Policy Brief, June 2020

How (not) to respond to low competition in renewable energy auctions

Endogenous rationing in renewable energy auctions

AURES II has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817619

Policy Brief, June 2020, How (not) to respond to low competition in renewable energy auctions

Authors: Ann-Katrin Hanke (Takon), Silvana Tiedemann (Guidehouse)

Reviewed by: Felix von Blücher (Guidehouse), Vasilios Anatolitis (Fraunhofer ISI), Bettina Dézsi and László Szabó (REKK), Karl-Martin Ehrhart (Takon)
Submission date: 15 June 2020
Project start date: 01 November 2018
Work Package: WP3
Work Package leader: Fraunhofer ISI

Dissemination level: PU (Public)

Contents

1 The problem of low competition in renewable energy auctions 4
2 Non-solution: endogenous rationing 6
2.1 General economic analysis 6
2.2 Auction-theoretic analysis 7
2.3 Experimental results 7
2.4 Empirical evidence of Switzerland 8
3 Potential solutions to increase competition 9
3.1 Revisit the auction design 9
3.2 Create targeted market signals 10
3.3 Think about multi-technology and cross-border auctions 10
3.4 Reduce the demand—temporarily 10
4 Conclusion 11
References 12

1 The problem of low competition in renewable energy auctions

Many countries worldwide share the common goal of increasing the number of renewable energy sources in energy generation to create a sustainable and environmentally friendly economy. While the introduction of competitive mechanisms to determine the level and the recipients of support for renewable energy sources (RES) is mandatory for EU countries, many more countries globally have introduced measures to determine the support competitively.

A major pillar in the achievement of countries' renewable energy targets is the continuous extension of renewable energies. Thus, the volume of demand needs to increase yet policy makers are still keen to keep cost for support to a minimum. An auction can offer lower prices compared to a scenario with administratively set fixed payments for all participants.[1] Therefore, policy makers introduced auctions for RES to lower prices and increase the volume.

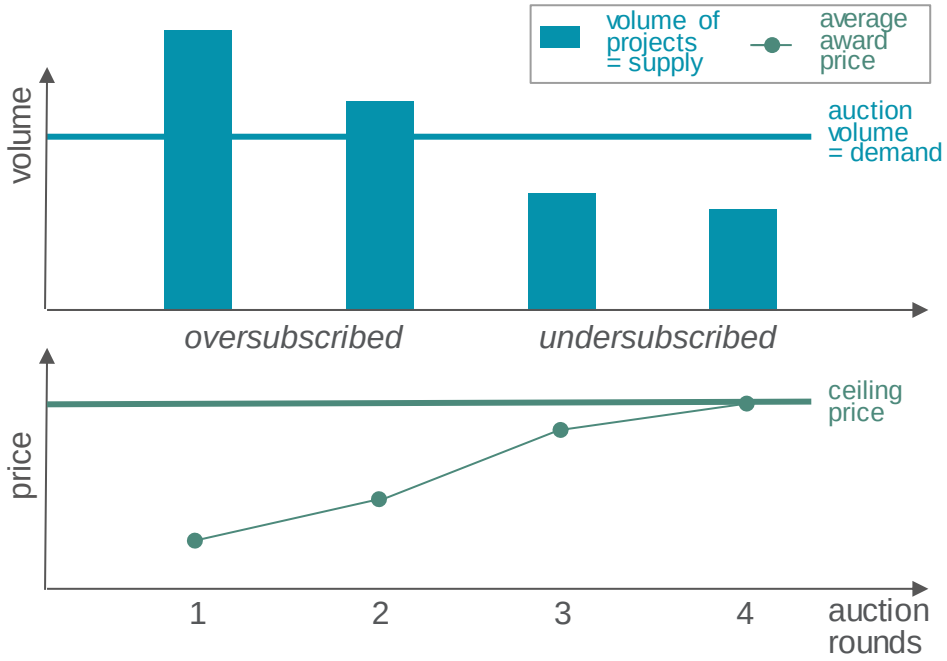

Figure 1: Generic visualisation of how the average award price (below) increases until reaching the ceiling price when the supply (above) decreases.

