CLEAN ENERGY MINISTERIAL
Accelerating the Transition to Clean Energy Technologies

IRENA
International Renewable Energy Agency

RENEWABLE ENERGY AUCTIONS: A GUIDE TO DESIGN

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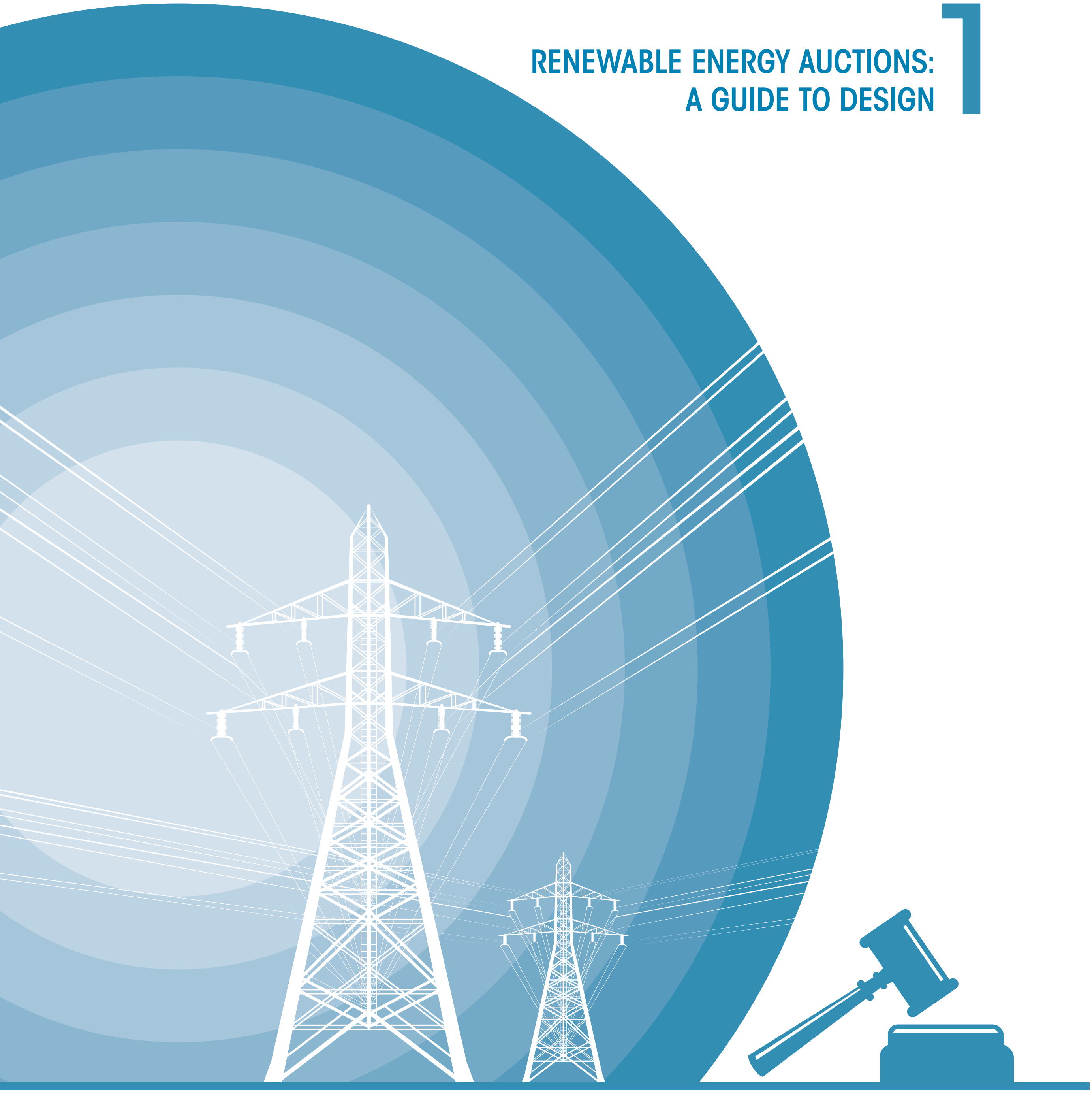

SUMMARY FOR POLICY MAKERS

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About IRENA

The International Renewable Energy Agency (IRENA) is an intergovernmental organisation that supports countries in their transition to a sustainable energy future, and serves as the principal platform for international co-operation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy. IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy, in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity. *www.irena.org*

About CEM

The Clean Energy Ministerial (CEM) is a high-level global forum to promote policies and programs that advance clean energy technology, to share lessons learned and best practices, and to encourage the transition to a global clean energy economy. Initiatives are based on areas of common interest among participating governments and other stakeholders.

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This guidebook comprises of six chapters and can be downloaded from *www.irena.org/Publications*.

SUMMARY FOR POLICY MAKERS

2015

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Acronyms

ANEEL	Agência Nacional de Energia Elétrica (Brazil)
BNEF	Bloomberg New Energy Finance
BNDES	Brazilian National Development Bank
CCEE	Câmara de Comercialização de Energia Elétrica (Chamber for Commercialisation of Electrical Energy, Brazil)
COD	Commercial Operation Date (or deadline)
CSP	Concentrated Solar Power
DEA	Danish Energy Authority
DEWA	Dubai Energy and Water Authority
DOE	Department of Energy (South Africa)
EIA	Environmental Impact Assessment
EC	European Commission
EPC	Engineering, Procurement and Construction
EPE	Empresa de Pesquisa Energética (Energy Research Company, Brazil)
EU	European Union
FEC	Firm Energy Certificates
FIP	Feed-In Premium
FIT	Feed-In Tariff
GDP	Gross Domestic Product
GNI/CAP	Gross National Income per Capita
IEA	International Energy Agency
IOU	Investor-Owned Utility
IPP	Independent Power Producer
kWh	kilowatt-hour
LCR	Local content requirements

MASEN	Agence Marocaine de l'énergie Solaire (Moroccan Agency for Solar Energy)
MEMEE	Ministry for Energy, Mines, Water and the Environment (Morocco)
MEN	Ministerio de Energía y Minas de Perú (Ministry of Energy And Mines of Peru)
MME	Ministério de Minas e Energia (Ministry of Mines and Energy, Brazil)
NDRC	National Development and Reform Commission (China)
NEA	National Energy Administration (China)
NERSA	National Energy Regulator of South Africa
NFFO	Non Fossil Fuel Obligation (UK)
NREAP	National Renewable Energy Action Plan
NREL	National Renewable Energy Laboratory
NSM	National Solar Mission (India)
PPA	Power Purchase Agreement
PROINFA	Programme of Incentives for Alternative Electricity Sources (Brazil)
PV	Photovoltaic
RAM	Renewable Auction Mechanism
REC	Renewable Energy Certificate
RPO	Renewable Purchase Obligation
RPS	Renewable Purchase Standard
REIPPP	Renewable Energy Independent Power Producer Procurement (South Africa)
TSO	Transmission System Operator
VGF	Viability Gap Funding
WTO	World Trade Organisation

Glossary

The following definitions reflect the nomenclature used by the International Renewable Energy Agency (IRENA) and are strictly related to the renewable energy industry; definitions used by other organisations and publications may vary.

Auction: Auctions refer to competitive bidding procurement processes for electricity from renewable energy or where renewable energy technologies are eligible. The auctioned product can be either capacity (MW) or energy (MWh).

Auction demand bands: Different categories within the total demand of an auction that require specific qualification requirements for submitting the bid (*e.g.* demand bands dedicated to specific technologies, project sizes, *etc*.).

Auctioned volume: The quantity of installed capacity (*e.g.* MW) or electricity generation (*e.g.* MWh) that the auctioneer is aiming to contract through the auction.

Auctioneer: The entity that is responsible for setting up the auction, receiving and ranking the bids.

Bid: A bidder's offer for the product awarded in the auction – most usually a power purchase agreement for the renewable energy generation or capacity.

Bidder: A physical or juridical entity that submits its offer in the auction process. Also referred as project developer, seller.

Levelised cost of electricity (LCOE): The constant unit cost of electricity per kWh of a payment stream that has the same present value as the total cost of building and operating a power plant over its useful life, including a return on equity.

Power Purchase Agreement (PPA): A legal contract between an electricity generator (the project developer) and a power purchaser (the government, a distribution company, or any other consumer).

