Pakistan Sustainable Energy Series

Variable Renewable Energy Competitive Bidding Study

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Variable Renewable Energy Competitive Bidding Study

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This report is based on a study carried out by Mercados Aries International, under contract to the World Bank from 2020 to 2021. The lead authors are Leonardo Lupano (Director Policy, Regulation & Strategy), Jeremy Hornby (Senior Consultant), and Jesús Paniagua Sánchez-Mateos (Senior Consultant). The study was commissioned and supervised by Oliver Knight (Senior Energy Specialist) and Anjum Ahmad (Senior Energy Specialist). Peer review was carried out by four World Bank Group staff: Rafael Ferreira (Senior Energy Economist), Pedro E. Sánchez (Lead Energy Specialist), Sabine Cornieti (Energy Specialist), and Surbhi Goyal (Senior Energy Specialist).

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Front cover: Inauguration of 100 MW Quaid-e-Azam Solar Power Project in Bahawalpur, Punjab (Credit: Quaid-e-Azam Solar Power (Pvt.) Limited).
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ATTRIBUTION

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ABBREVIATIONS AND ACRONYMS

AEDB	Alternative Energy Development Board
ANEEL	National Electric Energy Agency of Brazil
ARE	Alternative Renewable Energy
AREP	Alternative Renewable Energy Project
ARET	Alternative and Renewable Energy Technology
B2B	Business to Business
BNDES	Banco Nacional de Desenvolvimento Econômico e Social
BOO	Build Own Operate
BOOT	Build Own Operate Transfer
CA	Connection Agreement
CAPEX	Capital Expenditure
CCEE	Chamber for Commercialization of Electrical Energy of Brazil
CCoE	Cabinet Committee on Energy
CCI	Council of Common Interests
CDP	Common Delivery Points
COD	commercial operation date (commissioning)
CPI	Consumer Price Index
CPPA	Central Power Purchasing Agency
CTBCM	Competitive Trading Bilateral Contract Market
CYREPP	Current Year RE Procurement Plan
DISCO	Distribution Company
EOI	Expression of Interest
EPA	Energy Purchase Agreement
EPC	Engineering Procurement and Construction
EPE	Energy Research Company of Brazil
ESIA	Environmental and Social Impact Assessment
ESMAP	Energy Sector Management Assistance Program
FIT	Feed-in Tariff
G2G	Government to Government
GoP	Government of Pakistan
H&S	Health and Safety
IA	Implementation Agreement
IAA	Independent Tender Administrator
ICC	International Chamber of Commerce
IFC	International Finance Corporation
IGCEP	Indicative Generation Capacity Expansion Plan
IPP	Independent Power Producer

IRZ	Interconnection Ready Zones
ISO	Independent System Operator
KE	K-Electric
KP	Khyber Pakhtunkhwa
LCR	Local Content Requirements
LES	Localized Energy Systems
LIBOR	London InterBank Offered Rate
LOA	Letter of Award
LOCA	Letter of Conditional Award
LOI	Letter of Intent
LOS	Letter of Support
LUA	Land Use Agreement
MG	microgrid
MME	Ministry of Mines and Energy of Brazil
MO	Market Operator
MSP	Metering Service Provider
MW	megawatt
NDRC	National Development and Reform Commission (China)
NEA	National Energy Administration (China)
NEPRA	National Electric Power Regulatory Authority
NPTC	National Thermal Power Corporation (India)
NGC	National Grid Company
NREL	National Renewable Energy Laboratory
NTDC	National Transmission & Despatch Company
ONEE	National Office of Electricity and Water (Morocco)
OPEX	Operational Expenditure
O&M	Operation and Maintenance
PKR	Pakistani rupee
PLA	Park Lease Agreement
PPA	Power Purchase Agreement
PPIB	Private Power and Infrastructure Board
PPRA	Public Procurement Regulatory Authority
PPU	Public Power Utility
PV	photovoltaic
RE	Renewable Energy
REOI	Request for Expressions of Interest
RFP	Request for Proposals
RFO	Residual Furnace Oil
RLNG	Regasified Liquid Natural Gas
SCED	Security Constrained Economic Dispatch
SECI	Solar Energy Corporation of India
SEO	Search Engine Optimization
SPT	Special Purpose Trader
SPV	Special Purpose Vehicle

SO	System Operator
TSO	Transmission System Operator
T&D	Transmission and Distribution
UNCITRAL	United Nations Commission on International Trade Law
UNDP	United Nations Development Program
US$	US dollar
VRE	Variable Renewable Energy
WAPDA	Water & Power Development Authority

EXECUTIVE SUMMARY

This study was commissioned to support the Government of Pakistan, the provincial energy departments, and the electricity regulator in the implementation of competitive bidding for the procurement and development of all future variable renewable energy (VRE) capacity in the country. The decision was taken in 2017 to move from a "cost-plus" tariff-setting regime for future solar and wind power capacity to one based on the principles of competitive bidding, following international trends and the very positive results seen in terms of steep cost reductions in other countries. In many locations, these cost reductions have led to solar and wind becoming the "least-cost" form of power generation, although this has already been achieved in Pakistan through gradual declines in the tariff awarded on a cost-plus basis to solar and wind projects by NEPRA, the electricity regulator.

Nevertheless, competitive bidding can help to ensure that future procurement of VRE is carried out strategically, transparently, and at least-cost. Unfortunately, competitive bidding for new power capacity in Pakistan has yet to be implemented, delaying the expected benefits to consumers in terms of lower generation costs and the much-needed transition to a more secure, sustainable and affordable electricity sector.

With all the key policies for development of alternative and renewable energy now in place in Pakistan, this study attempts to answer the following questions:

1. Based on international experience, what models of competitive bidding are most appropriate in Pakistan, and how would different renewable energy technologies be considered?
2. How frequently should competitive bidding rounds occur, and what might be appropriate governance mechanisms?
3. What are the available options for design of the competitive bidding process, which ones best apply to the case of Pakistan, and how should the bidding process be implemented?

The study was carried out by a team of expert consultants over a period of 22 months in collaboration with all the key federal and provincial sector agencies, led by the Alternative Energy Development Board (AEDB) as the primary client counterpart. The study makes use of data and analysis from two prior World Bank studies on variable renewable energy and has been updated to reflect the conclusions of the Indicative Generation Capacity Expansion Plan (IGCEP) 2021–2030, published in September 2021. Consultations were carried out with all federal and provincial organizations at the analytical stage, and through circulation of the draft report, with their inputs and feedback integrated to the extent possible. A multistakeholder consultation workshop was also held virtually in December 2021.

The following is a summary of the key findings and recommendations.

Based on the Government's current projections, Pakistan will need to carry out competitive bidding for more than 11 GW of solar and wind power capacity between now and 2028, starting as soon as possible. The actual capacity required could be significantly higher than that.

With 1,700 MW of solar and wind power capacity installed as of September 2021, against a target of 12,900 MW by 2030, 11,200 MW must be installed between now and then. Allowing two years for project development means that procurement of this additional capacity must be completed by the end of 2028. The actual figure may need to be higher than this if capacity from other sources is delayed (or does not materialize), or if demand increases by more than expected. Indeed, analysis by the World Bank published in 2020 suggests that the "least-cost" generation mix would see at least 20 GW of solar and wind added by 2030. Even allowing for some reduction due to lower demand projections since then, 11 GW of additional solar and wind should be seen as the minimum that would be added over the next six years.

Considering the volume of capacity outlined, and the rate of past development (1,700 MW installed over roughly ten years), it should be clear that a phased approach beginning in 2022 is required. This will deliver immediate fuel savings—even after allowing for capacity payments—and help ensure that the country does not end up with a power supply deficit in the middle of this decade. Furthermore, early action will be critical to build the capacity of the relevant procuring authorities, allow for early lessons to be incorporated into the competitive bidding regime, and ensure that the private sector has the stability and predictability to bring forward competitive projects.

It is recommended that Pakistan adopts two models of site-specific competitive bidding, whereby the locations would be determined by the relevant authorities up-front.

Competitive bidding can be specific or neutral with regards to the locations or sites to be developed and the technologies to be used. After a review of international experience, and considering the needs and constraints in Pakistan, this study recommends two forms of competitive bidding that would be implemented in parallel:

i. ***Park-based bidding*** through the strategic identification of renewable energy parks, or "RE parks", which would be developed in zones where there is excellent solar and wind resource potential (allowing for improved utilization of transmission lines through what is sometimes referred to as "hybridization"), plenty of available land, an absence of environmental, social and other constraints, and viable options for large-scale power evacuation. Identification and development of such RE parks has been proposed under several previous studies, including the VRE Locational Study published by the World Bank in February 2021, and allows for the public sector to facilitate large additions of low-cost VRE capacity through development of "shared infrastructure" combined with competitive bidding.
ii. ***Substation-based bidding*** whereby substations with spare capacity would be identified and listed in a bidding round, with private developers invited to propose projects within a fixed radius from each substation. This approach would target smaller project sizes comprising mainly solar capacity, although wind power would also be eligible.

Park-based bidding would largely target zones with high wind resource potential in Balochistan and Sindh, since the solar resource potential is high across the country and especially in these two provinces. The project sizes would be larger, and such schemes would require substantial public and private sector investment in new infrastructure. Substation-based bidding would largely target additional solar power capacity, with smaller project sizes. However, this approach has the benefit of avoiding substantial new transmission infrastructure and of reducing technical losses, especially where solar capacity is placed at the ends of long radial lines. In both cases this study recommends a ***technology-specific*** approach whereby the competitive bidding rounds would target fixed quantities of solar and/or wind capacity as determined by the resource potential and a prior analysis of the optimal supply mix for each zone or site.

A third model, based on ***site-neutral bidding***, is not proposed for the time being but could be a further option once the market is more developed. This could be combined with technology-neutral bidding, which would introduce further complexity.

There should be a clear schedule for the volumes of renewable energy that will be procured through competitive bidding, with an annual cycle to provide certainty and confidence to the process.

Based on the IGCEP 2021–2030, and after allowing for planned capacity additions, around 8 GW of capacity would be subject to the competitive bidding regime outlined in this study under Category 4 (since the regime for Category 3 is already largely defined). This represents an average volume of 1,500 MW of VRE that needs to be put out to competitive bidding each year, starting in 2022, after allowing for the project development and financing timeline.

Since the volumes that will be procured under Category 3 are uncertain, and because demand and supply projections are likely to change over this period (including as a result of delays to other projects included in the current and future versions of the IGCEP), we recommend that the government publishes a Current Year VRE Procurement Plan, decided by the AEDB Steering Committee through consensus. The plan would include the capacity to be tendered, the split between solar and wind technologies, and the substations or zones where the capacity will be developed. This would be complemented by a non-binding competitive bidding plan for the following 5–10 years, to provide indicative capacity figures to the market.

In cases where there are connection options for renewable energy that exceed the capacity required, it is recommended that sites be selected mainly on the basis of their resource potential (and resulting economics), but with some consideration for provincial diversity.

As highlighted in the VRE Locational Study, there is already ample substation capacity to reach the interim target of 20 percent VRE capacity, meaning that there will likely be competition from the provinces to secure as much of the available capacity under each bidding round as possible. Hence we propose that in such cases, which are likely to occur in most years, 80 percent of the required capacity be determined according to the quality of the resource, with the remaining 20 percent prorated to each of the four provinces. The decision of the Steering Committee would be communicated through the Current Year RE Procurement Plan.

A high level of coordination will be required between the various federal and provincial authorities and organizations, coordinated by a steering committee established under AEDB, and responsible for developing the Current Year RE Procurement Plan (CYREPP).

We recommend that NEPRA becomes a non-voting member of the steering committee to facilitate coordination and speed up the process of supervision and approvals on their side. Currently the provincial energy departments would be responsible for organizing and implementing competitive bidding for the capacity within their territories. In the near-term some provincial energy departments will require technical assistance from AEDB or development partners to implement competitive bidding. In some cases, in particular for larger, strategic solar and wind developments such as those in Balochistan, AEDB may need to take up this role on behalf of the respective energy departments, with their active engagement. In the longer term the introduction of a competitive wholesale electricity market is likely to require centralization of this function at the federal level.

Based on a review of key features internationally, it is recommended to start with a relatively simple design for competitive bidding in Pakistan to build confidence.

The table below briefly lists the recommended key features of the initial rounds of competitive bidding, although these could be modified over time as experience is gained.

Key Feature	Recommendation
Size of each round of bidding	Annual limited bidding based on the CYREPP (building on IGCEP and VRE Locational Study); avoid connection points of less than 50 MW; assign parcels of 300MW–600MW in the power parks; but no further size constraint for individual bid volume by connection point or total volume per developer.
Stages	Two-stage bidding regime with prequalification as the first stage.
Type of bid	Two-envelope sealed bid.
Award criteria	Price only.
Pricing	Pay-as-bid.
Reserve price	Undisclosed reserve price based on results of previous round of bidding and market trends.

In addition to the above high-level recommendations, we also propose the following:

- **The competitive bidding regime should be designed to achieve approval of a tariff 33 weeks following the commencement of the process, requiring all organizations to streamline their approval processes.**
- **To support project bankability, a relatively simple indexation and compliance bond formula should be implemented.**
- **The RFP process should include provisions for environmental and social assessments and local benefit sharing, in line with international good practice.**
- **An IT platform should be used for carrying out the competitive bidding process to ensure transparency and promote market confidence, combined with a communications strategy to reach as many bidders as possible.**
- **Pakistan should seek to maximize the economic development benefits from the expansion of VRE, but we do not recommend stringent local content requirements.**

1. INTRODUCTION

The objective of this study is to provide strategic analysis and advice to the Alternative Energy Development Board (AEDB), Private Power and Infrastructure Board (PPIB), and other relevant sector agencies on the implementation of competitive bidding for the contracting of variable renewable energy (VRE) capacity to achieve the policy objectives and targets outlined by the Government of Pakistan in the Alternative Renewable Energy Policy 2019 ("ARE Policy 2019") and the Indicative Generation Capacity Expansion Plan 2021–2030 ("IGCEP 2021–2030"). For the purposes of this study VRE is defined as solar and wind power generation, although the report's findings and recommendations could be applied to the procurement of other forms of power generation.

The study will offer recommendations on:

- The form and timing of competitive selection of future VRE capacity; and
- The institutional arrangements for competitive bidding accordingly.

Following the development of proposed competitive bidding mechanisms under this study, bilateral consultations were held between February and April 2021 with the governments of the four provinces (Balochistan, Khyber Pakhtunkhwa [KP], Punjab and Sindh), the National Electric Power Regulatory Authority (NEPRA), and the Central Power Purchasing Agency (CPPA). The comments received at these meetings, and subsequent written observations received through AEDB, are incorporated into this report.

The report is structured as follows:

- Section 2 outlines key background issues of relevance to competitive bidding mechanisms for RE in Pakistan;
- Section considers potential arrangements for deployment of competitive bidding;
- Section 4 analyzes tender governance processes;
- Section 5 examines detailed arrangements for the design of competitive bidding;
- Section 6 evaluates implementation arrangements;
- Section 7 considers the impact of the forthcoming Competitive Trading Bilateral Contract Market (CTBCM) on renewable energy (RE) competitive bidding mechanisms;
- Section 8 reviews information technology needs;
- Section 9 considers communications and marketing strategies; and
- Section 10 reviews the potential for introducing local content arrangements.

In addition, Annex A extends the background information provided in Section 2; Annex B summarizes international experience in competitive bidding governance; and Annex C gives international examples on developing local industry through RE deployment.

2. BACKGROUND

Pakistan's electricity sector is headed by the Ministry of Energy (Power Division), which is the Government of Pakistan's (GoP's) executive arm for all issues relating to electricity generation, transmission, and distribution (T&D) in the country and exercises this function through its various line agencies as well as relevant autonomous bodies. These include the:

- National Electric Power Regulatory Authority (NEPRA), the main regulator, set up under the *Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997* (also known as the "*NEPRA Act*") to function as an independent regulator and ensure a transparent, competitive power market in Pakistan;
- Central Power Purchasing Agency (CPPA), responsible for market operations and presently functioning as the market operator in accordance with Rule 5 of the *NEPRA Market Operator (registration, standards, and procedure) Rules 2015;*
- Alternative Energy Development Board (AEDB), responsible for promoting and facilitating alternative renewable energy (ARE) deployment;
- Private Power and Infrastructure Board (PPIB), responsible for facilitating private investment in the power sector;
- National Transmission & Despatch Company Limited (NTDC), which operates as the Transmission Network Operator and System Operator;
- Power distribution companies (DISCOs), responsible for the distribution and supply of electricity; and the
- Water & Power Development Authority (WAPDA), responsible for hydropower generation.

The institutional arrangement of the power sector in Pakistan is outlined below (Figure 2-1).

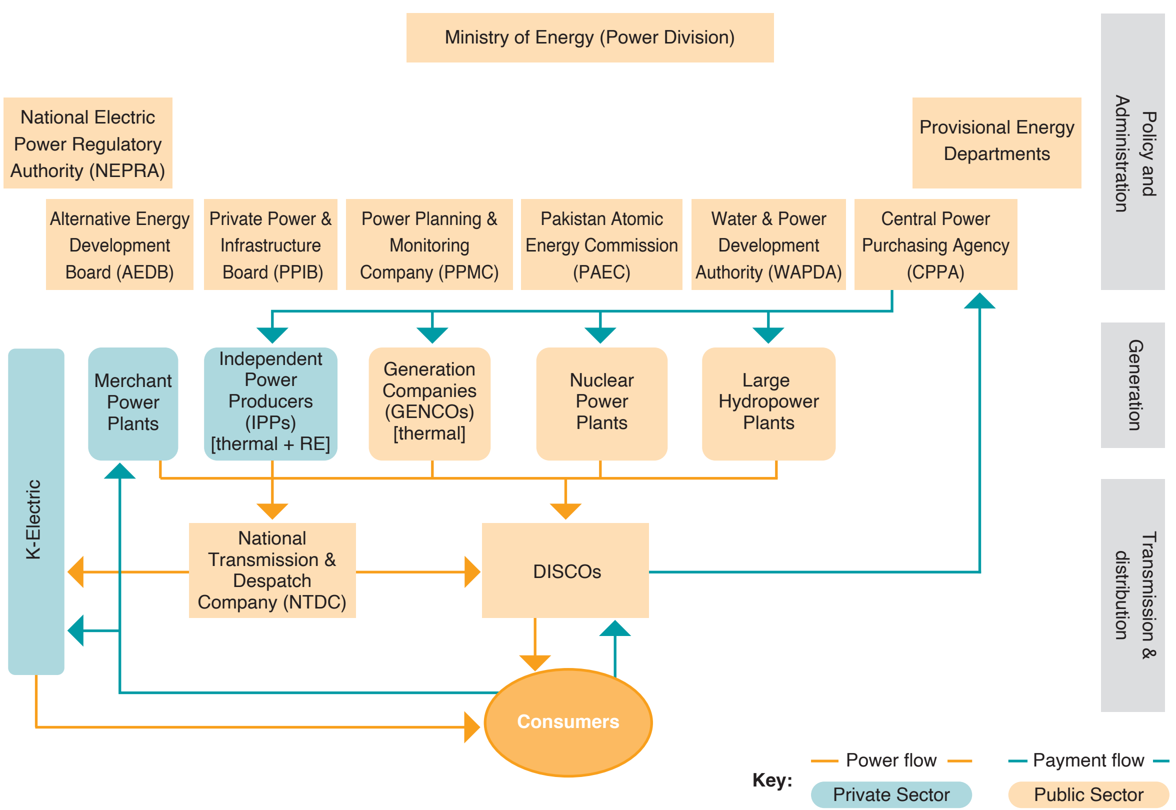
The GoP initiated the development of the ARE[1] Sector under RE Policy 2006. The federal organization mandated to promote ARE technologies in the country is AEDB.

Pakistan's current installed generation capacity from all sources is 34,776 MW, including 430 MW of solar PV and 1,335 MW of wind power connected to the grid. In fiscal year 2019–2020 around 30.9 percent of energy produced was from hydroelectric sources, 58.4 percent from thermal sources (including natural gas, local coal, imported coal, residual fuel oil, and technologies based on regasified liquefied natural gas), 8.2 percent from nuclear, and 2.4 percent from ARE sources (including solar, wind, and bagasse-based technologies). In fiscal year 2019–20, power production from these ARE technologies totaled 2,057 GWh.[2] The current population of the country is approximately 220 million, and per capita electricity consumption is estimated at approximately 500 kWh.

Almost all the renewable energy (RE) projects developed to date are owned by international and local independent power producers (IPPs) and most of these projects were awarded under the Cost-Plus Tariff

[1] The term alternative renewable energy includes the following technologies: biogas, biomass, energy from waste, geothermal, hydrogen, synthetic gas, ocean/tidal/wave energy, solar, wind, and any hybrid that combines any of them.
[2] Pakistan Economic Survey 2019–2020. By contrast, the figures for the previous year, FY 2018–19, show significantly higher generation from renewables (7,955 GWh). That previous year, consumption broken down by technology was: 63.0 percent thermal; 25.8 percent hydro; 8.2 percent renewables; and 3.0 percent nuclear.

FIGURE 2-1: INSTITUTIONAL ARRANGEMENT OF THE POWER SECTOR IN PAKISTAN



Source: World Bank based on a diagram from the IRENA Renewables Readiness Assessment. IRENA (2018). *Renewables Readiness Assessment: Pakistan*. International Renewable Energy Agency (IRENA), Abu Dhabi.
Note: Diagram represents a simplified characterization of the power sector and does not cover all institutions, flows and relationships.

regime. However, to promote competition NEPRA announced an end to that regime[3] in 2017 and encouraged policy makers and project development organizations of the federal and provincial governments to move toward competitive bidding (an auction).

To diversify the country's energy mix and harness untapped generation resources, the GOP is prioritizing the development of Pakistan's ARE. The "ARE Policy 2019" was approved by the Council of Common Interests (CCI) in August 2020 and notified in October 2020.[4] As part of this policy the GOP decided that by 2025 20 percent of Pakistan's generation capacity—and by 2030 30 percent—shall consist of non-hydro renewable energy resources, likely to be primarily utility-scale solar photovoltaic (PV) and onshore wind facilities. The core of the ARE Policy 2019 is the development of ARE projects by the private sector through a competitive bidding process led by AEDB plus the four provincial energy departments.

A detailed review of the main policies, regulations, plans, and procedures is included in Annex A. The crucial regulations and documents are as follows:

[3] This can be seen as equivalent to a "feed-in tariff" scheme, or FiT.
[4] https://www.aedb.org/images/ARE_Policy_2019_-_Gazette_Notified.pdf.

- **RE Policy 2006**: Published by the AEDB, this seeks to increase the deployment of RE technologies, creating financial incentives to encourage IPPs to invest in the sector, requiring purchase by NTDC/CPPA of energy derived from RE projects, for example, or allowing net metering and billing.

  At the time, the policy faced several challenges, particularly the high cost of solar and wind technologies—compounded by the absence of resource data—leading to delays in the deployment of projects.
- **ARE Policy 2019**: Finally approved by the CCI in August 2020, this sets RE generation capacity targets of 20 percent by 2025 and 30 percent by 2030 based on the Indicative Generation Capacity Expansion Plan (IGCEP). It seeks to reduce the national cost of generation and displace expensive thermal power plants. RE projects will be procured primarily through competitive bidding; the policy also promotes indigenization and local content in the development of these projects.
- **Indicative Generation Capacity Expansion Plan 2021–2030**: The IGCEP is the cornerstone document of the ARE Policy 2019, which stipulates that IGCEP outputs will underpin all on-grid capacity procurements (except net-metering), and that AEDB will announce bidding volumes annually based on IGCEP outputs. The IGCEP is thus intended to be an iterative plan submitted annually for re-approval based on the electricity demand–supply situation and least-cost generation options. The approved IGCEP 2021–2030 includes hydropower projects as part of a broader target for at least 60 percent of total power generation capacity to come from "clean energy" sources by 2030, as announced by the Prime Minister of Pakistan in December 2020. Our assumption in this report is that installed and planned hydropower capacity will be added to the ARE capacity targets of 20 percent by 2025, and 30 percent by 2030, resulting in a 50 percent "renewable energy" target by 2025 and 60 percent target by 2030.
- **Variable Renewable Energy (VRE) Locational Study**: Published by the World Bank in February 2021, this seeks to identify the best locations for VRE deployment and thereby inform the strategic planning process for future VRE capacity and related upgrades to the transmission grid. According to this study, limited additional transmission infrastructure capacity in the electric grid is needed to reach the target in ARE Policy 2019 of 20 percent ARE capacity installed by 2025. However, additional transmission lines are needed to connect the large-scale solar and wind parks required to reach the 2030 target of 30 percent.
- **Competitive Trading Bilateral Contract Market (CTBCM) Model**: The high-level design of the CTBCM model was submitted in March 2018 and approved by NEPRA in December 2019. The overall target is to have the CTBCM ready to start 18 months after approval by NEPRA of the detailed design and implementation roadmap, which was submitted in February 2020. It was approved in November 2020, thus the deadline for commercial operation is April 2022.

  The CTBCM and the future wholesale electricity market is likely to have important implications for design and implementation of the bidding process, as discussed extensively in this report. This is because the introduction of the CTBCM will modify the institutional framework governing bidding for VRE capacity. It will change the current role of CPPA as the off-taker of the energy supply connected to the transmission grid, placing the DISCOs as future off-takers. Furthermore, its detailed market rules may affect the VRE in terms of balanced costs, capacity payments, and responsibility of large eligible customers, among others.
- **NEPRA Competitive Bidding Tariff (approval procedure) of 2017**: Approved in May 2017, these regulations are applicable to setting the generation and transmission tariff in cases where detailed feasibility studies are available.

  The competitive bidding regulations already consolidate a well-structured bidding framework which we believe should apply in subsequent competitive tenders. However, the regulations establish in clause 14 the possibility of removal or relaxation of requirements if any difficulty arises in giving effect to any provision of these regulations. In this report, we recommended that this clause be invoked in certain contexts to streamline the tendering process.

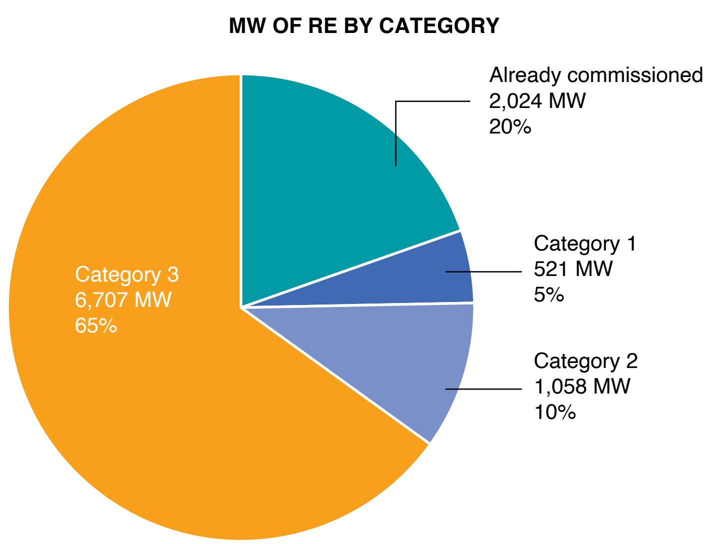
2.1 RE PROJECTS

Although NEPRA announced the end of the Cost-Plus regime for regular VRE procurement in 2017 and encouraged policy makers and project development organizations of the federal and provincial governments to move toward competitive bidding, there is an extensive pipeline of projects that have already been granted under the Cost-Plus scheme.

2.1.1 Categories of future RE projects

The current pipeline of VRE projects is divided into four categories; these categories stem from amendments decided by the Cabinet Committee on Energy (CCoE) on April 4, 2019, with figures updated accordingly in IGCEP 2021–2030. The capacity and breakdown between categories is provided in Figures 2-2, 2-3.

FIGURE 2-2: CURRENT CAPACITY OF RE BY CATEGORY (INCLUDING BAGASSE AND WASTE TO ENERGY)

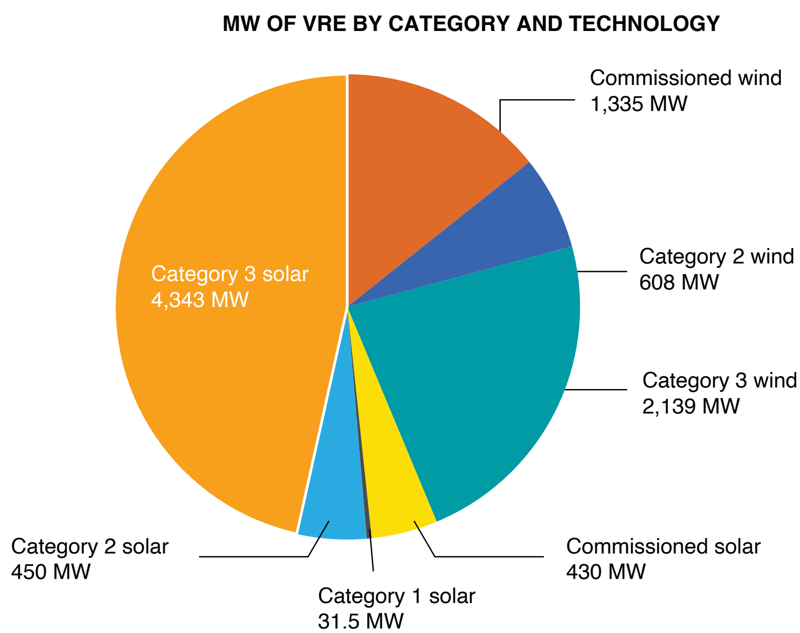


Source: AEDB and IGCEP 2021–30.

Category 1: All those projects which have been granted a Letter of Support (LOS) by AEDB. These projects will be allowed to proceed toward the achievement of their requisite milestones as per the 2006 Policy.[5] However, if more than one year has elapsed since the determination by NEPRA of the relevant tariff, it will be subject to review.

[5] RE resource risk is given to the seller as explained in Annex B.

FIGURE 2-3: CURRENT CAPACITY OF VRE BY CATEGORY AND TECHNOLOGY (SOLAR AND WIND ONLY)



Source: IRENA Renewables Readiness Assessment.

Projects currently at the LOS stage include four solar PV projects with a total capacity of 31.5 MW, and 15 bagasse-based power projects with a total capacity of 489.5 MW.

Category 2: All projects granted a Letter of Intent (LOI) and a tariff by NEPRA, with a generation license. These projects too may proceed as prescribed by RE Policy 2006.

The projects remaining in this category have a total capacity of 1058.3 MW (450 MW of solar PV plus 608.3 MW of wind).

Category 3: All projects issued a LOI prior to the expiry (on March 2018) of RE Policy 2006 but not in receipt of a tariff approval from NEPRA. These projects may be allowed to proceed in the event that they win the bidding conducted by AEDB (as tailored to each technology using the quantum provided by the IGCEP 2021–2030 and the VRE Locational Study). To participate in the bidding process, project developers must provide an undertaking to withdraw any and all lawsuits against federal and provincial governments.

There are 110 projects in this category with a total capacity of 6,707 MW comprising 31 wind projects (2,139 MW), 72 solar PV projects (4,343.5 MW), and seven bagasse projects (224.5 MW).

The competitive bidding for Category 3 projects is intended to set a precedent for future rounds of bidding, although this process may overlap with a small number of projects under Category 4 (see below). According to the draft Request for Proposals (RFP), the main features of the process envisaged are as follows:

- AEDB will conduct the competitive bidding process independently for each technology on a Build Own Operate (BOO) basis;

- The resource risk is borne by the bidder;
- The successful bidder will receive a Letter of Conditional Award (LOCA), which after the fulfilment of its conditions will trigger a LOS by AEDB and the execution of an Implementation Agreement (IA) and Energy Purchase Agreement (EPA);
- After issuance of the LOS, the project agreements and the financial closing (FC) must be completed as per the timelines approved by NEPRA;
- The EPA will have a life period of 25 years;
- The RFP is structured on a single-stage, two-envelope sealed-bid process (Envelope I—Technical; and Envelope II—Financial);
- Bidders are required to present a bid bond of US$5,000/MW and a non-refundable bid processing fee of US$300/MW;
- Bidders must conduct due diligence, including investigations to obtain information or data, entirely at their own risk and expense;
- Bidders can submit a bid not higher than 104 percent of the installed capacity specified in its LOI—already issued—following the principle of 'one LOI, one bid'. Bidders holding more than one LOI may submit a bid in respect of one or more LOIs held by them and are not obligated to submit a bid for all LOIs held by them. Such bidders may, with prior approval of the LOI issuing authority, merge multiple LOIs to submit a bid in respect of the cumulative merged capacity. No bidder can submit a bid for a project in respect of which it does not hold an LOI;
- Successful bidders will have offered the lowest net present value of the bid tariffs, which in a pay-as-bid pricing system must be all-inclusive;
- The benchmark tariff serves as a ceiling for the bid tariff the bidders may offer. Any bidder offering a bid tariff equal to or above the benchmark tariff will be deemed financially nonresponsive and will be disqualified;[6]
- Once the successful bidder is selected, they must submit a performance guarantee of US$2,500/MW and a project processing fee of US$50,000 for projects up to 50 MW, and US$100,000 for projects with higher capacities;
- The bidders need to submit a land title for the relevant site within the Interconnection Ready Zones (IRZs) yet to be determined (NTDC to confirm): registered sale/conveyance deed; notarized agreement to sell with firm price stated and unconditional obligations of the seller and the buyer to execute the sale deed or lease deed upon award of the project; registered lease for a term not less than 30 years; or a final order of allotment issued by the provincial government; and
- Tariffs will be escalated annually with the percentage increase (not exceeding 2.5 percent) stated in the financial bid.

Competition and transparency must be key features of the bidding, and the IRZs available in the competitive bidding should be spread across the country (rather than being concentrated in a certain province) so as not to favor some projects over others. The selection of these nodes derives from a locational study that applied a least-cost criterion.

[6] The authority for this round of competitive bidding has decided to approve a benchmark tariff (ceiling price) of PKR 6/kWh (both for solar and wind projects) with an annual increase thereon to the maximum limit of 2.5 percent.

When bidding is completed, unsuccessful projects lose any former rights. The consequences of LOI termination and any possible legal claims, depending on the stage reached—feasibility study, access to land, and so forth—might impact future rounds of bidding.

Category 4: All future grid-connected, utility-scale VRE projects excluding "behind-the-meter" facilities: a new category subject to future rounds of bidding—and the focus of this study.

3. DEPLOYMENT SCHEMES

3.1 TYPE OF COMPETITIVE BIDDING

The stark choice between site-specific or site-neutral tenders is a key decision in design of the bidding system, especially during a system's infancy, or when only a few specific sites can conceivably be regarded as suitable. However, between these extreme scenarios, intermediate approaches remain possible.

3.1.1 Site-specific tenders

In site-specific tenders a competent authority has selected the land or connection point where the projects will be constructed. The projects tendered are required to show detailed specifications, given that the developer cannot subsequently modify the location or connection point.

A site-specific tender relates to a project of a predetermined size that deploys a particular technology. Because the land and connection points have already been selected, the technology to be used and the size of the project are bounded.[7]

The relative advantages and disadvantages of site-specific tenders are summarized below (Table 3-1).

TABLE 3-1: ADVANTAGES AND DISADVANTAGES OF SITE-SPECIFIC TENDERS

Advantages	Disadvantages
• Reduce up-front costs for developers. • Reduce providers' liabilities to secure land, obtain permissions, perform assessments, and secure access to the grid. • Reduce entry barriers and facilitate the participation of a larger number of bidders. • Favor grid absorption and lower network constraints through use of non-congested areas. • Compliance rules tend to be less stringent.	• May require additional government resources. • May result in delays due to project preparation. • Selected sites may be less attractive for developers.

Site-specific tenders have several implications:

- The project, and therefore the capacity of the tender and the developers' bid are of fixed size and technology.
- The tendering authority needs to make the relevant area of land available and assign a determined connection point. This implies that as part of the tender package, the following documents must be included:
  - Land use agreement with all conditions and associated costs; and
  - Connection agreement with all associated costs stated and defining the maximum absorption capacity.

[7] It should not be inferred from the existence of an upper bound that site-specific tenders necessarily involve small projects. On the contrary, competent authorities can find large areas with available capacity, and the largest developments internationally tend to fall into this category.

- The tendering authority must conduct a resource assessment that is sufficiently exhaustive to establish the bankability of the selected site. However, bidders shall make their own assessment of all the information provided in the RFP regarding the resource assessment, because ultimately any resource risk will not typically be allocated to the tendering authority.[8]
- The measurements and studies included in the due diligence and resource assessment are of a duration dictated by the technology. Prospective wind power projects usually require continuous on-site testing for at least a year to accumulate sufficient data to demonstrate bankability. By contrast, solar power projects usually need a resource assessment of two to three months' duration, and sometimes data from nearby areas will suffice instead of on-site assessment.[9] The disparity of duration implies a difference in associated costs accordingly.
- A preliminary environmental and social impact assessment (ESIA) must be completed by the tendering authority, approved by the relevant local and national authorities, and included as an integral element of the tender package. That assessment will focus exclusively on issues related to the selected land.[10]
- In the case of hydropower facilities, a full feasibility study is needed, including a geotechnical study and hydrology study. Hydropower facilities are normally developed under a site-specific scheme.[11]

In general, for a site-specific tender, the tendering authority maintains more detailed control of the ultimate outcome than for the other types, although developers still have flexibility in the design of their power plants (that is, layout and specific design of the technology involved). All studies and assessments needed for project implementation licenses and permits must be undertaken prior to the bidding.

EXISTING WIND SITES

In Pakistan, most of the installed wind capacity has been developed under a site-specific scheme in the Gharo-Keti Bandar wind corridor, with a high degree of oversight and direction in selecting and parcelling the sites by the government, although without competitive bidding.

The capacity as well as the technology were specified in the Letter of Intent (LOI) issued. The land was allocated by the provincial government on the basis of that capacity.

3.1.2 Tenders within RE parks

A variant on the site-specific tender is the case of RE parks. Solar parks have a successful track record of deployment in Morocco and India, and in Punjab province Pakistan already has its own example in the

[8] The resource assessment for solar power projects tends to cost US$5,000–8,000 (satellite-based without on-site measurement) increasing to US$30,000-50,000 if ground measurements are included. The assessment for wind power needs to gather more exhaustive performance measurements, at an estimated cost of US$100,000–120,000 (average cost of measurements on flat land for roughly 50 MW–80 MW capacity—one wind assessment met mast). The cost increases in mountainous land. For hydropower, cost and required time are quite sensitive to data availability (such as waterflow statistics).
[9] On-site assessment for solar power projects is more time-consuming.
[10] It should be noted that the developer is required to develop a full-fledged ESIA as a part of the full feasibility study.
[11] Site-specific bidding is more relevant for hydropower projects, which are beyond the scope of ARE Policy 2019.

