Gerard Wynn, Energy Finance Consultant
Arjun Flora, Energy Finance Analyst
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Institute for Energy Economics and Financial Analysis
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Beyond Coal: Investing in Kosovo's Energy Future

Executive Summary

In this brief review, we examine the potential for meeting Kosovo's energy demand growth, focusing on electricity. We find that Kosovo can seize on the readiness of international financial institutions and development banks to invest in the country's energy transition beyond coal. Kosovo can use these funds to develop a world-class, energy-efficient, renewables-based economy. Technologies and market innovations to enable such a transition are already available, and include battery storage, demand-side response (DSR) and more robust interconnection.

Main Findings

Electricity demand growth and energy efficiency: We expect electricity demand will increase as much as 20% by 2030, driven by income growth and gradual electrification of the wider energy sector, implying an additional 1,200 gigawatt-hour (GWh) annual demand in 2030. However, this level of demand growth can be reduced by investment in energy efficiency. A World Bank analysis indicates a conservative potential for highly cost-effective electricity savings, equivalent to at least 1,000 GWh annually by 2030, through investment in public and residential buildings. There are three main sources of energy Kosovo can potentially use to satisfy this demand—lignite, gas and renewables.

Lignite: We no longer see any realistic prospect for external financing of a new lignite power plant in Kosovo. Meanwhile, the older of the two existing lignite power plants, Kosovo A, will have to close soon, implying a loss of 2,100 GWh annual supply, based on 2019 output.

- Kosovo's two existing lignite power plants, Kosovo A and Kosovo B, were commissioned in the early 1970s and mid-1980s. Their advanced age and inflexibility, coupled with their dominance of the grid, contribute to Kosovo's poor quality of electricity supply.

- ContourGlobal, a London-listed investor, and the World Bank recently withdrew equity and credit support respectively for a proposed new lignite power plant in Kosovo. The reason for their withdrawal was simple: Coal is no longer the least-cost electricity option for Kosovo; the offtake price for the project would have been €80/megawatt-hour (MWh). It is also one of the highest risk technologies, because of hardening attitudes towards high-carbon power generation among policymakers, regulators and financial institutions. This is particularly evident in Europe with the EU's 2050 net zero target and plans to introduce a carbon border tariff.

Gas:

- Kosovo has no gas market or infrastructure, but wants to connect with several prospective pipeline projects, including the Trans-Adriatic Pipeline via Albania. According to the IEA, gas-fired generation has a levelised cost of energy (LCOE) of over $90/MWh (~€76+/MWh), but this does not include the large cost of new infrastructure that would be required to secure gas supply into Kosovo.

Renewables plus battery storage: The launch last year of Kosovo's first large-scale wind and solar power projects revealed the first performance data for such projects. The results are promising. Electricity generation equals or outperforms peer and neighbouring countries, strengthening the case for renewables deployment. Kosovo can also exploit tumbling battery costs to bolster this resource by developing a cutting-edge supply of electricity from domestic renewables plus storage, totalling an additional 1,500 GWh annually.

- Based on the new renewables performance data, we estimate that wind and solar power capacity presently in the planning pipeline or under construction can supply an additional 400 GWh annually.

- A cost analysis completed in 2018 in the region indicates that a large-scale project combining wind and solar power with battery storage could be achieved at lower cost than new lignite-fired generation (i.e., at a LCOE of €60 to €70/MWh vs. €80/MWh). These figures will be even lower today, as costs of renewables and storage have continued to decrease. Such analysis indicates that a combined large-scale solar (400MW), wind (170MW), and battery storage (120MW/350MWh) project, could deliver an additional 1,100 GWh annually.

Balancing the grid: Kosovo would benefit from additional investment in interconnection, electricity networks and micro-renewables as a cost-effective way to deliver at least an additional 1,500 GWh annually by 2030.

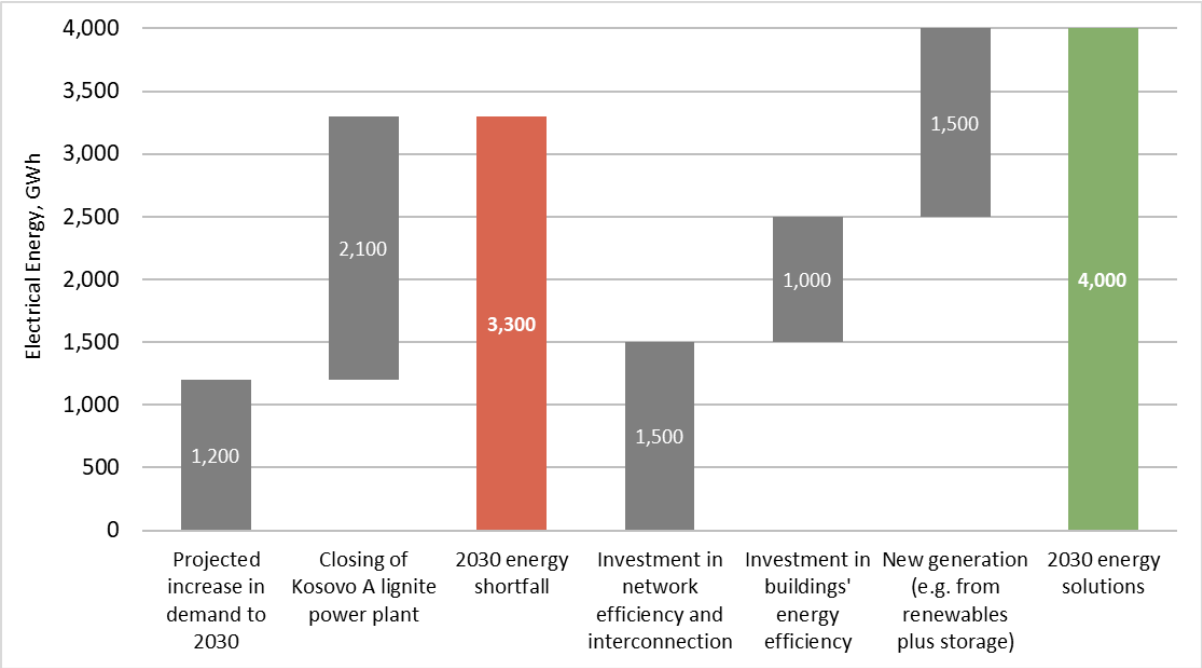
- **Expanded interconnection:** In early 2020, Kosovo struck a deal with the association of European grid operators to connect with the continental European grid, allowing it to operationalise an under-used 400 kilovolt (kV) interconnection with Albania. Increased interconnection is a low-cost way for Kosovo to import flexible hydropower from Albania and export variable renewables to its neighbours. A new interconnection can add at least 1,000 GWh annually in secure imports and valuable export revenue.

- **Investment in electricity networks:** A World Bank analysis indicates a highly conservative potential for savings of more than 800 GWh annually by 2030 through investment to reduce network losses; lower unbilled losses including thefts on the distribution network; and lower technical losses in both transmission and distribution. We note that at present, losses in the low-voltage distribution network are an extraordinary 26% (1,378 GWh) of total distribution network demand, shared equally between technical losses and "unbilled energy."

