

*“National Strategies for Decarbonization of Energy Sector
and Impacts to Electric Power System”*

Second CIGRE SEERC Colloquium

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09:00 – 13:30



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National Committee CIGRE Kosovo

PART 1

National Strategies for DE carbonization of Energy Sector and Impact on Electric Power System

PART 2

*PV Project 100 MW: “**SOLAR4KOSOVO I PHOTOVOLTAIC**”
and*

*Diversification of Energy at the largest Generation Company in Kosovo – **KEK J.S.C.***

PART 1

Content:

1. Overview of Kosovo Power System – Current Situation
2. National climate strategies 2024 – main points submitted to EU
3. Penetration level of Renewables in the Grid today and challenges,
 - RES Developments in Kosovo Power System
4. Plans for penetration of solar and wind power plants, inertia issue if exist,
 - Impact of RES on System reserve requirements
5. Storages in power system issues,
 - Balancing Technology Investments due to the increase of RES Integration – BESS Project
6. National grid development as answer to DE carbonization issues,
 - Transmission Performance Metrics and Achievement
7. Regional power systems integration issues,
 - Development and Integration of Electricity Market between Albania and Kosovo – ALPEX
8. New technology challenges or innovations applied due to Green Transition
9. Distribution network and mobility interactions, solutions

Relevant Work of CIGRE on the Hot Topics of Energy Transition



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**Solar PV
and Wind**

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**Grids and
Flexibility**

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**Consumers,
Prosumers and
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and Climate**

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Integration**

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Overview of Kosovo Power System – Current Situation



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Load, Demand and Generation (2023):

1. Electricity Peak and Electricity Demand:

- Peak demand occurs in the winter, the maximal peak measured is **1413 MW**.
- Yearly(2023) Electricity Demand is **6.7 TWh**

The household demand contributes around 51%, due to the use of electricity for heating. There is no gas infrastructure, and central heating systems are only in the Capital City Pristina, and in Gjakova municipality

2. Electricity Generation:

- **920 MW** from two Thermal Power Plants – based coal lignite (TPP Kosovo A and TPP Kosovo B, very aged facilities)
- **137 MW** from two Wind Power Plants (WPP Kitka – 32.4 MW and WPP Selac – 105 MW) connected in 110 kV grid
- **132 MW** from few Hydro Power Plants, connected to transmission and distribution grid
- **20 MW** from few Solar Parks connected only to the distribution network (~ 9 MW are prosumers, rooftop PVs)

3. Other Facts:

- Generation of Electricity(2023) from all types of generators: **5.7 TWh** or 85% of domestic consumption (6.7 TWh)
- Around 90% was generated by the Thermal Power Plants (based coal lignite) and only 10% from RES
- The main behaviour of Kosovo Power System is: Importing during the winter load and exporting the night surpluses and during (April-June) and (September-October)



Kosovo's parliament adopted the first Law on Climate Change, envisaging a range of activities including the development of a long-term national decarbonization strategy and a system for monitoring, reporting, and verifying greenhouse gas emissions.

Actually, the National Plan for Energy and Climate is in the process of drafting and will include the period 2024 – 2050.

The law aims to identify issues and challenges for improving secondary legislation on climate change through the transposition of the European Union's legislation

- Law on Energy
- Law on Electricity
- Law on Energy Efficiency

RES Developments in Kosovo Power System:

Launch of the First RES Auction:

In May 2023, the Ministry of Economy of Kosova initiated the first auction for the 100 MW Solar Park Kramovik, which will be seamlessly integrated into the 110 kV transmission network. This marks a significant step towards expanding renewable energy capacity. The KOSTT has ensured a very robust connection point for this Solar Park.

RES Investments:

During the same month (May 2023) Solar Energy Group Europe commenced the construction of a 136 MW solar power plant in the municipality of Gjakova, located in the western part of Kosovo. This project, connected to the 110 kV network, will contribute to the growth of solar energy and is being built by Siemens Energy.

