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Solar Power Energy

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Solar power is the conversion of sunlight into electricity through the use of solar cells, i.e., photovoltaic (PV) cells, or the use of concentrated solar power (CSP).

Solar energy systems can be either grid-connected or off-grid:

1. Grid-Connected Project

- Utility-scale grid-connected centralized generation feeds large amounts of electricity into the transmission lines. Similar to conventional energy projects utility scale PV (or CPS) projects are typically located far from areas of high population
- Grid-connected distributed generation sources, such as rooftop solar PV, can provide electricity with little impact on land use. They use existing infrastructure to harness solar energy and can be located in urban areas.

2. Off-Grid Electrification Projects

- Off-grid electrification projects principally aim to improve electricity access for populations in remote areas that are unlikely to be reached by grid extension within a reasonable time frame. These could be small solar rooftop projects or other small energy projects.

Below are examples of laws and regulations in various jurisdictions along with sample agreements relating to grid-connected centralized and distributed solar power projects, as well as further reading materials and resources.

Policies, Laws and Regulations: Solar Power

Global

- IEA/IRENA Global Renewable Energy Policies and Measures Database - The International Renewable Energy Agency (IRENA) maintains a joint database with the International Energy Agency (IEA) for policies and measures pertaining to renewable energy from around the world. The database is searchable by country and sector.

Project Documents and Contracts: Solar Power

Solar Roof Top

Chile

- Public Solar Roofs Program, which involves the installation of photovoltaic solar systems on roofs of public buildings. (El Programa Techos Solares Públicos (PTSP) está orientado a instalar sistemas fotovoltaicos en los techos de los edificios públicos). (Spanish)
- Ley para la Generación Distribuida 20571 of 6 September 2014 and Reglamentos.

France

- Standard contracts (approved by the Ministry of Energy Transformation and Solidarity - Ministère de Transition écologique et solidaire) related to PV solar projects (Contrats Filière photovoltaïque) published by EDF together with relevant legislation.
- Additional Information is available on the website of the Ministry of Energy Transformation and Solidarity Ministère de Transition ecologique et solidaire.

India

- Model Memorandum of Understanding (MOU) between Government Ministry/Departments and Expert Public Sector Undertakings (PSUs) for Development of Grid Connected and Off-Grid Roof-Top Solar Photovoltaic and Small Solar Power Plants of November 2016. Ministry/Department desires to implement grid connected rooftop solar PV projects on the roofs of its buildings/offices as well as ground mounted solar PV systems and desires to engage with PSUs for setting up such solar PV system and supply solar power at a tariff determined through competitive bidding processes. The parties enter into MOU for collaborating and jointly undertaking the identification, technical evaluation and development of potential sites for execution of solar power projects.
- Model Power Purchase Agreement (PPA) between Contractor and Government Organization/ PSU and Government Offices for Design, Manufacture, Supply, Erection, Testing and Commissioning including Warranty, Operation & Maintenance of Grid Connected Roof-Top Solar Photovoltaic and Small Solar Power Plants in RESCO model of November 2016
- Model Engineering, Procurement & Construction (EPC) Agreement Between Contractor and Government organization, PSU and Govt. Offices for Design, Manufacture, Supply, Erection, Testing and Commissioning including Warranty, Operation & Maintenance of Grid Connected and Off-grid Roof-Top Solar Photovoltaic and Small Solar Power Plants in CAPEX model of November 2016.
- Model Tender for implementation of 500 MW Grid Connected Rooftop SPV of May 2016 - Solar Energy Corporation of India Limited invites requests for selection (RfS) of bidders for implementation of 500 MW grid connected roof top solar PV scheme in different states of India under CAPEX and RESCO (Renewable Energy Service Company) model dated 22.4. 2016. In a RESCO model the bidders intend to take a rooftop owned by some other entity on mutually agreed terms and conditions

including lease agreement from the roof top owner(s) and enters into the PPA with a rooftop owner/DISCOM /others for supply of solar power by 25 year at a tariff as per RfS from the date of Commissioning of project. Under the "CAPEX Model" the bidder enters into an agreement with the rooftop owner at the quoted project cost as per RfS for the Scope of work not limited to that indicated in the RfS as per mutually agreed terms and conditions. This model also allows energy sale at a tariff as per RfS.

- Model Tender Document for Grid connected Rooftop Solar PV (Posted on 21.10.2015).

Maldives

- Bidding Documents for roof top solar PV project on a design, build, finance, operate and transfer (DBFOOT) basis. According to the bidding documents the private partner would design, build, finance own and operate the grid-connected solar PV electric generating facilities situated at the roof top of government owned buildings. The electricity generated would be purchased by a state-owned utility under a long-term Power Purchase Agreement at a fixed tariff. The IPP would lease the property necessary for setting up the electricity generating facilities under a Roof Lease Agreement.

