IMPACT OF CURRENT MARKET DISTORTIONS IN COMMODITY AND ENERGY MARKETS ON LEVELIZED COSTS OF ELECTRICITY OF PV IN AUSTRIA

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Overview

In the last years, levelized costs of electricity (LCOEs) for PV systems have decreased significantly. However, due to current global market turmoil, an investment cost increase in PV system components, but also an increase in wholesale and consumer electricity prices (enhancing profitability of self-consumption) could be observed. This has lead to an upwards trend concerning LCOEs of PV. In order to guarantee the broad deployment and expansion of renewable electricity generation technologies to achieve energy policy goals and tackle climate change, this circumstance must also be considered in support for renewables. In Austria, for example, operational support (provided in the form of auctioned market premiums[1]) is being increased in order to cushion current market developments and to push the large-scale expansion of renewables. Thus, this study aims to calculate current LCOEs of PV that take into account present cost increases in order to determine adequate operational support for PV systems. For this, historical PV system costs are collected and statistically analyzed, as well as compared with current cost increases in order to determine LCOEs and, based on these, a ceiling price for bids under the auction scheme for providing operational support in Austria.

Methods

To calculate LCOEs, total investment costs, operational costs as well as financing terms must be set. The following Table 1 shows the inputs to the LCOE calculation of PV for each segment.

Table 1: Input parameters for the levelized costs of electricity calculation for PV

Investment costs	Operational costs	Financing terms
• PV system costs (modules, inverter, substructure, cabling, assembly, installation, lightning protection, overvoltage protection, measurement technology and the commissioning) • Initial grid connection costs • Costs for planning and project execution	• Personnel expenses • Operational management • Maintenance/servicing • Insurance • Other OPEX such as lease, • Running grid costs for feeders • Any imbalance settlement expenses (depending on the marketing model) • Revenues from guarantees of origin (depending on the marketing model)	• Interest rate • Inflation • Period under consideration

The LCOEs are calculated according to Equation 1, whereas I_0 are the investment costs, A_t are the total costs in year t, M_{el} is the electricity generation in year t, i is the interest rate (here the weighted average cost of capital WACC), n the period under consideration and t the specific year of consideration.

$$LCOE = \frac{I_0 + \sum_{t=1}^{n} \frac{A_t}{(1+i)^t}}{\sum_{t=1}^{n} \frac{M_{el}}{(1+i)^t}} \quad (1)$$

A detailed data collection for PV systems in Austria, installed between 2018 and beginning of 2021, is conducted to define the input parameters for the calculations [1]. For the evaluation of the data, these were statistically analyzed. In order to avoid a distortion of the mean value by strongly deviating and not verifiable data points, the statistical value of the truncated mean was applied.

[1] Starting in 2022, operational support for renewable electricity plants in Austria will be awarded predominantely on the basis of auctions for market premiums. In this context, electricity from subsidized plants must be marketed directly e.g. via power exchanges, with the subsidy provider granting a sliding market premium in addition to these electricity market revenues in order to ensure a certain total revenue and thus the economic operation of renewable electricity plants.

As a further step, current effects (market distortions in commodity and energy markets) need to be considered and and are to be compared with the historical cost data. For this, the currently noticeable investment cost increase as well as rising electricity prices are quantified. Table 2 shows the PV investment cost increase for beginning of 2022 derived from PV module price increases, construction cost increases and rising wages for labor.

Table 2: PV investment cost increase

Detailed components of PV investment costs	Cost share	Cost increase beginning 2022 (compared to beginning 2021)
PV modules	40% [2]	26% [3]
Inverter	13% [2]	0%[2] [4]
Grid connection/commissioning	12% [2]	8% [5][3]
Installation	25% [2]	15% [5]
Planning and project execution costs	6% [2]	3% [6]
Approvals, subsidy submissions, tenders	4% [2]	3% [6]
TOTAL COST INCREASE for PV systems in Austria	15%	

For the electricity price increase for the entire period under consideration (20 years forward-looking), an average increase of 48% in comparison to previous trend expectations is assumed [7].

Results

The average LCOEs of PV across all capacity sizes show a significant upwards trend due to rising investment costs, but also experience a rather high damping effect if self-consumption of the electricity, especially with high consumer prices, is considered. The LCOEs for a 20 year period, with consideration of self-consumption, increase from 82.1 to 88.9 €/MWh, which constitutes a rise by approximately 8.2%.

For the recommendation of a ceiling price for bids under the auction scheme related to operational support (as sliding market premiums), a markup on the averaged LCOEs for PV is set. A markup of 5% for the determination of the recommendation for a ceiling prices in the auction scheme seems to adequately reflect cost uncertainties. These result from expenses for imbalance settlement, possible lower self-consumption of PV electricity, additional risks such as higher financing and administrative costs under the new auction scheme (in comparison to the former administratively set feed-in tariff sceme). Accordingly, a ceiling price of 93.3 €/MWh is recommended for PV in Austria.

Conclusions

The current market dislocations are expected to lead to significantly increasing LCOEs of PV over the next few years. Notable cost increases and thus also increases in the LCOEs are already apparent at present. In order to guarantee the broad expansion of renewable energies, subsidy regimes must be adapted accordingly, as is presented in this study for the Austrian case. Regulators and policy maker in other countries can also draw conclusions from this analysis and its method for increasing LCOEs with regard to necessary subsidy adjustments for renewables. As final remark we want to stress that identified cost increases of renewables do not imply a decline in their commercial viability because their fossil competitors like gas and coal have been facing even higher cost increases recently.

References

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[2] No cost increases could be identified for inverters. This can possibly be explained by the increasing power density of inverters.

[3] The total construction cost index of 15% is reduced by constant flat-rate network access charges.