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Analysing viable renewable procurement options of renewable power: An integral decarbonisation tool for C&I consumers in India

Neha Makol [1], Puja Gupta [2], Meenakshi Mital [3], Matt Syal [4]
[1,2,3] Lady Irwin College, University of Delhi, Delhi, India.
[4] School of Planning, Design & Construction, Michigan State University, USA.
[1] Corresponding author: neha_mac@hotmail.com

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Abstract: C&I consumers account for more than 50% share of total power consumption in India. Studies show that corporate renewable procurement will play a critical role in supporting the country achieve its renewable and emission reduction targets. This has resulted in a sharp increase in corporate renewable power demand. Renewable power is touted as one of the most commercially and technologically viable option with carbon abatement potential. Multiple avenues of renewable purchase are available for companies which include rooftop solar, open access, renewable energy certificates (RECs), green tariffs and buying renewable power on exchange. Several factors including flexibility, simplicity, reliability, cost affordability, market maturity and policy, construction, operation and maintenance risk associated with procurement route should be considered while curating the renewable procurement options mix. This paper gives a deep dive analysis of these procurement routes on these parameters which can help companies draw their own procurement strategy. While solar rooftop and open access PPAs have a more profound role owing to their higher market maturity and ability to procure large quantum of power at affordable costs, other routes including power exchange, green tariffs and RECs are better suited for a short-term role in procurement mix. Government incentives are critical to realise maximum potential in corporate renewable market and support country goals of meeting higher renewable penetration targets.

Introduction

Renewable energy has become the backbone of India's energy mix with a contribution of 40% and has a target to increase it to 50% by 2030 (MNRE, 2021). Falling costs of renewable power supported by strong political will and its geographical location has made the country, a highly attractive renewables market in the world. India ranked third in EY renewable energy country attractiveness index in 2021 (Majid, M., 2020). India crossed the 100 GW renewable installed capacity milestone in August 2021 (Mercom, 2021). A total installed capacity of 114.07 GW with 60 GW of projects in pipeline until June end has placed India in a more comfortable position to achieve its target of 175 GW by 2022. The target includes 100 GW of solar, 60 GW of wind, 10 GW of biopower and 5 GW from small hydro projects (MNRE, 2018). The pledge to build a net zero economy by 2070 is going to further propel the development of renewables in the country (BBC, 2021). Commercial and industrial (C&I) consumers account for more than 50% of total power consumption in India which makes their role more critical for the country to meet its targets (WWF, 2019). Currently, significant proportion of the current renewable installed capacity in the country has come through utility scale projects. Total wind and solar capacity in the country stood at 98.5 GW and C&I consumers accounted for only 23% (23 GW) as of June 2022 (The Economic Times, 2021a; Bridge to India, 2022).

Motivations to procure renewables

Growing pressure on the companies to take climate action and build net zero companies has made renewables, a critical lever for decarbonisation. According to research by McKinsey & Company, high commercial and technological maturity with high carbon abatement potential makes renewable power, one of the most reliable routes to decarbonisation (Net Zero by 2035: A Pathway to Rapidly Decarbonize the US Power System, 2021). Increasing pressure from investors, consumers and government mandates coupled with the need to build strong company reputation and maintain competence in global marketplace are also driving companies to take action. Many C&I entities have committed to global pacts like RE100, an initiative assisting corporate consumers to procure 100% of their power from renewable sources, SBTi (Science based targets initiative), an initiative helping to develop science-based emission reduction targets, Climate Disclosure Project (CDP), a global disclosure system

for companies, investors, cities, states, regions to manage their environmental impact (The Economic Times, 2021b). Other than sustainability requirements, C&I consumers are also strongly driven by the need to reduce cost of power. In order to cross subsidise agricultural and residential consumers, C&I segment is charged a premium, increasing their grid tariffs which further pushes corporates to switch to independent power sources. Studies have shown that perception of self-effectiveness, awareness about renewable power and its associated benefits have also led consumers to adopt renewable energy (Wall et. Al., 2021).

