HOW ELECTRICITY DISTRIBUTION COMPANIES IN INDIA CAN WORK WITH COMMERCIAL AND INDUSTRIAL CONSUMERS FOR RENEWABLE ENERGY PROCUREMENT

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EXECUTIVE SUMMARY

Highlights

- Commercial and Industrial (C&I) consumers worldwide are proactively, voluntarily, and consciously attempting to increase their share of renewable energy (RE) consumption. This is a result of internal pressures (for example, from shareholders) as well as external factors such as government policies that mandate them to procure RE, increasing grid tariffs, and so on.
- This has resulted in companies worldwide entering into specific agreements with utilities for "green tariffs," which are based on long-term contracting between utilities, corporate consumers, and RE producers.
- The uptake of green tariffs has seen a reasonable degree of success in countries such as the United States of America, even though these products may typically require the buyer to pay a premium for the guaranteed procurement of RE.
- Now is a strategic time to explore the possibility of using green tariffs for Indian corporate consumers, in view of their potential benefits for electricity distribution companies (discoms, as these utilities are termed in India).
- Green tariffs in India must be informed, on the one hand, by the principles adopted for the formulation of successful green tariffs worldwide, and on the other hand, by the nuances of the regulatory framework governing the electricity sector in India, such as cross-subsidization of agricultural and residential consumers by C&I consumers.

CONTENTS

Working Papers contain preliminary research, analysis, findings, and recommendations. They are circulated to stimulate timely discussion and critical feedback and to influence ongoing debate on emerging issues. Most working papers are eventually published in another form and their content may be revised.

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Context

As a result of a multitude of factors, such as national and international commitments to RE, falling RE prices, government regulation promoting RE, and the advent of sustainability targets, C&I consumers all over the world have begun to actively explore the possibility of increasing the share of RE in their power mix. This presents two opportunities: one, an opportunity for C&I consumers to drive the demand for RE products, and two, a unique opportunity for utilities to market new RE products to C&I consumers. This is a topic that merits deeper analysis in the Indian context.

About this Paper

This paper aims to explore utility-offered RE tariffs in India, a relatively new and underdeveloped topic in the Indian energy sector. It begins with a review of the available literature on existing green tariff products across multiple jurisdictions, such as Australia, the United States, the United Kingdom, China, and a few European countries. It then sets out the Indian regulatory framework on tariffs, covering aspects such as cross-subsidies, as well as the limited forays into green tariffs in India thus far. The analysis of green tariffs in India is supplemented by interviews with C&I consumers. The paper highlights the key principles that could serve to guide the development of green tariffs in India, based on a study of the literature worldwide, as well as on an analysis of the Indian scenario and the interviews conducted.

The paper deals with the following research questions:

- What green tariff structures are available to C&I consumers around the world? What are their features?
- What is the applicability of such tariffs in India within the existing market structures? This will examine aspects such as the following:
  - The inherent skew in the tariff structure due to which C&I consumers pay more than other categories of consumers.
  - The ability of a discom to enter into RE contracts exclusively for a few companies.
  - The features of a green tariff and their applicability.
- What factors should be considered when designing green tariffs in India?

Table ES-1 | **Comparison of Green Tariffs in Andhra Pradesh and Karnataka**

	ANDHRA PRADESH	KARNATAKA
Tariff design	A new tariff replaces the existing tariff of the consumer	A "rider" (additional cost) is added to the existing tariff of the consumer
Contract type	Discoms of both states offer a variation of subscription programs that are based on the amount of excess RE in the utilities' mix beyond their Renewable Purchase Obligations (RPOs)	
Price certainty	Premium pricing is fixed for a year (until the next tariff revision). Andhra Pradesh charges a higher fixed tariff with no demand charges for green energy, whereas Karnataka charges a premium of Rs. 0.50/kilowatt-hour (kWh) in addition to the existing consumer tariff. Savings are not possible in both states, as of now	
Contract tenure	Annual, subject to the availability of RE beyond discoms' RPO mandates, and tariff (category) revisions	
Capacity restrictions	Up to 100% consumption subject to availability	
Net-metering ability	Permitted	Unclear

Findings and Recommendations

This paper concludes that this is a suitable time for exploring green tariffs in India, in view of the inclination of C&I consumers to switch to large-scale RE procurement and the need to provide a well-defined role to utilities in the shift toward providing large-scale RE to corporate consumers. Thus far, the experiments of two Indian states (Andhra Pradesh and Karnataka) with green tariffs have been largely ad hoc in nature (Table ES-1), and future efforts must necessarily be preceded by systematic planning and be implemented through long-term contracts.

In both states, the green tariffs are simple premium pricing models based on the surplus RE available with the utilities subsequent to fulfillment of their RPOs; there is no long-term outlook or contracting structures, in contrast to the situation in the United States. Very low uptake of the green tariffs, as evidenced by only one subscribed consumer in each of these states, may have prevented the evolution of more sophisticated green tariffs in India.

Globally, particularly in the United States, green tariffs have emerged as a popular option for companies to procure RE, and for the respective utilities to also gain from this. The successes in the United States are based on tailor-made options enabled by a consultative approach within the limits of the market ecosystem.

A similar approach needs to be adopted by Indian electricity discoms. They are losing out on electricity sales to C&I consumers who prefer to access some, or all, of their electricity requirement through open access (OA) contracts (with both RE and non-RE generators) and on-site solutions such as rooftop solar. A potential solution by way of green tariffs (customized to the Indian context) could in theory enable discoms to retain and attract C&I consumers.

This paper argues that in order to ensure the successful formulation and uptake of green tariffs in India, certain principles and best practices should be followed. These include consultative deliberations to ensure that green tariffs do not disadvantage other consumer groups, suitable regulations and policies to provide greater certainty and predictability for long-term green tariffs, regular interaction between the discom and the regulator to ensure the harmonizing of different policies aimed at promoting RE, and the development of specific products to meet the needs of different subcategories of C&I consumers.

1. INTRODUCTION

A. RE Procurement by C&I Consumers: An Overview

The demand for RE from corporate buyers has expanded significantly over the past decade, particularly owing to companies publicly setting goals for sustainability and clean energy (Bonugli 2017). This demand for RE is driven by the increasing pressure from consumers, shareholders, and employees for companies to adhere to sustainability targets, and falling RE prices, which enable corporate consumers to reduce their electricity costs and long-term electricity risks (Barua 2017; Dingenen et al. 2018).

At the end of 2019, as many as 211 companies had committed to move toward sourcing all their electricity requirements from renewable sources (RE100 2019). More than 500 companies from around the world have set science-based carbon reduction targets (Science Based Targets 2019), in line with the latest climate science aimed at meeting the goals of the Paris Agreement (Science Based Targets n.d.). According to a recent study by Bloomberg New Energy Finance (BloombergNEF 2019), corporations purchased 13.4 gigawatts (GW) of clean power capacity globally through long-term contracts in 2018. This is estimated to be double the total purchases in 2017. Agreements were signed by 121 corporations in 21 countries. The capacity of global corporate purchases has reached a total of 42 GW.

A significant chunk of this growth has come from the Americas, with Europe in the second position followed by the Asia-Pacific region, which is slowly but steadily matching the growth in Europe.

B. Different Mechanisms for RE Procurement

Globally, the following mechanisms have been adopted for RE procurement:

- Renewable Energy Certificates (RECs) are tradable certificates that represent the environmental attributes of energy generated from renewable sources. Typically, each certificate represents 1 megawatt-hour (MWh) of RE. In India, RECs could be used to fulfill the Renewable Purchase Obligations (RPOs) mandated by various state electricity regulatory commissions on large electricity consumers.
- Guarantees of Origin (GOs) are tradable certificates, standardized under the European Energy Certificate System (EECS), that guarantee 1 MWh of RE (AIB n.d.).

- Power Purchase Agreements (PPAs) are agreements signed between two parties, in which a party buys electricity generated by another party at a specific tariff, subject to detailed terms and conditions.
- Virtual Power Purchase Agreements are a variation of the standard PPA in which the RE generator sells electricity to the local grid at the market price, but passes on the RECs to the consumer in exchange for the price differential between the market price and a prefixed hedge price (EPA 2016).

One of the emerging RE procurement options for C&I consumers in traditional regulated markets is a "green tariff." Under a green tariff arrangement, particularly in the United States, the consumer typically enters into a long-term contract to purchase renewable electricity (and associated Energy Attribute Certificates, as the case may be), provided by the utility, and usually generated by a determined resource or asset (Barua 2017; IRENA 2018). Energy Attribute Certificates are similar to the RECs in the United States or GOs in Europe, as explained above and in RE-Source (RE-Source 2020).

The corporate consumer pays the utility and benefits from the potential cost savings that accrue (IRENA 2018). The utility acts as an intermediary between the electricity consumer and the RE generator—the arrangement involves the utility procuring RE from the RE generator on behalf of the consumer, who in turn pays a special utility green tariff rate for the RE service (Bird et al. 2017).

C. Why are Green Tariffs Attractive?

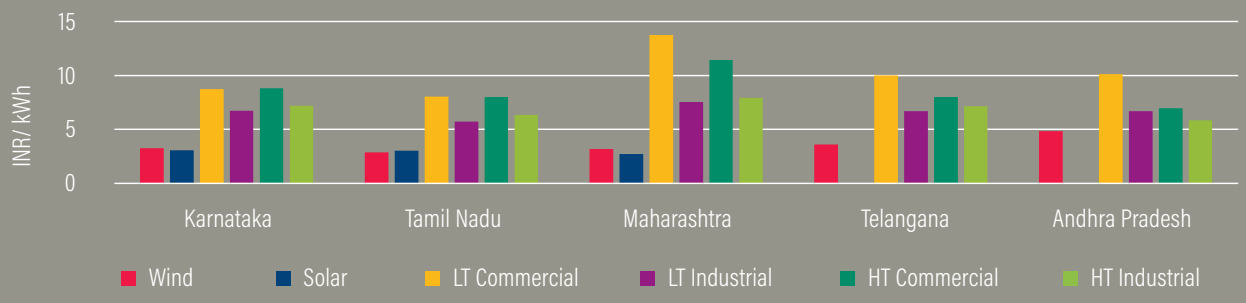
It is observed that green tariffs have globally emerged as an attractive option for corporate sourcing for a wide variety of reasons:

- Consumers can source up to 100 percent of their electricity from renewable sources (IRENA 2018).

