German Energy Agency

THE ECONOMIES OF SUPPORT POLICIES FOR RENEWABLES

Money well spent

Effective allocation of financial support and enhancement of system integration of renewable energies.

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Publisher
Deutsche Energie-Agentur GmbH (dena)
German Energy Agency
Chausseestrasse 128 a
10115 Berlin, Germany
Tel: +49 (0)30 66 777 - 0
Fax: +49 (0)30 66 777 - 699
Internet: www.dena.de

Authors
Carolin Schenuit, dena
Annegret Dünnwald, dena
Anders Hove, GIZ
Wang Xinnan, GIZ

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Foreword

The past decade has seen rapid development in renewable energy technology, industry, and markets in China, especially in solar and wind power. For the solar PV industry, in 2017 China accounted for more than 50% global market share for both installation and manufacturing. For wind power, China accounted for more than 25% of global installations. The development of China's renewable energy sector has facilitated a significant decline in wind and solar costs, enhancing the economic competiveness of clean energy worldwide. Renewable energy today is the lowest-cost source of new power generation in several countries and regions, and its scale and applications are expanding rapidly. Hence, the development of renewable energy in China not only set a solid foundation for China's own energy revolution and clean energy transition, but also made a significant contribution to global renewable energy adoption, reduction of greenhouse gas emission, and future low-carbon development.

China's renewable energy sector has benefitted from the country's system of policy incentives. In this field, China has drawn inspiration from German cases, as well as from other international experiences, though China's policies have many unique, local characteristics. Renewable energy feed-in tariffs (FiT) and remuneration on costs are the core renewable incentive policies in China. As China's energy market and renewable energy have developed, and after an extremely effective 12 years in promoting renewable energy, it is time for China to evolve its renewable energy incentive policies in terms of both quantity and quality. New renewable incentive policies will also need to resolve current problems of wind and solar development, such as promoting renewable energy participation in the power market, creating a level playing field for clean energy given the current circumstances of power system reform. New policies must simultaneously promote cost reduction—including facilitating a simultaneously drop on price and cost—as well as enhance the effectiveness of subsidies, enabling incentive policies and markets to work together in tandem to adjust the pace of renewable energy development.

The new incentive mechanism should represent a combination of policies, including the existing policy of mandatory purchase of renewable electricity policy, and the new renewable energy obligation still under development. Competitive price auctions for setting feed-in tariffs are the most important renewable support policies under development in China in the near term. China has held competitive auctions in some fields of solar PV generation, such as in the Top Runner solar PV program, and China will shift to auctions for the wind power sector in 2019. Prior to full implementation of competitive auctions for renewable energy, China will still have to overcome many obstacles.

The renewable energy industry and market have achieved commercial scale at the global level, and wind and solar today are global industries. This means that to facilitate the development of renewable energy, countries have much to learn from one another in terms of renewable energy support mechanisms and implementation experiences. For China, the experiences and lessons learned from implementation of competitive renewable energy auction mechanisms in more than 30 countries globally have provided a valuable reference for designing and implementing competitive auction policies.

With the support of the German Federal Ministry for Economic Affairs and Energy (BMWi), the Deutsche Energie-Agentur (dena) – the German Energy Agency – and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) have completed this report in the course of preparation of the China Renewable

Energy Outlook (CREO) 2018. It includes a systematic analysis regarding multiple factors of international tendering and auction mechanisms including their strengths and weaknesses, key design characteristic, success factors, policy interactions, and risks. This report also uses Germany and the United States as case studies to provide detailed explanations about the specifics of different auction designs, implementation effectiveness, and experiences that China can learn from, and proposes suggestions for China's framework for incentive mechanisms.

Prof. Shi Jingli

Professor at the Center for Renewable Energy Development

Energy Research Institute (ERI), National Development and Reform Commission of China

Effective allocation of financial support and enhancement of market integration of RE

In the recent decade, China has supported a large scale deployment of wind and solar through FiTs funded by a surcharge on the consumer electricity price. This support mechanism has been a success in the sense that the planned deployment of wind and solar has been more than reached. The flip-side of the support mechanism is that the surcharge fund is no longer sufficient for the support and it not possible for political reasons to raise the surcharge further. That's why NEA is evaluating new ways of ensuring the continued deployment of renewable energies (RE) intensively. Furthermore, since China is developing electricity markets, it is relevant to look into support systems which can be adapted to market mechanisms.

In the CREO 2017, insight was provided into commonly used mechanisms for RE support, ranging from feed-in tariffs (FIT) and feed-in premiums (FIP) to obligatory quota systems, green electricity certificates. The goal of all support policies for RE is an energy system and market situation in which RE can participate and compete equally and, in the long run, become the main source of power. One step into this direction which is being chosen by more and more countries is the introduction of auction mechanisms for the allocation of financial support. That's why the focus of this report are RE auction systems and their design and competitive bidding principles for RE project support. This focus is in line with the CREO 2017 policy roadmap and the common use of auctions within FIP-systems:

In this report, at first an overview of auction design elements is given including a case study of auction design and experiences in Germany. Secondly, it is analysed which underlying market conditions are necessary to bring forward cost competitive RE projects. Thirdly, the developments in the Chinese markets are described and ideas for next steps in the Chinese policy design are discussed.

Figure 1: CREO 2017 Roadmap From Incentives To Market Driven Deployment[1]

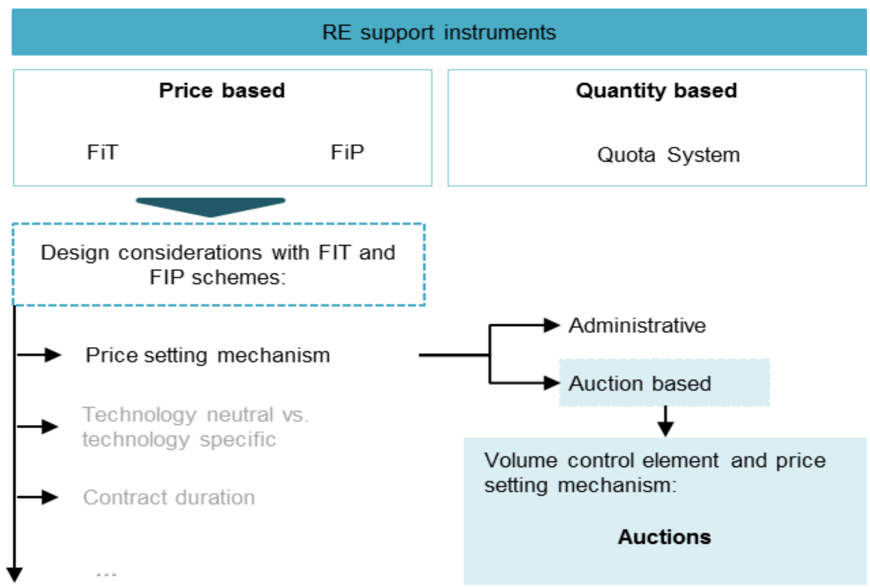
1 Use of auctions for RE projects

According to the "Renewable Energy Policy Network for the 21st Century", auctions are becoming the preferred support policy for large-scale RE projects. The number of countries using multi-criteria or pure price-based auctions is increasing rapidly. In 2017, auctions were held in at least 29 countries mostly for solar, but also for wind and geothermal power.[2] The European Commission demands auctions for RE support from its Member States and even in less developed countries the importance of auction as policy mechanism is increasing.[3]

In RE auctions, the auctioneer (usually regulators or utilities) determines a certain amount of RE capacity (MW) or energy (MWh) that should be built during a specific period. Then an auction is issued in order to find the RE developers which can build the determined volume with the lowest required support. The winner of the auction has to construct the RE project within a certain time frame and receives support payment guarantees for the produced energy for a predetermined period.[4] Auctions can be designed that the winner is selected only based on the lowest price (pure-price based auctions) or multiple criteria can be applied within the winner selection process (multi-criteria auctions). The latter is also referred to as "tenders". However, in this report the wording "auction" is used because it is the commonly used term. Pure price-based auctions use the price as the only award criterion, multi-criteria auctions consider additional criteria in the winner selection process.

Auctions are often viewed as an additional instrument to support RE. However, an auction is **not a support instrument in itself,** but a design element of the general support instrument(s). For example, Feed in Tariffs (FiT) or Feed in Premiums (FiP) can be the general support instrument in which the level of support is determined in an auction process in order to allocate financial support cost effectively. Other design elements of the support instrument (e.g. priority feed-in, grid connection guarantee et al) can be also be specified and often influence the resulting price bids. The following graphic gives an overview about the relation between auctions and other support instruments.

Figure 2: Classification of RE support schemes[5]



The following chapters provide an overview about strength and weaknesses of auctions, general auction design elements and success factors for auctions. Afterwards, experiences with auctions in Germany are described including the auction design and an analysis of auction results.

2 Strengths and weaknesses of auctions

Manifold reasons exist for the implementation of auctions in the context of RE. The main strength of auctions is the **increased cost efficiency** resulting from direct competition between market participants.[6] Well-designed auctions can provide **real-world prices** for RE electricity and can help to avoid windfall profits or underfinanced projects that don't get realized. Project developers have more information on expected costs than the government. If project developers determine the level of RE support in their bids, the information asymmetry is decreased[7]. This is especially important because the economies of RE technologies are still developing at a fast pace and therefore the level of support needed is decreasing. Another valid reason for auctions is that the overall cost, the **expansion rate of RE, and the energy mix can be planned and controlled**. The auctioneer can either set a budget cap for RE support or an annual capacity cap. Moreover, auction caps can be defined technology-specific or site/region-specific to determine the energy mix and geographical expansion of RE. A well-designed auction results in a contract between the project developer and the regulator. This provides transparency and states the commitment and liabilities of each party. The contract offers a secure investment environment for the further project development and increases the **commitment to build the project and limits the investment risk**. Auctions are **very flexible** in their design and can be adapted to the underlying circumstances of any countries' energy system. Different design elements can be combined to meet the countries requirements and objectives. The different design elements are explained in chapter 3.2 General auction elements.

Despite all stated strengths of auctions, it needs to be considered that there are also relevant weaknesses and risks related to the use of this mechanism. A major weakness of auctions is the **risk of underbuilding and delays** in the development and construction phase. The competitive bidding can result in overly low bids which do not represent real prices. Underestimations or too optimistic cost development estimations can have the same effect. This may lead to non-fulfilment of RE deployment targets and potential political consequences. Furthermore, auctions contain **relative high transaction cost**, both on the one hand for the project developer who has to take part in costly administrative procedures before the auction takes place, and on the other for the auctioneer who has to setup the design and monitoring of the mechanisms and handle the evaluation and comparison of the various bids. Ideally, a continuous improvement process is also foreseen which shall lead to more and more efficient auction execution and target achievement. High transaction cost can become a barrier to enter the market, particularly for small players. This may **reduce competition** and bears the risk that a **few, dominant players control the market** and the auctions bids. [8] Eventually, this can lead to **higher-than-necessary price levels and thwart cost-efficiency targets**. **The extent** to which each of the strengths and weaknesses affects the outcome of auctions **highly depends on the auction design.**

