Report D6.3, June 2017

Hybrids and Transitions

Managing transitions to auction-based support schemes, and combining auctions with non-auction design elements

Short about the project

Auctions for Renewable Energy Support: Effective use and efficient implementation options (AURES)

This project helps assessing the applicability of different auction types to renewable support under different market conditions. It also explores which auction types and design specifications suit particular requirements and policy goals in European countries. By establishing best practices and a knowledge sharing network, we contribute to informed policy decision-making and to the success of auction implementations across Europe.

Target-oriented analysis: Through analysis of empirical experiences, experiments and simulation, we will create a flexible policy support tool that supports policy makers in deciding on the applicability of auction types and certain design specifications for their specific situation.

Capacity building activities: We undertake specific implementation cases to derive best practices and trigger knowledge sharing amongst Member States. We strive to create a strong network with workshops, webinars, bilateral meetings, newsletters, a website that will serve as capacity building platform for both policy makers and market participants (including project developers, auctioneers, etc.). Wherever required, we can set up specific bilateral and multilateral meetings on specific auction issues and facilitate cooperation and knowledge sharing. Additionally, we offer sparring on specific implementation options, drawing from insights gained during the first phases of the project (empirical analysis of previous auctions in Europe and the world), conceptual and theoretical analysis on the applicability of specific designs in certain market conditions and for certain policy goals issues and facilitate cooperation and knowledge sharing. Additionally, we offer sparring on specific implementation options, drawing from insights gained during the first phases of the project (empirical analysis of previous auctions in Europe and the world), conceptual and theoretical analysis on the applicability of specific designs in certain market conditions and for certain policy goals.

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Managing transitions to auction-based support schemes, and combining auctions with non-auction design elements

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Executive Summary

This report is part of the AURES work package 6 and comprises the work carried out in the Task 6.3. It examines how hybrid auction schemes can combine auction and non-auction based mechanisms, and the transition processes from existing support policies to auction-based support schemes. Therefore, we analyse real-life examples in the context of four country case studies. The report comprises two sections. The first section looks at the recent transition of the UK and the German offshore support schemes. The second part illustrates the combination of auction and non-auction elements under one support mechanism by providing an overview of the Californian and Mexican renewable energy support schemes.

The UK switched from a quota-obligation with tradable green certificates, the so-called "Renewables Obligation", to the auction-based contract-for-difference (CfD) mechanism, with the transition period lasting from mid-2014 until March 2017. In general, project developers could choose between the two schemes, but with solar PV and onshore wind power subject to an earlier phase-out than originally anticipated. Moreover, the UK offered early investment contracts, the so-called "Final Investment Decision enabling Renewables" (FIDeR), to ensure project development and mainly due to pressure from the industry. In Germany, policymakers introduced auctions instead of feed-in premiums as the main mechanism of renewable energy support for large-scale projects in 2016. Our focus in this report lies on the German support for offshore wind power. To ensure a smooth transition process to the new scheme, Germany enabled strict (and less attractive) transitional exemptions to certain projects, ran a transitional auctions for existing projects and furthermore, provided step-in rights during the enduring scheme for unsuccessful projects. While the German auction transition – with the first transitional auction resulting in an average price of 4.4 €/MWh – has been quite successful so far (should the projects indeed be realized in the future), the British transition process was mostly dominated by unexpected measures due to political changes in the country. This resulted in relatively high prices in the first CfD auction, investor uncertainty regarding the future of renewable energy support and unnecessary expenditure regarding the so-called FIDeR enabling contracts.

Our primary finding is that policymakers should announce a clear trajectory with fixed dates and auctioned volumes to raise certainty for investors and to help securing the local supply chain. Furthermore, although a high stakeholder involvement is desirable, it might lead to unnecessary measures designed to satisfy stakeholders (e.g. FIDeR). When designing the transition period, one should consider making the old scheme less attractive in order to prevent market actors from rushing into the old scheme and thus ensuring enough competition in the new auctions. General uncertainty of phase-outs for certain technologies might increase this rush. Concerning possible compensation claims for already approved projects, introducing market-based solutions, as e.g. the transitional auctions in Germany, might lead to a favourable outcome.

The second part of our report examines the combination of auctions with non-auction design elements under a single support scheme. This can help policymakers make use of complementary advantages of more than one class of policy instrument. Therefore, we have analysed the hybrid scheme in California, as well as in Mexico. In 2002, California introduced the "Renewable Portfolio Standard", one of the most ambitious quota obligations in the US. It obliges the three major investor-owned utilities in California to procure a certain amount of their

sold electricity from renewable energy sources. The "Renewable Auction Mechanism" (RAM) is one mechanism to procure the renewable electricity from large-scale projects. Furthermore, the first round of the RAM set the initial tariff for California's renewable energy feed-in tariff (ReMAT). Mexico liberalised its electricity market in 2013 and at the same time introduced renewable energy policies. In this context, the government implemented long-term (clean energy) auctions with three distinct products: generation, capacity and green certificates, where bidders can submit complex bids for as many (or as few) products as they wish. These auctions help attract investment in RES and ensure the fulfilment of the clean energy obligation.

Regarding hybrid auction mechanisms, we conclude that although linking auctions with feed-in tariffs/premiums can help identify the correct market prices, it might lead to distortions in the feed-in scheme, due to low prices in the auctions. Moreover, this connection may induce strategic bidding in the auction if there is little competition and multi-project bidders with high market power participate in both schemes. Another point we have identified, is that combining two mechanisms can help reduce the transaction costs of participation in market-based schemes, especially for smaller market actors. Whenever countries aim to transition towards an auction-based support scheme, introducing hybrid schemes can reduce costs and uncertainty, which would have occurred during a transition process towards the completely new support scheme. Another point is that several mechanisms under one scheme provide policymakers with the opportunity to gain experience and decide in the long-term for the most efficient scheme. Hybrid schemes provide to market actors the flexibility to choose the scheme which suits their needs best. Finally, as was seen in the case of introducing identical PPAs under the RAM in California, policymakers should not only focus on the auctions' design, but also on the auctioned product.

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1 Introduction

This report is part of the AURES work package 6 and comprises the work carried out in the Task 6.3, which - sought to understand the co-existence and interaction between auction and non-auction support policies better.

When discussing the co-existence of auction-based and non-auction based support schemes for electricity from renewable energy sources (RES), we can distinguish between three definitions for hybrids:

i) auction schemes **limited to certain technologies and installation sizes**, with other installations supported by non-auction schemes (the most common form of co-existence, as small installations are usually exempt from auctions in most existing auction schemes),
ii) **temporally limited coexistence** of non-auction and auction scheme during transition phase (examples include UK, Germany, and Italy), and
iii) auctions and non-auction instruments **combined in a single support scheme** (examples include California and Mexico).

In table 1, we provide an overview of the main interactions between auction-based and non-auction based support schemes:

Table 1 – Interactions between auction-based and non-auction based support schemes

	Co-existence for different technologies/sizes	**Co-existence during transition phase**	**True hybrid schemes**
Competition level in auction scheme	Little interaction. Financing may be channelled away from auctions if other technologies/sizes are supported under schemes that are more attractive.	If projects can choose freely which scheme to enter, competition in auctions may be low if non-auction scheme is still attractive.	Depends on design of hybrid.
Deployment level in non-auction scheme	Depends on attractiveness of the non-auction scheme and the number of small actors in the market.	Possible rush to realise projects under the old scheme, if investors are unsure about attractiveness of the new auction scheme.	Depends on the type of the non-auction scheme. Unattractive feed-in schemes might be undersubscribed. Quota obligations have been in

			some cases successful.
Bidding behaviour in auctions	No interaction between the two schemes.	Non-auction scheme as a fall-back option might lead to higher bids in the auction.	Strategic bidding possible if both schemes are linked directly (e.g. FITs determined by auction outcome)

Since the first example is, in effect an exemption from the auction as discussed in our report on task 6.2, in this analysis, we will focus only on examples of policies in categories ii) and iii).

