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 Feed-in Tariff and Maximum Strike Price for the 100 MW Solar 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 100 MW Solar Auction. The report does not represent a decision of ERO and shall not be interpreted as such.

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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 solar auction of 100 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.

This Consultation Report is compiled in accordance with the Methodology on Determination of Maximum Fixed Premium, Maximum Strike Price and Maximum Feed-in Tariff (the Methodology) and is intended to determine a price above which bids submitted to the auction will not be accepted or will be disqualified by the Commission established by the Ministry of Economy, while the lowest offers are considered economically favourable, therefore they will not be excluded from the bidding process. The methodology stipulates that, in setting the Maximum Strike Price, the Regulator will aim to set that price at a level that allows for sufficient competition within the competitive bidding process by ensuring that the capacity targeted at the auction can be contracted at a reasonable price.

This Consultation Paper provides ERO's proposal for the Maximum Strike Price for the 100 MW solar auction and is structured as follows:

- Chapter 2 explains the methodology for evaluating the Maximum Strike Price;
- Chapter 3 evaluates the parameters of input values on determination of the price;
- Chapter 4 provides the ERO's proposal for the price.

Comments of stakeholders

Consultation with interested parties is essential in drafting sustainable regulatory policies. ERO invites customers, 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 Report 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 Pristina, Kosovo,

The deadline for comments is 27 December 2023.

Following the review of 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 Report will be published along with the Final Report.

2 LCOE Methodology

The methodology for assessing the Maximum Strike Price for the 100 MW solar auction which is announced by the Ministry of Economy is based on the calculation of the Levelized Cost of Energy (LCOE) as well as market analysis of photovoltaic energy 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:

Maximum Incentivizing/Strike Price = LCOE

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

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

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

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

Where:

$LCOE$ - Levelized Cost of Electricity, to set the Maximum Feed-in Tariff / Maximum Strike Price;

C_t - Costs/expenditures in year t, (including but not limited to the expenditures mentioned in Article 6, paragraph 1 of this Methodology), conducted during the construction and during the Support Contract;

E_t - Electricity generated at the metering point in year t;

r - Depreciation rate (WACC);

n - Duration of the Support Contract set for the specific auction.

3 Evaluation of main parameters

3.1 General parameters

The general input parameters used in the Maximum Price analysis based on the methodology of the Levelized Cost of Energy are shown in Table 1, along with the source of the information.

.Table 1. General parameters considered in calculation.

Parameter	Considered values	Source
Capacity of photovoltaic system	100 MW	Auction tender
Duration of the power purchase contract	15 years	Auction tender
Production of electricity from PV System	1,212.9 – 1,340.6 kWh/kWp (+/- 5% of 1,276.78)	Measurements of USAID for 100 MW PV system in Kramovik
Degradation of production from photovoltaic system	0.5 %/year	Reported values
TOTAL CAPEX	659.7 – 779.1 €/kWp	IRENA
Weighted Average Cost of Capital (MPKK), real post-tax	7.69 %	ERO – V_1634_2022[1]

The capacity of the photovoltaic system (100 MW), as well as the duration of the contract for the purchase of energy (15 years) are based on the specific data of the analysed photovoltaic auction.

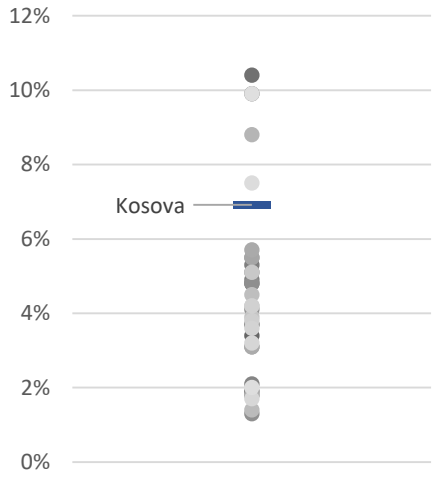
Based on analysis by USAID, the 100 MW photovoltaic system in Kramovik can produce energy on average of 1,276 kWh/kWp net per year. However, because the production capacity of the photovoltaic system has a great impact on the evaluation of the Levelized Cost of Energy, the Regulator has also analysed other photovoltaic systems connected to the transmission system in Kosovo. Based on the results, the production of a photovoltaic system in Kosovo in the past has varied between 1,170 kWh/kWp and 1,608 kWh/kWp. Based on the analysis of USAID and other energy production systems from solar technology, the Regulator will take into account the energy production of 1,276 kWh/kWp for the photovoltaic system in Kramovik, while the variation of investment costs will be used in the construction of the minimum limit and maximum LCOE.

