Report D2.2 (a), October 2015

Overview of Design Elements for RES-E Auctions

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WP2 - Framing and conceptual aspects of auctions for RES-E.
Task 2.1 - Overview of design elements for auctions for RES-E

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Executive Summary

This report provides the foundations for the rest of the AURES project. WP2 deals with framing the general approach and the conceptual aspects of auctions. It will create a comprehensive overview of auction options available for RES, create an evaluation framework based on assessment criteria relevant for policy makers, and identify the main market condition categories for auctions for electricity from renewable energy sources (RES-E), and will thus lay the important groundwork for a common understanding and terminology in all subsequent activities.

This report is elaborated to comply with Task 2.1 (Overview of design elements for auctions for RES-E) in the AURES project. According to the Proposal, "*The aim of this task is to identify and give a structured overview of options for auctions in the RES-E realm. This will be based on an in-depth review of the literature on RES-E support schemes generally and auctions for RES-E more specifically. A database with relevant documents for the whole project will be built. This will also support the analysis carried out in other WPs and, particularly, WP2 and WP3. The literature review will include both theoretical and empirical studies. This task provides a comprehensive overview of the different options and design elements available, and thus creates a common framework, that helps to improve the understanding and the use of a common terminology throughout the project*".

Accordingly, the aim of this report is to provide a general context for design elements and a structured overview of options and design elements for auctions in the RES-E realm. It classifies these design elements, grouped in several categories and discusses their pros and cons with respect to the alternatives.

1. Introduction

Auctions have recently been regarded as a useful alternative to other RES-E support schemes for the setting of the remuneration of RES-E projects. This interest goes beyond the academic realm. Many EU and non-EU countries have recently or are on the way to implement auctions for RES, either as the main support scheme or for specific technologies. It is being used in some EU countries to set the support levels under FITs or FIPs. According to REN21 (2015), at least 60 countries had held renewable energy tenders as of early 2015, up from 9 countries in 2009.

In the EU, the Guidelines on State aid for environmental protection and energy 2014-2020 (EC, 2014) (Guidelines from now on) mention that market-based instruments, including competitive bidding processes, should gradually replace existing renewable support schemes from 2015 onwards. Those instruments are expected to increase cost-effectiveness and mitigate the distortions on competition. Competitive auctions will have to be implemented in order to provide support to all new installations from 2017 onwards.

Some exceptions to the use of auctions are envisaged, however. Alternatives could be used if: 1) Small installations or technologies are in an initial stage of development[1]; 2) Member States (MS) could show that auctions would lead to a non-satisfactory outcome because they would only promote a few projects or sites, because they would result in higher support levels or because they would be ineffective.

As with other support schemes, whether auctions will fulfill the expectations and result in a successful promotion of RES-E depends on the design elements chosen. The aim of this report is to provide a list of design elements for auctions for RES, discuss their pros and cons and illustrate how they have been applied in real policy practice around the globe, with a special focus on the EU. WP4 will provide a detailed analysis on their real-world functioning.

This report provides the foundations for the rest of the AURES project. WP2 deals with framing the general approach and the conceptual aspects of auctions. It will create a comprehensive overview of auction options available for RES, create an evaluation framework based on assessment criteria relevant for policy makers, and identify the main market condition categories for RES-E auctions, and will thus lay the important groundwork for a common understanding and terminology in all subsequent activities.

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[1] According to the Guidelines, small renewable energy installations are those with an installed electricity capacity of less than 1 MW. The threshold for wind plants is 6 MW.

Accordingly, this report is structured as follows. The next section provides a general context for design elements. Section 3 discusses the methodology for the identification of such design elements. Section 4, which is the core of this report, provides a structured overview of options and design elements for auctions in the RES-E realm. It classifies and discusses these design elements, grouped in several categories.

This project deals with auctions for RES-E support. An auction is a process in which a good or several goods (here: the power (MW) or energy (MWh) of renewables) are offered up for bidding. It is a market mechanism with the aim of competitive price determination and allocating goods efficiently. Consequently, auctions for RES-E support are applied with the aim of decreasing costs of support and identifying the 'best' suppliers for renewable energy (with respect to predefined targets and criteria).

Since those suppliers act as bidders (sellers), who offer the auctioned good to the auctioneer, we consider so-called procurement auctions. That is, the auctioneer will buy the good from the bidders offering the best bid, e.g. lowest price. Since the auctioned volume might be split up and delivered by several bidders, the analysis in AURES can be limited on multi-unit auctions with homogenous goods (e.g. 400 MWh per annum).Thereby, the best bid can either be determined based solely on the price (i.e. costs of support) or by multi-attribute criteria, such as price, geographical and technological conditions, etc. (i.e. in a tender process).

2. Putting design elements into context

Before going into detail into the design elements for RES, it is important to put the role that auctions for RES and design elements can play into context. Several issues are considered relevant in this regard.

2.1. Terminology: tenders or auctions for RES?

This report focuses on auctions for RES. An initially relevant issue is how these are defined. The impact assessment to the aforementioned Guidelines mentions "competitive bidding processes". It defines competitive bidding process as a bidding process where a sufficient number of undertakings participate and aid shall be granted on the basis of the initial bid submitted by the bidder; the budget related to the bidding process should be a binding constraint in the sense that not all bidders can receive aid. The competitive process may be sequential (with a cap or reservation price imposed at different stages of the bidding process) to ensure a competitive bidding process that avoids overly high compensation to RES-E producers (EC 2014).

Three terms are used interchangeably in the literature on RES support: tenders, auctions and bidding. Tenders and auctions are procurement systems that include a bidding process and competition between different bidders for a given volume of electricity (MW installed or MWh purchased). Competitive tenders (also referred to as 'multi-criteria auction') generally incorporate a weighting of price and non-price factors while auctions are awarded solely on the basis of lowest price among qualified bidders (Meier et al 2015). This report considers both price-only and multi criteria auctions. Bidding refers to the price-discovery procedure in the tender or auction scheme. In addition, there are other relevant terminological definitions, which are not discussed in this section, but are included when considering specific design elements in detail in section 4.

2.2. RES-auctions as instruments or design elements

The literature on RES-E support schemes has traditionally distinguished among several instruments. Two main support instruments have captured most of the attention: feed-in laws (both feed-in tariffs and feed-in premiums) and quotas with tradable green certificates (TGCs). Other secondary instruments have been used in the past, including investment subsidies and fiscal incentives. Auctions have traditionally been considered as an additional instrument. However, auctions could be viewed not as an instrument in their own right, but as a design element for other instruments (particularly FIPs, FITs and investment subsidies) to set the remuneration level. In other words, auctions would be an alternative to the administrative support level setting that has been common in European FIT and FIP schemes in the past. Auctions in turn are characterized by their own specific set of design elements, as illustrated in figure 1:

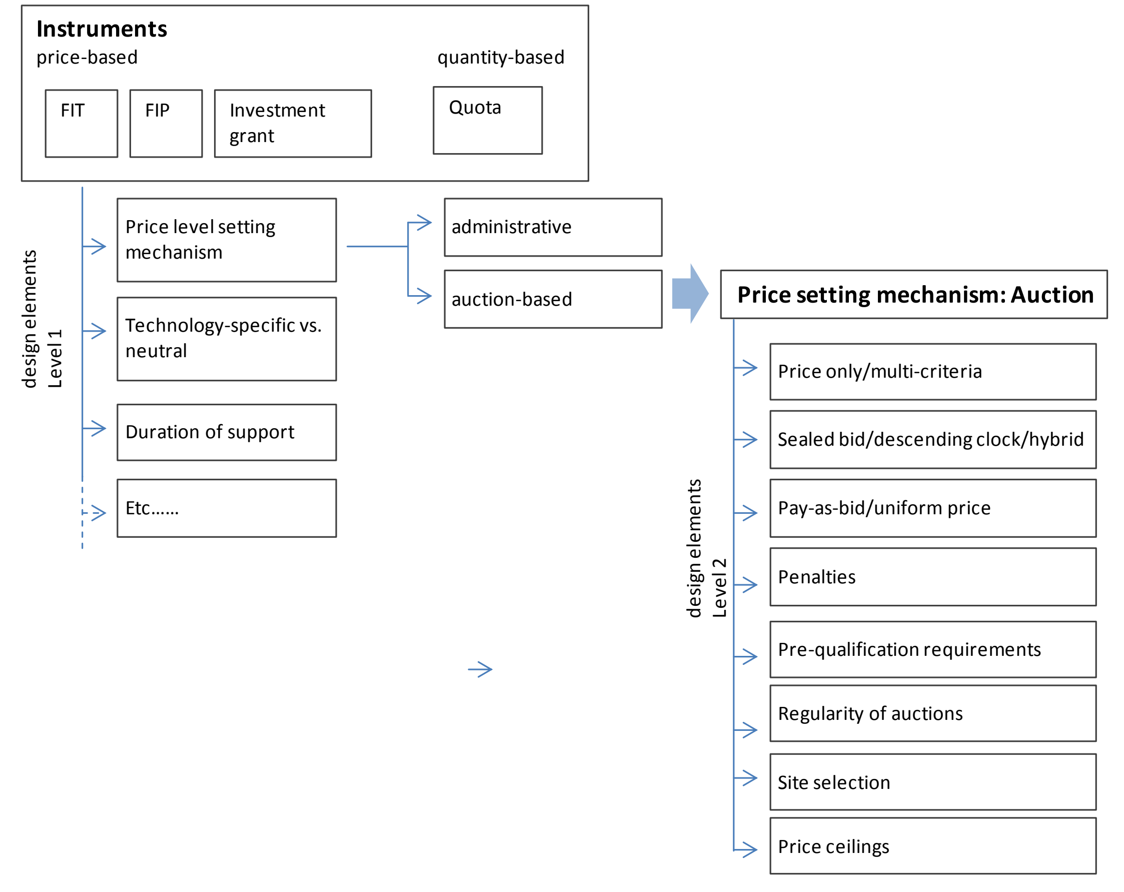

Figure 1: Levels of design elements

As shown in the figure, level 1 design elements are more general and help to describe the characteristics of the remuneration streams. In contrast, level 2 design elements refer specifically to how an auction mechanism itself is designed, i.e. according to which rules the remuneration streams is allocated to interested RES producers in a competitive process. Both levels of design elements will be discussed in this report, as summarized in tables 1 and 2 below. However, the focus of the project lies on level 2 design elements.

2.3. The difference between design elements from RES-auctions and support instruments

Design elements can be grouped in two categories. Some are common to all RES support schemes and others are common, but their implementation is instrument-specific (i.e., the specific form this may take may differ between instruments). Both of these categories encompass level 1 design elements. Finally, others are specific for auctions (level 2 design elements). This paper focuses on instrument-specific and auction-specific design elements. A detailed discussion of those design elements is provided in section 4.

Table 1: A classification of design elements for RES-E support schemes (level 1 design elements)

COMMON DESIGN ELEMENTS	
Target setting	Targets are an inherent design element in TGCs (quotas) and tenders. Absolute (MW, MWh), relative (% of electricity demand). Capacity (MW), generation (MWh), budget (M€) caps. RES targets are currently relative. In the past, absolute capacity caps (FITs, tenders), generation caps (TGCs) and budget caps (the Netherlands) were common.
Budget vs. consumer-financed.	The cost burden for RES-E support may lie on either electricity consumers or taxpayers (i.e., the public budget). In the EU, it usually falls on consumers.
Existing vs. new plants included	Either existing or new plants may be eligible for support. The aim of support schemes is mainly to promote new capacity. However, following the principle of non-retroactivity, existing plants would be promoted under current (national) RES-E support schemes until these are phased-out (i.e., until the guaranteed period for support ends). Auctions can also be used to remunerate the continuous operation or retrofitting of existing plants where the old support duration is running out.
COMMON DESIGN ELEMENTS WITH INSTRUMENT-SPECIFIC IMPLEMENTATION	
Support-level setting	RES-E support is usually provided per unit of output (MWh), but can generally also be provided per unit of capacities installed (MW).The level of remuneration can be set in a different manner in different instruments. Under FIPs and FIT schemes, as well as for investment grants, support levels can be set either administratively or through an auction mechanism. Under a quota scheme with TGCs are also set competitively (depending on the interactions between supply and demand in the TGC market in this later case).
Technology-specific vs. technology-neutral	A similar support level might be provided for all technologies (regardless of their generation costs) or support may be modulated according to those costs. The manner in which support is provided to specific technologies is clearly very different under different support schemes in practice: FITs and FIPs are usually differentiated across technologies to reflect technology-specific generation costs. The alternative is to have a uniform fixed tariff or a uniform premium for all technologies. If the FIT or FIP level is set through an auction mechanism rather than administratively, technology-neutral auctions can be used to set a uniform tariff, and separate auction rounds for different technologies can be used to set technology-specific support levels. Quotas with TGC: Banding can be implemented through carve outs or through credit multipliers. Under carve-outs, targets for different technologies exist, leading to a fragmentation of the TGC market, with one quota for the mature and another for the non-mature technologies. Under credit multipliers, more TGCs are granted per unit of MWh generated for immature technologies compared to mature technologies. The alternative is no use of carve-outs or credit multipliers

Location specific vs. location-neutral	Support levels might be modulated according to the location of the plant, with greater support levels provided for plants deployed in places with greater generation costs (e.g., worse resource conditions). At first, this may seem at odds with economic efficiency, since installations would not be promoted where generation costs are minimised. However, if the good sites are limited, the producer surplus could be excessive and plant installation not be in pace with grid development. The rationale behind location-specific support is to avoid concentration of renewable energy projects in a few locations and avoid excessive remuneration levels in favourable locations. FIT and FIP: Administratively set support levels can be modulated according to the location of the plant (stepped FIT/FIP). The same is possible for FITs/FIPs allocated by auctions. In addition, site selection under auctions can be influenced by considering only pre-approved sites. TGCs: Different number of TGC according to the location of the plant.
Size-specific vs. size-neutral	Support may be differentiated according to the size of the installation, taking into account that, generally, the generation costs (€/MWh) of larger installations are lower since they benefit from economies of scale. FIT and FIP: Under administrative support level setting, FIT/FIP level modulated according to the plant size. Smaller FIT for large-scale and higher tariffs for small-scale plants. Only installations below a certain capacity threshold would receive the support (stepped FIT/FIP). Under FIT/FIP level setting with auctions, it is theoretically possible to control for plant size by holding different auction rounds for different size projects. However, allocating FITs/FIPs through an auction mechanism is generally more appropriate for large-scale installations. TGCs: Small-scale installations receive more TGCs than large-scale installations. Only installations below a certain capacity threshold are eligible to receive TGCs.
Constant or decreasing support level during support period	Support for existing plants may be greater at the start of the period and be reduced over time (either an annual percentage reduction or a stepped reduction after some years) or support may be constant over time. All in all, the terms and conditions of this reduction should be known beforehand and are instrument-specific.

