PACE-D Technical Assistance Program

Utility-Centric Business Models for Rooftop Solar Projects

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Acknowledgments

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Introduction

Overview of Rooftop Solar in India

India commenced its solar energy journey in the year 2008 with the launch of the Government of India's National Action Plan on Climate Change (NAPCC). The Jawaharlal Nehru National Solar Mission (the Solar Mission) was launched under the NAPCC to significantly increase the share of solar energy in India's energy mix. The Solar Mission stressed on need for widespread diffusion of renewable energy technologies, to realize the opportunity for enhancing India's energy security and reducing greenhouse gas (GHG) emissions at the same time by tapping the spread availability and potential of solar resources in the country.

Under the Solar Mission, India set a target of 100 GW solar installations by 2022. Out of this 40 GW was set as a target for rooftop solar sector. Over the last seven years, India has made significant strides on solar deployment, made possible through the active participation by all stakeholders, including national and state governments, utilities, investors, developers and other significant private and public-sector organizations. Overall, India's installed solar capacity is expected to reach 20 GW by the end of 2017-18.

After a more modest start, rooftop solar capacity additions too, have increased over the years, growing at an annual rate of 80 percent in 2017 to reach 1.8 GW of installed capacity. A large part of the installation in the rooftop category has been driven by installations for consumers in the industry and commercial segment, primarily driven by prevalence of high electricity tariffs.

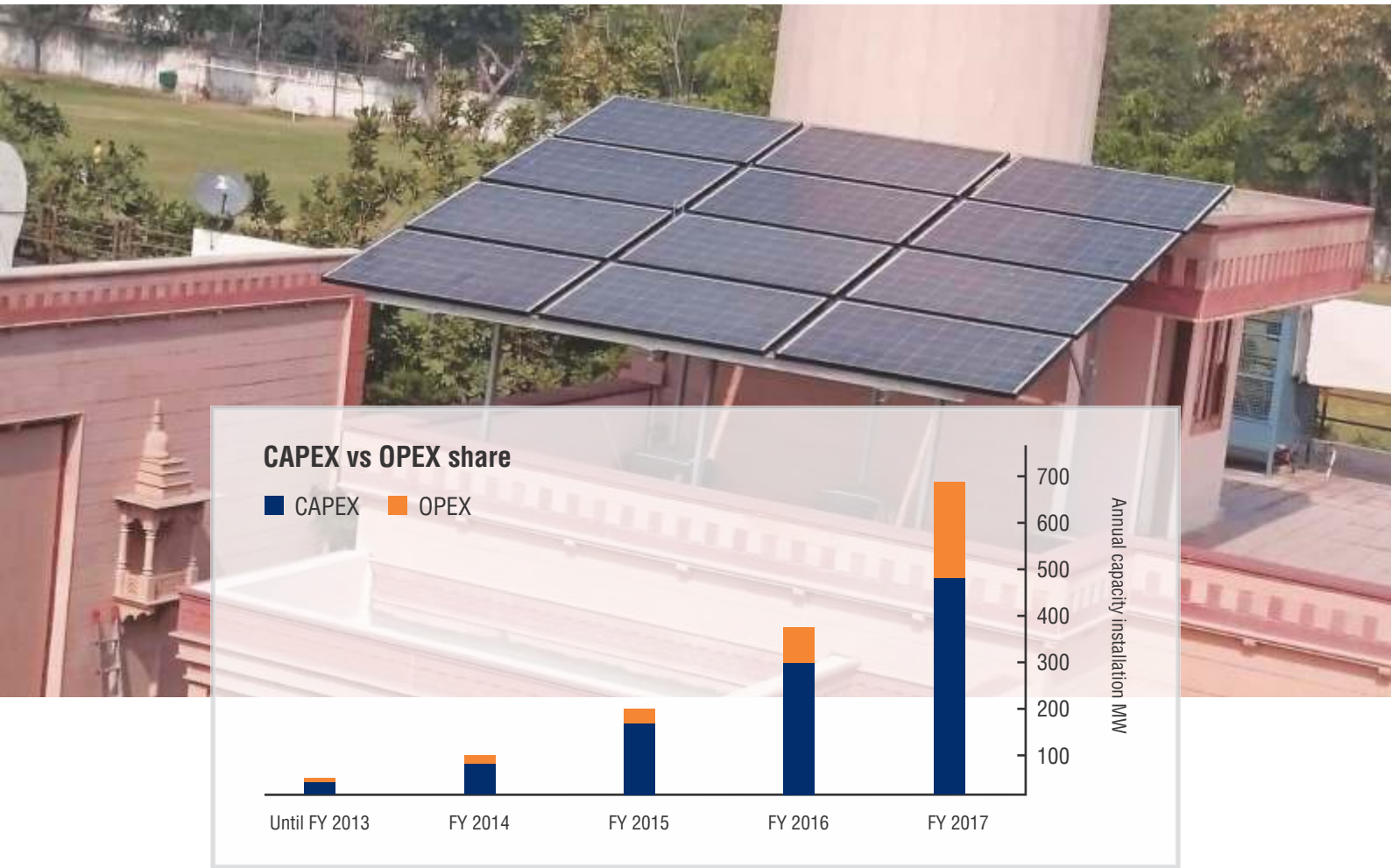

Figure 1: Share of Capex and Opex in Annual Rooftop Solar Installations

•Source: Bridge to India analysis. Available at
http://www.livemint.com/Industry/73JVBX0URBJqvJVyp9qpwN/India-to-reach-20-GW-of-installed-solar-capacity-by-FY18end.html
•Source: Bridge to India analysis. Available at
https://www.pv-magazine.com/2017/12/04/india-installs-1861-mw-rooftop-pv-maharashtra-leads-the-market/

The Government of India has been able to put in place a significant number of policies, regulatory and market related initiatives which have created the necessary framework for the deployment of rooftop solar and kick-started the market. Some of these initiatives include:

- A capital subsidy as well as incentive-based schemes for residential and institutional consumers by the Ministry of New and Renewable Energy (MNRE).
- Net and Gross Metering Regulations by 29 states and seven union territories.
- Streamlined interconnection guidelines for accommodating rooftop solar generation into the grid infrastructure have either been adopted or are in the process of being adopted by most state power distribution companies (DISCOMs or utilities).
- More than USD 1,470 million in the form of concessional lines of credit has been raised by the government with assistance from multilateral financial institutions for development of rooftop solar in the country.

India has significant potential for rooftop solar energy. A potential of 6 GW of rooftop installations have been identified so far, and dedicated solar energy organizations such as Solar Energy Corporation of India (SECI) have already initiated the process for tendering 500 MW capacity. Large public-sector enterprises such as Indian Railways, Indian Oil, and others, have set internal targets for rooftop solar deployment.

Growth in the solar PV installations has been driven largely by favorable economics. Prices have seen a steady fall over the past few years, and landed cost of solar energy has reduced by more than 70 percent over the past seven years.

The modest rooftop solar capacity installed across India till date has largely been driven through self-owned projects. In early days of the Solar Mission, installations were driven and funded primarily by the end consumer. This model, known as the Capital Expenditure (CAPEX) model, accounts for approximately 84 percent of current installed capacity according to market research firm Bridge to India. The alternative model, involving a third-party specialist organization (called a renewable energy service company, or RESCO), involves installation on an operational expense (or OPEX) basis. OPEX projects are gaining ground in the recent years, and constituted 30 percent of all projects installed in 2017, rising threefold from only about 10 percent of projects installed in 2015. Most mature markets are primarily driven by financed installations supported by RESCO companies. It is expected that over the medium term, India, too will follow a similar trajectory, and the share of financed, RESCO-based installations will grow.

Business Models for Decentralized Solar Energy

Globally, rooftop solar energy businesses have followed two broad routes for development. The first route has been focused on consumers, who develop small decentralized distributed solar projects, mostly on their rooftops. Such small projects range from a few kilowatts to megawatts in case of industry and commercial consumers, and are developed under facilitating policy and regulatory framework, with the role of utility being limited to granting permissions and facilitating interconnection with the grid. Facilitative policies, incentives, tax rebates, capital subsidies, feed in tariffs and net metering have been key drivers of such business models. Customer-focused routes—or business models—can also involve a third-party, rooftop developer, known as a RESCO. RESCOs often facilitate financing for the systems they install, service and maintain on behalf of the consumers, against payment for energy generation.

A second route for decentralized solar energy involves direct involvement by the utility, which plays an active role in developing rooftop solar projects, including investment, facilitation, or development with third party developers. Utilities have the inherent advantage because they are customer facing, and act as the interface between the customer and the grid. Declining cost of solar and simultaneous increases in the costs of conventional power has resulted in an increased interest from a variety of stakeholders in decentralized distributed solar models, including utilities. Utilities enjoy a particular advantage due to their central role in the solar value chain. Table 1 summarizes both customer-centric and utility-centric business models.