Based on expert reports and analysis, they estimate that on average production from photovoltaic systems (specifically photovoltaic modules) decreases by 0.5% per year, due to the degradation of photovoltaic modules[2]. This value is considered in the analysis.

[1] https://www.ero-ks.org/zrre/sites/default/files/Publikimet/Vendimet/Vendimet%202022/V_1634_2022.pdf

[2] Atia, D.M., Hassan, A.A., El-Madany, H.T. *et al.* Degradation and energy performance evaluation of mono-crystalline photovoltaic modules in Egypt. *Sci Rep* **13**, 13066 (2023). https://doi.org/10.1038/s41598-023-40168-8

Figure 1. Reported WACC in European countries for photovoltaic systems, pre-tax



The Weighted Average Cost of Capital (WACC), or WACC, is an important component of LCOE analysis. ERO has conducted the evaluation of WACC during the year 2022 for the energy sector in Kosovo. ERO considers that the circumstances of an investor, who after winning the auction is guaranteed the sale of energy, do not differ significantly from the circumstances analysed in the ERO Consultation Report. ERO has also analysed the reported levels of WACC for European countries, based on data collected by IRENA (Figure 1)[3]. It should be noted that for comparison with WACC reported by IRENA, the considered WACC has been converted from real post-tax WACC to real pre-tax WACC. The IRENA database also includes energy projects for which there is no sale agreement with a guaranteed price.

3.2 Capital costs (CAPEX)

Capital costs include all costs of installing the photovoltaic system from an investor's perspective. The main components of CAPEX are photovoltaic modules, inverters, construction and installation, connection to the transmission grid (including substation), DC cables, costs for occupational safety, monitoring, electrical and mechanical installations, inspection as well as system design.

For the analysis of capital costs (CAPEX), the report prepared by IRENA on Renewable Energy Generation Costs for 2022, published in August 2023[4] , was taken as the main basis. IRENA's report contains detailed costs for each component of CAPEX for different countries of Europe. The data for Europe have been adjusted from 2022 to 2023, taking into account inflation (based on the HICP indicator).

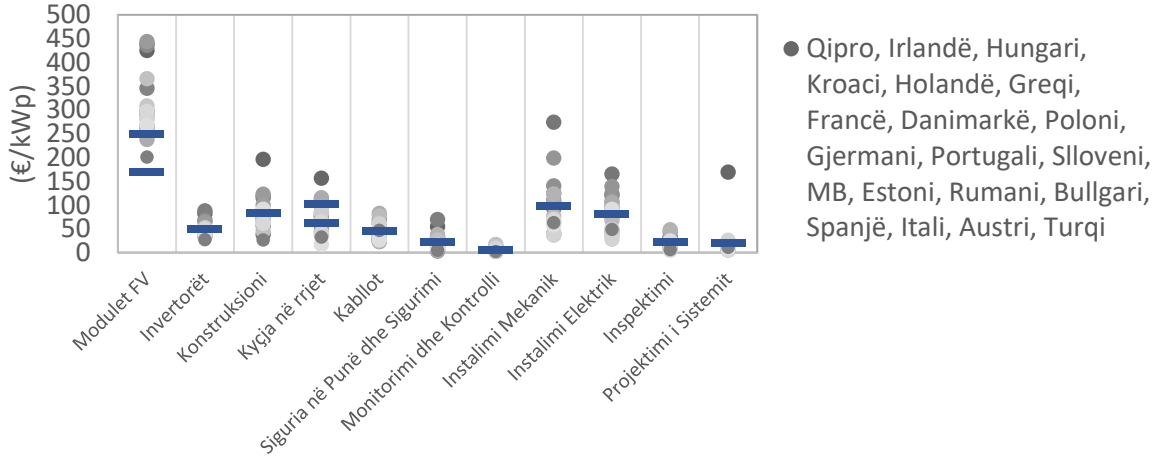
The components for which there are more detailed and more approximate data to the context in Kosovo in 2023 and the auction in question, have been changed from the average values from the IRENA Report. Table 2 presents the relevant values obtained and the limits used in the calculation of LCOE, as well as the source of the data. Figure 2 presents these values in relation to the values reported by IRENA.