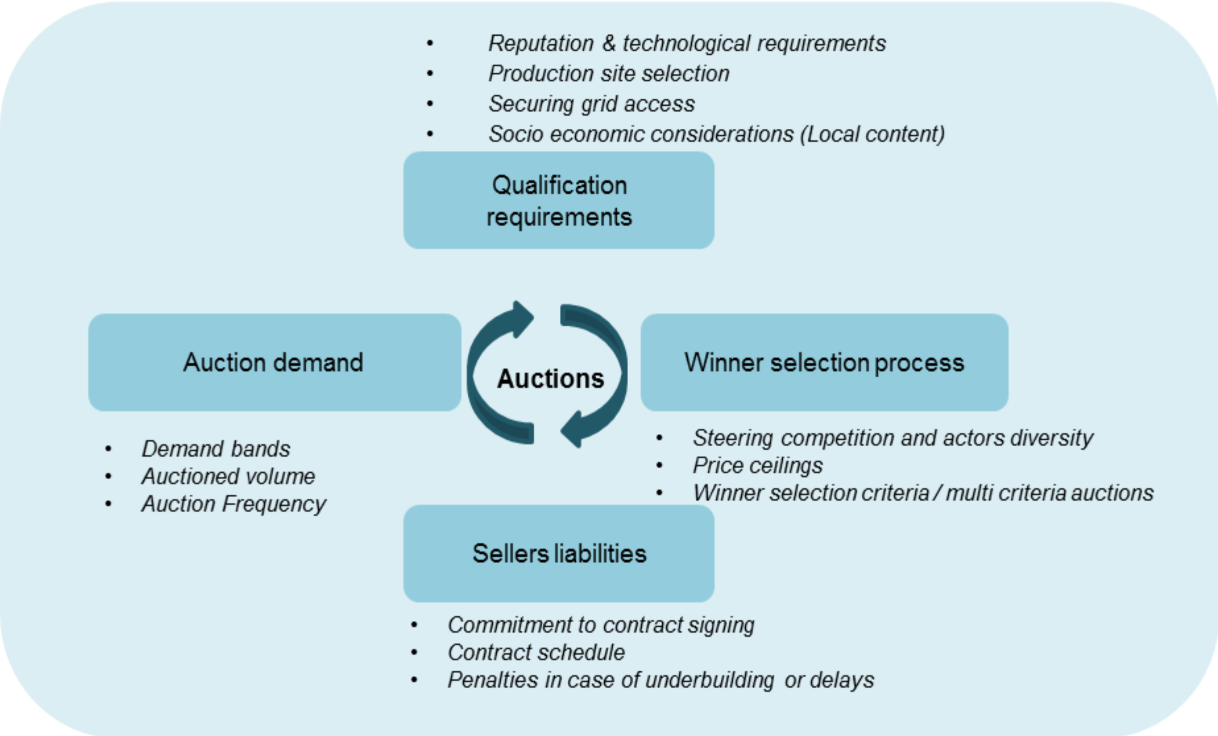
2.1 Designing auctions to foster dynamic RE development

Auctions consist of four main elements which can be designed differently considering the underlying context. The following graphic gives an overview of auction elements.[9] The four elements, 1) Auction demand, 2) Seller liabilities 3) Qualification requirements and 4) Winner selection process are described further.

2.1.1 Auction demand

In the auction demand setting process, regulators have to make key decisions about the auctioned product and the conditions. First of all, the auction volume has to be determined. The communication process how the volume is expressed to auction participants needs to get defined as well. Secondly, it has to be determined how and if the demand is shared between different RE technologies. Thirdly, decisions have to be made concerning the auction frequency.

Figure 3: Auction elements[10]



Auctioned volume

One of the first steps when implementing auctions is the determination of the auctioned volume. The volume has to be aligned with the RE goals as well as with the existing systems' technical capabilities, for example grid capacities. The auction volume can be determined based on received price bids or it can be set with a multi-criteria method.

A **fixed auction volume** is most common and simple to implement. The main advantage of fixed auction volumes is that it provides clear guidance and transparency for project developers. In **price sensitive demand curves**, the auctioned volume is adjusted in case of lower or higher prices than anticipated. This approach is more complex than fixed auctioned volumes, but it provides the possibility to control the overall policy costs and make the most of the existing budget. In a multi-criteria method, the volume is set involving multiple criteria. The auctioned in terms of capacity in MW can for instance depend on the number of suppliers which bid in the auction.[11] It needs to be decided if the auction volume is expressed in terms of capacity (MW), generation (MWh) or monetary budget. The main aim of the auction volume expressed in MW or MWh is to achieve a predetermined RE target. Bids will be awarded until the expansion level is reached. As a downside to this approach, total support costs remain uncertain.[12]

If the auction volume is defined in terms of capacity (MW), the bidder commits to install a certain capacity within a given time frame. Since support payments are often payed according to energy generated (€/MWh), capacity volumes bear higher risk and planning uncertainties for the overall policy costs. For project developers, capacity volumes are favourable because they create a secure planning environment. Beside that the realization rates of auctions can be measured as soon as the capacity is installed.[13]

Generation-based volumes (MWh) can be either set in terms of actual generation within a given time frame or via standardized, technology-specific full load hours. This approach provides more predictability on policy costs than capacity targets. Besides that, generation-based volumes provide a good planning environment for the electricity sector and enable monitoring regarding the achievement of RE targets, especially if these are formulated as a share of electricity generation. However, due to the fluctuating availability of PV and wind generation, it is more difficult to set and reach definitive targets.[14] Actual generation will fluctuate from year to year due to natural variation in weather conditions. A more feasible approach for generation-based volumes is the definition of minimum and maximum generation volumes.

The auction volume can also be expressed in terms of monetary budget. Support is allocated until the predetermined budget is reached. This approach ensures that policy costs are within the budget limit. Major downsides are that it is not fully predictable how much capacity will be installed with the given budget. If bids are relatively high, the total budget is reached early and RE targets may not be met.[15] With the specification of the character of the auctioned volume, it is necessary to decide if and how the volume is divided between different demand bands. The demand bands determine how total generation based volumes or capacity based volumes are structured. Most typically, demand is separated according to RE technologies, i.e. splitting the total volume in smaller volumes for wind projects, PV, etc. Other possibilities are to split demand based geographical locations or project size.[16]

Setting exclusive demand bands for auctions e.g. splitting the demand between different RE technologies is similar to the organization of entirely different auctions for different technologies. Clear criteria for each technology are defined and set the scope of action for the bidder. The opposite of exclusive demand bands are competitive demand bands. Each bidder is treated equally independently from the project characteristics. An example for competitive demand bands are technology-neutral auctions in which different RE technologies compete against each other. All bids are compared based on the same criteria.

Table 1: Advantages and Disadvantages of exclusive and competitive demand bands[17]

Exclusive demand bands	+ Different technologies can develop at their own pace + Increases the technology mix in the energy supply + Security for project developers - Decrease in competition which may lead to higher prices
Competitive demand bands	+ Increase competition and number of auction participants + Greater cost efficiency - Variety in the energy mix is not fostered - Promotion of mature technologies - Differences in generation profiles between different technologies (timing of generation)

It also has to be decided if the auction volume will be disclosed to all participants or if the auction volume remains undisclosed during the auction procedure. Disclosed auction volumes provide a better possibility for the bidder to estimate the level of competition. If the level of competition is expected to be rather high, the more aggressive is the bidding behaviour of auction participants i.e. the lower are submitted bids[18]. Disclosed auction volumes are regarded as fair and transparent and create reliability for the bidders. This builds trust in the auction process and increases the acceptance of the auction and minimizes the risk. Not disclosing the auction volumes bears some disadvantages. Potential bidders are faced with a high level of uncertainties. This may decrease the acceptance of the auction or even lower the participation. and thus lead to less participation which in turn decreases competition. Moreover, it is hardly possible to estimate the level of competition, which may result in less aggressive bids. However, wrong estimations can always happen in both directions and in case the competition is overestimated, this can result in lower prices. Nevertheless, a non-disclosed auction should be carefully evaluated and implemented with caution.[19]

Auction frequency

Another important consideration is the frequency of auctions and the schedule. When introducing auction schemes, auctioneers can either introduce stand-alone schemes or a systematic auctioning scheme involving multiple rounds and long term plans.

Table 2: Advantages and Disadvantages of stand-alone and systematic auction schemes[20]

Stand-alone scheme	+ Less administrational procedure especially if auctioned demand is small + Beneficial to gain experience with auctions + Can be easily adopted if circumstances change - Limited security on possible future auctions for project developers - Less ability to plan
Systematic auctioning scheme	+ Makes long-term planning possible + Helps to develop a local industry + Provides a framework for grid planning + Increases confidence of project developers in the scheme - Predetermined schedule might be too rigid to adapt to changing circumstances

2.1.2 Seller liabilities

One major risk of auctions is that project developers withdraw from project realization although their projects have been awarded. This may happen early after the auction is won but before the contract is signed or within the project realization period. In both cases high transaction costs are involved and achievement of RE targets may be at risk.[21] To ensure high realization rates in time, sellers' liabilities and obligations have to be implemented in the auction process. This involves factors like payment of bid bonds, commitment to contract signing and penalties, the contract schedule and the remuneration profile. Each element and their implications are described further in the following paragraphs.[22]

Commitment to contract signing and fulfilment of contractual obligations
Usually most obligations are stated in the contract which is signed with the winning bidder after the auction is carried out. In order to ensure that only bids with the intention to realize the projects, bid bonds can be used which have to be submitted to the auctioneer with the bid. Bid bonds are guarantees for payments from the project developers. These payments are retained as part of the penalty payment by the auctioneer in case the project developer withdraws from signing the contract or fails to realize the project in time or to realize it at all.[23] Contractual penalties are used in the contract design to ensure project realization and an adequate operating performance. Penalties can apply if the project is not developed in time, if the agreed amount of electricity cannot be delivered, the agreed capacity is not built or if the whole project is delayed or not realized. Penalties may be: termination of contract, lowering of support levels, shortening of support periods or payments because of delays in the project realization. Even though bid bonds and penalties might be favourable for project realisation, policy makers have to bear in mind that this can impose prohibitive burdens on potential bidders especially if they are small or new in the market. This might decrease the number of bidders and thus the level of competition. Bid bonds and strict penalties may also increase the risk premium that bidders include in their bid calculation. This may result in higher price bids and decreased overall cost efficiency.[24]

Contract schedule
In addition to penalties and bid bonds, the contract schedule which clearly determines the overall timeframe of the contract as well as related liabilities is crucial for a punctual project implementation. This includes considerations regarding the contract lead time, the lengths of support payments and post contract provisions. The contract lead time is the time required to build the project A short lead time increases the risk for project developers that the project cannot be built in time and may increase risk premiums especially if strict penalties are enforced in case the lead time cannot be met. However, long deadlines bear the risk of strategic bids because project developers may anticipate decreasing technology prices that may prove to be incorrect. This jeopardize the project realization and project developers may withdraw from the contract.[25] In general, construction times of RE plants are relatively well-known and depend on the technology. Not just construction times need to be considered but the time needed for administrative requirements. Several approaches are possible to design the appropriate lead time. It can start with contract signing rather than with the awarding of the contract. The lead time could also be included as a flexible winner selection criterion. so project developers would have to state their needed lead time. This incentivizes to build the project as soon as possible.[26] The contract duration determines over which period of time support payments are made. It is essential to specify the contract duration because it defines the investment risk for project developers and on the same time it keeps policy costs under control. Contract durations which are rather short lead to higher prices in the auction. For the ideal support duration the costs of the project and reasonable profit levels have to be taken into account.[27] The average usual duration is 15 – 20 years.

2.1.3 Qualification requirements

Qualification requirements have to be fulfilled as a bidding precondition in order to be allowed to participate in the auction. The use of qualification requirements also aims to ensure high realisation rates. Common qualification requirements are:

Table 3: Common qualification requirements[28]

Reputation requirements	- Legal requirements, - Proof of financial stability - Agreements and partnerships - Past experience requirements
Technological requirements	- Renewable energy generation technology - Technical or quality standards
Price ceilings	- Maximum price for bids
Project size	- Minimum/Maximum project size constraints
Production site requirements (in case bidder is responsible for site selection)	- Ownership documents - RE resource assessment - Feasibility of grid connection
Grid access requirements	- Grid access permits
Social and economic requirements	- Local content requirements - Contribution to local welfare (e.g. local ownership benefits)

Reputation and technological requirements aim to ensure that the bidding company has the capacity and knowhow to build the project.

2.1.4 Ceiling prices

Ceiling prices in auction schemes determine maximum prices for bids. Bids above these ceiling prices are not accepted. Ceiling prices are beneficial to control policy costs and thus decrease budget risks. However, setting the ceiling price is not an easy task. It has to be high enough to attract bidders and low enough to prevent strategic bidding. Price ceilings can be disclosed or be handled as a non-disclosed assessment criterion. Ceiling price disclosure may bias the bid and results in strategic bids close to the ceiling price, but it also provides transparency and may prevent collusive behaviour. Transparency builds confidence and leads to acceptance. No disclosed ceiling prices lead to higher risks for the bidders and thus higher bids.[29]

2.1.5 Project size

Another qualification requirement may be constraints regarding the minimum or maximum project size for individual projects. This determines how many projects are awarded and has influence on the level of competition. A small number of rather big projects will decrease transaction costs and could enable economies of scale. On the other hand, allowing smaller project sizes enables more and smaller players to participate in the auction. This increases competition and could prevent that few players dominate the development. Plenty of smaller projects also reduce the risk of not meeting the RE target because the volume is spread between many players and the realization rates could benefit from that. A downside of too inflexible definition of project sizes is that it may lead to suboptimal technology configuration which can increase the costs.[30]

2.1.6 Geographical site selection

Considerations regarding the geographical location of projects can also be a qualification requirement. This depends on whether the auctioneer or the bidder is responsible to choose the project site. In case the bidder is responsible, bidders have to provide relevant ownership/lease documents, carry out resource assessments, prove the feasibility of grid connection and the completion or current status of the environmental impact assessment (EIA). Hence, project developers make comprehensive analyses and investments upfront to fulfil qualification requirements. In case the auctioneer defines the project site, there could be more pre-defined and thus simplified conditions, for example regarding the issue of land ownership/land lease. The following advantages and disadvantages can be derived.

