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Accelerating the Transition to Clean Energy Technologies

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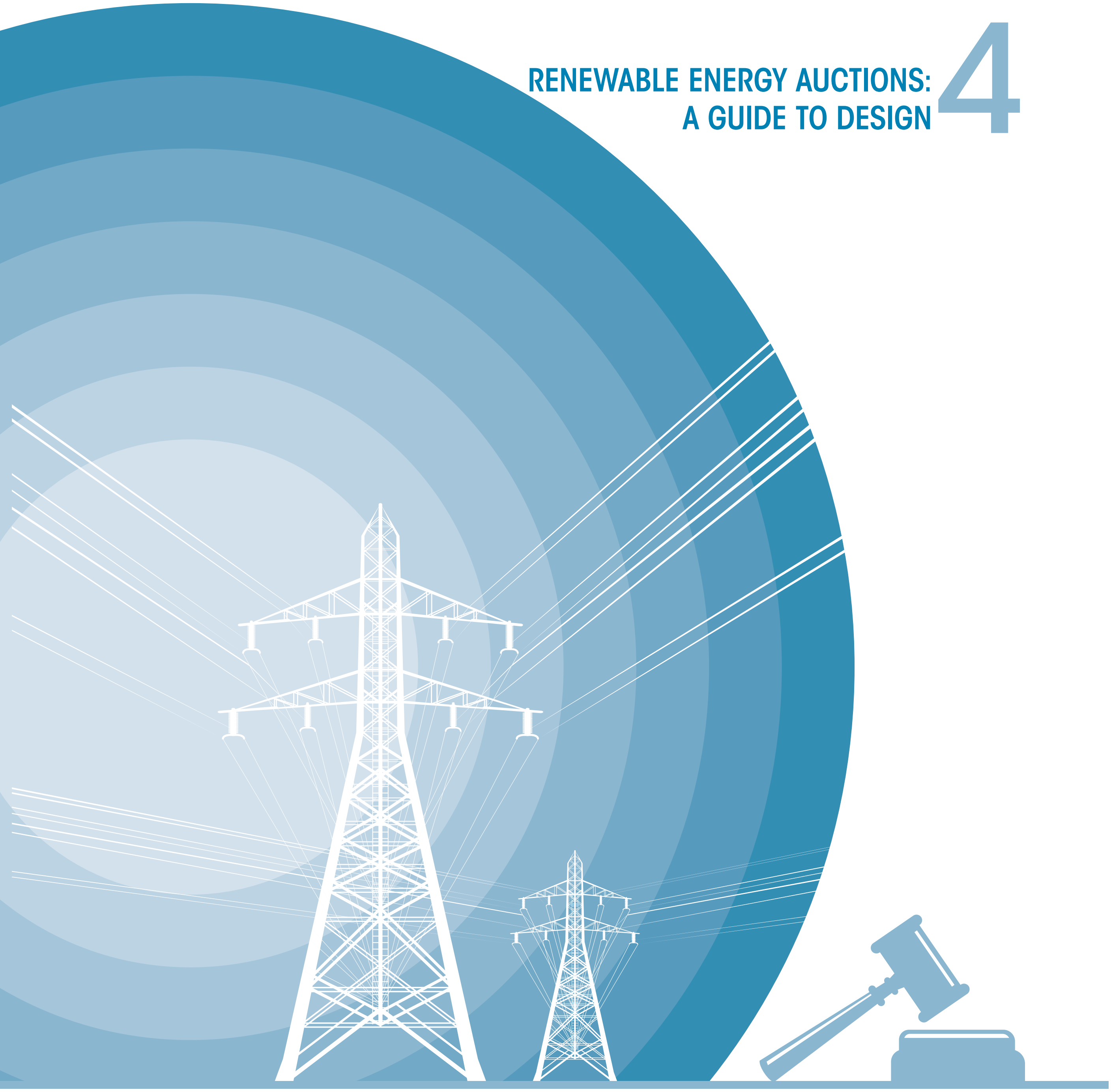
RENEWABLE ENERGY AUCTIONS: A GUIDE TO DESIGN 4



AUCTION DESIGN: QUALIFICATION REQUIREMENTS

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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.*

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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.

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 Organization

4 Auction design: Qualification Requirements

Qualification requirements determine which suppliers are eligible to participate in the auction, including the conditions they must comply with and the documentation that they must provide prior to the bidding stage. This category encompasses requirements related to: 1) *reputation*, which relates to the capability of the bidding company to develop the project; 2) *technology*; 3) p*roduction site selection;* 4) *securing grid access*; and 5) *instruments to promote local socio-economic development.*

In general, having stricter requirements allows the government greater opportunities for guidance and ensures a greater level of commitment by the project developer. In the U.S. state of California, qualification requirements have mainly been used to prevent speculative bidding, as detailed in Box 4.1.

Qualification requirements are very useful in mitigating the risk that the companies will engage in "adventurous" bidding without necessarily having the capability to deliver the project, a known challenge in auction implementation. However, this comes at the cost of magnifying another common challenge: high transaction costs and a tendency to alienate (and ultimately exclude) smaller players that may be unable to comply with the stringent conditions. This has the undesired side effect of reducing competition at the auction. Even if smaller players could theoretically comply with the stricter requirements, the resulting transaction costs can be an issue not only to bidders (who must procure the necessary documentation), but also to the auctioneer (who must validate and catalogue this information). Ultimately, these conflicting interests must be balanced when selecting harsher or milder qualification requirements. Figure 4.1 summarises the different types of qualification requirements for renewable energy auctions, which are further developed in the chapter.

4.1 REPUTATION REQUIREMENTS

Reputation requirements relate to the documentation that must be provided about the bidding company itself, proving that it has the adequate capacity to develop the project. Although reputation requirements can vary considerably, they typically can be categorised as: 1) *legal requirements*, which are more administrative in nature; 2) *proof of financial health*, which serves to indicate that the company is able to take the project to completion; 3) *agreements and partnerships*, which involves documenting third-party involvement in the project; and 4) *past experience requirements*.

BOX 4.1: STRICT QUALIFICATION REQUIREMENTS IN CALIFORNIA'S AUCTION

In California, the three large investor-owned utilities (IOUs) have set project viability requirements to prevent speculative bidding in the state's Renewable Auction Mechanism (RAM). The set requirements aim to discourage the participation of "concept-only" projects "that have not been sufficiently vetted for economic viability, permitting risks, interconnection costs, and development schedule." For example, 100% site control is required (through either direct ownership or lease), and previous experience with project development is relevant. The IOUs also are responsible for evaluating whether the bids are suitable for each particular project, using information provided by the bidders on project location, commercialised technology, developer experience, interconnection studies and the development schedule.