Project developer: The physical or juridical entity that handles all the tasks for moving the project towards a successful completion. Also referred as seller and bidder, since the developer is the one who bids in the auction.

Off-taker: The purchaser of a project's electricity generation.

Overcontracting capacity: Contracting more capacity than the auction volume.

Underbidding: Offering a bid price that is not cost-recovering due to high competition and therefore increasing the risk that the projects will not be implemented.

Underbuilding: Not being able to bring the project to completion due to underbidding.

Undercontracting capacity: Contracting less capacity than the auction volume.

About the report

In 2013, IRENA carried out its first study on the topic, *Renewable Energy Auctions in Developing Countries*, which highlighted key lessons learned from developing countries that have implemented auctions, namely Brazil, China, Morocco, Peru and South Africa. The report presented an analysis on auction design options, as well as best practices on the implementation of auctions in the form of recommendations for policy makers. Furthermore, IRENA's *Adapting Renewable Energy Policies to Dynamic Market Conditions* report reiterated the importance of auctions in today's electricity markets.

Building on this work, the present guidebook assists policy makers in understanding the implication of different approaches to renewable energy auctions. Structured around four key design elements, it offers a range of choices and makes recommendations to facilitate optimal decision-making in a given context. The analysis focuses on potential challenges that need to be addressed, and the guidebook assesses alternatives that may be considered for each auction design element. Achieving objectives of renewable energy policies, such as cost-effectiveness, security of supply, and contributions to socio-economic development, among others, is thoroughly discussed. The guidebook presents the main trade-offs involved in decisions on auction design (*e.g.* between reduction of barriers to entry and discouragement of underbuilding, or between design simplicity and the ability to reflect exact preferences regarding the technology mix and spatial distribution of the renewable energy capacity to be contracted) and offers guidance on how to find an optimal balance that takes into account the objectives and circumstances of each jurisdiction.

The analysis is supported by specific country experiences, representing different contexts and circumstances, and offers lessons learned and best practices on how governments can design and implement auctions to meet their objectives. Divided into six chapters, this guidebook supports policy-makers in designing renewable energy auctions tailored to their needs.

Chapter 1 (Summary for Policy Makers) synthesises the findings and presents the main conclusions and policy recommendations for the design of auctions.

Chapter 2 (Renewable energy policies and auctions) contextualises auctions within the larger realm of renewable energy support schemes. It provides an overview of recent international trends in renewable energy policies, highlighting the role that auctions have been playing in many electricity markets worldwide. This analysis is complemented by an overview of the key strengths and weaknesses of auctions.

The next four chapters discuss different components that make up a renewable energy auction scheme, presenting analyses of past experiences and lessons learned. The key elements of auction design have been classified into four categories, each of them analysed in a separate chapter.

Chapter 3 (Auction Design: Demand) addresses design alternatives involving the auction demand, which comprises key decisions on what exactly is to be purchased in the auction, and under what conditions.

Chapter 4 (Auction Design: Qualification Requirements) analyses the qualification requirements to determine which suppliers are eligible to participate in an auction, as well as the conditions with which they must comply and the documentation required prior to the bidding stage.

Chapter 5 (Auction Design: Winner Selection) discusses design choices regarding the winner selection, which is at the heart of the auction process and involves handling the bidding and clearing rules, as well as awarding the winners' products.

Chapter 6 (Auction Design: Sellers' Liabilities) addresses the seller's liabilities, primarily associated with the characteristics of the product being auctioned, along with responsibilities and obligations stipulated in the auction documents.

The geographical scope of the work is global, as the recommendations from the guidebook could apply to all countries that are considering adopting auctions schemes. The report is focused on electricity, and mostly on solar and wind auctions.

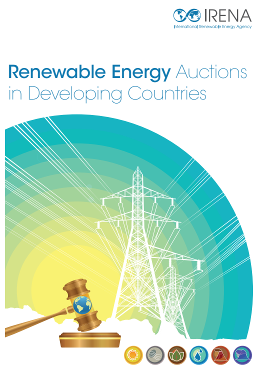
1 Summary for Policy Makers

A global energy transition is underway, with the reality of a sustainable energy system based on renewables beginning to emerge. As of today, 164 countries have set renewable energy targets and have adopted support policies to address market failures in an effort to help reach them[1]. These policies typically aim to promote the deployment of renewable energy while achieving broader development objectives, including socio-economic benefits such as income generation and job creation. Indeed, IRENA estimates that by the end of 2014, there were 7.7 million jobs worldwide in the renewable energy sector, excluding large hydropower[2].

1.1 TRENDS IN RENEWABLE ENERGY POLICY

Despite the extensive experience in policy design acquired over the past decade, the need to craft and implement tailored policies as well as learn from past experiences remains important in addressing prevalent barriers to renewable energy deployment. Recently, factors that influence policy-making have shifted dramatically. These include the rapid decline in the costs of renewable energy technologies, approaching grid parity and the growing share of variable renewable energy.

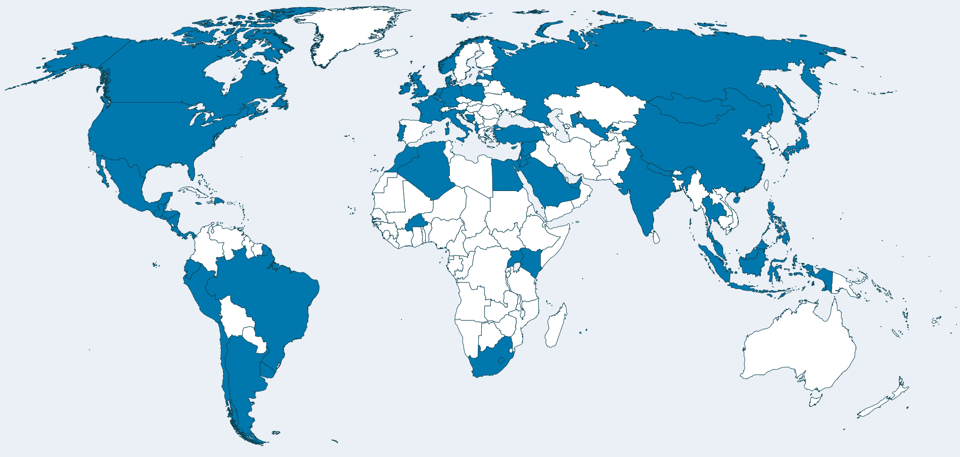
To account for these dynamics, support mechanisms need continual adaptation to maintain a stable and attractive environment for investments in the sector while ensuring the long-term reliability of the energy system in a cost-effective manner (IRENA, 2014a). In this context, auctions have become increasingly popular, often being the preferred policy – alone or in combination with other measures - to provide incentives to renewable energy deployment. The number of countries that have adopted renewable energy auctions increased from 6 in 2005 to at least 60 by early 2015 (Figure 1.1).



IRENA's 2013 report *Renewable Energy Auctions in Developing Countries* demonstrated the effectiveness of auctions in selected markets. Building on this work, IRENA has produced the guidebook, *Renewable Energy Auctions: A Guide to Design,* which analyses the different auction design elements and highlights best practices for policy makers and investors. This *Summary for Policy Makers* highlights the main findings and provides recommendations to guide decision-making on the design and implementation of auctions.

[1] *IRENA (2015), Renewable Energy Targets Setting*
[2] *IRENA (2015), Renewable Energy and Jobs – Annual Review 2015*

Figure 1.1: Countries that have implemented renewable energy auctions by early 2015 (in blue)



Source: Based on data from REN21, 2015

The designations employed and the presentation of material in this map do not imply the expression of any opinion on the part of IRENA concerning the legal status of any region, country, territory, or area, or concerning the delimitation of frontiers or boundaries.

1.2 STRENGTHS AND WEAKNESSES OF AUCTIONS

Renewable energy auctions are also known as "demand auctions" or "procurement auctions", whereby the government issues a call for tenders to procure a certain capacity or generation of renewables-based electricity. Project developers who participate in the auction typically submit a bid with a price per unit of electricity at which they are able to realise the project. The auctioneer evaluates the offers on the basis of the price and other criteria and signs a power purchase agreement with the successful bidder.

The increasing interest in auction schemes is driven by their ability to achieve deployment of renewable electricity in a well-planned, cost-efficient and transparent manner while also achieving a number of other objectives. The strengths of auctions lie in their i) flexibility, ii) potential for real price discovery, iii) ability to ensure greater certainty in price and quantity and iv) capability to guarantee commitments and transparency.

