

DOI: 10.5281/zenodo.20459679

OVERVIEW OF THE LAW AND OPPORTUNITIES FOR NUCLEAR ENERGY- COMPARISON WITH BALKAN COUNTRIES AND ALBANIA

Dr.Lindita Liçaj¹, Dr.Eriola Cakrani², Azeta Tartaraj³, Luljeta Berisha⁴

¹University Ismail Qemali Vlorë, Albania, Orcid nr: 0009-0006-1897-1413 lindit.licaj@gmail.com,
lindita.licaj@univlora.edu.al

²University Ismail Qemali Vlorë, Albania, eriola_hoxha@yahoo.it, eriola.hoxha@univlora.edu.al

³University Aleksandër Moisiu Durrës Albania Orcid nr: 0000-0002-7276-0565, azetatarataraj@uamd.edu.al

⁴Univerisy "Luigi Vanvitelli", Italy luljeta.berisha@unicampania.it

Received: 04/04/2026

Accepted: 20/05/2026

Corresponding Author: Dr.Lindita Liçaj

(lindit.licaj@gmail.com, lindita.licaj@univlora.edu.al)

ABSTRACT

Sustainable development is today the focus of every state policy. Today, states aim to develop economically while preserving the environment and nature. In the last decade alone, they have significantly increased the focus, production, and consumption of electricity through nuclear power generation. Focusing on the production of energy at the lowest possible environmental and ecological cost, today, the diversification of energy supply sources is increasingly being aimed at, towards a mixed energy where the focus is on renewable energies, wind energy, solar energy, and, of course, nuclear energy. Albania, in the field of electricity production from renewable energy, is lagging behind the countries of the region and Europe. The Albanian state has a need to dimension this process of energy development, where the primary is the appropriate legislation that legally regulates this entire new process of energy production, as well as the drafting and implementation of long-term strategies. The aim of this article is to present the current legislation in force in the Republic of Albania and compare it with that of other Balkan countries. Data from the Institute of Statistics, the International Energy Agency, and the International Institute for Applied Systems Analysis show that the Albanian state meets its energy supply and production needs within the territory of the Republic of Albania, drawing on its hydro resources and imports. Nuclear energy in Albania is still a possible strategic option for the distant future, not at all a current or near-future reality. The Albanian state has harmonized its legislation with EU legislation and has built institutional capacities in radiological safety. International cooperation in energy does not focus on this type of energy, nor does it build any nuclear power plants.

KEYWORDS: Law on Nuclear Energy, Sustainable Development, Approximation of Legislation.

1. INTRODUCTION

Sustainable development, as defined by the World Commission on Environment and Development (Brundtland Commission, 1987), is a development that aims to meet the needs of the present and the current generation without jeopardizing the ability of future generations to meet their own needs by creating a development that is safe and without harmful effects on the environment, nature, economy and life on earth. Sustainable development is also based on an important element: the provision of energy in a clean, sustainable way, with minimal impact on the environment, by protecting and not degrading it. Sustainable development is today the focus of every state policy. States aim to develop economically while preserving the environment and nature today. Only in the last decade have they significantly increased the focus, production, and consumption of electricity through the use of nuclear energy. The process of energy production itself is a major issue for every independent and sovereign state. During the implementation of each country's long-term strategic policies, the process of energy production from traditional and new sources runs parallel to changes in legislation and the country's economic development. With attention on energy production at the lowest possible environmental and ecological cost today, the diversification of energy supply sources is increasingly being aimed at, towards a mixed energy where the focus is on renewable energies, wind energy, solar energy, and, of course, nuclear energy.

The energy production process is a primary source of greenhouse gas emissions and environmental pollution when it is not supported by advanced technology or relies on nonrenewable energy sources. Sustainable development can only be achieved if countries reduce their dependence on fossil fuels and diversify their energy portfolio, including renewable energy and, in some cases, nuclear energy (International Energy Agency [IEA], 2022). This obliges countries to develop plans, strategies, and laws for energy production, with a concentration on minimizing emissions of polluting, environmentally destructive gases.

The option of using nuclear energy constitutes one of the most important technological developments of the 20th and 21st centuries, having an important role in the production of electricity, in achieving energy security, and in reducing greenhouse gas emissions to zero. Today, data from many developed countries and some countries of South-Eastern Europe show that nuclear energy has been integrated into the

national energy mix, producing energy in a sustainable, long-term manner. There is no uniform approach to nuclear energy across countries that produce it. The situation of countries varies from one country to another in terms of the legal framework, technical capacities, public perception, and calculated plans for the development of energy and the economy in each country.

