Republika e Kosovës
Republika Kosova - Republic of Kosovo

ZYRA E RREGULLATORIT PËR ENERGJI
REGULATORNI URED ZA ENERGIJU
ENERGY REGULATORY OFFICE

Consultation Report

Assessment of the Maximum Strike Price for the 75 MW Wind Power Auction

DISCLAIMER

This Consultation Report is prepared by ERO with the purpose of informing stakeholders on the assessment of Maximum Feed-in Tariff and Maximum Strike Price for the Wind Auction 75 MW. The report does not represent a decision of ERO and shall not be interpreted as such.

13 September 2024

Adress: St. Bekim Fehmiu (ex Fazita building), 2nd floor, 10000 Prishtinë, Kosovo
Tel: 038 247 615 lok. 101, Fax: 038 247 620, E-mail: info@ero-ks.org, web: www.ero-ks.org

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1 Introduction

The Energy Regulatory Office presents this consultation report based on the request of the Ministry of Economy to evaluate the maximum strike price for the wind auction of 75 MW, given that the reference price does not provide enough incentive to have enough bidders to offer the necessary competition for the auction announced by the Ministry.

The Energy Regulatory Office (ERO) is currently in the process of assessing the maximum strike price for the upcoming 75 MW wind auction. This Consultation Paper is prepared in accordance with the Methodology for Determining the Maximum Fixed Premium, Maximum Strike Price, and Maximum Feed-in Tariff, which is published on ERO's website.

As per Article 11, point 6, of the Law No. 08/L-258 on the Promotion of the Use of Renewable Energy Sources (RES Law), the Regulator shall, within a deadline of thirty (30) days from the request of the Ministry, set the Maximum Fixed Premium or Maximum Strike Price for each Competitive Bidding Process. The Law no. 08/L-258 on the Promotion of the Use of Renewable Energy Sources foresees the development of the regulatory framework for the promotion of the use of Renewable Energy Sources in the Republic of Kosovo, including the promotion of competitive, transparent Support Schemes and other mechanisms of public-private partnership.

The report aims to establish a price above which bids submitted in the auction will not be accepted or will be disqualified by the Commission established by the Ministry of Economy as per Article 18, point 2 of the Law on the Promotion of the Use of Renewable Energy Sources, while lower bids are considered economically favorable and therefore will not be excluded from the bidding process. The Methodology stipulates that, when setting the maximum strike price, the Regulator will aim to set that price at a level that allows sufficient competition within the competitive bidding process, ensuring that the targeted capacity in the auction can be contracted at a reasonable price.

This Consultation Paper provides ERO's proposal for the maximum strike price for the 75 MW wind auction and is structured as follows:

- Chapter 2 explains the methodology for assessing the maximum strike price;
- Chapter 3 explains the background and context of the wind auction;
- Chapter 4 evaluates the input parameters for determining the price;
- Chapter 5 provides the ERO's proposal for the price.

Consultation with interested parties is essential in drafting sustainable regulatory policies. ERO invites wind developers, consumers, civil society, and other interested parties to review the data and positions of the ERO presented in this Report, with which they may disagree, and to comment on them based on facts, offering counterarguments, or providing new data that the ERO may not have considered in its proposal. Comments on this Consultation Paper can be submitted electronically via email at ero.pricing-tariffs@ero-ks.org or submitted in printed form to the following address:

Energy Regulatory Office
Tariffs and Pricing Department
St. Bekim Fehmiu (ex. Fazita Building) floor 2, 10000 Prishtina, Kosovo,

The deadline for comments is 27 September 2024.

After reviewing the received comments, ERO will publish the Final Report along with responses to comments received during the consultation period. The comments received on this Consultation Paper will be published along with the Final Report.

2 Methodology of Levelized Cost of Energy

The methodology for assessing the Maximum Strike Price for the 75 MW wind auction which is expected to be announced by the Ministry of Economy is based on the calculation of the Levelized Cost of Energy (LCOE) of a typical wind farm, and with supporting analysis of the wind energy market in Europe.

The calculation of the Levelized Cost of Energy is based on Article 7 and Article 8 of the Methodology for Determining the Maximum Fixed Premium, Maximum Strike Price and Maximum Feed-in Tariff. The Maximum Strike Price and Maximum Feed-in Tariff, established according to the LCOE alternative, apply the following equation:

$$\boldsymbol{LCOE = \frac{Total\ project\ cost}{Total\ project\ output}}$$

$$\boldsymbol{Total\ project\ cost = \sum_{t=1}^{n} \frac{C_t}{(1+r)^t}}$$

$$\boldsymbol{Total\ project\ output = \sum_{t=1}^{n} \frac{E_t}{(1+r)^t}}$$

$$\boldsymbol{LCOE = \frac{\sum_{t=1}^{n} \frac{C_t}{(1+r)^t}}{\sum_{t=1}^{n} \frac{E_t}{(1+r)^t}}}$$

