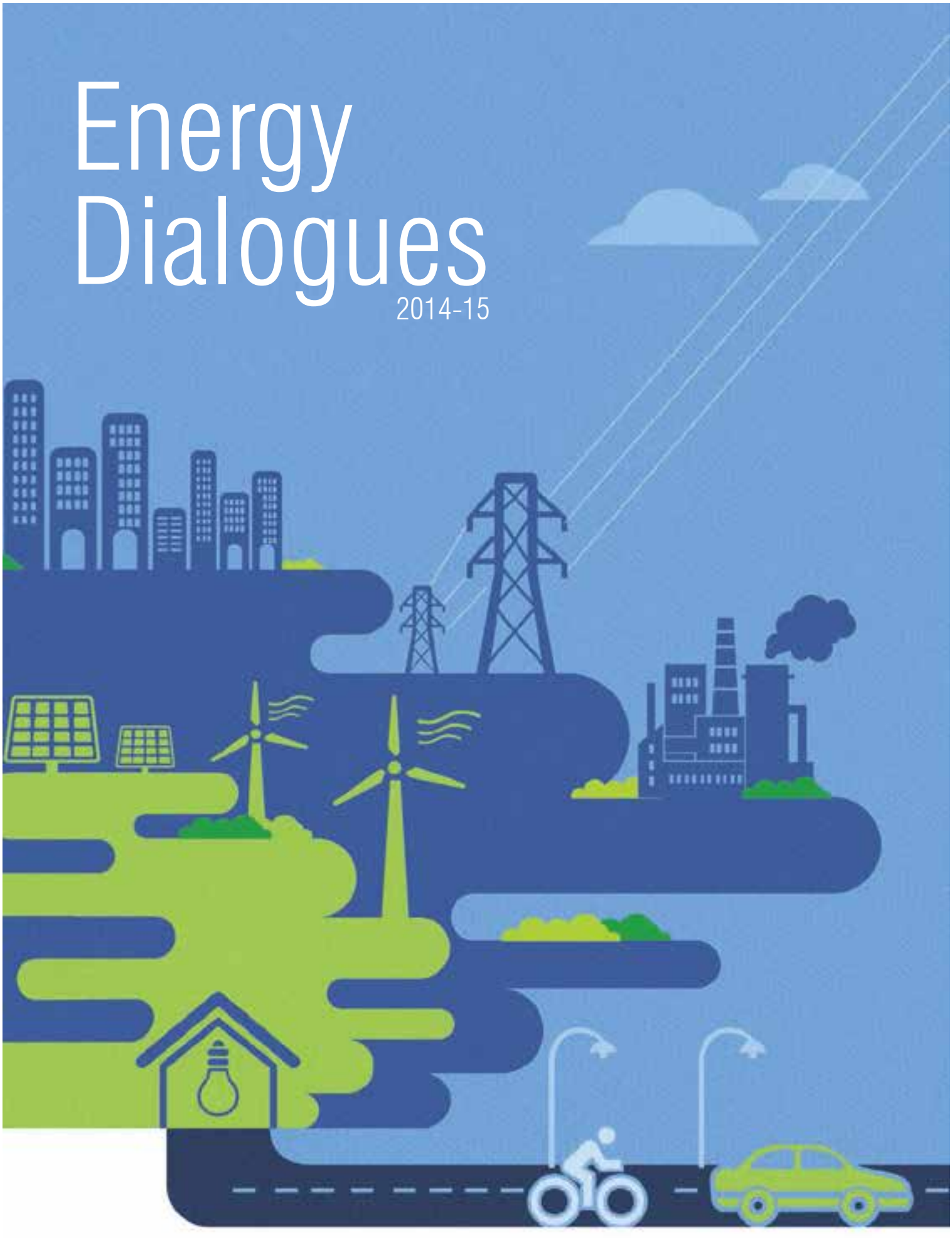
September 2015

SHAKTI
SUSTAINABLE ENERGY
FOUNDATION

Energy Dialogues

2014-15



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Who we are

Shakti Sustainable Energy Foundation was established in 2009 to support India's developmental objectives. We seek to facilitate India's transition to a sustainable energy future by promoting policies that encourage energy efficiency, renewable energy and the adoption of sustainable transport solutions.

Advancing smart energy policies will be key to meeting the defining challenge of the next generation—how to provide millions of Indians with reliable, affordable, secure access to energy in a sustainable manner.

We support the development of research and analysis to provide policy makers with concrete, and practical policy recommendations for an energy secure future.

The energy choices that India makes in the coming years will be of profound importance. Meaningful policy action on India's energy challenges will strengthen national security, create jobs and keep our environment clean.

Vision

A clean, secure and equitable energy future.

Our Approach

- We believe robust energy policy frameworks are necessary for large-scale, transformative change.
- We facilitate strategic policy interventions evaluating all aspects of the policy spectrum.
- We bring together experts from government (national, state and local decision-makers), business, civil society and academia to craft robust energy policies.
- We evaluate the results of our own work rigorously, measuring success using clear metrics based on quantifiable clean energy contributions.
- We work through cross sectoral strategies with the goal of achieving synergistic results and broad impact.
- We emphasise strategic communications to expand our impact and reach.

Board of Directors

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Chairman, Godrej & Boyce Manufacturing Company Limited

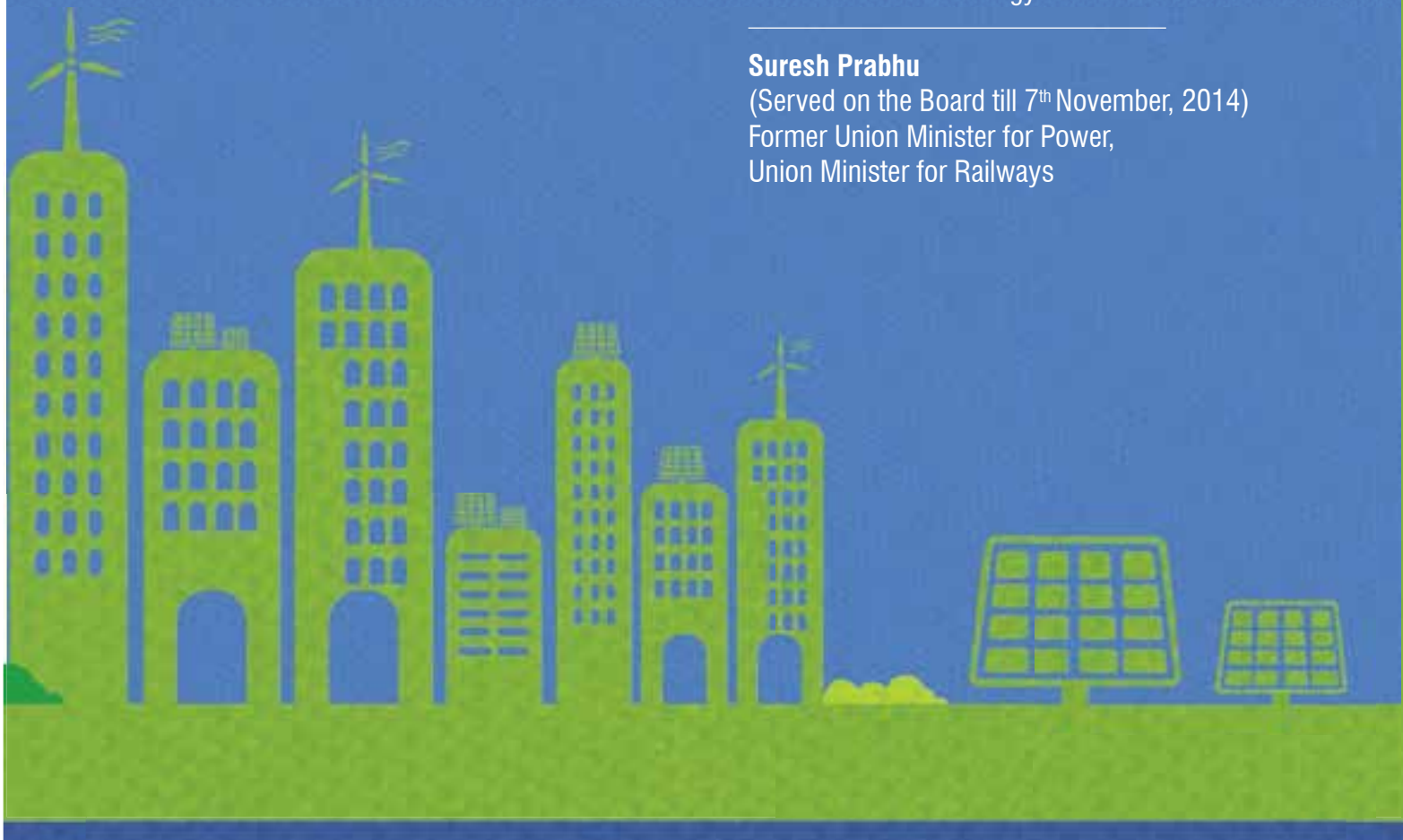
Naina Lal Kidwai
Country Head, HSBC India

Nitin Desai
Former Under Secretary General, United Nations

Meher Pudumjee
Chairperson, Thermax Limited

Krishan Dhawan
Chief Executive Officer, Shakti Sustainable Energy Foundation

Suresh Prabhu
(Served on the Board till 7th November, 2014)
Former Union Minister for Power, Union Minister for Railways



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Message from the Chairman

Dear Friends,

2014 was a year of significant developments for India. The government committed to providing affordable, 24x7 power by 2019 to all homes, industrial and commercial establishments, and adequate power to farms. Critical energy policies and programmes have been rolled out towards this end.

