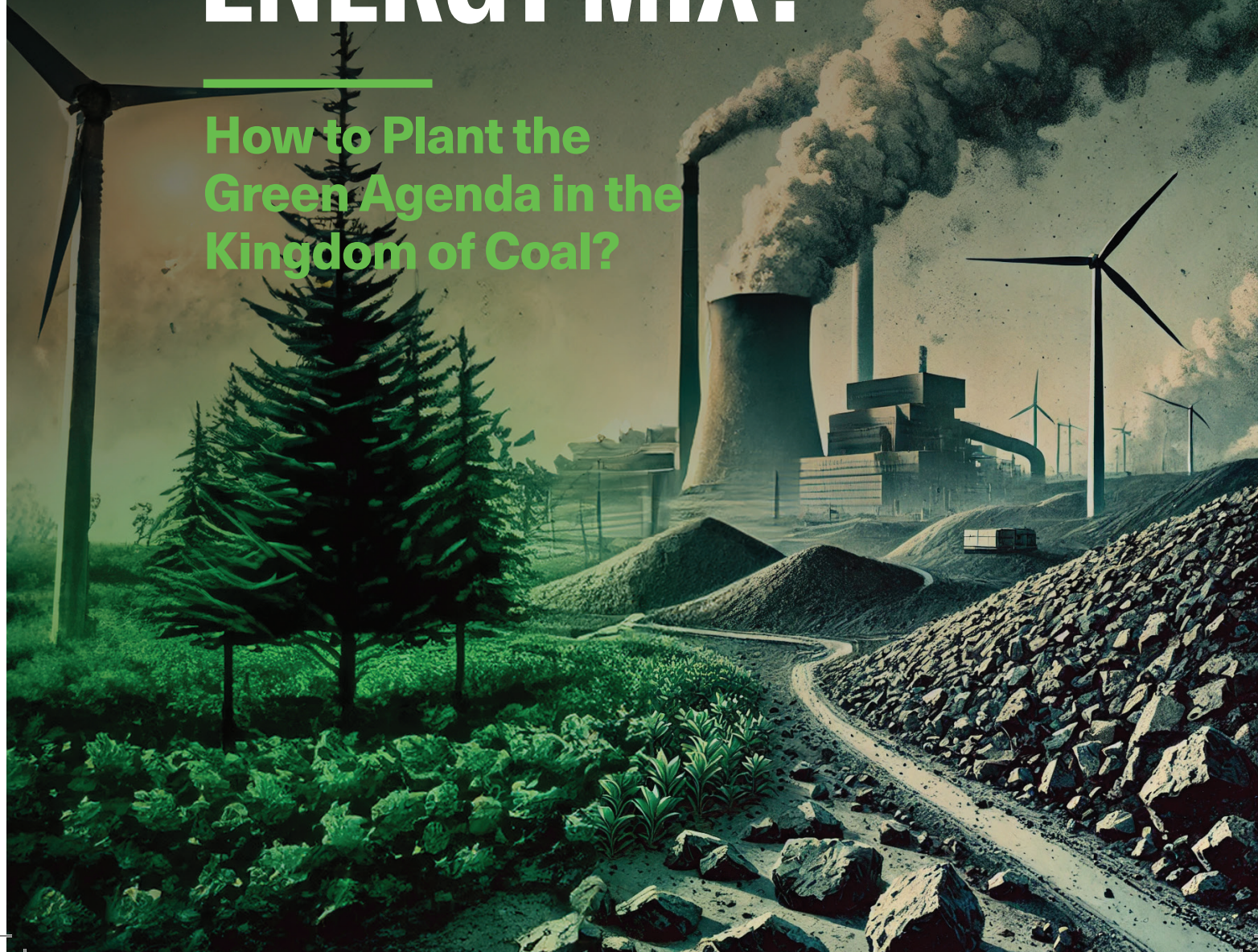


WHAT'S THE RIGHT ENERGY MIX?

How to Plant the
Green Agenda in the
Kingdom of Coal?





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Green Agenda in
the Kingdom of
Coal?**

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Introduction

Kosovo, burdened by a long history of deep dependence on lignite, stands at a critical developmental crossroads. The prevailing sentiment, deeply ingrained in the minds of many citizens and policymakers, is that “we sleep on coal and must exploit this advantage.” Lignite, considered a symbol of prosperity and economic strength, has long fueled the country’s development. However, this deep-seated reliance clashes with international commitments and the pressure of European integration, which have ushered in a new paradigm—the Green Agenda—demanding a shift towards more sustainable energy sources. Today, Kosovo faces a critical challenge: how to avert a future energy crisis and integrate into a world rapidly transitioning towards a cleaner, more sustainable energy future.

Previous governments in Kosovo have not challenged this mentality, further complicating the energy transition. Even within the framework of the Green Agenda, which Kosovo is obligated to implement for European Union accession, there is a lack of decisive action to move away from lignite and embrace a more ambitious energy transition with a stronger focus on renewable energy sources.

The energy sector in Kosovo is characterized by a stark duality. Lignite remains the dominant fuel for electricity generation, supplying 95% of the country’s current needs. Yet, renewable energy has emerged as a beacon of hope for a more sustainable future. However, this transition is hampered by significant challenges. Policymakers have historically favored lignite, while experts and civil society groups advocate for a faster and more dynamic transition towards new and renewable energy sources (RES).

This complex situation highlights a persistent challenge: while awareness of Kosovo’s energy dependence and its associated environmental and health consequences is widespread, there is a lack of concrete action to move beyond coal. The country faces a pressing need to address environmental and health challenges, including air pollution and the global commitment to carbon neutrality.

Key characteristics define the Kosovo energy landscape:

- 1** the dominance of lignite in electricity production from the Kosova A and Kosova B power plants, which generate over 90 % of the country's electricity;
- 2** a limited potential for RES, which, while growing, currently represents a small portion of the overall energy balance;
- 3** the aging Kosova A and Kosova B power plants, operating in their sixth and fifth decades respectively, are among the oldest power plants in the world; and
- 4** reliance on coal generates significant environmental concerns, including air pollution and greenhouse gas emissions.

This situation presents Kosovo with numerous challenges:

- 1** energy security, heavily reliant on energy imports, making the country vulnerable to price fluctuations and supply disruptions;
- 2** the urgent need for environmental intervention, caused by coal dependence, with severe consequences for the environment and public health, contributing to air pollution and climate change;
- 3** the financial strain imposed by the maintenance and upgrading of aging power plants, placing a heavy burden on public finances and hindering investments in renewable energy development; and
- 4** EU integration necessitates compliance with the global commitment to carbon neutrality by 2050, effectively pressuring Kosovo to transition away from coal and embrace clean energy sources.