These two goals—low prices and high auction volumes—can only be achieved, if the supply of pre-developed RES projects[2] is sufficiently high. This is not always the case. So, sites available for RES (or a specific technology) can be limited in countries with little free space or high restrictions for building plants. The number of suitable sites is inelastic, if not almost fixed, in many cases. Further, the market cannot always immediately react to market incentives because the project development can have a high lag time due to mandatory environmental permits, for example. All in all, there is a rather low elasticity of supply. The supply is vulnerable to external incidents such as legal actions against projects, which can result in severe damages to renewable energy projects and their development. A generic example of possible price developments because of a supply shortage can be found in Figure 1.

[1] Assuming a considerate ceiling price in the auction.

[2] Throughout this paper, supply is defined as the market supply side of RES projects, i.e. the pre-defined available renewable energy projects being able to compete in the auction.

A prominent example is the undersubscription of wind onshore auctions in Germany. Since 2018, the technology-specific auctions were almost always undersubscribed–i.e. the auction volume was higher than the offered supply—resulting in prices at the ceiling price (Tiedemann, et al., 2019). The same could be observed in the second wind onshore auction in France, where only 230 MW of bids were submitted, while 500 MW were originally auctioned. After reconsiderations, only 120 MW were awarded to guarantee prices at the same level as in prior auction rounds. The reduced auction volume in France was not announced prior to the auction (reNews, 2018). The decision to not announce goes hand-in-hand with a proposal emerging in several countries to introduce measures to reduce auction volumes or ceiling prices in times of low competition, i.e. low supply. We call an auction volume or ceiling price that depends on the level of competition *endogenously* determined. Because both decrease with a decreasing level of competition, we speak of *endogenous rationing*.

The rationale behind endogenous rationing, by sometimes referred to as the 80% rule,[3] first appears to be rather intuitive. In times of low competition, policy makers must choose between low prices and high auction volumes. To guarantee both low prices and high volumes, they want to artificially create competition.

This policy brief explains why the approach of endogenous adaption mechanisms should not be followed and is hindering renewable energy expansion. We propose other options to meet the problems emerging from low supply and low competition in auctions.

[3] Many countries suggest an implementation of awarding only 80% of the submitted volume in times of low competition.

2 Non-solution: endogenous rationing

The most prominent and commonly proposed solution is a mechanism called *endogenous rationing*. Endogenous rationing has two variants: the endogenous adaption of auction volume (also known as the 80% rule), and the endogenous determination of the ceiling price. Both variants set key parameters of the auction, namely the volume and the ceiling price, as a function of the supply.

The endogenous setting of the volume works as follows: If supply does not exceed the auction volume (or only slightly exceeds it), only a certain fraction of the supply gets an award. When countries use the 80% rule, they only award 80% of the supply volume. The original auction volume decreases up to the point where 20% of the supplied volume does not receive an award. The idea behind this mechanism is to guarantee competition: a fraction of the bids is always unsuccessful. Bidders have no incentive to bid at the ceiling price, so they make competitive bids to increase their chance of winning.

This kind of rationing is or will be applied in several countries, including Germany (Deutsche Bundesregierung, 2019), France (Ministre de l'Europe et des Affaires étrangères, 2018) and Ukraine (Legislation of Ukraine, 2019). Variations of this measure, e.g. the suspension of entire auction rounds if not enough competition is present, can be found in Greece (Papachristou, Kapetana, Daliouris, & Petmezas, 2017), Kazakhstan (Abylkairova, 2018), Mexico (Jiménez, 2016), Brazil (IRENA, 2015) and Switzerland (Bundesamt für Energie, 2019).[4] The Switzerland example is discussed in Section 2.4 because it provides enough data to evaluate the measure.