Where:

$\boldsymbol{LCOE}$	-	*Levelized Cost of Electricity, to set the Maximum Feed-in Tariff / Maximum Strike Price;*
$\boldsymbol{C_t}$	-	*Costs/expenditures in year t, incurred during construction and during the Support Contract period;*
$\boldsymbol{E_t}$	-	*Electricity generated at the metering point in year t;*
$\boldsymbol{r}$	-	*Discount rate (WACC);*
$\boldsymbol{n}$	-	*Duration of the Support Contract set for the specific auction.*

3 Background Information on the Wind Auction

The upcoming wind energy auction will have a total capacity of 150 MW, with a 15-year Power Purchase Agreement (PPA). The auction is divided into two tenders: 75 MW will be awarded in 2024 and the remaining capacity in 2025. The maximum strike price in this report is analyzed for the first auction only (75 MW), which is non-site-specific. The award criteria for this auction is price-only, using a pay-as-bid pricing rule.

The Administrative Instruction (ME) No. 02/2023 on the Target of Electricity from Renewable Energy Sources in Annex I (Electricity Capacity from RES (MW)) foresees the national trajectory for the construction of new generating capacities based on Wind technology at a capacity of 677 MW until 2030. In order to ensure the fulfillment of the long-term and annual goal of electricity from renewable energy sources, support measures will also be used through competitive procedures.

The support price will be indexed to inflation, and the volume coverage will be on a pay-as-produced basis, covering 100% of the volume. The support scheme is based on the Feed-in Tariff provisions as per Article 12 of the Law on the Promoting the Use of Renewable Energy Sources. According to RES law provisions, conversion to a two-sided Contract for Difference (CfD) will occur once the day-ahead market in Kosovo is operational for 12 consecutive months (Article 12). Lastly, the balancing responsibility, also under RES law (Article 14), is limited to imbalance volumes greater than 10%.

4 Evaluation of the main auction parameters

This chapter will delve into the main parameters for the wind auction, focusing on the capacity factor, Weighted Average Cost of Capital (WACC), Capital Expenditures (CAPEX), and Operating Expenditures (OPEX). This evaluation was based on data gathered from reports prepared by Fraunhofer[1] [2]Lazard[3], IRENA[4], NREL[5], WindEurope[6], and the UK Department for Business, Energy & Industrial Strategy[7].

4.1 Capacity Factor

The Capacity Factor is an important input element for the calculation of the LCOE and maximum auction price. The Capacity Factor for wind power plants is affected by the wind speed, wind speed distribution,

[1] Fraunhofer Institute for Solar Energy Systems ISE, 2021. Levelized Cost of Electricity: Renewable Energy Technologies.

[2] Fraunhofer Institute for Solar Energy Systems ISE, 2024. Levelized Cost of Electricity: Renewable Energy Technologies.

[3] Lazard, 2024. Levelized Cost of Energy+

[4] IRENA, 2023. Renewable Power Generation Costs in 2022

[5] NREL, 2023. 2022 Cost of Wind Energy Review

[6] Wind Europe, 2024. Wind energy in Europe: 2023 Statistics and the outlook for 2024-2030

[7] UK Department for Business, Energy & Industrial Strategy, 2023. Electricity Generation Costs 2023

turbine type (rotor diameter, hub height) and the balance-of-plant technology used. Due to the non-site-specific nature of the auction, ERO cannot conduct a site-specific analysis of the Capacity Factor from wind speed data on the system location. Thus, ERO shall rely on available data from wind power plant capacity factors reported in Kosovo and Europe.

Based on the energy production of WP Kitka and WP Selaci and reported installed capacities, WP Kitka and WP Selaci from 2020 to 2022 (Figure 1, left), have achieved Capacity Factors between 28.2% and 32.2%. Both these wind farms are supported under the Feed-in Tariff compensation scheme, with no curtailment and no limitations on the amount of purchased power through the PPA.

Figure 1 also presents Kosovo's wind atlas[8] for capacity factors of IEC Class III wind turbines. IEC Class III wind turbines are designed for sites with average wind speeds up to 7.5 m/s, and these turbines typically have extra-large rotors to allow them to capture as much energy as possible from the lower wind speeds, they are subjected to. The map highlights regions with varying wind speeds and the potential for wind energy development. The map's color gradients indicate the wind resource availability across different regions. As seen, in most regions with significant potential the capacity factor ranges from 25% to 40%.