This analysis aims to provide relevant information about the current energy situation in Kosovo, drawing on official reports and the National Energy and Climate Plan 2025-2030, which projects the future development of the energy sector until 2040. It will critically examine the development scenarios presented, seeking to answer the following questions:

- Can Kosovo achieve its aspirations of European integration while simultaneously fulfilling the ambitious goals of the Green Deal, particularly regarding dependence on lignite? What are the tradeoffs that can be made between economic growth, energy security, and environmental sustainability?
- What is the optimal energy mix for Kosovo, taking into account the constraints of its resources and development models based on the EU's Green Agenda? This analysis will assess the potential of RES, particularly solar, wind, and water, to replace lignite as the primary energy source.
- How can Kosovo meet its short-term energy needs while simultaneously laying the foundation for a sustainable, long-term energy system? This involves considering the current state of the energy sector, existing infrastructure, and the potential for new investments in renewable energy technologies.

Kosovo needs a new motto to replace its old ones, which can be defined as *“less lignite, more Europe”*.

Kosovo's dominant reliance on fossil resources – lignite – presents significant environmental and economic challenges. The ambitious goals of the Green Deal, coupled with the need for EU membership, create a compelling argument for transitioning to a cleaner energy future. However, this transition requires a careful examination of Kosovo's specifics, especially its large lignite reserves and its dependence on coal-fired power plants, which have long since passed their normal operating lifespan.

To address the current global challenges, Kosovo needs a carefully crafted energy mix that takes into account these premises:

- The gradual transition from lignite to other energy resources will be vital, requiring a balanced approach that takes into account existing infrastructure, economic impact, and the development of alternative energy generation options.
- The exploitation of solar, wind, and hydro potential is key to replacing lignite. However, Kosovo's limited water resources pose significant constraints on the potential for developing hydro energy.
- Optimizing energy consumption through improved efficiency measures and demand management can reduce the need for new energy generation capacities and ensure a more sustainable energy system.

Executive Summary

Kosovo finds itself at a critical juncture. A long history of heavy reliance on lignite, which generates over 90% of the country's electricity, clashes with the promise of a European future, which brings with it commitments to the Green Agenda. This mentality of the last few decades, that "we live in the Kingdom of Coal", has created a difficult dilemma: how to balance the need for economic development with the responsibility to the environment and a sustainable future?

This document analyzes the challenges and opportunities that Kosovo faces in its journey towards a clean energy future. It explores a possible energy mix, which could provide sufficient energy for the country's development, while staying within the Green Agenda's framework. The document emphasizes the importance of diversifying energy sources and developing a more ambitious energy strategy.

The analysis reveals a monumental challenge: Kosovo's future energy planning does not fully take into account the realities of growing demand for electricity, the constraints of renewable resources in the country, and the challenges of transitioning away from lignite. The National Energy and Climate Strategy 2022-2031 aims to increase renewable energy and improve energy efficiency, but these measures are not sufficient to guarantee a sustainable and secure future.

The analysis shows that Kosovo will face an energy deficit of approximately 2,500 GWh by 2040, even after implementing its current plans. This means that Kosovo will have to rely on energy imports, increasing its dependence on external suppliers and making the country more vulnerable to fluctuating prices and potential disruptions. To address this challenge more responsibly, Kosovo urgently needs to consider alternative options, including:

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● **Importing Liquefied Natural Gas (LNG):** LNG, as a cleaner energy source than lignite, could play a crucial role in the energy transition toward 2050 when greenhouse gas emissions are expected to reach net zero. Importing LNG from Greece or connecting to the Adriatic pipeline in Albania are options that need to be seriously considered, taking into account costs, benefits, and potential challenges.

● **Lignite gasification in Obiliq:** This would bring back the experience of the last two decades with synthetic gas (sin-gas) in Kosovo. This strategy, combined with modern carbon capture technologies, could offer a more sustainable alternative to lignite use.

● **Investing in Albanian Hydro Resources:** Albania possesses significant hydro energy potential that could be harnessed to generate clean energy for both countries. To date, all cooperative efforts have focused on energy exchange, but the possibility of generating energy based on Albanian hydro potential has never been seriously considered. This requires closer regional cooperation.

● **Developing a Sustainable Water Management Strategy:** In light of Kosovo's limited water resources, it is essential to develop a sustainable water management strategy. This plan should include investments in water infrastructure, improving water usage efficiency, and reducing water pollution. It should also avoid the construction of hydroelectric plants in protected areas.

To avoid an energy crisis in the future, Kosovo must act swiftly and decisively. A clear energy plan that encompasses a wide range of solutions, taking into account the importance of ongoing investments in renewable energy, exploring alternative energy sources, improving energy efficiency, and promoting regional cooperation, is crucial to securing a sustainable and affordable energy future for Kosovo..

Kosovo's Energy Trilemma

Kosovo stands at a crossroads, caught between three major challenges that define its energy future.

First, the country boasts vast reserves of lignite, enough to fuel its power plants for decades. The phrase “we sleep on coal,” deeply rooted in the minds of many citizens and decision-makers, has given the country a perception of economic power and energy abundance.

Second, Kosovo is deeply committed to integrating into the European Union, a path that requires harmonizing its energy strategy with the ambitious goals of the Green Deal. This commitment demands a clear transition away from lignite and an embrace of clean energy sources, presenting a significant challenge: how to manage the long-standing dependence on lignite while fulfilling environmental obligations?

Third, to further complicate matters, Kosovo faces a severe lack of water resources, making it one of the poorest countries in Europe in this regard.

This unique trilemma—abundant lignite reserves, the commitment to a lignite-free future, and the scarcity of water resources—creates a critical challenge that significantly hinders the country's future energy development. How can economic interests be harmonized with environmental aspirations and the desire for European integration? What Energy Mix can truly meet future energy needs, balancing the potential of renewable energy with the need for a swift transition to a new era without lignite as a fuel source, and taking into account the limitations imposed by the lack of water?

This analysis aims to navigate this complex landscape, exploring possible solutions and ultimately seeking to answer this crucial question: Can Kosovo build a sustainable energy future that balances economic growth, environmental responsibility, and European integration?

Kosovo is caught in a difficult confrontation between a deeply ingrained mindset of living in the “Kingdom of Coal” and the promise of a clean future according to the EU's Green Agenda.



Living in the “Kingdom of Coal”

Kosovo is caught in a difficult confrontation between a deeply ingrained mindset of living in the “Kingdom of Coal” and the promise of a clean future according to the EU's Green Agenda. The country's vast lignite reserves have created a perception of national wealth, linking coal with prosperity, national pride, and political stability. This close association, reinforced by a deep sense of national pride for this resource, has shaped political discourse and public opinion. However, this association is becoming increasingly irrelevant in the face of the EU's commitment to carbon neutrality and its focus on clean energy. The EU's vision of phasing out fossil fuels creates a significant conflict with Kosovo's traditional reliance on lignite, presenting a major challenge to Kosovo as it navigates its path towards EU integration.

