Report D4.1-CN, March 2016

Onshore wind concession auctions in China: Instruments and lessons learnt

AURES

HORIZON 2020

Short about the project

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

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

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

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

Project consortium: eight renowned public institutions and private firms from five European countries and combines some of the leading energy policy experts in Europe, with an impressive track record of successful research and coordination projects.

This report deals with onshore wind concessions in China.

The report contributes to the first and second of three tasks in work package 4 of the AURES project:

T4.1 Providing a characterisation of the different auctions

T4.2 Making an assessment of auctions and case-specific lessons learnt

T4.3 Interpreting and summarise the general lessons learnt and resulting and thereby outline specific recommendations

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Onshore wind concessions in China: Instruments and lessons learnt

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Project deliverable:
WP4 - Empirical aspects of auctions for RES-E: Learning from real experiences.
Task 4.1 Characteristics of auctions
Task 4.2 Assessment of auctions and case-specific lessons learnt

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1. Characteristics of auctions in China

Table 1. Characterisation of auctions in China

Characteristics	Description
Country characteristics	China has committed to a consumption target of 11.4% non-fossil fuels in primary energy consumption and a capacity target of 30% non-fossils in installed power generation capacity, both by 2015 (Information Office of the State Council, 2012). The term “non-fossil” thereby includes both renewable energy sources (RES) and nuclear energy. In a joint agreement with the US, China has further pledged to have its carbon emissions peak in 2030 and to aim for 20% non-fossil energy sources in 2030 (Landler, 2014). China’s RES sector is rapidly growing. In 2014, installed capacities (excluding hydro), stood at 153 GW, making China the world’s biggest RES market (REN21, 2015).
Market characteristics	The Chinese electricity sector is still undergoing transformation towards a market-based system. Since the 1980s, the system has evolved into one where generation is largely separated from grid operation. 40% of generation is owned by the five largest generation groups, the rest by a multitude of small generators (World Bank Group, 2014). The electricity transmission grid is dominated by the State Grid Corporation and two smaller regional monopolies, while the distribution segment is characterised by several thousand small players on provincial, prefectural, and county level (World Bank Group, 2014). Further reforms towards a liberalised electricity market are underway as of early 2015. Regarding RES, technology-specific administratively set feed-in tariffs (FITs), auction schemes, and other support instruments have existed in some regions since 2003. They evolved independently on the basis of provincial or local administrative measures, laws, and regulations. A national Renewable Energy Law came into effect in 2006, with an amendment in 2010. The law was intended to provide the basis for a nation-wide FIT with administratively set tariff levels for several technologies. However, the FIT scheme relied on auctions in the beginning to identify suitable tariff levels.
Name of auction scheme	This case study focuses on the Chinese auctions for **onshore wind concessions** (风电特许权招标) **on national level**, from 2003-2007. Auction-based concessions were allocated for large-scale wind farms under this scheme. At the same time, government-approved FIT, set by

Characteristics	Description
	provincial authorities on a case-by-case basis and sometimes also via an auction mechanism, were used for wind projects of less than 50 MW (IRENA and GWEC, 2013). Separate national-level auction schemes were launched for offshore wind, large-scale PV, and CSP.
Objectives	To achieve commercialisation of the domestic wind industry, including the related value chain; identify appropriate prices for the planned later introduction of administratively set FIT as foreseen in the 2006 Renewable Energy Law.
Contracting authority	In case of onshore wind, the National Development and Reform Commission (NDRC) was in charge of the auctions. It selected suitable project sites based on suggestions by local governments. Winning bidders sign a power purchase agreement (PPA) with the local utility and a concession agreement with the local government.
Main features	The Chinese wind auctions were single-item multi-criteria concession auctions. Next to the price criterion, benefits to the local economy as well as the company's background were taken into account, with the weighting of criteria varying over different auction rounds.
Year of introduction	Onshore wind auctions took place between 2003 and 2007. Afterwards, they were discontinued as a national administratively set FIT scheme was introduced.
Technology focus and differentiation	China ran, or is still running, national-level technology-specific auctions for several large-scale RES technologies. After the onshore wind concession programme, offshore wind auctions started in 2011. PV auctions were introduced in 2009 and a CSP auction took place in 2010.
Lead time before auction	Approximately 3 months. For the auction rounds of 2003 and 2004, bidding documents were published in July and the submitted bids were publicly opened in September.
Min. / max. size of project	Concessions were auctioned for wind parks of at least 100 MW installed capacity.
What is auctioned?	The winning bidders received a PPA for a period of 25 years. The price level identified in the auction process was applicable for the first 30,000 full load hours, after which the remuneration decreases to converge with