Albania, in the field of electricity production from renewable energy, has been compared with countries in the region and with European countries. Albania, compared with neighboring countries, represents a special case in the entire Balkan region. The Albanian state, within its territory, has not had, and does not have to this day, the capacities and means to produce electricity from nuclear sources. Based on this, the discussion on nuclear energy in Albania is purely theoretical and political, not practical. But this topic continues to be of interest in light of regional and global developments, and where Albania also, in certain sectors, aims to carry out activities to move towards environmentally sustainable development.

The Albanian state needs to dimension this energy development process, with the primary focus on appropriate legislation that legally regulates this new process of energy production, as well as the drafting and implementation of long-term strategies. The need and possibilities of applying nuclear energy for the production of electricity in Albania have changed significantly in the last decade, referring to the current state of the country's energy system, as well as in the perspective of the development of the nuclear energy sector. Data from the Institute of Statistics, the International Energy Agency, and the International Institute for Applied Systems Analysis show that the Albanian state supplies and produces energy within the territory of the Republic of Albania from its own hydropower resources and imports. However, these forms constitute a major challenge for today's reality, where large hydroelectric power plants in Albania were built during the communist period, and their cycle is in the closing phase and towards the end of its cycle. In the domestic production of electricity, hydroelectric power plants in Albania account for 100% of its production, which is still far from today's energy requirements, and even more insufficient to meet future energy needs. (Hydro Power – Meps Albania, 2024) Meanwhile, taking into account that hydroelectric power plants have a limited life cycle, which according to data fluctuates around 50–70 years, this situation will further deteriorate if investments are not made to build new sources for the production of electricity (Flury, Frischknecht, 2011). A strategic plan for the

expansion of energy sources is urgent, both using diversification and increasing generation capacities. This reality would be helped by production through renewable energies, including nuclear energy. While the application of renewable energies is still at an initial stage due to the high prices of produced energy and unconsolidated technology, taking into account the long experience with nuclear energy applications, the latter potentially constitutes an efficient solution to the problem of energy security in Albania, as it can furnish the missing amount of energy as well as its stability from climatic conditions. (Qysri & Fuga, 2015). Although the Albanian energy system has generally relied entirely on hydropower resources, making the country dependent on climatic conditions and seasonal changes, this does not mean that we should not create new renewable energies that run parallel to technological developments.

The Albanian state does not have nuclear capacities that would enable the production of electricity, and on the other hand, the current government has no plans to build a nuclear power plant in the short or medium term. In reference to the national strategies for the production of electricity, the lack of a vision for the production of energy through nuclear energy is noted. The legislation in force in the territory of the Albanian state on the concepts of nuclear energy has mainly defined only radiation protection and the use of radioactive materials for medical purposes, for use in industry or laboratory research purposes, representing the country's policy for safety and environmental protection before entering into the development of nuclear infrastructure. In a comparative view with the countries of the Balkan region, several countries already have active nuclear power plants, integrated into their energy supply. These countries offer a valuable reference point for examining the possibilities and production of nuclear energy in the territory of Albania.

Based on the history of electricity production and sources, Albania has never had nuclear power plants or nuclear research reactors, neither before the 1990s nor after the fall of the dictatorship in 1991. During the socialist period (1945–1990), there was limited academic interest regarding nuclear physics and the use of radioactive isotopes, where research on these activities was limited to small uses in medicine, industry, and laboratory research. During that period of political isolation, no national program for nuclear energy was created, given that Albania itself did not

have the infrastructure, expertise, and international support required for the development of nuclear technologies for energy production within the territory of the Socialist Republic of Albania.

After the 1990s, when the democratic Albanian state was no longer under political isolation, the gradual integration into international structures created the opportunity for Albania to build a legal framework that focused mainly on radiological safety and protection from ionizing radiation, in accordance with the standards of the International Atomic Energy Agency (IAEA). The Albanian legal framework does not aim at the development of nuclear energy, but it guarantees the safety of the use of existing radioactive sources within the territory of the Republic of Albania. At the same time, after the 1990s, neighboring Balkan countries, such as Bulgaria, Romania, and Slovenia, have developed and consolidated nuclear capacities and the necessary means, creating a clear regional contrast compared to Albania.

This paper aims to analyze Albania's current position on nuclear energy through an overview of the existing legal framework, the potential opportunities for the future that nuclear energy production and use represent, and compare it with other Balkan countries. The analysis in this paper aims to contribute to the academic and political debate on the role of nuclear energy in the long-term development of the energy sector in Albania and on the possibility of amending the legislation on nuclear energy.