Because the interactions depend largely on the specific combination of support schemes, we will analyse real-life examples in the following case studies. The remainder of this report comprises two sections:

- **Section 2** deals with the category of transitional coexistence. We look at the recent procedures of the UK and the German offshore support scheme;
- **Section 3** illustrates the combination under one support mechanism by providing an overview of the Californian and Mexican RES support schemes.

2 Transitions from a non-auction to an auction-based support scheme

When switching from a non-auction scheme, e.g. feed-in premiums/tariffs or green certificates, to an auction-based support scheme for electricity from RES, policymakers face a variety of questions and challenges:

- General uncertainty regarding the new support scheme for investors, which might lead to higher risk premiums in the auctions
- Possible break in the trajectory path of renewable energy deployment, which may lead to loss of learning effects and industries (supply chain)
- Handling of already planned projects and allocated construction permits or grid connection agreements
- Possible rush for participation in the non-auction scheme due to lack of experience and trust in the new one, which leads to less competition in the first auctions and sub-optimal auction outcomes
- Lack of experience with auctions may also lead to irrational bidding (e.g. winner's curse)
- Duration of transition period

In the following case studies, we analyse the transition phases in both the UK and in Germany. We identify and evaluate the policy measures taken in both countries in order to manage the transition towards auction-based support schemes efficiently.

2.1 Case Study: The transition to CfDs in the UK

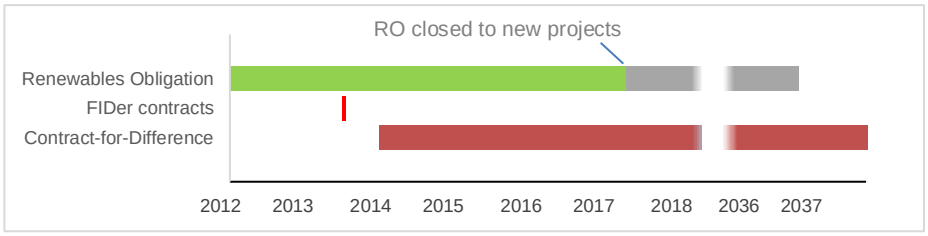
Under the framework of the Electricity Market Reform (EMR), the UK committed itself to transforming the national electricity sector. Amongst other measures, the quota-based support mechanism for large-scale renewable electricity generation known as the renewables obligation (RO) was replaced with the "Contracts for Difference" (CfD) scheme, which includes renewables and Carbon Capture and Storage projects larger than 5 MW (UK DECC 2013). Originally, the CfD scheme was intended to include nuclear power plants as well but was finally only open to non-nuclear technologies. Due to the low award prices, it seems unlikely that nuclear would have been successful even if it had been included in the existing technology pots. For projects smaller than the 5 MW capacity threshold, a fixed feed-in tariff is applied.

The gradual transition to the CfD was conducted by a step-wise exclusion of technologies from the old quota scheme. Introduced in 2014, Contracts for Difference replaced the previous support scheme for large scale solar in April 2015, for onshore wind in April 2016 and for other technologies from 2017. The first CfD bidding round took place in late 2014. The unclear future development of both the CfD and the quota scheme led to investor uncertainty and partly to irrational bidding behaviour in the first CfD auction. The following pages describe the important features of the two support schemes as well as the challenges facing policymakers and the solutions adopted to overcome those challenges.

Table 2 – The transition to auctions in the UK

Previous non-auction scheme	The current "CfD" support scheme was preceded by the "Renewables Obligation" (RO), a quota-based support mechanism. Introduced in April 2002 and open for new participants until March 2017, it obliges electricity suppliers to procure a certain proportion from RES. To ensure that all suppliers meet the quota obligations, the regulator "Office of Gas and Electricity Markets" (Ofgem), issues tradable "RO Certificates" for generated electricity to registered operators for a duration of 20 years. This enables generators to receive a (variable) premium on top of the wholesale price of their sold electricity. Suppliers who do not submit a sufficient number of certificates have to pay a buy-out price determined by Ofgem. The scheme will continue to pay support to registered operators until 2037, although plans exists to transform the quota-based certificates mechanism to a fixed price certificate scheme by 2027 due to a decreasing volume of certificates in the market. By fixing the price of certificates at the 2027 buy-out price plus 10%, the scheme will in fact work as a fixed feed-in premium from 2027 onwards (Ofgem 2017).
New auction scheme	In 2014, the Contracts for Difference (CfD) support mechanism was introduced. A CfD is a 15-year contract between an electricity generator and the government-owned Low Carbon Contracts Company (LCCC). In general, an electricity generator possessing a CfD sells power on the wholesale market. If the specific market reference price is lower than the strike price set in the contract, the LCCC will compensate the generator by paying the difference between these two prices (and vice-versa, if the wholesale price is higher than the strike price). The CfD is a feed-in premium instrument that guarantees stable long-term revenues for the electricity generator and thus reduces wholesale price exposure and therefore the projects' cost of capital. Strike prices are determined via an auction-based mechanism. To date, the outcome of one auction round has been announced while the results from second are awaited. During the allocation process, technology-specific ceiling prices ("administrative strike prices") are applied, which try to represent investor returns similar to the RO. The applicable volume is determined by the available budget, which is set on a year-to-year basis according to the Levy Control Framework (LCF), a multi annual budget envelope for levies on consumers' electricity bills.

	Since the payments from the LCCC are funded through a levy on electricity consumers, the LCF has been implemented to control the costs for the consumers. In the first application round, the available budget was divided into two pots: one for established technologies (onshore wind, solar, waste CHP, hydro...), the other one for less established technologies (offshore wind, biomass CHP, wave, tidal stream...). Although a third pot for biomass conversion exists, no budget was allocated in either the first or the second auction round. For specific technologies, minimum and maximum capacities can be set (which has only been applied for wave and tidal stream technologies and for fuelled technologies so far). The contracting body in charge of auction design and ultimately responsible for auctions was the national Department of Energy and Climate Change (DECC), the functions of which became the responsibility of the newly created Department for Business, Energy & Industrial Strategy (BEIS) in July 2016. The Treasury manages budgetary implications of the auctions, while "National Grid PLC" – the British TSO company – is responsible for conducting the auctions. Auction process: If applications do not exceed the applicable budget pot, applicants are offered a contract at the Administrative Strike Price. If this is not the case, an auction is triggered, which is a multi-unit, sealed-bid, uniform price auction. Flexible bids are possible regarding capacity, price or delivery date. Bids are ordered and awarded ascendingly until the budget constraint is reached. If capacity constraints are violated by a bid, it is rejected. The award prices are the marginal prices within each year up to each technology's ceiling price or the marginal price within a capacity minimum. Design of the administrative strike prices: The government's aim was to set a strike price [£/MWh] able to "maximize the delivery of Government objectives for the electricity system", such as affordability, secure supply and reduction of carbon intensity. To quantify the impact of a strike price on these objectives, National Grid conducted an analysis. In addition, prices were chosen in a manner in which generators' net total discounted cash flows are comparable to those received under the RO scheme. This approach should ensure that both schemes work effectively in parallel during the transition period and the new scheme appears successful. Some observers, considering the RO already overgenerous, criticize this process and the resulting overcompensation (e.g. Fabra et al. 2015). Finally, to take into consideration the cost development over time, strike prices decline over the Delivery Plan period.

	For detailed information on the new auction scheme, please refer to the AURES case study on the UK's auctions (Fitch-Roy, Woodman 2016).
Challenges and solutions during the transition process	The transition period in which the two instruments co-existed began in October 2014 and ran to end of March 2017, during which the Renewables Obligation and the CfD mechanism – preceded by "Final Investment Decision enabling Renewables" (FIDeR) contracts, an early form of CfDs. The first official CfD bidding round took place in late 2014. Although some analyses suggest that the change from the RO to the CfD scheme led to a decrease in the WACC of around 3% (Newbery 2015), this occurred probably due to the introduction of the long-term stable revenues provided by the CfDs and not by managing the transition to an auction system properly. Nevertheless, there were several critical points regarding the management of the transition process and the solutions to the challenges.  *Figure 1: Timeline of the introduction of CfDs, Source: own elaboration* **Challenge:** Project developers may prefer an existing support scheme over new and unknown auction scheme. **Solution:** A gradual technology-specific exclusion from the RO scheme was foreseen, starting with large scale solar PV in April 2015, followed by onshore wind in April 2016 and the other technologies in 2017. New generating installations could apply for only one of the two schemes, thus facing a one-off choice between them. Only if the original application was rejected were generators allowed to apply for the alternative scheme. It is however not possible to receive support for the same generating capacity under both support mechanisms, thereby avoiding overcompensation. Furthermore, once an installation has received accreditation under one scheme, it is not possible to change, even when the support period reaches its end. **Evaluation:** The introduction of the one-off choice between RO and the CfD scheme during the transition period might have intensified the "rush into RO".