- **Support for prosumers**: Kosovo has only a negligible rooftop solar photovoltaic (PV) market, but it does have the required legal and financial framework, including a net metering scheme. Growing the market 10-fold with solar prosumers—customers who both generate and consume power on the grid—could deliver an additional 10 GWh annually. Encouraging private household investment in solar PV can reduce pressure on scarce state resources and reduce network losses.

Investment in demand-side response: One cost-effective way to reduce load shedding (when the power supply to a particular area is cut to protect against excessive demand) may be to establish a demand-side response (DSR) market that would contract with energy-intensive users to reduce demand when required.

Summary Chart: Mitigating Kosovo's 2030 Energy Shortfall



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Current and Historical Situation

Energy Sector Overview

Policy Context

Kosovo is a member of the Energy Community, an international organisation that brings together the European Union and its neighbours in southeast Europe to create an integrated pan-European energy market. The organisation was founded by the 2006 Energy Community Treaty to extend the EU internal energy market to southeast Europe. The Energy Community requires Western Balkan countries to implement a large body of EU energy-related directives and regulations, including some related to energy efficiency and renewable energy.[1] In addition, the Energy Community requires Kosovo to reduce air pollution from large combustion plants, under the EU's Large Combustion Plant Directive (LCPD), impacting the capital and operating costs of coal and biomass. Recent analysis by the Energy Community shows that Kosovo's lignite power plants today on average exceed LCPD dust limits by 400% and are nearly double applicable NOX limits.[2] Dust and NOX are major contributors to premature death from cardiovascular and respiratory diseases.

The next step for Kosovo's energy sector will be to align with the EU's 2017 clean energy package, which sets ambitious, comprehensive goals to create a more flexible, low-carbon, renewables-based energy system by 2030. Beyond that, the EU recently adopted a political goal of net-zero greenhouse gas emissions by 2050, which implies a further tightening of greenhouse gas emissions in the near- to medium-term. The European Commission has also made clear its plans to introduce a carbon border tariff, which may require neighbouring countries in the Energy Community to adopt an explicit carbon price much sooner than expected. Furthermore, like other Western Balkan nations, Kosovo ultimately aims to join the EU, which would require full adoption of these energy policies.

Kosovo should be in no doubt about the direction of travel of its energy sector, as required by the Energy Community and the EU. As a coal-dominated country today, ignoring such long-term trends could inflict great near-term costs, including rising environmental compliance costs from a highly inefficient, fossil fuel-based energy system, and the resulting, premature write-off of fossil fuels assets. Poland is a case in point. Having long resisted EU low-carbon targets and policies, the country's biggest energy company, the highly coal-intensive PGE, recently described itself as under threat of bankruptcy.[3]

Among its domestic energy policies, Kosovo's overarching Energy Strategy 2017-2026 adopted a "catch-all" approach to ensure security of supply; integrate with regional energy markets; expand thermal generation; establish gas infrastructure;

[1] Western Balkans Investment Framework. Investing in Clean Energy in the Western Balkans. 2019.
[2] Energy Community, 2020. WB6: Energy Transition Tracker.
[3] Warsaw Business Journal, 2020. Energy firm in danger of collapsing says head. Available at: https://www.wbj.pl/energy-firm-in-danger-of-collapsing-says-head/post/127707

and meet renewables targets.[4] The new government's energy programme, as described in a four-paragraph summary seen by the authors of this report, affirms this broad strategy, including the construction of a new lignite power plant; upgrading the existing Kosovo B lignite power plant; boosting energy efficiency; expanding district heating; liberalising energy markets; integrating with Albania in a new electricity control area; and completing a feasibility analysis for new gas infrastructure.

Natural Resources

Kosovo has depended overwhelmingly on domestic lignite (low-grade coal) to meet energy demand, using its massive lignite reserves, as shown in Table 1. Annual lignite production in Kosovo has varied between 7 million and 9 million tonnes for the past decade, broadly in line with annual lignite demand. Table 1 also shows the technical potential for renewables, as estimated by the International Renewable Energy Agency (IRENA), and the technical sustainable biomass potential compared to consumption, according to a World Bank study.

Table 1 indicates that Kosovo has ample energy resources, not only in lignite but renewables too, allowing it to choose the least-cost option going forward. The one exception is annual biomass consumption, which consists entirely of woody biomass and exceeds sustainable resources.[5]

Table 1: Technical Potential Versus Installed Capacity and Consumption, for Renewable Electricity, Lignite and Biomass

Fuel source	Units	Technical potential	Installed capacity, 2019
Large-scale solar	MW	3,006	10
Onshore wind	MW	13,860	34
Hydropower	MW	4,853	95
		Exploitable reserves	Consumption, 2019
Lignite	mln t	10,400	8
		Sustainable annual potential	Consumption, 2013
Woody biomass	ktoe	216	441
All biomass including energy crops	ktoe	665	441

Sources: ERO 2019; IRENA 2019, World Bank 2017.

Electricity Sector

Kosovo's electricity system largely consists of state-owned generation and transmission companies.[6] Electrical capacity is presently dominated by two lignite power plants, Kosovo A (three units, net capacity 432 megawatts (MW),

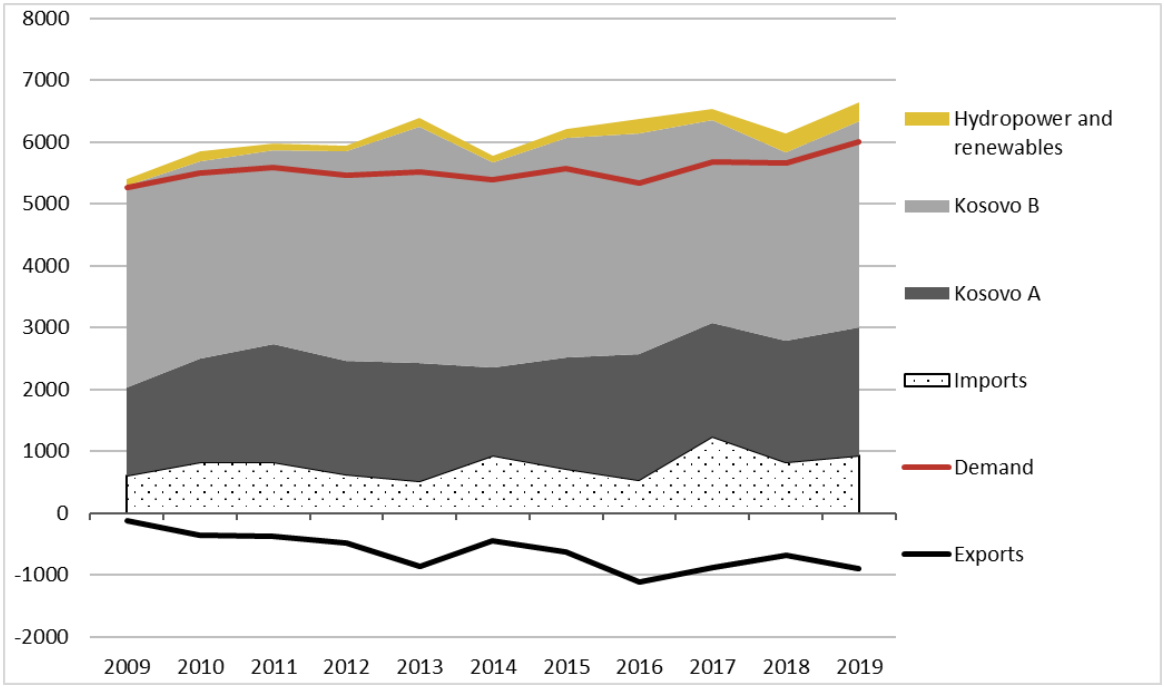
[4] Kosovo Ministry of Economic Development. Energy Strategy of the Republic of Kosovo 2017-2026. 2017.
[5] World Bank and Energy Community. Biomass-based heating in the Western Balkans: A Roadmap for Sustainable Development. October 1, 2017.
[6] ERO. Annual Report. 2019.