Flexibility. Auctions are flexible in their design, allowing the possibility to combine and tailor different design elements to meet deployment and development objectives. Therefore, one of the mechanism's strengths is its ability to cater to different jurisdictions reflecting their economic situation, the structure of their energy sector, the maturity of their power market and their level of renewable energy deployment.

Real price discovery. A key strength of auctions is their effectiveness as mechanisms of price discovery. A good auction design brings out the real price of the product being auctioned in a structured, transparent and, most importantly, competitive process. This addresses the fundamental problem of information asymmetry between the regulator (or any other entity responsible for determining purchase prices and support levels) and project developers. This is of particular relevance in the context of procurement of and support to renewable energy, given that these technologies are still evolving at a significant pace and also considering the development of local supply chains and the maturity of the market.

Greater certainty regarding prices and quantities. Auctions allow policy makers to control both the price and quantity of renewable energy produced by providing stable revenue guarantees for project developers (similar to the feed-in tariff) while at the same time ensuring that the renewable generation target is met more precisely (similar to quotas and tradable green certificates). Therefore, both investors and policy makers benefit from greater certainty on the future outcome of the policy.

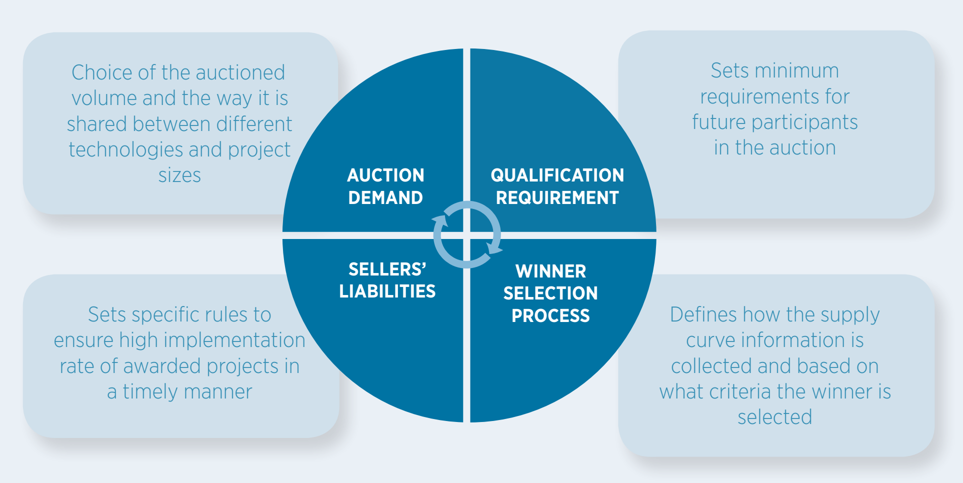
Commitments and transparency. Another feature of auctions is that they result in a contract between two entities that clearly states the commitments and liabilities of each party. This type of structure can offer greater regulatory certainty to investors, minimising the likelihood that their remuneration would be challenged in the future even as the market and policy landscapes change. Furthermore, by ensuring a transparent, fair, open and timely procurement process, an auction minimises the risk of market distortion and the possibility that the consumer would overpay for the product. However, auctions are normally associated with relatively high transaction costs, for both the bidders and the auctioneer, and with a certain risk of underbuilding and delays.

Relatively high transaction costs associated with the administrative procedures necessary to take part in the auction (*e.g.*, qualification arrangements) may constitute potential barriers to the participation in the bid, especially for small and/or new players, thereby reducing competition. Transaction costs incurred by the entity in charge of organising and holding the auction are also occasionally mentioned as a weakness of this scheme.

Risk of underbuilding and delays. Another potential weakness of auctions relates to underbuilding and delays in the construction. Overly aggressive bidding in the competitive environment of the auction can be traced to a variety of factors, from excessive optimism about the evolution of technology costs to the underestimation of financial consequences in case of project delays.

The extent to which each of the above-mentioned strengths and weaknesses will affect the results of any given auction depends largely on design choices (Figure 1.2) and how well adapted they are to the circumstances and specific country context of the auction. To increase deployment in a cost-efficient way and meet development

Figure 1.2: Categories of auction design elements



objectives, the auctioneer can tailor and combine different design elements, which can be categorised as the auction demand, the qualification requirements, the winner selection process and the sellers' liabilities (Box 1.1). Each of these categories and its constituent design elements are discussed in a dedicated chapter of this guidebook.

The potential of an auction to achieve deployment in a cost-efficient way is of particular relevance in the context of procurement of renewable energy, given that the technology is still evolving at a significant pace. For a successful auction, its design should ensure: i) increased competition among participating bidders in order to bring the prices down; and ii) that the participation in the auction is limited to bidders that have the capacity to implement projects at the contracted price in the given timeframe while contributing to the broader development goals.

1.3 INCREASING COMPETITION FOR A COST-EFFICIENT MECHANISM

The level of competition in the auction is determined by the diversity of technologies that can compete, the volume that is auctioned, and the level of participation of bidders in the auction. In addition, the prevention of collusive behaviour among bidders and the manipulation of prices need to be ensured, especially when the competition is limited, in order to maximise the cost-efficiency of the auction.

Diversity of competing technologies

The level of competition in the auction is initially determined by the diversity of technologies that can compete. In technology neutral auctions, different technologies compete among each other, which enables the deployment of the least-cost technologies. For instance, in Brazil, renewable energy technologies were competing

BOX 1.1: CATEGORIES OF AUCTION DESIGN ELEMENTS

The **auction demand** refers to the choice of the volume auctioned and the way it is divided between different technologies and project sizes. There are various arrangements - technology-neutral auctions or technology-specific auctions, and standalone or systematic auctioning schemes - that can define how the penetration of renewables in the generation mix will take place. Other considerations include the allocation of costs and responsibilities among different stakeholders (see Guidebook Chapter 3).

The **qualification requirements** determine which suppliers are eligible to participate in the auction, including the conditions they must comply with and documentation they must provide prior to the bidding stage. This category encompasses requirements related to reputation, equipment, production site selection, securing grid access, and instruments to promote local socio-economic development (see Guidebook Chapter 4).

The **winner selection process** is at the heart of the auction procedure, and it involves the application of the bidding and clearing rules, as well as awarding contracts to the winners. This category covers the bidding procedure, the requirements of minimal competition, the winner selection criteria, the clearing mechanism and marginal bids, and the payment to the auction winner (see Guidebook Chapter 5).

The **sellers' liabilities** are primarily associated with the characteristics of the product being auctioned, along with certain responsibilities and obligations stipulated in the auction documents. This category of design elements involves commitments to contract signing, contract schedule, remuneration profile and financial risks, nature of the quantity liabilities, settlement rules and underperformance penalties, and the delay and underbuilding penalties (see Guidebook Chapter 6).

directly with natural gas in 2011 and the price of wind energy was much lower than expected.

Auctions can also be limited to selected technologies (see Guidebook Section 4.2) to support their development or to reach specific renewable energy deployment. For example, auctions held under India's National Solar Mission focused on concentrated solar power and photovoltaic specifically. As such, India committed to a systematic auctioning scheme that promoted competition within each technology.

Apart from increasing competition, technology-neutral auctions reduce the risk of undercontracting due to the high level of participation of potential project developers in the bid. Technology-specific auctions have the potential to further reduce prices due to the resulting development of the technology, as well as provide additional guidance to developers. Table 1.1 highlights the impact of technology requirements on the outcome of the auction.

Table 1.1: Summary comparison of technology requirements

Criteria \ Options	Technology specific auctions	Technology natural auctions
Simplicity	Straightforward division of demand	Rules to compare different bidders competing in the same demand band
Guidance from auctioneer	Strict criteria for each category	Bidders are treated equally, with more relaxed guidance
Promotion of competition	Competition only within a single technology	Seeks the most cost-effective technologies
Avoided under contracting	Any of the sub-auctions might fail to attract bidders	High flexibility in matching bids to demand bands

Characteristics of the relevant attribute: *Poor* *Medium* *Very good*

Separating the auctioned volume in different products by imposing different qualification requirements is referred to as defining the auction demand bands (see Guidebook Section 3.1). In addition to segmenting demand by the type of renewable energy technologies, many other different criteria have been used, such as project sizes, locally manufactured versus internationally manufactured equipment *etc*. In India, for instance, a specific share of the total volume of photovoltaic auctioned is meant to be developed through locally manufactured equipment. Other auctions have defined demand bands on the basis of the generation profiles. In the Californian scheme (Box 1.2), for example, the auction demand is split into three different categories. Even though each category might favour specific technologies, a project can choose to participate in any of the bands defined: i) baseload electricity; ii) peaking electricity; and iii) non-peaking electricity. These auctions have resulted in a major representation of wind power in the non-peaking category and a total dominance of photovoltaic in the peaking group.