A large number of projects are screened during each bidding round, and many are considered unsuitable for participating in the auction. In the first round, half of the projects were rejected for failing to demonstrate the ability to meet the required commercial operation deadline (COD) of 18 months, based on the IOUs' assessment of the interconnection studies and schedules of milestones submitted with the offer. For this reason, the COD was revised to 24 months. As a result, the percentage of projects disqualified for this reason dropped significantly in subsequent bidding rounds (see Table 4.1). Another reason for rejecting projects was the failure to provide conforming documentation to support the offer. Table 4.1 shows the number of projects allocated to one of the three California IOUs that have not passed the qualification stage in the four RAM rounds. Although it is difficult to evaluate whether the RAM qualification requirements are overly stringent based on these results alone, the fact that the percentage of projects screened out for COD decreased after the first round demonstrates a learning by doing process.

Table 4.1: Number of offers passing the auction qualification stage for a Californian IOU

	RAM 1	RAM 2	RAM 3	RAM 4
Number of offers	92	142	130	126
Offers screened out for COD	45	22	16	30
Offers screened out for other reasons	1	7	21	16
Total projects screened out	46	29	37	46
Percentage of projects screened out	50%	20%	28%	37%

Figure 4.1: Overview of the different types of qualification requirements

Reputation requirements

Usually based on the following information regarding the bidding company itself:

- Legal requirements
- Proof of financial health
- Agreements and partnerships
- Past experience requirements

Socio-economic development instrument

Maximising the socio-economic benefit through:

- Empowerment and employment requirements mainly focused on the local community
- Local content requirements - aimed to promote the local industry

Technological requirements

Supply-side constraints:

- Renewable energy generation source
- Equipment specifications
- Project size constraints

Production site selection

The following aspects must be defined

- Site selection responsibility
- Location constraints
- Site documentation requirements

Securing grid access

Defines how the physical access to the electric grid will be ensured

Legal requirements

Legal requirements are never fully absent from auction procedures, since a minimum amount of documentation that uniquely identifies the bidder and proves its compliance with local laws will always be necessary. Additional requirements specific to each auctioning procedure may involve, for example, instructions on how bidding consortia must be registered, and, potentially, constraints to participation depending on the company's ownership and shareholding structure. In Chilean auctions, for example, a specific-purpose company must be formed in order to participate in the bidding process.

Proof of financial health

Proof of financial health involves documentation on the company's financial situation, proving that it is capable of completing the project, and that it is at least able to shoulder the liabilities rather than simply declaring bankruptcy in case it is unable to deliver (see Section 6.6). A requirement of minimum net worth is typically used to this end, although different countries have used different metrics. In Chile, for example, the bidder's credit rating (published by a reputable company) must meet minimal requirements, while in Morocco, developers need to prove their financial capacity. Also loosely related to the company's financial health are the up front deposits typically required prior to the bidding stage, which are meant to ensure the bidder's commitment: the bid bond (usually refunded once the contracts are signed; see Section 6.1) and the completion bond (see Section 6.6).

Agreements and partnerships

Agreements and partnerships refer to the requirement that the bidders disclose not only partner companies participating in the bidding consortium, but also service providers and other contractors for the project. Most commonly, this involves revealing the identity of the manufacturer of renewable energy equipment so that the auctioneer can verify its reputation. In South Africa, for example, bidders have been required to prove the reliability of their suppliers, and in China's 2006 wind power auction, the equipment manufacturer was required to have a stake in the bidding consortium as a way to develop a local manufacturing industry (see Section 4.5). Another possible arrangement would be to require information, for example, on the lending companies financing the project, which would effectively require the developer to secure financing upfront, before it obtains its power purchase agreement (PPA).

Past experience requirements

Past experience requirements imply that the bidding company or consortium must prove its competence by indicating that it has successfully completed similar projects. These can range from lenient to constraining and specific. Box 4.2 illustrates the case of Morocco, where strict requirements regarding past experiences are implemented.

BOX 4.2: PAST EXPERIENCE REQUIREMENTS IN AUCTIONS: THE CASE OF MOROCCO

The first stage of tendering for solar power in Morocco is a pre-qualification stage, in which participants must comply with strict requirements in order to participate in the tender itself (the second stage). For example, in the solar auction organised in 2011 by the Moroccan Agency for Solar Energy (MASEN), qualification was based on assessment of the following criteria relating to past experience:

- Past experience in developing tendered solar projects: the bidding company must have developed and operated solar thermal power plants with a minimum capacity of 45 MW, which must have been won in a past bidding process. Furthermore, this project must not have been liable for penalties or damages for delays or underperformance in excess of 5% of its contract value.
- Past experience with thermal power projects: the bidding company must have developed, operated and managed thermal power plants in the last ten years totalling at least 500 MW, including a minimum capacity of 100 MW in the last seven years.

These strict qualification requirements represented a strong barrier to entry for many project developers, as only large and experienced companies with resources to participate in the auction were able to qualify. Ultimately, MASEN received only 12 bids for its first auction. Furthermore, the demanding conditions resulted in two-thirds of the received bids being disqualified in the pre-qualification round. Only 4 out of the 12 applications went on to the second stage, which may have limited competition.

In contrast, in Brazil the emphasis is on technical documentation with less strict past experience requirements (see Box 4.3).

BOX 4.3: PAST EXPERIENCE REQUIREMENTS IN AUCTIONS: THE CASE OF BRAZIL

For project developers to participate in auctions in Brazil, they have to fulfill a number of technical requirements, such as obtaining a prior environmental licence, a preliminary grid access authorisation, in addition to financial qualifications. However, there are no past experience requirements. The qualification requirement stage is highly standardised and fully automated (web-based), being tailored for each technology. For example, the steps to register for a solar PV and wind A-5 auction organised in 2014 were as follows:

- Project registration at the regulator (ANEEL)
- All technical data concerning the project must be entered on the Empresa de Pesquisa Energetica (EPE) website
- Environmental licence
- Studies and reports on environmental impact
- Grid access authorisation
- For solar PV auctions, PV modules and inverters must be new and their electrical behavior must be in accordance with the grid procedures
- Certification of solar/wind metric data and annual energy production
- The certifying company must not be a shareholder, directly or indirectly, and must not be responsible for the development of the project
- Official documents proving the right to use the land
- Participants' net worth must be at least 10% of the project's estimated investment cost

As illustrated by the list above, qualification requirements in the Brazilian auctions relate mostly to grid access authorisation (see Section 4.4), site documentation (see Section 4.3) and technology-specific requirements (see Section 4.2). The relatively loose reputation requirements mean that the Brazilian auctions are more inclusive, and have likely allowed a higher rate of projects to pass the qualification stage (as illustrated in Table 4.2). Furthermore, because qualification requirements almost never change from one auction to the next, a project that has been qualified once is likely to succeed in qualifying for subsequent auctions if it does not win.

Table 4.2: Results in the qualification stage of the Brazilian New Energy Auction in 2014

	Bidders interested in participating in the auction		**Bidders qualified to participate in the auction**	
Renewable energy source	Number of projects	Volume (MW)	Number of projects	Volume (MW)
Wind	763	18 760	557	14 155
Solar PV	224	6 068	179	4 872
Small hydro plants (<30 MW)	30	526	25	412

Sources: (Elizondo-Azuela, Barroso et al., 2014), (Maurer, Barroso, 2011).