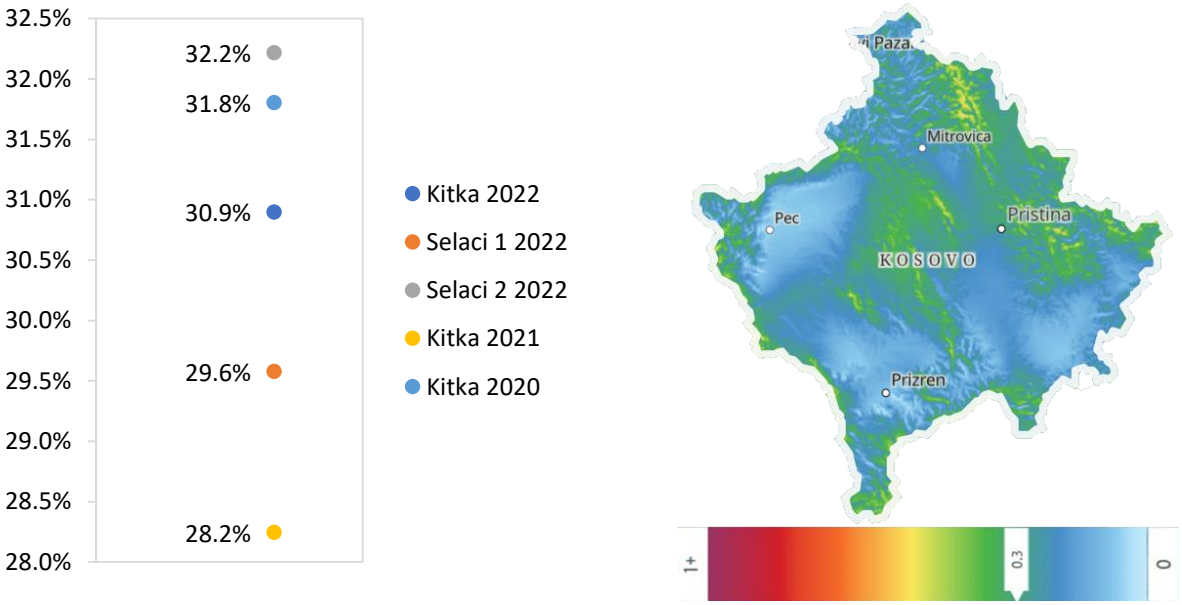

Figure 1. Capacity Factor of WP Kitka and WP Selaci during 2020 – 2022 (left). Capacity Factor for Kosovo based on Wind Atlas (right)

To provide a comprehensive overview of wind energy performance in Europe, ERO examined the capacity factors of wind farms in different countries.

Figure 2 displays the weighted average wind farm capacity factors for different countries in Europe. As seen, capacity factors have increased steadily due to improvements in wind turbine technologies. However, during recent years the average wind farm capacity factor has decreased, and this may be attributed to the fact that investors are moving to sites with lower wind speeds, due to sites with higher

[8] https://globalwindatlas.info/en/area/Kosovo

wind speed locations having already been developed as projects. The lowest capacity factors in 2022 were reported in Germany at 28%, and the highest in Ireland at 40%.