When development policies remain stuck in last century paradigms

Kosovo faces a major challenge in transitioning from lignite to alternative energy sources. Policymakers, deeply entrenched in the “we sleep on coal” mentality, view lignite as a secure energy source, making the shift to a sustainable future difficult. This perception, reinforced by fears of job losses and economic instability, overshadows the need to seriously consider alternative energy sources.

For decades, Kosovo has been seen as a “regional energy power” due to its vast lignite reserves. This “Kingdom of Coal” has shaped the country's economic and political landscape, placing the exploitation of this resource at the forefront while neglecting the need to diversify energy sources. Within this context, the environmental impact of coal remains overlooked, with severe consequences for citizens' health and the environment.

This mentality, further reinforced by political leaders who believe that challenging the use of lignite will elicit a strong backlash from voters who see it as a symbol of prosperity and national pride, has slowed down the necessary change. Moreover, the coal industry in Kosovo employs a significant number of people and generates a substantial portion of the country's economic output. This has made it difficult to challenge the status quo, creating a dynamic where economic concerns are prioritized over those of the environment and long-term sustainability.

To successfully navigate this political landscape, Kosovo needs courageous and strong political decision-making, effective communication, and inclusive strategies that address the concerns of all stakeholders. A clear vision for a sustainable energy future, a commitment to long-term investments, and an open dialogue with citizens, businesses, and industry leaders are crucial for building consensus around a future that aligns with contemporary development trends.

Kosovo's Energy Strategy 2022-2031: An Incomplete Document

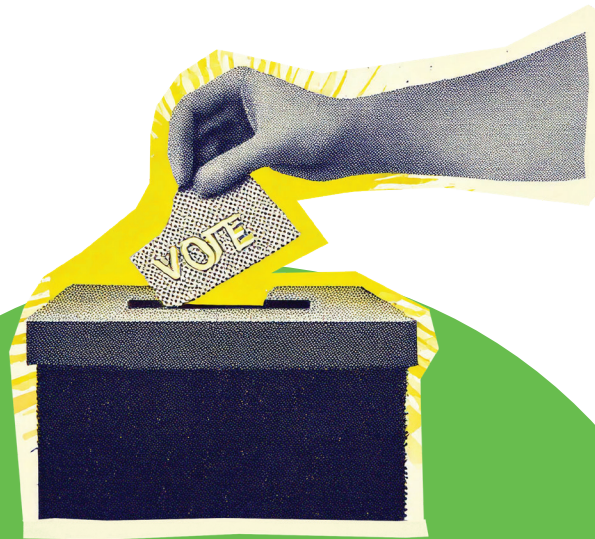
While Kosovo faces a critical energy crisis, the new Energy Strategy for the period 2022-2031 fails to offer a clear and suitable plan to address current challenges. On the contrary, the strategy presents some significant shortcomings that raise concerns about its effectiveness.

The Strategy lacks coherence with the previous Strategy, creating a sense of unnecessary repetition without introducing new elements to address current challenges. Furthermore, it presents a clear contradiction by proposing the reconstruction of the old Kosova A and Kosova B thermal power plants, despite the country's decarbonization goals. Such an investment in outdated technology that requires more coal to produce the same amount of energy that current power plants use today is a step backward in efforts to achieve decarbonization and energy security.

The new Strategy also fails to adequately address issues related to renewable energy and regional cooperation. It does not provide sufficient guarantees for environmental protection and public health, incorporating these aspects only marginally.

Ultimately, the new Energy Strategy lacks the necessary vision and courage to present long-term and high-cost projects, which are essential to address the current energy crisis and ensure a sustainable energy future for Kosovo.





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Lignite, the beloved enemy!

Kosovo boasts the largest lignite reserves in Europe, estimated at 14 billion tons. This resource has been the cornerstone of its energy generation system for decades, providing a cheap and readily available fuel source. However, the country's continued dependence on lignite faces significant challenges. It presents a three-fold concern, hindering Kosovo's path towards a sustainable energy future:

- **PUBLIC HEALTH RISKS:** Using lignite for energy generation poses considerable health risks, particularly due to the proximity of the Kosova A and Kosova B thermal power plants to Pristina and its surrounding area. A population of approximately 300,000 to 400,000 inhabitants lives within a 30-kilometer radius of the power plants' smokestacks. Burning lignite emits substantial amounts of greenhouse gases, as well as primary air pollutants, including carbon dioxide, sulfur dioxide, nitrogen oxides, and dust. These pollutants contribute to respiratory illnesses, cardiovascular problems, and other health issues, especially for vulnerable populations. Moreover, decades of surface mining, coupled with insufficient maintenance of ash deposits located just 3-4 km away from Pristina, pose a constant risk. These deposits, covering thousands of hectares, contain a significant amount of ash from the burning of lignite. Whenever winds blow towards Pristina, a large amount of inhalable dust reaches the city and surrounding residential areas, posing a serious threat to the health of its inhabitants.
- **AGING INFRASTRUCTURE:** The use of lignite in Kosovo is further complicated by the fact that the two power plants, Kosova A and Kosova B, are very old. These thermal power plants were built several decades ago and lack the appropriate technology to minimize emissions of greenhouse gases and air and water pollutants. Even despite occasional interventions, the power plants have remained with low standards for mitigating environmental problems, contributing to air pollution and increasing health risks for the surrounding population.

- **AN OUTDATED RESOURCE:** The continued dependence on lignite is an outdated strategy in the context of the EU's Green Deal and Kosovo's aspirations for European integration. The Green Deal sets ambitious targets for reducing greenhouse gas emissions and strongly calls for the phasing out of fossil fuels, including lignite. Kosovo, as a future EU member, would have to harmonize its energy policies with EU regulations and potentially face sanctions if it fails to meet the Green Deal's targets.

The National Energy and Climate Plan 2025-2030 (PNEK) acknowledges the need to reduce greenhouse gas emissions (GHG), aiming for a 16.3% reduction compared to 2016 levels by 2030. This target is set by the Energy Community, to which Kosovo is a member. PNEK outlines this scenario for achieving this reduction: a 36% reduction in GHG emissions by 2030 compared to 2016 levels must be achieved primarily through energy efficiency measures and some expansion of renewable energy.