[3] https://www.irena.org/Publications/2023/Aug/Renewable-Power-Generation-Costs-in-2022
[4] https://www.irena.org/Publications/2023/Aug/Renewable-Power-Generation-Costs-in-2022

Table 2. Summary of Capital Costs (CAPEX) of photovoltaic system

Parameter	Considered values (€/kWp)	Source
Photovoltaic modules	170.0 – 250.0	Minimum value (170 €/kWp) – Index of PV panels prices in November 2023. Maximum value – (250 €/kWp) Average of the index of PV panels prices in 2023.[5]
Inverters	49.1	Average from IRENA for European countries
Construction	83.1	Average from IRENA for European countries
Connection to the gird (includes the construction of the substation and connection to the transmission grid)	64.6 – 104.0	Based on the Technical Analysis of connection from KOSTT and other costs per unit by ACER[6].
Cables	46.0	Average FROM IRENA for European countries
Safety at work and insurance	23.1	Average FROM IRENA for European countries
Monitoring and control	6.9	Average FROM IRENA for European countries
Mechanical installation	98.5	Average FROM IRENA for European countries
Electrical installation	82.4	Average FROM IRENA for European countries
Inspection	22.6	Average FROM IRENA for European countries
System projection	13.4	Average FROM IRENA for European countries
TOTAL CAPEX	659.7 – 779.1	

Figure 2. Comparison of considered CAPEX values with the CAPEX values of European countries, reported by IRENA for 2022



[5] https://www.pvxchange.com/Price-Index
[6] https://www.acer.europa.eu/Publications/UIC_report_2023.pdf

3.3 Operational costs (OPEX)

The operating costs can be divided into fixed and variable operating costs. For photovoltaic systems, most of the operating costs are fixed. The only variable costs identified are the costs for the use of the transmission, which are summarized in the approved tariffs for the Transmission Use of Network (2023), based on the decision of V_1712_2023[7]. These include the System Operator Tariff and the Market Operator Tariff. In total, variable operating costs are €2,053/MWh.

Fixed Operating Costs include technical operation costs, system insurance, preventive and corrective maintenance, operation, land clearing, system security, panel cleaning and plot rental costs. Based on the IRENA report, the average operating costs for photovoltaic systems in Europe are $8.4/kW/year in 2022. After currency conversion and adjustment for inflation in Europe, this value is around €8.13/kW/year. The portion of the plot rent that the investor will pay is also added to this value. In total, fixed operating costs are €9.57/kW/year.

The considered operating costs are summarized in Table 3.

Table 3. Summary of operating costs (OPEX) of the photovoltaic system

Parameter	Considered values	Source
OPEX Variable	2.053 €/MWh	Approved tariffs for the Transmission Use of System (2023)
OPEX Fixed	9,571 €/MW/year	Average from IRENA for European countries and rental costs for the plot

3.4 Summary of main parameters and results of the Levelized Cost of Energy Analysis (LCOE)

Main parameters are summarized in Table 4. The calculation of the LCOE for the photovoltaic system 100 MW is conducted by analysing borderline cases, where LCOE has the minimum and maximum value.

Table 4. Summary of parameters for calculation of LCOE.

