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**REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND
THE COUNCIL**

**on the performance of support for electricity from renewable sources granted by means
of tendering procedures in the Union**

1. Introduction

The transition towards a climate-neutral economy will require accelerated deployment of renewable power generation at distributed level as well as for utility-scale projects. This should be increasingly market-based due to the decreasing trend in costs of renewable technologies, but so far the majority of projects¹ have enjoyed some kind of public support. Support schemes can take various forms, structured in two main categories – investment support (such as investment grants, discount on loans or rebates) and operational support (such as certificate schemes, tariffs or premiums). Across the EU, operational support is more widely applied, allocated in the case of utility-scale projects most often on a market basis through competitive tendering procedures (referred to in this report as tenders or auctions).

The role of the tender-based support schemes for renewable energy and their principles are recognised in Article 4 of Directive (EU) 2018/2001 (‘Renewable Energy Directive’). In addition, the State aid rules² also prioritise competitive bidding processes such as tenders as the appropriate mechanism to allocate support to renewable energy producers.

In order to understand the impact of tendering support schemes from a broader perspective, Article 4(8) of the Renewable Energy Directive mandates the Commission to report to the European Parliament and to the Council on how these support schemes are performing, measured against seven performance dimensions, namely: (i) achieve cost reduction; (ii) achieve technological improvement; (iii) achieve high realisation rates; (iv) provide non-discriminatory participation of small actors, where applicable local authorities; (v) limit environmental impact; (vi) ensure local acceptability; (vii) ensure security of supply and grid integration.

In this context, the report analyses how tendering procedures, as one of the forms of public support, are fostering the deployment of renewables as part of the wider transition of the energy system. Consequently, the focus of the report is the comparison between tenders and support schemes which are not tender-based, rather than a comparison between different tender design options. In addition, the report provides insights into how the tendering procedures may evolve in the future to address the current energy policy context, the state of play of the energy markets and the latest challenges for the market integration of renewables.

The conclusions of the report should be seen in the context of the European Green Deal implementation as well as the REPowerEU plan, which rely on accelerated large-scale deployment of renewable energy as a key driver for the decarbonisation of the economy and the electricity sector.

2. Methodology

The methodological basis for the report is structured around the seven elements referred to in Article 4(8) of the Renewable Energy Directive, against which the Commission shall measure the performance of the tendering support schemes. These seven ‘performance dimensions’

¹ In 2018, 62% of the renewable electricity produced received support, according to CEER Report “Status Review of Renewable Support Schemes in Europe for 2018 and 2019”, 28 June 2021.

² Guidelines on State aid for environmental protection and energy 2014-2020 (2014/C 200/01) and the Guidelines on State aid for climate, environmental protection and energy 2022 (2022/C 80/01).

are first translated into specific indicators that measure the concrete effects of applying the tendering procedure³.

The next methodological step is to compare the performance of the tendering procedure with a counterfactual, in order to estimate the difference between scenarios with and without the tendering procedure in place. The report uses the following methods to estimate the effects:

The first type of counterfactual – ‘within country comparison’ – is used for those countries where there is available data on the indicator before and after the introduction of the tendering procedure. This is the most useful method to identify short-term effects, notably when comparing the period before the tendering scheme was introduced and the first period on which the tendering scheme had effect. This comparison potentially excludes other external factors that might affect the analysed indicator.

The second type of counterfactual – the cross-country comparison – compares the situation in a country with a benchmark country that is similar. In this case, the before-and-after difference of the analysed country is compared to a benchmark performance in another country, which did not introduce tendering support schemes in the same period, and the difference of the two performances will provide an estimation of the effect of the tendering schemes.

The analysis in this report relies on four main information sources: (i) the AURES II auction database⁴ which includes information on auctions (dates, rounds, technology, rules, awarded capacities, prices, etc.); (ii) publicly available data on the auctioneers’ websites (mostly national regulatory agencies); (iii) publicly available reports and publications; (iv) data submission of the auctioneers which replied to data requests from the Commission. The data availability is the reason for including or not including specific Member States in the comparisons and the calculations in the report.

The report conducts quantitative analysis to measure the effect on performance dimensions wherever this was possible. This is the case for the performance dimensions (i) to (iv). A qualitative analysis using case studies was performed for dimensions (v) to (vii) to present the relevant practices in the Member States in the case where comparisons cannot be designed (due to distortive factors or lack of data).

The Commission organised a workshop on 22 April 2022 where stakeholders had the opportunity to comment on the findings of a draft study that served as a basis for the preparation of the present report⁵. Representatives of auctioneers and regulators from Member States and independent experts in the field of renewable electricity and auctions participated.

³ When analysing the effects of the tenders under the specific indicator, special attention is paid to disqualify, as much as possible, external factors unrelated to the support scheme, which might directly or indirectly affect the indicator. Examples of such factors are sectoral regulation, technological development and macro-economic trends.

⁴ AURES database, available at: <http://aures2project.eu/auction-database/>.

⁵ “Study on the performance of support for electricity from renewable sources granted by means of tendering procedures in the Union” [DOI 10.2833/93256; ISBN 978-92-76-58625-8], prepared by MRC Consultants and Transaction Advisers and REKK Energiapiaci Tanacsado Kft. The study is contracted by the European Commission

3. Assessment of the dimensions

3.1. Cost reduction

The performance dimension “achieve cost reduction” pursuant to Article 4(8)(a) of the Renewable Energy Directive is interpreted in this report as the reduction of the amount of support cost to renewable energy installations from a public budget point of view, thus reducing the burden on consumers and taxpayers. The indicator to measure the support cost reduction is the unit electricity price paid to renewables producers for a MWh, defined as the price paid from the tender budget to the producer for every unit of electricity.

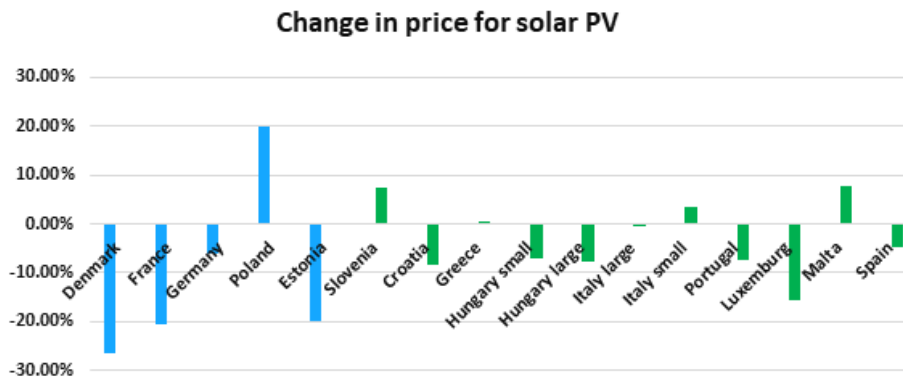
Before tenders were widely introduced, the most common support scheme was the feed-in tariff, which offered guaranteed prices for renewable energy producers, usually set by the government or the regulator. They were effective as a tool to increase the deployment of renewables, but not necessarily efficient from a budgetary point of view. Subsidy rates were based on cost estimates and the information asymmetry between project developers and those responsible for determining prices and quantities was in some cases significant. The financing of the feed-in tariffs through levies on all (or a specific subsection) of electricity demand led to a financial burden for many electricity consumers. As a result, the approach of feed-in tariffs for large-scale projects was discussed and challenged.