BOX 1.2: COMPETITIVE DEMAND BAND AUCTIONS IN CALIFORNIA

- Auction demand bands are defined according to the generation profile:
  i. Baseload electricity (*e.g.* biomass, biogas, geothermal)
  ii. Peaking electricity (*e.g.* solar PV, solar thermal)
  iii. Non-peaking intermittent (*e.g.* wind, smal hydro)
- The bands are competitive, since a generator car bid in any band.

Volume auctioned

Aside from determining the eligible technologies, the level of competition in the auction is also influenced by the volume auctioned. One of the challenges for the auctioneer is deciding on the number of rounds and the volumes to auction in each round. Auctioning a large volume at once allows for rapid capacity addition in economies that experience fast energy demand growth. However, it might result in a lack of competition, especially in markets with a small number of project developers. A case in point is South Africa's 2011 auction, where the first round was not very successful in enhancing competition, given that the volumes auctioned were not defined for the different demand bands. There was no capacity limit attributed to this first phase other than the 3 725 MW target for the entire programme (involving five rounds), which meant that demand far outstripped supply. In the second round, a volume cap was set, leading to strong competition and a reduction in prices.

The volume auctioned does not necessarily need to be fixed. Price-sensitive demand curves can be used to contract more than the minimum quantity required when the auctioned price is low, leading to optimal quantity and price (see Guidebook Section 3.2). This option is favourable when the cost of technology is changing at a fast pace and the government faces the risk of misestimating the price of developing projects (for example solar PV). In this case, the volume contracted can be increased from the initial plan. Price-sensitive demand curves may be defined, for example, by determining a total budget for renewable energy expansion which results in the auction demand being inversely proportional to the equilibrium price, as in the case of Netherlands (Box 1.3).

BOX 1.3: PRICE SENSITIVE VOLUME AUCTIONED IN THE NETHERLANDS

Auctions in the Netherlands are based on a well-defined annual budget since 2011 and they are technology-neutral. For each round, the government sets support levels that increase from one round to the next. In 2013, for example, these were 70 EUR/MWh (92 USD/MWh) for the first round, 80 EUR/MWh (105 USD/MWh) for the second round, 90 EUR/MWh (119 USD/MWh) for the third round*, etc.*

This way, low-cost renewable energy technologies are the first to submit their bids and be granted financial support, as the selection takes place on a "first come, first served" basis. Renewable energy technologies with higher costs can participate in subsequent bidding rounds, which are held until the maximum amount of the available budget has been allocated - EUR 1.5 billion in 2011 (USD 2.085 billion); EUR 1.7 billion in 2012 (USD 2.17 billion); EUR 2.2 billion in 2013 (USD 2.9 billion); and EUR 3.5 billion in 2014 (USD 4.655 billion) distributed over the lifetime of the plants. Therefore, bidders waiting for a higher remuneration level round risk having the auction's budget exhausted before reaching that round.

Level of participation of bidders

Reducing entry barriers for potential bidders and their perception of associated risk contribute to spurring competition by increasing the number of participants in the auction. Encouraging the participation of a large number of bidders also reduces the risk of collusion.

Reducing entry barriers

The auctioneer can increase competition by reducing barriers to entry for potential bidders. This can be done by: introducing qualification requirements and compliance rules that correspond to the conditions of the market; reducing administrative procedures and transaction costs; and providing timely and comprehensive information to bidders.

Imposing qualification requirements and compliance rules for the participation in the auction allows the auctioneer to restrict competition to bidders who have the capability to deliver the quantity of energy promised in the contract in a timely manner. However, if too stringent, these requirements could pose an entry barrier for small and/or new market players. In the case of the 2009 auction in Peru, strict compliance rules limited the participation in the bid to only 27 bidders (Box 1.4).

BOX 1.4: COMPLIANCE RULES AND DELAY PENALTIES IN PERU

In Peru's auction that started in 2009, bidders are required to deposit several guarantees, including a bid bond of USD 20,000/MW of capacity installed which is lost if the bid is won but the bidder fails to sign the contract. At a later stage, a performance bond of USD 100,000/MW of capacity installed is required.

If delays occur in the construction phase for two consecutive quarters, 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. 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 government 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.

Entry barriers can be reduced with the government's providing the needed resource assessments, feasibility studies and permits to the bidders, that reduce transaction costs. The auctioneer can also streamline administrative procedures by simplifying processes or setting up a one-stop-shop for collecting or submitting documents. For instance, responsibility of securing grid access and siting permits is normally undertaken by the government, such as in the case of France offshore wind auction in 2011. The auctioneer took on the responsibility of selecting the most appropriate site, including grid access and maritime permits, assisted in the logistical arrangements for the delivery of parts and set up a one-stop-shop for administrative procedures. The same approach was taken in the Danish offshore wind auction (Box 1.5).

Finally, the auctioneer must define fair and transparent rules and obligations for all stakeholders and any additional information or adjustments about the bid must be clearly communicated to all the competitors equally. This is crucial to encourage the participation of a higher number of bidders. For example, in South Africa, a conference is organised at the beginning of the auction and a dedicated website is set up that enables the government to communicate any changes to all market agents equally.

BOX 1.5: CENTRALISED PROJECT LICENSING IN DENMARK

Denmark is planning an auction for near-shore wind farm projects in which the government is responsible for selecting a large number of candidate sites, only a few of which will be contracted. Six near-shore sites compete in this first round to host a total of 350 MW (it is expected that three sites will be contracted).

The transmission system operator will carry out environmental impact assessments and conduct preliminary surveys for all six sites. These include geophysical and geotechnical surveys (wind, current, tidal and wave conditions). The surveys are planned in a way that the results are published before the completion of the tendering procedure, informing bidders of the conditions and risks of building at the sites. This considerably facilitates the work of project developers, encourages their participation in the bid and lowers their costs.

Reducing the perception of risk

In addition to addressing entry barriers, reducing investors' risk perception can contribute to increasing the level of participation. This can be done by ensuring that the demand-side responsibilities will be met (*e.g.* the reliability of the contract off-taker), by mitigating the risks related to the financial market (inflation and currency exchange) and increasing certainty and regularity in the way the auction rounds are scheduled.

At the outset, the government needs to ensure that the demand-side responsibilities will be met, by considering the reliability of the contract off-taker, the type of contracting scheme and the allocation of cost (see Guidebook Section 3.4). When the utilities are creditworthy, selecting them as the off-takers offers sufficient guarantees to project developers. Another potential off-taker could be the government itself.

In addition, the type of contracting scheme also affects the confidence of project developers. For example, investors' risk perceptions can be reduced by opting for a contract for engineering, procurement, and construction (EPC) of a power plant without the obligation to operate and maintain it over an extended period of time. Such a scheme was successfully implemented in Morocco for wind and hydro until 2010. Another contracting scheme could be to involve the government in the project's equity –such as in the Dubai solar power auction in 2014, where the Dubai Electricity and Water Authority (DEWA) has a mandated 51% equity share in the project. As for the allocation of costs, the selected design impacts the outcome in different ways. In most instances, the cost of the scheme is passed on to the consumers, and the risk perception usually depends on the credibility of the distribution companies and whether they have stable schemes in place to ensure collection of the consumers' payments. Table 1.2 summarises the benefits of each option.

Table 1.2: Summay comparison of cost allocation and contract off-taker

	Contract off-taker		**Allocation of costs**	
Options / Criteria	Independent entities: *e.g.* utilities	Government-backed contracts	Passed-through to consumers	Fully subsidised by the state
Investors' confidence	May have issues with credit-worthiness	Usually very credible	As long as tariffs are cost-reflective	As long as state companies are solvent
Simplicity	Experience in collecting tariffs	Greater bureaucracy	Utilities usually collect tariffs	Centralised payments

Characteristics of the relevant attribute: *Poor* *Medium* *Very good*

Investor confidence can also be enhanced through different methods of allocating financial risks related to exchange rate and/or inflation that can impact income throughout the contract period (see Guidebook Section 6.3). There are straightforward escalation clauses that can be used to reduce those risks. For example, in Chile, the auctioned contracts are denominated in US dollars and adjusted periodically according to the United States' Consumer Price Index– which implies that developers are shielded from both interest rate risks and inflation risks. A similar scheme is applied in Brazil, where contracts are nominated in Brazilian Reals but adjusted yearly for domestic price inflation. In contrast, in India, the contracts offered have so far been nominated in Indian rupees with no adjustment for inflation. These methods differ essentially in the risk allocation between consumer and project developer and as a result, in the price.