India has raised its solar capacity target by five times to 100 GW by 2022, of which 40 GW is expected to be met through rooftop solar and 60 GW through large and medium scale grid connected solar power projects. A National Offshore Wind Energy Policy is underway and the wind energy target has been increased to 75 GW by 2022 as well.

The government has introduced measures for mainstreaming the use of LED for lighting and to encourage the rapid shift to more energy efficient lighting technology. It has also fast tracked the segregation of distribution of feeders in rural areas, and augmented sub-transmission and distribution, including 100% metering in urban areas.

All these measures will assist in meeting India's growing needs in a more sustainable and efficient manner. Shakti applauds these efforts and seeks to continue to support the establishment and implementation of a policy framework that fosters the use of renewable energy, encourages energy efficiency and advances sustainable transport solutions.

The following pages present Shakti's main achievements last year. We invite you to read about our work and look forward to continued progress in 2015.

I wish to thank all stakeholders, both internal and external, for their continued effort and support.

Jamshyd Godrej
Board Chair
Shakti Sustainable Energy Foundation

Message from the CEO

As Shakti Sustainable Energy Foundation enters its sixth year of operations, our commitment to supporting India's transition to a clean and energy secure future remains as strong as ever.

We greeted with enthusiasm the government's clean energy and climate change initiatives. These ranged from the 175 GW renewable energy target and the 100 Smart Cities Mission, to India's positive engagement with international climate change discussions. Progress was seen on a number of other important efficiency and clean energy initiatives that we expect to be announced in the months ahead.

This positive landscape allowed Shakti to increase its engagement with policy makers. We participated in the development of a renewable energy roadmap for India along with the NITI Aayog; the drafting of a Renewable Energy Policy along with the Ministry of New and Renewable Energy; the roll out of fuel efficiency standards for passenger cars along with the Bureau of Energy Efficiency; the development of recommendations for state level guidelines to implement the Solar Pumping Programme for Irrigation and Drinking Water along with the Ministry of New and Renewable Energy; and the preparation of an India briefing paper for the Lima Conference of Parties for the Ministry of Environment, Forests and Climate Change, among others.

We also extended the range of our work to bring new focus on areas such as air quality, energy access and urbanization, and their links with emissions and climate change.

We were especially pleased to host the Shakti Dialogues in 2014 which saw leading energy stakeholders including policy makers, industry representatives and civil society discuss critical issues and opportunities relating to energy efficiency, sustainable urban transport, power and low-carbon development.

A very significant milestone in our organizational journey was the receipt of our FCRA registration in October 2014. With this, we have been able to reach out to international funders who have a strong commitment to mitigating global climate change and supporting clean energy, and who recognize Shakti's unique role in India.

As this annual report will demonstrate, we have devoted our energies to facilitating evidence-based research and strategic policy, market and institutional interventions that will help India chart out a sustainable development trajectory. We are committed to funding policy research that will help bridge India's energy deficit and help realize the quality of life which Indians deserve and aspire to.

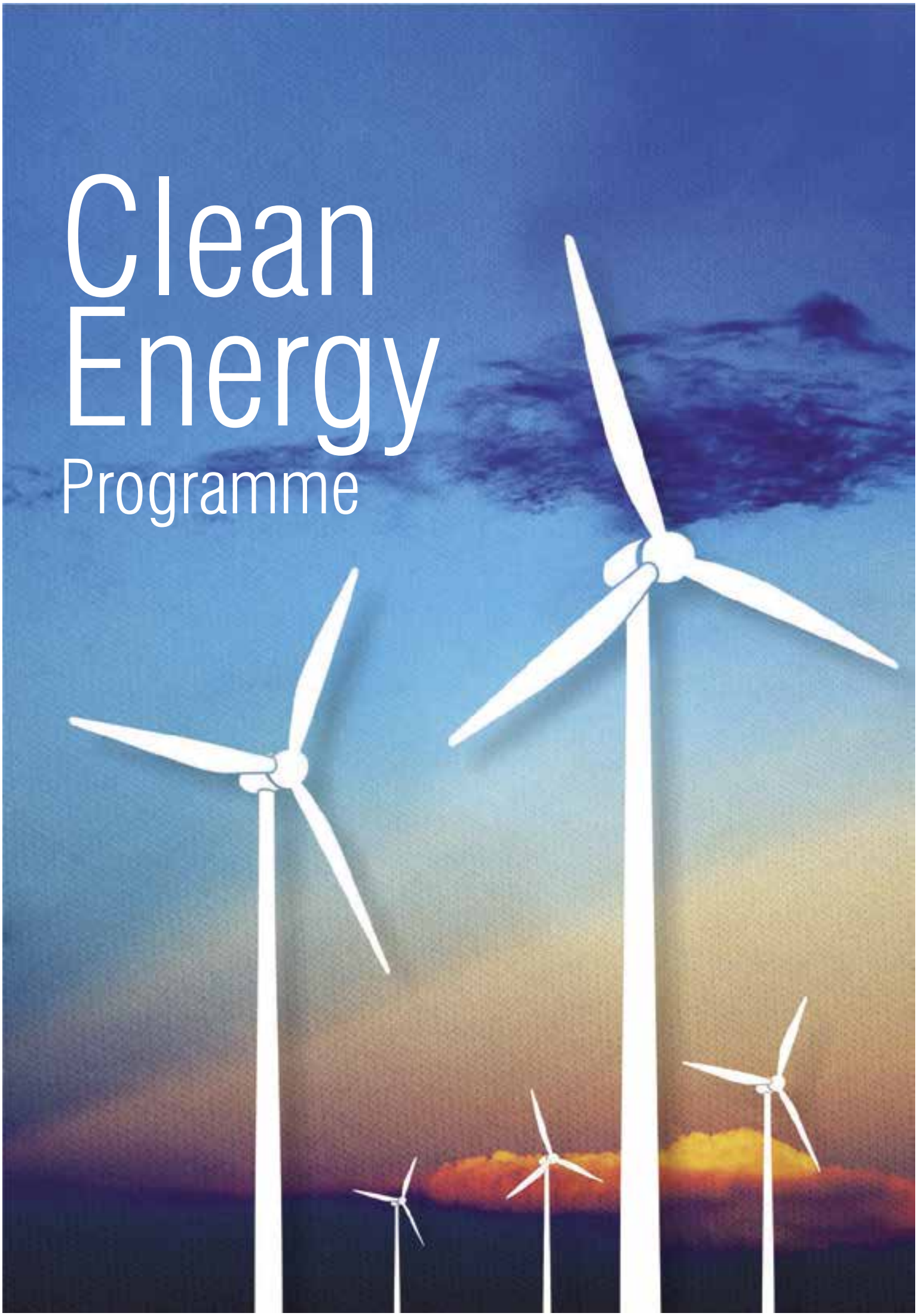
In the current year, we are scaling our work to results for even greater impact. We are optimistic that our efforts, amplified with our partners, are shaping a more sustainable energy future for the country.

I would like to take this opportunity to express special thanks to Mr. Suresh Prabhu, who stepped down from the Shakti Board in November 2014 on being appointed Union Minister of Railways. Mr. Prabhu was a founding Director of Shakti and was intimately involved in the growth and evolution of the organization over the five years that he served on our Board. We wish him all the very best on his current challenging assignment.

I would like to record my thanks to our staff, Directors, funders, and partners who together make our work happen.

Krishan Dhawan,
CEO, Shakti Sustainable Energy Foundation
September 2015

Clean Energy Programme



India hopes to achieve high economic growth rate over the next several decades. Energy availability is a pre-requisite to sustain targeted levels of development.

As the demand for power has grown, India has added large-scale conventional resources to its electricity mix. Over two-thirds of installed capacity is based on conventional fossil fuels, which are emission intensive and, of late, are becoming expensive too.

Paradoxically, despite the increase in installed capacity, some parts of the country continue to face acute power shortages, and nearly 300 million Indians lack access to electricity. Power shortages are exacerbated by inefficiencies in power generation, distribution and end-use. To compound the problem, India has an energy import bill of around USD 150 billion at present, which is expected to double by 2030. About 80% of crude oil requirements are imported and coal imports are increasing.

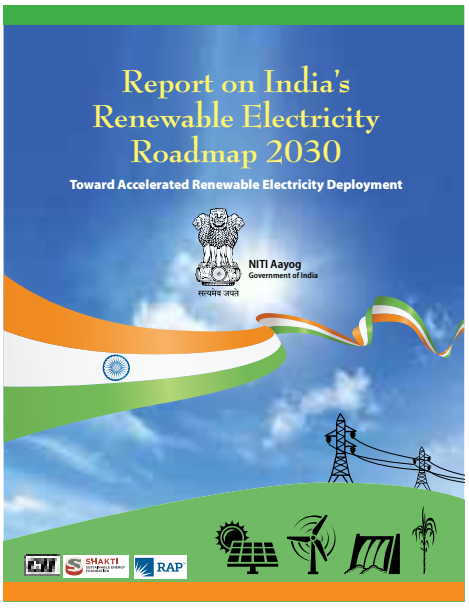
Amidst energy security concerns fuelled by substantially increased energy demand and volatile prices of traditional fuels, India is increasingly putting greater emphasis on the transition to cleaner, local and efficient sources of energy in national development planning.