There are several routes available in India to procure renewables which include solar rooftop, open access solar, open access wind, green power exchange, green tariffs and renewable energy certificates. But each route has its own set of challenges which deter consumers to source green power. A strong policy and regulatory outlook are a critical requirement for corporate renewable procurement. Central government has been consistently making efforts through policy initiatives and regulatory framework to provide a facilitating environment for C&I consumers to adopt renewables. Several incentives including central financial assistance, viability gap funding, accelerated depreciation benefits has helped market grow. However, power is a concurrent subject which allows states to formulate their policies and not necessarily follow central recommendations. But states have also showed support with attractive policy incentives and enabling regulatory framework. But the slow growth points out a need to analyse the initiatives and regulatory framework to understand the challenges in the market.

This paper attempts to provide a comparative assessment of available routes on various parameters including market maturity, policy risk, financial investment, time commitment, flexibility of procurement, reliability of power, construction, operation and maintenance risk. This exercise will help to understand the facilitators and hindrances in each route. Subsequently, this paper aims to provide recommendations to government that can support C&I consumers play a greater role in renewable energy transition journey of the country.

Renewable procurement routes

Solar rooftop

Solar rooftop has been the fastest growing sector in renewable energy market in India with a CAGR of 116% between 2012 and 2018 (Garg, 2019). It is the only onsite procurement option which is highly cost attractive and involves minimal distribution losses with low land and transmission infrastructure requirements (GEMI & USAID, 2016). It is an option available for most C&I consumers subject to rooftop space availability. Solar rooftop can be installed through a CAPEX (capital expenditure), where the consumers is required to invest a significant amount of capital or via an OPEX (operational expenditure) model, where a renewable energy developer installs a solar rooftop system on the roof of the property of the consumer and a 25-year-old power purchase agreement (PPA) is signed between the two parties on a mutually agreed tariff (Prasad, 2020). The total installed solar rooftop capacity stood at 7.9 GW as of June 2022 (Joshi, 2022). C&I solar rooftop market has grown at a CAGR of 77% during the period 2014-19, with a total cumulative capacity of 7.7 GW as of June 2022 (Bridge to India, 2022; WWF, 2019). Net metering, gross metering and behind the meter are available metering arrangement depending on state rooftop solar policies.

Net metering is a bi-directional meter arrangement where surplus power is exported to the grid (DISCOMs) and power is imported from grid during hours of no solar generation. This allows power purchased from DISCOMs to be adjusted against solar power exported to the grid at the same rate. This allows consumer to access grid effectively as financial battery. Net profit to the consumer is high as in other metering arrangements like gross metering, DISCOMs make more profit. In gross metering, all the power generated from solar rooftop system is exported to the grid at a low tariff and consumers continues to consume power from DISCOMs. This essentially means consumer sells power to DISCOMs at a lower price and buys the same power by paying higher rate (Centre for Energy Finance, 2019).

Behind the meter rooftop solar system is not connected to the grid and consumer is compelled to consume all the power generated from the system or switch off the system in the event of no consumption. This system is only viable for consumer if the system output matches the consumption load of the consumer or excess power is stored in batteries. States have not issued any formal policies for behind the meter arrangement except Maharashtra. Other metering arrangements like net billing have been recently introduced by few states, which is similar to net metering but the only difference is the treatment of excess power units. Under net metering setup, excess power units are carried forward to next month until end of financial year but in net billing, cost of excess power (lower tariff) is carried forward to next month. The latter option is attractive for both consumers and DISCOMs. But this arrangement in available in very few states (“Behind-the-meter: What You Need to Know,” 2019).
Net metering arrangement is not cost attractive for DISCOMs which has resulted in strong resistance from them. It is available in most states, but with restrictions such as capping on system sizes, mostly 1 MW. In some states like Maharashtra and Haryana, consumers are not allowed to install a net metered solar rooftop system, if the consumer is procuring power from an open access arrangement (Bridge to India, 2021b). This has affected market sentiment and most consumers have migrated to behind the meter arrangements.

States have been issuing restrictive and discouraging policy and regulatory changes in the last two years. Cross subsidy charges and grid support charges are currently exempted in most states. However, Maharashtra and Tamil Nadu have announced that they will levy grid support charges/ network charges on solar rooftop projects in the coming years which will steeply increase the total cost of power (Prasad, 2021; The Hindu, 2021). Despite of the unfavourable environment, the landed cost of solar rooftop is the least when compared to other procurement routes at about INR 3.50- 3.75/ kWh (Bridge to India, 2021a). But the policy volatility and levy of charges in future are going to affect the financial viability of solar projects in future.

