Auctions for Renewable Energy Support: Lessons Learned in the AURES Project

BY LENA KITZING, VASILIOS ANATOLITIS, OSCAR FITCH-ROY, CORINNA KLESSMANN, JAN KREISS, PABLO DEL RÍO, FABIAN WIGAND, BRIDGET WOODMAN

Market-based, competitive bidding processes, i.e., auctions, are becoming a dominant policy instrument for securing future electricity production from renewable energy sources (RES) around the world. The rapid growth is striking: in 2005, only six countries employed RES auctions, and by 2017 at least 84 countries had adopted the mechanism [1,2]. This article outlines the rationale for the shift, describes some of the key design characteristics of auctions, together with best practices and potential pitfalls, and briefly considers the future of auctions in the face of declining support needs.

The research underpinning this article was developed by AURES, a European Horizon 2020 project. Between 2015 and 2017, it supported the implementation of RES auctions in EU Member states. Through theory-based work, empirical analysis of auctions in 12 European and 8 non-European countries, model simulations and economic experiments, AURES generated new insights on the applicability of specific auction designs under different market conditions and policy goals. A second phase of the project (AURES II) is currently ongoing (aures2project.eu).

A RES auction is usually a procurement auction (or tender), where a certain volume of new RES is demanded by a government (or private) entity. Bidders compete to be selected to deliver (part of) the volume based on the financial support they require (often a premium in EUR/MWh). Typically, the projects with the lowest required support win the auction and are then granted the right to receive support payments for a given period of time.

Non-discriminatory volume control mechanisms with competitive price determination

Two main arguments are often identified as driving the use of RES auctions: First, they allow an efficient allocation of support at a level that is competitively determined and reflects realistic cost for the selected projects at the time when they are built. Second, they allow for non-discriminatory and competitive volume control of RES deployment (i.e., avoiding first-come-first-served schemes) and thus control of total support budgets. Both of these can be attractive to policymakers faced with growing support commitments that burden consumers/taxpayers. Additionally, the maturing of many renewable technologies means that exposure to more competitive mechanisms might now be more appropriate than previously when more protective feed-in tariffs were the support mechanism of choice [3].

Lena Kitzing is the corresponding author and with the Techical University of Denmark. She may be reached at lkit@dtu.dk

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Auctions are also extremely flexible allocation mechanisms, allowing policymakers to specify when to call for a certain amount of new RES deployment, what technologies are to be supported, which type of support they receive and when projects should be delivered. As with other RES support schemes, the success of auctions depends on the design elements chosen and how well they address specific characteristics of the technologies and markets.

The switch to auctions entails several new implications through the introducing of direct and immediate competition between RES projects. Not all 'good' projects can be developed anymore – competition only arises if there are more projects bidding than are awarded. RES developers are thus forced to move from a rather 'technocratic' focus on optimising their own projects, into becoming 'strategic' competitors, where the success of one's projects depends on the strength (or weakness) of others. This is also a challenge for policymakers: They now have to take care of 1) ensuring sufficient competition for a well-functioning price formation, 2) avoiding undesired incentives, collusion 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).

Mixed results with RES auctions so far due to challenging design compromises

Renewable energy auctions have had a difficult history. Some early experiences showed either very low project realisation rates or lack of competition (too few bidders), which resulted in high costs due to flawed design [4,5]. We have found that auctions can only successfully contribute to achieving effective and efficient RES deployment if they are designed to match the specific market environment in the area where the auction is conducted. In addition, certain design choices pose trade-offs, e.g., prequalification rules can increase realisation rates but also the risks and costs for bidders, potentially lowering competition and cost-efficiency. At a broader level, policymakers often pursue several policy goals with a single mechanism, and are, for example, concerned with encouraging local industries or actor diversity through auctions. Finding a balance between different policy goals without compromising on well-functioning price formation is a challenging task. However, improved understanding of the pitfalls of auctions led to more carefully designed auctions using appropriate safeguards. Today, many auctions have delivered on their policy goals and achieved renewable energy deployment at low costs.

When not to auction?