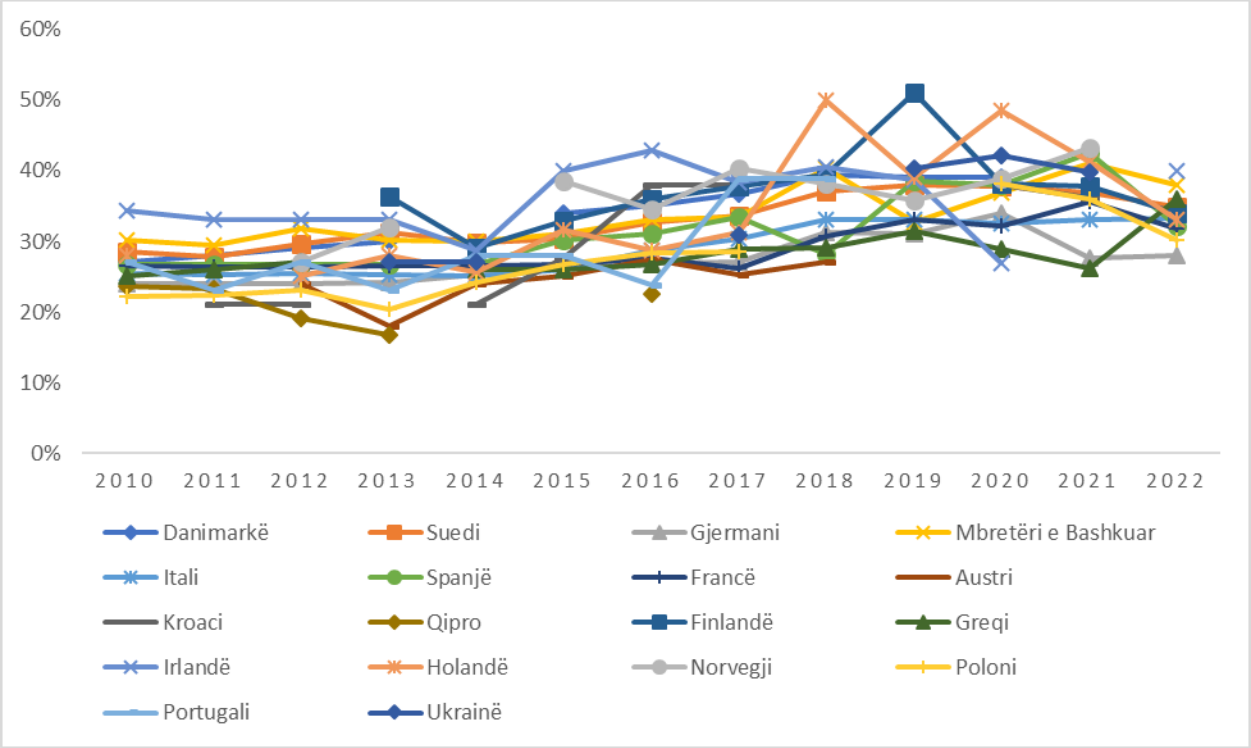

Figure 2. Weighted Average Capacity Factor of onshore wind farm in Europe (IRENA, 2023)

WindEurope (2024), estimates that capacity factors for new onshore wind farms shall be between 30 and 35%. The UK Department for Business, Energy & Industrial Strategy (2020), used a capacity factor of 34.8%, as an average. Fraunhofer (2021) uses different capacity factors based on different locations in Germany. For unfavorable locations Fraunhofer estimates a capacity factor of 20.5%, in Northern Germany where wind speeds tend to be higher, they estimate 28.5%, and for coastal and high wind locations they estimate capacity factors of up to 36.5% (Fraunhofer IWES, 2024). The average capacity factor for onshore WPP constructed in 2016, in Germany, was at 31.1% (Fraunhofer IWES, 2018).

Based on this analysis, ERO assesses that the capacity factors achieved by the wind farms installed in Kosovo, despite their small number, provide a closer estimate of the average capacity factors expected to be reached in Kosovo. These capacity factors are also similar to those reported in Europe. ERO assumes the capacity factor for the auction to be between 28.2% and 32.2%. This capacity factor results in an annual energy production of 185,274 MWh – 211,554 MWh for the specific project of installed 75 MW. This rate aligns with the collected data and provides a realistic and achievable target for wind energy production in Kosovo.

4.2 Weighted Average Cost of Capital (WACC)

The Weighted Average Cost of Capital (WACC), is an important component of LCOE analysis. ERO has made the assessment of WACC during 2022 for the energy sector in Kosovo. ERO considers that the circumstances of an investor, who is guaranteed the sale of energy after winning the auction, do not significantly differ from the circumstances analyzed in ERO's consultative report.

Table 1. WACC parameters

Gearing ratio	40.00%
Corporate Income tax rate	10.00%
Real risk-free rate	3.65%
Debt Premium	2.09%
Equity Beta	0.88
Equity Risk Premium	5.04%
Real cost of equity	8.09%
Real cost of debt	5.74%
Real WACC – pre-tax	**7.69%**

ERO has also analyzed the reported levels of WACC for European countries for onshore wind energy systems, based on data collected by IRENA. It should be noted that for comparison with the WACC reported by IRENA, the considered WACC has been converted from the real pre-tax WACC to the real post-tax WACC. ERO considers that the WACC taken into account reflects the cost of capital from investors and is comparable with the countries in the region.