Open access

Procuring renewable power through open access arrangement is available via three models- captive, group captive and third party. Consumers with roof constraints and large power consumption needs are best suited to procure renewable power through open access. This is available for consumers with a sanctioned load of 1 MW and it is further recommended by the MNRE to allow consumers with a sanctioned load of 100 kW to procure power through open access (Chauhan, 2021). Open access power purchase agreements (PPAs) are typically for 15 -25 years duration which ties the consumer for a long period. It allows corporates to bypass discoms and procure power at a lower tariff. Solar, wind and solar-wind hybrid open access projects can be developed by corporate consumers depending on the resource availability in the location. States like Maharashtra, Karnataka, Tamil Nadu, Gujarat and Rajasthan are suitable states for open access projects owing to more favourable policy and regulatory framework whereas other states have a still evolving environment. 100% captive projects involve a very large sum of investment, making it suitable only for large consumers. Landed cost of power through open access solar in group captive mode is the most financially attractive option for C&I consumers due to exemption from cross subsidy surcharge and additional surcharge. High open access charges (transmission charges, transmission losses, wheeling charges, wheeling loss, cross subsidy charges, additional surcharge, electricity duty, banking charges, state load dispatch centre charges) levied on third-party open access projects makes it the costliest route (Bridge to India, 2021b; The Economic Times, 2021b).

Most of the states provide exemption from the OA charges while some of the states like Maharashtra, Andhra Pradesh, Karnataka and Madhya Pradesh have started to withdraw incentives owing to increasing resistance from the discoms. In addition to this, Discoms have also denied OA approvals citing arbitrary issues (WWF, 2019). Risk of losing revenue and high paying consumers is one of the main reasons for resistance by discoms (Josey, et AL., 2021). Poor financial health and frequent shareholding pattern change in a group captive arrangement by the consumers and lack of clarity on a competent authority verifying the captive and group captive consumers in open access are some of the reasons cited by Discoms for not supporting open access. Discoms have recognised the need for revisiting levy of charges to ensure the revenues of the discoms stay unaffected when consumers switch to open access arrangement (TERI, 2020). However, frequent policy turnarounds, policy changes and adverse steps taken by Discoms severely hurt the interest of the developers and consumers and overall affect growth of renewables (Prasanth et AL., 2021).

Green power on exchange

Renewable power on exchange was introduced in the form of green term ahead market (GTAM) and green day ahead market (GDAM) in 2020 and 2021 respectively. Dedicated exchange for renewable power provides consumers to buy bundled power without going into long-term PPAs. This option is available for consumers with a contracted load of 1 MW and above to procure renewable energy on short term basis (IEX, 2021). Various short-term contracts covered under the GTAM are intra-day contracts, day ahead contingency contracts, weekly, daily and monthly contracts (CEEW, 2021a). It allows consumers to buy power on competitive prices through a flexible and transparent approach. Buying renewable power is more expensive than buying open access power as it enjoys no exemptions in grid charges. In order to give this route a nudge, inter-state transmission charge waivers have been proposed for green power bought on exchange. However, this proposal is yet to receive any formal acceptance (Chatterjee, 2021).

Green tariffs

Green tariff is basically green power offered by discoms for a premium applicable over grid tariffs, which makes it a financially unattractive option for C&I consumers. But these can be procured for one year which makes it an easy and convenient option to procure power with less commitment. This option is available to C&I consumers in Andhra Pradesh, Maharashtra, Karnataka and Gujarat (CEEW, 2021b). It has been recently introduced in more states but proper guidelines are yet to be issued by Discoms (Parashar, 2022). While in other countries like in US, discoms provide a lower rate than grid tariffs which attracts consumers to switch renewable energy, all states in India charge a premium over already high grid tariffs (Das, 2021). The cost of renewable energy has been fallen drastically over the years, as the tariffs for utility scale projects hit an all-time low of INR 1.99/ kWh and INR 2.43/kWh for solar and wind, making it unreasonable to charge consumers a high tariff (Bhaskar, 2021).