Recent estimates indicate that India's solar potential is greater than 10,000 GW and its wind potential could be higher than 2,000 GW. Recognizing this, India has launched accelerated and ambitious plans for wind and solar to increase the contribution of renewables in India's electricity mix. Schemes have also been introduced to strengthen the transmission and distribution network in rural and urban areas.

In tandem with these aspirations, Shakti is working to support India's clean energy scale-up through several initiatives, which include mainstreaming renewable energy sources in the power mix of the country and reducing energy demand through efficiency measures.

India's Renewable Electricity Roadmap 2030

Shakti has contributed to the development of India's Renewable Electricity Roadmap 2030, a ground breaking initiative launched by the NITI (National Institution for Transforming India) Aayog (the erstwhile Planning Commission of India) in its role as co-leader of the 21st Century Power Partnership. As a knowledge partner in this process, Shakti in collaboration with other key players facilitated an extensive stakeholder-driven exercise to identify the policy changes required to adopt renewables on a large scale.



India's Renewable Electricity Roadmap 2030 identifies the policy changes required to adopt renewables on a large scale.

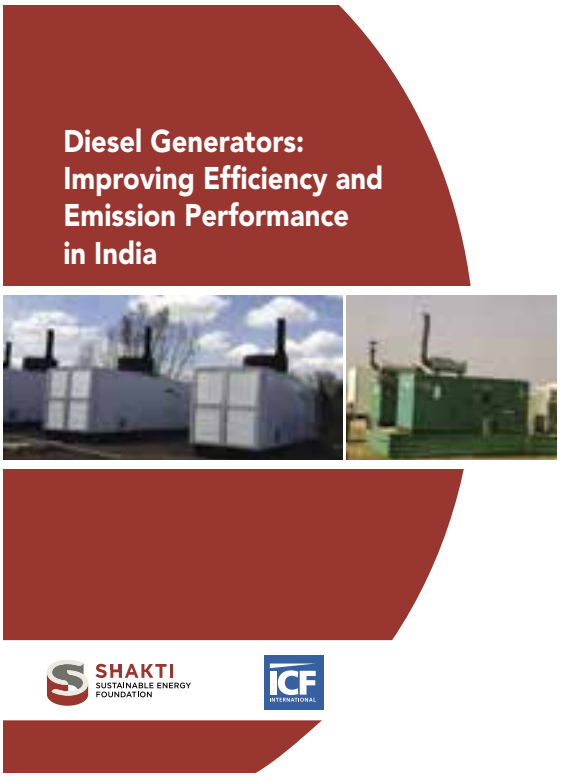
Leveraging rich stakeholder expertise, the analysis and practical "next-step" recommendations emerging from this exercise are particularly significant when India is increasing its renewable energy aspirations multifold. A few areas of intervention have been proposed– a comprehensive national policy framework for renewable energy; smoother renewable energy project development; and grid integration

The final report titled, *India's Renewable Electricity Roadmap 2030—Toward Accelerated Renewable Electricity Deployment* was launched at the REInvest Conference, as the first initiative of the NITI Aayog, receiving substantial policy and media attention. Shakti will now focus on the implementation of the recommendations emerging from the roadmap.

Diesel Generators: Improving Efficiency and Emission Performance in India

At a time when demand for power is increasing rapidly, yet there is a supply deficit situation, the demand for diesel generators, particularly in most urban centres, continues to increase. According to estimates, India's captive diesel generation capacity (>100kVA) has grown to 90,000 MW, or the equivalent of one-third of the total installed grid -scale generation capacity. This leads to significant fuel consumption and emissions. Therefore, Shakti supported a study to recommend an intervention strategy in this space. The findings of the study are quite interesting– Under an aggressive intervention scenario, based on the introduction of various efficiency improvement measures, India has a cumulative diesel saving potential of 0.32 billion litres and 1.56 billion litres by 2017 and 2022 as compared to a Business as Usual Scenario. This will amount to a saving of 1.4 billion USD by 2022.

These findings have generated interest amongst policy makers. Last year, the Bureau of Energy Efficiency launched a rating scheme for diesel generator sets under the Standards and Labeling



Examining efficiency and emission performance in diesel generators

Program. The scheme will be applicable to diesel generator sets having an engine capacity of up to 19 kW, and based on the findings of the study, there is still significant scope to reduce energy consumption in and emissions from diesel generators.

Wind power development in India

Shakti is working to increase the share of renewables, particularly wind, in India's electricity mix. Our support to national and state level wind potential assessments has drawn attention to the vast untapped potential of the wind sector. The Government of India has recently constituted a committee to reassess India's wind potential, of which Shakti is a formal member. We have also commissioned several studies on the technical and commercial aspects of wind power deployment, which have bolstered the support for wind energy.

Following this, the government recommended the establishment of a National Wind Energy Mission in the 12th Five Year Plan. In 2014, Shakti supported the development of a

blueprint for this Mission and was part of the stakeholder consultation process initiated by the government to finalise its operational mechanisms. The proposed Mission plans to achieve 100 GW of wind capacity by 2022. With the Mission slated to be launched under the National Action Plan on Climate Change, Shakti is now providing strategic inputs for its effective functioning.

We have been regularly convening the Wind Discussion Forum for building a common vision for the wind sector and for a better understanding of stakeholder perspectives. In 2015, this engagement will work towards informing wind policies and the implementation of the Mission.

A Renewable Energy Act on the anvil

Shakti is part of the committee set up by the Ministry of New and Renewable Energy to draft a renewable energy act for India. The proposed act will help boost investor confidence, promote the capacity addition of renewable energy and streamline its supply. Currently, electricity generation from renewable energy is under the ambit of India's Electricity Act, but a comprehensive legislation such as this will enable renewable energy development across a wide spectrum–off grid electrification, non electricity applications and grid connected electricity.

Priming the Solar Pump

In the agriculture sector, solar irrigation pumps are a promising alternative to traditional water pumping systems which usually operate using grid electricity, diesel or kerosene. A study supported by Shakti has suggested that it is technically and economically feasible to meet the unmet irrigation pumping demand in India using solar pumps. Coming at a time when India is trying to meet rapidly increasing demand for energy, this study has strengthened the case for scaling up solar-agri pumps. Its recommendations have found their way into the state level guidelines for the implementation of "Solar Pumping Programme for Irrigation and Drinking Water" under Off Grid and Decentralised Solar applications scheme.

A Shakti-supported study has provided recommendations for state level guidelines to implement the "Solar Pumping Programme for Irrigation and Drinking Water" under the Off Grid and Decentralised Solar applications scheme.

The India Energy Security Scenarios 2047 (IESS)

Shakti has been closely associated with the NITI Aayog in the development and launch of a tool which explores a range of future energy scenarios for India, for several energy demand and supply sectors leading up to 2047. It allows users to interactively make energy choices, and explore a range of outcomes for the country – from carbon dioxide emissions and import

dependence to land-use. As a step forward, the tool has been updated to quantify the cost implications of the scenarios for deeper analysis and was recently launched in New Delhi.

Fast tracking renewable energy project deployment in India

A number of Shakti-supported initiatives have facilitated the quick and increased deployment of renewable energy projects at the national level and in select states. With support from the state government of Gujarat, Renewable Energy zones are being identified and planned in the state with the aim of encouraging industry to invest in and deploy renewable energy projects. The first ever cloud-based, open-source Web-GIS tool for estimating the rooftop solar power potential of Chandigarh city has been launched. The tool can be replicated easily in other Indian cities and will help consumers estimate the potential solar PV capacity that can be installed on their rooftops. The Green Power Market Development Group in state of Karnataka has also become a strong platform for industry, government, and civil society organizations to come together and build critical support for renewable energy markets in India.

The Clean Energy Access Network

Shakti is a founding member and resource partner of the Clean Energy Access Network (CLEAN), an alliance that aims to bring together clean energy access practitioners in India. A pan India network, CLEAN aims to strengthen India's energy ecosystem and mobilize market-driven approaches for scaling-up access to decentralized clean energy. CLEAN plans to work in the following areas–access to finance, capacity building, testing and certification of technology, policy dialogue and advocacy, and networking.

Promoting decentralized renewable energy

Shakti has been engaging with practitioners to promote decentralized renewable energy. A capacity building programme for energy entrepreneurs in

The Vaishno Village organization in Madhubani district in Bihar gets its own microgrid under the Energy Entrepreneur Incubation Programme

Shakti is a founding member and resource partner of the Clean Energy Access Network (CLEAN), an alliance that aims to mobilize market-driven approaches for scaling-up access to decentralized clean energy.

Bihar (the Energy Entrepreneurship Incubation Program or EEIP) has served as a springboard for local candidates willing to set up last mile energy enterprises. After being connected with energy technology providers for an extensive incubation support programme, these entrepreneurs have launched their businesses independently.

Shakti has also supported the development of a briefing paper series on decentralized renewable energy (DRE) that will capitalize on practitioner experience to help inform new interventions. Some of the themes under this series include human resource capacities for DRE, clean cook stoves and solar home lighting systems.

Strengthening the renewable energy ecosystem in India

Given India's ambitious goals for renewable energy, Shakti is focusing on two critical areas to bolster this sector – finance and manufacturing.