Box 1 | **C&I Electricity Consumption in India, Re Procurement Commitments and Benchmark Costs**

Indian companies are also participating in the trend to shift to increased procurement of renewable energy. Five Indian companies—Dalmia, HatsunAgro Industries, Club Mahindra, Infosys, and Tata Motors—have publicly committed to operating 100% on RE as part of the RE100 campaign. Other Indian corporates are increasingly setting RE targets for themselves (RE100 targets, Science Based Targets, etc.) following mandates set by regulators, and are also trying to capitalize on the increasing affordability (see Figure B-1) of electricity from RE sources.

FIGURE B-1 | BENCHMARK COST OF WIND AND SOLAR POWER VERSUS ELECTRICITY TARIFFS IN MAJOR INDIAN STATES



Note: [a] The figures for the cost of power are sourced from the latest available tariff orders of the respective states. [b] The solar power costs correspond to grid-connected, MW-scale projects—and usually exclude Accelerated Depreciation (AD) (a Government-of-India-approved methodology in which RE projects depreciate at a higher rate in the initial years of the project, a concept useful for minimizing taxable income). [c] The wind and solar costs are at the bus bars of the respective plants; additional grid usage charges and surcharges will apply. Even considering these, C&I consumers gain Rs. 1–2 in comparison with the utility tariff. [d] Maharashtra's wind tariff is applicable for Zone 4 as classified by Maharashtra Energy Development Agency (MEDA). [e] High tension (HT) tariffs usually correspond to 33 kilovolts (kV).

India has set itself a target of 175 GW of installed capacity of RE by 2022. As of March 31, 2019, a total of 78.3 GW of RE had been installed (MNRE 2019). In the year 2016–17, the industrial sector was the largest consumer of electricity, accounting for 40.01% of the total electricity consumption, while the commercial sector accounted for 9.22% (CSO 2018). In the period between 2007–08 and 2016–17, the consumption of electricity in the industrial sector grew faster than in the other sectors, at a compound annual growth rate (CAGR) of 8.46%. These patterns highlight the importance of the C&I sector's participation for achieving India's ambitious RE targets.

- Consumers can save on up-front capital investment, and subsequent operations and maintenance costs, through green tariffs (Bird et al. 2017). In addition, green tariffs may offer the corporate off-taker the chance to diversify its power sources without the responsibilities and costs associated with managing a renewable project (Dingenen et al. 2018). The cost of identifying the appropriate third-party producer(s) for directly accessing RE can also be mitigated by approaching the local utility to enter into a green tariff arrangement with it.
- Given the increasingly cost-competitive nature of solar and wind energy, for some, long-term contracting for purchasing RE at a fixed or predictable price (for example, through green tariffs) is an appealing option in comparison to the alternative: volatile electricity prices driven by fossil fuels and peak demand (Barua 2017; Bird et al. 2017).
- Corporate off-takers can also signal their leadership to the market through RE procurement via green tariffs, by highlighting their role in a greenfield RE project and its associated emission reductions (Dingenen et al. 2018). By seeking locally available options, companies can drive the growth of the RE sector (IRENA 2018) and "encourage new RE projects in regions where they operate and influence the local electric mix" (Bird et al. 2017).
- From the utilities' perspective, green tariffs represent an opportunity to prevent the migration of large C&I consumers to cheaper RE, meet regulatory targets for renewable energy supply, and attract new consumers as well. In the United States, certain companies have been reported to select new sites based on the offering of green tariffs by the local utilities (Barua 2017). Since RE purchase by corporates is expected to grow, it is expected that the market for green tariffs will remain strong (Barua 2017).

D. Green Tariffs in India: Relevance and Timing

Having piloted the Green Power Market Development Group (GPMDG) (GPMDG n.d.) initiative from January 2013, we at WRI India have had a chance to witness the growth of RE among C&I consumers (both on- and off-site). However, the discom, a key player in the ecosystem, was not a key beneficiary of the prevalent business models for C&I uptake of RE. It is necessary to explore the feasibility of new discom-centric models that would benefit all key stakeholders: the generator, the discom, and the C&I consumers. For example, a discom-centric business model proposed for rooftop solar in Karnataka involves the discom, solar provider, and consumer entering a three-way agreement in which the discom would directly pay for installing the modules on the consumer premises and recover payments from the consumer via equated monthly installments. Green tariffs, which are premised on placing utilities at the forefront, are ripe for being tested in India. Although green tariffs have been tried in some ad hoc forms in Karnataka, and more recently in Andhra Pradesh, it is appropriate to examine the factors for their limited success and examine the potential for redesigning them. This is described in detail in the subsequent sections. Hence, we undertook this study to understand if the success of green tariffs in other countries can be replicated in India, and if not, what are some of the best practices for successful design of green tariffs for C&I consumers in India.

E. Objectives of the Paper

The objectives of this paper are as follows:

- Identify green tariffs applicable to C&I consumers around the world, and analyze their features.
- Analyze their applicability in India within the existing market structures. This will look at aspects such as

  a. the inherent skew in the tariff structure due to which C&I consumers pay more than other categories,
  b. the ability of the utility to enter into RE contracts exclusively for a few consumers, and
  c. the structure of a green tariff and applicability of the components.

  This will be based on both secondary data analysis as well as interviews with C&I consumers and utilities in India.
- Outline factors that should be considered for designing green tariffs in India, based on the above two analyses.

2. METHODOLOGY

The following primary and secondary research methods are used for this paper:

- Review of the literature with the following goals:
  - Study green tariffs, and their features, that are available to C&I consumers around the world. Research databases such as Google Scholar, Science Direct/Elsevier, and ResearchGate were utilized to conduct research for this paper. Some of the key search terms used for the desk research were "green tariffs," "green electricity,"

"utility procurement," "corporate sourcing," and "sustainability targets."

- Identify and analyze the key policy and market factors that have a bearing on the successful design of green tariffs for India.

- Analysis of tariff orders issued by various regulatory commissions; annual reports issued by companies that have gone ahead with procuring electricity through the green tariff route; and research reports published in the Indian context pertaining to C&I RE procurement.
- Interviews (see Appendix B) with C&I consumers in India to understand their perspectives on green tariffs.

The literature review consisted of applying the different combinations of keywords identified in the research questions to the various types of online journal databases. We then analyzed the papers based on the different geographies to understand the specific details of the green tariff markets that exist there. The purpose was to identify and understand the best practices followed in these geographies, and the overall context of the success of these programs across the world. The literature review also helped us analyze and understand what kind of best practices should be followed in the Indian case.

During the course of this exercise, we also analyzed various tariff orders to gain a better understanding of tariffs for different types of consumers in select states of India. This information was used to understand the tariff structure and possibilities in the Indian context. Our data in most of the cases are drawn from the published research work in the international context and governments' tariff orders that are published from time to time in India. Since the green tariff is a recent phenomenon, the data points are generally limited to the last 10 years for the Indian cases.

We also circulated a survey among companies, most of whom were members of the GPMDG, and also spoke to a few of them. The survey aimed to capture the current tariff being paid by the companies; their current RE procurement levels; plans for procurement; perceived barriers in increasing the RE proportion in their energy mix; and their willingness to procure RE if offered by discoms. The survey is documented in Appendix B.

In addition, we also looked at the prevailing examples of green tariffs in India, assessed their performance, and tried to understand why they have not worked. Following this, we attempted to outline a set of principles that need to be kept in mind while designing green tariffs.

3. LITERATURE REVIEW

A. Green Tariffs for C&I Consumers Around the World

The available literature shows that green tariffs are being used by corporate consumers in Australia, China, the United States, United Kingdom, and many European countries. However, except for the United States, there is no publicly available description of the features of green tariffs in these countries.

At a global level, the RE-Source platform has issued a document that provides an overview of 14 existing business models of corporate renewable electricity sourcing (RE-Source 2020). The International Renewable Energy Agency (IRENA), in its flagship publication Corporate Sourcing of Renewables: Market and Industry Trends (IRENA 2018), provides an overview of corporate PPAs and a list of utility-enabled RE offerings.

In the next few paragraphs, we provide a brief overview of the information we were able to find about green tariffs in specific countries.