<table>
<tr><th>Characteristics</th><th>Description</th></tr>
<tr><td></td><td>the mean market electricity prices for the remainder of the contract period.</td></tr>
<tr><td>Budgetary expenditures per auction and per year</td><td>An exemplary estimate is shown here for the four projects contracted in the 4th auction round held in 2006. Contract prices refer to those prices which will be paid until the wind park has reached a cumulative 30 000 full-load hours. With the annual full-load hours assumed here, this will take between 11-13 years. After this, the per-kWh remuneration will decrease to converge with the average local electricity price. During this first phase, the four parks will receive a remuneration of roughly 109 million EUR per year.
<table>
<tr><th>Wind farm</th><th>Installed capacity [MW]</th><th>annual full-load hours *</th><th>Contract price [RMB_{2007}/kWh ($€_{2007}$/kWh)]</th><th>Remuneration received by wind farm [RMB_{2007} ($€_{2007}$)]</th></tr>
<tr><td>Inner Mongolia Huitengliang 1</td><td>300</td><td>2 726</td><td>0.42756 (0.040)</td><td>349 658 568 (32 756 014)</td></tr>
<tr><td>Inner Mongolia Huitengliang 2</td><td>300</td><td>2 726</td><td>0.4275 (0.040)</td><td>349 658 568 (32 756 014)</td></tr>
<tr><td>Inner Mongolia Bayin</td><td>200</td><td>2 383</td><td>0.4739 (0.044)</td><td>225 899 249 (21 162 241)</td></tr>
<tr><td>Hebei Zhangbei</td><td>200</td><td>2 369</td><td>0.5096 (0.048)</td><td>241 453 597 (22 619 372)</td></tr>
</table>
*assumed, from feasibility study data. Source: Li et al., 2006, p.37</td></tr>
<tr><td>Frequency of auctions</td><td>For onshore wind, auction rounds were held once a year for five consecutive years (Tao, 2012).</td></tr>
<tr><td>Volume of the tender</td><td>The capacities for the individual project sites in the auction ranged between 100 – 300 MW. The final actual capacities of realised projects was often higher than the capacities awarded in the auction, as capacities were re-negotiated with the auctioneer in the contracting phase (World Bank Group, 2014).

The table below gives an overview of contracted projects in the five auction rounds (Tao, 2012; Li, 2006).</td></tr>
</table>

Characteristics	Description

Auction round	Wind farm	Installed capacity [MW]	Winning bidder
1st round, 2003	Jiangsu Rudong 1	100	Huarui
	Guangdong Huilai	100	Guangdong Yuedian
2nd round, 2004	Inner Mongolia Huitengxile 1	100	Beijing International Power
	Inner Mongolia Huitengxile 2	100	China Huadian
	Jilin Tongyu	200	China Guodian
	Jilin Tongyu	200	China Huaneng
	Jiangsu Rudong 2	100	China Guodian
3rd round, 2005	Jiangsu Dongtai	200	China Guohua
	Jiangsu Dafeng	200	China Power Investment
	Gansu Anxi	100	Upstream Huanghe Hydropower Development Company
4th round, 2006	Inner Mongolia Huitengliang 1	300	China Guangdong Nuclear Energy Development Corporation (CGNEDC)
	Inner Mongolia Huitengliang 2	300	North United Power Company
	Inner Mongolia Bayin	200	China Guodian (?)
	Hebei Zhangbei	200	China Energy Conservation Investment Corporation (CECIC)
5th round, 2007	Inner Mongolia Wulanyili	300	Beijing Jingneng
	Inner Mongolia Tongliao	300	China Huadian
	Hebei Chengde	150	Hebei Province Construction and Investment Corporation
	Gansu Yumen	200	China Energy Conservation Investment Corporation (CECIC)

