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ANALYSIS OF RENEWABLE ENERGY AUCTIONS IN SIX COUNTRIES

Climate Economic Analysis for Development, Investment and Resilience (CEADIR)

Contract No.: AID-OAA-I-12-00038, Task Order AID-OAA-TO-14-00007

June 7, 2018

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Task Order AID-OAA-TO-14-00007

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

AFORES	Administradores de Fondos para el Retiro (Retirement Funds Administrators, Mexico)
BDAN	Banco de Desarrollo de América del Norte (North American Development Bank)
BNDES	Banco Nacional de Desenvolvimento Econômico e Social (Brazilian development bank)
BNEF	Bloomberg New Energy Finance
C2F	Canadian Climate Fund for the Private Sector in the Americas
CE	Clean energy
CEL	Certificado de Energía Limpia (Clean Energy Certificate)
CEADIR	Climate Economic Analysis for Development, Investment, and Resilience
CENACE	Centro Nacional de Control de Energía (National Energy Control Center, Mexico)
CFE	Comisión Federal de Electricidad (Federal Electricity Commission, Mexico)
CKD	Certificado de Capital de Desarrollo (Capital Development Certificate, Mexico)
CNE	Comisión Nacional de Energía (National Energy Commission, Mexico)
COFIDE	Corporación Financiera de Desarrollo (Financial Development Corporation, Peru)
CRE	Comisión Reguladora de Energía (Energy Regulatory Commission, Mexico)
DEMEX	Desarrollos Eólicos Mexicanos (Mexican Ecological Development, Mexico)
DFI	Development finance institution
DISCO	Distribution company
ECAs	Export credit agencies
EIB	European Investment Bank
Eximbank	Export-Import Bank (United States)
Fibra-E	Fideicomiso de Inversión en Infraestructura y Energía (Infrastructure and Energy Securitized Investments, Mexico)
FiTs	Feed-in-tariffs
GoB	Government of Brazil
GoES	Government of El Salvador
GoI	Government of India
GoM	Government of Mexico
GoP	Government of Peru
GW	Gigawatt
GWh	Gigawatt-hour
IDB	Inter-American Development Bank
IFC	International Finance Corporation
IFI	International financial institution
IIC	Inter-American Investment Corporation
IPP	Independent power producer
IRENA	International Renewable Energy Agency
IRR	Internal rate of return
ISO	Independent system operator
KFW	Kreditanstalt für Wiederaufbau (German government-owned development bank)
KWh	Kilowatt-hour
MDB	Multilateral development bank
MEM	Ministerio de Energía y Minas (Ministry of Energy and Mines)
MW	Megawatt
MWh	Megawatt-hour
NAFIN	Nacional Financiera (Mexican development bank)
NSMP	National Solar Mission Program (India)
OECD	Organisation for Economic Co-operation and Development
OPIC	Overseas Private Investment Corporation (United States)
OSINERGMIN	Organismo Supervisor de la Inversión en Energía y Minería (Supervisory Body for Energy and Mining Investment, Peru)

PPA	Power Purchase Agreement
PRODESEN	Programa de Desarrollo del Sistema Eléctrico Nacional (National Electric System Development Program, Mexico)
RE	Renewable energy
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme (South Africa)
RSA	Republic of South Africa
SENER	Secretaría Nacional de Energía (National Secretary of Energy, Mexico)
SIGET	Superintendencia General de Electricidad y Telecomunicaciones (General Superintendence of Electricity and Telecommunications, El Salvador)
SPV	Special-purpose vehicle
TWh	Terawatt-hours
USAID	United States Agency for International Development

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EXECUTIVE SUMMARY

USAID asked CEADIR to analyze recent experiences with renewable energy (RE) reverse auctions in El Salvador, Mexico, and Peru. This report focuses on the policy and regulatory environment, characteristics and results of the auctions, and financing of winning bids. USAID also requested shorter summaries of experiences in Brazil, India, and South Africa. This report is based on interviews with investors and representatives of financial institutions and governmental entities in El Salvador, Mexico, and Peru and secondary information sources.

Feed-in-tariffs (FiTs) are long-term contracts for electricity generation that offer premium prices as an incentive for increasing private sector investments. In recent years, there has been a trend away from FiTs to reverse auctions. *Reverse auctions* stimulate competition for more efficient price discovery. They can reduce costs by broadening private sector participation in RE development and financing.

The Governments of El Salvador, Mexico, and Peru have successfully attracted experienced private sector investors and developers through RE reverse auctions. These three countries have obtained new renewable electricity capacity at lower contracted prices in each succeeding auction as technologies have improved, manufacturing costs have declined due to economies of scale, and experience with these investments in the countries has increased.

Financing sources have varied with the types of winning bidders. Global energy companies have often had access to corporate equity and on-balance sheet corporate debt. Independent Power Producers (IPPs) and domestic RE developers have often relied on project financing capitalized by development finance institutions (DFIs) and national development banks or investment funds. There has been relatively limited involvement by commercial banks due to the 15-20-year loan tenors needed to meet investment return targets for investments in renewable electric power generation. The more stringent Basel III capital and liquidity requirements have also reduced commercial bank interest in utility-scale RE development. However, some commercial banks have structured innovative RE financing, often with development banks or institutional investors. Examples include 1) mini-perm loans with requirements or incentives for refinancing within 5-10 years when net revenues are favorable; 2) warehousing of loans for securitization through long-term project bonds (green bonds) on domestic or global capital markets; and 3) energy investment trusts that can be sold on equity markets, such as Mexico's Fibra-E.

INTRODUCTION

Some governments have used feed-in-tariffs (FiTs) — long-term contracts with premium prices — to provide an incentive for increasing renewable electricity generation. FiTs were more appropriate when the costs of renewables were substantially higher than nonrenewables. However, in recent years, costs have become competitive or lower for electricity from renewable energy than nonrenewable sources. As a result, there has been a trend away from FiTs toward auctions, especially reverse auctions, to stimulate competition that can drive down capital and operating costs. *Renewable energy auctions* are competitive bidding processes for procuring electricity capacity (MW) or generation (MWh) that are limited to RE sources (Ferroukhi et al. 2015). *Reverse auctions* are a type of auction in which the lowest priced bids win (Lawson 2016). Some countries, such as Peru, have adopted a combination of FiTs and reverse auctions.

In 2016, $120 billion was invested to develop 61 gigawatts (GW) of RE power capacity in 71 emerging market countries (Bloomberg New Energy Finance (BNEF) 2017).[1] This investment included 19 gigawatts (GW) of wind power at $55 billion and 34 GW of solar power at $52 billion. In 2016, auctions were used to contract for 34 GW of electricity generation capacity (BNEF 2017).

Auctions can increase transparency and broaden private sector participation in the development and financing of electric power capacity. As a result, they can help reduce the costs of RE development to national and subnational governments and utility companies and attract the interest of large-scale investors and other sources of financing. Since many countries have not held any RE auctions yet, the experiences in other countries can help government decision makers, energy developers, financial institutions and investors, and industrial or commercial users design and implement them successfully.

USAID asked the CEADIR Activity to analyze recent reverse RE auctions in El Salvador, Mexico, and Peru through key informant interviews and a literature review. For a broader geographic scope, USAID also asked CEADIR to include shorter summaries of experiences in Brazil, India, and South Africa based only on secondary information.

CEADIR interviewed a total of 19 financiers, project developers, and government officials in El Salvador, Mexico, and Peru about RE auction strategies and arrangements, with particular attention to the incentives for attracting developers and investors. The team reviewed the:

1. Policy and regulatory environment;
2. Investment risks and mitigants for winning bidders; and
3. Challenges and successes in obtaining financing (with examples of closed financing deals).

This report also examined how winning bids were financially structured, a critical element of the potential for scaling up renewable electric power generation. The team considered the perspectives of developers, financial institutions, investors, governments, and electricity users. Annex D defines some terminology which may be useful for readers who are not experts in financing.

[1]Throughout this document, the dollar sign refers to U.S. dollars.

1. EL SALVADOR

1.1 BACKGROUND

In 2016, the total installed capacity for electric power in El Salvador was 1,742 MW. Nearly 25 percent of the total (432 MW) was from RE resources. The most recent plan update of the Comisión Nacional de Energía (CNE) projected a 2.5 percent average annual growth of electricity demand. This growth rate would require a total installed capacity of 2,608 MW by 2021. The plan proposed that 33 percent of the total capacity (852 MW) in 2021 be from RE resources (CNE 2016).

1.2 POLICY AND REGULATORY ENVIRONMENT

The CNE is responsible for developing the national energy policies for reducing the dependency on fossil fuels in electric power production by contracting for renewable sources of power. El Salvador has provided the following incentives for renewable electric power investments: 1) long-term Power Purchase Agreements (PPAs) (20 years); 2) guaranteed priority dispatch with an assigned marginal cost of zero;[2] 3) import tax exemptions for machinery and equipment; 4) income tax exemptions for the first 10 years for an installed capacity up to 10 MW and five years above 10 MW; and 5) an income tax exemption on revenues from the certified emission reduction sales.[3]

1.3 CHARACTERISTICS AND RESULTS OF THE AUCTIONS

The National Electricity Law of 2007 authorized contracting for renewable power through auctions that award long-term PPAs. CNE defined the amount of electric power capacity contracted in each auction by type of technology. The Superintendencia General de Electricidad y Telecomunicaciones (SIGET) regulated electricity generation and transmission. SIGET set ceiling prices for each technology and approved the bidding documents. The private company DelSur was contracted to conduct the energy auctions to date.