Main findings

More recent auctions usually implement minimum requirements to ensure that a bidding company is financially, technically and legally capable of developing the project. However, there is less consensus about how strict these requirements should be. Brazil, for example, requires little reputation-related documentation beyond standard legal compliance and a minimum net worth, whereas Morocco and California have adopted more stringent requirements in their auctioning schemes.

The trade-offs involved in adopting stricter or more lenient requirements tend to be very similar for each of the reputation requirements discussed in this section. For this reason, the main strengths and weaknesses of reputation requirements can be described using a single category of possible implementations, as summarised in Table 4.3.

Table 4.3: Summary comparison of reputation requirements

Criteria \ Options	Strict requirements	Lenient requirements
Level of participation	Many potential bidders may be excluded	Lower barriers to entry
Reduced transaction costs	Costs for bidders (gathering documentation) and the auctioneer (reviewing documents)	Less administrative burden
Ensured project completion	Higher guarantees	Must rely on contractual penalties and liabilities
Guidance from the auctioneer	Control over companies' disclosure of information	Very little control

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

4.2 TECHNOLOGICAL REQUIREMENTS

Technological requirements that must be met by the project developer include: 1) the choice of *renewable energy generation source*; 2) *equipment specifications*, which impose certain constraints on the equipment to be used; and 3) *project size constraints*, which indicate the minimum and maximum scale to which projects must conform.

Renewable energy generation source

The choice of renewable energy generation source is generally driven by government-mandated targets. It is typically an essential part of the auction, as some degree of specification is needed to distinguish the auction's renewable energy focus from conventional electricity generation. In practice, the easiest way to implement this is by listing each of the generation sources that may participate in the auction individually. In multi-technology auctions, separate demand bands are often introduced for the different renewable energy generation sources (as described in Section 3.1), although some auctions allow for direct competition among the various technologies.

Sometimes, the renewable source is further broken down into sub-categories, such as technologies that have different technical and economic characteristics. It is common, for example, to distinguish between onshore and offshore wind, as well as between solar thermal and solar PV. In India's 2010 solar auction, a distinction was even made between thin film and crystalline silicon solar PV panels; although these two classes competed against each other in the auction, thin film panels were made exempt from the local content requirement (see Section 4.5). Similarly, bioelectricity is often classified according to fuel, such as biogas, biomass from urban and rural residue. In general, all of these specifications are viable options – although stricter technology requirements may limit the number of potential bidders, reducing competition.

Equipment specifications

Equipment specifications aim to ensure that the country's renewable resources will be developed using state-of-the-art and quality equipment – *e.g.*, requiring certification and compliance to international standards. Adopting equipment specifications is a relatively mild (and less invasive) alternative to having the auctioneer verify the equipment supplier's reputation during the qualification process (see Section 4.1 on Agreements and partnerships), as it requires only the seller's commitment to ensure compliance of the equipment. In South Africa, for example, wind turbines were required to be compliant with the international technical standard IEC 61400-1, while in Brazil, wind equipment was required to be new and to have a minimum nominal capacity of 1.5 MW (except domestically produced generators, which could be smaller).

In general, explicit equipment specifications are most useful when generators are partially or fully shielded from risks (see Section 6.4), since project developers may not always have optimal incentives to adopt state-of-the-art technologies. If equipment specifications are too stringent, however, this could lead to an undesirable increase in transaction costs and limit competition among equipment suppliers. For example, requirements on renewable energy generation equipment may translate into documentation requirements for the equipment supplier (see Section 4.1) and/or specific requirements regarding domestic manufacturing (see Section 4.5).

Project size constraints

Project size constraints refer to how the total installed capacity for individual projects must remain within an upper and lower bound defined in the auction. In California, for example, projects were required to be between 3 MW and 20 MW (the lower bound was raised from the originally proposed 1 MW), whereas in India's 2011 solar auction, projects were between 5 MW and 20 MW (the upper bound was increased to 50 MW in the 2014 auction). Project size constraints are strongly related to the number of projects that are approved by the auction – and therefore, they have implications for the level of competition in the auction procedure (see Section 5.2).

Both maximum and minimum size constraints can be desirable for different reasons (see Box 2.8 on the relationship between project size and renewable energy support policies). A minimum size constraint can be justified as a way to limit the associated administrative work (*e.g.,* separate contracts must be signed for individual, small projects). In addition, small projects can reduce the benefits of economies of scale. On the other hand, implementing a maximum size constraint can encourage the participation of smaller players, as it becomes more difficult for large companies to dominate the auction, and it can also mitigate environmental concerns (as in the case of the pilot PV auctions in Germany). Another side benefit of having multiple winning projects when the maximum project size is small is that the country could benefit from a "portfolio effect" – reducing the risks of projects not coming online on time or at all.

A potential impact of imposing maximum and minimum project sizes is that project developers may have to choose sub-optimal configurations to exploit a given renewable resource. This is most noticeable in the trade-off between maximum project size and economies of scale. In the 2014 solar auction in Dubai, for example, the entirety of the auction demand was awarded to a single bidder at extremely competitive costs, and by increasing the contracted amount from 100 MW to 200 MW, it was possible to reduce the winning bid even further (from 59.90 USD/MWh to 58.40 USD/MWh). The benefits of economies of scale also were visible in the 2010 wind auction in Uruguay, where even though the project size requirement was set between 30 and 50 MW, all three winning projects had a capacity equal to the upper limit.

Main findings

Renewable energy auctions normally specify which renewable energy generation sources are allowed to participate; some auctions are exclusive to a single technology while others allow for the participation of multiple technologies (sometimes involving separate technology bands, as described in Section 3.1). A summary comparison of the requirements related to the renewable energy generation sources is provided in Table 4.4.

Equipment specifications tend to have smaller impact on the outcomes of the auction overall, as long as specifications are not too strict. Finally, imposing minimum and

Table 4.4: Summary comparison generation source requirements

Criteria / Options	Choice of renewable energy generation source	
	Technology-specific auctions	Technology-neutral auctions
Guidance from the auctioneer	Supports the development of selected technologies	Tends to favor more mature technologies
Cost-effectiveness	Competition only within a single technology	Seeks the most cost-effective technologies
Simplicity	Straightforward quantity goals	Criteria is defined to compare technologies

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

maximum size constraints are another common requirement that can lead to desirable outcomes – although they may also limit the price reductions achievable from the auctions, as developers may need to adapt their projects to these requirements. A summary comparison of the different technological requirements related to equipment specification and project size constraints is provided in Table 4.5.

Table 4.5: Summary comparison of equipment specifications and project size requirements

Criteria / Options	Equipment specifications		Project size constraints	
	Strict requirements	Lenient requirements	Strict requirements	Lenient requirements
Guidance from the auctioneer	Can ensure usage of top-of-the-line equipment	Bidder will select most cost-effective options	Can control minimum and maximum size	Tends to favor large-sized projects
Level of participation	Might exclude some participants	Lower barriers to participation	Might exclude some participants	Lower barriers to participation
Cost-effectiveness	More limited options for manufacturers	Bidder will select most cost-effective options	May force suboptimal configurations	Bidder will select most cost-effective options

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

4.3 PRODUCTION SITE SELECTION AND DOCUMENTATION

Another category of important requirements relates to production site documentation. From a design standpoint, the most important elements to consider are: 1) who is responsible for the task of *site selection* (usually either the government or the project developer); 2) *location constraints*, which are conditions related to the geographical distribution of the renewable energy projects; and 3) *site-specific documentation requirements*, which the project developers must comply with prior to the auction.