Phasing Out Lignite: A Necessary Transition

Kosovo's Energy Strategy's most critical shortcoming is the lack of a strategic plan for phasing out lignite. Kosovo must develop a comprehensive plan based on the following:

- **GRADUAL CLOSURE OF THERMAL POWER PLANTS:** Setting a clear timeframe for the closure of the Kosova A and Kosova B thermal power plants, ensuring a smooth transition to alternative energy sources.
- **INVESTMENT IN RENEWABLE ENERGY:** Prioritizing investments in solar energy, wind energy, and hydro power, along with energy efficiency measures, to replace energy generation based on lignite.
- **REGIONAL COOPERATION:** Engaging with neighboring countries, especially Albania, to develop joint projects for generating renewable energy and cross-border trade.
- **FINANCIAL RESOURCES:** Securing funding from the EU and other international partners to support the transition towards renewable resources and regional projects.
- **REHABILITATION OF ENVIRONMENTAL DAMAGES:** Developing a plan for the environmental management of existing ash deposits, as well as the polluted areas around existing power plants, including possible measures to minimize negative impacts on the health of the surrounding population.

Greenhouse Gas Emissions from the Energy Sector

The energy sector is responsible for the vast majority of greenhouse gas emissions in Kosovo. Around 86% of total emissions, or 8.7 million tons CO₂ eq., originate from this sector. The primary culprit is lignite combustion for electricity production.

The energy industry is the largest contributor, generating 73% of energy sector emissions, or 6.3 million tons CO₂ eq. Following closely is transportation at 15%, followed by manufacturing and construction at 7%, and other energy sectors at 5%.

Emissions from lignite mining are limited but still a concern. Conversely, carbon dioxide capture and transportation are not relevant to Kosovo at this time. Of the emitted gases, carbon dioxide (CO₂) is dominant, accounting for 99.95% of the total, while methane represents only 0.5%.

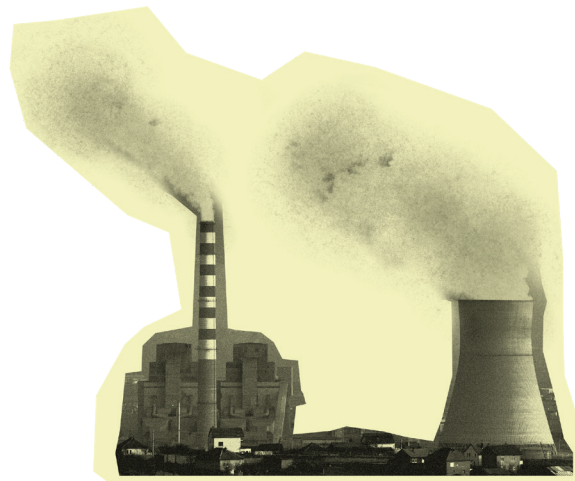
Although Kosovo has lower CO₂ emissions per capita (5 tons CO₂ equivalent) than the EU average, its emissions are higher than some countries in the region. Worryingly, CO₂ emissions per unit of Gross Domestic Product (GDP) are very high in Kosovo, at 0.5 kg CO₂ per unit. This is higher than the EU average and higher than all countries in the region, except Bosnia and Herzegovina.

These figures underscore the importance of energy transition in Kosovo, making decarbonization a top priority to achieve a sustainable future.

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Water Scarcity

Kosovo, unlike many other countries in the Balkans, has a significant water problem. Water resources are severely limited, hindering the development of hydropower, a vital source of renewable energy. Only 10% of the water flowing through Kosovo originates from external sources, while the rest are transboundary. This makes water management even more complex and exposes Kosovo to enormous pressure from climate change, which is expected to reduce water availability by 20% by 2046-2065. Consider these facts:

- Annual rainfall per capita in Kosovo is 4,107 m³, compared to 10,705 m³ in the region.
- Kosovo has an installed hydropower capacity of 108.24 MW, which is very small compared to the potential of other Balkan countries.
- In 2019, HEPs (Hydroelectric Power Plants) contributed only about 10% of Kosovo's total energy production.
- The White River, the Ibar River, the Morava e Binçës River, and the Lepenica River, which constitute Kosovo's main water sources, have an estimated hydropower potential of about 700 GWh/year. However, the majority of this potential is located in protected areas, making the development of HEPs in these locations difficult.

Renewable energy sources

The government's plan to increase the share of renewable energy sources in the overall energy mix is ambitious, aiming to reach 43% renewable energy in final energy consumption by 2030. This plan envisions a significant expansion of solar, wind, hydro, and biomass energy. Broken down by source, the plan projects that by 2030, wind energy will dominate renewable electricity production, contributing 25%, followed by solar photovoltaic at 13% and hydro at 5%. The remaining 7 TWh, predicted to be the total consumption by 2030, will be generated by lignite-powered thermal power plants (57%). The plan also anticipates a total installed capacity of 1,400 MW, from solar photovoltaic (730 MW) and wind (670 MW) by 2030.

However, realizing this vision is fraught with challenges, particularly considering Kosovo's specific circumstances. There is a common misconception that installing a certain capacity of solar or wind energy will translate directly into the same amount of energy production. In reality, the effective output of solar panels and wind turbines is significantly lower due to factors like weather conditions, interruptions, and energy storage limitations. Typically, solar and wind installations generate only 15-30% of their installed capacity. This means that the planned 1,400 MW capacity from solar and wind energy might generate only 300-350 MW power. This is significantly less than the current output generated by the Kosova A and Kosova B plants, which together currently have over 900 MW of available power.

Kosovo, unlike many other countries in the Balkans, faces a significant challenge discussed earlier: it has a limited capacity to develop hydropower, which would be a crucial source of renewable energy. While small hydro projects can be constructed, large-scale hydroelectric plants with over 100 MW of power cannot find suitable watercourses for construction.

Due to this limitation, Kosovo will have to rely primarily on other energy sources, such as solar and wind energy. To meet renewable energy targets, regional cooperation with neighboring countries, such as Albania, which has a significant hydro potential, is crucial. Studies conducted by the Kosovo government in 2006, 2009, and 2010 indicate that the Peja and Junik areas have the greatest hydropower potential, but these are located in protected areas. This clearly demonstrates that Kosovo faces a difficult dilemma: the full utilization of its water resources would risk the

environment and biodiversity of protected areas. Therefore, while Kosovo may not be able to rely on hydropower as a major source of renewable energy, it is crucial to create a strategic plan for water management. This involves preserving water resources, investing in infrastructure, and developing new technologies for better utilizing limited water resources.

