



POLICY BRIEF

BULK PROCUREMENT IN ROOM AIR CONDITIONING

A Critical Analysis of the EESL programme

Manjeet Singh
Gurprasad Gurumurthy



THE ENERGY AND RESOURCES INSTITUTE
Creating Innovative Solutions for a Sustainable Future



SHAKTI
SUSTAINABLE ENERGY
FOUNDATION

JANUARY 2019

© The Energy and Resources Institute 2018

The material in this publication is copyrighted. Content from this policy brief may be used for non-commercial purposes, provided it is attributed to the source. Enquiries concerning reproduction should be sent to the address:

The Energy and Resources Institute
Darbari Seth Block, India Habitat Centre, Lodhi Road, New Delhi – 110 003, India

Authors

Mr Manjeet Singh, Associate Fellow, The Energy and Resources Institute (TERI)
Mr Gurprasad Gurumurthy, Research Associate, The Energy and Resources Institute (TERI)

Reviewers

Mr Girija Shankar, Additional General Manager, Energy Efficiency Services Limited (EESL)
Mr Karan Mangotra, Associate Director and Fellow, The Energy and Resources Institute (TERI)

ACKNOWLEDGEMENTS

Shakti Sustainable Energy Foundation (Shakti) seeks to facilitate India's transition to a sustainable energy future by aiding the design and implementation of policies in the following sectors: clean power, energy efficiency, sustainable urban transport, climate policy and clean energy finance.

This policy brief is a critical analysis of the EESL Super-Efficient Air Conditioners Programme (ESEAP) for bulk procurement of room air-conditioners in India. The is supported by Shakti Sustainable Energy Foundation (SSEF).

The authors would like to thank the following people for their constructive comments on earlier drafts: Mr Girija Shankar, Additional General Manager, Energy Efficiency Services Limited (EESL) and Mr Karan Mangotra, Associate Director, TERI.

All opinions expressed, as well as omissions and eventual errors are the responsibility of the authors alone.

SUGGESTED FORMAT FOR CITATION

Manjeet Singh, Gurprasad Gurumurthy, TERI Policy Brief 2019
Bulk Procurement in Room Air Conditioning: A Critical Analysis of the EESL programme. New Delhi: The Energy and Resources Institute. 12 pp.

Editorial and design: Shikha Dimri, Rajiv Sharma

PUBLISHED BY

The Energy and Resources Institute (TERI)

FOR MORE INFORMATION

Project Monitoring Cell
TERI, Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi 110 003, India
Tel.: +91 11 2468 2100 or 2468 2111 | Fax: +91 11 2468 2144 or 2468 2145
Email: pmc@teri.res.in | Web: www.teriin.org

TABLE OF CONTENTS

List of Abbreviations	4
Room Air Conditioner Market in India	5
Introduction	5
Existing Policy Context for Pro-Energy Efficient Appliances	5
EESL Bulk-Procurement Model	6
Background	6
EESL Super-Efficient Air Conditioning Programme (ESEAP)	6
Outcome	6
Key Takeaways	6
Business Models: Cases from International and Domestic Markets	7
Inclusion and Trust: Learning from Rooftop Solar PV	7
Fiscal Instruments	8
Subscribe for Cooling	8
E-marketplace	8
Role of E-commerce	8
Conclusion	9
Endnotes	11
Suggested Readings	12

ABBREVIATIONS

GWP	:	global warming potential
TWh	:	terrawatt-hours
AC	:	air conditioner
ISEER	:	Indian Seasonal Energy Efficiency Ratio
MEPS	:	minimum energy performance standards
PV	:	photovoltaic
LED	:	light emitting diode
O&M	:	operation and maintenance
MoEF&CC	:	Ministry of Environment, Forest and Climate Change
HFC	:	hydrofluorocarbon
HCFC	:	hydrochlorofluorocarbon
DISCOM	:	distribution company
kWp	:	kilowatt-peak
RESCO	:	renewable energy service company
HVAC	:	heating, ventilation and air conditioning

ROOM AIR-CONDITIONER MARKET IN INDIA

Introduction

India has seen rapid urbanization in the past decade, which resulted in greater employment opportunities, better facilities, intermixing of cultures, and the centralization of resources. However, this unfettered growth has occurred at the expense of an increase in energy consumption, transportation, and population density. The current consumption of electricity in India is 997.48 TWh; the residential sector accounts for 23.86% (238 TWh), while the commercial sector accounts for 9% of this consumption. The electricity demand for the residential sector is likely to increase by nearly five times, to 1,115 TWh, by 2040.