The endogenous determination of the ceiling price sets the ceiling price in relation to the bids submitted in current or past round(s). In contrast to the endogenous setting of the auction volume, the submitted prices are the basis for the rationing. In cases of supply shortages, the submitted bids determine the ceiling price which is lower than the original ceiling price. A basis for this new ceiling price can be the bids' median or mean. Only bids lower than this new ceiling price get an award. By design, the most expensive bids never get an award, which should secure competition. In this case, it does not matter if the non-awarded bids are on the level of the old ceiling price, or significantly lower than it. France (Ministre de l'Europe et des Affaires étrangères, 2019) and Peru (Comité 2015) apply endogenous ceiling prices.

In the following sections, the use of endogenous rationing mechanisms is critically analysed with basic economic approaches and with methods from auction theory and laboratory experiments. Real-world data from Switzerland is also analysed to support the critique.

2.1 General economic analysis[5]

An auction is an allocation mechanism to balance supply and demand—i.e. to determine which participants are awarded support and at what level. By the very principles of a market, an auction is not suitable to remedy a lack of competition. The clearing prices (i.e. the award prices) are determined by the balance of supply and demand and reflect scarcity in the market. If there is excessive demand (e.g. in undersubscribed auctions), the clearing price is the ceiling price, i.e. the maximum willingness-to-pay of the auctioneer. These prices generate an investment signal by showing it is worthwhile to invest and are important drivers for future market development. By introducing endogenous rationing mechanisms, this balance is artificially disrupted. Only one market side, the supply side, determines the awarded volume and award prices. This contradiction of basic market principles can result in various undesired side effects (discussed in Section 2.3).

Endogenous rationing may damage the reliability and trustworthiness of the auctioneer and the market, and prevent smaller bidders from participating in the auction. Moreover, larger bidders with multiple projects could introduce untruthful bids on dummy projects to ensure their other projects receive an award even with

[4] In Kazakhstan (Abylkairova, 2018) and Greece (Papachristou, Kapetana, Daliouris, & Petmezas, 2017) the auction does not take place if there is not enough competition; in Brazil (IRENA, 2015) the competition level is secured by a demand parameter, which reduces the auction volume if the initial volume does not meet the parameter. Mexico aims to maximize economic surplus, and bidders have to adapt their bids until a minimal level of surplus is reached (Jiménez, 2016).

[5] The analysis in this section is founded on basic economic principles described e.g. in *Principles of Economics* (Mankiw, 2017).

high prices. Anecdotal evidence shows that market participants easily adapt (unwanted) strategies to increase their profit—for example the first wind onshore auctions in Germany, where almost all bidders defined themselves as energy-communities to profit from more attractive rules. In the Greek Solar PV pilot auction in 2016, one bidder admitted after the auction that they registered multiple projects without the intention to realise the projects, just so that the threshold level, under which the auction would not have taken place, would be met (K.-M. Ehrhart 2017). This strategic behaviour repeated in December 2018, when the auction was cancelled due to excessive registrations of dummy projects (Anatolitis, 2020).

To guarantee sustainable competition, it is vital to continuously create investment signals for project developers. The market must be predictable and attractive. An auction with endogenous rationing does not trigger investments; rather, it increases market distortions and undesirable results, such as untruthful bids manipulating the auction.

2.2 Auction-theoretic analysis[6]

In auctions with costly participation (for example due to prequalification criteria) not all potential project developers will participate (Samuelson, 1985). Bidders with relatively high costs know they have comparably high costs and low chances of getting awarded; they will not risk losing money by developing their project and participating in the auction. In the auction-theoretic equilibrium, the last bidder that participates in the auction, the bidder with the highest costs, has an expected profit that exactly compensates his prior payments. By introducing measures of endogenous rationing, the award chances of the last bidder abruptly drop to zero. This bidder will no longer participate, so the second-to-last bidder becomes the last bidder. This results in a downward spiral of supply. In the auction-theoretic equilibrium, no potential bidder will participate in the auction. Here it does not matter whether the auction volume is endogenously adapted, or if the ceiling price is endogenously determined.