Source: Own elaboration.

Table 2: Design elements of auctions (level 2 design elements)

GENERAL AUCTION-SPECIFIC DESIGN ELEMENTS	
Price-only auctions vs. multi-criteria auctions	Pure price-based auctions, with the price as the only award criterion. Multi-criteria auctions (also called tenders), where the price is the main criterion and additional prequalification requirements represent additional criteria (e.g. local content rules, impact on local R&D and industry, environmental impacts) (Held et al 2014).
Sealed bid / descending clock / hybrid.	Under sealed-bid auction, project developers simultaneously submit their bids with an undisclosed offer of the price at which the electricity would be sold under a power purchase agreement. An auctioneer ranks and awards projects until the sum of the quantities that they offer covers the volume of energy being auctioned. Under the multi-round descending-clock auction, the auctioneer offers a price in an initial round, and developers bid with offers of the quantity they would be willing to provide at that price. The auctioneer then progressively lowers the offered price in successive rounds until the quantity in a bid matches the quantity to be procured. Hybrid models may use the descending clock auction in a first phase and the sealed-bid auction in a second phase (IRENA 2013).
Pay-as-bid /vs. uniform price.	There are basically two different ways to set support levels. Under uniform pricing all winners receive the strike price set by the last bid needed to meet the quota or the first bid that does not meet the quota. Under the pay-as-bid alternative, the strike price sets the amount of generation eligible for support and each winner receives his or her bid.
Price ceilings	In order to limit the cost of support, the auctioneer can set a ceiling price for each technology, above which projects are not considered (IRENA 2013).
Minimum number of bidders.	Seller concentration rules might be implemented (as in California, India and Portugal) in order to mitigate the risk of market power. The size of the bidding share by a single actor might also be limited for the same reason.
RES-E SPECIFIC DESIGN ELEMENTS	
Penalties for non-compliance or delays	Penalties can take different forms: banning the defaulting bidder for a series of future auction rounds, termination of contracts, lowering of support levels, shortening support periods by the time of the delay, confiscation of bid bonds guarantees or penalty payments. Regarding the latter, they can be in the form of a fixed amount (the Netherlands) and modulated by the delay (Denmark, India). They can be set per MW (Quebec, Peru, India, Argentina), per kWh (Denmark) or as a % of the investment made (Brazil)(see del Río and Linares 2014 and Held et al 2014 for further details).
Pre-qualification criteria	They are required in order to participate in the bidding procedure and checked before the auction. They can refer to: specifications of the bid/offered project, such as technical requirements, documentation requirements and preliminary licenses or to the bidding party and require certifications, giving evidence of the technical or financial capability of the bidding party (Held et al 2014). They are chosen to prove the seriousness of the bid and/or the probability of the realization of the bid.
Regularity/ periodicity of auctions	Existence of a long-term schedule for regular auctions with sufficient anticipation (i.e., 3 years, depending on the technology) to reach RES targets.

Pre-approved list of technology-specific sites	A pre-approved list of technology-specific renewable energy sites is approved before the bidding procedure (see del Río and Linares 2014 for further details).

Source: Own elaboration

2.4. How to measure success in auction-based RES promotion?

An obvious issue is, then, what it is understood by "successful". A common practice is to consider several criteria on the basis of which the specific support scheme (FITs, FIPs, auction, quotas with TGCs…) can be assessed. Previous studies have proposed a number of criteria (see, e.g., Mitchell et al 2011, del Río et al 2012, IRENA 2014). A whole report on assessment criteria accompanies this one on design elements. The criteria considered in this report are effectiveness, static and dynamic efficiency, minimization of policy costs, socio-political feasibility, legal feasibility and local impacts. An instrument is considered successful if it scores high in most criteria.

2.5. Relevance of focus on design elements

The success of policies for the promotion of RES-E does not only depend on the choice of instruments, but on the selection of design elements for specific instruments as well, i.e. the devil is in the details. The RES-E literature has been trapped into "instrumentalism", often times providing a too abstract, blackboard discussion on "which are the best instruments". Only recently have researchers stressed that the success or failure of instruments applied in the real world mostly depend on their design elements, i.e. intra-instrument differences may be as important as inter-instrument ones. This has been clearly shown in empirical analyses (see del Río et al 2012, Ragwitz et al 2007, IEA 2008, IEA 2011).

The discussion on design elements is quite relevant. While the choice of instruments and support level setting mechanism is set in the State Aid Guidelines for energy and environmental protection, with a move to market-based instruments being required, Member States have some margin of discretion to design their support schemes, both with regard to the design of the instrument as well as the design of the auction mechanism.

Therefore, the choice of design elements is also critical to ensure the success of auctions for RES. Design elements may improve the score of the auction procedure on the aforementioned criteria. They may also mitigate some of the problems usually associated to auctions (collusion, underbidding…) (see attached methodological note for further details). However, design elements may not solve all problems and trade-offs between design elements are likely (see below). Therefore, an open question remains: are these and other problems and the traditional poor score in some criteria (effectiveness and dynamic efficiency) an inherent problem of auctions or can they be effectively mitigated by choosing the right design elements? This will be a main focus of the research carried out in WP6.

2.6. Trade-offs between different design elements and criteria

Design elements do not work in a vacuum, isolated from each other, but are likely to interact with respect to the mitigation of problems and in complying with relevant assessment criteria. This means that a design element might be implemented with the aim to solve one problem while contributing to others in return. For example, too harsh compliance measures (penalties or pre-qualification criteria) may increase the risks for plant operators and therefore lead to higher risk premiums and policy costs (Held et al 2014). Another challenge of auction schemes is to guarantee the continuity of support.

There is a possible risk of stop-and-go cycles due to the one-off approval of support, which may increase the risk premiums required by bidders. Regular and predictable auction timetables can avoid this problem, but too regular schedules might increase the possibility of strategic behaviour by larger market players at the same time (Held et al 2014). In South Africa and Peru, the undisclosed ceiling prices in the second round led to lower bidding prices as compared to the first round with disclosed ceiling prices. Penalties are usually mentioned as one crucial requirement to ensure the effectiveness of auctions. At low levels, the higher the penalties, the higher the effectiveness (since the lower is the probability of project back-out) but also the higher the probability of costly bidding strategies.

These and other trade-offs should be identified and taken into account in real policy practice, i.e., when designing auction schemes which inevitably involve the combination of different design elements. This report discusses some of the trade-offs when explaining the pros and cons of different design elements. See also the report on assessment criteria for RES auctions.

2.7. Other factors influencing RES-E deployment

In addition to support policies, several factors contribute to the success in RES-E deployment. These factors include the existence of plentiful resources, a good investment climate, economic prosperity/crisis, easy access to credit, institutional conditions, including the features of the electricity system/market and market conditions in other countries that influence the level of competition. Only a few of these factors can be (partly) influenced by policy choices (e.g. access to credit for RES investments and building permits or authorized areas to build a plant) but others are totally disconnected from the RES-E policy, i.e., they work mostly as a restriction in an optimization problem. In addition, “policies” is a broad term which includes instruments, design elements, policy mixes and regulatory stability. Therefore, even within the policy realm, design elements are only one factor among many. Those external factors (or context conditions) should be taken into account when proposing the implementation of auctions and when designing them.

2.8. Context dependant implementation

Applied auction schemes in the different countries can be characterized by very heterogeneous objectives, framework conditions and implementation design of auction schemes (Held et al 2014). Based on national energy plans as well as the size and maturity of the renewable energy market, the design of auction schemes will reflect each country’s priorities in terms of technology, volume and location (IRENA 2013). None of the schemes have proven to be perfect, serving as a blueprint for other countries. And each scheme is designed to fit in a particular political, economic and social context, as well as to meet different policy objectives beyond the procurement of RE electricity (de Lovinfosse et al 2014). As a natural consequence, e.g. different context conditions across countries, a perfect, one-suit-fits-all design element or package of elements is unlikely to exist. This project will not look after a blue-print but will make a dynamic tool for finding good options for specific contexts.

2.9. Change of RES auction designs over time

The relatively recent experiences with tenders suggest that the choice of design elements is likely to change over time, as more experience is gathered with the instrument in a learning-by-doing exercise by policy-makers. This has also been the case with other support schemes, particularly FITs and quotas with TGCs. Indeed, auction designs have been frequently changed in most countries, sometimes to correct previous mistakes and sometimes to experiment with different auction designs (Klessmann 2013). Building on worldwide experiences with auctions in energy policy and other industries and on close cooperation with ongoing auction implementation cases in Europe, a strong knowledge base will be developed in this project, enabling policy makers and market participants to make informed decisions. This knowledge base will be processed in a flexible policy support tool that provides policy makers with tailor-made information suited to their specific situation and policy preferences.

2.10. Measures for successful RES auctions

Several pre-conditions and factors are more likely to lead to the success of RES-E deployment support with auctions than others. Some of them are general for RES support schemes, i.e., they do not only affect auctions for RES, but they may have a particularly negative influence in this instrument, given the particular features of this instrument, i.e., the bidding procedure with the participation of different actors.

2.10.1. Sufficient competition

The most crucial precondition for the success of auctions is the existence of sufficient competition. Competition crucially depends on the number of bidders as well as their diversity (see report on the assessment criteria). However, since the level of competition in a market is difficult to assess in advance, corrections concerning the auction volume, frequency and design might be needed, should the auction not lead to the desired results.

2.10.2. Low-cost financing

At times of economic and financial crisis, such as the one experienced in the EU, access to credit becomes much more difficult, particularly for actors with high debt/equity ratios, such as smaller ones. This lower actors' diversity, which is generally regarded as a positive factor in auctions for RES, since it leads to greater competition and a lower likelihood of market power (collusion).This may call for an active role of the public sector to facilitate access to finance at low costs, for example by combining auctions with soft loans.

2.10.3. Coordination of administrative, grid access and bidding procedures

Streamlined administrative procedures, with communication and transparency provided equally to all bidders, are essential to the success of an auction scheme (IRENA 2013). Transparent grid tariffs, guaranteed grid access and priority dispatch are key success factors to lower the risk premium and avoid project delays (de Lovinfosse et al 2013).

Administrative barriers are a crucial factor affecting the uptake of renewable electricity. Their relevance has been highlighted by several EU-funded projects and by the European Commission itself.

Difficulties in obtaining planning and other permits increase investors’ risks (especially the smaller ones) and transaction costs, acting as a deterrent to investors. Although they are common to other instruments, these problems are aggravated under tenders if the bidding procedure and the granting of administrative permits are not coordinated (del Río and Linares 2014).A best-practice model in this context might be in Denmark.

The Danish Energy Agency streamlines the administrative procedures in terms of a one-stop shop for permits, providing the draft permits as part of the tender material. Certain permits are then required to be included into the bid. In addition, the required environmental impact assessment (EIA) has to be undertaken by Danish authorities before tender submission starts. The agreement with the required Danish authorities on the use of the respective offshore location is thus guaranteed for tenderers. With regard to grid connection, costs are borne by electricity consumers. The Danish TSO (Energienet.dk) guarantees the grid connection to the offshore plants for the large projects only. The wind farms must bear the cost of connecting to the offshore substation. The near shore projects have to finance their own offshore substation and connection to land. In case of connection problems, clear compensation rules have been defined. Priority access to the grid is granted for successful projects (Held et al 2014, p.62)[2].

2.10.4. Communication and participation

The experience with offshore wind auctions in Denmark shows that a clear communication strategy, together with emphasis on dialogue and some flexibility in the process can improve competition (Kitzing 2013). A participatory approach such as in Denmark and transparent provision of information as well as clear political and social acceptance are considered by many as a guarantee for success (Fraunhofer ISI et al 2014). However, the issue is whether this approach can be extrapolated to countries with a different institutional context and a different culture of relationships between companies and the government. In addition, this approach may be more amenable to lobbyism, regulatory capture and rent seeking.

2.10.5. Power Purchase Agreements (PPAs)

A PPA is signed with the awarded bidder. This contract provides the renewable generators with a fixed price for a certain number of years and a guaranteed purchase for all generation, which can be used as the basis for financing the project (IRENA 2013). Using standardized PPAs with conditions known in advance by bidders can help to limit risks and uncertainties (de Lovinfosse et al 2013). We assume that PPAs are an inherent part of bidding procedures.

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[2]Notwithstanding, although the Danish model can be considered a success story, such an approach also has risks, e.g. removing part of the project development value chain from the market and placing it into the governments hands, thereby limiting competition.

3. Methodology

The identification of relevant design elements for RES-E auctions has been based on a literature review of past, current and planned schemes around the globe. WP4 provides full details on the international experiences with design elements in auctions for RES. However, although in a different institutional context, some schemes outside Europe have innovative design elements and there is a considerable experience with the use of auctions from which to learn. Indeed, in some regions (Latin America), auctions are the dominating instrument.

Several sources of information have been consulted:

1. Top academic journals on energy, including Energy Policy, Renewable and Sustainable Energy Reviews, Energy & Environment, Energy Journal, Energy, Applied Energy, Economics of Energy and Environmental Policy, Electricity Journal, Utilities Policy, Renewable Energy, Journal of Renewable and Sustainable Energy, Climate Policy, Mitigation and Adaptation Strategies for Global Change, International Journal of Electrical Power & Energy Systems. In these journals, the journal internal search engine has been used to identify relevant articles. Terms such as “tenders”, “auctions” or “bidding” were inserted. The corresponding articles were filtered manually in order to discard those which were not directly related to auctions for RES.
2. Reports with an extensive coverage of auctions for RES from international institutions such as IRENA (IRENA 2013), the World Bank (Maurer and Barroso 2011), from EU projects (Held et al 2014) and others (Fraunhofer ISI et al 2014, de Lovinfosse et al 2013) which have recently been published.
3. Grey literature. In addition, a Google search has been performed, with the terms “tenders for renewable energy”, “auctions for renewable energy” or “bidding for renewable energy”. This search has revealed the existence of very useful information sources, generally focusing on the design of auctions in particular countries. These have included independent sources of information (in energy and renewable journals) and government reports.
4. Previous reviews on the literature on auctions for RES. While the previous sources provide a substantial amount of information, they do not cover all the past and present schemes. One exception is Del Río and Linares (2014), which provide a previous review on this literature.

Overall, about 200 relevant documents have been read, and their insights integrated in the contents of this report. A database with relevant documents for the whole project has been made available for the rest of the partners in the consortium.

4. Categories of design elements for RES-E auctions: classification and description

The following box shows a list of the different design elements considered in this report, which will be discussed in the rest of this section. The different elements will be analysed in more detail in the rest of this project.

