WRI INDIA

Confederation of Indian Industry

WORKING PAPER

AGGREGATING DEMAND FOR CORPORATE ROOFTOP SOLAR INSTALLATIONS: LESSONS FROM THE COLLABORATIVE SOLAR PV PROCUREMENT PROJECT

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EXECUTIVE SUMMARY

Corporate consumers are increasingly concerned about the carbon footprint of their businesses. Electricity consumption of commercial and industrial companies is largely sourced from fossil fuel-based generation and accounts for a significant portion of their Green House Gas (GHG) emissions. Hence procurement of renewable energy (RE) has become a central piece of companies' corporate sustainability strategy, something that is also aided by the declining costs of RE. Among various forms of renewable energy in India, rooftop solar photovoltaic (PV) technology can offer increasingly affordable, clean and reliable electricity at the site of consumption itself.

The scale of rooftop solar deployment can be limited by the amount of roof space at an individual site and various other competing uses the roof has. This may limit the individual project size at each site which could result in increased transaction costs for the vendors because of the time and resources they need to invest in exploiting each of them. However if this demand is aggregated, data collection process streamlined, and buyers coordinated in the timing of a purchase, the transaction costs can be reduced to help these projects move forward. To address these issues, WRI India and Confederation of Indian Industry (CII) through the Green Power Market Development Group (GPMDG) initiative attempted to aggregate energy demand from six corporate buyers in Bengaluru—Coca Cola, Infosys, IBM, Cognizant, Philips and Bangalore International Exhibition Center (BIEC). The aim was to combine their RE procurement into one bid to achieve economies of scale and reduce transaction costs per project. This larger combined project size made this opportunity more attractive for project developers and financiers. Our hope was to demonstrate a new aggregated procurement model that could be replicated

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across India to accelerate the deployment of rooftop solar power. GPMDG called this aggregated procurement model as the CollabSolar project.

This working paper outlines the processes, barriers and key lessons learned from the CollabSolar project in Bengaluru (2014), which can help advance additional aggregation strategies going forward.

The lessons and experience gained from this pilot are as follows.