One of the reasons for this high energy demand by the residential sector has been the increase in the usage of air conditioners (ACs). This is particularly true for the northern and western states of India, which, characteristically, have a warmer climate, as well as the southern region, which experiences high humidity. Rapid urbanization in these parts of the country, coupled with increasing population and rising incomes, has resulted in a higher cooling demand from the residents. This has led to an increase in the installation and usage of ACs, creating a national market for the product that is worth Rs 12,000 crore. This market is expected to grow at a rate of 6.7% up till 2020. Of this country-wide demand, 40% comes from the northern region of India. There is a higher preference for split ACs over window ACs, with the demand for the former being about 4.08 million units in 2017, while the share of window ACs reduced from 80% to 20% in less than a decade.

A large number of AC installations in cities have led to significant levels of carbon emissions. They have also created localized heat islands, which adversely impact human well-being. This highlights the need for energy efficient devices and climate friendly solutions to be incorporated at the consumer level, which would further help in reducing emissions as well as in promoting large-scale energy savings.

Existing Policy Context for Pro-Energy Efficient Appliances

The drive for energy-efficient appliances, in both commercial and non-commercial sectors, was initiated

by the BEE's star-rating programme under the Energy Conservation Act, 2001. The programme was successful in orienting the consumer towards energy-efficient appliances. In general, the rating system evolved in a phased-wise manner with upgrade in efficiency. Thus, an AC that was given 5 stars by the Indian Seasonal Energy Efficiency Ratio (ISEER) rating in 2010 is now equivalent to only 1 star, according to the ratings implemented since January, 2018. However, analysts believe that this change in rating can trigger an increase in AC prices by 10%, reducing the large-scale uptake of the product by consumers.

Recently, the Ministry of Power issued voluntary guidelines to set the minimum temperature as 24 °C for ACs as a measure to reduce load and power consumption. After an awareness campaign lasting 4–6 months, followed by a survey to gather public feedback, the Ministry planned to make this mandatory.

In addition to regulatory measures such as the Minimum Energy Performance Standard (MEPS) and star labelling, market transformation to energy efficient appliances can also be achieved through mechanisms, such as fiscal, financial, and business models. A good example of this is the LED bulk-procurement model of Energy Efficiency Services Limited (EESL), which has been used to successfully drive the market towards energy-efficient lighting. Taking a cue from the LED bulk-procurement model's success, EESL launched a bulk-procurement programme to promote the uptake of super-efficient ACs.

EESL Bulk-Procurement Model

Background

Bulk-procurement programmes can help the next-generation technologies penetrate the market. They do this by aggregating the demand for the technology and establishing a demand market for participating manufacturers, thereby leading to rapid reduction in prices. Demand-aggregation concepts, although novel in the Indian context, have been previously applied in the US to promote their rooftop solar PV market.

In the first of its kind, the National Mission for Enhanced

Energy Efficiency (NMEEE), in association with BEE–Unnat Jyoti by Affordable LEDs for All (UJALA) scheme, EESL tendered to procure a substantial volume of 7,00,000 LED bulbs. This was done with the dual aim of increasing the market size of this product and lowering the cost of energy-efficient LED lighting. The initial cost of an LED light was INR 310 per piece in 2014, while by September 2016, prices dropped to INR 38. The UJALA scheme has distributed more than 100 million LED bulbs across 120 cities and 14 major states of India, demonstrating the positive impact of bulk procurement. The following figure details the cost reduction of LED lights seen in the years subsequent to the rollout of the bulk-procurement programme.