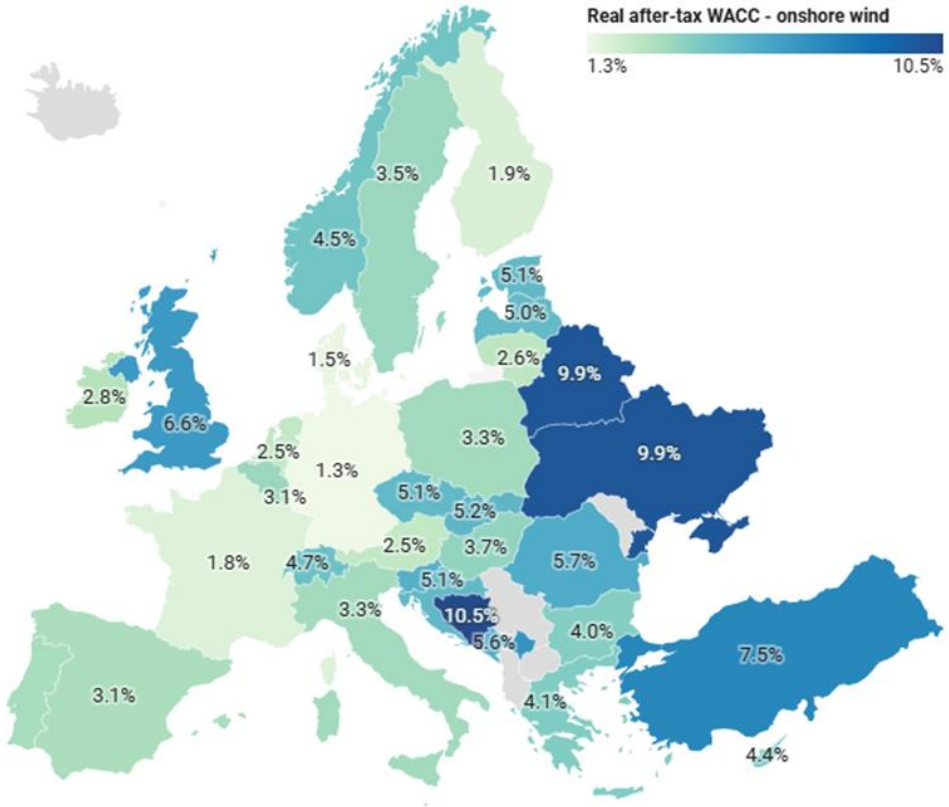

Figure 3. Reported WACC in European countries for onshore wind plants, real pre-tax (IRENA, 2023)[9]

4.3 Capital Expenditures (CAPEX)

Capital expenditures include all installation costs of the wind turbines from an investor's perspective. The main components of CAPEX are wind turbine generators, inverters, construction and mounting, connection to the transmission grid (including the substation), DC cables, safety at work costs, monitoring, electrical and mechanical installations, inspection, and system design. For the analysis of capital costs (CAPEX), ERO analyzed data from reports prepared by Fraunhofer, Lazard, IRENA, and the UK Department for Business, Energy & Industrial Strategy, from 2021 to 2024. These reports contain estimates of total costs for onshore wind projects in Europe. This data is presented on Figure 3, where the currencies have been converted based on historical exchange rates. Fraunhofer (2024) used a total CAPEX value of 1,900 €/kW as the highest value for total capex costs of wind plants. The lowest value estimated in 2024 is from the UK Department for Business, Energy & Industrial Strategy (2024) at 1,095 €/kW.

[9] IRENA (2023), The cost of financing for renewable power, International Renewable Energy Agency, Abu Dhabi

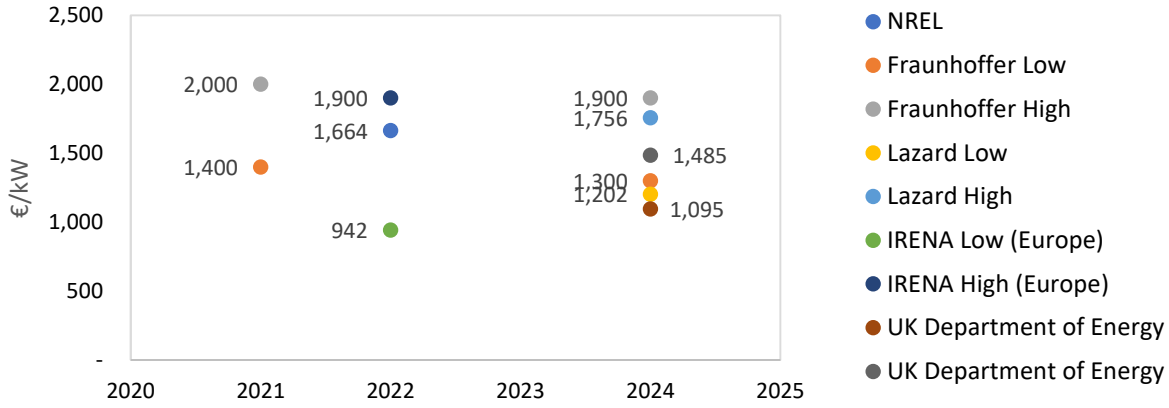

Figure 3. CAPEX estimations for wind projects

The values in Figure 4 are based on data from IRENA (2023) and WindEurope (2024). Total capacity costs vary from country to country in Europe where the main driving factors for these differences are the maturity of wind component value chains and land and permitting constraints. IRENA and WindEurope provide total CAPEX estimations for 2022. The values were adjusted to 2024 currency considering Kosovo HICP index reported by the Kosovo Statistics Agency.