List of relevant design elements for RES-E auctions

4.1. AUCTION-SPECIFIC DESIGN ELEMENTS

- 4.1.1. Price-only/multi criteria auctions
- 4.1.2. Type of auction: auction formats and pricing rules
- 4.1.3. Price ceilings and minimum prices
- 4.1.4. Other
  - 4.1.4.1. Seller concentration rules
  - 4.1.4.2. Information provision
  - 4.1.4.3. Web-based vs. in-person auctions
  - 4.1.4.4. Secondary market

4.2. ADDITIONAL RES AUCTION-SPECIFIC DESIGN ELEMENTS

- 4,2.1. Targets/Scope/Volume auctioned
  - 4.2.1.1 How to set the volume auctioned?
  - 4.2.1.2. Energy or capacity-related remuneration
  - 4.2.1.3. Volumes auctioned
  - 4.2.1.4. Number and frequency of rounds
  - 4.2.1.5. Volume auctioned in each round
  - 4.2.1.6. What to do with the amounts not awarded and not built
- 4.2.2. Diversity: Technological, size, actors, geographical
  - 4.2.2.1. Technological diversity
  - 4.2.2.2. Size diversity
  - 4.2.2.3. Geographical diversity
  - 4.2.2.4. Actor diversity
  - 4.2.2.5. Other diversity types
- 4.2.3. Prequalification criteria
- 4.2.4. Duration of contract
- 4.2.5. Penalties for non-compliance/delays
- 4.2.6. Updating of remuneration over time
- 4.2.7. Other design elements
  - 4.2.7.1. Local content rules
  - 4.2.7.2.. Deadlines and grace periods.

4.1. Auction-Specific Design Elements

4.1.1. Price-only/multi criteria auctions

Auctions could be organized using only a criterion (the bid price) or combining this criterion with others, such as local content requirements.

Pros and cons

Selection of the preferred bidder on criteria other than price allows for the achievement of multiple policy objectives (*e.g.* local employment, local environment, industrial development, *etc.*). Projects could be scored higher, for example, if they are located in high-load areas or in areas that currently lack electricity access, thereby engendering additional economic benefits to the jurisdiction (IRENA 2013). Two main drawbacks of multicriteria auctions with respect to single criterion ones would be: 1) the least cost bidders might not be selected. This creates an extra cost which has to be weighted with the benefits stemming from achieving those other policy objectives; 2) The weights of the criteria have to be very clear from the start in order to avoid subjective decisions. For example, in South Africa at the start of the tender DoE holds a conference for bidders to understand the tender criteria and the different requirements for each technology (de Lovinfosse et al 2013). In any case, the transparency of the choice of bidder is lower with multi criteria auctions. Sometimes these criteria are mixed with prequalification requirements and taken into account in the prequalification stage (as in the Australian Capital Territory auction).

Design alternatives

Two alternatives:

- Multi criteria auctions.
- Single criterion auctions.

Implementation in the EU

In Denmark, of the different auctions, two were tenders with different criteria (e.g. park layout) and two were auctions (price-only).

In France, the solar PV tenders are based on a points-based criteria system, with an overall maximum score of 30 points. Table 3 shows the weighting of the relevant criteria with their individual maximum scores for the respective tenders, based on CRE (2013a) and CRE (2013b). While the actual tariff level (price) receives most points in the simplified tender, environmental impact and R&D contribution are weighted stronger in the tender for plants larger than 250 kW.

Table 3: Criteria system with weightings (maximum scores) in French PV tenders

Criteria	Simplified tender (100 up to 250 kW)	Tender for installations larger than 250 kW	
		Sub categories 1a, 1b, 2	Sub categories 3, 4, 5
Price (tariff level)	20	12	12
Simplified carbon evaluation	10		
Environmental impact		10	8
Contribution to research and development		8	10
Total	30	30	30

Source: Grau (2014)

Implementation in non-EU countries

In South Africa, *in the second evaluation stage* of the auction, bidders are assessed based on the following: 70% of the weight is allocated to the price offered and 30% is allocated to the project's level of contribution to economic development (job creation, local content, preferential procurement, enterprise development, and socioeconomic development (Eberhard 2013, IRENA 2013).

In Brazil, selection is made in one stage, based on price, following the 'lowest price wins' criterion, or weighted score from price and local content. For onshore wind: 'lowest price wins' for the first two rounds, 40% weight for price in third round (2005),decreasing to 25% by the fourth round (2006).Other evaluation criteria included technical expertise and local economic benefits. Auctions for solar and offshore wind are mainly 'lowest price win' auctions (IRENA 2013).

In Morocco, in the evaluation phase the criteria that the bidders must include in their offers are technical specifications, the debt/equity ratio, the percentage of public participation in the capital and the requirement on local content. Projects are also evaluated based on the price (IRENA 2013).

In Australia (ACT),the bid winner was not awarded a FiT entitlement on the basis of its FiT price alone. Alongside FiT price, five evaluation criteria, detailed in the reverse auction document, were considered by the Advisory Panel when assessing each bid. The five evaluation criteria were: 1) Demonstrate understanding of legal and regulatory environment that will impact the successful implementation of the proposal; 2) Access to funds and commercial viability of the proponent and the proposal; 3) Capacity to maximise National Electricity Market (NEM) sales; 4) Realistic and timely implementation schedule; 5) Proposal financial guarantee (only applicable in the regular stream). These criteria were given a score out of 10 and then weighted to provide a final value, which was compared with the proposed FiT rate. Of these criteria, most weight was given to the first two. This high weighting represented the Advisory Panel's understanding that a proposal's ability to demonstrate access to finance acted as a proxy for a range of technology, development and commercial risks (Buckman et al 2014, Alexander et al 2013).

In China, when winning bids in early auctions of concessions proved too low, the minimum price criterion was supplemented with other criteria designed to discourage irrational bidding behaviour, to reward technological innovation, and to take into account bidders' previous experience. The Chinese government also added local content requirements, intending to promote its wind power manufacturing industry and to reduce costs. In the auction launched in 2005, the price criterion made up 40 percent of the index used to compare bids; in the 2006 auction it represented only 25percent. Even with the addition of the other criteria, the winning bids were still those that offered the lowest prices (Wang et al 2014).

4.1.2. Type of auction: auction formats

Design alternatives

The most common types of auction designs used to set the remuneration level for the support of RES-E are the sealed-bid, descending clock and hybrid:

Sealed-bid

According to Maurer and Barroso (2011, p.8), sealed-bid auctions represent a special category whereby each pre-qualified bidder submits a schedule of prices and quantities. In this type of auction, all bidders simultaneously submit sealed bids so that bidders do not know the bid of any other participant and cannot adjust their own bids accordingly.

There are basically four alternatives, differentiated on the basis of whether there is a single product to be allocated to a single owner or multiple units of the same product to one or multiple owners and, in the latter case, on which price is received (the same price in the case of uniform pricing or different prices in the case of discriminatory pricing). Both single-item auctions (e.g. for offshore wind in Denmark) and multi-item auctions (e.g. for solar PV in France) have been used in the past to promote RES deployment.

Sealed-bid auctions may be used when there is a single object or product to be allocated to a single owner, for example, the construction of a power plant, and the bid consists of a single price.

> First-price sealed bid auction: In a first-price sealed bid auction, all bidders submit their bids simultaneously and unaware of the competitors' bids. The highest bid will be awarded and determine the award price, i.e. the winning bidder receives her bid in case of winning.

> Second-price sealed bid auction: In a second-price sealed-bid auction, all bidders submit their bids simultaneously and unaware of the competitors' bids. The highest bid will be awarded, but in contrast to the first-price auction not determine the price: the award price is determined by the second highest submitted bid, i.e. by the bid of another bidder if all bidders submitted only one single bid.

Sealed-bid may also be used when the auction involves several units of the same product.

> Pay-as-bid auction: In the pay-as-bid auction bids must contain quantities and respective prices. The auctioneer gathers together all the bids, creating an aggregate supply curve, and matches it with the quantity to be procured. The clearing price is determined when supply equals demand. The winners are all those bidders whose bids, or sections of their bids, offered lower prices than the clearing price. The winners will receive different prices based on their financial offers, i.e. their bids, why they are often also called discriminatory pricing auctions.

Uniform price sealed-bid auction: The uniform price sealed-bid auction is also used when there are multiple units of the same object or product to be allocated, resulting in a single price. Bidders are allowed to bid in a similar way as in the pay-as-bid auction, and the process for selecting the winners is the same. The only difference with the pay-as-bid auction is the price each bidder receives. In the uniform price sealed-bid auction, all the winners receive the same price, which is the market clearing price. Thereby we distinguish two variants: Either the highest accepted bid determines the award price or the lowest rejected bid determines the award price.

Vickrey Auction: Under the Vickrey auction, a winning bidder receives the prices equal to the not successful bids, which would have been successful, if the winning bidder had not participated in the auction (opportunity costs approach).

Descending clock

The price is determined throughout the auction process via multi-round bids. According to this arrangement, the auctioneer starts by calling a high price and asking bidders to state the quantities they wish to sell at such a price. If the quantity offered exceeds the target quantity to be procured, the auctioneer names a lower price, and again asks bidders the quantities they want to offer at the new price. This process continues until the quantity offered matches the quantity to be procured or until excess supply is negligible. The winners are those bidders who offer a quantity at the clearing price (i.e. the price where supply equals demand). The payment of a winner equals the clearing price times the quantity offered at that price (Maurer and Barroso 2011, p.10).

Hybrid designs

Combinations of the above are possible and would bring advantages in terms of mitigating the drawbacks of the pay-as-bid and descending clock alternatives. A combination which seems to have worked quite well in Brazil (Elizondo et al 2014) is a descending clock stage followed by pay-as-bid auction. The first phase (Phase I—Price Disclosure) encompasses a descending price clock auction. Once it is concluded, a second phase (Phase II—Negotiation), with a final round of bids using a pay-as-bid scheme, is used for the "classified" bidders of the first phase. This auction is generally used to extract value from bidders in auctions of goods with lesser-known values. The objective of the first phase is to provide some price discovery for the players so that those bidders who can sell the product at the lowest cost are selected for the second phase. Since only a small number of bidders might be left in the auction as the price decreases, it is preferable to switch to a sealed-bid stage to minimize the chances of collusion and therefore reduce the final auction price as much as possible.

Pros and cons of the different options[3]

Sealed bid with respect to descending clock: Sealed bids have some advantages. One of them is their simplicity. According to Maurer and Barroso (2011), it is clear for bidders how these auctions work, so the cost

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[3] This section heavily draws on Maurer and Elizondo (2011).

of participation tends to be lower than in more complex auction designs. When competition in an auction is weak, not revealing any information during the auction process becomes an advantage of sealed-bid auctions.

The main disadvantage of sealed bids is that they do not allow bidders to acquire information on the price of the products and it is more likely to lead to the winner's curse. The Winner's Curse is a phenomenon which occurs in auctions where bidders do not know their actual valuation for the good. Uncertainty related to the price of a product must be translated into a single bid, which cannot be adjusted when more information is revealed. Under the descending clock auction design allows for a strong price discovery, which makes it efficient. Its main advantage over sealed-bid auctions is that a bidder can condition his/her bids based on information from early bidding rounds (op.cit., p.10).

The main advantage of dynamic auctions in general (descending clock auctions are one example) is that bidders can adjust their bids based on information revealed throughout the auction, improving the efficiency of the auction and mitigating the winner's curse. However, when competition is not very strong, revealing excessive information can be counterproductive because bidders could use that information to coordinate their bidding, increasing the final price of the auction (op.cit., p.11).

Even though descending clock auctions might seem more complex than sealed-bid auctions, experience shows that they are not difficult to implement and the implementation cost is not significant. Practical realities such as budget constraints are alleviated in dynamic auctions since the bidder has the time between rounds to adjust his/her pricing and quantity decisions according to the information revealed during the auction. Another advantage of dynamic auctions is that they are less vulnerable to corruption.

Since the process used to determine the winners is open, there is no secrecy. In a descending clock auction, the winning bidders do not necessarily disclose the lowest price(s) they are willing to receive in order to supply the product(s), since the auction stops when demand equals supply. This is an advantage of descending clock auctions, particularly when bidders participate in several auctions run by the same auctioneer, because it increases participation (op.cit., p.11).

Within sealed bid, there are advantages and disadvantages of the different pricing rules. The main advantage of a pay-as-bid auction is its simplicity. The uniform price sealed-bid auction is viewed as a fair auction since all winners receive the same price, which is not the case for the pay-as-bid auction since it discriminates among bidders. However, it may sometimes be difficult to justify having sellers (i.e. bidders) with very different cost structures receiving an identical price for the energy sold. Hence, if the government is the auctioneer, the choice of a uniform price sealed-bid auction may have a high political cost.

Implementation in the EU

In Denmark, where tendering is used to support offshore wind power, a two-stage procedure has usually (but not always) been applied: In the first phase, offers are collected in a manner equivalent to a *sealed-bid auction*. Several offers are then preselected primarily based on their price. Finally, a dialogue is launched, enabling bidders to improve their offers.

The model in the Netherlands is also notable for several features: its support for renewable energy is based on a well-defined annual budget. To exhaust this budget, multiple auctions are held with predefined FIPs tied to the level of technology. Auctions take place sequentially with increasing prices – the lowest price category is tendered at the beginning, when offers regarding the quantity of energy to be produced are collected (volume tender). The next tender round is held for the next price category, and this is repeated until the predefined budget is exhausted. The compensation rates are determined in advance based on the technology level. However, potential plant operators have the opportunity to submit their project within a “free category” and can thus request a lower level of compensation than that scheduled (Fraunhofer ISI et al 2014). The government defines base amounts for each round and the bidders offer the respective volume. This is called a volume tender. Developers that wait until round 6 could benefit from a higher subsidy, but they will run the risk that the SDE+ will be closed before round 6 if the annual budget ceiling has been reached. The scheme works on a first come first serve basis. Although the design of the instrument differentiates between technology categories or bidding rounds, the scheme in practice resembles rather a technology-neutral scheme (Held et al 2014).

In Cyprus, sealed bid has been proposed (Kylili and Fokaides 2015).

In Germany, initially one time, concealed bids will be submitted, setting the funding level which cannot then subsequently be altered by the bidder (pay-as-bid). For the second and the third round of bids the unit price method (uniform pricing) will be adopted to gain experience with this pricing rule. The awarding authority, the Federal Network Agency, can thereby determine the current market price, which is then to be paid for all winning projects. In addition, a "more ambitious maximum price" will be put in effect, corresponding to the value to be applied, as stipulated by the Renewable Energy Act, for roof systems with a capacity of up to 1 MW (Hannen 2014).If the total bid volume exceeds the auction’s value, valid bids will be accepted from lowest to highest bid value until the volume of the auction is first reached or exceeded. The value of the accepted bids replaces the relevant statutory reference amount for freestanding PV set out in Section 23 (1) sentence 2 EEG. In principle, the financial support awarded will amount to the value offered in the bid (pay-as-bid system). However, in order to gather a broader experience, the uniform pricing system will be used for the auctions on August 1st and December 1st 2015, i.e. all successful bidders will receive financial support based on the value of the highest bid accepted. (Baker and McKenzie 2015).