Governments switched to competitive bidding procedures to determine the necessary level of support, to reveal the real cost of projects, and thus to allocate the lowest possible subsidy for an energy unit. With this approach, multiple sellers are able to offer bids in the tender, as long as they meet all of the tender specifications. The level of competition is crucial when assessing the impact on cost reduction. When the number of participants is low, the competitive pressure is too weak to induce bidders to optimise each segment of the project development value chain and the resulting bid prices do not reveal the real cost of projects.

Solar PV

The following figure shows the percentage change in prices achieved as a result of introducing auctions. For the countries marked in blue, the change in price is calculated as the difference between the support price paid from the budget to producers (as €/MWh) in the last year of the administratively set tariff and the support price paid in the first year of implementation of tenders. For the countries in green⁶, a cross-country comparison is made between the relative price decrease of the same period compared to a benchmark – the administratively set tariff in Austria for the period of 2012-2019. Austria is used as a benchmark because it is the only EU country that implemented administratively set tariff for a sufficiently long period, making the set of values of the tariff reliable for a robust comparison to take place.

⁶ For Hungary and Italy, the table includes auctions which targeted different size of solar PV projects.



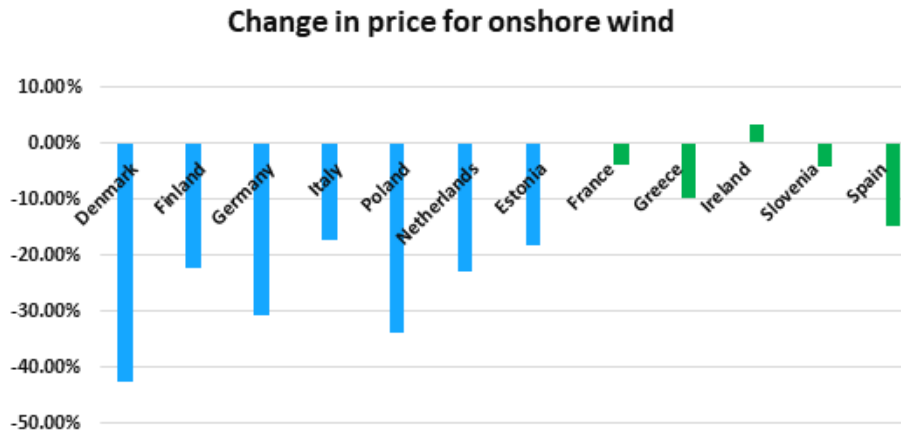
Source of data: Aures II auction database

Figure 1: Cross-EU comparison of change of support costs for solar PV.

The average change in price, i.e. the change in total support costs is calculated at -4.73% . As a general conclusion, in most countries the introduction of tenders resulted in lower unit electricity prices, thus lower support costs and less burden on consumers or State budget for PV technology. The exceptions are Italy (small-scale PV auction), Greece, Malta, Poland and Slovenia. For these countries, the increase in prices can be explained by external factors. In Slovenia, under the feed-in tariff system prior to the tender, the prices that were set by the administration were reduced at a very fast pace, reaching a level too low for the producers. In Poland, a green certificate system was in place, where a significant oversupply occurred in 2015 (just before the introduction of auctions) drastically lowering prices that year. The increase of support costs for small PV technology in Italy is explained by the fact that historically this technology is better promoted through administrative support schemes due to the less informed project developers, in particular before 2019. In Greece, the level of competition was not very high (only slight oversubscription) in the first tender, which may have resulted in similar outcomes to feed-in tariff prices. Similar external factors were not identified for the main group of countries where a decrease of the prices is observed.

Onshore wind

An identical analysis is performed also for onshore wind tender. The results show that in the case of all the countries considered in the analysis, except for Ireland, the introduction of the tender scheme led to a decrease in the support prices paid for this technology, leading to an average reduction of the support costs at -14.02% . In Ireland the first auction round was undersubscribed which may be the main reason behind the increase in prices.



Source of data: Aures II auction database

Figure 2: Cross-EU comparison of change of support costs for onshore wind in the period 2010 – 2020.

Offshore wind

With the exception of Denmark and the Netherlands, tenders for the support of offshore wind installations are more recent and have only been implemented in a limited number of countries. In some of them the timespan between the tender and the old support scheme is significant (9 years in France and 5 years in Germany), which does not allow for robust comparison. Nevertheless, the shift in support costs in France and Germany is noticeable, with a reduction from 115,5 €/MWh and 140,3 €/MWh paid through administrative determined support level to 60 €/MWh and 46,6 €/MWh in the first tender, respectively. In other countries there are examples of extreme reduction of the support costs through zero or negative bids. Lithuania’s new offshore wind tender model, as well as the last Dutch tender for two sites at Hollandse Kust West allow for negative bidding. The winner of Denmark’s last offshore wind tender is paying the government €375 million to develop a 1 GW wind farm. In all these cases however there was a scarcity in terms of limited geographical locations or grid connection, as well as public support for connection and infrastructure costs in some cases, which incentivised the project developers to lower their bid.

Impact of the tender design on cost reduction

Even though the objective of the report is not to analyse the different design options of tenders, but rather to look at tender-based support for renewables in general, it is worth mentioning the effect of the choice of a tender type on the indicator of cost reduction in case of high volatility of market prices.

In the EU, three main types of tendering support schemes are implemented: one-sided sliding premium, two-sided sliding premium (referred to as ‘contract for difference’) and fixed premium⁷.

⁷ In the one-sided premium system, if market price is below auction strike price, producers receive support that covers the gap, and if market price is higher, they can keep the excess revenue. The two-sided premium operates in a similar fashion, however excess revenue must be paid back by the producer. In the fixed premium scheme, producers receive a fixed amount of excess revenue on top of the market price.