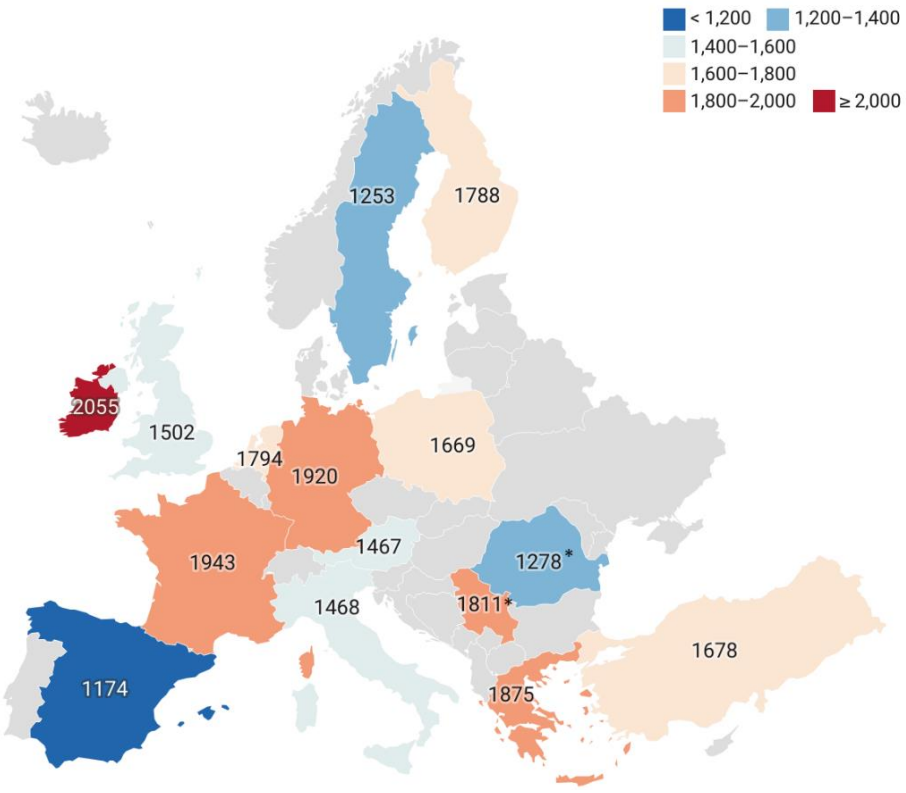

*Figure 4. Total CAPEX in €/kW for different European countries (IRENA, 2023) in 2022, adjusted for inflation to 2024. *Data from WindEurope*

The data in Figure 4 is also presented in a box-whisker plot in Figure 6.

The box plot illustrates the distribution of CAPEX values, showing the interquartile range (IQR) from 1,467 €/kW to 1,875 €/kW. The median CAPEX is 1,678 €/kW. The 75th percentile, at 1,875 €/kW, indicates that 75% of the data points are below this value, highlighting the upper range of typical CAPEX costs for wind energy projects.

Considering this analysis, ERO considers total CAPEX costs for the non-site-specific wind auction will range from 1,467 €/kW – 1,875 €/kW.

This range of estimates is in line with reported CAPEX values for onshore wind projects in the region.

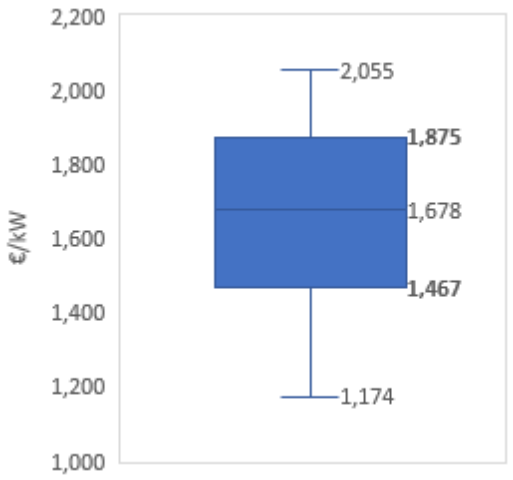

Figure 5. Box-whisker plot of reported CAPEX values, in 2024 €/kW

4.4 Operating Expenditures (OPEX)

Fixed operating expenditures (OPEX) for wind energy include technical operation costs, system insurance, preventive and corrective maintenance, operation management, land lease costs, and security of the wind farm. IRENA's Renewable Power Generation Costs Report (2022), presents Initial Full-Service Contracts for onshore wind farms based on Bloomberg New Energy Finance (BNEF) O&M price indexes. Initial Full-Service Contracts do not include expenses not covered by service contracts (e.g., insurance, land lease payments, local taxes, and other factors).