Key elements of El Salvador's RE auctions have included

1. A transparent, publicly disclosed process;
2. No local content requirements;
3. Technology-specific auctions with defined quotas and a reallocation mechanism. If the target for one technology was not met, additional amounts of other technologies can be contracted to fill the gap;
4. Contracts were awarded through a pay-as-bid selection process. Auction winners are paid a price equal to the offeror bids;
5. Ceiling prices were only disclosed when bids are opened;
6. Winning bidders were awarded 20-year PPA contracts for installed capacity
    a. Winners committed to delivering all electricity generated from the awarded capacity;

[2] Authorized by Decree 80 of 2012

[3] Authorized by Decree 462 of 2015

b. Contracted amounts were allocated proportionally to each of the seven private distribution companies based on their shares of the wholesale market;
c. Contracted prices were paid in U.S. dollars and indexed to the U.S. inflation rate;
7. Nonsite-specific procurement -- Bidders proposed their own sites;
8. Bidders were responsible for ensuring the technical viability of their proposals and submitting documentation on the energy resources, technical specifications and capacity factor, and available grid capacity (transmission, interconnection nodes, substations, and network grids). This documentation was made publicly available; and
9. Relatively few qualification requirements for bidders to attract more private investors.

Table A-1 in Annex A lists the key risks and mitigants for RE auction participants in El Salvador. The main risks were construction (including environmental and social permits), offtaker and revenues, operation, PPA termination, currency and inflation, and curtailment risks. The key mitigants included: 1) contractual obligations under the PPAs (including performance, construction, and operation bonds and penalties for delays or underperformance); 2) requirements for financing (due diligence reviews and independent technical and financial analysis of the proposed investments); 3) independent supervision of the project's relevant design, construction, environmental, social, and operational aspects; 4) assignment of rights to the lenders to resolve termination events; 5) use of long-term PPAs denominated in U.S. dollars and indexed to the U.S. inflation rate; 6) preferential grid dispatch; and 7) proven track records of annual extensions of assigned rights to transmission grids.

The Government of El Salvador (GoES) held a small pilot auction in 2013-2014 for 15 MW of solar, biomass, and small-scale hydropower. It also held two technology-specific RE auctions launched in 2014 and 2016. The auction process was similar for the 2014 and 2016 auctions, except for some changes in the PPAs that were recommended by lenders. These changes included creditor guarantees and typical assignments of rights in project finance (e.g., step-in-rights to cure PPA terminations, information disclosures, and consent rights).

The first auction had a target of contracting 60 MW of solar and 40 MW of wind power. The reallocation mechanism was triggered since none of the qualifying bids for wind power were below the ceiling price. As a result, a larger amount of solar power was contracted. The second auction had pre-targets of 100 MW of solar and 70 MW of wind power. The reallocation mechanism was also triggered in this auctions since only 50 MW of wind power was contracted. Together, the two auctions in 2014 and 2016 contracted a total of 263.5 MW of installed capacity—213.5 MW of solar power and 50 MW of wind power (Table 1).

Table 1. Results of the 2014 and 2016 RE Auctions in El Salvador

Auction Year	Installed Capacity (MW)	Solar Power Prices ($ per MWh)	Wind Power Prices	Percent of Target Volume Awarded
2014	Solar: 94 MW [a]	$101.90 - 123.41	N/A	94.0%
2016	Solar: 119.5 MW Wind: 50.0 MW [b]	$49.55 – 67.24/MWh	$98.78	99.7%

Sources: DELSUR 2014 and 2016

[a] Capacity targets were 60 MW of solar power and 40 MW of wind power. The reallocation mechanism between solar and wind power was triggered since there was no qualifying bids for wind power below the ceiling price.
[b] Capacity targets were 100 MW of solar power and 70 MW of wind power. The reallocation mechanism was triggered because only 50 MW of wind power capacity was contracted.

The contracted prices per MWh decreased from $101.90-$123.41 for solar power in the 2014 auction to $49.55-$67.25 in the 2016 auction. The contracted price for wind in the 2016 auction was $98.78 per MWh. The GoES plans to conduct a small auction for 20 MW of distributed energy in 2018 and a larger RE auction in 2019.

Table A-2 and Table A-3 in Annex A contain more detailed information on the results of El Salvador's RE auctions. The bidders with the largest awarded capacity in the two RE auctions were Neon-Almaval (61 percent of the total), Tracia Network Corporation (19 percent), and the Real Infrastructure Fund (17 percent). These bidders were able to offer low prices due to decreasing equipment and installation costs, greater investor confidence in the auction process, and the good track record of PPA offtakers for RE investments.

1.4 FINANCING WINNING BIDS IN EL SALVADOR'S RE AUCTIONS

Equity. Most of the RE auction contracts in El Salvador have been awarded to international Independent Power Producers (IPPs) and private equity funds supported by institutional investors. Neoen-Almaval (an international IPP) and the Real Renewable Infrastructure Fund (a private equity fund) obtained a total of nearly 78 percent of the contracted amounts. Another bid winner, the Tracia Network Corporation (a Guatemalan electric power developer) had capital from regional corporate sources.

Debt financing. Winning bidders in El Salvador have generally sought project financing with a loan tenor that matched the 20-year term of the PPAs to help them reach their target IRRs. However, there have been few examples of project financing for large-scale development of private infrastructure in El Salvador. The government development bank, Bandesal, mainly provided corporate financing to small- and medium-sized companies. It has not provided long-term project financing for RE development. Long-term project financing has only been available from funds provided by multilateral development banks (MDBs) and export credit agencies (ECAs).

There has been little private infrastructure or electricity project financing in El Salvador. Neoen-Almaval's 101 MW Providencia Project awarded in the 2014 auction raised 18.5-year project financing from the IDB, Inter-American Investment Corporation (IIC), a Canadian climate fund, and the French ECA Proparco. Real Infrastructure Capital Partners has obtained approval from the Overseas Private Investment Corporation (OPIC) for financing its RE contracts awarded in the 2014 and 2016 auctions. As bidders gain a track record in obtaining and repaying long-term project financing for RE investments, new sources of financing may emerge, including the participation of regional commercial banks and capital markets. El Salvador has functioning capital markets with private pension funds investing in corporate bonds securitized by future cash flows from public infrastructure. However, the domestic bond markets are unlikely to become major sources of financing for RE in the near future.

2. MEXICO

2.1 BACKGROUND

The Government of Mexico (GoM) defined *clean energy* as electricity generated from biomass, geothermal, small- and large-scale hydropower, solar power, wind power, and nuclear energy or efficient co-generation.[4] In 2016, Mexico had 73 GW of installed capacity for electricity generation, including 29 percent (21 GW) from clean energy. Mexico's Programa de Desarrollo del Sistema Eléctrico Nacional (PRODESEN) forecast a three percent average annual growth rate for electricity demand between 2017 and 2031 (SENER 2017). This demand growth would require an installed capacity of 113 GW by 2031. PRODESEN projected that nearly 50 percent of this (56 GW) would be from CE sources.

2.2 POLICY AND REGULATORY ENVIRONMENT

Before 2014, private power producers in Mexico were allowed to generate electricity for sale to the single government-owned company—the Comisión Federal de Electricidad (CFE) — through PPAs. Self-generation schemes to supply private off-takers were also allowed. The Electricity Industry Law of 2014 authorized some major reforms:

1. Unbundling CFE into separate, autonomous, government-owned companies for electricity generation, transmission, and distribution;
2. Liberalizing energy generation and sales with open participation from private generators and CFE subsidiaries generators;
3. Allowing any electric power generator to connect and deliver electricity to the transmission and distribution grid under specified procedures;
4. Creating a wholesale spot market for electricity sales by private companies and CFE with the Centro Nacional de Control de Energía (CENACE) ensuring fair competition;
5. Establishing a system of tradable CE certificates to promote CE generation. These Certificados de Energia Limpia (CELs) will be provided to electricity producers based on their certified CE power generation (1 CEL per MWh). Electricity producers will be required to meet minimum requirements for CE production or purchase CELs from others;
6. Implementing CE auctions through 15-year contracts for electric power and firm capacity, 20-year contracts for CELs, and up to 3-year contracts for other types of electric power generation; and
7. Holding auctions for power transmission rights.

The Energy Transition Law of 2015 set minimum CE consumption levels for electricity retailers and large users of electricity. The initial target was five percent of total electricity consumption in 2018, increasing to 14 percent by 2022. Electricity retailers and large users can meet the target by purchasing clean electricity or CELs.

This law also authorized some favorable institutional arrangements for CE producers, including long-term PPAs, net metering, preferential dispatch, and tax incentives. Imbalances between contracted

[4] USAID used a different definition of *clean energy* that included renewable energy and energy efficiency improvements.

electricity or CELs and actual dispatched amounts are liquidated annually at wholesale spot market prices. Tax benefits for CE include accelerated depreciation of 100 percent of the investment costs.

Three governmental entities had major responsibilities affecting CE generation in Mexico. The Secretaría Nacional de Energía (SENER) set energy policies, forecast the long-term demand for electric power capacity (including CE), planned expansion of the national grid, and set CEL requirements. The Centro Nacional de Control de Energía (CENACE) organized and conducted CE auctions, administered awarded contracts, served as a clearinghouse for the wholesale energy market, and ensured open access to transmission and distribution grids. The Comisión Reguladora de Energía (CRE) regulated electricity markets, issued grid connection and electricity generation permits, and approved ceiling prices.

2.3 CHARACTERISTICS AND RESULTS OF THE FIRST THREE CE AUCTIONS IN MEXICO

Mexico held three technology-neutral energy auctions between March 2016 and November 2017. These three auctions resulted in contracts for the following:

1. CE: 19,806 terawatt-hours (60 percent solar, 39 percent wind, and 1 percent geothermal);
2. CELs: 21 million certificates (60 percent solar, 37 percent wind, 2 percent hydropower, and 1 percent geothermal); and
3. Firm capacity: 1,780 megawatts (76 percent natural gas, 12 percent wind, 11 percent solar, and 1 percent geothermal).

Current regulations called for the GoM to hold annual auctions for electric power generation capacity, CELs, and firm capacity.

Table B-1 in Annex B lists the key risks and mitigants for RE auction participants in Mexico. Table B-2 summarizes the results of the first three energy auctions in Mexico for capacity, power generation, and prices. Table B-3, Table B-4, and Table B-5 contain detailed information on the winning bids in the first (March 2016), second (September 2016), and third (November 2017) clean energy auctions.