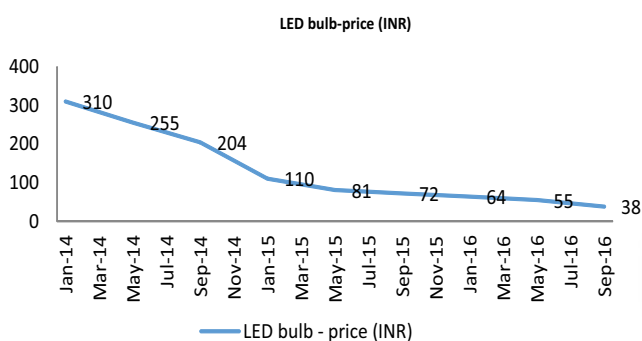


Figure 1: LED bulb price trend (bulk-procurement mode)

Source: EESL

EESL Super-Efficient Air Conditioning Programme (ESEAP)

In keeping with the success of the aforementioned efforts, and to achieve a low-emission and high energy-efficient pathway for India, EESL created the ESEAP, which aimed to collaborate with leaders in the AC industry and introduce super-efficient ACs into the market. Technical specifications for super-efficient ACs have been decided based on the best technology available in the market.

EESL floated a tender in early 2017 for the procurement of 100,000 super-efficient 1.5 TR ISEER 5.2 (minimum) inverter room ACs, primarily for residential and institutional use. The tender requirements mandated that the manufacturers design, manufacture, supply, install, and provide after-sales O&M with extended customer support. While the government preferred to utilize environmentally friendly refrigerants in order to enable more manufacturers to participate in the tender, there was no restriction on refrigerant use as long as they complied with the Ministry of Environment, Forest and Climate Change’s (MoEF&CC) regulatory requirements.

Outcome

For the first tender of the ESEAP, three companies have participated namely Panasonic, Godrej and Daikin. Panasonic submitted the lowest price bid, offering a price of INR 35,000 per unit, while Daikin bid INR 41,000 for superior 5.4 ISEER R-32 ACs. Godrej offered INR 51,000 for HC-290 ACs with ISEER of 5.2. Following this bidding, Daikin and Godrej were given an opportunity to match the lowest price bid, without changing the technical specifications. EESL announced in mid-2017 that 60,000 units would be contracted to Panasonic, and the remaining 40,000 to Godrej, as Daikin finally decided not to match the lowest price bid. Considering that this was the first attempt at bulk procurement for super-efficient ACs, it was encouraging to see that 40% of the bids went towards a low-GWP refrigerant. The following figure outlays the details of the programme outcome :

EESL Tender for super-efficient ACs

- 1000,000, 1.5 TR, 5.2 ISEER and above, super-efficient ACs

Tender Specifications

- 1.5 TR
- Window or split
- ISEER 5.2 or greater
- 1 (+2) year warranty
- Additional component warranty - 5 years warranty on condenser/evaporator coil and 10 years warranty on compressor
- Design, manufacture, supply, Installation and after-sales services
- No mention of Low-GWP refrigerant requirement

Successful bidders

- Panasonic - L1 @ INR 35000
- Daikin - INR 41000
- Godrej - INR 51000

Contract awarded

- Panasonic - 60,000 ACs, ISEER 5.2,
- Godrej - 40,000 ACs, ISEER 5.2, HC-290 refrigerant

Key Takeaways

Estimation of the Critical Mass

It is important to estimate the critical mass/procurement size to design an effective bid. This size should be based on assessments of payback, detailed market surveys, evaluation of consumer demand, identification of sector specific needs and regulatory requirements. This aids in avoiding excess product procurement, erroneously assessing transportation needs and saving on storage and warehousing requirements that may not have been incorporated into the planning process.

Importance of Stakeholder Consultation

While the ESEAP was successful in the procurement part, it was found wanting in the demand aggregation aspect. It was observed that success depended on actionable inputs from key stakeholders, namely, manufacturers, DISCOMs, and policymakers. Some of the most important inputs, such as minimum features in the procured equipment, current consumer preferences, industry capacity, after-sales servicing mechanism, and sector-wise analysis of the estimated demand for room ACs, play a major role in developing the demand aggregation strategy of the programme. However, due to the lack of wider specification options and focused deliberations, all the inputs from stakeholders were not properly received. Consequently, implementation of the planned strategies to create demand was adversely affected.

LED's vs. Room AC's

Sizing of the equipment also plays a part in influencing buyers' choice. The success of the LED bulb programme could also be attributed to the size of the equipment; it was a smaller equipment with much less cost and had no maintenance or repair costs associated with it. Nor did it require O&M and annual servicing. It could be easily disposed of and repurchased. Air-conditioning equipment, on the other hand, has higher upfront costs, annual maintenance requirement, and a higher liability. This could have added to the consumer inertia in purchasing. However, the impact of higher prices is not as significant, owing to the increasing purchasing power and indispensability of ACs, due to the ever-increasing urban ambient temperatures.