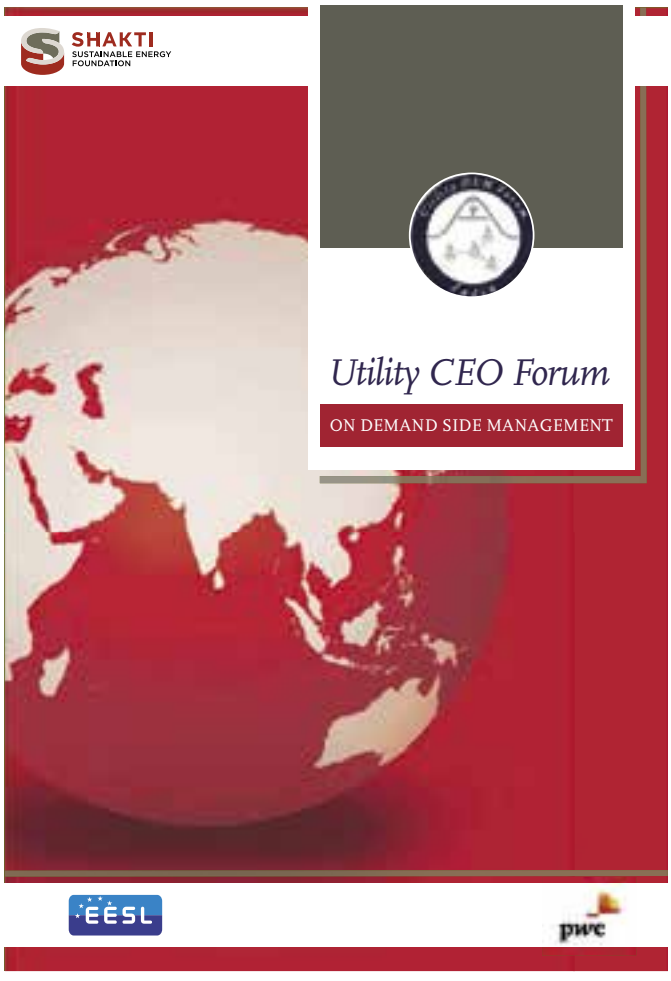
Research supported by Shakti has identified innovative financing mechanisms applicable to the Indian context, which can scale up financing for the sector. For instance, instruments such as green bonds can help reduce the high cost of renewable energy and investor confidence can be enhanced by the strict enforcement of Renewable Purchase Obligations (RPOs) and nurturing the Renewable Energy Certificate (REC) market.

The renewable energy manufacturing sector has received a boost under the "Make in India". This will help generate jobs and foster technological innovation. A recent study supported by Shakti has reviewed the manufacturing supply chain of wind and solar energy technologies and also proposed measures to scale up the manufacturing capacity of the sector. Other studies supported by Shakti underscore that the sector has immense potential for job creation. Their findings reveal that solar photovoltaic projects commissioned in India between 2011 and 2014 created approximately 24,000 full time equivalent (FTE) jobs, and grid-connected renewable energy nearly 70,000 FTE jobs so far. This further strengthens the case for boosting renewable energy deployment including its manufacturing.

Scaling up Demand Side Management (DSM)

Shakti is working towards mainstreaming demand side options in the energy mix of the country, which can help mitigate electricity shortages in a cost effective way. The Utility CEO forum brings together Indian Electricity Distribution Companies (Discoms) to identify and address DSM related challenges through knowledge and experience sharing. The Forum has already helped participants identify concrete intervention opportunities that can fast track DSM in India.

To support the Forum and power utilities, Shakti has supported development of a tool to test the cost effectiveness of various DSM programmes having high energy and peak demand saving potential. The tool is available online and can enable utilities make informed investment decisions in favour of large-scale DSM programmes.



The Utility CEO Forum identifies concrete intervention opportunities to fast track DSM in India

In parallel, Shakti is working to build the capacity of utilities and regulatory agencies to design and implement large-scale DSM programmes. Last year, we launched a partnership with the Indian Institute of Technology, Bombay to help them develop as a resource centre on DSM for utilities and regulatory commissions. Cutting edge research on DSM landscape and technology assessments is already being published and disseminated amongst utilities, regulator, industry representatives, and consumer organisations.

Standard Offer Programme to boost energy efficiency

A significant proportion of household lighting needs are conventionally met through energy inefficient lighting devices. It is estimated that the use of efficient lighting in the household sector can reduce the electricity consumption by as much as 50 billion kWh every year in India. However, the prohibitive price of efficient LED bulbs hinders their use in households.

To address this barrier, Shakti conceptualized India's first ever standard offer programme on energy efficiency, which provides a framework to the utilities to "purchase energy efficiency as a resource" similar to conventional or renewable power. The concept was socialized with stakeholders in Puducherry who agreed to roll out the programme. The scale of the programme required significant investments and EESL was roped-in to make the investments and implement the programme. Nearly 750,000 LEDs were distributed to 2.45 lakh households in Puducherry as a replacement to incandescent bulbs. In energy terms, this will enable Puducherry to save up to 48 million units each year.

The successful implementation of this programme has created momentum to replicate the model in other states and bring down the price of the LED bulb from approximately INR 400 to less than INR 100 per unit. Consequently, the Government of India has announced a national level programme for LED based lighting branded as DSM based Efficient Lighting Programme (DELP). Shakti is in discussions with BEE and EESL to expand the program to other appliances.

A New Resource – Demand Response bidding in Rajasthan

Demand response, which enables consumers to shift their electricity consumption during peak hours to leaner demand periods, can help in managing the load and balancing of renewable power. Shakti supported India's first ever market-based Demand Response pilot in collaboration with the Jaipur Vidyut Vitran Nigam Limited and India Energy Exchange (IEX). The pilot targeted industrial consumers in Jaipur, giving them incentives to curtail their load during peak times. The discom, during times of need, invited interest from consumers, to which consumers responded indicating the quantum through the market platform. Four DR events were organized through summer of 2014 and resulted in an average curtailment of 22 MW per event. Moving forward, Shakti is working with Rajasthan discoms to design and implement a large-scale DR bidding programme in the state.

Towards improving Quality of Power Supply

Historically, India has focused on expanding its power generation base to cater to the rising demand for power. The scenario has been changing significantly where consumers are now increasingly sensitive to quality of electricity supplied to them. With more choices soon expected to be available to consumers, it is important that utilities focus on both supply and services. India's Forum of Regulators has already established an enabling mechanism for this through the "Model standard of performance regulations for distribution licensees". However, its implementation needs to be strengthened to improve customer satisfaction. Shakti considers this a priority area and has responded by initiating an early effort to assess the existing status of quality of supply standards in India. Taking ground realities into account, a roadmap is being prepared for the implementation of the regulations in select states.

Thermal power plants: A pathway for increased efficiency and lesser emissions

Thermal power plants account for a major share of power generation in India. They currently constitute around 70% of the total installed capacity of the country, of which coal-based plants account for nearly 60% of the total installed capacity. Cleaner and more efficient thermal power plants will lead to better use of scarce resources and help mitigate their environmental impact. A recent Shakti-supported study has assessed the current performance of coal-based thermal power plants, both on efficiency and emissions. The study proposes measures for efficiency and emissions control, along with technological and

regulatory interventions, intended to help policy makers improve the performance of the sector. The interplay between efficiency and emission control measures are taken into account in the analysis.

Promotion of energy efficient technologies in Industry

Shakti is helping to promote comprehensive technology packages for industries, particularly for energy-intensive ones, through technology demonstration and diffusion. It is also helping to create an enabling environment for the large-scale adoption of advanced technological options. Building on the momentum of the Indo-Japanese joint statement in 2013 and in collaboration with the Institute for Global Environmental Strategies, a number of promising technologies have already been identified for select industrial sectors falling under the Perform, Achieve and Trade scheme. Shakti is conducting a feasibility assessment of some of these technologies to promote their adoption in Indian industry. On a similar note, select energy efficient technologies from Shakti-supported technology compendiums released last year, are now being piloted in the iron and steel, pulp and paper, and cement sectors under the PAT scheme.

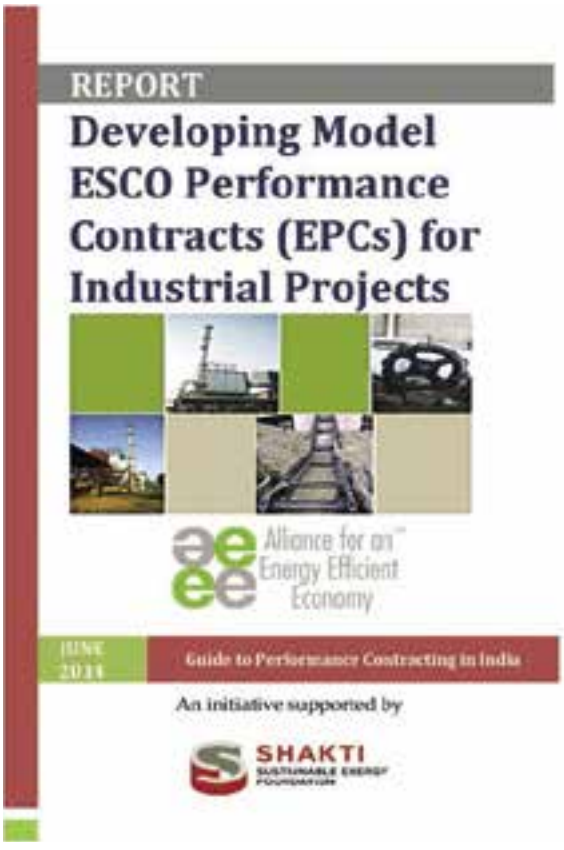
The PAT scheme: Insights and way ahead

The first phase of India's ambitious Perform, Achieve and Trade scheme was launched in 2012 for eight selected industrial sectors and is expected to end in March 2015. Shakti has been actively supporting the Bureau of Energy Efficiency in the design and the smooth roll out of this scheme. The first phase has generated an optimistic response from Indian Industry. In preparation for the next phase, Shakti commissioned a study to assess the performance of the scheme thus far and recommend ways to strengthen its performance in future phases. The report is a result of extensive stakeholder consultations, both at the levels of policy making entities as well as industries. Given that the PAT scheme

has immense potential, this analysis can help policymakers make informed decisions about the scheme.