Table 4: Advantages and disadvantages with respect to the project site selection

Site selection by the auctioneer	+ costs for bidders can be reduced; the land lease contract setup may be simplified, resource assessment could be facilitated etc. + grid access can be ensured and grid bottlenecks can be prevented - contractual freedom of project developers and land owner is limited - potential land use competition between RE projects and agriculture, other projects, space for living, etc. - expropriation of land may become necessary - limited sites available
Site selection by the project developer	+ project developers are incentivised to find the highest performing sites + the project portfolio created by competing companies may be more attractive than a portfolio created by the government - sites with the best RE resources might get (over)exploited which may result in grid bottlenecks

A very decisive factor for the site selection is grid access and sufficient grid transport capacity in order to integrate the produced energy into the energy system. In case the site selection is done by the project developer, grid access should be a winner selection factor or part of the qualification requirements.

To sum it up, clear qualification requirements may improve project realisation rates but may also increase transaction cost and the complexity of the auction. The bidder has to prove that the qualification requirements are fulfilled and the auctioneer has to evaluate and check the fulfilment. One of the main strengths of auctions is the competitive price determination. However, this strength can only be exploited if competition is ensured. Auctions aim to create a sufficiently broad diversity between different types of actors because different actors offer different technologies, different project sizes and increase the diversity in the energy mix. Smaller actors might invest in individual wind turbines whereas bigger corporations aim for the installation of wind farms. This variety ensures that RE resources are optimally exploited.[31] Putting high costs on the project developer upfront, which might be sunk in case the auction is lost, might result in decreased participation. This risk can be mitigated with a long-term auction schedule which allows project developers to apply again in the following auctions. Designing qualification requirements is not a straightforward task and balance is needed between ensuring project realization and ensuring competition.

Winner selection criteria

The winner can be selected according to the lowest price only or according to a set of multiple criteria. The following table provides an overview of different forms of the winner selection processes.

Table 5: Overview winner selection criteria

Price-only	Winning bids are selected according to the lowest price
Price-only for multiple technologies	Winning bids are selected according to the lowest price after they are adjusted with a correction factor to compare different bids on the same basis
Multi-criteria	Winning bids are selected according to more than one criterion to fulfil multiple policy objectives, e.g. industrial development, project lead time, certain geographic distribution

The price-only auction is relatively simple and benefits from its objectiveness. Multi-criteria auctions aim to enable projects which usually have higher structural generation costs but fulfill secondary objectives for example a certain geographical distribution of RE projects or the development of a local industry. Depending on the political priorities, the achievement of secondary objects can be emphasized by multi-criteria auctions. The main downside of multi-criteria auctions is that economic efficiency is decreased which results in higher policy costs. The benefits of the other policy objectives have to justify the higher costs. Besides the higher costs, multi criteria auctions decrease transparency for bidders. In case multi-criteria auctions are applied, the scoring system and weighting of different criteria and the evaluation methods have to be disclosed to the participants, ideally together with the tender documents.[32] Multi-criteria objectives can also be incorporated in the qualification requirements instead of being part of the winner selection process. This means that bids are not accepted upfront if certain requirements are not fulfilled.[33]

2.1.7 Auction Types

Sealed-bid auction

In a sealed-bid auction, each prequalified bidder provides his bid with volumes and prices within a predetermined deadline directly to the auctioneer. The bids are undisclosed and participants do not have any knowledge about competing bids. The bids remain sealed until the end of the bidding period and the auctioneer aims to prevent the exchange of information between the participants. The auctioneer gathers the bids and creates an aggregated supply curve starting with the lowest bid. If demand is less or equal to supply, a clearing price is determined. All bids with prices below or equal to the clearing price are awarded with contracts. In case of multi-criteria auctions, non-price criteria also have to be considered in the supply curve.[34]

Winner's curse

The main disadvantage of sealed bid auctions is that all the uncertainty related to the price of a product must be translated into a single bid. In case there are many uncertainties, the risk of wrong or too optimistic estimations of costs increases. Winning the auction could also mean "bad news" and that cost estimates were wrong because no other bidder was willing to bid as little for the RE project. This is also known in auction theory as the "winners curse". [35] Besides that it is difficult to incorporate sensitivities in the bid. In case one project developer wins multiple projects and economies of scale can be realized this can hardly be incorporated in the bid.

Pricing scheme

The remuneration of the winning project can be according to the bid in a pay-as-bid pricing scheme. In that case, the project remuneration can differ for each awarded bidder. Contrary to the pay-as-bid pricing scheme is the uniform pricing scheme. In the uniform pricing scheme each project developper receives the same remuneration, which is usually the price of the most expensive accepted bid, the "clearing price". The following tables states the advantages and disadvantages of the different pricing schemes.

Table 6: Advantages and disadvantages of pay as bid and uniform pricing schemes

Pay as bid pricing scheme	+ possibility to decrease policy cost because payments are limited to the price in the bid + social and political acceptance because project developers do not get paid more than they ask for - risk of winners curse
Uniform pricing scheme	+ regarded as fair: every winner receives the same payment + reduces the risk of winners' curse + attracts the participation of small bidders - decrease in social and political acceptance because winning project developers receive higher prices than they ask for

3 Success factors for auctions

Auction design **is highly context specific and a challenging task for auctioneers**. Best practice examples of one market are often not applicable in other markets. Despite the need to design each auction according to the underlying context, some critical factors of success are commonly valid and need to be considered. (David Mora et al. 2017:3)

In order to obtain increased cost efficiency, **sufficient competition is needed**. A different price-setting mechanism should be used in case reasonable competition cannot be expected.[36]

The suitable **adaptation to the specific situation** is also highly relevant. The optimal auction design choices are highly dependent on the policy goals and the current market situation. A comprehensive market research regarding the available technologies, the potential suppliers and the project pipeline should always be the start of the auction design considerations. Moreover, auction rules should provide some flexibility that auctioneers can change the design in case the underlying circumstances change. However, any change in the policy design should be communicated well in advance to provide security for project developers.[37]

An **individual and context related auction design** is also highly important.[38] Details in the auction design are important for the auction outcome and should not be neglected. Policy makers should consider the macro-economic conditions of the country as well as the state of the electricity industry when designing the auction scheme. Furthermore, the interaction between different design criteria and resulting potential trade-offs have to be considered. Policy objectives should be weighed against cost-efficiency and design elements have to be chosen in line with the overall objectives.[39]

In order to ensure policy effectiveness, **project realization** needs to be **secured**. This can be done via qualification requirements and penalties. Winning projects should receive remuneration at least according to their bid to decrease the risk of winner's curse. (see sections 3.2.2 Seller liabilities and 3.2.3 Qualification requirements).

Another key factor of success relates to a **clear and well specified communication of auction rules**. Auction rules should consider all relevant possible scenarios to avoid uncertainty and eliminate room for interpretation. Bidders have to be informed early and enough time should be provided that bidders get familiar with the rules. Auction objectives and the operation should be clearly stated prior to the auction procedure itself.

Besides a clear communication of auction rules, **regulatory stability** is a key element for a functional auction process. Constant changes in the regulatory framework create uncertainties and increase the risk perception by investors.[40] In case changes in the auction procedure become necessary, they should be communicated clearly and well in advance. Empirical analyses also show that a **long term auction schedule** with fixed dates increase planning reliability for investors and should be preferred over a "stop-and-go" implementation. Moreover, the auction design should be kept **as simple as possible**. A complicated winner selection processes which cannot be retraced by the auction participants afterwards and confusing qualification rules discourage potential bidders.[41]

3.1 Experiences with auctions in German

3.1.1 Background of Auctions in Germany

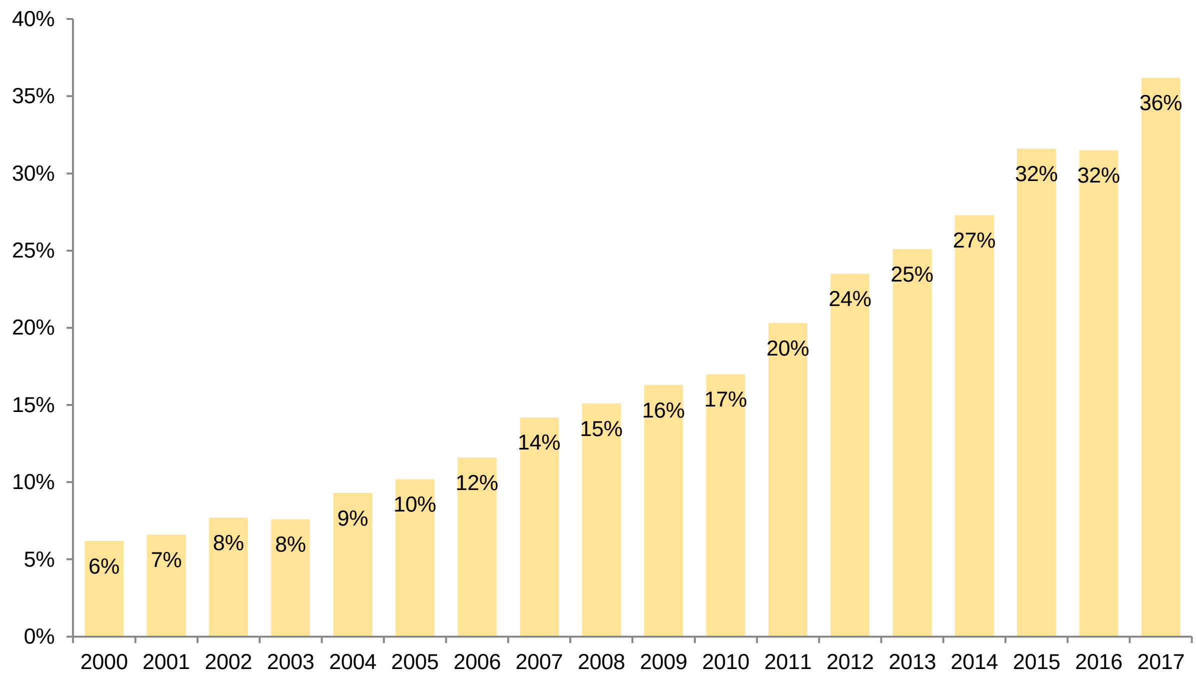
Germany has set ambitious RE energy targets. Table 7 shows the RE share targets for the electricity sector and for the overall energy consumption.

Table 7: RE targets in Germany until 2050[42]

	2020	2030	2050
Share of gross electricity consumption	35 %	50 %	80 %
Share of gross energy consumption	18 %	30 %	60 %

So far, the share of RE of the electricity consumption increased from 6 % in 2000 to 36 % in 2017. With 36 % in 2017, RE has the largest share of energy consumption in the energy mix followed by lignite with 22.5 % and hard coal with 14.1 %.[43] Figure 4 shows the development of RE from 2000 until 2017. This growth was strongly driven by the renewable energy sources act 2017 (EEG 2017). The EEG was already implemented in 2000. Since then the law has been reformed several times.

Figure 4: Development of RE in total electricity consumption in Germany[44]



Key elements of the EEG which are essential for the integration of RE are:

- Grid connection obligation: system operators are obliged to connect the RE plant to the grid without undue delay and with priority, to the voltage level which is appropriate and in the shortest distance.
- Priority feed-in: system operators must transmit and distribute electricity from RE as a priority and without delay.
- Compensation for curtailment: In case the grid operator has to curtail RE because of grid bottlenecks, the RE operator receives a financial compensation that amount to ~95% of the awarded price.