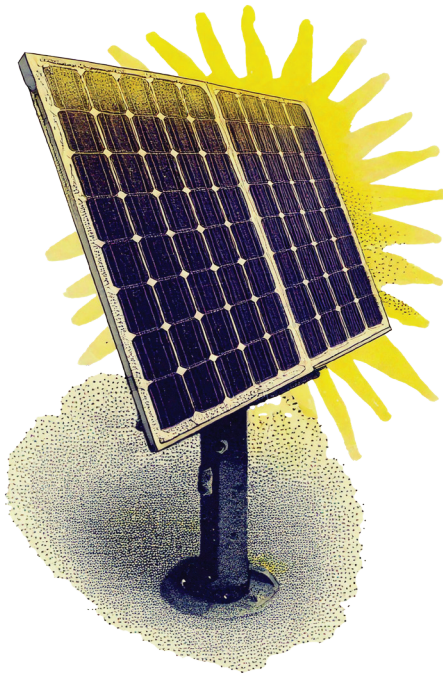
Kosovo is one of the most water-stressed countries in Southeast Europe due to specific natural characteristics combined with human pressure: lack of investment in water infrastructure, inefficient water usage, and water pollution from mining, untreated sewage, and agricultural runoff. The growing demand for water exacerbates the challenge. Modifications to river flows and structures, as well as basin alterations, increase the risk of drought and flooding. The intervention of climate change increases the sensitivity of ecosystems and the economy. The transboundary nature of four river basins further complicates water management. Although the National Water Policy promotes an IWRM (Integrated Water Resources Management) approach, and the Water Law presents modern EU-based water management practices, a functioning IWRM framework has not yet been established in Kosovo.

With an area of approximately 10,000 square kilometers and a dense population of less than 200 inhabitants per square kilometer, Kosovo has limited available land suitable for large-scale solar and wind energy installations. Moreover, Kosovo has a continental climate with limited sunny days and relatively moderate wind potential.

It is also important to note that all officially presented data on renewable energy in Kosovo to date rely on the use of biomass, especially wood. Currently used for heating, wood is a polluting fuel that further degrades environmental quality. If Kosovo were to change its reliance and use less wood for heating, it would face significant challenges in reaching its renewable energy target of 32%. PNEK estimates that by 2030, the installed capacity of renewable energy sources for electricity production will be around 59% of total installed capacity, with significant contributions from wind and solar energy. However, the current installed capacity of renewable energy sources in Kosovo is significantly lower than this projected future capacity.

In conclusion, the widespread adoption of renewable energy in Kosovo faces several barriers: limited water resources, lack of water in the country significantly limits the potential for hydropower development, a crucial obstacle for a sustainable energy transformation. Other contributing factors include (1) Kosovo's small size and dense population, which limit the availability of land suitable for large-scale solar and wind installations; (2) the country's continental climate, with limited sunny days and moderate wind potential; and (3) the current reliance on wood for heating, a polluting fuel that also depletes forest resources, raising concerns about sustainability and environmental impact. The planned capacity for wind and solar energy, while ambitious, is not sufficient to replace energy production from coal-fired power plants, making the phasing out of these aging power plants a very difficult task.

Addressing these challenges requires a strategic and multidimensional approach. Investing in sustainable biomass resources, such as agricultural waste, is crucial to mitigating the environmental impact of biomass use. Innovative solutions must be found: Kosovo needs to significantly expand renewable energy potential, also considering energy storage systems. Support for stimulating investment policies in renewable energy, which primarily simplifies the investment licensing process and promotes energy efficiency, should not be neglected. While the vision for a renewable energy future in Kosovo is ambitious, the reality on the ground presents significant barriers.



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Gas, a bridge to a cleaner future?

The penultimate Kosovo Energy Strategy 2019-2027, which was replaced by the 2022-2031 Strategy before its expiration, planned for gas as a strategic fuel and a part of the Energy Mix for the foreseeable future. Moreover, the Kosovo Parliament passed the Law on Natural Gas in 2016. However, the existing 2022-2031 Strategy does not account for gas use in the future and does not include it in the mix envisioned for the next three decades. This Strategy focuses on transitioning towards a cleaner energy future by continuing to utilize existing lignite-powered thermal power plants for several decades while also relying on renewable energy sources, coupled with increased energy efficiency. However, this transition will require careful planning and significant investment, especially given the limitations of renewable energy deployment in Kosovo.

The reality is that a complete replacement of lignite in the near future is impossible. The Kosova A and Kosova B power plants currently produce around 5 TWh of electricity per year, covering a significant portion of the country's energy consumption. The Strategy plans for the country to continue relying on lignite-powered power plants without specifying a timeframe for their closure. As Kosovo seeks EU integration, pressure to decarbonize its energy sector will increase.

Replacing current lignite-based energy generation with renewable sources will require substantial investment and rapid development of supporting infrastructure. To achieve the goals outlined in the Sofia Declaration, Kosovo needs to completely phase out coal-fired power plants by 2050, with a clear target of reaching 55% renewable energy consumption by 2035. Even assuming a more gradual transition, aiming to replace the 3.5 TWh of electricity currently generated in power plants with solar and wind energy by 2040, Kosovo would need to install around 3,000 MW of RES capacity to meet this demand. The government's current plans, as outlined in PNEK, do not reflect this need and do not project such an investment, creating a potential gap between ambitions and reality.

Further complicating the situation, Kosovo currently imports around 20% of its electricity. To achieve energy independence, after being obligated to abandon lignite, the country will need to significantly increase electricity production capacity domestically. Given the highly limited hydropower potential and a less promising perspective for RES installations, the country will have to consider other electricity generation sources.

Exploring Gas as a Potential Solution:

In this context, gas imports, both liquefied petroleum gas (LPG) and synthetic gas produced through lignite gasification, could be a significant potential solution to bridge the gap that will arise after Kosovo is forced to shut down its current power plants.

The global gas market is in a state of flux, driven by the war in Ukraine and the resulting energy crisis. The world currently has around 7,000 billion cubic meters of proven gas reserves, enough to meet current consumption levels for 53 years. The global gas market was valued at \$182 billion in 2022, highlighting the importance of this energy source in the global energy mix. However, the war in Ukraine has disrupted traditional energy supply chains, especially Russian gas, a primary source for Europe. This has led to rising gas prices and, in turn, a global scramble for alternative sources. While natural gas is generally considered a cleaner alternative to coal, it still contributes to greenhouse gas emissions, and its long-term role in a sustainable energy future is being debated. In this context, Kosovo, a country without access to regional natural gas infrastructure and heavily reliant on lignite, faces a complex challenge in determining its energy future. Kosovo's historical experience, as a country that produced gas by gasifying lignite between 1970 and 1989, and produced so-called synthetic gas, could offer a possible solution, but it requires careful consideration of environmental impacts and the availability of carbon capture technologies.

