Report D9.2, December 2017

Auctions for renewable energy support - Taming the beast of competitive bidding

Final report of the AURES Project

AURES

Horizon 2020

Auctions for Renewable Energy Support - AURES - is a coordination and support action financed by the European Commission under the Horizon 2020 program to improve the implementation of renewable energy policies in EU Member States.

AURES was conceived by the need of implementing market-based instruments including competitive bidding processes (i.e. auctions or tenders) to allocate support for renewable energy sources (RES) in the European electricity sector from 2015 onwards as stipulated in the EC State Aid Guidelines.

Many European countries have by now undertaken competitive auctions for different technologies with mixed experiences while others have recently started or are at the verge of starting the implementation process. Energy community countries may also soon introduce competition for support payments. Therefore, there exists the need for capacity building of policy makers and market participants to successfully design, implement and use auctions for RES support.

AURES ran from January 2015 to December 2017 and has generated new insights on the applicability of auctions for renewable support and on specific auction designs under different market conditions and policy goals in European countries. These insights are based on theoretical and empirical analysis (energy auctions in 12 European countries and 8 non-European countries), the use of state of the art simulation models and experiments, and through cooperation cases with some Member States providing tailor-made policy support in the implementation of auctions.

AURES contributed to a strong knowledge-sharing with workshops, webinars, bi- and multilateral meetings, an interactive website and dedicated auction tools (AURES cash flow model and AURES auction designer).

This final report covers a discussion of major findings and insights in regards to auction designs that AURES has identified to be relevant in the context of renewable energy.

Report D9.2, December 2017
AURES project Final Report

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1 Introduction: auctions for renewable energy support

Auctions for renewable energy (RES) support are market-based, competitive bidding processes to identify the most appropriate RES projects to be constructed within a certain time frame and geographical area and to allocate appropriate support payments to these projects. A RES auction is a procurement auction, where typically a certain amount of power (MW) or energy (MWh) of renewables are offered up for bidding. Bidders compete to be allowed to deliver these volumes on basis of their required support level (often a premium in EUR/MWh). The projects with the lowest required support levels typically win the auction. Winners are then granted the right to construct their RES projects and the right to receive support payments for these projects for a given period of time.

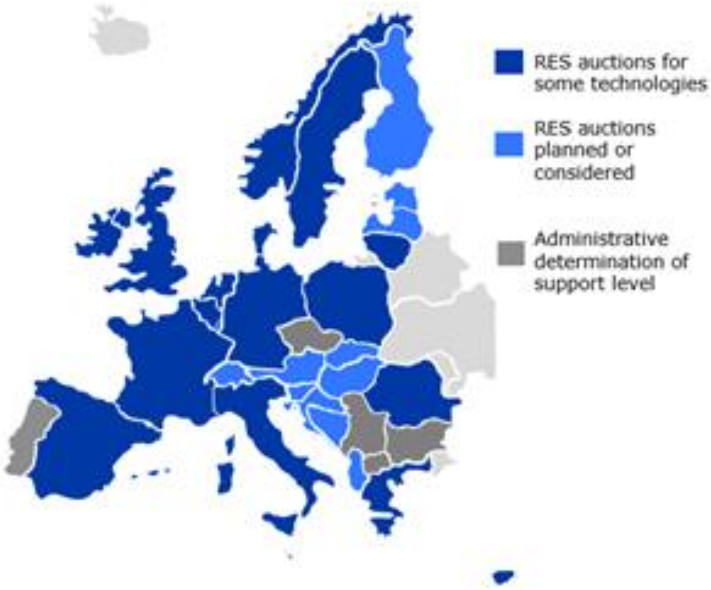

Figure 1: Use of RES auctions in Europe (Ecofys 2017)

Competitive bidding processes are actively demanded by the European Commission as RES support allocation instrument (EC State Aid Guidelines[1]). During the past years, we have seen a steep increase in the use of RES auctions in many countries in Europe (see Figure 1), as well as in other countries around the world.

There are two main arguments for the use of RES auctions: First, they allow an efficient allocation of support at a support level that is competitively determined and timely updated. Second, they allow for non-discriminatory volume control of RES deployment and thus control of total support budgets. As with other RES support schemes, the success of auctions, and whether they can fulfil expectations regarding e.g. efficiency gains (i.e. lowest cost deployment), depends on the design elements chosen and how well they address specific characteristics of technology and market.

Although more and more experience is generated by using auctions as support allocation instrument, a number of questions have not been univocally answered yet. These questions include: When are RES auctions a good idea, i.e. under which circumstances are they preferable to e.g. administratively set tariffs or quotas? How should RES auctions be designed to achieve desired outcomes? What design options exist? What are their benefits and challenges? Which design should be chosen for a particular auction implementation depending on certain policy goals and market situation? Answering these questions was the focus of the AURES project. This report summarises some of the major findings from the past three years.

[1] European Commission guidance for the design of renewables support schemes (2014): Guidelines on State aid for environmental protection and energy 2014-2020. link

GENERAL AUCTION DESIGN ELEMENTS		RES-SPECIFIC AUCTION DESIGN ELEMENTS	
Selection criteria Price-only Multi-criteria (tenders)		**Scope** Auction volume Periodicity (number and frequency of rounds) Target achievement safeguards (dealing with amounts not awarded/built)	
Auction format Single-item Multi-item (homogenous or heterogeneous) ***Auction type*** Sealed-bid (static auctions) Descending clock (dynamic auctions) Hybrid designs ***Pricing rule*** Pay-as-bid (in single-item auctions: first price) Vickrey (in single-item auctions: second price) Uniform price		**Support** Remuneration type (energy or capacity-related) Duration of contract Updating of remuneration over time	
		Diversity Technological diversity Size diversity Geographical diversity Actor diversity Other diversity types	**Prequalification criteria** Technical requirements Documentation requirements Preliminary licences Deposits and other guarantees Financial capability requirements Experience
Price limits Price ceilings Minimum prices	**Other** Seller concentration rules Information provision Web-based vs. in-person Secondary market	**Penalties** Penalising non-compliance Penalising delays	**Other** Local content rules Deadlines and grace periods

POLICY DECISIONS THAT INFLUENCE THE DESIGN OF A RES AUCTION	MARKET CHARACTERISTICS THAT INFLUENCE THE DESIGN OF A RES AUCTION
Technology focus (single technology, technology baskets or technology neutral (open to all)) Deployment target for at least the next five years Planned auction volume (capacities, generation or budget) and how this relates to the deployment target Remuneration type in the auction (in terms of implications, e.g. on winner's curse) Resources of the auctioneer (sufficient for complex design and monitoring?)	Expected market potential (project pipeline) and how this relates to the auction volume (next round and long term schedule) Average project size (per technology) and how this relates to auction volume and frequency (number of auction rounds per year) Expected number of bidders and bids Distribution of project costs among bidders (how asymmetric, systematically different project costs are) Relative strengths of bidders and how familiar they are with each other (how well they can assess each other's cost)

2 Before we start: a word of caution

Renewable energy auctions have been shown to be an important policy instrument for allocating renewable energy support and setting appropriate support levels. However, auctions are no panacea, i.e. they are not the ‘golden bullet’ that is superior to any other support allocation mechanism at any time.

The use of auctions has several implications that are new in RES policy making: They introduce direct and immediate competition between favourable RES projects. It is in the nature of competitive allocation mechanisms that not all ‘good’ projects can be developed – competition can only be sufficient if there are more bids of strong projects than demand for them. The renewable energy sector is thus forced to move from being rather ‘technocratic’ developers, where everyone optimises their own projects, into being ‘strategic’ developers, where the success of one’s projects depends on the strength of others. This can become a challenge for policy makers: They now have to take care of 1) ensuring sufficient competition for a well-functioning price formation, 2) avoiding undesired strategic incentives, collusion[2] and other market distortions, and importantly 3) dealing with risk of low realisation rates, e.g. caused by underbidding or the existence of non-cost barriers (such as timing or permits).

Often, the specific design solutions for these issues are highly context-specific and what works in one market is not necessarily applicable to another. In addition, different design elements might mitigate some issues but affect other factors, e.g. pre-qualification rules and penalties can increase realisation rates but can also increase the risk and thus the costs for bidders. In addition, policy makers often pursue other policy goals (secondary objectives) with energy support policy, e.g. increasing security of supply or encouraging actor diversity. Finding a compromise between encouraging different policy goals without compromising on well-functioning price formation proves to be a challenging task.

For this reason, the AURES project does not offer simple prescriptions of the ‘best’ auction design. It offers a framework for evaluation, insights on suitable design options, including their benefits and challenges, as well as results of modelling, simulating, experimenting and analysing different auction designs. The project also shares experiences from past, ongoing and future auction implementations, including specific and general lessons learnt. We do derive some general good practices, which are listed in the end of this report.