Quaid-e-Azam Solar Park in Bahawalpur. In a park-based scheme, the competent public authority identifies the site or sites, conducts land clearance, and constructs infrastructure that can range from the power transmission line (for evacuation of power) to other elements such as the fence, roads, and street lighting. Once the site is ready for competitive bidding, the bidding procedure begins and one or more successful IPPs become responsible for the financing, construction, and operation of projects within the RE park.

The main advantage of a park-based scheme is to significantly lower development risks (particularly those associated with acquiring land and grid connection consents) and shorten the development timeline for the private sector, which results in cost savings and lower tariffs.

The main drawback is that the implementing agency will need time and an up-front budget to develop the RE park facility before conducting the bidding. There is a risk that the infrastructure expected by the government is not built to the timeline agreed with the successful IPP(s), leading to extra costs to the public authorities arising from compensation payments. It is important to adopt a realistic view of potential delays and on that basis decide what the public authorities will build and what will be left to the IPP(s).

Park-based schemes are mostly used for solar technology. Solar parks can be comparatively compact, and flexible, in the sense that neither quantity nor quality of output is affected when different solar plants are located side by side in the same park. That is not the case for wind, because neighboring wind farms are affected by turbulence—the wake effect—especially when an adjacent array 'catches the wind first', being located in the predominant wind direction. To preclude the wake effect, a wind park must be considerably larger than the average solar park. An example is the wind park being developed in Egypt on the Red Sea coast, where extensive plots of land are available to harness one of the world's greatest wind resources.

In Pakistan there is good potential for RE parks that include both solar and wind projects within the same large area that would share the same transmission line, especially in Balochistan. This would increase the line utilization factor and help justify the significant cost for the related shared infrastructure.

3.1.3 Tenders for preselected locations or substations

These two types of scheme may be regarded as intermediate approaches (distinct from both site-specific and site-neutral tenders at the respective extremes) whereby the developer will encounter some constraints but at the same time enjoy a certain flexibility when selecting the ultimate site or connection point.

A determined MW capacity is tendered (with constraints on individual project sizes if required), and even though the developer is free to bid for the quantity of MW it wants and not for the entirety of a predefined project, the site is restricted to one or more predefined areas. In the case of countries such as Brazil, Denmark, Kazakhstan, Mexico,[12] or Uganda, successful competitive bidding has centered on land plots reserved by the state for the construction of VRE facilities, with the transmission system operator (TSO) or distribution system operator (DSO) providing and reserving grid connection points accordingly.

The advantages and disadvantages of opting for preselected locations are outlined in Table 3-2.

[12] In Mexico, the substation-based criteria are indirectly included through a Regional Adjustment (nodal pricing). The different locations offer incentives or penalties to be accommodated by the bid offer depending on whether they are beneficial for the power system or likely to impose additional costs.

TABLE 3-2: ADVANTAGES AND DISADVANTAGES OF TENDERS WITH PRESELECTED LOCATIONS	
Advantages	**Disadvantages**
• Limited to making the land available and assigning the connection point; • Faster to implement and less burden on the public agency or tendering authority than a site-specific tender as it does not require project preparation.	• Potential additional costs for developers; • More time needed to commission after bidding is concluded; • Selection of unsuitable sites may lead to unsuccessful bids; • Offering a predetermined connection point could cause land disputes if privately-owned or blocked somehow by speculators.

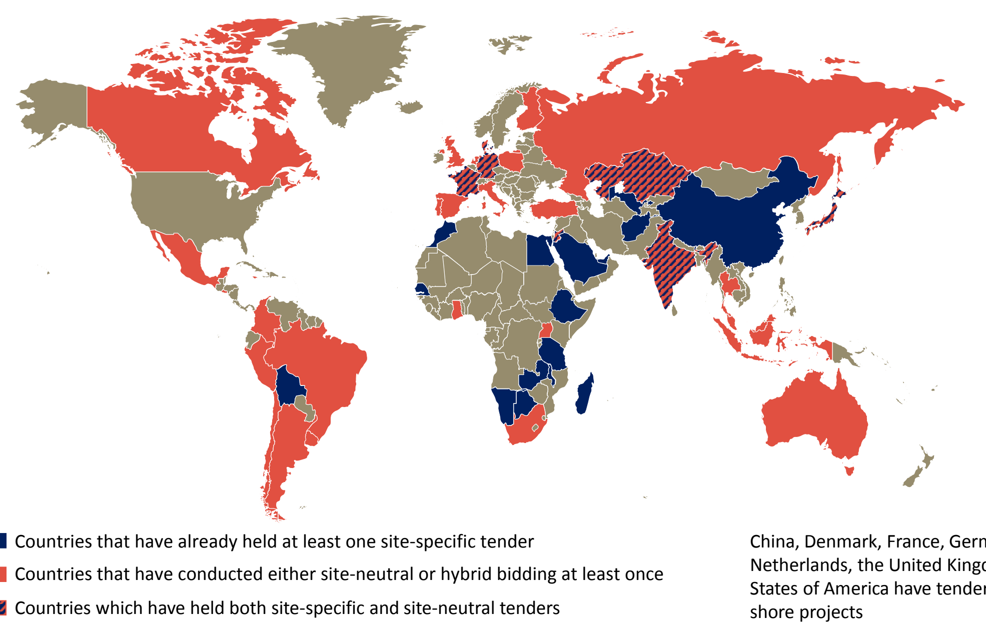
A variation of this scheme is the substation-based scheme in which the competent authority identifies substations with available capacity, and a certain MW capacity at each substation is opened for bidding. In this case, the land is not directly chosen by the authority, but it is often limited to an area surrounding the selected substation, allowing the developer to bid for the capacity that it wants (within the limits stipulated).

The substation-based model would add the following observations to Table 3-2: Advantages and disadvantages of tenders with preselected locations:

- Advantage—it requires less effort from the authorities, because although the connection point is chosen, the land is not. Therefore, developers must identify land details combined with a short prefeasibility study of the project.
- Disadvantage—if there are too few selected substations, lively competition for land around the substation could result, driving up the EPA price.

Figure 3-1: Sample of countries which have held site-specific and site-neutral competitive bidding processes shows a sample of countries that have implemented site-specific or site-neutral competitive bidding processes.

FIGURE 3-1: SAMPLE OF COUNTRIES WHICH HAVE HELD SITE-SPECIFIC AND SITE-NEUTRAL COMPETITIVE BIDDING PROCESSES



Source: Authors.

3.1.4 Site-neutral tenders

In site-neutral tenders (also called location-agnostic tenders), a production capacity (specified in MW) is put out to tender, and developers are free to connect to the grid and locate that capacity in an undetermined site. Developers are required to acquire their own land, find the connection point, and negotiate connection agreements. In the extreme case, what is bid is the right to sell a specified volume of power at a predefined price or floor price over a predefined time; all development costs and liabilities are allocated to developers.

In most cases, the TSO publicly releases key technical information on each of the grid connection points, including available absorption capacity.

The advantages and disadvantages of site-neutral tenders are outlined in Table 3-3.

TABLE 3-3: ADVANTAGES AND DISADVANTAGES OF SITE-NEUTRAL TENDERS

Advantages	Disadvantages
• Cheapest projects—from developers' perspective—will be developed. • Simplest and fastest to implement.	• Additional costs for developers. • Concentration of projects in resource-rich areas may complicate grid connection. • Uneven distribution may create opposition in regions with high concentration of VRE provision. • Land speculation. • Higher risk of project not being developed unless high bid bonds are implemented.

Source: Authors.

The implications of a site-neutral tender are diametrically oppositeto those of a site-specific one: the developer needs to decide where to obtain land, perform the assessment studies at their own risk and make them bankable, and find a proper connection point. This type of competitive bidding process also offers bidders greater flexibility on design of the power plant.

3.2 TECHNOLOGY-SPECIFIC OR TECHNOLOGY-NEUTRAL

With regard to technology, there are two different types of tender: technology-specific (also called technology-wise) and technology-neutral (or technology-agnostic), the advantages and disadvantages of which are provided in Table 3-4.

As described above, in site-specific bidding the technology of the project is usually predetermined according to the characteristics of the site. In this sense, technology-specific and site-specific tenders go together. There may be cases of multitechnology projects,[13] but the most common case of hybridization is solar photovoltaic (PV) plus concentrated solar power (CSP) or solar PV-wind power plant (WPP) (+ storage/diesel).

ARE Policy 2019 does not specify whether tenders are restricted to single or multiple technologies. However, for site-specific park-based schemes we recommend technology-specific tenders, which would

[13] India launched solar-wind hybrid bidding in 2019.

TABLE 3-4: ADVANTAGES AND DISADVANTAGES OF TECHNOLOGY-SPECIFIC OR TECHNOLOGY-NEUTRAL TENDERS

	Definition	Advantages	Disadvantages	International experience
Technology-specific tenders.	Only the stipulated VRE technology allowed.	Achieve diversification and reduce technology risk. Allow specific industry development. Simplicity. Can help achieve grid stability and VRE absorption by implementing targeted technology-specific auctions.	The VRE market does not develop in the most efficient way, which affects the final cost.	Specific rounds of bidding in Brazil before 2010 helped the wind industry to develop and made wind energy competitive within the energy mix. Other countries such as China, Colombia (2019), India, Morocco, Peru, South Africa, Uganda, the United Arab Emirates, and Zambia implemented technology-specific tenders.
Technology-neutral tenders.	All VRE technologies allowed.	Allow discovery of the most competitive technology. Foster competition.	Lack of diversification if the market is not mature enough.	In Brazil, after 2010, technology-neutral tenders were implemented, and VRE was more competitive than natural gas. Chile, Colombia (before 2006–2018), Denmark, Finland, Mexico, the Netherlands, Spain, and USA (California; Hawaii) have also implemented technology-neutral tenders.

Source: Authors.

tend to simplify the bidding process and allow tighter control over any technological diversification strategy centered on appropriate development and consolidation of a given industry: a core target of ARE Policy 2019.

Technology-specific tenders will help in the development of hybrid RE parks with high transmission grid utilization factors. The risk with technology-neutral tenders is that a single technology may clear all the volumes under the tenders, potentially achieving cheaper generation prices but not minimizing the total cost (generation plus transmission). By contrast, a technology-specific tender will avoid the risk of developers failing to maximize the line utilization factor for lack of relevant incentives to do so (or immunity from any costs of such a failure).

An alternative, applicable to hybrid parks, would be to impose a mandatory grid utilization on all projects proposed. However, this alternative, while achieving the same target, may make the tenders more complex to evaluate.

It is important to note that different technologies will imply different requirements, not least because solar and wind projects differ substantially. These different requirements, such as time required for the resource assessment, feasibility study, or construction, are explained later in this report.

For the substation-based model, a technology-neutral tender is recommended in order to maximize the available capacity of the substation. However, as noted in the VRE Locational Study, most of this capacity would correspond to solar PV technology as per the characteristics of available sites.

TIME OF USE RATES IN CHILE

In Chile, bidders compete either for seasonal (quarterly) blocks of time, or on an hourly basis, to accommodate specific resources in technology-neutral tenders (including fossil fuel sources), with a price revision mechanism that allows the price to be changed in the event of significant and unexpected legal, regulatory, or fiscal changes.

Although the tender is ostensibly technology-agnostic, it is designed in a way that favors certain technologies. Whereas quarterly blocks benefit wind and hydro, the hourly blocks particularly benefit PV.

The possibility of considering indexation factors when assessing the bids (levelized price) is a design element incorporated into recent tenders.

In the future Pakistan may too explore more innovative bidding designs, such as by specifying a minimum capacity factor or setting time of use (TOU) rates, which could incentivize storage or small-scale hydropower.

3.3 SELECTION OF A TYPE OF COMPETITIVE BIDDING FOR PAKISTAN

Deployment schemes must be selected on the basis of:[14]

1. The assessment of the risks perceived by the private sector;
2. The country's willingness to contribute to the development activities; and
3. The country's specific restrictions.

Most frequently, key project development risks are related to legal constraints, and land and grid connection, as summarized in Table 3-5:

- Secured land rights are critical for long-term investment and financing. The main asset considered a security for the lender is the plant. Its ownership relies on legal rights over the land, enabling the project company to hold the plant during the lifetime of the project agreements. IPPs assess the country's land tenure system to evaluate the level of security it provides. If land cannot be secured in a bankable manner, IPPs will not normally invest in the country, and in the event that they do, will expect very high equity returns.

  Contention over land usually increases in proportion to the size (area) of the site, such that the use of large sites for large projects (often strategic developments) is more difficult to agree than land rights for smaller plots of land, where domestic private developers tend to reach successful agreements.
- If land availability or the security of tenure are identified as high-risk issues, park schemes should be favored by relevant authorities because these could offer act as a mitigation measure for large sites.

[14] "World Bank. 2019. "A Sure Path to Sustainable Solar." Washington, DC: World Bank. Guidelines for public investment in solar parks.

- A limited knowledge of grid availability and conditions leads to: (1) the developers spending excessive time trying to get information from the government or utility to conduct a grid integration study for the specific project; and (2) an incomplete grid integration study that may not represent the reality of the grid. If the project is based on an incomplete grid study, there is a potential risk of curtailment because the project would not have been conceived on a sound technical and commercial footing. In general, the public agency sponsoring the VRE park would be charge of doing the connection study.

If the grid is identified as a high-level risk issue, public authorities may opt for:

1. A site-neutral scheme along with compulsory reliable information available for developers by TSO;
2. A substation-based scheme; or
3. A park scheme.

TABLE 3-5: SUMMARY OF RISK MATRIX FOR PAKISTAN

		SOLAR	WIND
LAND	Land right	Possibility of acquiring land for private parties. Province may help by providing public lands.	
	Land availability	High and distributed.	Scarce and concentrated.
GRID	Availability	Yes, for small/medium projects.	No, for large projects.
	Information/condition	Lack of public reliable information at the required level of detail.	

Source: Authors based on World Bank. 2019. "A Sure Path to Sustainable Solar." Washington, DC: World Bank. 2019. (see Section 4.4: Selecting a deployment scheme).

According to the VRE Locational Study and based on the resource mapping and connection analysis performed, Pakistan has limited wind corridors (in Balochistan and Sindh) but available solar potential across the country. The study also proposes the development of projects of various sizes, mostly in the range of 100 MW to 500 MW[15] of solar PV and wind between 2022 and 2025, finishing with larger projects of up to 4,000 MW by 2030.[16] These larger projects will require the development of important infrastructure. For the larger projects, we recommend the implementation of a park-based deployment scheme to limit both land and connection risks for future developers.

As previously noted, this approach can be applied to solar power projects and to wind projects—addressing the technical constraints mainly produced by the wake effect of neighboring wind plants—by disseminating the information to the bidders and enabling them to bring yield losses into their initial energy yield calculations. Park-based schemes will be strategic for wind projects as available land in the country is limited for this technology in Pakistan.

Based on the results of the VRE Locational Study, looking at large developments of solar PV and wind power in the same areas, we propose multitechnology RE parks where each block (or parcel) of an agreed

[15] There are some exceptions, such as one wind project of 860 MW in 2022 and one solar project of 650 MW in 2023.
[16] The largest site aims to develop 4,500 MW of wind power plus 3,250 MW of solar PV in Chaghi (Balochistan). After the publication of the latest update of the IGCEP, these large projects may be delayed because of the reduction on RE capacity.

capacity[17] is technology-specific (solar PV, wind, and perhaps also concentrating solar power, or CSP). This approach avoids the possibility of all blocks of the park ultimately being developed with the same technology (that is, a 100 percent wind or solar PV park tendered on a technology-agnostic basis), and the grid utilization factor is maximized by ensuring the optimal mix of different technologies.

Furthermore, for small and medium-size projects, we recommended a technology-neutral substation-based deployment scheme within a predetermined land perimeter. A substation-based scheme can limit grid connection and land acquisition risks,[18] although this leaves the final choice of the site to the developer. It would also be able to take advantage of the excess capacity in some existing substations using either solar PV or wind technologies, and with the infrastructure already in place it should be easier to start with these tenders. Although the deployment scheme would be introduced through a technology-neutral tender, the VRE Locational Study shows how solar PV resource is more widely distributed in the country and would cover most of these small and medium-size projects.

We recommend that for the substation-based projects a perimeter be set, of a magnitude appropriate to the size of the tender and characteristics of the land, and where public authorities might facilitate land acquisition by the developers. Notwithstanding this recommendation, the possibility of developing projects outside these limits should be studied,[19] and analyzed on a case-by-case basis, taking the substation as fixed and considering whether it would be possible to get a lower price than in the predetermined area if:

- The developer shoulders all costs of the construction of the line from the point of generation to the substation;
- NTDC or the relevant distribution company (DISCO) operates the line as soon as it is built; and
- All the required permits can be obtained (right of way and power transmission line, environmental permit, construction permit and so forth), as well as agreement with NTDC/DISCOs.

This option, while complicating the required procedures, might be economically efficient and attractive when areas with high potential resources are placed far away from the available substations. This would also increase participation in the tenders.

The competitive bidding projects will be developed as public–private partnerships, where Build Own Operate (BOO) and Build Own Operate Transfer (BOOT) will be the main approaches. In park-based schemes for large wind and solar PV projects, where the provinces own the park, both BOO and BOOT approaches may be considered, whereas for substation-based schemes, BOO will be the only option considered. The advantages and disadvantages of both schemes are explained in Table 3-6.

In a BOO approach, once the EPA, the Park Lease Agreement, and the related agreements expire,[20] the project owner will be in charge of the decommissioning of the projects. The land (always owned by the

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17 To be defined in the Current Year RE Procurement Plan (CYREPP), we recommend 300–500 MW per block/parcel, which is further explained in section 5.1. Once the parcels are defined, the capacity for each technology will be defined.
18 The land parcels are not selected by the public authorities, but the land aquisition risk is limited through the selection of substations where there is the likelihood of available land, either privately or publicly owned.
19 This recommendation is usually valid for only a few km beyond the selected perimeter, as longer distances are most likely unfeasible due to the cost of the line.
20 They can be extended after negotiation if the different parties agree, as explained in sections 6.3.3 and 6.3.4.

TABLE 3-6: ADVANTAGES AND DISADVANTAGES OF BOO AND BOOT APPROACHES IN COMPETITIVE BIDDING

	Advantages	Disadvantages
BOO	Decommissioning of the plant burden allocated to seller. Site ready for new rounds of bidding with limited additional cost.	Some potential financial benefit to provinces lost.
BOOT	Some financial gains for the province, either due to: • keeping the facilities running for several years; or • tendering out the repowering.	Higher operational expenditures. Repowering likely needed. More complex agreements.

province but leased to the project owner) will now be back in the province's hands, and ready for a new round of BOO bidding as soon as the country needs more RE capacity and the authority approves the process. This approach is simpler, but BOOT schemes can be further evaluated on a case-by-case basis by the provincial authorities and the Alternative Energy Development Board (AEDB). In any case, the line from the facility to the connection point must be developed under BOOT or directly handed over to the TSO.

4. COMPETITIVE BIDDING GOVERNANCE

4.1 FREQUENCY AND PLANNING

It is essential to have a clear schedule for regular bidding. A regular, consistent, and well-structured annual bidding program will promote continuous development of VRE and its associated industries. It will also allow for year-on-year improvements in the design of the tender regime itself, reflecting past experience. A regular competitive bidding program will allow delineation of the size of the bidding process and will help developers in planning ahead to meet the tender schedules. The more accurate the competitive bidding schedule is, the more precise bidding timelines can be. Figure 4-1: Countries with regular tender schemes lists a number of countries that hold regular rounds of bidding, all of which have built up substantial markets for VRE.

There are alternatives to an annual tendering schedule that may also work, so long as they are based on the same principles of regularity and continuity, such as implementing tenders with longer intervals (for example, every 18–24 months). Nevertheless, one year is the recommended interval for Pakistan, with year-to-year tenders aligned with the yearly introduction of VRE as explained in section A.3.

FIGURE 4-1: COUNTRIES WITH REGULAR TENDER SCHEMES

Country	Year												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
South Africa					✓	✓	✓	✓	✓				
Brazil	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
India[a]				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Germany									✓	✓	✓	✓	✓
Abu Dhabi									✓	✓	✓	✓	✓
France										✓	✓	✓	✓

[a] India includes regional and national tenders

Source: Authors.

Within the regular tender system, it remains possible to interpolate stand-alone tenders if needed, and to modify the scheduled ones where particular circumstances warrant it (for example, the opening of a new out-of-schedule tender as a result of an empty one). The commissioning of the tenders held and the quality of the projects developed are also equally important.

The sizing of the VRE tenders should consider the following aspects of the supply–demand scenario in Pakistan:

1. The targets of ARE Policy 2019;
2. The Indicative Generation Capacity Expansion Plan (IGCEP), as summarized below in Table 4-1;[21]
3. The current installed VRE capacity of 1,765.1 MW, consisting of 430 MW of solar photovoltaic (PV) and 1,335.1 MW of wind power;
4. Category 1 projects comprising 31.52 MW of solar PV, and Category 2 projects comprising 608.3 MW of wind power plus 450 MW of solar PV;
5. The current installed bagasse capacity of 259 MW; Category 1 bagasse projects account for a further 489.5 MW (15 projects);
6. Category 3 projects subject to competitive bidding, which have a cap in an undetermined percentage of their total volume of 6,707 MW, among those: 31 wind projects (2,139 MW), 72 solar PV projects (4,343.5 MW), and seven bagasse projects (224.5 MW).

TABLE 4-1: PLANNED SOLAR AND WIND CAPACITY IN THE IGCEP 2021–30, 2023–2030 (MW)

Year	Solar	Wind
2023	—	—
2024	1,000	1,000
2025	1,000	1,000
2026	1,000	1,000
2027	1,000	62
2028	1,000	—
2029	1,000	—
2030	1,000	—
Total 2023–2030	7,000	3,062

Source: IGCEP 2021–30.

The capacity of solar and wind projects already commissioned and expected under Categories 1–3 is summarized in Table 4-2.

TABLE 4-2: SOLAR AND WIND CAPACITY THAT IS ALREADY COMMISSIONED OR DUE TO BE DEVELOPED UNDER CATEGORIES 1–3

	Commissioned	Cat 1	Cat 2	Subtotal Com+Cat1&2	Assumption: % of Cat 3 to be tendered	Cat 3	Total
Wind	1,335.1	0	608.3	1,943.4	46.7%	2,139.0	2,943.4
Solar	430.0	31.5	450.0	911.5	24.1%	4,143.5	1,911.5
Total	1,765.1	31.5	1,058.3	2,854.9	31.8%	6,282.5	4,854.9

Source: Compiled by the authors from various sources.

21 The IGCEP is a live document that the NTDC and NGC are required to submit annually to NEPRA for approval based on the electricity demand–supply situation and least-cost generation options.

Therefore, considering the targets, the expected installed capacity of the IGCEP, the already commissioned capacity, and Categories 1 and 2 committed projects, the total capacity to be installed through competitive bidding is:

$$\begin{aligned}&\textit{Volume Category } 3 \textit{ and Category } 4\\ &\quad = \textit{IGCEP Wind and Solar Capacity by } 2030 - \textit{Commissioned} - \textit{Cat } 1\\ &\quad - \textit{Cat } 2 = (5{,}005 + 7{,}932) - 1{,}765.1 - 31.5 - 1{,}058.3 = 10{,}082.1 \textit{ MW}\end{aligned}$$

Under the assumption that all the capacity to be developed by year 2024 derives from competitive bidding under Category 3, which according to the IGCEP implies a maximum of 1,000 MW of wind power and 1,000 MW of solar power, Category 3 would involve at maximum the successful award of 46.7 percent of the required wind capacity and 24.1 percent of the required solar capacity. Thus, the volume left to be tendered under Category 4 competitive bidding would be slightly more than 8 GW.

$$\begin{aligned}&\textit{Volume Category } 4\\ &\quad = \textit{IGCEP Wind and Solar Capacity by } 2030 - \textit{Commissioned} - \textit{Cat } 1\\ &\quad - \textit{Cat } \ 2 - \textit{Cat } 2 = (5{,}005 + 7{,}932) - 1{,}765.1 - 31.5 - 1{,}058.3 - 2{,}000 = 10{,}082.1 \textit{ MW}\end{aligned}$$

This number could vary, theoretically from as low as 3.8 GW, if all the capacity currently in Category 3 is tendered and awarded, to as much as 10.0 GW in the extreme (and unlikely) case of totally unsubscribed bidding. The central assumption is that solar and wind developments from year 2025 will be based on competitive bidding under Category 4.

According to the IGCEP 2021–2030, an annual amount of 1,000 MW of solar PV will be tendered every year, while wind varies from 62 MW to 1,000 MW until reaching 10 GW of new deployed VRE by 2030. From 2024 to 2030 an average volume of almost 1,450 MW of VRE is to be tendered every year (including Category 3), with around 70 percent accounted for by solar PV and 30 percent by wind.[22]

In view of the required bidding and development timelines—approximately eight months for bidding and obtaining a Letter of Support (LOS); plus 8–16 months to achieve financial closure and execute the project agreements; plus 12–24 months[23] until commercial operation—the full process would require 2–4 years from commencement of bidding to commissioning of the project. Therefore, to meet the IGCEP calendar, the first rounds of bidding for solar PV and wind must be held in 2022, and the last one in 2026–2028,[24] to reach the 2030 target.

Besides the IGCEP and the VRE Locational Study,[25] two other technical documents are still needed to accurately design the bidding:

- A Transmission System Expansion Plan; and
- A Transmission System Investment Plan.

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22 The VRE Locational Study looked at starting development earlier, with additions of 3,082 MW of solar PV and 1,480 MW of wind power by 2023, requiring an earlier start than IGCEP. However, given the delays to VRE implementation caused by the COVID-19 pandemic and other changes, the IGCEP 2021–30 calendar is more relevant.
23 Additional time dependent on the technology: longer period needed for wind projects. See section 6.1.3.
24 2026 for wind tenders and 2028 for solar PV tenders.
25 World Bank. 2021. Variable Renewable Energy Locational Study. Pakistan Sustainable Energy Series. Washington, DC: World Bank.

These documents are key to providing accurate timelines for the readiness of the infrastructure associated with the new VRE capacity to be installed. It is also important to periodically update the numbers according to new master plans, integration of the grid, demand studies, and the accomplishment of the targets, as the long-term strategy is extended to future years with new goals.

Under the selected deployment scheme, various procedures are required to ensure the correct execution of the competitive bidding process and avoid any possible blockages. In essence, these procedures determine the volume to be tendered, the connection point, and the associated land (if any). In this context, we propose the following procedure:

1. A steering committee established under AEDB shall decide through consensus the Current Year RE Procurement Plan (CYREPP), which includes:
   a. The capacity to be tendered;
   b. The split between solar and wind technologies;[26] and
   c. The substation where the capacity will be connected.[27]
2. Based on the latest IGCEP and informed by the VRE Locational Study or subsequent, more detailed locational studies (perhaps at the provincial level), the steering committee shall decide the final capacity and the selection of connection points to be proposed for bidding, which include:
   a. If the capacity plan to be tendered during the year is higher than the available capacity of the substations, all the available capacity will be tendered for its associated technology in the available sites.
   b. If the capacity to be tendered during the year is lower than the available capacity of the substations, the steering committee will select based on the following different options:
      i. Market-based options, where all the available connection points go to the tender and are finally selected by the offers of the bidders during the competitive bidding, strictly based on the prices. This model is difficult to constitute as ARE Policy 2019 vests to the provinces the role of making land available and extending other facilities to the bidding process. In addition, it would be difficult to prepare all the substations under the selected park-based and substation-based deployment schemes, as that would imply higher internal resources for the tendering authority;
      ii. Pro rata procedurally among the provinces, with 25 percent of the volume to be tendered assigned to each province and the province later allowed to choose the substation it considers more suitable;
      iii. Variable assignation of the connection points based on the quality of the resource (80 percent) and the province where the connection point is located (20 percent). In this case, 80 percent of the volume to be tendered shall be allocated to the connection points with better quality of resources, least expense on transmission/distribution network augmentation and adequate system reliability independently of the province where

[26] When designing a power project, the technology selected (wind, solar or hybrid) will determine the grid utilization factor. The developers might accordingly be asked in the future to achieve a minimum grid utilization factor, in light of the available grid capacity. A high utilization factor would optimize the production of energy from the developers' side. The minimum utilization factor must be analyzed for each case by NTDC, which might then see fit to make it mandatory. This grid utilization factor may be also used for the prioritization of hybrid sites, which could be based on the results of the VRE Locational Study or other more recent analysis.

[27] Both for park-based and substation-based deployment schemes.

the area is located,[28] and the other 20 percent of the volume shall be equally prorated among the four provinces (one-quarter for each); or

iv. Full resource-based criteria, where the chosen connection points shall be decided considering only the prospective final price based on the solar and wind resource potential, without considering the province where the substation is located.

While option (iv) is the most economically efficient for the system, we recommend option (iii) to avoid barriers and conflicts among the provinces themselves and other members of the steering committee.

3. The steering committee shall decide by consensus, and the first version of the CYREPP must be submitted to AEDB for approval by September 30 at the latest.
4. If AEDB does not approve any aspect of the CYREPP (volume, technologies, and/or substations), the AEDB shall explain its reasons and the steering committee shall decide and reach consensus again.
5. AEDB will finally approve the CYREPP with its possible changes by December 31 at the latest.

Finally, we also recommend that the steering committee prepare a non-binding tendering plan for the next 5–10 years. This will help the preparation of CYREPPs[29] in future years and offer an outline view of future rounds of bidding that will prompt developers to take a good look at Pakistan. This longer plan will help in the development of the required infrastructure for future projects. Additionally, as a part of this plan, barren areas of land will be identified (because it is not generally possible to build solar plants on agricultural or productive lands).

4.2 GOVERNANCE ROLES AND RESPONSIBILITIES

4.2.1 Roles and responsibilities of relevant institutions

A crucial aspect of bidding process design is the designation of institutions to run it (and their respective roles). According to ARE Policy 2019, AEDB, the provinces,[30] and the steering committee assume the main responsibilities for governance of the bidding. However, under its current competitive bidding framework, Pakistan additionally involves several other institutions in the process, as follows:

- **Alternative Energy Development Board (AEDB):** This announces the competitive bidding volumes based on the outputs of the technical documents (especially the IGCEP and VRE Locational Study); approves the RFP and associated contract package;[31] sets the competitive bidding calendar and

[28] Variable assignation would be based on resource potential. It may also consider other characteristics, such as the load centers in the vicinity, and the interconnection capacity, to minimize losses and maximize the grid utilization factor. This tallies with proposals in the VRE Locational Study for the development of power plants at the 132 kV connection levels of DISCOs, feeding the load locally, especially in the short- and medium-term scenarios.

[29] As per the CTBCM, there will be a Capacity Procurement Plan based on the calculated gap, taking into consideration energy policies of the government, IGCEP, and the Transmission System Expansion Plan and complementary reports on transmission constraints and investments. This process will be undertaken as per provisions of the relevant regulations of NEPRA. The Capacity Procurement Plan will propose the quantities to be tendered (capacity and/or energy) and whether the tender(s) will be differentiated by technology or will be technology-neutral.

[30] Provinces are also part of the AEDB Board.

[31] Further approval by NEPRA is also required.

schedule; approves the CYREPP; awards the concession on behalf of the government; and provides the government guarantee through the Implementation Agreement (IA).

- **Provincial energy departments (the provinces):** These conduct the rounds of competitive bidding,[32] make land available,[33] and facilitate the bidding process in other ways.
- **Steering committee,** formed as a subcommittee of the AEDB,[34] it prepares the RFP and the associated contract package; liaises with the provinces to identify land parcels and other facilities (such as access roads) that the provinces are willing to offer to the VRE projects based on IGCEP and locations confirmed by the National Grid Company[35] (NGC); prepares a provisional CYREPP for the subsequent fiscal year and makes the required revisions (capacity to be tendered and connection points); and prepares the contractual framework (expression of interest (EOI), RFP, and project agreements).

  The composition of the steering committee includes seven voting members plus two nonvoting members to whom will be added one more nonvoting member as soon as the new wholesale electricity market is implemented:
  - An additional secretary of Ministry of Energy (power division) (1)
  - A joint secretary of Ministry of Energy (power division) (1)
  - The CEO of AEDB (1)
  - Provincial Energy Secretaries (4)
  - The Managing Director, NGC (nonvoting member) (1)
  - The CEO of the Market Operator (nonvoting member) (1)
  - The CEO of the System Operator as soon as a separate entity is created and licensed (nonvoting member) (1)
- **National Electric Power Regulatory Authority (NEPRA):** This provides overall approval of the tender documents and process, tariffs, and indexation, based on the results of the competitive bidding; and grants the generation license. We also recommend that NEPRA become a nonvoting member of the steering committee, because this would tend to facilitate—and speed up—the process of supervision required of the authority.
- **Central Power Purchasing Agency (CPPA):** This is the off-taker of the tendered power connected to the transmission grid.
- **GoP:** The government secures payment obligations over the term of the EPA with sovereign guarantees through the IA provided by AEDB (on behalf of the government).
- **NTDC/DISCO:** They conduct the IGCEP and its further revisions; take part in the connection agreement and permissions.

The steering committee will take an essential role because it includes AEDB and provincial members (one for each province, and collectively the largest voting group).

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32 One representative of the AEDB will be associated with the bidding process conducted by the provinces.
33 Under a park-based scheme the province will remain fully and directly in control, but in a substation-based scheme, where the provinces might delimit the land available around the substation, there also exists the possibility of making agreements and obtaining land from private owners within the specified perimeter. This is further elaborated under sections 6.3.1 and 6.3.2.
34 The steering committee might be placed outside the administrative ambit of the AEDB, to grant it greater autonomy.
35 Currently this role is carried out by NTDC.

According to ARE Policy 2019, the provinces take the role of tendering authority or conductor of the rounds of bidding. As illustrated in Figure B-1 (Annex B), in most countries a variety of bodies will jointly take on the governance and implementation of bidding. However, the role of tendering authority is not commonly shared among different institutions in a provincial or regional setting; on the contrary, the most common dispensation is to vest the role of tendering authority in a single national organization. While there are international examples of provincial competitive bidding in India, Australia, the US, or Canada, in the cases of Australia, Canada, and the US there are independent and autonomous transmission system operators (TSOs) in all those countries (apart from India) and these cover different provinces or regions, such as the Alberta System Operator in Canada, the California Independent System Operator, the Southwest Power Pool (with headquarters in Arkansas), or the Electric Reliability Council of Texas. This model differs from the Pakistani structure, with NTDC operating the national backbone transmission system (except for K-Electric). India is a similar example, with its Power Grid Corporation of India Limited at the national level and several state transmission utilities.

INDIA

Utility-scale tenders in India for solar PV have been implemented using the following different tender schemes:

- Central public sector agencies acting as tendering authorities and off-takers; for example, the Solar Energy Corporation of India (SECI), and the National Thermal Power Corporation (NTPC). These agencies then sign power sale agreements with state distribution companies or another institutional off-taker;
- Individual states organizing tenders to meet state-level renewable energy targets with state distribution companies as off-takers; and
- A hybrid approach involves the development of solar parks where central and state institutions jointly create implementing bodies that undertake the tasks associated with land procurement and infrastructure development, and then invite the private sector to develop projects within these solar parks.

State-level tenders conducted in 2016–2019 yielded higher bids compared to other tenders because of higher land and project development costs, relatively low radiation levels, and poor credit rating of off-takers, among other factors. In 2016, tenders under the National Solar Mission were the most common. A key characteristic of these tenders is that both SECI and NTPC are highly bankable off-takers and substantially reduce the risks for investors. Furthermore, both entities are now part of a tripartite agreement between the government of India, state governments, and the Reserve Bank of India, which protects them in the event of a payment default.

The Constitution of Pakistan establishes in article 157.2 that the government of a province may:

1. to the extent electricity is supplied to that province from the national grid, require supply to be made in bulk for transmission and distribution within the province,
2. levy taxes on the consumption of electricity within the province,

3. construct power houses and grid stations and lay transmission lines for use within the province, and
4. determine the tariff for distribution of electricity within the province.

Points (1) and (2) above are reflected in the NEPRA Act Chapter II, article 7.4.

ARE Policy 2019 thus recognizes the right of the provinces *"to develop their own power generation projects, lay transmission lines, distribute electricity, and even set their own tariffs, if the power generated is for use within the boundary of the relevant province and the ARE project (AREP) is not connected to the national grid. Recognizing these constitutional rights, the provinces are free to institute their own policies for projects where neither the power off-take is by a Federal entity nor the interconnection is provided by NTDC/DISCO. The contracts in such cases shall be directly between the AREPs and the Provincial Government or its agencies, without financial or contractual commitment of the Federal Government or any of its entities."*

When considering the main features required of a tendering authority, the provinces will be seen to have credibility, and a good reputation; furthermore, two of them (Punjab and KP) have previous experience of tender administration for renewable energy hydro power projects. However, a gap assessment should be carried out of the three main stakeholders—AEDB, the provinces, and the steering committee—reviewing their technical and human resource capacity based on the assigned tasks, to make sure that the work will be properly executed according to the work plan and avoiding delays. The gap assessment should evaluate:

- The technical capacity of the steering committee to develop the needed documentation setting out technical specifications alongside the elaboration and standardization of formats for the tender package documents;
- The capacity of those three stakeholders (AEDB, the provinces, and the steering committee) to solve technical and legal issues that may arise during preparation or implementation of bidding; and
- Their human resources capabilities and, in consequence, the necessity or otherwise of external support for preparation and implementation of the competitive bidding.

Based on the gap assessment, collaboration among the different stakeholders is essential. In the case of huge projects, such as the solar and wind park in Balochistan, provinces may wish to request support from federal authorities or development partners to prepare and run the competitive bidding (if the work surpasses the capacity of their internal resources or if the project is of strategic national importance). Another option to be considered is full externalization. Also, based on the results of the gap assessment, targeted training may be needed to improve the capacity of the various stakeholders.