The first and second auctions were only open to the generation utility, the Comisión Federal de Electricidad (CFE). Ceiling prices in the first auction were too low and no qualifying bids for firm capacity were received. The ceiling price for firm capacity was approximately 172 times higher in the second auction.

Mexico's third auction differed from the previous two. First, it was open to private offtakers in addition to the CFE. Second, the GoM established a clearinghouse to execute separate contracts with the developers and offtakers. The clearinghouse also managed the contractual obligations of all parties by requiring financial guarantees for performance and payment obligations.

CE auctions in Mexico have incorporated a *nodal price adjustment* to encourage developers to site production units near nodes with relatively low installed capacity and discourage them in areas with excess supply. Winners were selected after adjusting the received bids for the positive or negative nodal factor. However, nodal price adjustments were not included in the prices in the contracts awarded to the winners. CENACE reduced the nodal price adjustments from a span of $45 in the first auction (+$10.7 to -$34.3) to a span of $13.5 in the third auction.

The average contracted prices for electricity from clean energy and CELs decreased 58 percent between the first and third auctions (from $47.6/MWh to $19.8/MWh). Over this period, there were substantial reductions in the costs of solar and wind power due to: 1) lower world market prices for solar and wind equipment from technological and manufacturing improvements and increases in the volume of production; 2) learning curve improvements for purchasing, installing, and operating clean energy systems in Mexico; 3) changes in auction procedures that increased competition; 4) greater confidence in the implementation of the sector reforms; and 5) an increased interest in developing and financing clean energy.

Winners of the third auction included international energy companies (Enel Green Power, Engie, Canadian Solar, Acciona, and Invenergy) and global IPPs backed by private equity funds and institutional investors (X-Elio and Neoen). Large, international companies were able to raise low-cost capital from corporate or project debt financing and negotiate better terms from suppliers. Although the winning bids were relatively low, the winners were still expected to be able to meet their IRR targets, which were reportedly in the mid- to high-single digits.

The bidders with the largest contracted amounts in the three auctions were 1) Enel Green Power (a transnational company based in Italy) with 24 percent of the awarded CE capacity and 23 percent of the CELs; 2) Zuma (an international IPP owned by Actis and Mesoamerica) with 12 percent of the awarded CE capacity and CELs; and 3) Engie (a transnational company based in France) with 11 percent of the awarded CE capacity and CELs. The third auction awarded two private offtakers (Iberdrola and Cemex) contracts for approximately 10 percent of the CE capacity (534 GWh) and CELs (532,000 certificates) plus 21 percent of the firm capacity (124 MW).

2.4 FINANCING WINNING BIDS IN MEXICO'S CE AUCTIONS

Two transnational companies won approximately 35 percent of the aggregate contracted energy and CELs in the first three Mexican CE auctions. Mexico has a well-functioning domestic capital market for clean energy investments.[5] International IPPs and electricity project developers based in Mexico received capital from private equity funds and institutional investors. These investors reportedly included Actis, Mesoamerica, the Ontario Teachers' Pension Plan, PSP Investments, the Canadian pension fund Caisse de Depot et Placement du Quebec (CDPQ), and the Mexican pension fund Certificado de Capital de Desarrollo Infraestructura Mexico (CKD IM). The Administradores de Fondos para el Retiro (AFORES) has noted the interest in CE investing.

In 2015, a new financing vehicle was created for CE in Mexico — the Fideicomiso de Inversión en Infraestructura y Energía (Fibra-E). This Infrastructure and Energy Investment Trust is similar to energy investment trusts in the United States, which were based on the model of master limited partnerships for real estate. Trust shares can be publicly traded and offer tax advantages for investors.[6]

Table B-6 lists some closed financing deals for CE in Mexico that have been publicly disclosed. Most of these deals have been structured as syndicated project financing with the participation of DFIs, such as the Inter-American Development Bank (IDB), International Finance Corporation (IFC), and Kreditanstalt für Wiederaufbau (KFW) or government development banks (Bancomext, Banobras, Nacional

[5]In 2010, wind power investments in Mexico were financed under a self-generation scheme. Transnational energy companies and IPPs (e.g., Iberdrola, Acciona, and Enel) and private equity funds (e.g., Macquarie Infrastructure Fund, Conduit Capital Partners, and Actis/Mesoamerica) established special-purpose vehicles (SPVs) based on long-term PPAs with private offtakers. These SPVs mainly raised project financing from DFIs, national development banks, and commercial banks with 15-20 year tenors and flexible repayment schedules based on predicted cash flows.

[6] Desarrollos Eólicos Mexicanos (DEMEX), an SPV owned by the Spanish Renovalia Energy IPP, obtained $126 million in bond financing for a large wind power project. The 15-year Mexican peso-denominated bond was floated on the domestic capital market in December of 2015. The bond proceeds were used to refinance bank loans for the Piedra Larga wind PPA with the Grupo Bimbo company for self generation.

Financiera (NAFIN), and Banco de Desarrollo de América del Norte (BDAN)). A smaller share involved commercial lenders, such as Banco Santander, ING, and Mitsubishi UFJ Financial Group (MUFG).

Financing arrangements for auctioned contracts awarded to transnational energy companies are confidential, but are likely to have included some corporate debt or equity financing. Enel Green Energy has emphasized corporate debt financing and has sometimes sold its majority ownership of CE investments after completion of construction. Enel agreed to scale down its participation and reportedly sold 80 percent of its portfolio of solar and wind power special purpose vehicles (SPVs) awarded in the CE auctions to a consortium of the CDPQ and CKD IM (CDPQ 2017).

DFIs and government development banks have been important sources of financing for the contracts awarded in Mexico's CE auctions because of their willingness to allow long loan tenors. The terms and conditions of specific loans were confidential. However, it is likely that CE developers would want 17-year loans (two years of construction plus a 15-year period of operation) and at least 20-year loans for CELs. Some commercial banks have participated in CE financing through mini-perm structures with 5-10-year tenors. Commercial financing of CE is expected to continue to gain momentum as the auction process, clearinghouse, and wholesale spot market mature and developers gain more experience in managing technology and resource risks (or obtain parametric insurance products.

3. PERU

3.1 BACKGROUND

In 2016, Peru had a total installed capacity of 13 GW of electric power with approximately nine percent (1 GW) from RE, including small hydropower (BNEF 2017). The Ministerio de Energía y Minas (MEM) prepared the national RE plan and policy. In 2014, it issued the National Energy Plan for 2014-2025, which projected a five percent share for renewable sources of electricity other than hydropower through 2024.

3.2 POLICY AND REGULATORY ENVIRONMENT

Legislative Decree 1002 of 2008 established the current regulatory framework for renewable electricity in Peru. The Electricity Generation Investment Promotion Law authorized auctions for government contracting for on- and off-grid renewable electric power capacity through long-term PPAs. This law also set a target of five percent of electricity from renewable sources, excluding small-scale hydropower, for 2008 to 2013. This target was to be reviewed every five years, but has not yet been changed. RE auction contracts in Peru benefit from long-term PPAs with prices guaranteed by the MEM through feed-in-tariffs, preferential dispatch, value added tax (VAT) reimbursement, and accelerated depreciation.

3.3 CHARACTERISTICS AND RESULTS OF THE RE AUCTIONS

The MEM determined the need for RE auctions and the targeted amount of capacity by technology type. The Organismo Supervisor de la Inversión en Energía y Minería (Osinergmin) planned and conducted the auctions and set ceiling prices for each technology. The MEM signed PPAs for the contracted capacity with the auction winners. Osinergmin administered payments to the generators and supervised contract compliance.

The key elements in Peru's RE auctions were

1. A transparent, publicly disclosed auction process;
2. Established targets for RE resources;
3. No local content requirements;
4. Inclusion of all RE technologies with specific quotas and ceiling prices for each technology type and a reallocation mechanism if the quota for a technology was not met;
5. Contracts awarded through a pay-as-bid selection process with winners receiving the prices they bid;
6. Two-round auction process: Price ceilings were only revealed in the second round when the first round did not result in contracts for the desired total capacity and had at least one bid above the ceiling price;

7. Winning bidders received 20-year PPAs with guaranteed, long-term sales prices that included premium feed-in tariffs;[7]
8. Contract prices indexed to the U.S. dollar exchange rate and inflation and rate, but all payments to be made in domestic currency;
9. RE auction winners were eligible for preferential dispatch and access to transmission networks at an effective variable cost of zero for their dispatched electricity;
10. Nonsite-specific auction: Bidders were able to identify potential sites and submitting documentation including resource assessment and grid interconnection; bidding documents listed available capacities of transmission interconnection nodes, substations, and network grids with the bidders responsible for confirming that the proposed project site is technically viable;
11. Relatively few qualification requirements to attract more private investors; and
12. Financial guarantees with strict penalties for delays or failure to deliver the contracted energy helped ensure that bidders committed to completing the projects.

Table C-1 in Annex C shows the main risks and risk mitigants in Peru's RE auctions. The main risks are institutional, construction (including the environmental and social permits), PPA offtaker and revenues, operational, PPA termination, currency and inflation, and curtailment. The key mitigants are: 1) contractual obligations under the long-term PPAs signed with the MEM as a guarantor representing the GoP; 2) use of performance, construction, and operation bonds and penalties for delays and underperformance; 3) due diligence reviews and timely independent supervision of the design, construction, operations, and environmental and social impacts; 4) assignment of rights to lenders to resolve terminations; and 5) indexing of prices to U.S. dollars and the U.S. inflation rate with Osinergmin supervision of the payment structure; and preferential dispatch.

The GoP held auctions for on-grid renewable electric power capacity in 2009, 2011, 2013, and 2015. Some aspects of the auction design changed over this period.[8] The bid bond equivalent was raised from $20,000/MW of installed capacity to $50,000/MW in 2013. The performance completion bond amount was increased from $100,000/MW of installed capacity to $250,000/MW in 2015.