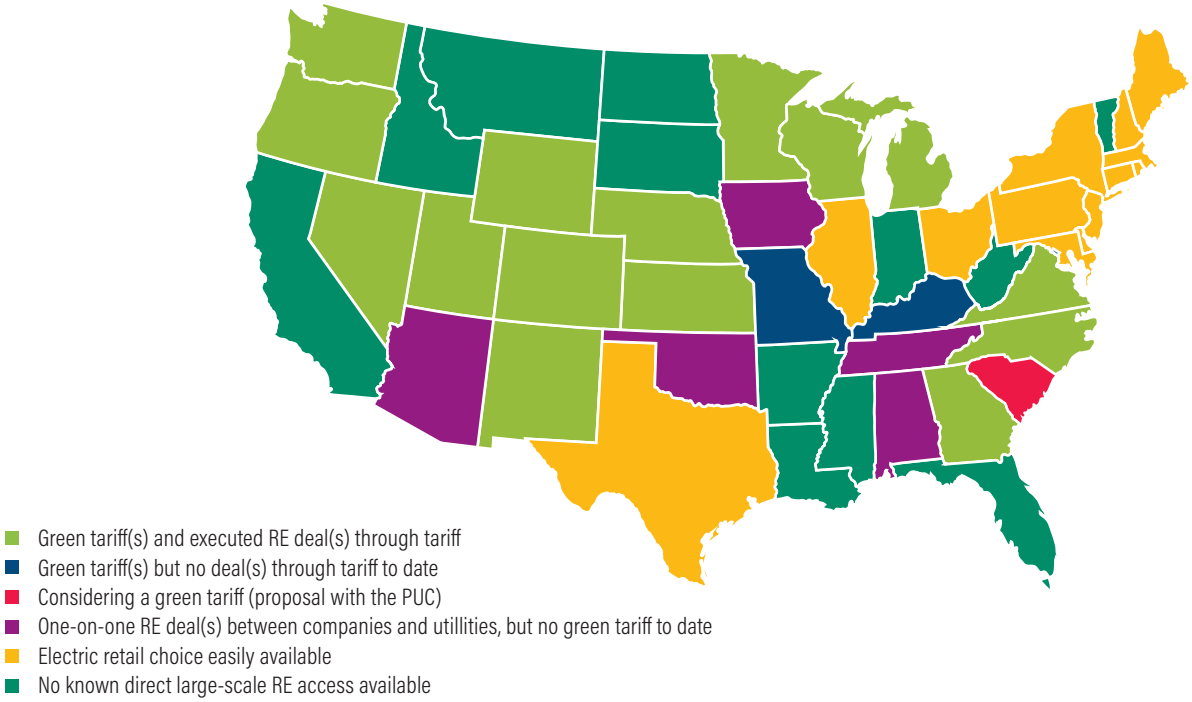
United States

Given WRI's deep engagement with utilities and companies in coming up with green tariffs, information here was the easiest to find and most abundant. All green tariffs involve mechanisms that transfer RECs associated with the RE project to the consumer, or retire them on behalf of the consumer, by the utility. As of November 2019, as many as 31 green tariffs were approved or awaiting approval in 18 U.S. states (see Figure 1). A summary of the key features of these tariffs is presented in Appendix A, and an analysis is provided in subsection B of this section, titled "Analysis of Off-Site Green Tariff Models for C&I Consumers in the United States." Most of the traditional green tariffs in the United States charged a premium of 1.5 cents/kilowatt-hour (kWh). On the other hand, emerging green tariffs offer cost savings in the long term (Shah 2018).

Europe

Across Europe, green-sourced electricity products are generally accessible to residential consumers and small-scale commercial consumers (MacDonald 2016). As of 2018, C&I green tariff deals have been reported across the United Kingdom, Spain, Germany, Sweden, Italy, Switzerland, and the Netherlands (IRENA 2018). These deals represent both the supply of electricity from a designated renewable power plant (Frangoul 2017) and the supply of regular grid electricity combined with Energy Attribute Certificates (EACs) or GOs. Most of them involve varying levels of premium pricing.

Figure 1 | **Utility Renewable Energy (RE) Deals in the United States**



Source: Bonugli 2019.

For example, HSE—a utility in Slovenia—offers green tariff under the brand "Blue Energy" to its commercial consumers as well (MacDonald 2016). The hydropower under this tariff is priced at a premium of €0.00417 per kWh. Consumers can opt for 10–100 percent of their electricity under this tariff structure.

In the United Kingdom, many retailers provide a "green tariff" option in which up to 100 percent of electricity comes from renewable generation. Ofgem (Office of Gas and Electricity Markets) administers the Renewable Energy Guarantees of Origin (REGO) scheme and requires generators to retire certificates once they are sold to consumers. GOs allow businesses to pay slightly higher tariffs to meet their RE targets (Pérez 2019).

China

We could find information only about the green electricity supply scheme of the Shanghai Municipal Electric Power Company (SMEPC). SMEPC started a voluntary green electricity supply scheme (Berrah et al. 2006) as a culmination of the efforts of Shanghai Economic Commission, Shanghai Energy Conservation Supervision Center (SECSC), and the World Bank. The program offered renewable electricity from largely wind and a nominal volume of solar PV sources, at a premium of RMB 0.53/kWh to interested residential and non-residential consumers. The price remained unregulated throughout the program tenure. As shown in Table 1, the program saw a decline of demand beyond the relatively higher demand of the first three years, largely due to the absence of any financial incentives to the consumers.

Australia

GreenPower is the Australian government's voluntary accredited program that enables consumers to purchase RE in the retail electricity market. The program is a joint initiative of the Australian Capital Territory (ACT), New South Wales (NSW), South Australia (SA), and Victoria (VIC) governments and began in 1997 in consultation with various nongovernmental organizations (NGOs), including Greenpeace, the Australian Conservation Foundation, and the World Wide Fund for Nature (GreenPower n.d.). The program allows accredited energy providers to sell GreenPower Products and thereby grant a consumer Large-scale Generation Certificates (LGCs) as an option to ensure certain increments of RE in relation to a consumer's monthly electricity consumption. Although GreenPower tariffs are often more expensive than conventional tariffs, consumers have a variety of options, ranging from 10 percent to 100 percent of their electricity to be sourced from RE.

As of December 2018, a total of 31 providers in the National GreenPower Accreditation Program sold green electricity at a premium, through 32 accredited products, to residential consumers (251,676 MWh) and business consumers (235,448 MWh) (Clear Environment Pty Ltd. 2019).

Table 1 | **Sales of Green Electricity in Shanghai During, 2005–10**

YEAR	NUMBER OF CONSUMERS		PURCHASED GREEN ELECTRICITY (MWH)	
	Non residential	Residential	Non residential	Residential
2005	22	27	12,540	7
2006	7	6,847	2,220	964
2007	8	414	2,658	67
2008	3	6	182	0.7
2009	6	8	1,500	1.2
2010	3	1	1,320	0.1
Total	49	7,303	20,420	1,040

B. Analysis of Off-Site Green Tariff Models for C&I Consumers in the United States

As mentioned earlier, WRI has worked extensively with utilities and companies to develop green tariffs. This work has now become an initiative of the Renewable Energy Buyers' Alliance (REBA—https://www.rebuyers.org). This has helped us understand the different types of green tariffs in greater detail.

The evolution of green tariffs in the United States is primarily a result of consumers' voluntary efforts to access large-scale RE. "The Corporate Renewable Energy Buyers' Principles initiative launched by WRI and WWF has begun to capture this consumer interest (see Box 2)." As of July 2019, as many as 78 companies had signed on to the Principles, representing corporate RE demand of 69 million MWh by 2020 (Corporate Renewable Energy Buyers' Principles n.d.).

In the United States, green tariffs have emerged in three main models or forms (for further details, see [Barua 2017]):

- Sleeved PPAs (the consumer negotiates the agreement directly with an RE generator, then contracts through a utility) that grants access to individual physical PPAs (involving physical transmission of electricity) through the utility network
- Subscriber programs (a utility procures RE, then sells portions to consumers) that allow multiple consumers to subscribe to a portion of one or more large RE projects while the utility holds the PPA
- Market-based rate programs, which allow for wholesale market participation through the utility

In recent years, utilities have been increasingly designing programs that provide a combination of these styles. For example, one green tariff program allows consumers to access RE through a sleeved PPA or through a subscriber. This is often done to cater to multiple consumer preferences—providing options depending on how large a role the consumer wants to play.

However, sleeved PPAs remain the common design model, with subscription programs increasing in popularity, as well as programs that offer a combination of models.

Box 2 | **Framework for Consumer Choice – RE Buyer's Principles**

The Corporate Renewable Energy Buyers' Principles Establish the Framework for What Customers are Seeking from Electricity Providers:

- Greater choice in options to procure renewable energy
- Cost competitiveness between traditional and renewable energy rates
- Access to longer-term, fixed-price renewable energy
- Access to projects that are new or assistance in driving new projects in order to reduce energy emissions beyond business as usual
- Increased access to third-party financing vehicles, as well as standardized and simplified processes, contracts, and financing for renewable energy projects
- Opportunities to work with utilities and regulators to expand the choices for buying renewable energy

Source: Corporate Renewable Energy Buyers' Principles n.d.

Green tariff programs can appear on the consumer's bill as a rider (additional rate) or through participation in a subsequent tariff (Barua 2017). Tariffs and riders are equally prevalent in the United States.

The key features of the 31 off-site green tariffs in the United States (see Appendix A) that emerge from the available literature can be categorized into the following six themes, which are reflective of the utilities' efforts to cater to the Corporate Renewable Energy Buyers' Principles (Bonugli 2017).

- **Cost mechanism**
  Green tariffs have a cost mechanism that allows the consumer to be more directly linked to the cost and benefits of the RE resource procured. How the cost mechanism is structured varies across the United States. For example, it can appear like a fuel swap, where the green tariff costs replaces the consumer's standard electricity rate, often with the cost of the renewable energy from the PPA and/or some credit for the services no longer being utilized (such as the fossil-fuel-based power replaced by the consumer) or the capacity provided by the RE resource.

- **Available to a class of consumers**
  Unlike special contracts or one-on-one deals where a utility procures large-scale renewables for one or a handful of specific consumers, green tariffs are available to a class of eligible consumers.

- **Access to large-scale bundled RE**
  Green tariffs enable consumers to source up to 100 percent of the energy from a renewable energy project and receive the associated RECs.

- **Price certainty**
  Most programs offer price certainty, often through fixed long-term contracts, and the possibility of savings in the long term.

  However, with market-based-rate green tariff models, consumers can access volatile wholesale market prices. This option caters to consumer preference and consumer interest in the declining costs of RE.

- **Contract predictability or tenure**
  Most programs require a tenure of 5–10 years. Green tariffs are increasingly being offered to consumers on a regular long-term contract, although some programs offer shorter-term contract options at higher prices. Sleeved PPAs that involve the setting up/contracting of new capacity by the utility require a longer tenure that reflects the project life.

- **Eligibility criteria**
  Most programs target consumers with more than 1 MW of load, while at least one (PGE's Green FutureSM Impact) caters to an aggregated demand of 30 kW. This trend could change with the introduction of green tariffs to residential and smaller consumers. Originally, green tariff programs served only new consumer loads. However, utilities are increasingly providing access to green tariffs for existing consumers as well. Rider programs offer a specific percentage of the RE mix in the total consumption. Sleeved PPA programs offer custom project sizes, whereas subscriber programs allow blocks of generation to be contracted.

  In many cases, green tariffs also offer access to new RE resources that go beyond what the utility would otherwise be procuring.