Parameter	Considered values
Capacity of photovoltaic system	100 MW
Duration of the power purchase contract	15 years
Production of electricity from PV system	1,276 kWh/kWp/year
Degradation of production from photovoltaic system	0.5 %/year
Depreciation rate (WACC)	7.69 %
CAPEX	659.7 – 779.1 €/kWp
OPEX Variable	2.05 €/MWh
OPEX Fixed	9,571 €/MW/year

[7] https://www.ero-ks.org/zrre/sites/default/files/Publikimet/Vendimet/Vendimet%202023/V_1712_2023.pdf

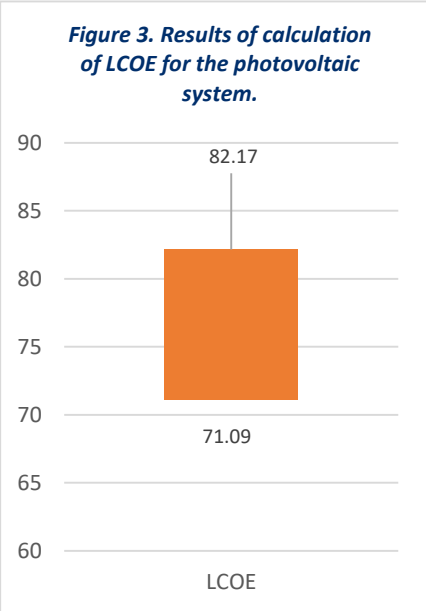


Figure 3. Results of calculation of LCOE for the photovoltaic system.

Figure 3 presents the results of the calculation of the levelized cost of energy. The minimum result that resulted is 71.09 €/MWh, while the maximum result is 82.17 €/MWh.

ERO considers that the analysed parameters and subsequent results are to a significant extent close to the parameters and results that are in the field.

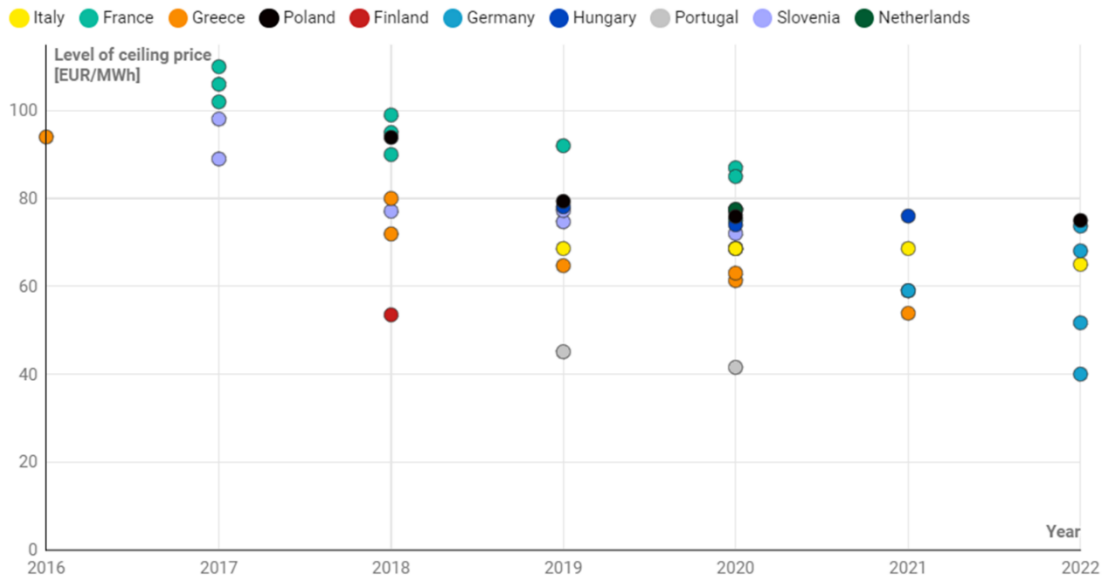
ERO in this report also analyses the results from similar auctions in Europe and solar energy prices in European markets. ERO also considers that the maximum price should be set at a level that does not limit competition in the solar auction, but also does not provide excessive profits in case of low competition.