Table 2. Total Results of the Four RE Auctions in Peru for On-Grid Power, 2009-2015

Auction Years	Technology	Capacity (MW)	Generation (MWh/year)
2009-2015	Small-scale hydropower	603 MW	3,500 MWh/year
	Wind	394 MW	1,700 MWh/year
	Photovoltaics	281 MW	739 MWh/year
	Biomass and biogas	35 MW	198 MWh/year
TOTAL		**1,313 MW**	**6,160 MWh/year**

Sources: Osinergmin 2014, 2015, and 2016.

[7]Renewable electric power producers received the wholesale spot market prices for electricity paid to all generators plus a variable price premium as needed. Premium prices for renewable electricity were incorporated in the tariffs paid by end users.

Table 3. Results of Each of the RE Auctions in Peru for On-Grid Power, 2009-2015

Auction Year	Technology	Projects	Awarded Capacity (MW)	Awarded Generation (GWh/year)	Average Price ($/MWh)
2009	Small-scale hydropower	19	181	1,091	59.9
	Wind	3	142	571	80.4
	Photovoltaics	4	80	173	221.1
	Biomass and biogas	3	29	155	58.8
Subtotal		**29**	**432**	**1,990**	**79.7**
2011	Small-scale hydropower	7	102	680	53.2
	Wind	1	90	416	69.0
	Photovoltaics	1	16	43	119.9
	Biomass and biogas	1	2	14	100.0
Subtotal		**10**	**210**	**1,153**	**62.0**
2013	Small-scale hydropower	19	240	1,278	56.6
Subtotal		**19**	**240**	**1,278**	**56.6**
2015	Small-scale hydropower	6	80	448	43.9
	Wind	3	162	739	37.7
	Photovoltaics	2	184	523	48.1
	Biomass and biogas	2	4	29	77.0
Subtotal		**13**	**430**	**1,739**	**43.1**
TOTAL		**71**	**1,312**	**6,160**	**61.2**

The four auctions led to contracts for nearly, 6,160 MWh-year of renewable electric power. About 56.5 percent was for small-scale hydropower, 27.4 percent for wind, 11.9 percent for solar, and 3.2 percent for biomass and biogas. In 2014, the GoP also held a separate auction for off-grid photovoltaics. Another auction for on-grid RE capacity was scheduled for 2017, but postponed to 2018 because the additional capacity was not yet needed.

The average contracted price per MWh decreased between the 2009 and 2015 auctions from $221 to $48 for solar power, from $80 to $38 for wind power, from $110 to $77 for biomass and biogas, and from $60 to $44 for small-scale hydropower. Between the 2013 and 2015 auctions, the average price fell 60 percent for solar power and 45 percent for wind power. The price reductions were mainly due to lower equipment and installation costs, developer learning curves, and increased interest in financing RE development.

Table C-2 in Annex C lists the winning bidders in Peru's fourth RE auction. International energy companies were most successful in this auction. Enel and Engie obtained contracts for nearly 71 percent of the total electricity. Grenergy Renovables, a Spanish IPP, was awarded 10 percent of the total.

Other winning bidders included an SPV owned by a Peruvian industrial group and some domestic developers.

Large, international companies have a comparative advantage in raising relatively low-cost capital through corporate or project financing and negotiating prices with their suppliers. As a result, they were able to submit competitive bids that still met their targeted investment returns. Other factors contributing to the dominance of large, international companies included the performance, construction, and commissioning bonds and penalties for delays in completing construction or producing less the contracted amounts of power.

3.4 FINANCING WINNING BIDS IN PERU'S FOURTH RE AUCTION

Equity. Enel, Engie, and Grenergy relied on low-cost capital from their corporate balance sheets. The Peruvian industrial group SPV and other domestic developers had publicly traded shares on the domestic stock exchange and corporate equity capital.

Debt financing. The winning bidders have sought project financing with loan tenors close to the 20-year length of their PPAs. The main sources of long-term financing for the winning bidders have been DFIs, domestic government development banks, and ECAs with some participation by commercial banks. This financing typically had 15-20-year tenors with a flexible repayment schedule. The government development bank, Corporación Financiera de Desarrollo (COFIDE) has mainly financed small-scale hydropower and biomass and biogas electricity, but has also participated in financing for large-scale RE developments. MDBs have mobilized commercial bank lending and helped facilitate partnerships with international companies.

Some RE developers in Peru have obtained long-term project financing, but the terms have generally been confidential. Some IPPs created SPVs to finance projects awarded in the auctions, such as Solarpack Corporación Tecnología and Cobra (a subsidiary of Grupo ACS). Ergon Peru was still in the process of structuring project financing with COFIDE and an international commercial bank for a photovoltaic contract awarded in the 2014 off-grid auction.

Capital markets. To date, most project bonds for infrastructure in Peru have been issued on the capital markets of other countries. In 2015, Energía Eólica S.A (a subsidiary of Contour Global) issued a 10-year, $204 million green bond denominated in U.S. dollars on a foreign capital market. This bond refinanced the pre-establishment and construction debt for the Cupisnique and Talara wind power projects awarded in Peru's first RE auction. However, Peru has a well-functioning domestic, capital market. Since private pension funds, insurance companies, and investment or lending trusts have purchased bonds for other types of infrastructure on the domestic capital market, there are potential opportunities for RE project bonds.

Although capital market transactions are potentially viable for long-term financing of RE development, they are unlikely to be used extensively in the short and medium-terms. The RE projects awarded through the auctions to date are too small for bond transactions. Also, project sponsors prefer to raise long-term project financing before construction begins. Furthermore, long-term debt financing has been available in Peru from DFIs with the participation of COFIDE and some commercial banks.

4. BRAZIL, INDIA, AND SOUTH AFRICA

4.1 BRAZIL

In 2016, the total installed capacity of electric power in Brazil was 149 GW, including approximately 19 percent (28 GW) from RE sources (BNEF 2017). Brazil has set capacity targets of 24 GW of wind power and 7 GW of solar power by 2024. Law 10.438 of 2002 created the Program of Incentives for Alternative Electricity Sources through a feed-in-tariff mechanism. Laws 10.847 and 10.848 in 2004 authorized RE auctions.

Two types of reverse energy auctions have been held in Brazil. Electricity distribution companies (DISCOs) have held auctions for new supply through PPAs. The costs of this electricity were passed on consumers via regulated tariffs. In addition, the Government of Brazil (GoB) has conducted auctions to contract for supplementary capacity to increase the system's reserve margin. The GoB auctions resulted in PPAs with the wholesale electricity market operator and the costs were passed on to all consumers through a reserve energy charge (Lucas, Ferroukhi, and Hawila 2013; Ferroukhi et al. 2015). Brazil held its first technology-specific power auctions in 2007.

Brazil's main policy incentives for RE included

- Competition among technologies through a hybrid two-phase auction selection process. The first phase is a descending price clock auction. The second phase is a pay-as-bid round with sealed-bids;
- Multi-year settlements to reduce the generators' volume risk;
- PPAs for 20-30 years with guaranteed tariffs paid in domestic currency adjusted for inflation;
- No local content requirements for auction bidders. However, some local content is needed to apply for low-cost, loans from the government development bank, Banco Nacional de Desenvolvimento Econômico e Social (BNDES);
- Import tax and state tax exemptions;
- Transmission discounts and preferences; and
- Net metering (Lucas, Ferroukhi, and Hawila 2013; Ferroukhi *et al.* 2015).

BNDES and other government development banks (such as Banco do Brasil and Banco do Nordeste do Brasil) have been the main financing sources for RE in the country. BNDES has provided RE financing since 2002. In 2009, Law 12.114 established a National Climate Change Fund Credit Line (Fundo Clima). This credit line enabled BNDES to provide long-term, low-cost, domestic currency loans for up to 70 percent of the capital cost of RE development and energy efficiency. Between 2006 and 2016, BNDES lent nearly $29 billion for RE development (excluding large hydropower). Some commercial banks have financed RE development by international companies (e.g., ENEL and Iberdrola) or local companies that have established client relationships with them (e.g., CPFL Energía).

Many auction participants in Brazil have faced challenges due to commercial bank concerns about project revenue risk because of the PPAs denominated in local currency and the overcontracting of RE generation in the 2014 and 2015 auctions. Brazil's recession and accompanying currency depreciation in 2015-2016 reduced the availability of lending capital from government development banks and commercial banks. These challenges have been reduced after some new sources of long-term financing entered the Brazilian RE market in 2016 and 2017 and the GoB held decontracting auctions in 2017 to reduce excess contracted capacity.

Some new financing sources have entered the Brazilian RE market. For example, Proparco (the private sector financing arm of the Agence Française de Développement) financed a solar power development by ENEL. KFW provided a credit line for BNDES on-lending that financed a solar power development by the French utility Électricité de France and Canadian Solar. Law 12.431 in 2011 authorized a tax exemption for domestic retail and foreign investors in local currency infrastructure bonds (debentures) on the domestic capital markets. Approximately $600 million of these debentures have been issued for wind power and hydropower in Brazil (Ferroukhi et al. 2015; Hawila, Cunha, and Bastos 2017; Lucas, Ferroukhi, and Hawila 2013).

The decontracting auctions relieved winning bidders of their obligations to develop new RE capacity or pay a large penalty. PPA holders who wanted to exit bid to reduce the cancellation penalties under their contracts. In 2017, the GoB agreed to cancel contracts for a total of 576 MW of wind and solar power capacity. The average original penalty for cancelling wind power contracts was $70.65 per MWh and winners of the decontracting auction winners were able to reduce this penalty to $22.9 per megawatt-hour. The average, original contractual penalty for cancelling a PV project per MWh was $57.84 and decontracting auction winners were able to reduce this to $15.6 per megawatt-hour (BNEF 2017). Brazil's decontracting auctions may be an interesting model for other countries facing an excess supply of RE capacity from auctions with "play or pay" requirements.

4.2 INDIA

In 2016, the total installed capacity for electric power in India was 314 GW and 16.5 percent (52 GW) was from renewable sources (BNEF 2017). The Government of India (GoI) set a target of 175 GW of RE by 2022, including 100 GW of solar power and 60 GW of wind power. In 2008, the GOI established the National Solar Mission Program (NSMP), which included feed-in-tariffs, auctions, and a requirement for electricity distribution companies to purchase RE or RE certificates.