In Italy, auctions take place sequentially– the lowest price category is tendered first and offers are obtained concerning the amount of energy produced (volume tender); the following auction round is for the next highest price category, and so on, until the budget is exhausted (Fraunhofer ISI et al 2014).

In France, there is a two-step procedure: Descending clock in round 1 for pre-selection and determination of a price-cap; round 2 is based on the pay-as-bid principle (while reducing the amount of energy being tendered) (Fraunhofer ISI et al 2014).

Implementation in non-EU countries

In Brazil there is a hybrid mechanism whereby: The first stage operates as a descending price clock auction with competitive bidding from lowest bidders and it aims to discover the price ceiling (Couture, et al., 2010). The auction is initiated with a high price that is expected to create excess supply and bidders state the quantity they would supply at this price. While there is still excess supply, the auctioneer decreases the price until supply is met, in addition to a certain margin. This margin would be used in the next stage to keep competition among the bidders who pass the first stage. The second stage is a final pay-as-bid sealed-bid auction. Winners of the first stage bid a final sealed price, which cannot be higher than the price disclosed in the first stage (Kreycik et al 2011). The second stage is held to meet the actual demand and assure that there is no collusion between small numbers of participants for setting the final price (IRENA 2013).

In China, in 2007 a new methodology for scoring the price criteria was adopted that favoured the average price (excluding lowest and highest bid), to address underbidding[4]. Bids closest to the average score the highest (IRENA 2013).

4.1.3. Price ceilings and minimum prices

4.1.3.1. Price ceilings

In most auction procedures, there is the possibility to set a maximum price (or price ceiling) for bids, above which no bids are accepted. Ceiling prices can be set for all the modalities mentioned in the previous section

Pros and cons

There is a broad agreement that ceiling prices are necessary to cap the risk of high cost to consumers and mitigate budget risk in case there is not enough competition. Therefore, the discussion is about the level of the price, not its existence.

Design alternatives

There are two main choices to be made when implementing maximum prices.

How to set the ceiling price and its level

Setting the ceiling price at an “appropriate” level is not a trivial exercise and bears the risk of falling under the asymmetric information problem which is a main feature of FITs (del Río and Linares 2014). How to set this price is a crucial issue since it affects the level of competition and technological diversity. If this price is set too high, auction results might be inefficient, since bidders might collectively be tempted to bid well above their lowest possible profit margin. If it is set too low, only few bidders will enter into the auction, leading to undersupply and a lack of competition. In the case of Brazil, in some technology-specific auctions (for instance, December 2005 and October 2006), thermoelectric and hydro power have been auctioned separately. However, the price cap for thermoelectric power was set higher than for hydropower, resulting in a higher average price for thermoelectric power. As a result, the final price for the overall procured electricity was higher than it would have been, if more (cheaper) hydro power had been auctioned than the more expensive thermoelectric power (Held et al 2014). Elizondo et al (2014) criticize the ceiling prices issued by the government in 2013 in Brazil, which have been comparatively low. As a result, the marginal price of each of the three auctions was very close to the ceiling price, indicating that competition in those recent auctions

[4] In a very general context "underbidding" means that the bid is lower than a certain benchmark bid, whereby several options exist to determine different benchmark bids (e.g. straightforward truthful bid (cost-covering bid), equilibrium bid, etc.). In the context of this project “underbidding” refers to a bid submitted by a bidder which is not cost-covering. There are two reasons for "underbidding": First bidders may have high uncertainties in estimating their costs and revenues and thus "underbidding" occurs unconsciously. Second, bidders may practice underbidding consciously for strategic reasons, e.g. to enter the market.

was relatively low (even bids offering the ceiling price were accepted). This is a dangerous path to follow, since if the entirety of the auctioned demand is not met, consumers will incur a higher risk of undersupply (Elizondo et al 2014).

Different mechanisms are used to determine the ceiling price: 1) using the tariffs set by previous policies, *e.g.* the first round of the South African auction in 2011 that set ceiling prices based on the FIT levels of the preceding FIT scheme; 2) Another option is applicable in the case of a hybrid auction, *e.g.* the Brazilian case, by running a descending price clock auction in the initial stage that results in a price that is used as the ceiling in the second phase which is a sealed-bid auction. 3) Conducting a market research, as shown in the case of Peru. One essential aspect is that the ceiling price should be set appropriately following consultation from the industry and the bidders (de Lovinfosse et al 2013). However, this may run into the aforementioned problem of asymmetric information which FITs have been criticized for.

Whether the price should be disclosed or not

Ceiling prices can be disclosed before the auction or not. There is a broad agreement and empirical evidence that disclosure usually biases the results of the auction as was the case in the first rounds in South Africa (Eberhard 2013) and Peru (IRENA 2013) since bidders tend to propose relatively high bids which are marginally close to that price, resulting in unnecessarily high support costs. There are pros and cons in disclosing the ceiling price, which will be analysed in the course of this project. According to general auction theory, disclosure of ceiling price has several advantages: 1) It sets a signal of competition; 2) It mitigates the risk of collusive behaviour (strategic supply reduction); 3) No disclosure leads to higher risks for the bidders and, thus, higher bids and; 4) Transparency builds confidence and leads to acceptance

Implementation in EU and non-EU countries

In the EU, price ceilings exist in the Netherlands, Poland, Italy and Germany, and not in Denmark (offshore) and France.

In non-EU countries

Price ceilings have been implemented in Brazil, Peru, South Africa and California, but not in China (Held et al 2014).In Brazil, the auction price ceiling is the opening price of the descending-clock auction in the first phase (Elizondo and Barroso 2014). In Peru, the ceiling price was set based on an assessment of technology costs (de Lovinfosse et al 2013). In South Africa, the ceiling price was based on previously set FIT prices.

4.1.3.2. Minimum prices

On the other hand, minimum prices might be implemented in descending clock auctions in order to prevent too low bids. This has been the Case in Cyprus, where a safety net was established below which bids would be excluded. However, the safety nets were not announced before the tender and were intended to be an exclusion criterion for any project bidding at a lower price (Kylili and Fokaides 2015). There is also a minimum price in Italy, set at 89€/MWh by the tendering authority (Fraunhofer ISI et al 2014).

4.1.4. Other

4.1.4.1. Seller concentration rules

Pros and cons

Seller concentration rules can be justified in order to enhance competition and actors' diversity. This may be required to prevent that, if there is only a single bidder, he captures the whole budget with a very high bidding price (in the absence of a reserve price). For some, a negative aspect would be that these rules interfere with the market allocation. They may make sense in some market contexts more than in others.

Design alternatives

- Setting a minimum number of bidders under which the auction will not be carried out.
- The size of bids per bidder can also be limited.
- Limiting the number of rounds in which bidders can participate
- Another alternative would be to cancel the bidding procedure if the bidding price is excessively high (as done in Denmark for offshore wind), but this would involve an arbitrary administrative decision, entailing substantial investors' risks (del Río and Linares 2014).

Implementation in the EU and non EU-countries

In Portugal, successful bidders in one round could not participate in the next round (Heer and Langniss 2007).

In Germany, bidders are allowed to submit more than one bid, but no single bidder can be awarded more than 10 projects per auction (Morris 2015).

In Poland, a minimum number of bidders is required. The auction will require the submission of a minimum 3 offers (DMP 2014).

In Denmark (off-shore wind), the bidding procedure can be cancelled if the bidding price is excessively high.

Implementation in non-EU countries

In California, one seller could not contract for more than 50% of capacity or revenue cap in each auction (across all bids) (CPUC 2009).

In India, the total capacity of solar PV projects to be allocated to a company is limited to 50 MW. The number or the size of bids per bidder may be limited (Vasandani 2011).

In Australia (ACT), all proposals had to be at least 2 MW in capacity and no bidder could submit proposals, or be awarded a FiT entitlement, for capacity that totalled more than 20 MW. According to Buckman et al (2013), the proposal cap of 20 MW ensured that more than one proposal would be successful.

4.1.4.2. Information provision

Information could be provided by regulators or by an independent body to potential bidders.

Pros and cons

Lack of information on the characteristics of the resource and, thus, about capacity factors may lead to excessively optimistic bids, i.e., to underbidding. Therefore, information provision (e.g. site assessment) could mitigate this problem. A rationale for publicly-supporting this information provision has to do with the existence of a possible market failure, i.e. with the public good character of the information. This allows all bidders more equal conditions to sharply calculate foreseen electricity generation costs (Held et al 2014). In addition, it is likely that smaller actors suffer more from this information provision problem. However, provision of this information would reduce the risks and costs for bidders at the expense of increasing the policy costs of the support scheme. Therefore, the advantages have to be compared to the potential benefits in specific cases. In addition, the extent of the measure should be defined from the start, i.e., what type of information is provided.

Design alternatives

Either the information is not provided or it is. In the latter case, two issues are crucial:

Who is providing this information? Two alternatives exist in this regard:

- The regulators.
- And independent body, being supported with public money.

What information is provided? There are several alternatives:

- Geological and meteorological information, e.g. resource measurements.
- Information on administrative requirements.

Implementation in EU and non-EU countries

This design element does not seem to be widespread. The only country where we have found information in this regard is Denmark, where there is extensive provision of geological and meteorological information for off-shore wind bidders before submission of tenders, including wind measurements (speeds), waves, currents, exploration of the seabed and assessment of environmental compatibility from the Danish Energy Agency (Fraunhofer ISI et al 2014, Held et al 2014).

4.1.4.3. Web-based vs. in-person auctions

Bidders in auctions could submit their bids through a web-based procedure or in person.

Pros and cons

Web-based auctions would possibly reduce transaction costs for participants and policy makers. However, this has to be weighed against the fact that they may increase the possibilities for strategic and/or collusive behaviour, as seems to have been the case in Brazil (see de Lovinfosse et al 2013).

Design alternatives

- Web-based auction procedure.
- Letter-based auction procedure (for sealed bid static auctions)
- In-person auction procedure.

Implementation in EU and non-EU countries

In the EU
Online auctions for building integrated photovoltaics (100 to 250kW) have been used in France since 2011 (Fraunhofer ISI et al 2014).

In non-EU countries
The web-based auction procedure has been used in Brazil.

4.1.4.4. Secondary market

Under this design element, auctioning awards would be tradable in a secondary market, making the support pledge and project obligation transferrable to other projects and/or market actors. Alternatively, auctioning awards may not be traded freely, but could be changed within the portfolio of the bidder (within the same natural person).

Pros and cons

The main advantages of this design element is increasing effectiveness (achieving high realization rates, improve the realisation rate of projects in the mid-term), creating flexibility for market actors, limiting risks for bidders and ensuring sufficient number of bids (Klessmann 2013, de Vos and Klessman 2014, Held et al 2014). According to Fraunhofer ISI et al (2014),if this secondary market is established in an efficient way, this would help to reduce the risk associated with the obligation to realize a project– and, by extension, the risk premium priced into the bidder's offer. The priced-in realization risk is then no longer the bidder's individual risk, but rather that of a substantially larger group, ideally consisting of all market participants.

Several disadvantages of this design element are that it may create speculation and tends to increase the required implementation periods and thereby delays information for auctioning authority whether it is on track for target fulfilment (de Vos and Klessman 2014). It may also increase the complexity of the auction, and could increase the possibility of strategic behaviour and/or collusion between participants (Fraunhofer ISI et al 2014).

Design alternatives

- Not allowing the auction awards to be traded in the secondary market.
- Allowing so.

Implementation in EU and non-EU countries

Brazil seems to be the only country in the world where auctioning awards are tradable, resulting in a "secondary market". Some experts estimate that around 30 % of earlier auctions are dealt with in a secondary market (Held et al 2014).

4.2. Additional RES auction-specific design elements

4.2.1. Targets/scope/volume auctioned

Differently from other support instruments, auctions have an in-built feature for providing volume and budget control. This is positive both in terms of controlling the overall costs of policy costs and to facilitate grid-integration of RES-E generation. The only exception to the existence of volume caps has been the first round in South Africa (in 2011) whereby no volume cap was decided apart from the total 3725 MW target of the program (de Lovinfosse et al 2013).

Long-term targets are usually considered as a success factor for RES-E investments. The absence of a long-term plan with specific RE targets per technology creates significant uncertainty for investors on the volumes that will be auctioned, discouraging project developers to plan in advance. In turn, this reduces the chances of the auction scheme to stimulate enough competition (de Lovinfosse et al 2013). Several design elements with respect to the targets and the volumes auctioned can be considered.

4.2.1.1. How to set the volume auctioned

Design alternatives

There are three main ways to set the volume auctioned: capacity, generation or budget.

- Electricity generation targets. In this case, bids are awarded per kWh or MWh and there is a goal of a total amount of MWh.
- Capacity targets. A total quantity in terms of MW is auctioned.
- Budget targets. There is an overall amount of support to be provided. It can be combined with the other two alternatives.

Advantages and disadvantages of different alternatives (preliminary, subject to definition in the corresponding task)

A main advantage of using electricity generation in this context is that there is more certainty than capacity targets on the total policy costs. The greatest certainty in this sense takes place under budget caps. Certainty on generation is obviously greatest under the generation metric, and this can be considered a particularly positive feature with respect to grid management. However, compared to capacity targets, electricity generation targets are probably more difficult to set and might be too restrictive and risky for investors. It is more difficult to ensure that the target is exactly met, since with intermitted renewable, an amount of generation above or below the pre-set target are likely.

Implementation in EU and non-EU countries

Capacity targets whereby the auction aims at procuring a capacity of renewable energy have been the most widespread choice in the past. They have been implemented in Morocco and South Africa, for example. Generation targets have been set in Peru, i.e., in this country the auction calls for volumes of RES-E generation (de Lovinfosse et al 2013). In Poland, there is a maximum volume and value of electrical energy purchased (Norton Rose Fulbright 2014).In France, remuneration (in the form of feed-in tariffs) is guaranteed for 20 years, limitation on the base of full load hours (1580 h/a mainland, 1800 h/a Corsica and overseas)

(Fraunhofer ISI et al 2014).In Brazil, there is a cap on total generation cap eligible for support. For onshore wind, the support tariff (resulting from auction) is paid for 30,000 full load hours; after that the average electricity tariff in the market is paid (IRENA 2013). In Denmark tenders for offshore wind are for Feed-in Tariffs (guaranteed prices) for50.000 full-load hours, ca. 12-14 years of operation (Kitzing 2013). A budget cap has been implemented in the Netherlands. A budget cap per project has been set in Poland. The maximum government funding for a project is composed of 1) the difference between the revenue actually achieved from the sale of energy on the basis of the auction price and the mean market value of the same quantity of energy; 2) the revenue from the sale of negotiable instruments (certificates) on the basis of the mean market value of the certificates established for the period between 2011 and 2013; 3) possible tax privileges and exemptions tied to the generation of renewable energy; and 4) possible additional revenues from setting up or modernizing the renewable energy facility. The sum total of those items must not exceed such amount resulting from the difference between the reference price for energy and the revenues from the sale of the equivalent energy quantity at the as curtained mean market value (DMP 2014).