Responsibility for site selection

The default choice in the design of renewable energy auctions is to assign the project developer the responsibility of evaluating candidate sites and selecting the most suitable one. However, there are several instances in which the auctioneer (usually, the government) assumes this responsibility instead. One important upside of this is that it can drastically reduce the costs for bidders, as they do not need to invest in collecting the relevant documentation, carrying out resource assessments and studying grid connection options for each candidate production site. This may also facilitate the licensing procedure itself, which can be critical in bringing the projects online in time. In the early renewable energy auctions in the United Kingdom this was a major problem that kept projects from being finalised.

A potential weakness of making the auctioneer responsible for site evaluation, however, is that government-selected projects can be less attractive than the portfolio that would be formed by several competing companies. In addition, companies can be more agile than the state in selecting and evaluating new sites. This is especially valuable when there is a constant need for a steady stream of new renewable energy projects.

Schemes in which the auctioneer assumes responsibility for site selection are often associated with project-specific auctions *(i.e.,* auctions in which each production site is allocated its own demand band; see Section 3.1). Even though this type of auction is exclusive in principle, it usually facilitates the participation of a larger number of bidders because the government takes more responsibility for site selection and documentation, reducing the time and resources that each bidder needs to commit. Egypt has adopted such a scheme in its wind auction in 2014 that resulted in record low bid prices. However, there are also schemes in which multiple government-selected sites compete for a limited demand, such that only a fraction of the production sites identified by the government would be contracted in the auction procedure. Examples of this alternative can be found in Brazil and Denmark (see Box 4.4).

It is also relevant to note that, if a long-term auctioning schedule is in place (see Section 3.3), a company that fails to win a particular auction may use the documentation already gathered to participate in future rounds. As a consequence, the costs incurred by potential bidders in preparation for the auction are not necessarily irrecoverable.

BOX 4.4: CENTRALISED PROJECT LICENSING IN BRAZIL AND DENMARK

Brazil

Since the inception of its electricity auctions in 2005, Brazil has adopted a special scheme for selecting large hydropower projects. Although for most generation technologies, production site selection is carried out by the project developers, in the case of large hydro plants, the government assumes this responsibility. This is largely due to the higher complexity of the necessary technical and environmental studies, which involve negotiations with different levels of government (multiple uses of water are regulated by various agencies and often involve municipal and state governments as well as the federal government).

The auction scheme was designed under the notion that the government would provide a steady stream of new hydro projects to be auctioned, such that the overall supply of project sites would be systematically greater than the total demand for projects. This would result in competition between project sites, and only the most promising locations would be selected. Sites not selected would remain available for subsequent auctions. However, due to the lack of sufficient human resources and a complex (multi-institution) licensing process, the government has not been able to provide enough projects to be auctioned, becoming a limiting factor to large hydropower expansion in the country.

The Brazilian experience illustrates that, although allocating the responsibility for site selection to the government might ease the project developers' work and decrease costs, it may not lead to the best results if all responsible entities are not properly equipped to meet this challenge. At the same time, there does not seem to be an easy solution to this conundrum, as project developers too would have difficulties in carrying out the complex procedures for environmental licensing of large hydro plants.

Denmark

Similar to the Brazilian model, Denmark is planning an auction for near-shore wind farm projects in which the government is responsible for selecting candidate sites, only a few of which will be contracted. The first such tender is planned for 2015, with operation starting by 2020. A broad majority in the Parliament made the decision that six near-shore sites (all of which located a minimum of 4 kilometres from the shore, and each with a capacity of up to 200 MW) will compete in this first auction round to host a total of 350 MW; thus, it is not expected that more than three sites will be contracted in this round.

The transmission system operator will carry out environmental impact assessments (EIAs) and conduct preliminary surveys for all six sites. These include geophysical and geotechnical surveys, EIAs and MetOcean surveys (wind, current, tidal and wave conditions). The preliminary surveys have been planned so that the results are published before completion of the tendering procedure, informing bidders of the conditions and risks of building at the sites. As with Brazil's large hydropower auctions, the Danish government has a strong role in the organisation of the auctions, considerably facilitating the work of project developers and lowering their costs.

Sources: (Maurer, Barroso, 2011); (Danish Energy Agency, 2013).

Location constraints

In auction designs where the project developers are responsible for site selection, "location constraints" refer to the extent to which the developers are free to choose their production sites. Renewable energy auctions can be either location-agnostic or location-specific (with project-specific auctions representing a particular type of location-specific schemes).

Under location-agnostic schemes, the project developer is responsible for finding a suitable production site. Because there is no guidance in the selection of a potential location, project developers are incentivised to find the highest-performing sites. Although attractive in principle, this type of mechanism tends to concentrate the development of projects in resource-rich locations, which can have unintended consequences. For example, the grid infrastructure might not be able to integrate such large capacity into the system, or residents in regions with a high concentration of new installations may develop "not in my back yard" (NIMBY) sentiments. Finally, this would result in uneven distribution of economic activity, and less-viable regions may have less opportunity to reap the economic benefits from renewable energy deployment. Therefore, policy makers have good reasons to try to minimise the concentration of new renewable energy development to specific areas.

One way of tackling this issue is by introducing location constraints on renewable energy project, usually aiming either to achieve greater geographic dispersion of projects, or to ensure proximity to the grid and/or loads. Location constraints can be introduced in the form of location-specific demand bands (see Section 3.1), or alternatively, by incorporating a "project location" component in the winner selection criteria (see Section 5.3). Wind auctions in Uruguay have chosen the latter option (see Box 4.5).

Location constraints can also be introduced in order to avoid competition in the land usage between the energy production and food production (IRENA, 2015b). Large solar ground mounted systems, for instance, are usually restricted to unusable land. In the case of Germany, the large-scale construction of PV systems on arable land has been discouraged 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 also 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.

When considering the issue of location constraints in auction design in a given jurisdiction, a possible issue of interest is whether projects that are physically located in another country are eligible for participation (*i.e.,* representing a cross-border

BOX 4.5: LOCATION-DEPENDENT ELEMENTS IN URUGUAY'S WIND AUCTIONS

Although the location constraint was not explicitly stated in the wind farm auction organised in Uruguay in 2013, the auction design highlighted the potential trade-off between the wind regime and the cost of connection to the national grid – two of the most important location dependent attributes.

- For the resource potential, one of the technological requirements in the auction referred to the plant utilisation factor, which had to be at least 30%. If this requirement is not met, a penalty is applied for the underproduction, as defined in the contract. Therefore, even though site selection is the responsibility of the project developer, it is essentially restricted to areas with a favourable wind regime. In practice, however, economic incentives likely played a much greater role in directing site selection. At a price of around 85 USD/MWh, a utilisation factor of 40% doubles the internal rate of return of the project, compared to a 30% utilisation factor (for a given investment cost). Project developers detected some areas with capacity factors of over 35%.
- The cost of connecting the plant to the national grid was incorporated in the evaluated bid price, serving as a secondary locational price signal. This is especially relevant in cases when several plants share a connection, as the costs for its construction can be split. In practice, however, the connection costs of the winning bids did not exceed 2% of the total price offered.