The article is based on the qualitative and comparative method, with the aim of analyzing Albania's position on nuclear energy within the legal framework in force, the implementing institutional structures, and the first practice of countries in the region.

Of particular importance in this research is the analysis of Albanian legislation on protection from ionizing radiation, national strategies for alternative energy to nuclear energy, and official reports from international institutions such as the International Atomic Energy Agency and the European Commission. All these sources will make it possible to assess the level of compliance of Albania with international nuclear safety standards.

The paper also uses a regional comparative method, focusing on and analyzing the policies and experiences of Balkan countries that have or have had nuclear capabilities, such as Bulgaria, Romania, Slovenia, and Croatia, as well as countries without nuclear capabilities, such as Serbia and North Macedonia.

The paper includes an interpretative analysis of the opportunities and constraints for the development of nuclear energy in Albania, referring to economic, environmental, social, and geopolitical factors. This picture aims to provide a reality on the possible perspectives of nuclear energy in the country and on the harmonization of the law in this field.

According to studies, nuclear energy accounts for about a quarter of the world's low-carbon electricity compared to other energy sources, with hundreds of reactors active globally and important roles in delivering a stable supply of electricity and reducing carbon emissions. (World Nuclear Performance Report 2025, n.d.)

Albania, as a country that does not have any nuclear power plants and faces an energy power dominated by hydropower and, increasingly, renewable energy, as well as the idea of nuclear energy, remains to be discussed as a strategic opportunity for diversifying energy sources and increasing energy security in the region and within the framework of global sustainable development.

2. LEGAL FRAMEWORK FOR NUCLEAR ISSUES IN ALBANIA

Albanian legislation on nuclear issues in Albania defines and presents only the preventive and regulatory approach to nuclear energy, focusing mostly on radiological safety with the aim of protecting public health and protecting the environment. In this way, this legislation does not define the purpose and possibilities for the development of nuclear energy for energy production. This approach is directly related to the fact that Albania has not historically had capacities for nuclear energy production nor has it developed a national program in this field (IAEA, 2020). Consequently, Albanian legislation does not address the full cycle of nuclear energy, but focuses on the control of radioactive sources and the minimization of risks associated with ionizing radiation.

Unlike countries that operate nuclear power plants, Albania does not have a dedicated nuclear energy law that regulates the construction, operation, dismantling, and management of nuclear waste. The European Commission, in its 2021 report on Albania's EU accession process, has determined that the lack of a relevant law on the development of nuclear energy does not constitute a legal gap in the formal sense. In Albania, it clearly reflects the strategic orientation of the energy sector, which has historically relied almost entirely on hydropower and, more recently, is moving towards the use of

other renewable sources (European Commission, 2021).

The absence and deficiency in a specialized legal framework for nuclear energy would constitute a serious obstacle if Albania were to aim to develop nuclear capacities in the future (OECD & NEA, 2019). Moving towards such an initiative would require the drafting of a new comprehensive law, the creation of an independent regulatory authority, and the approximation of national legislation with the *acquis communautaire* of the European Union in the field of nuclear safety.

In Albania, the legislation defining and regulating nuclear technology is Law No. 8025, dated 9.11.1995, "On Protection from Ionizing Radiation" (Republic of Albania, 1995). This law constitutes the legal basis for exercising control over any activity involving radioactive sources and equipment that produce ionizing radiation, regardless of the purpose of their use.

The main purpose of the law is to protect human life and health, as well as the environment, from the harmful effects of ionizing radiation during use by authorized entities (Republic of Albania, 1995). The law adopts the fundamental principles of radiological protection, including the principle of exposure justification, dose optimization, and exposure limitation, in accordance with the standards recommended by the International Commission on Radiological Protection and the IAEA (IAEA, 2018).

The law clearly defines the obligation to obtain a license for any entity whose main purpose is to produce, import, transport, store, or use radioactive materials. This definition is particularly important for understanding the Albanian reality regarding radioactive materials, given that their use is mainly concentrated in the healthcare equipment services sector and the industrial field (IAEA, 2020).

The law also defines the mechanism of implementation for protection from ionizing radiation, where implementation is carried out by a specialized institutional structure, where the activity of the Radiation Protection Commission has the greatest importance. This institution, as the national regulatory authority for radiological safety, operates on the basis of the law, and its competences extend to the drafting of sub-legal acts for the implementation of the legal consequences determined by the law, as well as the competences related to the granting of licenses, conducting inspections, and monitoring radiation levels for entities that use these materials (Republic of Albania, 1995).