In addition to the abovementioned institutions, the competitive bidding model needs the creation of a new institution: an evaluation committee, distinct from the steering committee. This will be responsible for evaluation of prequalification and procedural requirements and the financial bids of the tender. We recommend the outsourcing of the evaluation committee—for example to a transaction advisory firm—to avoid a conflict of interests with the other stakeholders involved (that is, AEDB, the provinces, or the steering committee). Outsourcing for the evaluation would also lighten the burden of activities undertaken by the provincial departments for the preparation of the competitive bidding.[36] The evaluation

[36] We acknowledge that in the past some provinces have conducted evaluation for competitive bidding processes. However, although some provinces could arguably undertake evaluation for small projects, others lack the

must be conducted by a suitable entity with previous specialist experience using an appropriate evaluation framework; the cost will be relatively small in the context of the benefits that will flow from a well-executed competitive bidding process.

Table 4-3 shows the different roles and responsibilities involved in the competitive bidding process; while Table 4-4 shows the roles to be taken up by public or private parties (or both) depending on the deployment scheme selected.

TABLE 4-3: ROLES AND RESPONSIBILITIES IN THE COMPETITIVE BIDDING PROCESS

	Responsible	Other Main Stakeholders
Set General Guidelines and Define Rules	NEPRA	
Request for Proposal and Tender Package (EPA,IA, CA and PLA/LA)	Steering Committee	AEDB and NEPRA must approve the RFP and the associated tender package
Selection of Capacity and Annual Procurement Plan	Steering Committee	AEDB has to approve the volume to be auctioned every year
Selection of the Interconnection Nodes	Steering Committee	AEDB has to approve the selected substations for the tenders
Selection of the Location	Steering Committee and Provinces	Province have the last decision as main owners of public lands
Conduct the Tender	Provinces	One representative of the AEDB will be associated with the bidding process
Evaluation	Evaluation Committee	NEPRA must approve the Bid Evaluation Report
Tariff and Indexation	NEPRA, AEDB and Steering Committee	NEPRA must approve
Award of Concession	AEDB	AEDB awards the concession on behalf of GOP
Monitor & Surveillance	AEDB/Steering Committee/Provinces	NEPRA shall supervise at the end of the process that has been performed according to the regulations and baaed on the Bid Evaluation Report

Source: Authors.

For a park-based scheme, the winning bidder will need to develop its own (private) Special Purpose Vehicle (SPV) to implement the project, to be reflected in the organizational and legal structure accordingly. This may be supplemented by a public SPV, bearing in mind that:

- The creation of a public SPV in the park is most feasible for larger parks with assets shared among different developers (such as fencing, common infrastructure, water services, roads, or shared medium voltage wiring). The SPV will serve as a mechanism for the ownership of these assets and for recovery of the relevant investment through the Park Lease Agreement (PLA) payment; and
- Meanwhile, for smaller parks with fewer common services, issues like land lease and possible auxiliary services may be best dealt with between the provinces and the successful bidders through direct agreements without the creation of a public SPV.

necessary resources and capacity. Very large and complex projects are not infrequent, and here outsourcing is bound to help the tendering authority, and preclude any conflict of interests. In any case, the competitive bidding process must be designed as a unified, universally applicable system.

TABLE 4-4: DEPLOYMENT SCHEME-BASED SPECIFIC ROLES

	Park-Based	Substation-Based
Decision to launch a bid for a given capacity	Public Party	Public Party
Ranking of substations with associated capacity		
Preconnection agreement		
Land selection and acquisition		Public/Private Party
Site assessment		Private Party
Pre-environmental study and other permits		
SPV Setup	Public/Private Party	
Full feasibility study	Private Party	
Generation license		
Design and construction	Public/Private Party	
Commissioning	Private Party	
Operation		
Decommission		

Source: Authors based on "World Bank. 2019. "A Sure Path to Sustainable Solar." Washington DC: World Bank."

Further specification on the works that should be performed on the land for the preparation of the park is detailed in section 6.3.3.1.

It is essential for the competitive bidding process to have secured prior approval from NEPRA before tenders are launched, to preclude subsequent regulatory complications. To ensure independence and open competition, NEPRA, as the competent regulatory body, will also supervise the process (under its monitoring and surveillance remit), providing a point of view that recognizes—but remains wholly independent of—the various interests of federal and provincial governments, consumers, and companies; while ensuring that the process remains transparent, and that collusion does not occur.

After conclusion of the tender, the evaluation committee will be responsible for writing the Bid Evaluation Report, including: (1) a briefing of the process undertaken; (2) details of bidders, tariffs, and rates; (3) the rationale behind rejection of bids; (4) grid interconnection studies;[37] and (5) details of the successful bidder, and thereby evidence of the transparency and competition achieved as set out in the NEPRA Competitive Bidding Rules (see Annex A, section 6 for details). Beside these compulsory contents, we recommend introducing in the report proposals for future improvement, with lessons learned if needed, and a comparison with previous tenders already held in Pakistan. If NEPRA finds irregularities in the competitive bidding process (such as collusion, violation of tender rules, use of inside information, and so forth), NEPRA may invalidate the bidding process.

Finally, the planning of competitive bidding needs to be cognizant of future changes to the wholesale electricity market. It should be set up in such a way that governance of the bidding process can be straightforwardly modified. Instead of the AEDB having the main coordination role, this could be allocated to the Competitive Trading Bilateral Contract Market (CTBCM), such that AEDB alongside the Private Power and Infrastructure Board (PPIB) would head the Independent Tender Administrator (IAA),

[37] In section 6.1.2., we propose to remove the inclusion of grid interconnection studies in the Bid Evaluation Report.

while the IAA would take the roles currently given to the AEDB and the steering committee. However, unlike current ARE Policy 2019, the future CTBCM envisages the IAA as the conductor of centralized tenders, rather than the provinces. The CTBCM also tasks the IAA and DISCOs with preparation of a 10-year forecast, to be revised annually, including plans for new procurement, which will set the gap between contracted capacity and capacity obligations, aligned with the year-to-year competitive biddings as proposed in section 4.1. This role of the AEDB as tendering authority in the first stage of the CTBCM is also aligned with its role of tendering authority in the Category 3 tender. Therefore, the IAA in the CTBCM would in fact act only as an administrator of the tenders, bringing together the most important functions of AEDB, the steering committee, and the provinces, which would be still supervised by NEPRA. This centralized IAA model would be simpler and more efficient if well implemented, but would still need the support of the provinces, as they own most of the relevant available land.

These two models may create an institutional conflict in the transfer of the tendering authority role. To solve it, we recommend that the CTBCM includes the possibility of giving IAA the right to hand over the role of tendering authority to the provinces during the first five years. Subsequently we support the DISCOs taking the role of tendering authority in the competitive bidding process.

5. COMPETITIVE BIDDING DESIGN

5.1 SIZE OF TENDERS

When designing the bidding, one of the most important issues is to determine the how much variable renewable energy (VRE) is sought. Size limits can be implemented in various ways (see Table 5-1 below).

TABLE 5-1: ADVANTAGES AND DISADVANTAGES OF SIZING IN TENDERS

	Definition	Advantages	Disadvantages	International experience
Total size limit	Total amount of capacity generation to be tendered in each competitive bidding. This is determined based on the country energy plans and renewable energy source targets.	Close control of VRE development in case of site-neutral tenders. Fosters competition.	Limits faster growth. Limits achieving economies of scale (especially if the limit is low).	Argentina, China, India, Morocco, Peru, South Africa, Spain, Uganda, USA (Hawaii) and Zambia set size limits on their tenders. In 2011, in South Africa's first round of bidding there was a lack of competition as volumes were not limited. However, a capacity limit of 3,725 MW was applied to the entire program (five rounds). In the next round, once a volume cap was set, competition increased, and prices were substantially lower.
Size limit/ constraints for individual projects in the connection points	Total amount of capacity generation to be installed in a single project within one connection point. This is implicit when choosing tenders for site-specific projects. Size constraints are closely related to the number of projects approved.	Limit administrative work and ensure grid absorption per project in the connection points. May encourage the participation of smaller developers.	Limits achieving greater economies of scale and deters the participation of big developers if the upper bound is not large enough. Leads to nonoptimal configurations.	California (USA) has size constraints between 3 and 20 MW; the lower bound was originally 1 MW. In India's 2011 PV tender, the bounds were 5 MW and 20 MW; in 2014 the upper bound increased to 50 MW. In Dubai and Uruguay large upper bounds in tenders allowed economies of scales and low costs to be achieved. In Spain the minimum size is 100 kW and the maximum the total size limit. In Germany, PV plants are 10 kW–10 MW in size, and in Zambia, 33 MW–55 MW. Upper bounds in Argentina depend on the technology (100 MW for wind and solar). Minimum size in South Africa and Uganda is 5 MW.
Number of projects/ MW[a] cap per developer	Restriction in the number of projects/MW per project which can be awarded to the same developer.	Secure participation and promote competition among multiple project developers. Portfolio effect reduces risk of projects not being completed.	Limits achieving greater economies of scale. May deter the participation of large developers.	In California, a single bidder cannot bid for more than 50% of all the tendered capacity. In Portugal, successful bidders in one round of the competitive bidding are not allowed to bid in the next round. In Uganda, developers can be awarded up to two projects.

Source: Authors.
[a] Cap on number of projects when choosing tenders of site-specific projects; cap on MW capacity when choosing MW tenders.

In the bidding design it is possible to combine the different types of size limit. In Pakistan, the total (combined) size limit of successive rounds of bidding will be set annually by the steering committee and approved in the Current Year RE Procurement Plan (CYREPP) based on the Indicative Generation Capacity Expansion Plan (IGCEP) and the variable renewable energy (VRE) Locational Study as previously explained in section 4.1. Thus, limitless tenders are not envisaged.

Assuming the variable assignation model of the connection points (defined in section 4.1) based on (1) the highest quality resource locations with available connection points[38] (80 percent of the volume), and (2) the pro rata capacity among the provinces, with connection points for each of the four provinces (five percent each), and considering a maximum volume to be tendered of 1 GW of solar power and 1 GW of wind power, then according to the IGCEP this would imply a maximum of roughly 850 MW for each technology in a single connection point,[39] which would match the size of a park to be tendered in one year, according to the VRE Locational Study, but which might be parceled in different blocks/allotments (that is, two sites of 400–500 MW each if deemed necessary). Our recommendation is to distribute the parks in parcels of roughly 300–600 MW to encourage the participation of smaller bidders and to be able to divide the different technologies which participate in the park in a suitable way. These parcels will be awarded to a single winning bidder for its exact capacity, as further explained in section 6.1.2. These parcels will be defined by the steering committee through the CYREPP and do not apply to the substation-based scheme.

Besides dividing park-based projects in 300 MW–600 MW parcels, we do not recommend any other size limit, such as: constraints for individual bid volumes at each connection point; volume caps for substation-based schemes; or a cap in the number of parcels per developer in the park-based scheme.

Finally, at sites where there is a large high-quality resource availability that exceeds the volume to be tendered (that is, an area of 4 GW with connection availability), there is a possibility of dividing these sites and tendering the total size in different phases over different years. This is especially important for solar and wind parks, where the public administration might schedule the preparation of land and civil works and subsequent bidding over different years.

5.2 COMPETITIVE BIDDING STAGES

Bidding can be designed with, one, two, or even more stages. The most appropriate form will be dictated by what is to be evaluated and how (see Table 5-2).

There are sophisticated cases, such as Uganda in small-scale photovoltaic (PV) generation, that have entailed three-stage tenders. The prequalification stage was divided in two, with the first stage an assessment of technical and financial capabilities, the second stage being a more detailed assessment based on technical, financial, social, and environmental parameters, and the third and final stage evaluating the financial proposals of the projects which had passed the previous stages.

[38] Including consideration of the cost of augmenting transmission/distribution network and capacity utilization of the grid system.

[39] The assumption is based on one location with the best possible quality resource in Pakistan for each technology; this implies 80 percent of 1,000, that is, 800 MW + (200/4 = 50) MW assigned to each province, which could be placed in the same connection point if the capacity of the substation allows it, resulting in a maximum of 850 MW. This situation might happen in large parks where there is just a single connection point with the best resource mapping and available capacity. The amount of capacity to be connected could also decrease if there are many different connection points with a similar quality of resources.

TABLE 5-2: ADVANTAGES AND DISADVANTAGES OF COMPETITIVE BIDDING STAGES

	Definition	Advantages	Disadvantages	International experience
Single-stage tenders	The evaluation requisites are assessed in one step under the assumption that there is no prequalification phase. Legal, financial, technical, and/or environmental issues are assessed at the same time as the winner selection process.	Easiest and fastest method. Avoid higher transaction costs.	Increase probability of underbidding. Entrance of noncompetent developers. Increase possibility of projects which do not reach financial closure or Commercial Operation Date (COD).	China Germany India Peru
Two-stage tenders	The evaluation requisites are assessed in two steps, whereby the first (prequalification) usually relates to legal, financial, technical, and/or environmental issues, whereas the second usually relates to economic issues and prices (winner selection process).	Ensure a better legal, financial, technical, and/or environmental performance and avoid future risks of projects not being completed.	More complex and time demanding method.	Argentina, Brazil Colombia, India Morocco, South Africa, United Arab Emirates, USA (Hawaii), and Zambia.[a]

Source: Authors.
[a] After starting with two-stage competitive biddings, SECI has moved to one stage given the large number of EOIs received.

A two-stage competitive bidding system is recommended for Pakistan. In this system, the evaluation requisites are evaluated in two stages:

- The first stage, also called prequalification (further explained in section 6.1.1), relates to legal, financial, and technical requirements the bidders need to fulfil prior to acceptance in the tender and the evaluation of the offer; and
- The second stage (further explained in section 6.1.2), relates to detailed procedural issues and the price that the bidders offer to develop the project.

For Pakistan, two-stage competitive bidding[40] ensures better legal, financial, and technical performance and avoids future risks of projects not being completed because of underbidding or lack of competence of the developers, considering that the final offer is not evaluated until the bidder passes the first-stage requirements. On the other hand, the two-stage system is more time-consuming and increases transaction costs.

A multiplicity of stringent requirements may reduce the participation of bidders, lead to a lack of competition, and diminish cost efficiency. Therefore, the trade-off between vital requirements and a reduction of barriers must be carefully balanced.

A similar option that may be feasible for the country is to have single-stage competitive bidding with a prequalification register, which can shorten the timeline by approximately six weeks. This option will be further explained in section 6.1.1.

[40] Other tender processes, such as for Category 3 projects, use a one-stage regime. However, that model is more suitable for them because the participating projects were already prequalified and held a Letter of Intent (LOI).

5.3 TYPES OF BID

The most common types of bid in competitive biddings are single-sealed bids, and reverse and descending clock tenders, but there are many different hybrid types combining these three main models or adding rounds to them (see Table 5-3).

Theoretically, a properly conducted sealed-bid process is just as likely to produce the best price as a properly conducted descending clock or reverse tender. A properly conducted descending clock or

TABLE 5-3: ADVANTAGES AND DISADVANTAGES OF TYPES OF BID

	Definition	Advantages	Disadvantages	International experience
Sealed-bid tender[a]	Providers submit their quantity and price in at the same time, and no bidder knows another participant's bid. It can be one- or two-stage competitive bidding.	Simple, clear, and easy to implement. Less administration. Low possibility of retaliation or collusion among bidders. Possibility of ranking projects not only according to the price.	Less dynamic sequence of events. As bidders do not know each other's prices they cannot subsequently react and bid lower. Lack of price discovery, which is only achieved at the end of the tender.	China, India, Germany, Peru (single sealed-bid tender). Argentina, Morocco, South Africa, Spain, Zambia (two-stage sealed-bid tender).
Descending clock tender	This is multiround competitive bidding that starts with the tendering authority setting a high price where bidders reveal the quantities which they wish to offer at that price. In subsequent rounds, the tendering authority announces lower prices and bidders reveal the quantities until the quantity offered matches the quantity procured.	Allows fast price discovery and possible bidders' reactions.	Possibility of collusion and/or strategic bidding. Complex.	Italy
Reverse tender	This is an open procurement process whereby during a determined time bidders can continuously modify their offers by submitting a new one with a lower price. They are mostly currently linked with electronic and real-time competitive bidding.	Allow fast price discovery and possible bidders' reactions. Market power mitigation	Possibility of collusion and/or strategic bidding. Complex	India Kazakhstan
Hybrid 1	This combines the characteristics of sealed-bid and descending clock competitive bidding: it starts with descending clock competitive bidding until supply and demand are roughly matched, within a certain margin (not disclosed to bidders), then a sealed bid starts where the remaining bidders lower their bids without information about competitors.	Allows price discovery and limits strategic bidding among participants.	More complex process	Brazil

(continued on next page)

TABLE 5-3: ADVANTAGES AND DISADVANTAGES OF TYPES OF BID *(continued)*

	Definition	Advantages	Disadvantages	International experience
Hybrid 2	In the first phase bidders submit sealed bids with a price and quantity. Bids are evaluated with lowest prices being most competitive and accepted until demand is met. The next phase is a descending clock iteration of 3–5 minutes during which any temporarily disqualified bidder can replace a temporary winner by submitting a bid lower than the marginal price minus a decrement set in advance by the tendering authority. This mechanism continues until no temporarily disqualified bidders submit new bids with decrement.	Market power mitigation mechanism, because the first phase does not allow the bidders to tacitly agree to conclude the competitive bidding at a higher price.	More complex process	Brazil

Source: Authors.

[a] There are variants to the sealed-bid tender, such as the Vickrey tender or second-price sealed bid, where the winner receives the price of the second most competitive bid, instead of their own bid price.

reverse tender will require significantly more up-front work and transaction costs (ultimately borne by the buyer) than a sealed-bid approach.

Because of the simplicity, clarity, lower implementation cost, and low possibility of collusion, we recommend the use of a sealed-bid tender with two envelopes, one for procedural evaluation and another with the final price.[41]

However, in the future and in the event that more complex schemes are supported by Pakistani authorities, we suggest having a reverse tender, which might promote competition through dynamic reaction among the bidders. In this way, the price uncertainty from the bidders' side, which is one of the main disadvantages of a sealed bid tender, is reduced. In this type of bid, once the bidders pass all the prequalifications and procedural requirements, they will submit their price bid electronically and the tendering authority will create as many aggregated supply curves as there are parks or substations participating and will determine the price in each curve through the last bid that matches with the available volume in each park or substation (clearing price where supply matches demand).[42]

In the case of substation-based scheme:

The qualified bidders for round 2 will be all the bidders with a price lower than the clearing price as per each supply curve, plus bidders whose final price has an add-on equal to or lower than the difference between the lowest bid and the clearing price if the price is lower than the undisclosed reserve price, when the other bidders are disqualified.[43]

$$\textit{Qualification price} \rightarrow \textit{Price bid} < \textit{Clearing price} + (\textit{clearing price} - \textit{lowest bid}) \cap \textit{Price bid} < \textit{reserve price}$$

[41] For details of the contents of the envelopes and award procedures see section 6.2.2.

[42] This alternative, although it is valid for both park-based and substation-based schemes, shows its full potential under the substation-based scheme, whereas for park-based schemes the bids must be adjusted to the capacity of each parcel, therefore the aggregated curve will be a straight line until it matches the available volume.

[43] All the bids will be transparently published.

In the second and last round, the qualified bidders must submit a new bid whose price must be equal to or lower than their previous bid. This sets a disclosed price cap equal to the clearing price of each curve in the first round, in which the opportunity arises solely for price reductions. Qualified bidders who submitted an offer that was higher than the clearing price in round 1 would need to submit a new bid lower than the round 1 clearing price. The same is applicable with the other bidders, who cannot submit bids whose price is equal to a previous submitted bid in round 1.

Again, the algorithm will create as many aggregated supply curves as substations taking part in the competitive bidding and will determine the price in each curve. The last bid that matches the available volume in each substation will set the market clearing price, with all bidders selected who enter bids equal to or lower than the new clearing price.

In the case of park-based scheme:

The same approach as above will be adapted with the bids adjusted to the capacity of each parcel, such that there is just one winner per parcel and no lower prices than the selected bid. Therefore, the bidders who qualify for the second round will be all those whose price has an add-on equal to or lower than a determined percentage of the winning bid:

$$\textit{Qualification price} \rightarrow \textit{Price bid} < \textit{Winner bid} + 10\% \cap \textit{Price bid} < \textit{reserve price}$$

Our recommendation is initially to use a sealed-bid tender, for its effectiveness and simplicity at the outset. After some years, the preferable model might instead be a more complex option, like those described above.

5.4 AWARD CRITERIA

The selection of winning bids must be conducted with clear criteria about how to rank the bids. This is necessary to ensure credibility and transparency. When designing the bidding process, policy makers can adopt different criteria to achieve different objectives. There are two main evaluation methods, price-based and multidriver-based (see Table 5-4).[44]

Based on a two-stage competitive bidding selection in Pakistan, a price-only award method is recommended. In this approach, bidders would be simply evaluated on their price after meeting prequalification requirements (first stage), promoting cost-effectiveness and simplicity. This method is aligned with ARE Policy 2019, which establishes the lowest tariff as the primary evaluation method. Even though local content is not included as an award criterion, it is possible to include local content requirements as part of the RFP if the steering committee considers it necessary, as further explained in section 6.3.1.1.

5.5 COMPETITIVE BIDDING PRICING

A winner's remuneration is dependent on the pricing format followed: typically either pay-as-bid or marginal pricing (see Table 5-5).

[44] Second-level selection issues like tied bids, where two or more bidders bid the same quantity at the same time and price, are not addressed here, because these are rare occurrences and are not accommodated by common tender regimes. For further detail see section 6.2.2.

TABLE 5-4: ADVANTAGES AND DISADVANTAGES OF AWARD CRITERIA IN COMPETITIVE BIDDING

	Definition	Advantages	Disadvantages	International experience
Price only	Classical implementation, where the target is to reach the lowest possible cost. If there are different products in a competitive bidding, the price bid must be transformed using a correction factor to make a comparison possible on the same basis (e.g., competitive biddings involving biomass and wind energy).	Simplicity. Transparency and objectiveness. Cost-effectiveness.	Underbidding risk. Non-monetary benefits are not promoted.	Chile, China (in some competitive biddings multidriver method is also used in China), Denmark, Germany, India, Peru, Spain, United Arab Emirates, and Zambia. Brazil and Mexico (adopting a correction factor).
Multi driver	Criteria other than price are considered to select the winner bid. These criteria are used to promote socioeconomic development. At the time of evaluating the criteria, it is usual to do it as a bonus, adding value from price selection. Example of the criteria are: job creation, cost efficiency, research and development support, and use of new technology.	Create different incentives beside the cost efficiency. Decrease of underbidding risk. Policy makers in control.	Need to translate the different aspects measured into a one-dimensional index. The translation should be explained well enough in advance of the competitive bidding. Complexity. Domination of nonmonetary criteria may be read as an unfair method.	South Africa (70/30 split among price and socioeconomic targets), China (25/75 split), Uganda (35/30/35 split among economic, environmental, and technical criteria), Taiwan (60/40 split among technical and price criteria), other countries are Argentina, Brazil, Colombia, France, Morocco, and USA (Hawaii).

Source: Authors.

Pay-as-bid pricing would benefit Pakistan because it is more cost-efficient and simple to implement, involving straightforward remuneration established under sealed-bid tenders. This scheme entails less risk to both the developers and off-takers, as the remuneration is set before the contract is signed.

5.6 RESERVE PRICE

A price ceiling or a price cap is a mechanism to limit the risk faced by the tendering authority when providers bid too high, as bids above the cap will be rejected. It is particularly useful in initial rounds of bidding with size limits and with low competition, although it implies the risk of contracting a suboptimal capacity. A price cap must be compatible with the expected cost of building and operating the power plants. There are different ways to determine this cap: using previous feed-in tariffs if they were active; or conducting market research on the relevant technologies involved. The price cap can be made public or kept undisclosed (see Table 5-6).

Although both public and undisclosed ceiling price are valid options, the crux here is the decision to set a ceiling price in the first place (Table 5-6). Setting an undisclosed ceiling price would benefit Pakistan,

TABLE 5-5: ADVANTAGES AND DISADVANTAGES OF COMPETITIVE BIDDING PRICING

Format	Definition	Advantages	Disadvantages	International experience
Pay-as-bid pricing	The winner's remuneration is simply their bid. Therefore, different projects with the same technology will be paid differently. This is the most common payment format, and is usually related to sealed-bid tenders.	Simplicity. Minimizes costs. Perceived in social and political contexts to be fair.	Complicates achievement of optimal bidding, as bidders do not seek just to win, but also to win with the highest possible bid.	Very widespread: Brazil, Chile, China, France, Germany (1st and 4th rounds), India, Peru, South Africa, United Arab Emirates, and Zambia.
Marginal pricing	The remuneration is the last bid accepted (the most expensive) to meet the demand offered in the competitive bidding. Therefore, all the projects with the same technology will be paid equal. It is usually related to descending clock tenders.	Incentive to get lower costs as cheaper suppliers get higher benefits.	It may generate higher costs for the off-taker. Perceived social unfairness in the imposition on the consumer of an unnecessary burden, because all generation is paid according to the highest accepted bid. Greater risk of underbidding in the hope that it will be offset by a future higher marginal price.	Denmark, Germany (2nd and 3rd rounds), Spain.
Nonstandard pricing	The remuneration is set after negotiation between the winner and the tendering authority.	Possibility of getting better deals through negotiation.	Lack of transparency and competition. Risk of not meeting demand if bidders reject final negotiated offer. Possibility of aggressively low bids being entered, with the intention of securing substantial upward adjustment during post-award negotiation.	Some states in India.

Source: Authors.

because that would push the developers to be more competitive and favor achieving realistic market prices. However, using a disclosed reserve price obtained from Category 3 tenders for the same technology would ensure transparency in the competitive bidding process, with providing the same public information to all the bidders. If the first few rounds of bidding turn out to be successful (that is, enough participants yielding acceptably priced bids), then a gradual lowering of the ceiling price may be considered to reflect the tendency over time of mature technology (widely used, often improved) to bring down the market price. However, consideration must be given to the possibility of upward price fluctuations due to global supply chain or other issues, especially once relatively low prices are reached.

The Competitive Bidding Rules (article 4.4) require that a benchmark tariff be set to act as a reserve price during reverse competitive biddings. However, it does not require this for other type of bids (for example, sealed bids).

The National Electric Power Regulatory Authority (NEPRA) will be responsible for determination of the ceiling price, keeping in view market conditions, prices, and other relevant factors.

TABLE 5-6: ADVANTAGES AND DISADVANTAGES OF RESERVE PRICE IN COMPETITIVE BIDDING

	Definition	Advantages	Disadvantages	International experience
Undisclosed ceiling price	Price cap is unknown both at the beginning and at the end of the bidding.	Push the developers to be more competitive and favor achieving realistic market prices.	If the price cap is too low, there is a considerable risk of not meeting the capacity demanded. Perceived opacity of process may deter potential developers during future rounds.	In Peru a price cap in 2010 that proved to be too low made it impossible to meet the expected capacity target; however, it did succeed in bringing the prices down. Argentina and South Africa use undisclosed price caps.
Public ceiling price	Price cap is known before bidding starts.	Makes the bidding process more transparent.	Risk of all participants bidding close to the price cap, such that final prices are equal to the cap, which is not necessarily the most efficient price. Risk of not meeting all the tendered demand, although that risk is lower than with an undisclosed ceiling price.	In a first round in South Africa in 2011, a public ceiling price passed on high final bids and prices. In the second round, the ceiling price was undisclosed, achieving a final price reduction. In India, during solar competitive biddings in 2010 and 2011, due to very high competition, the public ceiling price proved irrelevant, but in 2019, a high ceiling price reduced participation. Brazil, Denmark, Germany, Italy, Mexico and The Netherlands use public ceiling prices in their competitive biddings.
No ceiling price	There is no limitation on acceptance of a bid.	If bids exceed or match the capacity tendered, that entire volume will be contracted. No control on final cost of the policy.	If all participants bid with a high price, the winners' offer cannot be accepted because the off-taker cannot afford to pay that much (it would be socially and economically unacceptable). If final prices are perceived to be too high for stakeholders, there is the risk that the process will be cancelled. The market is not readily amenable to control.	

Source: Authors.

5.7 CONCLUSION

The deployment schemes that we recommend for Pakistan to reach the VRE targets of ARE Policy 2019 are:

- A park-based deployment scheme for large wind and solar power projects to limit both land and connection risk for future developers; this is especially important for large wind power projects due to the limitation of wind corridors in Pakistan. These parks might combine solar PV and wind technologies under hybrid multitechnology parks parceled under site-specific tenders to be awarded to single bidders with a limitation in the number of parcels; and

- A substation-based deployment scheme under a predetermined land perimeter for medium and small-scale projects; this also limits grid connection and land risk, although it leaves the developer responsible for site selection, which will be key to increased renewable energy (RE) across the country in substations with available capacity. The available capacity should be awarded to bidders under price-based criteria derived from the aggregated supply curves for each connection point.

The recommendations are summarized as follows (Table 5-7):

TABLE 5-7: RECOMMENDED KEY FEATURES OF BIDDING DESIGN

Key feature	Recommendation
Size of each competitive bidding	Annual limited bidding based on the CYREPP, which at the same time comes from IGCEP and VRE Locational Study having parcels of 300 MW–600 MW in the power parks; and with no further size constraints for individual bid volume by connection points or total volume per developer.
Competitive bidding stages	Two stages with prequalification as the first stage.
Type of bid	Sealed bid with two envelopes.
Award criteria	Price only.
Competitive bidding pricing	Pay-as-bid.
Reserve price	Disclosed reserve price based on previous competitive bidding results and market trends, ensuring transparency.

Source: Authors.

6. IMPLEMENTATION OF THE SELECTED SCHEME

The bidding framework provides details of bidding mechanisms, the procurement framework, and the contractual arrangements (as per tender package).

6.1 BIDDING MECHANISMS

6.1.1 Stages in the tender and prequalification requirements

In the proposed two-stage competitive bidding model, prequalification (first stage) is essential for prospective participants, regardless of the award criteria used (see next section below). Tendering authorities need to make sure that bidders fulfill a set of prerequisites to enter a tender and ensure its correct performance. These prerequisites may be used to achieve different objectives by policy makers and increase control over the competitive bidding.

The Competitive Bidding Regulations already consider the possibility of having prequalifications in a tender process, where the relevant agency—in this case the steering committee with the final approval of the Alternative Energy Development Board (AEDB)—prepares and announces in its request for expression of interest (REOI) all information required for prequalification, including instructions for preparation and submission, the requirements, and the evaluation criteria.

Based on the same Competitive Bidding Regulations, the prospective bidders shall be prequalified based on:

1. Their ability to successfully execute the project.
2. Relevant experience.
3. History of legal and regulatory compliance.
4. Financial standing.

In the event that an applicant is denied prequalification, written notification stating the reasons for denial is provided.

The REOI shall include:

- The capacity to be tendered and its location according to the Current Year RE Procurement Plan (CYREPP) approved by AEDB;[45]
- General prequalification requirements for participants (capacity for individuals or legal entities to be bidders; see below);
- General terms of agreements;

[45] The announcement, although included in the REOI, will also have been published by AEDB (at least six weeks in advance).

- Brief description of the stages and procedures of the tender; and
- Details of the method and deadline to participate in tender.

To meet prequalification requirements (first stage), the bidder must demonstrate:

- Assurance of technical capacity and proven experience as developer:
  - International experience in utility-scale technology-specific projects, preferably in countries with similar climatic conditions.
  - Execution and operation of projects with a minimum of 10 MW and accumulated installed capacity of 200 MW of high-voltage grid connected generation facilities in operation.[46]

  Evidence (both for developing and operation and maintenance [O&M]) must be submitted in the formats specified by the steering committee, along with separate sheets for the audited projects mentioned.
- Assurance of bidders' good standing:
  - If the bidder is a consortium, no consortium shall include a member that is a member of another bidder consortium.
  - The bidders must prove their good reputation by providing information regarding their ownership structure. Bidders must furnish evidence of the legal structure as a single company, or as a consortium, including, without limitation, information with respect to the legal relationship among the consortium members and the role and responsibility of each one.
  - Ownership declarations and evidence that they are not being investigated or have been convicted of fraudulent or similar conduct.
  - If the bidder is a consortium, the organizational documents of each member must be presented, including memoranda and articles of association, commercial or trading licenses, and certificates of good standing.
  - Details of any formal, direct, or indirect connection between the bidder and existing participants in the energy sector, including ownership, shareholding, consulting, and service agreements.

  Evidence of good standing must be submitted in the specific formats stipulated by the steering committee, along with appropriate certified documents from relevant authorities.
- Assurance of bidders' financial requirements:
  - Financial equity of the bidder company or all the consortium members (if applicable) in the previous three years should be at least US$100,000/MW.
  - Annual turnover of the bidder company or all the consortium members (if applicable) in the previous three years must be at least US$1 million/MW to be installed.
  - Cumulated earnings before interest, taxes, depreciation, and amortization (EBITDA) of the bidder company or all the consortium members (if applicable) in the previous three years must be at least US$150,000/MW.

  Evidence of meeting these financial prequalification requirements must be submitted in the formats specified by the steering committee, along with separate sheets under the letterhead of

[46] To comply with these requirements and the following ones, local companies or newcomers may create consortia with other companies that have the required experience.

the company's accountant providing the required details and with certified copies of the audited accounts.

- Land prequalification, which will depend on the selected scheme and technology:
  - Park-based competitive biddings: Bidders must submit any requirement defined by the relevant province as owner of the land to be granted to the selected site.
  - Substation-based competitive biddings: Bidders must reach a pre-agreement with the owner (private or public) of the specific land they select in the preliminary area around the substation. The pre-agreement must include the security of a future signature of a land-use agreement in case they are selected as successful bidders.

The evaluation of this first stage will be based on a pass/no pass criterion without number limitation. Therefore, if bidders comply with all the prequalification requirements, they will be allowed to receive the tender invitation and participate in the second stage of the competitive bidding process. The evaluation committee, as stated in section 4.2.2 will be responsible for the prequalification assessment, being the same one which will be responsible for the second-stage evaluation.

As an alternative, it is also possible to have a single-stage competitive bidding with a prequalification register. In that case, the REOI would be substituted by a prequalification register with the same prequalification requirements (that is, in an online bidding system). Even though it is conceptually the same, the main advantage is that the first steps of the schedule related to the REOI, consultation, clarification, publication, and submission may be shortened from 13 weeks to 8 weeks.

6.1.2 Award criteria and evaluation

Prequalified bidders can ask for the RFP and its associated tender package and bid in the second stage of the process.

The competitive bidding will be performed under an anonymous sealed bid with two envelopes. Bidders will submit the two envelopes at the same time as their procedural requirements and financial proposal, and no bidder will know another participant's bid until the evaluation takes place, because the bids will remain sealed until that time.

When submitting those anonymous offers, each bidder will bear all costs and expenses associated with the preparation and submission of its proposal, which must be written in English. The bid validity period is 180 days from the bid submission deadline of the competitive bidding.

Bidders are compelled to obtain under their own responsibility all information necessary for the preparation of the proposal and must separate the sealed bid in:

- Envelope 1:
  - Bid letter/cover letter;
  - Power of attorney verified by Pakistani authorities;
  - Legal identity, structure, and ultimate beneficial ownership;
  - Consortium agreement (if applicable);
  - Integrity pact;

- — Bid processing fee;
- — Bid bond;
- — Capacity of the bid[47] and park/substation to which bid pertains; and
- — Support letter from the lending institutions/banks proving sufficient line of credit of the bidder company or all the consortium members (if applicable) to develop the project and for completion bond issuance, indicating the funding mechanisms.

- Envelope 2 (financial):
  - — The final price for the energy to be generated by the plant in the currency established by the EPA, in local currency (PKR) to within four decimal places.

The selection of winning bids must be carried out by the evaluation committees defined in section 4.2.2., with clear criteria about how to rank the bids; this is a key aspect when ensuring credibility and transparency.

In the first envelope of the first round the evaluation will be performed based on compliance with:

- Completeness and accuracy of the envelope:
  - — Original and copies of required documents.
  - — Validity of the bid.
  - — Acceptability of the bid bond.
  - — Overall compliance with the envelope and RFP conditions.

The first envelope should be evaluated against predefined criteria to ensure objectivity. Where bidders are compliant, their financial offers will be evaluated in this case under a price-only criterion. Nonqualified bidders have the right to make a representation before the Committee for Redressal of Grievances challenging their technical nonqualification within seven days of their declaration as a nonqualified bidder.

It is envisaged that the competitive bidding process will procure a certain capacity divided in different parks or substations,[48] where each bidder submits bid(s) with a proposed capacity in a determined park or substation. Thus, for all the bidders with accepted proposals, the tendering authority will open the envelopes and gather all the financial bids, creating as many aggregated supply curves as there are parks/substations taking part in the competitive bidding. The maximum accepted price bid is determined when supply matches demand in each curve, and all the bidders with a price equal or lower will be selected on a pay-as-bid basis.

All the bids will be transparently disclosed after the financial evaluation, and any nonqualified bidder will have the right to make a representation before the Committee for Redressal of Grievances challenging its nonqualification within seven days of its declaration as a financially nonqualified bidder.

In the case of park-based deployments, and as previously noted, the volume of the bid must be equal to the capacity of the parcel to be tendered. This approach facilitates the award, as the lowest bid for each parcel will be selected and it will match the exact capacity tendered. However, in the case of

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[47] The capacity of the bid must be equal to the capacity of each parcel in the case of park-based deployments, and equal to or lower than the capacity available for substation-based deployments.
[48] As per the deployment scheme of wind and solar technologies based on the approved CYREPP, the IGCEP, and the VRE Locational Study.

substation-based deployments, the volume of the bid can be equal to or lower than the available capacity of the substation according to the CYREPP. This implies that the final volume that is bid for the substation might not match the total volume tendered.