Finally, the use of systematic auctioning schemes increases investors' confidence by ensuring a commitment to an auctioning schedule with planned rounds. This option allows market agents to better adjust their expectations and plan for longer term. This, however, carries a risk of over commitment, in which case it may be possible to dynamically adjust the auction schedule and quantities according to perceived shifts in the market conditions. Another advantage of splitting demand into several auctions according to a long-term plan is the steep learning curve from the first few rounds, for both the project developers and the auctioneer. Box 1.6 shows the benefits of implementing auctions regularly in South Africa and India.

Preventing collusion and price manipulation

The most effective way of ensuring cost efficiency in an auction implementation is to steer competition. When competition is significant – with a large number of bidders with similar cost structures and risk preferences – opportunities for collusion decrease dramatically. Yet, when there is uncertainty in the number of participants in the auction or when achieving high competition is not possible, explicit measures may be adopted to prevent collusion and price manipulation.

Bidding procedure and payment to the auction winner

A well-chosen design of the bidding process (see Guidebook section 5.1) could make collusion more difficult. In general, policy makers should avoid revealing too much information on the auction demand. Attempts to prevent communication and exchange of information among bidders during the auction can also be made.

» Sealed-bid processes are straightforward and potential suppliers are required to provide their bid information directly to the auctioneer. Typically, offers are kept undisclosed until the day of the auction to prevent players from getting an advantage through privileged information. It makes the exchange of information and the explicit or tacit co-ordination among bidders more difficult. This is also the case in hybrid designs with a sealed-bid auction step.

BOX 1.6: REGULAR AUCTIONING SCHEME IN SOUTH AFRICA AND INDIA

South Africa and India have committed to a particular auction schedule and the experience seems to indicate a success of this strategy, as illustrated in Table 1.3.

In South Africa, the Renewable Energy Independent Power Project Procurement Programme was changed from a standalone tender to a rolling series of bidding rounds. The commitment to multiple rounds has had a significant impact in terms of building confidence among bidders and learning by doing. Between the first and second round, the number of bids received increased by 49%, the percentage of qualifying bids increased from 53% to 64% and the price dropped by 39% for photovoltaic and 23% for wind.

The National Solar Mission in India aimed to support the development of the solar power sector and committed to a systematic auctioning scheme. Between the first and second round, the total capacity offered in the bids increased by 100%, the percentage of projects installed in a timely manner increased from 89% to 100%, and the price dropped by 28%.

Table 1.3: Systematic auctions and the learning curve impact

Country	Renewable energy technology	First iteration	Second iteration	Learning curve impact
South Africa	Various	2011: 53% bids qualified	2012: 64.5% bids qualified	11% increase in bid qualification rate
India	Solar PV	2010: 12.16 INR/kWh	2011: 8.77 INR/kWh	28% decrease in contracted price

» Iterative processes, in contrast, allow bidders to only gradually disclose their bid information during the auctioning rounds. The most common way to implement this type of scheme is via a so-called descending clock auction. In the case of Brazil (see Box 1.7), the auctioneer proposes a new, slightly lower price in each round and the participants make their offers for the decremented price. This iterative process continues until supply and demand match. As such, this type of dynamic revision typically relies on information being disclosed by the auctioneer at every bidding round. If bidders have information on the supply-side quantity at each round, they can bid strategically in an attempt to end the auction prematurely and increase their own remuneration.

BOX 1.7: THE BRAZILIAN HYBRID AUCTIONS

In its auction process, Brazil has combined a descending-clock auction followed by a pay-as-bid round. The auctioneer iteratively decreases prices, collecting investor's quantity bids, until a point when overall supply is greater than demand by a certain factor, unknown to the bidders. After this, a sealed-bid auction takes place.

Table 1.4 summarises the impact of different bidding procedures on the outcome of an auction. By defining how the winner's remuneration is related to the bid price (see Section 5.5), policy makers can prevent participants from strategically bidding.

Table 1.4: Summary comparison of bidding procedures

Criteria \ Options	Sealed-bid process	Iterative process	Hybrid process
Simplicity	Straightforward	Requires gathering all the bidders	More difficult to implement and communicate
Transparency and fairness	Possibly opaque mechanism once offers are opened	Open real-time information	Ensured by the iterative phase
Bidders' ability to react	Information must be disclosed beforehand	Gradual disclosure of information, allowing agents to respond	Only during the iterative phase
Prevention of collusion and price manipulation	Undisclosed information makes bid coordination more difficult	Bidders may force the auction to terminate early	Second phase makes collusion more difficult
Matching supply and demand	Supply and demand curves fully known	Requires some assumptions for optimal results	Supply and demand curves fully known in the second phase

Characteristics of the relevant attribute: *Poor* *Medium* *Very good*

In pay-as-bid schemes, the bidders do not seek to simply win the auction, but rather to win it while submitting the highest possible bid – implying that estimating other players' bids plays an important role. In marginal pricing schemes, by making project developers' remuneration essentially independent from their bid price, bidders are encouraged to disclose their actual costs.

Ceiling price mechanism

The adoption of ceiling prices is aimed to prevent exceedingly high prices that could result from collusion. Although effective at maintaining the price below a given limit, determining the price ceiling can be challenging, as setting a price that is too low can adversely limit competition to big players (able to bid at prices lower than the ceiling). The auctioneer still needs to decide whether the ceiling price should be disclosed prior to the auction.

Full disclosure tends to involve a slightly greater degree of transparency, but may result in bids that are just below the ceiling price (in the case of limited competition). Maintaining the ceiling price undisclosed however, can result in disqualification of otherwise sound bids that are only slightly higher than the ceiling price. By introducing a ceiling price, there is an upfront acknowledgement of a risk that the auction scheme may not fulfil its intended role of achieving low prices and that, as a result, the auctioned volume will not be fully contracted (see Box 1.8).

BOX 1.8: PRICE CEILINGS IN SOUTH AFRICA AND INDIA

- In South Africa, the disclosure of the ceiling price combined with the lack of a strict volume cap resulted in high prices. The subsequent rounds, with undisclosed ceiling prices and well-defined volume caps, led to significantly lower prices.
- The intense competition in the Indian auction meant that the "anchoring" caused by the disclosed price caps was of little concern.

1.4 ENSURING THAT PARTICIPATION IS LIMITED TO BIDDERS THAT CAN SUCCESSFULLY MEET THE AUCTION'S GOALS

While auctions have been successful in triggering competition and ensuring cost effective renewable capacity additions, experience shows that certain design elements are essential to ensure that: i) participation is limited to bidders that have the capacity to deliver the quantity of energy promised in the contract in a timely manner; ii) the projects are selected in a way that fulfils the country's renewable energy deployment goals; and iii) socio-economic objectives can be reached. Such design elements include qualification requirements to participate in the bid, criteria in selecting the auction winner and rules that project developers must comply with after being selected.

Ensuring the successful development of the renewable energy project

Qualification requirements can be a means to ensuring that the bidders have the financial, technical and legal capability to develop the project. Once the winner is selected, compliance rules are important to ensure a timely development of the renewable energy projects. Imposing qualification requirements and strict compliance rules can help reduce the risk of underbidding. Such requirements have been successful in preventing speculative bidding in many jurisdictions. In the state of California, project viability requirements have been set to prevent speculative bidding and limit the participation to projects that can demonstrate economic viability, using information on developer experience, project location, interconnection studies and development schedule (Box 1.9).

Reputation requirements

Reputation requirements are generally associated with the information that must be provided regarding the bidding company, proving that it is adequately prepared to develop the project. These can include legal requirements, proof of financial health, agreements and partnerships and past experience requirements.

BOX 1.9: STRICT DOCUMENTATION REQUIREMENTS IN CALIFORNIA

The strict documentation requirements introduced in the Californian auction aim to:

- prevent speculative bidding;
- discourage participation of "concept only" projects;
- assess whether the price bid is realistic through the required information about site location, commercialised technology, and developer's experience.