The evaluation framework applied in the AURES project uses seven different dimensions, or success criteria. All auction assessment in this project is based on these dimensions, namely effectiveness, static efficiency, dynamic efficiency, support costs, legal feasibility, socio-political feasibility and local impacts (for more detail see del Río et al., 2015a[3]). The weight and importance of each of these dimensions in assessing the successfulness of an auction is a matter of policy preferences. There is no ‘perfect’ or standard set of assessment criteria to measure success.

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[2] Collusion: bidders communicating with each other without the knowledge of the auctioneer in order to obtain an auction outcome more favourable to them. While explicit collusion is commonly prohibited by law, implicit collusion can be observed in real-world applications, i.e. by bidders trying to communicate via hidden clues.

[3] del Río et al. (2015a): Overview of Design Elements for RES-E Auctions. AURES report D2.2 (a). link

3 To auction or not to auction: When are RES auctions actually a good idea?

Despite their success in a range of contexts, auctions should not be seen as a one-size-fits-all policy prescription. There are a few situations in which an auction may not be appropriate and alternative or complementary policies should be considered. There is a strong empirical basis for considering alternatives in situations where reasonable competition cannot be expected, project costs are especially uncertain or policy goals other than lowest cost, such as actor diversity, are being pursued. These criteria are often met when policy makers are seeking to promote immature or innovative RES technologies.

This empirical insight is supported by our theoretical work in Kitzing et al. (2016a)[4], which shows that small markets are best supported by means other than auctions. The EC State Aid Guidelines[5] that encourage Member States to adopt auctions offer a number of exemptions broadly in line with this analysis, as long as the Member State applying for the exemption can demonstrate that the alternative policy instrument does not over-compensate the energy producer.

To aid selection of alternatives, in del Río et al. (2016a)[6] the full range of alternative instruments and designs are evaluated against the above mentioned criteria of efficiency, cost containment and market integration that can be used to evaluate RES support. It is shown that there are ample design features that can be applied to instruments such as feed-in premiums to fulfil the same criteria as auctions, but there are also trade-offs and conflicts between criteria and care must be taken to match the design with its context and policy goals.

	OBSERVATIONS	RECOMMENDATIONS
AUCTIONS	Can be effective at meeting policy goals under the right conditions. However, small markets and immature technologies may require exemption.	Consider employing alternative instruments in small markets and for immature technologies.
ADMINISTRATIVELY SET SUPPORT (such as feed-in tariffs)	May be more appropriate in some situations (such as small markets and immature technologies).	When using administratively set support, ensure that appropriate cost and volume control is implemented (if desired) through careful design.
OTHER MARKET-BASED SUPPORT (such as certificates)	Promises some of the static efficiency benefit of auctions but often complex to implement and introduces new market risks to participants.	Using other market based support may be appropriate in markets with an established certificate scheme. However, be cautious using it as substitute for auctions where exemptions are warranted.

[4] Kitzing et al. (2016a): Comparison of auctions and alternative policy options for RES-E support. AURES report D6.2. link
[5] European Commission guidance for the design of renewables support schemes (2014): Guidelines on State aid for environmental protection and energy 2014-2020. link
[6] del Río et al. (2016a): Identification of alternative policy options to auctions for RES-E support. AURES report D6.1. link

4 Apples and oranges in the same basket? Technology neutral vs. specific auctions

The question of whether to conduct technology neutral or technology specific auctions is a much debated topic. A main reason is that the EC State Aid Guidelines[7] suggest a technology neutral approach, while most countries have a tradition for technology specific RES support. The main argument for combining several technologies in one auction is the better allocative efficiency when compared to separate, technology-specific auctions, as the lowest-cost projects across technologies are awarded. However, setting design elements such as ceiling prices, material and financial pre-qualifications, penalties and realisation deadlines is more challenging when several technologies are grouped together.

There are many variations of multi-technology auctions. They range from truly technology neutral auctions, which combine all potential technologies into a single auction, to technology-basket auctions, which group together only two or three technologies with similar characteristics (for instance, technologies with similar generation costs).

The idea behind a technology neutral auction is that all renewable energy technologies compete against each other on a level playing field in order to support those bidders which require the lowest support payment to supply the renewable electricity. Thus, in theory, in a technology neutral auction the bidders with the lowest generation costs are awarded and the outcome is considered efficient. However, this only holds for the static perspective. The assessment from a dynamic system perspective must consider additional aspects: Technology learning might reduce the costs of currently more expensive technologies in the future so that it becomes the most cost-efficient one. Hence, technology neutral auctions might not lead to the lowest generation costs when considering a longer time period. In addition, if technology neutrality leads to a reduction of investor diversity, this may decrease the level of competition and liquidity of auctions in the long run and hence increase costs.

Furthermore, depending on policy goals, higher importance may be given to limiting support expenditures rather than minimising generation costs. If support expenditures are prioritised, then a technology specific auction will most probably be preferable, as support levels can specifically be differentiated between technologies. Also multi-technology auctions can achieve differentiation through implementation of discriminatory elements such as a quota or bonus or through different ceiling prices. If appropriately designed, such an auction uses the principle of third degree price discrimination to reduce the producer rent and thus the overall support costs. It is often referred to as to reducing windfall profits. However, such an auction design might lead to inefficient auction outcomes regarding the generation costs (Kreiss et al., 2017a[8]).

[7] European Commission guidance for the design of renewables support schemes (2014): Guidelines on State aid for environmental protection and energy 2014-2020. link

[8] Kreiss et al. (2017a): Different cost perspectives for renewable energy support: Assessment of technology-neutral and discriminatory auctions. Forthcoming (submitted to scientific journal).

Finally, it is very difficult to design an auction that is actually neutral to all technologies. The different technologies have diverse characteristics (e.g. regarding planning procedures) and are therefore impacted differently by the same prequalification criteria and realisation periods. To avoid any favouritism, the auction design tends to be very complex. In summary, there is a trade-off between a technology neutral auction that in theory leads to an efficient outcome from a static perspective and the difficulties to design a real neutral auction as well as long term and cost advantages of technology specific and discriminatory multi technology auctions on the other hand.

	OBSERVATIONS	RECOMMENDATIONS
TECHNOLOGY NEUTRAL	All renewable technologies compete against each other to determine those projects with overall lowest generation costs, in the best case leading to efficiency and welfare maximum.	A real neutral auction is very difficult to implement. Furthermore, it may not be efficient in a dynamic perspective and not lead to lowest cost deployment.
MULTI-TECHNOLOGY WITH DISCRIMINATORY INSTRUMENTS	Instruments, such as quota, maximum price and bonus, help to control the support for the different technologies and enable cost minimizing results for the auctioneer.	Might reduce the allocative efficiency and also require some market knowledge to be implemented optimally.
TECHNOLOGY SPECIFIC	Gives full control over the support for the different technologies and high certainties for project developers.	Might reduce the allocative efficiency and lead to high support prices through support of higher cost technologies.

5 How big should the party be? Single vs multiple item auctions

Auctions for renewable energy support are usually multiple item auction where multiple item does generally not mean that a certain number of projects is awarded but a certain capacity (MW) or energy (MWh). This awarded amount is a divisible good and therefore more than one bidder can be awarded. Bidders compete with their projects, which they have pre-developed at sites selected by themselves. Winning projects are accepted until the target auction volume is full. For non-awarded bidders, the costs for pre-developing sites are sunk if they cannot compete in another auction round. Some auctions explicitly restrict the size of the winning projects to a level below the auctioned volume, whereas in other cases it would be theoretically possible that only one bidder is awarded, but this is unlikely. Multiple-item auctions are therefore suitable when the individual projects are smaller than the targeted auction volume and when there exists a solid pipeline with a steady flow of new projects – then several auction rounds can be undertaken each year.

Single item auctions are the exception rather than the rule for renewable energy support. There are two reasons for implementing such an auction: 1) the auction volume is rather small, e.g. in small countries, and the project pipeline is not quite continuous (note: this is merely a special case of the multi-item auction); 2) the auctioneer selects a site for the future installation and pre-develops the site to a certain degree (this may include environmental evaluations, measurement of resource availability, evaluations on geological structure, etc.). Bidders then compete for the right to construct their renewable installations at this specific site. Due to the similar cost and revenue expectations for the competing bidders, there is a high risk for the awarded bidder to suffer the Winner's curse[9]. Usually the grid infrastructure is then also developed and constructed in the same time frame as the renewable energy project. This is often the case for wind-offshore projects or large hydro projects (Haufe and Ehrhart, 2016[10]).