Since an application for the CfD mechanism is already considered a choice, it might have led to some actors preferring the more secure and familiar RO.

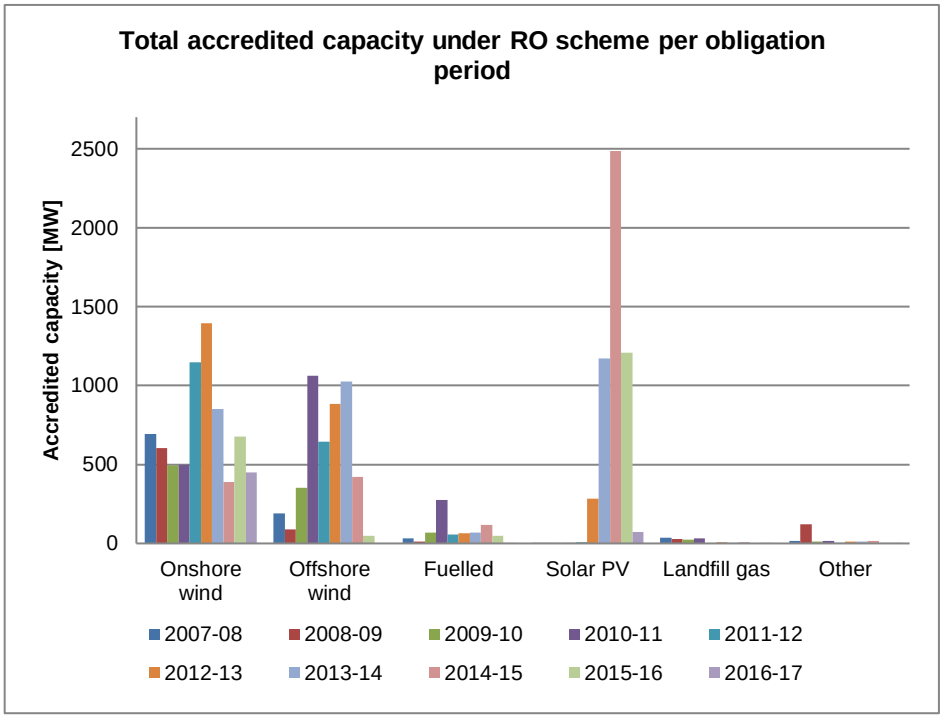


Figure 2: Accredited capacity under the RO scheme. Source: Ofgem

Figure 2 shows the capacity accredited in the RO leading up to and immediately after the first CfD auction. In the first CfD auction round it seems that only a few solar projects participated. Looking at the number of accredited PV projects under the RO, we can clearly observe a peak of around 2.5 GW in the obligation period of 2014/15. This indicates that most PV developers chose to participate under the RO before their cut-off in March 2015 or focused on projects smaller than 5 MW to avoid the cost/risk of an auction.

Challenge: The introduction of the CfD was preceded by political discussions during which the change to a new scheme was already decided on, but the concrete details of the new CfD scheme remained unclear to investors. Due to this uncertainty, policymakers became concerned about ceasing or interrupted growth of renewable energy capacity. Several industry stakeholders complained and pointed out the danger of investors delaying or not even commissioning projects.

Solution: The government decided to offer a contract similar to the CfDs prior to the official introduction of the scheme due to fears of decreases in investment in RES and pressure from the RES industry. These Investment Contracts were

made available as part of the FIDeR to ensure early investment decisions prior to the full implementation of EMR and to support projects which were at risk of delay (DECC 2013).

FID Investment contracts can be transferred to a CfD counterparty once the CfD mechanism is established. They follow similar rules as CfDs with some differences as the EMR framework was not yet in place. Strike prices in Investment Contracts are set in accordance with those designed for the CfD applications.

Evaluation: Under this "Final Investment Decision enabling for Renewables" (FIDeR) mechanism, eight projects with a total capacity of around 4.5 GW signed a contract in May 2014. Two of the contracts are for power plants converted from burning coal to biomass, five are for offshore wind farms and one is for a purpose-built biomass plant providing heat as well as power. The resulting acceleration in time amounts to roughly half a year, which is criticized by NAO (2014) regarding the contracts as "unnecessary and poorly timed". These projects received a bilaterally negotiated strike price and did not undergo a competitive bidding process, which might have led to lower strike prices, since the DECC did not expect enough competition until 2017. The figure below shows the FIDer price, the administrative strike prices and outturn auction prices. The the auction closed at prices significantly below the administratively set prices, which in turn were lower that the bilateral FIDer prices.

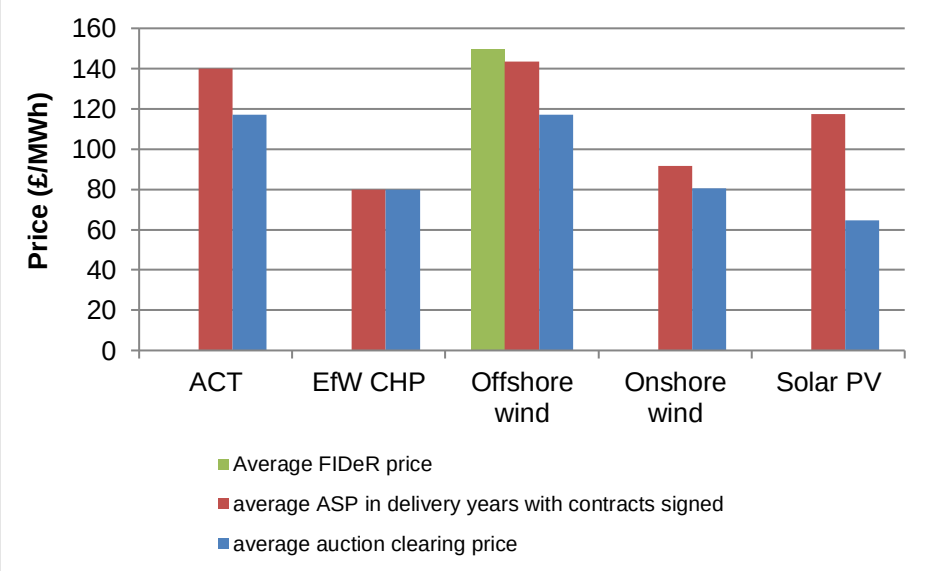


Figure 3: Auction outturn prices (National Audit Office, 2014; DECC, 2015a)

The FIDeR might well have led to lower competition regarding offshore wind farms in the enduring CfD auctions. Furthermore, the already allocated budget will be subtracted from the amount foreseen for the full CfD scheme and thus limiting the available funds.

The change from the quota-based support scheme of the Renewables Obligation to the auction-based Contracts for Difference was successful in terms of lowering the market price exposure to investors and thus reducing the cost of capital. Nevertheless, the transition process lacked a clear communication and intervening political events made rendered the timeline unreliable. Finally, the introduction of the FIDeR was retrospectively deemed unnecessary from a cost-benefit perspective.

2.2 Case Study: Offshore wind power in Germany

Germany will introduce static single-item auctions for offshore wind as part of a wider transition from non-auction to auction-based RES support in 2021. The German Parliament has introduced an auction system as an amendment to the 2017 "Renewable Energy Sources Act" (EEG 2017). Within this law, general rules are set for photovoltaic, onshore/offshore wind power, as well as biomass, all of which are auctioned separately.