Investment Potential in Gas:

While natural gas burns cleaner than oil and coal-based fuels, emitting significantly less carbon dioxide (CO₂), nitrogen oxide (NO_x), and sulfur dioxide (SO₂), it still emits carbon dioxide. To minimize the impact on the climate, carbon capture and storage technologies must be implemented. Gas-fired power plants can easily replace the energy currently produced by lignite-based power plants, providing a relatively quick transition to a less polluting energy source. The existing gasification infrastructure in Obiliq and gas pipelines can be partially used to generate synthetic gas, reducing the need for significant new construction.

On the other hand, gas (LPG) can be imported from Greece through existing pipelines and seaports like Alexandroupolis, ensuring a relatively direct supply chain. A cost-benefit analysis suggests that using natural gas could offer significant cost savings for customers compared to oil-based fuels and electricity, especially after the cost of electricity from existing lignite-powered power plants significantly increases after the implementation of EU carbon taxes known as ETS and CBAM, as well as due to the ongoing reconstruction needed in the aging power plants. Switching from burning lignite in power plants to using natural gas for industrial and commercial purposes can significantly reduce electricity demand, decreasing the need for further energy generation and reducing dependence on electricity imports. Natural gas should also be used for space heating, water heating, and cooking, replacing inefficient and polluting coal or wood-burning appliances in homes and industrial sectors. This will reduce dependence on electricity for heating and decrease emissions.

The introduction of gas as part of Kosovo's Energy Mix is as challenging as it is a promising opportunity that raises hope for finding a long-term solution for decades to come.

Challenges, Opportunities, and Potential Options

The potential of gas has significance in transitioning towards sustainable energy resources and necessarily requires detailed and careful consideration. Can it provide a temporary solution to replace lignite? However, it is essential to recognize the environmental and economic challenges associated with gas and to develop a plan that addresses these concerns. A prompt feasibility study in this regard would be crucial to finding an answer.

Using gas as part of the Energy Mix presents both challenges and opportunities: (1) Building a gas pipeline network in Kosovo would require substantial investment and could take several years to complete; (2) The costs of importing LPG or developing a plant for producing synthetic gas must be weighed against the potential economic benefits of transitioning to a gas-based energy system; (3) The environmental impacts of gas use, including potential greenhouse gas emissions, must be carefully considered, and suitable pollution mitigation strategies must be implemented, even though the pollution caused is significantly less than that from coal-fired power plants.

Importing LPG from Greece:

LPG can be imported from Greece through existing pipelines and seaports, ensuring a relatively direct supply chain. This option would require creating a gas transportation network in Kosovo and distributing it.

Connecting to TAP in Albania:

The Albania-Kosovo Gas Pipeline (ALKOGAP) project aims to connect the existing and planned gas transmission system of the Republic of Albania (including the TAP project) to the planned gas transmission system of the Republic of Kosovo, as well as to the transmission connections that are part of the eastern branch of the Energy Community Gas Ring (ECGR). This project aims to create a new supply route for natural gas from the Middle East and the Caspian region, transported via the Trans-Adriatic Pipeline, towards the northwest of the Western Balkan region towards Serbia. The ALKOGAP project is planned as a two-way pipeline, so the potential direction of supply can be either from north to south, from ECGR, or from other sources.

The construction of this pipeline would enable the gasification of Albania and Kosovo and provide a diversified and reliable natural gas supply. This gas supply project, with a total length of approximately 260 km, would create preconditions for further development of Albania's natural gas markets and the creation and development of Kosovo's natural gas markets at an estimated annual level of 1.5 - 2 bcm (1-1.3 bcm for Albania and 0.5 - 0.7 bcm for Kosovo). It would be possible to increase its capacity (double or triple) if ALKOGAP were used to supply Serbia and other countries with gas from the Caspian Sea or the Middle East. This transmission link, in addition to the benefits for the European market, would also provide a significant impetus for economic development in the countries it passes through.

Lignite Gasification:

Kosovo has a history of producing synthetic gas from lignite, operating such a plant between 1970 and 1989. This plant, part of an energy-chemical chain, was known as "Gasification" and was located in Obiliq. The technology used at the time was "Lurgi", a coal gasification process designed in Germany.

This plant used a complex process to produce synthetic gas. Lignite was burned at high temperatures to create synthetic gas, which was then used as fuel for industries from Skopje to Trepca-Mitrovica.

To accurately assess the possibility of reactivating this plant, the many challenges it presents must be considered. For example, carbon capture technologies were not as developed in the 1970s and 1980s. This plant did not pose local environmental problems, but today, in light of global warming, carbon dioxide has become the “greatest enemy” of the planet. To avoid pollution, significant investments in modern carbon capture and storage technologies are crucial, as are more efficient environmental standards for synthetic gas production. Additionally, the condition of the existing infrastructure must be carefully examined, including pipelines, equipment, and control systems. A detailed technical assessment will be needed to determine their current state and identify necessary investments to bring them in line with modern standards.

Despite Kosovo’s historical experience with lignite gasification, the revival of this plant requires in-depth analysis, careful assessments, and substantial investment to ensure it is a sustainable and environmentally sound solution.

Given the highly limited hydropower potential and a less promising perspective for RES installations, the country will have to consider other electricity generation sources.



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Lignite Gasification in Obiliq

Kosovo has a well-developed underground gas pipeline infrastructure for synthetic or generative gas, which is obtained by gasifying lignite. This infrastructure, part of the former Xehtaro Energjetiko Kimik (KXEK) (Mining, Energy, and Chemical Complex), represents a valuable asset and demonstrates a long history of using the produced gas.

The underground gas pipeline, stretching for approximately 240 km, extends from Obiliq in different directions, including Fushë Kosovë-Pristina-Ferizaj-Kaçanik-Hani i Elezit-Shkup, Obiliq - TC Kosova B-Vushtrri-Mitrovicë-Zveçan and Obiliq-Drenas. It previously supplied economic consumers, mainly in industry and district heating.

Despite the poor condition of the existing infrastructure, the pipeline's trajectory is accurate and represents a valuable asset to KEK. The pipeline itself, as an economic asset, and the 18 years of experience with using generative gas, primarily in industry, is a strong argument for our decision-makers to be more active in exploring gas supply alternatives. It is worth noting that the Gasification plant had increasing demands for new users, reaching 1 billion cubic meters per year. Even before, there were plans for Kosovo to connect to the regional gas pipelines in various variations, but the focus was always on expanding existing capacities due to demands from the domestic industry.

The lignite gasification plant had the capacity to produce 90,000 m³/h of unprocessed gas (60,000 m³/h of pure gas from 5 Lurgi-type generators). This production required 80 tons/hour of dried lignite; 9,900 m³ of oxygen with 96% purity; 65 tons/hour of technological steam; and about 28 MW of electricity. The air separation unit produced nitrogen, necessary for ammonia synthesis, in addition to oxygen for the production of generative gas.

The lignite gasification process also produced byproducts such as: middle oil, tar, phenol, ammonia water, light gasoline, etc.