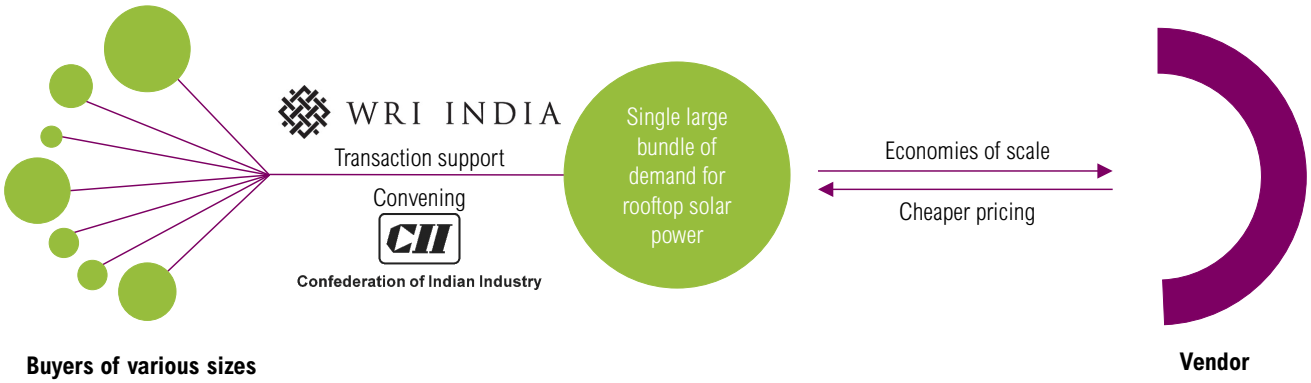
- The Aggregation model works best with companies within a small geographic area such as an industrial or business park level.
- Aggregating across a group of buyers with a collective minimum renewable energy demand of 8-10 million kWh/year (~5-6 MW in project size) will negate the risk of project failure from any one individual buyer pulling out of the initiative.
- The creditworthiness of the buyers helps to mitigate the financial risks to project developers and can reduce the cost of project financing. Usually large companies which consume at least 1 million kWh per annum tend to fall under this category and they can act as the anchor buyers.
- Aggregating renewable energy demand based on the preference of the procurement business model is critical to be able to select the right vendors. For example, commercial buyers in our bundle paid a higher tariff to the grid and hence preferred a Power Purchase Agreement (PPA) with a solar power vendor to save on their bills. Industrial buyers in our group paid a lower tariff to the grid and preferred to invest in the renewable energy plant directly to make use of the capital tax benefit.
- Buyers need to become more comfortable with providing roof top data in order to get accurate proposals. Buyers we worked with were typically wary of disclosing rooftop data to the solar power vendors because of perceived security concerns. Design of solar power plants is highly location specific and needs to be optimised to maximise the return on investments. Better design leads to lower costs and more value to the buyers. Making buyers more comfortable with signing Non-Disclosure Agreements (NDAs) with the supplier to provide this information will improve the data collection process.
- Net-metering schemes which allow for excess rooftop solar power to be sold to the utilities will improve the economics of on-site solar. However, at the time of this pilot, Bengaluru did not have such a scheme in place. Thus the systems at individual sites had to be sized to the minimum load as there was no compensation for power sold to the grid. We used electricity demand on a typical weekend as a reference to quantify the minimum demand of a buyer. Sizing systems to the minimum load resulted in a smaller transaction size, as neither the vendor nor the buyers wanted to pay for the excess generation during the weekends.
- Early engagement with building owners/property management companies is needed. Several of the participants were in a leased space and found that in order to install a rooftop solar system on their premises, a tripartite commercial agreement between the buyer, vendor and the landlords was needed. Some building owners expressed interest in supporting a solar purchase, but others did not.
- Multi-National Companies (MNCs) who prefer to invest their own capital in a rooftop solar plant need to change their corporate charter to permit their entry into power generation business. While some companies in the collaborative solar project were willing to invest the time engaging relevant stakeholders to make this change to their corporate charters, most of them preferred a PPA as this does not require a change to their corporate charters. Companies need to check on the feasibility of changing their charters before making a final decision between a captive purchase model (using their own capital) and a PPA model (using operating budgets).

This experience will inform the design of the next iteration of demand aggregation projects to be handled by GPMDG across industrial or business parks in Karnataka, Tamil Nadu and other states. This guide can also serve as a reference for others working on demand aggregation models.

BACKGROUND: THE COLLABORATIVE SOLAR PV PROCUREMENT PROJECT

The Green Power Market Development Group (GPMDG) - India is a collaboration between WRI India and the Confederation of Indian Industry (CII), launched in 2013. GPMDG recognises that while many initiatives in India and globally are focused on increasing the supply of renewable energy, more efforts are needed to build demand for renewable energy with large buyers. GPMDG attempted to

Figure 1 | **Conceptual representation of the CollabSolar project**



accomplish this by aggregating corporate demand through the collaborative solar procurement (CollabSolar) project.

By aggregating the demand across multiple commercial and industrial customers into a single purchase for on-site solar photovoltaic (PV) systems the CollabSolar project aimed to:

- increase the scale and accelerate the rate of deployment of solar technologies used by the largest electricity consumers,
- support the increased adoption of renewable energy in commercial and industrial energy strategies,
- increase the scale of on-site solar projects to reduce transaction costs and reduce greenhouse gas emissions.

Corporate buyers participating in the project understood that photovoltaic (PV) installations can lower facility reliance on grid electricity and reduce the carbon footprint of their operations while also providing environmental leadership for the community.

COLLABSOLAR PROCESS AND TIME LINE

CollabSolar project was the first initiative that the participating companies of GPMDG pursued. WRI India offered the know-how related to Indian policy framework and technical assistance. CII brought in their outreach capabilities to convene prospective corporate buyers and bring more buyers into the program. A conceptual representation of the CollabSolar project is presented in Figure 1.