3.5 Results from similar auctions in Europe and the region

The maximum prices obtained from similar photovoltaic auctions in Europe are summarized by the AURES II project [8]. Figure 4 summarizes these data over the years. It can be seen from the figure that during the last years there has been a decrease in the maximum prices in the auctions organized in Europe.

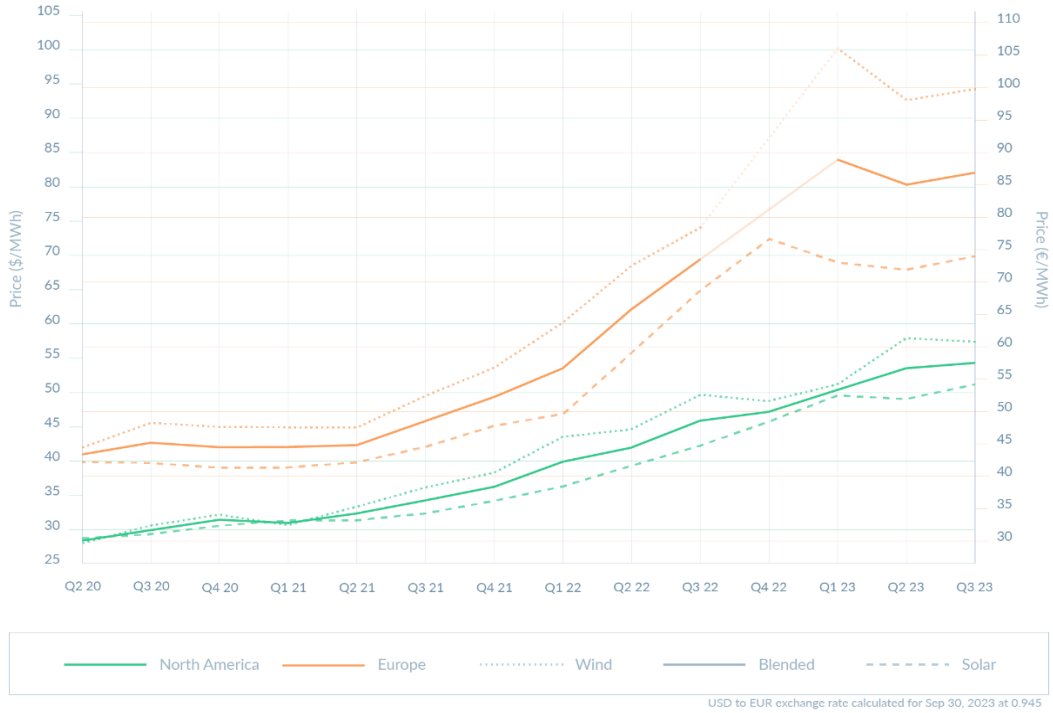
[8] http://aures2project.eu/

Figure 3. Maximum prices of auctions reported by AURES II.



Based on the 2023 auctions, it is noticed that there is an increase in the maximum price, as well as in the winning prices. Also, based on the auction in Poland, a lower interest from investors in participating in auctions is noticed. One of the reasons is the increase in the prices of solar energy purchase agreements in the free market, due to the energy crisis. In Figure 5, it is seen that during the year 2023, these prices have reached the value of €75/MWh.

Figure 4. Prices of power purchase agreements from photovoltaic systems in the market.



4 Evaluation of the Maximum Feed-in Tariff and Maximum Strike Price for the solar photovoltaic auction 100 MW

Based on the evaluation of the Levelized Cost of Energy (LCOE), as well as the evaluation of the photovoltaic energy market, ERO considers that the maximum price should be set at the level of 75 €/MWh, in order to ensure sufficient interest and competition for the 100 MW solar auction. Therefore, in accordance with Article 3 of the Methodology on Determination of Maximum Fixed Premium, Maximum Strike Price and Maximum Feed-in Tariff, only offers that exceed the Maximum Strike Price of €75/MWh are excluded from the competitive bidding process.