Development of ESCO-based models

Harnessing the business potential for ESCOs in India can provide the support and expertise needed for energy efficiency projects. It can also mitigate the investment risk and upfront costs that are currently hindering widespread adoption. However, the ESCO industry is relatively new and needs impetus to grow. Shakti is supporting the development of an ESCO-based model which can help unlock the energy efficiency potential and enable industries to achieve their energy savings targets. The model seeks to provide business and financial guidelines for the implementation of ESCO-based projects. It has been piloted with 10 ESCOs and has already generated a positive response.

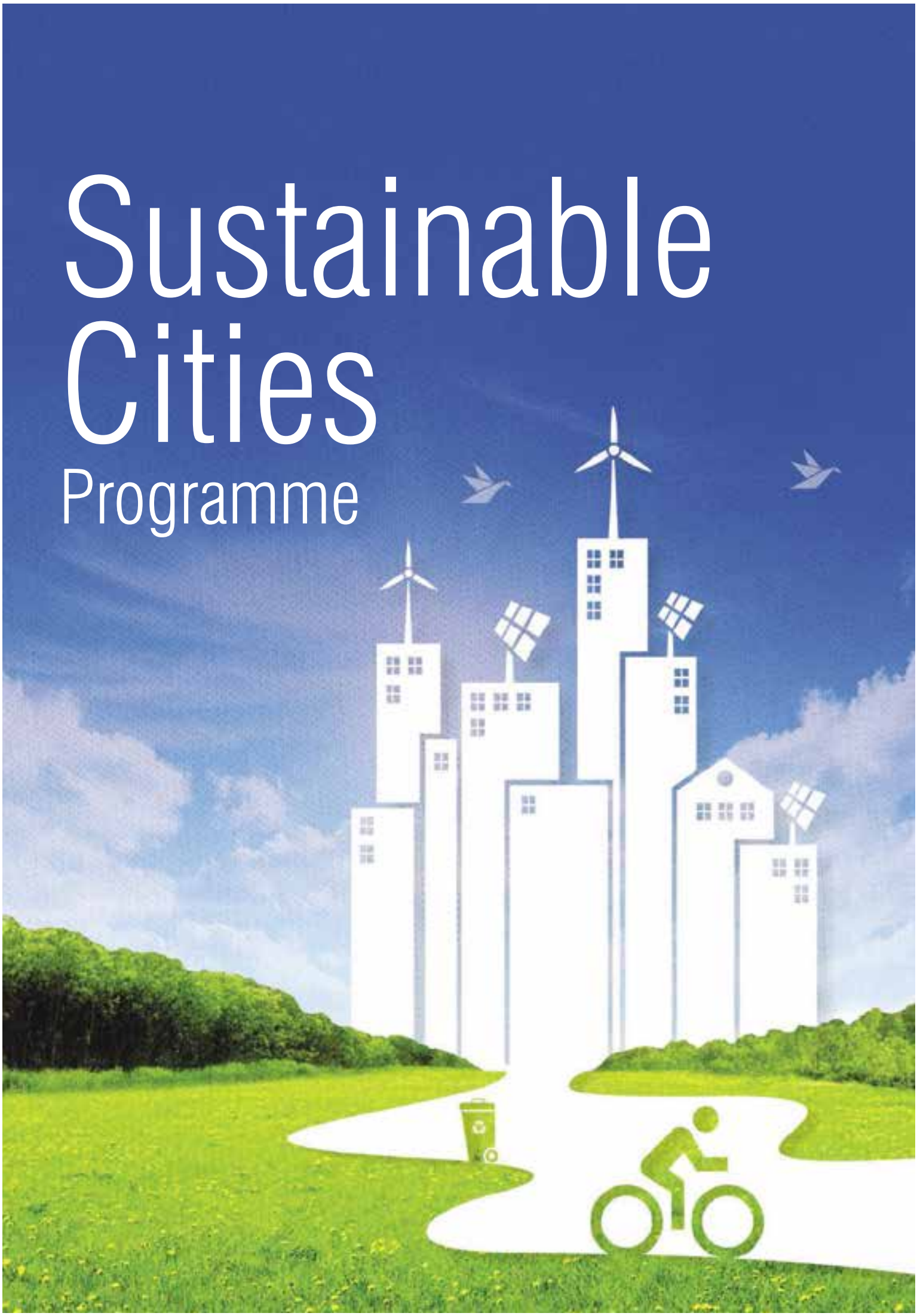


Capacity building of stakeholders

Shakti is building the capacity of various Industry stakeholders through training and technical assistance, to improve the implementation of energy efficiency policies and programmes in India, particularly the Perform Achieve and Trade (PAT) scheme. More than 300 practicing energy auditors from various states have been trained in energy auditing and solution development, as well as regulations and standards. This will help them provide value added services to industries in various sectors. Shakti is also supporting a capacity building programme for large industrial units in Maharashtha, which will address knowledge gaps in technological options and advanced auditing practices.

> Through capacity buildings programmes, practicing energy auditors from various states have been trained in energy auditing and solution development, as well as regulations and standards.

Sustainable Cities Programme



Cities have been called "engines of economic growth", bustling centers of creativity and innovation. But as more people move to urban areas, the challenge of creating environmentally sound cities is growing. This is particularly apparent in India, one of the most rapidly urbanizing nations today. Already, about 400 million people live in cities, and this number is expected to increase to 600 million by 2030. By then, cities will contribute to around 75 percent of India's GDP. The rapid urbanization will create a huge demand for energy and increase environmental impact.

According to the Ministry of Urban Development, around 70 percent of India's urban areas will be built from ground up over the next two decades—this is an opportunity to plan for new urban spaces using a sustainable and energy-efficient development model.

Urban infrastructure must be planned to meet the challenges of city environments: pollution and emissions; traffic congestion and the population growth. Urbanization will also drive the demand for more consumer products such as cars and home appliances. In a business as usual (BAU) scenario, the emissions from the transport sector and the building sector each are expected to increase two fold by 2031 (UNEP, 2013).[1]

India has an extraordinary opportunity to pioneer and effect new, innovative blueprints for urban growth. Concrete steps have already been taken in this direction. The government has allocated INR 98,000 crores for the Smart Cities Mission and the Atal Mission for Rejuvenation and Urban Transformation (AMRUT), plans to rejuvenate 500 Indian towns and cities. In addition, government mandates in the form of the National Urban Transport Policy and the National Mission for Sustainable Habitat provide guidelines for sustainable urban development.

In response to these opportunities, Shakti works towards accelerating the transition to sustainable cities that are better planned and more liveable. Shakti focuses on three cross cutting themes: pursuing sustainable principles in urban planning; advancing the mandate for sustainable transport and promoting energy efficiency in the built environment with a focus on new buildings and efficient appliances.

Sustainability Principles In Urban Planning

The built environment is subject to a number of policies and guidelines which have an impact on the energy demand and consumption in urban areas. A greater understanding of this current policy landscape and governance structures is crucial towards enabling sustainable and liveable urban spaces.

Shakti recently supported a study "A Status Review of Efficiency in the Urban Built Environment". This report, for the first time, assessed policies related to four key areas – energy, water, transport and land – which are crucial for impacting resource efficiency in urban areas. The report identified

1 UNEP 2013. A guidebook on Low Carbon City Planning in India. United Nations Environment Program (UNEP).

some 27 policies related to urban built environment being enforced by 6 different ministries and highlighted the need for harmonised approaches. We are working with all concerned stakeholders to socialise the findings and obtain inputs towards developing practical and easy to implement arrangements.

We analysed the Urban Heat Island (UHI) effect, a cross-cutting issue that impacts energy use in urban areas. India's expected large-scale urbanization makes it critical to account for this phenomenon urgently. However, research until recently has not focused on the causative factors of the UHI effect or ways to effectively mitigate it. Our report fills this gap by identifying current policy provisions and strategies which can be effectively employed to help facilitate mitigation of the UHI effect in Indian cities while also highlighting the need for new policy developments.

Traffic impact assessment of Transit Oriented Development

Cities should encourage Transit Oriented Development (TOD) where transit systems are put in place and the built environment is concentrated around these systems in order to minimise travel-related emissions. Delhi has already made efforts towards developing a Transit Oriented Development (TOD) policy for the city. Building on this, Shakti has assisted the city to conduct a modelling study that will help determine the traffic impacts of TOD. As a part of this project, pilot TOD corridors have been identified to test the draft policy for its feasibility for transport infrastructure as well as its impact on Delhi's urban form.

The study has culminated in the development of tool that will test the TOD model and guide decision making about desired modal share, public transport and parking policies. The tool has since been used by the Delhi Development Authority to test the draft TOD policy and its impact on traffic. The TOD policy has now been included in the transport chapter of the Master Plan of Delhi, 2021. The tool can now be used in other cities that are in the process of incorporating the TOD model in urban planning.

Local area planning for accessibility and development

City level and local area development plans should feed into each other to create a seamless planning framework for the city. But this has not been the case for most Indian cities.