KEK Generation:

Kosovo Energy Corporation (KEK) has initiated the development of infrastructure for renewable energy projects, including a 100 MW solar power plant. This solar park will be connected to the 110 kV transmission network, aligning with Kosovo's transition to cleaner energy sources.

Plans for Penetration of Solar and Wind Power Plants



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Plans for the Penetration of Solar and Wind Power Plants are defined on Energy Strategy for period 2022 -2031

RES Investments based on Energy Strategy 2022 – 2031 are:

Till 2031 in Kosovo's power system is planned to integrate:

- **700 MW** wind,
- **600 MW** solar,
- **100 MW** prosumers (PV rooftop).

Till end of 2023, capacity application **for technical information** from KOSTT are:

- ~ **5000 MW** for Solar, and
- ~ **800 MW** for Wind.



Balancing Technology Investments due to the increase of RES Integration – BESS Project:

Kosovo's commitment to energy storage is reinforced by support from the United States through MCC (Millennium Challenge Corporation). This support will introduce advanced BESS technology, with completion expected by 2028.

The deployment of Battery Energy Storage Systems represents modern approach to grid flexibility (Energy Strategy), ensuring that the increasing penetration of variable renewable energy sources can be seamlessly integrated while maintaining a secure and stable energy supply.

The 170 MW (340 MWh) Battery Storage System will play a crucial role in supporting the System Operator. It will provide various balancing services to ensure a stable and reliable grid operation, including:

- *aFRR Services (Secondary Reserve)*
- *mFRR (tertiary reserve)*
- *Load Shifting (charging with solar during the day, discharge in the peak period)*
- *Energy Arbitrage*
- *Black Start Capability*

The 170 MW BESS will be contained by three separate Battery Systems which will be connected to a 110 kV transmission grid in three different locations of the Kosovo Transmission System.

National Grid Development as answer to DE carbonization



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Transmission Performance Metrics and Achievement:

1. Grid Losses:

Kosovo's transmission system has achieved commendable results with losses amounting to 125 GWh yearly, representing a mere 1.29% of the total electricity transmitted. This efficient operation minimizes energy wastage and supports sustainability.

2. N-1 Criterion Fulfilment:

The N-1 criterion, a crucial aspect of grid reliability, is met at an impressive rate of 95% throughout the year. This means that the transmission system reliably maintains its operation, even when faced with a single component failure, ensuring continuous electricity supply. There are no overloaded lines or transformers.

3. Quality of supply:

The transmission system consistently maintains the required voltage profile during high-demand periods, as mandated by Grid Code Requirements. This stability supports a reliable power supply, particularly during peak usage times.

4. Robust interconnection:

The thermal capacity of four 400 kV and two 220 kV interconnection lines which interconnect the Kosova Transmission system with all neighbouring TSOs is more than 4 times higher than national peak demand.

5. Average Interruption Time (AIT):

Kosovo's transmission system boasts an average interruption time (AIT) of just 35.5 minutes per year. This low AIT value is a testament to the system's robustness, ensuring that power interruptions are kept to a minimum, contributing to a reliable electricity supply.

6. Investments (2023-2027):

More than 100 mln Euro are planned to be invested for next 5 years.



Development and Integration of Electricity Market between Albania and Kosovo – ALPEX

The establishment and imminent market coupling between Albania and Kosovo through ALPEX represent a significant milestone in advancing regional cooperation and the shared benefits of market integration:

ALPEX became operational in Albania in April 2023 and in Kosovo on 31 January 2024, marking the beginning of a new era in energy trading and market development. This collaborative effort promises numerous advantages for both parties involved.