In case of unexpected drop in the electricity market price, from the point of view of cost reduction, the fixed premium scheme performs the best. Under such scheme, all the risk associated with low prices is borne by producers, thus it does not generate excess burden on consumers or on the budget. In sliding premium schemes, support costs may rise drastically as the drop in price needs to be covered. This risk however can be mitigated if the total amount of paid support is capped by the auctioneer.

If prices become unexpectedly high, contract for difference performs the best, because its pay-back obligation avoids excess revenues for a project that has received public support. It also generates revenue for the state. The role of contracts for difference as an instrument to capture the infra-marginal rents in periods of high prices is already reflected in the REPowerEU Communication.⁸ In the one-sided scheme, there is no excess support burden for the budget, but excess revenue for the project is generated. For the fixed premium, no additional support costs occur, though over-subsidisation can occur, which is not an optimal allocation of resources. This effect can be mitigated, however, by introducing a price cap in a fixed premium scheme, above which there are no supports paid.

Conclusions for Dimension 1: Cost reduction

- Tendering procedures provide the necessary framework to deploy electricity from renewable sources at the lowest possible cost, as data indicates that in most of the cases the cost-reduction has been a result of the implementation of a tender-based scheme for all investigated technologies.
- For both solar PV and onshore wind, evidence shows that if competition in the auction is high (i.e. reaching an oversubscription level of more than 1.5), then reduction of support costs tends to be higher than for those auctions where competition is less intense. In other words, tendering procedures achieve cost reductions if they generate a sufficient level of competition.

3.2. Technological improvement

The performance dimension “achieve technological improvement” pursuant to Article 4(8)(b) of the Renewable Energy Directive is interpreted in this report as the reduction of the cost for production of renewable energy, following the development of renewable energy technologies.

The indicator to measure the achieved technological improvement is the levelised cost of electricity.⁹ This indicator is suitable as it incorporates the direct cost reduction through capital expenditure (CAPEX) and the operational expenditure (OPEX), which results from the improvement of the renewable energy technologies. Nevertheless, LCOE decreased significantly between 2010 and 2020, especially in the case of PV technology, as a result of the global technology development, not necessarily linked to the introduction of tenders, but rather due to other factors such as spill-over effects, innovation, increased demand for

⁸ REPowerEU: Joint European Action for more affordable, secure and sustainable energy, COM(2022) 108 final, 8.3.2022.

⁹ The LCOE is the average net present cost of electricity generation for a generating plant over its lifetime, incorporating the sum of all investment, operational and maintenance cost over its lifetime divided by the total electrical energy produced over the lifetime. The value is discounted with WACC (weighted average cost of capital) in order to receive the present value.

renewable energy as part of public support measures, improved financing conditions such as the weighted average cost of capital etc.¹⁰ In order to account for these external factors, the LCOE evolution in the analysed countries is compared with the performance in a benchmark country without tender-based support scheme, as well as to the global performance for the technology.

Onshore wind

The following table summarizes the average yearly change of LCOE. In the column ‘In the country’, the value shows the comparison between the LCOE value before and after the first tender has been organized, where 3–5-year long periods are considered.

In addition to the difference of the LCOE within the countries, and in order to consider other cost-determining factors that are independent from the applied support scheme, comparisons are presented with two benchmarks: Sweden and the global average. Sweden did not apply tendering schemes, yet managed to reach large capacity additions for onshore wind through a competitive green certificate scheme. The global average values cover all installations regardless of the regulatory environment, location, or investors’ experience, including the analysed countries. Although global average is clearly not a counterfactual as it contains both auctioneer and non-auctioneer countries, it can serve as a suitable benchmark because if tenders fostered technological development, the auctioneer countries’ performance would be better than the average performance.

Countries	Year of first auction	Difference in average change rate of LCOE (before and during auctions)			Comparison	
		In the country	In Sweden	Globally	To Sweden	To global average
Italy	2012	-5.5%	-3.7%	2.0%	-1.8%	-7.5%
Spain	2016	-2.7%	-5.7%	-5.5%	2.9%	2.7%
Germany	2017	-7.4%	-7.0%	-7.5%	-0.5%	0.1%
Denmark	2018	3.9%	0.0%	-5.6%	3.9%	9.5%
France	2018	-12.1%	0.0%	-5.6%	-12.1%	-6.5%
Average	-	-4.8%	-3.3%	-4.4%	-1.5%	-0.4%

Source of data: IRENA (2021)

Figure 3: Comparisons of average change of LCOE for onshore wind

The data shows that the average LCOE decrease in the analysed auctioneer countries (-4.8%) is higher than the benchmarks of Sweden and globally (-3.3%, -4.4%), therefore the tendering schemes slightly outperformed the benchmarks (in average). Nevertheless, LCOE values in

¹⁰ According to IRENA (IRENA, *Renewable Power Generation Costs for 2020*, IRENA, Abu Dhabi, 2021, <https://www.irena.org/publications/2021/Jun/Renewable-Power-Costs-in-2020>), the cost of PV diminished by 83% over this period globally (yearly average 16% reduction), while the cost of onshore wind dropped by 47% (6% average annual reduction).

Sweden and also globally decrease at similarly fast pace, which means that the technological development is improved also independently from a tender-based support scheme.

In addition, the country-level effects are diverse. The auction schemes outperformed both the Swedish green certificate system and the global average in Italy and France, underperformed in Spain and Denmark, while the German system reached similar achievements as the benchmarks. Without prejudice to other factors, the most plausible explanation is that auction schemes can contribute to significant cost reductions if costs are at a higher level at the moment of the introduction of the tender, while they are less effective in the case of more mature and efficient technologies.

Solar PV

The following table, in the column ‘In the country’, summarizes the average change rate of LCOE for solar PV before and after the auctions were introduced for few countries, however the analysis is less robust than for onshore wind because of lack of data for specific years.¹¹

The country-level results are highly diverse for the three countries, culminating in a close-to-zero average difference. The table suggests that the difference between the observed cost reductions before and during the auction schemes is largely a function of the time of the introduction: the earlier the introduction of auctions took place, the higher the potential of the tender is to contribute to LCOE reduction. However, this may be associated with general cost development patterns, namely the cost of the technology decreased faster in the period between 2012 and 2015 than before or after in all four countries.

The cost development pattern of the analysed countries is compared to two benchmarks – to the global average and to a country-level example where LCOE values are available and no solar PV tender was held. Such a country-level example does not exist in the EU, therefore a third country with comparable technological progress in renewables was selected. For reasons of data availability, the most relevant example as a benchmark is the Republic of Korea.