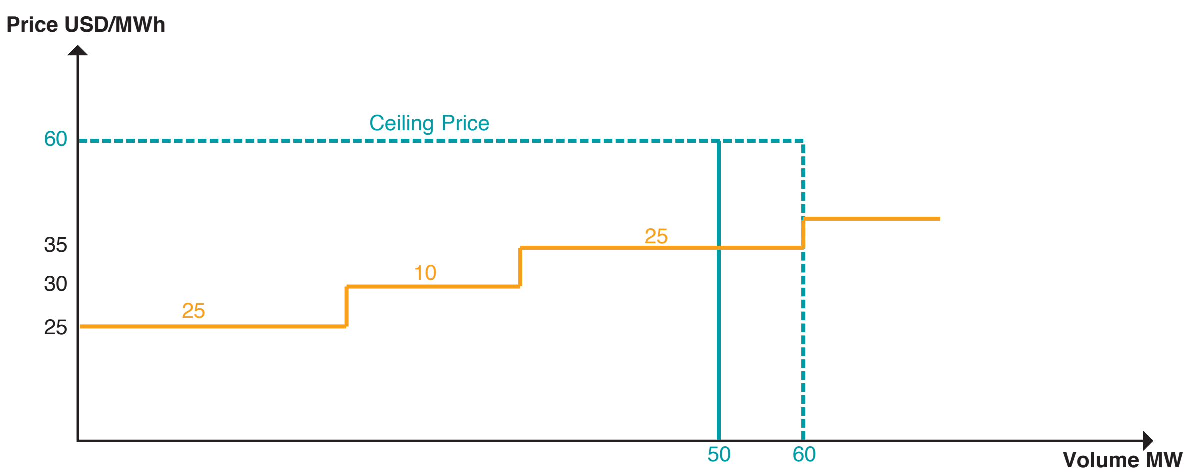
When the size of the maximum accepted bid volume exceeds the volume to be tendered as per the substation supply curve, the tendering authority might proceed as per one of the following two cases:

1. Where the last accepted bid in the supply curve represents more than 50 percent of the offered capacity in that bid, the bid shall be accepted in full, providing the bid is lower than 50 MW and the substation has available capacity (see Figure 6-1).
2. Where the last accepted bid in the supply curve represents less than 50 percent of the offered capacity in that bid, the bidder shall be asked whether without any modification of the price it consents to modify the capacity (MW) included in its bid to match the available capacity in the substation. If the bidder accepts, it shall be selected as one of the successful bidders. If the bidder does not accept, the bid will be rendered null and void, with the relevant capacity passing forward to subsequent bidding if approved by the steering committee.

In the unlikely case of tied bids, where two or more bidders submit the same four decimal digit price, and exceeding the capacity put out to tender, we recommend that the tendering authority consider two different options:

1. Ask for a discount: thus, the two (or more) bidders will send a new final sealed envelope with a new final price[49] for the energy to be generated limited to the remaining available power according to the supply curve, and the bidder with the lowest price will be selected.[50]

FIGURE 6-1: THEORETICAL PRICE CALCULATION EXAMPLE WHERE THE FINAL VOLUME ACCEPTED IN THE COMPETITIVE BIDDING INCREASES 10 MW (CASE 1)



Source: Authors.

[49] The new price should be lower than the current price and higher than the next lower bid in the curve. To avoid incongruence, in the event that these limits are consecutive numbers to four-digit accuracy, it will be possible to send the discount to five-digit accuracy.
[50] This is the only recommendation for park-based deployments.

2. Split the tendered capacity depending on the volume offered in the bid at the tied price and the available capacity at the connection point, that is, if both tied bids offer more than 50 percent of the available capacity left, it is possible to split the MW with 50 percent of capacity for each bidder. However, in the event that one of the bidders offers less than 50 percent of the available capacity, it may be convenient to award the totality of the capacity to the other bidder to avoid developing a higher number of small projects, although this will depend on the capacity at the connection point.

In the event that the bidders do not offer any discount nor accept a volume lower than that offered, the bidder with the next higher offer will be appointed as successful bidder, providing the price is lower than the cap.

In addition, the competitive bidding in each substation or park will not be considered valid if:

- The total volume of bids in terms of capacity in each substation or park is lower than 150 percent of volume to be tendered in the same substation.
- Fewer than three participants submit bids in each substation or park.

In the event that the bidding is not valid for one or more substations or parks, the volume will be tendered again for the next round of bidding.

When the competitive bidding has been evaluated, the successful bidder(s) will receive a Letter of Award (LOA) and will need to obtain in its own name or on behalf of the project company all approvals, licenses, fees, and permits required by the Pakistani authorities for the implementation of the plant in compliance with NEPRA's regulatory framework,[51] including the tariff endorsement and generation license, the signature of the EPA and the other agreements (connection agreement, land agreement, implementation agreement).

6.1.3 Schedule

The schedule must grant enough time to allow all steps to be performed correctly by the bidders, with the schedule binding for the tendering authority and all other stakeholders. The schedule will be presented as part of the announcement of the competitive bidding process. Table 6-1, below, is a sample schedule showing the different steps and recommended times between them. Figure 6-2 then shows the same sequence as a flow diagram, highlighting decision nodes.

After receiving a letter of support (LOS), the awarded project will need a further period dictated by the technology involved (for wind, more time is needed for subsequent evaluation of conditions than for solar).[52] Therefore, the proposed schedule gives 122 weeks and 234 weeks, respectively, for solar PV

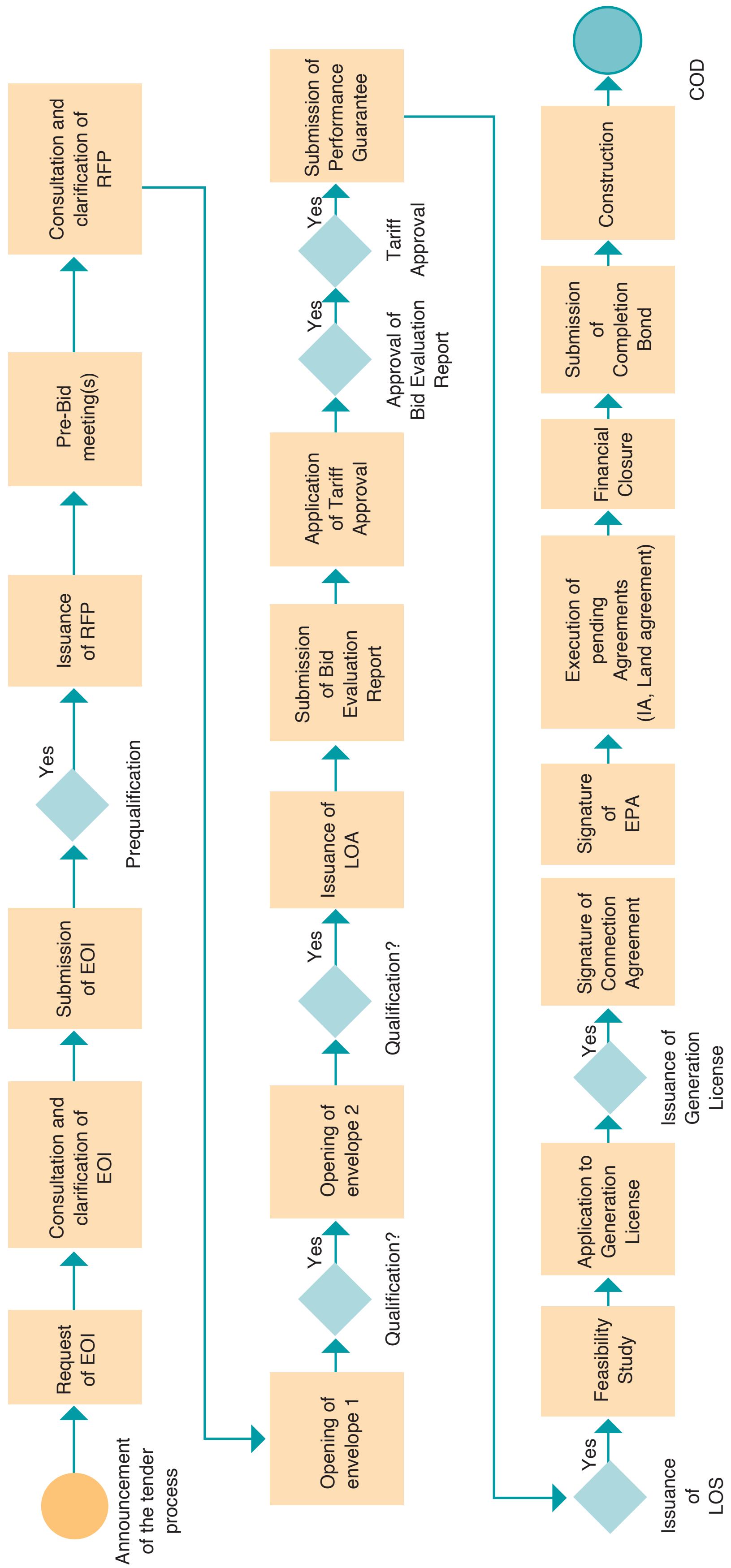
[51] Including any future adjustment to the current framework.
[52] Lead times are generally shorter in solar PV than in wind tenders. For example, in their solar tenders, India and Germany adopted 13- and 18-month lead times, respectively, although the exact target varies for each individual tender. For wind, Italy's tenders involved 28- and 31-month lead times in 2012 and 2016. In some cases, lead times are the same for both technologies. In Brazil, 36- or 60-month lead times apply to solar and wind, depending on the category (A3 or A5, see IRENA (2013) Renewable Energy Auctions in Developing Countries). In Mexico and South Africa, project developers may suggest their own commercial operation date up to a maximum of 30 and 24 months, respectively. In Japan, the first solar tender allowed project developers to set their lead time. Less than one-half of the bidders set it to less than 36 months (IRENA (2019) Renewable energy auctions: Status and trends beyond price; International Renewable Energy Agency, Abu Dhabi).

TABLE 6-1: INDICATIVE COMPETITIVE BIDDING SCHEDULE

	(Calendar weeks from initial date)
Announcement of the competitive bidding process	(A six-week run-up to Week 0)
Request for expression of interest (REOI)	Week 0
Limit date for clarification requirements and consultation of REOI	Week 1
Publication of the clarifications of the REOI[a]	Week 3
EOI submission with prequalifications	Week 5
List of prequalified bidders and issuance of RFP	Week 7
Prebid meeting	Week 9
Limit date for clarification requirements and consultation of RFP	Week 11
Publication of the clarifications of the RFP[b,c]	Week 13
Deadline for submission of bids	Week 19
Opening of envelope I	Week 19
Evaluation of envelope I	Week 19
Announcement of qualified bidders	Week 20
Opening of envelope 2 of qualified bidders	Week 21
Evaluation of envelope 2 (financial)	Week 24
Issuance of LOA to the successful bidders and submission of bid evaluation report to NEPRA pursuant to the NEPRA regulations	Week 26
Application to tariff endorsement by the successful bidder	Week 28
NEPRA tariff endorsement[d]	Week 30
Submission of performance guarantee	Week 32
Issuance of Letter of Support (LOS)	Week 32
Application to NEPRA generation license + feasibility study[e]	For solar up to Week 50 For wind up to Week 94
Issuance of the generation license	+ 12 weeks from application Solar: Week 62 Wind: Week 106
Signature of connection agreement (CA)	Solar: Week 63 Wind: Week 107
Signature of the EPA further to fulfillment of all conditional precedents	Solar: Week 64 Wind: Week 108
Execution of pending agreements (implementation agreement and land agreement)	Solar: Week 66 Wind: Week 110
Financial closure and submission of completion bond	Solar: Week 70 Wind: Week 114
Commercial operation date	Solar (+1 year) Week 122 Wind (+2 year) Week 234

[a] In the event of any clarifications or corrigenda to the REOI, if the need arises, the time taken by NEPRA for approval to be excluded from the stated timeframes. If the corrigenda or clarification are material, AEDB may announce an extension to the deadline, and the timeframes will be modified accordingly.
[b] In the event of any clarifications or corrigenda to the RFP, the time taken by NEPRA for approval shall be excluded from the stated timeframes. If the corrigenda or clarification are material, AEDB may announce an extension to the deadline, and the timeframes will be modified accordingly.
[c] As the RFP is prepared by the steering committee and approved by AEDB, we recommend that the steering committee issue clarifications—it being the better suited institution for that task—even though the provinces act as tendering authorities and will continue to do so.
[d] Week 32 in case of public hearing, which implies two more weeks in the following part of the schedule.
[e] Placing the feasibility study after the tender award avoids the risk of developers spending money for a full-fledged feasibility study before evaluation.

FIGURE 6-2: PROCESS FLOWCHART



Source: Authors.

projects and wind power projects, meaning 2.3 years and 4.5 years from REOI to commercial operation date (COD).

Modifications to fixed schemes (year to year competitive biddings) must be notified in sufficient time to avoid certain bidders obtaining a potential advantage, maintaining at least four weeks prior to the EOI bid submission date.

The schedule involves the following steps:

NEPRA tariff endorsement: As soon as the evaluation committee sends the bid evaluation report to NEPRA, the successful bidder will send an application for tariff endorsement and pay the associated fees. NEPRA, according to the Competitive Bidding Tariff Regulations shall then:

1. Review the bid evaluation report certifying that the bidding was correctly and transparently conducted; considering the aspects mentioned in section 11.6 of this report and clause 11 of the regulation, which includes the grid interconnection studies approved by the transmission company, based on clause 14 of the regulation. However, we recommend removing this requirement as it will be further agreed with NTDC in the connection agreement that both NTDC and the developer would have more time to perform the studies, and the sites of the competitive biddings are selected based on the Indicative Generation Capacity Expansion Plan (IGCEP) performed by NTDC, and that should guarantee a feasible interconnection.
2. Endorse the tariff—if the bid evaluation report is acceptable. Here, we recommend removing some approval requirements:
   a. Equipment, model, supplier, useful life, and year of manufacturing—as this information will be submitted later, in the application for the generation license.
   b. The generation license application (at this stage) because it will be required later in accordance with the schedule.
   c. The draft EPA, whose template should be already approved by NEPRA, and which will later be signed and subject to condition precedents.

   We recommend reducing the time currently required for tariff endorsement from four months to two weeks for two reasons. First, the reserve price will already have been approved by NEPRA, so there will not be any tariffs that exceed the cap NEPRA considers fair. Second, NEPRA has already received and assessed the bid evaluation report submitted by the evaluation committee.

   Consequently, tariffs will be lower than the set price cap, and by ensuring that the bid is performed according to the Competitive Bidding Regulations, less time should be needed for its approval than in previous schemes.

   It should be noted that at this stage the most critical action is to corroborate that the competitive bidding has been performed correctly according to the Competitive Bidding Regulations and that no bidding irregularities have been found (collusion, violation of rules, use of inside information, and so forth). Thus, the tariff endorsement does not mean the reassessment of individual bids and ought to be expedited fairly rapidly.

Generation License: According to the NEPRA Licensing Rules, the license requires the location, size, technology, interconnection arrangements, technical limits, technical functional specifications, and other details specific to the generation facilities. NEPRA may refuse to issue a license where the site, technology, design, tariff, or other matters germane to the proposed generation facility (in an application for a generation license) are either not suitable on environmental grounds or do not satisfy the least-cost option criteria.

Therefore, to apply for such a license, the developer should perform a detailed feasibility study, to include: plant equipment siting details; detailed power production estimates based on site resources; soil test reports; equipment model, supplier, useful life, and year of manufacture; environmental study; project layout; technical limits and functional specifications.

In addition, the developer will undertake an independent assessment of site conditions as it will bear the resource risk during the operation of the plant. The assessment will vary depending on the technology; for this reason the schedules are split from this point.

The generation license is therefore separated from the tariff approval, both in time and form.

Connection agreement: Further explained in section 6.3.2

Energy purchase agreement: Further explained in section 6.3.6

Implementation agreement: Further explained in section 6.3.7

Land agreements: Further explained in section 6.3.2

6.2 PROCUREMENT FRAMEWORK

6.2.1 Risk allocation matrix

Risk allocation is at the center of every transaction and will guide the drafting of successful contracts. The tender package needs to address the different risks and their allocation, and devise recommended measures to: (1) balance the risks among the different stakeholders to mitigate the risks for both public and private parties, (2) manage risks in a cost-effective way, and (3) ensure bankability of the projects in Pakistan. These measures always respond to a trade-off between the final price and the risks finally assumed by the parties under a Build Own Operate (BOO) model.

As shown in Table 6-2 above, most of the risks are allocated in the EPA, and are allocated to the developer, public party, or shared if they are too substantial or there is no clear separation of responsibilities.

6.2.2 Counterparty

The off-taker is key for the bankability of variable renewable energy (VRE) projects under a project-finance basis, as only the creditworthiness of the off-taker and unfailingly prompt payment can ensure solvency of the project. Thus, liquidity and termination risk are critical.

A guarantee of payment (credit support) provides confidence to investors, is likely to increase the number of bidders, and may decrease the final tender price. In Pakistan, with the Central Power Purchasing

TABLE 6-2: RISK ALLOCATION MATRIX

Category	Risk	Risk allocation	Rationale and mitigation	Contractual document
Land	Provision and ownership	Public (province) for park-based scheme Private/ public (province) for substation-based scheme	In park-based schemes the public party is fully responsible for selection and provision of the site under park agreements in lands owned by the provinces. In substation-based schemes the developer is able to choose land within a predetermined area and to set a land use agreement with private owners or with provinces (if publicly owned land is involved). If the land is privately owned, the risk will be borne by the private side.	Park Lease Agreement/ Land Use Agreement
Land	Access	Public (province) / private	Public parties will be responsible for granting access under feasibility, construction, or operation stages in publicly owned lands both for park-based schemes and substation-based schemes when developers choose public lands. If developers choose private lands under substation-based schemes the risk shall be borne by them.	Park Lease Agreement
Land	Suitability	Private	Even though the public party (province) must perform an analysis for the selection of the land/substation area—mapping or satellite-based resource assessment and nondependent technology information (ground information)—the developer must re-assess the land under its full feasibility study (to be performed once it is selected as successful bidder).	Park Lease Agreement for park-based scheme
Land	Security	Public (province)/ private	Public parties have the choice to develop fencing and security systems under park-based schemes; the risk shall be borne by private parties under substation-based schemes.	Park Lease Agreement for park-based scheme
Land	Conditions	Public (province)	Any future unpredictable finding unrelated to assessed land conditions—archaeological finds, munitions and so forth—and consequential costs shall be borne by public authorities.	Land agreements
Grid	Right of way for the transmission infrastructure to be built by the developer	Public (NTDC)	Public party ensures the connection from start of bidding process. The line from the plant to the connection point is built by the developer and then handed over to NTDC who will operate it. But a right of way for the public party will be retained, subject to standard exceptions expressed in the grid code (that is, instability of the grid, maintenance works, and so forth).	Connection agreement/IA

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TABLE 6-2: RISK ALLOCATION MATRIX *(continued)*

Category	Risk	Risk allocation	Rationale and mitigation	Contractual document
Grid	Connection	Public (NTDC)/ private	This risk shall be shared between the private party (connection from the facility to the connection point) and the public party (reinforcement of the substation and grid if required or construction of new line substation if needed), with associated penalties in case of delay of planned commercial operation date (COD).	Connection agreement
Environmental	Permits and compliance	Private	Private party shall assume responsibility for obtaining detailed environmental licenses or permits related to the project, for future associated compliance therewith, and any consequences therefrom.	EPA
Social	Permits	Private	Private party shall obtain social permits and bear all risks arising from noncompliance with any associated measure agreed with the public administration.	EPA
Social	Other interruption	Public (GoP)	Any other risk associated with the agreed measures prerequisite to issue of the social permits shall be borne by the public parties (such as resettlement).	IA
Social	Strikes	Public (GoP)/ private	Labor disputes shall be handled by the private parties unless they derive from national or sectoral issues (such as a nationwide strike) covered by the public parties.	IA
Procurement	Transparency	Shared	Public release of bidding results and NEPRA revision guarantee the transparency of the process, such that developers may appeal against any perceived faulty evaluation; also, NEPRA may invalidate the process on its own initiative. In such cases, the costs are borne by the public parties—the private party would be affected in terms of time invested and costs—and bid bonds shall be returned to bidders.	REOI and RFP
Development	Competition	Public (steering committee)	The public parties shall bear the risk of having a minimum of three bids per site + 150 percent of auctioned volume. If those criteria are not met, developers will receive a refund of their participation fee, but no further claim against the tendering authority will be allowed.	RFP
Permits	Generation license	Private	The developer shall bear the risk of obtaining the generation license (with associated permits required). If failure to obtain it is the developer's fault (rather than a public party error or delay) the developer shall lose its performance guarantee. If, by contrast, NEPRA is at fault, that eventuality is covered by the implementation agreement (IA).	Generation license/IA

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TABLE 6-2: RISK ALLOCATION MATRIX *(continued)*

Category	Risk	Risk allocation	Rationale and mitigation	Contractual document
Financing	Financial closure	Private	With all the permits and tender package signed, the responsibility of reaching financial closure is fully assigned to the private party, being secured with the performance guarantee in case of failure.	EPA
Construction	Conclusion of works	Private	After reaching financial closure, the conclusion of the construction is secured through the completion bond, which will be released after the COD, discounting any penalty or liquidated damage. Construction problems are generally allocated to engineering procurement and construction (EPC).	EPA & EPC contract
Construction	Investment cost overrun	Private	Any construction costs exceeding those assumed in the financial model shall be assumed by the developer, who could transfer all construction liabilities to EPC contractors or subcontractors (that is, through performance guarantees).	EPA & EPC contract
Construction	Defective material	Private	The construction of the project must be in accordance with industry practice. The developer bears the risk of and responsibility for completing the project free of defects and could mitigate the risk by transferring it to the subcontractors.	EPC
Construction	Delays	Private	In the same way, the EPA shall specify that delays be assumed by developers. The liquidated damages and loss of expected revenues when COD is not met could be also covered by transferring them to the subcontractors.	EPA & EPC contract
Construction	Health and safety (H&S)	Private	The private party bears the risk of complying with H&S requirements during the construction.	EPA & EPC contract
Construction	Liability for property damage and personal injury	Private	All consequences of damage to external properties and personal injuries during construction shall be borne by the private party, who must be insured accordingly.	EPA & EPC contract
Construction/ operation	Vandalism	Public/ shared/ private	This risk is usually borne by the developer unless a determined threshold is in place. In the case of a park-based scheme where the public party is responsible for fencing and security, the risk shall be borne by the public administration.	EPA and Park Lease Agreement and insurance contract
Operation	Unrecovered operational cost overruns (OPEX risk)	Private	Unexpected increased cost during operation (extra maintenance costs) shall be borne by the developer.	O&M contract if it exists
Operation	Resource	Private	The private party bears the resource risk once it performs the full feasibility study.	EPA

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TABLE 6-2: RISK ALLOCATION MATRIX *(continued)*

Category	Risk	Risk allocation	Rationale and mitigation	Contractual document
Operation	Health and safety (H&S)	Private	The private party bears the risk of complying with H&S requirements during the operation and maintenance of the plant.	O&M contract if it exists
Operation	Liability for property damage and personal injury	Private	All consequences of damage to external properties and personal injuries during operation shall be borne by the private party, who must be insured accordingly.	O&M contract if it exists
Operation	Maintenance	Private	The private party shall assume the risk of conducting adequate day-to-day and lifecycle maintenance of the plant.	Supply maintenance contract if it exists
Operation/ revenue	Sale of energy	Public (off-taker)	Given that the developer has no alternative way to sell the energy generated, the public party takes the risk of taking all that energy under a take-or-pay agreement, with payment to the developer. The energy must be taken for the fixed term defined in the EPA.	EPA
Operation/ revenue	Curtailment	Public (off-taker)	Curtailed energy due to failures not associated with the developer shall be paid by the off-taker on a deemed energy basis.	EPA
Operation	Low performance	Private	The private party shall bear the risk of low performance of the plant consequent upon degradation of materials and machinery over the years.	EPC and machinery guarantee
Revenue	Payment security	Public (GoP)	The GoP secures payment through sovereign guarantees in case of payment delays/ defaults by the off-taker.	IA
Financial	Inflation/ Foreign exchange	Private/ public (off-taker)	Under the construction phase the inflation risk shall be borne by the private party for the notional single year of construction, while during the operation of the facility (20 years), the tariff will be indexed to inflation and FX variations according to the share of the costs. Depending on the indexation format, different levels of risk are allocated to the developer; however, if these are unbalanced, financial closure is compromised.	EPA
Financial	Foreign currency availability	Public (GoP)	The developer shall be guaranteed with preference in local currency exchange, rather than hard currency, limited to the amount of its cost contracted in foreign currency.	IA
Financial	Interest rate	Private	The private party bears the risk of interest rate fluctuations over the life of the project. The private party shall try to cover its risk with hedging arrangements, which might be limited with local currency.	Swaps with financial institutions(if available)

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TABLE 6-2: RISK ALLOCATION MATRIX *(continued)*

Category	Risk	Risk allocation	Rationale and mitigation	Contractual document
Financial	Refinancing	Private	The cost of changing debt obligation shall be borne by the private party. Refinancing might affect a project at different points, so it is advisable to do it with prior public party approval.	EPA
Insurance	Unavailability of insurance	Shared	Although securing—and paying for—insurance is a private party responsibility, it is customary to provide for sharing of the insurance burden if it becomes unacceptably costly (or even unavailable) because of external factors beyond the control of either party.	EPA
Partnering	Private partner insolvency	Private	Risk of failing technical or financial capabilities.	EPA
Partnering	Subcontractor insolvency	Private	The private party shall be responsible for any failure or insolvency on the part of a subcontractor.	EPC and other private contracts
Partnering	Change in private partner ownership	Private	Compliance with any contractual restriction or change in ownership will be a private partner risk, and original ownership restrictions shall remain (for example, the possibility of foreign ownership or partnership).	EPA
Partnering	Change in off-taker status	Public (off-taker/ GoP)	The off-taker should bear the risk of any change to its ownership/status which adversely affects the project, and the developer shall be entitled to termination and compensation if certain criteria are not met.	EPA/IA
Partnering	Disputes	Shared	Dispute resolution and all associated consequences will derive from an amicable settlement, or agreed expert intervention, or an agreed tribunal under international procedures.	EPA/IA
Force majeure	Force majeure (acts of God)	Shared/ public (off-taker/ GoP)	When events outside the reasonable control of the parties prevent them from complying with the contractual agreement (that is, natural events: floods, earthquakes, pandemic; or political events: war, strikes) the risk is usually shared, and after a period (prolonged force majeure) the parties shall be entitled to termination options. As the risk is shared, both parties bear their own losses (are relieved from contractual obligations that would otherwise prevail). In some cases, certain political risk events are fully allocated by the public side (such as military conflict).	EPA/IA

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TABLE 6-2: RISK ALLOCATION MATRIX *(continued)*

Category	Risk	Risk allocation	Rationale and mitigation	Contractual document
Political	Governmental actions	Public (off-taker/ GoP)	The public party shall bear the cost and delays due to political events affecting the private party and its contractual obligations. This might end in termination under prolonged events (such as, nationalizations, expropriations, moratorium of payments, and so forth).	EPA/IA
Change in law	Change in law	Public (off-taker/ GoP)	Unexpected changes in law affecting developers' contractual obligations with extra costs, delays, or unfeasible changes shall be borne by the public party. In this case, the private party shall be entitled to relief from breach of contract when a change in law contravenes contractual obligations.	EPA/IA
Early termination	Off-taker default	Public (off-taker/ GoP)	Different events are included which imply the private party is deprived of its expected revenue. The private party shall be entitled to termination and shall be fully compensated by public authorities as if the contract had run until its natural termination, where it usually gets senior and junior debt, equity investment, a level of equity return, redundancy payments, and subcontractor costs.	EPA/IA
Early termination	Governmental actions	Public (off-taker/ GoP)	In case of political decisions such as nationalizations, expropriations, or moratorium of payments, the private party shall be entitled to termination and/or shall be fully compensated by public authorities as if the contract had run until its natural termination where the public party may negotiate reduced payments in the contract termination.	EPA/IA
Early termination	Change in law	Public (off-taker/ GoP)	In case of unexpected changes in law affecting developers' contractual obligations with extra costs, delays, or unfeasible changes, the private party shall be entitled to termination and/or shall be fully compensated by public authorities as if the contract had run until its natural termination where the public party may negotiate reduced payments in the termination.	EPA/IA
Early termination	Voluntary by off-taker side	Public (off-taker/ GoP)	As this depends on the off-taker side, it shall bear the costs of the risk. The private party shall be fully compensated by public authorities as if the contract had run until its natural termination.	EPA/IA

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TABLE 6-2: RISK ALLOCATION MATRIX *(continued)*

Category	Risk	Risk allocation	Rationale and mitigation	Contractual document
Early termination	Force majeure	Shared	Termination rights shall be available after a prolonged time (6–12 months). The compensation shall not be in full; instead, financial risks are usually shared and the private party is compensated for the senior debt, initial equity, redundancy payments, and subcontractor costs, while the private party loses the equity return.	EPA/IA
Early termination	Developer default	Private	The developer bears the risk of termination arising from failures of project delivery. This could occur before construction (financial closure), during construction, or during operation. There should be tolerances to differentiate low performance from default, and rectification opportunities must be given to the developer. The off-taker shall be entitled to seek termination, and the private partner will typically be entitled to a compensation amount equal to a present percentage (around 80–100 percent although in some emerging markets this can be as high as 90 percent) of the scheduled outstanding debt, minus applicable deductions, and no equity compensation. The aim of a lender "hair cut" of less than 100 percent debt is to provide incentives to lenders to conduct due diligence and exercise their monitoring and step-in rights to ensure the private partner delivers the project satisfactorily so that it avoids termination and can repay the whole of the lenders' outstanding debt.	EPA/IA

Source: Authors based on PPP Risk Allocation Tool 2019 Edition – Energy, Communications and Industrial Parks. Global Infrastructure Hub.

Agency (CPPA) as the off-taker, and being a 100 percent public company, the government can secure and support payment to the VRE producers through sovereign guarantee via an implementation agreement.

These guarantees are a common practice in various countries, where different mechanisms apply. In Argentina, the renewable energy development fund (FODER) provides liquidity guarantees ensuring the continuity of cashflow and termination guarantees that are also backed by the World Bank; in Peru, the government itself was the contract's off-taker in order to eliminate any doubts about counterparty creditworthiness;[53] and in Zambia, liquidity arrangements issued by local banks are partially backed by international institutions (World Bank), and in the event of buyer default the government does not take on responsibility for the payments but instead guarantees to buy the shares in the project company at a predetermined price.

Currently, the credibility of the CPPA as off-taker in the tender backed by the Government of Pakistan (GoP) should allow projects to raise financing and reduce the cost of capital, with favorable consequences

53 Nowadays, producers sell their production to the power pool and at marginal cost. To achieve the guaranteed revenue, the regulator defines an additional payment that is paid by all the GENCOs and transferred to the end-consumers.

for the final price. However, when the Competitive Trading Bilateral Contract Market (CTBCM) is established and credit cover mechanisms are substituted for sovereign guarantees, there may be a need for further government support for non-creditworthy distribution companies (DISCOs). At a minimum, it will be crucial to support some DISCOs to improve their services and collection practices, improve grid quality to reduce technical losses, and target their fuel and electricity subsidies to the poorest segments of the population. Such support will strengthen the financial performance and creditworthiness of DISCOs.

6.2.3 Indexation and taxation

A mechanism that enhances investor confidence is denomination of contracts in hard currencies (such as USD or euros), and indexation.[54]

The most efficient structural hedging is to borrow in local currency and procure goods from the local market. Due to gaps in both of these in Pakistan, the tariff nomination and indexation is a core decision in the risk allocation for both currency and inflation risks.

Internationally, countries approach these risks in different ways:

- In Chile, contracts are denominated in USD and adjusted to inflation using the US consumer price index (CPI), to serve as a shield against both currency and inflation risks to developers with constant real contract prices (IRENA (2017), 'Renewable Energy Auctions: Analysing 2016'. IRENA, Abu Dhabi).
- In India, Germany, and Italy there is no indexation of prices, nor hedges against currency risk. The risk entailed principally affects their solar tenders, as the three countries have strong wind component markets (IRENA (2019) Renewable energy auctions: Status and trends beyond price, International Renewable Energy Agency, Abu Dhabi).
- In Mexico, developers can select their level of exposure to risk because they can choose to index their offers to local currency or USD; in either instance they are somewhat shielded from inflation. Offers indexed to USD shield the developer against currency risk but suffer a penalty in the award criteria (IRENA (2019) as above).
- In Brazil, contracts are not adjusted to foreign exchange risk, but most financing comes in local currency from Banco Nacional de Desenvolvimento Econômico e Social (BNDES) at attractive interest rates, with loans for up to 70 percent of the total capital requirements of renewable energy projects, and private banks could not profitably compete with the interest rates it offered, which were as low as 2 percent per year in real terms, which represents a very low cost of capital.

  Brazil has also managed to develop a local wind industry. Consequently, the currency risk in Brazilian wind tenders is relatively low, as most of the project developers' costs and revenues are in the same (local) currency.

Currently, for the Category 3 tenders a simple indexation is envisaged based on a fixed adjustment of the bid tariff not exceeding 2.5 percent annually as per the escalation determined in the bid. This escalation process, to be followed every year, will be automatic and will not require the approval of NEPRA.

For future tenders we recommend a simple indexation with predefined fixed shares in the indexation components among local and foreign currency, keeping indexation for local inflation and exchange rates,

[54] Most project developers prefer the tariff to be indexed to a hard currency; however, off-takers must remain cautious, because indexation and payments in other than local currencies shift the currency exchange risk to the off-taker: this is dangerous for countries with significant currency depreciation, such as Pakistan.

with payments in local currency, and without interest rate indexation. This would favor the adjustment of components having different currencies while keeping a simple assessment and evaluation of the bids, the EPA, and a symmetrical and equivalent indexation level for all capacity developed under the tenders.

The fixed shares could be adapted over time, which could be especially important once the local industry is able to produce components for the generation plants, which might facilitate finance and payments in local currency.

Taxation is another critical issue, where it may be possible to provide tax holidays on profit or custom duties.

6.2.4 Fees and bonds

6.2.4.1 Cost of preparation of documents

To reduce costs incurred by the steering committee and the tendering authority for the preparation of the tender package and the tender process, we recommend setting a low nonrefundable fee (of around US$100/MW) to be paid by all the potential bidders when requesting the RFP. This would fund the possible internal or external cost of the document preparation and its later processing and evaluation.

The low fee should not imply any possible entrance barrier and should be paid in PKR equivalent of USD, as per the rate published by the National Bank of Pakistan, seven working days before the bid submission deadline of the tender.

This fee may be split and shared among: (1) the steering committee, for the preparation of the RFP; and (2) the provinces, for the cost of tender processing and evaluation, including the payment of the outsourced evaluation committee/transaction adviser. In this regard, we suggest an equal split for this fee: US$50/MW to AEDB and US$50/MW for the province conducting the tender.

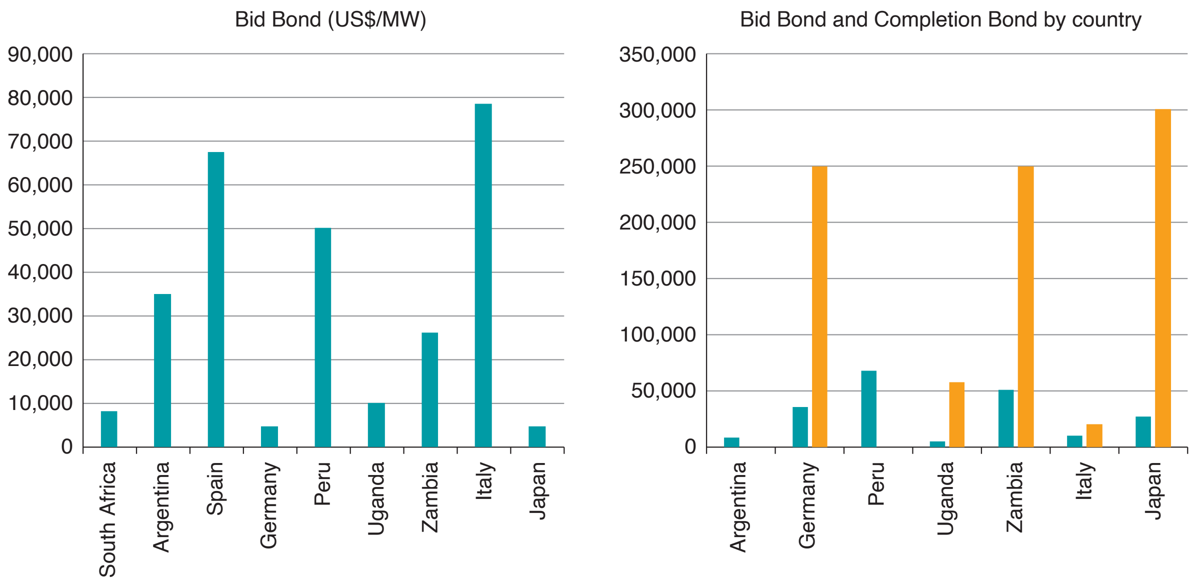
6.2.4.2 Compliance bonds

Compliance bonds are instruments to ensure the completion of the project by the winner of the tender in compliance with the contractual schedule. These bonds are especially important if the tender is run on a price-only basis.

The use of compliance bonds may relax other mechanisms which also aim to ensure the completion of the projects as per the prequalification requirements. The more stringent the compliance rules, the higher the security of the project completion, but at the same time this stringency deters the participation of more bidders in the tender.

Bid bonds are required as a precondition of participation in the tender and to avoid the risk of the winning bidders not signing the Letter of Award (LOA) and subsequent contractual documents; this therefore reduces the risk of underbidding. For Pakistan, based on the proposed design which includes prequalification, we recommend setting a relatively low bid bond to encourage bidders to participate. We suggest implementing a bid bond of approximately US$7,500/MW, aligned roughly with the amount requested in Category 3 tenders, albeit slightly higher considering that Category 3 projects already have an issued Letter of Intent (LOI). From an international perspective, this is comparatively low (see Figure 6-3, below).

FIGURE 6-3: SAMPLE OF BID AND COMPLETION BONDS[a]



Source: Authors.
[a] There are other countries which have bid and completion bonds based on the cost of the projects, such as Brazil (1 percent and 5 percent of the total cost); or Denmark, which has a completion bond based on the energy to be produced (US$25.7/MWh/year). India has different bid and completion bonds depending on the project.

The bid bond must be provided by all the bidders in the form of an irrevocable and unconditional guarantee through a deposit or issued by a recognized bank domiciled or licensed to conduct business in Pakistan in the name of the bidder company or consortium and issued in PKR equivalent of USD, as per the rate published by the National Bank of Pakistan, seven working days before the bid submission deadline of the tender. The bid bond must be valid for a period of 60 days after the expiry of the validity period of the submitted proposal (180 days from the deadline for receipt of bids, to be extended if required by the tendering authority due to unforeseen circumstances).[55] The tendering authority (province) will act as the bond counterparty.