commissioned early 1970s) and Kosovo B (two units, net capacity 528 MW, commissioned mid-1980s). Both are owned by KEK, the state generation company. There are also multiple smaller hydropower and renewable energy facilities. The sole state-owned transmission system operator, KOSTT, is also the market operator. The distribution system operator, KEDS, is privately owned. Electricity is exclusively supplied by KESCO.

The wholesale electricity market consists of bilateral contracts, largely between the generator, KEK, and the supplier, KESCO. The wholesale power price is based on historical prices that are approved by the energy regulator, ERO. All other trade is completed bilaterally, i.e., between traders and small electricity generators. There is no forward market, and no spot or forward index. Regarding electricity market plans, Kosovo has opted to be a part of an Albanian power exchange rather than a national exchange.

Figure 1 compares electricity demand and supply. Demand was flat from 2009 to 2016, but has since grown incrementally, rising 5.8% last year to a new peak of 6,001 GWh. Electricity demand shows strong seasonality, partly as a result of household electric heating. Domestic generation last year rose 7.7%, to 5,718 GWh. Kosovo's electricity system is dominated by lignite. In 2019, lignite accounted for 94.5% of total generation, followed by hydropower (3.7%), wind power (1.6%) and solar (0.2%). Kosovo is a net importer of electricity.

Figure 1: Electricity Generation, Demand, Imports & Exports, GWh, 2009-2019



Source: ERO 2019.

Retail electricity prices in Kosovo are regulated. Household prices averaged 5.68 euro cents per kWh last year, lower than the country's neighbours.

Kosovo's two lignite power plants are old, inflexible and inefficient, contributing to poor security of supply and high load shedding. The three units at Kosovo A have an average electrical efficiency of 23% and the two units of Kosovo B an average efficiency of 31%. A common score for quality of electricity supply is SAIDI (the system average interruption duration index). SAIDI measures the average total duration of power outages per year per customer, including planned and unplanned outages and load shedding. In Kosovo, outages on the distribution network were exceptionally high for a European country at 69 hours in 2019, according to the ERO. (The figure was down from 110 hours in 2018, as a result of investment in the distribution network.) According to the World Bank's latest "Doing Business" report, Kosovo's SAIDI score ranked 164th of 202 countries, below neighbouring North Macedonia and Serbia, but above Montenegro and Albania.[7] A lack of tertiary reserve coupled with two ageing coal plants in Kosovo is a major cause of frequent load shedding. One cost-effective way to tackle this may be for Kosovo to establish a demand-side response (DSR) market to contract with energy-intensive users and reduce demand when required.[8]

Losses in the high-voltage transmission network last year were 1.7% (105 GWh) of total demand. Losses in the low-voltage distribution network were very high, at 26% (1,378 GWh) of total distribution network demand, shared equally between technical losses and "unbilled energy." The unbilled energy of 694 GWh is equivalent to more than double the total generation from renewable sources in 2019. Some of these losses are attributed to thefts and some to the uncalculated electricity consumption in northern Kosovo (294 GWh).

Heating Sector

Heating in Kosovo is presently dominated by household burning of biomass (at 60% of total residential heating demand) as well as lignite, followed by electric heating, and some limited district heating (equivalent to around 5% of space heating demand), using captured waste heat from the Kosovo B lignite power plant and from oil-fired heat plants.[9]

Burning biomass in inefficient stoves is a serious health risk. A recent World Bank study concluded that the first priority for biomass energy in Kosovo should be to upgrade biomass stoves in single houses and biomass boilers in multi-storey apartments. The second priority could be to expand biomass supply to include energy crops, beyond woody biomass which is presently over-exploited as discussed above.

Centralised district heating has certain advantages over household-level heating,

[7] World Bank. Doing Business 2020. 2020.
[8] Energy Community. Analyses on system adequacy and capacity mechanisms in the Western Balkans. December 2019.
[9] Kosovo Ministry of Economic Development. Energy Strategy of the Republic of Kosovo 2017-2026. 2017.

including no indoor air pollution and better access to more energy sources, including waste heat and renewables, as well as centralised heat plants. Kosovo has four district heating systems, in Pristina, Gjakova, Zvecan and Mitrovica. The latter has political issues related to its proximity to Serbia, and less data availability. The Pristina network is served by a heating plant, NQ Termokos, supplied by fuel oil boilers and waste heat from the Kosovo B lignite power plant, for a combined thermal capacity of 274 megawatts thermal (MWth). The Gjakova network is served by an oil-fired heating plant with a thermal capacity of 39 MWth. District heating losses are estimated at 15% to 20% of delivered heat. District heating upgrades planned or under construction in Pristina include network expansion, improvements to reduce heat losses and an additional 29 MWth of solar thermal. Upgrades in Gjakova include the addition of 15 MWth biomass cogeneration, replacing fuel oil.

In its Energy Strategy 2017-2026, Kosovo describes the country's high use of electric heating as a "weakness." It may be more accurate to describe Kosovo's over-stretched electricity system as a weakness. In fact, many European countries are pivoting towards electric heating, away from gas, and promoting heat pumps and electric heaters, because of the unproven nature of alternative zero-carbon, thermal heating sources such as hydrogen. We note that it is first vital to improve the energy efficiency of buildings, before pivoting to electric heating, to mitigate strain on the electricity network.