Among the main steps taken in this regard are:

- *Signing of the electricity market coupling agreement by the regulators and TSOs of the two countries.*
- *Establishment of the Albanian Power Exchange (ALPEX) and opening of its branch in Kosovo.*
- *Designation of ALPEX as the nominated electricity market operator (NEMO) for Albanian and Kosovo bidding zones by the regulators of the two countries.*
- *ALPEX started the operation of the Day-Ahead Market (DAM) for the bidding zone of Albania since April 2023 and on January 31, 2024, for the bidding zone of Kosovo, while simultaneously being coupled with the Albanian market.*

The Intra-Day Market (IDM) go-live is currently scheduled for Q2 of 2024 in Albania, while two months later, the operationalization of IDM is planned for Kosovo, with simultaneous coupling with the Albanian market.

New Technology Challenges or Innovations applied due to Green Transition



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DSO of Kosovo laid the foundations for the transformation of the electrical distribution network into a digital network with last word equipments and the integration of various advanced technologies.

The application of these solutions in power distribution networks plays a critical role in advancing the green transition and building a more sustainable energy future. By embracing innovative technologies DSO of Kosovo is contributing to energy security and economic development in the transition towards a low-carbon society.

Existing plans in the energy infrastructure of the distribution network are focused on:

- Revitalization, construction and extension of energy infrastructure
- Digitalization of network

With a high focus on digitalization and the integration of new technologies in the network, DSO of Kosovo is committed to leading the way to a sustainable future by constantly exploring innovative technologies and solutions to optimize our services and provide our customers best service in terms of electricity supply.



Distribution Network and Mobility Interactions



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Innovations applied due to Green Transition in DSO of Kosovo:

Distribution Grid Modernization

Revitalization of substations, modernization of infrastructure, investing in smart equipments for fault location, rehabilitation and strengthening of the network at the LV and MV level are some of the main points in which DSO of Kosovo was focused during last years.

Smart Grid Technologies

DSO of Kosovo it is using all technologies regarding monitoring and controlling of distribution network. SCADA, DMS, OMS, Kosova Net, Low Voltage Monitoring are some of the powerful systems used in Kosovo. While FIDs, Autoreclosers, Voltage Regulators are some of other devices integrated lately in the network.

Advanced Metering Infrastructure

Installation of smart meters for real-time monitoring and billing, automation of meter reading through HandHeld devices and PLC installation are some of the key areas where DSO of Kosovo is focused.

Asset Management

DSO right now it is developing GIS that it can be also used to assess the environmental impact of infrastructure projects, such as line expansions or substation upgrades, by analyzing factors like habitat conservation, water resources, and carbon footprint, to ensure compliance with regulatory requirements and minimize ecological footprint.

Integration of RES in network

Increase of capacities in the network for integration of RES, grid adaptation for renewable energy producers, investing in several special lines built exclusively for the operation of generating companies are some of the main points that shows that DSO works to support RES integration.

EV Charging Infrastructure

DSO of Kosovo it is developing a robust charging network to support the growing adoption of electric vehicles. The company that operates with distribution network has integrated electric cars for their operation and has build charging stations throughout the network.



Distribution Network and Mobility Interactions

The distribution network of Kosovo faces several challenges on the road to green transition, but the 3 main ones are:

Managing Integration
of RES

Distribution Grid
Stability

Data Management and
Cybersecurity

Managing integration of RES: In Kosovo, there has been a significant increase in the integration of Renewable Energy Sources (RES) in recent years, with a growing number of prosumers connected to the network. Despite continuous efforts by the distribution network operator to expand and accommodate these resources, managing the growing demand remains a persistent challenge because it requires advanced forecasting, storage solutions, and demand response programs.

Distribution grid stability: Balancing supply and demand, managing voltage fluctuations, and ensuring grid stability become more challenging with the increasing penetration of renewables.

Data Management and Cybersecurity: Effectively managing the substantial volume of data produced by smart grid technologies and safeguarding the cybersecurity of grid infrastructure are crucial challenges. Protecting sensitive data, preventing cyber threats, and maintaining system reliability are paramount considerations in the green transition.