Compared to auctions without endogenous rationing mechanisms implemented, auctions with endogenous rationing lead to a lower number of awards and an additional shortage of supply because more potential project developers pull back from developing their project. Moreover, both for the auctioneer (the state) and the society (energy consumers) the economic benefit resulting from high amounts of award volume together with low prices[7] decreases. Further, social costs increase compared to auctions without these measures. The costs for supplying energy rise. All these effects stem from the lower award volume, as the loss of award volume predominates the possible lower prices in the auction.

Although this theoretic equilibrium is not likely to be observed directly in the first auction after its implementation, results from experimental economic research shows that market participants learn and adapt to the equilibrium fast. Therefore, it is likely that in real-life application, the effect of an even lower participation rate will occur with all negative effects this implies in the mid- or long-term. From an auction-theoretic point of view, endogenous rationing does not help the situation— it worsens it.

2.3 Experimental results[8]

In addition to the auction-theoretic analysis, a laboratory experiment with 144 students at KD2lab[9] in Karlsruhe, Germany, was conducted. In repeated auction rounds, participants had to decide first on their participation, which was costly, and second, on the level of their bid. Two types of auctions were compared:

- Control group: Half of the participants participated in auctions without endogenous rationing.
- Endogenous group: The other half of participants participated in auctions with endogenous adaption of auction volume.

[6] The analysis in this section is based on the "A Small Volume Reduction that Melts Down the Market: Auctions with Endogenous Rationing" working paper (Ehrhart, Hanke, & Ott, 2020).
[7] that is, auctioneer's surplus as well consumer's surplus
[8] The analysis in this section is based on "Auctions with Endogenous Rationing – An Experimental Study" (Dorner, Ehrhart, & Hanke, 2019).
[9] The KD2lab (Karlsruhe Decision and Design Lab) is DFG-funded and situated at the Karlsruhe Institute of Technology. For further information see https://www.kd2lab.kit.edu/english/index.php.

The results of this experiment are in line with the theoretic results. While the number of bids in the auctions of the control group are on average constant over the rounds on the level of the auction volume, the number of bids decrease drastically in the auctions of the endogenous group. There are even auction rounds present without any bids submitted. Though prices are lower in the endogenous auctions, auctioneer's surplus and social welfare are always lower in the endogenous group than in the control group. The difference between auctions of the different groups increases over the rounds, as surplus and welfare decrease in the endogenous auctions. This finding shows that although prices may decrease by implementing endogenous rationing measures because of the even lower number of projects compared to standard auctions, the overall effects of these mechanisms are negative.

2.4 Empirical evidence of Switzerland

Switzerland introduced endogenous rationing measures relatively early, so the available data is sufficient to analyse effects. The Swiss auction for energy efficiency projects and programs introduced endogenous volume reduction in 2013. In this auction, the auction volume is budget and projects and programs designed to save energy through efficiency measures can apply for support. If less than 120% of the announced budget is demanded, the rationing rule is applied and only 83.33% (five-sixths), of the demanded budget is awarded. In 2011 and 2012, the auctions were under- or only slightly oversubscribed (Bundesamt für Energie, 2019). In 2013, the demand volume was almost twice the auction volume, leading to a sufficient competition level. Nevertheless, the rationing rule was introduced. After the introduction of this rule, the relative demand in the following auctions has decreased continuously to only 60% of the auction volume. Figure 2 Figure 2 depicts this development, where the auction volume is set at 100% (yellow line) for better presentation.[10] The relative demanded budget (green line) is decreasing since 2013 (red dashed vertical line). Since this mechanism prevents 1/6 of the bidders from award, there is relatively even less budget awarded than in auction rounds without the rationing mechanism. The cost-effectiveness analysis of these auctions shows that the ratio of subsidies to power savings is, if at all, low. In 2013, this value was at 3.3 Rp/kWh, while in 2017 it is expected to be 3.2 Rp/kWh[11] (Bundesamt für Energie, 2019).