	OBSERVATIONS	RECOMMENDATIONS
SINGLE ITEM	Typically no regular auction schedule, therefore risk of unsteady award of projects and risk of the Winner's curse.	Should be implemented for very large projects that are pre-developed by the auctioneer, e.g. wind offshore projects.
MULTIPLE ITEM	The auction volume is awarded to the projects with the lowest costs. Sunk costs are incurred for pre-development for many more projects than awarded.	Suitable when project sizes are smaller than the auction volume. There should always be enough projects in the pipeline.

[9] Winner's curse: Occurs when a winning bidder unintentionally underestimates their true costs and is awarded not because they actually have the lowest costs, but the most optimistic estimate of (uncertain) future costs. This may likely result in a loss for the project and increases risk of non-realisation. Theoretically, rational bidders include this risk in their bid and the winner's curse does not occur. In practice however, it is evident. Auctioneers can mitigate the winner's curse through pre-qualifications and penalties.

[10] Haufe and Ehrhart (2016): Assessment of Auction Types Suitable for RES-E. AURES report D3.1. link

6 Running fast and long: auction schedule and frequency

The empirical analysis carried out in AURES with case studies has shown that continuity in the implementation of auction rounds, as opposed to a "stop-and-go" implementation, increases long-term planning certainty for market players (Wigand et al., 2016[11]). Visibility of upcoming auction rounds with fixed dates enables the supply chain to plan for participation, and develop projects accordingly. This can add to high auction participation[12]. Our analysis shows that there are indeed numerous examples of the detrimental consequences of irregular or infrequent auctions, where losing in an auction means a long waiting time for project developers until further support options become available. This can lead to underbidding[13], high investor risks and financing costs, low effectiveness[14], low participation and issues with competition[15].

A long-term auction schedule is highly relevant in order to ensure a framework of certainty for investors. This certainly does not only avoid unnecessary investor risks but also unfavourable auction outcomes. If a single auction is undertaken without any envisaged repetition for the next years, this may push bidders to bid (too) aggressively and potentially underbid. When there are no obvious possibilities for obtaining support at a later point in time, developers may this way try to limit their losses especially when they already are in late project realisation phases. Auctions may then seem successful as they result in low support levels. However, this may eventually lead to low realisation rates if bidders cannot cover their costs with the awarded support level.

In addition, a schedule facilitates the development of a robust supply chain because equipment manufacturers can plan their investments accordingly (del Río and Linares, 2014[16]), with auctions providing a steady stream of newly contracted projects[17]. In order to increase flexibility for the auctioning authority while accommodating the need for investor certainty, a two-step approach can be beneficial. The first step is an auction roadmap with a time horizon of up to 10 years (but for at least 3-5 years). The second step is a more detailed auction schedule with specific description of the upcoming auctions to be published at least every 2 years for the next 2 years (see Kitzing et al., 2016b[18] for further details).

A main lesson from AURES is that auction frequency is context- and technology-dependent. It is always a challenge to balance increased risks for investors in case of a low frequency with higher transaction costs and fluctuations in the competition level in case of a high frequency (Kitzing et al., 2016b[18]). The optimal number

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[11] Wigand et al. (2016): Auctions for renewable energy support: lessons learnt from international experiences. AURES report D4.2. link

[12] See e.g. for California in Fitch-Roy (2015): Auctions for Renewable Support in California: Instruments and lessons learnt. AURES report D4.1-CAL. link and Wigand et al. (2016): Auctions for renewable energy support: lessons learnt from international experiences. AURES report D4.2. link

[13] See e.g. for Poland in Kitzing and Wendring (2016): Implementation of Auctions for Renewable Energy Support in Poland: A case study. AURES report D7.1-PL. link and for the UK in Fitch-Roy and Woodman (2016): Auctions for Renewable Energy Support in the United Kingdom: Instruments and lessons learnt. AURES report D4.1-UK. link

[14] See e.g. for Ireland in Steinhilber (2016): Auctions for Renewable Energy Support in Ireland: Instruments and Lessons Learnt. AURES report D4.1-IE. link

[15] See e.g. for Denmark in Kitzing and Wendring (2015): Implementing Auctions for Renewable Support in Denmark: Instruments and lessons learnt. AURES report D4.1-DK. link; and for the UK in Butler and Neuhoff (2008): Comparison of Feed-in Tariff, Quota and Auction Mechanisms to Support Wind Power Development. Renewable Energy 33, 1854-1867.

[16] del Río and Linares. (2014): Back to the future? Rethinking auctions for renewable electricity support. Renewable and Sustainable Energy Reviews 35, 42-56.

[17] See e.g. the positive effects on the wind industry in Brazil in Elizondo et al (2014): Promoting Renewable Energy through Auctions: The Case of Brazil. The World Bank.

[18] Kitzing et al. (2016b): Recommendations on the role of auctions in a new renewable energy directive. AURES report. link

of auction rounds per period is likely to depend on the technology and situation of the market, with fewer rounds for technologies with potentially fewer actors (such as offshore wind) and more frequent rounds in the case of technologies (or technology groups) with more potential participants (such as roof-top solar PV) (del Río et al., 2015b[19]).

If markets are large enough, it can be beneficial to undertake auctions several times a year, e.g. once every quarter, but it is also common that in small markets or for single projects, auctions are undertaken once a year or even less often (Kitzing et al., 2016b[18]). A frequency of more than one round per year can reduce project development risks (such as the risk of expiring permits), but may also increase transaction costs. As a safeguard, regulators (or any other auctioneering authority) should be allowed to adjust auction schedules according to perceived shifts in market conditions (Wigand et al., 2016[20]).

	OBSERVATIONS	RECOMMENDATIONS
SCHEDULE FOR AUCTIONS	A long-term auction schedule avoids unnecessary investor risks, unfavourable auction outcomes (too aggressive bidding) and facilitates the development of a robust supply chain.	Long term, forward-looking auction roadmaps should be adopted (at least 3-5 years ahead), as well as detailed auction schedules (2 years ahead).
FREQUENCY OF AUCTIONS	Auction frequency is context- and technology-dependent.	The optimal number of rounds is between 4 times a year and once every few years, depending on technology, auction volumes and market situation.

[19] del Río et al. (2015b): Assessment criteria for RES-E Auctions. AURES report D2.2 (b). link
[20] Wigand et al. (2016): Auctions for renewable energy support: lessons learnt from international experiences. AURES report D4.2. link

7 Beauty contest: auction volumes and limits

The auction volume can be defined in terms of capacity (MW), generation (MWh), or budget (€). All of these options have benefits and drawbacks, as explained below[21]. In previous RES auctions, capacity caps have been the most common, while budget caps have been introduced in three of the countries analysed in AURES (Wigand et al., 2016[22]).

Auction volume determined in terms of capacity (MW)

When the target volume of an auction is expressed in terms of installed capacity, the auctioned good is in most cases also defined in terms of capacity. A bidder thus commits to installing the offered capacity within the specified realisation deadline. Since the support payments are often based on RES generation (in €/MWh), a capacity target volume provides less ex-ante security on total policy costs compared to a budget-based auction target. By setting an appropriate ceiling price, it is possible to contain this risk. Auctions with capacity target volumes provide a good planning environment for the electricity sector and enable easy monitoring regarding the achievement of RES policy goals (which are often stated in terms of capacity or production shares). In contrast, under budget caps the amount of RES received will depend purely on the emerging price of the auction. When capacity volumes are auctioned, realisation of the auctioned volume can be measured as soon as capacity is installed, whereas budget and generation volumes rely on project operation to realise the contracted volumes.

From the perspective of a winning bidder, committing to realise a certain capacity (rather than production volume), comes with fewer uncertainties. Capacity-based volumes also give the strongest signal to equipment manufacturers and developers about the relevant market size for the future, and may therefore lead to further cost reductions from innovation and supply chain improvements (Kitzing et al., 2016b[23])[24].

Auction volume determined in terms of generation (MWh)

Generation-based targets are unusual. Two options are possible: 1) the auction volume is set in terms of actual generation over the course of a given time frame (or an actual annual average); or 2) annual generation is estimated by combining standardised technology-specific annual full-load-hours with installed capacities. From the viewpoint of a policy maker, a generation target volume provides less ex-ante security on total policy costs, compared to a budget-based auction target. However, by setting an appropriate ceiling price, it is possible to contain this risk. Auctions with generation-based target volumes provide a good planning environment for the whole electricity sector and enable easy monitoring regarding the achievement of RES policy targets, especially if these are formulated in terms of share of total electricity generation. For bidders, committing to the delivery of a certain generation volume is more risky than a certain capacity, exposing them e.g. to variations in weather conditions. This can be mitigated by defining a range (minimum and maximum) of

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[21] See also aueresproject.eu/auction-volume for further details.