Consultations with potential buyers

Two consultation meetings were organised by GPMDG on 9 January and 25 February, 2013. The meetings were attended by large corporate buyers, clean energy suppliers and officials from the Karnataka state government. WRI India presented World Resource Institute's (WRI) experience with aggregating demand for solar PV in California and lessons learned from that initiative (Goodward et al. 2011). This included analysis on potential economies of scale from aggregation, the process that was used, and how this model has been replicated by partners in the US public sector. A cross sectoral and international mix of companies – Coca Cola, Infosys, IBM, Cognizant, Philips and Bangalore International Exhibition Center (BIEC) – signed up for the first phase of the project. Subsequently, the CollabSolar project was officially launched in Bengaluru in August 2013. A brief representation of the steps invovled in the CollabSolar project is presented in Figure 2.

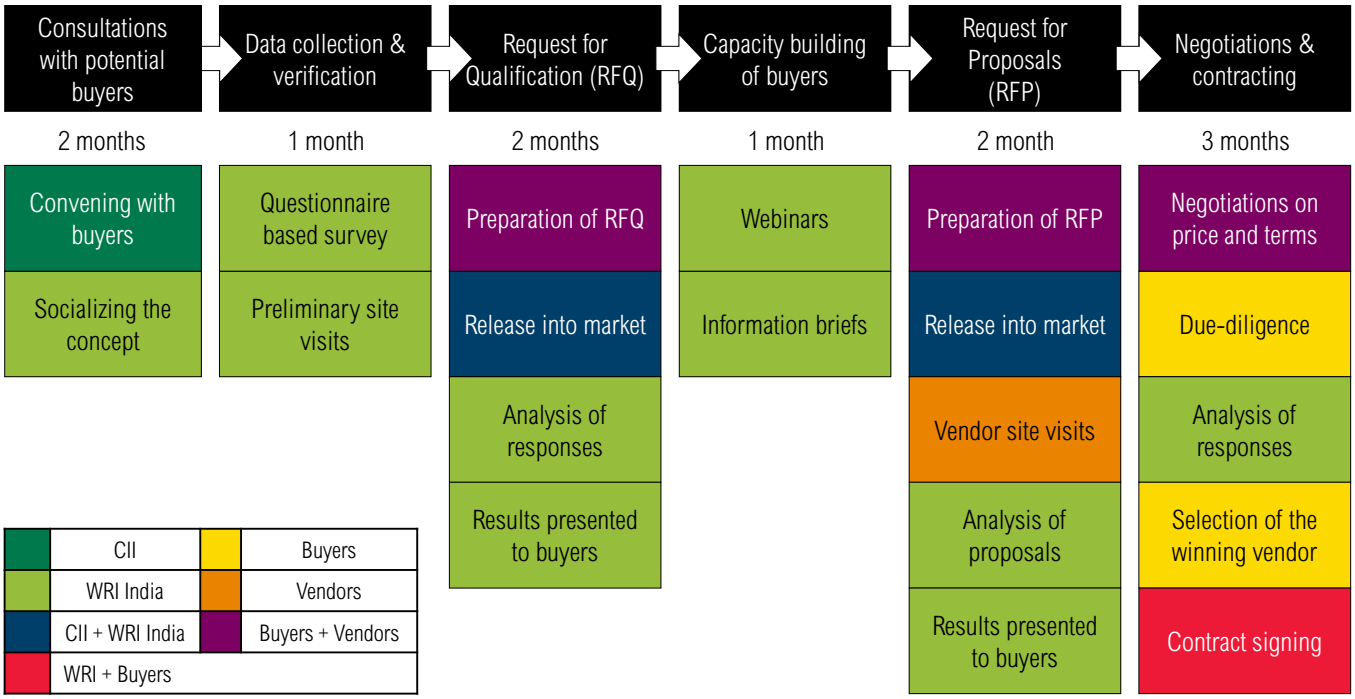
Data collection from interested buyers

Soon after the launch, a questionnaire (Annexure I) was sent out to the buyers to collect preliminary data such as location of the premises, annual electricity consumption, roof space available for solar installation etc. Top management of the respective buyers were requested to nominate dedicated executive staff to answer these questionnaires and provide additional clarifications to WRI India. Having a dedicated staff person at each company to support this data collection is critical to a smooth process.