4.2.1.2. Energy or capacity-related remuneration

Irrespective of the type of metric being used to set the auctioned volume, energy-related compensation rather than capacity-related remuneration has been the norm. There are some exceptions, however, which are mostly related to residential solar PV installations. In the tendering of small photovoltaic facilities in Austria, investment grants are awarded in a simplified manner (Fraunhofer et al 2014).The product awarded in the rooftop auctions in India involves a capital subsidy for part of the plant's investment cost (Khana and Barroso 2014). There have been capacity-based auctions for RES-support in Russia in September 2013 (Held et al 2014). This is also the system implemented in Colombia and Ireland.

4.2.1.3. Volumes auctioned

Targets represent a goal for either RES-E generation or RES-E capacity in either the short, medium or long term (e.g. the 20% EU target for 2020). Targets provide an investment signal, contain policy support costs and allow the planning of the integration of intermittent RES into the grid. Obviously, the volume auctioned should be in line with those targets. Otherwise, competition would be affected and, thus, bid prices and support levels. A high auction volume (with respect to the market) results in limited price competition. The reason is that this leads to little scarcity being created in the bidding procedure.

An example is the first RES auction in South Africa in 2011. The size and readiness of the local renewable energy market were initially overestimated, resulting in less capacity being bid than was made available. There was thus limited competition in round one, and bid prices were close to the price cap. Use of the single-price offer (rather than a dynamic reverse auction as employed, for example, in Brazil) also restricted competition (Eberhard 2013, p.6). The introduction of a ceiling price was key to avoid paying very high prices for the energy auctioned, given the low demand for some technologies. The low demand was addressed by reducing the volumes offered for hydro and solar in the second auction; however biomass still has had a very low coverage (around 2%)(de Lovinfosse et al 2013). Something similar occurred in Peru, where the volume auctioned was reduced by almost 78% from the first round in order to increase competition and reduce prices (IRENA 2013). Targets should take into account the technology market in the country. In this sense, targets and technological diversity are somehow related. For example, according to Fraunhofer ISI et al (2014), in view of the Netherlands' 2020 RE targets, the system is far from offering sufficient incentives for more costly RE options, which appear necessary to achieve RE targets through domestic action.

Setting the volumes that should be auctioned and the targets themselves is an important decision in ensuring the effectiveness of the tendering scheme. Obviously, the targets should be set in relation to the capacity of the market to deliver. Intuitively, the amount to be auctioned should be in line with the RES-E targets. However, an alternative could be to auction higher volumes than the target, in order to guarantee a deployment level, taking into account that not all projects that are selected will actually be carried out (de Vos and Klessman 2014). However, it might be difficult to politically communicate a seeming inconsistency between the expansion goal and the tendered quantity. On the other hand, from a practical point of view, it is difficult to determine beforehand the "excess quantity" that should be tendered (Fraunhofer ISI et al 2014).

4.2.1.4. Number and frequency of rounds

Pros and cons of periodicity

The intermittent nature of the calls for auctions results in stop-and-go tender schemes and is not conducive to stable conditions (European Commission 2005), leading to greater risks for investors and possibly lower levels of participation, higher bid prices and negative impacts on the RE supply chain (del Río and Linares 2014)[5]. Unless auction schemes are linked to a fixed schedule of auctions at regular intervals (*e.g.*, more than once per year) they may lead to a stop-and-go pattern of deployment. Some studies suggest that these conditions prevent investment in local manufacturing facilities and the development of a robust supply chain (IRENA 2013). Elizondo et al (2014) argue that with periodic auctions providing a steady stream of newly contracted wind power projects, the wind equipment industry in Brazil flourished. These issues as well as the specific impact on RES-E support in Europe will be further investigated in the course of this project.

Design alternatives

Determining the optimal number of rounds and the volumes that would create greater competition is a challenge that requires learning by doing (IRENA 2013). More rounds may create a "narrow market" problem in each round, reducing the level of competition. Large volumes auctioned in one specific round would stifle completion in that round. However, the "optimal" number of rounds is likely to depend on the technology and situation of the market, with fewer rounds for technologies with potentially fewer actors (offshore wind) and more frequent rounds in the case of technologies and bands with more potential participants (roof-top solar PV). For example, auctions in France (solar PV) are quite frequent (5 rounds in 2012).

Implementation in the EU

In Poland: The auctions must be held by the URE at least once every year (DMP 2014).

In the Netherlands, there is an annual auction with new budgets each year (Held et al 2014)

In Denmark, the frequency is according to schedule (Held et al 2014)

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[5] For example, in the tranche-oriented system of the NFFO, a call for bids was made every 2 years and it was unknown when the next NFFO round would take place.

In France, regular schedule is foreseen, with 4 or 5 rounds per year (Held et al 2014).

Implementation in non-EU countries

In China: In general, auctions are run at irregular intervals, based on decisions made by national authorities with no long-term agenda. Between 2003 and 2007, onshore wind auctions were organized annually. Currently auctions are organized on an ad-hoc basis for wind and solar (IRENA 2013)

In Morocco auctions for CSP have been run annually between 2010 and 2012 (IRENA 2013)

In Brazil: A-3 auctions (used for wind, solar and small-hydro) have generally been held annually (IRENA 2013), although there is not a fixed schedule (Held et al 2014).

In California, auctions were organized biannually between 2011 and 2013 (Held et al 2014).

In South Africa, up to five discrete bidding rounds were envisaged, at more or less six-month intervals, with the first round of bids due in November 2011 (Eberhard 2013).

4.2.1.5. Volume auctioned in each round

Deciding on the volume to be auctioned in each round represents a challenge for policy-makers. Two broad alternatives exist. Either relatively larger volumes are auctioned in the first or in later rounds. Auctioning larger amounts of capacity in the short term would have the advantage of being able to pass the capacity not built to later rounds, mitigating the negative impact on the effectiveness of the scheme. The main disadvantage is that too large volumes can lead to lower levels of competition.

In the German's PV auction starting this year, the amounts of MW being auctioned are reduced each year during the next three years. This year, 500 megawatts is to be auctioned, followed by 400 in 2016 and 300 in 2017. In general an average of 400 MW of projects is envisaged per year. Any amount not built will be passed on to future auctions (Morris 2015). If the annual target capacity is not reached, the following year's tender will be adjusted accordingly (Meza 2015). The first auction took place on 15 April 2015 with a volume of 150 MW. This will be followed by bid dates on 1 August 2015 (150 MW) and 1 December 2015 (100 MW)(Baker and McKenzie 2015). In the April auction, 170 bids were placed, and 25 contracts awarded (Morris 2015). If an auction's volume limit is not reached by the accepted bids, the next auction's volume will be raised by the amount corresponding to the difference between the volume of the previous auction and the accepted bids (Baker and McKenzie 2015).

4.2.1.6. What to do with the amounts not awarded and not built

Finally, in order to mitigate negative impacts on the effectiveness of the scheme, a mechanism for reallocation of energy or capacity that has not been awarded should be devised. For example, in Peru, if the target capacity for a certain technology is not achieved within a given round, the needed capacity is added to the subsequent round to ensure that the total capacity target is achieved in the end (IRENA 2013).

The amount contracted and not built would obviously also lead to an ineffective scheme. An alternative would be to pass the amount not built to future rounds (as with the German solar PV auction).In South Africa, if the capacity limits are not achieved in the precedent tender, the capacity is added to the subsequent tender to ensure that the total capacity target is achieved in the end (de Lovinfosse et al 2013). However, this may have drawbacks in terms of too high volumes auctioned in the future and, thus, too low competition and too high bid prices.

4.2.2. Diversity: Technological, size, actors, geographical

Policy makers may be willing to introduce design elements which increase diversity with respect to technologies, size of the installations, actors and locations for a number of reasons (see below). In this section, we argue neither in favour nor against diversity. We provide some arguments that in the literature have been put forward to defend or reject the existence of diversity. We only inform on the alternatives to promote diversity, in case governments want to promote it.

Unfortunately, trade-offs in promoting diversity exist. In general, a problem with increasing diversity in auctions for RES is market segmentation. This reduces the degree of competition and makes collusive behaviour and strategic behaviour (i.e., win the bid, then adjust) more likely, resulting in higher bid prices. In addition, a greater technological diversity is likely to result in higher system costs. Therefore, the advantages of promoting diversity in terms of minimisation of support costs (lower windfall profits) have to be weighed against the disadvantages.

Again, the specific technology and market situation in specific European countries should be analysed in order to argue in favour or against diversity. In this context, the shape of the cost-resource curve seems to be a critical element in the discussion. According to Held et al (2014), in case of a rather flat cost-resource curve, there might not be a need for differentiation, since deployment of the most cost-effective plants is encouraged, without providing too high windfall profits for the low cost technologies. However, if differences in technology costs are stronger, the technology-specific and possibly intra-technology differentiation of support may help reduce windfall profits.

However, a stronger differentiation should still favour slightly lower cost technologies, e.g. provide a higher profit level for wind power plants build in locations with favourable wind conditions.

4.2.2.1. Technological diversity

Pros and cons of technological diversity
Technological diversity is justified at the global (worldwide, maybe EU) level for inter temporal (dynamic) efficiency to take place, i.e., in order to achieve long-term RES-E and CO2 targets cost-efficiently. From a national policy maker perspective, the reason for technological diversity might be different: to reduce support costs (minimize windfall profits), exploit different types of resources, benefit from comparative industrial advantages and support the local industrial value chain.

Technological neutrality is justified to comply with short-term targets cost-efficiently (allocative efficiency, i.e., minimum system costs).

A balance needs to be struck here. A single band discourages technological diversity, since only the mature technologies are promoted. Bands also have disadvantages: they lead to a fragmentation of the tendering process and, thus, lower competition levels. Too many bands may lead to a lack of qualified bidders in each band and too few actors, reducing the benefits of competition. It may also lead to market power (del Río and Linares 2014).

Design alternatives

No diversity:

- One auction for all technologies. Ceteris paribus, a single auction is less likely to be attractive to the more expensive technologies. In Brazil all auctions were technology-neutral until 2007.
- Relatively low volumes being auctioned. In this case, technologies with higher costs are unlikely to be needed to meet the auction volume. In contrast, if the targets/volumes auctioned are large, then less mature technologies could have a chance. For example, as mentioned above, in view of the Netherlands' 2020 RE targets, the system is far from offering sufficient incentives for less mature technologies (Fraunhofer ISI et al 2014). In the Netherlands only established, low-cost technologies will receive support. The Netherlands argue that it will be too expensive to reach the 2020 renewable energy target with innovative projects and technologies. It is however questionable if the 2020 RES target will be reached with only low-cost technologies and more costly RE options might be needed to achieve RES targets through domestic action. (Held et al 2014).
- Very low maximum price. If the maximum price is too low, it is unlikely to be attractive for the most expensive technologies. For example, in Brazil, the round of bidding in the fall of 2013 did not elicit a single submission for photovoltaic because the starting price was far too low (Morris 2014).

Diversity:

- Different technology bands. Compared to single auctions for all technologies, separate bidding procedures for each technology is an obvious way to promote technological diversity. Again, designing these procedures is a crucial issue. The technological and market situation has to be taken into account in order to create sufficient scarcity and mitigate the problems of low competition and collusive behaviour.
- % requirements. Requiring that a certain percentage of the overall auctioned volume is met with different technologies is an alternative. However, setting such percentage and the practicalities involved may be cumbersome.
- Other alternatives might include supporting higher-cost, less mature technologies with other support schemes and a bonus for different technologies.

Implementation in EU and non-EU countries

In the EU

In some countries, auctions for RES have been used only for a specific technology (i.e., solar PV in France, wind-offshore in Denmark, solar PV in Germany). Technology-neutral auctions have been organized in the Netherlands (SDE+ program).

Outside the EU

Differentiating between technologies is a widespread practice. For example, in South Africa, there have been five tenders planned to allocate the total target of 3,725 MW, with specific amounts of capacity targeted for each technology: onshore wind 1850 MW; CSP 200 MW; Solar PV 1450 MW; Biomass12.5 MW; Biogas 12.5 MW; Landfill gas 25 MW; Small Hydro 75 MW; and the 100 MW for small projects <5 MW. In each tender capacity limits are set for each technology, so there is no competition between different technologies (de Lovinfosse et al 2013).Since 2007, technology-specific auctions targeting RE technologies (wind, but also bioelectricity and small-hydro) have been implemented (de Lovinfosse et al 2013).Auctions in Brazil can be technology-specific (e.g. biomass only auction in 2008 and wind only auction in 2009 and 2010), alternative energy auctions (wind, small hydro and biomass in 2007 and in 2010) and technology-neutral auctions (carried out regularly since 2005, where all RETs have been participating since 2011) (IRENA 2013). Technology-specific auctions also exist in Peru, Morocco.

4.2.2.2. Installation size diversity

Why size diversity and why not? Auction schemes seem to be particularly suitable for large installations, since economies of scale are inherently promoted and the transaction costs fall disproportionately on the smaller actors, which are the ones more likely to invest in smaller plants. This means that low-size RES-E plants are less likely to be promoted under this scheme. It might be argued that inducing this diversity interferes with the market and reduces allocative efficiency and economies of scale. While it is true that static efficiency may be higher with larger installations, there are some advantages in having smaller installations in place. One is that this is an indirect manner to encourage actor diversity (see next subsection). In addition, smaller installations are likely to lead to lower environmental impacts in terms of land occupation (Morris 2015) and visual intrusion (thus, less NIMBY and more socio-political acceptability) and lower degrees of grid congestion (although grid extension would be more likely).

Design alternatives

No diversity:

- A size-neutral auction procedure is organized.

Diversity:

- Size-differentiated tendering procedures. This would entail different bidding procedures for different plant sizes.
- An exemption of small projects from the need to participate in the auction could grant them access to an administratively-set support scheme, such as a feed-in tariff. Alternatively small projects could also be granted access to the strike price of a separate auction of larger projects without having to participate in the auction process. This mechanism would only be an option if there is little difference in production costs between small and large projects except in the way small projects can handle the bidder risk.
- Through an administratively-set bonus, bids from smaller projects receive a rebate in the auction and thereby have higher chances to be awarded.

Implementation in EU and non-EU countries

In the EU
The EU State Aid Guidelines allow in their De-minimis-rules exceptions for small projects in the need to participate in auctions.