Utility-focused solar business models	Customer-focused solar business models
Utility-owned, on customer or utility premises	Consumer (rooftop owner)-owned (CAPEX)
Community-owned and utility-facilitated	RESCO (third-party)-owned (OPEX)
Utility-financed	

Table 1 - Types of Business Models for Rooftop Solar

Consumer-focused business models, including CAPEX as well as OPEX models, have been the predominant approach to deployment of rooftop solar capacity in India, and are subject of much discussion. On the other hand, utility-focused business models are yet to emerge on a large scale. A utility-centric approach for scaling rooftop solar can help address several challenges plaguing deployment of rooftop solar, especially the problems plaguing the CAPEX and RESCO business models. The following sections focus on key characteristics of utility-driven business models, and the role they can play in the development of India's rooftop market, while helping India achieve its solar energy targets.

Source: Bridge to India Analysis, available on
http://www.bridgetoindia.com/wp-content/uploads/2017/12/India-Solar-rooftop-Map-Dec.pdf

Challenges of Implementing Rooftop Solar

India's current rooftop solar capacity installations have been almost entirely developed through customer-driven CAPEX and OPEX business models. These business models suffer from several challenges, especially high upfront and transaction costs, high off-taker risks (in case of RESCOs) and performance risks in case of CAPEX, limited availability of finance from mainstream financial institutions, lack of standardized procurement processes, and limited consumer awareness. As a result, growth in installations has been slow, and India stands to miss the target of 40 GW rooftop solar capacity by 2022.

Challenges for Developers

A number of challenges plague developers and businesses pursuing customer-centric business models, which increase costs of customer acquisition and project development. Some key hurdles under current business models include:

1. Developers have limited bandwidth to reach a large number of consumers, and each consumer has small size rooftop systems. As a result of small project sizes, developers must put in a high degree of customization for each project, whether it is in the form of the system design, or in terms of arranging financing, getting approvals, etc.

2. Consumers and financial institutions who would lend to such projects lack confidence in rooftop solar technology, and developers do not yet have strong track record of implementation. Financial institutions still lack appropriate tools and expertise to evaluate rooftop solar projects especially from a long-term risk perspective. As new business models come into the market, a number of mainstream banks have yet to develop their capacity to analyze and finance rooftop solar projects.

3. For RESCO projects, there is a significant issue of contractual and payment risk for the developer, and performance risk for the consumer, and this renders several projects being unable to get access to finance.

4. For RESCO projects, installations are limited to large-scale, highly credit worthy commercial and industry customers, who are able to sign bankable, long-term contracts. Financial institutions too prefer such customers, and are unwilling to lend for smaller scale customers with poor credit. This limits the market, excluding a vast majority of customers with poor or no credit rating, and who do not have access to bank finance to meet high upfront cost of the system.

5. There is a lack of reliable agencies that can certify installations, to improve customer and lender confidence in long term system performance. Long term performance of projects installed over the last few years is still unproven, and there is a dearth of data showing long term energy generation, and impact of local factors on operations and maintenance costs of the systems is not understood in detail.

As a result of the challenges above, the majority of rooftop solar installations have been driven by direct financing by end customers. Since 2015, owing to significant push by the government, investment by development financial institutions such as the World Bank and Asian Development Bank, new financing lines have been introduced to provide low cost loans for RESCOs and customers installing rooftop solar projects. This, in addition to an improving regulatory landscape and clarity on net metering, alongside action by selected states has driven rooftop installations through the OPEX route. However, India needs to significantly ramp up installations in this sector in order to meet targets, and a utility-centric approach provides several advantages, which may give a much-needed boost to the sector.

Challenges for Utilities

The growth and large-scale implementation of renewable energy technologies is bringing about a transformative change to the Indian power sector. The sector is facing internal and external factors that stress the traditional operating model for incumbent utility companies. India's generation mix is shifting from centralized, high carbon, coal-dominated supply to distributed and renewable sources of generation. Utilities world over are adapting as the centralized and single directional grid design transitions into a grid with greater penetration of renewables, more intermittent, distributed, interactive and dynamic generation, which is enabled by two-way flow of electricity and data. With the advent of smart grids and imminent increase in use of electric vehicles, utilities must also prepare themselves for large-scale incorporation of new types of

demands on their networks, further adding to their technical and business model challenges. While distribution utilities are at the heart of this transformation, their role is in a flux. With the advent of widespread rooftop solar adoption, utilities stand to face the following challenges:

1. Customers are emerging as the center of the new utility business landscape, evolving into self-generating prosumers who can distribute energy to others directly or through the grid. Utilities must adapt to the evolving role of the consumer.

2. Indian utilities are aware of potential loss of high value customers, made possible by the rapidly falling costs of renewable energy. Leading utilities have initiated the process for re-evaluating their business strategy due to changing dynamics.

3. Regulators across the country recognize the need for utilities to invest continually in grid maintenance, modernization, resiliency and security. At the same time, there is widespread acknowledgement that there is no appetite for rate increases by consumers. The balance struck between competing interests is pushing utilities towards evaluation of additional sources of revenue via new business models.

4. Utilities' staff and management are focused on the conventional distribution model, and awareness of rooftop solar within utility staff is minimal. There is a need for training and capacity building as their roles expand to include additional services made possible by greater penetration of rooftop solar energy. Utilities also lack standardized interconnection processes.

Utility-Centric Business Models for Scaling Rooftop Solar

Utility-Centric Business Models

Utility-driven business models can play a transformative role in development of India's rooftop solar market, while helping the country achieve its solar energy targets. Utilities can increase their participation in deployment of rooftop solar through facilitation or through direct investment. Two possible approaches are summarized as follows.

1 **Facilitation Approach,** where the utility aggregates projects and facilitates procurement of systems or solar power services, which are then paid for by the end consumer or the RESCO. Under this approach the utility can charge for facilitation services, creating an additional source of revenue for itself. Some benefits of this approach include:

- **Aggregation of Projects:** Utility aggregates demand from a large number of interested consumers. This allows aggregation of capacity which in-turn allows procuring in large quantities leading to economies of scale.
- **Standardization of Components and Services:** For large-scale procurement, utilities can standardize components and services as part of bidding documents. These standards can help create benchmarks for consumers and developers, irrespective of their participation in utility procurement programs.
- **Timely Execution and Quality:** Utilities have technical know-how and capability to monitor the quality and timely execution of projects.

2 **Investment Approach,** where the utility aggregates projects and invests in developing those projects. Utilities can also play a key role in financing these systems through linkages with financial institutions either as on-lender or as a collection agency. Some of the advantages of the approach, in addition to all the advantages of the facilitation approach, are as following:

- **Better Enforcement of Contracts:** Utilities are capable of developing and enforcing contracts, reducing risk for consumers, developers as well as financial institutions. Further, the contracts developed and used by the utilities can become benchmarks for other consumer and developers.
- **Improve Bankability:** Utilities, especially government-owned utilities, being large corporations with long track record enjoy confidence of the financial institutions. Their participation in the rooftop solar projects improves the enforceability of the contracts and off take. Improved risk profiles lead to improved bankability of the projects enabling increased participation of the financial institutions in the projects and hence the sector.

Both approaches of utility driven rooftop solar offer unique benefits. These include:

	Facilitation Approach	Investment Approach

Role of Utility	**Procurement**
	• Aggregates roofs from consumers and conducts initial site surveys
	• Structures projects
	• Carries out bidding for aggregated capacity
	  • Develops bidding documents and contracts
	  • Invites bids
	  • Assesses and selects the bidder from the received bids
	• Facilitates signing of standardized contracts
		Procurement
		• Aggregates roofs from consumers and carries out the initial site survey

	Facilitation Approach	Investment Approach
Role of Utility	**Execution** • Supervises progress • Carries out regular quality checks	**Execution** • Builds plants through contracted engineering, procurement and construction (EPC) company
	Operations • Supervises operations and maintenance (O&M) on behalf of consumers	**Operations** • Carries out O&M (a back to back O&M contract can be arranged)
Advantages	**To Consumer** • Reduction in cost of system/services due to economies of scale due to aggregation • Better performance due to DISCOM led supervision at commissioning stage • Reduced risks of default on services from developer/RESCO • Standardized contract facilitated and vetted by utility protects consumer interest	**To Consumers** • Reduction in cost of system/services due to economies of scale due to aggregation • Ensured availability of O&M services by utility throughout the project life
	To EPC/RESCO • Attractive project sizing • Reduced consumer acquisition cost • Lower cost of procurement • Recurring revenue through utility reduces collection costs and risks	**To EPC/RESCO** • Reduced consumer acquisition cost • Lower cost of procurement/sale • More payment security
	To DISCOM • Earns facilitation fee • May achieve benefit by development of rooftop clusters in congested areas in a planned manner • Indirectly helps in postponing the network augmentation for increased load due to localized generation and consumption from rooftop projects	**To DISCOM** • Project returns • Higher control on the assets • All benefits as in case of facilitation will also be available

Table 2 - Benefits of Utility-Driven Business Models for Key Stakeholders

Benefits of Utility-Centric Business Models

Distributed renewable energy technologies such as grid-connected rooftop solar systems are changing the way power utilities function across the world. New technologies provide consumers the possibility and opportunity to offset utility dependency in a low-cost and reliable manner. Additional customer incentives to achieving green energy contribution further complements the increasing adoption of this technology.