Auction design elements	See Table 2

Figure 1

Design elements for the assessment of auction schemes for RES-E

Table 2. Design elements for the assessment of auction schemes for RES-E

Design elements	
Single- or multiple-item auctions	Concessions for pre-defined project sites were allocated to bidders in the Chinese onshore wind auction scheme. This corresponds to a single-item auction, of which several were held in parallel in each auction round. The government was responsible for securing the land and obtaining environmental permits, the local utility was responsible for adequate grid connection.
Auction procedure	The auctions themselves were held in a static multi-criteria sealed-bid type format. In such static auctions, bidders have no information on their competitors' bids and cannot react to them. Each auction was followed by negotiation rounds with the highest-ranked bidders. Only thereafter projects were contracted. For onshore wind auctions, NDRC first selected the project sites for which concessions were to be auctioned. China International Bidding Co. and China Hydro Engineering and Consultation Group Co. were then nominated to carry out the practical organisation of the bidding process. The two companies drafted and published bidding documents online and in print media each year in April (Li et al., 2006). The bidding companies also issued clarifications and updates to bidders. Provincial branches of the NDRC (DRCs) and the bidding companies organised field visits and bidding meetings for interested bidders (Li et al., 2006). Submitted bids were then assessed by an evaluation committee consisting of representatives from the NDRC, provincial DRCs, state utilities, provincial power companies, bidding agencies, and technical experts. The process involved multiple steps, including pre-qualification, detailed evaluation, and ranking of candidates. The first- to third-ranked bidders were candidates for negotiation. The committee then began negotiations with the first-ranked candidate. Points of negotiation included both price and non-price items. After negotiations were concluded, the NDRC decided on the winning bidder (Li et al., 2006). Due to the negotiations which took place after the auction, the contracted projects listed in the table above do not exactly reflect the outcome of the auction itself. For instance, in the second round, Beijing International Power and its partners won the initially auctioned concession for a 100 MW wind farm at Huitengxile, Inner Mongolia, for a price of 0.3820 RMB / kWh (€3.8 c_{2007} / kWh). China Huadian came in second, having offered a price of 0.3938 RMB/kWh (€3.9 c_{2007} / kWh). However, as NDRC deemed the wind resource in the area

Design elements	
	very good, they negotiated the construction of a second 100 MW wind park, at the winning price, with China Huadian. Similarly, in the 4th round, the originally auctioned concession for 300 MW at Huitengliang, Inner Mongolia, was extended during negotiations to two wind parks at 300 MW each, developed by the two lowest bidders for the price of 0.4200 RMB/kWh (€4 c_{2007} / kWh). The price originally bid by CGNEDC had been 0.4058 RMB/kWh (€3.9 c_{2007} / kWh) (Li et al., 2006).
Pricing rules	Pricing rules were adapted over the years to resolve problems identified in previous auction rounds. In the early auction rounds, the lowest bidder won with regard to the price criterion. This led to very aggressive bidding behaviour, partly because inexperienced bidders were overly optimistic in estimating their true costs, and partly because large state-owned bidders were able to consciously bid below their true costs in order to gain market shares. The weight of the price criterion was thus reduced to 40% in the following auction rounds, in order to favour more realistically calculated projects. However, the winning bidders were in most cases still those which had offered the lowest prices, as bidders were not very differentiated across the other criteria (World Bank Group, 2014). In 2007, the pricing rule was changed to favour the bid which was closest to the average of all submitted bids, excluding the highest and the lowest bids. This rule forced bidders to estimate competitors' bidding prices and was intended to discourage aggressive underbidding (World Bank Group, 2014).
Ceiling price	None
Qualification criteria	Each wind farm was foreseen to have a capacity of 100 MW or more. Winning bidders had to utilise turbines with a capacity of no less than 0.6 MW. The onshore wind concession auctions were multi-criteria auctions, taking into account non-price criteria in addition to the price. Note that these non-price criteria were not qualification criteria in the sense that they filtered out non-qualified bidders in a preliminary step before the auction. Rather, price and non-price criteria of participating bidders were evaluated in a single step to identify the top-ranking bidder. Thus, while minimum threshold values had to be fulfilled by bidders to qualify, over fulfilment had a positive effect on a bidder's score in the evaluation. Non-price criteria and their weighting evolved over the years: • 1st round, 2003: a minimum local content of 50% was required • 3rd round, 2005: the weight of the non-price criteria increased to 60%, while price accounted for 40%. The non-price criteria included local