Compared to countries with advanced nuclear

programs and nuclear power generation, these functions are generally exercised by independent nuclear safety agencies of a special nature and exercise only functions related to the safety of nuclear energy. In Albania, due to the lack of nuclear power installations for the purpose of energy production, the Radiation Protection Commission fulfills an expanded role, covering the entire spectrum of radiological activities carried out within the territory of the Republic of Albania (OECD & NEA, 2019). Its activities focus on the control of medical diagnostic equipment, radiotherapy equipment, and the industrial use of radioactive sources in the country.

Current Albanian legislation is in line with international nuclear and radiological safety standards, indicating a similar law to other developed countries. Albania, as a member state of several international and regional organizations, is also a party to several international conventions, including the Convention on Nuclear Safety and the Convention on Early Notification in the Event of a Nuclear Accident, as a full member, assuming obligations for transparency and periodic reporting (IAEA, 2020).

The Albanian state reports through the periodic national reports submitted to the IAEA show that Albania has slowly and continuously created the legal resources and institutional capacities for the management of radioactive sources, although these capacities are not designed for the supervision of nuclear power plants (IAEA, 2020). The harmonization of the law is of particular importance within the framework of the European integration process. Nuclear safety and radiation protection are an integral part of EU legislation and countries that are in the process of accession, as in the case of Albania, must harmonize these laws in accordance with EU law (European Commission, 2021).

We acknowledge that the legislation in force in the Republic of Albania provides a satisfactory level of radiological protection and sets clear limitations from the perspective of the development of nuclear energy. The legislation in force does not address essential issues such as the licensing of nuclear reactors, civil liability for nuclear damage, long-term management of radioactive waste, and the dismantling of nuclear installations (OECD & NEA, 2019).

Referring to the provisions set out in the relevant law, we say that the Albanian legal framework should be seen as a basic structure with an orientation and focus on safety and control, but not as a complete system for the development of nuclear energy in the country. Any future initiative for

nuclear energy would require deep legal reforms, a defined strategic plan, institutional reform and strengthening, and close cooperation with international organizations such as the IAEA and the European Union (Agency, 2024)

3. REASONS FOR THE LACK OF NUCLEAR ENERGY IN ALBANIA

The Albanian energy system relies almost entirely on hydropower, which accounts for the vast majority of domestic electricity production, supplemented by other renewable sources such as solar and wind energy (Ministry of Infrastructure and Energy of Albania, 2022). In this context, nuclear energy is not part of the national energy mix or short or medium term energy development strategies. The use of nuclear technologies in Albania is limited to non-energy applications, mainly in the fields of medicine (diagnosis and therapy), industry, and scientific research. These activities are regulated by legislation on protection from ionizing radiation and monitored by the relevant national authorities, in cooperation with the International Atomic Energy Agency (IAEA, 2020). Albania regularly reports to the IAEA on the state of radiological safety, demonstrating compliance with basic international standards, but without having any objective for the development of nuclear energy.

From an institutional perspective, the country does not have a specialized authority for nuclear safety in the full sense of the word, as is the case in countries with nuclear power plants. Regulatory functions are exercised by the Radiation Protection Commission, which covers only aspects of radiological safety and not the management of nuclear power installations (Republic of Albania, 1995). This situation clearly reflects the fact that nuclear energy is not part of the operational reality of the Albanian energy sector.

National energy strategies in Albania are oriented towards increasing renewable capacities, improving energy efficiency, and diversifying import sources, instead of developing nuclear technologies (Ministry of Infrastructure and Energy of Albania, 2022). All these orientations for the development of efficient and safe nuclear energy are in line with the European Union policies for the energy transition and decarbonization of the economy, favoring clean and flexible sources in achieving a green economy and environmentally friendly development.

But nuclear energy, although internationally accepted and technologically proven as a low-carbon source, has not been included in Albanian strategic documents as a real alternative. In this way, this

absence reflects not only technical and financial constraints but also a political choice to avoid high-risk technologies and heavy institutional requirements for Albanian tourism. (European Commission, 2021).

A main reason directly related to Albania for not having nuclear energy is related to the very high capital costs required to build a nuclear power plant on Albanian territory, also laying out the Albanian investment policy that directly links energy production to the creation of energy produced by hydroelectric power plants or through purchase. All these costs are smaller compared to the costs of investing in the construction of a nuclear power plant. International literature shows that the initial investments for a nuclear power plant are among the highest in the energy sector, requiring financial capacities and long-term state guarantees (Sovacool, 2011). For a relatively small economy like the Albanian one, such an investment would constitute a considerable fiscal and financial burden.