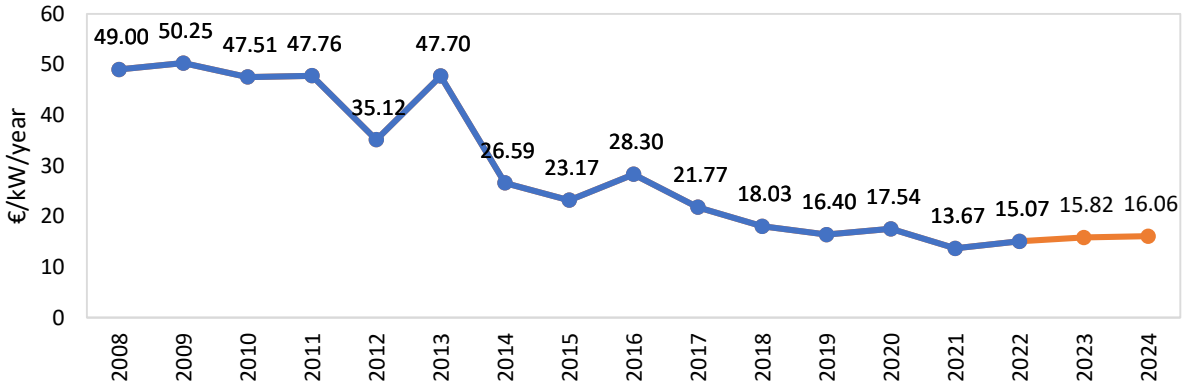

Figure 6. Initial Full-Service Contracts for O&M (BNEF, 2022). Adjusted for 2023 and 2024 using HICP

Initial Full-Service Contracts for Wind Power Plants in 2022 were valued at 15.8 $/kW, or 15.07 €/kW. Adjusted for inflation in Kosovo (based on HICP values reported by Kosovo Statistics Agency), Initial Full-Service Contracts for Wind Power Plants in 2024 are estimated at 16.06 €/kW or 16,058 €/MW (Figure 6).

4.5 Summary of key parameters and results of the Levelized Cost of Energy (LCOE) Analysis

Table 2. Summary of parameters for the LCOE calculation

Parameter	Considered Values
Auction Volume	75 MW
Power Purchase Agreement	15 Years
Capacity Factor of the Wind Farm	28.2% - 32.2%
WACC – pre-tax	7.69%
CAPEX	1,467 – 1,875 €/kW
O&M	16,058 €/MW/year

The main parameters of the LCOE calculation are summarized in Table 2.

Figure 8 presents the results of the LCOE calculations. The minimum result is 65.3 €/MWh, while the maximum is 93.5 €/MWh. ERO considers that due to the nature of the auction with a non-specific location, investors will consider locations with high investment costs (CAPEX) only in cases where those locations have high-capacity factors, and vice versa. Based on this principle, ERO estimates that the maximum price for the wind auction with an unspecified location should be between 74.6 €/MWh and 81.9 €/MWh.

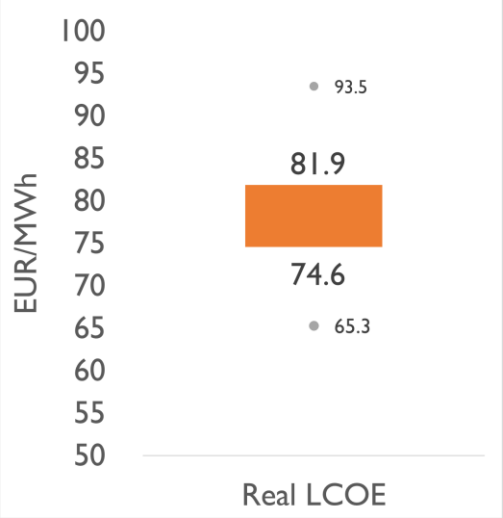

Figure 7. Results of the LCOE calculation

ERO believes that the analyzed parameters and subsequent results closely approximate the parameters and outcomes observed in the field.

For this reason, ERO also analyzes the results from similar auctions in Europe and the prices of wind energy in European markets in this report. ERO further considers that the maximum price should be set at a level that does not restrict competition in the wind auction but also does not provide excessive profits in cases of low competition.

4.6 Results from similar auctions in Europe

4.6.1 Regional maximum strike prices (ceiling prices) for Wind Auctions

Table 3 provides an overview of recent wind energy auction maximum strike prices across various regional countries, demonstrating the diversity in auction outcomes and ceiling prices. For instance, Albania's July 2023 auction set a ceiling price of 75 €/MWh, resulting in 222.5 MW being awarded with awarded prices ranging between 44.88 €/MWh and 74.95 €/MWh. In Serbia's August 2023 auction, the ceiling price was set at 105 €/MWh, with awarded wind capacity priced between 64.48 €/MWh and 84 €/MWh, where inflation-indexed strike prices were applied. Moldova, planning an auction for 2025, has proposed a ceiling price of 77.88 €/MWh, though outcomes are pending. In Croatia, the ceiling price for the 2022 auction was set at 61.1 €/MWh, however, due to undersubscription of the Auction capacities, the ceiling price was increased to 75.27 €/MWh in 2024. There were no awarded wind projects in Croatia's 2024 wind auction. Additionally, Romania has set its maximum strike prices at 93 €/MWh.