RE auctions have been conducted in India at both the national and state government levels. At the national level, the National Thermal Power Corporation or the Solar Energy Corporation of India had authority to sign PPAs with government-owned DISCOs or other institutional offtakers. State governments could also sign PPAs with state-owned DISCOs. National and state government agencies could also create joint entities for procurement of land and infrastructure for solar parks and invite private companies to bid on solar energy development.

The GoI established the following incentives for RE development:

- Guaranteed prices through 20-year PPAs in domestic currency without an adjustment for inflation;
- Feed-in tariffs;
- RE auctions;
- Accelerated depreciation;
- *Viability gap funding*: Payment of a capital subsidy in the initial years of operation in addition to a fixed tariff over the plant's useful life; and
- *Flexible local content requirement*: Bidders choose whether to accept a local content requirement by participating in a separate auction category with different pricing. Bidders can participate in both categories, submitting offers with and without local content.

Energy developers have faced some challenges with the RE auctions in India:

- High project revenue risk due to domestic currency payments without an inflation adjustment have reduced investor and commercial bank interest in financing;

- Reductions in the planned frequency of RE auctions and the amount of renewable electricity available for contracting due to slower-than-expected growth in the demand for electricity and oversupply from previous auctions;
- Reluctance of offtakers to agree to new auctions or sign PPAs with winning bidders who obtained high prices; and
- State utility offtakers with below-investment grade ratings had difficulty obtaining long-term financing (BNEF 2017; Hawila, Cunha, and Bastos 2017; Lucas, Ferroukhi, and Hawila 2013).

The GoI has been considering ways to address some of these challenges by diversifying sources of long-term financing, incorporating credit guarantee structures to mitigate offtaker risks, and developing a currency hedging facility. The main sources of long-term funding were government and state-owned development banks, government agencies, some domestic commercial banks, and DFIs offering concessional financing. Government entities were also considering the issuance of tax-free bonds on the domestic capital market.

4.3 SOUTH AFRICA

The Republic of South Africa had an installed electric power capacity of 48.27 GW, with 80 percent from coal and only seven percent from RE sources (Reuters 2018). The country has generated as much as 7,646 GWh of renewable electricity per year. The utility company ESKOM generated 95 percent of the electricity used in the country and was the sole buyer of independently produced power. The country has had rolling power blackouts due to maintenance problems at aging coal-fired plants (BNEF 2017). South Africa's Integrated Resource Electricity Plan (IRP) 2010–2030 set a target of 17.8 GW of renewable electric power capacity by 2030. Although the government has proposed to reduce this target, a change has not yet been approved (Climate Action Tracker 2018).

In 2011, the RSA introduced the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) program. The objectives of REIPPPP were to 1) increase total power generation capacity; 2) diversify the energy mix with less carbon-intensive technologies at lower prices; and 3) promote local economic development by awarding contracts based on a 70 percent/30 percent split between price and economic development considerations. REIPPPP's target was 13 GW of RE with an initial 3.7 MW target to be contracted through five technology-specific auctions by 2016. There were separate targets for each RE technology: 1,850 MW from wind power, 1,450 MW from photovoltaics, 200 MW from concentrating solar technologies, 25 MW from landfill gas, 12.5 MW from biomass, 12.5 MW from biogas, 5 MW from small-scale hydropower, and 100 MW from various types of small applications below 5 megawatts.

The main incentive for RE auction bidders in South Africa was the availability of 20-year PPAs with fixed tariffs denominated in local currency and indexed to domestic inflation. Winners received PPAs signed by the offtaker utility Eskom and the South African Department of Energy. Government participation was viewed as providing a sovereign guarantee in the event of a default by Eskom.

The results of South Africa's first RE auction in 2011 raised concerns with Eskom because the contracted prices were higher than anticipated. The winning bids were relatively high because the ceiling prices were based on the previous feed-in-tariffs and were disclosed before the auction. As a result, bidders viewed the ceiling prices as a benchmark. In addition, the lack of capacity caps for each RE technology reduced competition and contributed to keeping the average bids near the ceiling prices. The RSA addressed these problems by changing the design of subsequent RE auctions. The changes included lower ceiling prices that were not disclosed for each RE technology, capacity caps for each technology, and clearer criteria for economic development scoring. These changes and the market's learning-curve raised competition in the subsequent six rounds through 2015 (Lucas, Ferroukhi, and Hawila 2013; Ferroukhi et al. 2015).

Most of the winning bids from the first three auction rounds that obtained financing had project finance loans with a tenor of 15 to 17 years. However, some transnational companies (e.g., Enel) used corporate debt. The Touwsrivier Solar Park was financed by a corporate bond on the domestic capital market (Eberhard, Anton; Joel Kolker; and James Leigland 2014). The external financing sources in the first three auctions were local commercial banks (64 percent of the total), DFIs (31 percent) and pension and insurance funds (five percent). Nearly 86 percent of the debt financing included the participation of large, domestic commercial banks as co-lenders or providers of subordinated debt. These sources included 1) government development banks (the Industrial Development Corporation and the Development Bank of Southern Africa), 2) domestic insurance companies and pension funds directly or through investment funds, and 3) domestic and international energy developers. Some of the commercial bank loans are expected to be sold on the secondary capital markets over time to manage risk and finance new loans.

The REIPPPP was successful in generating RE developer interest and the first four auctions were oversubscribed. Table 4 lists the companies that participated in the first four auctions. A serious bottleneck emerged after the fourth auction and a follow-on solicitation. In 2015, the Department of Energy (DOE) had approved bids for 2,230 MW of renewable electric power capacity (including 1,372 MW of onshore wind, 830 MW of PV, 40 MW of biomass, and five MW of small-scale hydropower). However, the winning bidders could not obtain financing or proceed with development because Eskom refused to sign offtaker agreements. Eskom was in financial distress and claimed that the transmission infrastructure was inadequate for the new RE capacity. The South African Renewable Energy Council threatened to sue Eskom over its alleged preference for nuclear power over renewable energy. The impasse continued for nearly three years, despite pressure from the Ministry of Energy and the president.

In July of 2016, the African Development Bank provided a $1.34 billion loan to Eskom to expand and improve the transmission network. However, the utility was still at risk of bankruptcy and faced weak demand for electricity, allegations of corruption, and unanticipated costs for construction of two large coal-fired plants that were over budget.

On September 1, 2017, the DOE said that PPAs for 27 of the winning bidders from 2015 would be signed by October 28, 2017, but at a lower renegotiated tariff of 770 rand per MWh or less and with additional local ownership requirements. However, this did not happen. In February of 2018, Eskom obtained a short-term, $400 million bridge loan from South Africa's Public Investment Corporation and a government employees pension fund as well as a one-year, $1.7 billion loan from a group of banks (Burkhardt 2018; Deign 2018).

After the new loans improved its financial position, Eskom finally signed $4.7 billion of offtaker agreements with 27 auction winners from 2015 in April of 2018 (Reuters 2018). These agreements included the price cap announced in 2017. Figure 1 shows the effect of the price cap on the winning bids from the 2015 auction.

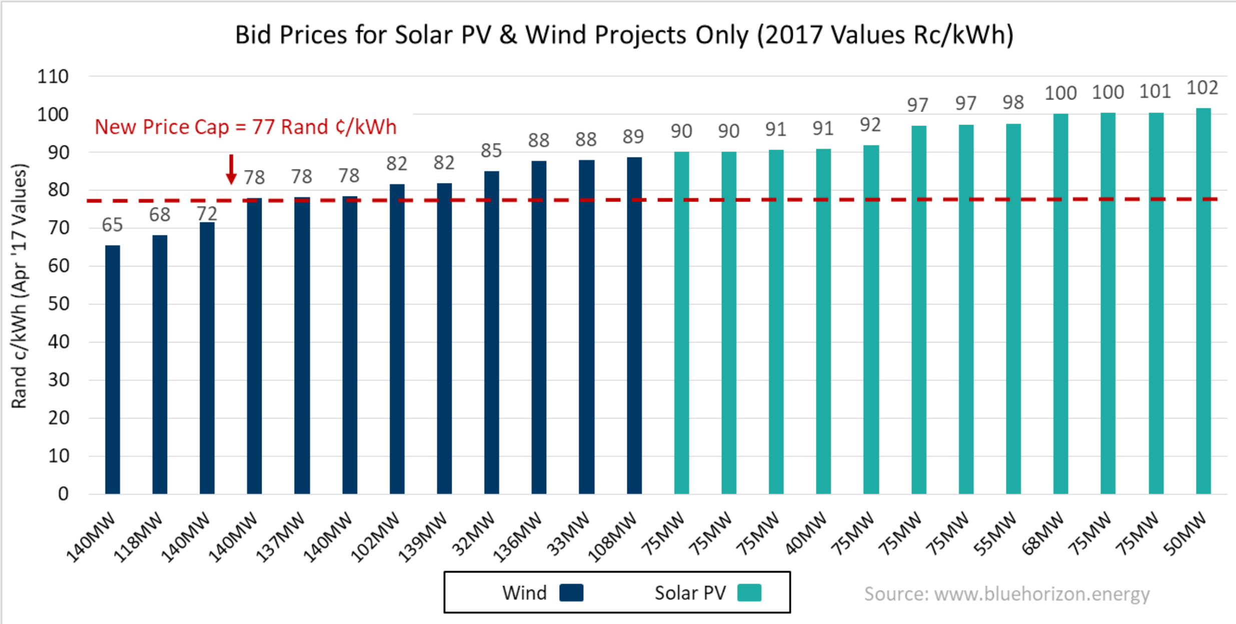
Table 4. Companies Participating in the First Four RE Auctions in South Africa