General economic analyses, auction theory, experimental results, and empirical evidence all come to the same conclusion: endogenous rationing mechanisms cannot secure competition and will harm the market in the long-term by weakening the supply side through additional uncertainties for bidders (as well as the auctioneer). Though lower prices could be seen at first, the mid- and long-term effects outweigh this (possible) positive tendency. Instead of generating incentives for market entry, the mechanisms generate incentives for manipulation. We advise using a different approach to address the lack of supply in auctions for RES (discussed further in Section 3).

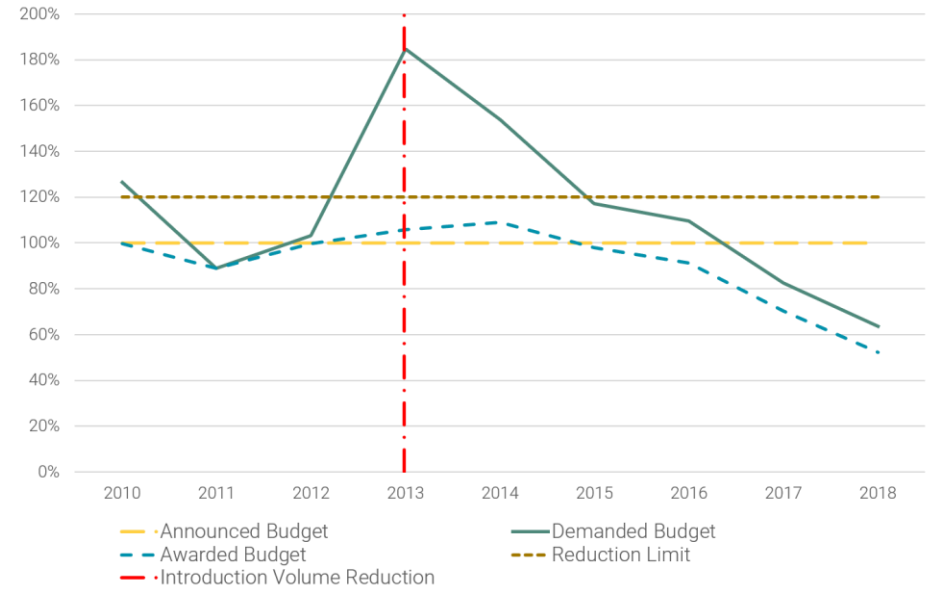

Figure 2: Results of Swiss auction (graph based on data from (Bundesamt für Energie, 2019))

[10] Note that the actual auction volume differs between auction rounds, while here we show the relative development.
[11] Since not all projects and programs are realised, this is still an estimation.

3 Potential solutions to increase competition

This section discusses more suitable options to meet the problems emerging from low supply and thus, low competition in auctions. We argue, that policy makers need to analyse the cause of the supply shortage first to react appropriately. While a short-term shortage of supply can be combatted rather efficiently, long-term shortage tends to be based on more structural reasons and is harder to eliminate.

We define short-term supply shortages as periods in which the volume of projects does not meet the volume of the auction for less than the time project developers normally need to develop projects until they are able to participate in the auction. We assume that bidders need to provide a building permit to participate in the auction and that it takes 2 years to acquire the permit. Under such an auction design, a short-term shortage is any shortage that lasts for two years or less. Consequently, late auctions have longer short-term shortages than early auctions.[12] In the latter, project developers face lower prequalification requirements and therefore need less time. Long-term shortages are any shortages that last for more than that normal predevelopment time (meaning approximately 2 years).