The main support instrument for RE projects in Germany are sliding FiPs. Since the EEG 2014, the price level of the FiP is determined in an auction process. The auctions are technology-specific with separate demand bands and requirements for each technology.[45] Auctions in Germany aim to fulfil three main objectives:

- Control and steer the expansion volume
- Decrease policy support costs by competitive price determination
- Achieve a high level of participation and diversity of bidders

These objectives impose various requirements on the auction design. Effective volume control can only be reached with high realisation rates and with reasonable project lead times. Competitive price determination requires a high level of competition and low transaction costs. A high level of participation can only be reached with transparent auction rules and qualification requirements which can be fulfilled without high upfront costs. Tables 8-10 provide an overview about design elements for auctions in Germany.[46] Although the basic auction design is separated by technology, common auctions for solar and wind projects and cross border auctions with partner countries are possible and being tested in pilot auction rounds. (§ 39i EEG 2017). The type of the auction is not specified by law but until now, only sealed-bid auctioned were performed.

Table 8: Auction design in Germany for Wind offshore

Wind offshore	**Auction demand:** • Frequency: once per year • Auctioned volume: - Transition phase: 3.100 MW total in 2017 and 2018, plants are regarded as existing because they already obtained permits before 2017, commission will start after 2020 - Central model: starting 2021 the annual volume will be 700-900 MW (central model), the sites will be predetermined
	Seller liabilities: • Bid bonds: Transition phase: 100 €/kW when the bids are submitted, Central model: 200 €/kW when the bids are submitted
	Qualification requirements: • central model (starting from 2021): bids can only be submitted for predetermined sites • bid must fulfill size criteria according to the selected site • Price ceiling: 10 cent/kWh (for existing projects) for predetermined sites
	Winner selection process: • Price is the only award criterion • Remuneration is paid according to pay-as-bid scheme • Grid access is only guaranteed for successful bidders

Table 9: Auction design in Germany for PV[47]

PV	**Auction demand**: • Frequency: three times per year (1 February, 1 June, 1 October) • Auctioned volume: 200 MW per auction in 2018, subject to adjustments
	Seller liabilities: • Lead time: 24 months • Bid bonds: First bid bond has to be provided as a security 5 €/kW), Second bid bond has to be provided right after the auction by every successful bidder (45 €/kW)
	Qualification requirements: • Required project size: > 750 kW, maximum size of one bid: 10 MW • Site selection: Bids must include specifics about the location • Price ceiling: 8.84 cent/kWh (2018)
	Winner selection process: • Price-only auction; if two bids have the same price, the smaller project is awarded • Remuneration is paid according to a pay as bid scheme

Table 10: Auction design in Germany for Wind onshore

Wind onshore	**Auction demand:** • Frequency: four times per year in 2018/2019 (1st February, 1st May, 1st August, 1st October) • Auctioned volume in 2018: February 700MW, May 670 MW, August 670 MW (volumes are subject to adjust-ment) • Upper capacity limit in designated "network expansion area"
	Seller liabilities: • Lead time: 24 months without penalties, granted remuneration expires after 30 month • Bid bonds: - Bid bond to be provided as security when the bids are submitted (30 €/kW) - Community owned projects: 15 €/kW when the bids are submitted, 15 €/kW after the auction by every successful bidder • Penalties: - Projects realized later than 24 months after announcement of the winning bid: 10 €/kW - Projects realized later than 26 months after announcement: 20 €/kW - Projects realized later than 28 months after announcement: 30 €/kW (bid bond)
	Qualification requirements: • Required project size: > 750 kW • Permits according to the Federal Emissions Protection Act to be issued no later than 3 weeks before the bidding deadline • Permission status must be announced to the Federal Network Agency no later than 3 weeks before the bidding deadline • Price ceiling: 6.3 cent/kWh (2018), which is based on winning bids of 2017

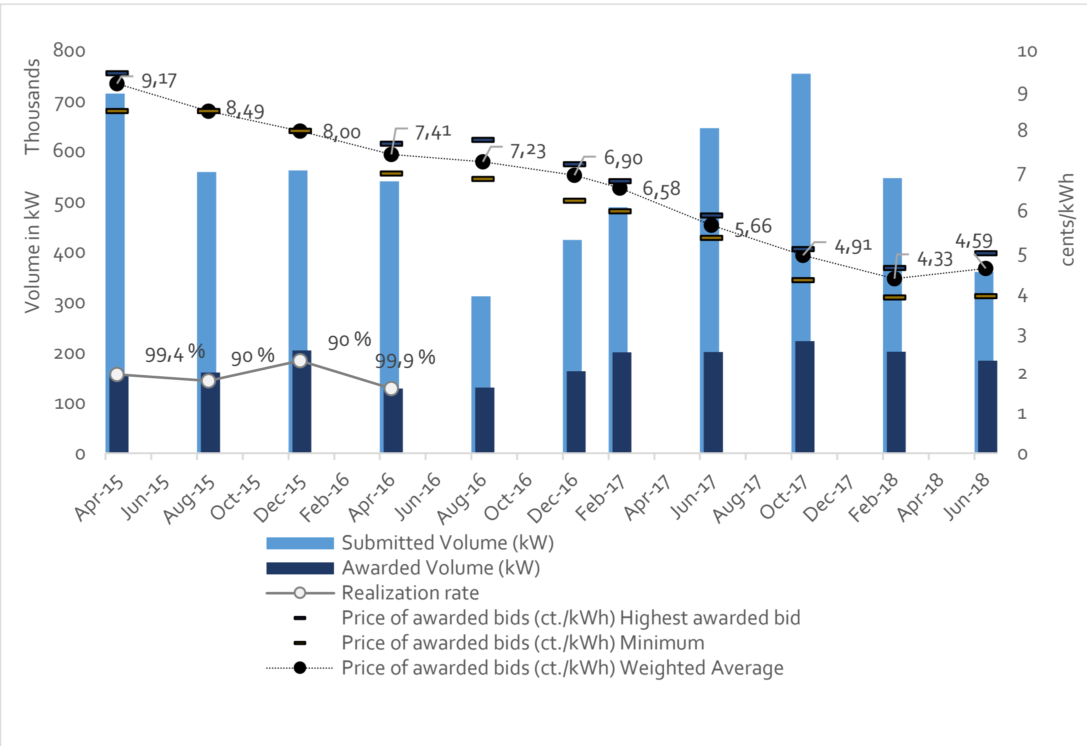
	• To create comparability, auction participants have to calculate the needed remuneration for one common reference site, the actual remuneration may differ (reference yield model)
	Winner selection process: • Price only auction • If two bids have the same price, the smaller project is awarded • Bids in the network expansion area are awarded until capacity limit is reached, afterwards only bids outside the network expansion area are awarded, even though the price might be higher • Remuneration is paid according to pay-as-bid scheme • For community-owned projects, remuneration is paid via uniform pricing scheme according to the last awarded bid

3.1.2 **Auction results**

PV

Auctions for PV already started in 2015. Figure 5 summarizes the auction results from 2015 until 2018. The diagram shows the submitted volume from bidders and the awarded volume. It can be seen that the submitted volume exceeded the awarded volume. In addition, the realization rate of the awarded project is shown in Figure 5. So far, statements about the realization rate for PV auction in Germany can be made for the first four auction rounds from April 2015 until April 2016, which lies between 90 % and 99.9 %. Moreover, Figure 5 shows the price of the awarded bids, including the weighted average price of awarded bids, the highest awarded bid as well as the lowest awarded bid in each auction round. Prices decreased from 9.17 cents/kWh in the first auction in 2015 to 4.59 cents/kWh in 2018[48].

Figure 5: Results of PV Auctions in Germany[49]



Evaluating the auctions based on the given objectives, the following conclusions can be made.

1. **Controlling and steering the expansion volume:** Until now the realization rates for PV projects are relatively high (90 - 99.9 %). This indicates success with regard to volume control. Profound analyses will be possible within the next years, when more data are available. However, the auction results until now seem promising.
2. **Decreasing policy support cost by competitive price determination:** With the competitive bidding in PV auctions, support payments decreased from 9.17 € cents/kWh in 2015 to 4.59 € cents/kWh in 2018. This equals a decrease by 50 % which can be attributed to high levels of competition and decreasing technology cost. Since 2017, agricultural land was allowed in some areas for PV projects which decreased bid prices further
3. **Achieving a high level of participation:** The level of submitted bids in every auction round is significant higher than the awarded volume. Therefore, it can be concluded that participation and competition is high. However, analyses show that the bids were mainly submitted by professional project developers, the participation of small or community owned projects was rather low.

Wind onshore

Since the introduction of auctions in 2017, five auction rounds for onshore wind took place with a total awarded capacity of 4,133 MW. Notable are three special conditions in the auction design[50]:

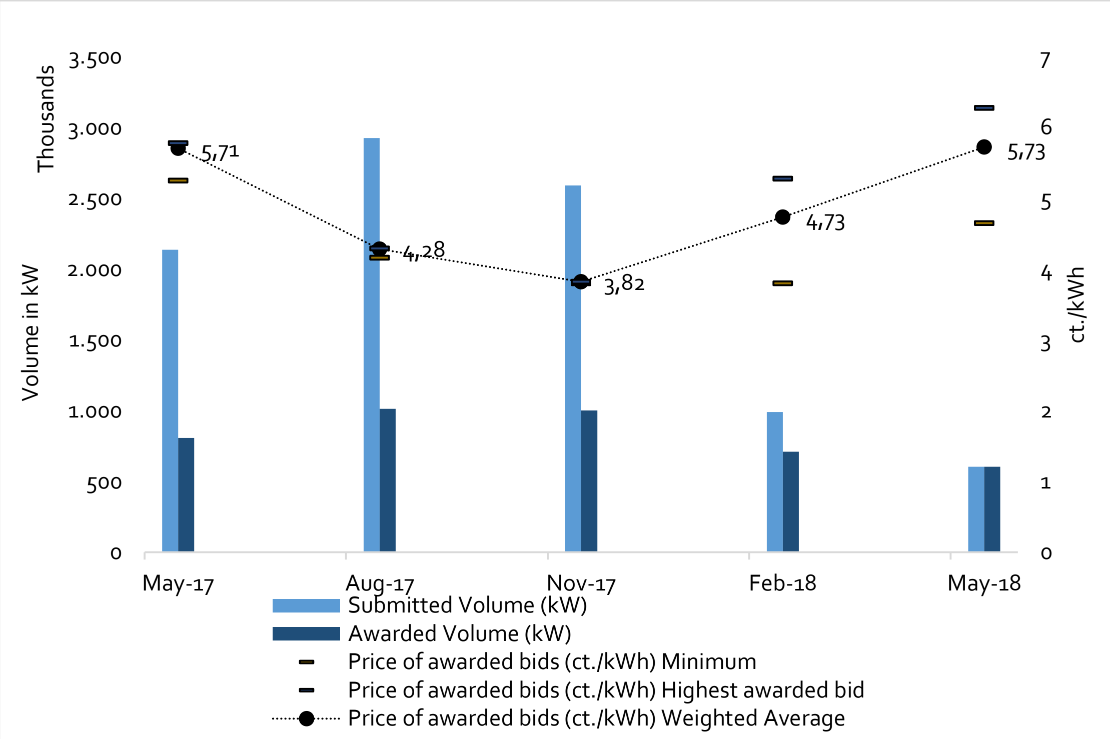
First of all, auction participants submit their bid according to the "reference yield model", which means that bids are calculated for one reference location in order to address price distortions by different local wind conditions. This aims to enable wind energy projects throughout the whole German territory and not just in locations where the wind conditions are superior. The remuneration level is adjusted according to the wind conditions of the actual location after the auction. The adjustment mechanism is transparent for project developers and known in advance.

Secondly, there are volume quotas for so called "grid expansion areas". These areas where defined because a regional concentration happened in previous years and let to grid bottlenecks. Grid expansion areas are locations where grid bottlenecks occur more frequently and where grid expansion is necessary. New projects within grid expansion areas are only awarded until a predetermined capacity threshold is reached. Afterwards no projects are awarded in these areas, even though submitted prices may be below the prices of bids for other regions.

Thirdly, privileged qualification requirements were applied for community-owned projects until 2018 (small project developers). This included longer lead times for provision of the permit according to the Federal Pollution Control Act (BImSchG) and project realization lead times (4.5 years compared to 2 years for regular projects). The objective of these privileged qualifications requirements was mainly to ensure bidder diversity. As a result, almost all of the auction volumes were awarded to community-owned projects in 2017 (May 2017: 96 %, August 2017: 95 %, November 2017: 99,26 %). This high concentration on one bidder segment increases the risk of delayed or failed project realization.

Criticism has occurred because of the unclear role of several professional project developers in the community-owned projects who supposedly took advantage of unclear definitions for qualified corporations. As a consequence, since 2018 some of the special requirements for community-owned projects were suspended and benefit from fewer exemptions. The following figure shows the results for onshore wind auction in Germany.