Table 2.3 Green tariffs offered in different states

States	Applicable reen tariff/ premium
Maharashtra	Premium of INR 0.66/ kWh
Karnataka	Premium of INR 0.50/ kWh
Andhra Pradesh	INR 12.50 per kWh instead of applicable grid tariff of INR 11.30/ kWh
Tamil Nadu	10% premium over grid tariff
Telangana	INR 0.66/ kWh
Madhya Pradesh	INR 1.13/ kWh
Uttar Pradesh	INR 0.54/ kWh
Uttarakhand	INR 0.45/ kWh
West Bengal	INR 0.50/ kWh
Haryana	INR 1.00-2.00/ kWh
Odisha	INR 0.50/ kWh

Source: CEEW, 2021

Maharashtra started to offer green tariffs from March 2021, while Andhra Pradesh and Karnataka have been offering this option since 2008 and 2015 respectively. However, only a few C&I consumers have adopted for green tariffs despite of the option being available for more years in few states. C&I procure renewable and require the green attribute for claiming and proving their renewable procurement and meet their voluntary targets. However, under the current framework, green attributes are retained by the Discom and only a green certificate/ bill is issued to the consumer (Bridge to India, 2021c).
Ministry of Power has recently issued draft green power rules which aims to restructure green tariffs option but failed to address the main issue of high premium and providing a clear methodology to determine the tariff. A green tariff policy expected to be issued, is anticipated to determine a tariff which will be lower than conventional power tariff (Bhaskar, 2021).

Renewable energy certificates (RECs)

Renewable energy certificates, introduced in 2011 allow consumers to buy only the green attribute associated with the power. This route is more suitable for consumers with lack of access to other routes as it has no eligibility requirements. Like green tariffs, RECs are also a cost-plus option, as the consumers have to still procure power from its existing sources. It is the only recognised instrument to buy environmental attributes in India. This procurement route requires no commitment and can be bought from the power exchange only once a month. It helps consumes with mismatch between their renewable power availability and targets or renewable purchase obligations (RPO) (Sonee et al., 2017). But frequent revision in RECs have led to many legal disputes and suspension in trading. Frequent policy setbacks and shutdown of trading have severely hurt the reliability of the route for consumers and market perception (CEEW, 2021c). As per the applicable floor and ceiling price revised in 2017, solar RECs cost between INR 1/ kWh and INR 2.4/ kWh and non-solar RECs cost between INR 1/kWh and INR 3/kWh (Parikh, 2020). Revision in forbearance price and removal of floor price in 2020 led to suspension for 16 months and the revisions were retracted and trading was resumed in November 2021 with floor and forbearance prices as applicable in 2017. Ministry of Power has proposed amendments in RECs framework to provide more liquidity in the market. The amendments propose to provide bilateral trading option, no floor and forbearance price, perpetual validity of RECs and a technology multiplier to promote new and innovative renewable technologies (Ministry of Power, 2021). These regulations will come into effect in 2023.
Other than Indian RECs available for C&I consumers, internationally renewable energy certificates (I-RECs) and The Tradeable Instruments for Global Renewables (TIGRs) are globally available tradeable instruments, available for much lesser price (INR 0.70/ MWh). These instruments are not eligible to meet RPO targets but can be used to meet voluntary commitments (WWF, 2021).

Some other procurement routes expected to be provided for C&I consumers are Virtual Power Purchase Agreements (VPPAs), P2P trading which are yet to come to power markets. VPPAs have especially proved its effectiveness in helping consumers achieve 100% RE. VPPAs are a financial transaction in which generator sells electricity on the power exchange and buyer buys electricity and settle price difference on a monthly basis. A

strike price is decided between the generator and buyer, when the market price is higher than the strike price, generator pays the difference to the buyer and vice versa. This is being used in UK, US and Australia by many consumers to achieve their renewable targets (WWF, 2019). But VPPAs are still unviable for consumers in India as contracts for difference mechanism is not allowed (ET Energy World, 2020).

Discussion

The table below assess different procurement routes on various parameters and summarises the discussion in the paper.