Auctions can overcome short-term periods of supply without any interventions by the policy maker if the bidders can react to the market signal ("Let the market do"-solution). Like any market mechanism, auctions match supply and demand. The demand is normally inelastic due to the politically determined renewable energy goals. Low supply means that the existing supply can realise higher prices. As prices rise:

- Project developers accelerate existing activities to benefit from the period of high prices.
- Investments in new projects become more attractive which can attract new actors with additional projects to the market.
- Projects that were previously considered to have a low chance of winning and are economically unattractive suddenly seem attractive.

These factors lead to an automatic stabilisation of the level of competition even if it may take a while. The situation is more problematic if bidders cannot react to market signals.

If bidders cannot react to market signals, policy makers need to investigate the cause of the problem more systematically.

3.1 Revisit the auction design

Even in periods with short-term shortages that may eventually resolve themselves, policy makers should both revisit the auction design to find potential flaws, and support the supply side. The following questions help to do so:

- Do all bidders and projects have a fair chance?

Diverse actors make up the renewable energy sector. They come with different characteristics regarding their credit worthiness, liquidity, number of projects, experience etc. The auction design sets prequalification requirements that can provide a hurdle to specific actors. Policy makers should revisit the auction design and assess if all market actors could meet the prequalification requirements or if they are discriminating some. A balance needs to be found between the non-discrimination of bidders and ensuring a high realisation rate. Furthermore, the ceiling price could be too low and exclude certain projects from the start.

- Can successful bidders realise their projects in due time without facing inadequate risks?

The auction design defines the time available for realising the project. If it is too short, successful bidders face a high penalty risk. To reduce the risk, bidders could refrain from participating in the auction. Policy makers should therefore consider whether the realisation period is long enough. Furthermore, shielding successful bidders from penalties in case of an unforeseen lawsuit against the project or in case of force majeure could also increase participation rates. Finally, the penalty itself could be too high, i.e. prohibitive.

[12] Early auctions require a relatively small amount of project development prior to the auction, while in late auctions projects must be developed much more to be able to participate.

3.2 Create targeted market signals

In several countries there are projects that are required to fulfil the renewable energy targets in the long-term but that are not competitive due to natural conditions of a location, i.e. the solar irradiation or the wind speed. Instead of raising the ceiling price for all projects, measures that only target these projects can increase competition in the medium-term and reduce cost in the long-term due to learning effects. The measures at hand are bonuses and quota.[13] Bonuses can better internalise quantifiable cost which were previously an externality to the system. As projects that receive a preferential treatment are still competing with all projects, bonuses distort the market to a lesser extent; quotas provide the more reliable investment signal for project developers. Policy makers should keep in mind that projects at sites with worse natural conditions produce less electricity, which means auction volumes defined in capacity terms need to increase. These measures can even lower support costs in the auctions (Kreiss, Ehrhart, Haufe, & Rosenlund Soysal, 2020).

3.3 Think about multi-technology and cross-border auctions

In multi-technology auctions two or more technologies compete. The low supply of one technology can be compensated by higher supply from the other(s). If policy makers consider this option, they should make sure that technologies compete on equal terms, the technologies are equally valuable in terms of system integration cost (or if grid and system integration cost are not correctly reflected in the bidding price), and avoid boom and bust cycles. Furthermore, policy makers should keep in mind that prices for supporting the less expensive technology that was previously facing competition may go up.

A country with insufficient supply can consider opening its auction for the participation of projects located in another country. Across-border auction allows a country to tap into another country's supply and creates competition between domestic projects and projects located in the other country or countries, if more than two countries conclude a contract. In return for a (potential) transfer of support payments to foreign projects, the RES benefits of those projects will be allocated to the country conducting the auction through a transfer of RES statistics. Cross-border auctions can reduce the need for support if it provides access to better natural potential, higher market values or a lower cost of capital in the cooperating country (von Blücher, et al., 2019). Before implementing a cross-border auction, effects on supply in auctions of the cooperating country should be considered, as well as the potential impacts on the domestic RES supply. Countries further should avoid drying up their domestic project pipelines.