Auctions might not always be the best choice. There is strong empirical basis for considering alternatives to auctions in situations where 1) reasonable competition cannot be expected, 2) project costs are particularly uncertain due to external factors or 3) secondary policy goals, such as ensuring local added value or actor diversity, are being pursued. These situations occur often when policymakers are seeking to promote immature or innovative RES technologies. The empirical insight that immature technologies in small markets are best supported outside of competitive auction mechanisms is also supported by recent theoretical work [6].

What influences auction design?

The design of a RES auction needs to reflect several aspects, including political priorities, technology characteristics, the country's market and socio-institutional context and the auctioneer's capabilities. Policymakers pursue policy goals with different priorities, which influences the optimal choice of design elements. For example, it is by now commonly agreed that prequalifications are a must in any RES auction (see below), but their stringency is directly affected by policy priorities. Compared to strict prequalifications, lenient ones may lead to lower support costs, but also lower realisation rates. This illustrates one of the trade-offs policymakers face when designing an auction.

Many design choices, such as auction format (single- or multi-unit), volumes and frequency, depend on technological characteristics, including unit sizes and cost structures. RES technologies have diverse characteristics (e.g., regarding planning procedures) and are therefore impacted in different ways by the same design elements (e.g., realisation periods).

Market characteristics that must be considered when designing auctions are the expected market potential and how this relates to the auction volumes, as well as long-term project pipelines compared to deployment targets. The expected number of bidders and bids, potential bidder structure, competitive positioning of bidders and risk of collusion, the distribution of project costs among bidders (how asymmetric they are), and the relative strengths of bidders and how familiar they are with each other (how well they can assess each other's costs), are all important aspects that policymakers need to consider for successful market facilitation.

Not to be neglected are institutional resources and capabilities. Policymakers designing the auction and auctioneers undertaking the auctions must have sufficient resources to deal with the challenges that auctions imply. Often, the required design solutions are highly context-specific and what works in one market is not necessarily applicable to another. The optimal design of an auction in a certain market therefore may be very different from the optimal design in a different market or even time period. In fact, occasional small changes to auction design over time are helpful, as bidders have less chance of becoming too familiar with one particular design. This helps avoiding implicit collusion.

Setting auction volumes is challenging

Setting an appropriate volume level is a challenging, but critical issue. Auction volumes can be defined in terms of capacity (MW), generation (MWh), or budget (million €). Each of these options has benefits and drawbacks. So far, capacity caps have been the most common, while budget caps have been introduced in three of the countries analysed in AURES [7,8]. A budget-based volume provides certainty on the upper level of support costs, but not on the total amount of capacity deployed or electricity generated. A capacity-based volume provides the strongest signal about the future market size (for project developers and equipment manufacturers) and it allows for early auction result assessment (as soon as the capacity is commissioned). But it does not provide certainty on the exact amount of RES production, which is the typical measure in political RES target setting (i.e., as a percentage of electricity demand) [2]. Generation-based auction volumes make it easier to plan and monitor political target achievement, and also facilitate grid management. However, the variability in production of some RES makes it difficult to make definitive contractual arrangements regarding the support payments.

Auction formats and pricing rules are less problematic

The choice between auction format (single-item or multiple-item), auction type (dynamic or static), and pricing rule (uniform or pay-as-bid) is inarguably intertwined. Policymakers often discuss at great length which auction type and pricing rule to choose. Complex auction types (i.e., dynamic ascending or descending clock) may seem, depending on the technology and format, most desirable for achieving efficient outcomes. However, during the work in AURES, we have found that they also attract fewer eligible bids, and are less favourable especially in the early phases of auction introduction, when some policy learning must be expected: due to the very context-specific design requirements, RES auctions are predestined for unforeseen strategic incentives and loopholes that later need to be mitigated. This is generally much easier in a simple static format. Simpler designs are also more robust against unclear market situations and irrational actions of inexperienced bidders.

Uniform pricing is regularly referred to as the theoretically favourable option due to its incentive compatibility, i.e., the bidders' optimal strategy is to bid according to their true costs. Indisputably, this is a much-desired characteristic for both the auctioneer (to learn from the bids) and bidders (easily calculated 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, in more than one auction round or their costs have some common components (e.g., PV-module prices), uniform pricing is no longer incentive compatible, and thus cannot be expected to automatically lead to superior results as compared to pay-as-bid. Most countries analysed in AURES used pay-as-bid, which is relatively robust against irrational actions.