Countries	Year of first auction	Difference in average change rate of LCOE (before and during auctions)			Comparison (difference-in-differences)	
		In the country	In Korea	Globally	To Korea	To global average
France	2012	-16.8%	8.1%	-3.8%	-24.9%	-13.0%
Germany	2015	5.1%	5.8%	2.8%	-0.7%	2.2%
Italy	2019	8.5%	1.9%	4.9%	6.7%	3.6%
Average	-	-1.1%	5.3%	1.3%	-6.3%	-2.4%

Source of data: IRENA (2021)

Figure 4: Comparisons of average change of LCOE for PV

¹¹ IRENA (2021) database starts at 2010 for PV and does not contain data for 2012 for France, when the first auction was held in the country. For Spain, LCOE data is not available for 2016, 2017 and 2018, while the auctions started in 2017, therefore only the pre- and post-auction price levels can be compared, but not the decreasing rates.

The analysis shows that the direction of the effects does not change, only their magnitude. The cost development in Korea was highly different compared to Italy and France (and similar to Germany), making the country-level results even more diverse. The average value suggests that the tender-based scheme outperformed the Korean benchmark (6% faster cost reduction). In contrast, the global cost development was similar to the European result but shows smaller (closer to zero) differences between the periods before and during auction. This leads to the conclusion that global cost trends can partially explain the observed differences, but not entirely. On average, the tendering procedures' performance was slightly better (faster cost reduction) than the global average, but this conclusion comes from the strong cost reduction in France. It is noteworthy that the global average development contains (i) also the analysed countries, and (ii) many other countries, where PV development started later, therefore higher cost reductions can be achieved. Moreover, due to the spill-over effect and other external factors, cost reductions achieved in auctioneer countries can lower costs in non-auctioneer countries as well.

Conclusions for Dimension 2: Technological improvement

- The LCOE development as a benchmark for technological improvement shows that tender-based support schemes may have an effect on the cost development, but other general and country-specific factors may have stronger influence. The maturity of the technology, the financing conditions, the overall global capacity deployment (and the associated learning and impacts on LCOE), as well as the country's position on the learning curve (capacity additions, investors' experience) play a crucial role in this regard and can be considered as stronger drivers for technological improvement.
- The LCOE of onshore wind technology decreased faster (on average) after the tenders were introduced. However, this conclusion is valid mainly for those countries where costs were high and stagnating before the introduction of tenders. Other types of market-based schemes can also effectively drive the cost down (e.g. the Swedish green certificate system).
- Currently, tenders in the EU are mostly centred around three technologies, solar PV, onshore wind, and offshore wind. For other technologies tenders are relatively rare, and only contribute to a limited extent toward technological improvement for these technologies.

3.3. High realisation rates

The performance dimension “achieve high realisation rates” pursuant to Article 4(8)(c) of the Renewable Energy Directive is interpreted in this report as the total volume of renewable energy capacity added after the introduction of tenders, compared to capacity volumes added before¹².

It is important to highlight that European countries operate many other types of supports schemes, such as investment grants, or net metering for household projects, meaning that capacity deployment is also possible even in the absence of operational support. In addition, there might be external factors that impact the pace of deployment, such as shift in the policy

¹² An interpretation of high realisation rates as a share of projects in a tender that are realized fully and on time would go beyond the scope of the report, because it depends on the features of the tender design (e.g. the penalty system, prequalification requirements etc.) and thus on the choice of tendering option that would require a comparison between them.

The following table compares the yearly average volume of new renewable capacity which is added in the selected countries in the periods before and after the tender. The first year corresponds to the date when projects awarded in the tender are expected to start operation. This is the realisation deadline of the first tender round, which divides the dataset into the pre-tender and post-tender periods. The table includes only support schemes associated with operational support of non-household size projects.

Country and technology	First year of completion of the tendered capacity	Average yearly capacity addition pre-tender period (MW)	Average yearly capacity addition post-tender period (MW)	Previous non-tender based operational support scheme	Change % (compared to last 3 non-tender years)
Denmark PV	2018	99.7	131.3	Feed-in premium	32%
Denmark Onshore Wind	2020	196.7	136.0	Feed-in premium	-31%
Finland Onshore Wind	2020	239.3	302.0	Feed-in tariff	26%
France PV	2014	1411.0	921.0	Feed-in tariff	-35%
Germany PV	2017	1323.0	3276.0	Feed-in tariff	148%
Germany Onshore Wind	2018	4549.0	1517.0	Feed-in tariff	-67%
Greece PV	2017	8.3	160.8	Feed-in tariff	1829%
Greece Onshore Wind	2019	242.7	622.0	Feed-in tariff	156%
Italy Onshore Wind	2015	594.7	105.2	Green certificate	-82%
Lithuania Onshore Wind	2015	25.6	37.2	Feed-in tariff	45%
Luxemburg PV	2020	12.7	35.0	Feed-in tariff	176%
Netherlands PV	2015	286.0	1534.3	Feed-in tariff	436%
Netherlands Onshore Wind	2016	320.7	223.4	Feed-in tariff	-30%
Poland PV	2019	151.3	1687.0	Green certificate	1015%
Slovenia PV	2018	9.7	6.7	Feed-in tariff	-31%
Spain PV	2020	1420.0	2812.0	None ¹³	98%
Spain Onshore Wind	2019	179.0	1859.5	None	939%

Source: own calculation based on IRENA (2021)

Figure 5: Comparison of yearly average new capacities in the pre- and post-tender period

In the table, 17 cases are presented of which 11 show positive change in the yearly new capacities. In many cases the magnitude of this growth is very large, which can be the result of two situations.

Firstly, there are countries in which the relevant technology was not present or not well established before the tendering period. In these cases, it can be argued that tender-based support scheme was the first real opportunity for producers to receive support and to start the wide scale deployment. This explanation mainly applies for PV, as the technology became mature later in Europe, thus implementation of tender design coincided with technological maturity. Two very good examples are Netherlands and Poland, both for PV, where before

¹³ In Spain a feed-in tariff was in place, but it was suspended so no new projects were allowed to be constructed within the scheme.

the tender scheme new capacity additions were low, and the tendering scheme accelerated technology development. In Germany and Luxembourg a similarly high increase in PV capacity can be observed, even with a higher pre-tender baseline value.

Secondly, there are some countries where capacity additions were very low in the years just before the introduction of tendering due to the country's regulation. In these countries it is clear that as long as support is provided, large capacity expansions are observable.