Preliminary site visits

After the preliminary data was collected, WRI India's experts conducted site visits to evaluate the site conditions and verify the data provided by the participants. One of major concerns that emerged during the preliminary site visits was the information provided about the roof space. Typically only about 1/3rd of a commercial building's total roof space is usable for rooftop solar PV installations

Figure 2 | **Collaborative Solar power procurement project: Process chart and stakeholders**



because of orientation, shadows, obstructions, access restrictions and some structural reasons. Buyers were either unaware of these technical aspects or not capable of making such accurate technical assessments. Hence, even though the survey questionnaire asked for shade-free usable roof space for solar PV installations, they provided data of total roof area, which often had to be re-checked.

Preparation and release of the Request for Qualification (RFQ) document

After the site visits, a Request For Qualification (RFQ) was prepared by WRI India to be circulated in the market. It was an adapted version of the RFQ that WRI developed for an aggregated solar purchase in California (Goodward et al. 2011). Optony, one of WRI's partners in that effort, has since replicated this aggregation across government purchasers. WRI and Optony's previous experience helped inform the Bengaluru project and prepare associated documents.

The RFQ described the buyers who were a part of the collaborative procurement. It included preliminary details about the companies, their locations, roof spaces, annual electricity consumption, utility tariffs etc., collected from the buyers. It also requested minimum eligibility criteria for selection of the vendors and the choice of business models of the buyers.

The RFQ was widely circulated among the solar developer community through mass mailing and sharing on CII's website. This purchase was expected to be large, and the buyers had high standards in terms of performance track record, financial condition, and team expertise. Despite the large number of solar installers in India, only four vendors responded to the RFQ.

At this stage, IBM, a company that is predominantly in leased office space, chose to exit from the project and maintain an observer's role. IBM was not sure if they would maintain the leases over the contract period. This hampered their ability to operationalize a long-term Power Purchase Agreement (PPA) with third-party Solar PV vendors.

Analysis and screening of responses to RFQ

The responses to the RFQ were screened by WRI India and Optony to identify vendors who would qualify to participate in the Request For Proposals (RFP) stage. The team, with input from all the buyers continued preparing the RFP documents during the screening process, so it could be promptly shared with the shortlisted vendors.

With one buyer exiting in the RFQ stage, the final RFP included the remaining five buyers with a cumulative capacity of 3 MW. During the process, it became clear that some of the companies preferred a capital purchase while others preferred a PPA structure. For this reason, only vendors who could serve both capital purchase and

PPA models were allowed to respond to the RFP. The companies that preferred different financial structures were not separated into two different RFPs in order to maintain the economies of scale from a single transaction. Vendor feedback from the RFQ process highlighted some key points to inform future project strategy.

- Aggregation benefits can be realised only when system size is at least 100kW with even better economies of scale above 1 MW. Smaller system sizes require many string inverters instead of a single cost effective central inverter. Opting for individual string inverters is a costlier proposition.
- Cost savings of aggregation can be realised only when projects are awarded to a limited number of vendors.
- Single large roof-top installations that support at least 1MW capacity can cross-subsidise smaller roof-top installations. Projects of 1MW size can result in a price less than ₹ 7/ kWh in 2014, which is the range that most buyers were comfortable with.
- In case of projects of 10MW size prices less than ₹ 7/ kWh can be achieved even if Renewable Energy Certificates (RECs) are retained by the buyers. [Each REC represents the environmental attributes of one MWh of renewable energy. RECs can be generated by an RE vendor in case of selling the power to a state utility at its average power procurement cost. They can also be generated in case of selling the power to a third party buyer at a mutually agreed tariff. RECs are tradeable on power exchanges and are used by corporates to fulfill mandatory renewables purchase obligations or voluntary sustainability compliances.]