Further, with active participation in up-scaling the rooftop solar market, utilities can maximize their immediate gains, which currently challenge them. Utilities face several challenges, which are addressable through increased focus on rooftop solar. By active participation, utilities can maximize their gains and also contribute to the accelerated growth of rooftop sector. In addition, rooftop solar can also be effectively leveraged to integrate new technologies, such as energy storage and charging of electric vehicles. With an active participation of utilities in development of rooftop solar, all major stakeholders stand to gain, as described in Table 3.

Challenges		Advantage of Utility-Centric Business Models
Customer Challenges	High system upfront cost funder Capex model	Utility brings in aggregation and economies of scale, business model helps brings down upfront costs, and can pass on these savings to end consumers, while ensuring better quality of systems installed.
	Low customer awareness about benefits of rooftop solar	Given utilities' existing relationship with the consumers, utility-led rooftop solar programs are likely to be well received, with increased awareness by end consumer.
	Poor access to financing, and challenge of dealing with suppliers	Utility-centric business models help customers gain easier access to low cost financing, made possible through partnerships with financial institutions. Consumers also benefit from not having to deal with a multitude of suppliers, and can select utility offered standardized service offerings and contracts.
Developer Challenges	High cost, and challenges of customer acquisition	Given existing relationship with the customer, the utility is ideally positioned to acquire consumers. This can significantly bring down outreach expense, currently being met by developers. Dedicated utility-led awareness programs can further expedite customer acquisition and facilitate demand aggregation. Developers benefit from improved payment security and contract sanctity, and as a result, improved bankability of projects leading to low cost financing.
	Permissions, statutory clearances & regulatory hurdles	The utility can lead efforts to standardize technical specifications, and provide expedited interconnection process for customers.
	Consumer non-payment, poor system performance and credit risk	Existing relationships with consumers help utilities assess their payment track record, which can help in assessing credit worthiness of consumers who get financing offers.
Utility Challenges	Reluctance of utility	Utility takes the lead in developing rooftop, and drives the model as it stands to diversify its income from sale of conventional and renewable power.
	Challenges Meeting Renewable Purchase Obligation (RPO) Targets	Distribution companies rely on rooftop solar to meet about 3.2 percent of solar RPO (40 percent of the 8 percent solar RPO target). By focusing on directly deploying rooftop solar, utilities can proactively work towards meeting this target.
	Network Congestion and Capital Investment Network Upgrade	Urban grids are increasingly under pressure due to rapidly increasing energy demand, and utilities face challenges in finding capital for investment in upgrades. Rooftop solar can help decongest distribution infrastructure, and help arrest distribution losses. Promoting rooftop solar systems can also help postpone infrastructure upgrades and save capital investment costs for utilities.
	Loss of Revenue Due to Net Metering	Net Metering can have significant financial implications for utilities. By facilitating rooftop solar or directly investing in projects, utilities can diversify revenue sources, earn additional fees, and help reduce losses due to Net Metering.
	Policy and Regulation Challenge	Currently, there is no incentive for utility to promote rooftop solar other than RPO compliance. By switching to rooftop-focused business models, they gain access to additional revenues while promoting renewable energy.
State Government Challenges	Difficulty Meeting Renewable Energy Mandates	Utility-centric business models can help states achieve their renewable energy mandates, and help mobilize investment.

Table 3 - Rooftop Solar Challenges and Benefits of Utility-Centric Business Models

Examples of Utility-Centric Business Models

Table 4 lists the four types of utility-anchored business models that are possible, based on the role of utilities and advantages of the business models as highlighted in the sections earlier.

Anchored-Procurement	· Facilitate procurement model · EPC contractor model
On-bill-financing	· Facilitate collection of EMIs for FIs · On-lending
Utility as Super-RESCO	· Facilitate services · Utility as RESCO
Payment Assurance Model	· Facilitate financing of systems and collection of payments by system provider/ EPC contractor

Table 4 - Types of Utility-Centric Business Models

Anchored Procurement

Through Anchored Procurement, utilities assist consumers in procuring rooftop solar systems. This model is suitable for consumers interested in developing rooftop solar projects through self-owned CAPEX model. It has been seen that a large majority of residential and institutional consumers would be more comfortable and consequently more interested in procuring their rooftop solar services through the utilities, with whom they already have an established relationship. This model can be sub-divided into two variants:

a. **Facilitated Procurement Model:**
The Facilitated Procurement Model allows the utility to act as a single point stop for the consumer to procure rooftop solar services through a third party who has been wetted and evaluated by the utility. The utility, acting for the consumer (or a large number of consumers in a group), facilitates the procurement and installation of rooftop solar systems for consumers. This model benefits from economics of scale, better quality of systems due to utility defined standards and inspections, improved O&M services, faster installation and lower transaction costs as well as lower payment risks to vendors and suppliers. Under this model, the utility enrolls consumers interested in setting up rooftop solar projects (aggregation of consumers), and signs a standard Project Management Services agreement (which outlines services to be offered to consumers by the utility and through the utility by the developer/vendor). The agreement includes services offered by the utility and developer; the outline of bidding process; templates of the EPC agreement; and terms and conditions. The utility runs a competitive bidding process for the aggregated capacity on behalf of consumers. Once the successful bidder has been chosen, the consumers sign an EPC agreement with the selected developer(s). The utility collects facilitation fee from developer(s). Project management services offered by the utility cover quality control and project monitoring on behalf of the customer. The broad overview of the business model is provided in Figure 2.

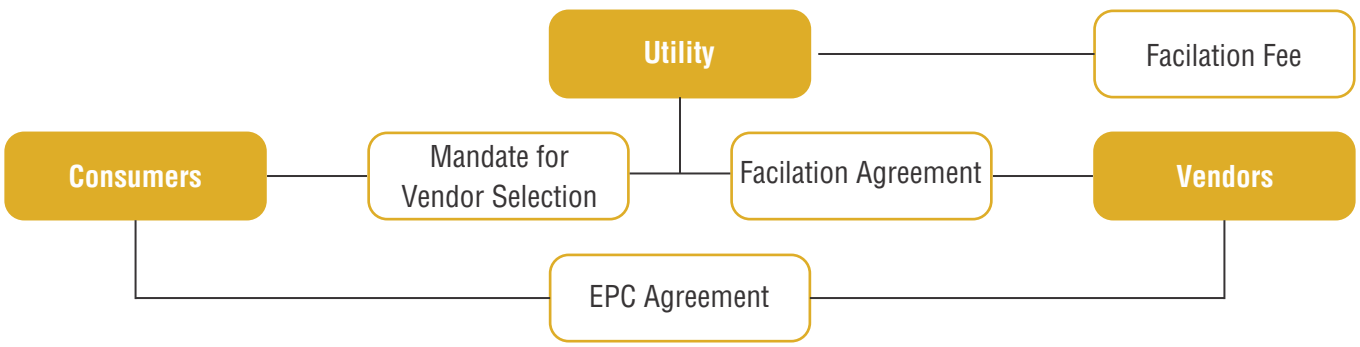

Figure 2 - Schematic of Anchored Procurement

Source: PACE-D TA Program Analysis

b. EPC Contractor Model:

Under this model, the utility acts as the developer as well. Utilities directly enter into an EPC agreement with the consumers for the design, supply, engineering, installation and commissioning of systems. Utility in turn can (if desired) enter into a back-to-back EPC agreement with a project developer. Utility can identify developer(s) through a competitive bidding process for developing the aggregated capacity. The utility, through back to back EPC contracts with consumer and developer, has better control in the project development process, as described in Figure 3. This ensures better contract enforceability, quality control and timely execution. The utility can earn a margin i.e., difference between the value of back to back EPC contracts on each project. The roles of the key stakeholders involved in the model have been highlighted in Table 5.