The return on investment in nuclear energy is long-term, while Albania has preferred projects with a shorter implementation cycle and greater flexibility, such as hydropower and solar plants (Kesh, 2020). These economic factors have influenced the exclusion of nuclear energy from practical energy development options for the coming years and even for the distant future.

For the Albanian state, the lack of technical expertise and the lack of specialized human resources in the field of nuclear energy production constitute another essential obstacle to the possibility of using this type of energy. Nuclear energy requires qualified personnel, strong regulatory institutions, and advanced capacities for managing nuclear emergencies (IAEA, 2018). Albania currently does not have such a base of technical and institutional structural means, where its production would require decades of investment in the field of education and training in order to implement the necessary knowledge and the appropriate infrastructure for emergency production.

The lack of a specialized legal framework for nuclear energy constitutes a serious primary institutional limitation, where any development is hindered by the legislation in force in a given country. As highlighted by the OECD and NEA, the development of nuclear energy requires a complex legal system covering safety, civil liability, and radioactive waste management (OECD & NEA, 2019). In the case of Albania, even today, these elements are not integrated into its legislation that is in force throughout the country.

The information dissemination and public awareness in the Albanian state present a different reality from other countries in the region. (Public Perceptions, Awareness, and Social Acceptance of Hydrogen Technologies in Albania, 2023) Public perception of nuclear energy is an additional factor influencing its absence in Albania. Regional studies show that in the Western Balkan countries, which do not have a nuclear history, there is a high level of skepticism and public concern regarding the safety and environmental impact of nuclear power plants (Železnik & Golob, 2018). In Albania, where public awareness of nuclear technologies is limited, social support for such projects would be uncertain and would have difficulty in initial acceptance and later implementation, taking into account the fact that the current government did not even go into its action plan until 2030.

Geopolitically, Albania benefits from proximity to neighboring countries that already produce nuclear energy, such as Bulgaria and Romania, through the regional energy market, creating an optimistic perspective for the future. This reduces the pressure to develop domestic nuclear capacity, making imports a simpler and less risky alternative (World Nuclear Association, 2023).

Based on the factors listed above, nuclear energy in Albania remains a theoretical and long-term option, but not a real alternative in the current energy policy of the Albanian energy sector. (Law No. 24/2023 on the promotion of the use of energy from renewable energy sources, n.d.)

4. NUCLEAR ENERGY IN THE BALKANS COMPARED TO ALBANIA

In some Balkan countries, nuclear energy has played and continues to play a strategic role, particularly in the context of energy security, stability of supply, and meeting carbon emission reduction targets with a clear aim of reducing environmental pollution. In the region, countries that have developed nuclear capacity consider this energy source as a long-term component of their energy mix, which guarantees stable and climate independent production (World Nuclear Association, 2023). This position has been further strengthened after the recent energy crises in Europe, which clearly highlighted the importance of basic energy sources with continuous production. In this regional position, Albania appears as a clear exception, as it has not developed and does not currently plan nuclear energy capacities. Comparing Albania with neighboring countries on the expected benefits of nuclear energy use provides a valuable perspective

to understand not only the structural and institutional changes, but also the strategic alternatives that Albania may consider in the future to benefit from nuclear energy at the desired levels.

Bulgaria, as an EU member state, is one of the main countries in the Balkans that relies on nuclear energy for electricity production. The Kozloduy Nuclear Power Plant constitutes a key pillar of the Bulgarian energy system, making a major contribution to domestic production in Bulgaria and regional energy exports carried out by the country (World Nuclear Association, 2023). In Bulgaria, nuclear energy represents not only a low-carbon energy source while preserving the environment but also a means to increase energy independence and strengthen its position in the regional market. Strategically, Bulgaria has continuously invested in improving the legal framework and institutional structures for nuclear safety, in line with European Union standards (European Commission, 2021). This high level of production and institutionalization has made nuclear energy a viable and politically acceptable option, in line with the policy of integration into the European Union, and at the same time, achieving sustainable development for the entire Bulgarian state. Romania is another country where the Cernavoda nuclear power plant provides a significant share of the country's electricity production and plays a key role in the national decarbonization strategy (Stan & Gheorghe, 2017). Romania has shown great interest in developing new technologies, such as small modular reactors which are considered more flexible and suitable for modern energy systems (International Atomic Energy Agency [IAEA], 2022). The strategy for the development of nuclear energy in Romania shows that nuclear energy is seen as a long-term investment, requiring political stability, financial capacity and international partnerships. This model of the Romanian state is an important indicator for Albania, as it highlights the level of commitment and preparation necessary to develop a nuclear program following the example of a country in the region.