	IPPs & Project Developers	Project Financiers & Equity Firms	OEMs & Suppliers
Americas	BrightSource Energy (U.S.) Globeleq (U.S.) SkyPower (Canada) SolarReserve (U.S.) SunPower (U.S.) SunEdison (U.S.)	International Finance Corporation (U.S.) Overseas Private Investment Corporation (U.S.)	First Solar (U.S. SunPower (U.S.)
Asia	China Longyuan Power (China) Shapoorji Pallonji Group (India)	China Development Bank (China) Industrial and Commercial Bank of China (China)	JinkoSolar (China) ReneSola (China) Vikram Solar (India)
Europe	Abengoa (Spain) Acciona Energia (Spain) Building Energy (Italy) EDF Energies Nouvelles Enel Greenpower (Italy) Engie (France) Grupo Cobra (Spain) Juwi Renewable Energies (Germany) Mainstream Renewable Power (Ireland) Norwegian Investment Fund (Norway) Scatec Solar (Norway) Solafrica (Switzerland) Solairedirect (France)	Actis Africa (UK) Deutsche Bank (Germany) Investec (UK)	ABB (Switzerland) Elettronica Santerno (Italy) Energia Ercam (Spain) FG.de (Germany) GRI Renewable Industries (Spain) Nordex SE (Germany) Siemens (Germany) SMA (Germany) Vestas (Denmark)
Middle East	ACWA Power (Saudi Arabia)		
South Africa	AE AMD Renewable Energy; Afri-Devo; Ample Solar; CEF Group; Enzani Technologies; Emvelo; Ennex Developments; Eskom; Mulilo Renewable Energy; Old Mutual Life Assurance Company; Red Cap Investments; Simacel; Solar Capital; Thebe Investment Corporation; Usizo Engineering	ABSA Bank; African Infrastructure Investment Managers; Industrial Development Corporation; Nedbank; Public Investment Corporation; Rand Merchant Bank; Standard Bank	ARTsolar DCD Wind Towers

Source: Research by New Energy Update

Source: Energy Intelligence (2016).

Figure 1. Effects of the 2017 Price Cap on 2015 Auction Winners in South Africa



Source: Ahlfeldt 2017

6. CONCLUSIONS

Reverse auctions have become widely used in many developing countries to encourage private investment in renewable electric power capacity and generation. Reverse auctions foster competition to help ensure that the lowest prices can be obtained. They are particularly useful as equipment and installation costs decrease due to technological improvements, economies of scale in manufacturing and installation, and the domestic learning curve in RE development and financing. The governments of El Salvador, Mexico, and Peru have successfully attracted experienced private sector RE developers and investors at lower contracted prices in each of the reverse auctions held to date. Brazil, India, and South Africa have also had successful RE auctions.

The policy and regulatory environment for RE development affect the prospects for successful implementation of reverse auctions and completion of the awarded projects. Key elements include transparency and freedom from corruption in the auction and contracting processes and construction and operation stages. Specific targets for RE capacity or generation and a schedule of future dates for reverse auctions can facilitate private sector planning and financing. Reverse auctions work best when combined with well-structured, long-term PPAs indexed to a major foreign currency and the inflation rate. Tax incentives and foreign investment and trade policies also affect the prospects for success. Timely access to accurate information on the capacity of transmission interconnection grids and nodes is important for good site selection. Priority dispatch and access to transmission grids mitigates the risks of curtailment that reduces revenues from the generated power. El Salvador, Mexico, and Peru have revamped their policy and regulatory environments to facilitate private investment in RE and continue procurement through new capacity through competitive auctions.

As the economic viability of RE development has approached and even exceeded that of conventional power resources, international and domestic private financial institutions and investors have become increasingly interested in providing debt and equity financing. The financing of RE is no longer primarily the domain of multilateral development banks, bilateral donors, and domestic government development banks.

Some challenges remain in scaling up the results that have already been achieved through RE auctions in the countries discussed in this report. Mexico was still in the process of sustaining its power generation and distribution reforms, including privatization and deregulation and operations of the auction clearinghouse and wholesale spot market. It will also need to continue investing in expansion and improvement of the transmission grid, especially in remote areas. Peru was coordinating with key stakeholders to update its long-term energy plan and targets. El Salvador should consider establishing targets for RE sources and the frequency of RE auctions.

Brazil has had to hold decontracting auctions because it had awarded PPAs for too much renewable power too quickly. Domestic currency and inflation risks have caused financing problems for bid winners in India. South Africa has faced bottlenecks from the poor financial position of its single utility. Many other developing countries have not yet used reverse auctions for RE development.

Access to financing is critical to ensure that the contracted RE development is built in a timely manner or at all. The types of financing required varies with the characteristics of the winning bidders. Large, international companies have greater access to their own corporate equity and balance sheet debt financing. Smaller IPPs and domestic energy developers often need long-term, limited-recourse project financing. In many countries, the main sources of long-term project financing for RE development over the past decade have been DFIs and national government development banks, although there has been increasing participation by commercial banks in recent years.

Commercial banks and institutional investors have gained confidence in the technical and financial viability of renewable electric power generation due to the technological improvements and cost reductions. Nevertheless, the relatively long tenors and high leverage ratios needed for many RE investments present challenges for many commercial banks. For-profit financial institutions that have provided long-term project financing for RE investments have typically offered shorter loan tenors than multilateral development banks or government development banks. Although the technology risks and unit costs of these investments have greatly decreased, some commercial banks may face pressures to reduce their long-tenor lending to meet the more stringent minimum capital, leverage, and liquidity requirements under the finalized Basel III agreement for 2017 to 2027.

Some commercial banks have adapted financing structures for other types of long-term infrastructure investments to RE development.   One example is the use of mini-perm loans with medium-term tenors to be refinanced after the RE facility has a sufficient track record of revenue generation. Another example is the energy investment trust, which can potentially offer higher investment returns with higher risks and can be sold on equity markets for greater liquidity.

Project bonds can be issued on foreign or domestic capital markets to finance or refinance develop and operation of a very large RE project or set of projects long-term financing of RE development and operations. Bonds can provide institutional investors with moderate, but relatively stable, long-term returns backed by project revenues. The risks of bonds are relatively low and can be mitigated by government or donor guarantees. Since bonds are tradeable, they also offer the advantage of liquidity. Infrastructure revenue bonds can attract new international capital into the country and may also interest domestic institutional investors such as private pension funds and insurance companies with continuing obligations for local currency payments. However, a typical bond issuance will need to be $100 million or more.   Commercial bank or development bank loans can also be securitized into bonds, but a portfolio of loans will need to be held or sold and warehoused until a sufficient volume has been accumulated for securitization. Banks can then use the proceeds for new lending.

ANNEX A. EL SALVADOR TABLES

Table A-1: Investment Risks and Mitigants for Bidders in El Salvador's RE Auctions

Types of Risks	Risk Mitigants
Approval and Construction Delays: Risks associated with obtaining permits and licenses. License and environmental and social permits may be problematic for developers who have not secured land and development rights and obtained agreement from local communities.	• Winning bidders bear the risks of ensuring technical viability of the project and obtaining the required permits and licenses. • Contractual obligations under the PPAs, including performance, construction, and operation guarantees and penalties for delays and underperformance.
Offtaker: Contracted power capacity and associated generation are stated in separate PPA contracts with each of the seven privately owned, power distribution companies in proportion to their shares of the wholesale market. No cross-default mechanisms.	• Performance and payment guarantees posted by the offtakers. • Functioning wholesale spot market. • Approximately 97 percent of the power generation was contracted with distribution companies owned by international energy companies with good performance and payment track records (AES owned four distribution companies with 70 percent of the contracted volumes. Colombian Empresas Públicas de Medellin owned DelSur with 27 percent of the total). • Regulatory framework set forth contractual obligations under the PPAs.
Net Revenue: PPAs require winning bidders to sell all the electricity from the awarded installed capacity.	• The PPAs were not financial contracts. • No net metering, required annual rebalancing of energy dispatched, or direct exposure to the wholesale spot market. • Regulatory framework of the RE auctions that set forth the contractual obligations under the PPAs. • Project financing incorporating structured to mitigate the potential adverse impact of lower project revenues.
Operational: Exposure to land tenure conflicts arising from: 1) periodic land lease renewal contracts; 2) unforeseen environmental or social issues: 3) poor management: 4) lower than planned availability of RE resources: and 5) higher than anticipated costs for maintenance and replacement.	• Requirements for comprehensive due diligence and timely, independent review of the relevant design, construction, planned operations, and environmental and social impacts. • Construction, performance, and operation guarantees required under the PPA and project financing.

Table A-1. Investment Risks and Mitigants for Bidders in El Salvador's RE Auctions (Continued)

Types of Risks	Risk Mitigants
PPA Termination: No termination payments for generators for any reason.	• Defined time period for lenders or other financing sources to cure defaults or noncompliance by RE developers or generators.
Currency and Inflation: A lower exchange rate for domestic currency against major foreign currencies can reduce profitability if financing costs are denominated in foreign currency and revenues are set in domestic currency. Inflation can also increase operating costs and erode the value of non-inflation indexed revenues.	• Payments made in U.S. dollars indexed to the U.S. inflation rate.
Curtailment: Power generation facilities that depend on sales to the transmission grid may not be able to sell all their electricity if the demand is less than the supply when it is available and power storage technologies are not used. Power dispatch to the grid may also be hindered by safety and reliability problems in the transmission network.	• Awarded projects are required to demonstrate technical viability, including interconnection to transmission grids with available capacities for each node. • Available grid capacities disclosed in the bidding documents. • Awarded projects have preferential dispatch to the transmission grids. • Proven track record of annual grid extensions. Failure to renew assigned rights to access the transmission grid can only be justified due to safety and reliability concerns and has rarely occurred.

Table A-2. Awarded Capacity and Prices in El Salvador's 2014 RE Auction

Winning Bidders (Companies)	Power Source	Capacity (MW)	Price ($/MWh)
Neoen-Almaval	Photovoltaics	60	$101.90
Real Renewable Infrastructure Fund	Photovoltaics	8	$123.41
Real Renewable Infrastructure Fund	Photovoltaics	6	$123.41
Solar Reserve Development (Subsequently acquired by Real Renewable Infrastructure Fund)	Photovoltaics	20	$123.41
TOTALS		**94**	**$472.13**

Source: DELSUR (2014).