Table 3. Regional maximum strike prices (ceiling prices) for wind auctions

Country	Capacity auctioned	Auction result for wind (nominal)	Ceiling price for wind (nominal)	Comments	Sources
Albania 2023	Target: 100 MW	€44.88 - €74.95/MWh	75 €/MWh	No inflation indexation is applied to strike prices. Outcome: 222.5 MW (support and merchant capacities)	Balkan Green Energy News EBRD MIE
Serbia 2023	Target: 400 MW for quota for wind, 50 MW quota for solar	€64.48 - €84/MWh	105 €/MWh	Inflation-indexed strike prices applied. Outcome: 400 MW of wind, only 11.6 MW of solar	Taiyang news Taiyang news MRE
Moldova 2025	Target: 105 MW for wind, 60 MW for solar.	*N/A*	77.88 €/MWh		MoE
Croatia 2024	Target: 150 MW for wind	*N/A*	75.27 €/MWh	Outcome: No wind capacity awarded. Wind power plants of 200 kW to 18 MW.	Balkan Green Energy News PV Magazine
Croatia 2022	Target: 300 MW for wind, 300 MW for solar, and 30 MW for other RE.	€60.38/MWh (awarded to two projects by Acciona, 78 MW)	61.1 €/MWh (460.91 HRK /MWh)	Auction is largely unsubscribed	PV Magazine Enerdata Ballkan Green Energy News
Romania 2024	Target: 5000 MW of solar and wind	*N/A*	93 €/MWh	PPA: 15-year CFD	PV Magazine

4.6.2 Results from European Wind Auctions

This chart in Figure 8 illustrates information gathered from Wind Power Monthly's Tender Watch presents the average bid prices (€/MWh) for wind energy auctions in various countries from 2017 to 2024. Prior to 2022, prices generally remained stable or declined, with the weighted average bid prices being 43.01 €/MWh in 2017 and 57.63 €/MWh in 2019. However, starting in 2022, there is a noticeable increase of average prices, with prices rising to 77.55 €/MWh in 2023 to 77.96 €/MWh in 2024. This upward trend reflects changing market conditions and increased costs in recent years.

ERO does not base the ceiling price assessment on results from onshore wind power auctions in Europe, due to differences in sites, auction specifications, and support mechanisms. However, this analysis serves as a basis on regional trends of onshore wind market auctions and their outcomes.

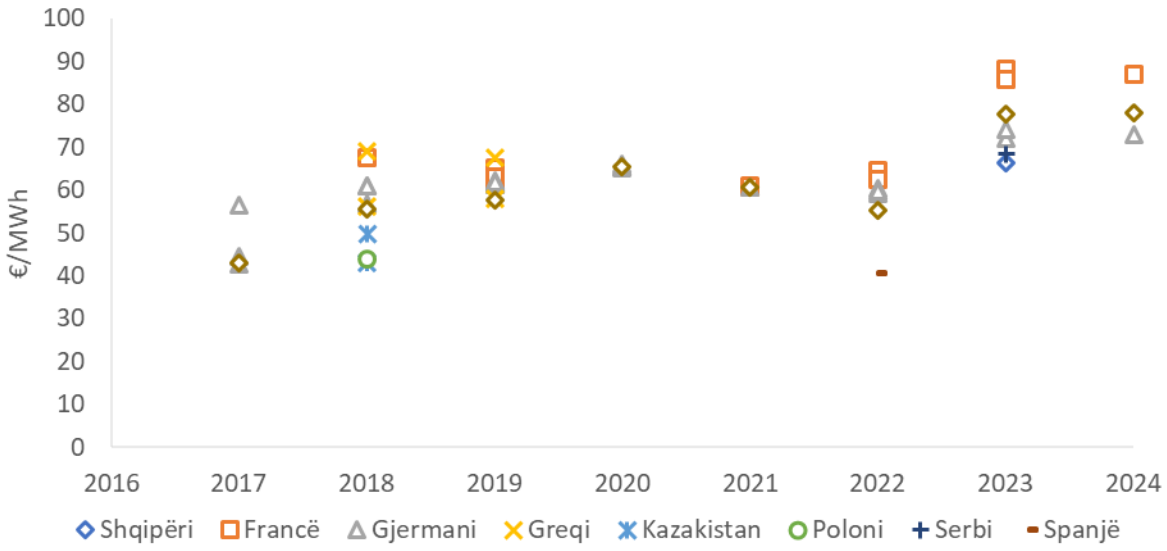

Figure 8. Average resulting bid price from onshore wind energy Auctions

5 Assessment of the Maximum Strike Price for the 75MW Wind Auction

Based on the evaluation of the Levelized Cost of Energy (LCOE), as well as the evaluation of the wind energy market, ERO considers that the maximum strike price should be set at the level of 78.5 €/MWh, in order to ensure sufficient interest and competition for the wind auction of 75 MW. Therefore, in line with Article 3 of the Methodology for Determining the Maximum Fixed Premium, the Maximum Strike Price and the Maximum Feed-in Tariff, only offers that exceed the Maximum Strike Price of €78.5 €/MWh are excluded from the competitive bidding process.