[22] Wigand et al. (2016): Auctions for renewable energy support: lessons learnt from international experiences. AURES report D4.2. link

[23] Kitzing et al. (2016b): Recommendations on the role of auctions in a new renewable energy directive. AURES report. link

[24] The market signal for equipment manufacturers would be uncertain in generation-based targets and absent in budget-based targets. See also del Río et al (2016b): Policy Memo 3: The effect of award types on auction outcomes. AURES report. link

annual production delivery, increasing the period in which contracted volumes are to be delivered, or by including some corrections in relation to 'normal' production years.

Auction volume determined in terms of budget (€)

When the target volume of an auction is set in terms of a maximum budget, winners are allocated support concessions until the full budget is used. The auctioned good is still usually either expressed in terms of generation (MWh) or capacity (MW). For generation-based remuneration schemes, it is typically the auctioneer who, in order to select winners until the budget limit is reached, estimates the total support expenditures per project, either based on own estimations of production or on information given by the bidders. A budget target volume sets a clear upper limit for support expenditures, thus providing security regarding policy costs for the regulator, and ultimately, electricity consumers. However, with a budget cap it is *ex-ante* unclear how much capacity will be installed as a result of each auction round. This makes planning in the electricity system more difficult. It also means that the achievement of policy targets (which are usually expressed in terms of installed capacities or shares of total electricity production) is more difficult to monitor. This can lead to both under- or overachievement of policy targets. Budget caps are thus less straightforward to be deduced from existing policy targets and must be constantly monitored and readjusted according to technology cost developments.

Disclosure of auction volumes

Auction volumes can be disclosed or kept hidden from the bidders during the auction. Undisclosed volumes can mitigate cases of uncertain competitive situations, by reducing the likelihood of strategic bidding. This could prevent auctions from ending prematurely and avoid artificially high support levels. Some countries decided not to disclose volumes to discourage strategic behaviour and collusion[25]. On the other hand, a disclosed, reliable auction volume can also create competition by sending a strong signal to investors to develop the required project pipeline (Wigand et al., 2016[26]).

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[25] See e.g. in Brazil (Förster and Amato (2016): Auctions for Renewable Energy Support in Brazil: Instruments and lessons learnt. AURES report D4.1-BRA. link) and in South Africa (del Río (2016): Auctions for Renewable Energy Support in South Africa: Instruments and lessons learnt. AURES report D4.1-ZA. link)

[26] Wigand et al. (2016): Auctions for renewable energy support: lessons learnt from international experiences. AURES report D4.2. link

	OBSERVATIONS	RECOMMENDATIONS
CAPACITY CAP	Easy and quick assessment of the achievement of RES policy targets Less ex-ante security on total policy costs than budget-based caps Strongest signal to equipment manufacturers and developers about the relevant market size for the future Fewer uncertainties for awarded bidders regarding compliance	Apply capacity caps to achieve a good balance across policy trade-offs: control of policy costs, monitoring of effectiveness (realisation rates) and risks for bidders.
ENERGY CAP	Less ex-ante security on total policy costs than budget-based caps Committing to the delivery of a certain annual generation volume is more risky for bidders than committing to the installation of a certain capacity. Similar to capacity caps, but lower score regarding monitoring of effectiveness and risks for bidders	Apply energy caps for an easy and quick assessment of the achievement of RES policy targets.
BUDGET CAP	More ex-ante security on total policy costs More challenging to monitor the achievement of policy targets in terms of installed capacities or shares of total electricity production	Apply budget-based caps when the control support costs is virtually the only policy goal.

8 What to do, how to do it: process and procedures for auctions

The process of designing RES auctions requires capacity and resources that should not be underestimated. The starting point of auction design is the individual policy goals on one hand and the current market situation on the other. The optimal choices regarding design options (including type, pricing mechanism, and more) heavily depend on these two fundamental factors. No single perfect auction design exists, as auctions need to be tailored to the specific situation. Otherwise, competiveness and efficient outcomes might be endangered.

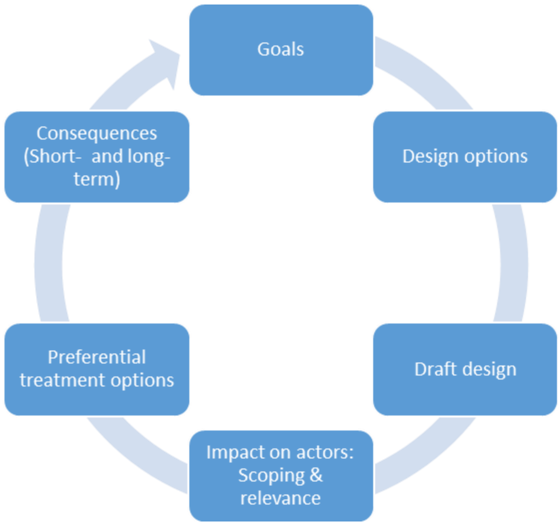

Figure 2: Process for the design of an auction, Source: Wigand and Tiedemann (2016[27])

The auction design process should therefore start with extensive market research, especially regarding the project pipeline of the targeted technologies, the potential market participants, likely bidders and their comparative competitive positions. On this basis, design choices can be made (as described elsewhere in this report). To ensure high participation and optimise the auction design, we recommend to test the draft auction design with stakeholders, especially also regarding the impact on different actor groups (if e.g. actor diversity is an issue). Preferential treatment options could be implemented to adjust for unwanted effects on certain actor groups. Finally, short and long term consequences of the auction should be analysed and monitored throughout the implementation period and auction design continuously updated based on these results, as well as based on changed policy goals and market environments.

Since all auction designs have to be specifically tailored to individual market situations, the found solutions are often unique, implying that often unexpected and unwanted effects will occur, e.g. related to strategic bidding or creative rule interpretation by market participants. Therefore, it is very important to monitor results and continuously adjust designs in preceding auction rounds.

Certain general design options regarding process can help to ensure successful auctions. These include publishing a long-term auction roadmap, and a more detailed auction plan for shorter time horizons, as mentioned above. In any case, project realisation time granted to winners should be reasonable, considering typical project development cycles and required project progress ("early" or "late" auction).

[27] Wigand and Tiedemann (2016): Specific design elements for RES auctions: ensuring actor diversity. AURES Auction Academy webinar #7. link

Early or late auctions?

Auctions can take place at different stages of the project development process. They could e.g. be conducted rather early in the project planning process (as illustrated in Tiedemann and Haufe, 2016[28]). Alternatively, projects can be required to wait until e.g. after the permitting procedure to participate in an auction. This has implications on the cost, the risk level, and also on the actor composition, as illustrated in Figure 3 below. Generally, one could expect to have a larger number of bidders in early auctions, most of which are project developers. If auctions are conducted later in the project development process (i.e. through prequalification requirements), typically fewer projects would qualify and they have incurred greater costs before the auction. In late auctions, lower penalty levels can be set, since prequalification requirements already incentivise bidders to be more 'serious'.

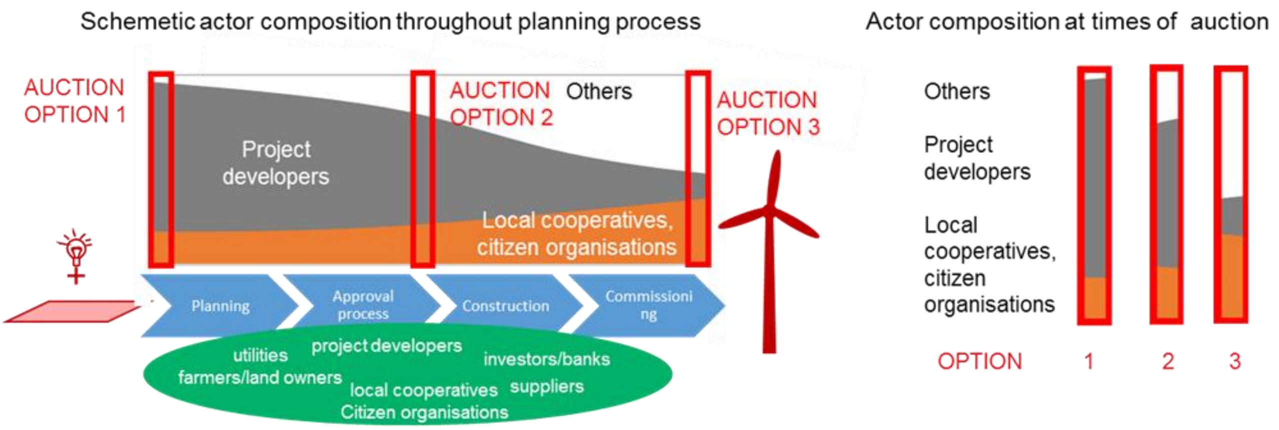

Figure 3: Changing actor composition for auctions conducted at different stages (Wigand and Tiedemann, 2016[29])

Sunk cost problem in auctions

The later the auctions are placed in the process, the higher the sunk costs that project developers incur ahead of the auction. Since sunk cost play no role in economic considerations after they have occurred, they do not enter strictly economically rationale bids. If bidders behave this way, it is likely that winning projects will incur a loss over the lifetime, which in the long term reduces the acceptance of the support scheme. In addition, investors may be driven out of the market and participation might decrease, leading to a decline in competition.