Figure 6: Results for onshore wind auctions in Germany[51]



Evaluating the auctions based on the given objectives, the following conclusions can be made.

1. **Controlling and steering the expansion volume**: For auctions in 2017, nearly all of the awarded bids were submitted by community-owned projects. Therefore, the project realization period ends in 2021/2022 which contains a higher risk of failed or delayed realization than the shorter realization period for other bidders. Industry experts estimate that there is a risk of ~30% that the planned projects will not receive the BImSchG approval. Moreover, the third auction resulted in relatively low prices (3.82 cents/kWh). It is possible that projects prove to be unprofitable in retrospect and bidders withdraw from the projects. With regard to auctions in 2018, reliable statements regarding the realization rate cannot be made yet. However, since special regulations for community-owned projects changed, industry experts expect generally higher realization rates.

2. **Decreasing policy support costs by competitive price determination:** Prices decreased in 2017, which was mainly caused by the competitive advantage derived by some project developers from the special regulations for community-owned projects. The achieved results in 2017 are seen as critical because they are perceived as too low with regard to current price levels. So the risk of winners curse for the actual project realization is seen as rather high. Prices increased in 2018 because the special regulations were changed.

3. **Achieving a high level of participation:** The privileged requirements for community-owned projects were initially introduced to enable bidder diversity. However, auction results in 2017 showed the very opposite, a high concentration of successful bids in one bidder segment. Representatives of community-owned projects argued that the regulation did not target the needs of the intended target grou0p.

3.2 Experiences with auctions in the US

U.S. utility-led tenders also driving down costs

Auctions and tenders are increasingly prominent in the deployment of RE in the U.S., which historically relied on tax credits, renewable portfolio standards, and net metering credits to support wind and solar. Many U.S. utilities use auctions or tenders to acquire RE, either in support of state clean energy mandates, or simply to meet basic demand for new generation resources. Because wind and solar are among the lowest-cost energy sources for new generation today, in some cases wind and solar have won tenders that were technology neutral and were not designed with the objective of promoting RE specifically.

Tech-neutral tenders for peaking power won by solar and storage

For example, in 2018 Arizona Public Service (APS) announced that it would award a peaking power project to First Solar to provide electricity to APS during the hours between 3 pm and 8 pm. First Solar would supply the power from a 65 MW solar plant paired with a 50 MW, 135 MWh battery. While prices were not disclosed, a similar system recently contracted in Arizona will supply energy for US$ 0.045/kWh. The APS project showed how solar and storage are now cheap enough, at least in Arizona, to compete head-to-head with natural gas for peaking power.52

Tenders for offshore wind driving down prices

In other cases, states and utilities have used technology-specific auctions to drive down the price for clean energy. Recently, the 800-MW Vineyard wind farm in Massachusetts was awarded through a tender, coming in at US$ 0.074/kWh. This is down from $0.132/kWh just a year ago in the case of an auction in Maryland, and US$ 0.244/kWh for the only offshore wind farm currently operating at Block Island, Rhode Island.53 This 70% decline in cost over just a handful of years shows the power of tender processes to stimulate price efficiencies.

RE winning technology-neutral capacity auctions

Wind, solar, and demand response have also gone head-to-head against conventional fossil fuel resources in capacity auctions led by the PJM regional transmission organization, which serves several states in the U.S. Midwest. In PJM's most recent capacity auction, 11 GW of demand response, 1.4 GW of wind, and 500 MW of solar were awarded capacity contracts for the 2020-2021 period. The capacity auction is technology neutral, and features strict performance standards for delivering power. Wind and solar typically bid capacity together, paired with demand response or other resources to make up for their variable and seasonal output.

3.2.1 Nevada case study: typical bidding requirements

States or utilities seeking to acquire generation resources are becoming more experienced in how they conduct tenders, as reflected by bidding documents available online. In 2018, Nevada's largest utility, Sierra Pacific Resources, issued a request-for-proposals (RFP) to procure from 35-330 MW of RE.54 Although the tender is reserved for renewable energy, it is open to solar, wind, geothermal, and biomass resources. The tender explicitly encourages storage up to 35% of the facility capacity, and bids are evaluated in part based on provision of firm capacity. The utility is seeking to sign a 25-year contract for power, either based on a power-purchase agreement (PPA) or a build-transfer agreement (BTA) model. The tender specifies the power plant must be in place by 2020.

To ensure quality bids, tender processes generally require bidders to supply a variety of information to prove their bona fides, a process that is more complex for bids where multiple technologies might compete. The Nevada RFP provides a detailed list of information requirements from wind and solar plants, for example. Solar bids must include insolation data as well as the data source to prove capacity factor, choice of Tier 1 solar panel providers, and choice of inverters from a list of qualified suppliers. Wind bids must include a full year of wind data from at least two anemometers on or near the site, plus information about long-term wind trends, as well as confirmation of turbine availability, manufacturer, and size. Bidders also must provide a great deal of documentation of a more general nature to demonstrate their ability to deliver:

Financial: Bidders are asked to provide full company financials, ownership structure, a description of contractor's work experience and experience in Nevada, ownership of other energy facilities, bond ratings and credit ratings, audited financial statements for three years, and financing plan for the facility.

Property: The tender requires bidders to provide a full legal description of the site along with Google Images of the site, plus copies of any legal documents providing ownership or access to the site.

Environmental: Bidders must describe all environmental permitting requirements, demonstrate plans to meet these requirements, provide any environmental site surveys or data, list adjacent landowners and land uses, show plans to obtain community support and approval, and provide information relating to air rights if relevant.

Regulatory: The bidders must also supply an interconnection agreement, or a plan for obtaining interconnection, along with a full plan for delivering the project on time including assurance of equipment supply, and a detailed project schedule including environmental and regulatory approvals as well as financing and construction. Bidders must also supply detailed plans for operating and maintaining the facility.

One of the potential drawbacks of tender processes is administrative complexity for both bidders and utilities. To reduce administrative costs, Nevada's tender contains pro forma power-purchase or build-transfer agreements and asks that bidders either accept the pro forma conditions or provide marked-up versions of the contracts along with legal certification that any markups are substantially complete. Furthermore, acceptance of pro forma agreements without modification is included as a criterion for evaluating bids, helping motivate bidders to reduce or forego modifications.

Evaluation criteria for the Nevada tender are based 60% on price, 30% on non-price factors, and 10% on economic factors. Non-price factors include bidder and contractor expertise, technical feasibility, resource quality, environmental benefits, development milestones, and transmission upgrades. Economic factors include Nevada jobs created in construction and operation as well as the value of expenditures in Nevada. The Nevada tender sets out a detailed schedule for the bidding process. Bidders have less than four weeks to submit bids, and the utility has one month to short-list potential winners. After completing the final short-list, the utility has six weeks to conduct negotiations with short-listed bidders, followed by contract signing. Winning bidders must submit regulatory filings by June 2018 and regulators have six months to approve the bids. Bidders are required to deposit up to $10,000 to bid and up to $250,000 once the bid is won. The utility's RFP document is 58 pages long, which indicates the administrative complexity of tendering, but also provides ample public information to attract qualified bidders and weed out unqualified bidders. Though the process is transparent, some elements are confidential, and additional information and requirements are available online through a bidding portal, where bidders can submit documents in confidence.

4 Towards a market environment for cost competitive RE

In 2017, global new investments in RE power and fuels were US$ 279.8 billion (not including hydropower projects larger than 50 MW) and China was the largest investor with US$ 126.6 billion.[55] RE technology cost have fallen sharply and the global growth in RE generation capacity has exceeded investment growth in relation because the same investment value enables more RE deployment. However, technology costs are not the only driving cost factor which determine the total cost of a RE project. The money needed for investments must come from private or institutional equity and banks who cover the debt portion of the total financing volume (hereafter both referred to as "investors"). Investors require return on their investment in form of interest. The interest rate can differ for the different forms of financing and investment. The interest rate for the riskier construction phase is usually quite high since the construction is often de-coupled form the long-term finance contract and conditions which come with more safeties and lower interest rates. The interest rates are referred to as capital costs and are a considerable cost factor for RE projects. Consequently, low capital costs are paramount for a cost-effective transformation of the energy system. So one of the primary goals of RE support schemes should be to provide a framework for affordable and cost effective financing conditions.

The capital costs are influenced by several factors such as the risk perception of investors, the overall macro-economic conditions of a country and previous experiences with similar investments. In case the risk perception is high, investors ask for a higher return on their investment to compensate that risk. This increases the total costs for realizing a RE project.[56] Hence, risk is an important factor which needs to be considered in the transformation towards an RE system with cost competitive generation of RE. The following subchapters focus on the relation between investment risk and cost for RE projects. Moreover, different risk factors in the course of RE projects are outlined including mitigation strategies. Finally, a German case study shows how the RE support policy design as well as different underlying political and economic parameters led to zero premium-bids for offshore wind projects.

4.1 Secure investment environment: risks can become costly

Investment risk can be defined as the probability of events that have an impact on the expected return of the investment. Both parameters, the probability of an event as well as the impact defines the scale of risk and form the basis of risk perception. Investors expect safe returns on their investments, preferably with upside potential for the level of returns. Therefore, prior to the investment decision, investors analyze which factors may influence their investment and the level of expected returns to decide whether to invest or not. Investors usually aim to minimize risk but are willing to accept risks, if they are compensated with higher returns. Therefore, the higher the risk, the higher the so-called risk premium (increased returns) investors aim to receive to compensate for the risk.

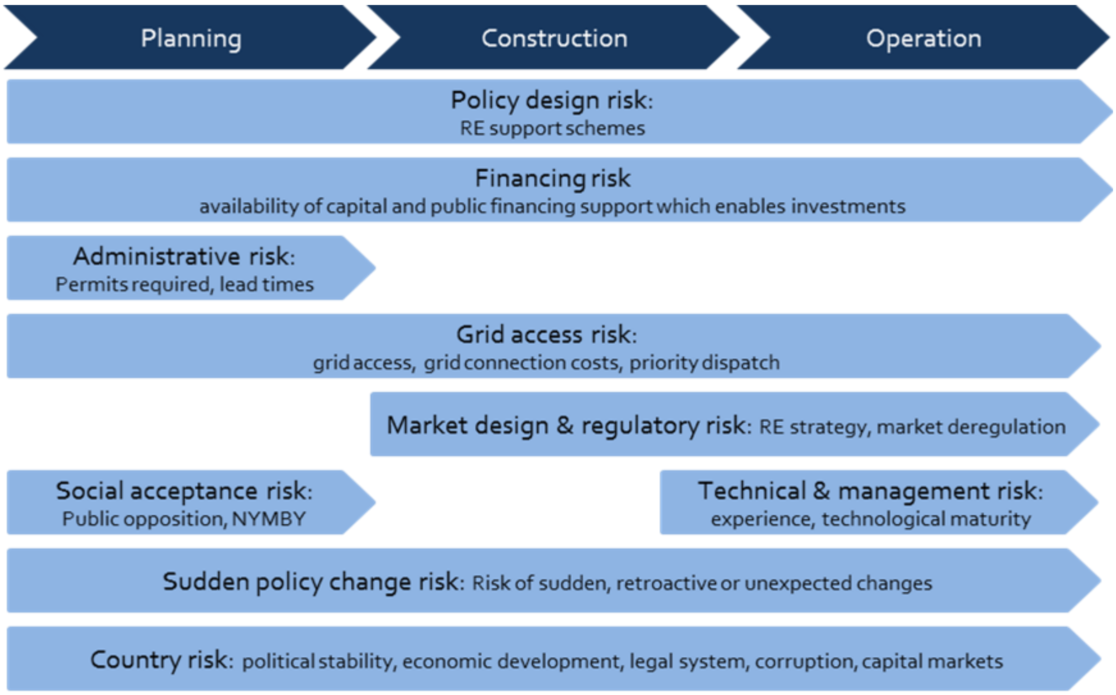
In case RE auctions are used to determine the level of remuneration, auction results are highly effected by the risk perception and the related risk premium which become part of the price bid. RE projects with a high risk premium have to bid higher prices simply because their capital costs are higher. The more uncertainty exists regarding different risk categories, the higher are the costs for RE projects. In other words, a secure investment environment contributes significantly to decrease costs of capital and is necessary to achieve cost competitive RE generation. The next subchapter sheds light on risk factors that influence investments and the level of risk premium with regard to RE projects. Strategies to mitigate and address each risk are shortly outlined.