Educating the buyers for decision-making

WRI India and Optany, organised two webinars for the buyers, one each on 10 and 11 June, 2013. The first webinar focused on solar project economics and financing models including direct purchase, power purchase agreements and leases. The second webinar advanced the conversation with discussions on different solar technologies and installation types, major considerations for system design, project management, and operational aspects. Staff nominated by the buyers attended these webinars which helped clarify any concerns and build their capacity.

It was very important for WRI India to set up this kind of information sharing and capacity building to give all the buyers in a collaborative purchase, a common point of reference.

Preparation and the release of the Request for Proposals (RFP) document

The RFP was prepared using a template developed by WRI for aggregated solar purchases in the US with relevant modifications to suit Indian business conditions. The quality of the solar power plant equipment was based on the standards set by the Indian government for public procurement projects to suit local conditions Ministry of New and Renewable Energy (MNRE).

The RFP incorporated clauses like performance guarantee and force majeure that were discussed with the buyers to screen highly competitive and capable vendors. For instance, a performance guarantee clause allows for compensation if the delivered energy (adjusting for degradation of equipment) was less than 95 percent (95%) of the total Expected Annual Contract Quantity for the first three Contract Years. This was to ensure that the vendors quote in a realistic manner and stand by their quote.

Developer site visits

Vendors were required to conduct detailed site visits before submitting the bid in response to the RFP. A lot of planning went into the scheduling exercise to coordinate with the management teams and match the availability of the executive teams on both sides. The site visits were arranged such that each developer covers all the sites in a single schedule to maximise efficiency and reduce costs. WRI India used an online self-scheduling tool to help fix the site meetings. Using a scheduling tool eliminated the need for a coordinator to set up site visits, which saved considerable time. WRI India sent questionnaires to the executive teams from each of the buyers before the site visits to ensure buyers were prepared and the site visits were productive. The vendors had to cross check the data provided and assess for additional information that had to be collected. During the detailed site assessments, acquiring information about the building rooftop and Single Line Electrical Drawings (SLDs) were key concerns. A second round of clarifications was facilitated between the vendors and buyers.

Analysis of the responses to RFP

WRI India and partners carefully evaluated each proposal for completeness and accuracy, as well as the technical and financial capacity of the vendors. Levelised Cost of Energy (LCOE) was the metric used to compare the competitiveness of the proposals. LCOE is calculated as follows:

$$\text{Levelized Cost of Energy (₹/ kWh)} = \frac{\text{Life time project costs adjusted for discounting (₹)}}{\text{Life time expected power generation (kWh)}}$$

This was complemented with an analysis of grid tariffs in Bengaluru over the last five years to assess the proposals.

The vendors were evaluated based on the parameters shown in Table 1.

Table 1 | **Methodology of vendor evaluation**

	Parameter	Weightage (Points)
1	Proposer Qualifications & Experience	20
2	Technical Proposal	20
3	Project Costs	40
4	Implementation Plan and Schedule	15
5	Contract Terms & Conditions	5
	Total	**100**

WRI India convened a meeting with the buyers on 23 Jan 2014, to discuss the results of the evaluation of the proposals. As per the analysis and discussions with the buyers, two vendors were screened as having the capabilities and resources to execute on this project for both buyers interested in a PPA structure and a capital purchase.

Unfortunately, during the final negotiations, the proposed anti-dumping duty (Engelmeier 2014) on imported solar equipment by the Government of India, which qualified as a force majeure event, affected the negotiation process. The selected vendors were unsure about committing to a particular price while the anti-dumping fee was being considered as most of the market depended on imported solar panels.