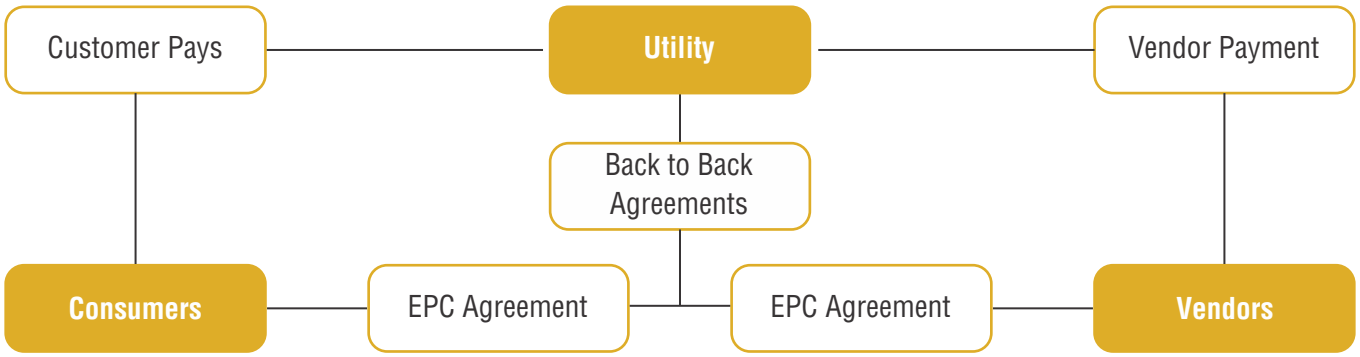

Figure 3 - Anchored Procurement - Back to Back Contract

Source: PACE-D TA Program Analysis

	Challenges	Utility	Vendor	Financier
Procurement Phase	Desirous of a quality system installed at competitive prices	Engage consumers and vendors to execute back to back agreement. Facilitating procurement by aggregating rooftop and selecting EPC vendors through bidding process for execution.	Vendors apply for empanelment with utility through a bidding or selection process	Lender scrutinizes the consumer credit history and approves financing
Project Development	Facilitate vendor access to rooftop for systems set up	Facilitation of project execution; Utility can charge facilitation fees in this process	Set up of system as per agreed terms and conditions	Timely disbursement of loan amount as working capital for vendor
O&M Phase	Timely payment for energy services to utility; provide roof access for O&M activities	Acts as collector of payments, passes it on to vendor	Offers quality O&M service and ensure maximum possible generation	Collection of loan repayments from vendor and ongoing monitoring

Table 5 - Role of Key Stakeholders in Anchored-Procurement Model

A summary of the benefit-risk analysis for each of the stakeholder working under the anchored-procurement approach is illustrated in Table 5.

Consumer	Utility	Vendor	Financier
• Lower cost due to economies of scale and reduced transaction cost • Quality products • Seamless deployment • Ease of financing	• Generate revenue on margins on procurement of EPC services and products	• Savings in transaction cost, customer acquisition, EPC marketing, etc. • Increased payment security through utility involvement • Economies of scale	• Lower transaction costs due to aggregation facilitated by utility • Increased payment security
Risks			
• Lower technology risk	• Lower risk of non-performance of products • Moderate to high risk in back to back arrangement of performance on utility	• Low payment risk from utility • Minimal payment risk from consumers due to utility involvement	• Low risk of consumer default on loan repayment

Table 6 - Risk-Benefit Assessment on Stakeholders under Anchored Procurement

Source: PACE-D TA Program Analysis

On-Bill Financing

This type of model involves three stakeholders, the consumer, the lender and the utility. This model is suitable for consumers who are interested in developing rooftop solar projects through self-owned model. It is a preferred model for residential consumers. The utility assists the consumers by facilitating access to finance. As the utility acts as the go-between the consumer and the financial institution, the cost of financing is lower due to economies of scale, lower cost of financing due to preferential rates available to the consumer, lower risk profile and lower transaction costs. Under this model, the utility collects, preferably through the electricity bill, equated monthly installments (EMIs) on the loans taken by consumers for rooftop solar systems. EMIs are passed on to the financial institution by utility for a small service fee. For effective implementation, the utility can tie up with their preferred banking partners. Key features of this type of business model include:

a. Utility raises cheaper debt for consumers by leveraging itself and acting as a facilitator between the consumer and lender;
b. Consumers repay the loan in installments, minimizing risk of consumer payment defaults while safeguarding lenders and EPC interests;
c. Reduced transaction time and cost for consumer and bank lenders become more approachable to consumers and documentation can be standardized;
d. Higher payment security for the bank and EPC contractor; and
e. Aggregation of demand and lower customer acquisition costs for EPC.

The involvement of all the stakeholders in this model is highlighted in Figure 4.

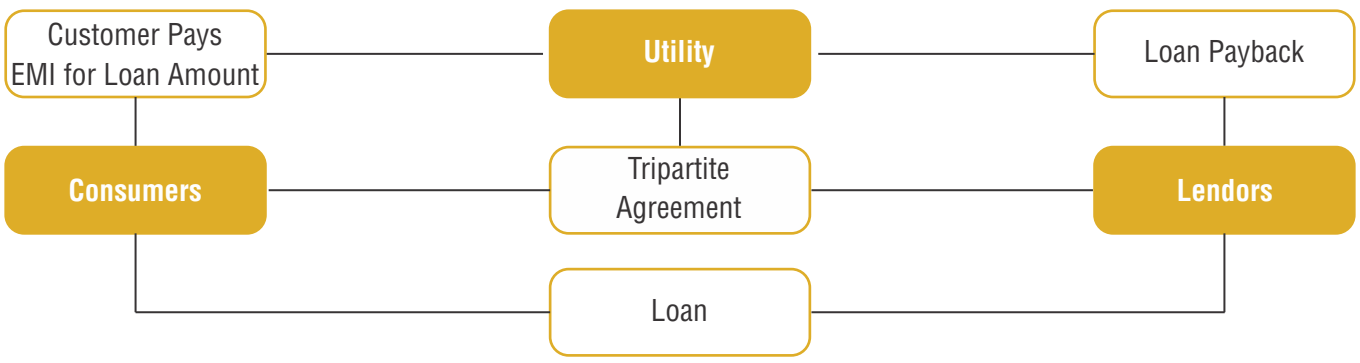

Figure 4 - On-Bill Financing Model

Source: PACE-D TA Program Analysis

As highlighted in Figure 4, the tripartite agreement envisages appropriate terms and conditions which safeguard the interests of the utility. This model, due to utility's involvement, helps consumers avail loans with ease. The utility collects payments as an easy monthly installment from consumers (as a part of the monthly electricity bill), and passes on the installment (post deduction of facilitation charges) to the lender/financial institution. The consumer may be offered a free choice of EPC vendors under this model.

Further, this model can be clubbed with anchored procurement model, giving consumers access to easy finance, reliable selection of vendors selected through a bidding process, and quality systems installed in a time bound manner. The EPC firms' consumer acquisition cost is minimized and they are assured of timely payments. Roles of stakeholders involved in this business model are highlighted in Table 7.

	Consumer	Utility	Vendor	Financier
Procurement Phase	Desirous of a quality system installed at competitive prices.	Engage consumers and lenders to execute tripartite agreement. Assists lender in evaluating customer loan.	Vendors apply for empanelment with utility through a bidding or selection process.	Lender scrutinizes the consumer credit history and approves financing.
Project Development	Facilitate vendor access to rooftop for systems set up.	No role during project development, only facilitate in financing.	Set up of system as per agreed terms and conditions.	Timely disbursement of loan amount as working capital for vendor.
O&M Phase	Timely repayment of loan amount in EMI to utility provide access to roof for O&M-related activities.	Conduit of payment to lender.	Offers quality O&M service and ensure maximum possible generation.	Collection of loan repayments and ongoing monitoring of loan portfolio.

Table 7 - Role of Key Stakeholders in On-Bill Financing Model at Various Stages of Project

Given that rooftop solar sector is relatively nascent, banks and lending agencies remain skeptical to lend to individual consumers (unless they are already consumers of the banks and have an excellent credit history), since they are still unfamiliar with the technology, and few companies have significant implementation experience. Utility involvement in this financial transaction, through a standardized tripartite agreement, can help alleviate some lender concerns, and act as a well-packaged solution for all stakeholders involved. A comparison of benefits vis-à-vis perceived risks to different stakeholders under this model is provided in Table 8.

Consumer	Utility	Vendor	Financier
Benefits			
• Lower transaction costs • Lower interest rates • EMIs collected through utility existing channels. • If offered along with EPC, one stop shop for rooftop solar.	• Utility collection/ transaction charges	• Savings in transaction cost, customer acquisition, EPC marketing, etc. • Increased payment security through utility involvement • Economies of scale	• Lower transaction costs, higher payment security

Risks			
• Lower risk as technical vetting would have been done by the utility	• Increased financial burden if consumer defaults – however chances very low as the loan is bundled with conventional utility services • Increased transaction costs as its core competence is not as a payment collection agent	• Low payment risk from bank • No payment risk from consumers, as vendor gets paid by lender up front	• Very low risk of payment default by utility • Delays in payments may be a slightly higher risk

Source: PACE-D TA Program Analysis

Table 8 - Risk-Benefit Assessment for Stakeholders under On-Bill Financing

Utility as a Super-RESCO

There exists a huge opportunity for the utility to integrate backwards, using the decentralized renewable energy generation technologies and provide on-site generation services to its own consumers while ensuring benefits (from arbitrage) for both itself and the consumers. Under this business model, the utility acts as a Super-RESCO. Key features of this type of business models are:

1. Utility owns and invests, or procures rooftop solar power from third party developer(s) and supplies power to the consumer. Under this model the consumer does not own the systems but enters into a long-term Power Purchase Agreement to buy solar power from the utility at a mutually defined price;
2. Utility-based RESCO model allows for improved contractual security, aggregation and scale; and
3. These models can be as investment light or heavy, depending on the utility preference.

