptionnelle de torchage de gaz. N°66: August 2021.
[44] JOURNAL OFFICIEL DE LA REPUBLIQUE ALGERIENNE Secrétariat Général du Gouvernement. (1999). Loi n° 99-09 du 28 Juillet 1999 relative à la maîtrise de l'energie. N°51: February 1999.
[45] Journal Officiel de la République Algérienne Secrétariat Général du Gouvernement. (2022). Loi n° 02-01 du 5 février 2002 relative à l'électricité et à la distribution du gaz par canalisations. Journal Officiel de la République Algérienne, 8: June 2022.
[46] Journal Officiel de la République Algérienne Secrétariat Général du Gouvernement. (2004). Loi n° 04-09 du 14 août 2004 relative à la promotion des énergies renouvelables dans le cadre du développement durable. Journal Officiel de la République Algérienne, 52: August 2004.
[47] Journal Officiel de la République Algérienne Secrétariat Général du Gouvernement. (2015). Loi n 15-18 du 30 décembre 2015 portant loi de finances pour 2016. Journal Officiel de la République Algérienne, 72: December 2015.

[48] Journal Officiel de la République Algérienne Secrétariat Général du Gouvernement. (2000). Décret exécutif n° 2000-90 du 24 avril 2000 portant réglementation thermique dans les bâtiments neufs. Journal Officiel de la République Algérienne, 25: April 2000.
[49] Journal Officiel de la République Algérienne Secrétariat Général du Gouvernement. (2004). Décret exécutif n° 04-92 du 25 mars 2004 relatif aux coûts de diversification de la production d'électricité. Journal Officiel de la République Algérienne, 19: March 2004.
[50] Journal Officiel de la République Algérienne Secrétariat Général du Gouvernement. (2013). Décret exécutif n°13-424 du 18 décembre 2013 modifiant et complétant le décret exécutif n°05-495 du 26 décembre 2005 relatif à l'audit énergétique des établissements grands consommateurs d'énergie. Journal Officiel de la République Algérienne, 65: December 2013.
[51] Journal Officiel de la République Algérienne Secrétariat Général du Gouvernement. (2006). Décret exécutif n° 06-429 du 26 novembre 2006 fixant le cahier des charges relatif aux droits et obligations du producteur d'électricité. Journal Officiel de la République Algérienne, 76: November 2006.
[52] Commissariat aux Energies Renouvelables et à l'Efficacité Energétique Premier Ministre. (2022). Textes législatifs et réglementaires relatifs aux énergies renouvelables et à l'efficacité énergétique. https://www.cerefe.gov.dz/wp-content/uploads/2022/06/Receuil_2022.pdf.
[53] Journal Officiel de la République Algérienne Secrétariat Général du Gouvernement. (2017). Décret exécutif n° 17-167 du 22 mai 2017 modifiant et complétant le décret exécutif n° 15-69 du 11 février 2015 fixant les modalités de certification de l'origine de l'énergie renouvelable et de l'usage de ces certificats. Journal Officiel de la République Algérienne, 31: May 2017.
[54] Journal Officiel de la République Algérienne Secrétariat Général du Gouvernement. (2021). Décret exécutif n° 21-158 du 24 avril 2021 modifiant le décret exécutif n° 17-98 du 26 février 2017 définissant la procédure d'appel d'offres pour la production des énergies renouvelables ou de cogénération et leur intégration dans le système national d'approvisionnement en énergie électrique. Journal Officiel de la République Algérienne, N°32: April 2021.
[55] Journal Officiel de La Republique Algerienne Secrétariat Général du Gouvernement. (2021). Décret exécutif n° 21-106 du 17 mars 2021 modifiant et complétant le décret n° 85- 235 du 25 août 1985 portant création d'une agence pour la promotion et la rationalisation de l'utilisation de l'énergie," N°22, Mar. 2021.
[56] Journal Officiel de la République Algérienne, Secrétariat Général du Gouvernement. (2019). Décret exécutif n° 19-280 du 20 octobre 2019 portant création, organisation et fonctionnement du commissariat aux énergies renouvelables et à l'efficacité énergétique. Journal Officiel de la République Algérienne, 44: 44.
[57] Journal Officiel de la République Algérienne, Secrétariat Général du Gouvernement. (2004). Décret exécutif n° 04-149 du 19 mai 2004 fixant les modalités d'élaboration du programme national de maîtrise de l'énergie (PNME). Journal Officiel de la République Algérienne, 32: 32.
[58] Journal Officiel de la République Algérienne, Secrétariat Général du Gouvernement. (2020). Décret exécutif n° 20-285 du 10 octobre 2020 modifiant et complétant le décret exécutif n° 15-319 du 13 décembre 2015 fixant les modalités de fonctionnement du compte d'affectation spéciale n° 302-131 intitulé « fonds national pour la maîtrise de l'énergie et pour les énergies renouvelables et de la cogénération ». Journal Officiel de la République Algérienne, 61: 61.