3.4 Reduce the demand—temporarily

Policy makers could reduce the demand in auctions temporarily by administratively, not endogenously, reducing the volume up to a point where it is more likely to meet the available supply. In this case, policy makers further define a reliable, unconditional trajectory for an increase of the volume. Annual volumes in the future need to exceed the current levels to make up for the reduction. The advantage of the option is that competitively set prices are more likely but because of the reliable, unconditional trajectory all project developers still have an incentive to invest in the development of projects. This option should only be considered if policy makers have a pretty good understanding of the roots of the shortage and its likely end. Furthermore, policy makers should consider combining the increasing trajectory for the volume with a decreasing trajectory for the ceiling price. Otherwise the design creates an incentive to hold back readily available projects now to benefit from higher volumes (and higher prices) in the future.

[13] Quotas ensure a minimum or maximum award volume for one technology, while bonuses improve a bidder's project—for example by decreasing their bid automatically in the auction, so it is more competitive. In this example, bidders nevertheless receive their original bid.

4 Conclusion

To address the problems of supply shortage in auctions for RES, it is important to understand the reasons for this shortage. Only then can adequate measures be taken. Short-term shortages— e.g. because of short delays in project development—can be addressed more easily. In a functioning market, incentives work so supply will increase in future auctions. Nevertheless, measures to reduce the duration of these shortages can be applied. It is harder to find an appropriate answer for long-term shortages—for example caused by too low elasticity of supply.

If the reason for the supply shortage is based on the auction design itself (strong disadvantages for one bidder group) it is a good idea to change the auction design to gain a more favourable outcome. Auction design changes can be combined with targeted interventions for disadvantaged bidder groups. Such interventions can take the form of specific bonuses or quota in the auction. If the technology itself cannot generate enough supply, multi-technology or cross-border auctions can be helpful. In these instances, the required auction volume can be filled with supply from other technologies or countries without supply shortages. When designed appropriately, these types of auctions can lead to lower support cost in the short term. If the end of the supply shortage can be foreseen by the policy maker, it might be possible to reduce the auction volume temporarily. The missing volume can be added to future auctions when the supply side has recovered. Temporarily reducing the auction volume should be combined with a declining ceiling price over time to avoid windfall profits and creating incentives to delay the participating in the auction.

In no case should the reduced auction volume or the ceiling price be determined endogenously within the auction—only administratively (prior to the auction with a deterministic (political) decision). While short-term improvements may be possible with endogenous rationing, long-term effects such as missing renewable energy targets, prevail. Endogenous rationing not only decreases social welfare and increases costs, but also damages the market in the long term by further weakening the supply side and generating unwanted market distortions. This has been proven theoretically, experimentally, and with real-world examples.

The problematics of supply shortage are not easily responded to. Nevertheless, it is vital to carefully analyse the reasons and then act accordingly to fulfil renewable energy targets and set course to a sustainable and affordable future.

References

Abylkairova, B. (2018). *The first renewable energy auctions in Kazakhstan. Lessons learned and recommendations to improve the environment for private investments in renewable energy.* Retrieved from http:////ptfcar.org/wp-content/uploads/2018/07/Day-2_Bayan-Abylkairova_RE-workshop_Tashkent_day-2_July-12_En.pdf

Anatolitis, V. (2020). *Auctions for the support of renewable energy in Greece*. Retrieved from http://aures2project.eu/wp-content/uploads/2020/03/AURES_II_case_study_Greece.pdf

Bundesamt für Energie. (2019). *Wettbewerbliche Ausschreibungen - ProKilowatt.* Retrieved from https://www.bfe.admin.ch/bfe/de/home/foerderung/energieeffizienz/wettbewerbliche-ausschreibungen-prokilowatt.html#kw-83176

Comité para la conducción del proceso de la cuarta subasta de suministro de electricidad con recursos energéticos renovables [Comité]. (2015). *Circular No. 5.* Retrieved from http://www.osinergmin.gob.pe/seccion/centro documental/energias-renovables/Subastas/Circular\%20N05_\%20Precion%20M\%C3\%A1ximo.pdf