For the cases where the new capacities are reduced compared to the pre-tender period, there are several explanations. Firstly, if a technology can be considered mature in a country with already high operating capacities, natural reduction in the new added capacities is expected. In such cases grid availability issues may also incentivise auctioneers to reduce volumes offered to the auctions. Also, mainly for onshore wind technology, with a lot of capacities already installed in the country, deployment issues may occur with a lack of suitable locations, which can significantly limit capacity expansions. Lastly, an important consideration is that where feed-in tariffs provided very generous support for new projects, the deployment in the pre-tender scheme was faster. In these instances, lower tender-based remuneration may have provided less incentive for producers to build new renewable energy capacities.

In 2021, a drastic expansion of new renewable capacities based on power-purchase agreements (PPAs) is observed.¹⁴ This is partly due to the increasing maturity of the PPA market as well as the increasing electricity market prices, creating increased demand for PPAs from corporate offtakers. Furthermore, there is an interplay between the availability of public support schemes and the market for PPAs. For example, the cancellation of multi-technology tenders in Lithuania in 2020 and Denmark in 2021 due to low participation has resulted in the emergence of a number of PPA projects for deploying additional renewable capacity, suggesting that PPAs can be a more attractive and market-based alternative to public support schemes. The concrete impacts of the cancellation of support schemes on an increased PPA market cannot be confirmed by quantitative analysis as PPAs only start to develop in a small number of EU countries in the last couple of years, and very limited data is available on them.

Conclusions for Dimension 3: High realization rates

- Tenders contribute significantly to the capacity expansion of wind and solar projects, without prejudice to other external factors. Post auction period capacity expansion is larger than before tenders were introduced in many of the European schemes.
- Slower deployment mostly occurred in countries where at the time of the introduction of tenders, the relevant technology was already widely applied, but the rate of reduction is relatively small even in these cases.
- In some European countries such as Poland or the Netherlands, the introduction of auction directly resulted in the starting of large-scale deployment of a given renewable technology (in this case – solar PV).
- PPA contracted capacities experience a significant increase – this very positive development constitutes an alternative or complementary avenue to tenders, and may result in undersubscribed auctions.

¹⁴ In 2021 the total PPA contracted capacities in Europe stood at 6.7 GW, of which the market leaders are Spain, Sweden and Germany.

3.4. Non-discriminatory participation of small actors and, where applicable, local authorities

The performance dimension “provide non-discriminatory participation of small actors and, where applicable, local authorities” pursuant to Article 4(8)(d) of the Renewable Energy Directive is interpreted in this report as the capability of small actors to participate with small-size projects on equal footing and be awarded in tenders. The indicator to measure this dimension is the average size of new projects awarded through tenders, showing how tender design was able to provide such incentives that the initial barriers affecting small actors (e.g. lack of economies of scale, worse loan conditions, higher project costs per energy output, lower level of specialization) were tackled. As there are no available examples of local authorities that participate in the tender as bidders, tendering aspects related to the involvement of local stakeholders in a broader sense are covered in Section 3.6.

The level of participation of small actors and projects is determined by the restrictions on project size, incorporated in the design of the tender. In order to have an overview, 4 types of tender design in respect to the project size restrictions can be distinguished:

- *small*: this includes the tenders targeting small scale projects with capacity of up to 1 MW for solar PV and 3 MW for onshore wind;
- *balanced*: this includes the tenders allowing participation of small-scale projects, at least to some extent (less than 1 MW for solar PV and 3 MW for onshore wind), and medium-size projects (up to 50 MW) on equal footing, i.e. allowing competition between them, but excluding very large projects to avoid price advantages resulting from economies of scale.
- *size category*: this includes parallel tenders organized within one year, where at least one tender targets small-scale, and at least one tender targets large-scale projects, whereby the two projects types are not in competition with each other.
- *large*: this includes tenders where small-scale projects were excluded, or there was no maximum capacity limit of the tenders

Solar PV

The results of the analysis for the period 2010 - 2020 shows that Croatia, Estonia, France and Poland are the countries in which tender design in some years directly targeted small-scale projects only. In Croatia there was one, while in Estonia two pilot tenders were organised for small projects only, however both countries are planning the introduction of large-scale tenders soon. In Poland, the tendering procedure started with small-scale tenders in 2016 and 2017, but in later years, large tenders were organised in parallel as well. Early tenders in France targeted small-scale projects too: in the years 2014 and 2016 only such auctions were organised. The average size of the projects in these tenders is very low, ranging from 0.24 MW to 0.65 MW.

A special treatment for small-scale projects under the ‘size category’ option was applied in many countries – Denmark, France, Greece, Hungary, Italy, Luxembourg, and Poland. In addition, the Netherlands used a dynamic, ascending clock type of auction, with different ceiling prices for different solar PV project sizes. Thus, for solar PV, this solution where parallel tenders are organised within one year, one of which targets small-scale project, can

be considered as common but not universal in Europe. Size categorisation tends to keep average project size closer to small-scale, as average sizes range between 0.38 MW (Italy) and 5.45 MW (Denmark).

Onshore wind

The option of tenders that favour small-scale projects is less common for onshore wind than for solar PV – only Estonia in 2020 and Poland until 2018 organised them. The average size in both countries is less than 1 MW in these associated time periods.

With respect to the other three design types, the results are very heterogeneous across Europe, leading to very different average awarded sizes. The smallest project sizes were identified in Estonia, with less than 0.5 MW, but also in the relevant period low values were associated with Italy, Slovenia, and the Netherlands. These results indicate that small-scale onshore wind applications are a viable solution for the European energy mix.

The EU-wide results for the average size of the awarded projects under the four approaches to tender design are presented in the table below and allow for the following conclusions, taking into account the very different composition of the tender design options between solar PV and onshore wind. Firstly, there are existing tenders aimed at the preferential treatment of small-scale wind. Secondly, the ‘size category’ solution on average leads to lower average project size compared to the ‘balanced’ solution. Thirdly, if maximum capacity limit does not exist, and no size categories are applied, then very large projects tend to dominate the auctions results.