United States

- To help streamline the federal on-site renewable power purchase agreement (PPA) process, the Federal Energy Management Program works with agencies and partners to assemble sample documents (request for proposals, PPAs) from completed projects including solar roof projects.

Vietnam

- The Vietnamese Government has issued a new model PPA for rooftop solar projects under Circular No. 05/2019 TT-BCT, dated 11 March 2019.

Solar Utility Scale/Ground-Mounted

Argentina

- RenovAR, Argentina has been holding public auctions to buy RE under a program called "RenovAR". The program applies for wind energy, solar energy, biomass and small hydroelectric plants and biogas. It includes a "green trust fund" to provide security and confidence to investors. Cammesa (Compañía Administradora del Mercado Mayorista Eléctrico) has published the relevant laws, and bidding documents (including **draft PPAs**) on its website.
- **Bidding documents** (in English and Spanish)

Australia

- Utility Scale Solar PV, PwC 2017 - Suite of precedent project documents developed by PwC to facilitate the contracting process for small to midscale solar PV facilities. While the detail of the contractual structure will vary from project to project, depending on size, location and parties, these documents encompass the majority of key relationships in the financing and development of a solar facility.

Ethiopia

- Draft Sample Solar PV PPA of May 2015 between small power producer (Seller) and the Ethiopian Electric Utility "EEU" as off-taker relating to a solar PV electric power generation facility. Seller will develop, build, own and operate solar PV electric power generating facility and EEU to purchase the electrical energy produced at the facility in accordance with the terms and conditions of the PPA. 20 year contract. Pricing based on feed-in tariff.

India

- **National**
  - Jawaharlal Nehru National Solar Mission - Guidelines for Development of Solar Parks, Government of India Ministry of New & Renewable Energy February, 2016. The Jawaharlal Nehru National Solar Mission is a major initiative of the Government of India with active participation from States to promote ecologically sustainable growth while addressing India's energy security challenge. The solar park is a concentrated zone of development of solar power generation projects and provides developers an area that is well characterized, with proper infrastructure and access to amenities and where the risk of the projects can be minimized. Solar parks are envisaged to be developed following four modes described in the scheme. The Solar Project Developers within the solar park shall enter into PPAs with the Central Utilities, State Utilities, and Discoms, Captive Users/Third parties who are willing to buy power from the developer. The tariff for the sale of power through PPAs could be either based on the tariff determined by the Central Electricity Regulatory commission, the State Electricity Regulatory commission or as determined through bidding process.
    - **Annexure III** contains Implementation Agreement between Solar Power Park Developer (SPPD) and Solar Project Developer (SPD).
    - **Annexure VI** Lease Deed between the SPPD and the Solar Project Developer.
- **Odisha**
  - The **Green Energy Development Corporation of Odisha Limited** has published tender documents it has issued on its website. See, for example:
  - Tender Document: Design Engineering, Procurement, Construction, Operation and Maintenance of 20MW Grid-Connected Crystalline Photo Voltaic Solar Power Plant of April 2014.
  - Revised PPA: Selection of Solar Power Developers for Development of 20MW Grid Connected Solar Photo Voltaic Power Projects in Odisha of April 2016.

Malaysia

- Renewable Energy standardized Power purchase agreements for solar PV projects (up to 10 MW, 12 MW and 30 MW) published by the Sustainable Energy Development Authority Malaysia. Based on feed-in tariff system.

Pakistan

- Standard Energy Purchase Agreement of 29 June 2015 relating to a solar powered power generation complex between Seller (private energy company) and Purchaser (Central Power Purchasing Agency (Guarantee) Limited acting on behalf of the former government-owned public utility maintaining power in Pakistan, (Water and Power Development Authority ("WAPDA") Distribution Companies). Seller to design, engineer, construct, insure, commission, operate and maintain a solar powered electric generation facility on build, own and operate (BOO) basis. Purchaser to purchase all of the net delivered energy generated by the complex and delivered to the interconnection point. 25 year contract.
- Standard Implementation Agreement between Seller and Government of Pakistan of 29 June 2015.

Tanzania

- Model PPA for solar projects - Approved by EWURA for solar powered generating plant of total installed capacity more than 10 MW; the Seller and the Purchaser agree to develop the Project under [an Independent Power Producer (IPP)/Public-Private Partnership (PPP)] arrangements and recognize that training citizens of Tanzania in the design, construction, installation, operation, maintenance and management of the Project and maximizing technology transfer are central to the interests of the Purchaser in the Project; 20 years operation phase.