[28] Tiedemann and Haufe (2016): How to participate in an auction for RES support. AURES Auction Academy webinar #5. link

[29] Wigand and Tiedemann (2016): Specific design elements for RES auctions: ensuring actor diversity. AURES Auction Academy webinar #7. link

	OBSERVATIONS	RECOMMENDATIONS
AUCTION DESIGN CHOICES	No single perfect auction design exits.	Auction design needs to consider policy goals and the current market situation. Auction design should be monitored to implement adjustments for updated policy goals and market environments.
EARLY OR LATE AUCTION	Auction can take place at different stages of the project.	A balance between pre-qualification requirements and penalties should be created: Early auctions: lower prequalification requirements balanced by penalties Late auctions: lower penalties balanced by pre-qualification requirements

9 The more the merrier: participation enhancing measures

Attracting the largest possible number of participants is an important success factor for auctions. All auction design processes should consider participation enhancing measures. Barriers to participation should be avoided (such as publishing of tender material in local language only etc.). In the AURES case studies, we have found that participation can be facilitated by a transparent and inclusive design and implementation process, together with the incorporation of feedback from developers into the final auction specifications (Wigand et al., 2016[30]). We suggest auction design processes to incorporate: 1) A process for stakeholder consultation: conduct at least one stakeholder dialogue meeting before tender material is published; 2) Sufficient consultation time: Give at least 15-30 days for commenting on draft specifications; 3) Sufficient bid preparation time: Allow at least 60-90 days between official final call (with published final tender specifications) and bid submission deadline.

	OBSERVATIONS	RECOMMENDATIONS
BIDDERS PARTICIPATION	Attracting participants is an important success factor for auctions.	Incorporate stakeholder consultations Give sufficient consultation and bid preparation time

[30] Wigand et al. (2016): Auctions for renewable energy support: lessons learnt from international experiences. AURES report D4.2. link

10 Beacon in the dark: ceiling prices in auctions

A ceiling price is a maximum price in an auction, where bids above the ceiling price will be disqualified. There are several arguments for and against ceiling prices in RES auctions. On the downside, ceiling prices could limit competition and work as a focus point of bids. This can distort the price signal of the auction when bidders orient their bids towards the ceiling prices rather than their true costs. Overly aggressive ceiling prices can also be distorting as they may make an auction unattractive for investors, potentially resulting in situations where not all auctioned volume is awarded (no "market-clearing"). On the upside, especially in multi-technology auctions and uncertain competitive situations, ceiling prices can help to differentiate between bidder groups and orient stronger bidders towards the ceiling price instead of weaker bids, which is beneficial for competition. If less bids are offered than there is auction volume, ceiling prices can ‘save’ the auction by providing an objective award price. They also put a cap on total support costs and thus increase budget certainty for years in advance.

In general, if there is sufficient competition in the auction (a pre-condition for successful auctions), the potential distortion introduced by a ceiling price should be compensated because bidders still have the incentive to place competitive bids. In that sense, ceiling prices can do more good than harm.

Disclosing the ceiling price to bidders in advance has the advantage that it prevents otherwise qualifying projects from being rejected simply because bidders did not know the ceiling price. The disclosure of the ceiling price also gives bidders more planning security, increasing the acceptance of the auction. A disadvantage of disclosing ceiling prices in a static auction (e.g. sealed-bid auction) is that it can weaken the competitive price discovery of the auction if bidders orient their bids toward the ceiling price (see above).

Usually ceiling prices are set based on an assessment of generation costs (LCOE) and thus technology specific. The LCOE-based ceiling price should be calculated from the perspective of a typical investor, taking regulatory framework and transaction costs into account (taxes and tax exemptions, market risk premiums, financing conditions, etc.). Since auctions increase risks for investors (as compared to administratively set support), the LCOE calculation should also account for this risk. Ceiling prices need to be regularly adapted to evolving technology costs and market realities. This could be done by (manual) recalculation by the administrative authority, by indexing to economic indicators (such as raw material prices, interest rates, etc.), or they could be adjusted based on the auction outcomes of previous rounds. The first option involves regular transaction costs but is well established in many countries with feed-in tariffs, the second option requires higher transaction cost to set up the methodology, and the third option requires some attention to the risk of underbidding (Kitzing et al., 2016b[31]).

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[31] Kitzing et al. (2016b): Recommendations on the role of auctions in a new renewable energy directive. AURES report. link

	OBSERVATIONS	RECOMMENDATIONS
SETTING A CEILING PRICE	Ceiling prices put a cap on total support costs, so policy makers have more certainty about policy expenditures. If competition is low, a ceiling price can incentivise bidders to place bids close to the ceiling price rather than to their true costs. If the ceiling price is set too low, the auction may become unattractive for investors, decreasing competition.	Under sufficient competition, the distortional effect of a ceiling price is not determinant, while it increases certainty about policy costs. We therefore suggest the use of ceiling prices. Ceiling prices should be calculated using an LCOE-based approach and be adjusted regularly.
DISCLOSING A CEILING PRICE	Prevents otherwise qualifying projects from being rejected in the auction. Gives bidders more planning security, particularly in the face of sunk costs of participating in the auction. Weakens the competitive price discovery of the auction if bidders orient their bids toward the ceiling price.	Ceiling prices should be disclosed to bidders in advance of the auction, as otherwise qualifying projects could be rejected in the auction, and additional uncertainty for developers would be created.

11 Realisation safeguards: prequalification requirements and penalties

The primary aim of prequalification criteria and penalties as design elements in the auctions is to secure a high project realisation rate and reduce delay. However, policy makers may also use prequalification requirements in relation to secondary objectives (see Section 12). Setting adequate pre-qualification criteria and penalties is one of the most important and challenging tasks of designing an auction, because they highly affect the risk level of the participating bidders and thus the bid prices and competition level (Kreiss et al., 2017b[32]).

We generally distinguish three types of prequalification requirements: 1) Restrictions, which limit the participation in the auction and only allow bidders or projects with certain qualities, e.g. experience level or technology type; 2) Material prequalification, which requires a certain project development stage upon entering the auction, e.g. obtained planning permits or grid concession; and 3) Financial pre-qualification, which are financial guarantees to secure the completion of the project and usually connected to the penalties,

[32] Kreiss et al. (2017b): Appropriate design of auctions for renewable energy support – Prequalifications and penalties. AURES deliverable D3.2, published in Energy Policy 101, 512-520.

e.g. bid bonds. The three types affect auction outcomes differently as briefly discussed in the table below (see Rosenlund Soysal, 2016[33] for more detail).

Auction participation and bidding behaviour can be affected by pre-qualification requirements. Here, it is not only a question of how strict the requirements are, but also of which practical barriers exist related to pre-qualification. For instance, obtaining permits may pose a significant administrative burden on the project developers and increase the cost of project development. Policy makers can limit the amount of double or triple work related to e.g. obtaining permits by adapting auction rules to the existing permit system. Additionally, auctions should be conducted frequently enough to prevent obtained permits from expiring before bidders get 'another shot'. This way, bidders can re-enter auctions without significant additional costs. Another example is the amount of time given to auction participants to negotiate bid bonds with financial institutions. Allowing more time gives bidders the opportunity to get better deals.