In addressing larger, city-level issues, the planning process has ignored micro details such as people's accessibility to basic transport services within a neighbourhood. Shakti supported a pilot project in Rajkot to identify gaps in the current top-down approach and addressed them through participatory planning processes. The lessons learned in Rajkot have been documented in a comprehensive guidebook with the goal of informing similar initiatives in other Indian cities.

Advancing the mandate for sustainable transport

A state urban transport policy for Tamil Nadu

Shakti is working closely with the state government of Tamil Nadu to facilitate the creation and adoption of a State Urban Transport Policy (SUTP) based on the principles of sustainable transport. SUTPs will ensure that all cities within the state are guided by this vision, thereby bringing to scale the country's mobility and accessibility planning exercise. A strategic analysis of five of the largest and fast growing cities in Tamil Nadu was conducted, based on which a draft SUTP policy for Tamil Nadu was created. This framework has been presented to the state government for review and to serve as reference document.

A planning and design manual for bicycle friendly cities

Encouraging people to walk and cycle is critical to developing sustainable urban transport systems. In particular, making cities cycling-friendly requires extensive network level planning and also management of micro-level design

> The "Planning and Design Guideline for Cycle Infrastructure" provides a menu of interventions to help policy makers improve cycle infrastructure in Indian cities.

The manual on bicycle infrastructure provides recommendations to improve cycle infrastructure in Indian cities.

details. However, Indian cities lack the capacity to plan and design such systems. To help address this gap, Shakti has supported the development of a manual on bicycle infrastructure, which provides a menu of interventions to help designers and policy makers improve cycle infrastructure in Indian cities. The guideline has generated interest from a number of stakeholders and some of its recommendations have already been incorporated into the draft of Indian Roads Congress's manual on "Design and lay of Cycle Tracks (IRC:11)" which is currently being revised.

For easy access and understanding, the information presented in this manual is available in the form of a user-friendly, web-based interactive tool termed CyLOS – Cycling level of Service Evaluation (http://cylos.in/). The tool can be used by civic authorities to evaluate the best possible design of cycling infrastructure in a given context.

Best practices in action

REJUVENATING OUR COMMERCIAL CENTRES: A FOCUS ON NEHRU PLACE

As India's population rapidly increases, the need for sustainable urban development and transport must be addressed. This is particularly true for commercial districts in Indian cities, which are hubs of activity and attract a large number of trips every day. In recent years, commercial districts are increasingly becoming car oriented and unfriendly in terms of access for pedestrians, cyclists and public transport users.

To demonstrate the sustainable and people-friendly design for a commercial area, Shakti has supported the design of a pilot project in one of these commercial districts–the Nehru Place–which is the second largest commercial district in New Delhi. A multi-disciplinary set of partners have come together to analyse the current situation in Nehru Place and recommend a range of interventions for place making and multi-modal integration for the area. The findings from this analysis are useful for other commercial areas that face similar mobility issues. The proposed designs have been approved by Unified Traffic and Transportation Infrastructure (Planning & Engineering) Centre (UTTIPEC) of the Delhi Development Authority for implementation, which is slated to begin soon.

PARKING POLICY FOR COIMBATORE

An on-street parking management model has been developed for the city of Coimbatore. Parking is considered to be one of the major transport issues in urban areas. The road space allocation in Coimbatore is currently overly biased towards private motor vehicles. To reclaim this space, it is necessary to manage on-street parking and convert it into a more efficient public space by providing footpaths and cycle tracks. The strategy provides an operational model to address the parking issues prevailing in Coimbatore.

PUBLIC BICYCLE SHARING SYSTEM FOR DELHI

Shakti has identified a unique opportunity to provide technical and advisory support for a groundbreaking initiative in New Delhi–a public bicycle sharing programme that will serve parts of the city. The programme is being implemented in Dwarka by the Delhi Development Authority and in South Delhi by the South Delhi Municipal Corporation. Intended to provide first and last mile connectivity to public transport users, the system is primarily intended to provide access to transit stations like bus stops and metro stations and also for short distance daily commute trips. Cycles can be rented from and then returned to any station in the system. This will create an efficient network with many possible points and combinations of departure and arrival.

In New Delhi, cycling accounts for over 9 percent of all trips. The programme will encourage more people to use cycles as a means of transport. This in turn will improve air quality, reduce fuel consumption and congestion on streets.

Development of fuel efficiency standards for passenger cars and HDVs

Fuel efficiency standards for passenger vehicles were notified in early 2014. The Bureau of Energy Efficiency, which has notified the standards, has also proposed a star-based labelling programme reflecting the efficiency levels of vehicles. Car models will be ranked on a scale of one to five stars based on their fuel efficiency. Shakti is providing technical assistance to the Bureau of Energy Efficiency to roll out this car labelling program.

Encouraged by the passenger car fuel efficiency standards, efforts are now underway to develop the fuel efficiency standards for Heavy Duty Vehicles (HDVs). Shakti is part of the technical committee that will facilitate the standard setting process for HDVs in India.

Advancing the adoption of India's Building Energy Code

The Energy Conservation Building Code (ECBC) is a first step towards promoting energy efficiency in the building sector. The nationwide enforcement of the Code is expected to yield considerable energy savings. In pursuance of this, Shakti has worked with the state governments of Gujarat, Tamil Nadu and Maharashtra to facilitate the enforcement of the Code. Now, an implementation roadmap for Maharashtra is being developed in coordination with the Madhya Pradesh Urja Vikas Nigam Limited (MPUVNL). The roadmap is expected to support the state to mandate and enforce the Code.

Driving building energy performance through certification and labeling

The Bureau of Energy Efficiency (BEE) has introduced the star labeling programme for existing commercial buildings, which rates buildings on a scale of one to five. It is currently operational for offices, BPOs and retail malls. Shakti supported the BEE to develop energy performance

Energy performance benchmarks have been developed for hospitals as a part of India's star labelling programme for buildings. A supporting web-based tool, ECObench, was also updated and can be used to understand the energy performance of a hospital building and to apply for star rating and the associated label.

benchmarks for hospitals as part of the star labelling programme for buildings. A supporting web-based tool, ECObench, was also updated and can be used to understand the energy performance of a hospital building and to apply for star rating and the associated label. The programme was officially launched by Shri Dharmendra Pradhan, Minister of State for Petroleum and Natural Gas (Independent Charge) last year as part of a landmark three-package initiative to promote energy efficiency in India. It is expected to contribute significantly in driving energy efficient practices in hospital buildings.

Contextualising Indian building energy regulations: An adaptive thermal comfort standard

Energy use for space cooling is expected to be a key driver of energy demand in the near future. At present, the trend in India is to design air-conditioned office buildings that operate at 22.5 ± 1°C all year round. An adaptive comfort thermal model, on the other hand, allows for a flexible range of temperatures, within which the user of the building is considered to be comfortable, in relation to the outdoor temperature. Such a standard can play a major role in reducing energy use for cooling while maintaining the comfort of building occupants. To address this, the Ministry of New and Renewable Energy and Shakti have supported the development of an adaptive thermal comfort standard specific to the Indian climate. This approach is now being referred to in the National Building Code, the model building code that all state codes refer to.

Accelerating the shift to energy efficient appliances

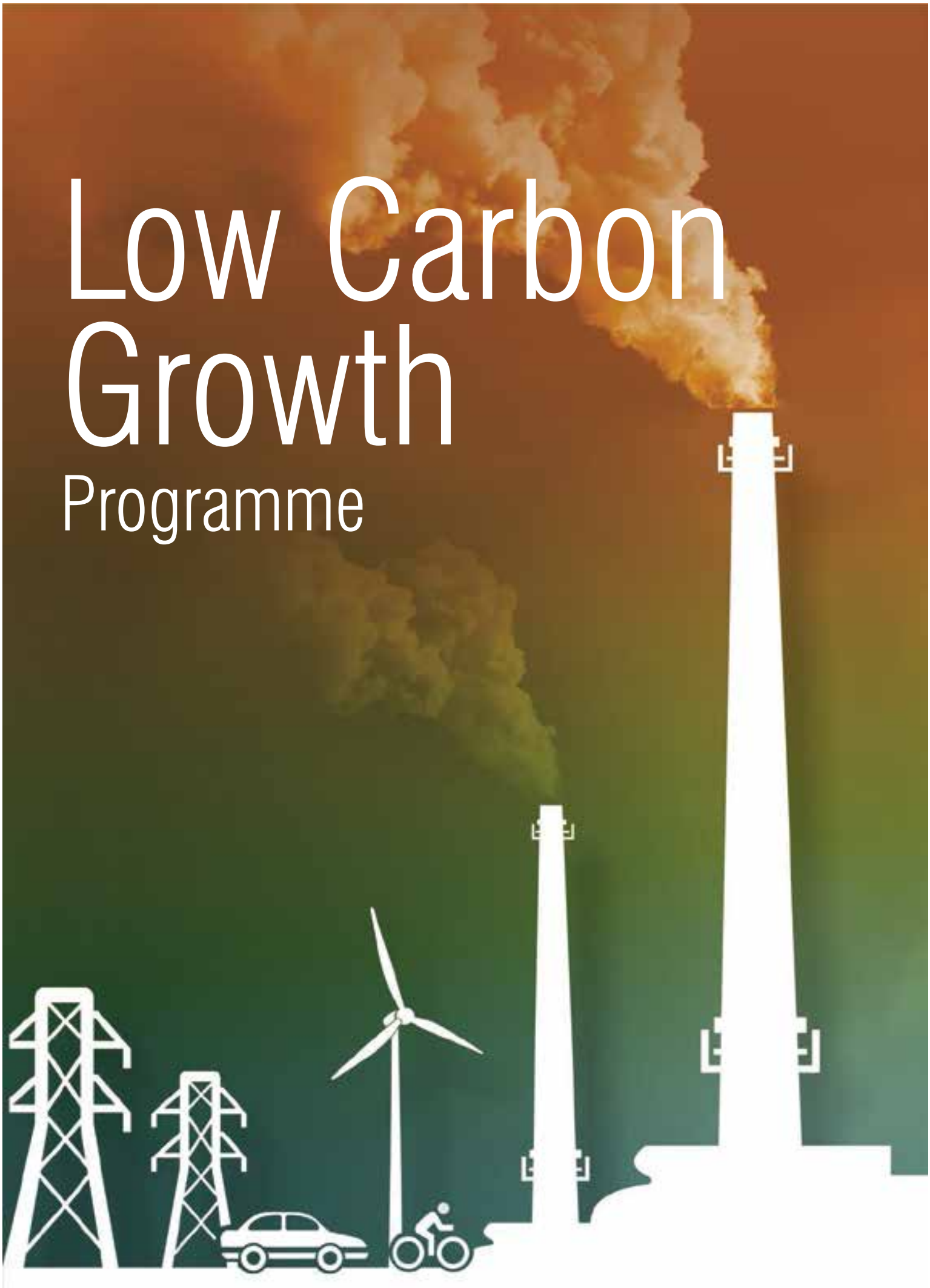
While India's Appliances Standards and Labelling programme has immense potential to achieve energy savings, these savings will be realised only with large scale market adoption of efficient appliances. Retailers are crucial in increasing adoption of energy efficient labelled appliances as they can influence consumers' buying decisions.