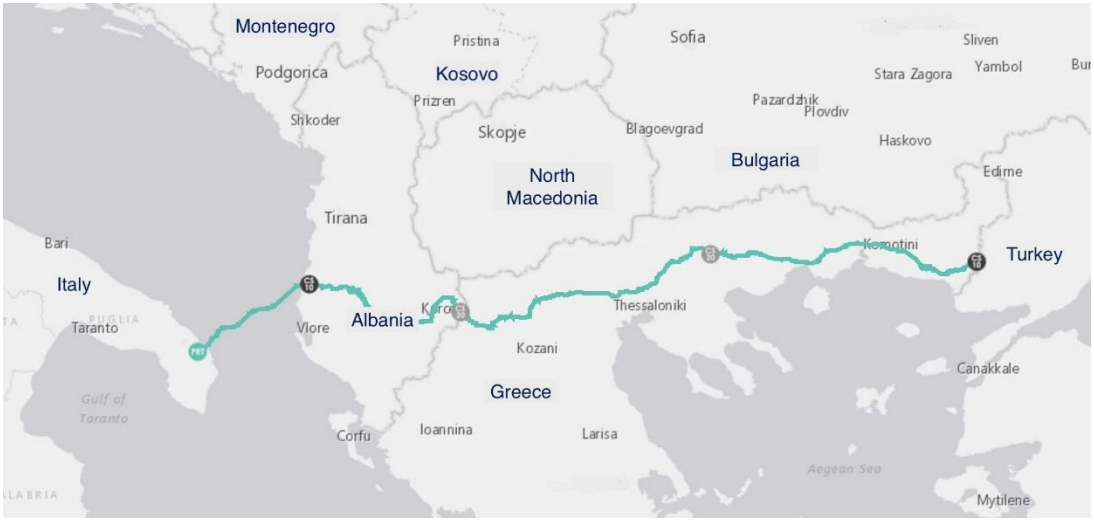
Gas Infrastructure

Kosovo has no gas infrastructure or gas market. The country is interested in the development of such infrastructure to connect with the Trans Adriatic Pipeline (TAP). The TAP is expected to complete in 2021 at the latest, supplying Azerbaijani gas to southern Italy via northern Greece and Albania (Figure 2).[10] Kosovo has ambitions to connect with the TAP via the so-called Albanian Kosovo Gas Pipeline project (ALKOGAP). Kosovo has secured financial assistance from the Western Balkans Investment Framework (WBIF)—a joint donor initiative of the EU and financial institutions—to develop a "Gas Master Plan." However, we note that it is not immediately clear how much of the TAP's prospective gas supply is actually still available for contract, if any.

Kosovo's Energy Regulatory Office (ERO) is participating in various regional gas initiatives of the Energy Community and the USAID-funded Southeast Europe Natural Gas Transmission and Distribution Grid Codes Project to investigate the feasibility of new gas infrastructure in the region. In addition, the U.S.-based Millennium Challenge Corporation has offered around $9 million for Kosovo to investigate the feasibility of energy diversification, including gas.[11]

[10] Trans Adriatic Pipeline. Trans Adriatic Pipeline Route. 2020.
[11] Millennium Challenge Corporation. Amended and restated grant and implementation agreement. 2018.

Figure 2: Trans Adriatic Pipeline (TAP) Route



Electricity Sector Focus

The Fate of Kosova e Re

Successive governments have sought to secure financial backing to build a new lignite-fired, Kosova e Re Power Plant (KRPP). The motive for new lignite generation was to capitalise on the country's vast lignite reserves and replace its ageing lignite power plants. Estimates for the capital cost, all likely underestimates, range from €1 billion (the government of Kosovo) to $1.3 billion (ContourGlobal) to $2 billion (the World Bank), partly reflecting ranges in expected capacity, from 350 MW to 500 MW.

The Kosovo government asked the World Bank in 2011 for a partial risk guarantee for the project to attract private lenders.[12] However, the World Bank withdrew its guarantee in 2018 and decided to stop providing credit for coal projects. World Bank President Jim Yong Kim said the bank was obliged to pursue the lowest cost option, and renewables were less expensive than coal.[13] The Kosovo government has since approached the U.S. Development Finance Corporation (DFC), for an alternative source of subsidised credit. The DFC has made no public statement, however. Regarding equity financing, the Kosovo government in 2015 awarded an international financing firm, ContourGlobal, the contract to develop KRPP.[14] ContourGlobal signed commercial agreements in 2017, including a power purchase agreement. In March 2020, however, ContourGlobal withdrew, blaming political instability, and ruling out any further investments in coal.[15]

It seems there is no prospect for KRPP to proceed except as a state-owned project. It seems unlikely that Kosovo has the financial resources to become the main

[12] The World Bank. Integrated Safeguards Data Sheet Concept Stage. 2011.
[13] Reuters. World Bank pulls out of Kosovo coal power plant project. October 10, 2018.
[14] ContourGlobal. Annual Report 2018. April 4, 2019.
[15] ContourGlobal. FY 2019 Preliminary Results Presentation. March 2020.

guarantor for a project costing at least $2 billion, equivalent to a quarter of annual GDP, especially when there are cheaper options.

Renewables Targets

Energy Community countries have to adopt National Renewable Energy Action Plans (NREAPs), under the EU Renewable Energy Directive. The NREAPs comprise targets for renewables as a share of total energy consumption in 2020. Kosovo's Ministry of Economic Development set a target of 25%, compared with 19% in the base year 2009. Kosovo had already achieved 24% renewables in 2016, as a result of a revision of its baseline data, rather than through investment in renewables.

Kosovo has also set targets for renewable electrical generating capacity in 2020. Table 2 below compares those capacity targets with actual installed capacity, and the pipeline of upcoming projects. The pipeline is based on ERO data for projects applying for various authorisations or under construction in 2019. Table 2 shows that Kosovo will miss its 2020 renewables targets. But it could hit its 150 MW wind power target in 2021 because of a large wind farm under construction. It may also hit the 30MW solar PV target soon, because of a large planning pipeline of solar projects. Table 2 does not include very small rooftop solar applications for residential and commercial prosumers. The ERO said it only approved 20 such solar projects last year, with a total installed capacity of 0.5 MW.

Table 2: Electricity Fuel Mix - Installed and Planned Net Capacity Versus National Targets, MW

NET CAPACITY, MW	Installed (2019)	Under construction (in 2020)	Installed plus under construction (in 2019-2020)	Renewables target (2020)	Pipeline			
					Licence applications (submitted in 2019)	Authorisation applications (submitted in 2019)	Prelim authorisation (in 2019)	Total pipeline
Lignite	960	-	960	N/A	450			450
Hydro	95	6	101	240	34	13		47
Wind power	34	114	148	150				-
Solar PV	10		10	30			66	66
Biomass	-	1	1	20				-
TOTAL	1,099	120	1,219	420	484	13	66	563

Source: ERO Annual report 2019.

Looking beyond 2020, the EU has a binding target for a 32% share of renewables in gross final energy consumption in 2030. This translates into a share of roughly 50% to 60% of renewables in the electricity sector. Together with EU energy efficiency targets mentioned above, these targets imply a minimum reduction in greenhouse gas emissions of 40% by 2030, compared with 1990. The Energy Community undertook a brief assessment of the implications for Kosovo and other Western

Balkan countries.[16] They estimated that Kosovo could target a 34% to 39% share of renewables in all energy consumption (not just electricity), in 2030, rising from the existing target of 25% in 2020. The target would be largely met by the use of bioenergy in the heating sector, followed by onshore wind and hydropower, and then solar power.

The Importance of Electrical Interconnection

Cross-border electrical interconnection with its neighbouring countries is vital to Kosovo's security of supply. Electricity imports to Kosovo are needed especially in winter, when electric heating leads to high daily volatility in demand, with daily shifts between imports and exports. Demand peaked last year at 1,253 MW (in the early evening of December 31), exceeding available supply by more than 300 MW, with imports covering the difference. Interconnection is also important to provide fast-response balancing energy, given that Kosovo's electricity supply is dominated by two ageing lignite power plants. Kosovo's annual electricity imports and exports were both above 900 GWh last year, equivalent to more than 15% of total demand.