The delay that this policy uncertainty caused led to two of the large buyers – Coca Cola and Infosys – to take a strategic decision to go ahead with independent solar purchases. With the anti-dumping policy unresolved and a smaller transaction size, GPMDG chose to bring the project to a close. So while this project did not go forward in the end, it did help the participants make the business case to implement solar projects on their own. It also provided GPMDG with important lessons learned to replicate a similar model for future projects.

LESSONS LEARNED

GPMDG has learned the following lessons during the CollabSolar project.

Aggregate bundles at industrial park level to allow for fluctuations of demand and supply

Once one of the buyers pulled out of the CollabSolar bundle, the project's scale was not viable for any of the vendors. The benefits of aggregation can be best achieved in a bundle with 3-5 large buyers (whose demand is at least 1 million kWh / annum) along with several small buyers. The minimum total demand of the bundle needs to be in the range of 8-10 million kWh per annum. In such a bundle, even if a large buyer pulls out of the project, the rest of the buyers in the bundle can purchase the leftover power from the vendor. Large buyers with good credit ratings who act as anchor buyers, make financial institutions more comfortable and can result in reduced financing costs for the project. If all the participating buyers are situated within close proximity, the logistical and transaction costs can be reduced even further. Hence we feel industrial parks are best suited for aggregated procurement models as they offer scale and geographic proximity. The industrial parks around Bengaluru and Chennai are suitable for the next phase of the CollabSolar project.

Segregate commercial and industrial buyers into two different bundles

In India industrial category buyers pay a lower tariff to the state power utilities than commercial category buyers. These two categories of buyers can have very different appetites to use their own capital for projects which can lead them to prefer a particular type of business models to purchase solar power.

The cost of solar power is around ₹ 6-7/ kWh in India. Commercial buyers pay higher tariffs that are usually in the range of ₹ 8-11/ kWh. Third-party PPAs are considered convenient for such users, as they offer a cheaper alternative over grid power. But for industrial category buyers who usually pay around ₹ 5-7/ kWh for grid power, solar PPA is an expensive alternative. Our experience with industrial buyers like Coca Cola shows that they are more willing to invest their own capital in setting up solar power plants. Through this business model, they can make use of the Accelerated Depreciation (AD) tax benefit which allows solar power to become cheaper than grid power. [AD benefit allows professional companies who invest in solar

PV projects in India, set off their tax liability on the taxable income to the tune of 80% of such investment in the first year and 20% in the second year.]

The vendors in the renewable energy industry operate in two different models. In the Capital Purchase or CAPEX model, an Engineering, Procurement and Construction (EPC) vendor sells solar system hardware directly to customers. In the Operating Expense or OPEX model an Independent Power Producers (IPP) sells the energy from the solar system to customers. While EPC players are the technical hardware solution providers, IPPs invest to set up plants to generate power that is, in turn, sold directly to the buyers through a PPA.

Both type of vendors have their unique expertise and capabilities in the business models they operate in. There are very few players who can offer both the models. Hence if a bundle has a mix of commercial and industrial buyers, the CollabSolar project limitation (single vendor) means reduced options (vendors who can offer both EPC and IPP services) to negotiate with. From the perspective of the buyers, this scenario may limit the number of bids that will be received which may result in a higher overall bid. It may also preclude bids from companies that are specialised in one of the business models and offer competitive pricing for that model. As the market in India continues to mature, there may be more and more companies that can offer the full range of models, but for now, the bidding strategy should take into account the types of vendors active in the market.