Offshore wind is currently supported by an administratively set feed-in premium (FIP). German policy makers have now specified the details of the planned auction scheme as well as transitional steps leading to the new scheme's introduction. Where it deviates from regulations for other technologies, offshore wind power is addressed in a separate law, the Offshore Wind Act (WindSeeG), which was adopted simultaneously with the EEG 2017. This law's essential objective is to offer a regulative framework in order to consistently control site selection and auctions – from tender announcement to commissioning. The following pages review the transition arrangements for offshore wind support in Germany.

Table 3 – The transition to auctions in the German offshore wind sector

Previous non-auction scheme	Until the introduction of the 2017 Renewable Energy Sources Act (EEG 2017) administratively set sliding feed-in premiums (FIP) were the main support mechanism for renewable energies. Under this scheme, generators sell their generated electricity on the wholesale electricity market and receive the difference between the market price and the administratively set, technology-specific reference value as a market premium. Whenever the wholesale price exceeds the reference value, the generators receive an additional income to the market premium. Unlike the UK's CfD, the generator is not required to 'pay-back' to the contract counterparty in the event that wholesale prices are greater than the support level. The basic reference value for the 20-year FIPs for offshore wind power was set at 39 €/MWh (EEG 2014). Generators could choose one of two alternatives of a higher, initial reference value: *Basic model:* Under this scheme, generators received 154 €/MWh for 12 years with an extension of 0.5 months for every additional nautical mile further away

	than 12 nautical miles from the shore. Furthermore, every meter in water depth of more than 20 m extends the period by 1.7 months. *Acceleration model:* The generator received for the first 8 years 19.4 ct/kWh. An extension of the period similar to the basic model is foreseen, but with the reference value of 154 €/MWh. New offshore wind power projects were still eligible to participate in the FIP scheme under certain circumstances until the end of 2016.
New auction scheme	Starting in 2021, the final auction scheme will be applied, foreseeing static, sealed-bid, single-item auctions on predefined, partially developed specific projects with a commissioning date in 2026 or later (EEG 2017). Following this model, an area development plan (Flächenentwicklungsplan) fixing specific sites for wind parks is determined by the German government (in particular the Federal Maritime and Hydrographic Agency and Federal Network Agency) which at the same time decides when and how these locations are connected to the grid. In addition, the Federal Maritime and Hydrographic Agency (Bundesamt für Seeschifffahrt und Hydrographie) is in charge of conducting the predevelopment of designated sites *(WindSeeG §11,1).*They carry out an enhanced strategic environmental impact assessment (SUPplus), which is made available to all bidders. The auctioned volume is set at 700 - 900 MW per year with a lead-time of at least six months prior to the auction. Each bidder has to provide a bid bond of 200 €/kW prior to the auction. Importantly, the lowest awarded bid in the transitional auction in April 2018 will determine the ceiling price for the future auctions. For each site, the bidder with the lowest bid receives the award. He subsequently initiates the planning and authorization procedure and receives funding in form of a sliding feed-in premium corresponding to his bid (pay-as-bid pricing rule) for 20 years from commissioning. Awarded bidders subsequently sell their electricity at the wholesale market and receive the difference between their reference value and the wholesale market price. The main support mechanism is similar to the previous FIP scheme. The major difference consists of a competitive bidding process, i.e. auctions determining the reference value in contrast to the administratively set tariffs.
Challenges and solutions during the transition process	In order to ensure a smooth transition from administratively set FIPs to auction-based FIPs, the German government took several measures:

Challenge: Projects with existing permits might prefer the previous FIPs to the new and unknown auction scheme and "rush" into the old scheme. Furthermore, large investments together with long planning and realization periods of up to 10 years (figure 2) pose a major challenge to determining the optimal time in the project development process for the auction to take place.

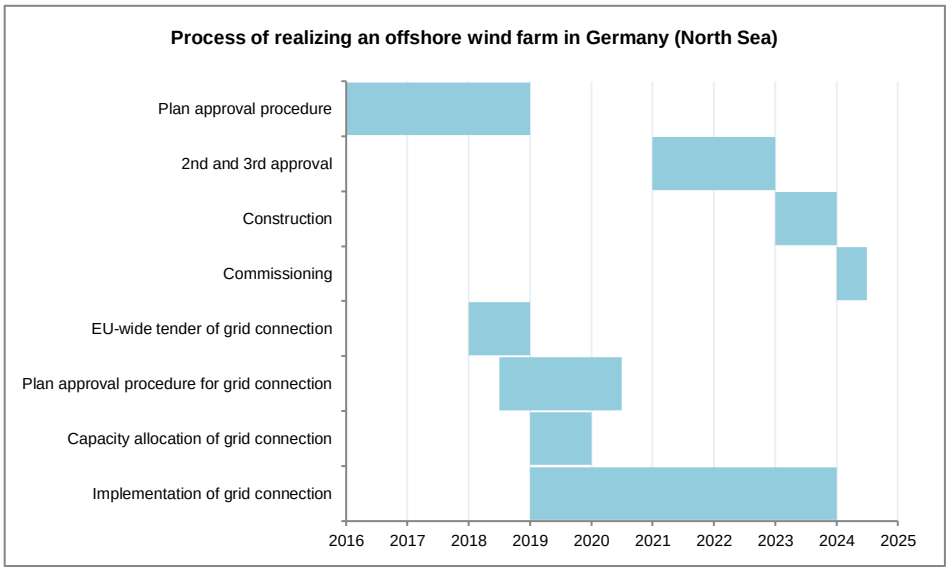


Figure 4: Realization process of an offshore wind farm in Germany, Source: own elaboration

Solution: German policy makers introduced transitional exemptions, through which generators receive their remuneration under the traditional FIP scheme for a period of 20 years as (§22 Abs. 5 and §47 EEG 2017). Offshore wind projects are eligible to participate only if they have received an unconditional grid access confirmation or an allocation of connection capacity before 1st January 2017 and are able to commission their projects before 1st January 2021.

As mentioned above, the basic reference value for the 20-year administratively set FIPs is set at 39 €/MWh. The higher, initial reference values under both models decrease during the transitional period. The idea is to account for decreases in the cost structure and furthermore to implement an economic incentive in favour of the transitional auctions and to discourage actors to "rush" into the existing scheme:

Basic model: A degression of 5 €/MWh (down to 149 €/MWh) applies to the basic model's 12-year reference value if the wind farm is commissioned in 2018 or 2019 and if commissioned in 2020 an additional decrease of 10 €/MWh (down to 139 €/MWh) is foreseen. The extensions for specific distances are still valid.

Acceleration model: This alternative can only be chosen if the project is commissioned before 1st January 2020. Then, the generator receives for the first 8 years 194 €/MWh (lowered by 1 ct/kWh if commissioned in 2018 or 2019). The extension of the period is implemented, but the reference value of 154 €/MWh is applied (which is lowered by 5 €/MWh if commissioned in 2018 or 2019).[1]

Challenge: Already approved, but not yet realized, wind power projects pose a major obstacle for the transition. The various permits and grid connection commitments, paired with projects at distinct stages in the planning procedure and different incurred costs might hinder the transition process. The question arises of whether and how to integrate these projects in the future auction design and whether they are eligible for compensation. Additionally, project sites have already been allocated to developers several years ago but haven't been assigned a grid connection yet.

Solutions:

Transitional auctions: Two transitional auction rounds (April 2017 and 2018) are held in which only "existing projects" are allowed to participate. An existing project is defined as an offshore wind park which before August 2016 had either obtained a plan approval or permit under the Offshore Installations Ordinance (SeeAnlV), a permit under the Federal Immision Control Act (BImSchG) or had already been discussed in a public hearing (Erörterungstermin) during the course of an approval procedure. Furthermore, the projects should not have received either a grid access confirmation or an allocation of connection capacity.