	OBSERVATIONS	RECOMMENDATIONS
RESTRICTIONS	Restrictions provide control over the groups of bidders participating in an auction (e.g. technology, size, experience etc.). They reduce allocative efficiency by preventing certain bidders from participating. Support cost will potentially increase.	Can be implemented with care if experience is highly important or realisation of projects essential. Also, if auctions shall have a narrow technology focus.
MATERIAL PRE-QUALIFICATION	Ensures high project realisation and reduces risk of Winner's curse, because it forces bidders to know their project and its costs well. Increases sunk cost for the project developers, and causes additional risk.	Material pre-qualifications such as requiring a certain project development stage (having obtained crucial permits) have proven to be an important safeguard for project realisation.
FINANCIAL PRE-QUALIFICATION AND PENALTIES	Reduces incentives for underbidding, thus helps to secure seriousness of bids. Reduces delay and increases project realisation. Financial pre-qualification can guarantee the payments of penalties (through the use of bid bonds to be placed at bidding). Penalties increase the risk of the bidders, potentially leading to higher bid prices. If penalties are too large and financial guarantees too difficult to obtain, they may deter project developers from participating.	Penalties and connected financial pre-qualification requirements (through bid bonds) have proven to be an important safeguard for project realisation. Pay special attention to the design of pre-qualification and penalties; adapt these to technology, market conditions, and existing regulatory regime.

[33] Rosenlund Soysal (2016). Policy Memo 2: Pre-qualification and Penalties. AURES Report. link

12 What if least cost is not the only policy goal: secondary objectives in auctions

Next to achieving an economically efficient allocation of support funds, a policy maker may have other policy objectives. The most common secondary objectives are actor diversity (usually, this means improving the chances of small actors), a certain geographic distribution, domestic industry development, system integration, or certain technical specifications. Different measures exist to take into account each of these objectives. Of course, desirable projects can also be favoured *outside* of the auction, for example by providing them with extra counselling during participation, or by exempting them from auctions altogether. In the table below, measures to implement secondary objectives *within* an auction are listed, based on findings and information from Steinhilber and Rosenlund Soysal (2016)[34] as well as the AURES Auction Designer[35].

By definition, measures to internalise secondary objectives into an auction are applied to favour projects that otherwise would have lower chances of winning, usually because they have structurally higher generation costs. In such case, the policy maker faces a trade-off with the objective of economic efficiency (i.e. awarding those projects with the lowest costs). In many cases, compromising on economic efficiency will also translate into higher support expenditures. However, there may be cases in which separating the favoured higher-cost from lower-cost bidders (i.e. by creating contingents) may actually increase competitive pressure among lower-cost bidders, thus leading to overall lower support costs (Kreiss et al., 2017a[36]).

	OBSERVATIONS	POSSIBLE MEASURES
ACTOR DIVERSITY	Defining "small" actors is challenging. Favourable treatment creates an incentive for all actors to try being included in the exemption.	Reduced financial or material prequalification / penalty for small actors Different pricing rule for small actors Contingents (quotas) for small actors
GEOGRAPHIC DISTRIBUTION	This is only relevant for multiple-item auctions, as single-item auctions usually have a pre-determined and pre-developed location.	Contingents (quotas) for certain locations Prequalification criterion for certain locations Criterion in auction to favour certain locations Reference yield model

[34] Steinhilber and Rosenlund Soysal (2016). Policy Memo 1: Secondary Objectives in Auctions. AURES report. link
[35] auresproject.eu/auctiondesigner
[36] Kreiss et al. (2017a): Different cost perspectives for renewable energy support: Assessment of technology-neutral and discriminatory auctions. Forthcoming (submitted to scientific journal).

DOMESTIC INDUSTRY DEVELOPMENT	Local content rules in auctions are in many cases legally problematic.	Prequalification requirement regarding job and cluster creation Criterion in auction to favour job and cluster creation Consider to include options outside the auction such as creation of innovation clusters and through training programmes. This may result in a more cost-efficient measure.
SYSTEM INTEGRATION	Under current state aid regulation, generation-based support is required to be paid in the form of a feed-in premium in EU Member States, exposing RES projects to electricity prices to differing degrees, depending on the design.	Select a remuneration award metric that exposes RES to electricity prices. Deep connection cost charging
TECHNICAL SPECIFICATIONS	Conceptually, favouring certain technical specifications in an auction is no different from differentiating between RES technologies (such as onshore wind, hydro, PV, etc.). Similar arguments apply.	Conduct separate auctions for separate technology groups. Contingents (Quotas) Criterion in auction for desired technical specification Boni for desired technical specification

13 Can bigger be better? Cross-border auctions

Awarding support for renewable energy has so far mainly been a national matter, related to national deployment targets and national fiscal policies. However, cross-border auctions that allow projects located in one country to participate in support auctions of another country, are a trend arising from European market integration and are in fact requested by the European Commission[37]. The economic rationale behind cross-border auctions is that they could lead to more efficient RES deployment and induce support cost savings. Cost savings can be achieved when a specified output of electricity can be generated at lower costs by two or more countries than it could by each country providing the output individually, e.g. when additional low-cost sites become accessible. In addition, economies of scale and of scope can be achieved if two or more countries jointly organise an auction. Another benefit might be the increased competition and reduction of implicit collusion, which can also lead to efficiency gains.

[37] European Commission (2017), Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (recast). link

Despite potential efficiency gains, most countries are still reluctant to implement cross-border auctions due to low public acceptance of paying support to RES projects located in other countries (Klessmann et al., 2014[38]). The process of reaching a cross-border agreement is complex because the design and implementation process includes negotiations between at least two countries, agreements between different regulatory agencies, two sets of market conditions and two governments with each their political considerations. However, once the parties reach agreement on a cross-border support scheme, they may be less likely to re-open negotiations for adjustments, which may results in increased stability for market players.

There are several types of cross-border auctions: 1) national auctions may be unilaterally opened, 2) national auctions may be mutually opened, or 3) joint auctions can be conducted. These options come with different involvement by the participating countries and with increased complexity.

For a well-functioning auction, it is necessary to create a level playing field, i.e. for all bidders to participate on equal basis. This can be challenging when bidders participate under different physical and fiscal regulations. In addition, different design choices can either increase or decrease complexity. For example, sliding premiums require selecting a reference market for determining the support to be paid out, which has implications on both the risk allocation, the attractiveness of the auction and the monitoring. A fixed premium will be easier to handle, as no market price calculations are necessary, see Gephart and Kitzing (2016)[39] for a more detailed discussion. The auctioneer of a cross-border auction may face additional administrative challenges. For instance, it may be difficult to assess the pre-qualification documentation and monitoring the project implementation in another country. It is crucial to agree on cross-border mechanisms ensuring close cooperation between administrations.

	OBSERVATIONS	RECOMMENDATIONS
CROSS-BORDER AUCTIONS	Potential for improved efficiency through regional integration Commitment of policy makers to negotiate a cross-border agreement promotes stability and predictability for the market players. To place a reasonable bid, the auction participants need to know not only their own market but also the market of the other countries.	It is crucial to create a level playing field for all bidders and implement cross-border mechanisms between administrations to control bidder's pre-conditions and project implementation.

[38] Klessmann et al. (2014): Cooperation between EU MS under the RES Directive. link
[39] Gephart and Kitzing (2016): Implementation of Auctions for Renewable Energy Support in in the Netherlands and Denmark: a Cooperation Case Study. AURES report D7.1-NL/DK. link

14 Auction myths

Myth #1: Auctions are the best solution

The AURES project has shown that auctions can be a suitable instrument for allocating support under budget and volume limitations and that they can achieve significant short-term efficiency gains. We expect that adequate auction design tailored to national market conditions and policy goals synchronised with project development made by the industry will further reduce the cost of renewable energy and facilitate increasing their share in the energy system.

Auctions ensure through competition that renewable energy is delivered cheaper to final consumers and taxpayers and at the same time give the industry an incentive to improve their performance and deliver competitive solutions. However, it has not been proven that auctions in general are better suited to support renewables than other instruments. Certain market conditions are necessary for competitive price determination to be preferable to administrative price setting (e.g. through feed-in schemes). For example, sufficient resource and market potential must be available. Supply must always exceed demand (i.e. the political target for renewable build-out), so that competition in each auction can be achieved. Additionally, a sufficient amount of bidders must be attracted to participate in the auction and they must have similar cost structures so that true competition can evolve. If these basic conditions for competition are not fulfilled, then administratively set prices can be preferable.

Auctions require certain institutional capacity. It has to be ensured that policy makers designing the auction and auctioneers undertaking the auctions have enough resources to deal with the new challenges that auctions imply, such as ensuring sufficient competition for a well-functioning price formation, avoiding undesired strategic incentives, collusion and other market distortions, and importantly dealing with risk of low realisation rates.

Myth #2: Auctions are the worst option

Renewable energy auctions have had a difficult history. Some early experiences showed either very low project realisation rates or lack of competition (bidders), which resulted in high costs. More recently, however, improved understanding of the pitfalls of auction design and consequently careful auction designs using appropriate safeguards means that many auctions have delivered on their policy goals of renewable energy deployment at costs that appear favourable. Auctions are not a one-size-fits all solution; there are situations in which they are not appropriate. However, in the right situation and with the right goals in mind, auctions can be a useful part of the renewable energy policy toolbox.