Slovenia and Croatia have jointly built the Krško nuclear power plant and cooperate and operate in a solidarity manner. The cooperation is a unique example of international cooperation in nuclear energy in the Balkans. This plant supplies energy to both countries and contributes to the stability of the regional energy market (Železnik & Golob, 2018). From a strategic perspective, the joint ownership of this plant has reduced the financial burden for each country and increased the political acceptability of nuclear energy in each country. In this cooperation,

the development strategies of nuclear energy have common and mutual benefits for each country. This regional cooperation model is a possible alternative for smaller countries, but it requires a high level of institutional trust between states, legal and administrative coordination, and public consensus. All these elements must be fulfilled simultaneously. As we refer to Albania, we acknowledge that these are missing in the Albanian context. (Public Perceptions, Awareness, and Social Acceptance of Hydrogen Technologies in Albania, 2024)

In the Western Balkans, Serbia, North Macedonia, Montenegro, and Albania do not have operational nuclear power plants and do not have a strategy for the creation of nuclear energy. The viewpoint and policy of these countries towards nuclear energy vary significantly, even when compared to each other or other neighboring countries. Serbia has initiated strategic discussions and preliminary studies on the possible role of nuclear energy in the future, considering it as a long-term option for energy diversification (OECD & NEA, 2019). Albania has taken a more reserved stance, excluding nuclear energy from its national strategic documents. This change shows that the lack of nuclear capacity does not necessarily exclude strategic interest in this technology. In Albania, the lack of institutional and strategic debate on nuclear energy leaves the country less prepared to respond to potential changes in the regional and European energy context. (Albania's Atomic Ambitions, 2023)

Comparing Albania to Balkan countries developing nuclear energy for use and export, Albania differs from them in several ways:

- -The Albanian energy system is largely dependent on hydropower resources, making it vulnerable to climate change and droughts (Kesh, 2020). Unlike Bulgaria or Romania, Albania lacks a base load energy source that guarantees stable production throughout the year.
- Albania has not yet established the necessary legislation and institutional capacities necessary to oversee a nuclear program. Where one of the basic conditions for the development of nuclear energy is the existence of an independent regulatory authority and a comprehensive legal framework for nuclear safety and responsibility (IAEA, 2018). In this regard, Albania is at an initial stage and needs a lot of work to reach the levels of other countries.
- Public perception and nuclear safety culture in Albania are relatively underdeveloped in the

direction of nuclear energy production, compared to countries with decades of nuclear experience. Albania faces a lack of information and public trust, which would make it difficult to achieve social consensus for such projects (Železnik & Golob, 2018).

Nuclear energy production for Albania remains a long-term and hypothetical option whether to develop in the near or long term. In the short and medium term, the country has chosen to focus on renewable energies and integration into the regional energy market. However, developments in the Balkans show that nuclear energy can play a stabilizing role in energy systems, especially in a context of growing energy demand and decarbonization pressures (European Commission, 2021).

In this sense, a realistic perspective for Albania would not necessarily be the construction of a national nuclear power plant, but rather increased regional cooperation, including access to nuclear energy produced in neighboring countries and participation in joint research and institutional projects. This approach would allow Albania to benefit from the stability of nuclear energy without directly facing its costs and risks.

The comparison with the Balkan countries shows that nuclear energy is an important strategic instrument for some countries in the region, but not a universal solution. Albania, due to economic, institutional and social conditions, is currently outside this development model. A more active approach at the regional level and a structured debate on the role of nuclear energy would be beneficial for the long-term planning of the energy sector in Albania.

5. CONCLUSIONS

The analysis of the possibility of nuclear energy production in Albania clearly shows that the country is in a different position regarding the development of this energy source compared to other forms of energy production or even renewable energy. Compared to other Balkan countries, Albania has never developed nuclear capacity and does not yet have a concrete plan to build a nuclear power plant. The Albanian energy system relies mainly on hydropower resources, which are sensitive to climate change and seasonality, creating ongoing challenges for providing a stable supply of electricity (Kesh, 2020). The historical table also shows that although there have been some discussions on the possibility of nuclear energy after the 1990s, these have not managed to materialize into concrete projects due to

economic constraints, lack of infrastructure, institutional challenges and mainly the lack of focus on this energy in the development policy of the Albanian state.