Kosovo should carefully consider the possibility of reactivating gasification, taking into account new carbon capture technologies to minimize environmental impact. This would require a detailed assessment of the current state of infrastructure and the necessary investments for modernization.

The Region: A Missed Opportunity for Cooperation

The Western Balkans finds itself in a complex situation where decarbonization efforts are few and far between, and largely ineffective. While the region is committed to joining the EU's Green Agenda and achieving carbon neutrality by 2050, the results so far are concerning. EU policies and mechanisms for supporting the energy transition, particularly in achieving decarbonization goals by 2030 and 2050, are not yielding the expected results.

Energy experts in the region believe that without significant changes in EU policies and support mechanisms for the Western Balkans, decarbonization in the region will remain inadequate, with countries offering empty promises of decarbonization in their policies.

A recent analysis conducted in 2023 assessed the effectiveness of current government policies in the Western Balkans towards energy and climate, based on EU standards for the region. The analysis identified major challenges and obstacles in decarbonizing the energy sector in respective countries. The findings were alarming, and some of the root causes include:

- **LACK OF BROAD PUBLIC CONSULTATION OR ENGAGEMENT:** There is a lack of broad public consultation or engagement in the energy transition process in Western Balkan countries due to a top-down approach by the Energy Community Treaty. This lack of democratic ownership weakens the sustainability and pace of the transition.
- **LIMITED IMPACT OF CBAM:** The EU's Carbon Border Adjustment Mechanism (CBAM) is not expected to significantly accelerate decarbonization of the energy sector in the Western Balkans. It may not even encourage the introduction of carbon pricing mechanisms in the region, despite current government statements.
- **LACK OF FINANCIAL AND TECHNICAL CAPACITY:** While governments see public energy companies as the key players in the energy transition, these companies lack the necessary financial and technical capacity to lead the development of renewable energy. The role of other key actors, such as private investors, local

governments, SMEs, and citizens, in facilitating a sustainable energy transition, is largely neglected.

- **THE JUST TRANSITION GAP:** Although the EU emphasizes the concept of a Just Transition, providing considerable technical and financial assistance for coal regions, the Western Balkans has been slow to embrace these programs. This is primarily due to a lack of fundamental preconditions for a Just Transition, including binding decisions on deadlines for ending coal use and comprehensive strategies for supporting coal-dependent regions.
- **FINANCIAL BARRIERS:** The energy transition in the Western Balkans, the economically poorest region in Europe, will not be possible without significant financial support from the EU and other developed countries. Current reliance on state budgets and local energy consumers to finance the transition is unrealistic, especially given the region's limited resources.

Therefore, while the Western Balkans has committed to a clean future, achieving this goal through concrete actions remains difficult. There is no specific plan for phasing out coal, and there is a significant lack of investment and support from the EU. To avoid a disorderly and inefficient decarbonization, clear and rapid measures must be taken to change energy sector reform strategies in the region.

Western Balkans Still Far from the Sofia Agreement

The Western Balkans remains a region heavily reliant on fossil fuel energy sources, particularly coal. Albania currently has an installed hydropower capacity of around 2,600 MW, making it a major producer of renewable energy in the region. Kosovo, however, is dominated by lignite, which accounts for over 95% of its energy production. Serbia, Montenegro, and Bosnia and Herzegovina are also heavily reliant on coal, making this region one of the most polluted in Europe.

In 2020, coal usage in the Western Balkans reached 48% of the Energy Mix, while renewable energy reached only 22%. This clearly shows that the region still has a significant dependence on coal, and efforts to transition to clean energy sources are progressing at a slow pace.

A 2023 study concluded that decarbonization of the energy sector in the Western Balkans is disorderly and “illusory.” There is a major conflict between political promises of a clean future and the reality of continued coal dependence. This difficulty in transitioning away from coal can be attributed to multiple factors, such as the lack of public consultation, the limited impact of EU decarbonization mechanisms, and the lack of financial and technical capacities in most of the region's countries. In this context, the agreements reached in Sofia for a sustainable energy transition in the region, including the Sofia Declaration, seem to be nothing more than promises without concrete actions.



The energy transition in the Western Balkans, the economically poorest region in Europe, will not be possible without significant financial support from the EU and other developed countries.

Can We Secure Energy Security Within the Current Strategy?

Kosovo faces significant challenges in securing its energy supply, primarily due to its dependence on two aging lignite-powered energy plants, Kosova A and Kosova B. These power plants lack sufficient capacity to meet domestic demand, particularly during winter, and to meet the reserve capacity requirements of the energy system.

The Kosovo government has adopted the National Energy Strategy 2022-2031. The primary objective of this strategy is the complete decarbonization of the energy sector, relying on renewable energy sources (RES), primarily wind and solar energy, as well as energy efficiency. The strategy aims to increase the share of renewable energy in electricity consumption to 35% by 2031, from 6.3% in 2021.

To secure energy supply, the strategy foresees investments in existing lignite-based power generation capacities. Two units of the Kosova B Thermal Power Plant, the strategy states, will undergo a major overhaul, enabling them to function at optimal technical parameters, both in ensuring their generating capacity and upgrading equipment to meet the emission standards outlined in European environmental standards.

The strategy also plans for 170 MW of battery storage capacity. This will facilitate the integration of electricity from renewable sources and ensure compliance with ENTSO-E requirements for energy reserves.

Kosovo currently has an agreement with the Albanian Power Corporation (KESH) for exchanging energy as needed. However, Kosovo still relies on electricity imports, especially during the heating season, when electricity demand is high.

To reduce dependence on imports, this Strategy aims to increase energy efficiency and invest in existing lignite-based power generation capacities to prepare for critical years when Kosovo is expected to meet Energy Community requirements and fulfill all obligations undertaken by signing the Sofia Declaration regarding the implementation of the Green Agenda.

What's the Right Energy Mix?

Another crucial objective in this strategy is to increase the flexibility of the energy system. Kosovo plans to create a functional market, integrate suppliers into the system, join EU common balancing platforms (MARI, PICASSO, IGCC), and implement dynamic pricing for commercial and household consumers.

However, it is crucial to emphasize that the National Energy Strategy, while attempting to address the challenges of the energy transition, has some critical shortcomings. For instance, the Strategy does not set a specific timeframe for closing lignite-powered thermal power plants and does not offer a detailed plan to replace the lost capacity from these plants. The Strategy is also unclear regarding the role of natural gas and the potential for regional cooperation with Albania, especially for hydropower development. Moreover, it does not offer sufficient guarantees for environmental protection and public health.

Therefore, to guarantee a sustainable energy future, Kosovo must carefully revise its energy strategy, making it more focused, detailed, and ambitious.