PART 2



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Presentation:

*PV Project 100 MW: “**SOLAR4KOSOVO I PHOTOVOLTAIC**”
&
Diversification of Energy at the largest Generation Company in
Kosovo – **KEK J.S.C.***

Presenter:

Erdoan ZASELLA
Manager of RES, KEK



Few Facts for Kosovo Energy Corporation - KEK J.S.C.



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Kosovo Energy Corporation – KEK J.S.C. is Kosovo's largest coal mining and electricity generation company. As a publicly-owned company, KEK operates with the following capacities:

Thermal Power Plant – TPP Kosova A, with three generation units (A3, A4, and A5) with an estimated net capacity of 400 MW.

Thermal Power Plant – TPP Kosovo B, with two generation units (B1 and B2) with a net capacity of 520 MW for electrical energy and an additional 140 MW for thermal energy generation, used for residential heating

The Coal Production Division (CPD), ensuring planned coal generation and maintaining ample reserves to supply both Power Plants.

In 2024, KEK aims to achieve an annual electricity generation of approximately **6 TWh** and aims to produce around 9 million tons of lignite (coal).

KEK's electricity production consistently covers about 90 percent of domestic consumption in Kosovo.



PV Project 100 MW “SOLAR4KOSOVO I PHOTOVOLTAIC”



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As part of the transition towards renewable energy, KEK is in the process of implementing the first 100MW solar park.

This strategic project is set to be realized through close collaboration between KEK and KfW (German bank).

Funding for the initiative will be secured through a grant provided by WBIF/EU, a soft loan extended by KfW & EIB, and KEK's own contribution.