4. STATE OF PLAY IN INDIA

A. Current Business Models and Challenges for C&I Consumers

The electricity sector in India before 2003 was dominated by vertically integrated monopolies called state electricity boards (SEBs), which became progressively inefficient. This changed with the Electricity Act 2003 (EA 2003), which mandated the unbundling of SEBs, that is, the separation of generation, transmission, and distribution functions into separate companies. Under EA 2003, the electricity policies and regulations in India are designed to promote competition and development in the electricity sector, ensure supply of electricity to all areas, and protect the interests of all consumers. The EA 2003 also attempted to usher in competition to the three functions with the introduction of an open access (OA) mechanism that permits usage of the transmission and/or distribution networks of licensee(s) by C&I consumers for a fee, to wheel the power contracted from an independent generator of electricity.

Concurrently, there are two standard business models for C&I consumers to procure renewable electricity: first, through a fully or partially owned captive RE plant, and second, through a PPA, whether physical or virtual, with independent power producers (IPPs) that own such plants. Depending on the location of these plants, RE projects can be on-site (often) rooftop solar PV plants that sell excess power to the grid, or off-site plants that pay grid usage fees to the utilities.

Consumption of electricity from on-site power plants does not typically attract any additional charges. Excess solar power, if injected into the grid, is usually adjusted against subsequent months' consumption or paid for via an arrangement called "net metering." Only consumers with a connected load of more than 1 MW are eligible for off-site procurement of electricity from third-party producers through under the OA mechanism.

OA grid usage charges for off-site RE projects vary across all states. They are also based on many parameters such as consumer category, voltage at the injection point, voltage at the drawal (consumption) point, the nature of ownership (captive/PPA), the type of fuel the project runs on, and year of commissioning. A summary of these business models is provided in Table 2.

B. Impacts on Discoms

Cross-subsidy is a mechanism by which a section of the electricity consumers is charged a tariff higher than the actual cost of supplying power to them. The excess revenue generated from this higher rate is used to compensate the utility for undercharging other classes of consumers such as agricultural, residential, and below-poverty-line consumers (FoR 2015). This is a key component of electricity tariff design in India.

EA 2003 contains a provision for the imposition of cross-subsidy surcharges (CSSs) on OA transactions to compensate the utilities for the loss of high-paying consumers. CSS was prescribed as an interim measure that was meant to be phased out after the projected efficiency improvements across the discoms are achieved. Despite the intended unbundling, distribution companies are still largely publicly owned and face little to no competition in their territories. OA provisions are not yet implemented in their true spirit (Sarode et al. 2017). Referring to the Fourth Report of the Standing Committee on Energy, 16th Lok Sabha, the authors note that "there are issues around implementation of open access at [the] distribution level. Some State Governments have issued statutory orders blocking the flow of electricity beyond their boundaries. There is a conflict of interest due to existence of cross-subsidies in the retail tariff structure so that the discoms do not want to lose paying/subsidising consumers. Ring fencing of SLDCs, reasonable open access charges and availability of surplus power are also required for successful implementation of open access" (Lok Sabha Secretariat 2015). Among other factors, a sizable proportion of people without access to electricity in the country (167 million) (IEA 2018) and 30 million irrigation pump sets that run on completely subsidized electricity (Raymond and Jain 2018) make the phasing out of CSS very difficult. India's Appellate Tribunal for Electricity (APTEL 2013) highlights this in the following statement: "The National Tariff Policy clearly mandates that the regulatory commissions ought to strike a balance between the requirements of the commercial viability of Distribution Licensees and the Consumer interest."

In line with the Indian government's 175 GW RE target by 2022, major Indian discoms have initially permitted OA RE transactions through measures like low or completely waived CSS and grid usage charges—mainly with the goal of promoting RE plants (Sarode et al. 2017). CSS, derived from a formula specified by state electricity regulatory commissions, usually does not cover the entire cross-subsidy requirement. As pointed out in (Singh 2017), it is difficult to fully compensate the discom for subsidizing revenue lost during OA and for attempting to make OA transactions economical. However, the recent falling prices in RE generation could potentially act as an enabler for OA even in a scenario of high CSS.

Table 2 | **Business Models for Renewable Electricity Procurement by Corporate and Industrial (C&I) Consumers**

LOCATION OF RE PLANT	BUSINESS MODEL	OWNERSHIP OF RE PLANT	POLICY
On-site	Captive	Consumer	Net metering
Off-site	Captive	Consumer	Open Access (OA)
On-site	Power Purchase Agreement (PPA)	Independent Power Producer (IPP)	Net metering
Off-site	Power Purchase Agreement (PPA)	Independent Power Producer (IPP)	Open Access (OA)
On-site	Group captive	Consumer and Independent Power Producer (IPP)	Open Access (OA)

Source: WRI research.

This trend is very clear for high tension (HT) commercial consumers across the states, and hence discoms are concerned about losing revenue from them. However, exceptions exist, as in the case of Andhra Pradesh, where CSS is typically higher than cross-subsidy (CS) from tariff. Such differences are a result of variations in the methodologies of tariff calculation that states adopt. For example, Maharashtra calculates the average billing rate (ABR = total revenue from consumers/total units of electricity sold) for each consumer tariff category, whereas Andhra Pradesh calculates it separately for each supply voltage. Figure 2 illustrates this difference across a selection of states.

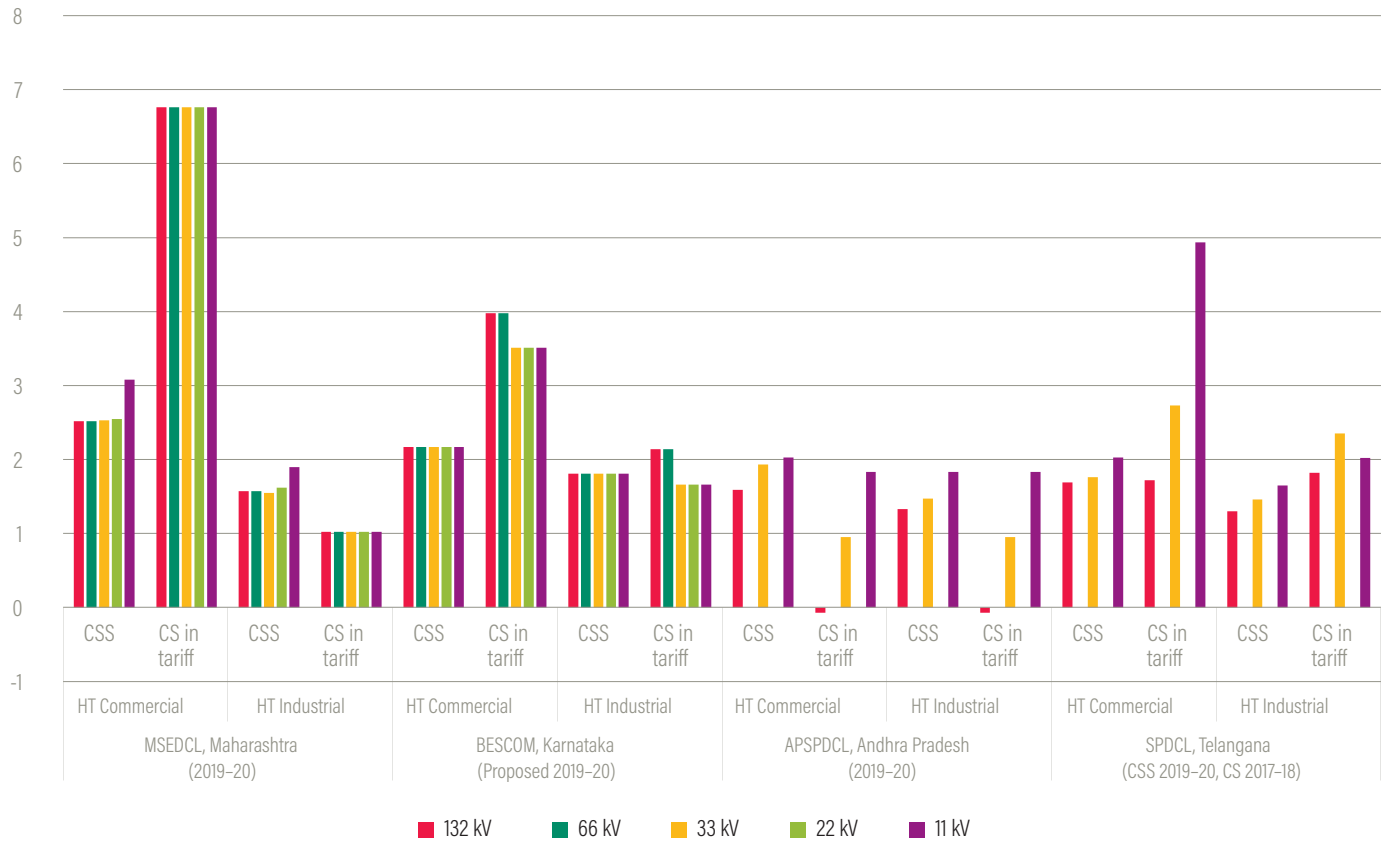
As a result, there is strain on the utility finances in two ways: first, due to the under-recovery of revenue, and second, due to the continued payment for excess capacity that has usually been contracted via a take-or-pay basis. To compensate for these losses, over the recent years, various distribution utilities have imposed additional surcharges (ASs) over and above the CSS for OA RE projects (see Figure 3).

In recent years, distribution utilities have stated that OA provisions and the price differentials have resulted in very frequent switching between the open market and regulated supply from the distribution utility by C&I consumers (MoP 2017; Singh 2017). This creates uncertainty in planning power procurement and tends to result in stranded generating assets. Hence, there is an increasing realization among utilities about the need to serve the changing requirements of C&I consumers through innovative business models, or risk losing these high-value consumers to increasingly affordable renewables and storage. There have been a few efforts on this front.