The bid bond will be returned to any nonselected bidder within 30 days after:

- The first envelope evaluation of the awarding process if its bid is not accepted;
- The notification and publication of the tender winner(s) after the second envelope evaluation if its bid is not selected; and
- Not extending the validity of the bond if there is more than one period of extension.

The bid bond of the successful bidder will be retained and extended until they deposit the completion or performance bond of the project.

The bid bond will not be returned and will be converted into cash by the tendering authority if:

- The bidder withdraws its submitted proposal during the validity period;

[55] In the event that the bidding process is not completed until the end of the extended period, the validity period might be extended again.

- The bidder defaults at any stage before the submission of the performance guarantee/issuance of Letter of Support (LOS); or
- The successful bidder refuses or fails to sign the LOA or the LOS.

Completion bonds are required to ensure that projects are completed in timely sequential fashion prior to commissioning (concession of generation license, signature of EPA and other agreements, achieving financial closure, and so forth). The following relationship with the performance guarantee is proposed:

- Performance guarantee: required prior to the issuance of the letter of support until financial closure where the AEDB acts as a counterparty.
- Completion bond: required after financial closure of the project until its final commission where CPPA acts as a counterparty.

For Pakistan we recommend setting the level of the completion bond at around US$30,000/MW. This is comparatively low, from an international perspective, in view of the wide range from US$20,000/MW to US$300,000/MW shown in Figure 6-3 below. We recommend setting the performance guarantee at US$12,500,[56] which lies between recommended values for the bid bond and the completion bond (and would not exceed the completion bond value even if it were to be doubled).

The performance guarantee must be provided prior to the issuance and signature of the LOS by the successful bidder (as a prerequisite of LOS) and hence before signature of the EPA. The performance guarantee may be made through a deposit, or a performance guarantee in the name of the bidder company or consortium may be issued by a recognized bank domiciled or licensed to conduct business in Pakistan. The guarantee will be issued in a PKR equivalent of the USD value, as per the rate published by the National Bank of Pakistan, seven working days before the signature day. As soon as the successful bidder presents the performance guarantee, its bid bond will be returned. The performance guarantee is required to be in place until the achievement of financial closure, with AEDB acting as the counterparty.

The performance guarantee will be forfeited and converted into cash by AEDB if financial closure is not achieved as per the date agreed (eight months from LOS for solar PV projects and 16 months for wind projects). However, the project company must not be penalized if:

- The delay is caused by the actions of the GoP, the AEDB, or the purchaser; or
- The AEDB determines that any delay by the project company in achieving financial closure is due to events beyond the company's reasonable control or that financial closure can be achieved shortly. In these cases, the AEDB may grant in writing to the project company a one-time extension of up to six months beyond the date set in the calendar for the financial closure, if NEPRA approves it. Currently, the maximum extension time is six months, and the completion bond must be doubled. Although we agree on the period of extension, we believe that the increment of the bond should be reduced from 100 percent to 50 percent.

In the event that the winning bidder does not provide the performance guarantee prior to signing the LOS, its bid bond will be forfeited and the bidder with the second lowest energy price will be awarded.

Also, it is possible to allow the project company to terminate the LOS and the signed agreements before financial closure under a penalty directly proportional to time elapsed since LOS signature divided by

[56] This is higher than in a Category 3 tender considering that these bids require less technical preparation and thus present a greater risk of underbidding.

total time from LOS signature to date of financial closure. If the project company does not pay that penalty, AEDB will be allowed to convert into cash the full performance guarantee.

The completion bond must be provided after the achievement of financial closure either through a deposit, or as issued by a recognized bank domiciled or licensed to conduct business in Pakistan. The bond will be in the name of the bidder company or consortium and be issued in the PKR equivalent of the USD value, based on the exchange rate published by the National Bank of Pakistan, seven working days before the date of financial closure. As soon as the successful bidder presents the completion bond, its performance guarantee will be returned to it. The completion bond is required to be in place until the project commercial operation date as security for potential costs and damages, with CPPA acting as the counterparty.

The completion bond will be partially or totally forfeited and converted into cash by CPPA when:

- The project company fails to achieve the certification of all the conditions precedent under the EPA by the date specified in the EPA, where the responsible party for the delay is the project company and when this delay is not due to events beyond the reasonable control of the project company;
- The project company fails to pay any liquidated damage payable pursuant to the terms of the EPA;
- The project company abandons the development of the project;
- The project company does not meet its insurance obligations under the EPA;
- There is evidence of default by the project company under the EPA; or
- Having been formally notified (required) to extend the duration of the completion bond, the project company fails to do so within 14 days of such notification or 30 days prior to the bond's expiry.

The completion bond, when it is partially forfeited because of delay penalties, acts as a strong incentive for quick commissioning by the project company. Once the project is successfully commissioned, the completion bond is redeemed.

Besides the partial or total forfeiture of the bond, there are other types of penalties that usually apply when there are low completion bonds. However, we do not recommend these:

- Reduction of the project's contractual remuneration through reduction of the contract tariff. (For example, Germany reduces the tariff 3€/MWh if the COD is reached after 18 months; Italy reduces the tariff by 0.5 percent per month of delay with a maximum of 24 months; and India reduces INR 0.005/kWh per day after three months of delay. Note that this penalty would impact on bankability as the final energy price is affected in case of delay.)
- Reduction of the project's contractual remuneration through the reduction of the contract time. (For example, in Japan the procurement period is shortened by one month for each month of delay; and in South Africa, for every delayed day, the contract is reduced by an additional day.)

6.2.5 Dispute resolution mechanisms

6.2.5.1 The importance of complaint and dispute resolution mechanisms

Dealing swiftly with potential complaints and disputes that may arise during tendering is critical for the swift and effective implementation of VRE projects in Pakistan. Complaints or disputes may arise at all stages of the project, from early stages of tendering through into the long-term operational stage.

The respective dispute resolution mechanisms need to facilitate the resolution of potential disputes at all implementation stages, covering complaints that may arise during the tendering stage as well as subsequent contractual disputes.

Addressing potential disputes is especially important to enhance the developer's confidence in markets with limited experience of support mechanisms, as in Pakistan.

6.2.5.2 Effectiveness as overall objective of complaint and dispute resolution mechanism

At any stage of implementation, the appropriate mechanism must be designed to resolve any dispute effectively and decisively—with binding effect—and with minimum impact on the implementation timeline of the project.

6.2.5.3 Effective mechanisms for dealing with complaints during RE tendering

A wide range of options exists to effectively resolve complaints that may arise in relation with tendering procedures. However, in all cases the review procedures should be designed to allow resolution of the complaint within a minimum time. At an early stage the complaint should be reviewed by an independent entity, typically a tendering complaints board that is specifically constituted for the purpose of dealing with such complaints. This entity would need to determine whether the tendering procedure that has given rise to the complaint has been conducted in compliance with an existing tendering law or not. If an infringement of existing tendering rules is found, the tendering procedure would normally need to be cancelled. Alternatively, it might be deemed fit to proceed as scheduled, in which case that decision could be appealed and a second review conducted by another independent body. These procedures are similar to ordinary judicial process, except that the timeframe is normally stricter, requiring timely resolution of the complaint (within a month or two at most).

In Pakistan, the Category 3 tenders already envisages a Committee for Redress of Grievances, which allows the bidder to challenge either technical or financial nonqualification (or both) within 15 days of respective declaration. That Committee will then give its decision within 15 days. We agree with this procedure as it is aligned with best practices, and we recommend using it for future tenders, although for new tenders we propose to reduce the appeal time and the response time to seven days each.

6.2.5.4 Effective contractual dispute resolution mechanisms for RE projects

In addition to the above, it is critical that the contracts that govern the implementation of VRE projects provide for adequate dispute resolution mechanisms. Typically, contractual dispute resolution mechanisms provide for resolution in one, two or three phases. The first comprises an amicable settlement mechanism, the second (if applicable) incorporates an amicable settlement mechanism supervised by an independent authority (that is, a regulatory authority), while the third involves a binding national or international arbitration procedure, in the case of international investors typically arbitration under the United Nations Commission on International Trade Law (UNCITRAL) arbitration rules or International Chamber of Commerce (ICC) arbitration rules. In terms of effectiveness, the effect of the dispute resolution mechanism is binding upon the parties. The dispute resolution mechanism itself does not have a suspensive effect on any obligations of the parties, and thereby has no impact on the implementation of the project.

Ultimately, the availability of international arbitration provides further assurance to lenders and IPPs in the event of termination or breach of contract. This is critical, especially in countries where the justice system does not meet accepted international standards.

The EPAs established in Pakistan under the Category 3 tender process establish three steps as per best international practices with:

1. Resolution by parties within 30 days (amicable mechanism); or
2. Determination by expert, where the expert shall be agreed by both parties (amicable settlement mechanism supervised by an independent authority—not binding unless previously agreed); or
3. Arbitration under the rules of the London Court of International Arbitration (when the dispute is not resolved in the previous steps).

This procedure is aligned with best practices, and we recommend using it for future tenders.

Appellate procedures are also established under section 12-G of the NEPRA Act. Under these procedures, an appeal can be made to the appellate tribunal against any decision or order of NEPRA within 30 days of that decision. The tribunal must then issue a written decision on the appeal within three months of its filing. Later, the decision can be appealed to the high court.

6.3 TENDER PACKAGE

The tender package is the set of documents needed in the tender process. Typically, many of these documents—especially in connection with EPAs—have been inherited from predominantly conventional, large-scale, and technically complex power projects. These documents are typically intricately and legalistically structured, resulting in high transaction costs, which have been passed onto renewable energy projects. But renewable energy projects do not require such complex tender documents. An opportunity thus emerges to decrease transaction costs and at the same time cost-effectively to achieve a balanced allocation of risk among public and private parties.

The most relevant documents in the tender package are:

1. Request for Proposal (RFP);
2. Connection Agreement;
3. Land Agreement;
4. Land/Park Lease Agreement;
5. Energy Purchase Agreement (EPA); and
6. Implementation Agreement (IA).

6.3.1 Request for Proposal

The RFP provides the detailed information about the tender to the prospective bidders when they pass the prequalification requirements. It should contain:

- The tender invitation, with:
  - The type of tender, term, and acceptance of the terms of future agreements;
  - The capacities and the locations according to the CYREPP;
  - The land use specifications, including exact dimensions, coordinates, and studies performed for selection, with details as developed in the land agreement;[57] and
  - Any requirement determined by the steering committee regarding social, economic, or environmental gains for the development of local communities impacted by the project (section).
- The detailed instructions of the tender:
  - Schedule of the process, including the deadlines and steps to sign the different project agreements (section 6.1.3);
  - Comments, consultation, and clarification procedures;
  - Law applicable in the procedure (section 6.2.4);
  - Compliance bonds (section 6.2.3.2);
  - Contents to submit in the bid (section 6.1.2);
  - Award instructions and qualifications of the bids (section 6.1.2);
  - Contents and templates for the first envelope;
  - Contents and templates for the second envelope; and
  - Set of templates of the project agreements (connection agreement, land/park agreement, full EPA, and implementation agreement).

    Although the templates of the project agreements are usually presented as documents annexed to the RFP, it is common to introduce important parts of the project agreements in the main sections of the RFP to afford a better understanding of the principles underpinning the tender. For example, it is common to reference the indexation that will be applied in the tariff, the different risks to be borne by the developer or the power off-taker, and any applicable guarantee.

To the best of our knowledge, the RFP for Category 3 tenders is aligned with best international practices and includes the above requirements. If it is slightly modified to reflect the new tender process to be implemented, the new chosen scheme and the key features of the tender, it could be adapted for future tenders in the country.

6.3.1.1 Local benefit sharing

According to a report published by the International Finance Corporation (IFC),[58] the development of renewable energy projects creates potential social risks and opportunities, especially for local communities in the vicinity of the project:

- The need to secure large lands for projects and parks;
- Community expectations about job creation and new opportunities, especially impacting marginalized host communities; and sometimes

[57] The land agreement and site specification for a park-based scheme will differ from those for a substation-based scheme.
[58] IFC. 2019. "*Local Benefit Sharing in Large-Scale Wind and Solar Projects.*"

- Access to electricity (when the project is located in areas not currently connected to the main electricity grid).

Local benefit sharing aims to ensure that host and impacted communities receive value from the project in form of social, economic, and environmental gains. Benefit sharing is a handy umbrella term for the variety of ways in which a project, organization, or industry contributes positively to socioeconomic development. Other descriptors are corporate social responsibility, local content, community and/or social investment, sustainable development, socioeconomic development, shared value, and responsible investment.

Mitigating negative actual or perceived impacts from solar and wind projects is essential to avoid harm or undermining trust on the part of host communities. There is a strong community need to see tangible and authentic benefit sharing, so developers must demonstrate that local communities will see their fair share of benefits from renewables projects—beyond the value yielded to national or regional clean energy agendas. Lack of community acceptance of a project can lead to project delays, cancelations, and cost overruns. In this regard, the Inter-America Development Bank studied more than 200 projects in South America, finding that a lack of community benefits was among the strongest drivers of conflict, being implicated in 84 percent of cases.[59]

Developers have different options to implement benefit sharing: there is no single, one-size-fits-all design or approach. The International Finance Corporation divides them into:

1. **Revenue sharing and shared ownership** through various fees, taxes, leasing structures, and royalties, as well as through commitments to specific revenue-sharing formulas. Examples include:
   a. Recurring payments to the local community: taxes and fees, land lease payments, local funds.
   b. Preferential electricity rates.
   c. Shared ownership: distribution of profits/co-ownerships with local communities taking an equity stake in the project using funds from local loans, or through crowdfunding mechanisms.
2. **Provision of public services and infrastructure,** where options include:
   a. Basic services and infrastructure: education; health; water and sanitation; roads and transportation.
   b. Well-being amenities: culture and sport; centers and marketplaces; recreation places and activities.
   c. Energy services: electrification; energy services.
3. **Skills and livelihoods:** job creation of any kind (direct, indirect, and induced) is often viewed as a key socioeconomic benefit. This includes:
   a. Employment and local procurement: training for local residents and preference for procurement of local goods and services.
   b. Alternative skills and livelihoods: training; income generation, and/or microcredit programs.
   c. Local and institutional capacity building.

59 Inter-American Development Bank (IDB). 2017. "*Lessons from four decades of infrastructure project-related conflicts in Latin America and the Caribbean.*"

4. **Environmental stewardship:** implementing activities and programs to improve the local environment, aligned to meet climate change mitigation. This can include:
   a. Environmental enhancements: improvement to the local environment and wildlife.
   b. Low carbon community development: education and awareness; ecofriendly products and services; energy efficiency or recycling plans.

Although any of the four options could be applicable, depending on the context, we mainly recommend options 2 and 3. These commonly reach out to communities as a whole, and the benefits are felt by all. However, it is important to consider the following factors:

- For project developers, ensuring that opportunities exist for job-seekers from host communities will play an important role in the overall local benefit-sharing strategy. Typically, job-seekers in host communities are unskilled or semiskilled. They generally find work and contracting opportunities in security, cleaning—offices, solar panels, and vehicles—land preparation, road work, fencing, digging, or road safety jobs. However, once the project is operational, it becomes more difficult to employ large numbers of unskilled or semiskilled workers, so even with the best intentions, it can be difficult to optimize local hiring, and community expectations outstrip a developer's concept of what is reasonable. Training is essential to sustain work positions during the O&M phase of the project.
- An advantage of this option, if well developed, is that it can carve out a special place for women in the community, creating opportunities for their integration into the employment market.
- When communities hosting a wind or solar project are not themselves connected to the grid, they confidently expect that the project will yield major benefits in the form of access to electricity. But connecting households directly to the energy generated by wind and solar is often hampered by technical constraints and even precluded by restrictions imposed by the electricity regulator. To find a solution, the company will have to collaborate with a willing electricity provider, and that might cause implementation problems. An alternative is to offer off-grid household or community-scale renewable energy technologies and services, and these can prove appropriate and welcome.
- We do not recommend the revenue sharing and shared ownership options because difficulties arise with: lack of clarity on governance of assets; access to finance; distribution of community benefits; and the need for capacity building on community ownership.

As we do not recommend the imposition of local content provisions, we do not support the use of a benefit sharing mechanism as a key driver in the award of the project in the tender due to inherent subjectivity, project specific factors, and measurement complexity; preferring instead the objectivity, simplicity, and transparency of the price-only award criteria. Therefore, we recommend that the steering committee bases any benefit sharing requirements in the RFP on specific features of the project, its context, location, and the surrounding local communities, calling upon the members' expertise and knowledge of the region, especially those from the province in question. When setting a mandatory condition for developers in the RFP, the steering committee must consider the competences and motivations driving prospective developers. Common benefit-sharing business drivers for developers of wind and solar projects are: (1) better access to finance because of the reduction of the social risk; (2) social license to operate (community assent); (3) easier access to approvals; (4) better reputation; and (5) better access to land[60] and resources.

[60] This is especially important under the substation-based scheme.

Finally, various lessons have already been learned from VRE projects according to the IFC:

- Benefit sharing requires commitment from the top—strategic aspect of the business, and support from management.
- A thorough planning approach starts early, bearing in mind that the mere presence of a benefit sharing strategy or plan does not guarantee successful implementation.
- Community engagement is critical.
- Management should aim for inclusion and consideration of various groups in local communities: young, elderly, gender initiatives, and so forth.
- Transparency and accountability matter, especially during implementation, with direct access to primary sources, data sharing policies, and community meetings.
- Robust monitoring enables mid-course correction and reporting on results. Without documentation and evaluation, it is difficult to know what is working and what might be ineffective, superfluous, or even have a negative impact.
- Partnerships, industry collaboration, and collective action represent major opportunities for greater impact, including alignment with local governments, other industries, nongovernmental organizations (NGOs) and others.

Examples of benefit sharing actions can be seen in different countries:

- In South Africa, some wind power plants involve participation with equity from local communities, derived from local loans, while others have provided household-level renewable energy services.
- In Kenya, a new project improved the roads, facilitating access for local communities.
- In Senegal, a wind power plant built a new marketplace with shelters and stalls.
- In Nepal, distribution microenterprises managed by women were created and now give service to 182,000 people.
- In Rwanda, a solar power plant hired local experts to complete surveying and feasibility studies, and local workers for site preparation, including women for security, cleaning, and administrative work.
- In India, a solar power plant improved the health system with no-cost medical services for local communities around the plant.
- In Colombia, more than 10 million trees will be planted, as a consequence of RE projects.

6.3.2 Connection Agreement (CA)

The successful bidder will need to sign a Connection Agreement (CA) with NTDC or the relevant DISCO if the connection is at a voltage lower than 132 kV. This agreement will establish a contractual framework between the parties to provide for the connection of the plant to the electricity grid. The CA will incorporate salient aspects of the grid code and will remain subject to the grid code.

Prior to signing the CA, the developer must perform a grid connection feasibility study, which is approved by NTDC[61] or the DISCO. This study will include simulation studies of the effect of power evacuation to

[61] This involves payment of a fee.

the grid in accordance with the project timeline, making sure that the power injected to the grid will not have any adverse effect on the national grid as required under the grid code.

- The template shall describe:
- Connection conditions;
- Technical operational conditions;
- Interconnection arrangements, with the required infrastructure to be developed by the bidder and NTDC/DISCO;[62]
- Detailed description of the required studies;[63]
- Conditions for rights of way;
- Any other cost chargeable to the project company;
- Date of commission of the infrastructure and calendar for development of the interconnection; and
- Penalties applicable to either side in the event of delays in the development of the interconnection infrastructure.

ARE Policy 2019 in its section 2.2.1 allows for the building of connection infrastructure by the provincial grid companies or the private sponsors side in the following case:

> *"If the National Grid Company (NGC) due to technical or financial limitation is not in a position to commit to requisite timelines for evacuation of power from approved projects, then the Provincial grid company and/or project sponsors shall be allowed the option of undertaking such interconnection/evacuation subject to conformity to the Grid Code. NEPRA will determine tariff for such interconnection investment on cost plus basis, if such interconnection component is not part of the project tender, with the same return on equity/IRR as it grants to NGC for such interconnection. The contractual and financial obligations associated with the interconnection and evacuation of power shall be assumed exclusively by the Provincial grid company and/or project sponsor against indemnity to NGC and the relevant DISCO."*

This option, if applicable, demands the utmost clarity in both the payment and operation modality among the parts to avoid future negotiations and discussions at the time of signing the tender package.

6.3.3 Land Agreements

Land agreements must be signed within at most two weeks of signature of the EPA. The land agreement will vary depending on the scheme and the technology specified in the tender.

6.3.3.1 Park Lease Agreement (PLA)

A Park Lease Agreement (PLA) would need to be made between the province and the successful bidder for solar or wind park schemes.[64] In these cases, the land will first be secured by the province, as soon the

[62] We recommend keeping the current shallow grid connection policy, where the developer pays for the connection from the facility to the connection point and the transmission/distribution company undertakes any required reinforcement of the grid.
[63] Electrical studies (including but not limited to a short-circuit study, power quality study, load flow study, and stability study).
[64] The PLA can be signed within a public SPV or without it.

CYREPP is agreed by the steering committee and approved by AEDB. With the PLA, the province leases the secured land to the successful bidder after signature of the EPA.

Under the PLA, the land should be secured with use and access granted until the termination date of the EPA. The PLA should consider possible extension of the lease in case of: (1) extension of the EPA after agreement between the parties, or (2) a new EPA once the previous EPA has concluded and the plant is granted permission to keep its operation. The PLA should also consider a decommissioning period (of six months, at most) when the power plant has ceased to operate.

Under the PLA, the provinces, as owner of the land, shall specify:

- The civil works that will be performed on the land for the preparation of the park. The most common works are listed below,[65] and the selection must be based on the budget allocated and capacity to manage the process:
  - Fencing;
  - Land preparation;
  - Connection line to the substation;
  - Water supply and drains;
  - Access roads;
  - Street lighting;
  - Weather station; and
  - Fire station.

  It is more efficient for these works to be undertaken by the public party in case there is more than one successful bidder in the park.[66] The public body bears the risk of undersubscribed tenders, which can be partially mitigated by implementing the work after the successful bidder is selected. However, in the case of tenders with different phases, the risk of future undersubscribed tenders is difficult to avoid if the public party is interested in achieving economies of scale by performing all the works at the same time.

  Among the proposed works, we do not recommend the implementation of the connection line from the park to the connection point as it would attract greater risk to the public side, including future deemed energy costs in case of connection issues. However, the right of way for the developers is a critical component that must be secured.
- The works performed for the selection of the land by the provinces, which shall include, among others, costs of consultation on resource assessments (mapping or satellite-based resource assessment) and evaluation of nondependent technology information (on-site climate conditions, geotechnical report, digital elevation model, hydrology study; and soiling measurements, with respect to dust and other contaminants).

The lease fee shall be specified and available for bidders to let them accurately calculate their final energy price bid, for which we recommend inclusion of all the costs mentioned above.

The PLA, by securing land owned by the provinces will reduce uncertainty and risk to the bidders, which should translate into lower bids.

[65] World Bank. 2019. "A Sure Path to Sustainable Solar." Washington DC: World Bank. Guidelines for public investments in solar parks.
[66] Different winners in different parcels, as each parcel can have only one winner.

A template of the PLA, including the features of the park and the costs to the bidders must be included in the RFP.

As stated in section 4.2.1, the province is in charge of developing the required studies, and civil works must be allowed to request support from development partners or the federal government for the performance of works or its financing if deemed necessary.

6.3.3.2 Land Use Agreement (LUA)

Land Use Agreements (LUAs) are used for substation-based schemes for solar photovoltaic (PV) power projects. Under this scheme the steering committee along with the provinces will define the area around the connection point where the project site must be located. Depending on the title to the land, developers have two main options:[67]

- Private land: this implies direct negotiation between developers and landowners. To that end, developers may find the land themselves within the specified area or through the approach of AEDB, which has identified several private sites close to transmission lines, and which under the Cost-Plus Tariff regime has encouraged land purchase by developers under private treaty. If the land around the substation is comparatively expensive, this substation will face higher bids.
- Public land: this is the remit of the provinces, which have different procedures (for example, under Policy 2006 Punjab used to advertise properties before allocation to a developer, whereas Sindh gave land identified on a 'first come, first served' basis). Furthermore the province could lease public land to the successful developers, as explained in section , but in that case the provinces would not perform any class of civil or selection works, so the lease fee would cover use of the land only.

In both cases, although the LUA will be signed after the EPA, developers must have obtained access to the land to carry out the feasibility study required for the generation license under a pre-agreement with the owner of the land (public or private); this is also a prequalification requirement for the tender.

6.3.4 Energy Purchase Agreement

Pakistan has vast experience of development and implementation of EPAs, both for conventional projects and renewable energy projects (under cost-plus, Category 3, and so forth). The EPA and the implementation agreement are the key documents of the tender package. In this section we do not aim to develop all the details of the EPA but to provide recommendations to enhance attractiveness to bidders based on an effective risk allocation.

We recommend having a bilateral EPA, to be signed between CPPA and the successful bidder, rather than tripartite agreements with NTDC. NTDC's role, as previously explained, would be limited to signing the connection agreement.

The EPA will contain commercial and legal stipulations covering, among other issues:

- Term;
- Conditions precedent;

[67] IFC. 2016. "*A Solar Developer's Guide to Pakistan.*"

- Development, procurement, manufacturing, and construction;
- Commissioning;
- Commercial operation and maintenance of the facility;
- Testing of the facility;
- Sale of net electrical energy generated and delivered by the seller to the off-taker and its conditions;
- Shortfall and excess in generation;
- Off-take constraints and dispatch regulation;
- Off-taker payment obligations, monitoring rights, and billing;
- Metering, communication, control, and information systems;
- Tariff for delivered energy, currency, and indexation;
- Early commissioning procedure and tariff;
- Insurance;
- Force majeure;
- Events of default, termination, and lenders' step-in rights;
- Indemnification of losses;
- Governing law, changes in law, and dispute resolution; and
- Expiry of term, decommissioning, and dismantling of the facility.

The EPA shall also include the different penalties or liquidated damages, which will apply for the break or delay in the fulfillment of the agreement, and how they will affect the completion bond.

The previous EPAs in Pakistan cover in general the abovementioned features, where for new tenders we have the following recommendations:

- **Term:** We recommend having a fixed long-term EPA of 20 or 25 years to protect the developers. A long-term valid agreement will act as a shield, noting that there is a partial correlation between the length of the agreement and the price reached in the tender. There are more innovative mechanisms for setting the term of the EPA as in Uruguay, where the contract length (which should be between 10 and 20 years), is proposed by bidders and included in the bidding documents. In the end, developers tend to submit proposals at the allowed maximum (20-year EPA). Thus, we propose a fixed term with a simple process.
- **Commercial conditions:** In the case of park-based deployments, take-or-pay models will provide strong incentives to generators to choose the most cost-efficient equipment to maximize their investment, whereas in the case of substation-based deployments the take-or-pay model will provide strong incentives for the selection of land with the highest available resource within the delimited area. These advantages are aligned with economic maximization of the power generation and therefore we recommend this model in Pakistan. Nevertheless, take-or-pay arrangements may have substantial repercussions for sector liquidity and the issue of "circular debt".[68]

[68] In Pakistan, circular debt is a public debt which is a cascade of unpaid government subsidies, which results in accumulation of debt on distribution companies. (Source: Wikipedia, 2022)

Article 2.4 of ARE Policy 2019 recommends: (1) a "must-purchase obligation" for a duration of not less than the debt-repayment period and not more than the period stated in the RFP from time to time, and (2) the balance term being on a take-and-pay basis at the option of the power purchaser—provided the AREP will continue to be dispatched on merit order dispatch criteria for the balance term of the EPA after the expiry of the must-purchase obligation period. However, we suggest that the best option to both help incentivizing the efficient generation of RE and avoid liquidity issues is to introduce take-or-pay EPAs for a defined amount of generated energy based on the average capacity of the plant and its technology or at least 15 years, with a take-and-pay clause applicable once that amount is exceeded.

- **Curtailment:** In the EPA, curtailment provisions generally are closely related with the selected type of tender and impacts on the final bid price.

  In site-specific projects the curtailment risk is usually assumed by the off-taker by paying all the curtailed energy[69] on a deemed energy basis; this provides a high incentive, especially in developing markets, as exemplified in Bangladesh and Afghanistan.

  In site-neutral tenders, curtailment payments may provide strong incentives for inefficient investments, where the developer may focus more on the potential of the site rather than on the strength of the grid, ending in high curtailment costs. In this case, a better option is to shift the curtailment cost to the reinforcement of the grid. Therefore, in recent years there has been a shift toward the allocation of curtailment risk to the developer, as in Namibia or Sri Lanka. The allocation of the risk to the developer is usually reflected in a final price increase, because developers will price possible curtailment (difficult to forecast) in their final offers.

  There are also hybrid methods such as setting an annual threshold above which the developer is compensated for curtailed energy. This model also has variants: it can be balanced more favorably to the developer (for example, the case of Portugal, where producers take the risk of the first 50 hours of curtailment per year) or it can be balanced in favor of the off-taker (as in Japan, where producers take the risk of 30 days of curtailment per year).

  For Pakistan, we recommend performing curtailment payments on a deemed energy basis, as the connection points are selected by the steering committee and not by the developers. This places significant importance on the careful selection of the connection points to be tendered.

- **Decommissioning:** We strongly recommend introducing a decommissioning clause in the EPA, to fix times for decommissioning once the term of the EPA is finished (and not extended). The clause would have to indicate that all the costs of decommissioning are borne by the generator, and must therefore be considered in its bid.

6.3.5 Implementation Agreement

The implementation agreement (IA) is a key project document where the government secures and supports the payment to the VRE producers through a sovereign guarantee. The IA must be signed by the GoP and the successful bidder up to two weeks after signature of the EPA.

As for the EPA, Pakistan has experience in the development of IAs for renewable generation under feed-in tariff (FIT) and cost-plus schemes, with this also being the intention for the Category 3 tenders.

69 In the event that the generator is not at fault.

The following shall be included in the IA:

- Term (same as the EPA);
- Protection of the leased site;[70]
- Support from GoP (sovereign guarantee of the payment obligations of the purchaser);
- Seller's consents;
- Rights to import;
- Taxation conditions and protection;
- Coverage for foreign currency exchange;
- Force majeure;
- Compensation on termination depending on the event (event of default, change in law, political events, force majeure, and so forth);
- Restriction on acquisition and transfer of the facility;
- Security interests; and
- Dispute resolution.

According to the analysis carried out for this study, most of the existing IAs cover all those issues;[71] alongside the EPA, they should be enough to ensure bankability. Thus, the retention of the Pakistan government guarantee underwriting the IA for future tenders, as per ARE Policy 2019, is strongly recommended.

6.3.6 Openness to negotiation

The tender package presented in this section aims to be as complete as possible, in order to preclude ad hoc negotiation of the agreements. We do not recommend face-to-face negotiation of the agreements with the successful bidder. That would prolong the tender process and, in a worst-case scenario, a disagreement could imply new negotiations or a new tender for the project.

Standardization of agreements is the best way to avoid post-award negotiation, and making them public removes scope for the bidders to negotiate.

However, the bidders will be able to comment on both REOI and the RFP launched by the tendering authority during a specified consultation period expressed in the tender calendar. If the comments are ultimately accepted by AEDB and NEPRA, either the REOI or the RFP will be changed accordingly by the tendering authority and released again. In any case, they will remain equal for all participants according to the principles of transparency and competitiveness built into the bidding process. Alternatively, any comments or lessons learned that are not immediately incorporated can be applied to the next round of competitive bidding.

The consultation held for the REOI and RFP includes comments to any of the attached documents, as is the case for the EPA and IA. Once the observations and suggestions are assessed and incorporated, the revised version will be considered final and not subject to any future representations.

[70] Only in the case of leased land owned by the provinces.
[71] However, some of them do require changes, for example, the custom duties based on the new policy, the final taxation, or the consents.

7. CTBCM AND ITS IMPLICATIONS FOR VRE

There are chiefly four ways in which the new Competitive Trading Bilateral Contract Market (CTBCM) model will affect the implementation of the procurement and operation of renewable energy (RE) projects. We consider each in turn, and how best to introduce variable renewable energy (VRE), while managing potential risk and institutional issues created by that market model.

The first issue is the change of governance model, especially the institutional framework for competitive bidding, consequent upon the assumption by the Independent Tender Administrator (IAA) (see section 4.2.2) of the leading role in the tender process (becoming the tendering authority).

TABLE 7-1: ADVANTAGES AND DISADVANTAGES OF MODELS OF GOVERNANCE OF TENDERS

Option	Advantages	Disadvantages
Separation of tendering authority, steering committee, and AEDB as per ARE Policy 2019.	• Involvement of different bodies ensuring agreement for the entire process and coordination.	• More resources needed.
IAA (AEDB) as only administrator.	• Greater efficiency.	• Land is mostly owned by provinces. • Not aligned with ARE 2019. • There might be coordination issues.
DISCOs as capacity procurement conductors.	• Potentially the best option in the long run.	• Current lack of maturity and capacity.

Although it is essentially an institutional decision to be taken by the GoP, we believe that the only two realistic options in the short run are the first two outlined in Table 7-1 above. To an extent they can be merged as a single option. To facilitate a smooth transition we recommend that that the CTBCM includes the possibility of giving the Alternative Energy Development Board (AEDB; acting as IAA) the right (but not the obligation) to hand over the role of tendering authority to the provinces for the first five years. Then when the IAA role expires, the distribution companies (DISCOs) should take on the role of tendering authority.

The second issue is the change in the off-taker role, which is currently performed by the Central Power Purchasing Agency (CPPA) but will be transferred to the DISCOs as the CPPA will act as pure market operator in the CTBCM. This change will imply the supplanting of sovereign guarantees by credit cover mechanisms for creditworthy DISCOs (already explained in section 6.2.2).

We believe that the current role of the CPPA as energy off-taker is more favorable for the development of VRE in Pakistan. Nevertheless, we understand what is needed to develop a wholesale electricity market, the incompatibility of CPPA acting as market operator and energy off-taker at the same time, and the impact on national accounts of sovereign guarantees. Therefore, the continued use of sovereign guarantees to support the development of VRE is recommended, ideally underwriting the entire volume of power to be tendered under ARE Policy 2019 until the CTBCM is mature enough. It will also be crucial

TABLE 7-2: ADVANTAGES AND DISADVANTAGES OF ENERGY OFF-TAKER OPTIONS

Option	Advantages	Disadvantages
CPPA as energy off-taker.	• Creditworthiness backed with sovereign guarantees, which helps bankability of projects, raises financing, and reduces the cost of capital.	• Contingent liability on Government of Pakistan.
DISCOS as energy off-taker.	• Whether DISCOs are creditworthy enough is open to question, although it is true that the proposed rules include the mitigation of creditworthiness disadvantage through sovereign guarantees from the GoP managed by IAA during the first years of CTBCM.	• Lack of creditworthiness. • Lack of credit cover. • DISCOs affected by circular debt problems as more business to business (B2B) and behind the meter capacity is introduced.[a] • More expensive prices. • Lackluster incentive to participate in the process.

[a] This is actually a structural issue in the electricity system and not a problem derived from the CTBCM.

to support most of the DISCOs to improve their services and collect payments, improve grid quality to reduce technical losses, and target the fuel and electricity subsidies to the poorest segments of the population to strengthen the financial performance and creditworthiness of DISCOs in the long run.

A third key issue is how to manage the market opening in relation to RE targets. To the best of our knowledge, the issue of the introduction of responsibilities of large eligible consumers that may procure power directly from a third party—and how that will relate to accomplishment of the VRE target—is being analyzed under the procurement regulation related to the CTBCM (still under discussion). This is a critical design issue: who is ultimately responsible for VRE penetration? The users or the system? To refine the question: in the event that a large user decides to procure power from a conventional power plant, does it need to procure a share of green power? There are different ways of addressing this issue:

- A socialized add-on to the wheeling tariff: all consumers, regardless of whether they are supplied by CPPA, a DISCO, or a third party, will pay any extra costs—and enjoy any savings—that arise from the VRE procured under tenders. This will be proportional to the energy consumption[72] in their regulated wheeling tariff. The cost/saving will be calculated among all the users connected to the system; or
- A VRE quota in bilateral contracts: in this way all the contracts signed between an eligible customer and a third party must include a minimum percent of energy generated by VRE sources aligned with ARE Policy 2019.[73]

We believe that the socialized add-on to the wheeling tariff is the option best suited for the coming years when ARE Policy 2019 applies, as the potential extra cost should be low; it splits any costs of VRE among all the market participants and minimizes complications in the event that consumers decide to seek supply by a party other than the DISCO. In the long run, and potentially under a different ARE policy and a mature power market, once the CTBCM is fully introduced and operative, different options should

[72] There will be extra costs/benefits if VRE is more expensive than market energy minus capacity revenues. This settlement must be done on an hourly basis.
[73] The ARE Policy 2019 target is based on a percentage of capacity (30 percent), which will be converted to energy (roughly 10 percent).

TABLE 7-3: ADVANTAGES AND DISADVANTAGES OF OPTIONS REGARDING ELIGIBLE CONSUMERS' RESPONSIBILITIES

Option	Advantages	Disadvantages
Socialized add-on to the wheeling tariff	• All the users are required to bear the costs/benefits. • It does not distort the option of eligible consumers leaving the DISCOs.	• Perception of unfairness when consumers do not use VRE. • Settlement and NEPRA involvement and approval is needed on regular (quarterly) basis.
VRE quota in bilateral contracts for eligible users	• Does not need centralized settlement in the long run if the DISCOs are ultimately responsible for the procurement of VRE under a quota.	• May impact the market opening; perceived by large users to be riskier. • Need VRE supply (VRE generation merchant or one devoted to supply large customers only). • Requires monitoring by AEDB/NEPRA.

be carefully analyzed, such as a VRE quota in bilateral contracts for eligible users. At that time, renewable power purchase obligations (RPO) for DISCOS and eligible consumers may be considered under a wholesale market.