Typically, having more constraining requirements allows the government to provide guidance and ensure a greater level of commitment by the project developer, although this could potentially hinder the participation of small players and/or new market entrants. Table 1.5 summarises the results that can be anticipated from the level of the strictness of the requirements. Box 1.10 discusses the reputation requirements for participation in Morocco's Concentrated Solar Power (CSP) auction in 2012.

Table 1.5: Summary comparison of reputation requirements

Options / Criteria	Strict reputation requirements	Lenient reputation requirements
Level of participation	Many potential bidders may be excluded	Lower barriers to entry
Transaction costs	Costs for bidders (gathering documentation) and the auctioneer (revising it)	Less bureaucracy
Project completion	Higher guarantees	Must rely on contractual penalties and liabilities
Guidance from Auctioneer	Control over companies' shareholding structure and disclosure of information	Very little control

Characteristics of the relevant attribute: *Poor* *Medium* *Very good*

Compliance rules

Stringent compliance rules are meant to ensure that, once the winners are selected, contracts will be signed, projects will be completed on time and the risk of under (or over) performance is reduced. They include bid bonds (see Guidebook Section 6.1); rules related to project lead times (see Guidebook Section 6.2); penalties for delays and underbuilding (see Guidebook Section 6.6); penalties for underperformance (see Guidebook Section 6.5); and the assignment of liabilities for transmission delays (see Guidebook Section 6.7).

BOX 1.10: REPUTATION REQUIREMENTS IN MOROCCO'S CSP AUCTION IN 2012

In Morocco's CSP auction in 2012, qualification requirements included proof of financial capacity, access to finance and technical experience. The lead of the consortium had to 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 had to have a net worth of at least USD 200 million.

As for the consortium's technical experience, the lead company had to have developed, operated and managed thermal power plant(s) 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 also had to have successfully developed and operated a minimum capacity of 45 MW thermal solar power plant without being liable for penalties or damages in performance or delay, in excess of 5% of the contract value.

A common concern of auctions is to what extent the project developer's bid is a binding commitment, since most liabilities are enforced by the power purchase agreement, which is not signed until after the auction is complete and the bidders are announced. Most auctions involve either: 1) no specific commitments at the bidding round; or 2) bid bonds, requiring bidders to provide an initial deposit that would be lost in case the selected bidder does not go through with signing the contract, as in the case of Germany (Box 1.11). Bid bond requirements reduce the risks that the winning bidder might not sign the contract, but they do not totally guarantee the bidders' reliability. Under specific circumstances, auction implementations with no bid bonds may be a reasonable choice as they are simpler to implement and more attractive to bidders.

BOX 1.11: BID BONDS IN THE GERMAN SOLAR AUCTION OF 2015-2017

In Germany's 2015-2017 solar auctions, each bidder must provide a bid bond worth EUR 4 (USD 4.47 at 2015 average exchange rate) per kW to be installed in order to be considered in the auction. This deposit is reduced to EUR 2 (USD 2.23) per kW if the bidder already has a building permit, as this eases the after-auction work and decreases the auctioneer's risk of not having a signed contract. Lowering the bid bond can also facilitate the participation of smaller players. The regulatory agency, Bundesnetzagentur, sorts the bids from the lowest to highest price, and projects are selected until the auction volume has been filled. Bids beyond the auction volume do not receive the right to remuneration for their output and get their bid bond back.

The lead time, i.e. the time given to project developers to complete the power plant before the contract begins, is a key attribute of renewable energy auctions. The degree of flexibility given to the auction winner can vary from the point that the tender documents are published to the point of contract signing. It is also possible to let bidders suggest desired lead time, taking this variable into account in the winner selection process (see Guidebook Section 5.3).

Having defined the time limit for project completion, the auction design can include elements to minimise the risk of delays and to ensure that projects are built according to the contractual schedule. Such elements include completion bonds, delay-specific penalties, clauses that determine the obligations during the delay period and contract resolution clauses. Particular attention has been given to such mechanisms due to delays in early and even some recent auctions, many of which reportedly associated with underbidding, as in the case of offshore wind in Denmark (Box 1.12).

BOX 1.12: PENALTIES IN DENMARK'S ANHOLT WIND FARM AUCTION IN 2010

The auction was designed to guarantee an installation of 400 MW of offshore wind within 20 months after the winner was announced. Bidders were incentivised to offer the lowest possible price as this was the only selection criteria. As such, strict penalties and non-compliance rules had to be applied to guarantee compliance with the schedule.

Delay time	Penalty
Up to five months	DKK 10 (USD 1.78) per MWh (around 1% reduction of the remuneration)
Between five and nine months	DKK 20 (USD 3.56) per MWh (around 2% reduction of the remuneration)
Up to one year	DKK 30 (USD 5.34) per MWh (around 3% reduction of the remuneration)
More than one year	DKK 400 million (around USD 71 million)

Note: Average 5.6 DKK/USD in 2010

If the winner chooses not to install the plant at all, the following fees apply:

Time to decide	Penalty
Up to five months from winning the contract	DKK 100 million (around USD 17.75 million)
Between six and twelve months	DKK 200 million (around USD 35.5 million)
More than one year	DKK 400 million (around USD 71 million)

In this specific auction, if the winner opted out within the first six months, the second winner could take over the contract and undertake the project within the same time frame, having an increased risk of running into penalties due to time pressure. This specification (not included in subsequent auctions), combined with high penalties for delays and a very strict time plan, resulted in low interest in the Anholt tender and a low competition level. A key lesson from this experience is that, while penalties can help to ensure project implementation, overly harsh limitations can reduce competition.

Once the project is completed, the commitments assumed by the project developer can be ensured through the inclusion of settlement rules in the design of the auction. When applied, these rules define how deviating from contractual obligations would affect the plant's remuneration. These design elements can address the following attributes: 1) frequency in assessing performance; 2) variation of contract remuneration based on over- or under-performance; and 3) revision of the quantity that was committed at the time the contract was signed.

Settlement rules are an important element of auction design primarily because of concern about perverse incentives, that might reward developers for systematically over- (or under-) estimating their generation expectations. Including settlement rules is a way of ensuring that the project developer's declarations of expected renewable energy generation are realistic and with commensurate remuneration. Brazil has implemented such sophisticated settlement rules described in Box 1.13.

BOX 1.13: BRAZIL UNDERPERFORMANCE PENALTIES AND OVER-PERFORMANCE COMPENSATIONS

In Brazilian auctions, the penalties for over- and underperformance vary depending on the renewable energy technology and the type of auction conducted. For new energy auctions, penalties for underperformance are calculated annually and in a cumulative manner every four years:

- Annual underperformance penalties are applied when the average annual generation is less than 90% of the contracted amount. In this case, the developer must pay either: 1) the product of the average spot price in that respective year and the quantity not delivered; or 2) the product of the contract price and the quantity not delivered, whichever is higher.
- Given the generation variability of some renewable energy technologies, a cumulative four-year performance assessment takes place. In this case, if the average four-year generation falls below the amount contracted, the developer must pay either: 1) the product of the average spot price of the four years and quantity not delivered; or 2) 1.06 times the contract price times the quantity not delivered, whichever is higher. The additional 6% over the contract price is a penalty for not delivering the contracted energy over the four years.

Upper limits are also established, so that any generation that surpasses the upper limit can be sold at the spot price. In the case of wind generation, the upper limit for the first year is set at 130%, for the second at 120%, for the third year at 110% and for the fourth year at 100%, after which the cycle is repeated.

There are different indicators to detect under- (or over-) performance. They can be related to capacity-oriented agreements, energy-oriented agreements or financial agreements, with different levels of associated risks (see Guidebook Section 6.4).

- Capacity-oriented agreements imply a commitment to install, maintain and operate renewable energy capacity only, with no obligation regarding the quantity of electricity generated, implying the allocation of risk to the buyer.
- Energy-oriented agreements represent a commitment to deliver a given amount of renewable energy, and they imply a more balanced risk allocation between project developers and the electricity buyer.
- Financial agreements represent a commitment to a certain generation profile and any deviations between the actual plant generation and the quantity committed in the contract must be settled at the electricity spot price. This implies that the project developer assumes the responsibilities associated with these deviations.