Maybe surprisingly for some, the choice of pricing rule is not nearly as significant for efficient results as other factors such as the level of competition, or whether ceiling prices, prequalifications and penalties are designed well. Experiences with PV pilot auctions in Germany have, for example, shown that alternating between uniform pricing and pay-as-bid pricing rules seemed to have no significant influence on the resulting price.

Technology focus: Separate or pooled?

The question of whether to conduct separate auctions for each RES technology or to pool them together is a much debated topic. From a static perspective, combining several technologies in one auction is more allocatively efficient than separate technology-specific auctions: requiring all relevant projects to compete with each other will result in awarding the projects with the lowest costs. However, from a dynamic system perspective, one must take into account the prospect of technology learning: supporting technologies which are *currently* more expensive can help them become the most cost-efficient ones in the *future*. The extraordinary price decreases of solar PV are evidence for this.

Furthermore, the competitive pressure in multi-technology auctions may result in stop-and-go development for certain technologies, which is particularly challenging for smaller, single-technology project developers (e.g., in the Netherlands, onshore wind and PV were crowded out by cheaper RES heat technologies in the 2012-2013 auctions).

Multi-technology auctions are often adopted on the basis that they would lead to lower support costs. However, the opposite is often the case: in technology-specific auctions, support levels can be better differentiated by technology. This is a direct effect under uniform pricing where technology-specific auctions result in different prices per technology instead of one overall price, so that prices become more tightly linked to the costs of each technology. The reduction also materialises in pay-as-bid auctions through competitive effects where bidders with cheaper technologies tend to bid more aggressively when only competing against each other in their own separate auction.

In recent years, the concept of 'technology neutral' auctions has emerged. In fact, it is very difficult to design an auction that is actually neutral to all eligible technologies within it. 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 favouritism, the auction design tends to be very complex (and ultimately specific per technology). Ensuring a level playing field when setting design elements such as ceiling prices, material and financial prequalifications, penalties and realisation deadlines can therefore become challenging.

Reliable long-term auction schedules are indispensable

A long-term auction schedule ensures a degree of certainty for investors to avoid both unnecessary investor risks and unfavourable auction outcomes. An auction undertaken without any envisaged repetition for the future could potentially push bidders to underbid in an attempt to limit their losses especially when they already are in late project development phases. Auctions may then seem successful as they result in low support levels, but this may eventually lead to low realisation rates and the failure to achieve RES targets. Empirical analysis carried out in AURES shows that continuity in auction rounds, rather than "stop-and-go" implementation, increases long-term planning certainty for market players [7]. 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, as seen e.g., in California [9].

A main lesson from AURES is that auction frequency is context- and technology-dependent. In general, a lower auction frequency is appropriate for technologies with potentially fewer bidders and larger project sizes (such as offshore wind) and more frequent rounds in the case of technologies (or technology groups) with more potential participants (such as solar PV). If markets are large enough, it can be beneficial to undertake auctions several times a year but it is also common that, in small markets, auctions are undertaken once a year or even less often [10].

Realisation safeguards are a must

The primary aim of prequalification criteria and penalties is to secure high project realisation and reduce delays. Material prequalifications such as requiring a certain project development stage or permits have proven to be an important safeguard for project realisation. They also reduce the risk of the Winner's Curse (where winning bidders are struck by higher than expected costs), because they force bidders to develop projects well before entering an auction, thus improving cost estimates. But they also increase sunk costs for project developers and increase non-allocation risk.

Penalties and connected financial prequalifications (through bid bonds) are also an important safeguard for project realisation, and can reduce incentives for underbidding and delays. However, they increase bidder risks, potentially leading to higher prices. If penalties are high and financial guarantees difficult to obtain, they may deter project developers from participating in the auction, which reduces the level of competition and may increase bid prices [11].