C. Initial Attempts to Introduce Green Tariffs

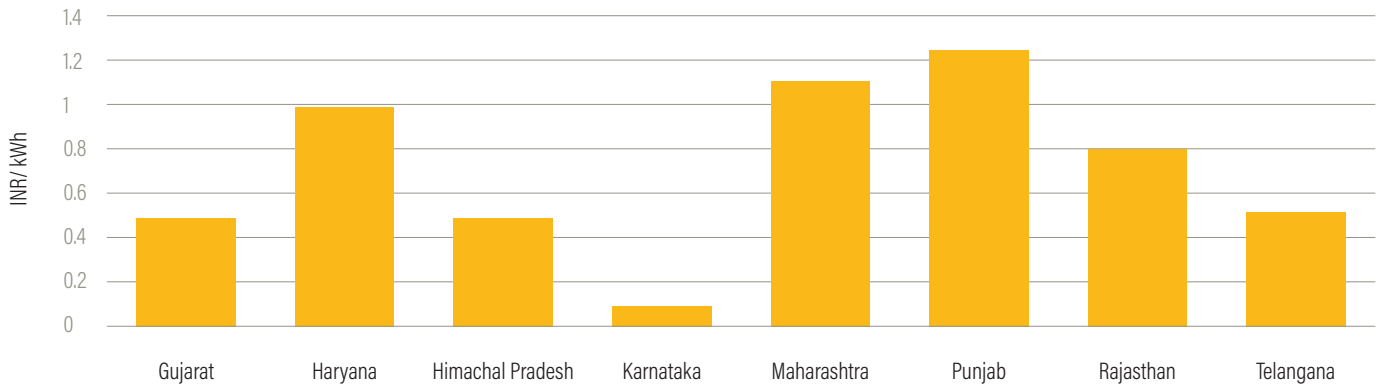
At present, discoms in India have been mandated to meet RPOs under EA 2003 and the National Tariff Policy of 2006. Green attributes of renewables in a discom's electricity mix are passed on uniformly to all consumer categories, except in Andhra Pradesh and Karnataka. In these two states, there are unique tariff categories under which C&I consumers can opt for

Figure 2 | **Cross-Subsidy in Tariff Versus Cross-subsidy Surcharge for Corporate and Industrial (C&I) Consumers Across Maharashtra, Karnataka, Telangana, and Andhra Pradesh**



Source: TSERC 2017; MERC 2018; TSERC 2018; KERC 2018a; APERC 2019a.
Abbreviations: CS - Cross Subsidy; CSS - Cross Subsidy Surcharge; MSEDCL - Maharashtra State Electricity Distribution Company Limited; BESCOM - Bangalore Electricity Supply Company Limited; APSPDCL - Andhra Pradesh Southern Power Distribution Company Limited; SPDCL - Southern Power Distribution Company Limited

Figure 3 | **Additional Surcharge on Open Access Renewable Energy Transactions as of May 2018**



Source: KERC 2018b.

100 percent renewable electricity inclusive of green attributes. Barring these two states, there is no exclusive RE tariff product offered by the utility to C&I consumers in India.

Andhra Pradesh

In 2008–09, for the first time, Andhra Pradesh introduced an optional green power tariff for C&I consumers at a premium price of Rs. 6.7/kWh (IDFC 2010). In the 2017–18 tariff order, this category was removed by citing the absence of sales since inception. In response to a petition by the only consumer who subscribed to this tariff category in 2016 and 2017, APERC re-introduced the "HT Category VII-Green Power" tariff category in 2018–19 for HT consumers "who wish to avail power from Non-conventional sources of energy voluntarily and show their support to an environmental cause" (APERC 2018). At Rs. 11.32/kVAh, subscription to this tariff category is optional and concomitantly entitles the subscribing HT consumers to RECs as well. There is no restriction on the end-use purpose of this green energy (except for use as start-up power for generating plants), and no monthly minimum charges are levied under this category. This has been continued even in the latest tariff order dated February 10, 2020.

Karnataka

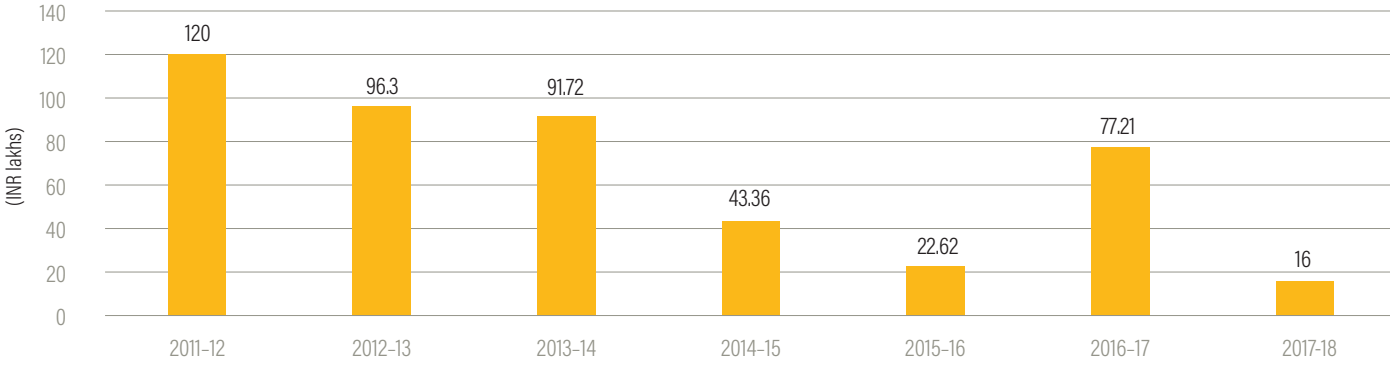
From December 7, 2010, HT consumers in Karnataka could opt for green power (electricity bundled with RE attributes) directly from the utility by paying an additional Rs. 1/kWh on their existing grid tariff (power thus procured would be over and above their RPO), which was termed as a "green tariff" (KERC 2010). In its petition requesting such a tariff category, Bangalore Electricity Supply Company Ltd. (BESCOM) had stated that "there is [a] group of customers who want to purchase power from green sources and would not mind paying more for such power." This was reduced to Rs. 0.50/kWh by the KERC in its order dated May 13, 2013, and has been maintained at this level in its most recent order of May 30, 2019.

At the moment, there are no clear means or criteria of establishing the success/failure of this scheme. There is a report that mentions that some companies have availed themselves of this option as part of their CSR obligations (CUTS International 2018). However, an earlier tariff order for BESCOM mentions Infosys purchasing green power through the OA mode, and not through the utility (KERC 2013). In addition, an examination of the tariff orders, tariff petitions, and annual reports of the electricity distribution companies in Karnataka indicates that the initiative has been only a partial success. As per publicly available information (see Figure 4), only one utility—Mangalore Electricity Supply Company Limited (MESCOM)—has successfully sold electricity under this green tariff.

Madhya Pradesh

The Madhya Pradesh State Action Plan on Climate Change (MP SAPCC), under the heading "Key Strategies for Energy Sector," states the intention to "[s]tructure green tariff for incentivising the production of clean energy" (Government of Madhya Pradesh 2013). Further, the MP SAPCC states that "[g]reen tariff should be designed to motivate clean energy generation in the state" as a medium-priority area, by the Department of Energy, Commerce, Industries and Employment Department, Madhya Pradesh Urja Vikas Nigam Limited (MPUVNL), Ministry of Power and New and Renewable Energy Department (Government of

Figure 4 | **Sales Under Green Tariff by Mangalore Electric Supply Company Ltd. (MESCOM) (2011–18)**



Source: MESCOM annual reports for the respective years (MESCOM 2014, 2015, 2016, 2017).

Madhya Pradesh 2013). However, the MP SAPCC does not provide further details on the nature or mode of implementation of such green tariffs. At the time of this writing, there was no evidence of any of the Madhya Pradesh utilities having implemented green tariffs.

1. Summary and Comparison of the Two Models

Green tariff models available to C&I consumers in the states of Andhra Pradesh and Karnataka are analyzed below, based on the features identified in the U.S. context.

Andhra Pradesh has only one consumer of green tariff (Company S), which was interviewed for this study. Karnataka also seems to have only a single consumer of green tariff. In both states, the green tariffs are simple premium pricing models based on surplus RE with the utilities and have no long-term outlook or contracting structures as in the United States. Very low uptake of the green tariffs in these states may have prevented the evolution of more sophisticated green tariffs in India.

Table 3 | **Green Tariffs in Andhra Pradesh and Karnataka**

	ANDHRA PRADESH	KARNATAKA
Tariff design	A new tariff replaces the existing tariff of the consumer	A "rider" is added to the existing tariff of the consumer
Contract type	Utilities of both states offer a variation of subscription programs that are based on the quantum of excess renewable energy (RE) in the utilities' mix beyond their renewable purchase obligation (RPO) mandates	
Price certainty	Premium pricing is fixed for a year (until the next tariff revision). Andhra Pradesh charges a higher fixed tariff with no demand charges for green energy, whereas Karnataka charges a premium of Rs. 0.50/kWh in addition to the existing consumer tariff. Savings are not possible in either state, as of now	
Contract tenure	Annual; subject to availability of RE beyond utilities' RPO mandates and tariff (category) revisions	
Capacity restrictions	Up to 100% consumption subject to availability	
Net-metering ability	Permitted	Unclear

Source: APERC 2018, KERC 2010, etc.

5. PERSPECTIVES OF C&I CONSUMERS IN INDIA

Ten companies responded to our survey (see Appendix B) titled "Green tariffs Offered by Utilities/Discoms: A Questionnaire for C&I Customers in India." Three of them represent the automobile sector, two represent the oil and gas sector, another two represent the IT & ITES sector, and the rest are spread across cement, consumer durables, and manufacturing sectors.

A. Companies that Consume ~10 Million kWh/Year or More

Summarising the results of the survey for companies, who consume ~10 Million kWh/year or more,

- All of them have operations in Maharashtra. Four of them (B, C, E, and F) also operate in Karnataka. Company C operates in Tamil Nadu. Three have operations across many Indian states.
- This consumption would correspond to a connected load of more than 1 MW, and hence they are all eligible to procure electricity through the grid from sources other than the utility, under the OA mechanism.
- Two companies pay Rs. 5.32/kWh and Rs. 7.2/kWh, respectively, for grid electricity, excluding the fixed demand charges and duties/taxes. The remaining companies pay around Rs. 8.5/kWh.
- B, C, and F have signed OA third-party PPAs in Karnataka, while A and E have set up on-site captive plants in Maharashtra.
- All companies have internal sustainability targets, but only four (C, D, E, and F) declared them publicly; a respondent from A is unsure about public disclosure. A and B have targets of 30 percent and 20 percent RE, respectively, while C and D target 100 percent RE. E and F have sustainability targets with respect to net carbon reduction, not necessarily as an RE percentage.
- All companies cited internal sustainability targets as one of the reasons for exploring RE procurement, while four of them (A, B, E, and F) mentioned cost savings as another reason.