Ensuring that the renewable energy deployment goals are reached

Policy makers can limit participation in the auction to those projects that are aligned with the country's policies in reaching the renewable energy targets. Technological requirements can be imposed when specific renewable energy technologies are intended to be developed, and the project size requirements can be designed according to the deployment goals. Moreover, location constraints can be introduced to control the geographical distribution of renewable energy deployment, and grid access requirements can be enforced to ensure feasibility of integrating renewable generation into the system.

Technological requirements

The auctioneer can also define other technological requirements, in addition to selecting the technologies that can compete, such as specifications on the equipment used.

Imposing equipment specifications can help ensure that the sector will be developed using state-of-the-art technology and appropriate quality of components. In South Africa, for example, wind turbines had to be compliant with the international technical standard IEC 61400-1, while in Brazil, wind turbines had to be new with a minimum nominal capacity of 1.5 MW. The latter did not apply to domestically produced turbines, which could be smaller.

Project size requirements

Imposing constraints on the project size can take a form of an upper and lower bound which defines the range of installed capacity of individual projects.

Maximum and minimum size constraints can be desirable for different reasons. Implementing a minimum size constraint has the potential to increase the benefits of economies of scale and reduce the transaction costs associated with small projects, although potentially deterring the participation of small players. By contrast, a maximum size constraint can encourage the participation of smaller players (as it becomes more difficult for large projects to dominate the auction), increasing participation of bidders. In addition, small-scale renewable energy projects might sometimes be preferred as they tend to result in a better geographical dispersion, greater proximity to loads, and fewer concerns regarding environmental impacts.

In the case of Dubai, the trade-off between project size and economies of scale has been addressed by modifying the size of the project (Box 1.14).

BOX 1.14: TRADE-OFF BETWEEN MAXIMUM PROJECT SIZE AND ECONOMIES OF SCALE

In the 2014 project-specific solar auction in Dubai, the project was awarded at a very competitive price of USD 59.9 per MWh. By increasing the project size from 100 MW to 200 MW during ex-post negotiations, a further price reduction of the winning bid to USD 58.4 per MWh was possible.

Location constraints

Policy makers may add constraints regarding the sites to develop the renewable energy projects. In the absence of such constraints, project developers will select the highest-performing sites, thereby concentrating the development of renewable energy in resource-rich locations.

Imposing location constraints is usually intended to either achieve greater geographic diversity of projects, or to ensure proximity to the grid and/or loads, or to address other considerations. This can be done by introducing: i) location-specific demand bands (see Guidebook Section 3.1); ii) a "project location" component in the winner selection criteria (see Guidebook Section 5.3); or iii) a location requirement for the participating projects. For example, in the German solar PV auctions in April 2015, location requirements were introduced in order to avoid competition in the land usage between energy and food production (Box 1.15).

Grid access requirements

The consideration of grid access requirements as a precondition to participating in the auction is important to ensure the feasibility of integrating renewable generation into the grid. These requirements can take the following forms (ranging from more-lenient to strict): 1) no access permit is required to qualify to bid (auction winners obtain the permits after the auction); 2) an access permit is required before the auction, regardless of whether grid expansion or strengthening is required; and 3) an access permit is required before the auction, and only projects that do not necessitate grid expansion or strengthening are allowed to participate. One reason for including this

BOX 1.15: LOCATION CONSTRAINTS IN GERMAN SOLAR PV AUCTIONS

The large-scale construction of PV systems on arable land has been discouraged in Germany by the Renewable Energy Act since July 2010, and FITs are not offered to projects located in such areas. This resulted in the concentration of large PV systems on specific redeveloped brownfield sites or in the close vicinity of highways and railway lines. The German solar PV auction in 2015 specified that project locations will indeed be restricted to the areas already indicated in the Renewable Energy Act (brownfields). In the 2016 auctions, these restrictions will be made more flexible and the permitted project locations will include unproductive agricultural land.

requirement is that it generally takes less time to implement a renewable energy project than it does to build new transmission facilities. The possible advantages or disadvantages of each option are summarised in Table 1.6.

Ensuring socio-economic development through renewable energy deployment

In line with the country's overall objectives, policy makers can introduce design elements to maximise socio-economic benefits from renewable energy deployment. Usually these goals are reached either by imposing qualification requirements or by introducing a criteria in the winner selection process. For example, South Africa adopted both mechanisms to design its auction in a way that promotes job creation, local enterprise development, and empowerment of marginalised social groups and local communities.

Qualification requirements promoting socio-economic development

Qualification requirements to promote socio-economic development can be aimed at local industry development or local empowerment and employment.

To support the development of a nascent domestic industry, policy makers can include local content requirements that mandate foreign or domestic developers

Table 1.6: Summary comparison of grid access permit requirements

Options / Criteria	No grid access permit required	Grid access permit required, allowing participation of projects that demand grid expansion/ reinforcement	Grid access permit required, constrained to projects that do not demand grid expansion/ reinforcement
Avoided risk of delays	The access permit must be obtained afterwards	Possible delays due to grid expansion	Safest option as both the grid and the grid access permit available
Simplicity	Less bureaucracy and transaction costs	Additional complexity in selecting auction winners	Complex and costly process to provide permits to all bidders
Level of participation of bidders	Lower entry costs and transaction costs	Wider variety of projects accepted	More restrictive in terms of options

Characteristics of the relevant attribute: *Poor* *Medium* *Very good*

to source a certain share of equipment or a portion of overall costs from local manufacturers or producers. Table 1.7 shows the implementation of local content requirements in selected countries. It is important that such requirements are applied with other design elements that support the development of a local industry. For example, certainty and regularity in the way the auction rounds are scheduled gives market agents the right signal for long term investments.

Careful policy consideration is needed with regard to designing and implementing local content requirements. They should be time-bound and accompanied by measures to facilitate the creation of a strong domestic supply chain and a skilled workforce.

In conclusion, having more constraining requirements allows the auctioneer greater opportunities for guidance and ensures a greater level of commitment, but often at the expense of cost efficiency and potentially detering prospective bidders.

Table 1.7: Local content requirements in auctions

Jurisdiction	Year	Description
Brazil	2009	To qualify for subsidised loans by the Brazilian Development Bank (BNDES) under its FINAME programme, wind turbine makers participating in auctions were initially required to get 40% of components from Brazilian suppliers, rising to 60% in 2012. From 2013, manufacturers have to produce or assemble at least three of the four main wind farm elements (*i.e.* towers, blades, nacelles and hubs) in Brazil. This policy has led to the rapid growth of a domestic supply chain.
Quebec (Canada)	2003	In the 1 GW wind auction, a local content requirement was set of 40% (first 200 MW), 50% (next 100 MW), and 60% (remaining 700 MW).
	2005	A second auction of 2 GW required 60% local content requirement.
	2010	60% local content requirement.
China	2003	50% local content requirement and counted for 20% of bid evaluation.
	2005	70% local content requirement and counted for 35% of bid evaluation.
	2006	Wind power equipment manufacturers were required to participate in the bid, individually or part of a consortium.
	2009	The requirements on local content were abolished. By 2012, four out of the top ten manufacturing companies were Chinese and they accounted for 27% of the total market share.
India	2014	PV auction of 375 MW with local content requirement .
South Africa	2011	Wind auction requirement of 25% local content, which the government aims to raise step-by-step to 45% (first bid submission phase), 60% (second phase), and 65% (third phase). For solar PV, the local content requirement rose from 28.5% under the first round to 47.5% in the second.

Multi-criteria selection process

Another mechanism to promote socio-economic development in a renewable energy auction is the introduction of additional criteria in the comparison of bids. This is similar to introducing "soft" qualification requirements, as bidders who meet the desirable qualities regarding the socio-economic impact receive bonuses for the purpose of bid comparison. For instance, it is possible to offer a bonus to projects that use locally manufactured equipment, rather than introducing local content requirements. Such a mechanism has been implemented in South Africa (Box 1.16).

Other jurisdictions have adopted multi-criteria bid evaluation methods in order to create different incentives. The French auction starting in 1996 used a compound winner selection criteria to reach cost efficiency, location and technological diversity and research and development support (Box 1.17).

BOX 1.16: COMPOUND WINNER SELECTION PROCESS IN SOUTH AFRICA

The project selection criteria was based on a 70/30 split between price and economic development considerations in the South African auction.