Finally, it is important to highlight that the market design should ultimately address the following issues to balance the risks allocated to VRE producers:

- Allocation of capacity sale and the amount of firm capacity reserved to VRE.[74]
- The balancing mechanism and the cost of deviation. According to the current design, it appears that VRE generators will not be liable for balancing costs provided they are subject to other supply contracts, as generation must follow supply contracts. Nevertheless, the precise remaining risk will depend on the detailed market rules, in which we recommend explicitly shielding generators participating in the renewable energy bidding from impacts of changes in risk allocation arising from the decisions on the final design of the CTBCM.[75]
- Coordination between generation and transmission-distribution. The methods for charging generators for the use of the grid can play an important role in the coordination of generation and transmission, including the allocation of scarce grid capacity in competitive bidding processes. For instance, some jurisdictions impose transmission use-of-system tariffs with a locational signal to generators. This means that tariffs are higher for generators whose production imposes higher expansion costs on to the transmission grid. This option, which may move toward locational spot pricing, may be considered once the CTBCM is implemented in the country.

74 The potential revenue from capacity payments should probably be allocated to the off-taker instead of the developer, as it would be very difficult for the developer to value such payment and it might not be fully considered when bidding.

75 Another option to address this issue is to offer a contract for difference instead of a PPA as the result of the competitive bidding process. This would make it explicitly designed to operate in a wholesale market. In the near term—in the absence of a market—the contract for difference would function as a PPA.

8. IT PLATFORM

The use of an information technology (IT) platform is recommended to ensure transparency and efficiency in key processes. The IT platform used and its key features may differ between tenders depending on the type of tender, the award criteria, and its evaluation.

As explained in sections 5.3 and 6.1.2 we recommend initially using an anonymous sealed two-envelope tender, for its effectiveness and simplicity. This approach may be changed to more a complex option over time, such as reverse or hybrid tenders.

For sealed bid tenders, the IT platform must incorporate communication, document sharing, and submission of documents, making all participants use a single, uniform system, and ensuring the security of the process.

It is essential to ensure that the IT platform can encompass information developed by different stakeholders of the bidding process. Thus, coordination is necessary; at a minimum there is a need to capture the roles of:

- AEDB: announcement of the tender and its associated volumes and awarding of concession on behalf of GoP;
- Steering committee: development of the RFP and the associated tender package; and
- Evaluation committee: evaluation of the bids received for each tender.[76]

As the provinces are in charge of holding the tender process, we recommend that they all use the same IT platform, to simplify the process for the participants. There are two avenues of approach here:

- AEDB might develop[77] an IT platform to be used in procurement processes across the four provinces; or
- Provinces might agree on the contracting of an independent consultant or specialized company to develop the common IT platform, for subsequent use whenever and wherever needed by the relevant province.

The main features of the platform, besides the transparency and security previously mentioned, include:

1. Announcement and marketing of current and future tenders in the province and country;
2. Electronic subscription to specialist news and new tenders in the provinces and country;
3. Electronic access to and possibility of downloading:
    a. Contractual documents (REOI, RFP, EPA, CA, PLA/LUA, and IA),
    b. Technical specifications,
    c. Questions and answers regarding the published documents;

[76] We recommend the evaluation be outsourced to a certified and independent entity with relevant experience.
[77] In-house, or by contracting a specialist consultant.

4. Instructions to upload the documents required in the respective envelopes to participate in the tender, augmented by the creation and communication of evidence of satisfactory completion of the different steps of the uploading process through notifications to bidders;
5. Announcement of qualified bidders and final winner(s) of the tender;
6. Lodging of the contact address with the tendering authority; and
7. Optional key performance indicators to be automatically evaluated and reported, such as the number of participants, differences in prices per site, or estimated savings compared to a conventional nonelectronic tender process.

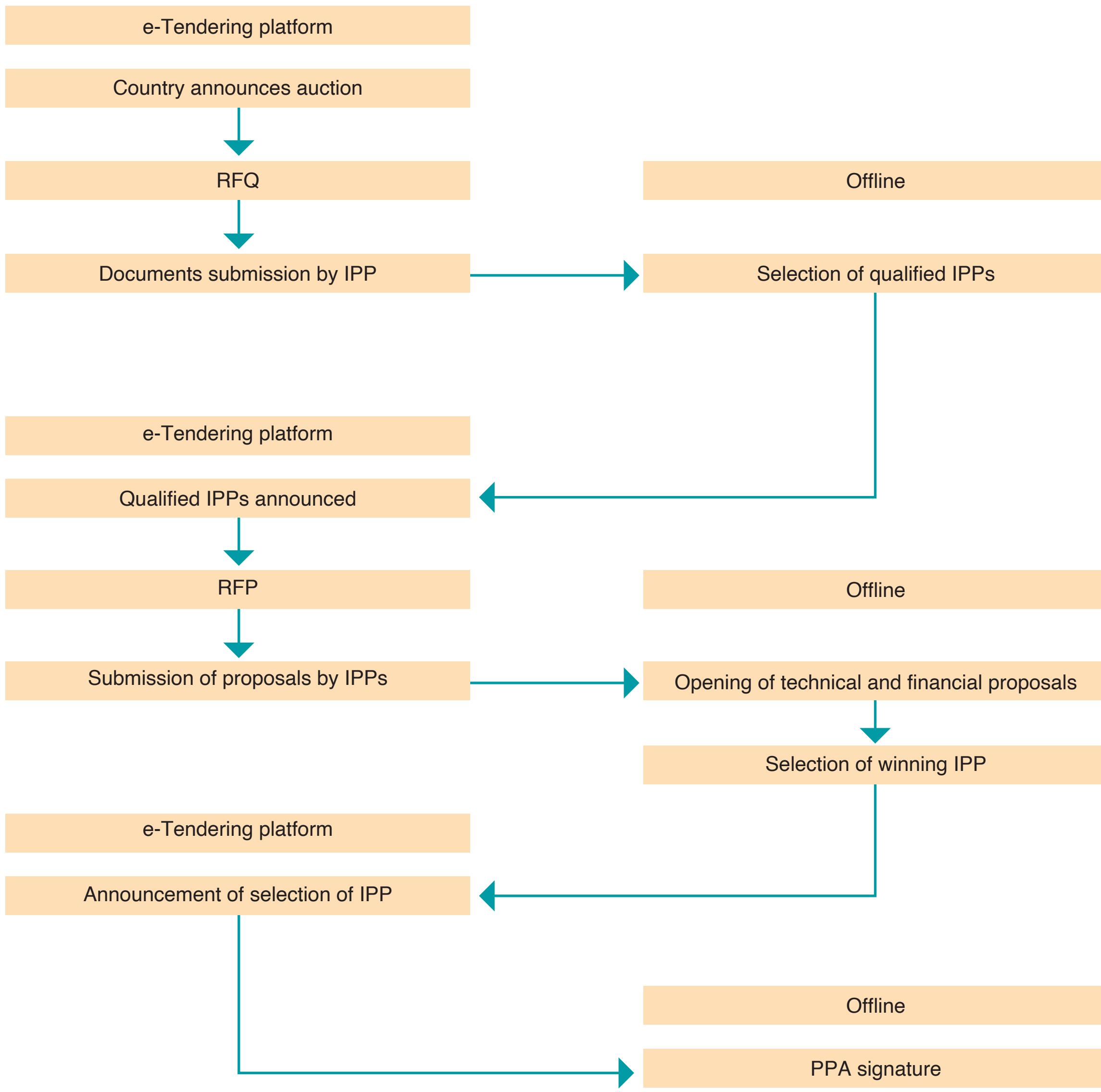
The tendering authority will benefit from the platform because it will reduce administrative time and effort spent on putting together tendering documents and offers; reduce costs and time spent re-editing and distributing tender documents; cut through procedural doubts and queries by publishing frequently asked questions (plus answers); and, perhaps above all, increase the security and transparency of the process.

There are many specialized companies and consultants able to develop an IT platform with the above-mentioned features, using a variety of software and technologies (that is, cloud-based services; in-house systems; blockchain-based procurement and so forth). The developer of the IT platform could be tasked with evaluation of the envelopes. However, as shown in Figure 8-1 below, that the bid evaluation process might be best undertaken offline to simplify the process. The first stage is based on qualitative criteria such as completeness, accuracy and compliance (for the first envelope and prequalification), before proceeding to the quantitative stage whereby the lowest bid wins (in case of the second envelope). Moreover, once the evaluation is undertaken, the qualified and successful bidders must be published on the platform, as well as the reasons for disqualification of other bidders.

However, recent e-tender platforms also include the possibility of selecting the type of tender (sealed bid, reverse, descending clock, hybrid, and so forth) and evaluating the bids in the platform, including qualitative criteria and even allowing for signature of the contractual documents to be undertaken digitally. These mechanisms could be useful for the tendering authority if the type of tender could change in the future, although these services would increase the cost of IT platform development. Moreover, for the current sealed bid design, they are not necessary.

Finally, the platform developers will need to provide thorough training on the use of the new platform to key personnel in each province in charge of conducting the tenders.

FIGURE 8-1: BIDDING PROCESS IN A SEALED BID TENDER USING AN IT PLATFORM



Source: World Bank. 2019. "A Sure Path to Sustainable Solar." Washington DC: World Bank.

9. COMMUNICATION AND MARKETING STRATEGY

A digital communications strategy can enhance the credibility and effectiveness of a tender process. The use of email, social media, search engine optimization (SEO), and content marketing strategies can gain much greater national and international exposure for a tender than traditional methods.

Communication and marketing strategies must never lose sight of two main factors: what is tendered and the nature of potential bidders.

The announcement of tenders should be both in Urdu and English to attract local and international developers. In addition to the IT platform, the information should be published on the website of the Ministry of Energy (power division) and AEDB website, accessed by clicking/selecting the news button, or a new one created specifically for the tender processes; in national newspapers; and at conferences or colloquia with a targeted audience.

In this regard, the Public Procurement Regulatory Authority (PPRA) defines in its rules that procurements over PKR 500,000 and up to a limit of PKR 3 million shall be advertised on the authority's website and may also be advertised in print media or newspapers with a wide circulation, if deemed necessary by the procuring agency. The advertisement in the newspapers shall appear in at least two national dailies, one in English and the other in Urdu. If the procuring agency has its own website, it may also post all advertisements concerning procurement on that website as well.

At the start of the process, it is critical to inform the market about the tender program, with communication targeted to the principal market participants to sound out their interest. This market sounding should gather the view of the market on the structuring of the tender process, and thereby facilitate an evaluation of the market participants' expectations. It would usually start with an email to all possible interested developers with some information and brochures, followed by an investors conference where the tender process is explained (including a question-and-answer session). Afterwards, and if the site has already been selected, field visits might be part of the market sounding.

There should also be a subscription process whereby interested parties are able to receive notifications and news from official entities, in a similar way to the information technology (IT) platform. This notification will include information from the Ministry of Energy (power division) and the Alternative Energy Development Board (AEDB) regarding the development of the tender program in the country and related news (such as new tenders, results of the tender, modification of relevant regulations).

In addition to the communication channels described (official websites, email subscription, advertising in newspapers, other websites), and the IT platform, there might be an announcement and advertising of the tender process in social media through the official accounts of the stakeholders (such as the official Twitter account of AEDB, the power division of the Ministry of Energy, or NEPRA); through search engine optimization (SEO); or online mechanisms such as webinars or virtual workshops. This would create a mix of outbound and inbound communication.

Table 9-1 sets out some advantages and disadvantages of the different communication and marketing channels.

TABLE 9-1: ADVANTAGES AND DISADVANTAGES OF COMMUNICATION AND MARKETING CHANNELS

Option	Advantages	Disadvantages
Newspaper advertising, print and digital (outbound)	• Trade publications and specific publications in the energy field/RE is well targeted. • Might be seen as more authoritative.	• High cost.
Presential (not virtual) conferences and colloquia (outbound)	• Interaction with audience. • Targeted audience. • Before and after personal networking.	• Need for travel, especially for international companies and representatives (particularly difficult during a pandemic). • Logistics needed.
Official websites/IT platform (outbound/inbound)	• Official channel. • Already visited by interested audience. • Low cost once the website or IT platform is created. • Possibility of subscription for loyal audience.[a]	• Regular updates needed for news/newsletter and issues related to the tender.
Digital conferences and colloquia (inbound)	• Cheaper than presential ones. • Easier to connect from any place. • Interaction with audience.	• Lack of technology (such as sufficient bandwidth). • Lack of personal networking.
E-mail/IT platform (inbound)	• Possibility of subscription for loyal audience. • Cheap. • Rapidly contact many recipients.	• Regular updates needed for news/newsletter and issues related to the tender. • Potential spam from audience.
Website SEO (inbound)	• Broad audience • Easy tracking.	• Requires optimization of keywords. • More expensive than other inbound techniques.
Social media—content marketing (including newsletters) (inbound)	• Low cost in terms of platforms (Twitter, LinkedIn, and other social networks). • Easy to link to other channels. • Interactive.	• Relatively small audience in Pakistan. • May be expensive depending on the content created (e.g., infographic videos). • Might not be seen as authoritative as other channels.

[a] IEEE reported that technical professionals "subscribe to an average of 4.4 digital publications, in contrast to 1.4 printed trade magazines."

Timing is key in the communication strategy, and we recommend releasing an announcement of the tender process in the national press six weeks before the REOI. Other communications ought to be more continuous (such as updates in the official websites, social media, on the IT platform and their subscriptions, supported by SEO techniques). These cost much less, and maintain a more constant awareness of the tender. However, there are still target audiences that might be better served by traditional methods; furthermore, the inbound techniques require more consistent monitoring.

Finally, we recommend a drop-down menu on the IT platform asking bidders to state how they were informed of the tender process. This will track and measure the success of the different communication and marketing channels, the better to facilitate future adaptation.

10. STRENGTHENING DOMESTIC SUPPLY CHAINS AND INCREASING LOCAL CONTENT

10.1 INTRODUCTION

The potential employment and broader economic benefits from the expansion of forms of Alternative and Renewable Energy Technology (ARET) are significant. The International Renewable Energy Agency (IRENA) estimates that globally by 2050 up to 6 million new jobs can be supported in the solar photovoltaic (PV) sector and 2.5 million new jobs in the onshore wind sector,[78] figures that will more than offset any potential contraction in employment in conventional energy. Moreover, Asia is an important growth hub: most jobs in onshore wind are already in Asia, while for solar PV, there has been a shift toward certain parts of Asia. IRENA highlights that employment has contracted in Japan and the European Union at the expense of those parts of Asia most closely involved in manufacturing and assembly (for example, China, Malaysia, Republic of Korea, and Thailand).

The potential growth opportunities will not be equally distributed, especially in Asia, where China is a dominant manufacturer of key components. Notwithstanding the importance of China, Pakistan potentially offers a large market to suppliers and providers of services, and hence it is important for Pakistan to be well positioned to take advantage of these global developments and reap the full available economic benefits associated with new renewable capacity.

10.2 OVERVIEW OF SUPPLY CHAINS

The employment and innovation options associated with renewable energy are considered through an evaluation of the various steps in the supply chain. As the supply chain differs between technologies, these are assessed first for solar PV and subsequently for onshore wind, following the approach set out in IRENA's publications on leveraging local capacity for renewable energy. The purpose of this subsection is to identify key issues for each technology—subsequently evaluated in greater detail for Pakistan.

10.2.1 Solar PV supply chain

Following the schematic in IRENA (2017a), the potential for local provision and/or employment can be seen in line with the steps of the solar PV supply chain shown in Figure 10-1 below.

IRENA estimates that for a 50 MW solar plant, the key pre- and post-operational steps— that is, including construction and decommissioning but excluding operation and maintenance—require roughly 100,000 person-days of labor. Although the analysis does not consider the value of this labor, that figure is a useful basis from which to consider the potential contribution of the sector.

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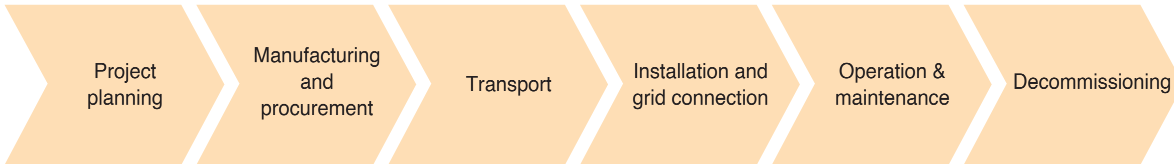
[78] IRENA. 2017a. Renewable energy benefits: Leveraging local capacity for solar PV, International Renewable Energy Agency, Abu Dhabi; IRENA. 2017b. Renewable energy benefits: Leveraging local capacity for onshore wind, International Renewable Energy Agency, Abu Dhabi.

FIGURE 10-1: SOLAR PV SUPPLY CHAIN



Source: IRENA (2017), Renewable energy benefits: Leveraging local capacity for solar PV, International Renewable Energy Agency, Abu Dhabi.

Of the total days, around two percent, or 2,120 days are required for **project planning**, which is further broken down into project development (59 percent), site selection (17 percent), engineering design (12 percent), and a feasibility analysis (12 percent). The key areas of expertise required include the law, energy regulation, real estate, taxation, engineering, plus environmental, and health and safety input. These are skills that are available locally in many countries, including in Pakistan where there is a trained labor force and an increasing range of undergraduate and graduate courses on renewable energy and associated technical training. (By contrast, in some other countries a lack of these skills can be a significant constraint, and attempts to remedy it can prove short-lived).

Some support equipment is required for project planning, such as equipment to measure solar resources, energy simulation programs, and computers. While these products are generally available internationally, the need for bankable feasibility studies provides incentives for local production.

The main components that require **manufacturing** are the solar cells, solar modules, inverters, trackers, mounting structures, and general electrical components. IRENA estimates that 50,225 person-days are required to manufacture the main components of a 50 MW plant, of which around 50 percent relates to the solar cells, 21 percent to the modules, 17 percent to inverters, and 14 percent to solar trackers and structures. Of this labor force, 64 percent are factory workers and technicians, 10 percent industrial engineers, with the remainder experts in marketing, sales, logistics, administration, and regulation.

The scope to manufacture locally varies by component. For solar cells and modules, the ability to manufacture depends on ready access to glass and silicon technologies, and then the capacity for sufficient output—to be price competitive against Chinese suppliers. Given the difficulty of competing against Chinese producers, some countries (for example Bangladesh, India, Thailand) have responded by becoming low-cost assemblers and distributors of cells and modules using Chinese technology; this promotes local labor and business, albeit with a relatively low value added.

For inverters, key challenges relate to the use of technology and intellectual property rights, where several recent technological advancements in inverter performance are covered by patents by major manufacturers like SMA, Fronius, and Sungrow, whose products are keenly sought by independent power producers (IPPs) and commercial and industrial customers due to proven on-field performance and a comprehensive reliability testing record. However, the availability of material is less crucial than for cells, for which key resource requirements include availability of aluminium, steel, concrete, plastics, and polymers. There is also a need for cranes, and rolling and welding machines.

The capacity to manufacture mounting components and electrical components should already be locally available.

A key issue for Pakistan is to identify latent capacity in the above areas that could be mobilized in a cost-efficient manner.

The **transportation** of solar PV components is estimated to require 3,475 person-days, and can be carried out by local resources, the key needs being truck drivers and loading and off-loading personnel.

Installation and connection of solar PV plants is also generally dominated by local labor, estimated at 39,380 person-days for a 50 MW plant. The largest component is estimated to be site preparation and civil works (42 percent), followed by assembling (24 percent), and cabling and grid connection (16 percent). Ninety percent of the required staff are classed as construction workers and technical personnel, most of whom are available domestically. Other required personnel include civil engineers and forepersons. Most materials and equipment needed for installation are available locally.

Operation and maintenance (O&M) activities are estimated to require 13,560 person- days per year, with 86 percent for corrective maintenance (such as panel cleaning) and the remainder for operations, including remote operation via SCADA. To put that into broader perspective, using those estimates, the O&M labor needs over 7.5 years are equivalent to the person-days estimated for the key construction and decommissioning activities. Given the long life of a plant and relatively high resource intensity for O&M activities, ensuring the use of local O&M can provide important ongoing employment impacts.

Decommissioning of a plant is estimated to require 5,150 person-days, including dismantling (60 percent), disposing of equipment (21 percent), and site clearing (17 percent). These activities are commonly undertaken locally.

The above figures suggest that even without local manufacturing industry, up to 50 percent of labor input to the construction process should be local, with a much greater proportion of ongoing O&M costs potentially sourced nationally. Again using IRENA figures, Table 10-1 outlines three possible scenarios, quantified as working days, based on minimal, moderate and extensive development of local industry—all feasible in a country like Pakistan. The low scenario represents limited intervention; the medium scenario involves capacitation of staff and local manufacturing of inverters; whereas the high scenario envisages local manufacturing (assembly) of modules.

TABLE 10-1: SCENARIOS FOR WORKING DAYS PERFORMED LOCALLY FOR A 50 MW SOLAR PLANT

	Days	Low	Medium	High
Project planning	2,120	76%	88%	100%
Manufacturing	50,225	14%	31%	52%
Transportation	3,475	100%	100%	100%
Installation and connection	39,380	90%	95%	100%
Decommissioning	5,150	90%	95%	100%
TOTAL	**100,350**	**52,195**	**63,214**	**76,242**
Percent of total days		**52.0%**	**63.0%**	**76.0%**
O&M (total per year and share)	**13,560**	**0%**	**80%**	**100%**
O&M days per year		0	10,848	13,560

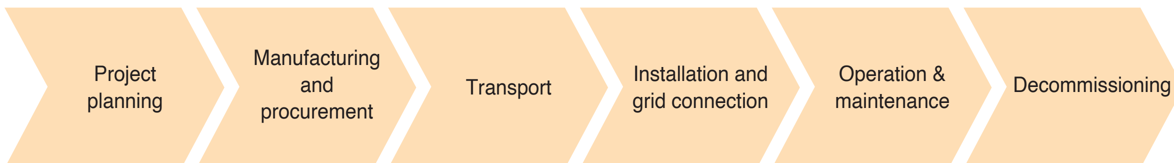
Source: IRENA (2017a) and authors' calculations.

The current situation in Pakistan, which is explored in greater detail in subsequent sections, is most akin to the low scenario in Table 10-1. The estimates in that table can only be taken as a rough guide, because the commercial value (labor cost plus returns on capital) of a given day worked can vary significantly by activity; for example, the commercial value of an average day dedicated to developing inverters, or to certain technical studies, is likely to be much higher than a day spent on assembly and transportation.

10.2.2 Onshore wind

Using the approach set out in IRENA (2017b), the same components of the onshore wind supply chain emerge (Figure 10-2) as did for solar PV (Figure 10-1).

FIGURE 10-2: ONSHORE WIND SUPPLY CHAIN



Source: IRENA (2017), Renewable energy benefits: Leveraging local capacity for onshore wind, International Renewable Energy Agency, Abu Dhabi.

IRENA estimates that around 65,000 days of labor input are required for the manufacture, construction, and decommissioning of a 50 MW wind plant (excluding O&M and research and development).

Of this total, 2,580 days are required for **project planning,** incorporating project development (70 percent), engineering design (12 percent), site selection (11 percent), and feasibility analysis (8 percent). The key areas of expertise required include the law, energy regulation, real estate, taxation, engineering, plus environmental, and health and safety input. Roughly 16 percent of this total is considered to require experts specialized in the wind sector, who would need to be hired from overseas or be trained locally.

Key considerations regarding the local **manufacturing** of wind components (18,967 person-days) will depend on: expected local or regional demand for wind energy; the availability of raw materials and presence of related domestic industries; and the high costs and logistical challenges related to transporting bulky equipment. Turbines, including their installation, account for between 64 percent and 84 percent of total costs. The key components include:

- The nacelle (49 percent of labor), which includes the gearbox, generator, transformer, brake, axes, hub, hydraulic system, platform, bearings, and electric/electronic components; it can be more than 15 meters in length and weigh over 300 tons. Many components of the nacelle (gearbox, generator, electric components) are highly specialized, thus not all relevant skills are generally available locally, although a large proportion of labor needs are unskilled;
- Rotor and blades (24 percent of labor), which are generally made from glass and carbon-fiber materials. Owing to the challenge of transportation, local manufacturing is more feasible where there is already local production of steel and fiberglass; and

- The tower (24 percent of labor), which is commonly made from steel, but in some cases from concrete. Given the high transport costs—and relatively straightforward design requirements—the manufacture of towers is often subcontracted to local manufacturers.

The above considerations suggest greater scope for local manufacture of the tower, followed by the blades and then the nacelle. However, a key issue with turbine manufacturing is the highly capital-intensive nature of production, which requires production facilities to have an expectation of ongoing activity to be economically feasible.

The **transportation** of wind turbine components is complicated and expensive and hence provides a rationale for production closer to project sites. IRENA estimates that it costs 875 person-days to transport a 50 MW facility a distance of 300 miles, with the key need being truck drivers, and loading and off-loading personnel, as well as trucks that can support the size and load requirements.[79]

The installation and connection of a wind turbine are also generally dominated by local labor, estimated at 34,500 days for a 50 MW plant. The largest component is estimated to be on-site preparation and civil works (48 percent), followed by assembling (30 percent), and cabling and grid connection (19 percent). More than 75 percent of the required staff are classed as construction workers and technical personnel, most of whom are available domestically. Other required personnel include crane operators and truck drivers. Most materials and equipment needed for installation are available locally.

Operation and maintenance (O&M) is estimated to require 2,665 person-days per year, with 66 percent for operations and around 34 percent for maintenance. Most plants are remotely operated via SCADA. It is common for a large proportion of O&M work to be carried out by the turbine manufacturer, though it will incur local costs in insurance and land rental.

Decommissioning of a plant is estimated to require 8,420 person-days, including dismantling (74 percent), disposing of equipment (14 percent), and site clearing (11 percent). These activities are commonly undertaken locally.

As for solar, the above figures suggest that even without the local manufacturing industry, at least 50 percent of labor input to the construction process should be local. However, the requirements for ongoing O&M are more specialized and probably difficult to source nationally without supporting conditions in place. Table 10-2 uses IRENA figures to look at potential scenarios, quantified as working days, based on the local industry that can be developed. The low scenario represents limited intervention; the medium scenario involves capacitation of staff and local manufacturing of towers; whereas the high scenario envisages local manufacturing of blades as well as towers.

Due to limited large-scale wind activity in Pakistan, the expectation is that the low scenario would best reflect the starting position. As with the solar analysis in Table 10-1, these figures need to be interpreted with care as they do not incorporate the value of the dedicated resources (wages and capital returns).

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[79] IRENA. 2017. Renewable Energy Benefits: Leveraging Local Capacity for Onshore Wind. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Jun/IRENA_Leveraging_for_Onshore_Wind_Executive_Summary_2017.pdf.

TABLE 10-2: SCENARIOS FOR WORKING DAYS PERFORMED LOCALLY FOR A 50 MW WIND PLANT

	Days	Low	Medium	High
Project planning	2,580	84%	92%	100%
Manufacturing	18,967	0%	24%	48%
Transportation	3,500	100%	100%	100%
Installation and connection	34,500	90%	95%	100%
Decommissioning	8,420	90%	95%	100%
TOTAL	**67,967**	**57,092**	**62,529**	**67,967**
Percent of total days		**84%**	**92%**	**100%**
O&M (total per year and share)	**2,665**	**10%**	**25%**	**80%**
O&M days per year		267	666	2,132

Source: IRENA (2017b) and author calculations.

10.2.3 Implications

The foregoing sections show that solar PV and wind can have important employment impacts in the local economy, even with relatively passive policies. In practice, the calculations made on the impact of policy intervention on labor use in the solar and wind sectors are highly simplified, as they focus solely on direct labor. As a result, they ignore the broader economic benefits that could flow from the development of value-added industry and related economic impacts (including the possibility of consequent export opportunities).

The narrow focus does nevertheless show how the potential employment and broader economic benefits from the use of local resources will vary by production stage and technology for solar PV and wind. Against that backdrop, it should also be borne in mind that:

- For both solar PV and wind, there are aspects of project delivery and implementation that should be carried out locally—particularly large aspects of project planning, transportation, and installation;
- Due to the need for specialized equipment and due to the need to be competitive in production, some aspects of manufacturing are unlikely to be cost effective in Pakistan without strong policy support. This includes the production of nacelles and solar cells; the latter is likely to be difficult due to the nature of the technology, and its high energy requirements, leaving existing producers in a dominant position;
- In other cases, greater use of local resources may be a more promising prospect, including:
  - Skilled experts trained in the specific needs of solar PV and wind (instead of international experts on project planning and implementation);
  - Local manufacturing for more standardized equipment, including support structures for solar PV and towers for wind energy;
  - Assembly of solar panels using the imported cells;
  - Local resources for O&M in solar PV; and
  - Potential involvement in more technically demanding areas, such as inverters and trackers for solar PV and blades for wind, depending on resource availability and economic viability for potential manufacturers.

The above factors are critical when assessing the extent to which greater local involvement in the Pakistan renewable energy sector is possible. Moreover, once the potential is identified, there is a need to consider support for local private sector involvement, which can include:

- Clear plans for the development of renewable energy, giving potential suppliers confidence in future industry needs;
- Targeted education and training programs, particularly in project planning and management;
- Policy measures for manufacturing, to strengthen competitiveness through the presence of industrial development programs and incentives; and
- Broader policy support, including time-bound policies that consider factors over and above human resources, deployment, and industrial development (see, for example, section 10.5).

It is important to highlight that local content policies cannot reasonably be decided without an analysis of their impact on project costs, bids submitted, and final end-user tariffs. During the first stages of deployment of the target technologies, impacts on project costs and thus on bids can be relevant, whereas impacts on end-user tariffs remain very limited simply because these technologies account for a small share of the generation mix. However, as the participation of the target technologies in the electricity mix increases, so too does their impact on end-user tariffs, and at this point the government will have to evaluate if it is still meaningful to incentivize local supply chains via electricity tariffs. Therefore, local content policies need periodic re-evaluation.

10.3 CURRENT SITUATION IN PAKISTAN

The following aspects of the current situation for local production for ARET in Pakistan are considered:

- Legislative, regulatory, and policy status.
- Relevant status of industries and expertise in ARET.

10.3.1 Legislative and regulatory requirements

The key regulatory document is the alternative and renewable energy (ARE) policy, approved by the Alternative Energy Development Board (AEDB) in August 2020.

The ARE Policy observes at the outset that a simple dichotomy of 'local versus international' is misleading owing to the presence of joint ventures (JVs) in which some components are manufactured locally and others overseas. Although the commoditized nature of certain aspects of solar production has limited the role of JVs, an exception in Pakistan is that between Risen Solar (manufacturer) and Inverex (local distributor/seller).

To maximize the production of ARET within Pakistan, the following policy measures are stated in the ARE policy:

- AEDB will request the Federal Board of Revenue (FBR) and the Engineering Development Board (EDB) to withdraw the import duty exemptions on ARET based consumer items which local industry is capable of manufacturing or undertakes to manufacture;

- Plant and machinery imported by an existing or new industrial concern shall be free of import duties where the plant and machinery are imported for manufacture of a generation project using ARET (AREP) or components thereof; and
- The exemption from the locally manufactured machinery (LMM) condition for duty free import for AREPs above 25 MW will be abolished for items that local industry is capable of supplying to the required specifications and, where applicable, with the requisite certification.

A part of the latter point is that AEDB will engage with the Chambers of Commerce and Industry, EDB, and other organizations to prepare a user-friendly database of LMM and AREP and ARET products or parts thereof, together with the quantitative demand the local industry can meet from time to time (ARE Policy 2019, section 4.4.a)

Another important development in the policy, which affects local capacity to implement a project, is the decision that AEDB will set up an Institute of Renewable Energy Technologies under the aegis of academic or institutional frameworks, with the flexibility to set up sub-campuses of the institute across the country.

The aims of the institute will extend to the award of academic qualifications, imparting practical, marketable skills, and undertaking research, testing, and certification. These activities and the research output will also be used for commercial applications to make this institute a financially self-sustaining body. The institute can be co-sponsored by the industry for needs-based training and job creation.

10.3.2 Overview of industries and expertise available in Pakistan

The level of local expertise and production capabilities in Pakistan varies by component but has been increasing, consistent with growth in the solar and wind sectors.

For **project planning and development activities,** there is generally a sufficient range of qualified local engineers, lawyers, economists, and environmental experts with experience in the solar and wind sectors to support local project development in Pakistan. Moreover, there are many universities that offer graduate courses on clean energy development, for example, Hamdard University, University of Agriculture Faisalabad, National University of Sciences and Technology (NUST), The NED University of Engineering and Technology, and the University of Engineering & Technology, Lahore; Balochistan University of Information Technology, Engineering and Management Sciences, Quetta; and University of Engineering and Technology, Peshawar.

An important local industry supporting developments in the solar sector has arisen, with a relatively large deployment of solar equipment in distributed generation. While there are few good records of the amount of capacity installed, in 2019 there were 350 new solar companies established, serving commercial, industrial, and residential customers, many of which were operating on an off-grid basis. AEDB data also show 21 companies certified as vendors, installers, or service providers for solar and wind net metering installations up to 1,000 kW,[80] and 42 certified for installations of up to 250 kW capacity.[81]

80 http://www.aedb.org/images/List_of_Certified_Vendor__Installers_Service_Providers_under_category_ARE_V_1.pdf.
81 http://www.aedb.org/component/ judownload/root/3-solar/113-list-of-certified-companies-under-aedb-certification-regulation-2018#.

Solar panels, however, are generally imported. Reports from trade data suggest that roughly 900 MW of solar panels were imported in the 2017–18 financial year, though fewer were subsequently imported. Around 95 percent of panels are believed to be imported from China; most inverters are imported from China and Europe.

Although panels are not made locally, a small nucleus of companies are involved in the import of components and assembly within Pakistan, including:

- Akhtar Solar (30 MW annual capacity)
- Ikram Solar (15 MW)
- Sara Solar (10 MW)
- Tesla Solar (unknown capacity)

At present, most of these companies are understood to be in rural areas, where providing a low-cost solution is key.

As noted earlier, intellectual property and a long history of strong performance provide overseas providers such as SMA, Fronius, and Sungrow with an advantage in the inverter market. However, there are still small local inverter assemblers in Pakistan such as Systek catering to the customer-based market. With sustained long-term demand, inverter assembly is expected to increase. Similarly, local manufacture (assembly) of panels should become feasible with larger market volumes.

Local manufacture is more common for structures; in fact, most steel structures are produced locally using local steel. A smaller part of the market (possibly 15–20 percent) involves developing aluminium structures, which are generally used in coastal areas like Karachi where corrosion is an issue. Local manufacturing is developing, but the market share is much lower, with a key issue being price competitiveness against Chinese imports. Generally, other components like cables, communications, and cabinets are made locally.

International companies, including Goldwind, Nordex, and Siemens are already active in the Pakistan wind market through the supply of turbines and nacelles and as project developers. While turbines and nacelles are currently imported, towers are increasingly being developed locally for large projects through companies like Karachi Shipyard. Moreover, O&M has an important local component, with Goldwind providing local support for its O&M activities at its Three Gorges plants.

Concessional finance for renewable energy has been made available from the State Bank of Pakistan (SBP) with a base rate of two percent over 12 years and a (commercial) bank spread of up to four percent, resulting in a maximum interest rate of six percent. This scheme, which was introduced in 2016, has been extended to June 30, 2022. The scheme covers different types of projects:[82]

- For those below 1 MW a maximum loan of PKR 400 million is possible, covering 100 percent of the necessary finance; and
- For projects between 1 and 50 MW, a maximum loan of PKR 6 billion is possible, covering up to 100 percent of total debt financing for an eligible project up to 20 MW and up to 50 percent of total debt financing for a project of more than 20 MW.

[82] http://www.sbp.org.pk/smefd/circulars/2019/C10.htm.

The financing is provided to project sponsors looking to develop renewable energy projects, and who meet all applicable requirements of AEDB, the National Electric Power Regulatory Authority (NEPRA), and other government departments. No explicit requirements are placed on local production or local content. A total of 12 wind power projects (610 MW cumulative capacity) have recently achieved financial closure based on the SBPs financing facility.

The scope for the development of local industry will also depend to a large degree on the potential size of the market and introducing all the projects highlighted in NTDC's Indicative Generation Capacity Expansion Plan 2021–30 of September 2021, which includes the following solar PV and onshore wind projects by year (Table 10-3).

TABLE 10-3: PLANNED SOLAR AND WIND CAPACITY IN THE IGCEP 2021–30, 2023–2030 (MW)

Year	Solar	Wind
2023	—	—
2024	1,000	1,000
2025	1,000	1,000
2026	1,000	1,000
2027	1,000	62
2028	1,000	—
2029	1,000	—
2030	1,000	—
Total 2023–2030	**7,000**	**3,062**

Source: IGCEP 2021–30.

The following developments are considered possible in an expanded solar PV market:

- The scale-up of the local assembly of solar panels from a focus on rural installations to larger projects. As noted earlier, the potential for local cell manufacture will be difficult due to the energy-intensive nature of production, but a market in assembly and development of the panels should be possible;
- Local manufacturing (assembly) of inverters; and
- Development of local battery management systems (BMS), though development of the batteries may be difficult.

A key constraint to the development of local solar production and assembly is the large amount of PV module manufacturing capacity currently available globally, and existing stock languishing in warehouses that could potentially be dumped in Pakistan at low prices. To encourage and protect local manufacturing, such an outcome should be prevented.

For wind, the potential for the local manufacture of turbines and nacelles will be challenging in the medium term, though major international companies like GE have agreements with local producers for gas turbines that could be extended to supplying wind turbines in a similar manner. Fiscal incentives may be a way to accelerate any change: for example, Danish company Vestas has recently expressed an interest in developing a wind turbine factory in the China–Pakistan Economic Corridor (CPEC) Special Economic Zone.[83]

10.4 INTERNATIONAL EXPERIENCE

There is a growing literature on the success of renewable energy in developing local industry. Most of this focuses on local content requirements (LCR), though the findings have broader ramifications.

While this section of the report focuses on the implication for Pakistan of relevant international cases, the case studies considered are detailed in Annex C of this report.

10.4.1 Implications for Pakistan

The assessment of the experience of these countries suggests that the potential to develop local industry alongside growth in large utility-scale projects is theoretically greater in onshore wind than solar PV. In solar PV, a common feature is that local manufacturing has generally been focused on module assembly (given the difficulty of competing with Chinese suppliers on cells and inverters). Further local presence in structures, installation, planning and O&M is evident. For wind, in Brazil and India, local manufacturing has been more widespread, partly due to large volumes of wind capacity tendered, with local industry in Brazil also supported through concessionary finance. First mover advantages are also cited as an important driver of local industry in Brazil.