In Poland, separate auctions for the installations of between 40kW and 1MW in size and above 1 MW are envisaged. The bids will need to specify the price and the volume of electricity to be sold. The purchase of electricity is awarded to the lowest bidders. A quarter of approved projects will be in the smaller range (profiPV 2014, DMP 2014). According to the new Act, renewable energy installations up to 10 kW (micro-installations) will be supported by feed-in tariffs, while larger systems can apply for FIT distributed in an auction system (EBA 2015).

In Italy, there is a size threshold to participate in the auction. A minimum size limit of 5MW has been set.

In Lithuania, auction participants are producers with installed capacity over 10 kW (Baliunaité 2013).In France (non-residential solar PV), there is a tender for >250 kW, and a simplified tender for 100-250kW. Installations <100kW are promoted with FITs (Grau2014).

In Germany, auctions for PV are for larger than 100 kilowatts but smaller than 10 megawatts (Morris 2015), corresponding to a maximum area of 20 hectares. "By limiting the tender volume and the maximum size, excessive land use, as existed in the past, will be prevented in the future. At the same time, suitable measures will ensure that projects will be distributed over a large area and not concentrated in one region." (Germany's Federal Ministry of Economic Affairs and Energy 2014, draft guidelines, cited in Hannen (2014)).

Outside the EU
In California, the Renewable Auction Mechanism limited the participation of projects to those below 20MW capacity. This threshold has also been set in the solar PV auction in India. In South Africa projects had to be larger than 1 megawatt, and an upper limit was set for different technologies—for example, 50 megawatts for concentrated solar and 140 megawatts for a wind project. Another 100 megawatts was reserved for small projects below 5 megawatts (Eberhard et al 2013).

4.2.2.3. Geographical diversity

Pros and cons of geographical diversity

Despite the well-known claim that a greater geographical diversity would result in lower levels of allocative efficiency, several arguments in favour of this diversity exist, including more social acceptability given the lower NIMBY phenomena, the lower excessive remuneration in the best sites and fewer grid restrictions. Held et al (2014) argue that misdirected incentives for over-dimensioning of the rated capacity can be avoided by linking the support level directly to location-specific wind conditions i.e. in terms of wind speeds. According to IRENA, site-specific auctions require additional government resources, but they present advantages that include reduced risk of non-compliance by freeing the investors from the liability of securing land, obtaining environmental permits, carrying out resource assessments and securing access to the grid (IRENA 2013).

Design alternatives

No diversity:

- A location-neutral auction is organized.

Diversity:

- Pre-selection of sites. Location-specific tendering schemes, e.g. different bidding procedures for different sites would be organized.
- location-specific differentiation of ceiling prices
- differentiation of remuneration according to local resource conditions

Implementation in EU and non-EU countries

In the EU
Location-specific auctions seem to be more common in the EU. One exception is Italy, where there is free choice of location. In contrast, the Netherlands, Germany and Denmark have location-specific auctions. In the

Netherlands, in 2013, the Dutch SDE+ programme further refined the location-specific differentiation of the ceiling prices in its principally technology-neutral auction scheme by introducing a stronger diversification depending on the full-load hours that restrict the annual electricity eligible for financial support. Auctions for onshore wind are separated in six different phases with different base amounts or price limits. In addition to the stronger tariff differentiation, a wind factor (1.25) has been introduced in order to avoid support losses resulting from the annual restriction of full-load hours due to inter-annual fluctuation in wind electricity production (Held et al 2014).The SDE+ differentiations the remuneration for wind projects according to the location-specific wind conditions in terms of annual full-load hours. The fewer the amount of full load hours, the higher the basic sum, the later the auction round, the less probable that there is still budget left. In Denmark, the tender for offshore/is location-specific, but the upcoming near shore tender will be a multi-site one where bidders can choose between six pre-defined locations.

Outside the EU

Location-specific auctions are also common in non-EU countries. Nevertheless, Brazil is an example of location-neutral auctions with nationwide competition for the best locations. Morocco holds site-specific auctions. In China, a fixed tariff was introduced in 2009 for on-shore wind following the auction scheme and it led to the setting of four different tariff levels17 according to the resource availability of the site. It is a site-specific auction whereby companies bid to develop projects in predetermined areas (IRENA 2013).

4.2.2.4. Actor diversity

Pros and cons of actor diversity

A major empirical lesson of tenders is that they are unsuitable for small installations and smaller actors. Competition may thus be affected. It has been argued that some of the aforementioned factors and, namely, information failure and difficult access to finance, have a disproportionately negative impact on small actors and, thus, that the instrument is not suitable for small actors, suggesting that smaller projects should be promoted with a different instrument (Morthorst et al 2005, Mitchell 1995).It is difficult to tell a priori if encouraging large installation or actors instead of small ones is a negative aspect. These and other issues will be analysed during the project.

Although the superiority of large installations is often taken as given in part of the specialised literature, size is a double-edged sword. Larger installations facilitate economies of scale in production but a model of distributed generation calls for smaller plants scattered around the territory. Furthermore, some RE projects are inherently large (offshore wind and concentrated solar power) and tenders may be particularly suitable for these technologies. In contrast, smaller projects may need to be promoted with another instrument. Actor diversity seems to bring a number of advantages which, again, have to be weighed against possible drawbacks in terms of static efficiency, although in this case this is not so clear, as competition may be enhanced. Bringing different types of actors would alter the market structure to which the bidding procedure applies.

This diversity (i.e., small together with large companies) would increase competition, reduce the likelihood of market power and collusive and strategic behaviour, and would result in lower bid prices.[6] According to Fraunhofer ISI et al (2014), ensuring a broad diversity of actors could be beneficial. Different investor types address different parts of the overall potential of a technology. Thus, for example, utilities might focus on large wind farms, whereas local communities might invest in individual wind turbines. Accordingly, a variety of actors might be needed to fully exploit the potential for RE expansion. In addition, small actors often have lower return expectations and sometimes lower development costs because of high local acceptance and support. If smaller projects are awarded the bid this is also diversifying the risk of degrees of target default (that can occur if large project are not realized).

Design alternatives

No diversity:

- Smaller players have apparently been excluded from auctions in Brazil. Despite the initial transaction costs for the qualification phase not being excessive, they have been impeding for smaller actors. This can partly be attributed to the fact that the required bid bonds have posed significant barriers for smaller (and for local) potential bidders. And local bidders participating in the auctions have largely not been able to compete with the international investors (Held et al 2014).

Diversity:

- Alternative bidding procedures for different types of actors
  For example, a bidding procedure for “small” actors and another for “larger” ones could be organized. The clear disadvantage is that this could lead to market segmentation, less market liquidity and the benefits of combining different types of actors would be lost. In addition, defining “smallness” may be a difficult task.
- Minimum quotas for small actors ensure that small actors have preferential access to a defined share of the auction volume. Only once the share of awarded bids of small actors exceeds this defined share, small actors are in competition with bids from larger actors. A drawback here might be that in case of insufficient bids by small actors, these bidders can however hand it high bids (up to the ceiling price, if there is one) and thereby receive high windfall profits.
- Seller concentration rules
  Requirements that one bidder cannot capture more than a given share of the market could also be helpful in this regard (see below).
- (Partial) compensation of project development costs (e.g. prefeasibility studies) can reduce the bidder risks of not being successful in the auction. This option could however lead to unwanted strategic behaviour, for instance should non-profitable projects participate in the auction to receive reimbursements for part of the development costs.
- Indirect measures
  Other design elements may have indirect consequences in terms of enhancing or being a barrier to the participation of smaller actors. For example, high penalties or prequalification requirements may fall disproportionately on these actors. In general, high transaction costs or too complex procedures are likely to make the participation of these actors relatively less attractive compared to larger ones.

[6] As argued in Fraunhofer ISI et al (2014), essentially, actors can be classified as investors, developers, plant operators or sales agents. Following this source, in this report, the discussion focuses on investors and the owners of renewable energy plants, as these actors receive the support granted in the tendering procedure.

Support outside auction scheme can include reducing the transaction costs for smaller bidders to participate in the auctions, e.g. through advice on the tender documents by government agencies, or through access to preferential financing conditions to countervail the lower credit-worthiness of smaller bidders when they need to submit bid-bonds.

Implementation in EU and non-EU countries

In the EU
Surprisingly, measures to increase actors' diversity are rather rare in the EU. One goal of Germany's Energiewende is to promote SMEs and citizen co-ops. In the EU the definition of small- and medium-sized enterprises is widely accepted and could also be applied to define small actors eligible for exemption (EC 2003). There is also evidence that the indirect measures have had a positive or a negative impact on actors' diversity. For example, design has been made simple in France solar PV auction in order (presumably among other goals), not to impose an obstacle for small agents) (Fraunhofer ISI et al 2014).Denmark is supporting small actors through a fund for wind onshore prefeasibility studies. Small actors get a loan of 67,000 EUR that only has to be paid back if the plant is realized (Jacobs et al 2014).

Outside the EU
Promoting diversity among bidders was not a goal in Brazil and, in fact, there was little diversity in this sense. Smaller players have apparently been excluded from auctions in Brazil. Despite the initial transaction costs for the qualification phase not being excessive, they have excluded smaller actors. This can partly be attributed to the fact that the required bid bonds have posed significant barriers for smaller (and for local) potential bidders. And local bidders participating in the auctions have largely not been able to compete with the low-bid strategies of international investors (Held et al 2014). In Ontario small energy cooperatives can also submit a request for funding prefeasibility studies to the „Community Energy Partnership Program"(Jacobs et al 2014).

4.2.2.5. Other diversity types

Policy makers may also be willing to implement design elements which lead to diversity in other respects and, in particular:

- Base-load technologies, versus peaking-as-available (PV) and non-peaking-as-available (wind and hydro)
- Dispatchable vs. non-dispatchable technologies.
- Auctions with local content rules and without.[7]
- New and existing projects. For example, in Poland, the auctions will be conducted separately for existing and new projects.8

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[7]This has been the case in India (see section 9 and Khana and Barroso 2014).

[8]If an operator approved for the auction system registered its participation, it will be assigned to the respective auction based on the progress of the specific project that it is offering. According to art. 74 section 3 of the draft law, two separate auction groups are to be created: one for old, thus already completed facilities which at the time of the auction are already connected to the grid, even if they were modernised in line with statutory regulations; and another for new and modernised project facilities which will only be connected to the grid once the respective auction has ended. Already existing facilities, however, may only participate in an auction system for projects that are to be newly built subject to the condition that after the 4th section of the draft law came into effect, certain upgrades had been carried out and the facility was not as yet

4.2.3. Prequalification criteria

Pros and cons

The aim of prequalification criteria is to ensure the seriousness of bids and to reduce the risk of undesired strategic behaviour. This also includes the avoidance of incentives for bidders to block other bidders by outbidding. Successful projects not being built block projects which have not been successful in the tender (del Río and Linares 2014). As a favourable side effect, a fulfilled prequalification reduces the risk of project failure.

These requirements may fall either on projects or project developers. Designing prequalification requirements is a sensitive issue, since they may bring some negative consequences. They may discourage the participation of actors (especially the smaller ones) by increasing the costs of participation because prequalification costs are sunk costs. Such requirements can deter participation by new entrants and those with low capital reserves but without a system of deposits, an incentive is created to bid artificially low (Moore and Newey 2013). As a result, a lower level of competition, higher bid prices and policy costs would result. The impact of these requirements on risks for investors is ambiguous. Bid bonds, which are payments required from the bidding participants or only from the successful participants to prove their serious intentions to put the project into practice (Held et al 2014) increase these risks (in case of non-completion), specially for actors with low equity/debt ratios. Financial guarantees such as deposits aim to reduce the societal risk of non-delivery leading to electricity supply shortages, transferring it solely to the developer (Moore and Newey 2013). As these costs are sunk at the time of the auction there is an inherent risk that they cannot be recovered (Fraunhofer ISI et al 2014). But, on the other hand, they offer some guarantee that project developers participating in the auction will finally carry out the project. However, such requirements can deter participation by new entrants and those with low capital reserves.

Design alternatives

As suggested above, determining the level of the bid bond is a sensitive task, provided that excessive bid bonds may increase the risk premium for bidders and discourage actors from participating in an auction, whilst too low bid bond guarantees may imply low implementation rates.

Prequalification requirements may fall either on the project or the project developer or both:

<u>Requirements on the project</u>
They aim at ensuring the feasibility of the project. They may entail technical requirements, documentation requirements or preliminary licences. More specifically, they may entail:

- Proven technology: winning bids can be required to use a technology that has been successfully demonstrated.
- Land secured: ensuring developers already have rights to develop the land they need prevents this becoming a reason for project failure.

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connected to the grid at the time of the auction. According to this, facilities must have recorded an increase in their performance capability following the upgrade and the cost of modernising them must total a minimum 30% of the original total project volume in addition to the modernised plant not being used to produce energy using biomass, bio fluids or biogas (DMP 2014, profi PV 2014).

- Environmental licence obtained: for the same reasons as the land requirement, environmental permits may be required in advance of bids winning approval (Moore and Newey 2013).
- Building permit obtained (e.g. Germany).

Requirements on the project developer

Their aim is to guarantee the financial viability of the project developer. They may include:

- Deposits and other guarantees: for a winning bid to be approved, developers may be required to provide capital up front, to be returned on completion of the auctioned contract, as an indemnity against project failure. Several alternatives in this context include bid bonds, bid guarantees, performance bonds, project completion bonds and contract termination clauses in case of delays.
- Financial capability requirements: for a winning bid to be approved, the bidder may be required to have a specified amount of cash-on-hand, or fulfil other balance sheet requirements, to determine that they are in sufficient financial health to complete the auctioned contract. There might be minimum rating requirements (e.g. Standard & Poor, Moody's, rating), as in Denmark.
- Experience: in some markets, winning firms are required to demonstrate experience in delivering the kind of project being auctioned (Moore and Newey 2013).

These requirements can either be applied in a separate phase before the actual bidding takes places or bids can be evaluated according to qualification criteria after being submitted (Held et al 2014).

Documents related to prequalification requirements should be handed in before the auction and penalty bid bonds should be handed in right after the auction. However, if the bidder is not able to do so, there should be a fast mechanism to replace such bidder by another one who can provide the required documents. One option is to have a short-term backup procedure, as in Brazil. If a bidder cannot deliver all necessary documents within 48 hours after the auction is closed, his project is excluded and the next lowest bid is included into the selection of projects (Kopp et al. 2013, Held et al (2014).

Implementation in the EU

The use of prequalification criteria is widespread in the EU.

In the Netherlands, an environmental licence, a water permit (geothermal projects) and written permission of the owner of the land (if relevant) are required (Fraunhofer ISI et al 2014).

In France, the bidder has to be the owner of the building (relevant for residential solar PV) and a CO2 assessment is required (Fraunhofer ISI et al 2014).

In Italy, a financing bond (5% of the project cost) has to be deposited by the bidder (Fraunhofer ISI et al 2014).