Design elements	
	economic benefits and company background (technical expertise, project management experience) and a local content of at least 70% • 4th round, 2006: the price criterion's weight was further reduced to 25%. Regarding non-price requirements, wind power equipment manufacturers were now required to participate in the bidding directly (individually or with an investment consortium)
Penalties	There were no clear penalties for non-compliance.
Monitoring of realisation progress	A period of three years was foreseen for the wind farms to start operations. If construction took longer, specific explanations had to be given by the project developer. If these were not satisfactory, the local government could withdraw from the support contract, with the developer bearing the resulting losses.
Exceptions from requirements for small plants/developers?	None
Support auctioned	In the Chinese wind auctions, the development of a specific wind park with a given capacity [MW] at a specific site was tendered. Participating bidders formulated their bids as per-kWh prices for the price criterion, and provided information on local content and cooperating suppliers, etc. for the other criteria.
Transferability of support right	Support rights are not meant to be freely transferable to other market actors.

2. Evaluation criteria for the assessment of auction schemes for RES-E

Actor variety and social acceptability

Most of the participating bidders were state-owned companies who are able to cross-subsidise their wind projects and thus bid a very low price in order to gain market share in the wind sector (Li, 2006, p. 41). The chances of small actors to enter the industry under these circumstances are very slim.

Policy effectiveness (effectiveness of auctions)

Despite the aggressive bidding that was observed mainly in the early rounds, the projects saw good realisation rates. All of the concessions granted in the 2003 and 2004 rounds were realised by 2007. In total,

all auction rounds incentivised the construction of almost 3.5 GW of capacity (World Bank Group, 2014). As mentioned above, the negotiation process sometimes resulted in more capacities being contracted than having been offered by the auctioneer originally. However, some projects did experience difficulties and delays resulting from lower-than-expected full-load hours at the site. This was in part due to inaccurate information provided by the auctioneer and to the lack of experience among bidders who had placed very ambitious bids with slim profit margins.

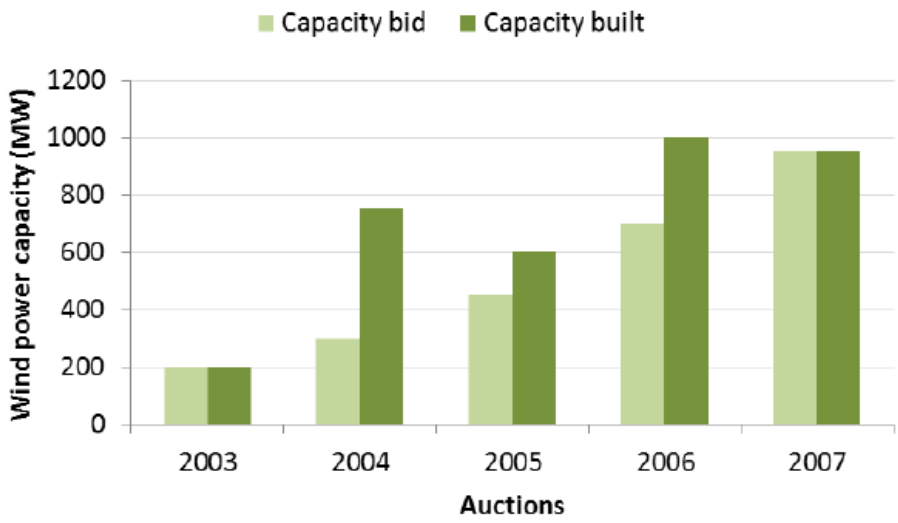

Figure 1: Comparison of auctioned capacities vs. realised capacities in China (Source: World Bank Group, 2014, p.28)

Static efficiency or cost effectiveness (including transaction and administrative costs)

Static efficiency, meaning that the targeted electricity production is realised at the lowest possible cost, was not the main objective of the Chinese auction scheme, neither for wind onshore nor for the other auctioned technologies.

In general, as in any technology-specific support scheme, technology-specific auctions per se limit competition to those projects belonging to the eligible technology. They therefore do not minimise generation costs across technologies. However, in the case of onshore wind, costs are likely to be competitive with other RES-E technologies for a large portion of projects.

Secondly, in the Chinese concession scheme design, the project sites were pre-selected by political actors. While cost considerations may have been part of the selection process, the choice of site itself is not a factor in the competition induced by the auction, thus decreasing static efficiency. Nevertheless, there can of course be valid reasons for restricting the number of available sites, including grid connection and other spatial planning considerations, or legal and political constraints.