Socio-economic development factors were used as eliminatory requirements in the qualification phase by setting thresholds for different indicators, such as local content, job creation and ownership. In the selection phase, the bids were "graded" according to their degree of compliance with each of the economic development features, based on a target level for each variable. Ten points were awarded for achievement between threshold and target levels, and an additional ten points for achievements above the target level.

For instance, in the job creation criteria, a fraction of 18% of skilled black employees is the minimum to pass the qualification phase, but the target used in the second phase is 30%. Similarly, the minimum share of employees that must belong to local communities must be 12%, but a share of 20% guarantees the highest grade in the second phase. In parallel, the value of local content spending has a minimum of 25% but a target of 45% guarantees the highest grade, and so forth.

Furthermore, the risk of underbidding decreases by introducing additional criteria in the comparison of bids, thus decreasing the price weight such as the case of China (Box 1.18).

BOX 1.17: COMPOUND WINNER SELECTION CRITERIA IN FRANCE

In the French auction, the price has always been an important criterion in the selection of the winners, but not the only one. The French government emphasised a mix of factors such as the cost efficiency of production, research and development support, local benefits and emergence of new technology. Therefore, the bids were evaluated based on the following criteria: electricity purchasing price per kWh; economic advantages of the project; long-term benefits of the chosen technical solutions; technical and financial reliability; environmental aspects; contribution to research and development; and local stakeholder opinion.

Compound winner selection may result in other priorities being met, but may sacrifice price efficiency. Some evidence of this can be found by comparing the prices resulting from wind auctions held around the same time in France and the UK. The French auction resulted in an average price of 0.052 EUR/kWh compared to 0.047 EUR/kWh in the UK where the electricity price was the only criteria for bid selection. It should also be noted that in the French case it was the first auction round whilst in the UK's case it was the fourth round.

BOX 1.18: AVERAGE-PRICE CRITERION IN CHINA'S PROJECT-SPECIFIC AUCTIONS

In the third wind power auction in 2005 in China, the contribution of price to the final score was reduced to 40% and to 25% in the 2006 auction.

In its fifth wind power auction in 2007, the price criterion, still accounting for 25% of the bid score, was redesigned to benefit the bid closest to the average (highest and lowest bids being excluded). This mechanism was adopted as a protection against adventurer bidders who might not be able to honour the contract and to discourage bidders from offering below-market prices.

Although this scheme was successful in limiting underbidding, it disregarded the most competitive bidders (*e.g.* the ones with higher technology productivity) to the benefit of the those closer to the average price. Consequently, the average price achieved in the 2007 auction was approximately 12% higher than in the previous auction.

1.5 POLICY RECOMMENDATIONS

Renewable energy auctions play an important role in the new generation of policies due to their ability to support deployment while increasing transparency and fostering competition, resulting in lower prices. Auctions are flexible in their design, allowing the possibility to combine and tailor different design elements to meet deployment and development objectives. Therefore, one of the mechanism's strengths is its ability to cater to different jurisdictions reflecting their economic situation, the structure of their energy sector, the maturity of their power market and their level of renewable energy deployment.

Renewable energy auctions have gained popularity as an instrument to support renewable energy deployment and have been adopted by more than 60 countries by early 2015, up from 6 in 2005. They have become increasingly successful and sophisticated in their design and many lessons can be learnt from the vast pool of country experiences in terms of attracting a large number of players, increasing competition and ensuring lower costs. While designing auctions, policy makers may want to consider the following recommendations:

Account for trade-offs between different design elements

When selecting design elements, policy makers should carefully consider the inherent trade-offs between potentially the most cost-effective outcome and other objectives.

In defining the **auction's demand**, ambition for a greater role of renewables in the energy mix must be weighed against cost-effectiveness.

- When the objective is to develop a specific technology, policy makers may want to select a *technology-specific auction* – one of the ways of defining "*exclusive demand bands*". If the goal is minimising costs, a *technology-neutral auction* can be introduced, allowing competition between technologies, therefore favouring the more mature and cost-competitive ones.
- When the objective is to meet urgent capacity needs while retaining flexibility in holding auctions, policy makers may auction the total volume at once through a *standalone auction*. If the objective is to further enhance investors' confidence for a most cost-effective outcome, the total volume auctioned, if considerable, can be divided into different rounds in a *systematic auctioning* scheme, with a cap on the volume auctioned in each round. This facilitates long-term planning by policy makers, bidders, and equipment suppliers, which may be beneficial to the country's renewable energy industry and to the grid planning.

In establishing the **qualification requirements,** there is a trade-off between reducing entry barriers to encourage competition and discouraging underbuilding.

- Allowing the participation of a large number of bidders while ensuring that they can successfully deliver the project requires a careful selection of qualification requirements. While the requirement for an extensive track record in the field, for example, can help ensure timely project completion, it may also limit the participation of new and/or small players.
- Specific renewable energy deployment goals can be reached through qualification requirements, such as technological requirements, project size requirements or location constraints. Although they can lead to desirable outcomes, they may increase the contracted price, as developers need to adapt their projects to these requirements.
- If the objective is to also meet broader development goals, policy makers can include additional selection criteria. Local content requirements, for example, can support the local industry, job creation and other socio-economic benefits. Such requirements are most effective when aligned with other design elements, such as a long-term auction schedule, and applied with other supporting policies.

While a simple **winner selection process** provides greater transparency, some degree of complexity may have to be implemented to ensure that the objectives of the country are achieved by the auction.

- If the objective is to reach the lowest price using a simple and straightforward procedure, policy makers can choose to adopt the classical *minimum-price criteria* for the selection of a winner. However, other objectives can be achieved by incorporating non-monetary criteria, such as socio-economic benefits, location, developer's experience *etc*. This may, however, result in higher prices and a more complex mechanism.

- When the main objective is to ensure cost effectiveness, policy makers can also set a ceiling price above which bids are not considered. However, if the ceiling price is not calibrated properly, there is a risk that a suboptimal amount of renewable energy will be contracted, as it could lead to the outright rejection of certain perfectly reasonable bids. Experience has shown that keeping the price ceiling undisclosed can help increase the cost effectiveness of the scheme but at the risk of disqualifying potentially good projects that are just above the ceiling. Disclosing the ceiling price in auctions where competition is not fierce, might result in equilibrium prices right below the ceiling.

In determining the **sellers' liabilities** in the contract, there are various ways to allocate risks between the project developer, the auctioneer and the contract off-taker, including financial, operational and project implementation risks. The over allocation of risks to developers impacts the level of participation of bidders and ultimately the contracted price.

- In order to limit the risk of delays and underbidding, policy makers can enforce stringent compliance rules, but at the expense of increasing transaction costs, which in turn may limit the participation of bidders and also result in an increase in price.
- Developers might be subject to risk, but they should not be subject to uncertainties. The risk allocated should be clearly communicated, transparent, fully quantifiable, and enforced. Protecting possible bidders against uncertainties is key to gaining their confidence.
- The auctioneer should ensure that the compliance rules and penalties included in the auction are enforced.

Ensure transparency to increase developers' confidence

Attracting bidders is key for the success of an auction. Transparency, simplicity and the developers' perception about the fairness of the process increase investors' confidence.

- The auctioneer must define fair and transparent rules and obligations for all stakeholders. Any information or adjustments about the bid must be clearly communicated to all competitors equally (dedicated website, conference at the start of the auction, *etc*.). Policy makers need to consider evaluating the process at the end of each round as it is important to factor lessons learned into the design of the following rounds.
- Administrative procedures should be simplified, streamlined and facilitated when possible (permits, grid connections, *etc*.). Setting up a one-stop-shop could help minimise transaction costs and efforts of the bidders, preventing delays in project implementation. Also, the time, humanpower and skills needed to evaluate bids have to be carefully estimated.

- Policy makers should minimise the investors' perceived risk through an institutional and regulatory framework that ensures a predictable and stable environment for investments. A good auction design is not enough in a market in which the level of scepticism is high and the credibility of the auctioneer is in question.

Tailor the design of auctions to the specific context

There is no "one-size-fits-all" formula for successful auctions. Different design elements should be selected and combined in a way that is tailored to meet the goals of the auction, according to the country's specific requirements and characteristics. While determining which auction design best fits the specific context, policy makers should take the following types of constraints into account: those arising from the macro-economic conditions (local and global), the characteristics of the power sector, and the inter-dependencies between design elements.

All the design elements, examples and other recommendations are analysed and illustrated in this study on *Renewable Energy Auctions: A Guide to Design*.

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