B. Companies that Consume in the Range of 16,800–72,000 kWh/Year

Summarising the results of the survey for companies, who consume in the range of 16,800-72,000 kWh/year or more,

Box 3 | **Summary of Barriers and Preferences for Re Procurement from Relatively Higher Electricity Consuming Companies**

- Only C and D chose on-site utility green tariffs as one of the top two preferences for RE procurement. A and B indicated that on-site captive and on-site third-party PPAs are the top two preferred options. E and F chose OA third-party PPAs as one of their top two preferences. B, C, D, and E were willing to pay a premium of <25%, 5–10%, <25%, and 76–100%, respectively, for green tariffs.
- Except A, all companies identified policy uncertainty as a strong barrier. A, E, and F identified grid usage charges as a strong barrier for RE procurement. C and F identified contractual terms (for RE procurement in leased spaces) as a strong barrier. B and F identified the "absence of smart PPA structures" and "time-of-day regulations" as additional barriers, respectively.
- C recommended RE100-compliant attribute-specific generation assets (supported by certificates), a simple application process, and logical billing as measures to increase the uptake of green tariffs by C&I consumers. B recommended "same pricing" and "billing O&M benefits" as measures to increase the uptake of green tariffs by C&I consumers.

- P and Q are from Karnataka. R and S are from Gujarat and Andhra Pradesh, respectively.
- P, Q, R, and S pay Rs. 7.7, Rs. 5, Rs. 8.5, and Rs. 11.3, respectively, for a kilowatt-hour of grid electricity.
- Q and S have set up an on-site captive plant. Q and S have already subscribed to off-site utility green tariffs. Q has also signed an on-site third-party PPA.
- Q has sustainability targets, with a 100 percent RE component, that are driven by supply chain mandates and are publicly declared. This company has also signed up for a green tariff that is cheaper than the grid electricity tariff. However, they have also indicated their willingness to pay up to a 25 percent premium for green tariff.
- S has a unique situation where they are subscribed to a green tariff of Rs. 11.3/kWh without any demand charges. They also have a captive solar power plant that generates net excess power that is sold to the utility under net metering. As a result, they do not consume any grid electricity, and pay "zero" tariff to grid.
- P does not have any sustainability targets. R has a 100 percent renewable energy target that is not reported in the public domain.

Box 4 | **Summary of Barriers and Preferences for Re Procurement from Relatively Lower Electricity Consuming Companies**

- P has identified grid usage charges, policy uncertainty, their own knowledge of techno-commercial issues pertaining to RE, and access to financing/debt as strong barriers for RE procurement.
- S has identified grid usage charges, policy certainty, and availability of information about credible vendors/ service providers as strong barriers for RE procurement.
- P, Q, and S have identified on-site utility green tariffs as the first or second preferred option to procure RE.

C. Summary

Based on the survey responses provided by the companies, we are able to draw the following inferences

- Based on the interview process and the responses received, 5 out of the 10 companies have indicated that they would be open to considering discom-centered green tariffs as an option to procure RE.
- From the limited sample set, the interest levels among companies that are in the second tier of consumption seem to indicate that they prefer this route. This could reflect their ability and willingness to invest in greenfield assets on their own.
- Policy uncertainty is cited as a top challenge—this needs to be kept in mind when designing and implementing green tariffs in India.

The next section examines the best practices that need to be followed while designing green tariffs for discoms in India.

6. BEST PRACTICES FOR DESIGNING GREEN TARIFFS IN INDIA

On the basis of a review of the existing literature on green tariffs worldwide, and the responses received from the companies among whom we circulated a survey, we have documented a few best practices that utilities in India may consider while developing green tariff offerings. These are indicative. Utilities, regulators, C&I consumers, and RE developers must understand that each case is unique, and the stakeholders must actively engage with each other to develop a product that is tailored to their requirements.

A. Tariff Design, Planning, and Forecasting

Electricity tariff structures, among other factors, play an important role in the ease with which C&I consumers can switch to renewable electricity. Some data points chosen to highlight the RE potential, demand, paying capacity of the population, and the pattern of cross-subsidization of electricity tariffs for the top 12 countries in terms of RE deployment are shown in Table 4. From the table, it can be argued that utilities in countries with large populations of low-income residents with a limited ability to pay, like India and China, charge C&I consumers a higher tariff rate in order to subsidize low-income consumers. Hence, they are usually reluctant to allow these consumers to procure their own electricity, as it would lead to a loss of revenue. For any green tariff design to be successful in these countries, a simple price mark-up (like a rider in U.S. green tariffs) or even a fixed RE tariff that is initially expensive may not work. Four C&I consumers interviewed as part of this paper were interested in paying a premium for an RE-based tariff offering by the utility. However, these companies are the exception rather than the norm. C&I consumers who are already paying higher tariffs to discoms may not be willing to pay an additional price for RE, particularly when there is no cost attached to RPO noncompliance. The poor performance of premium-priced green tariffs in Karnataka and Andhra Pradesh supports this perspective.

To this extent, green tariffs based on on-site solar projects facilitated by discoms may work in India, owing to the cheaper cost of deployment and the absence of transmission & distribution (T&D) losses.

Since green tariffs are based on long-term contracts that discoms enter into with consumers on the one hand, and RE producers on the other hand, it is imperative that discoms invest in improving their planning and forecasting mechanisms to efficiently assess demand and supply, and strive toward creating optimal infrastructure. While enabling large consumers to choose their energy suppliers for the long term, discoms must also be cautious to avoid adding additional base load capacity without first undertaking a rigorous demand-supply analysis (Gambhir et al. 2019). On the one hand, discoms must assess the quantum and nature of demand from various consumer segments (for example, the specific demand for RE by C&I consumers based on their sustainability targets), and on the other hand, assess potential supply-side options (for example, the availability of third-party RE producers that are amenable to entering into long-term contracts with discoms). Instead of charging a fixed premium as part of the green tariffs, discoms could link the pricing of green tariffs to the price of RE in the long-term PPAs executed

Table 4 | **Electricity Tariff Structures, Per Capita GDP and Renewable Energy (RE), RE Percentage, and Electricity Access Across Countries with the Highest RE Capacity**

COUNTRIES WITH HIGHEST RENEWABLE ENERGY (RE) CAPACITY 2018		PER CAPITA				TARIFF STRUCTURE		
		GDP (USD) 2018	RE (MWH)	RE GENERATED (MWH) 2015	ELECTRICITY ACCESS (%) 2015	RESIDENTIAL = RES COMMERCIAL = COM INDUSTRIAL = IND		
						HIGH	MEDIUM	LOW
Americas								
1	Canada	44,871	11.8	63	100	Res	Com	Ind
2	United States	59,928	2.0	13	100	Res	Com	Ind
3	Brazil	9,812	2.2	74	99.6	Res	Com	Ind
Asia								
4	China	8,827	1.1	24	100	Com	Ind	Res
5	India	1,979	0.1	15	82	Com	Ind	Res
6	Japan	38,430	1.3	16	100	Res	Com	Ind
Europe								
7	Germany	44,666	2.3	29	100	Res	Com	Ind
8	Italy	32,110	1.8	39	100	Res	Com	Ind
9	France	38,484	1.4	16	100	Res	Com	Ind
10	Russian Federation	10,749	1.3	16	100	Ind?	Com?	
11	Spain	28,208	2.2	35	100	Res	Com	Ind
12	United Kingdom	39,954	1.3	25	100	Res	Com	Ind

Source: CEPCG n.d.; IRENA n.d.; World Bank n.d.; Zhang and Qin 2015; ANEEL 2018; Gubaydullina 2018; NRCan 2018; Eurostat 2019; USEIA 2019.

by the discoms and RE producers (Meister Consultants Group 2016) while at the same time adhering to the other guidelines previously discussed.

Integrated Resource Planning (IRP), or "Least Cost Planning," is a mechanism through which a discom creates a plan to meet the forecasted annual peak and overall energy demand, along with an established reserve margin, through a combination of supply-side and demand-side resources over a specified future period. This facilitates the reliable delivery of lowest-cost resources, reduces system costs, and benefits the environment (Thompson 2016). This approach could be compatible with long-term strategizing and provisioning for green tariffs. In fact, the IRP approach has served as the starting point for some green tariff programs, for example, in Georgia in the United States, where Georgia Power's Integrated Resource Plan for 2016 was approved by the Georgia Public Service Commission and paved the way for contracts with RE producers and C&I consumers (Makower 2019). The Clean Power Council (CPC) in the United States is an example of utilities and large-scale corporate consumers coming together to work collaboratively on joint planning for energy goals, including identifying mutually beneficial solutions and best practices (Ratz and Bird 2019a).

In India, an additional facet of planning will be based on the cross-subsidy structure prevalent in electricity tariffs and conformance to the underlying socioeconomic rationale thereof. Regulators must ensure that discoms are not formulating green tariffs in a manner that is beneficial to only the C&I segment at the expense of low-income consumers.

B. Tailor-Made Solutions for Different Categories within the C&I Sector

In order to increase corporate sourcing of RE, particularly among the small and medium enterprises (SMEs), there is a need to further develop procurement mechanisms (IRENA 2018). Green utility programs can accordingly be customized to the needs of different consumer categories (IRENA 2018). Utilities should be engaged for developing nuanced solutions for RE requirements across sectors.

In 2016, the C&I sector consumed almost two-thirds of the global electricity, and this demand is expected to jump from 13,500 terawatt-hours (TWh) in 2016 to 22,000 TWh in 2050 (of which 19,000 TWh is expected to be renewable electricity demand) (IRENA 2018). As mentioned above, the healthcare, real estate, and telecommunications services sectors have taken the lead in utility green tariff enrollment (IRENA 2018). In order to increase corporate sourcing of RE, particularly among SMEs, there is a need to further develop procurement mechanisms (IRENA 2018).