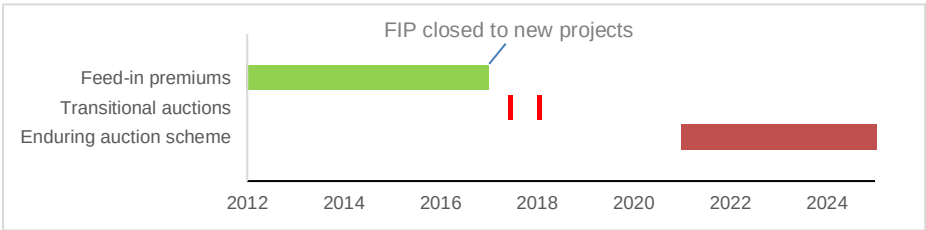


Figure 5: Timeline of the implementation of auctions in Germany, Source: own elaboration

The auctioned volume in each round is 1,550 MW compared to an overall eligible capacity of around 6000-7000 MW. At least 500 MW of the awarded projects have to be located in the Baltic Sea. Bids are subject to a ceiling price of 120 €/MWh. Due to the advanced planning stage of the projects, participants have to provide

[1] The same for most other RES-E technologies in Germany.

a (reduced) bid bond of 100 €/kW. In both static sealed-bid auctions, the "pay-as-bid" pricing rule is applied and thus the awarded bidder receives exactly his bid for the next 20 years.

Evaluation: The first transitional auction in 2017 resulted in an unexpectedly low average bid price of 4.4 €/MWh and an awarded volume of 1,490 MW. Surprisingly, out of the four awarded projects, three were awarded a bid price of 0.0 €/MWh and the fourth a price of 60 €/MWh. Under the assumptions that these projects will be realized, the results were highly successful regarding the reduction of support costs. According to several press releases, the awarded bidders are assuming cost reductions and increasing electricity prices in the future. Moreover, EnBW sees synergies between their new offshore wind park and their existing ones in the North Sea. Expanding the approved period for offshore wind farms from 20 to 25 years, and under certain circumstances even to 30 years, increases the profitability of the projects and thus leads to lower bids.

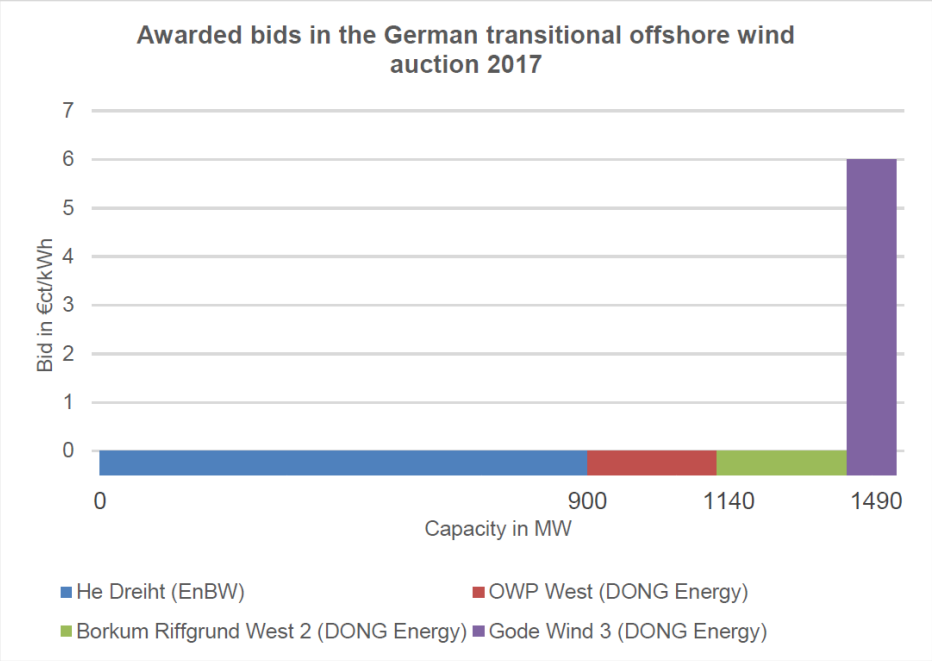


Figure 6: Results of the first transitional offshore wind auction in Germany (2017), Source: Bundesnetzagentur

In contrast to the UK, the EEG fixed and announced the transitional and enduring auctions' dates and volumes. This leads in general to a higher investor certainty and thus might have led to lower risk premiums. Furthermore, the dates are planned in advance in order to ensure that the deployment trajectory is achieved and to prevent a stop-and-go policy. Moreover, the government tries to prevent long-term judicial dispute due to compensation claims.

	Nevertheless, a critical point regarding the design of the transitional auctions is the fact that the lowest bid in the 2018 auction will determine the ceiling price of the enduring auction scheme starting in 2021. Thus, if a 0 €/MWh occurs in the 2018 auction, we might observe negative prices in the enduring auction. In order to prevent this kind of market distortion, the policymakers have to consider a change in the law.[2] ***Step-in rights:*** Projects that participate but are not successful in the two transitional auction rounds will not receive any compensation for their existing permits and incurred costs. Nevertheless, the German government provides "step-in rights" to unsuccessful bidders with existing projects for the enduring auction scheme. By exercising their right, the participant obtains the award for the project, even if his bid was not successful. The winning bid will nevertheless determine the reference value. As a prerequisite to obtain these rights, the site of the already planned project has to overlap predominantly with the auctioned project site. Furthermore, the interested party has to submit a bid for the respective site in both transitional auctions and in the enduring auction and abandon all rights, pre-investigation results and surveys of the project. *Evaluation:* These rights might increase the risk premiums for the "new" participants, due to the possibility to lose in the "last" moment. On the other hand, the step-in rights induce a higher competition, which might lead to more aggressive bids and the ambition to decrease the costs in order to prevent the existing project developer from executing his step-in right.

Germany introduced auctions as the new mechanism to determine support levels for big-scale RES projects. The main challenge during the transition process comprised possible lawsuits regarding compensation for already approved projects that might not be realized due to the introduction of the auction-based support scheme. By introducing two transitional auctions and step-in rights for existing projects, German policymakers provided the market-based opportunity to commission the project. Under the assumption of the projects being realized in the future, the first auction in 2017 has been successful concerning minimizing support payments and securing the deployment trajectory.

[2] Although the WindSeeG provides the German policymakers the option to increase the ceiling pricy by 10%, this will not have any effect if we observe again a bid of 0 €/MWh.

3 Hybrid support schemes

In recent years, more and more hybrid support schemes are being introduced as policy makers aim to combine the complementary advantages of the different support instruments under one scheme to achieve overall procurement targets effectively (IRENA, CEM 2015). Although a variety of possible combinations exists, we will focus on the interaction between auction and non-auction based support schemes. Depending on the concrete design of the hybrid scheme, combining auction and non-auction elements can have the following advantages and disadvantages from the viewpoint of policy makers:

Advantages:

- Auctions as a complement: Auctions can successfully complement existing support schemes such as quota obligations, FITs and tax reductions and provide a competition-based procurement option.
- Flexibility for the auctioneer: In the case of an inexperienced auctioneer, hybrid schemes give the opportunity to learn from different mechanisms and subsequently decide to implement the most successful scheme.
- Reducing the risk of overpayment: Especially in the case of FITs for small-scale projects, linking the tariffs with an auction-based mechanism helps to obtain realistic market prices and thus reduces the risk of overpayment to generators.
- Reducing administrative effort regarding transition to auction-based scheme: Instead of replacing the mechanism by a completely new support scheme and undergoing the risks of a transition process, policymakers can reduce transaction costs by adding the element of auctions into the existing scheme.