Kosovo has eight interconnections with its four neighbours, comprising four 400 kV interconnections, one each to Albania, North Macedonia, Montenegro and Serbia; two 200 kV interconnections, to Albania and Serbia; and two 110 kV lines to Serbia. The lines have a combined net transfer capacity of 3,200 MW—three times Kosovo's installed generating capacity, and more than double peak demand.[17]

Notwithstanding this excellent interconnection, Kosovo's historical membership of an electricity control bloc led by Serbia prevented the country from controlling its own cross-border transmission and prevented use of a new 400 kV line (600 MW net transfer capacity) interconnection with Albania. Kosovo's deal in April 2020 with the association of European transmission system operators (TSOs) to form a new connection with continental Europe was therefore of huge importance. The deal allows Kosovo to exit the Serbian-led control bloc, join a new control bloc with Albania, and fully operationalise the Albania interconnection. An Energy Community analysis indicates that full use of the interconnection will increase Kosovo's margin (the difference between available capacity and peak demand) by 50%.

We note that electricity import prices have been stable since 2009, last year averaging €56.1/MWh. Import prices have exceeded export prices since records began, but we note that export prices have been steadily rising since 2013, averaging €39.7/MWh last year. Media reports indicate the new Kosovo-Albania 400 kV line had a transfer capacity of 700 MW and cost €70 million, or €0.1 million per MW. The cost is a fraction of the funds needed to build new generating capacity—about €1 million per MW for a gas-fired power plant or large-scale solar (see Table 4 below).[18]

[16] Energy Community. Study on 2030 overall targets for the Energy Community. June 2019.
[17] Energy Community. Analyses on system adequacy and capacity mechanisms in the Western Balkans. December 2019
[18] Balkan Green Energy News. Interconnection with Kosovo comes online. June 28, 2016.

Case Study Examples of Renewables Potential

Within Kosovo

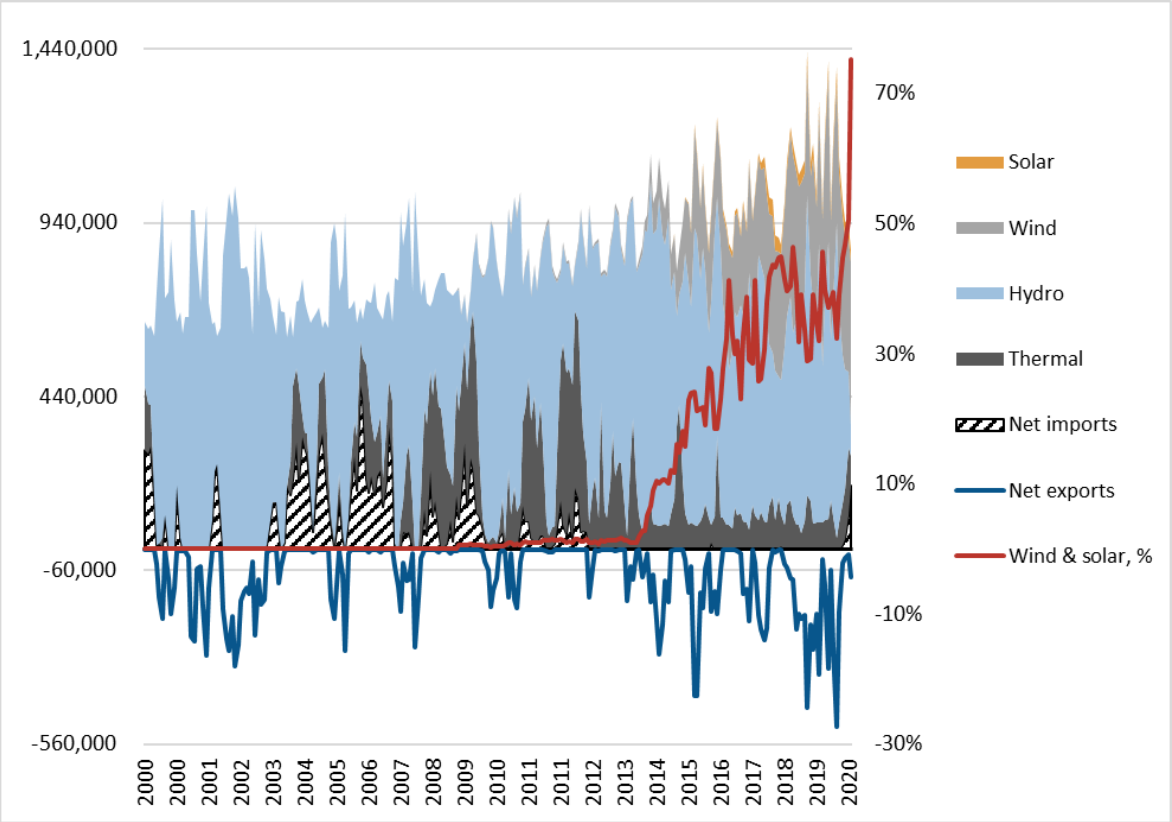
Last year provided the first hard data on the performance of variable renewables in Kosovo. It was the first full year of operation for a pair of 3 MW solar farms and a 32 MW wind farm. The wind farm performed with a 32% capacity factor, i.e., generating electricity equivalent to one-third of nameplate capacity. This wind power capacity factor exceeded the UK average, one of Europe's windiest countries, of 26% in 2018.[19] The two solar farms both achieved capacity factors of 16%. This capacity factor surpasses any location in Germany, Europe's leader by installed capacity, and is in line with countries such as Bulgaria and Turkey.[20]

Uruguay: Exploiting Interconnection and Hydropower To Become a Wind and Solar Superpower

Uruguay makes an interesting case study of a small country with bigger neighbours, notably Brazil and Argentina, and a largely state-owned energy sector, which has used variable renewables to cut fossil fuel and electricity imports, and increase domestic energy security. We see some parallels with the new Kosovo-Albania electricity control area, with its significant interconnections to Western Balkan neighbours; large hydropower resources in Albania; and the potential for rapid growth in variable renewables in Kosovo. Uruguay made a strategic decision around 2010 to ramp up renewable power. Figure 2 shows how very rapidly rising wind generation has turned electricity imports into exports and reduced thermal generation since 2014.[21] Wind generation has also reduced dependence on domestic hydropower, boosting resilience in dry years. Uruguay has seen record growth in wind and solar power generation, from a monthly average of near zero in 2013 to more than 75% of total power generation in April 2020.

[19] National Statistics. Digest of UK Energy Statistics: Renewable Sources of Energy. July 30, 2020.
[20] The World Bank. Global Solar Atlas. July 2020.
[21] Uruguay Ministry of Industry and Energy. Electrical Energy Statistical Series. 2020.

Figure 3: Uruguay Monthly Electricity Generation by Fuel Source, MWh, and % Wind and Solar Generation, 2000-2020



Source: Uruguay Ministry of Industry and Energy.

Estimates for Electricity Generation Costs by Technology

Renewables Costs

Case Study Examples

In Kosovo, the 32.4 MW Kitka wind farm, commissioned last year, had full installed costs of €73 million, or €2.3 million per MW, according to the European Bank for Reconstruction and Development (EBRD).[22] The project cost included a 14.5-kilometre, 110 kV transmission line, which may largely account for the slightly higher installed cost than international cost benchmarks of around $2 million per MW (see Table 4 below).