In addition, the tender did not specify the point of

delivery, which made it difficult for the bidder to price the transportation component effectively thereby resulting in higher transportation costs for room ACs.

Need to factor in the climate costs

Another important observation was that the bid for the major share of ACs was provided to the lowest cost bidder as it provided a reference technology which was already matured and, thus, available at a lower cost. In comparison, though the other bids provided medium and low-GWP refrigerants (RC-32 and R290), they were still at a nascent stage in the technology development cycle and, thus, more expensive. As we go ahead, we need to ensure the usage of metrics that evaluate the costs and GHG impacts together, such as the life cycle climate performance (LCCP) and total equivalent warming impact (TEWI).

Business Models: Cases from International and Domestic Markets

The current EESL business model looks at procuring energy-efficient devices in bulk, through tendering, where manufacturers can competitively bid for low prices. The winning bid receives the bulk order, manufactures the stipulated numbers, and installs at identified markets across the country. This model has been successful in reducing costs and increasing the market size for LED lamps, as discussed in the previous sections. This bulk procurement model can be applied successfully for promoting super-efficient ACs with climate-friendly refrigerants by taking cues from the following business models:

Inclusion and Trust: Learning from Rooftop Solar PV

The application of the bulk-procurement model to ACs has several advantages from a consumer's perspective—decrease in the cost of ownership by more than 30% for high-quality products offered by top brands and the availability of EMI options with zero down payments. However, the viability of the model, particularly for large consumer devices like ACs, is debatable, considering the cost of the equipment and the complex nature of the device in question, which contains several components and requires multiple steps for installation, customization, and alignment with consumer perspectives. It is here that drawing parallels between ACs and rooftop solar PV systems could shed some light on the challenges

and similarities. A crucial point: both devices aid in energy savings.

Learning from the rooftop solar PV sector would help enable strategies for marketing and consumer-conversion aspects. This could include, in addition to the economic benefits, the dimension of social and environmental benefits and inclusion, which play a vital role. This was demonstrated in the cases of Connecticut in the US and Dwarka in Delhi. In the US, large-scale consumer awareness campaigns were conducted at the city level. Participation from district or block representatives was sought and the programme functioned in association with competitively selected rooftop solar PV developers, who had a presence in the region. Consumers were informed about the advantages of solar energy, its economic benefits, savings, and returns. In order for consumers to become stakeholders, strong community influencers were dubbed as 'solar ambassadors', who actively aided in enhancing awareness in their neighbourhoods. These outreach activities and peer influencing made large-scale installations possible, which provided a perfect market for developers while causing a large reduction in the price per kWp of the PV system. Simultaneously, the cost of financing also reduced. Strategies for consumer inclusion, highlighting socio-environmental benefits, could potentially aid the bulk-procurement model during the rapid-deployment phase.

Fiscal Instruments

Tax credits, holidays, and rebates often play a vital role in increasing the penetration of clean energy and energy-efficient products. The Ministry of New and Renewable Energy's (MNRE) scheme for promotion of energy-efficient buildings focused on providing direct cash benefits to innovations in the sector, keeping in mind the effectiveness of not routing complete funds to state nodal agencies, NGOs, and other agencies. While developed economies, such as Japan and the USA, have definitive tax relief structures and subsidies in place, India would greatly benefit from using taxes as effective fiscal instruments. For instance, the MNRE channel-partner scheme, with up to 30% subsidy for solar projects, cannot be undervalued. The scheme aided in pushing initial installations and providing a market to new entrants with demonstrable capabilities. Similarly, a tax-incentive scheme could be introduced within AC bulk procurement program for leapfrogging the deployment of super-efficient air conditioners with low GWP refrigerants.

For instance, with property tax, the rebate could be proportional to the number of energy-efficient devices any household uses.

Subscribe for Cooling

As has been demonstrated by leading audio-visual content platforms in the world, which run on the subscription model, it has become easier to not only access content but also improve the overall effectiveness of media outreach through consumer aggregation. A singular platform was created, payments were streamlined, and multiple production studios were brought under a single label. The subscription model has the potential to be applied to the energy-efficiency segment as well. This could be viewed as an evolution of the renewable energy service company (RESCO) model, where energy-efficient heating, ventilation, and air-conditioning (HVAC) devices and controls would be installed at commercial and institutional establishments, while the service and repairs would be taken care of at no additional cost—except for a subscription fee and selected package; and some start-ups have been successful in demonstrating the subscription model for energy-efficient devices.