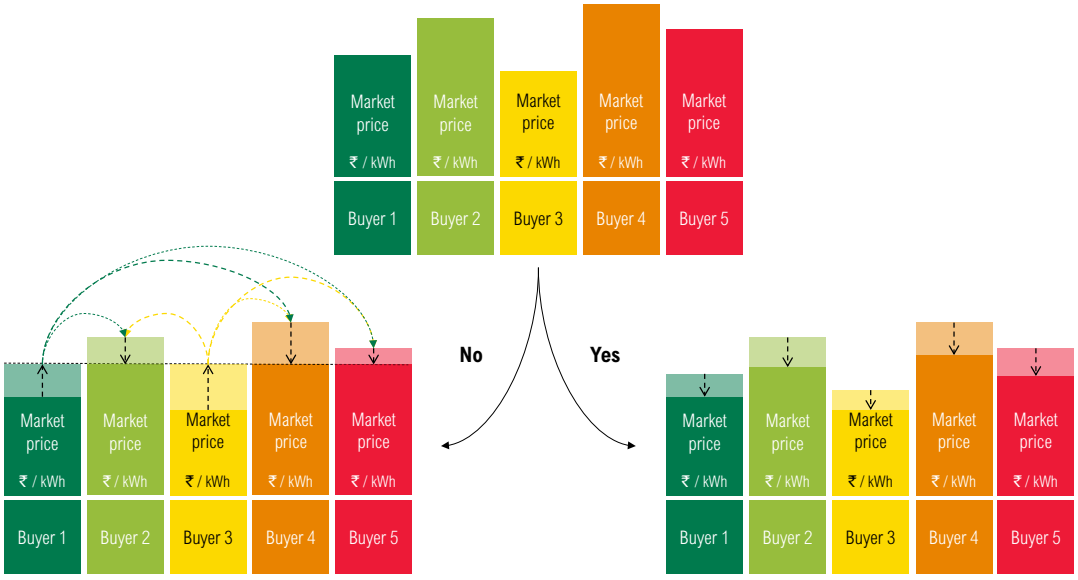
Clarity on "CollabSolar rebate" Vs "Cross subsidy within the buyers"

At the beginning of the project, there was lack of clarity over the CollabSolar pricing benefits. There was confusion as to whether the vendor was expected to give a uniform cheaper price for all buyers regardless of their share in the cumulative capacity. This was understood to cross-subsidise the smaller buyers by charging the large buyers at a higher rate. During the CollabSolar process, we clarified that the vendors were expected to give an individual price to each buyer based on their credentials and offer a uniform discount that is reflective of the CollabSolar benefit. This concept, represented in the Figure 3, will be the core of the next round of CollabSolar projects and made clear right at the beginning of the project.

Address data collection problems

Buyers are typically not very comfortable in providing rooftop and electricity data to facilitate rooftop solar installations. In some cases, this was attributed to the lack of "As-built" drawings while in most cases it was due to the data security concerns of the buyers. Some buyers expected the vendors to invest in creating those drawings for their usage. WRI India explained to the buyers that in the absence of a clear business opportunity, vendors cannot be expected to invest time and resources in reproducing data that is already available.

Figure 3 | **CollabSolar rebate Vs Cross subsidy within the buyers**



Productivity of the Solar PV installations is extremely sensitive to shadows and hence placement. Shadows that are cast on the installations reduce their productivity and make them an under-performing asset. Installing the panels in the right locations can yield maximum energy that can benefit both buyers and vendors. If the vendor is able to maximise his plant's efficiency he can pass on some of the benefits to the buyer with attractive pricing. Signing Non-Disclosure Agreements (NDAs) and having detailed clauses about access and ownership in the next phase could address most of the security concerns.

Address weekend (dynamic) demand, deemed generation and net-metering issues

One of the buyers who preferred the PPA model faced a unique scenario. They had a lot of roof space but their electricity consumption fell drastically over weekends. The buyer did not want to pay for the power that was not being consumed. Large scale storage options for solar power are not commercially viable yet and there is no other way that the vendor can realise the value of such power. Hence the vendor wanted to consider this as deemed generation. Typically in such scenarios, net-metering would solve the problem. Net-metering enables any consumer who generates solar power to inject excess power into the grid and get paid in return by the grid operators. During the CollabSolar negotiations, net-metering was still not in place in Bengaluru. With net-metering having been introduced recently (BESCOM 2014), the issue under discussion can be resolved easily.