This model can be sub-divided into two variants:

Utility-Owned Rooftop Systems

Under this model, the utility invests capital to set up rooftop solar projects on customer premises. Consumers agree to buy the electricity generated, and lease their rooftops, to site the system, to the utility for the useful life of the project (which is 25 years). As the utility is able to aggregate and procure large capacity up front, significant reduction in costs is available due to economies of scale. If the utility has potential to raise low cost debt, avail tax depreciation on assets, costs can further be further reduced, leading to lower cost of solar supply and/or higher margins. As the overall capital expenditure incurred by utility is lower than market rates, the cost of generation (vis a vis the CAPEX or OPEX (RESCO-based) models are reduced, and can be passed on to the consumer. Modalities under this variant of Super-RESCO have been highlighted in Figure 5.

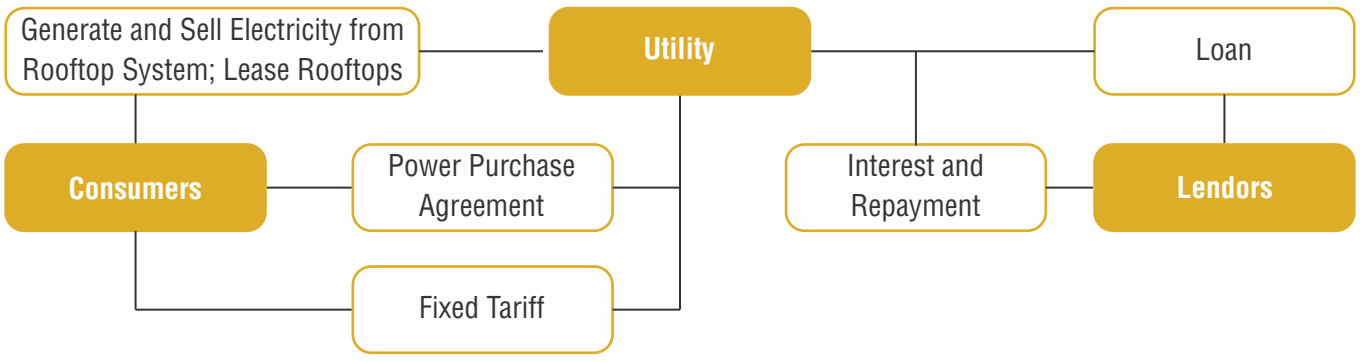

Figure 5 - Utility as Super-RESCO - Utility-Owned Rooftop Systems

Source: PACE-D TA Program Analysis

In this transaction the utility aggregates demand and offers consumers a system that is cheaper than market rates. The utility may subcontract EPC work to other vendors. This model can help reduce time delays in interconnection, and the entire transaction can be dealt with by the utility itself. The roles of the key stakeholders involved in this model are highlighted in Table 9.

	Consumer	Utility	Financier
Procurement Phase	Desirous of quality systems installed at competitive prices	Signs agreement with the consumer, avails low cost finance and procures system components	Lender scrutinizes the utility's credit worthiness, and provides finance to utility
Project Development	Facilitate utility/sub-contractors' access to rooftop for system set up	System set up and interconnection with the grid as per agreed terms and conditions	Lender scrutinizes the utility's credit worthiness, and provides finance to utility
Project Development O&M Phase	Purchases electricity	Owns and run the system. Sells electricity to consumer at agreed tariff and undertakes O&M. Repayment of loan to lender	Collection of loan repayments and ongoing monitoring of loan portfolio

Table 9 - Role of key stakeholders under Super-RESCO – Utility-Owned Model

RESCO-Owned Rooftop Systems

This is a variant similar to the present-day business model, but with the involvement of utility for efficient transaction. Under this business model the utility still acts as a Super-RESCO but does not set up, operate and own the systems. Essentially, the utility identifies interested consumers and aggregates the demand but services them through power purchased through interested RESCOs. During this entire transaction, the utility signs a power purchase agreement with RESCO (that sets up, own and operate the system on consumer premises) and a power sale agreement between the utility and consumer.

The consumers lease rooftops to the utility and the utility sub-leases it to the RESCO. Electricity generated is sold to the utility by the RESCO, and the same is then sold to the consumer by the utility. The utility essentially plays the role of a facilitator and a trader. Power is procured from the RESCO at a mutually agreed price (discovered via bidding process) and is sold to the consumer by including trading charges. These trading charges are the source of revenue for the utility in this model. The RESCO is allowed to set up rooftop solar systems without the headache of procuring consumers and also does not need to run the risk of consumer defaults. The aggregation of consumers by the utility and the reduced transaction costs due to the utility's involvement lead to reduced tariffs which can make this option attractive to consumers and the utility alike. The modalities under this variant of Super-RESCO are highlighted in Figure 6.

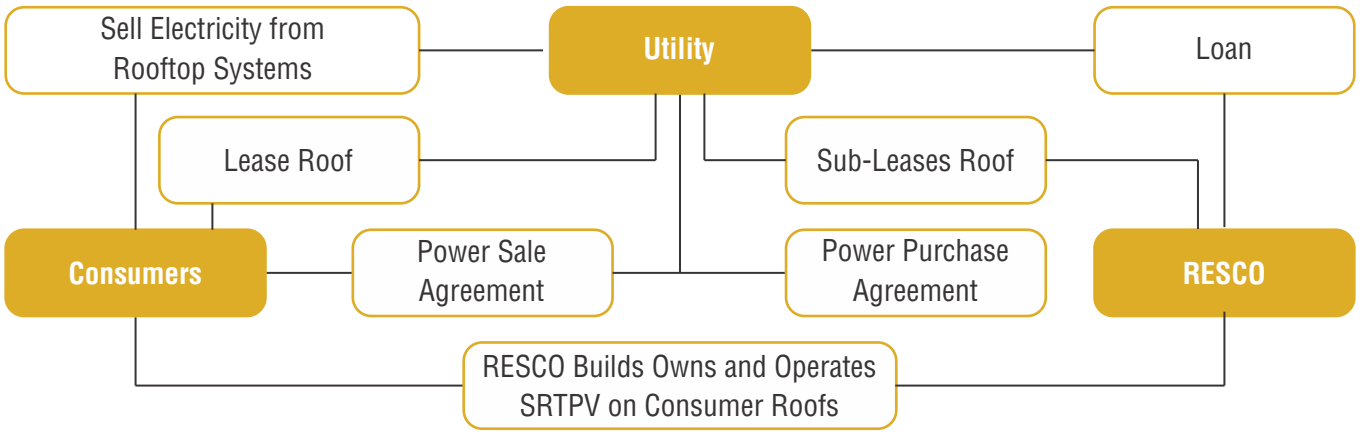

Figure 6 - Utility as Super-RESCO – RESCO-Owned Rooftop Systems

Source: PACE-D TA Program Analysis

The utility's involvement substantiates timely payment and quality service in the entire transaction, thus, the premium being charged is for the utility's facilitation to both the consumer and the RESCO. In this entire transaction, the utility does not invest any CAPEX, but may have to deploy its manpower to provide necessary facilitation. The roles of the key stakeholders involved in this model are highlighted in Table 10.

	Consumer	Utility	RESCO
Procurement Phase	Desirous of quality systems installed at competitive prices - leases rooftop to utility	Signs agreement with the consumer, avails low cost finance and procures system components	Lender scrutinizes the utility's credit worthiness, and provides finance to utility
Project Development	Facilitate RESCO, the access to rooftop for system set up	System set up and interconnection with the grid as per agreed terms and conditions	Lender scrutinizes the utility's credit worthiness, and provides finance to utility
O&M Phase	Receive electricity and rooftop lease charges	Acts as a trader, buys electricity from RESCO, adds facilitation charges and sells it to consumer	Owns, operates the system and repays loan for the system

Source: PACE-D TA Program Analysis

Table 10 - Role of key stakeholders under Super-RESCO – RESCO-Owned Model

Payment Assurance Model

This is a type of utility-centric business model, where the utility neither invests nor owns the system. It just acts as a facilitator between the consumer and other stakeholders (RESCO, developer and lender). This business model can be implemented in parallel with the above discussed business models as well. Key features of this business model are:

a. Utility collects payments for electricity generated from third party-owned rooftop solar systems from its clients and pays the roof top developer for a fee.
b. Utility reduces the payment risk to the developer and attracts financing as well as reduces the cost of finance.

The engagement of the stakeholders in this type of business model is highlighted in Figure 7.