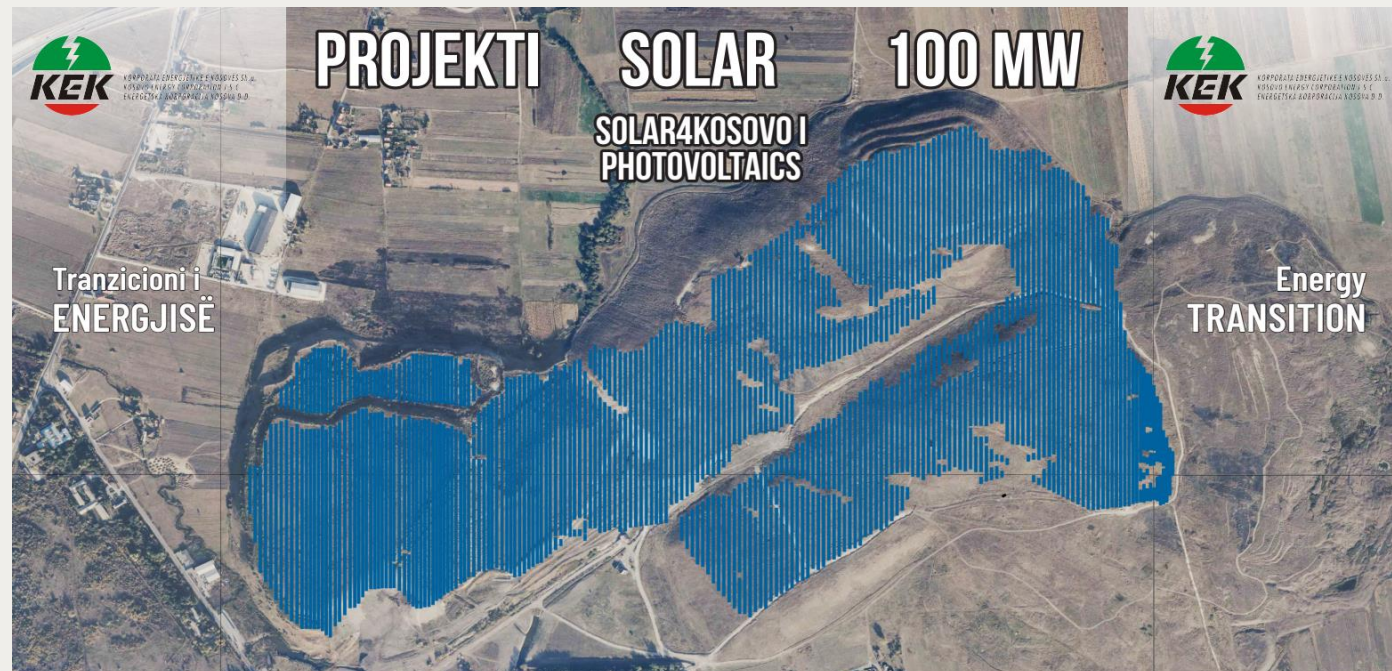
KfW



Western Balkans
Investment Framework **WBIF**
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KOSOVA ENERGY CORPORATION S.R.L.
ENERGETIKA KOSOVA D.O.O.



The location of the PV Project 100MW

LATITUDE	LONGITUDE	HEIGHT
42.660532N	21.102673E	584m

The proposed site for the "SOLAR4KOSOVO-I PHOTOVOLTAIC 100MW" project is situated in the central part of Kosovo, approx. 8 km far from the capital city, Pristina.

The project will be implemented on the former ash dump Kosovo A, located just 1000m east of the TPP Kosovo A.

The available area for this project is **153 ha**.

The ash has been deposited (ie folded) in this area since the beginning of work of the TPP Kosovo A dating as early as 1962.

Extensive geotechnical, seismic, and hydrological analyses have been conducted by KEK for this project.

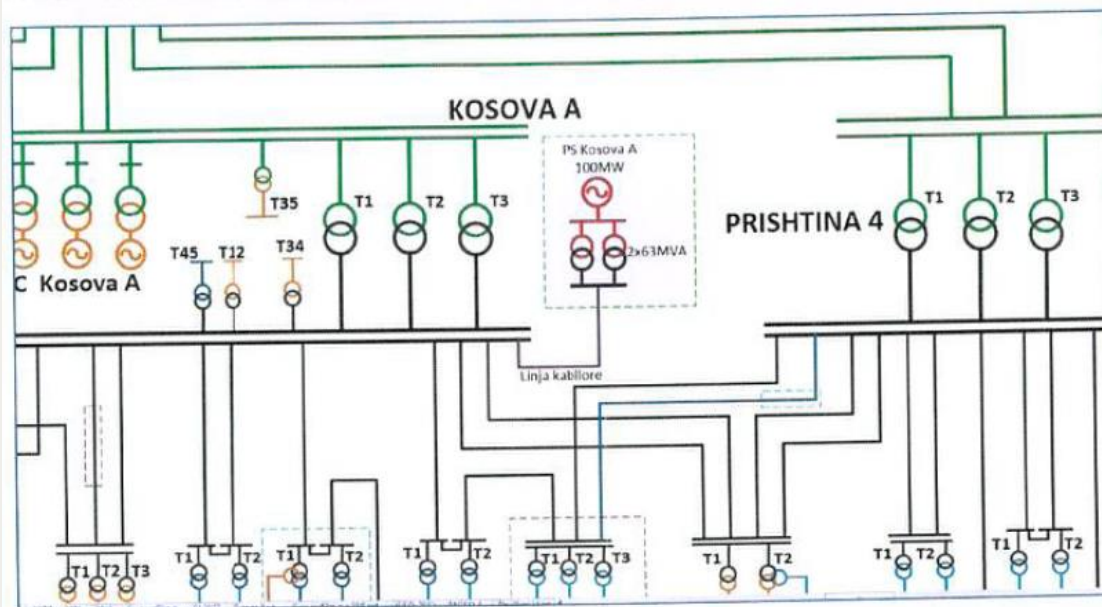
The conclusive findings from the report affirm the suitability of the land for the construction of the planned solar park.



Technical Details

KEK currently has prepared conceptual design and the feasibility study for the project.