4.2 Risk factors in RE project execution

With regard to RE projects, various risks can arise during the planning, construction and operating phase of the project which have impacts on the level of risk premium.[57] A special characteristic of RE projects is that most of the capital is required upfront before commissioning and operation. The investment cost for wind projects account for 80 % of the total lifecycle costs whereas the investment cost for gas power account for only 15 % of the total lifecycle costs. For RE, most of the investments need to be done before any income is generated. Any delays in the project development, construction and commissioning process also delays incoming cash flows to refinance the projects. The following figure gives an overview about different risks during the project lifecycle.

Each of the risk categories has a different relevance in the project lifecycle stage and different mitigation measures can be applied for each risk category. In general, investors can avoid, mitigate, transfer or accept risks. In the context of ambitious RE targets, government must aim to provide a secure investment environment which enables plannable investments and provides possibilities to mitigate risks. Otherwise high risk perceptions can lead to lack of investment or very high risk premiums which pose the threat of either not achieving RE targets or to achieve them only at high costs which in turn decreases the competitiveness of RE. The following subchapter explains each risk category and provides mitigation strategies.[58]

Figure 7: Risk in the context of RE projects [59]



4.2.1 Policy design risks

RE support policies are needed to correct market failures and to support innovative technologies that are not yet mature and cannot compete at the market. RE support policies have the objective to bridge the gap between the market prices and RE production costs. The fact that RE require support and are not profitable at the market without support payments increases the risk perception of investors. This risk perception can either increase further or decrease depending on the RE support policy design. RE support schemes which entail a higher exposure to fluctuating electricity prices and do not guarantee a reliable revenue stream ultimately increase risk premiums, whereas a policy design with a predictable revenue stream decreases the risk premiums. This is especially the case for RE technologies with a fixed cost base like wind and PV, where high fixed capital costs make it difficult to adapt to fluctuation or decreasing power market prices.

Mitigation strategy: By providing security of returns with RE support schemes, like FiT or FiP, governments are able to reduce the risk in the operation phase significantly. In order to create a stable investment environment, RE support schemes should address the level of the expected return and consider the deviation potentials in the expected return. This can be achieved with the following policy elements

- The revenue risk as well as the risk of highly fluctuating revenues can be addressed by fixed FiT and FiP support schemes.
- Auctioning schemes should incorporate financial and non-financial prequalification requirements and penalties to ensure a high project realization rate.
- Governments should increase the predictability of RE support by providing clarity on the amount of RE they intend to support for the upcoming years, for example via a long term auction plans.

4.2.2 Financing risks

Financing risk is related to the policy design risk and refers to the availability of capital and public financing support which enables investments. In case RE support schemes are in place but support payments are significantly delayed due to funding gaps or delayed administrative processes, investors might not be willing to provide capital for acceptable conditions. This may jeopardize the refinancing of RE projects and the realization of RE project in general. The counterpart risk can also be relevant, especially in emerging markets. If the financial counterpart to the RE project owner is not perceived to be reliable, e.g. a financially weak utility, the risk premium increases significantly.

Mitigation strategy: In order to avoid a funding gap, support payments to RE operators and the funding of those payments should be carefully aligned. This is only possible if the expansion of RE as well as the funding of support policy is predictable. Therefore, a long-term RE financing strategy is needed with expansion targets and forecasts on RE deployment. Governments can reduce the financial risk through their involvement on the financial market for example by setting up public investment funds or banks which provide loan guarantees. In emerging markets for RE, general information on capital availability for RE projects is helpful as well as training and information to bankers about the specifics of RE projects to improve financing conditions. A final option in case financing proves to be problematic are state guarantees.

4.2.3 **Administrative risks**

For the construction and operation of RE power plants, various permits are required. Missing permits can result in delays regarding the project commissioning, which in turn delay incoming cash-flows to refinance the project. The "administrative lead time" to obtain permits and licenses varies depending on the complexity of the projects as well as the administrative structure of responsible institutions and authorities.

Mitigation Strategy: Governments should keep in mind that a clear structure and efficient processing of public administrative systems are major factors for successful RE deployment. This includes the provision of transparent guidelines and sharing of good practice examples as well as education and training of civil servants. Smooth administrative processes need to be in place to shorten administrative lead times and to mitigate risks of delays. Another method, which requires significant amount of resources and know-how in the public administration, is the pre-definition and pre-qualification of sites by the government/auctioneer. Even parts of the official permitting process can get included in the prequalification. This is applied for example in large offshore markets like Denmark.

4.2.4 **Grid access risk**

Grid access is in most prerequisite for the operation of RE projects. The process includes the procedure to grant gird access, connection, operation and curtailment. Any uncertainties regarding grid access can result in delays regarding the project commissioning and the project returns. Curtailment due to grid bottlenecks can decrease the income of RE projects and hamper refinancing of the project. In case policies do not address these topics properly, risk premiums are increased. Remote operations as e.g. in mining or telecommunication are exemptions of this rule and do not represent a large portion of the relevant RE capacities.

Mitigation strategy: Governments and regulators have to provide clarity on procedures and processes with regard to grid extension, grid access, liabilities and compensation in case of delayed or interrupted access or curtailment. Transparent procedures to obtain grid access need to be implemented and provided. Moreover, a reliable compensation scheme should be in place which determines the lost production and lost returns in case of delayed or interrupted grid access. The main mitigation measure for grid-related curtailment is the investment in grid infrastructure. This requires long-term grid planning and extension. Grid-related curtailment is generally not in the responsibility of RE generators. Therefore, measures to compensate curtailment should be implemented.

4.2.5 **Market design and regulatory risks**

Market design and regulatory risks refer to the governments' energy strategy and regulations regarding the electricity market. The level of market design and regulatory risk highly depends on the presence of fair and independent regulations which safeguard that RE producers have access to the market.

Mitigation strategy: A common and transparent marketplace for all market actors helps to reduce market design and regulatory risks. The increased deployment and new forms of RE technologies in the energy system may result in conflicts between market actors, e.g. project operators and grid operators. To avoid lawsuits conflicts could be solved by the involvement of a neutral entity. A neutral and official entity should be implemented to avoid and settle disputes on market functionality. This entity can also actively provide advice on the interpretation of laws and regulations.

4.2.6 Technical and management risks

The technical and management risk refers to the technical availability of know-how and experience to successfully develop, construct, operate and decommission a particular RE project. This includes the availability of skilled and trained labour, experiences with the local regulations and geographical conditions and suitable industrial presences.

Mitigation strategy: Technical and management risks are within the responsibility of the project developer and operator of the RE project. However, support policies that contribute to a strong RE sector that can support the mitigation of that risk. In case auctions are used to select RE projects, personnel qualification requirements including project references can be used to mitigate the risk of delayed construction or default. Sharing of best practice experiences among industry players can accelerate the learning curve of RE technologies. This could be achieved through the implementation of an official obligatory registration of projects, including incidents during the project development and construction and lessons learned. The registration could be made obligatory as a condition to receive RE support payments.

4.2.7 Social acceptance risk

Lack of social acceptability of RE investments can cause investment risks through delays in or cancelation of projects. Citizens are generally in favour of RE projects, however the “Not in my backyard” (NIMBY) phenomena can often be observed, which means that citizens protest against projects in their immediate vicinity. The lack of social acceptability of RE investments predominantly occurs during the planning and development phase of project and can result in significant delays.

Mitigation strategy: The social acceptance risk can be decreased by addressing the root cause of the risk for example through a communication and a participation process during the project development. Policy makers should aim to involve all relevant stakeholders in an early stage and provide reliable information about the role of RE in current and future energy systems. The social acceptance can also be increased through the facilitation of citizen project ownership, so-called energy cooperatives. The cooperatives are a form of citizen participation in the development of TE, mainly on a regional level. Energy cooperatives act as a “normal” project developer in the auction. However, sometimes there are special qualification regulations for energy cooperatives (see International experiences with auctions wind onshore Germany). To enable this, remuneration procedures need to be designed in a simple and straightforward way.

The distribution of financial burdens of RE support policies needs to be addressed properly as well. In many countries, RE support instruments are financed by a surcharge on the electricity bill for energy consumers. An appropriate and fair design of the burden sharing is important to keep or increase social acceptance of RE high. Exemptions or privileges related to this surcharge may be deemed necessary for energy-intensive industry players, but the share of privileged electricity volumes should be kept as small as possible to avoid significant distortions in the burden sharing. A precondition for this is that clear rules are defined which industry and which players are eligible for exemptions form the surcharge payment obligation.

4.2.8 Sudden policy change risks

This risk refers to any unexpected, unanticipated, short-term announced or sudden change regarding policy design features. This changes may include changes of the RE support scheme, abandonment or retroactive changes of the RE support schemes or changes of the entire RE strategy.

Mitigation strategy: Policy makers should avoid sudden policy changes and provide a stable, predictable and enabling policy environment. The RE support policy design should be responsive in case underlying circumstances change but yet predictable to provide investment security. For example, the implementation of dynamic and regular (i.e. every year or quarter) digression mechanisms in the support payment design can be a way to manage cost risk on the policy side without the need to change the policy design substantially

4.2.9 Country risk

Country risk includes political stability, level of corruption, economic development, design and functioning of the legal system and exchange rate fluctuations. These risks affect not just RE projects but all investments in a country. High country risks result in high risk premiums and high required levels of financial support to incentive investments.

Mitigation strategy: In case the country risk is mainly related to economic conditions of a country, a long term RE strategy can be used to strengthen the economy. RE deployment may become part of an economic and industrial policy framework. Depending on specific national conditions like RE resource potential and existing industries, the government can promote elements of the RE value chain offering opportunities for economic growth and job creation. Another mitigation strategy could be to integrate development finance institutes into the RE strategy through use of guarantee products like the Partial Risk Guarantees.

4.3 Trust in regulations: an underestimated factor

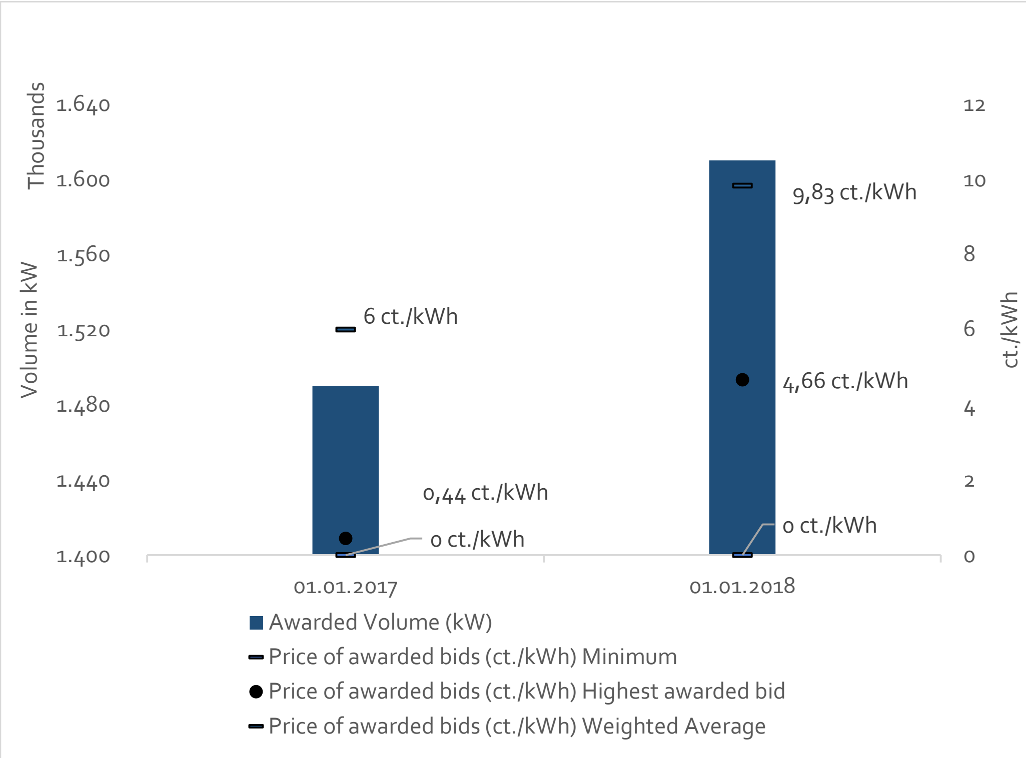
Trust plays an important factor for the risk perception of investors. In case RE support policies are in place but trust in those regulations is missing, the perceived risks will most likely not decrease. Hence, not just the right policies need to be in place but the execution of those policies must be predictable and well communicated in advance. The different design options and how they influence the risk perception are described in the next chapter. It needs to be noted that some of the risks are related to political circumstances and the underlying infrastructure of the energy system which cannot be fully influenced by the RE support policy design. For the transition of the energy system from conventional power towards RE, change in the whole energy system is needed.