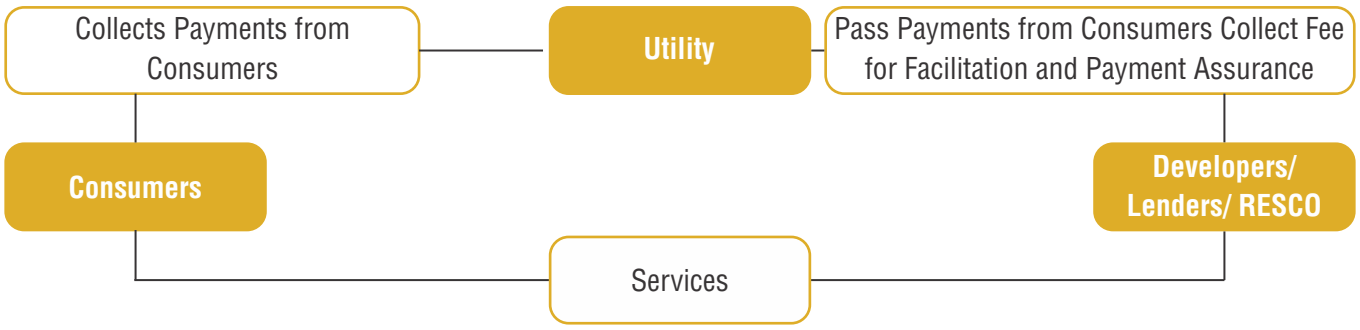

Figure 7 - Payment Assurance Model

This business model ensures payment by the consumer to all parties with involvement of utility. It also helps reduce counter party risk for the lenders and make projects more viable. The roles of the key stakeholders involved in this model are highlighted in Table 11.

	Consumer	Utility	Vendor
Procurement Phase	Desirous of quality systems installed at competitive prices. Identifies the EPC, and RESCO. Avails finance in case of CAPEX model.	Signs agreement with the EPC/RESCO and consumer to receive payment on agreed terms and conditions.	Procures system, and agrees to provide finance.
Project Development	Facilitate EPC/RESCO, the access to rooftop for system set up.	-	Sets up the system as per agreed terms and conditions; provides finance.
O&M Phase	Receive electricity and pays the utility.	Collects and assures timely payment from consumer and pays them to the Developer/Lender/ RESCO.	Owns, operates the system; Repayment of loans; Receives repayment.

Source: PACE-D TA Program Analysis

Table 11 - Role of Key Stakeholders under Payment Assurance Model

The involvement of utility ensures collection of payments for electricity generation, and payment to rooftop investors for a fee. A comparison of benefits vis-à-vis perceived risks to different stakeholders under this type of model is provided in Table 12.

Consumer	Utility	Vendor	Financier
		Benefits	
• Better access to OPEX models. • Lower cost of financing due to payment security.	• Facilitation fee payment from developers and vendors.	• Savings in transaction cost, customer acquisition, EPC marketing, etc. • Increased payment security through utility involvement. • Economies of scale.	• Savings in transaction costs (customer acquisition, marketing, etc.), higher payment security and lower capital costs due to economies of scale.
		Risks	
• Lower risk profile as OPEX models are performance based. • In EPC-based contracts – lower risk as utility will aim to provide quality assured services.	• Higher risk in case of lower than expected performance of systems under EPC.	• Financial health of DISCOMs. • Risk of non-payment by utility after collection from consumer.	• Collection risk significantly lower than conventional case. • Delays in payments may be a slightly higher risk.

Source: PACE-D TA Program Analysis

Table 12 - Risk-Benefit Assessment on Stakeholders under Payment Assurance

Emerging Models for Rooftop Solar

As new capacities of rooftop solar are installed, a number of new approaches and business models are emerging. Two key approaches are community solar, and roof rent-based business models.

- **Community Solar:** This approach enables maximum possible utilization of rooftop space for solar energy generation for consumers with multiple rooftops and service connections under the same distribution license, for example, for apartment complexes through resident welfare associations. To encourage rooftop solar plants on the buildings where entire energy generated by the project cannot be consumed locally, such type of consumers can be facilitated by the utility via the concept of group net metering. In this type of metering arrangement surplus energy generated at the project location is exported to the grid. Community solar projects can be developed as part of initiatives taken by a utility, particularly the super RESCO model with investment by either the utility or a third party.

- **Roof Rent-based Solar:**
  The Rent a Roof model allows independent third-party solar rooftop developers to rent a roof from the household/ building owners and install solar systems on the roof. The investment under this model is made by the solar rooftop developer who then pays a lease rental to the rooftop owner (this may be either based on the solar output (as has been the case in the Gandhinagar Solar Rooftop Program) or for the space (just like renting a room or a flat). The rental is either decided mutually or fixed under a program. The solar power so generated is sold to the grid where it is purchased by the utility under a Gross Metering arrangement.

Regulatory Modalities

These business models create new lines of revenue for utilities. Regulatory interventions and clarity are required in order to assimilate this revenue stream into the utility's existing regulated business. Modalities, such as, if this business is to be treated as a regulatory business or otherwise, need detailed deliberations by the electricity regulators prior implementing either or all of the above discussed business models.

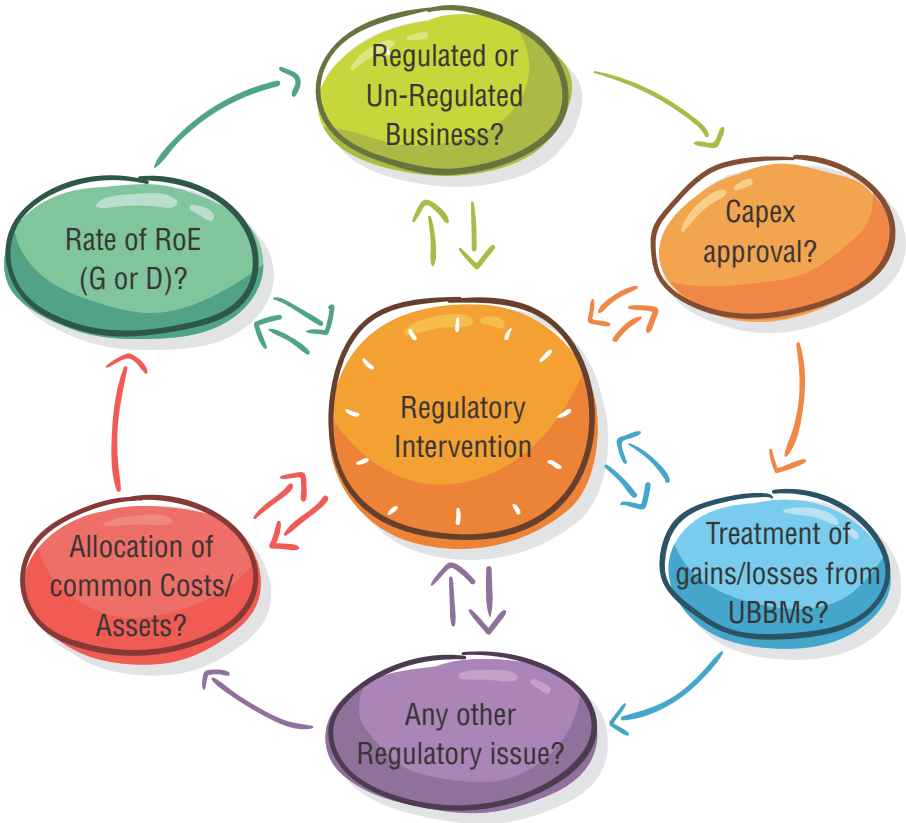

Figure 8 - Regulatory Modalities Concerning Utility-Centric Business Models

Comparison Matrix

Utility-based business models have significant potential to accelerate installation of rooftop solar projects. It is important to understand the applicability of these models. A snapshot of different utility-based business models, and respective applicability of each model and associated risks are provided in Table 13.

Model	Target Consumer Group	Risk to Utility	Investment Requirement	Transaction Costs	Institutional Capacity Utilization	Institutional Capacity Building	Returns
Utility Anchored Procurement	All Consumer Categories	Low	Low	Medium	Low	Low	Low
On Bill Financing	Large Institutions, Government, Commercial and Industrial Customers	Medium	Low	Low	Medium	Medium	Low
Super RESCO – (Utility Financed)	Large Institutions, Government, Commercial and Industrial Customers	Medium	High	High	High	High	High
Super RESCO – (Third party financed)	Large Institutions, Government, Commercial and Industrial Customers	Low	Low	Medium	Medium	Medium	Medium
Payment Assurance	All consumer categories	Medium	Low	Medium	Low	Low	Low

Source: PACE-D TA Program Analysis

Table 13 - Applicability of Utility-Centric Business Models

PACE-D Engagement

The U.S.-India bilateral Partnership to Advance Clean Energy – Deployment Technical Assistance Program (PACE-D TA, or the Program) has been instrumental in assisting BSES Rajdhani Power Limited (BRPL) with a way forward for exploring utility-centric business models. Various utility business models discussed in this report were proposed to BRPL by the Program. Each model was carefully evaluated and analyzed with their respective risk vs. benefit and implementation strategy. The models were modified, while keeping BRPL's interests and preferences in consideration. The Program along with BRPL finalized the aggregation model and a hybrid of payment assurance and anchored procurement as the preferred models for operation.

The Program assisted BRPL in ascertaining benefit of rooftop solar systems and its effects on the distribution infrastructure. As a result, BRPL shifted its strategy of target-driven RPO compliance, to that of decongesting over loaded distribution transformers (DT) with rooftop solar systems. This approach is now being considered by other state utilities wishing to replicate its processes.