Under the pay-as-you-save (PAYS) model, initial investments, in terms of the installation cost of energy-efficient devices, are made by the utility. The tariff contains a fixed charge, which is typically lower than the estimated monthly-bill savings from the energy-efficient device. A subscription model such as PAYS could pave the way for faster deployment and installation, minus the liability for consumers. Possibilities can be explored to incorporate this feature in the AC bulk procurement programme.

E-marketplace

The government of India had launched an e-procurement platform (Government e-Marketplace or GeM) for government agencies and departments, listing all important products and materials. This e-marketplace has been successful in connecting buyers and sellers. It also allows for open tendering, bidding, and selection in an efficient and transparent manner. Multiple product and services listing, direct purchasing, integrated payment mechanisms, user registration for authentication, comparison of products, and online training modules about the portal are some of the key features of GeM. The platform is popular among public sector entities that require products and services regularly. This could be leveraged for the listing of super-efficient ACs. Provisions for showcasing the benefits of adopting energy efficient air conditioners with low GWP refrigerants on the main

webpage could also be explored. Such a platform could be marketed on all social media platforms, thereby redirecting more traffic towards the GeM portal. The aggregated demand through the GeM, can be leveraged and bulk procurement model can be used to meet the demand.

Role of E-commerce

E-commerce platforms have gained prominence over the years, especially the ones that conduct large-scale B2B businesses. The increasing role of such platforms needs to be acknowledged and understood in order to explore opportunities and design effective super-efficiency programmes centred on e-commerce platforms. Online marketplaces aid in cutting costs, especially by avoiding expensive paper-based procurement processes. Data storage, accuracy, security, less redundancy, and streamlining of channels allow for easier business process flow.

Apart from functioning as an effective marketplace, it also allows buyers to compare and understand the specifications of the different available models, view the product, and read feedback from other buyers, which creates a more robust and transparent system. Fast and efficient delivery and support services have given consumers the confidence to purchase large consumer goods such as ACs online through popular e-commerce platforms.

Additionally, e-commerce platforms also double as effective marketing sites. Since multiple products are listed, consumers searching for other products could potentially be directed towards the product being marketed. This can be achieved using advertisements (pay-per-click [PPC] advertising), search engine optimization (SEO) tools, and other available methods.

The advantage of e-commerce platforms cannot be stressed further. One of the most influential facets of the platforms is the key feature that products could be displayed without actual stock. This is a popular exercise in the case of new mobile phones and may be easily applied in the case of super-efficient ACs. Since ACs with ISEER 5.0 and above are already in the Indian market, the EESL-tendered manufacturers would be able to push products into the mainstream in shorter time periods and in the process, transforming the market.

Conclusion

EESL's initiative to provide efficient and affordable cooling to all through the first bulk procurement is

commendable. However, having gone through the first tranche of procurement, there are important lessons that can be learnt for the subsequent phases.

The aforementioned cases highlight efficient methods to create awareness and increase adoption across consumers. Newer business models could be employed to boost sales and create a market for super-efficient ACs using climate friendly refrigerants. Although effectiveness increases with stronger stakeholder collaborations and attractive technology, effective marketing tools could also become drivers to increase uptake. Inclusivity of consumers, besides providing them with a platform to become stakeholders, is also an efficient process for improving the penetration of energy-efficient devices. Programme effectiveness increases when the consumer and environmental benefits of the programme are highlighted. Lastly, the aforementioned cases and exemplary programmes indicate the importance of super-energy-efficient devices and their relevance in the Indian consumer market. Better programme implementation would play a vital role in bringing a transition towards energy efficiency and environment friendly refrigerants to maximize climate benefits.

In addition to these strategies, DISCOMs, which are influential nodal points for consumers, could be engaged effectively. The aforementioned PAYS model offers an advantage in terms of zero upfront investment from the consumer end. This is a huge draw for consumers when accepting products.