Wind capacity included in the IGCEP 2021–30 is similar to that put out to competitive bidding in South Africa (where local manufacturing has only developed for towers), though much less than in Brazil (more than 16GW already installed) or India. Nonetheless, these volumes should provide a minimum baseline to attract some local manufacturing. Moreover, the strong industrial base of the country should be able to support development of high value-added components like blades. A key potential weakness is the lack of specified volumes after 2030 and patchy volumes in some years between 2025 and 2030.

For solar PV, there is a strong and consistent volume of capacity identified. The experience of other countries suggests that developing a strong local industry in cell manufacturing will be difficult, given the strong price and quality advantage of Chinese manufacturers, though assembly of modules and inverters should be feasible with policy support. Where local manufacturing is difficult, it is especially important to ensure that imports that enter Pakistan are of a high quality.

The review suggests a mixed role for LCR, with greater success occurring in areas where the market is at an early stage of development and large-scale production is possible (for example, Brazilian and Chinese wind sectors). The subsequent growth of the wind sector in India appears related to strong policies to support it and to LCRs. The Brazilian example suggests that important benefits may arise from tailoring subsidized lending toward local manufacturing.

Pakistan's current industrial base provides an important foundation that is already being used in the development of renewable energy. A critical constraint in adapting this to the high value-added components of solar PV and wind will be access to technology and being price competitive once the costs

[83] https://nation.com.pk/07-Feb-2020/wind-turbines-manufacturer-vestas-to-keen-establish-factory-in-pakistan.

associated with patents and intellectual property are taken into account, particularly in aspects of solar PV. Where Pakistan can be competitive, there may be opportunities to market its services in the Middle East and North Africa.

10.5 RECOMMENDATIONS FOR STRENGTHENING DOMESTIC SUPPLY CHAINS AND INCREASING LOCAL CONTENT

Based on the above, the following measures are suggested as additions to ARE policy measures.

In the area of **project planning and development,** Pakistan has a trained labor force experienced in renewable energies, with several advanced courses available. The proposed measure in the ARE policy to set up an Institute of Renewable Energy Technologies under the aegis of academic or institutional frameworks will reinforce this expertise. It also aims to undertake research, testing, and certifications, which are important needs. These measures could be expanded by the development of a local R&D fund to:

- Develop local design and installation standards;
- Develop state of the art solar testing labs; and
- Promote manufacturing R&D in the areas of solar PV and wind local indigenization.

For **manufacturing**, international experience suggests that in solar the local production of cells is unlikely to be feasible. The key areas where local industry may, however, develop are the assembly of panels and inverters, as well as reinforcing its position in the development of structures. In wind, there is potential for local manufacturing of blades, though the capacity allocated to wind in the IGCEP 2021–30 may be considered marginal for setting up local production facilities. For the development of local manufacturing in solar PV and wind, the following measures can be considered in addition to those already considered in ARE's policy:

- Setting high technical standards for solar PV module panels to reduce the dumping of low-cost products in the Pakistan market and to promote the development of local assembly in higher value sectors. An increase in technical standards can dovetail with ARE's policy to impose import duties while there is insufficient local manufacturing (assembly);
- Tax holidays for setting up solar PV manufacturing/assembly facilities or wind manufacturers (not towers) above or equal to 100 MW (annual capacity);
- Special provisions of industrial lands to be secured in China–Pakistan Economic Corridor (CPEC) for investors in solar or wind manufacturing facilities. The use of CPEC could also attract international sponsors interested in using Pakistan labor and its geostrategic position to export finished product to the Middle East and North Africa; and
- Adapt or tailor lending under the State Bank of Pakistan arrangements toward local manufacturing facilities.

Important supporting measures include ensuring a clear demonstrated policy and regulatory commitment to IGCEP 2021–30 targets for solar PV and wind, and the availability of concessional finance.

For **O&M activities** no specific recommendations are proposed, though the more important local manufacturing becomes, the greater is the spillover to local O&M activities, particularly in wind.

In general, the role for explicit LCRs may need to be reviewed on a case-by-case basis, especially given mixed success in solar and a moderate market size in wind. Nevertheless, many of the proposed measures, including strong quality standards, targeted fiscal and financial support to local manufacturers, import duties, and local training facilities, will favor local industry in the tenders.

ANNEX A: DEEP DIVE ON BACKGROUND: POLICIES, REGULATIONS, PLANS, AND PROCEDURES REVIEW

A.1: RE POLICY 2006

In 2006, AEDB published the "Policy of Development of Renewable Energy for Power Generation" with the objective to increase the deployment of RE technologies and facilitate investment interest in this sector. The following were the salient points of the policy:

- Investment invited from IPPs for sale to the grid only, either through captive grid spillover projects (for self-use and sale to utility), captive projects (for self or dedicated use), and isolated grid power projects (microgrids—small or standalone);
- Requirement of Letter of Intent (LOI), Letter of Support (LOS) and implementation agreement (IA) from government for IPP developed projects;
- Mandatory purchase by NTDC/CPPA of all energy from RE projects;
- Wheeling concept introduced, providing permission for investors to generate electricity based on renewable resources at one location and receive an equivalent amount for own use elsewhere on the grid at the investor's own cost of generation plus transmission charges;
- Allowance for net metering and billing, so that a producer can sell surplus electricity at one time and receive electricity from the grid at another time and settle accounts on a net basis. A net metering ceiling of 1 MW was set;
- Deregulation of smaller projects (less than 5 MW for hydro) and less than 1 MW for net metered sales to reduce time and cost of deployment;
- Protection of the investor from resource variability risk under a detailed mechanism outlined in the policy, with incentive incorporated for surplus generation above benchmark values;
- Incentives to IPPs for selling all generated electricity (minus auxiliary consumption) to the grid;
- Introduction of a system to acquire carbon credits;
- Five percent RE target by 2030 as per the Medium-Term Development Framework, translated into 9,700 MW at the time;
- An aim to facilitate private sector involvement and gradually reduce the energy price through competition in an increasingly deregulated power sector;
- Facilitate the establishment of domestic RE technology manufacturing;
- Requirement for an EPA to be signed with a RE power producer. The GoP would sign off an IA, which would guarantee payment obligations over the term of the EPA. Power would be purchased at a PKR/kwh rate under a no capacity charge, no capacity testing, no risk, and no penalty model;
- Deregulation of off-grid power generation;
- Financial incentives so that no customs duty or sale tax would be levied for machinery equipment and spares;

- Fiscal incentives, with an exemption from income tax, including turnover rate tax and withholding tax on imports; and
- The setting out of a detailed process of solicited and unsolicited proposals.

Some of the key challenges faced in the implementation of policy were as follows:

- Resource data for wind and solar—crucially important for a secure investment—were not readily available. Private investors had to put up measuring devices for wind and solar resource potential before setting up a project. This increased time and cost in deploying earlier projects. A resource mapping project was carried out by UNDP and NREL under Wind Energy Project[84] and subsequently the World Bank carried out a further detailed analysis under a global initiative of the Energy Sector Management Assistance Program (ESMAP), which was completed in 2018. Data are now freely available under the World Bank's Global Solar Atlas[85] and Global Wind Atlas;[86]
- Since this was the first RE policy for the country, human resource capacity building of the state institution was not at the required level and took time to cater for the RE interest in the country;
- Captive and grid spillover projects (that is, for self-use and sale to utility) had no mechanism to be documented, as LOI, LOS, and IA documents were not required. These projects faced delays in deployment;
- The net metering and billing concept was only published in October 2014.[87] This delayed individual investors in deploying distributed RE;
- It was subsequently decided that resource risk was to be borne by the developer, contrary to what was mentioned in the policy;
- Wheeling could not take off, due to the unwillingness of DISCOs to allow end users to opt for other sources of generation and hence reduce their demand and revenues;
- Policy could not encourage investors in deploying large-scale RE manufacturing capacity, primarily due to the duty structure which imposed taxes from 3 percent to 15 percent on machinery and equipment imported for industrial purposes;
- Relatively high cost of solar and wind during this period, and the perception that the grid could not absorb more than 5 percent VRE; and
- Multiple LOI providers at both federal and provincial levels, causing lack of clarity on the development and continuity of future projects.

A.2: ARE POLICY 2019

In 2019, AEDB started preparing a revision to the existing policy, seeking to further increase deployment of RE technologies and facilitate competition and investment interest. An additional objective was to expedite the development process and reduce uncertainty and wait times. The following are the salient points of the policy approved by the Council of Common Interests (CCI) in August 2020:

1. Previous policy expired in March 2018.
2. The on-grid RE generation capacity will be at least 20 percent by 2025 and at least 30 percent by 2030.

84 SWERA Project: https://openei.org/doe-opendata/dataset/swera.
85 https://globalsolaratlas.info/map.
86 https://globalwindatlas.info/.
87 https://www.nepra.org.pk/Legislation/Draft%20Net%20Metring%20Rules.pdf.

3. The outputs of the Indicative Generation Capacity Expansion Plan (IGCEP) will form the basis of all on-grid capacity procurements, except net metering.
4. RE projects are to reduce the national generation cost and displace expensive thermal-based power plants. AREP tariffs will not include capacity payments.
5. Modes of procurement defined are "competitive bidding," which will be most common. Government to government (G2G) and "unsolicited proposals" will only be permitted for special cases.[88, 89] Procurement of RE projects to be done primarily through competitive bidding, preferably on an annual basis.
6. Tariffs will be denominated in rupees. Up-front or cost-plus tariffs for mature technologies will be discontinued. NEPRA will determine the indexations allowed and foreign bidders may bid with indexation to a foreign currency in respect of tariff components. To promote new technologies, NEPRA may allow upfront or cost-plus tariffs for new technologies if it deems appropriate.[90]
7. While the concession package will continue to be followed (EPA, IA, and GoP guarantee), the policy proposes the EPA be divided into a first period of must-purchase obligation (take-or-pay) for a duration not less than the debt repayment period, and a second period on a take-and-pay basis.
8. Article 157 of the Constitution allows the provinces to develop their own power generation projects, lay transmission lines, distribute electricity, and even set their own tariffs, provided that the power generated is for use within the boundary of the relevant province and the AREP is not connected to the national grid.
9. The policy encourages a unified or modular tariff regime for non-utility procurement of AREPs, not entailing financial outlays by federally owned public power utilities (PPUs). NEPRA will modify its regulatory framework accordingly within six months of the promulgation of this policy.
10. AEDB will deepen its coordination, information creation and sharing, regulatory intervention and contracting support functions for off-grid, microgrid (MG), localized energy systems (LES), wheeling, B2B, and net metering solutions for AREPs, municipal bodies, prosumers, and entrepreneurs.
11. AEDB will prepare framework packages for municipal authorities and will facilitate initiatives for small-scale municipal-level AREPs.
12. AEDB will promote local manufacturing of RE technologies: by (1) withdrawing duty exemptions in a phased manner on import of ARET consumer items which local industry is capable of manufacturing; (2) introducing customs duties on machinery and equipment imported by an existing or new industrial concern; and (3) withdrawing duty exemption for imports in power plants above 25 MW.
13. AEDB will promote skill development and skill training through academic institutes.

The future development of power generation is expected to follow the IGCEP and guidelines put forth by CPPA (Commercial Code 2018 and Market Rules) for NTDC-connected IPP projects. These will not only

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88 These special cases are: (1) G2G projects with a resultant tariff below the tariff that would have been achieved on a commercial basis and below the average basket price of generation; and (2) projects for new technology that will require a feasibility study and will be allowed on a cost-plus method. The relevant tariff must be below the average basket price of generation, and these projects may be proposed by AEDB, provinces, or private sponsors.
89 Unsolicited proposals should be avoided; in fact, they may jeopardize the entire policy. If one company or foreign government is seen to be able to negotiate directly with the national or provincial government, the implicit message to the plurality of participants is not a welcome one. Participants who perceive discrimination will walk away.
90 NEPRA should be careful when allowing up-front or cost-plus tariffs; even in the case of new technologies they become additional costs to the energy bills.

be new projects at identified nodes but also displace ageing base load power stations across the system. More and more distributed generation will continue to enter the system on account of net metering, B2B bilateral EPAs, and larger captive RE projects for bulk consumers, who will not be selling to the grid. While current demand is relatively stable, growth is forecast to gradually increase.

Based on the experience of the previous policy and its implementation, actions are required to implement the new policy, many of them included in ARE Policy 2019:

1. Provinces and AEDB to develop a consensus on an engagement or participation framework regarding the governance and roles to be taken. The consensus must be reached through the steering committee, whose composition is described in section 4.2.1.
2. Clear annual roadmap and plan—including definition of exactly how much MW capacity will be tendered in each node—for investors and state institutions to plan accordingly.
3. Competitive bidding framework and tender package to be finalized at the earliest opportunity.[91]
4. Development of documentation process to acquire generation license for projects larger than 1 MW captive grid spill over RE, as per the net metering policy.
5. Duty structure to be revisited on the import duty exemptions on ARE technologies-based items which local industry can manufacture; plant and machinery imported by an existing or new industrial concern; the current duty-free import for AREPs above 25 MW; and other taxation anomalies that discriminate against local industry.
6. All LOI holders to compete for solicited nodes as determined by the IGCEP and VRE Locational Study to clear Category 3 and move toward a fully competitive bidding process.

A.3: INDICATIVE GENERATION CAPACITY EXPANSION PLAN 2021–30

The IGCEP is the cornerstone document of ARE Policy 2019. The policy already states that *"IGCEP outputs will form the basis of all on-grid capacity procurements (except net-metering)"* and that *"AEDB will announce the auction volumes annually based on IGCEP outputs."* The IGCEP is a live document that is required to be submitted annually for approval based on the electricity demand–supply situation and least-cost generation options.

The IGCEP 2021–30 was developed by NTDC and first submitted in May 2021. It was reviewed in September 2021 and finally approved by NEPRA. Previously, the IGCEP 2047 was finalized on the April 20, 2020, but it was never approved by NEPRA. The IGCEP 2021–30 facilitates a comprehensive view of the generation planning, which is composed of two key processes:

1. Load forecast.
2. Generation capacity expansion and dispatch optimization exercises.

The load forecast provides the basis for all the planning activities in the power sector, and the IGCEP. The forecast shows an increase of more than 58 percent of the energy demand from the current 130,652 GWh and a 56 percent increase of peak demand from the current 23,792 MW by 2030 (Table A-1).

[91] The broad parameters for finalization of the documents are required to be approved by the AEDB upon the recommendations of the steering committee.

TABLE A-1: SUMMARY OF LOAD FORECAST

Year	Normal	
	Energy	Peak demand
	GWh	MW
2020–21	130,652	23,729
2023–24	159,319	28,027
2026–27	181,834	32,276
2029–30	207,418	37,129
Annual Componded Growth Rate 2021–30	**5.27%**	**5.07%**

Source: IGCEP 2021–30.

The generation capacity expansion plan is developed with PLEXOS based on the existing and future generation power plants, existing policy framework, existing contractual obligations, natural resource, relevant provisions of the grid code, and CCI-approved assumption set.

These assumptions imply, among others:[92]

1. Retirement of existing thermal power plants including GENCOs will be considered as per expiry of contractual term of corresponding PPA and relevant Cabinet Committee on Energy (CCoE) decisions;
2. Until the expiry of contractual terms of corresponding PPA and GSA, existing regasified liquid natural gas (RLNG) and imported coal-based projects will be given a minimum dispatch as per contractual obligations;
3. A project will be input as "committed" and its capital cost or CAPEX will not be entered in the model if the project has obtained LOS as of December 2020 for private sector projects and if it is enlisted in Category I and II of CCoE's decision dated April 4, 2019, for non-hydro RE plants (wind, solar, bagasse); and
4. Hydro candidate projects are included in the definition of RE for the purpose of meeting a target of 60% by 2030.

The study plans an installed capacity of 61,112 MW in order to meet the peak demand of 37,129 MW. The installed capacity includes the use of existing generation facilities, consideration of committed power plants, optimization of candidate power plants, and the retirement of 6,447 MW of existing installed thermal power capacity encompassing natural gas, residual furnace oil (RFO) and RLNG. The share from solar, wind and bagasse is projected to be 7,932 MW; 5,005 MW; and 749 MW, respectively.

It is crucial to highlight that the IGCEP 2021–2030 deviates from the RE targets announced in the ARE Policy 2019 by including hydropower, as already noted (albeit under an amendment to ARE Policy 2019 mooted by CCI and yet to be ratified). As a result RE is projected to make up 62 percent of total capacity by 2030; however, without that amendment the share of non-hydro RE generation to the installed

92 Full set of assumptions approved by CCI can be found in section 5.2 of the IGCEP 2021–30.

TABLE A-2: SUMMARY OF INSTALLED CAPACITY (MW) AND ENERGY GENERATION/GWH) BY 2030

Technology	Installed capacity (MW)
Imported coal	4,920
Local coal	3,630
RLNG	6,786
Gas	2,582
Nuclear	3,635
Bagasse	748.6
Solar	7,932
Hydro	23,653
Cross Border	1,000
Wind	5,005
RFO	1,220
Total (MW)	**61,112**

Source: IGCEP 2021–30.

TABLE A-3: SUMMARY OF ENERGY GENERATION (GWH) BY 2030

Technology	Energy generation (GWh)
Imported coal	18,448
Local coal	32,145
RLNG	686
Gas	5,623
Nuclear	24,910
Bagasse	3,380
Solar	15,916
Hydro	94,649
Cross Border	4,436
Wind	17,225
RFO	—
Total (GWh)	**207,418**

Source: IGCEP 2021–30.

capacity would be 22 percent by 2030, below the original 30% target set under the ARE Policy 2019. This is an important distinction from the previous (and not approved) IGCEP 2047, which considered only solar, wind and bagasse technologies for the completion of the ARE Policy 2019 targets. Thus, by the year 2030 the previous IGCEP forecasted 4,861 MW more solar power and 5,322 MW more wind power, also considering that the total installed capacity of the country would be higher with a forecast of 76,391 MW, so solar and wind alone would imply 30 percent of the total installed capacity.

It is also worth mentioning that from the existing total installed capacity of Pakistan, the IGCEP 2021–30 considers 22,415 MW of committed projects until 2030, and the model optimizes wind and solar from the year 2024 in view of the technical and economic viability of the technologies totaling 10,062 MW and being the only selected candidate technologies due to their economic parameters.

TABLE A-4: ECONOMIC PARAMETERS OF CANDIDATE WIND AND SOLAR BLOCKS

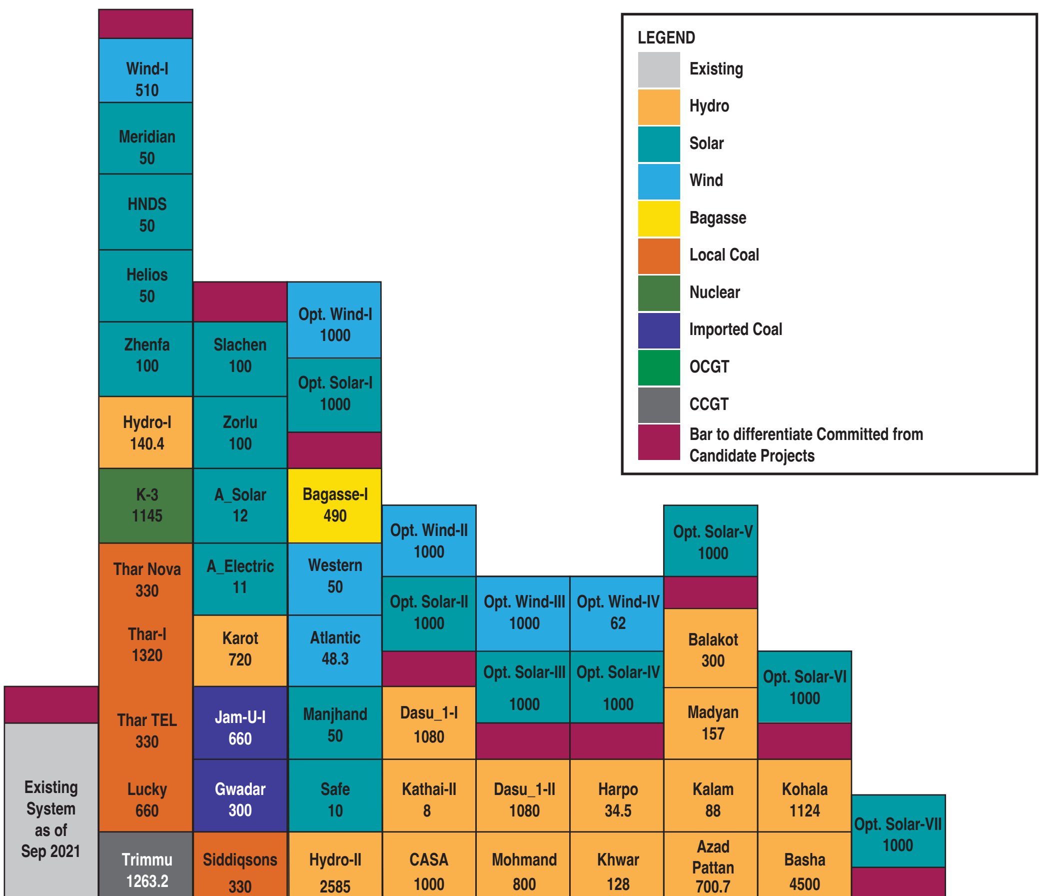
Technology	Installed capacity (MW)	Earliest availability (Year)	O&M ($/kW/Yr.)	Installed cost ($/kW)	Annual energy (GWh)	Plant factor (%)	Annualized cost of energy (c/kWh)	Annualized cost of energy ($/kW/Yr.)
Solar	50	2024	8.18	531	100.74	23	3.31	66.68
Wind	50	2024	19.48	955	186.15	43	3.35	124.69

Source: IGCEP 2021–30.

Key features of the IGCEP are:

- The development of wind energy stops by 2027, adding 3,062 MW of candidate projects, while solar PV continues growing until reaching 7,000 MW by 2030 in the base case scenario.

FIGURE A-1: GENERATION SEQUENCE (COMMITTED AND CANDIDATE PROJECTS) 2021–30



Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Commited MW	0	5,949	2,233	3,233	2,088	1,880	163	1,246	5,624	0	22,415
Candidate MW	0	0	0	2,000	2,000	2,000	1,062	1,000	1,000	1,000	10,062
Total MW	0	5,949	2,233	5,233	4,088	3,880	1,225	2,246	6,624	1,000	32,477

Source: IGCEP 2021–30.

TABLE A-5: ADDITION OF NEW CAPACITY BY YEAR UNTIL 2030

Fiscal year	Coal fired steam imported coal	Coal fired steam local coal	Combined cycle on RLNG	Combustion turbine in RLNG	Nuclear	Hydro	Solar	Wind	Bagasse	BESS	Per year capacity addition	Cumulative capacity addition
						MW						
2021	—	—	—	—	—	—	—	—	—	—	—	—
2022	—	—	—	—	—	—	—	—	—	—	—	—
2023	—	—	—	—	—	—	—	—	—	—	—	—
2024	—	—	—	—	—	—	1,000	1,000	—	—	2,000	2,000
2025	—	—	—	—	—	—	1,000	1,000	—	—	2,000	4,000
2026	—	—	—	—	—	—	1,000	1,000	—	—	2,000	6,000
2027	—	—	—	—	—	—	1,000	62	—	—	1,062	7,062
2028	—	—	—	—	—	—	1,000	—	—	—	1,000	8,062
2029	—	—	—	—	—	—	1,000	—	—	—	1,000	9,062
2030	—	—	—	—	—	—	1,000	—	—	—	1,000	10,062
Total	—	—	—	—	—	—	7,000	3,062	—	—	10,062	

Source: IGCEP 2021–30.

- The model computes required investment of US$39.2 billion, net present value including CAPEX and OPEX, and excluding existing capacity payments and the CAPEX of committed plants.
- Minimal reliance on imported fuels (imported coal, RLNG, and RFO-based technologies) and increased share of hydropower as well as local coal. It implies a shift in the indigenization ratio of generated energy from the current 60.0 percent to 75.9 percent by 2023 and 90.8 percent by 2030 due to inclusion of local coal, hydro, wind, and solar-based power plants.

As a result, the IGCEP solves some problematic issues faced by the country:

- Excess of supply: The IGCEP in its different scenarios clarifies and gives space to the VRE by 2030 from the current scenario, under which there is almost 36 GW of capacity installed and a peak load in summer of approximately 24 GW. This is on the basis that all candidate plants selected by the completion of the ARE Policy 2019 goals are wind and solar (VRE only).
- Displacement of expensive energy: ARE Policy 2019 already considers the displacement of the more expensive electricity generated by thermal plants whenever such displacement would lower average system generation cost (taking current contractual agreements into consideration).

However, to tackle other issues the IGCEP is not alone sufficient:

- The IGCEP is not the only technical document that plays a role in the selection of future capacity to be tendered out under ARE Policy 2019. Although the IGCEP establishes the quantity of VRE, other documents provide guidance on its location (VRE Locational Study, Transmission System Expansion Plan, and Transmission Investment Plan).
- The location of the VRE, under the new competitive bidding process, is most likely to be in areas where transmission and distribution (T&D) infrastructure is already developed. Developing suitable VRE projects in places far from the grid may be appropriate if the final energy price is low, and the developer builds the connection line. (For further guidance on this please see the VRE Locational Study, which is discussed below).

A.4: VARIABLE RENEWABLE ENERGY LOCATIONAL STUDY

The VRE Locational Study published by the World Bank in February 2021[93] aims to identify the most suitable location for VRE deployment to inform the strategic planning process for future VRE capacity and related transmission grid upgrades.

According to this study, the grid only needs limited additional transmission infrastructure to accommodate the target installed RE capacity by 2025, because spare capacities within the existing grid will almost suffice. Overall, the integration of VRE will in fact bring some relief to the grid and reduce transmission losses in some cases. However, to attain the 2030 target, additional transmission lines are needed to connect the relevant large-scale solar and wind parks. Among these, the high-voltage direct current (HVDC) Chaghi-Muzaffargarh connection between Balochistan and Punjab stands out. This is required to tap into the large wind resources in western Balochistan.

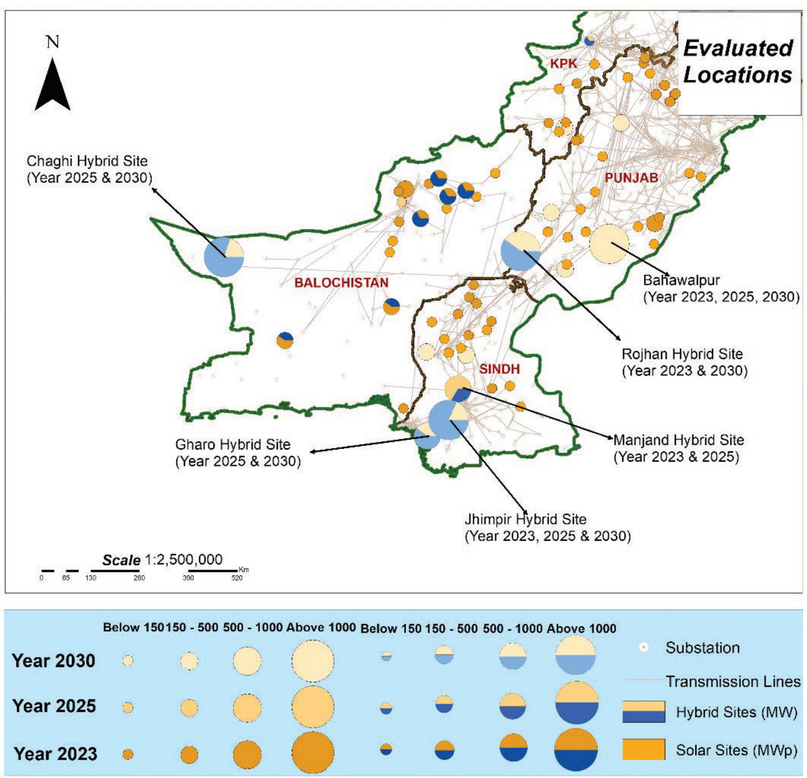
The study examines the four provinces in turn:

93 World Bank. 2021. "Variable Renewable Energy Locational Study". Pakistan Sustainable Energy Series. https://openknowledge.worldbank.org/handle/10986/35113 License: CC BY 3.0 IGO.

- *Punjab* has very good solar resources and a grid infrastructure which is already well developed. It also has many load centers, so the generated power can be consumed close to its sources, reducing losses. A challenge in Punjab is land availability, as in some areas the development of new solar power plants must compete with agriculture for land, which is very extensive in central and upper Punjab. However, suitable barren land is extensively available in southern Punjab, which is excellently suited for the development of new solar power plants.
- *Sindh* has excellent solar resources and two wind corridors (Jhimpir and Gharo). The wind corridors already have some wind parks installed, but there is potential for much more. Sindh also offers large areas with barren land, which is excellently suited for the development of new solar power plants.
- *Khyber Pakhtunkhwa (KP)* has fewer solar and wind resources than the other provinces. However, there is a limited zone worth exploring for wind power generation, and solar plants of medium size. In addition, KP still has a large untapped potential for hydropower plants; the focus in this province should therefore be on this abundant resource rather than VRE.
- *Balochistan* has excellent solar resources and large areas of unused land. Additionally, Balochistan has the highest wind resource potential of all the provinces of Pakistan, notably in western Balochistan (near Chaghi). The main challenge in Balochistan is the lack of existing grid infrastructure. Significant investment and effort will be required to develop a grid able to draw upon the abundance of wind. Such investment will be economically profitable, because the resulting per-unit cost for wind power from western Balochistan, including the evacuation infrastructure, will be competitive.

The locations and expected penetration of VRE are shown in Figure A-2.

FIGURE A-2: PROPOSED PROJECT SITES FOR 2023, 2025, AND 2030



Source: VRE Locational Study (World Bank, 2021).

TABLE A-6: VRE POTENTIAL FOR 2025 AND 2030

Year	Unit	Status quo 2019	Scenario 1 2025	Scenario 1 2030	Scenario 2 2025	Scenario 2 2030	Scenario 3 2025	Scenario 3 2030
VRE capacity share	%	4.9%	21.5%	31.4%	24.3%	37.4%	20.1%	31.5%
Total installed generation capacity	MW	35,130	61,941	75,595	61,941	75,595	61,941	75,595
VRE capacity (solar + wind)	MWp	1,735	13,340	23,740	15,050	28,237	12,481	23,801

Source: World Bank. 2021. "Variable Renewable Energy Locational Study".

TABLE A-7: VRE POTENTIAL: TECHNOLOGY CHOSEN AND GEOGRAPHICAL DISTRIBUTION

Year	Unit	Scenario 1 2025	Scenario 1 2030	Scenario 3 2025	Scenario 3 2030
Technology					
PV	MWp	8,165	13,465	8,726	13,546
Wind	MWp	5,175	10,275	3,755	10,255
Location (province)					
Balochistan	MWp	3,000	9,150	3,016	10,196
KP	MWp	575	975	260	280
Punjab	MWp	3,540	5,840	2,420	3,290
Sindh	MWp	6,225	7,775	6,765	10,035

Source: World Bank. 2021. "Variable Renewable Energy Locational Study".

The scenarios illustrated in Tables A-6 and A-7 reflect different approaches to plant sizing. Scenario 1 is based on a conventional sizing whereas Scenario 2 uses a progressive approach, resulting in the targets being exceeded. Scenario 3 is the recommended scenario. Its more optimized approach excludes the least financially attractive sites in Scenario 2, and still meets the targets for 2025 and 2030.[94] The numbers are derived on the basis of a top-down approach for the whole country, suggesting and ranking specific sites and then assessing available geographical and grid line data. The authors of the VRE Locational Study did not undertake site visits—with the exception of Sindh—therefore more detailed site-specific studies (prefeasibility studies) are recommended before tendering the specified sites.

Table A-7 includes some hybrid sites for the co-location of solar and wind power plants to make best use of the grid infrastructure. Capacity use factors for the evacuating grid lines are estimated at 40–50 percent, thereby minimizing infrastructure costs. In the same way, a certain oversizing of solar power plants, rather than evacuation capacity, is recommended to achieve better usage of the evacuation lines. This grid capacity evacuation factor, jointly with the IGCEP, may be used for the capacity split in different technologies or the prioritization of some projects, as discussed earlier in section4.11.

The study, which was concerned only with utility-scale VRE, anticipates a reduction in transmission losses during the daytime, as most proposed plants will be connected at 132 kV and feed the

[94] These targets expressed in MW were aligned with the previous IGCEP 2047. The IGCEP 2021–30 reduces the capacity additions for VRE when compared to what was envisaged by the VRE Locational Study (please see next footnote for explanation).

load locally—especially in the short- and medium-term scenarios—thereby reducing the loading on 500/200 kV and 220/132 kV transformers.

TABLE A-8: SUMMARY OF VRE ADDITION UNTIL 2030[a]

	Additions till 2023			Additions between 2023 and 2025			Additions between 2025 and 2030		
Province	**Wind**	**Solar**	**Total**	**Wind**	**Solar**	**Total**	**Wind**	**Solar**	**Total**
Sindh	480	700	1,180	900	1,350	2,250	500	950	1,450
Balochistan	800	1,050	1,850	500	650	1,150	4,000	2,150	6,150
Punjab	200	1,310	1,510	0	1,390	1,390	600	1,700	2,300
KP	0	200	200	50	325	375	0	400	400
VRE installed and committed	2,095	1,140	3,285	150	50	200	0	100	100
Total VRE	3,575	4,400	7,975	1,600	3,765	5,365	5,100	5,300	10,400
Total installed generation	53,685 MW			61,941 MW			75,595 MW		
% VRE of installed generation	**14.9%**			**20.5%**			**31.4%**		

Source: World Bank. 2021. "Variable Renewable Energy Locational Study. Pakistan Sustainable Energy Series." Washington, DC: World Bank.

[a] It is important to note that the numbers in the VRE Locational Study were mostly aligned with IGCEP 2047. The reduction of the installed capacity forecast in the updated IGCEP 2021–30 implies differences substantially at variance with the ostensibly more ambitious assumptions in theVRE Integration & Planning Study, upon which the VRE Locational Study was based. These differences must be solved by the steering committee and incorporated into the design of the Current Year RE Procurement Plan (CYREPP), which will prioritize the projects to be developed.

The IGCEP 2021–30 and the VRE Locational Study also differ regarding how they plan to develop VRE over time; the IGCEP 2021–30 plans to start the development of VRE by 2024 with 7,000 MW of solar PV and 3,062 MW of wind until 2030, while the VRE Locational Study envisages starting the development earlier than that, with additions of 3,082 MW of solar PV and 1,480 MW of wind power until 2023. The steering committee will be responsible for setting the final numbers of the yearly tender and solving these differences; our view is that as a result of delays caused by the COVID-19 pandemic, the most feasible schedule is that offered by the IGCEP 2021–2030.

Finally, out of 73 sites, the VRE Locational Study proposes that 12 be used for hybrid projects with both solar and wind technologies (all wind project sites were also evaluated for their solar power potential; the wind-solar option always scores higher than the wind-only option). Reflecting this finding, it proposes a technology-neutral (technology-agnostic) bidding process for tenders that provide incentives for a high utilization of the given grid evacuation capacity.

As previously stated, along with the IGCEP, the VRE Locational Study provides the basis for the determination and selection of future RE capacity to be developed under ARE Policy 2019. Therefore, we recommend the preparation and publication of yearly updates of the study, as in the case of the IGCEP. For such updates, it is critical to formally allocate responsibilities to ensure that timely updates are implemented. The World Bank has conducted the study in collaboration with NTDC, which is probably ideally placed for such activity, in coordination with preparation of the IGCEP.

A.5: COMPETITIVE TRADING BILATERAL CONTRACT MARKET MODEL

A Competitive Trading Bilateral Contract Market (CTBCM) model was first envisioned in the 1990s, with a determination made in 2002 to create a wholesale competitive electricity market by 2009 (postponed to

2012, then dropped). The development of a competitive model was revived in 2015 with the separation of the market operator function assigned to CPPA and the formulation of the Market Operator Registration, Standards and Procedure Rules. The high-level design of the CTBCM model was submitted in March 2018 and was approved by NEPRA in December 2019. The overall target is to have the CTBCM ready to start 18 months after approval by NEPRA of the detailed design and implementation roadmap, which was submitted in February 2020 and approved in November 2020, resulting in an April 2022 deadline for commercial operation.

The main objectives of the model are:

1. Create the conditions for a fair allocation of risk and benefit sharing between investors/sellers and buyers/consumers.
2. Level the playing field by removing conflict of interest to facilitate entry of new investors and participation of private entities, including bulk power customers.
3. Create the conditions to attract investments based on a credit cover provided by market participants, without the need for sovereign guarantees.
4. Put pressure on the payment discipline of market participants.
5. Improve efficiency arising from competition for the market (new capacity procurement) and in the market (optimization through centralized economic dispatch within system security constraints, to maximize the economic benefits of available resources and promote efficiency).
6. Enhance security of supply and generation adequacy to develop power sector sustainability in the short, medium, and long term.
7. Ensure accountability of all participants and service providers.
8. Ensure transparency and predictability in the market.
9. Ensure open access to information.

The design of the target market considers physical EPAs with very inflexible capacity payments or take-or-pay conditions which limit the introduction of competition. The existing EPAs will not necessarily be extended or revised, although they might be in the future if agreed by the parties. Thus the market will start with the existing EPAs. Pre-existing PPAs and EPAs will be commercially allocated to DISCOs in proportion to the relevant market shares of the aggregated demand of the DISCOs and K-Electric (KE). The Special Purpose Trader (SPT) will calculate the share that corresponds to each DISCO and KE, and for each period the energy and capacity quantity and payment that would correspond to each DISCO and KE should be considered as bilateral contracts. Consequently, each GENCO and IPP having at present an EPA signed by the CPPA, NTDC, or Water and Power Development Authority (WAPDA), will after the assignment have 10 EPAs, one with each DISCO. All other conditions of the EPAs will remain unchanged, with their rights and obligations protected, particularly the guarantees.[95]

However, there will be new contracts besides the pre-existing EPAs, namely supply contracts. These new contracts can be financial instruments to hedge prices or quantities (deliver energy and/or offer available capacity), or a mix of financial and physical contracts[96] setting a price, agreed in advance,

95 The Commercial Allocation Methodology is to be approved as per the approved implementation timelines of the CTBCM. The final scheme of arrangement will be clear after the said approval.