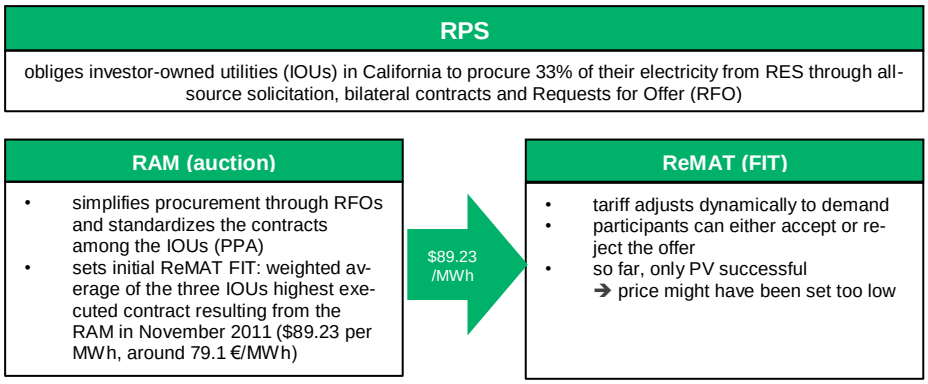
Challenges:

- Auction not the only reason for success: The auction design itself might not lead to a successful result alone, but the auctioned product (e.g. long-term stable revenues through PPAs) as well. Therefore, policymakers should not only focus on the auctions' design, but also on investor-friendly schemes.
- Influence of unfavourable results in the auction: If the resulting price in the auction is too low, it might lead to market distortions in the associated support scheme.
- Connection between schemes might lead to strategic bidding: A multi-project bidder with high market power who participates in both schemes, might have the incentive to overbid in the auction, if the possibility exists to influence the prices (e.g. the FIT) in the non-auction scheme to his favour.
- Increased transaction costs: Policymakers should take into consideration transaction and administrative costs when they design their support scheme. While a hybrid scheme may come with lower transaction costs in some cases, it may increase them in others. In some cases, for instance the implementation of administratively set sliding FIPs might be more efficient than a hybrid support scheme.

3.1 Case Study: California

California has one of the most ambitious renewables targets in the US. Since 2002, the "Renewable Portfolio Standard" (RPS) obliges the three investor-owned utilities ("IOUs") to procure a certain amount of their sold electricity from RES. The ”Renewable Auction Mechanism” (RAM) not only allocated capacities under the RPS, a quota-based scheme, but also set the initial prices for small-scale installations which receive fixed FITs under the ”Renewable Market Adjusting Tariff – ReMAT programme.

Table 4: Hybrid support scheme in California

Description of scheme	In 2002, California started the Renewables Portfolio Standard (RPS) program to stimulate RES growth (California State Senate 2002). It obliges investor-owned utilities (IOU), electric service providers, and community choice aggregators to procure a defined proportion of their portfolio from RES - 33% by 2020 and 50% by 2030 (California State Senate 2011). To comply to the RPS, IOUs can procure renewable electricity in three different ways: 1. All-source solicitation 2. Bilateral contracts 3. Requests for Offer (RFO) In the context of this study, the third procurement method is of particular interest: although the overall framework of the RPS consists of a quota obligation, it enables the IOUs to meet their targets by using auction-based mechanisms. Furthermore, the Californian support scheme combined an auction mechanism with a feed-in tariff as well: the RAM set the initial support levels for the Californian feed-in tariff, namely the ReMAT.  *Figure 7: Overview of California's hybrid auction scheme*

Renewable Auction Mechanism (Utility scale projects)	The Renewable Auction Mechanism (RAM) was introduced to simplify and streamline procurement through RFO until August 2015. The IOUs are still allowed to use the mechanism voluntarily, with the product types and standardized contracts still persisting in the RES procurement under the RPS. The RAM program offered a "standard non-negotiable contract (in form of a Power Purchase Agreement (PPA) and a standardized valuation process", which streamlined the process of procuring the necessary amount of RES-E and provided legally identical contracts (CPUC 2010). Thus, projects can go online faster and with lower transaction cost, which was highly appreciated by developers and investors. Renewable energy projects from **3 MW (initially 1 MW) to 20 MW** were eligible to participate with the program's total procurement volume set at approx. 1,300 MW. The length of the PPA can be either 10, 15 or 20 years and is chosen by the bidder and finally determined by the responsible IOU. Three different product types are auctioned: baseload, non-peaking as available (mainly wind power), and peaking as available (mainly solar power). During the multiple-item RAM, bids are awarded following the least-cost principle until each IOU's procurement target for each product type is reached. For more detailed information on the RAM, please refer to the AURES case study by Fitch-Roy (2015).
Renewable Market Adjusting Tariff (Small-scale distributed projects)	The main objectives of the Renewable Market Adjusting Tariff (ReMAT) program are to create a market in which overpayment is prevented, contract value to the ratepayer and utility is maximized by using the market to determine price, and speculative projects are prevented from occupying limited program capacity (CPUC 2012). Thus, the price-setting mechanism was linked to the RAM scheme with the intention of exposing smaller actors to market prices without incurring excessive transaction costs or risk of auction participation. The initial level of the ReMAT FIT was based on the weighted average of the three investor-owned utilities' highest executed contracts resulting from the RAM held in November 2011, which amounted **to $89.23 per MWh (around 79.1 €/MWh)** (CPUC 2012). This initial tariff applied on all technologies and IOUs. CPUC (2012) divides the eligible technologies into three categories, whose tariff is adapted separately by each IOU: Baseload (e.g. geothermal), As-Available Peaking (mostly solar), and As-Available Non-Peaking (wind and hydro). Based on deployment rates and

	number of applications each technology group's price is adjusted every two months. Applicants can either accept or reject the offered price. By accepting the offer, participants receive a PPA with a 10-, 15- or 20-year delivery term. The ReMAT was established to increase procurement of projects sized **up to 3 MW** (originally 1.5 MW) and became effective in 2013. The overall procurement target is 750 MW, of which 493.6 MW are procured by the three IOUs. Nevertheless, each IOU can increase its volume by assigning available capacity from other programmes (CPUC 2012). An additional capacity of 250 MW is offered for biomass projects under the Bio-MAT (Bioenergy Market Adjusting Tariff), starting with an initial, administratively set tariff of $127.72/MWh (113.2 €/MWh). Similar to the ReMAT, the price adapts to the level of competition dynamically. SDG&E closed its scheme in June 2016, since the Peaking As-Available product type capacity was fully subscribed in Program Period 4 (SDG&E 2013). Therefore, the programme closed down 24 months after period 4.
Evaluation	The RAM as a mechanism to procure RES under the RPS is considered successful, high deployment rates were achieved and California is on track regarding the RPS target of 33% in 2020. Investors consider especially the implementation of standardized contracts by the three IOUs an improvement. Furthermore, the volumes and dates are fixed which gives investors certainty and thus can decrease the cost of capital. For an in-depth evaluation of the RAM, please consult the AURES case study on the Californian auctions by Fitch-Roy (2015). For small-scale projects, the IOUs profit from the RAM by obtaining a realistic market price (at least in theory), and avoid high transaction costs for applicants by applying a feed-in tariff with a fixed price for all projects of the same category. Nevertheless, the interaction between the RAM and the ReMAT might have led to a not so favourable outcome. When large-scale tariffs are applied to small-scale projects, only the ones with the lowest cost are built. These tend to be the larger ones in each group, due to economies of scale. Therefore, most projects allocated support through the ReMAT are larger than 0.5 MW. High transaction cost for participating might hinder roof-top PV to participate in the ReMAT, although the previous roof-top support scheme (California Solar Initiative (CSI))

has ended in 2016. Furthermore, figure 4 shows the deployment levels for the different product groups under the ReMAT for the three investor-owned utilities PG&E, SCE, and SDG&E. Only "As-Available Peaking", i.e. solar power, has been deployed in relatively large quantities. Most other product groups have been undersubscribed with usually less than five projects on the waiting list.