United States

- California, United States. Solar Power Purchase Agreement - California, USA. This is a standard PPA for a 250 MG photovoltaic (PV) power plant developed as part of Southern California Edison's Request for Proposal for its solar energy program (.pdf in English).
- Oregon, United States Draft Solar Power Purchase Agreement (Photovoltaic Solar Electric Systems) between an Oregon provider and the State of Oregon whereby provider desires to install, maintain and operate the systems on the sites in the licensed areas and desires to sell electrical energy generated by the systems securing sustainable energy resources to support its operations at no greater cost for the energy than it would pay for the electricity otherwise supplied (in English).
- Annotated Solar Power Purchase Agreement (PPA) prepared by Sustainable Power Group (sPower), an independent power producer from the United States.
- US Virgin Islands solar PPA and RFP (in English). PPA and RFP documents for a project whereby the Virgin Islands Water and Power Authority is seeking a maximum of 10 megawatts (MW) of electrical capacity, allocating approximately 5 MW to each of its two generation facilities serving the districts of St. Thomas-St. John and St. Croix.

Further Reading and Resources

See also Further Reading and Resources Renewable Energy

Solar Roof Top

India

- Rooftop Solar in India - Addressing Policy Regulatory and Operational Barriers, Deloitte 2014 – Presentation summarizes the main global models and challenges associated therewith, with some recommendations on how to resolve those challenges in an Indian context.
- Harnessing Energy From the Sun, Empowering Rooftop Owners - white paper prepared by IFC for State of Gujarat that analyzes various business models used around the world and their associated issues and challenges and suggests next steps for a large-scale roll out.
- Public Private Partnerships Lessons from Gujarat Solar, Partnerships IQ Handshake publication, IFC 2014.

United States

- Solar Power Purchase Agreements - Online information provided by the United States Environmental Protection Agency.
- Solar Power Purchase Agreements: Identifying Risks for Municipalities in Massachusetts [PDF report] prepared by Tufts University. The report explores the perceived risks of 18 municipalities in Massachusetts (MA) throughout the negotiation of Solar PPAs with private sector project developers. It also contains an extensive literature review and analysis of the regulatory structure for PPAs in MA. Findings suggest that municipalities are largely uninhibited by identified risks with PPAs.

Solar Utility Scale / Ground-Mounted

Pakistan

- A Solar Developer's Guide for Pakistan, IFC 2016 - This document is intended as a guide for international developers and solar investors who are considering investing in Pakistan.

India

- Utility Scale Solar Power Plants: A Guide for Developers and Investors [PDF] This guidebook is a best practice manual for utility-scale solar power plants in India. It focuses primarily on ground mounted, fixed tilt projects and also covers solar tracking system technology. Intended to be a practical toolkit, the guidebook includes an annex that covers Concentrated Solar Power (CSP) technology and highlights aspects of the CSP project development process that differ from the equivalent. It also has annexes on construction, operation and maintenance contract terms.
- PPIAF Support Transforms Odisha's Enabling Environment to Tackle Climate Change through 1,000 MW Solar Park, Impact Story, PPIAF 2016.

United States

- Solar Power Purchase Agreements: Identifying Risks for Municipalities in Massachusetts [PDF report] prepared by Tufts University. The report explores the perceived risks of 18 municipalities in Massachusetts (MA) throughout the negotiation of Solar PPAs with private sector project developers. It also contains an extensive literature review and analysis of the regulatory structure for PPAs in MA. Findings suggest that municipalities are largely uninhibited by identified risks with PPAs.

Useful Links

- Off-Grid Solar Policy Toolkit - This Off-Grid Solar (OGS) policy toolkit is designed to assist governments in creating an enabling environment for OGS and pay-as-you-go (PAYG) sector growth by establishing policy reforms determined through a structured process of inter-ministerial policy dialogue. It identifies twelve key policy issues and considers the advantages and disadvantages of different policy approaches to each issue. The toolkit then outlines a step-by-step process that governments can use to facilitate policy dialogue, providing guidance and tools at each step. This process envisions a scenario where government ministries and agencies work together to advance policy reforms that accelerate progress in energy access, digital inclusion, and financial inclusion.
- Scaling Solar - Scaling Solar brings together a suite of World Bank Group services under a single engagement aimed at creating viable markets for solar power in each client country. The “one stop shop” program aims to make privately funded grid-connected solar projects operational within two years and at competitive tariffs.
- The Global Solar Standardization Initiative - The Global Solar Energy Standardisation Initiative is currently developing standardized solar contracts and guidelines that simplify and streamline existing best practice.

Related Content

- **Climate-Smart PPPs**
- **Climate-Smart PPP Legal and Regulatory Framework**
- **Preparing, Procuring and Implementing Climate-Smart PPPs**
- **?Sector-Specific Content on Climate-Smart**

- **Renewable Energy**

- **Climate-Smart PPPs: Further Reading and Resources**

Additional Resources

- Sub-national and Municipal PPPs
- Public-Private Partnerships for Transport
- Power and Renewable Energy PPPs
- The power of sunlight: incentivizing private investment in solar PV
- Wind Power Energy
- Hydropower
- Biomass
- Geothermal Energy

Partner Resources

Renewable Energy Project Resource Centre (REPRC)

hosted by Energypedia

Wiki-based library of energy project resources. Includes sample terms of references, procurement documents, economic analyses and case studies (success factors and lessons learned).