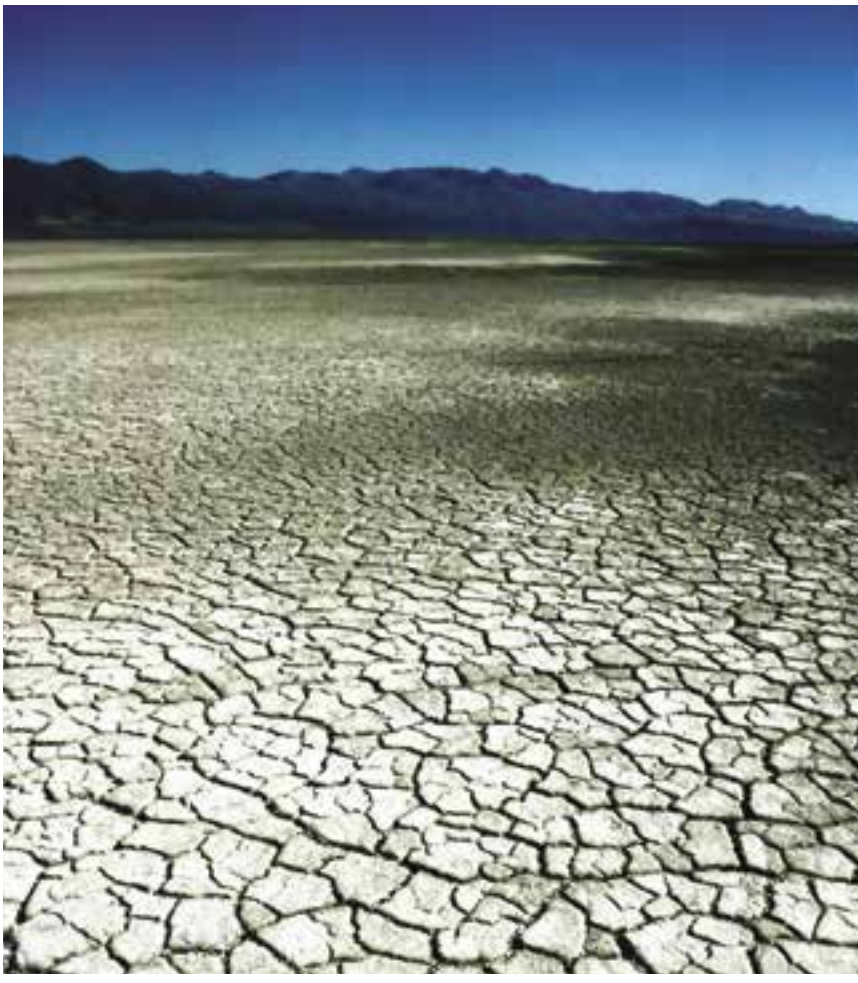
Shakti supported the development of a retailer engagement and awareness campaign with an objective to enable retailers to become willing and active participants in the process of first seeking and then proactively sharing information on energy labels. The programme was piloted in three cities of Gujarat in close collaboration with the BEE's counterpart agency at the state level - Gujarat Energy Development Authority (GEDA). More than 300 retailers participated in the training programme, and 200 more were provided hands on training at appliance stores. This was supported by creation of sales aids and tools to demystify the label and provide easy to understand and useful information to the retailers for effectively communicating about the energy and cost benefits of the label.

Enabling state level implementation and enforcement of the S&L programme

India's Standards & Labeling (S&L) Programme for appliances is maturing, and State Designated Agencies (SDAs) can play an important role in the implementation of this programme within their states. Shakti has commissioned an assessment of the capacities of select SDAs to facilitate successful program implementation. Building on this assessment, a priority matrix of actions has been developed for addressing the current gaps and barriers. This will assist SDAs in enabling the effective implementation of the programme.

Low Carbon Growth Programme

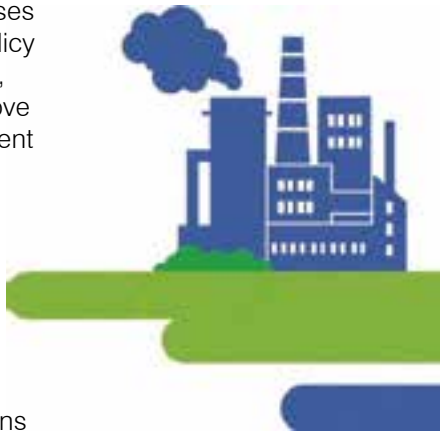




Climate change is one of the greatest challenges of this century, and India is already experiencing its adverse impacts. For years, the climate change conversation in India has largely focused on the North-South divide over historical emissions of countries and the distribution of responsibility among nations for mitigating climate change. However, in recent times, a robust dialogue has emerged on the actions that India should take domestically to pursue a more sustainable development path and also contribute to the global effort to address the threat of climate change.

Pursuing a low-carbon development pathway offers a practical organizing framework for future development planning in India. The 'Expert Group on Low-Carbon Strategies for Inclusive Growth' constituted by the erstwhile Planning Commission (now NITI Aayog) has made an important contribution in this direction. It evaluated a range of policy options available for India to pursue an inclusive and lower-emission development path. India has also initiated several other measures that will promote sustainable development and address the threat of climate change, including the announcement of ambitious renewable energy and energy efficiency objectives. These measures reflect a significant commitment on India's part. Going forward, the suite of policies and programmes is expected to grow. To support this effort, there is a strong need for mobilizing resources and building the institutions that can frame new instruments for action. Furthermore, the co-benefits of low-carbon development are potentially significant across India and include, among others, a cleaner environment and improvements in human health.

Recognising the growing relevance of low-carbon development planning in India, and to complement our work on clean energy and sustainable cities, Shakti is working with its partners to help promote several initiatives that are enabling India to develop in a more sustainable, climate-friendly manner. Under this programme, Shakti focuses on identifying and implementing policy opportunities on technical, financial, and institutional matters that will move India along a low-carbon development pathway at the national and sub national levels.



Modernizing the brick sector in bihar

Bihar's expanding brick sector is a key target for urgently needed actions for cleaner building materials. It uses traditional kiln technologies, which are extremely inefficient and polluting.

Given this, Shakti has been working to promote policy, financial and service delivery measures in favour of new brick making technologies. Studies supported by Shakti have presented a way forward to significantly reduce emissions from brick kilns by modernising the industry. Another important outcome of this engagement has been the establishment of a state constituted interdepartmental task force for promoting cleaner brick making technologies and alternate building materials in Bihar. As a result of our support, several enterprises using cleaner technologies have recently been set up. For instance, over 25 new fly ash brick units have been set up in the last two years as compared to five which existed prior to Shakti-supported interventions in the state. Based on technical assistance provided by Shakti, Bihar is developing a state-sponsored programme to retrofit inefficient kilns. As part of this effort, the state government has submitted a proposal to the National Clean Energy Fund for partially financing the programme.

The Track II Dialogue on Climate Change and Energy is a civil society led effort that identifies areas for joint action for India and the U.S as part of the global effort to tackle climate change. The Dialogue brings together prominent thought leaders from both countries to explore opportunities on climate change and energy.

US-India Track II Dialogue On Climate Change And Energy

Shakti supports the US-India Track II Dialogue on Climate Change and Energy–a civil-society led effort that identifies areas for joint action for both countries as part of the global effort to tackle climate change. The Dialogue brings together prominent thought leaders from both countries to explore opportunities on climate change and energy, both bilateral and multilateral. A strategic partnership such as this presents a unique opportunity to deliver gains on both sides, including job creation and enhancing energy security. The Fifth meeting of the Dialogue took place in late 2014, deepening the partnership to expand access to modern energy services by considering options to de-risk investment for innovations in energy, distributed generation and storage. A prior initiative of the Dialogue for building climate resilience in both countries has matured in to an official bilateral partnership between India and the US.