Source: (Mercados Energeticos Consultores, PSR, 2013).

supply resource). There have been recent discussions about whether cross-border resources are eligible to participate in capacity adequacy mechanisms in Europe (Henriot, 2014). Although these discussions are ongoing and no clear guidelines have been established so far, the topic of cross-border resource participation in renewable energy auctions is increasingly relevant, and policy makers should be aware of several important issues (see Box 4.6).

Site-specific documentation requirements

Site-specific documentations are required mainly in the situation in which the selection of the site falls in the project developer's responsibility and they can have a significant impact on the bidder's transaction costs. Although most auction mechanisms require some degree of site-specific documentation, the strictness of this requirement varies substantially among implementations. Some of the most common documentation requirements include proof of land-use rights, building permits, detailed construction plans, environmental and water licences, and renewable resource measurement records.

On the one hand, strict requirements imply a greater degree of commitment by the project developer and thus tend to reduce the likelihood that the project will be delayed or fail to come online. Because more information is known beforehand,

BOX 4.6: PARTICIPATION OF CROSS-BORDER RENEWABLE GENERATION RESOURCES: THE CASE OF EUROPE

A key issue with cross-border participation in auctions is compatibility with the strategic goals of a local renewable energy policy. For instance, if the priority is to develop a local industry, then allowing cross-border participation may not be desirable, since the resources to develop projects will be directed to other countries. On the other hand, such participation is not necessarily in conflict with goals, such as emission reduction, as the imported electricity would still displace local conventional generation.

Once the desirability of cross-border participation is evaluated, its feasibility should be assessed. An important requisite to ensure commercial feasibility is that the participation of cross-border resources does not result in double counting (which is relevant from the perspective of meeting renewable energy goals) or double remuneration (*i.e.,* preventing payments for generation – particularly those targeted specifically at renewable plants – from two jurisdictions simultaneously). Double remuneration would make projects appear more competitive, leading to inefficiencies in selecting auction winners.

Measuring the amount of renewable energy delivered to the jurisdiction where the auction is held is also important. Alternatively, the measured energy (considered for the purposes of clearing the contract awarded) could correspond to the energy delivered at the terminal of an interconnector. For example, the product contracted in the auction could be considered as energy imports backed up by renewable generation in the country in which the generator is located. It may be necessary to verify to what extent the energy delivered in the buying country is effectively backed up by the production of the contracted renewable energy. Exchange of information between the system/market operators may be required to enable this verification. Creating channels for information exchange and designing auction rules to prevent perverse incentives may result in additional costs for the buying country and in additional complexity of auction design. Difficulties may arise if the trading and measurement intervals used in the two countries do not coincide.

Assessing physical feasibility is also important while considering the participation of cross-border resources in auctions. One means to guarantee that enough cross-border transmission capacity will be available is to require selling generators to acquire the necessary transmission rights for the interconnection between the two countries. One challenge that may arise, however, is a mismatch between the duration of the transmission rights[1] and that of the contract awarded through the auction. Constraints to trading may also arise when scarcity conditions prevail in the country in which the generator is located. If local demand has priority over exports, when scarcity occurs this can result in discrimination between local and cross-border contracts[2]. This may be particular important if renewable energy development is seen as being critical to ensuring security of supply.

[1]*Depending on the nature of the seller's obligations and on the policy objectives of the buying country, either physical or financial transmission rights may be required. The differentiation of these instruments is beyond the scope of this guidebook and are discussed in detail in Batlle, Mastropietro and Gómez-Elvira (2014).*

[2]*In the EU, Directive 2005/89/EC introduces provisions to prevent such discrimination, by establishing that "[..] Member States shall not discriminate between cross-border contracts and national contracts" (EU, 2006). The extent to which this provision is effective is discussed in Batlle, Mastropietro and Gómez-Elvira (2014), where it is argued that scarcity events may be eventually categorised as force majeure.*

speculative bidding is minimised. Furthermore, when the project developer is responsible for selecting production sites, providing the government with more information on the project's future generation profile can be helpful for system planning purposes.

On the other hand, less-stringent requirements can play an important role in reducing auctions' transaction costs, both for the auctioneer and for the bidder (see Box 4.7). This is mostly relevant for unsuccessful bidders who otherwise would end up committing substantial resources in vain. This issue may be mitigated when there is a long-term auction schedule (see Section 3.3), as unsuccessful bidders may participate in subsequent auctions using the same documentation. Less-stringent site-specific requirements can also be more attractive to bidders who do not wish to disclose certain information (such as resource measurement records).

Main findings

Most renewable energy auction schemes in which the responsibility of selecting production sites falls on the government represent project-specific schemes – including China, Denmark, Dubai and Morocco, among others. The guidance provided by the auctioneer has the potential to substantially reduce bidders' transaction costs. However, the most common design choice seems to involve project developers selecting their own production sites (as seen in Brazil, India, South Africa), requiring a fair amount of site-specific documentation. Although including such requirements can deter the participation of bidders, they have many advantages as shown in Table 4.6.

Table 4.6: Summary comparison of site-specific requirements

Criteria / Options	Site-specific documentation requirements	
	Strict	**Lenient**
Reduced transaction costs	Costs for bidders (gathering documentation) and the auctioneer (reviewing it)	Less administrative burden
Avoided delays	Documentation already prepared	Documents may need to be procured after the auction
Level of participation	Potential bidders may be excluded	Lower barriers to entry

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

BOX 4.7: LESS-STRINGENT DOCUMENTATION REQUIREMENTS IN PROJECT-SPECIFIC AUCTIONS IN DENMARK

Increasing the share of wind-based electricity production is a high priority for the Danish government. Denmark commissioned its first offshore wind farm back in 1991, prior to most other countries, and this early start has allowed the country ample time to refine and adapt its support scheme for offshore wind. Because the government plays a strong role in the project-specific auction, this transfers much of the risk from the project developer to the authorities, limiting the developer's risks to those related to project implementation (delays, technology price changes, *etc*). Moreover, the documentation requirements in the qualification phase are rather lenient, since the government is responsible for pre-evaluating and selecting candidate sites. In the qualification phase, participants only need to prove their financial and technical capability to finance the wind farm's construction and operation.

When the concession is awarded to the successful bidder, the Danish Energy Agency (DEA), which is the national authority for renewable energy as well as the competent authority for offshore wind projects, provides the following:

- Licence to carry out preliminary investigations
- Licence to establish offshore wind turbines
- Licence to exploit wind power for 25 years, with the possibility of this being prolonged
- Approval for electricity production in compliance with electricity legislation.