The identification and study of the specific needs of different sectors may help utilities offer attractive customized green tariffs to different corporate consumers. On the other hand, if the success of green tariffs is to be predicated on the number of subscribers, utilities may not be able to aggregate consumers to leverage economies of scale if there is excessive customization and flexibility for each consumer (Makower 2019). Utilities must endeavor to find a balance between tailor-made green tariffs and economies of scale. These are areas for further research.

C. Fairness Toward Non-subsidizing Consumer Categories

The successful formulation of green tariffs by utilities entails working closely with regulators and consumers to ensure that the tariff adds value to certain consumers without unfairly shifting the cost of the tariff to other consumer groups (Barua 2017). Comprehensive discussions about the various cost components of green tariffs at an ex ante stage can further the goal of transparency and prevent the inequitable passing on of these costs to other groups at an ex post stage. Some of these discussions have resulted in regulators denying aggregation of existing green tariffs across different locations of the same consumer, on the ground that it would shift the financial burden on the other consumers—as was seen in the case of the State Corporation Commission of Virginia denying Walmart's request for aggregating its RE procurement across 164 store locations (Smart Energy Decisions 2019).On the other hand, Walmart has entered into long-term RE procurement contracts with a Georgia utility, where the underlying PPAs have been approved by the regulator (CISION PR Newswire 2018). This indicates that each green tariff model must be evaluated on its own merit, including its potential impact on other consumer categories.

The green tariff model offers a unique opportunity to utilities and regulators to reformulate tariffs to guarantee RE procurement to C&I consumers that are committed to sustainability targets. At the same time, the existing distribution infrastructure and economies of the utilities can be capitalized, and the interests of other consumer groups can be protected.

As discussed in the section titled "Impacts on Discoms," the Indian C&I sector cross-subsidizes other electricity consumer sections, either directly or through OA/CSSs. While formulating green tariffs in India, regulators must take this into account as an additional factor to consider. The green tariff arrived at should reflect not only the premium for procuring energy from a preferred RE source (Bird et al. 2017) but also any additional amount that will ensure that such a tariff is not prejudicial to domestic and agriculture electricity consumers, whose lower electricity tariffs are in part cross-subsidized by the higher tariffs of the C&I consumers.

The National Tariff Policy of 2016 says the following about cross-subsidy:

- Towards this end, the Appropriate Commission would ensure that cross-subsidies are reduced and the tariff for all consumer categories are brought within ±20% of the average cost of supply effective from 1st April 2019 or earlier. (Clause 8.3, Section 3)
- Provided further that the open access customer shall be liable to pay cross subsidy surcharge for a maximum period of one year from the date of opting for open access. (Clause 8.5.1)

However, until the time these guidelines are implemented on the ground, green tariffs need to reflect the social justice role that we have seen so far.

There is some evidence from the Indian state of Uttar Pradesh that C&I consumers are opposed to the cross-subsidy system, since this places an additional financial burden on them (Moerenhout et al. 2019). On the other hand, many Indian C&I consumers have also clearly signaled a commitment toward procuring RE, including at a premium (APERC 2018).

This indicates the clear need for a consultative process prior to and throughout the design of such tariffs.

D. Ensuring an Inclusive, Transparent Consultative Process

Utilities, regulators, and C&I purchasers are all relevant stakeholders with a unique perspective on the structuring of utility green tariffs, and therefore, effective green tariff formulation must involve all of them in a consultative process. Regulators would like to ensure that the tariff is structured in a manner that does not unreasonably burden nonparticipating consumers with program costs, project costs, and other regulatory costs. C&I consumers are interested in ensuring that the green tariff options do not have a very large mark-up in price.

Further, C&I consumers may need to make utilities aware of their specific requirements or constraints. For example, Walmart, which recently entered into a green tariff contract with a Georgia utility, has an internal corporate governance policy to not execute contracts longer than 15 years, an important consideration that was required to be communicated to the utilities (Makower 2019).

Lastly, utilities have an interest in ensuring that no renewable asset is left unsubscribed and that administrative costs are recovered from the corporate off-taker (Bird et al. 2017). The experience with green tariffs in the United States has shown that utilities can have greater success in attracting and retaining large-scale energy buyers when their products have been created through consumer engagement (Barua 2017). Collaborative exchanges between corporate consumers and utilities can help utilities with integrative resource planning, and help corporates achieve their decarbonization goals more quickly (Ratz and Bird 2019b). So far, in the Indian context, such exchanges under the aegis of fora like Green Power Market Development Group (GPMDG), Distribution Utilities Forum (DUF), and so on, have focused on enabling OA. A similar structure can be adopted for consultative processes to design green tariffs.

E. Transparency and Verifiability

Corporate sourcing of RE must also be backed by the establishment of long-term, stable, and predictable policy frameworks (IRENA 2018). Transparent and predictable energy prices through the duration of the green tariffs contract are one of the most valued features of successful green tariff contracts (Barua 2017). This is also something we were told by the companies who participated in our interviews. Utilities must be transparent about the quantum of RE sourced and the adjustment of RE credits (Barua 2017). Such transparency must also guide the discussions between utilities and stakeholders on tariffs. Utilities must clearly signal their intent to become long-term providers of RE to consumers such as the C&I segment in order to gain their trust and enable them to formulate their long-term energy procurement plans accordingly.

As part of this process, utilities must start publishing integrated resource plans (IRPs), which would describe their long-term RE sourcing plans, energy efficiency plans, and conventional plant retirements. At present, the guidelines on long-term demand forecasting are contained across a variety of different regulations and documents, across states. It has been recommended that a separate streamlined set of regulations for long-term demand forecasting and power procurement planning be developed, and that the task of long-term demand forecasting be undertaken separately, prior to the approval of the Aggregate Revenue Requirement (ARR) and tariff determination by the regulatory commission (Singh et al. 2019).

It is essential for the green tariffs framework to promote transparency of information and easy verifiability of the quantum of RE consumed. Low RE prices are an important motivation for C&I consumers in India to opt for RE. Therefore, with increasing RE purchases, an important best practice is the development of infrastructure that facilitates the verification and tracking of RE purchases, and provides strong contractual arrangements that enable corporates to have confidence in their procurement (Bird et al. 2017). One of the preferred modes for tracking and verifying RE purchases is Renewable Energy Certificates (RECs), which can be sold separately or together with the underlying electricity to the corporates. These certificates help corporates ensure that the RE is not double-counted by different end users, and allow them to corroborate their claims about their RE purchases (Bird et al. 2017).

7. CONCLUSION

In the context of utility-based green tariffs emerging as a mode of corporate procurement of RE, this paper set out to examine the feasibility of green tariffs in the Indian context. The literature review revealed that although forms of green tariffs exist in the United States, United Kingdom, China, Australia, and some

European countries, information on the way these tariffs are structured and used is scarce. The most information was available from the United States.

Although some Indian corporates are increasingly looking to set sustainability goals for their electricity procurement, India has seen limited experimentation with green tariffs, namely, in the states of Karnataka and Andhra Pradesh. Although the tariffs exhibited some typical features of green tariffs, they appeared to be more ad hoc than structured green tariffs involving a long-term contract. These tariffs also competed against mechanisms like OA. The response to these tariffs was predictably poor.

We supplemented our literature review with a survey conducted among companies (C&I consumers). Among the companies that responded to our survey, we noted a mixed response to the degree of preference for green tariffs as a chosen mode of meeting sustainability targets, but at the same time we observed that the respondents considered policy uncertainty to be a strong barrier to RE procurement.

Creating the appropriate regulatory environment may, therefore, incentivize the uptake of utility-based green tariffs. We identified some best practices that could foster such an environment. Some examples of these are improved planning and forecasting mechanisms to better assess demand and supply, planning for taking the cross-subsidy structure into account while formulating new tariffs for corporate consumers, identification and study of the specific electricity needs of specific corporate consumer categories to create tailor-made tariffs, a consultative process with regulators to ensure that other consumer categories are not unfairly burdened, promoting the transparency and verifiability of relevant information, and so on.

At the moment, C&I consumers have different avenues for procuring RE either on-site or through PPAs. The OA route and its variant—the group captive model—are well known. In addition, states (e.g., Uttar Pradesh and Haryana) have also begun allowing OA transactions for RE, but are retaining the green attributes. These represent some of the alternative options to a well-structured green tariff.

It is hoped that this study will inform future efforts in India to formulate utility-based green tariffs. A fundamental, ground-up, consultative approach is needed to ensure that these tariffs result in a win-win situation for all stakeholders.

APPENDIX A

Key Features of Off-Site Green Tariffs Offered by Utilities in the United States

UTILITY	TARIFF NAME	TARIFF DESIGN			CONTRACT TYPE		TENURE	PRICE CERTAINTY AND ITS VALUE	PERMITTED CONSUMPTION	NET METERING PERMITTED?
		RIDER	TARIFF	MARKET-BASED RATE	SLEEVED PPA	SUBSCRIBER PRODUCT				
Xcel Energy	Renewable* Connect, Schedule RC	✓				✓	Monthly, 5, 10 years	Yes. Savings possible in the long term	Up to 100%	Yes. On net load
Georgia Power	Commercial and Industrial REDI Schedule CIR -1	✓				✓	10, 15, 20, 25 or 30 years	Yes	100%	Yes
Westar Energy	Direct Renewable Participation Service (DRPS)		✓		✓		20 years	Yes. Immediate price reduction	Multiples of 500 kW until 2000 kW, and of 1000 kW beyond	Yes. On net load
Kentucky Power	Renewable Power Option Rider (RPO)	✓			✓	✓	Negotiable	Negotiable		Standard rules
Consumers Energy Company	Voluntary Large Customer Renewable Energy Pilot Program	✓		✓		✓	(A) Multiples of 3 years, up to 20 years (B) Negotiable	Yes. Savings possible under Market Index Provision	(A) 20–100% in increments of 5% (B) 100%	Yes
Xcel Energy	Renewable* Connect, Schedule RC		✓			✓	Monthly, 5, 10 years, single event	Yes. Initial premium, long-term savings possible	Up to 100%	Yes. On net load
Ameren Missouri	Renewable Choice Program	✓				✓	15 years	Yes. Savings if wholesale prices go up	0–100% in multiples of 1%	Yes. On net load
Omaha Public Power District (OPPD)	Schedule No. 261 M – Large Power – High Voltage Transmission Level – Market Energy		✓	✓			Min. 1 year	Partial	Min. 20,000 kW at 161,000 V or min. 200,000 kW at 345,000 V/month	No
NV Energy	Green Energy Rider, Schedule NGR	✓	✓				Min. 2 years	Possible	50%, 100% or negotiable	Yes
Public Service Company Of New Mexico (PNM)	Green Energy Rider, Rider No. 47	✓			✓			Not clear	New consumers of at least 10 MW load and 75% load factor	Yes
Duke Energy	Green Source Rider, Rider GS	✓			✓		3–15 years	Yes	New consumers of at least 1 MW load	Yes
Duke Energy	Green Source Advantage, Rider GSA	✓			✓		2, 5, or 20 years	Yes. Savings possible in the long term	Single load of at least 1 MW, or aggregate of at least 5 MW	Yes
Portland General Electric (PGE)	Green FutureSM Impact, Schedule number pending		✓			✓	5, 10, 15, or 20 years	Yes. Savings possible in the long term	Aggregate loads of more than 30 kW	Not applicable