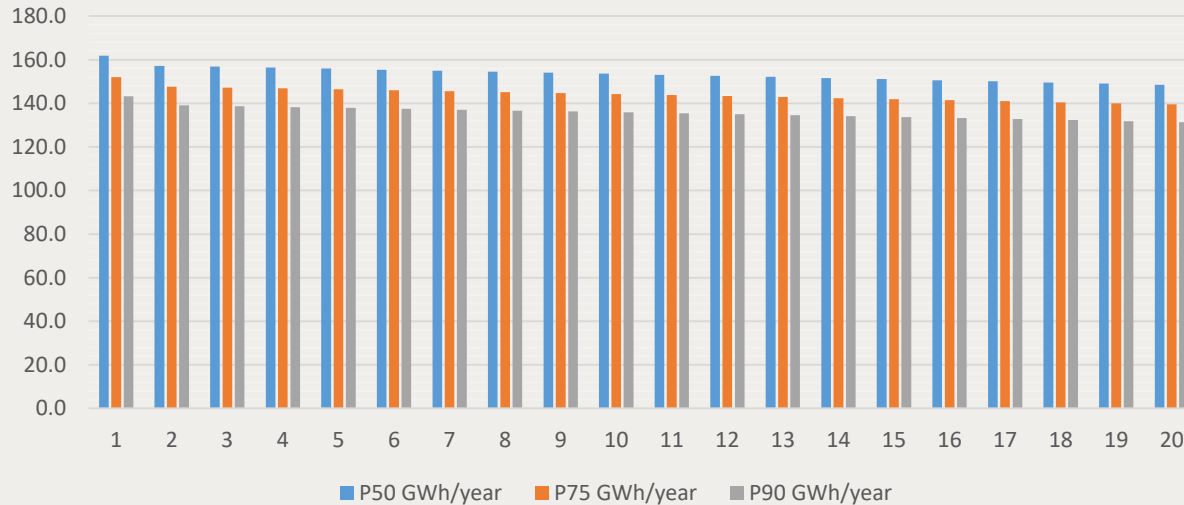
- The substation of the project will consist of two 63MVA power transformers.
- Using a 110kV cable line, the outputs of the two transformers will be connected to the grid connection point of the existing SS Kosovo A, at a distance of approximately 1km.



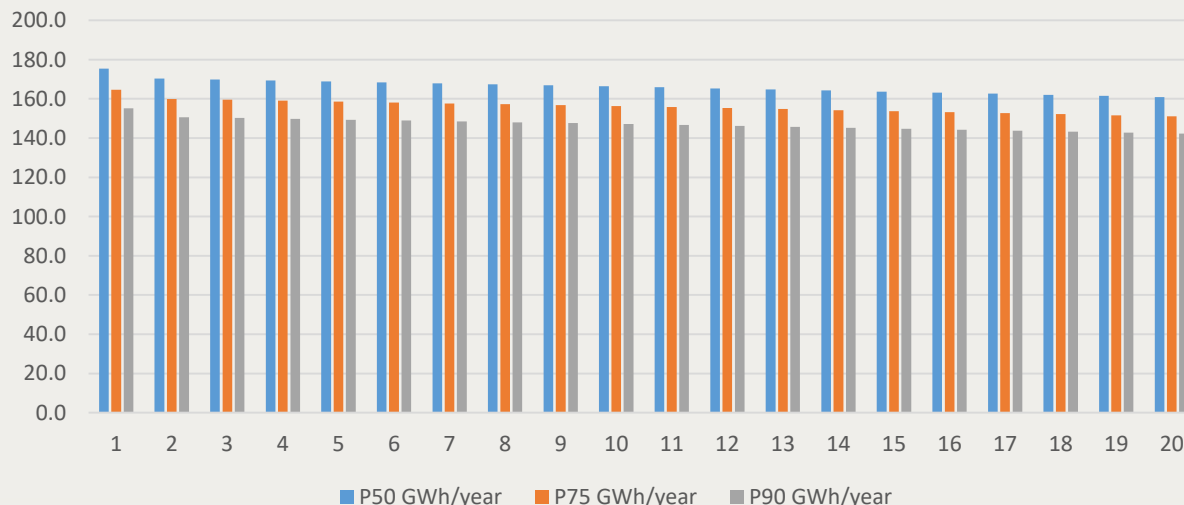
Parameter	Value
Installed Capacity (AC)	100 MW
Installed Capacity (DC)	120 MWp
Mounting Type	Fixed tilt / Single axis tracking
PV Technology	Mono cristaline Si.
Inverter Technology	Central
Internal MV Voltage Level	20kV
Grid Connection Voltage Level	110kV
Azimuth 0 - South	0
Total area for the project (excluding route, substation)	136 ha