The grid connection to the shore is also guaranteed (see Section 4.4), including the offshore platform which is designed, built and operated by the Danish system operator Energinet, with all costs covered. Energinet also has a proactive role in providing information on the site. In addition, the DEA is responsible for undertaking the environmental impact assessment (EIA) (this responsibility was assumed by the winner of the auction in earlier rounds). However, the DEA reserves its right to cancel the auction in case the EIA cannot be obtained or if the auctions prices are deemed too high.

As a result, both the risk premium and the cost of capital were greatly reduced in the latest auction held in early 2015. In addition, the time between the auction and the actual contracting was also reduced, resulting in more accurate price estimations on main components and services. The benefits have contributed to the winning price level for the 400 MW Horns Reef III being as low as DKK 0.77 per kWh (0.117 USD/MWh[i]) for 50 000 full load hours, representing the lowest price level in Europe for offshore wind.

In the Danish auction, the system is designed in a way that ensures that the best locations are utilised first. This is considered to be especially suitable for expensive offshore wind and is seen as a good tool for a small country like Denmark, which has limited opportunities to increase offshore capacity. However, this approach requires specific expertise from the DEA.

[i] *At an exchange rate of 6.6 DKK/USD, compatible with the exchange rate in early 2015 approximately.*

Sources: (Winkel et al., 2011), (Del Río, Linares, 2014), (Danish Energy Agency, 2009), (Danish Energy Agency, 2013), (IEA Wind, 2014).

Many different types of location constraints have also emerged, reflecting a wide array of different concerns – including network congestion and expansion costs (as in Uruguay) and land use considerations (as in Germany). In particular, several jurisdictions have also expressed an increasing concern with the high geographic concentration of renewable energy projects at the most suitable sites, which may pave the way for stricter location guidelines in the future.

A summary comparison of the different location constraints alternatives presented in this section is provided in Table 4.7.

Table 4.7: Summary comparison of location requirements

	Responsibility for site selection		Location constraints	
Options / Criteria	**Government**	**Project developer**	**Location-agnostic auction**	**Location-specific auction**
Guidance from the auctioneer	● May promote more uniform dispersion	○ Projects tend to be concentrated in selected sites	○ Projects tend to be concentrated in selected sites	◕ Control over which locations are acceptable
Investors' confidence	● Bidders do not spend resources on site searching	◔ Costs of seeking suitable sites	◔ Costs of seeking suitable sites	◑ Slightly more focused search
Effectiveness of site selection	◔ Site evaluation may be slow/ bureaucratic	● Evaluation carried out by many developers	● A wide range of candidate sites compete	◕ Evaluation restricted to a specified area

Characteristics of the relevant attribute: ○ *Poor* ◔ ◑ *Medium* ◕ ● *Very good*

4.4 SECURING GRID ACCESS

Physical access to the electric grid is an essential requirement to ensure the feasibility of integrating renewable generation into the network and allowing energy transactions to succeed. Conditions for grid access relate to several other topics addressed in this guidebook, such as the determination of the auction demand at each location and at each possible point of connection of candidate projects to the grid (see Section 3.1), the choice of contractual lead times, especially in cases where expansion of the grid may be required to access renewable energy resources (see Section 6.2), and the establishment of specific liabilities of the seller (see Section 6.7). This section focuses on access to transmission and distribution networks (the grid) as a qualification requirement for renewable energy auctions, briefly discussing how different design alternatives for this requirement may influence the topics listed above[3].

An access permit is an official document that entitles a project to connect to the electricity grid and to feed energy into it, starting at a date defined in the document and eventually conditioned to items such as grid strengthening or expansion. Due to the highly technical profile of grid operation activities and the need to evaluate the systemic impacts of integrating new generation, the issuing of an access permit by an administrative body that has competence over grid operation (*e.g.*, the transmission or distribution network operator) is required before the start of a project's commercial operations – but not necessarily before an auction. This permit may specify that the generator's access to the grid can occur only after certain activities are undertaken to expand the grid capacity (or strengthen existing grids) to levels required to accommodate the power output of the project. If such grid intervention is required, the entity liable for implementing these activities must be clearly defined.

Considering the above, the qualification requirements regarding grid access can take the following forms, ranging from more-lenient to strict: 1) *no access permit is required for qualification*, which enables auction winners to obtain the permits only after the auction; 2) *an access permit is required before the auction, but projects that necessitate grid expansion or grid enforcements are allowed to participate*; 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*.

No grid access permit required

The option of not requiring access permits for qualification, and thus allowing auction winners to obtain the permits only after the auction, is a design choice that decreases the workload of the administrative bodies responsible for issuing the access permits. This is because only auction winners will have to engage in the administrative process required to obtain the permit.

Grid access permit required, qualifying projects that necessitate grid expansion

Requiring that a grid access permit be obtained before the auction, and as a qualification requisite for participation, is a common design choice for renewable

[3] *There are other relevant aspects of the access to and use of the transmission and distribution grids, besides securing access to the public service networks, that will not be addressed here. For instance: the responsibility for the implementation of connection facilities (from the generation site to the public network); and the commercial treatment of any curtailment of the output of projects due to network constraints. These items are more generally related to the coordination of generation and transmission expansion and not solely to auctions in particular.*

energy auctions. This is largely because it generally takes less time to implement a renewable energy project than it does to build new transmission facilities – which can be relevant when the renewable energy potential to be developed is located far from the existing grid. Moreover, evaluating the technical feasibility of connecting a project to the grid before the auction takes place can provide developers with important information about any required grid expansion or strengthening before they prepare their offers and commit to delivery within the auction process. Because the access permits are typically administrative in nature, they serve as risk mitigation instruments for project developers when acquired prior to bidding.

Whenever project delivery lead times are compatible with the time required to execute grid expansion activities, allowing generators whose grid access is conditioned to grid expansion to participate in the auctions may result in opportunities for more-efficient contracting. In this case, generators whose access to the grid will be feasible only after the construction of new grid facilities (which can be pursued up to the time of product delivery) receive access permits and qualify for the auction.

However, allowing these generators to participate may result in additional complexities in the winner selection process. For example, in the case where two projects have almost identical technical and economic characteristics, except that the first requires costly network reinforcements to allow it access to the grid, and the second does not, selecting the second project may be preferred. One option would be to somehow specify the allocation of transmission infrastructure costs in order to create economic signals for the co-ordination of generation and transmission expansion within the winner selection process.

To co-ordinate the expansion of generation and transmission, it is possible to: (1) use a procedure for the allocation of network infrastructure costs that assigns to each project a portion of the costs of grid reinforcements required for power evacuation; and (2) ensure that these costs allocated to the project, through transmission access charges, are internalised by the investor in the bids. If the costs are properly internalised into bids, the winner selection process will result in the choice of the projects that result in the most efficient expansion of both the generation and the transmission systems. While defining the procedures for the calculation and application of grid access charges, it is recommended to define the conditions for their updating in a way that reduces the exposure of the project developers to fluctuations of the charges to the extent possible. These charges ultimately aim at guiding project siting decisions and changing them frequently after projects are built and already sited may significantly increase the risk perceived by project developers while bringing little benefits in most situations.