In Poland, before the respective plant operator is admitted to the auction he must undergo an approval procedure which verifies the individual prequalification criteria which include:

- Compliance of the investment with the applicable zoning plan or other comparable documents of the respective municipality;
- Grid connection conditions must be met;
- Environmental clearance certificate has been issued;
- Proof of the operator’s financial situation which secures the project financially;
- Implementation schedule for the investment (DMP 2014).

In Germany, bidders are required to provide a security payment of EUR 4 per kW of the bid volume to the Federal Network Agency in order for the bid to be allowed. This payment may be reduced by 50% if the bidder submits the copy of a zoning plan allowing the construction of the installation as planned or the local government's decision to carry out a public consultation of the draft zoning plan with the bid (Baker and McKenzie 2015).Bidders must moreover provide information on the land on which the installation is planned to be constructed, in order to foresee and adequately take into account potentially conflicting land usage. In this context, they are also required to submit (at least) the copy of a competent local government's decision to enact or alter a local zoning plan which would allow the construction of the planned PV installation. However, submitting decisions of a more advanced planning stage (i.e. an enacted zoning plan or a decision to carry out a public consultation of the draft plan, cf. Section 3(2) Federal Building Code) will entail a relaxation of the security payments (Baker and McKenzie 2015). The aforementioned payment of four Euros is cut in half to two Euros per kilowatt if the bidder is able to submit one of two types of building permits indicating that the land where the project is planned as already been set aside for ground-mounted PV (Morris 2015).

Denmark seems to adopt an all-encompassing and more *dirigiste* approach to this issue, with an integration of the permitting and bidding procedures and also for the grid connection infrastructure. Administrative and permitting issues and the organization in a one-stop shop are brought forward (Held et al 2014).

Regarding financial guarantees in the form of bid bonds, these are not required in The Netherlands and France. In Denmark, the winner has to put in bank guarantees for the potential penalties (Held et al 2014). France required financial guarantees of around 5% of the investment volume.

Implementation in non-EU countries

In Brazil, bidders are required to deposit a bid bond equal to 1% of the project estimated investment cost which must be declared by the investor and approved by the regulator beforehand. This guarantee is returned after the contract is signed if the investor wins the auction, otherwise it is returned after the auction. Auction winners also need to deposit a project completion guarantee equal to 5% of the investment cost that is released after certain project milestones are completed (IRENA 2013). In addition, in order to participate in the auction, bidders need a prior environmental license, a preliminary grid access authorization and other technology-specific documentation such as fuel contracts for biomass or certified production estimates (resource measurements by an independent authority) for wind (Cozzi 2012, de Lovinfosse et al 2013, Fraunhofer ISI et al 2014).

In Morocco, the prequalification criterion for wind on-shore differs from CSP. Regarding wind on-shore, Morocco had a pre-qualification rule in its tendering process for six 150MW wind farms that the bidder must have completed a minimum of 10 wind projects and at least two of them must be over 10 MW (IRENA 2013). Financial guarantees are requested from winning consortium (completion bonds and performance bonds, no bid bond)(de Lovinfosse et al 2013). With respect to CSP, participants must comply with three qualification conditions in order to participate in the tender:

- Experience in developing the solar technology tendered. E.g. the lead company of the consortium must also have developed and operated a minimum capacity of 45MW thermal solar power plant and not be liable for penalties or damages in performance or delay in excess of 5% contract value (Norton Rose, 2010).

- Experience in operating and managing thermal power projects elsewhere. E.g. the lead company of the consortium must have developed, operated and managed a thermal power plant in the last ten years totalling at least 500 MW including a minimum capacity of 100 MW in the last seven years (Norton Rose, 2010).
- Financial requirement: strong balance sheet. E.g. the lead company of the consortium must have developed, operated and managed a thermal power plant in the last ten years totalling at least 500 MW including a minimum capacity of 100MWin the last seven years (Norton Rose, 2010).
- Material dispute: A bidder must not have a material dispute pending or resolved against it in the past 10 years. “Material dispute” means a dispute where the amount in dispute is at least half of the net worth of the relevant company or where termination of a material agreement was sought (Norton Rose, 2010) (Lovinfosse et al 2013).

In the pre-qualification phase, bidders were selected if they satisfied pre-defined requirements including financial capacity, access to finance and technical experience. The lead of the consortium must have invested in two infrastructure projects with an aggregate amount of equity and debt of at least USD 800 million within the last ten years and the bidding consortium must have a net worth of at least USD 200 million. As for the consortium bid’s technical experience, the lead company must have developed, operated and managed a thermal power plant in the last ten years totalling at least 500 MW, including a minimum capacity of 100 MW in the last seven years. In addition, the lead company of the consortium must also have successfully developed and operated a minimum capacity of 45 MW thermal solar power plant (Norton, 2010)(IRENA 2013).

In Peru, a bid bond of US$20k/MW of capacity and a performance bond of US$100k/MW of capacity is required to ensure timely construction. In addition there is an operation guarantee.

In South Africa bidders must demonstrate that the planned project site has been secured and that all necessary approvals have been received. Moreover, bidders need to prove the commercial viability of the project (*i.e.* reliability of suppliers and ability to meet deadlines)(IRENA 2013). A bid guarantee is required for qualification of bidders. The following evidence or declaration must be submitted:

- Legal
- Land acquisition
- Environmental consent
- Finance
- Technical
- Economic development
- Bid guarantee (de Lovinfosse et al 2013).

In China, the bidder must be an independent legal entity whose net assets are larger than the capital value of the project, and with an existing wind farm capacity no smaller than the project’s capacity. The project can be financed partially with foreign capital. The project developer must sign a supply contract with a wind turbine manufacturer. The manufacturer must have installed more than 100 large wind turbines (larger than 1 MW). To ensure reliable offshore wind power, wind turbines must undergo a performance test (IRENA 2013).

In California, minimum viability criteria had to be met, including site control, equipment standards, developer experience, and use of a commercialized technology. The aim is to prevent the authorized capacity under the auction mechanism to be filled with non-viable projects to the detriment of projects that can come on line quickly (CPUC 2010).

In India, the auction would only be open to commercially proven technologies with a transmission agreement from the regional utility. In addition, the lower the bid, the higher the bidding fees the investor must pay. Finally, the investors were required to provide performance guarantees of 46400€/MW, which are to be forfeited in part or even fully in case accepted projects are not realised (Becker and Fischer 2013, Kylili and Fokaides 2015).

Financial guarantees in the form of bid bonds were are not required in China. In California they are required from successful bidders and in Brazil they were required to an amount of 1% in the first phase and 5% in the second phase.

4.2.4. Penalties for non-compliance/delays

Penalties: why and why not?

If there are no deadlines for project construction and no penalties if the project is delayed or not built, then, together with the other factors, ineffectiveness would occur. Similarly to pre-qualification requirements, strong penalties aim at ensuring the effectiveness of the scheme, reducing the possibility of delays, underperformance and project failures However, high penalties would lead to substantial risks for bidding participants, high bid prices (since bidders anticipate the risks of penalties in case of delays or non-realisation and price them in the submitted offers), negatively affect actor diversity and lead to higher support costs[9]. High penalties may just increase the cost and, by themselves, they will not ensure that projects are built (del Río and Linares 2014).

The widespread evidence is that penalties are necessary. When they are not there, ineffectiveness is likely to result, as in India's solar PV state auctions (Khana and Barroso 2014) or in past schemes as the NFFO. In China the authorities have learned that prequalification criteria, as well as penalties for noncompliance and non-performance by the winning bidder, are critical to the success of auctioned concessions (Wang et al 2014).

Therefore, it is an issue of how penalties should be implemented and what their level should be rather than whether they should be there. Setting an "appropriate" penalty is certainly a challenge. Their level should neither be too low (rendering them meaningless) nor too high (discouraging participation by actors).

In addition, when applying penalties a distinction must be made between events causing those project failures and delays which can be attributed to the project developer and those which are beyond the control of the project developers (RE resources, permitting process). Held et al (2014) argues that the project developer should only be sanctioned for those delays he is responsible for and that he can effectively address. For instance, if a project delay occurs because of complications in the supply chain, this is a regular part of project development. However, if a delay is caused by problems in public licensing procedures, the project developer might rather be compensated for unexpected revenue gaps, than being exposed to an additional economic

[9] Peru provides an example of too high bids discouraging participation of actors, especially small ones. Initial quotas in Peru were not covered (500 MW for biomass, solar and wind and 500 MW for small hydro).One of the reasons for the relatively low participation in the first call was the high guarantees required (between 20000 and 100000€/kW) (Novoa 2011).

burden. For example, in Brazil, Lovinfosse et a (2013) note that so far there has been no enforcement of these penalties and extensions have been granted to delayed projects because the delays have partially been caused by public entities and not necessarily by project developers (de Lovinfosse et al 2013). In South Africa, the requirement to start construction within 180 days regardless of timelines for physical grid connection constitutes an important risk. There are concerns that projects will not be connected in time, especially in areas with inadequate grid capacity. If such delays occur, the programme makes provision for certain compensation payments in the form of “deemed energy payments” to be paid to IPPs, although the implementation of these payments remains uncertain (de Lovinfosse et al 2013).However, while differentiating between the cause of the delay might seem fair, it brings about great legal uncertainty and risk target fulfilment. If a bidder foresees that he cannot realize the project, he can take measures not to be granted a permit and therefore not pay the penalty. This can be observed in Brazil where many exceptions existed and a black market for environmental permit rejections developed so project developers could claim non-responsibility and circumvented the penalty. As with other design elements, trade-offs exist.[10]

Financial guarantees in the form of deposits (mentioned in “prequalification requirements”) can also be regarded as a penalty for non-compliance, since there are negative financial consequences for the project developer in case the project is delayed or not built, i.e., if the deposits are confiscated. Financial guarantees have been dealt with under the “prequalification criteria”, because they are a requirement that projects have to comply with early in the process, even before the bidding procedure takes place. Therefore, we refer to the corresponding section for an overview of those deposits. Note that financial guarantees can be used as a prequalification requirement, in which case they have to be paid before the auction and will be immediately repaid in case of being not successful, but they can also be used as penalties. In this later case, they are only relevant for successful bidders. They could be paid before the auction and repaid to all unsuccessful bidders after the auction or could be paid after the auction only from successful bidders. They will be (partly or not at all) repaid after realization of the project (depending on delays or even non-realization).

Another relevant issue, related to the above, is whether to set a deadline for the winner projects to be built if they are to receive the contract, and how long this deadline should be (del Río and Linares 2014). A short deadline increases investors’ risks (of not deploying the project) and may put upward pressure on bids. A longer deadline will allow technology progress to take place, and therefore may result in lower expected prices for RE. However, it may also induce over optimism, and introduce significant uncertainty into the process. Therefore, we suggest setting short technology-dependent deadlines so that uncertainty (and also over optimism) is minimized. This may even be incorporated in the scoring of the auction (Lewis and Bajari 2011).

Design alternatives

The evident need for penalties leads us not to investigate whether penalties for non-compliance should be or should not be there, but how to design them appropriately. In particular, care should be taken when imposing penalties where delays or non-compliance cannot be attributed to the project developer. For instance, if a project delay occurs because of complications in the supply chain, this is a regular part of project development. However, if a delay is caused by problems in public licensing procedures, the project developer

[10] For example, between reaching a certain realization rate and the accepted support costs (Fraunhofer ISI et al 2014).

might rather be compensated for unexpected revenue gaps, than being exposed to an additional economic burden. As with other design elements, trade-offs are likely to occur, especially with high penalties.

Penalties can take different forms: their design might include the termination of contracts, lowering support levels, shortening support periods by the time of the delay (or multiplied by x), confiscation of bid bonds or even additional penalty payments, for instance, in case that a delay would harm security of supply (Held et al 2014).

Penalties can either be a fixed amount (i.e. the performance bond in the Netherlands) or be modulated by the delay (as in Denmark and India). They can be set per MW (as in Quebec, India, Peru and Argentina), per kWh (Denmark) or as a percentage of the investment made (Brazil)(del Río and Linares 2014).

In general, compliance rules should include:

- Requiring a bid bond (potentially as a percentage of total project cost) to avoid the risk of the winning bidders not signing the PPA under the terms at which they bid;
- Requiring a project completion bond (potentially as a percentage of total project cost) to avoid the risk of projects not coming to completion;
- Penalising developers for electricity shortfall or paying an agreed tariff for over-production to avoid the risk of projects not delivering the planned quantity of electricity;
- Imposing penalties for delays, to avoid the risk of facing setbacks at various stages (IRENA 2014).

There might be alternatives for flexibility in compliance. For example, Brazil has implemented a rather flexible set of compliance rules to reduce the risk on investors. In addition to the annual remuneration/ penalty on the yearly production deviations above/ below the agreed upon volume of electricity generated, a four year rule offers investors some degree of flexibility by allowing the producers to accumulate and carry over productions within some limits to make up for under production risks in future years (IRENA 2013). In Peru, the project developer may request to postpone the date of the commercial operation provided that it is within a defined deadline and no longer than three months. If the accumulated delay exceeds one year from the date specified in the bid, the MEN can choose to accept postponing the deadline accompanied by an increase in the performance bond by 50%. If it chooses not to, the contract is fully terminated (IRENA 2013).

In addition, there might be some alternatives to avoid facing unexpected delays such as putting in place early warning systems to identify slippages early on (Lovinfosse et al 2013).

Implementation in the EU

Experience in the past with auctions for RES in the U.K. NFFO shows that too many projects that won in NFFO auctions never generated any electricity because companies simply bid too low and there was no penalty for not completing the contract (Mitchell and O'Connor 2004).That example demonstrates the importance of a thorough regime of deposits and incentives to encourage responsible, credible bids (Moore and Newey 2013).

In the <u>Netherlands</u>, penalties are in place for non-realisation of projects within the required period. Project developers that do not realise their project within the predefined 4-year realization realisation period are excluded from SDE+ for five years for the same project. Penalties only apply to projects that claim over 400 mEUR. For projects with a budget claim >400 m EUR, a bank statement and a realization contract is required. The contract states that the project has to be realised within the given timeframe (Held et al 2014).In addition, the auction included a requirement for the second bidder to take over the tender with unchanged time planning. This meant a considerable risk to investors and foreign investors felt apparently as outsiders compared to national actors (Held et al 2014).

In Denmark, penalties in the Anholt off-shore wind project depended on whether there is non-compliance with the contract or a delay and they are progressive in both cases. Penalties of 100 million DKK (around 13 M€) for delays up to 5 months, 200 million DKK for delays between 6 months and 1 year and 400 million DKK for delays beyond one year were implemented. Generation-based penalties apply to delays: reduction of support levels of 1 ø /kWh for delays between 1 and 3 months, 2 ø /kWh between 4 and 8 months and 3 ø /kWh between 9 and 12 months (Kitzing 2013). In addition, there was a stand-by requirement: If the first winner of the bid opts out within the first 6 months, the second winner has to take over the contract and undertake the project within the same timeframe (op.cit).