Myth #3: Auctions lead to higher market concentration and penalise small bidders

Auctions can indeed lead to higher market concentration and penalise small bidders. Usually, auctions are cost-based, i.e. those bidders who can offer the lowest bids are awarded. Low costs can be offered especially by large and established companies, making use of economies of scale or a vertically integrated value chain. In the long run, when these bidders are frequently successful, smaller entities may be pushed out of the market. However, analysis in the AURES project has shown that auctions can be designed to safeguard actor diversity (e.g. applying additional criteria benefitting smaller bidders or exemption rules allowing them to receive non-auction based support). In fact, auctions can be efficient while not changing the market structure to the advantage of large-scale bidders.

Myth #4: Bidders behave rationally

In economic theory, market participants are usually described as to behaving rationally (*homo economicus*). However, recent field studies and experiments suggest that this is not always the case and that there are even structural flaws to this assumption (Haufe et al., 2017[40]). Thus, also auctions for renewable energy support can be exposed to unreasonable bidding and the auctioneer should seek for a design that minimises the risk ensuing from this behaviour and bidders should account for this possibility when deciding on their bidding strategy.

Myth #5: Auctions resulting in zero support will lead to zero revenue for investors

Record-low bids in recent auctions for offshore wind in Europe have made the news. In April 2017 in Germany, projects to be commissioned by 2024/25 were awarded with zero support[41]. In September 2017 in the UK, projects to be built by 2021/22 were awarded with unprecedented low support levels[42]. So why did we see zero bids in Germany and not in the UK? There are several factors explaining the auction price difference in these countries. One of them is the structure of the feed-in premium (FIP) awarded in each country. In the UK, auction winners sign a Contract for Difference (CfD) defining the type of FIP they are paid for generating electricity. If electricity prices are lower than the auction price (i.e. strike price), the operator receives the difference (a premium). If the electricity price exceeds the strike price, operators pay back the difference to the government. In Germany, on the other hand, a sliding FIP is paid where operators can keep the upside if the market price increases above the bid price. A zero-bid in Germany is therefore is not the same as a zero-bid in the United Kingdom. While a zero-bid in the United Kingdom would be equivalent to zero revenue, a zero-bid in Germany means that a project will be built with zero support but still with revenue from the sale of electricity at the wholesale market.

[40] Haufe et al. (2017) : The Winner's Curse in Discriminatory and Uniform Price Auctions under Varying Competition Levels. AURES report D3.4. link

[41] Bids by Ørsted (previously DONG Energy) and EnBW.

[42] €92.18/MWh (£74.75/MWh) and €70.91/MWh (£57.50/MWh), in 2012 prices (as the budget envelope (known as the Levy Control Framework) was conceived and implemented in 2012, with all future expenditure limits expressed in 2012 prices). Payments to operators will be adjusted for inflation. The 2012 exchange rate of 1 Euro = 0.811 Pound from the German Federal Bank was used.

Myth #6: Selecting pay-as-bid versus uniform pricing rule greatly influences the auction outcome

Policy makers often discuss at great length which pricing rule to choose for their auction. However, be aware that while this choice can of course affect the auction outcome, this effect is not nearly as strong as that of other factors, such as the level of competition, or whether ceiling prices, pre-qualifications, and penalties are designed well. Experiences with PV pilot auctions in Germany have shown that alternating between the pricing rule throughout several rounds seems to have no significant influence on the resulting price. Furthermore, making small changes to auction design, such as alternating pricing rules, can help avoid implicit collusion as bidders have less chance to get too used to one auction mechanism. Therefore, it could be beneficial to test both pay-as-bid as well as uniform pricing (with lowest rejected bid) in consecutive auction rounds.

Myth #7: The uniform pricing rule leads to better bids (is incentive compatible)

In the context of auctions for renewable energy support and the assessment of the two pricing rules pay-as-bid and uniform pricing, the latter one is regularly referred to as the favourable option as it is theoretically incentive compatible. An auction rule is incentive compatible if it is the optimal strategy for each bidder to bid according to their true costs. Indisputably, this is a much-desired characteristic for both the auctioneer (as they can learn most from the bids) and bidders (as they can easily calculate their bids). However, this characteristic only holds under particular (theoretic) assumptions that almost never materialise in realistic auction implementations. As soon as bidders participate with more than one bid or in more than one auction round or their costs have some common components (e.g. PV-module prices), uniform pricing is not incentive compatible anymore, and can thus not be expected to automatically lead to superior results as compared to pay-as-bid.

Myth #8: Technology neutral auctions achieve lower support costs

When only static cost-efficiency is taken into consideration, technology neutral auctions can indeed lead to superior outcomes, since technologies with the lowest generation costs are utilised first. Technology neutral auctions are also often proposed by governments based on the belief that they would lead to lower support costs compared to technology specific auctions. However, the opposite is the case: if the aim is not to reduce generation costs, but to reduce support expenditures, then a technology-specific auction would often be more suitable. The reason is that in such auctions support levels can be differentiated per technology, thus reducing profits for the cheapest technologies. The support levels would be more adapted to the costs of the different technologies, in accordance with the principle of third degree price discrimination (see Section 4 of this report).

15 Good practices in auction design

The AURES project has shown that auctions can only successfully contribute to achieving effective and efficient RES deployment if they are **specifically designed to match the market environment** in the area where the auction is conducted, taking into account **specific policy goals**, the **supply-demand situation** of RES projects, **project pipelines** in comparison to deployment targets, potential **bidder structure**, **competitive positioning** of bidders, **risk of collusion**, **experience** of bidders and/or auctioneer with previous auctions, level and quality of **market and cost information**, and more. The optimal auction design for a single implementation therefore may be very different from the optimal auction design for a different market or even time period. Nonetheless, we have identified several good practices that can with benefit be taken into consideration when designing auctions for renewable support:

#1 Always adapt auctions to the specific situation

- Auction design needs to match the current market environment and policy goals
- Auction design needs to be flexible and be updated often to accommodate changes in market situation and policy goals and to correct for previous unwanted incentives

#2 Secure sufficient competition

- Attract as many serious, true-cost bids as possible, by carefully choosing appropriate auction designs
- Ensure a large enough pool of similarly strong bidders (in some cases aided by granting privileges / discrimination) and avoid artificial market fragmentation (e.g. avoid splitting volumes into too many pools or baskets)
- Avoid expected supply-demand ratios below 1.5:1, in such case consider a smaller auction volume
- Implement participation enhancing measures (including an active communication strategy (in English), stakeholder consultations, at least 15-30 days consultation time on draft specifications, at least 60-90 days for bid preparation)

#3 Safeguard project realisation

- Ask for binding bids
- Winning projects should always receive at least their bid (the support level required to realise the project)
- Implement both pre-qualification requirements and penalties (esp. material pre-qualification regarding project development stage and bid bonds)

#4 Keep it simple

- Define clear and simple selection criteria, use price as selection criterion
- Avoid too harsh or confusing rules (such as stringent timelines, difficult to obtain documentation etc.)

- Use static auctions and consider pay-as-bid pricing if bidders and/or auctioneer are inexperienced, little cost or market information is available, and the competitive situation is uncertain[43].

#5 Provide abundant information to ensure a framework of certainty to potential investors

- Avoid uncertainty and unwanted incentives for strategic behaviour by missing or unclear information that leaves room for interpretation and/or speculation by bidders
- Publish a transparent and continuous auction schedule (to avoid 'desperate' bids)
- Implement cost-based ceiling prices (acts also as a safeguard in case of low competition / too few bids)
- Prioritise stakeholder consultations

[43] Uniform pricing rule may e.g. incentivise unfavourable strategic bidding activity of multi-project bidders in cases of low competition.