The above-mentioned recommendations should be evaluated, however, in light of other auction design goals that may have priority in a given jurisdiction. For instance, a certain pattern of spatial distribution of projects may be desired for social or political reasons and would require that projects imposing higher costs to grid expansion are built.

Another notable issue is that, under this design choice, the entity responsible for grid expansion (the transmission system operator, the central planning agency or other agents) can determine the auction demand and its segmentation among different substations of the grid. Introducing the right incentives for this entity to plan and implement grid expansion in an efficient and pro-active manner, based on prospective information on renewable energy potentials, is a demanding task for the regulator and for policy makers (see Section 6.7).

Grid access permit required, limited to projects that do not necessitate grid expansion

A safer design choice is to constrain the set of qualified projects to those that do not require any expansion of the electricity grid. Implementing this choice may appear conceptually simple at first: if the entity responsible for issuing the grid access permit determines that the network capacity[4] is insufficient, then the project does not receive the permit and does not qualify for the auction.

Yet greater complexity arises in cases where there is some available capacity at a given connection point to the grid, but the number of candidate generators seeking connection at that point exceeds this capacity. For example, if three projects, each with a capacity of 50 MW, seek connection at a substation that can accommodate only 100 MW. In this case, the three projects would individually receive the grid access permit, but the winner selection process would have to ensure that, at most, two projects are contracted.

Moreover, operationalising this design can be a complex task, in part because the loading of the grid depends on the interaction of the power output of all generators that win the auction in a given area. Therefore, evaluating several different scenarios of auction winners – either before the auction or during the winner selection process – may be necessary to determine the actual limit of contracting at each point of connection to the grid. An example of a situation in which projects exceeded the grid capacity at a specific connection point occurred in Turkey, which is now organising auctions to allocate connection rights (see Box 4.8).

[4] *Including the capacity of already existing facilities and that of facilities that are already planned and whose commercial operation will occur before the target date.*

BOX 4.8: AUCTIONS FOR GRID CONNECTION PERMITS FOR WIND AND SOLAR PROJECTS IN TURKEY

In recent years, Turkey's renewable energy development policy has focused mainly on wind power. In response to the large number of applications for wind power connections since 2007, the regulatory framework had to be adapted. To manage connection capacity, a unique queue management system was created by the transmission system operator and the regulator, which consists of an auctioning process for wind and solar installations to control the high uptake rate of renewables in the country.

In contrast to most countries, where grid connection is guaranteed to all renewable energy projects and the allocation strategies for connection are usually based on first-come-first-served or pro-rata schemes, in 2011 Turkey adopted an innovative way to manage the queue of grid connection requests for renewable energy technologies after experiencing a three-year delay in wind and solar applications. The objective of this strategy is to efficiently allocate connection permits while at the same time control the high volume of applications for grid connection driven by other incentives such as the feed-in tariff. The queue management process consists of the following steps:

1) The transmission system operator publishes the connection conditions and available capacity for each substation for connecting wind or solar, taking into account the stability of the current infrastructure.

2) Wind and solar power project proposals are sent to the regulator (EMRA) and the transmission system operator (TEIAS) to study connection opportunities.

3) EMRA provides licences to the projects in cases where the available grid capacity can accommodate them. Otherwise, TEIAS initiates an auction to determine the allocation of connection rights.

4) In the auction, all the applicants for the same substation send in their bids, representing a fee per MW of installed capacity — the "contribution margin" — that the project developer is willing to pay if the licence is obtained. The applicant with the highest bid wins the auction and the right to connect to the grid. The contribution margin is paid by the winner of the auction to TEIAS in addition to standard connection and grid usage fees.

This tendering tool allows the transmission system operator to receive information regarding both the applicants' willingness to pay to be connected and the regions where the grid needs reinforcements, in order to be capable of introducing more renewable energy.

With the success of the first grid connection auction for wind power, in June 2013 the first solar auction was organised, capped to 600 MW of grid capacity. A total of 9 GW of applications was received, only 7% of which was accommodated by the grid.

Sources: (Cetinkaya, 2013), (REKK, 2013), (Energy Market Regulatory Authority, 2015).

This design choice has the advantage of eliminating the risk of underdelivery due to delays in grid reinforcement, and it may be the only feasible choice when, for whatever reason, the lead time between the auction and the date of product delivery is smaller than the time required to expand the grid. The disadvantages are, besides the complexity introduced in the qualification stage and the winner selection process, the potential reduction of competition in the auction, since the limitation of the demand at each point of grid connection to the existing or already planned capacity results in a fragmentation of the auction demand.

Main findings

The decisions about whether or not to require a grid access permit as a qualification requirement for an auction, and whether or not to constrain qualification or winner selection to projects that do not require grid expansion, depends heavily on the characteristics of each jurisdiction. If the existing grid has enough spare transmission capacity that can be accessed easily or if the grid expansion can be executed within a suitable time frame, a decision not to require an access permit before the auction is feasible. If this is not the case, requiring an access permit before the auction can be a sensible solution. It will then be necessary to decide whether or not to constrain qualification or winner selection to projects that do not require grid expansions. The possible advantages or disadvantages of each option are summarised in Table 4.8.

Table 4.8: Summary comparison of grid access permit requirements

Criteria \ Options	No grid access permit required	Grid access permit required, allowing participation of projects that demand grid expansion	Grid access permit required, constrained to projects that do not demand grid expansion
Avoided 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	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*

4.5 INSTRUMENTS TO PROMOTE SOCIO-ECONOMIC DEVELOPMENT

At times, countries implementing renewable energy support schemes may wish to maximise the socio-economic benefits of this support on a higher level. As a consequence, many policy makers have been exploring the possibility of explicitly requiring auction winners to play an active role in regional development. Most commonly, mechanisms introduced in this regard relate to 1) *empowerment and employment*, which refers to economic activity at the local and regional levels; or 2) *local content requirements*, which are explicitly associated with the prospect of promoting the local renewable energy industry.

Empowerment and employment

Empowerment and employment requirements mostly seek to ensure that the local services economy will receive benefits from the renewable energy project – a phenomenon that can happen naturally even if no constraints are in place. South Africa adopted this type of requirement in its auction procedure (see Box 4.9), and China also made efforts to measure indirect economic benefits in some of its wind power auctions.

Local content requirements

Local content requirements (LCR) impose a minimum contribution from local suppliers for the development of the renewable power project. This has been a common approach in several countries seeking to support the development of a nascent national renewable energy industry, but the design and the way that the LCR are determined can vary significantly. Saudi Arabia, for example, proposes to require that a minimum of 20% of a project's components be produced locally, Morocco has an LCR for 30% of the project's capital cost, China required 50% local production of wind power equipment until 2006 and 70% until 2009, and South Africa requires 25% of total project spending to be local. Brazil did not impose LCR requirements on the auction scheme itself, although a minimum level of local content was necessary to apply for attractive state bank loans (IRENA, 2014c).

BOX 4.9: FOCUS ON SOCIO-ECONOMIC GOALS IN SOUTH AFRICAN RENEWABLE ENERGY AUCTIONS

The South African Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) is a competitive bidding mechanism with long-term PPAs for developers. Socio-economic benefits from renewable energy deployment represent one of the requirements in the qualification stage and are maximised through the use of weighted development criteria during bid evaluation (see Box 5.9).