The auction itself was designed to select bidders not only on the basis of their costs, but also on non-price criteria. It can further be assumed that the prices offered by the bidders did not reflect their true costs in many cases. The market situation and bidder structure was such that not necessarily those with the lowest costs, but also those with a high interest in gaining market share won the auction. In addition, bidders were faced with uncertainties in their valuation as crucial information such as wind speed data provided by the auctioneer were not reliably accurate. Finally, even if the auction design had led to the selection of lowest-cost bidders,

the subsequent negotiation phase led to results that could not necessarily be considered allocative efficient in the sense that the targeted electricity production was realised at the lowest possible cost.

Dynamic efficiency

The onshore wind auctions in China were held only for a short timeframe of five years. In addition, the first few rounds were affected by severe underbidding. It is thus not possible to identify a long-term downward trend in the prices resulting from the auctions. Yet this does not necessarily mean that the auctions did not promote technology learning. Learning effects could be seen during the timeframe in the domestic wind industry, although this can probably not be attributed solely to the auctions. Sinovel, Goldwind, and Dongfang, all of them Chinese wind power equipment manufacturers, had risen to the top ten in their field by 2010. Production facilities were set up in China by leading manufacturers such as Vestas, Suzlon, Gamesa, and GE (IRENA, 2013).

A final judgment of the dynamic efficiency of the Chinese auction scheme in comparison to other auction schemes seems not possible given the short duration of the scheme.

Compatibility with market principles and integration

The PPAs received by the winning bidders correspond to a fixed FIT as they cover the whole remuneration stream of the wind installation. Electricity is not sold directly on the market. The auction contains no requirements regarding demand-oriented generation or balancing responsibility. The compatibility with market principles is therefore low. As penetration rates of fluctuating renewables were low in the last decade in China, and as liberalised electricity markets were not fully developed, this criterion was not weighted highly by regulators.

Distributional effects & minimisation of support costs

The aggressive bidding behaviour especially in the early rounds[1] did not reflect the true costs of generation, yet support costs were minimised. Table 3 provides an overview of contract prices for the projects contracted after negotiation:

Table 3. Contract prices for projects contracted under the onshore wind concession scheme (Source: Li et al., 2006)

Auction round	Wind farm	Contract price [$RMB_{nominal}$/kWh]	Contract price [RMB_{2007}/kWh ($€_{2007}$/kWh)]
1st round, 2003	Jiangsu Rudong 1	0.4365	0.4715 (0.044)
	Guangdong Huilai	0.5013	0.5415 (0.050)
2nd round,	Inner Mongolia Huitengxile	0.3820	0.4085 (0.038)

[1] Bidding behaviour became notably less aggressive in the 4th round, where bidding prices were reasonable considering the resource, construction conditions, and the resulting estimated LCOE (Li et al., 2006). Before this, bids tended to be below the estimated generation costs for the sites.

2004	1		
	Inner Mongolia Huitengxile 2	0.3820	0.4085 (0.038)
	Jilin Tongyu	0.5090	0.5443 (0.051)
	Jilin Tongyu	0.5090	0.5443 (0.051)
	Jiangsu Rudong	0.5190	0.5550 (0.052)
3rd round, 2005	Jiangsu Dongtai	0.4877	0.5064 (0.047)
	Jiangsu Dafeng	0.4877	0.5064 (0.047)
	Gansu Anxi	0.4616	0.47930 (0.045)
4th round, 2006	Inner Mongolia Huitengliang 1	0.4200	0.42756 (0.040)
	Inner Mongolia Huitengliang 2	0.4200	0.4275 (0.040)
	Inner Mongolia Bayin	0.4656	0.4739 (0.044)
	Hebei Zhangbei	0.5006	0.5096 (0.048)
5th round, 2007	Inner Mongolia Wulanyili	0.4680	0.468 (0.043)
	Inner Mongolia Tongliao	0.5216	0.5216 (0.049)
	Hebei Chengde	0.5510	0.551 (0.051)
	Gansu Yumen	0.5206	0.5206 (0.049)

The prices realised in the Chinese onshore wind concession auctions were generally rather low, due to the above-mentioned frequent underbidding. Some bidders were willing to cross-subsidise their entry into the wind power market from other business activities. The administratively set FIT introduced shortly after the end of the auction scheme saw support levels comparable to the upper end of the price scale realised in the auctions, as shown in Figure 2.