Generation Forecast Scenarios of the PV Project 100 MW

Long-term energy yield – Fixed Tilt.



Long-term energy yield – Single axis.



The Plant degradation is estimated to be 0.4% for each year taking into account the guaranteed performance provided by the module manufacturers

Electricity Production year 1 – Fixed Tilt Configuration

- The resulting energy yield for the examined PV plant amounts to **161 911 MWh/year** based on P50 confidence level and year 1. This corresponds to a specific yield of **1349 kWh/kWp/year** and a performance ratio (PR) of **82.3 %**.

Electricity Production year 1 – Single Axis Configuration

- The resulting energy yield for the examined PV plant amounts to **175 380 MWh/year** based on P50 confidence level and year 1. This corresponds to a specific yield of **1462 kWh/kWp/year** and a performance ratio (PR) of **80.1 %**.

Monthly generation forecast of the PV Project compared with TPP Kosova A and Kosova B

Monthly electricity production from the 100MW PV project (P50, Single Axis Configuration):

Months		1	2	3	4	5	6	7	8	9	10	11	12
PV Project	MWh	6,125	8,243	13,815	18,400	21,477	24,263	27,064	19,136	16,438	11,421	8,162	5,608

Monthly electricity production from the Units of TPP Kosova A and Kosova B

Months		1	2	3	4	5	6	7	8	9	10	11	12
TPP-A A3	MWh	95,614	80,671	92,484	60,556	93,886	40,697	13,692	72,274	34,359	0	69,264	24,947
TPP-A A4		72,747	81,420	94,294	91,357	75,841	40,701	97,542	47,252	77,971	65,458	22,039	61,857
TPP-A A5		0	0	0	0	46,455	72,405	73,533	59,276	55,776	96,364	93,744	84,709
TPP-B B1		177,116	155,720	140,817	168,198	156,436	152,433	125,475	0	0	43,065	161,339	180,910
TPP-B B2		163,826	129,689	182,060	86,912	0	0	86,045	173,309	176,607	181,370	130,722	180,422

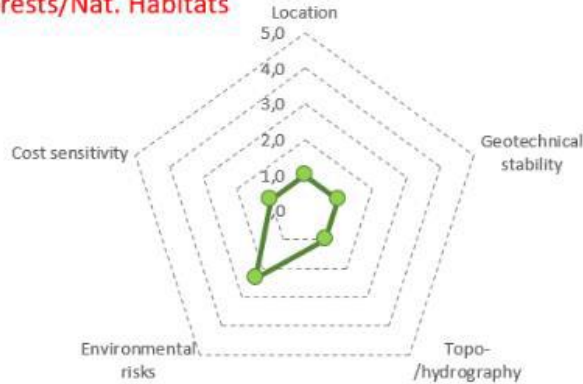
The PV project holds significant importance for KEK, particularly in the context of the maintenance and repair activities carried out on Units of TPP Kosova A and Kosova B. Traditionally, KEK conducts maintenance on their units during the summer, spanning a duration of 2 to 4 months, ensuring they are primed for optimal performance during the upcoming winter. Concurrently, the PV project is expected to generate a substantial amount of energy, primarily during the summer months. This generation aligns strategically with KEK's maintenance schedule.