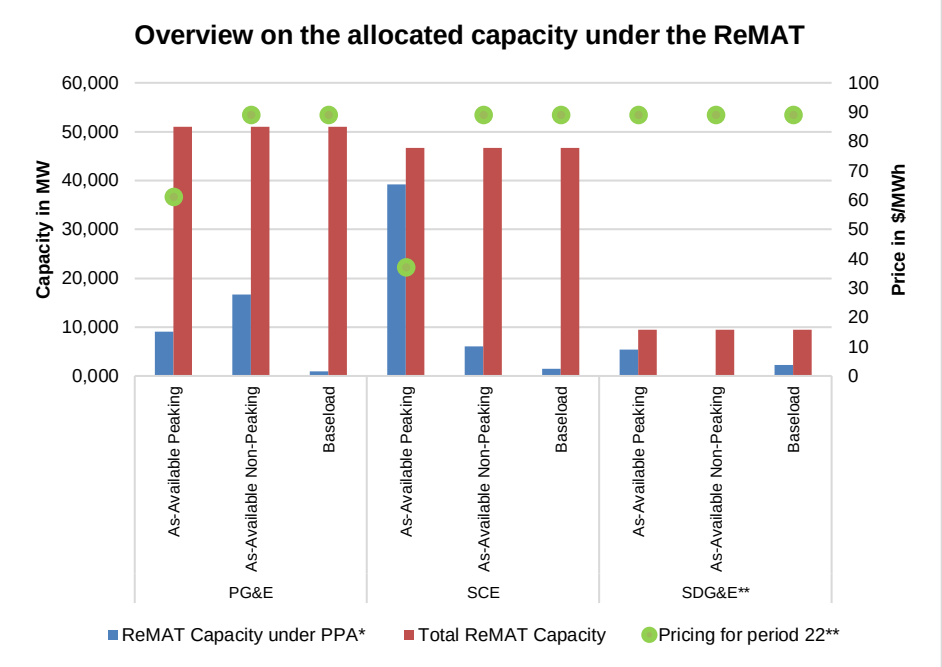


Figure 8: Allocated capacity under the ReMAT programme

* not including terminated contracts

**As of July 1, 2016 SDG&E's Re-MAT program is closed.

Another drawback of the ReMAT is the low realization rate. Out of 91 projects, which have accepted the offered price, only 57 are already operational or planned to be commissioned.

Table 5: Status of allocated projects under the ReMAT [MW]

	As Available Non Peaking	As Available Peaking	Baseload	Total
Operational	15.21	23.33	4.75	43.28
On-Schedule	3.74	20.08	0	23.82
Delayed	3.80	12.03	0	15.83
Terminated	6	51.54	0	57.54
Total allocated capacity	**28.74**	**106.98**	**4.75**	**140.46**

	This means, the realization rate – in terms of capacity – of around 60%. Naturally, the question arises if large projects should determine the feed-in tariff for smaller generation facilities. According to a stakeholder – a digester gas respondent, “the starting price needs to be higher than $89.00/MW to really launch projects” (PG&E et al. 2014).

An auction mechanism – the RAM – has been applied to procure utility scale renewable capacity between 3 and 20 MW per project. This mechanism was chosen to enhance competition among projects and thereby efficiency of the scheme, thus lowering costs for consumers. While the RAM has proven to be a successful mechanism, the ReMAT has several drawbacks, especially regarding the realization and deployment rate for technologies besides solar power.

3.2 Case Study: Mexico

In 2013, Mexico introduced its "Energy Reform", which liberalised and opened the electricity market to new participants, unbundled the "Comisión Federal de Electricidad" (CFE), and introduced decarbonisation policies. In this context, the government implemented long-term (clean energy) auctions with three distinct products: generation, capacity and green certificates, where bidders can submit complex bids for as many or as few products as they wish. These auctions help attract investment in RES and ensure the fulfilment of the clean energy obligation (IEA 2016).

Table 6: Mexico's long-term auctions

Description of scheme	Mexico's Energy Reform in 2013 simultaneously introduced competitive electricity markets and decarbonisation policies (in form of a clean energy obligation from 2018 on). By implementing those measures, Mexico aims to meet its long-term goal of generating 35% of electricity from RES by 2024 and 50% by 2050 (IEA 2016). The CFE (Federal Electric Commission), the state-owned, vertically integrated electricity supplier was restructured in 2013. The former main generator and distributor of electricity has now been unbundled into a number of individual subsidiaries, but still maintains a very relevant role in the Mexican electricity market and remains government-owned. In the past, independent power producers were obliged to sell all electricity to CFE under long-term power purchase agreements (PPA) or, under a specific permission scheme, to large industrial consumers. Furthermore, the new law distinguishes between two kinds of electricity users:

	- Basic/regulated users: they purchase electricity directly from the CFE or other suppliers at regulated tariffs implemented by the Federal Energy Commission (CRE) - Qualified/non-regulated users: those can purchase from CFE or other suppliers at freely negotiated rates, i.e. they participate in the electricity market. From 2018, all suppliers, including state-owned CFE, producers of electricity from sources other than RES as well as non-regulated consumers need to fulfil a RES quota obligation. To meet this target, they can either develop their own RES capacities or purchase the necessary amount of tradable green certificates - CELs (Certificados de Electricidad Limpia, certificates of clean energy) by securing long-term PPAs with clean energy producers or by buying them on the wholesale certificates market, which goes into operation in 2018 (IEA 2016: 96). Furthermore, suppliers to regulated consumers (at the moment only CFE) must purchase all electricity in competitive auctions (Mayer Brown 2016). **Long-term auctions** • target: 35% of electricity from RES by 2024 and 50% by 2050 • three categories exist in the long-term (clean-energy) auctions: generated electricity, green certificates, and capacity • bidders can submit bids for one, two or three categories • complex optimization algorithm chooses winning bids **Generation**: contract for 15 years; large (qualified) consumers can participate as well **CELs (certificates)**: contract for 20 years; CELs can either be bought through the auctions, bilaterally or on the wholesale market; share of clean energy 5% in 2018, in 2019 5.8% **Capacity**: contract for 15 years; only category in which conventional power plants can participate *Figure 9: Overview on Mexico's long-term auctions* Mexico thus combines two support schemes for RES in the long-term auctions, which traditionally exist separately: a quota obligation with tradable green certificates and an auction mechanism, which determines the long-term price for generated electricity from RES.
Clean Energy Certificates	By establishing the so-called CELs scheme, the Mexican government aims to stimulate investments in clean energy and secure its long-term RES target in a market-based manner through individual obligations for market actors. Through

	this instrument, Mexico hopes to accomplish its goals at the lowest cost possible. Therefore, suppliers, retailers, self-supply users and qualified/non-regulated consumers are required to purchase a minimum share of their electricity consumption by acquiring the equivalent amount of CELs or by securing PPAs with clean energy producers. Mexico's Energy Regulatory Commission (CRE) will administrate the scheme, while SENER publishes the necessary, yearly quota three years in advance. In 2018, the necessary quotient equals **5%,** whereas in 2019 it increases to **5.8%** (KPMG 2016). In Mexican law, "clean energy sources" comprise a variety of technologies: wind, solar, geothermal, hydroelectric and other RE, nuclear, certain biofuels, high-efficient cogeneration, waste-based generation, thermal power plants with CCS (Electric Industry Law, Art. 3 XXII). Generators receive one CEL for each MWh of clean energy produced by projects commissioned after 11th of August 2014 or by existing projects, which expanded their capacity after this date. CELs are tradeable bilaterally, through the long-term auctions or on the upcoming wholesale market, which starts operation in 2018. If market participants fail to deliver the necessary amount of certificates, CRE demands a fine for each missing CEL. CRE is also responsible for setting the fine sufficiently high, so that the upcoming certificates market will be working effectively.
Long-Term Auctions	The newly created, independent system operator CENACE conducts the long-term auctions on a yearly basis, while SENER, the Mexican Ministry of Energy, specifies the auction's procedure. In the Clean Energy Auction, three distinct products are auctioned: **capacity, generation and CELs** (clean energy certificates). In contrast to the usual procedure in auctions, bidders can submit offers for one, two or all of these categories. Subsequently, the buyer(s) specify the demanded volume and the maximum price for each category. In the first auction, CFE submitted a ceiling price for generation at 884 MXN/MWh (about 44 €/MWh), CELs at 444 MXN/MWh (about 22 €/CEL) and capacity at 10.000 MXN/MW (about 490 €//MW). In the following auction, CFE decreased their maximum prices due to the low offers and the high level of competition in the previous round: 766 MXN/MWh (38 €/MWh) for generation and 383 MXN/CEL (19 € for each CEL). Since no bid for capacity was submitted, CFE increased the ceiling price 170 times to 1.7mn MX/MW (about 83,500 €/MW) in order to increase interest from investors. So