Table A-3. Winning Bids in El Salvador's 2016 RE Auction

Winning Bidders (Companies)	Power Source	Capacity (MW)	Price ($/MWh)
Neoen-Almaval	Photovoltaics	50	$49.55
Neoen-Almaval	Photovoltaics	50	$49.56
Real Renewable Infrastructure Fund	Photovoltaics	10	$67.24
Asocio Ecosolar	Photovoltaics	9.9	$54.98
Tracia Network Corporation	Wind	50	$98.78
TOTALS		**169.9**	**$320.11**

Source: DELSUR (2016).

ANNEX B. MEXICO TABLES

Table B-1. Investment Risks and Mitigants for Bidders in Mexico's Energy Auctions

Types of Risks	Risk Mitigants
Institutional: Risks associated with energy sector reforms, operations of the clearinghouse, consolidation of wholesale spot market, and operations of the new entities.	• Current government commitment to the policy and regulatory reforms and clean energy auctions and the new sectoral entities and markets.
Approval and Construction Delays: Risks associated with obtaining permits and licenses. License and environmental and social permits may be problematic for developers who have not secured land and development rights and obtained agreement from local communities. Some areas with high wind power potential in Mexico have been blocked from development by conflicts with local communities with traditional land tenure systems.	• Winning bidders are responsible for technical and financial viability. • Contractual obligations under the PPAs, including performance, construction, and operation guarantees and penalties for delays or underperformance.
Offtaker: The CFE was the sole offtaker for the first two RE auctions. Private offtakers were allowed to participate in subsequent auctions, but had not proven their long-term viability. The wholesale spot market for electricity was still new.	• Regulatory framework for the CE auctions and CELs. • Clearinghouse guidelines for payment structures, funded reserves, performance bonds, developer performance bonds, and offtaker payment guarantees.
Net Revenue: The "deliver or pay" requirement of the PPAs makes it necessary to fill shortfalls in generation by buying power on the wholesale spot market. This purchase price could be higher than the sales price under the PPA. The lower awarded prices in PPAs based on recent auctions may increase net revenue risks. The PPAs also expose RE operators to hourly correction factors based on the time of sale of the electricity.	• Project financing limited to projected revenues from expected availability of RE resources. A credit line may be needed to mitigate larger supply shortfalls. • Risks of lower RE generation levels, higher spot market prices, and lower availability of CELs or firm capacity can be mitigated by a higher debt service coverage ratio, larger debt service reserve accounts, cash-sweep mechanisms for early debt repayment, and reducing debt after the PPA period.

Table B-1. Investment Risks and Mitigants for Bidders in Mexico's Energy Auctions (Continued)

Types of Risks	Risk Mitigants
Operational: Less than projected availability of RE resources, higher operating and maintenance costs, and costs or conflicts associated with land lease renewals.	• Land acquisition and access risks can be reduced by siting in areas where land is available for purchase or leasing and land and resource rights are not disputed by local populations. Environmental and social impacts can be carefully assessed and reduced or compensated and monitored during establishment and operations. • RE resource risks can be decreased through good siting, technology choice, well-managed operations, and purchase of parametric insurance for extreme weather conditions. • Financing can be structured to alleviate net revenue shortfalls. • Construction, performance, and operation guarantees required under RE sale agreements administered by the clearinghouse.
PPA Termination: RE developers or generators do not receive termination fees if a PPA is ended for reasons specified in the agreement.	• Since the third RE auction in Mexico, offtakers have had to post financial guarantees or funded reserves administered by the clearinghouse. • Defined time period for lenders or other financing sources to cure defaults or noncompliance by RE developers or generators.
Currency and Inflation: A lower exchange rate for domestic currency against major foreign currencies can reduce profitability if financing costs are denominated in foreign currency and revenues are set in domestic currency. Inflation can also increase operating costs and erode the value of non-inflation indexed revenues.	• PPA payments denominated in U.S. dollars indexed to the U.S. inflation rate.
Curtailment: Power generation facilities that depend on sales to the transmission grid may not be able to sell all their electricity if the demand is less than the supply when it is available and power storage technologies are not used. Power dispatch to the grid may also be hindered by safety and reliability problems in the transmission network.	• Requiring bidders to demonstrate technical viability, including interconnections to the transmission grid and the available capacity of each node grid. Exceptions have been allowed if additional investments in transmission grids were expected to be completed on time. Awarded projects also received preferential dispatch to the transmission grids.

Table B-2. Awarded Capacity, Power Generation, and Prices in Mexico's First Three CE Auctions

Auction Date	Target Volume Contracted	Target for CELs	Total Clean Energy Generation and Average Price	CELs (million)	Solar Power Price and Share	Wind Power Price and Percent Share	Firm Capacity and Price (Clean and Conventional Energy)
Auction 1 (March 2016)	Power generation: 85%	85%	5.4 TWh ($47.6/MWh)	5.4	$45.06/MWh (81%)	$55.33/MWh (19%)	No
Auction 2 (September 2016)[a]	Power generation: 84% Firm Capacity: 80%	87%	8.9 TWh ($33.5/MWh)	9.3	$31.81/MWh (54% of power generation and 53% of CELs)	$35.77/MWh (44% of power generation and 41% of CELs)	1,187 MW ($32.29/MWh): 72% natural gas,15% solar, 11% wind, and 2% geothermal
Auction 3 (November 2017)	Power generation 98% Firm Capacity: 42%	90% (of target volume to be contracted)	5.5 TWh ($19.8/MWh)	5.9	$19.0/MWh (55% of power generation and 58% of CELs)	$18.6/MWh (45% of power generation and 42% of CELs)	593 MW ($35.36/MWh): 84% natural gas, 14% wind, and 2% solar

[a] Includes contracted geothermal power and CELs from hydropower and geothermal power

Sources: CENACE (2016a; 2016b; 2017).

Table B-3. Winning Bidders in Mexico's First Energy Auction

Winning Bidders	Power Source	Awarded Generation (GWh)	Awarded CELs (Million)
Enel Green Power	Photovoltaics	2,200	2,200
Acciona Energy	Wind	586	586
Vega Solar	Photovoltaics	740	725
JinkoSolar	Photovoltaics	503	503
Consorcio Energía Limpia 2010	Wind	292	292
Sunpower	Photovoltaics	269	264
Energía Renovable de la Península	Wind	276	276
Aldesa	Wind	231	231
Recurrent Energy	Photovoltaics	141	141
Sol de Insurgentes	Photovoltaics	61	61
Photomeris	Photovoltaics	60	53

Source: CENACE (2016a).

Table B-4. Winning Bidders in Mexico's Second Energy Auction

Winning Bidders	Power Source	Awarded Generation (GWh)	Awarded CELs (Million)	Awarded Firm Capacity (MW)
Alten Energía Renovables Mexico Cuatro	Photovoltaics	722	812	75
AT Solar	Photovoltaics	478	478	29
Blumex Power	Photovoltaics	250	250	0
CFE	Natural gas	199	199	375
CFE	Geothermal	0	0	25
Consorcio ENGIE Solar Trompezón	Photovoltaics	343	339	0
Consorcio Fotowatio	Photovoltaics	779	779	0
Consorcio Guanajuato	Photovoltaics	147	147	12
Consorcio SMX	Photovoltaics	286	278	10
ENEL Green Power	Wind	399	399	0
Energía Renovable de la Península	Wind	0	0	30
Energía Sierra Juarez Holdings	Photovoltaics	114	117	0
Eólica de Oaxaca	Wind	818	818	0
Quetzal Energía México	Photovoltaics	394	394	0
OPDE	Photovoltaics	290	290	0
Generadora Fenix	Hydro	0	315	0
Parque Eólico Reynosa III	Wind	1,613	1,613	0
Kamet Energía México	Photovoltaics	353	353	0
X-Elio Energy	Photovoltaics	363	363	30
Parque Eólico El Mezquite	Wind	821	775	77
Frontera México Generación	Natural gas	0	0	475

Table B-4. Winning Bidders in Mexico's Second Energy Auction (Continued)

Winning Bidders	Power Source	Awarded Generation (GWh)	Awarded CELs (Million)	Awarded Firm Capacity (MW)
Tractebel de Energía de Altamira	Wind	223	223	0
HQ México Holdings	Photovoltaics	252	252	18
Green Hub	Photovoltaics	73	73	0

Source: CENACE (2016b).

Table B-5. Winning Bidders in Mexico's Third Energy Auction

Winning Bidders	Power Source	Awarded Generation (GWh)	Awarded CELs (Million)	Awarded Firm Capacity (MW)
ENEL Rinnovabile	Wind	2,090	2,090	0
Consorcio Engie Solar	Photovoltaics	1,146	1,262	0
France	Wind	363	392	31
Neoen International	Photovoltaics	617	771	0
Canadian Solar	Photovoltaics	652	765	0
X-Elio	Photovoltaics	435	484	10
Mitsui and Trina Solar	Photovoltaics	190	190	0
Energía Renovable del Istmo	Wind	0	0	52
Compañía Electricidad Los Ramones	Natural Gas	0	0	500

Source: CENACE (2017).