	Average size (MW) Solar PV	Average size (MW) Onshore wind
SMALL	0.47	0.59
BALANCED	2.61	12.78
SIZE CATEGORY	1.88	10.55
LARGE	40.85	43.83

Source: Own calculation based on IRENA (2021)

Figure 7. Average size of awarded projects in EU under the four design options for solar PV and onshore wind

It is important to note however, that the size limitation in tenders comes with a significant drop in price efficiency, which is also due to economies of scale, access to better location, financing and other factors. The support cost in the small category tends to be higher than in the large category, as shown in the following table:

Country and Technology	Year of investigated auction	Average winning price in the small category (EUR_2019/MWh)	Average winning price in the large category (EUR_2019/MWh)	Price difference of the two categories
France PV	2020	62.0	52.4	7.6
Greece PV	2018	79.4	64.6	14.8
Hungary PV	2020	62.8	48.4	14.4
Italy PV	2020	91.9	68.2	23.7
Poland PV	2020	57.3	49.9	7.4

Italy Onshore wind	2020	134.8	68.3	66.5
Lithuania Onshore wind	2013	111.0	76.4	34.6
Poland Onshore wind	2018	83.7	46.6	37.1

Source: AURES II auction database

Figure 8: Comparison of small- and large-scale auctions results in terms of awarded average prices

The results show that separate small-scale tenders have a significant price premium, in most of the cases larger than 10 EUR/MWh, except for PV in Poland and France. This price bonus is significantly larger for onshore wind (30 – 40 EUR/MWh) than for solar PV (around 11 EUR/MWh on average). Therefore, introducing tender specifications that favour small-scale projects is associated with additional financial burden in terms of cost of support, paid to the awarded projects.

<p><i>Conclusions for Dimension 4: Non-discriminatory participation of small actors</i></p> <ul style="list-style-type: none"> • More than half of the European countries organise(d) tenders for small-scale solar PV projects, whereby the introduction of size categories for solar PV projects can be considered a widely (but not universally) applied solution. • For those tenders where neither a maximum capacity limit is set nor separation of different baskets based on size occur, the general tendency is that large-scale projects dominate the tenders, giving smaller projects less chance of winning, mainly because of economies of scale. • Compared to maximum size limit set, size categories seem a more efficient way to enhance participation of small projects and hence – small actors. • When size category solution is applied, price efficiency drops considerably. Also, as participating projects are divided based on size, the intensity of competition may also be reduced.

3.5. Environmental impact

The performance dimension “limit environmental impact” pursuant to Article 4(8)(e) of the Renewable Energy Directive is challenging insofar as the theoretical connection between the implementation of auction-based support allocation and limiting environmental impact is not self-evident. The main determinant of environmental impact is not whether the support allocation is based on administrative, market or tender-based process, but what is the impact of the renewable energy capacities, e.g. by substituting conventional power plants and thus reducing greenhouse gas (‘GHG’) emissions, which depends on many other factors, such as specific environmental regulation and the location of the installation. Renewable energy projects may also have a range of impacts on other environmental objectives, such as soil, water, air and noise pollution, or habitats. Therefore, this dimension is analysed through case studies that show some specific design elements which are related to the wider environmental impact of the awarded renewable energy projects. Such design elements that are not related to ‘the main objectives’ of a support measure can form up to 30 % of the weighting of all the selection criteria in a tender, according to the state aid rules¹⁵, thus forming an important potential lever to contribute to specific policy objectives (e.g. circular economy with criteria

¹⁵ Commission’s Guidelines on State aid for climate, environmental protection and energy 2022, (2022/C 80/01) p. 50.

on recyclability, or other sustainability criteria). However, these criteria need to be carefully designed in order to not result in protectionist effects which are not in line with EU policies or WTO rules.

Case study - Italy

Italy implemented a tender scheme between 2019 – 2021 with seven separate auction rounds. Different baskets were created based on the size of planned projects (threshold 1 MW) and technologies.

For small hydroelectric power plants (less than 1 MW), the tender criteria allowed a hydroelectric power plant that complies with a list of environmental conditions on water management to be ranked high in the tender independent of the offered price. In all tender rounds (except the last one) an oversubscription occurred in the auctions, thus one aim of the tender was achieved, as projects better for water quality won. On the other hand, the tender design created a negative incentive in terms of non-competitive bidding, as those projects which fulfilled the required conditions were certainly winning, thus almost all such projects bid the ceiling price of the auction.

For solar PV plants (less than 1 MW), the tender included a separate category of projects where rooftop solar panels are installed as replacement of asbestos or slate. In addition, these projects received a 10 EUR/MWh premium in comparison to other types of small PV projects. The results of the awarded capacities in the tender rounds show a constantly increasing interest in the small-scale solar PV projects (8 MW in the first round, increased to 110 MW in the seventh round). However, in this special PV category, offered volumes by the government in the tender round were very high which resulted in the fact that all auction rounds were undersubscribed, leading to offered prices very close to the ceiling price. Furthermore, an adaptive behaviour of the bidders is identifiable, where in the first round bidders offered 0.4% lower price compared to the ceiling, and in the fifth round this decreased to 0.01%, making the tender sub-optimal in terms of cost-efficiency.

Thus, in this case tenders targeting projects with specific non-GHG reduction environmental impact achieved their objectives but did not promote competition and price discovery.

Case study – Netherlands

The Netherlands have applied tenders based only on price, however included pre-qualification requirements, including a complete environmental impact assessment for tenders which are site-specific. This ensures that the environmental implications of the project are taken into account before the decision about the awarded bidder is made, and that ex-ante public participation in decision-making takes place.

The evidence does not indicate a risk that an environmental criterion, applied prior to the tender, has an impact on the price. In the case of the Netherlands where the environmental impact assessment is mandatory ex-ante, the awarded price is lower than in other (comparable) countries where it is not. This confirms that an appreciable reduction in costs can still be achieved, even in case of tenders that take into account the projects' environmental impact.

In addition, the experience in the Netherlands shows that environmental pre-qualification requirements prevent the risk of delays in project commissioning, having a positive impact on

the realisation rate. However, in countries where the administrative process is long, the ex-ante requirement for environmental authorisation might make the tender too complex and create a risk of undersubscription.

Case study – Spain

In 2020, Spain approved a set of regulations on the tender procedures for renewable energy. This includes an obligation for bidders in a tender to submit a strategic plan with the estimates of the impact of the project on the industrial value chain, which is made public on the website of the Ministry for Ecological Transition and Demographic Challenge. The strategic plan must include the strategy of circular economy in relation to the treatment of equipment at the end of its life and an analysis of the carbon footprint during the life cycle of the facilities, including the manufacture and transportation of the main equipment used. The aim of this requirement is to impose pre-qualification criteria that enable only projects whose supply chains are in line with a predefined emission standard to participate. As a result, tenderers are asked to demonstrate the capability to develop the project in harmony with the environmental “externalities”, achieving the maximum possible resource efficiency and operational excellence along the entire value-chain, eventually generating a positive impact, resulting from the plant development and construction.

Conclusions for Dimension 5: Environmental impact

- The implementation of additional environmental aspects through design elements in the tender is not common in European auctions.
- Examples in Italy and Netherlands show positive cases where tendering procedures provide a clear pre-qualification requirement or other design elements that ensure that the environmental implications are taken into account before the final decision of awarding the projects is made. The development of specific evaluation criteria and weights as key award criteria tends to enhance the effectiveness of the implementation. However, in case of improper tender design, the additional criteria could lead to sub-optimal results in terms of cost-efficiency.
- Such environmentally friendly prequalification criteria and designs may lead to additional, non-environment-related effects in the tendering procedure, such as decreased cost efficiency (Italy) or potentially boosted realisation rates (Netherlands).