India: Becoming “Climate Finance” Ready

India has made significant commitments to improve its response to climate change. This will require an unprecedented mobilisation of financial resources through a combination of domestic and international climate finance. Yet, it is not always easy for countries like India to access internationally available funding and to direct the funds to where they can be used most effectively for climate change adaptation or mitigation.

Improving India's climate finance readiness

Through extensive consultations with experts, Shakti has supported a study on India's current "climate finance readiness", based on which a number of critical gaps were identified in India's ability to manage climate finance. The study recommends practical actions for policymakers to improve access to and utilise international climate finance. Some of the recommendations include: creating an independent coordinating agency to manage climate finance at the national level; developing measurement, reporting and verification (MRV) protocols to track climate finance; and increasing private sector engagement in national climate change policies.

The India GHG Programme

Several well-known Indian companies have started tracking and managing their greenhouse gas emissions under the India Greenhouse Gas (GHG) Programme, a voluntary programme supported by Shakti. Launched in 2013, the programme equips Indian companies with the technical knowledge and tools to measure and manage their GHG emissions. Regular capacity building workshops for professionals are organized to help them better track emissions using a globally consistent

An official India briefing paper for the Lima Conference of Parties (COP) 20

BRIEFING PAPER LAUNCHED AT COP-20

Shakti supported the Ministry of Environment Forest and Climate Change to prepare an official India briefing paper for the Lima Conference of Parties (COP), a first of its kind document for a COP meeting. The paper titled "India's Progress in Combating Climate Change" outlines India's efforts to tackle climate change and reduce the emissions intensity of its GDP. It formed part of a series of documents that featured India's actions in mitigating climate change and enhancing reliance on renewable energy and energy efficiency .

approach to GHG reporting and accounting. Among other activities, the programme is developing sector specific tools and customised emission factors for India that enable more accurate accounting and preparing case studies that demonstrate GHG management actions taken by leading companies. The programme has received strong support from industry leaders. Over 30 companies have signed up for the programme, including the Aditya Birla Group, Mahindra Group, Infosys, ITC Limited, and Godrej & Boyce Manufacturing Company Limited. With growing concern on climate change in India, the need for India's corporate sector to play a greater and more proactive role has never been more critical. The programme sets a strong precedent in India by collaboratively engaging on a multi-stakeholder platform to take the next leap on GHG measurement and management.

India Climate Dialogue: Bridging India's information gap

With increasing importance being assigned in India to clean energy and climate change, Shakti has supported the launch of a web-platform that carries timely and objective analysis and commentaries by subject experts and journalists on these issues. This is particularly relevant for India as better informed policymakers and stakeholders can support policy measures that can have a profound impact in furthering domestic and global actions that address climate change. Launched

last year, the website covers six broad thematic areas: Science, Impacts, Mitigation, Adaptation, Negotiations and Policymaking. The website aims to foster constructive debate around these themes and inform decision making.

An energy security index

Energy choices play a key role in defining an economy's growth trajectory as well its emissions intensity. An increasing reliance on cleaner sources of energy will over time drive a country on to a low-carbon development pathway. Over the years, India's energy needs have grown considerably, which has also increased India's dependence on imported energy. There now exists a complex set of factors that influences India's energy security such as, among others, economic viability, accessibility and reliability of supply and environmental sustainability. In this context, Shakti has supported the development of the forthcoming India Energy Security Index, with the goal of providing an objective assessment of India's current and future energy security landscape. The index will act as a quantitative indicator of India's energy security at a given point of time and enable tracking of this metric over time. It will help policy makers to identify and design policies that contribute positively to India's energy security by assessing the impacts of domestic policies and external developments on India's energy security.

Evaluation of the NAPCC Missions

The National Action Plan for Climate Change (NAPCC) lays the pathway for a directional shift in India's response to climate change. It houses eight core missions on the basis of which a low-carbon Indian economy is being built. Recognizing their importance, Shakti commissioned the first ever evaluation of the design of these missions, which was shared with policy makers. As a follow up, Shakti supported another study to assess the level of progress achieved

The India Energy Security Index will act as a quantitative indicator of India's energy security at a given point of time and enable tracking of this metric over time.

in the implementation of the Missions and whether they are on track to achieve their stated objectives. The study has prescribed several recommendations specific to each Mission along with overarching recommendations to improve their planning and implementation. This will help lay the groundwork for policymakers to make course corrections as required.

A GHG abatement cost curve for Madhya Pradesh

In its pursuit of low-carbon development, India must assign priority to the most cost-effective and feasible measures available. A greenhouse gas (GHG) abatement cost curve can be a useful planning tool for the country. Shakti supported the first ever GHG abatement cost curve for Madhya Pradesh, a fast growing state with a good institutional setup for working on climate change issues. The analysis provides policy makers with an understanding of the significance and cost of each possible method of reducing emissions and of the relative importance of different sectors. This is a rich source of analytics to inform the future planning efforts of various state departments and sets an example for other states to emulate.

The Shakti Dialogues

In November 2014, we hosted a series of focused dialogues on critical energy themes in India – Energy Efficiency, Urban Transport, Power and Climate Policy. The dialogues, which were designed to review our past work and to inform our future activities, brought together key grantees and stakeholders to review the challenges and opportunities relevant to each theme. Key initiatives undertaken by our partners were showcased to share best practices and encourage knowledge sharing amongst our partners. The event was attended by leading experts from regulatory commissions, civil society, academia, research institutes, and industry. We extend our thanks to all the participants who collectively contributed to a dynamic and interesting discussion.

Highlights from the Dialogues

SETTING STORE BY ENERGY EFFICIENCY

Energy efficiency is a high-value target for action and opportunity in India. According to estimates, the value of the energy efficiency market in India is estimated to be Rs. 74,000 crores, which remains largely untapped. Discussions at the energy efficiency session focused on the ways in which this potential could be realised in programmes directed at industry, buildings and appliances. A combination of innovative financials models and strong implementation frameworks, and measurement and verification can lead to substantial energy savings.

The strong need for data driven action for policy formulation was highlighted. Another area for stepped up action is effective communication strategies to influence consumer behaviour. Case studies on demand aggregation, partnerships, stakeholder capacity building and performance evaluation and certification for commercial buildings highlighted the lessons learned from various programmes underway across India.

Realizing the potential of energy efficiency in buildings, appliances and industries

URBAN TRANSPORT TO SHIFT GEARS

With growing population and greater prosperity, the number of vehicles on India's roads has grown seven times over the last two decades. This combined with the projected doubling of urban Indian population by 2030 makes it clear that current trends in urban transportation systems are not sustainable. There will be serious consequences for our environment, health and economic progress.

Discussions at the transport session revolved around the various components of a sustainable urban transport system and key drivers for improvements were recommended. A number of interesting case projects were showcased. Participants heard about how a community in New Delhi was working towards improving the mobility and accessibility of its neighbourhood. With more than 1,000 vehicles being added every day on New Delhi roads, a pilot bike sharing system implemented by the South Delhi Municipal Corporation, is a step ahead in the right direction.

Advancing the mandate for sustainable transport

EMPOWERING INDIA

The power sector has made impressive strides in these last few years, but various bottlenecks still exist that impede the country's economic growth aspirations. The availability of power in India has increased but demand has consistently outstripped supply. Substantial energy and peak shortages prevail in India.

Discussions at the power session revolved around the various opportunities and challenges on the generation, transmission and distribution side of this sector to help remedy this situation. There was a call for both efficiency and emissions reductions in the thermal power sector along with increasing the percentage of renewable energy in India's power mix. Challenges such as high costs, grid integration and the availability of new technology were discussed at length. Reducing energy losses and peak demand were identified as ways to increase the efficiency of the distribution sector.

Addressing generation, transmission and distribution side challenges in India's power sector

A LOW-CARBON DEVELOPMENT PATHWAY

India seeks a low-carbon development path that will meet our developmental needs without contributing to the harmful impacts of climate change on our habitat and environment. Several measures reflect India's commitment towards this change, but it is now time to take more concrete action.

The discussion on low-carbon development brought together experts to examine the options, the costs, the alternatives, and the multiple benefits of moving to such a low-carbon pathway. The State Action Plans on Climate Change have started the conversation on decentralised planning for climate action. It was pointed out that the benefits of GHG measurement, management and reporting are being recognised by Industry. It was also recognised that the media are an important influence on public attitudes towards climate change. Case studies shared by Shakti's partners showcased their efforts to help India transition to a low-carbon pathway. These spanned the areas of planning, finance, empowerment of civil society and policy implementation.

Creating the climate for India's low-carbon growth story

Our Partners

India needs a secure and reliable energy system to grow its economy and achieve sustainable development. This will require constant learning and expanded collaboration scaled to meet the challenge. At Shakti, we form strategic partnerships with organisations that share our vision of a future powered by clean, reliable, and secure sources of energy. We take this opportunity to acknowledge some of our partners over the last few years.

AB Lall Architects
Administrative Staff College of India
Alliance for an Energy Efficient Economy
Ananta Centre
Ashden India Renewable Energy Collective
Centre for Budget and Governance Accountability
Centre for Environment Education
Centre for Environmental Planning and Technology (University)
Centre for Green Mobility
Centre for Policy Research
Centre for Science and Environment
Centre for Study of Science, Technology and Policy
Confederation of Indian Industry
Council on Energy, Environment and Water
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Delhi integrated Multi-modal transit systems Ltd.
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Ernst & Young
Federation of Indian Chambers of Commerce and Industry
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