	far, only CFE has acted as buyer/off-taker in the auctions, although this is subject to change in the third overall auction in 2017, in which other buyers are expected to participate as well. The buyers submit the volume they need to procure, while the market decides which technology will realize it (IEA 2016). So far, only clean energy (as defined above) was eligible for participation in this technology-neutral auction, with capacity being the only category in which conventional power plants could participate. Neither restrictions nor exceptions regarding capacity have applied in the auction scheme. A highly complex optimisation algorithm selects the best projects in regard to cost, capacity and profit margin for the buyer (IRENA 2017). The awarded bidders receive PPAs with a duration of 15 years for generated electricity and capacity and a 20 year contract for their clean energy certificates (CELs) (IEA 2016). To account for the differences in electricity demand and supply in the market, elements of nodal pricing incentives were implemented in the long-term auctions. Incentives exist for regions, which experience high electricity costs compared to the rest of the country – mainly Yucatan and Baja California Sur – whereas penalties account for regions with low prices. This design element led to the majority of projects of the first auction being developed in Yucatan (James 2017). For more detailed information on the long-term auctions and the electricity market reform, please refer to the AURES case study on the Mexican auction scheme by del Río (2017).
Evaluation	The clean energy auctions and the energy reform have generally been viewed as promising in stimulating RES growth in Mexico (IRENA 2017). According to James (2017), many bidders submitted offers consisting of a combination of both CELs and clean energy generation. This seems to underline that both support schemes work complementary since CELs are designed as a top-up payment on the secure long-term revenue from generated electricity. In general, the CEL scheme provides flexibility achieving the RES targets on an individual basis: experienced generators (e.g. CFE) can decide to produce the clean energy themselves, whereas new (electricity) market actors, as e.g. a factory as a qualified consumer, might face challenges and high costs and therefore use the certificates market (del Razo 2016). The income from the CELs can be realized either by bilateral agreements, long-term auctions or by participating in

	the upcoming wholesale market (which is regarded as a residual market to the auctions), therefore providing additional flexibility for the generators. Mexico seems to be still experimenting with different instruments for RES support, which has to be viewed under the uncertainty of electricity prices and inexperience regarding competitive electricity markets. In most other OECD countries, the introduction of decarbonisation policies followed at least ten years after the liberalisation of the electricity market (IEA 2016).

Mexico combined in their energy reform a RES quota obligation with tradable green certificates with an auction-based support scheme. This hybrid scheme aims to ensure enough flexibility for the market actors to gain experience in the recently liberalised energy market. So far, the auctions seem to attract enough competition and stimulate RES investment in Mexico in order to reach the 35% RES target in 2024.

4 Conclusions and lessons learnt

In this report, we have analysed the transition process from a non-auction to an auction-based support scheme in both the UK and in the German offshore wind sector. While the German transition has been quite a success so far (should the projects indeed be realized in the future), the British transition period was mostly dominated by unexpected measures due to political changes in the country. Nevertheless, we can highlight the following general points of good practice when designing a transition from non-auction to auction-based support schemes:

- **Visibility:** Policymakers should announce a clear trajectory with fixed dates and auctioned volumes for both the future, enduring scheme, as well as possible transitional auction rounds. This raises certainty for investors and helps securing the local supply chain.
- **Independence:** Although in general a high stakeholder involvement is desirable, pressure from some stakeholders might lead to unnecessary measures (e.g. the UK FIDeR contracts).
- **Orderliness:** When designing the transition period, one should consider making the old scheme less attractive in order to prevent market actors from rushing into the old scheme and thus ensuring enough competition in the new auctions. General uncertainty of phase-outs for certain technologies might increase this rush.
- **Mitigation of sunk costs:** Regarding possible compensation claims for already approved projects, introducing market-based solutions, as e.g. the transitional auctions in Germany, might lead to a favourable outcome.

Combining auctions with non-auction design elements under a single support scheme can help policymakers to include complementary advantages of both policy mechanisms. Therefore, we have provided insights in both hybrid schemes in California, as well as in Mexico. The main points we have identified for future implementations of hybrid support schemes are the following:

- Although linking auctions with FITs/FIPs can help identify the correct market prices, it might lead to distortions in the feed-in scheme, due to low prices. This connection may induce strategic bidding in the auction if there is little competition and there are multi-project bidders with high market power.
- Combining two mechanisms can help reduce transaction costs, especially for smaller market actors.
- Introducing hybrid schemes can reduce costs and uncertainty, which would have occurred during a transition process towards a completely new support scheme.
- Several mechanisms under one scheme provide policymakers with the opportunity to gain experience and decide in the long-term for the most efficient mechanism.
- Hybrid schemes provide to market actors the flexibility to choose the scheme which suits their needs best.
- Policymakers should not only focus on the auctions' design, but also the auctioned product (e.g. the PPAs in the Californian RAM).

5 References

California State Senate (2002). Bill No. 1078.

California State Senate (2011). SB X 1-2.

CPUC (2010): Decision adopting the Renwable Energy Mechanism. Decision 10-12-048.

CPUC (2012): DECISION REVISING FEED-IN TARIFF PROGRAM. Decision 12-05-035.

DECC (2013): Increasing certainty for investors in renewable electricity - Final Investment Decision Enabling for Renewables. Available online at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/141873/FIDeR_update_doc_Invitation_to_Participate_2013_-_03_-_14_FINAL.pdf, checked on 6/18/2017.

del Razo, Carlos (2016): A SNAPSHOT OF THE MEXICAN CLEAN ENERGY OBLIGATIONS SYSTEM.

del Río, Pablo (2017): Case Study: Mexico Case Study: Mexico - Country report as part of analysis of international experiences with auctions.

EEG 2014 (2014): Erneuerbare-Energien-Gesetz.

EEG 2017 (2017): Erneuerbare-Energien-Gesetz.

Fabra, Natalia; Newbery, David; Matthes, Felix; Colombier, Michel; Rüdinger, Andreas (2015): The energy transition in Europe: initial lessons from Germany, the UK and France. Towards a low carbon European power sector. Available online at http://www.cerre.eu/sites/cerre/files/151006_CERREStudy_EnergyTransition_Final.pdf, checked on 6/18/2017.

Fitch-Roy, Oscar W. (2015): Auctions for Renewable Energy Support in California: Instruments and Lessons Learnt.

Fitch-Roy, Oscar W.; Woodman, Bridget (2016): Auctions for Renewable Energy Support in the United Kingdom: Instruments and lessons learnt.

IEA (2016): Mexico Energy Outlook.

IRENA (2017): Renewable Energy Auctions. Analysing 2016.

IRENA; CEM (2015): Renewable Energy Auctions – A Guide to Design.

James, C. (2017): Making sense of Mexico's renewable energy auctions. In Latin American Energy Review.

KPMG (2016): Opportunities in the Mexican Electricity Sector.

Mayer Brown: Mexico's Clean Energy Auction: Material Provisions of the Power Purchase Agreements. Available online at https://www.mayerbrown.com/files/Publication/e409d0a4-cf6d-4401-a3fe-6936303b8406/Presentation/PublicationAttachment/ad205ba9-b115-4a26-84fb-6b0a596fef78/160331-UPDATE-Energy-Mexico-PrjFin.pdf, checked on 6/18/2017.

NAO (2014): Early contracts for renewable electricity. Available online at https://www.nao.org.uk/wp-content/uploads/2014/06/Early-contracts-for-renewable-electricity1.pdf, checked on 6/18/2017.

Newbery, David M. (2015): The EU Energy Union’s transition to a low-carbon zero subsidy.

Ofgem (2017): Guidance for generators that receive or would like to receive support under the Renewables Obligation (RO) scheme.

PG&E; SDG&E; SCE (2014): ReMAT Stakeholder Forum on the Market Adjusting Pricing Mechanism, checked on 6/18/2017.

SDG&E (2013): SCHEDULE Re-MAT.

UK DECC (2013): Transition from the Renewables Obligation to Contracts for Difference.

AURES 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.

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