In neighbouring Montenegro, the Finnish utility, Fortum, won a public call in 2018 to build a 250 MW solar farm, the largest in the Western Balkans. The offtake price for the solar power will be at market price, as determined on the Hungarian Power

[22] EBRD. KITKA Wind. June 19, 2019.

Exchange (HUPX).[23] The average of all hourly settlements on the HUPX day-ahead market in 2020 to date (as of July 4) was €33.63/MWh.[24] We can compare this price with the proposed electricity offtake price for a new lignite power plant, as agreed between the Kosovo government and ContourGlobal (before its withdrawal from the project) of €80/MWh.[25] Bids for the Montenegro solar project were judged based on a land lease offer, the number of workers to be employed, and an assessment of bidder financial and technical capacity, and local investment.

World Bank Analysis

The World Bank analysed generation costs specific to Kosovo in its unpublished "options analysis," obtained and published by IEEFA last year.[26] The 2018 study used an hourly dispatch model through 2052. The study assumed improvements in public and residential building energy efficiency, and significant scale-up of renewables, broadly in line with Kosovo's 2020 targets as shown in Table 2. In addition, the study assumed continued 592 MW lignite generating capacity through upgrades at Kosovo B. After accounting for these assumptions, the study compared the cost of five broad technology options for bridging the remaining gap to meet domestic demand:

- Increase renewable power;
- Build a new 300 MW or 450 MW dual fuel power plant running on fuel oil or natural gas;
- Build fuel oil reciprocating engines, with installed capacity of 300 MW or 450 MW;
- Build a new, sub-critical, super-critical or ultra-super-critical (USC) lignite power plant, with 300-450 MW capacity, and some biomass co-firing capability; and
- Renovate two Kosovo A lignite units, with a capacity of 450 MW.

The study compared the cost of these technology options across three scenarios: A baseline that excluded environmental costs; the baseline plus local environmental costs from air pollution; and the baseline plus local environmental costs and a carbon price. The findings are summarised in Table 3. The study shows that renewables are the least expensive option after accounting for local air pollution and carbon prices. It seems unrealistic not to account for these costs, given EU directives and regulations apply such costs to the EU, and ultimately to Kosovo.

[23] Balkan Green Energy News. Montenegro leading the energy transition in the region. June 13, 2019.
[24] Hungarian Power Exchange. Historical Data. 2020.
[25] Government of Kosovo. PPA between the Republic of Kosovo and ContourGlobal. 2019.
[26] World Bank. Evaluation of Power Supply Options for Kosovo. August 2018.

Table 3: Cost Comparison of Different Electricity Generation Options for Kosovo

Source: World Bank.

Present value of total costs, € mln	Renewables scale-up with storage	USC lignite	Super-C lignite	Dual fuel	Sub-C lignite	Renovate Kosovo A	Dual fuel	Fuel oil	Fuel oil
	N/A	450 MW	450 MW	300 MW	300 MW	450 MW	450 MW	300 MW	450 MW
Baseline	3,978	4,265	4,233	4,064	3,899	3,691	4,272	4,188	4,411
Baseline plus air pollution costs	6,364	6,499	6,467	6,585	6,327	6,422	6,802	6,767	7,007
Baseline plus air pollution costs and carbon price	9,401	9,781	9,810	9,837	9,843	9,919	10,038	10,320	10,369

Battery Storage Costs

Case Studies

As described above, Kosovo is expanding its interconnection with Albania, and plans to enter a single bidding zone for electricity in forward and spot markets with Albania. These plans will help Kosovo access Albania's excellent hydro resources, optimise its own generation and balance variable renewables.

Large-scale battery storage is an additional, domestic option for Kosovo to balance renewables and increase grid flexibility. Battery storage is increasingly deployed with renewables and in standalone configurations to provide various services to the electricity grid, particularly to increase flexibility and resilience to shocks and fluctuations in supply and demand:

- Batteries can "firm" variable wind and solar generation, meaning they smooth production and match variable supply better with demand. They can make better use of wind and solar power by avoiding curtailment of excess supply.

- They can participate in power markets to provide various ancillary services such as frequency control. Frequency control means keeping the frequency of the electrical signal within the required range, i.e., ~50Hz in Europe, by acting like a shock absorber to respond rapidly to power fluctuations in the grid, over seconds and minutes. Batteries are well equipped to do this (unlike slower ramping technologies like lignite).

- They can reduce or defer large transmission and distribution investment costs, e.g., by locating a battery power plant next to a network bottleneck to alleviate peak congestion, thereby avoiding expensive infrastructure expansion.

- They can provide reserve capacity, 'black start' and other services, helping to reduce the risk of load shedding and blackout events.

Utility-scale battery storage deployment is increasing worldwide, and especially in

locations such as the United States, Britain, Western Europe and Australia. One example is the Hornsdale Power Reserve (HPR), a 100MW/129MWh battery installed in South Australia (SA). The battery cost about US$0.5 million per MWh of installed storage capacity, and was built next to the 315MW Hornsdale Wind Farm. Some 70% of the battery's discharge power capacity is reserved by the SA government for grid system services. In the first two years of operation, HPR's frequency control services saved the National Electricity Market an estimated $116 million by reducing payments to generators for frequency control ancillary services (FCAS) and by avoiding costs during faults at the nearby 600MW Heywood interconnector.[27] "Upon the introduction of HPR into the FCAS markets, average yearly Regulation FCAS costs from South Australian generators fell from $470/MWh to less than $40/MWh, a 91% reduction, where they remain today," the report found. As a result, HPR is being expanded to provide an additional 50MW/64.5MWh of capacity and grid services, including "virtual inertia," which will enable even more low-cost renewable generation to come online.

Local Analysis

In 2018, a private consortium performed detailed modelling of a potential installation in Kosovo, consisting of solar PV (400MW), wind (170MW) and batteries (120MW/350MWh). This unpublished analysis estimated a total capital expense of about €650 million (€0.94 million per MW), annual O&M of €9 million (year 1), and a combined LCOE of €70 per MWh. Given declining costs for renewables and battery storage, these costs may have fallen further. For example, we note that the analysis assumed battery storage capital costs of $331,000/MWh, but a Bloomberg analysis described below finds such costs have fallen to around $150,000/MWh. Such deflation would cut the cost of the combined project to €62/MWh from €70/MWh.

Current ERO Tariffs and Subsidies by Technology

Renewables

Kosovo has a renewables support scheme that provides 10- to 12-year contracts with priority grid dispatch at various rates. The highest tariff is for solar PV, at €136/MWh, followed by €85 for wind, €71 for biomass and €67 for hydropower. The size of eligible projects is capped at 15 MW for solar PV, 20 MW for wind, 5 MW for biomass and 3 MW for small hydro. These price levels are too generous, as indicated by the Montenegro solar case study above, where solar receives no subsidy at all. Kosovo's ERO aims to cut costs by transitioning to a competitive auction approach. There is currently no scheme in place to support the build-out of energy storage capacity for grid ancillary services.