Rooftop Targets

BRPL has successfully issued 411 Net Metering connections for a cumulative capacity of 12.5 MW rooftop solar projects developed by individual developers. Currently 17 MW of projects and 200 Net Metering applications are under process at various stages. The Delhi Electricity Regulatory Commission has released targets for every obligated entity to fulfill minimum percentage of total consumption from renewable energy sources, as RPO (Table 14).

Year	Solar	Total
2012-13	0.15%	3.40%
2013-14	0.20%	4.80%
2014-15	0.25%	6.20%
2015-16	0.30%	7.60%
2016-17	0.35%	9.00%
2017-18	4.75%	14.25%
2018-19	6.75%	17%
2019-20	8.75%	19.75%

Table 14 - RPO Targets by DERC

During FY 2016-17, BRPL procured 118 MU from renewable sources at an average tariff of INR 3.76 per unit. In addition, BRPL has also procured REC of 333 MU at a cost of INR 1.5 per unit to fulfill part of its RPO obligations.

1.1.Model Chosen

The Program's engagement with the BRPL helped in better understanding of the utility's role in promoting solar projects. The Program presented various utility-based models, of which BRPL chose the Anchored Procurement – Facilitation Model. BRPL chose a variation of anchored procurement, where it facilitates procurement between developers and consumers. BRPL selects vendors which agree to comply with certain technical specifications. Consumers are aggregated based on outreach initiatives under taken by BRPL for their rooftop program. BRPL also issues standard EPC contract for vendors and consumers, which is non-binding on BRPL. The advantages to stakeholder in facilitation model are highlighted in Table 15.

Consumer	Developers	BRPL
• Consumers are assured of installation of quality equipment. • Due to aggregated demand, consumers can leverage competitive pricing from the vendors. • Consumers can get financing assistance from banks through utility.	• Developers are assured of consumer aggregation from BRPL. This can bring considerable savings in terms of consumer marketing expenses and other transaction costs.	• BRPL can be assured of seamless integration of Distributed Energy Resource system into their distribution infrastructure while maintaining all quality and safety standards. • BRPL can facilitate a healthy competition amongst vendors and drive the rooftop market in Delhi. • BRPL can to an extent assure consumers of quality system installation.

Table 15 - Anchored Procurement – Facilitation Model

BRPL also chose a variation of payment assurance model for operating under RESCO mode (Figure 9). Here, BRPL would assure payment to RESCO from consumers. Consumers enter a Power Purchase Agreement between RESCO and agree to pay fixed tariff for the life of the project to BRPL. BRPL enters into a facilitation agreement with vendors for releasing payment received from consumers. This model however requires regulatory approval from the DERC. BRPL seeks to deliberate with the regulator for the same.

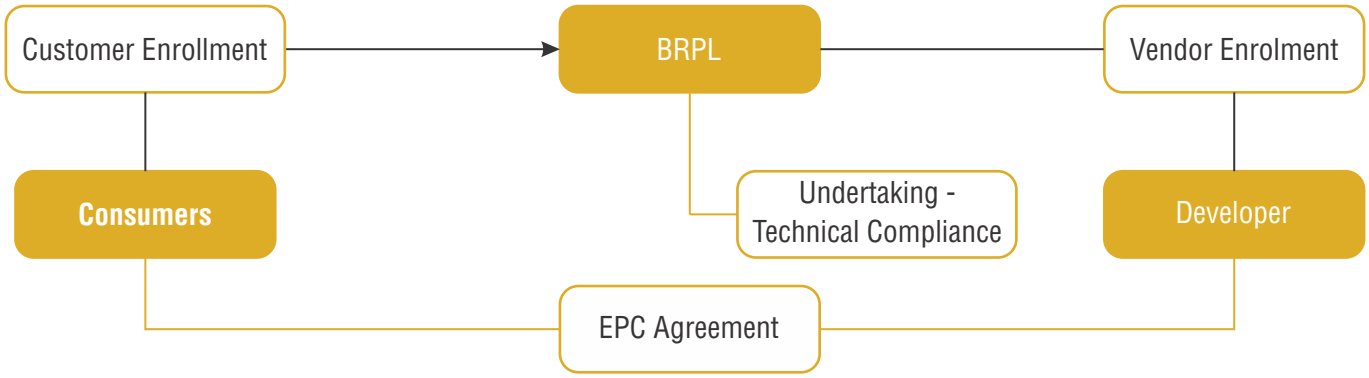

Figure 9 - Anchored Procurement – Facilitation Model

Case Studies

1.1. On-Bill Financing and On-Bill Repayment

On-bill financing refers to a business model where financing is made available to a consumer for the purchase of a rooftop solar system and the payback for the financing is collected by the utility through a monthly charge on the consumer's electricity bill. This financial product is serviced by or in partnership with a utility company for energy efficiency improvements and renewable energy adoption, and repaid by the customer on his or her monthly utility bill. On-bill financing in the U.S. was conceptualized in 1993, with the New London Resource Project, which was sponsored with help of Wisconsin Utility, to reduce the need for additional power plants. It was an exemplary success, and laid the foundation for all subsequent on-bill financing programs launched by states.

Currently, 20 states in the U.S. have utilities with on-bill financing programs, and many have legislation in place to support their adoption. Different variations of this model have been adopted with respect to varying consumer, utility and funding initiatives. Several states in the U.S. have adopted variation of on-bill financing program, and variations in programs depend on funding alternatives, target consumer and program administration.

Funding Alternatives

The funding alternatives prevalent in the U.S. are investor-owned utilities, cooperatives, state energy offices, community development financial institutions (CDFIs), and other third-party providers. There is no consistent "one-size-fits-all" approach to on-bill financing. Rather, it is an innovative collection mechanism that can be utilized in a variety of ways. Sources of capital for on-bill programs are varied. Table 16 examines a variety of methods for capitalization of on-bill finance mechanisms, and lists their strengths and weaknesses.

Capital Source	Strengths	Limitation
Utility		
Ratepayer Funds	Low-cost source of capital Accessible to utilities	Non-payment risk lies with utility Finite availability of funds imposes limits to program growth and expansion
Public		
Grants	Low-cost source of capital May be sizable	Uncertain availability in future May impose limitations on program design
Public Loan Funds Example: USDA Rural Utility Service Loans	May be more sustainable compared to one-time grants Can assist programs in building creditworthiness	May be perceived as risky to taxpayers.
Bond Issues	Potentially low interest rates and favorable terms Could be tax-exempt	Contingent upon voter approval in many cases Investments with lower, long term returns may be difficult to correlate with bond maturity
Revenue from Cap and Trade Programs Example: Regional Greenhouse Gas Initiative	Innovative and possibly unbudgeted source of capital	Programs need to be available and be lucrative

Private		
Local Banks and Credit Unions	• Experience in providing financial services to community can improve program access and facilitate risk management • Can act as partners in program administration • Can expand access to private capital	May have limitations on lending terms (constrained by industry underwriting standards).
Large Commercial Banks and Capital Markets	Potential resources for bringing programs to scale	• May not see on-bill programs as an asset class. • May be restricted by traditional measures of creditworthiness

Table 16 – Source of Capital for On-Bill Programs

Target Consumers

On-billing financing programs are designed with varied target consumers. Some examples include:

- Connecticut utilities offer on-bill programs for small-business consumers, residential and commercial consumers.
- Four large utilities in California (San Diego Gas & Electric, SoCalGas, SoCal Edison & Pacific Gas and Electric) operate on-bill loan programs for commercial customers.
- Many states such as South Carolina, Oregon, New York, Illinois, have dedicated on-bill financing programs for low income communities and home owners.

Program Administration

On-bill programs are administered in a variety of ways across the states. The structure of the program depends on the utility's business model, a state utility regulatory structure, customer base requirement and source of capital. Programs are administered by utilities themselves, third party lending institutions, or third-party service organizations.

On-Bill Loan Programs in the U.S.

The prevailing prevalent on-billing financing programs across various states in the U.S. have been described in Table 17.