Account for roof space limitations and ownership types into the business model

Availability of roof space is a limiting factor with respect to rooftop solar PV installations. The roof space of corporate offices are usually occupied by HVAC systems, lift rooms, water tanks etc., leaving only 1/3rd suitable for rooftop solar PV installations. As explained in previous sections, such projects satisfy only 1-3% of the annual electricity consumption of commercial companies. Hence buyers are wary of them except in areas where electricity reliability is a major concern. Issues of access and security have also come up during the CollabSolar project.

In case of buyers who were operating out of leased spaces, the vendors were not comfortable with a third-party PPA based rooftop solar PV installation. The minimum standard for PPA tenure in the Indian market is 10 years. Risk perception about the buyer remaining in the leased space for such long term and landlord's involvement over access to roof were their major concerns.

Signing a tripartite agreement between the vendor, landlord and the buyer might be a possible solution for such instances but the exact modalities of such models need to be worked out on a case to case basis.

Account for time needed for MNCs to change their corporate charter and obtain clearance from the headquarters for capital investments in solar projects

MNC buyers with headquarters in foreign countries have a two-layered decision making process. Any investments over a certain quantum have to get approvals from the senior management situated in the headquarters. Hence decisions like capital investments in solar plants can be delayed.

Similarly any company which does not have power generation mentioned in their corporate charter will have to get it incorporated before investing in captive power plants. If it is a listed company, then the decision will have to be deliberated by all the stake holders.

This is why facility managers of companies with headquarters in different countries, prefer a PPA to a capital investment.

INSIGHTS

Policy ramifications

The contemplation of anti-dumping duties and the lack of a net-metering scheme had affected the proceedings of the CollabSolar project. After the withdrawal of anti-dumping duties (Kumar and Singh 2014) and the introduction of net-metering scheme, vendors say that there has been a gradual rise in the procurement of rooftop solar projects by the corporates especially in Bengaluru. This goes to show the impact of policy dynamics on the renewable energy market, and the need for a conductive, stable and long-term policy to support it.

Evaluating various combination of bids

In the CollabSolar project, we have received a number of bids with various combinations of upfront and buyout payment values accompanying the tariff during the tenure of the PPA. Comparing multiple bids across vendors needs a common approach to comparing the diversity of terms used. We found that translating the bids into an LCOE metric allowed for good comparisons.

CONCLUSION

Although policy dynamics and the change in group demand affected the first round of the CollabSolar project, we gained invaluable experience on the CollabSolar model. At the beginning of the CollabSolar negotiations, vendors indicated that a discount of 5% over the market rates was possible. This could be one of the powerful levers to scale up deployment of rooftop solar power across India. GPMDG will incorporate the lessons learned from this pilot into the next phase, to make the model a successful working example that others can replicate.

GPMDG will continue working with forward-looking corporate leaders to join us in scaling up the deployment of renewable energy solutions in India, and help the country achieve its ambitious 175 GW target by 2022 (Nagarajan 2015).

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Annexure 1 | Sample Survey Questionnaire

Company details		Grid consumer category	Voltage 1 (kVA)	Consumption from grid	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Peak load periods
Name				Units consumed kWh													
Address				Tariff													
Business type			Voltage 2 (kVA)	Consumption from Grid	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
				Units consumed kWh													
				Tariff													
Details of contact person		No. of diesel generator sets	Voltage 1 (kVA)	Consumption from DG sets	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Name				Units consumed kWh													
Designation				Tariff													
E-mail			Voltage 2 (kVA)	Consumption from DG sets	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Phone				Units consumed kWh													
				Tariff													
		No. of renewable energy plants	Voltage 1 (kVA)	Consumption from renewables	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
				Units consumed kWh													
				Tariff													
			Voltage 2 (kVA)	Consumption from renewables	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
				Units consumed kWh													
				Tariff													
Existing energy efficiency measures		Interested in rooftop solar? (Yes/ No)		Roof details	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Floor details of office & terrace			Comments		
				Area (Square feet)													
				Age (Years)													

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