4.3.1 Offshore Auctions in Germany: subsidy-free bids, but with securities

In 2017 and 2018, two auction rounds for wind offshore projects took place with a total volume of 3.100 MW. At least 500 MW of the total volume were exclusively for the Baltic Sea. (For auction design elements see chapter: International experiences with auctions). The first two auction rounds in 2017 and 2018 were for" already existing projects", which means that the projects that were bid already got various relevant approvals in the previous years. The commissioning of the projects is planned between 2023 and 2025. The next auction round will take place in 2021 and will take place yearly. The auction volume will be between 700 –

900 MW per auction round. Grid access for offshore wind in Germany is regulated by the network development plan which is created conjointly by the four TSOs and approved by the Federal Network Agency. Project developers only receive grid access if they are awarded in the auction. The grid extension towards the grid connection point on sea is responsibility of the TSOs and refinanced via the grid fees for all consumers.

Figure 8: Results of offshore wind auctions in Germany



The auctions for offshore wind led to striking results: in the first auction round in 2017, 1,380 MW out of 1,490 MW were awarded at 0 €/kWh FP and were supposedly "zero subsidy"; that means that the project developer receives solely the wholesale electricity price without a FIP on top. The second auction round also included 0 €/kWh bids. There is a set of circumstances that enabled these bids:

- The auctions took place at a relatively late stage of the project development process. Project sites were already pre-developed and bidders already received necessary approvals, so the risk of non-realization of a project due to non-awarded permits did not exist.
- Winning the auction guarantees grid access and operation rights for 25 years. Moreover, electricity from RE is fed into the grid with priority in Germany. This guarantees that the produced energy is purchased and provides operating income security for the project.
- The level of competition was relatively high because winning the auction is a prerequisite for the very limited and regulated offshore project market. Nevertheless, a second chance for bidding was provided to the non-awarded bidders in the 2017 auction. The next auctions will take place in 2021 for projects which will be commissioned after 2026.
- The project lead times are relatively long and project commissioning is not planned before 2023. Project developers most likely factor in their expectation for increasing wholesale electricity prices. Nuclear power in Germany will be phased out until 2022 and there is an increasing call to phase out coal from the German

energy mix. These capacity reductions will reduce the offered electricity volumes at the wholesale exchange which will likely lead to price increases. In addition, a significant further RE technology progress with decreasing technology costs is expected.

- The penalty to withdraw from the project is rather low which may become an option to opt out if the assumptions for the low bidding price do not materialize. Phasing-out subsidies for conventional energy decreases RE support policy cost

In some markets (US, China, France, Poland) a trend towards corporate power purchase agreements (PPAs) can be observed. By such PPAs, project developers can stabilize through long-term contracts with private stakeholders like large industrial players. For each contract partner, the PPA is a part of their overall risk management strategy: RE project developers can secure an alternative source of income and industrial players can use the generated RW as a long-term, price-secure option for their electricity purchase portfolio.

5 True cost comparison: Enabling fair comparability

The previous analyses have shown how the right RE policy design and risk mitigation can lead to cost competitive RE technologies. However, not just RE policies can contribute to cost competitive RE generation, also policies and regulations for conventional energy have an impact. Subsidies for fossil fuels still exist in many countries and which make non-renewable energy cheaper than their real, full-cost market price would be. The IEA estimates subsidies to fossil fuels that are consumed directly by end-users or consumed as inputs to electricity generation at around 260 USD billion globally which is nearly as high as new investments in RE (see previous chapter).[60] Fossil fuel subsidies encourage inefficient use of energy, discourage investment in low-carbon technologies and energy-efficient equipment and thus increase energy-related CO2-emissions. It also decreases resources which are necessary for infrastructure investments, including those needed for energy supply, and social welfare programs.[61] The need to phase out these subsidies was stressed at the G20 Summit in Hamburg in July 2017. The *G20 Hamburg Climate and Energy Action Plan for Growth* highlighted the need to redirect investment flows from fossil fuels to sustainable energy sources such as RE and energy efficiency, and to create an investment environment conducive to the deployment of low-carbon technologies.[62] These subsidies make it more difficult to reach cost competitive RE deployment because the current costs of fossil fuels are also influenced and decreased by fossil fuel subsidies. Gradually phasing out subsidies for conventional energy can accelerate the process to reach cost competitiveness for RE.

5.1 A level-playing field for RE: Including external effects in the conventional power benchmark price

The market costs of generating electricity from RE, coal, nuclear or gas usually do not represent the true full costs of that generation technology. Externalities or external costs which represent the negative environmental and societal impacts of electricity generation, are mostly not considered.

External costs mainly occur because of the environmental impacts of conventional electricity generation due to its GHG emissions. However, there are more external costs of fossil energy generation than environmental effects caused by global warming: Diseases caused by air pollution or negative impacts on energy security in case of high import dependency. In addition, the benefits of RE regarding energy security or less air pollution are also not reflected in the market price of RE. Considering both, the negative effects of conventional energy as well as the positive effects of RE in the costs for electricity would improve the competitiveness of RE. In order to factor in external effects an estimation of external costs per unit of electricity generated is important to determine the related monetary impact. For instance, in 2015 damages caused from air pollution due to the use of fossil fuels in China accounted for roughly 4,876 Billion RMB.[63] In the EU, total external costs for hard coal-fired power plants are calculated to be above 90 € per MWh in 2012.[64]

Besides the monetary determination of external costs, a suitable instrument has to be implemented to reflect these costs in the electricity price. An Emission Trading System (ETS) aims to factor in the external effects. However, further instruments are needed in case the ETS does not send clear price signals for example a floor price, carbon taxes or an added cost component on fossil fuels.

In conclusion, RE support policies should not be seen as the only policy instrument to reach RE targets but have to be integrated in the overall policy mix. The determination of costs of fossil fuels with its external effects is another lever which can influence the cost competitiveness of RE.

5.2 Background: History of RE incentive policy in China

The Chinese government has used feed-in tariff (FiT) policy to subsidise RE more than a decade. While the FiT has helped scale up RE, it has also led to certain challenges, such as the subsidy payment deficit.

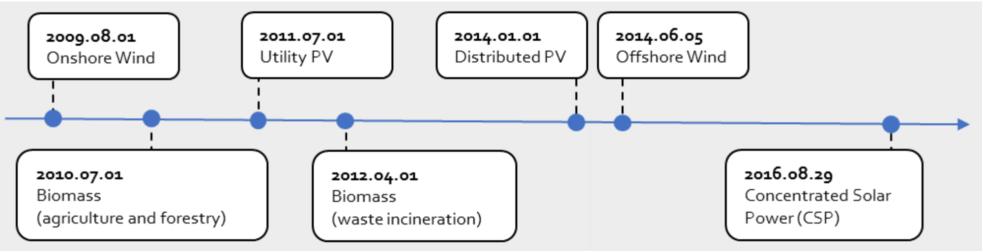
In January 2006, the National Development and Reform Commission (NDRC) established the legal framework of China's FiT policy.[65] The government planned to subsidize RE including wind, solar, biomass, marine and geothermal power by paying a higher on-grid tariff compared to coal. The difference between the level of the renewable tariff and the local desulfurized coal benchmark tariff would be paid by the government. Coming to 2009, the government officially introduced the FiT policy for wind power. It is a set of FiTs applying to all projects national wide. The tariffs were differentiated in several tiers to reflect regional differences in wind sources.[66] [67] To fund the FiT, the central government revised the Renewable Energy Law in 2009 and created a surcharge on retail electricity prices. Since 2012, the Ministry of Finance put the capital of surcharge together with certain amount of central financing budget into a dedicated Renewable Energy Development Fund. Although the surcharge has grown over time, the overall design has stayed constant.

Figure 9: Historical value of renewable surcharge (RMB/kWh) and its percentage in average retail electricity price of the year [68]

Note: *Share of RE surcharge in retail electricity price is RE surcharge of the year divided by annual national average electricity retail price paid by end-users. This price is published by the National Energy Administration (incl. former State Electricity Regulatory Commission) every year.*

The scheme experienced a few changes in the decade after the NDRC launched the FiT policy. First, high-cost RE technologies were gradually included: offshore wind in 2014 and Concentrated Solar Power (CSP) in 2016. Second, the FiTs decreased annually as costs fell. The onshore wind FiTs decreased from RMB 0.51-0.61/kWh in 2009 to RMB 0.40-0.57/kWh in mid-2018, while the utility-scale solar PV dropped from RMB 1-1.15/kWh in 2011 to RMB 0.5-0.7/kWh as of mid-2018.[69] Distributed solar PV projects have different subsidy schemes depending on the owner and scale of the project, and the subsidy is paid by the fund that supports FiT scheme. Household owned distributed PV and building rooftop PV projects do not have limit of subsidized capacity. Since 2014, distributed solar PV received a subsidy of electricity retail price plus RMB 0.42/kWh for the electricity for self-use and that of coal benchmark price plus the subsidy for the electricity fed in the grid. [70] As with FiTs, subsidy amounts have fallen over time: The current subsidy amount in 2018 is RMB 0.32/kWh.[71]

Figure 10: Timeline of the effective date of RE FiTs [72]



The drawback of the FiT design in China, as in other countries that have used FiTs, is that FiT levels are fixed administratively at levels designed to encourage investment in new technology, whereas technology cost reductions are determined by the market. When RE costs decline more rapidly than the FiT, the result is booming investment in clean energy - a good result FiTs are intended to promote - but also leading to excessive subsidy payments beyond policy-maker expectations. In China's case, because the amount of the renewable surcharge is set separately from the quota for new projects approved to receive FiT payments, the *Renewable Energy Development Fund* can experience either surplus or deficit depending on the rate of new project additions and level of renewable output.

In 2017, the deficit of the Renewable Energy Development Fund reached RMB 112.7 billion according to the National Energy Administration (NEA).[73] In recent years, the rapid development of the solar PV industry caught planners (and industry analysts) by surprise, contributing to the deficit. Given resistance to further increases of the renewable surcharge, which reached 2.87% of the average price of retail electricity as of 2016,the 13th FYP for Renewable Power Development targeted the wind power sector to achieve price parity with coal on-grid prices by 2020. [74] Solar PV was also expected to achieve cost parity compared to retail price of power by 2020.

5.3 Recent change in 2018: removal of new PV projects from FiT subsidy list

Starting in 2012, China introduced provincial quotas for FiT-qualified solar PV installations to prevent over-investment in regions with limited transmission and reduce the risk of over-capacity.[75]Only projects that have applied and obtained construction quota can receive the FiT subsidy. Faced with over 9.65 GW of solar PV installations in the first quarter of 2018 and a rising surcharge deficit, in May 2018, NDRC announced it would cease issuing FiT quotas for utility-scale PV for the remainder 2018, with some exceptions, as well as sharply limiting subsidy quotas for distributed solar.[76] The sudden change caused a sharp drop in solar installations.

In some respects, the policy change is healthy: PV installation growth indicates that FiT levels were unnecessarily high, leading to manufacturing overcapacity and over-building in transmission-constrained regions. A growing FiT deficit causes payment delays and cash-flow difficulties for RE operators. The new policy excludes poverty alleviation PV projects and technologically-advanced Top-Runner PV projects, meaning that the government will direct limited funds to continue supporting such projects that promote specific policy benefits. Reducing subsidies for utility PV also forces the solar industry to put more effort on lowering costs.