16 AURES resources and tools

FRAMING AND CONCEPTUAL ASPECTS

Overview of Design Elements for RES-E Auctions

Assessment Criteria for RES-E Auctions

Links Between Assessment of Design Elements

MODEL-BASED ANALYSIS

Cash flow analysis of past RES auctions in Germany, Spain and Denmark

Modelling of Renewable Energy Auctions: Game theoretic and Energy system Modelling

AUCTION DESIGN ASPECTS

Assessment of Auction Types Suitable for RES-E

Winner's Curse in Discriminatory and Uniform Price Auctions

EMPIRICAL ASPECTS OF AUCTIONS

Synthesis report on country case studies

EU country studies: Denmark, France, Germany, Ireland, Italy, Netherlands, Portugal, UK

Non-EU country studies: Brazil, China, South Africa, USA (California), Peru, Mexico, Chile, Zambia

AUCTIONS AND ALTERNATIVES

Identification of alternative policy options to auctions

Comparison of auctions and alternative policy options

Hybrids and Transitions

FUTURE IMPLEMENTATIONS

Introduction to the Case Studies

EU country studies: Croatia, Poland, Slovakia, Spain, Netherlands/Denmark

Policy cooperation cases: *information on request*

POLICY SUPPORT TOOLBOX

AURES Auction Designer

Cash Flow Model

AURES Auction Academy

RECOMMENDATIONS

Recommendations on the role of auctions in REDII

Policy Memo 1: Secondary objectives in auctions

Policy Memo 2: Pre-qualifications and penalties

Policy Memo 3: Award types and auction outcomes

Policy Memo 4: Competition in auctions

MEDIA

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17 References

Butler, L., Neuhoff, K. 2008. Comparison of Feed-in Tariff, Quota and Auction Mechanisms to Support Wind Power Development. Renewable Energy, 33, 1854-1867.

Elizondo, G., Barroso, L., Cunha, G. 2014. Promoting Renewable Energy through Auctions: The Case of Brazil. The World Bank.

European Commission guidance for the design of renewables support schemes (2014) Guidelines on State aid for environmental protection and energy 2014-2020. Official Journal of the European Union (2014/C 200/01). eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014XC0628(01)

European Commission (2017), Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (recast). 2016/0382 (COD), 23.2.2017. ec.europa.eu/energy/sites/ener/files/documents/1_en_act_part1_v7_1.pdf

Fitch-Roy, O. 2015. Auctions for Renewable Support in California: Instruments and lessons learnt. Report D4.1-CAL of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), December 2015. auresproject.eu/files/media/countryreports/pdf_california.pdf

Fitch-Roy, O., Woodman, B. 2016. Auctions for Renewable Energy Support in the United Kingdom: Instruments and lessons learnt. Report D4.1-UK of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), March 2016. auresproject.eu/files/media/documents/pdf_uk_rev1.pdf

Förster, S., Amato, A. 2016. Auctions for Renewable Energy Support in Brazil: Instruments and lessons learnt. Report D4.1-BRA of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), March 2016. auresproject.eu/files/media/countryreports/pdf3_brazil.pdf

Gephart, M., Kitzing, L. 2016. Implementation of Auctions for Renewable Energy Support in in the Netherlands and Denmark: a Cooperation Case Study. Report D7.1-NL/DK of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), March 2016. auresproject.eu/sites/aures.eu/files/media/documents/wp7_-_case_study_report_nl-dk_5.pdf

Haufe, M.-C., Ehrhart, K.-M. 2016. Assessment of Auction Types Suitable for RES-E. AURES report D3.1, of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), January 2016. auresproject.eu/sites/aures.eu/files/media/documents/d_3_1_assessment_of_auctions_final_mm.pdf

Haufe, M.-C., Kreiss, J., Ehrhart, K.-M. 2017. The Winner's Curse in Discriminatory and Uniform Price Auctions under Varying Competition Levels. Report D3.4 of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), June 2017. auresproject.eu/sites/aures.eu/files/media/documents/winnerscurse.pdf

Kitzing, L., Wendring, P. 2015. Auctions for Renewable Support in Denmark: Instruments and lessons learnt. Report D4.1-DK of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), December 2015. auresproject.eu/files/media/countryreports/pdf_denmark.pdf

Kitzing, L., Wendring, P. 2016. Implementation of Auctions for Renewable Energy Support in Poland: A case study. Report D7.1-PL of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), March 2016. orbit.dtu.dk/files/124056634/wp_7_case_study_report_poland_2.pdf

Kitzing, L., Islam, M., Fitch-Roy, O. 2016a. Comparison of auctions and alternative policy options for RES-E support. Report D6.2 of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), December 2016. auresproject.eu/sites/aures.eu/files/media/documents/report_6_2.pdf

Kitzing, L., Islam, M. Rosenlund, E., Held, A., Ragwitz, M., Winkler, J., Steinhilber, S., del Río, P., Wigand, F., Tiedemann, S., Klessmann, C., Busch, S., Ortner, A., Kreiß, J., Fitch-Roy, O., Woodman, B. 2016b. Recommendations on the role of auctions in a new renewable energy directive. Report of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), October 2016. auresproject.eu/sites/aures.eu/files/media/documents/redii_memo_final.pdf

Klessmann, C., de Visser, E., Wigand, F., Gephart, M., Resch, G., Busch, S. 2014. Cooperation between EU MS under the RES Directive. A report compiled within the European project "Cooperation between EU MS under the Renewable Energy Directive and interaction with support schemes". ecofys.com/files/files/ec-ecofys-tuvienna-2014-cooperation-member-states-res-directive.pdf

Kreiss, J., Ehrhart, K.-M., Haufe, M.-C., Rosenlund Soysal, E. 2017a. Different cost perspectives for renewable energy support: Assessment of technology-neutral and discriminatory auctions. Forthcoming (submitted to scientific journal).

Kreiss, J., Ehrhart, K.-M., Haufe, M.-C. 2017b. Appropriate design of auctions for renewable energy support – Prequalifications and penalties. Deliverable D3.2 of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172). Published in Energy Policy 101, 512-520.

del Río, P., Linares, P. 2014. Back to the future? Rethinking auctions for renewable electricity support. Renewable and Sustainable Energy Reviews 35, 42-56.

del Río, P., Haufe, M.C., Wigand, F., Steinhilber, S. 2015a. Overview of Design Elements for RES-E Auctions. Report D2.2 (a) of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), October 2015. auresproject.eu/sites/aures.eu/files/media/documents/design_elements_october2015.pdf

del Río, P., Wigand, F., Steinhilber, S. 2015b. Assessment criteria for RES-E Auctions. Report D2.2 (b) of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), October 2015. auresproject.eu/files/media/documents/assesment_criteria_october2015.pdf

del Río, P., Fitch-Roy, O., Woodman, B. 2016a. Identification of alternative policy options to auctions for RES-E support. Report D6.1 of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), March 2016. auresproject.eu/sites/aures.eu/files/media/documents/aures_d6_1_final.pdf

del Río, P., Steinhilber, S., Rosenlund, E. 2016b. Policy Memo 3: The effect of award types on auction outcomes. Report of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), October 2016. auresproject.eu/sites/aures.eu/files/media/documents/policy_memo_3_-_award_types_251016.pdf

del Río, P. 2016. Auctions for Renewable Energy Support in South Africa: Instruments and lessons learnt. Report D4.1-ZA of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), March 2016. auresproject.eu/files/media/countryreports/pdf2_south_africa.pdf

Rosenlund Soysal, E. 2016. Policy Memo 2: Pre-qualification and Penalties. Report of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), September 2016. auresproject.eu/sites/aures.eu/files/media/documents/policy_memo_2_pre-qualifications_and_penalties_251016.pdf

Steinhilber, S. 2016. Auctions for Renewable Energy Support in Ireland: Instruments and Lessons Learnt. Report D4.1-IE of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), March 2016. auresproject.eu/files/media/countryreports/pdf3_ireland.pdf

Steinhilber, S, Rosenlund Soysal, E. 2016. Policy Memo 1: Secondary Objectives in Auctions. Report of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), October 2016. auresproject.eu/sites/aures.eu/files/media/documents/policy_memo_1-_secondary_objectives_251016.pdf

Tiedemann, S., Haufe, M.-C. 2016. AURES Auction Academy #5: How to participate in an auction for RES support. Webinar of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), January 2016. auresproject.eu/events/aures-auction-academy-5

Wigand, F., Förster, S. 2016. AURES Auction Academy #4: How to design RES auctions: practical and empirical aspects. Webinar of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), January 2016. auresproject.eu/events/aures-auction-academy-4

Wigand, F., Förster, S., Amazo, A., Tiedemann, S. 2016. Auctions for renewable energy support: lessons learnt from international experiences. Report D4.2 of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), June 2016. auresproject.eu/files/media/documents/aures_wp4_synthesis_report.pdf

Wigand, F., Tiedemann, S. 2016. AURES Auction Academy #7: Specific design elements for RES auctions: ensuring actor diversity. Webinar of the AURES project, 'Auctions for renewable energy support: Effective use and efficient implementation options', a coordination and support action funded under the EU Horizon2020 programme (grant number 646172), February 2016. auresproject.eu/events/aures-auction-academy-7

AURES is a European coordination and support action on auction designs for renewable energy support (RES) in the EU Member States.

The general objective of the project is to promote an effective use and efficient implementation of auctions for RES to improve the performance of electricity from renewable energy sources in Europe.

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