An uncertain energy future - are the plans in the strategy sufficient?

Kosovo is experiencing significant economic growth and demographic changes that will lead to an increasingly high demand for electricity and district heating. According to projections outlined in the PNEK 2025-2030, electricity demand is expected to increase by 20.35% between 2021 and 2030, reaching 6,424 GWh, and by 45.91% by 2040, reaching 8,106 GWh. The demand for district heating is projected to grow even faster, by 96.54% by 2030, reaching 775 GWh, and by 185.5% by 2040, reaching 1,401 GWh.

Although Kosovo's Energy Strategy 2022-2031 outlines an ambitious plan to expand energy production from renewable sources, as well as to overhaul existing power generation capacities in the Kosova A and Kosova B power plants, there is a growing concern that these plans may not be sufficient to meet the country's growing demand.

The Strategy anticipates a substantial increase in renewable energy capacity, primarily solar and wind energy, by 2031. However, after this date, it does not provide information on further increases in energy generation and storage capacity between 2031 and 2040.

As the country faces a significant increase in electricity demand, the current plans outlined in the National Energy Strategy and the National Action Plan for Climate and Energy (PNEK) raise serious concerns about their long-term sufficiency. The analysis of the data reveals a dangerous mismatch between projections of energy consumption and plans for the development of the energy sector, suggesting that Kosovo could face an energy deficit in the coming years if immediate action is not taken.

What's the Right Energy Mix?

While the Energy Strategy aims for an energy mix with 35% renewable energy sources (RES) by 2031, including an increase of 1,600 MW in new RES capacity, the analysis shows that these targets are overly optimistic and do not fully account for the realities of energy production from renewable sources.

Taking into account the real efficiency of solar and wind energy, which is typically lower than official predictions, the overall projected RES output in 2030 will be significantly lower than the level needed to meet expected demand. This mismatch highlights the need for a more realistic assessment of RES potential and more strategic planning to ensure that Kosovo does not rely on unreliable predictions.

Furthermore, the analysis of PNEK data reveals an ambitious target for renewable energy in 2040: 66.3% of the energy mix is expected to come from renewable sources. However, achieving this goal, as well as completely phasing out coal by 2050, presents significant challenges.

Kosovo will need to have an installed RES capacity of approximately 2,067 MW, after 2031 and by 2040, to meet the target outlined in PNEK 2025-2030. This is a significant increase compared to the planned capacity of 1,600 MW by 2031. However, reaching this level of RES capacity, as well as completely phasing out coal by 2050, is extremely challenging for several reasons:

First, Kosovo has limited water resources for hydropower, and its potential for solar and wind energy is constrained by geographic factors. This means that increasing RES capacities will be difficult and costly.

Second, the pace of investment in RES is very slow. The addition of 1,600 MW of RES capacity by 2031 is a worthy goal but is still far from being reached and sufficient to meet long-term goals. Furthermore, significant and ongoing investments in RES will be needed between 2031 and 2050.

Third, completely phasing out coal by 2050 will require a radical transformation of Kosovo's energy sector. This will require not only significant investment in RES but also the development of the necessary infrastructure to support a new energy mix. Moreover, Kosovo will have to completely replace coal-based energy production by 2050. This means that the current share of energy production from coal (32.5% in 2040), which accounts for approximately 3,015 GWh, will have to be replaced by other sources.

Faced with these challenges, it is clear that Kosovo cannot rely solely on renewable energy to ensure a secure and sustainable energy future. The government must urgently consider other alternatives, such as:

- **IMPORTING NATURAL GAS:** Natural gas is a cleaner energy source than coal and could play a significant role in Kosovo's energy transition. Importing LNG from Greece or connecting to the Adriatic pipeline in Albania are options that should be seriously considered.
- **INVESTING IN ALBANIA'S WATER RESOURCES:** Albania has significant hydropower potential that could be harnessed to produce clean energy for both countries. Joint investments in the construction of hydroelectric plants in Albania, combined with agreements for energy exchange, could provide a sustainable energy source for Kosovo.

By exploring these alternatives, Kosovo can create a more diversified and secure energy mix, paving the way for a more sustainable energy future. Delays in making decisions on these alternatives could lead to an energy crisis in the future, making Kosovo dependent on imports and vulnerable to energy price fluctuations. Therefore, it is essential that the government act swiftly and decisively to ensure a secure and sustainable energy future for Kosovo.



Joint investments in the construction of hydroelectric plants in Albania, combined with agreements for energy exchange, could provide a sustainable energy source for Kosovo.

Recommendations

To avoid a future energy crisis and ensure a secure and sustainable energy supply, the Kosovo government must take bold action in fulfilling its commitments to implement the Green Agenda.

Here are some concrete recommendations that could help change the current course:

- 1** Urgent Revision of the Energy Strategy: The Kosovo government should urgently revise the Energy Strategy 2022-2031 and make the necessary adjustments to ensure alignment with the Green Agenda's goals. Priority should be given to clearly defining a timeframe for closing the Kosova A and Kosova B thermal power plants, including a detailed plan to replace the energy generated by these plants. The analysis shows that current plans are not sufficient to meet future energy needs.
- 2** Increased Investment in Solar and Wind Energy: Kosovo should significantly increase investments in solar and wind energy beyond the current plan of 1,600 MW, considering their real efficiency and the growing demand for electricity. The analysis shows that even with the planned increase of 1,600 MW, Kosovo will face an energy deficit of 2,524 GWh by 2040. To achieve its goals for a sustainable energy future, Kosovo must significantly increase its installed RES capacity, including further investments in new energy storage technologies.

- 3** **Serious Consideration of Natural Gas Imports:** Kosovo should seriously consider importing natural gas from Greece, as proposed by the MCC, or through the Adriatic pipeline in Albania. This would be a cleaner and more sustainable energy source than coal. Additionally, the possibility of reactivating lignite gasification using modern carbon capture technologies to minimize emissions should also be explored.
- 4** **Developing a Sustainable Water Management Strategy:** Kosovo must develop a sustainable water management strategy that takes into account the limitations of this vital resource. It should especially stop the operation of small hydroelectric plants operating in protected areas—national parks. This measure should include investing in water infrastructure, improving water usage efficiency, and reducing water pollution.
- 5** **Continued Investment in Energy Efficiency:** The government should continue investing in energy efficiency improvements, such as building insulation, using more energy-efficient appliances, and promoting public transportation. These initiatives should be significantly intensified as they would help reduce energy demand and lessen the pressure on existing energy resources.
- 6** **Open and Clear Communication:** It is crucial that the government communicates clearly and openly with citizens about the challenges Kosovo faces in the energy sector and explains the importance of diversifying energy sources. An open dialogue with all stakeholders could help build public support for necessary changes.

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