Based on the legislation on radioactive and ionizing substances, Albania has made considerable progress in approximating its framework to European standards, particularly in the field of radiological safety and management of radioactive sources. Law No. 8025/1995 "On protection against ionizing radiation" and subsequent regulations reflect the main principles of nuclear safety defined by the European Union and the International Atomic Energy Agency. The law and normative acts guarantee only the aspects of population protection, monitoring of radiation exposure, licensing of activities involving radioactive sources and the principles of justification, optimization and dose limitation. Although the law is in force, there is no full activity of the regulatory institutions. Ensuring their functional independence and developing technical capacities for radioactive waste management constitute the necessary elements for full harmonisation with European standards.

Neighboring countries such as Bulgaria, Romania, Slovenia and Croatia have developed sustainable nuclear capacities, becoming models for nuclear energy management and international cooperation. Bulgaria and Romania use their nuclear power plants to produce a significant share of their electricity. The joint ownership of the Krško power plant by Slovenia and Croatia is a successful example of regional cooperation. Comparison with these countries shows that Albania is not yet prepared to follow a similar path, lacking the infrastructure, institutional capacity and a broad public debate on the benefits and risks of nuclear energy.

In the context of international agreements, to strengthen regional security and cooperation, Albania has signed strategic energy agreements with countries such as Italy and the United Arab Emirates, but these agreements focus mainly on renewable energy and underwater energy connections, not on the construction of nuclear power plants (Prime Minister of Albania, 2025). The media have reported speculative discussions on the possibility of a nuclear power plant in Albania with an Italian partner, but these have not been confirmed by official documents and remain merely unofficial hypotheses (Faktor, 2025). This clearly shows that, at present, Albania has no legal or financial commitments to such a project, leaving nuclear energy at a level of theoretical discussions and long-term strategic planning.

Albania's European integration perspective in the

EU requires that meeting EU requirements for nuclear safety and protection from nuclear radiation is part of the legal and institutional harmonization process that can serve as a basis for future developments in the energy field (European Commission, 2021). The process of approximation of Albanian legislation is not just a formality on the part of the Albanian state, but ensures that Albania has reliable control and supervision mechanisms if the country aims and decides to develop nuclear projects in the future. On the other hand, approximation with European standards increases Albania's international credibility in the region and the world and may favor future investments, including regional cooperation on nuclear energy production and the acquisition of other renewable energy projects.

Albania has several strategic opportunities related to nuclear energy, even without a nuclear power plant because it can benefit from the experience of Balkan countries to develop institutional capacities, to create an advanced legal framework and to increase public awareness on radiological safety. Cooperation with neighboring countries that have nuclear power plants could provide indirect access to nuclear energy, for example through electricity import agreements or participation in regional research and development projects (World Nuclear Association, 2023; Železnik & Golob, 2018). In this way, Albania could create a strategic position to engage in the regional energy sector, without taking on the risk of building and operating a national nuclear power plant.

Nuclear energy is not a top priority of Albania's

energy policies at the moment, and the decision not to develop nuclear projects is related to economic, social and political factors. High initial costs, technical and infrastructure challenges, as well as public perception of nuclear safety, make nuclear energy a complicated option for Albania. Faced with these challenges and the costs of nuclear power generation, the Albanian state has chosen to invest in renewable energy and regional integration, building a sustainable basis for long-term energy development and meeting the objectives of reducing carbon emissions, in line with European standards and international strategies (Kesh, 2020; European Commission, 2021). In conclusion, the analysis shows that nuclear energy in Albania remains a potential strategic option for the future, but not a current reality. The country has made important steps in legal harmonization with the EU, has created institutional capacities based on radiological safety and has started international cooperation in energy, but has not built any nuclear power plants and there are no formal agreements for such projects. The comparison with the Balkan countries shows that in order to develop nuclear energy, specialized institutions, relevant technical capacities and public support are needed, which Albania needs time to develop in a gradual and continuous manner. The clearest strategy for Albania is a combination of institutional preparation, legal harmonization with European standards, and investments in renewable energy and regional cooperation, while keeping nuclear energy as a viable option for the coming decades.