Deutsche Bundesregierung. (2019). *Verordnung zu den Innovationnsausschreibungen und zur Änderung weiterer energiewissenschaftlicher Verordnungen, Artikel 1, Drucksache 19/14065 (Vorabfassung).* Retrieved from http://dip21.bundestag.de/dip21/btd/19/140/1914065.pdf

Dorner, V., Ehrhart, K.-M., & Hanke, A.-K. (2019). *Auctions with Endogenous Rationing - An Experimental Study.* Retrieved April 04, 2020, from http://games.econ.kit.edu/downloads/2019-11-29_Hanke.pdf

Ehrhart, K.-M. (2017). *Assessment of the PV Pilot Auction 2016 in Greece.* GIZ Report.

Ehrhart, K.-M., Hanke, A.-K., & Ott, M. (2020). *A Small Volume Reduction that Melts Down the Market: Auctions with Endogenous Rationing.* Retrieved from Working Paper: http://games.econ.kit.edu/downloads/EhrhartHankeOtt_EndogenousRationing.pdf

IRENA. (2015). *Renewable Energy Auctions: A Guide to Design.* Retrieved from https://www.irena.org/publications/2015/Jun/Renewable-Energy-Auctions-A-Guide-to-Design

Jiménez, M. (2016). *CENACE Obtains Definitive Results for the First Long-Term Electricity Tender.* Retrieved from http://www.renewableenergymexico.com/cenace-obtains-definitive-results-for-the-first-long-term-electricity-tender/

Kreiss, J., Ehrhart, K.-M., Haufe, M.-C., & Rosenlund Soysal, E. (2020). Different cost perspectives for renewable energy support: Assessment of technology-neutral and discriminatory auctions. *Economics of Energy and Environmental Policy*.

Legislation of Ukraine. (2019). *On Alternative Energy Sources (Document 555-IV).* Retrieved from https://zakon.rada.gov.ua/laws/show/555-15?lang=en

Mankiw, N. (2017). *Principles of Economics.* Cengage Learning.

Ministre de l'Europe et des Affaires étrangères. (2018). *Soutien de l'effacement en France par appel d'offres, SA.48490 - France.* Retrieved from https://ec.europa.eu/competition/elojade/isef/case details.cfm?proc_code=3_SA_48490

Ministre de l'Europe et des Affaires étrangères. (2019). *Soutien par appel d'offres au développement d'installations de production d'électricité à partir de l'énergie solaire dans le département du Haut-Rhin, Aide d'Etat SA.51190 -France.* Retrieved from https://ec.europa.eu/competition/state_aid/cases/274758/274758_2049151_113_2.pdf

Papachristou, D., Kapetana, P., Daliouris, P., & Petmezas, T. (2017). The Pilot Tender for PV in Greece within 2016. *33rd European Photovoltaic Solar Energy Conference and Exhibition.*

reNews. (2018, September 7). *France auctions 118 MW onshore*. Retrieved May 5, 2020, from https://renews.biz/47585/france-auctions-118mw-onshore/

Samuelson, W. (1985). Competitive Bidding with entry costs. *Economic Letters 17. 1-2*, pp. 53-57.

Tiedemann, S., Bons, M., Sach, T., Jakob, M., Klessmann, C., Anatolitis, V., . . . Hanke, A.-K. (2019). *Externer Evaluierungsbericht der Ausschreibungen für erneuerbare Energien.* Berlin: unpublished report for the German Federal Ministry of Economic Affairs and Energy.

von Blücher, F., Gephart, M., Wigand, F., Anatolitis, V., Winkler, J., Held, A., . . . Kitzing, L. (2019). *Design options for cross-border auctions*. Retrieved from http://aures2project.eu/wp-content/uploads/2019/06/AURES_II_D6_1_final.pdf

AURES II is a European research project 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.

www.aures2project.eu

AURES II has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817619