S.No.	State	Program Name	Features
1	Wisconsin	New London Resource Project (1993-1995)	• Residential energy savings estimated to be 1.8 GWh and 93,000 therms across the life of the investments. • The program reduced peak demand by 15 kW in the summer and 44 kW in the winter.
2	South Carolina	Rural Energy Savings Program	• Anticipated to impact 185,000-195,000 homes. • Energy savings from these retrofits are 2,668,800 MWh of electricity per year. • Allows for flexibility amongst home owners that do not wish to stay with their homes during the loan. • Loan tied to buildings meter. • Loan tied to buildings meter.
3	Portland City, Oregon	Clean Energy Works Oregon	• Program's loan portfolio is USD 7,789,871, with 599 loans having been issued. • Customers need to qualify minimum credit score after which loans are secured by participants' real property assets. • Project sites saved 4,249 kWh and 380 therms per year.
4	Connecticut	Small Business Energy Advantage Program (2000)	• United Illuminating (UI) offered USD 500 loans to small businesses and USD 1000 loans to commercial and industrial consumers having peak demand between 10 and 200 kW. • Project size ranges from USD 8,000 to USD 12,000 and is financed over an average term of 24 to 36 months.
		C&I Energy Efficient Loans	• Connecticut Light & Power (CL&P) has closed over 7,000 loans worth USD 72 million. • Savings for average participant of 20,000 kWh a year with an average life of 12.3 years.
		Home Energy Solutions	• Connecticut Home Energy Solutions program offered loan for residential consumers. • Loans range from USD 2,000 to USD 20,000 with terms extending out to 10 years.
5	California	California Investor-Owned Utilities Program - SDG&E/ SoCalGas	• Similar to Connecticut's on-bill financing program • Extended 856 loans totaling USD 20,800,000. • Loans are a minimum of USD 5,000 and can be up to USD 1 million (depending on the customer class), are issued at 0 percent interest, and are non-transferable.
6	New York	On-bill financing program	• Each loan is secured by a mortgage on the property, and is subordinate to current or future mortgages on the property. • In the event the ownership of the property is transferred prior to full repayment, the loan travels with the home.
7	Indianapolis	Neighbour Sweep Program	• Indianapolis Neighborhood Housing Partnership (INHP) launched a finance program for residential consumers. • It Sub granted USD 3 million for a loan-loss reserve, and raised USD 6 million from local banks with the goal of funding 1000 loans averaging USD 6,000.

Table 17 - Prevalent On-bill Loan Program in the U.S.

Similarly, On-billing tariff programs across various states in the U.S. have been explained in Table 18.

S.No.	State	Program Name	Features
1	New Hampshire	NHEC SmartSTART: Pay As You Go	• New Hampshire Smart Savings through Retrofit Technologies (SmartSTART) started in 2002 through New Hampshire Electric Cooperative. • Allows commercial and industrial customers to have energy-efficient products such as lighting upgrades, weatherization, air sealing, and insulation installed with no down payment. • The cost of the improvements is repaid based on 75 percent of the estimated energy bill savings. • Repayment of the loan follows the meter. • Between 2004 and 2010, 27 projects were completed with a total cost of USD 592,127. The average cost of projects is USD 21,930. • Loan terms can be up to five years and the average interest rate is 5.64 percent. Currently, the program is offering a fixed rate of 5.41 percent interest, which can vary depending on the market at closing. The average loan amount is USD 10,000.
	Kansas	Kansas HowSmart	• Midwest Energy launched on-bill financing for its residential consumers. • 350 of the 650 completed projects have utilized some low-cost source of funding. • Utility project investment has totaled over USD 3.7 million with customers adding another USD 1million to buy down project costs and pay program fees. The average program investment by the company is about USD 5,700. • Interest rates have varied from 0 percent to 8 percent depending on access to low-cost sources of funds. Currently, without access to low-cost money, the embedded interest rate is 5.05 percent for residential and 6.6 percent for commercial investment. • Savings from the efficiency measures are around 2,000 kWh per year for electricity projects and 260 therms per year for natural gas.
	Kentucky	MACED: How$martKY	• Administered by the Mountain Association for Community Economic Development (MACED). • The program will utilize up to USD 2 million from CDFI funds and a loan from the Ford Foundation to make energy efficiency investments to improve HVAC systems and building envelopes in 200-300 homes. • Seven homes have received complete retrofits, and another 18 are in the pipeline. • Currently limited to residential market.
	Portland	City of Portland Housing Bureau: Mpower	• Program designed to serve multifamily housing market in Portland Oregon. • Building owners enter into an energy services contract with the utility and agree to pay a voluntary energy efficiency tariff for the next 10 years. • The cost of the energy efficiency services is then passed on to the tenants who benefit from the cost-saving measures and ultimately see a net reduction in their monthly utility bills (which they may split with the owner in their rental agreement).

Table 18 - Prevalent On-bill Tariff Program in the U.S.

Super-RESCO Business Model: Utility-Owned Solar Program

Super-RESCO models are a new concept in the U.S., and first appeared in 2014 in Arizona, when the utility wanted to explore ways in expanding access to solar and other consumer oriented technologies. It believed that utility as a Super-RESCO would help in decongesting the grid, and result in savings for rate payers.

Arizona Public Service (APS): Solar Partner Program

Arizona Public Service (APS) is a large investor-owned utility in Arizona, and serves 1.2 million consumers. It has been operational for 120 years, with estimated enterprise value of USD 11 billion. It has the 5th largest service territory in the U.S. APS initially sought to develop 20 megawatts of solar PV on 3,000 rooftops, through its Solar Partner Program (SPP). It initiated the program to give customers a chance to go solar and allow the utility to study potential operational advantages of installing rooftop solar with advanced inverters.

The program was a huge success, and was the first of its kind utility-owned rooftop project. It received subscription from 1670 participating households. The project was built by Arizona-based project developers selected through competitive bidding, to encourage local participation. Customers received a USD 30 monthly credit for 20 years in exchange for leasing their rooftops to the utility. Rooftop PV systems size ranged from 4 kW to 8 kW. Under the SPP program, APC acted as a Super-RESCO and laid down the framework and specifications for control and curtailment of rooftop systems.

Cases from India

On-Bill Financing by Andhra Pradesh Eastern Power Distribution Company (APEPDL)

There were several on-bill financing programs launched in India similar to the ones prevalent in the U.S. On-bill financing program of the APEPDCL was one such program. APEPDCL signed a memorandum of understanding with Andhra Bank for arranging easy financing for specific consumers. The scheme was proposed for low income group community who were not able to arrange security deeds to arrange a loan. The low income group were marginal energy consumers, who had a monthly consumption lesser than 200 units. The utility collected EMIs from consumers, which was clubbed with the electricity consumption of the household. As a result of APEPDCL acting as a utility for bill financing, more than 600 applications have been registered and 250 applications have been processed for their respective bank loans. More than 100 rooftop solar systems of 1 kWp have been installed and synchronized to the grid.

Domestic Efficient Lighting Program (DELP)

The DELP was implemented by Energy Efficiency Services Limited (EESL). This program aims to urge citizens to switch to use of LED bulbs in place of incandescent bulbs and tube lights. The government targets replacing 77 crore incandescent bulbs with LEDs by 2019; leading to an expected reduction of installed load of 20 GW. The program is implemented through distribution utilities, and payments are linked to resultant energy and load reduction.

- The replacement has helped avoid peak load demand of 1326 MW and INR 5.55 crore in cost savings per day, leading to substantial reduction in carbon emissions.
- The program has been adopted by over 2.3 crore people across 11 states in the country.
- EESL achieved 75 percent reduction in price of LED bulbs through competitive procurement process, and passed the benefits on to consumers.

The DELP on-bill financing model overcomes the first cost barrier, and provides LEDs to the consumer at the cost of incandescent lamps. Consumers are eligible to purchase up to four LED bulbs at an upfront cost. The balance amount is recovered from the electricity bill per month for the next subsequent month. Utility may choose to finance the program by making suitable provision in Annual Revenue Requirement (ARR).

Indian Railways Anchored Procurement

Indian Railways prepared a model bid document, and initiated centralized bidding for rooftop solar to be installed at zonal buildings through its subsidiary, the Rail Energy Management Company Limited (REMCL). REMCL coordinated with 16 zonal railways, five railway factories and two metro stations for assessing maximum rooftop potential. The cumulative rooftop capacity collected was centrally tendered to developers. The tendering process was carried out in phases, and saw exemplary participation from developers, with all zonal capacities being bid out.

The anchored procurement business model helped accelerate the rooftop program for the Indian Railways. The model also sets an example to other public sector companies. Some of the inherent advantages for Indian Railways as a result of anchored procurement were:

- Centralized procurement resulted in discovery of new competitive market prices. Indian Railways' rooftop program helped breach the prevalent rooftop tariff from INR 4.5 to INR 3.8.
- Bought in economies of scale to the projects, which drastically lower transaction costs.
- Provided a higher degree of business assurance to developers, with payment assurance.

About the PACE-D TA Program

The USAID PACE-D TA Program is a part of the overall Partnership to Advance Clean Energy (PACE) initiative, the flagship program under the U.S.-India Energy Dialogue. The six year program is being implemented in collaboration with the Ministry of Power and Ministry of New and Renewable Energy. In the first five years, the Program focused on three key components: energy efficiency, renewable energy and cleaner fossil technologies, with the overall aim of accelerating the deployment of clean energy, expanding U.S.-India trade and investment linkages, and facilitating knowledge exchange. The Program's focus in the sixth year is largely on accelerating solar rooftop deployment across eight states: Andhra Pradesh, Assam, Haryana, Maharashtra, Punjab, Telangana, Uttar Pradesh and West Bengal, covering 15 utilities. The objectives of this scope of activities are to:

- Help utilities in quickly administering best practices, developing new, innovative and customized business models and developing streamlined access for consumers for implementing grid-connected solar PV rooftop projects.
- Train manpower at all the levels of utilities, and new entrepreneurs for scaling-up of rooftop solar PV power.
- Support MNRE in designing and establishing national level initiatives to support rooftop solar PV scale-up.

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