Lastly, from a technical standpoint, while it is easy to show which refrigerants have the least impact on global warming, it is much easier to market and sell products with lower costs. Therefore, in order to influence consumer outlook, information on affordability and other environment benefits must be clear, concise and, most importantly, simple. The graphical campaign flyers used during the Solarize programmes helped aggregate and present key points in a simplistic manner. A simple representation of the environmental impact of using low-GWP refrigerant could prove to be effective in orienting the consumer towards adopting super-efficient devices at affordable rates. Effectively engaging with stakeholders and understanding their key challenges, along with highlighting the importance of access to affordable and environment-friendly cooling products will benefit the society at large.

Notes

MOSPI, GOI. 2017. 'Energy Statistics' (Twenty-Fourth Issue), available at http://www.mospi.nic.in/sites/default/files/publication_reports/Energy_Statistics_2017r.pdf (last accessed on 22 November 2018).

International Energy Association. 2015. India Energy Outlook, WEO Special Report, available at https://www.iea.org/publications/freepublications/publication/IndiaEnergyOutlook_WEO2015.pdf (last accessed on 22 November 2018).

Attri, S.D. and Ajit Tyagi. 2010. India Environment Portal, available at http://www.indiaenvironmentportal.org.in/files/climate_profile.pdf (last accessed on 22 November 2018).

Indian Brand Equity Foundation. 2018. 'Consumer Durables', available at <https://www.ibef.org/download/Consumer-Durables-February-2018.pdf> (last accessed on 22 November 2018).

Japan Refrigeration and Air Conditioning Industry Association. 2018. World Air Conditioner Demand by Region, available at https://www.jraia.or.jp/english/World_AC_Demand.pdf (last accessed on 22 November 2018).

Ghosh, Pinak. 2017. 'Green Ratings to Push Up AC Prices'. The Telegraph, available at https://www.telegraphindia.com/1171009/jsp/business/story_176911.jsp (last accessed on 22 November 2018).

The Times of India. 2018. 'Power Ministry May Make 24 Degrees Celsius as Default Setting for Air Conditioners', available at <https://timesofindia.indiatimes.com/india/power-ministry-may-make-24-degree-celsius-as-default-setting-for-air-conditioners/articleshow/64701707.cms> (last accessed on 26 November 2018).

Singh, Sarita C. 2016. 'Prices of LED Bulbs Drop to Rs 38'. The Economic Times, available at <https://economictimes.indiatimes.com/industry/energy/power/prices-of-led-bulbs-drop-to-rs-38/articleshow/54326721.cms> (last accessed on 22 November 2018).

Energy Efficiency Services Limited. 'Role of Aggregation in Reducing Price of Pumps and LED Bulbs: Lesson for ISA', available at <http://isolaralliance.org/docs/GetTogether/EESL%20-%20ISA%20Final%20V1.pdf> (last accessed on 22 November 2018).

Energy Efficiency Services Limited. 'EESL Super-Efficient Air Conditioning Programme (ESEAP)', available at <https://www.eeslindia.org/EN/Eeac/About/> (last accessed on 22 November 2018).

Ministry of Environment and Forests. 2000. 'Notification', available at <http://envfor.nic.in/legis/ods/odsrcr.html> (last accessed on 26 November 2018).

TERI, IGSD, and TERRE. 2017. 'Leap Frogging to Super Efficiency', available at <http://www.igsd.org/wp-content/uploads/2017/08/Updated-EESL-AC-Bulk-Procurement-4-Aug.pdf> (last accessed on 22 November 2018).

Sengupta, Debjoy. 2017. 'Panasonic emerges as lowest bidder for EESL's super-efficient ACs', available at <https://economictimes.indiatimes.com/industry/cons-products/durables/panasonic-emerges-as-lowest-bidder-for-eesl-super-efficient-ac/articleshow/58813834.cms>

See <https://eeslindia.org/writereaddata/India%20Buisness%20Journal%2028-04-15%20.pdf> (last accessed on 26 November 2018).

Dutta, Arnab. 2017. 'ACs to Get Cheaper as Govt Launches New Project'. Business Standard, available at https://www.business-standard.com/article/companies/acs-to-get-cheaper-as-govt-launches-new-project-117011300633_1.html (last accessed on 22 November 2018).

BSES Rajdhani Private Limited. 2018. 'BRPL Solar City Initiative', available at <http://solarbses.com/> (last accessed on 22 November 2018).