The Energy Community published last year an analysis of energy subsidies in

[27] Hornsdale Power Reserve, Annual Technical & Market Impact Studies. 2018-2019

Kosovo, including both fossil fuels and renewables.[28] The study estimated that direct subsidies paid to renewables in 2017 totalled €5.6 million, adding €1.4/MWh to consumer electricity bills. The ERO reports that such support has since risen to €10 million in 2018 and nearly €14 million in 2019, underlining the importance of transitioning to a more cost-effective auction approach.[29]

Fossil Fuels

The same Energy Community study estimated direct subsidies paid to fossil fuels last year totalled €7.5 million, adding €1.9/MWh to consumer electricity bills. Regarding lignite-fired power generation, the study estimated that direct subsidies amounted to €2.93/MWh of generation, including state loan guarantees and the write-off of interest payments. According to EU State Aid Rules, such subsidies will need to be discontinued, and are already not allowed under Energy Community rules on state aid.

Regarding indirect subsidies, Western Balkan countries including Kosovo presently do not apply a carbon price, unlike EU member states. Failing to account for a carbon price when assessing the economics of investing in lignite will lead to wrong investment decisions and have implications for the profitability of power plants and the end user electricity price. The study estimated that applying present EU carbon prices would raise coal generation costs in Kosovo by €20/MWh, indicating total direct and indirect subsidies of €22.93/MWh. The amount compared with actual generation costs of coal generation, such as lignite mining costs of €29.14/MWh. Adding these costs and subsidies, we can estimate the total costs of existing lignite generation at €52.07/MWh. We would expect the cost of lignite generation from a new power plant to be much higher after adding undepreciated construction costs and ensuring compliance with the Industrial Emissions Directive.

In 2019, the state generation company, KEK, which owns and operates Kosovo's lignite generation, sold its electricity for an average €29.50/MWh, according to the ERO. These numbers indicate that Kosovo's lignite loses money at current wholesale power prices after taking subsidies into account. We can conclude that including the full cost would raise household electricity bills by one-third, to €7.87 cents/kWh, from €5.91 cents/kWh.

Forecast Situation

Electricity Demand Growth To 2030

We briefly consider the growth trajectory for electricity demand in Kosovo, as a result of various drivers:

- **Population growth**: Population growth is only a weak driver for electricity demand growth. The World Bank projects that Kosovo's population will

[28] The Energy Community. Rocking the Boat: What is Keeping the Energy Community's Coal Sector Afloat? June 6, 2019.
[29] Kosovo ERO annual reports 2017, 2018, 2019.

grow from 1.8 million in 2019 to 2.1 million in 2050.

- **Lagging per capita electricity consumption**: According to the IEA, Kosovo's per-capita power demand in 2017 (2.7 MWh) was less than half the EU average, but in line with lower income EU countries such as Romania, and more than some neighbouring countries such as Albania.[30]

- **Lagging per capita income**: World Bank data show that per-capita income in Kosovo was $11,839 (PPP international dollars) last year, well below neighbouring Albania ($14,495), and the EU average ($46,468). In addition, the OECD projects rapid GDP growth in the region.

- **Electricity sector trends**: Increasing electrification of space heating and transport through the adoption of electric heat pumps and electric vehicles is expected to drive electricity demand growth. The IEA projects the share of electricity in EU total energy demand will rise to 29% in 2040, from 21% today and driving 10% to 20% growth in per-capita electricity consumption.

- **EU energy efficiency targets**: We note an EU target to boost energy efficiency implies a 32.5% reduction in total energy demand by 2030, compared with a business-as-usual baseline from 2005. The Energy Community calculated that it would be "reasonable" to apply a slightly weaker target to Kosovo, implying total energy consumption (including electricity) would rise by 14% in 2030 versus 2017 levels.[31]

We conclude that Kosovo's national electricity demand will be about 20% higher in 2030 compared with 2020, implying 1.8% annual growth, driven by income growth and electrification of the energy sector. Cumulative demand growth of 20% implies an additional 1,200 GWh annually in 2030.

Cost Trajectory for Different Generation and Storage Technologies

The International Energy Agency

The International Energy Agency (IEA) estimates cost by broad geographical region in its 2019 World Energy Outlook. The two main types of costs are the upfront capital costs (capex), to build a power plant, and the ongoing fuel, operating and maintenance (O&M) costs. Capex and O&M costs can be combined in a single measure, summing lifetime capex and O&M costs, divided by expected lifetime power generation, to determine the levelized cost of electricity (LCOE).

Table 4 summarises IEA estimates for capex, O&M cost and LCOE of various electricity generation technologies in the EU in 2018 and 2040. The table shows that solar, wind

[30] International Energy Agency. World Energy Outlook 2019. November 2019.
[31] Energy Community. Study on 2030 overall targets for the Energy Community. June 12, 2019.

and combined cycle gas turbines (CCGT) are the most competitive options today, and solar and wind will be the most competitive in 2040.

Table 4: IEA Estimates and Projections for EU Electricity Generation New-Build Costs, by Technology, 2018 and 2040 (Ranked by LCOE in 2018)

	Capex, $/kW		Fuel and O&M costs, $/ MWh		LCOE, $/ MWh	
	2018	2040	2018	2040	2018	2040
Gas CCGT	1,000	1,000	60	70	90	115
Wind - onshore	1,950	1,760	20	15	95	85
Solar PV	1,090	610	15	10	110	65
Coal	2,000	2,000	45	45	120	145
Wind - offshore	4,920	2,580	20	10	140	65
Nuclear	6,600	4,500	35	35	150	110

Source: IEA WEO 2019.

The International Renewable Energy Agency

The International Renewable Energy Agency (IRENA) reported local costs in southeast Europe, finding slightly lower LCOE values than the IEA.[32] IRENA provided ranges for LCOE, depending on the cost of capital (Table 5).

Table 5: IRENA Cost Projections for Wind and Solar Power in Southeast Europe

	Capex, $/kW		LCOE, $/ MWh	
	2018	2025	2018	2025
Wind - onshore	2,030	1,650	45-80	39-65
Solar PV	1,215	850	75-120	61-93

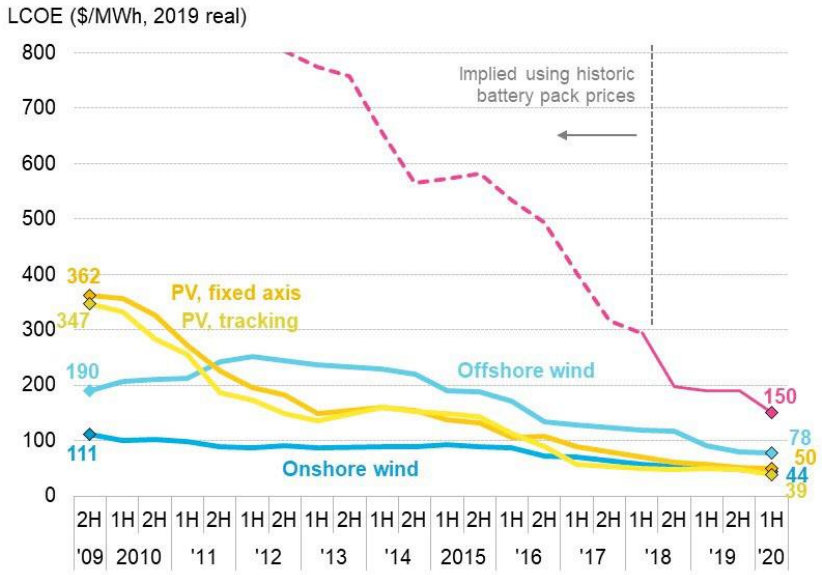
Source: IRENA.