Parameters/ Routes	**Rooftop solar**	**Open access**	**Green tariffs**	**Renewable energy certificates (RECs)**	**Green power on exchange**
Eligible consumers	All consumers with rooftop space available	Consumers with contract load of more than 1 MW	All consumers connected to DISCOM	No eligibility criteria	Consumers with contract load of more than 1 MW
Suitability	Consumers with small power demand, onsite space is typically exhausted before procuring from other routes	Most typically consumers with large power requirement	Consumers not eligible for other routes and with no requirements to claim to green attributes	Consumers with deficit in renewable targets or ineligible for other routes	Consumers located in RE deficient states
Flexibility	Available under net metering, not available in behind the meter arrangement	Monthly banking allowed in most states limited to 30% of power procured from DISCOMs	Minimum procurement for one year with quantum to be informed during application	Power not available, certificates can be bought only once a month	High due to availability of contracts with different time horizons
Reliability of power	Intermittent; depends on availability of sun; not available at night	Depending on source of technology, most stable power output profile in wind solar hybrid projects	High, as Discoms provide continuous supply of power	Power not available	Medium, chances of bids not getting cleared
Cost of power	Lowest cost of power; as no grid charges are applicable in most states	Medium- high cost of power; due to applicability of high open access charges	Very high tariff rates or premium applicable	Very high cost of procurement; as total cost of buying RECs and power from discoms is very high	High cost of power due to applicability of OA charges and ISTS losses with no exemptions
Market maturity	Solar rooftop market is very mature with many competent developers providing service	Very mature market, as open access route has been used for conventional power for many years	Nascent market with still evolving framework	High but minimal voluntary participation by C&I consumers	Nascent market with limited volumes available

Construction, operation and maintenance risk	Easy to execute due to no land constraints and requires only 6-8 months from planning to commission. Solar rooftop PPAs require negotiation which can be time consuming. Significant O&M requirements, which is mostly taken care off by developers	Land and transmission constraints in captive project other risks can be outsourced. Low risk in third party model	No infrastructure requirements	Requires experience in using power exchange to buy RECs	Requires experience in using power exchange to buy and forecast power
Policy environment	Solar rooftop metering regulations have been changing over time. Many states have withdrawn the net metering option and enforced restriction.	Several policy changes have been made in open access regulations and incentives. Many states are withdrawing incentives and banking provisions	Significant policy risk as the framework is still evolving	Lack of policy visibility and certainty	No policy changes but the market is still evolving
Commitment	Long term commitment required in both CAPEX and OPEX models	Long term commitment in all business models (third party, group captive and captive).	Typically, for one year	No commitment required	No commitment required

Source: Bridge to India, 2021; WBSCD, 2018; WWF, 2019

Corporates deals have shown that rooftop solar and open access will continue to be the most favoured options for renewable procurement. Solar rooftop and open access PPAs have a more profound role owing to their higher market maturity and ability to procure large quantum of power at affordable costs, other routes including power exchange, green tariffs and RECs are better suited for a short-term role in procurement mix. A basket of all procurement routes is ideal for companies to insulate them from associated market risks.

Factors such as intermittency, reliability, construction, operation and maintenance risk are more technology specific but policy and regulatory stability and financial attractiveness are variables that can be controlled and improved to ease procurement. These routes have remained riddled with policy and regulatory setbacks, opposition by local government bodies, land and transmission infrastructure constraints. All these challenges can be supported through a slew of policy measures.

Government enablers

Power being a concurrent subject, requires concerted efforts by central and state government. A more liberal policy framework should comprise of - ensuring availability of these options for each consumer located in different geographies, grid charge waivers, attractive business models and metering arrangements, low premiums for purchase of renewable power, policy visibility and consistency, more liquid power markets supported through incentives, availability of land parcels at subsidised rates, augmentation of transmission infrastructure, ensuring grid stability through ancillary services, research and development in new technologies like storage and green hydrogen and focussing on capacity building and skill development. Regulatory enablers should be focused on smooth implementation of policies, easy project approvals, no retrospective changes or grandfathering for older projects and support and cooperation by discoms. New procurement routes including virtual power purchase

agreements, sleeved PPAs, subscription based PPAs, 24/7 power purchase agreements can also be explored in the market.

Conclusion

Increasing pressure on companies to shift to renewable sources for power has led to many corporates committing to voluntary renewable targets. The present procurement options available in the country requires to be developed to make them more attractive for corporates. There are lack of incentives and supportive policies for corporate consumers to procure renewable power. Initiatives like net metering provisions, waivers on open access charges, banking facility should be provided. With routes like green tariffs and VPPAs, as they have been tested successful in other countries, government should give more attention to these routes. In presence of high charges and no incentives, corporates are unlikely to meet their net zero and renewable targets which will also affect the country's performance in meeting their commitments. Thus there is a need for policy support and initiatives while ensuring smooth implementation of policies, easy approvals, support and cooperation by discoms.

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