In France, there are financial securities necessary for small-scale solar PV (Fraunhofer ISI et al 2014). However, in case of construction delays: duration of support can be reduced by the delay, multiplied by two. The installation has to be up and connected 18 months after publication of the auction results (extendable by 2 months, if the delay is caused by the DSO). In case of delays, the duration of support can be reduced by the delay, multiplied by two (Held et al 2014).

In Germany, successful bidders who do not apply for a certificate of support (*Förderberechtigung*) within 24 months after commission of the plant have to pay a penalty of up to EUR 50 per kW based on the bid volume (Baker and McKenzie 2015). Projects are to be completed within 18 months, with delays leading to at least a contractual penalty: If the project has not been completed after 24 months, the grant funding will be revoked and the security deposit forfeited in full." During commissioning it must be shown that the project was built on the site specified in the bidding. If the project was completed elsewhere, the funding level will be reduced by €0.03 per kilowatt hour (transference penalty) (Hannen 2014)

In Italy, there is a deadline of20 months to construct and commission (after proclaiming the winner of the auction) (Fraunhofer ISI et al 2014).

Implementation in non-EU countries

In the auction scheme in the Australian Capital Territory, late completion of the project would result in a proportionately reduced support period (Buckman et al 2013).

In Brazil, all projects contracted in an auction are required to start delivery after three or five years (referred to as A-3 or A-5 auction respectively). A-3 auctions are typically used for wind, solar and small-hydro. A-5 auctions are used for large-scale hydro and conventional power sources and several penalties are applicable in case of delays. During the period in which the plant is delayed the contract price is reduced, and the regulator has the right to ask for contract termination for any delay of more than one year in the project milestones (Cunha, et al., 2012). As for penalties, in the case where the annual production is below 90% of the quantity of electricity contracted, the investor is penalised for the shortage by 115% of the contract price in addition to making up the deficit in the following year. In the case where the annual production exceeds 130% of the quantity contracted, the excess electricity generated receives a fixed tariff of 70% of the contract price and the surplus 30% is accumulated for accounting in the following year. Finally, any deviation between 90% and

130% is accumulated for four years and can be used in the accounting process of any of the years in that four-year period (IRENA 2013).[11]

Penalties are non-existent in California.

In Peru, a number of penalties are applicable. For delays in construction these include a construction guarantee increased by 20%. If the delay exceeds 1 year, there will be a contract termination or extension with increase guarantee by 50%.For annual under/over production, over production will be sold at market price (lower than contract price). Under production is penalised through a reduction of the tariff (Lovinsfosse et al 2013).[12]

In China, there are no clear compliance rules and no clear penalty for non-compliance (IRENA 2013).

In South Africa, bid guarantees are required by the bidders at the qualification stage. The last resort penalty for non-compliance with the developer's commitments under the agreements is the termination of the contracts. So far there has been no use of the guarantees or penalties (De Lovinfosse et al 2013).

In Morocco, requirements and enforcement rules for financial guarantees and penalties are defined in the contract with the winning projects (which is confidential). MASEN requires financial guarantees like completion bonds and performance bonds from the winning project consortium. Penalties for project delay vary with the severity of the non-compliance, but there have been no case of enforcement so far (de Lovinfosse et al 2013).

In India's solar PV state auctions, penalties have been missing, being a major factor behind the delays. [13], Turkey is another example where insufficient penalties led to only little projects being realized.

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[11]In addition, there are financial guarantees and penalties. Participants have to deposit a bid bond of 1% of the project's estimated investment cost in the qualification phase, and then a project completion bond of 5% of the estimated investment cost for the selected projects. Penalties are applied for delays in project delivery. If the delay exceeds one year, ANEEL has the right to terminate the contract and to keep the financial guarantee.

[12]Regarding guarantees, project developers have to provide three guarantees:

-A bid bond of 20.000$ per MW of installed capacity released at signature of the contracts. This is lost if the bid is won by the bidder fails to sign the contract.

-A performance bond of 100,000$/MW of capacity installed. If delays occur in the construction phase for two consecutive quarters with regard to the declared timeline, penalties are deducted from the deposited guarantee. In the case of delays to the start of commercial operation of the plant, the performance bond is increased by 20% over the outstanding amount from the date of verification.

-An operational guarantee maintained during the whole duration of the contract.

Once the project is successfully built, the operation guarantee is maintained during the whole duration of the contract. This guarantee can be exercised as a reduction in price proportional to the deviation of the actual annual energy generated from the annual energy offered in the auction (Lovinfosse et al 2013, IRENA 2013).

[13]According to Khana and Barroso (2014), Leniency with project delays has been the norm. According to announced schedules, the capacity contracted in the state auctions in Karnataka, Madhya Pradesh, and Rajasthan should be fully operational by now, yet delays of up to a year have occurred. All three states seem to have accepted the delays, extending deadlines with no penalties or requiring only minor justifications from the developers. Such practices set bad precedents, giving investors an extra incentive to be unrealistically aggressive on their planned schedules.

4.2.5. Duration of contract

Pros and cons of limited duration

Limiting the duration of support for specific projects is a common design element in tendering but also in FITs, FIPs and quotas with TGCs. The alternative would be to grant unlimited support for the whole lifetime of the project. The aim is to limit policy costs and provide certainty to investors on the period over which they can expect to be remunerated. No clear disadvantages in setting the duration of contracts have been identified. Therefore, the issue is not whether such duration should be set, but rather its length. Longerterm contracts make it easier to raise finance and may lead to lower bid prices[14].

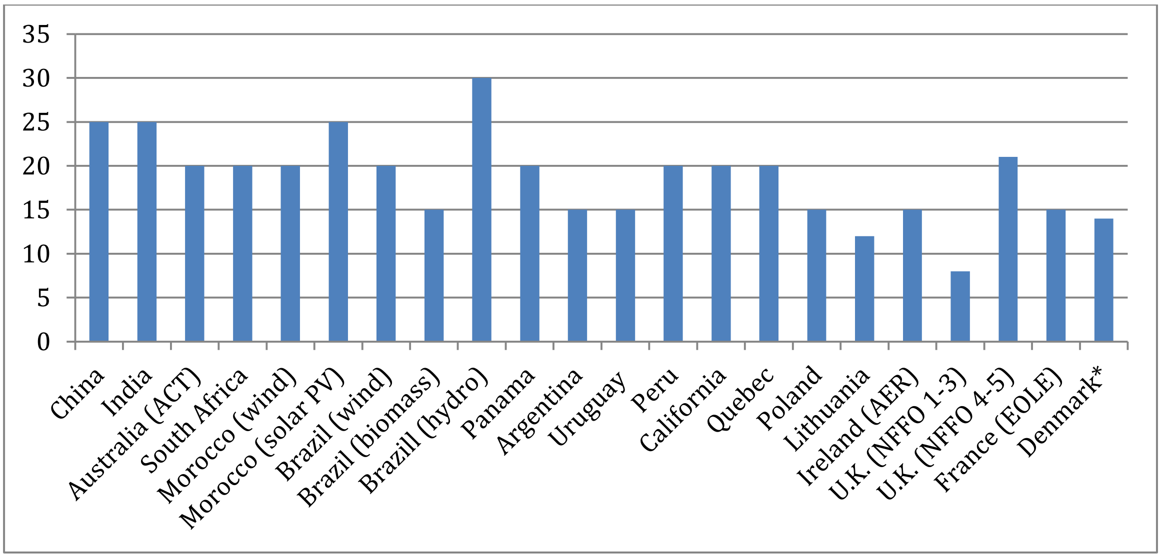
Design alternatives

Common economic sense suggests that the length of the contracting period should take into account the time over which the plant can recover its costs and receive a reasonable profitability level. The duration of the contract is likely to be different for different technologies. Both too long and too short periods should be avoided. The former would lead to a high consumer burden over time. *Too short support periods should also be avoided.* Initially, tenders were granted based on short-term contracts. This led to high prices per kWh so that projects could recoup their capital within the short time-span (higher cost of finance). While the cost per kWh may have been high, the total amount of support may not, since support has a short time span. If access to finance is more difficult for smaller actors, these will be more affected by the too short support periods (del Río and Linares 2014).

Implementation in EU and non-EU countries

In both the EU (past and present schemes) and non-EU countries, the length of the period has clearly been concentrated in the 15-20 years range (figure 2).

Figure 2: Duration of the contract for auction procedures around the world (in years)



[14] A longer duration period in NFFO3 (15 years) with respect to the NFFO2 was one of the factors leading to a reduction in the price, since the capital repayment costs per kWh decreased (Ruokonen et al 2010).

Source: Own elaboration. In Denmark, the duration of the contract is based on full-load hours (typical duration is 12-14 years).*

4.2.6. Updating of remuneration over time

Pros and cons

The rationale behind this design element is to adapt the remuneration level to the context conditions of the economy over time.

Design alternatives

The more logical manner to update the support over time is to link it to the consumer price index.

Implementation in EU and non-EU countries

In Poland, the remuneration will be inflation-indexed during a period of 15 years (profiPV 2014).

In France, 20% of the tariff is indexed annually with income levels in the energy industry and an industry-specific price index. (Held et al 2014).

In Brazil, the energy contracts are indexed to consumer price index (IRENA 2013).

In South Africa, bidders were asked to provide two prices: one fully indexed for inflation and the other partially indexed, with the bidder allowed to determine the proportion that would be indexed (Eberhard 2013).

4.2.7. Other design elements

4.2.7.1. Local content rules

Local content rules refer to the requirement to use renewable energy equipment being manufactured by local firms.

Pros and cons

Local content rules are aimed at enhancing the local economic development opportunities in the country. Some argue that beneficial innovation effects would result, but the impact on dynamic efficiency is unclear. While it is true that the local innovation-supply chain would be supported, it is unclear whether this is beneficial from a wider perspective. It is not straightforward that this would have benefits for the country in question since this depends on appropriate benefits from learning effects. If these were not locally appropriable, the benefits to the local economy would be modest and possibly non-existent. It seems that these requirements bring more disadvantages than advantages for the successful functioning of auctions. There are several drawbacks, including fewer bidders (since local content rules increase the costs and risks for investors), lower levels of competition and higher administrative costs (monitoring and verification of the localcontent impact of the projects). This would end up in higher bid prices and greater policy costs. For example, in India there have been two auctions one with local content and the other without. The local content sub auction received half as many bids as its open counterpart (700 MW vs. 1470 MW) and resulted in significantly higher bids (Khana and Barroso 2014). In Russia, local content rules (onerous local content requirements) were deemed the reason for the low interest by wind and hydro project developers in the auction (Rice et al 2014).

In addition, the project can be delayed if these rules are too stringent, negatively affecting the effectiveness of the scheme. For example, according to IRENA (2013), delays in the first wind auction in Brazil were caused by the requirement to have 60% of the cost of equipment spent locally, as only one manufacturer was operating at the time (IRENA 2013). In South Africa, the current lack of a competitive domestic RE industry and manufacturing capacity have led to concerns that the local content requirement may be too stringent for the early stages of RE development in the country and that it would be abottleneck for projects, increasing the costs and risk of failure in the construction phase (de Lovinfosse et al 2013).

Local content requirements constitute non-severable violations of EU law where the *grant* of aid is subject to the *obligation* for the beneficiary to use nationally produced goods or national services (EU STATE AID BLOG 2015).

Finally, an additional main drawback is that local content rules may violate WTO rules. For example, in India, this issue has been a major point of contention, as the United States filed an official complaint with the WTO against India's local content rules (Khana and Barroso 2014). This was also the reason that China ceased to apply local content rules since 2009.

A crucial issue is to take into account the situation of the local market with respect to the technology in question when setting these rules. If non-existent or low-quality local manufacturers are the norm, then a bottleneck for the successful completion of projects would exist.

Design alternatives

- A percentage of the renewable energy equipment being manufactured by local firms.
- Organizing two auctions, one for domestic content requirement, and the other without (as in India, see below).

Implementation in EU and non-EU countries

In the EU
There does not seem to be any local content rules in the EU, probably because it would represent a violation of the internal market rules.

In non-EU countries
In contrast, local content requirements in non-EU countries seem to be widespread. The only two countries which donot ask for (part of) the equipment to be manufactured locally are Peru and China (since 2009).

In Russia, wind, solar and hydropower projects coming online in 2015 must be able to source 55, 50 and 20% of production equipment from Russian manufacturers, respectively. The following year, those figures jump to 65, 70 and 45% (Rice et al 2014).

In India, the winners of the auction (first round) were required to buy solar cells domestically. Thin-film technology is exempt from the local sourcing rules (Obiko 2011). A differentia feature of India is that there have been two auctions, one for domestic content requirement, and the other without. In the phase 2 auction, demand has been separated into a “domestic content requirement” (DCR) portion and an “open” portion (375 MW each) (Khana and Barroso 2014).

In Morocco, local content is not a mandatory requirement in the selection of projects, but a local content of minimum 30% of the plant’s capital cost (local equipment manufacturing, operation and maintenance, R&D) is required in the tender document (IRENA 2013, de Lovinfosse et al 2013).

In Brazil, there is no requirement for local content in the bids. However, in practice all selected projects turn to the Brazilian national development bank BNDES (Banco Nacional de Desenvolvimento Econômico e Social) for funding, which requires 60% of the financed items to be manufactured locally (de Lovinfosse et al 2013, IRENA 2013).

In China, there used to be a local content requirement until 2009. For example, in the 2005 onshore wind auctions in China, the developers had to source 50% of the equipment from local manufacturers. In 2009, the auction was replaced with a FIT and the requirement on local content was abolished when the US-China Joint Commission on Commerce and Trade met and China agreed to remove its local content requirement on wind turbines (IRENA 2013).

In South Africa, there are local content rules differentiated per technology and year (2011-2013). They increase for all technologies in such a period: from 25% to 40% for on-shore wind, from 35% to 40% for solar PV, from 35% to 40% for CSP and from 25% to 40% for biomass, biogas and landfill gas (de Lovinfosse et al 2013).

4.2.7.2. Deadlines and grace periods

The projects awarded contracts will be required to be built by a given date. Deadlines are needed for the project to be built.

Pros and cons

Pros: give temporal flexibility to bidders in achieving compliance.

Cons: long “grace periods” between winning the bid and being required to start construction, increases the probability that “uncertain” factors such as increases in material costs discourage the realisation of projects (del Río and Linares 2014).This seems to have been the case in round 5 in the NFFO (reference needed).

Design alternatives

Probably not an issue of “if” but rather “how long” this grace period should last for.

Implementation

Long grace periods were implemented in the UK’s Non Fossil Fuel Obligation.

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

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

www.auresproject.eu