Bloomberg New Energy Finance (BNEF)

BNEF's 2020 global updates for wind and solar power LCOE are summarised in Figure 4. Solar LCOE estimates are lower than both IEA and IRENA estimates, most likely because of the growing economies of scale and the reduced capital costs in non-European countries like the United States and Australia.

[32] IRENA. Renewable Energy Market Analysis: Southeast Europe. December 2019.

Figure 4: BNEF Global LCOE Benchmarks for Wind, Solar and Battery Storage



Source: BNEF.

BNEF also showed that the average cost of battery storage has fallen by half in the past two years to $150/MWh. This is driven primarily by the global electric vehicle market, and prices are expected to continue falling.

Discussion: Options for New Generation Capacity

Easy Wins

We note there are some potential wins for Kosovo to improve security of supply, even before investing in new generating capacity:

- Investment in energy efficiency: Incremental investment in public and residential buildings could reduce Kosovo's national electricity consumption by about 600 GWh by 2030, according to the World Bank options study.

- Investment in interconnection: Full commissioning of the 400 kV/600 MW interconnector to Albania and construction of similar interconnectors could lower the cost of meeting demand by allowing imports that cost less than new power plants. Illustrating the potential from a single interconnector, the existing Kosovo-Serbia 400 kV interconnector sees annual electricity flows including transits of about 1,400 GWh annually.

- Investment in electricity transmission and distribution: According to the World Bank, annual technical losses from the distribution and transmission network could be reduced by 471 GWh annually by 2030. The World Bank

estimated that non-technical distribution network losses could be cut by around 350 GWh annually.

Gas Infrastructure – An Unnecessary Distraction?

Kosovo has no gas infrastructure. Establishing such infrastructure would require significant investment, both in a spur pipeline branching off the prospective Trans Adriatic Pipeline (TAP), initially estimated to cost €211 million,[33] as well as a new national gas distribution network. In addition to such physical infrastructure costs, Kosovo would have to secure gas import contracts, which may be complicated by low or highly seasonal demand. Furthermore, Kosovo would have to establish a gas market from scratch. All these costs would be additional to the cost of building a new gas-fired power plant.

We note that wind and solar power are already broadly competitive with gas-fired generation, and will soon be more competitive, even before accounting for these additional gas infrastructure costs. Given that many countries and financial institutions now view gas as a short-term energy option, it may make sense for Kosovo to leapfrog past gas, directly to a renewables-based economy. We note, for example, that several U.S. utilities recently announced they would be skipping new gas projects to focus on renewables and storage.[34] The European Investment Bank has ruled out financing new gas projects from 2022 onwards, as it pivots towards zero-carbon technologies.

Post- COVID: Prioritising Modular Construction at a Time of Uncertainty

We note the Kosovo government formally requested a World Bank credit guarantee supporting a new, 500 MW lignite power plant in 2011. Because of the massive upfront capital cost, long build-time, execution risk, and rising finance and regulatory headwinds facing new coal projects, and the refusal of the World Bank to provide credit, the proposed power plant had still not broken ground in 2020 and now appears highly unlikely to proceed.

By contrast, in 2020-2021 alone, Kosovo is expected to add more than 120 MW of renewables (see Table 2 above), principally wind power. Renewables are exceptionally fast to build and have a highly favourable financing environment. The EBRD will partially finance both of the country's wind farms. Lower execution, financing and regulatory risks will be even more critical in the aftermath of the coronavirus crisis. Financing is now harder to obtain, and electricity demand growth is harder to predict. Small modular projects that can be built quickly and attract international financial support should be prioritised.

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[33] Western Balkans Investment Framework, 2018. Closing workshop for EU-funded pre-feasibility study for Albania-Kosovo gas pipeline. Available at: https://wbif.eu/news-details/closing-workshop-eu-funded-pre-feasibility-study-albania-kosovo-gas-pipeline

[34] IEEFA. Utilities are now skipping the gas 'bridge' in transition from coal to renewables. July 2020.

Looking Ahead: Energy Storage To Boost Grid Stability

As the global market share of variable renewable generation and electric vehicles continues to gain momentum, it becomes increasingly important for Kosovo's electricity networks to have sufficient flexibility and resilience to deal with greater supply and demand variability. One source of increased flexibility will be expanded interconnection with Albania that accesses its ample hydropower resources. Battery storage is another potential source of flexibility, as a short-duration energy storage technology. However, there are certain regulatory and market hurdles that can block the development of energy storage. Enabling measures are required to create a suitable framework for the energy storage assets to be built and operated:

1. Ensuring energy storage is clearly defined as an asset class, so there is no confusion over how batteries are to be regulated, e.g., to ensure they are not being taxed twice for charging from/discharging to the grid.

2. Supporting the economic viability of projects by reducing upfront investment costs and/or providing surety of revenues for the various battery services. This can be through mechanisms such as construction grants, capacity payments, feed-in-tariffs, peak reduction incentives, investment tax credits or accelerated depreciation.

3. Creating a conducive regulatory and market framework to value energy storage services. Different countries have developed their own energy storage service markets, with various technical parameters and tariff levels, allowing battery plant operators to bid on defined services such as frequency control.

4. Pilot or demonstration projects are essential to understand battery plant performance and to develop know-how for successful scale-up. Funding is available from international organisations to support pilot programmes to evaluate the technical performance as well as to assess different business models for battery storage systems. For example, the European Investment Bank this year announced it expects to increase its backing of battery-related projects to more than €1 billion of financing in 2020, having funded €950 million in battery projects since 2010.[35]

5. Inclusion of energy storage solutions in long-term capacity expansion plans can optimise infrastructure spending by identifying the best locations for storage capacity on the network, and setting near-term installation targets to signal scale intentions to project developers.

For Kosovo, deploying large-scale battery installations with new renewable generation is an opportunity to capitalise on access to low-cost, forward-looking energy technology that can bring new technical skills, knowledge and jobs to the economy, while also delivering clean, domestically produced and low-cost electricity for its people.

[35] European Investment Bank. EIB reaffirms commitment to a European battery industry to boost green recovery. May 19, 2020.

About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

About the Authors

Gerard Wynn

Gerard Wynn is an energy finance consultant, specialising in the economics and finance of renewables and fossil fuel generation. He has previously worked as an analyst, editor and writer in the energy and environment sectors. He worked for a decade as a reporter and columnist at Reuters, covering energy and climate change. He started his career with a Ph.D. in agricultural economics.

Arjun Flora

Arjun Flora is an energy finance analyst at IEEFA, with a particular focus on the new energy technology sector. He previously spent six years working on M&A and financing transactions at Alexa Capital and Jefferies in London. He has also worked in transaction advisory and engineering at Arup and holds a M.Eng. from the University of Cambridge.