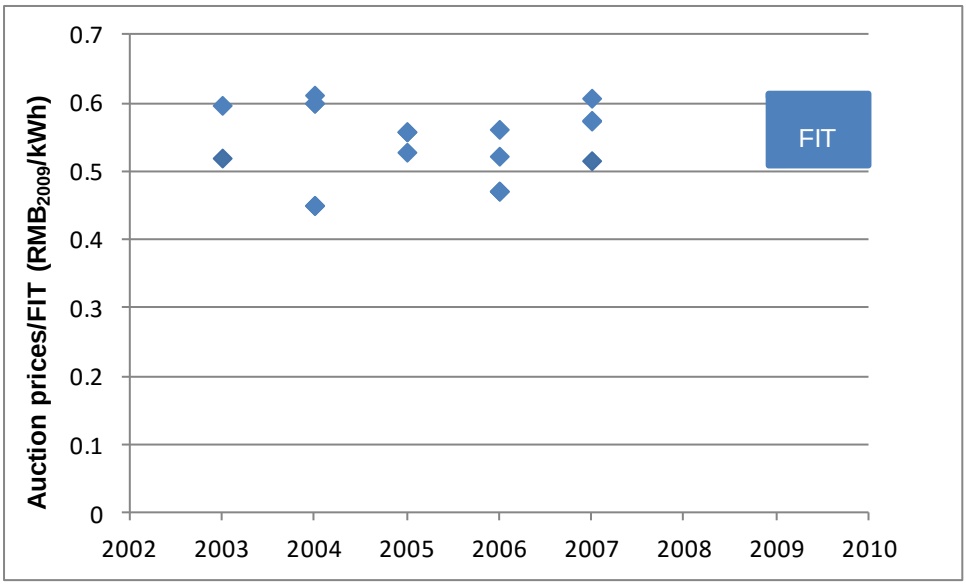

Figure 2: Comparison of contracted auction prices and FIT scheme with administratively set support levels

The cost of RES support is borne by consumers via an electricity bill surcharge of initially 0.001 RMB / kWh (€0.01 cent / kWh), which has since increased to 0.008 RMB / kWh (€0.1 cent / kWh).

3. Lessons learnt: key best practices and pitfalls identified

The main policy goal of the Chinese wind concession scheme was not primarily least-cost RES deployment or the achievement of allocative efficiency, but rather to foster the domestic wind industry by putting in place a support scheme which was both national in scale and had an ambitious local content requirement. The auction scheme was furthermore seen as a preparatory step for the administratively set national FIT which was put in place in 2009. Thus, one may consider the auction scheme as successful. However, the transferability of Chinese practices to countries who strive for auctions as a mechanism to ensure allocative efficiency is limited. Even for countries which mainly intend to support their domestic equipment manufacturers and related industries, setting high local content requirements may not always be a wise choice. China is big enough to have some competition even among its domestic industry players, which is not necessarily the case for smaller economies. Local content requirements can thus drive up costs in the absence of domestic competition. However, even with these caveats, some lessons and pitfalls can be identified:

- If sites are pre-developed by the auctioning authority, care must be taken to provide relevant and correct information in order to avoid unnecessary risks for bidders. Chinese government authorities provided information about the selected project sites in the bidding documents, upon which bidders based their offers. In the early rounds, this information sometimes contained errors, such as insufficient and misleading wind measurement data (Huilai wind farm, 1st round), or even a faulty

localisation of the project site, which the winning bidder later discovered to be covered by crops and forest (Tongyu wind farm, 2nd round).

- The industry structure (mainly large state-owned enterprises), a lack of experience by bidders, and possibly also the absence of penalties, led to underbidding in the early rounds. While realisation rates were still good, the very low prices in the early auctioning rounds sent a wrong market signal to the industry, discouraging investments by turbine and component manufacturers. With the adaptation of the auction design in later rounds, including higher weight on local content requirements, this development barrier was removed.
- VAT discounts are in place in China to attract foreign investors. Several bidders in the wind auctions created joint ventures with foreign market actors specifically for the auction in order to profit from VAT discounts on locally bought equipment, thus profiting from an indirect tax benefit. In such cases, the regulator needs to assess if the tax incentive still serves its original purpose. In case of conflicting policies, such loopholes need to be closed.

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