Protecting actor diversity is possible but needs to be applied with caution

Auctions can lead to higher market concentration, as smaller market actors and private investors are less able to cope with the complexity and competiveness of auctions. We have seen some examples of policymakers trying to protect small community actors by designated rules that reduce the auction risk for certain bidder groups. AURES analysis showed that auctions can use the following means to protect certain actor groups: 1) reduced financial/material prequalification, 2) implementing different pricing rules (e.g., favoured actors are granted the highest accepted bid even in pay-as-bid auctions), 3) creating contingents (quotas). Nevertheless, those measures should be applied with caution, since they can affect and distort the auction outcome significantly. Also, defining 'small' or 'community' actors is challenging and favourable treatment creates an incentive for all actors to try to be deemed eligible for it (e.g., in Germany, preferential rules led to the creation of artificial citizen energy communities for onshore wind who were awarded more than 90% of the auction volume in 2017).

Desirable projects and/or actors can also be favoured outside an auction, for example by providing them with additional legal and advisory support during participation, or by exempting them from participating in the auctions altogether and instead supporting them with administratively-set tariffs.

Auctions, a suitable and effective RES policy tool for now and the future

RES auctions can be a suitable instrument for allocating support under budget and volume limitations and can achieve significant short-term efficiency gains. However, auctions are not the silver bullet superior to any other support allocation mechanism. The success of any given auction depends on how well is it tailored to national market conditions and policy goals, and synchronised with project development activities by the industry. This requires certain institutional capacity.

Auctions are extremely flexible and their design can be adapted to local circumstances and reflect changes in the broader context. As the costs of renewable technologies decline, there is increasing attention on the possibility of eliminating support for some technologies. In this context, it would be possible to conduct 'subsidy free auctions' where there is no premium payment, but the support comes from a guaranteed buyer for a project's generation or from the cost-free provision of the necessary infrastructure, e.g., the site or the grid connection. Moves towards this can be seen from recent offshore wind auctions in Germany (2017) and the Netherlands (2018). As familiarity with auctions grows, also new actors are entering the arena. While current RES auctions are typically conducted by government entities on the grounds of national interest, they may also become the mechanism of choice for other actors such as large industrial companies to procure long-term renewable electricity in a cost-efficient manner. The flexibility of the mechanism suggests that it will remain popular with policymakers and the energy industry as the shift towards greater decarbonisation continues.

Footnote

[1] Estimates can be derived using average values per technology (e.g., annual full-load hours).

References

1 IRENA, (2017), *Renewable Energy Auctions; Analysing 2016.* International Energy Agency, link.

2 REN21, (2018), *Renewables 2018: Global Status Report,* link.

3 Kitzing, L., Fitch-Roy, O., Islam, M. & Mitchell, C., (2018), An evolving risk perspective for policy instrument choice in sustainability transitions. *Environmental Innovation and Societal Transitions*, in press.

4 del Río, P. & Linares, P., (2014), Back to the future? Rethinking auctions for renewable electricity support. *Renewable and Sustainable Energy Reviews* 35, 42–56.

5 Mitchell, C., (2000), The England and Wales Non-Fossil Fuel Obligation: History and Lessons. *Annual Review of Energy and the Environment* 25, 285–312.

6 Kitzing, L., Islam, M. & Fitch-Roy, O., (2016), *Comparison of auctions and alternative policy options for RES-E support.* Report D6.2 for AURES, EU Horizon2020, grant number 646172, link.

7 Wigand, F., Förster, S., Amazo, A. & Tiedemann, S., (2016), *Auctions for Renewable Energy Support: Lessons Learnt from International Experiences.* Report D4.2 for AURES, EU Horizon2020, grant number 646172, link.

8 Mora, D. et al., (2017), Experiences with auctions for renewable energy support. *International Conference on the European Energy Market EEM.*

9 Fitch-Roy, O., (2015), *Auctions for Renewable Energy Support in California: Instruments and Lessons Learnt.* Report D4.1-CAL for AURES, EU Horizon2020, grant number 646172, link.

10 Kitzing, L. et al., (2016), *Recommendations on the role of auctions in a new renewable energy directive (REDII)*. Report for AURES, EU Horizon2020, grant number 646172, link.

11 Kreiss, J., Ehrhart, K. M. & Haufe, M. C., (2017), Appropriate design of auctions for renewable energy support - Prequalifications and penalties. *Energy Policy* 101, 512–520.