Six types of factors are taken into account in the qualification requirements: environment (environmental authorization), land (land right, notarial lease registration, proof of land use application: see Section 4.3), commercial/legal (acceptance of the PPA, project structure), financial (full and partial price indexation, financial proposal), technical (energy resource, technical proneness: see Section 4.2) and economic development. The latter is most relevant to this particular design aspect. One of the requirements is that no more than 60% of project capital investment may consist of foreign currency. Other elements addressed by the "economic development" requirements are job creation, local content, ownership, management control, preferential procurement, enterprise development and socio-economic development.

For wind projects, for example, at least 12% of the shares of the project developer's company must be held by black South Africans and another 3% by local communities. In addition, at least 1% of project revenues must go to socio-economic contributions, and the minimum threshold for local content is set at 25%.

These economic development requirements are designed to incentivise bidders to promote job growth, domestic industrialisation, community development and black economic empowerment. However, the requirements have been controversial for several reasons: many international bidders felt that they were too demanding and played too substantial a role, whereas domestic participants, backed by South African trade unions, felt that they were not demanding enough. Government officials see these requirements as being excellent for achieving positive socio-economic outcomes. They see a potential to boost local manufacturing in a sector that is completely underdeveloped in the country. More detailed results regarding the impact of the auctions on the economic development are illustrated in Box 5.9.

The fourth round of the REIPPP Programme was held in August 2014 and the 13 winning bids, consisting in 6 solar PV projects, 5 onshore wind, one small hydro and one biomass project, represent a total investment of around USD 2 billion, with only 28% coming from foreign funding.

Sources: (IRENA, 2013a), (IRENA, 2014b), (Eberhard, Kolker, Leigland, 2014), (Department of Energy – Republic of South Africa, 2015).

However, to ensure that such an investment will eventually pay off, an LCR scheme should be coupled with a gradual phase-out plan – beyond which the national industry ought to be able to compete directly with international prices. China, for example, adopted LCR clauses in its early mechanisms for fostering renewable energy, but as the country's wind equipment industry flourished, these constraints were deemed no longer necessary.

Specific socio-economic benefits in line with national priorities can be targeted through the design of LCRs (Box 4.10). Generally, it is essential to consider existing areas of expertise in the design of such requirements and link them closely to a learning-by-doing process. To ensure the full-fledged development of an infant industry, LCR should be time-bound and accompanied by measures that facilitate financing of the industry, the creation of a strong domestic supply chain and a skilled workforce. This subject is addressed in greater depth in IRENA's 2014 report *Rethinking Energy*.

Another concern regarding LCR is a legal one. This type of practice has been questioned under World Trade Organization (WTO) rulings regarding competition, and international manufacturers that feel undermined by such policies can resort to international forums for complaints. For example, the United States filed a formal dispute at the WTO against India, questioning the use of LCR in India's National Solar Mission auctions. To some extent, it is possible to reduce the risk of this type of reaction by choosing "softer" LCR – for example, by introducing LCR as a weighted parameter in the winner selection process (see Section 5.3) rather than as a hard constraint, or by splitting the auction demand into "LCR" and "non-LCR" bands (see Section 3.1), as India did in its 2014 auction (see Box 4.10). However, there is a large grey area surrounding what types of LCR implementations are "acceptable" or not.

Main findings

Mandatory clauses aiming to promote economic development (either in the form of empowerment and employment clauses or in the form of LCR) have been relatively popular in renewable energy auction implementations, particularly among developing economies, despite some controversy surrounding the issue. In general, this type of design alternative may be desirable in a context of a larger policy, and as long as the economic sectors that benefit from these provisions can be expected to stand on their own later on.

BOX 4.10: LCR IN BRAZIL, INDIA AND SAUDI ARABIA

Brazil

In Brazil, the LCR is a requirement not from the auctioneer but from the Brazilian National Bank of Development (BNDES), in order for project developers to qualify for the highly attractive (subsidised) loans. The BNDES local content policy aims to develop the industrial manufacturing chain for the wind and solar sector. The first version of the programme required a minimum of 60% local content in order to apply for a loan for wind projects; however, the guidelines changed in 2013, establishing that project developers must meet at least three of the following four criteria for wind farms:

1) Wind towers manufactured in Brazil, with at least 70% of the steel (by weight) or reinforced concrete produced in Brazil;
2) Wind blades produced in Brazil;
3) Nacelle (the main part of the turbine) assembled in a local facility in Brazil;
4) Hub (the part that involves the nacelle) assembled in Brazil, using national cast iron.

As a result of this policy, international wind equipment manufacturers – including Alstom, GE Wind, Vestas, Suzlon and Gamesa – have set up local assembly plants in the country.

India

In the 2014 National Solar Mission auction, projects that used nationally manufactured equipment were auctioned separately. The difference between the "LCR" price and the "non-LCR" price reflected a difference in investment costs of around INR 10.6 million per MW ($171 per kW[i]), which suggests that the levelised cost of electricity generated by a plant complying with LCR was around 15% higher.

Saudi Arabia

An even stricter and more detailed LCR is proposed on bidders in renewable energy auctions in Saudi Arabia. The proposed auction design strongly favours local involvement in the production and construction of projects, as the levels of local content and local labour proposed by bidders are expected to play an important role in the winner selection process (see section 5.3).

For wind, maximum points would be awarded in the first round to bids with 50% of the project components produced locally, and 60% in the second round. There will be a minimum requirement of 20% local content, although no points awarded for this level.

Within the overall local content scores, different scores will be awarded to different components, with a view to encouraging the production of certain components in Saudi Arabia. For example, blades and towers will be awarded a score of 50%, while gearboxes are given a 100% rating and nacelle assembly 25%. These scores, along with the scores of all other components, will then be averaged out to derive the overall local content level.

[i] *At an exchange rate of 62 INR/USD.*

Source: (IRENA, 2014c), (Ministry of New and Renewable Energy, 2012), (Elizondo-Azuela, Barroso et al., 2014), (Cunha, Barroso, Porrua, Bezerra, 2012), (World Nuclear Association, 2015), (Del Río, Linares, 2014), (K.A.CARE, 2013).

Even though different alternatives to promote economic development can vary substantially in goals and scope, in general terms it is possible to define a broad spectrum between a very strict implementation and another imposing no provisions for economic development at all. A summary comparison of these alternatives is presented in Table 4.9.

Table 4.9: Summary comparison of the strictness of the different options to promote socio-economic development

Options / Criteria	Instruments to promote socio-economic development	
	Strict requirements	**Lenient requirements**
Guidance from the auctioneer	Formally guarantees that local industry/ communities will benefit	Relies on economic principles for enriching the region
Development of a local industry	Often seen as a "long-term investment", expecting local markets to flourish	No particular advantage (but some local development is likely to happen regardless)
Cost-effectiveness	It is often costly for developers to comply with the requirements	More competition among manufacturers and service providers
Transparency and fairness	Possible perception that local companies are favored. May lead to legal issues	Might favor international, well-established companies

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

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