REFERENCES

- Cash, E. (2020) 'Renewable energy dominance and energy security in Albania', *Energy Reports*, 6, pp. 276–284. <https://doi.org/10.1016/j.egy.2020.11.139>
- Climate Sceptics (2023) Albania's atomic ambitions. Available at: <https://www.climatesceptics.org/europe/albania/albania-s-atomic-ambitions>.
- European Commission (2021) EU nuclear safety and radiation protection framework. Luxembourg: Publications Office of the European Union.
- European External Action Service (2025) EU and EBRD strengthen Albania's energy security with support for new solar power plant, 24 July. Available at: https://www.eeas.europa.eu/delegations/albania/eu-and-ebrd-strengthen-albania%E2%80%99s-energy-security-support-new-solar-power-plant_en
- Factor (2025) "'Secret' agreement? Italian media: Meloni wants a nuclear power plant in Albania", *Factor*, 23 January. Available at: <https://faktor.al/2025/01/23/marveshja-sekrete-media-italiane-meloni-donje-central-berthamor-ne-shqiperi>
- Flury, K. and Frischknecht, R. (2011) *Life cycle inventories of hydroelectric power generation*. Dübendorf: Swiss Centre for Life Cycle Inventories.
- International Atomic Energy Agency (IAEA) (2018) *Radiation protection and safety of radiation sources: International basic safety standards (IAEA Safety Standards Series No. GSR Part 3)*. Vienna: IAEA.
- International Atomic Energy Agency (IAEA) (2020) *National report of Albania under the Convention on Nuclear Safety*. Vienna: IAEA.
- International Atomic Energy Agency (IAEA) (2022) *Small modular reactors and energy transition*. Vienna: IAEA.

- International Atomic Energy Agency (IAEA) (2024) The Republic of Albania signs its country programme framework (CPF) for 2024–2029, 6 November. Available at: <https://www.iaea.org/newscenter/news/the-republic-of-albania-signs-its-country-programme-framework-cpf-for-2024-2029>
- International Energy Agency (IEA) (2022) World energy outlook 2022. Paris: IEA.
- KPMG Albania (n.d.) Law No. 24/2023 on the promotion of the use of energy from renewable energy sources. Available at: <https://kpmg.com/al/en/home/insights/2023/05/new-law-on-promotion-of-the-use-of-energy-from-renewable-source.html>
- MEPS Albania (2024) Hydro power. Available at: <https://meps.al/hydro-power/>
- Ministry of Infrastructure and Energy of Albania (2022) National energy strategy 2022–2030. Tirana: Government of Albania.
- OECD Nuclear Energy Agency (NEA) (2021) The role of nuclear energy in a low-carbon future. Paris: NEA.
- Organisation for Economic Co-operation and Development (OECD) and Nuclear Energy Agency (NEA) (2019) Nuclear legislation in OECD and NEA countries. Paris: OECD Publishing.
- Prime Minister of Albania (2025) Abu Dhabi: Trilateral strategic agreement in the field of energy is signed between Albania, Italy, and the United Arab Emirates, 15 January. Available at: <https://www.kryeministria.al/en/newsroom/abu-dhabi-nenshkruhet-marreveshja-strategjike-trepaleshe-ne-fushen-e-energji-se-mes-alqiperise-italise-dhe-emirateve-te-bashkuara-arabe/>
- Qysri, A. and Fuga, P. (2015) 'Diversification of energy sources as a necessity for energy security in the country: Opportunities and dilemmas for nuclear energy', *Economicus*, 12
- Republic of Albania (1995) Law No. 8025 on protection from ionizing radiation. Tirana: Official Gazette of the Republic of Albania.
- Sovacool, B.K. (2011) 'The costs of failure: A preliminary assessment of major energy accidents, 1907–2007', *Energy Policy*, 36(5), pp. 1802–1820. <https://doi.org/10.1016/j.enpol.2008.01.040>
- Stan, S.D. and Gheorghe, A.V. (2017) 'Nuclear power and energy security in Romania', *International Journal of Energy Research*, 41(13), pp. 1936–1948. <https://doi.org/10.1002/er.3742>
- World Nuclear Association (2023a) Nuclear power in Europe. London: World Nuclear Association.
- World Nuclear Association (2023b) Nuclear power in sustainable development. Available at: <https://www.world-nuclear.org>
- World Nuclear Association (n.d.) World nuclear performance report 2025: Nuclear delivers record-breaking year in electricity generation. Available at: <https://world-nuclear.org/news-and-media/press-statements/world-nuclear-performance-report-2025-nuclear-delivers-record-breaking-year-in-electricity-generation>
- Železnik, N. and Golob, B. (2018) 'Public perception of nuclear energy in Slovenia and Croatia', *Energy, Sustainability and Society*, 8(1), pp. 1–12. <https://doi.org/10.1186/s13705-018-0162-4>.