Table B-6. Examples of Financial Institutions Participating in Publicly Disclosed, Closed Financing in Mexico's CE Auctions

Winning Bidders	Project Name and Energy Source	Development Finance Institutions	Government Development Banks	Commercial Banks
Cubico Sustainable Investments and Alten Energías Renovables	Solem I and II (solar)	IFC, IDB/IIC, the Chinese Co-financing Fund for Latin America and the Caribbean, and the Canadian Private Sector Climate Fund (C2F)	Banobras, Bancomext	Mitsubishi UFJ Financial Group (MUFG)
Cubico Sustainable Investments and Alten Energías Renovables	El Mezquite (wind)		Bancomext, Banobras, Banco de Desarrollo del Norte (BDAN)	
Zuma Energía	Santa Maria and Orejana (solar)		Banobras, NAFIN, Bancomext, BDAN	
Zuma Energía	Reynosa (wind)	EKF (Denmark Export Credit Agency)	Bancomext, NAFIN, Banobras	Banco Santander
Fotowatio Renewable Ventures (FRV)	Potosí Solar (solar)	KFW	Bancomext	ING
X-Elio (in structuring)	Conejos-Terranova, Xooxocotral, Guanajuato (wind)	IDB/IIC (currently mobilizing C2F), the Instituto de Crédito Oficial (Spain)		

ANNEX C. PERU TABLES

Table C-1. Investment Risks and Mitigants for Bidders in Peru's RE Auctions

Types of Risks	Risk Mitigants
Institutional: Uncertainty over the auction process and future volumes to be contracted through due to potential increases in the government's target for renewable electric power.	• The GoP's commitment to effective coordination among key stakeholders and the successful implementation of RE auctions. • Auctions specified targeted volumes to be contracted and the design of the auction process.
Approval and Construction Delays: Risks associated with obtaining permits and licenses. License and environmental and social permits may be problematic for developers who have not secured land and development rights and obtained agreement from local communities.	• Winning bidders are responsible for ensuring the project's technical viability and obtaining permits and licenses. • Contractual obligations under the PPAs, including performance, construction, and operation guarantees and penalties for delays and underperformance.
Offtaker: Risks associated with absence of a specific offtaker.	• The MEM signs the PPAs as the relevant governmental entity.
Net Revenue: Risks associated with the payment structure through feed-in tariffs with premiums over wholesale spot market prices.	• Osinergmin's supervision of the payment structure under the PPA. • 100 percent compliance with the PPA payment structure to date.
Operational: These risks are mainly from the exposure to potential difficulties from land tenure arrangements at the project site locations arising from: 1) periodic land lease renewal contracts; 2) unidentified environmental and/or social issues; 3) inadequate management or unforeseen claims by local communities at the site location; 4) lower availability of energy generation resources: and 5) larger required equipment maintenance than originally estimated.	• Project financing structured to reduce the adverse impact of lower project revenues. • Requirements for comprehensive due diligence and timely independent supervision of design, construction, environmental, social, and operation aspects. • Construction, performance, and operation guarantees required under the PPA and the debt project financing structural elements.
PPA Termination: PPAs do not contemplate a termination payment to the generator in the event the PPA is terminated due to any termination event contemplated in the PPA.	• The MEM serving as guarantor of the PPA. • Good track record of the payment mechanism under the PPA.

	• Assignment to project lenders of a period to cure any event of default or noncompliance by the generator that may lead to the termination of the PPA.

Table C-1. Investment Risks and Mitigants for Bidders in Peru's RE Auctions (Continued)

Types of Risks	Risk Mitigants
Currency and Inflation: A lower exchange rate for domestic currency against major foreign currencies can reduce profitability if financing costs are denominated in foreign currency and revenues are set in domestic currency. Inflation can also increase operating costs and erode the value of non-inflation indexed revenues.	• Payments under the PPA made in U.S. dollars and indexed to U.S. inflation.
Curtailment: Power generation facilities that depend on sales to the transmission grid may not be able to sell all their electricity if the demand is less than the supply when it is available and power storage technologies are not used. Power dispatch to the grid may also be hindered by safety and reliability problems in the transmission network.	• Awarded projects are required to demonstrate technical viability, including interconnection to transmission grids with available capacities based on each node grid available capacities disclosed in the bidding documents. • Awarded projects are in zones with transmission interconnection nodes with available capacities with no foreseen required investments. • Awarded projects also have preferential dispatch to the transmission grids.

Table C-2. Winning Bids in Peru's Fourth Auction

Winning Bidders	Technology	Installed Capacity (MW)	Associated Energy (GWh-year)	Awarded Price ($/MWh)
Enel Green Power	Wind	126	573	$37.8
Enel Green Power	Photovoltaics	144	415	$47.9
Enel Green Power	Small hydropower	20	132	$43.9
Edegel	Small hydropower	0.7	5	$58.2
Enersur	Photovoltaics	40	108	$48.5
Paino SAC	Wind	18	85	$36.8
GR Taruca	Wind	18	81	$37.7
Consorcio Hidroeléctrico Sur-Medio	Small hydropower	30	142	$45.4
Empresa Generación Eléctrica Rio Baños	Small hydropower	20	110	$40
Consorcio Hydrika	Small hydropower	9	60	$45.9
Empresa Concesionaria Energía Limpia	Biomass	4	29	$77

Source: Osinergmin (2015).

ANNEX D. TERMINOLOGY

Debt financing includes loans and bonds. For most RE investments, debt financing mainly refers to loans from commercial banks, government development banks, DFIs, climate investment funds, or investors. Direct bond financing may be available for very expensive RE investments, such as large-scale hydropower or geothermal. In addition, a large volume of bank loans can be securitized into a bond issuance to attract new sources of capital for RE investments that are individually less costly.

There are two main types of debt—corporate finance and project finance. *Corporate finance* provides lenders with full recourse to a company's assets in the event of a loan default. *Full recourse* means that a lender can claim any assets from a parent company to satisfy an unpaid debt. In the absence of donor or investor subsidies, corporate finance is generally less costly than project finance due to the lower risk for the lender.

Project finance is based on the projected cash flows from a specific investment and only provides limited recourse for lenders. *Limited recourse* means that a lender cannot claim the assets of the parent company if the loan collateral is insufficient to repay the debt. The loan collateral may include the assets financed by the loan. Although developers may have to provide corporate guarantees to cover unforeseen cost increases or underperformance with limited recourse financing, these commitments expire when the RE facility reaches the commissioning stage. Most developers prefer project finance over corporate finance because limited recourse reduces their potential losses in the event of a loan default. In developing countries, low-cost project finance for RE investments is often available from DFIs, such as multilateral development banks (MDBs), international financial institutions (IFIs), and international climate investment funds.

CE developers generally want long loan tenors that allow loan repayments that fit within projected cash flows. They also want a loan that covers a large loan share of their capital costs (high leverage ratio) to help them meet their targeted investment returns. Long loan tenors and high leverage ratios pose challenges for commercial banks lending with their own capital. More stringent, international banking standards (Basel III) have further restricted commercial banks' ability to offer long tenor loans. The commercial banks that have financed CE investments have often provided shorter-tenor loans than DFIs and government development banks are able to offer. Donor or DFI capital or loan guarantees have reduced commercial bank and development bans concerns about technology risks, long loan tenors, and high leverage ratios s and helped them gain experience in financing RE investments. Although technological improvements, economies of scale, and lower installation costs have decreased the capital costs of RE, they have also enabled developers to submit lower bid prices. As a result, RE investments may require longer loan repayment periods.

Mini-perm financing refers to short-term loans for income-producing construction or commercial or multi-family residential properties, usually payable in three to five years. "Perm" is short for "permanent". A *hard mini-perm* is a project finance structure that allows completion of a project and an initial period of operations, but forces a borrower to refinance before maturity or default. The maturity period is typically five to seven or ten years for renewable electric power. The demonstrated history of operations can make it easier to obtain refinancing, but the operator is exposed to positive or negative interest rate risk and refinancing costs in the future. A *soft mini-perm* does not require the borrower to refinance, but carries interest rates or fees that increase over time, providing an incentive to refinance. Soft mini-perms are more common than hard mini-perms. Both structures reduce lender risk and the time their capital is tied up. As a result, they could increase the willingness of lenders to provide the initial financing and reduce the costs to the borrower.

Export credit agencies (ECAs) may provide grants and relatively low cost project financing. However, ECAs are generally tied to purchases of equipment or services from the providing countries or regions that may be more expensive or less appropriate to the scale and local conditions.

Equity is the difference between what companies own and what they owe. When a developer has a large equity stake, an investment may be more bankable because of the lower risks to lending institutions and demonstrated the commitment of developers and investors. Transnational energy companies (such as Enel Green Power and Engie) can make large equity investments in power generation capacity as sponsors or as shareholders through SPVs created for each project. These companies can use capital from their corporate balance sheets to make more competitive bids in RE auctions and tenders.

Increasingly, *independent power producers* (IPPs) and electricity developers have received capital from private equity funds and institutional investors interested in diversified clean energy portfolios in developing countries with growing economies and favorable policy and regulatory environments for renewable electric power. These financing sources are particularly interested in investing in projects with long-term, *power purchase agreements* (PPAs) that provide predictable revenues linked to U.S. dollars or local currency inflation rates in local currencies. Private equity funds are generally willing to accept higher risks in exchange for higher potential returns. Impact investors such as foundations, climate investment funds, and donors may emphasize environmental or social objectives, typically have lower targets for financial returns.

Capital market financing refers to bonds with a specified maturation date and usually a fixed interest yield. Bonds are tradeable in secondary markets and may sell at a discount or premium as interest rates in the economy and risk perceptions for the bond change. Capital market financing is only available for a very large project or set of projects. Bonds can have various terms of recourse or guarantees and are a relatively low-cost source of long-term financing for infrastructure. Bonds are generally placed after the construction phase is completed and construction risk has been covered. As a result, bond terms tend to be more favorable for the developers than project financing that funds construction. Bonds can increase the supply of low-cost financing by attracting international and domestic institutional investors. International investors often prefer bonds denominated in U.S. dollars or other major currencies. However, pension funds and insurance companies in developing countries are often interested in buying bonds denominated in local currency since they provide a natural hedge to meet their future local currency payment obligations in.

Long-term power purchase agreements (PPAs) reduce offtaker risks for electricity generated through capital-intensive technologies to help achieve planned investment returns. The monetary risks of long-term PPAs are reduced through deliver-or-pay contracts set in local currency or U.S. dollars and indexed to inflation. *Net metering* allows generators of electricity for their own use to sell surplus power on the grid at the price they would have had to pay to buy grid electricity. *Preferential dispatch* of CE to the transmission grid reduces the risks of curtailment when electricity supply exceeds the demand.

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