3.6. Local acceptability

The performance dimension “ensure local acceptability” pursuant to Article 4(8)(f) of the Renewable Energy Directive is understood as the approval by the public for the promotion of renewable energy at local community level. Examples of challenges raised against wind farms include perceived noise pollution, possible associated harm to local wildlife caused by the turbines and the impact on landscape. Specific physical characteristics, such as the smell from biogas plants, are a frequent complaint from residents living near biogas plants. In the case of solar, concerns include the negative effect on landscapes. There are examples of tender design options which can mitigate the challenges related to local acceptability through e.g. promoting the sharing of the benefits of renewable energy projects with the local communities. These can be seen in the context of the best practices on community acceptance

and involvement, described in the Commission’s Guidance on speeding up permit-granting procedures.¹⁶

Location-related pre-qualification criteria are now applied for wind power plants in Poland, where municipalities declare their willingness to host the wind energy infrastructure. In this case the design element is an ex-ante involvement of local governments for making decisions on future onshore wind energy investments in consultation with the population. In Spain, the obligation for a bidder to submit a strategic plan, referred to in the previous dimensions, includes estimations of the impact on local employment and the opportunities for local business development.

The tendering authorities of Germany, Ireland and France have opted to design rules that enhance local acceptability by granting preferential treatment to energy communities.

In the case of Germany, the favourable conditions envisaged in the past Renewable Energy Act fostered community-based ownership projects and the first three rounds until November 2017 awarded over 90% of the total auction volume of 2 890 MW to energy communities’ projects. However, after two years, only 167 MW of the awarded wind capacity projects obtained a building permit. In addition, a large proportion of the capacity was awarded to only three professional multi-project developers that cooperated with natural persons in as many as 60 projects with a total volume of 1 GW, formally keeping a majority of the voting rights for the citizens. After the lenient bidding requirements were abolished, the share of community projects in tenders declined significantly from 71-88 % of the bid volume in 2017 to less than 16% at the end of 2018.

A preferential treatment to energy communities is also designed in Ireland, where the tenders have a separate category to facilitate the participation of energy communities. Such ad hoc basket is defined together with the introduction of size thresholds, whereby the aim is to avoid the discrimination of certain actors. Out of the 82 renewable energy projects awarded after the government approved the results of the first tender, seven are implemented by energy communities (five solar energy and two onshore wind community projects). As a result, new professional project developers at local level were born and have engaged actively in creating these projects.

In 2016 in France a specific citizen participation “bonus” was introduced, with the objective to increase public acceptance. To be eligible for the bonus, bidders demonstrated local participation through two different ownership models: (i) the amount of capital held by citizens; or (ii) the citizen participation in the overall financing of the project. The bonus consists of additional payment of 0.1 or 0.3 cent/kWh on top of the support cost, determined in the tender, provided over the full contract period of 20 years. An average of 36% of all awarded projects have applied for the bonus since 2016 across all tender rounds. The experience shows that the bonus was successful in incentivizing project developers towards more participatory shareholding structures. The involvement of natural persons in the financing of renewable energy projects by professional project developers in France was done through dedicated crowdfunding platforms. Between 2014 and 2017, funds from citizens mobilized for renewable energy projects through such platforms grew from EUR 120,000 to

¹⁶ SWD/2022/0149 final, 18.5.2022.

EUR 20.5 million. Nevertheless, some challenges emerged as well. This bonus was mainly used by project developers to increase the chances of winning in highly competitive tender rounds. The bonus' eligibility criterion according to which citizens need to have their primary residence in the same or bordering area of the project site creates challenges in regions with lower population densities. Community actors are usually represented only indirectly in an aggregated form in the governance and project developers are only bound by the eligibility criteria to receive the citizen participation bonus for three years from the date of commissioning.

Conclusion for Dimension 6: Local acceptability

- The tendering procedures may provide the necessary framework to ensure local acceptability, particularly when preferential treatment is granted to certain bidders that share the benefits of RES deployment with local communities and this treatment does not result in discriminatory advantage for local content. Projects that effectively involve local players may result in substantial added value in terms of local acceptance and access to additional private capital which results in greater participation (and investments) by citizens. Local engagement can facilitate the land acquisition process and thus ease the challenging pre-development phase (permitting).
- EU-wide experience shows that energy community projects participate in auctions if some preferential treatment is provided. However, the experience with the special rules is not always positive. Examples in Germany showed that providing preferential rules which are not well designed may lead traditional developers to only artificially label their initiative as a community project.
- Whereas the design of lenient bidding requirements (less strict pre-qualification) for small-scale projects in the overall tender basket is likely to have distorting effects, the experience with a separate tender basket specifically devoted to facilitate the participation of a certain category is quite positive.
- An incentive for increasing public acceptance for renewables in a broader sense is the participatory bonus to the project for the involvement of citizens in the financing and in the project governance.

3.7. Security of supply and grid integration.

The last performance dimension “ensure security of supply and grid integration” pursuant to Article 4(8)(g) of the Renewable Energy Directive is interpreted as the impact of tenders on keeping the stability of the energy system, balancing generation and demand by taking into account generation variability from renewables to be integrated into the grid.

This dimension is again linked little with the impact of tendering, but rather with external factors. Nevertheless, a few case studies show examples of how security of supply and grid integration are reflected in the tender design in order to facilitate not only the deployment of new renewable capacities, but also their effective integration into the system. Beyond the case studies, it is not common in the EU to incentivize flexible power through tenders for renewables where generation is supplemented with storage technology.

Case study – Portugal

A solar PV tender in Portugal in 2019 was designed with specific features aimed at locating the assets where they may relieve congestions in the system. In the 12 successive tender rounds, potential producers competed for the rights of grid connection capacity in different

fixed locations in Portugal. Effectively, this tender supported solar PV plants through the allocation of scarce connection capacities rather than remuneration for production of renewable electricity.

The tender was heavily oversubscribed for almost all the batches, with record-low bids significantly below the market prices, effectively leading to pay-back obligations for the producers. For the tendered 1400 MW grid connection capacity, offers totaling 10.19 GW were made, and a capacity of 1150 MW was awarded. The gap between the tendered and awarded capacity is due to the fact that for one lot, no offers were received in the auction, and for another lot, only one offer was submitted. This shows that despite large oversubscription on average, bidders were not willing to bid for locations which are not attractive because of low renewables potential. Such a scenario shows an important disadvantage of site-specific auctions, where the inappropriate selection of locations may lead to undersubscribed outcomes, and in an extreme but realistic case – in zero submitted bids.