Since these units are temporarily OFF for repairs, the PV project becomes crucial by supplying energy during this period where compensate the unavailable output from the units undergoing maintenance. This strategic synergy ensures a continuous and reliable energy supply, mitigating the impact of the unit downtime on overall energy availability.

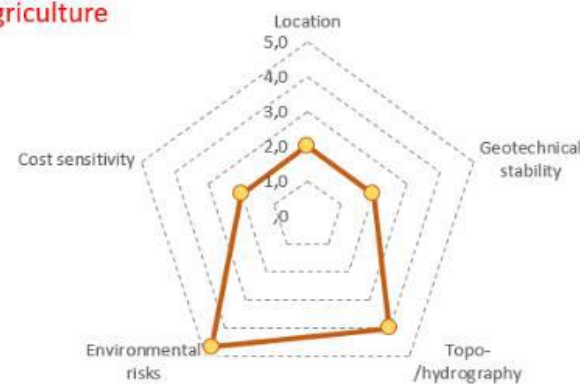
Future Plans regarding Energy Diversification in KEK (1/3)

KEK in corporation with the World Bank has finished Land Repurposing Assessment for the KEK's lands. The project has analyzed around 2600 hectares of land owned by KEK including former ash dumps, overburden dumps, mined pits etc.

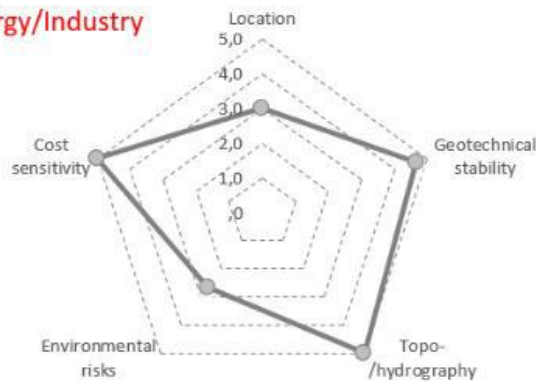
Forests/Nat. Habitats



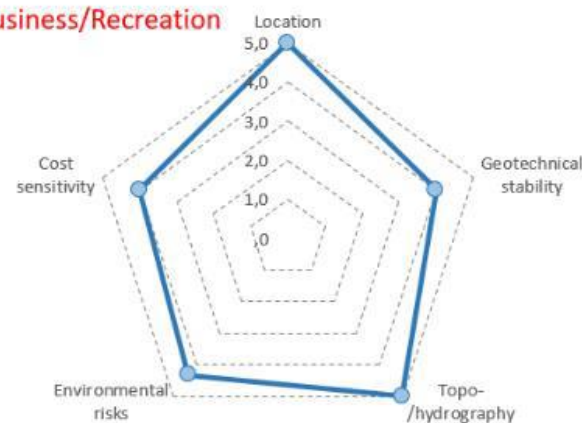
Agriculture



Energy/Industry



Business/Recreation



Land Classification Criteria:

Geotechnical properties: settlements, slope stability, erosion potential, collapses, sinkholes, surface subsidence

Topography and hydrography: flooding, water logging, groundwater rise

Environmental risks: soil chemistry, residual contaminations, ambient pollution, methane emissions

Location: distance from urban / economic centers, transport infrastructure and energy grids

Cost sensitivity / added value: how much would repurposing cost, what is the potential value gain.

Approximately 735 hectares (ha) of the analyzed area have been estimated as ready for development.

These areas are considered “ready for development” and in particular for energy production with the use of photovoltaic panels with minor additional earthworks.

Besides PV, **additional opportunities** exist for repurposing assets on the KEK concession:

- TPPs to synchronous condensers;
- Kosovo A site housing large scale battery storage (MCC);
- Solar district heating plant;
- Identify potential site for PSP on / near KEK lands
- TPPs to waste-to-energy plant (could be combined with district heating), combined with a waste management / processing plant;
- Explore other opportunities, e.g. logistics center, commercial / business parks.

Thank you for your attention!

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