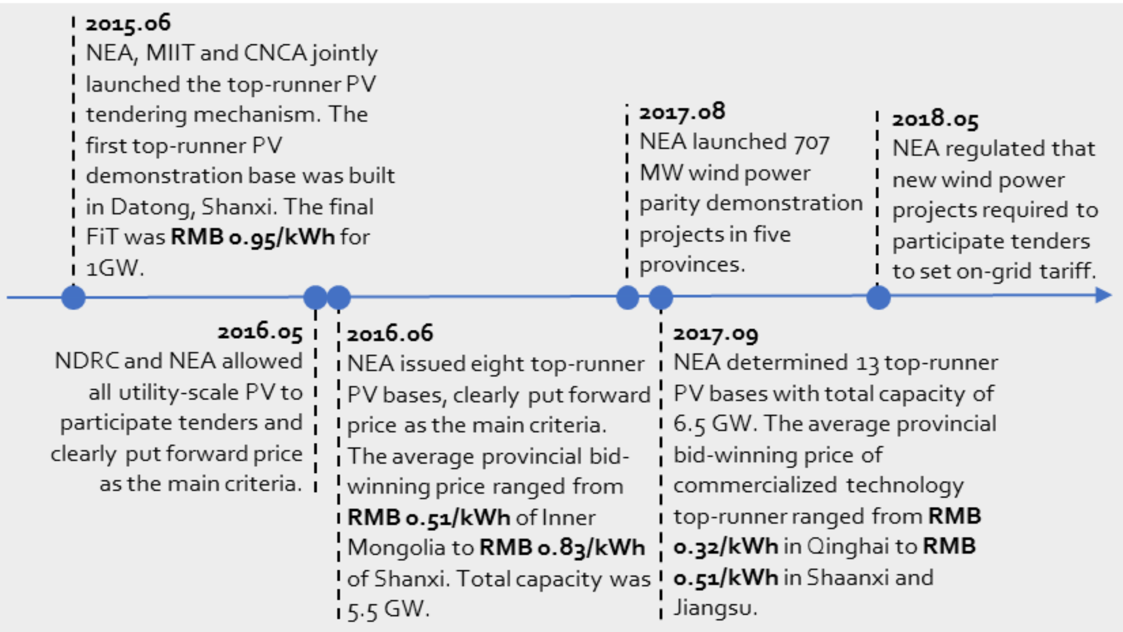
The sudden policy change also has drawbacks, however. A support policy that creates artificial and sudden booms and busts exacerbates uncertainty and risk attached to RE investment, ultimately raising investment costs, as has been demonstrated in chapter 1.2. On the manufacturing side, while there may be some inefficient solar manufacturing capacity, a sudden collapse in demand for solar could produce financial distress and factory closures at even top-quality suppliers, raising costs when production rebounds. Ultimately, a subsidy design that adjusts automatically and gradually would better suit the need for a national and global transition to clean energy. As this outlook shows, to meet the ambitions in both the Stated Policies scenario and the Below 2 Degree scenario requirements, China will need to see continued growth in wind and solar installations.

5.4 Renewable auctions as a potential solution

Auctions or tenders are a promising way to develop the current system further and determine the level of FiT for RE in a more differentiated way, while it should be accompanied by efforts to reduce risk and by pricing externalities to have effect. As with FiTs, China has long experience with RE tenders: The NDRC launched the first renewable tender in 2003, six years before creating the FiT policy, when the renewable industry was still its infancy. At that phase, the purpose of tenders was to find the actual market cost given the small the number of prior RE projects.[77] At that time, winning bids showed wide variance in bid prices, demonstrating the industry's immature stage of development.[78] Now that China has several years of experience and over 100 GW of wind and solar PV installed, auctions are likely to produce a more narrow range of pricing, and should help address the need to reduce investment cost while continuing deployment of low-carbon energy. In the mid-term, the auctioning of a FiP-like payment scheme should be targeted in order to link the RE incentive policies to the setup of power market structures in an early stage.

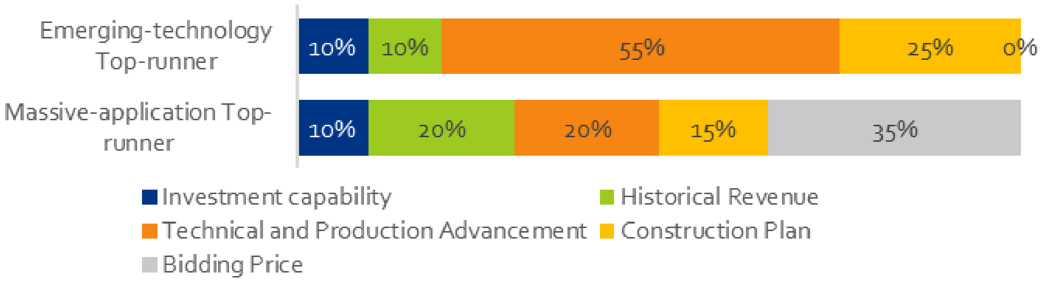
For solar PV, China has used separate tendering mechanisms in different provinces for utility-scale solar PV projects and for Top-Runner projects. In 2016, the NDRC and NEA issued policies that allowed all utility-scale PV projects to participate in tenders, which policy-makers hoped would lead to lower prices and reduce the subsidy burden.

Figure 11: Timeline of implementation of wind and PV tender mechanisms



To encourage regions to adopt tenders, the central government granted a larger total subsidized capacity quota, holding out the possibility of a higher overall amount of subsidy.[79] The Top-Runner program, which promotes construction of PV plants with advanced, high-efficiency PV technologies, has also employed tenders to determine the on-grid tariff.[80] The program, established in 2015 by NEA, the Ministry of Industry and Information Technology (MIIT) and the Certification and Accreditation Administration (CNCA), grants project winners priority to receive national PV construction quotas, which includes a government-guaranteed subsidy payment[81]. In 2017, NEA divided the Top-Runner program into two categories, commercialized technology top-runners and emerging-technology top-runners. The former for mature, large-scale PV products, while the latter focuses on fostering the cutting-edge technology for the future. The capacity of a commercialized technology top-runner base should be no larger than 650 MW, and that of an emerging-technology top-runner base should be no larger than 150 MW. [82] The tendering evaluation process considers not only the bidding price but also investment capability, technical and production advancement. In practice, most project bidders had similar characteristics, making price the most critical differentiating factor. The weight of each criteria is shown in Figure 12. The Top-Runner program so far has gone through three tendering cycles, each of which have shown a price decline. In a few regions, such as Baicheng in Jilin province, tendering solar PV has shown the technology is almost competitive with current prices set for local coal power. The average gap to local coal power prices was only RMB 55/MWh.[83] In 2018 NEA plans to launch demonstration projects for PV that is priced at or below local coal power tariffs.[84]

Figure 12: Selection criteria and their weights for Top-Runner PV developers



For wind energy, technology maturity has made wind economically comparable with conventional power plants on a larger scale. In August 2017, NEA officially approved the first batch of wind power parity demonstration projects in Hebei, Heilongjiang, Gansu, Ningxia and Xinjiang. Grid operators should purchase full amount of output but at the price of local coal power benchmark tariff.[85] Since May 2018, in provinces that have not issued 2018 wind power construction plans, centralized onshore projects and offshore projects where the main investors are undecided should set on-grid tariffs through competitive tenders. From 2019 onwards, all new provincial centralized onshore wind and offshore wind power projects will be required to participate in tender processes. The weight of the bidding price in assessing wind bids is at least 40%.[86]

Excursus: Wind projects where the main investors are undecided

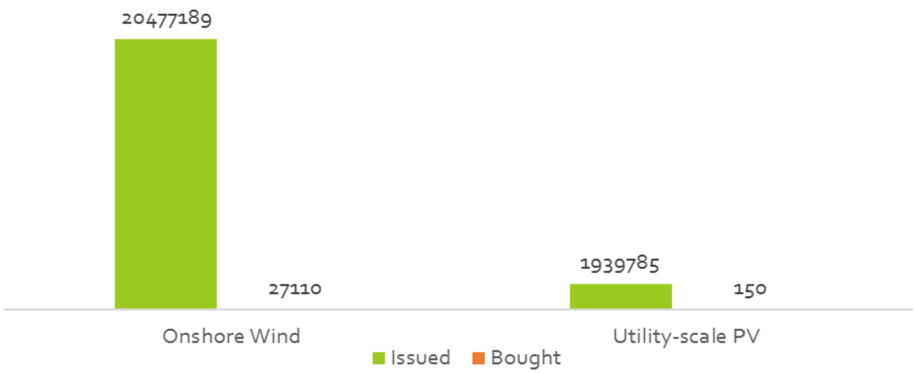
Wind projects can be categorized into two types, those with and without pre-determined investors. In the case of projects with pre-determined investors, the investor decides the project location, capacity, and investment, while competing for provincial approval, as indicated by inclusion in the province's quota for subsidies. In the case of projects without pre-determined investors, the government owns the project plan but seeks investment. This case only applies to very limited number of national strategic and pilot projects: for instance, wind power bases connected to HVDC lines, wind parity demonstration projects, and distributed wind power pilots.

5.4.1 Voluntary green certificate market introduced, but with limited uptake

The government had several goals in establishing the current voluntary green certificate market: reducing subsidy payments, promoting social awareness, and developing experiences with certificate markets. Voluntary green certificate markets have the potential to raise public awareness of sustainable development and encourage businesses and individuals to support RE. Green certificates could become the compliance mechanism for a future renewable obligation, so a voluntary green certificate market could help to develop experience with the platform.

Green certificate market transactions began on 1 July 2017. Onshore wind and utility solar PV producers were issued certificates each worth 1 MWh to cover the full value of production. Any enterprise or individual can purchase the certificates, but no secondary trading is permitted. The price of certificates is capped at the level of the government subsidy on the FiT for the respective technology. That is equal to the renewable FiT minus local coal power benchmark tariff. Generators that sell green certificates no longer receive investment in RE, known as additionality.[87] In China green certificate revenues merely substitute for subsidy payments already guaranteed to generators. In turn, generators perceived no incentive to offer certificates to buyers at prices lower than government-guaranteed subsidy payments, so certificates could not promote price competition. As a result of this design, few transactions have taken place, and the certificate market has not alleviated the subsidy deficit. Nevertheless, the non-binding market is expected to continue.

Figure 13: Certificates issued and trading volume (1 July 2017~ 25 June 2018) [88]



5.4.2 The renewable obligation mechanism: a possibility for future policy design

China is currently considering adopting a mandatory renewable obligation mechanism. In March 2018, NEA published a preliminary plan that would assign certain entities a quota for the percentage of electricity that needs to come from RE. Those entities include provincial grid companies, stated-owned and private distribution grid companies, electricity retail companies, industrial enterprises owning their own power plants, and large end-users participating in bilateral electricity trading. The policy could yet undergo major changes and a final rule is not anticipated before year-end 2018.[89]

6 Outlook

When designing incentive and support policy instruments for RE, it is important to consider the starting point of the respective national situation. All specific and general instruments that have been described and exemplified in this report have this factor in common: They exist within a given regulatory and market framework with whom they can have significant interdependencies. This is why a holistic approach to the topic is recommendable, especially with regard to the absolute overall cost of energy supply. This approach would include the surrounding factors in the energy system (e.g. grid, fossil power generation) as well as the macroeconomic factors (e.g. investment climate) and the climate protection factor (e.g. enabling honest cost comparability of renewable and conventional energy sources).

In order to design a successful RE support scheme that fulfils the given political goals regarding the speed, quality and cost of RE extension, there are a couple of important conclusions that can be drawn:

1. **Consider the goals when designing the tool:** Auctions are widespread and can be used to reach a competitive determination of the support (market) price of RE. They also allow a good level of control of the overall RE construction volumes, their cost and potentially the geographic location. But they come with rather high transaction cost since they are usually quite complex in their design. This setup bears the risk of delays of the actually realized RE projects and can lead to market player concentration and resulting market dominance which may jeopardize the goal of increased cost efficiency.
2. **There are several possible layers of competition:** An auction is not a support instrument in itself, but a design element of the general support instrument(s). This makes the tool very versatile because it can be used in a higly regulated context and based on a FiT-Design as well as within a market-based context where only premiums to market price are auctioned (FiP) or even request bids only for certain special rights such as guaranteed grid connection. So competition and increased cost efficiency can be achieved via different pathways.
3. **RE support policy is only half the story:** RE support policies should not be seen as the only policy instrument to reach RE targets but have to be integrated in the overall policy mix. The determination of costs of fossil fuels with its external effects is another lever which can influence the cost competitiveness of RE. As first steps, these cost can be addressed via ETS schemes, other price points on CO2 (taxes, levies) and the phase-out of subsidies and other privileges on fossil fuels.
4. **Why the investment climate matters**: Trust plays an important factor for the risk perception of investors. In case RE support policies are in place but trust in those regulations is missing, the perceived risks will most likely not decrease. Hence, not just the right policies need to be in place but the execution of those policies must be predictable and well communicated in advance.

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