96 The authority has approved the contract types on an indicative basis only. In this regard, the types of market contracts will be approved by the authority as per the approved implementation timelines. The final scheme of arrangement will be clear after the said approval.

for hourly volumes of energy and capacity. These will have supply obligations but not obligations to produce (for the seller side) and obligations to pay for the contracted quantities, but not to take/consume. Differences will be settled within the balancing mechanism.

Two separate products will be traded in the market: energy to supply electricity consumption and firm capacity to ensure long-term reliability of supply at competitive and efficient prices. VRE will participate in the capacity market with a firm capacity based on a procedure yet to be defined.

The market will create the SPT, a government-owned company (and a successor company to CPPA), which will be the purchaser of EPAs that have not been assigned yet or cannot be assigned to the DISCOs. The SPT will take over the transitional role of administering the existing EPAs, including the administrative and settlement functions, largely as performed today by CPPA. The SPT will administer the contracts as if these contracts are bilateral among DISCOs under law.

Among the service providers, which are not market participants:

1. The market operator (MO) will be a successor company to CPPA to ensure transparency and avoid conflict of interest; the MO will be responsible for administering the admission and registration of participants and contracts, registration of common delivery points (CDPs), the price calculation, security cover, and settlement and payment systems for the capacity and energy balancing mechanisms to clear differences between actual and contracted quantities.
2. The system operator (SO) role is assigned to NTDC. Among its duties are reliable operational planning (medium- and short-term), coordination of maintenance outages, implementing the Security Constrained Economic Dispatch (SCED), calculating the marginal prices for each hour, and keeping the system in permanent balance, taking due consideration of the security and reliability constraints. NTDC will also be the main transmission service provider and must adequately design, build, and maintain its transmission facilities.
3. The metering service provider (MSP), or providers, are responsible for collection of all metering information required by the market operator to perform the settlement functions. Although there could be more than one MSP in Pakistan, only NTDC has the required infrastructure, so it will most likely operate alone (at least when CTBCM begins).
4. Finally, the planner will develop a long-term least-cost-based indicative generation capacity expansion plan and a least-cost transmission system expansion plan as per provisions of the grid code and will produce annual updates; the function is now assigned to the system operator, so NTDC will continue to be responsible for this role.

The role of the Independent Tender Administrator (IAA) has special importance regarding the future competitive bidding. The capacity tenders—to be designed in the CTBCM as new contracts for capacity—are expected to be centralized and conducted by the IAA, a role which initially will be performed by the Private Power and Infrastructure Board (PPIB) and AEDB. IAA will be a state-owned company responsible for tenders for new capacity procurement contracts for DISCOs, aggregating the needs of DISCOs to comply with their capacity obligation during the earlier phase of the market (around five years) until DISCOs develop the skills and experience to tackle the new capacity procurement, meeting their projected demand growth and capacity obligations.

IAA's functions,[97] among others, are:

[97] IAA will be registered with the authority.

- Prepare and obtain the regulatory approval of EPA templates for the centralized tenders for procurement of new generation for DISCOs;
- Prepare the standard bidding documents and the design of the tender;
- Calculate the gap for each DISCO (demand forecast that is not already covered with contract(s) to meet capacity obligations);
- Preparation of the capacity procurement plan based on the calculated gap and taking into consideration the IGCEP prepared by NTDC and energy policies of the government, including renewable targets to determine quantity to be tendered (MW capacity) and whether technology-specific or technology-neutral;
- Obtain the required regulatory approvals for the procurement plan;
- Conduct the competitive tenders for the approved capacity procurement plan; and
- Assist the DISCOs in finalizing the bilateral PPAs/EPAs with each generator that has been awarded (bid successfully) in the tender.

Besides the main features, the commercial structures of the target market are:

- A bilateral contract market, in which sellers (generators and traders) will sell directly to the buyers (DISCOs, as suppliers, other retail suppliers, bulk supply customers);
- A balancing mechanism, to settle deviations between contracted amounts and actual amounts;
- Settlement and payment of bilateral transactions to be done bilaterally between sellers and buyers; and
- Settlement of contract deviations in the balancing mechanisms to be done through the market operator, with payment made by participants.

The market operator will oversee the balancing mechanisms and the settlements:

- The balancing will include energy balancing for demand participants, generators, traders (including imports and exports), and transmission losses, and capacity balancing for demand participants and generators;
- Purchase and sale of imbalances will be between the participants, and therefore will not involve the market operator. However, the market operator will remain responsible for ensuring that each and all participants provide sufficient credit cover for imbalances, to be used in the event of nonpayment;
- The recommended energy balancing period for the start of the market is one hour, where a balancing mechanism for capacity will be executed once a year during the two first months, and after the end of each fiscal year;
- For the balancing mechanisms, the settlement procedures and payment system will initially be on a monthly basis. The market operator will calculate imbalance energy and capacity quantity and prices, where energy balancing will be based on marginal cost principles, and the price of the capacity will be determined by estimating the cost of the most economic generation unit capable of providing 1 MW during defined "critical hours";[98]

[98] The balancing mechanism is to be approved as per the approved implementation timelines of the CTBCM. The final scheme of arrangement will be clear after that approval.

- Given the variability inherent to VRE, the form of the balancing mechanism may cause some problems for new projects, considering that:
  - Every demand participant will have a capacity obligation to contribute, representing a share of the required firm capacity, to ensure reliable supply (with adequate reserves as defined in the grid code);
  - A demand participant can cover its capacity obligation through its own firm capacity or contracts and by purchasing any shortage in the balancing mechanism for capacity administered by the market operator;
  - The amount of power capacity that will be credited to each generator for the capacity balancing mechanism (expressed in MW per year) will correspond to the capacity delivered by such generator to the system during the "critical hours" calculated using average production availability of each power plant during the identified hours; and
  - Provided that all VRE production is under generation following supply contracts, there will not be any balancing risk in the future.

For new market-based bilateral contracts there will be a credit cover mechanism, to the extent feasible, to move away from the sovereign guarantees. The financial health of each DISCO will be appraised with assistance from IAA to determine its creditworthiness and ability to provide the required credit cover from its own resources. DISCOs that cannot provide the credit cover can be eligible to receive the required credit cover through the IAA (government support for low performing public sector DISCOs). The generator can call the default of an EPA contract in case of nonpayment. In this situation, the generator will be able to continue to sell through the balancing mechanism until signing another contract, and the DISCO that defaulted in the contract will need to buy through the balancing mechanism.

The future wholesale electricity market may have important implications for design of the competitive bidding process and implementation covered in this report:

- The introduction of the CTBCM will modify the institutional framework for VRE bidding with the IAA taking the leading role in the tender, including the role of tendering authority instead of the provinces. The transition needs to be as smooth and progressive as possible.
- The introduction of an open wholesale electricity market will change the current role of CPPA as an off-taker of the energy supply connected to the transmission grid. In the new market, the CPPA will act as a pure market operator, being responsible for market settlements, without responsibility for buying power entering the grid. Future agreements will need to be modified, due to the changes in the sovereign guarantees whenever the DISCO is able to provide a credit cover mechanism. The creditworthiness of the new energy off-takers (the DISCOs) will be a key point for the tenders under CTBCM. This situation will be mitigated to some extent with the support of IAA for low performing DISCOs when the market is first introduced.
- The role of the DISCOs as off-takers will be also be affected by the inclusion of more B2B and behind-the-meter capacity, which will increase the so-called circular debt problem, impacting finance of the electricity system, especially at the distribution level, which will likely decrease their creditworthiness.

It is assumed in this analysis that VRE will not be liable for balancing costs (due to deviations) as all VRE energy will be under generation following supply contracts; nevertheless, the precise remaining risk will depend on the detailed market rules.

- There might be small capacity payments to VRE depending on the definition of the critical hours by the system operator (SO), which will have implications for the financial viability of a project and contracting arrangements. Most likely, VRE facilities willing to sell to large users will need to procure capacity, or alternatively, the large user will need to procure the capacity gap through capacity contracts or in the capacity market.
- The opening of the wholesale market must introduce the imposition of responsibilities incumbent on large eligible consumers in terms of their particular contribution to accomplishment of the RE target set by ARE Policy 2019. Various options must be studied, such as the imposition of a socialized add-on to the wheeling rate, including the difference between market prices and the EPA price for RE, or the introduction of an RE quota in their bilateral contracts.

A.6: NEPRA COMPETITIVE BIDDING TARIFF (APPROVAL PROCEDURE) REGULATIONS, 2017

The NEPRA Competitive Bidding Tariff (approval procedure) Regulations were approved in May 2017. These regulations ("competitive bidding regulations") are applicable to setting the generation and transmission tariff in cases where detailed feasibility studies are available.

These regulations set different conditions and duties for the different stakeholders involved in the competitive bidding process regarding:

- Duties of the tendering authority:
  - The committee constituted for evaluation of the bids has at least one member who has expertise in competitive bidding and fulfills the independence requirement.[99]
  - The bids clearly indicate the details of the technology and other technical specifications.
  - The bids are invited and processed transparently.
- Conditions of the bidding:
  - The competitive bidding shall be conducted by the relevant agency keeping in view the demand forecasted by a national grid company in accordance with the least-cost generation plan of each DISCO.
  - In the case of a reverse bidding method, a benchmark tariff[100] shall be approved by NEPRA which may be disclosed or not, where bids higher than the tariff must be rejected. For other methods of bidding, the approval of a benchmark tariff is not required.
- The relevant agency, prior to submitting an RFP for approval, may prequalify prospective bidders through a public process that is based on: (1) technical ability; (2) relevant experience; (3) legal and regulatory compliance; and (4) financial ability.
- The RFP must include details on:
  - Quantum of electricity proposed;
  - Tariff structure (depending on the fuel);

[99] The independence requirement means not being an officer or employee of the relevant agency, or any of its affiliates, and not having a direct or indirect interest, financial or otherwise, in the relevant agency or any of the bidders.
[100] Acting as ceiling price.

- Summary of the type(s) of project(s);
- Annual availability requirement to be met;
- Expected date of commencement of supply;
- In case of prequalification: list of prequalified bidders;
- Term of contract;
- Detailed feasibility study;
- Dispute resolution mechanism to be adopted by the relevant agency;
- Proposed price mechanism and cost parameters;
- Construction milestones to be specified by the bidders;
- Financial requirements to be met by bidders;
- Period of validity of offer of bidder;
- Other technical, operational and safety criteria to be met by bidder, including the provisions of the grid code;
- Conditions and criteria for bid disqualification;
- Methodology of bidding;
- Bid bond or other bid security instrument;
- Constitution of bid evaluating committee; and
- Timetable of the bidding process

NEPRA must approve the RFP and subsequent changes, conducting a hearing if deemed necessary.

- The bidding process shall be completed within three months after approval of the RFP by NEPRA and can be extended for a term not exceeding one month. The relevant agency shall provide a model EPA, transmission service agreement, or any other agreement, as necessary, to all bidders.
- Bid evaluation report: the relevant agency shall upon successful completion of the bidding process notify the successful bidder and forthwith submit to NEPRA the bid evaluation report, which shall include: (1) a briefing of the process undertaken and its compliance with the RFP; (2) details of bidders, tariffs, and rates; (3) the rationale of rejection of bids; (4) grid interconnection studies approved by NTDC; and (5) details of the successful bidder.
- The following provisions apply for tariff approval:
  - The successful bidder, as notified by the relevant agency, shall, within 15 days of the notification and submission of a bid evaluation report by the relevant agency to the authority, file an application with NEPRA seeking approval of the tariff, including:
    - Details of the project and the company.
    - Licenses or applications for them.
    - Draft EPA and any other agreement required.
  - The applicant shall pay a nonrefundable application fee to NEPRA.
  - NEPRA may, before approving the tariff, decide to conduct a hearing if deemed necessary.
  - NEPRA may reject the application if any information is found to be false, the competitive bidding does not follow the competitive bidding regulations, or the bid evaluation report is not in accordance with the competitive bidding regulations.
  - NEPRA may approve the tariff within 15 working days of its admission of the case or the date of hearing.

Finally, the competitive bidding regulations establish in clause 14 the possibility of removal or relaxation of the foregoing requirements if any difficulty arises in giving effect to any provision of these regulations.[101]

The competitive bidding regulations already consolidate a well-structured bidding framework which we believe should apply in subsequent tenders. However, these regulations would not apply for all VRE tenders. Part I Article 1.4 of the regulations states that they shall only be applicable in cases where detailed feasibility studies are available and are not applicable in cases of undeveloped sites, where ARE Policy 2019 in its article 2.2.1.h says that feasibility studies are not required. In some cases, the tendering authority will be carrying out studies in preparation for the tender, and this may open up a regulatory gap in the sense of doubt about whether the NEPRA competitive framework applies in full or partially. It would be advisable that AEDB and NEPRA clarify this issue in the future.

A.7: OTHER DOCUMENTS REVIEWED

Beside the aforementioned policies and regulations, other secondary regulations have been reviewed:

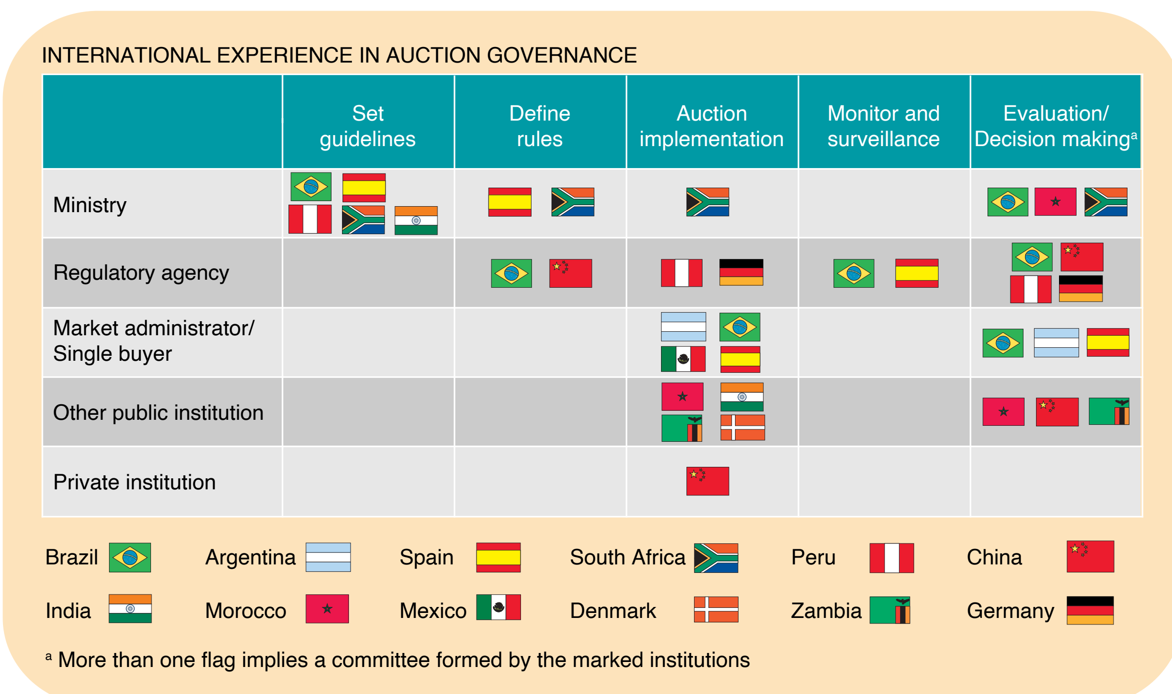
- *Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 and amended in 2018, also known as the "NEPRA Act"* includes several sections of relevance to competitive bidding:
  - It specifies the powers and functions of NEPRA, which among others are: grant licenses; ensure efficient tariff structures; determine tariff, rates, charges, and other terms and conditions for supply of electric power services; and extend advice to public sector projects.
  - It establishes the appellate tribunal and the appellate procedures.
  - It establishes the role of NEPRA for assisting the federal or provincial governments in preparing, reviewing, and revising electricity policies.
  - It establishes NEPRA as the issuer and registrar of main licenses in the electricity sector.
  - It enumerates the guidelines which shall be applicable to NEPRA in the determination, modification, or revision of rates, charges, and terms and conditions for provision of electric power services.
- *National Electric Power Regulatory Authority (wheeling of electric power) Regulations, 2015.* These regulations allow open access in the distribution of electricity. Every DISCO shall offer nondiscriminatory open access to its distribution and interconnection services to the applicants, who are either connected or intend to be connected to the distribution system of the DISCO, ensuring quality of service of the existing users and wheelers of electric power.
- *NEPRA Market Operator (registration, standards, and procedure) Rules 2015.* These regulations, more related to the market design than the competitive bidding, define the registration, authorization, and responsibilities of the market operator and the obligations of the market participants toward the market operator (MO).
- *NEPRA Licensing (generation) Rules.* These regulations define the different features and requirements to get a generation license, including technical specifications, fees, terms, tariffs, revocations, connection to the transmission system, and compliance with the grid code.

[101] That might apply to the requirement for the bidding process to be completed within three months, which might be restrictive for large tenders.

ANNEX B: INTERNATIONAL EXPERIENCE IN TENDER GOVERNANCE

From an international viewpoint, it becomes clear that ministries of energy commonly take on the role of setting general competitive bidding guidelines and defining their rules. This is explained by the fact that they are also responsible for the design of national energy policies and country targets. Frequently they share the task of designing the competitive bidding process with the regulatory agencies. Moreover, ministries of energy typically delegate the roles of power market or competitive bidding administrators to specifically created bodies. For example, in the case of Denmark, the body responsible for competitive bidding implementation is the Danish Energy Agency; in Morocco, the Moroccan Agency for Solar Energy (MASEN); in India, Solar Energy Corporation of India (SECI); or in Zambia, Zambia's Industrial Development Corporation (IDC) through Scaling Solar (backed by the World Bank Group). Figure B-1 summarizes international experience, with further details provided in Table B-1.

FIGURE B-1: INTERNATIONAL EXPERIENCE IN COMPETITIVE BIDDING GOVERNANCE



Source: Authors.

In countries with multiple stakeholders, committees are crucial to provide consensus among the different stakeholders involved in the implementation and governance of the competitive bidding.

Examples of countries that have implemented committees in their competitive biddings systems are:

1. Brazil: Formed by: the energy regulator National Electric Energy Agency (ANEEL); the Ministry of Mines and Energy (MME); the market administrator; Chamber for Commercialization of Electrical Energy (CCEE); and the Energy Research Company (EPE).
2. China: Formed by: the electricity market regulator National Development and Reform Commission (NDRC); the National Energy Administration (NEA), state-owned grid companies, provincial development and reform commissions, provincial power companies, bidding agencies, and technical experts.
3. Morocco: Formed by an interministerial committee and public utility National Office of Electricity and Water (ONEE).
4. Uganda: Investment committee made up of seven independent international renewable energy sector and infrastructure investment experts that was responsible for ultimate appraisal and selection of the projects. In addition, there was a steering committee formed by the Ministry of Energy and Mineral Development; the Ministry of Finance, Planning and Economic Development; and Development Partners from Germany, Norway, the UK, and the EU.

The following table summarizes the experience in a sample of countries regarding the different bodies in charge of implementing and managing tender processes. The countries analyzed are, Argentina, Brazil, China, Denmark, India Mexico, Morocco, Peru, Spain, South Africa, and Zambia.

TABLE B-1: INTERNATIONAL EXPERIENCE AND RESPONSIBLE BODIES FOR TENDER IMPLEMENTATION

Country	Responsible bodies
Argentina	**CAMMESA (Electricity Wholesale Market Administrator Company):** Market operator public–private company (20 percent–80 percent) which acts as the tender administrator. CAMMESA is formed by Argentinian generators, distributors, transmitters, large energy users, and the Ministry of Energy and Mines (20 percent each). Its main functions include coordination of the dispatch operations, responsibility for the establishment of wholesale prices, and administration of economic transactions made through the Interconnected Electricity System. CAMMESA supervises the operation of the MEM (wholesale electricity market), plans power needs, and enables it to run smoothly according to the rules set by the energy secretariat.
Brazil	A tender committee undertakes the main tender tasks, which are divided among **ANEEL, MME, CCEE, and EPE:** **ANEEL (National Electric Energy Agency):** This is the Brazilian Energy Regulator and the body which leads the tender process under the rules of the Ministry of Mines and Energy. ANEEL publishes and manages tenders, contract models, and the criteria for technical and financial qualification stipulated in tender rules. As the energy regulator, ANEEL is also responsible for regulating transmission and distribution activities, tariffs, and service quality. **Ministry of Mines and Energy (MME):** sets energy policy, capacity to be awarded and types of power elicited by tenders. **Electric Power Commercialization Chamber (CCEE):** This is the market administrator, a regulated nonprofit entity comprising representatives of the power market; it sets the spot price, is responsible for contract settlement, and conducts the tenders on behalf of ANEEL. **Energy Research Company (EPE):** It provides technical accreditation to bidders and also support to MME for energy planning.
China	**National Development and Reform Commission (NDRC):** This is the body in charge of onshore wind tenders. NDRC also acts as the electricity market regulator, setting the tariffs and levels of VRE-based electricity support, and approving the construction of new power plants.

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TABLE B-1: INTERNATIONAL EXPERIENCE AND RESPONSIBLE BODIES FOR TENDER IMPLEMENTATION *(continued)*

Country	Responsible bodies
	National Energy Administration (NEA): This body is in charge of solar and offshore wind tenders. NEA is responsible for formulating and implementing energy development plans and industrial policies, and administering and promoting reforms in the energy sector. Both NDCR and NEA publish tenders with detailed instructions. Practical management of the tenders is done by bidding agencies such as **Zhongshe International Bidding Co. Ltd.** and **China Hydro Power Project Consulting Group.**
Denmark	**Danish Energy Agency:** Public body dependent on the Ministry of Energy, Utilities and Climate. It acts as the contracting authority in VRE tenders. Also, the Danish Energy Agency manages the legislation on the electricity market in Denmark; and develops the legal framework for production, transmission, and distribution of electricity, and for competition, consumer protection and security of supply.
India	The **Ministry of New and Renewable Energy (MNRE)** sets the guidelines of national-level tenders. The announcement of the guidelines includes the capacity demanded, bidding format, tariff structure, type of tender, and so forth, and also identifies the tendering authority in each particular case for national-level tenders. **Solar Energy Corporation of India (SECI):** Public company that acts as the tendering authority in solar and new wind tenders. Besides managing the tenders SECI owns, manages, investigates, plans, promotes, develops, designs, constructs, operates, maintains, and renovates RE power projects in India and abroad. **National Thermal Power Corporation (NTPC):** Public company (60 percent shares) which acts as tendering authority for both renewable and conventional energy. It is the largest utility in India.
Mexico	**National Center for Energy Control (CENACE):** This is the Mexican System Operator and the body in charge of elaborating and conducting tenders and the contracts to be signed by the final buyer in compliance with Mexican law.
Morocco	**Ministry of Energy, Mines and Sustainable Development (MEMDD):** This ministry has overall responsibility for achieving RE targets and implementing the tenders. **National Office of Electricity and Water (ONEE):** Public utility responsible for managing wind and hydro tenders. ONEE publishes REOI, announces the tender, sets the criteria for the bidders to be included, and buys the electricity through a PPA. **Moroccan Agency for Solar Energy (MASEN):** Public–private company responsible for managing solar tenders. MASEN is a sponsor of renewable energy projects that issues calls for proposals to select IPPs to generate electricity from renewably energy. It also prepares the infrastructure, buys the land and equipment, and prepares feasibility studies and technical documents for such calls for proposals.
Peru	The **Ministry of Energy and Mines (MINEM)** designs the national VRE policy and defines the share of VRE energy (but not hydro) to be procured by the system. The **Energy and Mining Regulator (OSINERGMIN)** acts as the tender administrator. It determines the tender criteria caps on the generation and price ceilings for each tender and technology. As the energy regulator, OSINERGMIN also supervises companies in the electricity, oil, and mining sectors to see that they comply with relevant legal provisions.
South Africa	Tenders are announced on the **DOE, NERSA, and Eskom** websites. **Department of Energy (DOE):** Provides oversight over the national electricity sector, and under its separate unit **DOE IPP** designs and manages the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). The DOE IPP is led by a management team seconded from the public–private partnership unit of the National Treasury. The Development Bank of South Africa is also involved in the REIPPPP. **National Energy Regulator of South Africa (NERSA):** This is the body responsible for tariff approvals and the licensing of generators, transmitters, distributors, and traders. **Eskom Single Buyer Office:** Body in charge of implementing the REIPPPP and signing the PPA contracts. It is governed by the DOE and the Department of Public Enterprises.

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TABLE B-1: INTERNATIONAL EXPERIENCE AND RESPONSIBLE BODIES FOR TENDER IMPLEMENTATION *(continued)*

Country	Responsible bodies
Spain	**Ministry of Energy and Government:** Law 413/2014 and Decree IET/1045/2014 regulate VRE production, including payment and incentives, set and apply tender system guidelines, and specify which technologies are eligible. **Operator of the Iberian Energy Market (OMIE):** The Spanish market operator, through its subsidiary OMEL, acts as the administrator of the tender system and its tenders. Besides being the tendering authority, the OMIE manages the day-ahead and intra-day electricity markets. **National Commission of Markets and Competition (CNMC):** The Spanish energy regulator supervises the tenders. As the energy regulator, the CNMC perspective is independent of government, consumers, and companies, yet mindful of all. The CNMC defends the effective competition, objectivity, and operational transparency of the energy systems.
Zambia	**Industrial Development Corporation (IDC):** IDC implemented the Scaling Solar Programme in Zambia, acting as an agile procurement unit outside ministerial channels. It carries out: the selection of the site and leases the land to the solar projects; the permitting processes; the prequalification requirements; and the final awards. It acquires 20 percent of shares of the awarded projects. IDC is a development finance institution wholly owned by the Zambian government that serves as an investment holding company for state-owned enterprises and new investments.

ANNEX C: INTERNATIONAL EXPERIENCE ON DEVELOPING LOCAL VRE INDUSTRY: CASE STUDIES

There is a growing literature on the success of renewable energy in the development of local industry. Most of this focuses on local content requirements (LCR), though the findings have broader implications.

The following case studies are considered, with an important source document being the UNEP-DTU partnership (2019)[102] review of the effectiveness of local content regulations in local industrial development.

C.1 SOUTH AFRICA

Under the REIPPPP and the Small Projects IPP Procurement Programme (SP-IPPPP), important economic development requirements have been imposed on bidders. Under the REIPPPP, bid evaluation was based 70 percent on price and 30 percent on meeting economic development criteria. These economic development criteria included:

- Job creation (25 percent)—with minimum thresholds for local and black citizens and jobs created in local communities;
- Local content (25 percent)—based on the value of local spending;
- Ownership (15 percent)—with focus on ownership by local and black citizens in project companies (threshold of 12 percent by black people in the seller);
- Management control (5 percent);
- Preferential procurement (10 percent);
- Enterprise development (5 percent); and
- Socioeconomic development (15 percent).

The value thresholds in Table C-1 on local content spending were included in the bid windows (BW) for solar PV and onshore wind. The amount of promised local content spending in the bids received broadly increased in line with the targets.

For wind, despite the targets, limited progress in the development of local production is reported. Three local wind turbine tower manufacturers have been identified by various studies, though local production of high value-added wind turbine components, such as blades or nacelle components, has not been observed.[103] An important contributory factor was considered to be the relatively low volumes for

[102] Hansen, U. E., Nygaard, I., Morris, M., and Robbins, G. 2019. Local content requirements in tender schemes for renewable energy: Enabler of local industrial development in developing countries? UNEP DTU Partnership Working Paper Series 2019, Vol. 2.

[103] Hansen, U. E., Nygaard, I., Morris, M., and Robbins, G. 2019. Local content requirements in tender schemes for renewable energy: Enabler of local industrial development in developing countries? UNEP DTU Partnership Working Paper Series 2019, Vol. 2, p. 9.

TABLE C-1: SOUTH AFRICAN BID WINDOW, LOCAL CONTENT TARGETS, THRESHOLDS, AND BIDS (PERCENT)

Technology	BW	Threshold %	Target %	Average bids %
Solar	BW1	35	50	38.4
	BW2	35	60	53.4
	BW3	45	65	53.8
	BW4	45	65	62.3
Wind	BW1	25	45	27.4
	BW2	25	60	48.1
	BW3	40	65	46.9
	BW4	40	65	44.4

Source: IRENA 2018. "Renewable energy tenders: Cases from Sub-Saharan Africa," International Renewable Energy Agency, Abu Dhabi.

large-scale manufacturing under the scheme (although as of 2019, there was more than 2 GW of operating capacity and more than 3.3 GW of capacity assigned from preferred bidder wind IPPs),[104] as well as uncertain political signals.[105]

For solar PV, seven local module assembly factories are reported to have been set up, reflecting the involvement of Chinese and European companies. Although there is disagreement in the literature on whether LCR has promoted this development, there is a shared view that the overall level of local development has been limited.[106] Several authors argue that beyond defining thresholds, the government provided limited support to local companies, nor did it actively monitor local content requirement during implementation: consequently, companies met the thresholds through the purchase of noncritical inputs locally and by exploiting loopholes.[107]

C.2 BRAZIL

Brazil is considered a success story for the development of a local renewables industry, particularly for wind energy. IRENA estimates that the wind sector employs 34,000 people, of whom 33 percent are in manufacturing, 42 percent in construction, and the rest in operations and maintenance.[108] In 2019, GE, Siemens-Gamesa, and WEG were the leading wind companies in Brazil, all with local manufacturing facilities.[109] Moreover, IRENA reports a local content of 89 percent in Brazil's wind manufacturing sector in 2014. In addition, IRENA reports 15,600 jobs in solar PV, mostly in construction and installation, with an additional potential 15,000 jobs to be created through the 1 GW of solar to be installed in 2019.

Brazil started its renewable energy tenders in 2009, with 60 percent of LCRs imposed for wind. The LCRs were defined not only in terms of value, but also as the percentage of the total weight of the

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104 https://sawea.org.za/stats-and-facts-sawea/.
105 https://sawea.org.za/stats-and-facts-sawea/. p. 13.
106 https://sawea.org.za/stats-and-facts-sawea/. p. 10.
107 https://sawea.org.za/stats-and-facts-sawea/. p. 14.
108 IRENA. 2019. Renewable Energy and Jobs, Annual Review 2019, p. 26.
109 https://www.evwind.es/2020/05/12/ge-siemens-gamesa-and-weg-lead-installation-of-wind-turbines-in-brazil-in-2019/74694.

facility. This definition of the LCRs was found to be instrumental in its effectiveness, as it promoted initial development of towers, and soon several international manufacturers set up in Brazil. The UNEP-DTU study (2019) reports that by 2014, there were four manufacturers of wind turbines and seven turbine assemblers in Brazil, along with 13 manufacturers of towers and another 13 of parts and components.[110] Notably, in the case of Brazil, LCRs did not seek directly to dictate participation in the tenders, rather, to enforce access to low-cost debt from the Banco Nacional de Desenvolvimento Econômico e Social (BNDES). BNDES had very significant investment capacity, and the final effect was similar to establishing a local content requirement for participation in the tenders.

For solar, LCRs stipulated that projects receiving (concessional) funding must use PV modules assembled in Brazil using locally produced frames. While some studies report that local production and assembly were patchy in the earlier years, there appears now to be much greater local development, with a number of PV module manufacturing facilities present, the largest two being the 380 MW facility owned and operated by Canadian Solar and the 300 MW factory operated by China-based BYD. Moreover, Amerisolar has recently announced plans for a 200 MW factory, which would be the third largest.[111] This development notwithstanding, there are claims that LCRs have increased the cost of production, with local panels one-third more expensive than imported panels, and local developers finding it difficult to obtain subsidized credit, particularly for smaller projects.[112]

In both wind and solar, the allocation of a significant market size in tenders has been considered critical to promoting local industry, particularly for wind during the early stage of wind tenders, where there is now more than 16.0 GW of installed capacity, and more recently for solar PV, where there is more than 2.4 GW of installed capacity. These figures, particularly for wind, are significantly above those reported for South Africa.

The role of LCRs is debated, but the following are considered facilitating factors:

- Access to local development loans, with these loans based on the proportion of locally sourcing, and
- The high LCRs, with a weight requirement for wind at the early stages of industry development to ensure the development of towers.

Brazil also had an advantage in wind of being an early mover, and hence several of the suppliers that have set up production in Brazil can use these facilities as a base for supplying other markets in South America.

Another relevant topic that can be learned from Brazil relates to the global or regional competitiveness of local supply chains built on the back of local content policies. The economic crisis of 2015/16 in Brazil resulted in a lack of demand for new generation projects in 2016/17. This affected bidding for all technologies, including wind power. An analysis of barriers to export wind equipment to neighboring countries

110 Hansen, U. E., Nygaard, I., Morris, M., and Robbins, G. 2019. Local content requirements in tender schemes for renewable energy: Enabler of local industrial development in developing countries? UNEP DTU Partnership Working Paper Series 2019, Vol. 2, p. 10.
111 https://www.pv-magazine.com/2020/04/27/amerisolar-plans-new-200-mw-solar-panel-factory-in-brazil/.
112 https://staging.solarplaza.com/resource/11694/brazils-local-content-rules-slow-down-solar-growth/

revealed that some Brazilian manufacturing plants would only be able to deliver equipment at prices roughly 30 percent higher than prevailing market levels. Exporting did not seem particularly feasible on that occasion. Although macro factors played a role in this situation, this was also interpreted as evidence of the relatively low competitiveness of the local supply chain.

C.3 INDIA

In solar PV, despite a large market with high levels of installed capacity (24.4 GW of utility scale capacity by 2018), India has relied heavily on imports.[113] IRENA estimates that 115,000 jobs are supported in the on-grid solar sector (and possibly the same in off-grid). However, it also notes that seven of India's top 10 module suppliers are Chinese firms, while imports from Malaysia, Singapore, Thailand, and Vietnam are also important. Indian manufacturers cannot compete on cost, and many have limited access to low-cost loans. The domestic market share was estimated at only seven percent in 2018.[114] IRENA also reports that Chinese companies are taking an increasing market share in the inverter market, though local companies have a much stronger presence in project development and engineering, procurement, and construction.

The Indian government has tried several measures to increase local manufacturing, with mixed success:

- During its National Solar Mission (2010–17), the government stipulated technology-specific domestic contents requirements for crystalline silicon PV modules to support its manufacturing. However, there are mixed claims. Some authors claim that this helped increase local manufacturing capacity, whereas others point to a consequent shift in use to thin film imports, without any noticeable development of the local market having resulted from the LCR.[115]
- It launched a 10 GW tender linked to a 3 GW annual local manufacturing commitment of modules (for which polysilicon or other primary raw material could be imported); this was delayed several times and subsequently cancelled in early 2019, when only one bid was received, which was considered too high.
- It introduced "safeguard tariffs" on Chinese and Malaysian imports in mid-2018 of 15–20 percent for a period of two years. However, their success is considered limited due to the price advantage of these suppliers even incorporating the levy and the potential for high-quality importers to seek other markets, with the two-year period considered insufficient to promote domestic manufacturing activity.
- In 2019, it also announced 12 GW of solar projects to be developed by existing state-owned generators using local equipment. However, these projects will not be introduced via tenders.

Through its endeavors to protect local suppliers, the Indian government has had several difficulties with World Trade Organization (WTO) rules. In September 2016, the WTO appellate body upheld a ruling that India violated several core provisions relating to national treatment and trade-related investment measures. Under the national treatment rules, governments must treat imported products on a par with domestically manufactured ones.[116]

113 IRENA. 2019. p. 28 and p. 9.
114 IRENA. 2019. p. 28.
115 See discussion in Hansen et al. 2019. p. 11.
116 https://www.pv-magazine.com/2019/02/07/india-prioritizes-domestic-products-in-plan-for-12-gw-of-new-solar/.

In the wind sector, there are several local manufacturers, including Vestas, Suzlon, Inox Wind, and Siemens-Gamesa. While the government has provided support to the wind sector through several measures,[117] there appears to be limited specific support to local manufacturers that is not available to other suppliers. However, significant volumes of wind energy have been installed, with total installed capacity at 37.5 GW by the end of 2019. The large scale of development attracted multinational utilities, investors, and supply chain players to India's wind market,[118] with local manufacturers expected to continue to be active, as India has plans to install an additional 140 GW of wind capacity by 2030.

However, the growth of the market has its challenges. The Global Wind Energy Council reports that only 2.4 GW of wind capacity was installed in 2019—by contrast to 4.1 GW installed in 2017. While more than 17 GW of capacity has been tendered across the country by various power purchasing agencies in the last three years, nearly one-third went unsubscribed or was cancelled after award for various reasons, including stringent tender conditions, low tariff caps, off-taker risks, unavailability of grid, and land availability.[119]

C.4 KEY FACILITATING FACTORS

Based on its country review (and including China), the UNEP-DTU review highlights the following key facilitating factors in the development of local industry:

- Market size and stability—a minimum market size, with a stable stream of new capacity through a tender program is a prerequisite. This has helped develop the wind sectors in Brazil and India and is considered an important reason why the South African tenders have relied primarily on imports. However, market size alone is not a sufficient factor—a large solar PV market has arisen in India, yet it is highly dependent on imports.
- Policy design and coherence—policy coherence in terms of LCR and more general local manufacturing support are adduced as facilitating factors in the development of the Chinese wind sector. On the other hand, LCRs in South Africa were less clearly defined and implemented in the absence of additional supplementary policies. The growth of the Indian wind sector appears to reflect strong general policy support for wind, of which LCRs are one in a range of policies. Difficulties in developing coherent policies for local solar PV in India have included trade issues and difficulties in preventing loopholes in the manufacturing requirements.
- Restrictive (that is, stringent) LCRs are considered important factors in the development of local manufacturing in the Brazilian and Chinese wind sectors. However, these were introduced in large markets, and at a time when the international market was less developed than is currently the case.
- An important existing industrial base in heavy industry and engineering competences. In Brazil, the domestic steel industry was relatively well developed, which provided a suitable base from which local suppliers of steel structures could diversify into the production of wind turbine towers (an advantage less in evidence in South Africa).
- Access to concessional finance, linked to local manufacture, was also a strong supporting factor in Brazil.

117 For example, see Prem Kumar Chaurasiya, Vilas Warudkar, and Siraj Ahmed. 2019. "Wind energy development and policy in India: A review," Energy Strategy Reviews 24, 342–357.
118 Global Wind Energy Council, Global Wind Report 2019, p. 18.
119 Global Wind Energy Council, Global Wind Report 2019, p. 18.

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