Macunas, Matt. 2015. 'Commentary: Can a "Groupon-like" Model Lower the Cost of Solar Power?' Trendct, available at <https://trendct.org/2015/10/20/commentary-can-a-groupon-like-model-lower-the-cost-of-solar->

power/ (last accessed on 22 November 2018).

Yale Center for Business and the Environment. 2017. 'Solarize Your Community', available at <http://cbey.yale.edu/sites/default/files/Solarize%20Your%20Community%20-%20Digital.pdf> (last accessed on 26 November 2018).

Chaturvedi, Ipshita. 2016. 'Why Tax Incentives for Efficiency Are a Step Forward for India's Energy Security'. The Wire, available at <https://thewire.in/energy/energy-efficiency-tax-marrakech> (last accessed on 22 November 2018).

MNRE. 2018. 'Solar Rooftop-Grid Connected', available at <https://mnre.gov.in/solar-rooftop-grid-connected> (last accessed on 22 November 2018).

Kelly-Detwiler, Peter. 2018. 'Can a Subscription Approach Help Accelerate Adoption of Advanced Energy Technology?' Forbes, available at <https://www.forbes.com/sites/peterdetwiler/2018/01/02/can-a-subscription-approach-help-accelerate-adoption-of-advanced-energy-technology/#48d1678e6ef5> (last accessed on 22 November 2018).

Sparkfund. 2018. Sparkfund.com, available at <https://www.sparkfund.com/technology-subscription/> (last accessed on 22 November 2018).

Clean Energy Works. 2018. 'Pay As You Save® (PAYS®) Harnesses a Proven Utility Investment Model to Offer Virtually All Consumers Cost-Effective Energy Building Upgrades', available at <http://cleanenergyworks.org/blog/pays-financing/> (last accessed on 22 November 2018).

Government e-Marketplace, available at <https://gem.gov.in/> (last accessed on 22 November 2018).

Santoso, Clarissa. 2017. 'Why Businesses, Government Need to Keep Up with B2B Ecommerce Trends'. Tech in Asia, available at <https://www.techinasia.com/talk/why-business-government-procurement-need-keep-up-b2b-ecommerce-trend> (last accessed on 22 November 2018).

Bahukhandi, Rahul. 2018. 'Trends That Will Shape India's E-commerce in 2020', available at <https://www.entrepreneur.com/article/316573> (last accessed on 22 November 2018).

entrepreneur.com/article/316573 (last accessed on 22 November 2018).

Big Commerce. 2018. 'What Is Ecommerce Marketing?', available at <https://www.bigcommerce.com/ecommerce-answers/what-ecommerce-marketing/> (last accessed on 22 November 2018).

About TERI

The Energy and Resources Institute (TERI) is an independent non-profit organization, with capabilities in research, policy, consultancy and implementation. TERI has multi-disciplinary expertise in the areas of energy, environment, climate change, resources, and sustainability.

With the vision of creating innovative solutions for a sustainable future, TERI's mission is to usher in transitions to a cleaner and more sustainable future through the conservation and efficient use of the earth's resources and develop innovative ways of minimizing waste and reusing resources.

TERI's work across sectors is focused on:

- Promoting efficient use of resources across sectors
- Increasing access and uptake of sustainable practices
- Reducing the adverse impact on environment and climate

TERI works with a diverse range of stakeholders across governments, both at the National and State levels, international agencies, and civil society organizations to help deliver research-based transformative solutions. Headquartered in New Delhi, TERI has regional centres and campuses in Bengaluru, Gurugram, Guwahati, Mumbai, Nainital, and Panaji.

Currently, TERI's work is structured around seven sectors namely:

- Agriculture
- Climate
- Energy
- Environment
- Habitat
- Health and Nutrition
- Resources

Disclaimer

The views/analysis expressed in this report/document do not necessarily reflect the views of Shakti Sustainable Energy Foundation. The Foundation also does not guarantee the accuracy of any data included in this publication nor does it accept any responsibility for the consequences of its use.

For private circulation only

For more information, please visit: www.teriin.org

Karan Mangotra, Associate Director

Centre for Global Environment Research, The Energy and Resources Institute (TERI)
India Habitat Centre, Lodhi Road, New Delhi- 110003

+91-11 24682100, E-mail: mailbox@teri.res.in