UTILITY	TARIFF NAME	TARIFF DESIGN			CONTRACT TYPE		TENURE	PRICE CERTAINTY AND ITS VALUE	PERMITTED CONSUMPTION	NET METERING PERMITTED?
		RIDER	TARIFF	MARKET-BASED RATE	SLEEVED PPA	SUBSCRIBER PRODUCT				
Rocky Mountain Power (RMP)	Service from Renewable Energy Facilities, Schedule 32		✓		✓		Negotiable	Yes. Savings possible in the long term	Min. of 2 MW and max. of contracted load	No
Rocky Mountain Power (RMP)	Renewable Energy Purchases for Qualified Customers, Schedule 34		✓		✓		Min. tenure needs to match existing contract with utility	Yes. Savings possible in the long term	Aggregated min. of 5 MW peak annual demand	
Applachian Power Company (APCo)	Rider REO		✓			✓	Min. of 12 months	Yes		No
Dominion Energy	Schedule MBR		✓	✓			Min. 3 years. Automatic annual renewal	Yes. Savings possible	12 months billing history, with at least 3 months of 5 MW load @ 85% load factor	Not applicable
Dominion Energy	Schedule CRG (GS - 1,2,3,4; 27; 28)		✓		✓	✓	5 years or more	Yes	Peak demand of 1000 kW or more	No
Dominion Energy	Schedule RF	✓					Negotiable	Yes	New load of at least 30,000,000 kWh annually	Not applicable
Dominion Energy	Renewable Energy Supply Service, Schedule RG	✓			✓		Same as RE resource term in the RG Agreement	Yes. Savings possible	1 MW and more	Yes
Puget Sound Energy (PSE)	Long Term Renewable Energy Purchase Rider, Schedule No. 139, branded as "Green Direct"		✓			✓	Phase 1: 10, 15, or 20 years. Phase 2: 10, 15, or 18 years	Yes. Savings possible	Min. aggregated load of 10,000,000 kWh per year	Not clear
Madison Gas & Electric (MGE)	Renewable Energy Rider	✓			✓	✓	Negotiable	Yes	Customers on rate schedules: Cg-4, Cg-2, Cg-6, Sp-3, and Cp-1	Not clear
Black Hills Energy	Large Power Contract Service				✓	✓		Yes	New load of 13,000 kWh or more	No

APPENDIX B

Green Tariffs Offered by Utilities/Discoms: A Questionnaire for C&I Customers in India

1. Please provide the name and location of your company.

2. What is the primary area of business of your company?
Agriculture and allied industries | Automobiles | Auto components | Aviation | Banking | Cement | Consumer durables | E-commerce | Education and training | Engineering and capital goods | Financial services | FMCG | Gems and jewellery | Healthcare | Infrastructure | Insurance | IT & ITES | Manufacturing | Media and entertainment | Metals and mining | Oil and gas | Pharmaceuticals | Ports | Power | Railways | Real estate | Renewable energy | Retail | Roads | Science and technology | Services | Steel | Telecommunications | Textiles | Tourism and hospitality | (Other – Please specify)

3. Please provide details of your annual electricity consumption in kWh for April 2018–March 2019. If possible, please share copies of your electricity bills on a confidential basis at ashok.thanikonda@wri.org.

4. What electricity tariff (INR/kWh) does your company pay to the utility/DISCOM?

5. What is your current mode of procuring electricity? Please select all applicable choices.
- □ Utility/DISCOM
- □ Open access 3rd party PPAs
- □ Open access captive
- □ On-site 3rd party PPAs
- □ On-site captive

6. Is your company considering procuring renewable electricity?
- □ We are already procuring renewable electricity. We want to increase the volume of procurement
- □ We are already procuring renewable electricity to the fullest of our requirements
- □ Yes
- □ No
- □ Maybe

7. Are you aware of the percentage of your electricity that comes from renewable sources?
- □ Yes
- □ No
- □ Maybe

8. What percentage of your electricity comes from renewable sources on the date of taking this survey? Please select a suitable range or mention the accurate percentage, if you know, in the "other" option.
- □ Less than 25%
- □ 26–50%
- □ 51–75%
- □ More than 75%
- □ (Other – Please specify)

9. Why is your company procuring, or interested in procuring, renewable electricity?
- □ Internal sustainability targets
- □ Government mandates (e.g., Renewable Purchase Obligations)
- □ Supply chain mandates (e.g., as required by the MNCs you serve)
- □ Cost savings
- □ (Other – Please specify)

10. Does your company have any sustainability targets at present?
- □ Yes
- □ No
- □ Maybe

11. Are your company's sustainability targets publicly declared (e.g., in Annual Reports)?
- □ Yes
- □ No
- □ Maybe

12. What is the target of your company in relation to the procurement/use of renewable electricity?

13. Does your company have plans to put in place sustainability targets/science-based targets?
- □ Yes
- □ No
- □ Maybe

14. What do you think are the barriers for C&I customers procuring renewable electricity in India?

	NOT A BARRIER	DO NOT KNOW	MODERATE BARRIER	STRONG BARRIER
Cost of renewable electricity				
Grid usage charges (wheeling, banking, cross-subsidy, additional surcharges, etc.)				
Policy certainty				
Contractual terms (for example, in leased premises where the meter is in landlord's name)				
Government approvals/permissions				
Techno-commercial capacity of the C&I consumers				
Availability of information about credible vendors/service providers				
Access to financing/debt				
Utility/DISCOM electricity tariffs				

15. Please mention additional barriers, if any, that are not captured in the previous question.

16. How would you prefer to procure renewable electricity? Please arrange the following aspects in decreasing order of the preference, with the first option being the most preferable model.
- □ On-site from 3rd party developers/producers
- □ On-site from the utility/DISCOM (For example, utility sets up a rooftop solar plant on your premises)
- □ On-site captive renewable electricity plant
- □ Open access from 3rd party developers/producers
- □ Off-site from the utility/ DISCOM (like green tariffs offered by certain states)
- □ Open access captive renewable electricity plant
- □ None

17. Please provide reasons for your choices to the previous question.

18. What percentage of the tariff would you be willing to pay as a premium to the utility/DISCOM for renewable electricity, if you prefer green tariffs? Please specify specific percentage, if you have such a figure available, in the "other" option.
- □ Zero
- □ Less than 25%
- □ 26–50%
- □ 51–75%
- □ 76–100%
- □ (Other – Please specify)

19. If your company already signed up for green tariffs offered by the utility/DISCOM, what are the drivers?
- □ Ease and simplicity of procurement
- □ Green tariff is cheaper than regular electricity tariff
- □ Even if green tariff is costly, your consumption pattern results in net financial savings
- □ Even if green tariff is costly, your (internal/ external) sustainability targets are met
- □ Did not sign up for green tariffs
- □ (Other – Please specify)

20. Please provide more details about the green tariff your company has signed up for.

21. In your opinion, what measures could make the green tariffs offered by utilities/DISCOMs more attractive to your company?

22. Do you agree to be contacted in case of any follow-up questions?
- □ Yes – by mail
- □ Yes – on phone
- □ No

23. Please provide your name and contact details.

ENDNOTES

1. The literature in the field is heavily dominated by discussions on "feed-in tariffs" and "renewable energy certificates," which are not within the scope of this study, and such literature was, therefore, excluded. The search was restricted to research material in the English language only.
2. Recognizing that CSS and CS both have distortionary impacts, it has been proposed under the National Tariff Policy 2016 that the "Appropriate Commission would notify a roadmap such that tariffs are brought within ±20% of the average cost of supply." It also specifies that the CS surcharge would be capped "at 20% of the tariff applicable to the category of the consumers" (MoP 2017). This could theoretically offset revenue losses for the discoms.
3. A number of definitions for stranded assets are used by different organizations such as the IEA, Carbon Tracker Initiative, and the Generation Foundation. For the sake of simplicity, we have adopted the IEA's definition: "those investments which have already been made but which, at some time prior to the end of their economic life (as assumed at the investment decision point), are no longer able to earn an economic return as a result of changes in the market and regulatory environment brought about by climate policy." https://www.irena.org/DocumentDownloads/Publications/IRENA_REmap_Stranded_assets_and_renewables_2017.pdf.
4. The sole customer is Mangalore Chemicals and Fertilizers (MCF): http://www.kptcl.com/RPO_ESCOMS_04_12_2018.pdf.
5. Distribution utilities in India are typically referred to as distribution companies, or discoms.
6. Only two regulatory commissions have exclusively imposed penalty for RPO noncompliance, while four other commissions (including JERC for Goa and the union territories) have given specific directions for noncompliant consumers. https://posoco.in/wp-content/uploads/2018/08/REC_REPORT_17082018_fPRINT.pdf.

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We use our research to influence government policies, business strategies, and civil society action. We test projects with communities, companies, and government agencies to build a strong evidence base. Then, we work with partners to deliver change on the ground that alleviates poverty and strengthens society. We hold ourselves accountable to ensure that our outcomes will be bold and enduring.

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