On the other hand the Portuguese model allows for an optimal allocation of the generation with regard to existing grid capacity. In a system with shortage of available connection points, the zone-specific tender scheme suggests that such design element could be a novel way to encourage the minimization of costs and to integrate large amounts of variable renewables, optimizing constrained transmission infrastructure. In this example, the aim is not for renewable power plants to receive support on top of market price, but rather for the producers to compete for the allocation of scarce network connection capacities.

Case study – Germany

Germany introduced a specific tender design addressing the grid connection of renewables. The location of the power plants is factored into the system for awarding the winners in the tender. The tenders define dedicated transmission network expansion areas which are significantly overloaded and require additional upgrade of the grid. In these areas, a maximum amount of renewable electricity output by wind projects is set, allowing the new offshore or onshore wind projects awarded in tenders to align with Germany's transmission grid development plans. In addition, bids for projects located in one of those overloaded areas are penalised by adding a virtual premium to their bid prices, making them less competitive in the tender.

The second type of tender introduces a dedicated basket for projects combining renewable energy generation and storage. In Germany, a first tender round of this kind was held in 2021, awarding 258 MW of capacity to 18 projects for solar PV plants with energy storage. The tender was oversubscribed, with 43 bids for a total volume of 509 MW. The remuneration scheme was a fixed feed-in premium, meaning that the price should be added as a support on top of the market price. The bids were considerably lower than the tender's ceiling price (75 EUR/MWh) whereby the awarded bids were on average between 43 and 45 EUR/MWh. However, from the perspective of fixed feed-in premium tenders where in 2019 such a tender in Denmark resulted in an average price of 2 EUR/MWh, the values in the German example show the considerably higher support cost to hybrid projects combining generation and storage.

Conclusions for Dimension 7: Security of supply and grid integration

- The implementation of additional grid integration and security of supply aspects

through additional design elements of the tender is not common in the EU.

- Tendering procedures in the Union have not provided for a pipeline for projects combining renewable energy production and storage.
- Renewable tenders across the Union are traditionally organised to assign price support for generation of electricity from renewable power plants, but there are signs this rationale might change. The zone-specific schemes in Germany and the case of Portugal suggest that producers will start to compete for the opportunity to connect, optimizing constrained transmission and distribution grid infrastructure. Similar tendencies are observed in the offshore sector.
- Grid expansion takes time and locational design elements in a tender can help to ensure that, while the network is being expanded, the connection of renewables is not stalled by constrained network infrastructure. Clear pre-qualification requirements that ensure grid access may allow for better coordination between project construction and the required grid expansion, but in some instances this can lead to less intense competition.
- From a system point of view, the zone-specific auction scheme could be a novel way to encourage the minimization of costs to integrate large amounts of variable renewables into the system in particular in countries with shortage of available connection points. In such an auction however, it may be necessary to also consider locational electricity pricing to drive project development in the most useful locations and in a cost effective manner.
- Locational incentives (including a bonus/penalty to bids located in areas with available/insufficient grid capacities, maximum capacity quotas) in certain areas may succeed in avoiding the concentration of projects in resource-rich but potentially difficult-to-connect areas.

4. Final conclusions

The most important general conclusion of the report is that introduction of tenders for renewables was a clear success for the European Union. The analysis of the performance dimensions shows that in many Member States the tenders reduced the support cost significantly compared to administrative schemes, enhanced the deployment of renewable capacities and provided a solid framework for technological improvement.

The cost reduction seems to be clearly the dimension where tenders for renewables brought their largest benefit. Policy makers switched from offering administratively set feed-in tariffs to competitive bidding systems to find the level of support that is necessary, and thus the allocation of the lowest possible subsidy for an energy or capacity product. The introduction of market forces by tendering procedures contributed to improved price discovery and exercised pressure to reduce the project costs, which in turn led to lower support costs and reduced the burden on consumers and state budget.

Tenders achieved positive results in terms of capacity additions, as well as in terms of high realization rate of the awarded projects, without prejudice to additional factors. In some countries, the introduction of tenders was the regulatory measure which triggered the extensive deployment of some renewable technologies, while for many countries the tenders contributed to faster paced renewables deployment.

As regards technological development, the role of tenders is less clear. They provided a solid framework for improvement in particular for those countries where technology was not

mature at the time of the introduction of tenders. However, the external factors related to global technology trends seem to be the main factor for the technological development of renewables.

In a number of countries, the participation of small actors was facilitated through specific tender design elements. However, where thresholds for small-scale projects are introduced, the cost-efficiency of the tender decreases and higher support cost levels are observed.

Tenders can ensure that environmental implications other than emission reduction are taken into account before the final decisions of awarding the projects is made. Therefore, they can contribute to the achievement of different environmental objectives. Tenders can have effects also in terms of public acceptance for renewables and security of supply. Competitive procedures can contribute towards the goals of these last three dimensions through specific tender design elements that introduce additional selection criteria. However, a general conclusion can be formulated that often there is a trade-off between the introduced design elements and price efficiency.

Looking forward, on the basis of the evidence from the performance of tenders in the past, it can be expected that tendering schemes may face some challenges and transformations in the future. The recent results from solar PV and onshore tenders show that strike prices are very close, in some cases below long-term expected wholesale prices, especially when the wholesale prices are unexpectedly high. This justifies the choice of two-sided sliding premium as an option for tender design, in particular for mature technologies that are close to, or already at a state where no public support is needed. Since tenders were originally organized as an instrument to grant support, their role may decline. There is emerging evidence that PPAs are becoming an attractive route for the market-based development of renewable power projects. This will have implications for the design of auctions, which could face lower participation, especially in markets where the project pipeline for renewables projects is relatively small. This means that tendering schemes will have to be adapted to become complementary to or synergetic with renewable projects that are (partly) financed through PPAs.

Even if tenders might become less relevant in terms of financial support, they would however keep their strategic role as an instrument to effectively disburse scarce resources. Examples such as the auctions of Portugal that allocate grid connection capacities show that the tendering process can be redefined and linked to grid integration rather than to its original goal to allocate operational support.

The further impact of tendering support schemes as an instrument to foster the deployment of renewables and thus to contribute to the European Green Deal objectives and the implementation of the REPowerEU plan, as well as the exact effects of the latest trends for tenders remain to be seen and would be described in the next report by the Commission pursuant to Article 8(4) of the Renewable Energy Directive.