

Energy

DIALOGUES

Annual Report 2017-18



PUTTING CLEAN ENERGY IN THE PICTURE

It's never too early to start teaching young people about clean energy. Over the last two years, Shakti has supported art competitions on the theme 'Putting Clean Energy in the Picture' at Kendriya Vidyalaya, Pashchim Vihar in New Delhi. Over 100 students participated and showed off their talent and creativity. The idea behind this initiative is to enhance awareness among students on clean energy issues and on the need to protect our environment. We are pleased to showcase some of their work by using it as a backdrop on the pages of this year's Annual Report.







Content

Who we are	6
Our vision	7
Our approach	7
Letter from the Chairman	10
Letter from the CEO	11
Clean Power	12
Transport	20
Climate Policy	28
Energy Efficiency	32
Air Quality Management	38
Climate and Business	42
Clean Energy Finance	44
The Shakti Dialogues	47
Our donors	48
In collaboration with: over the past few years	50



Who we are

Shakti Sustainable Energy Foundation seeks to facilitate India's transition to a cleaner energy future by aiding the design and implementation of policies that promote clean power, energy efficiency, sustainable urban transport and climate action.

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

The energy choices that India makes today will be of profound importance for our future. Meaningful policy action on India's energy challenges will strengthen national energy security, support development and preserve our environment.

Our Vision

A clean and secure energy future

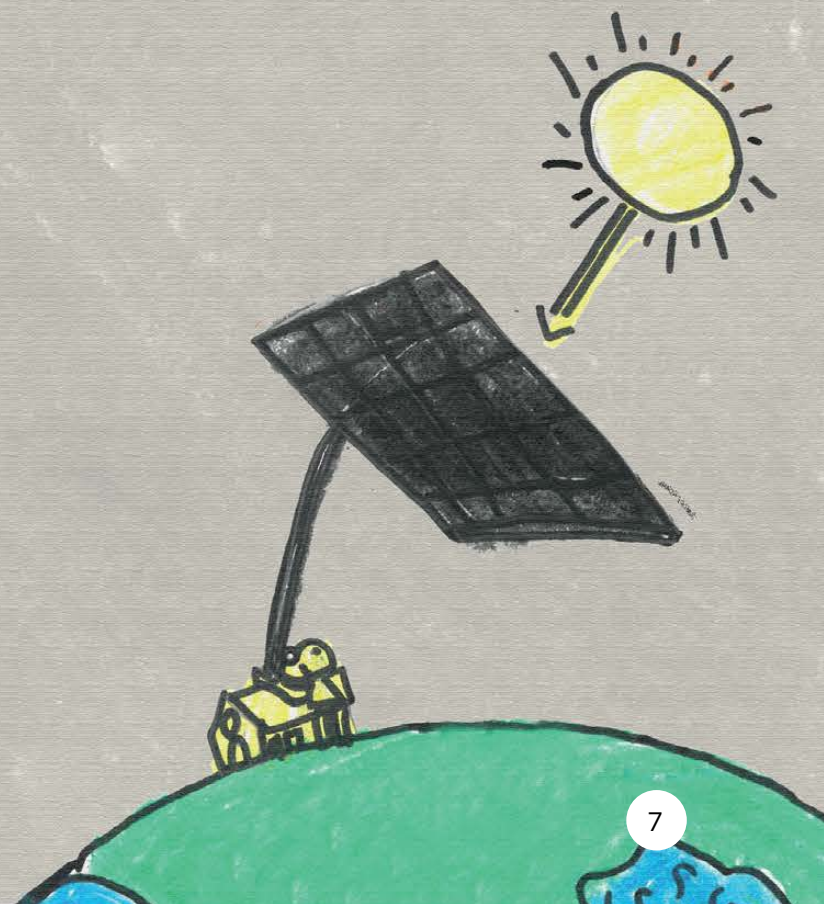
Our Approach

We believe robust energy policy frameworks are necessary for large-scale, transformative change.

We bring together experts from government, business, civil society and academia to craft effective 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.



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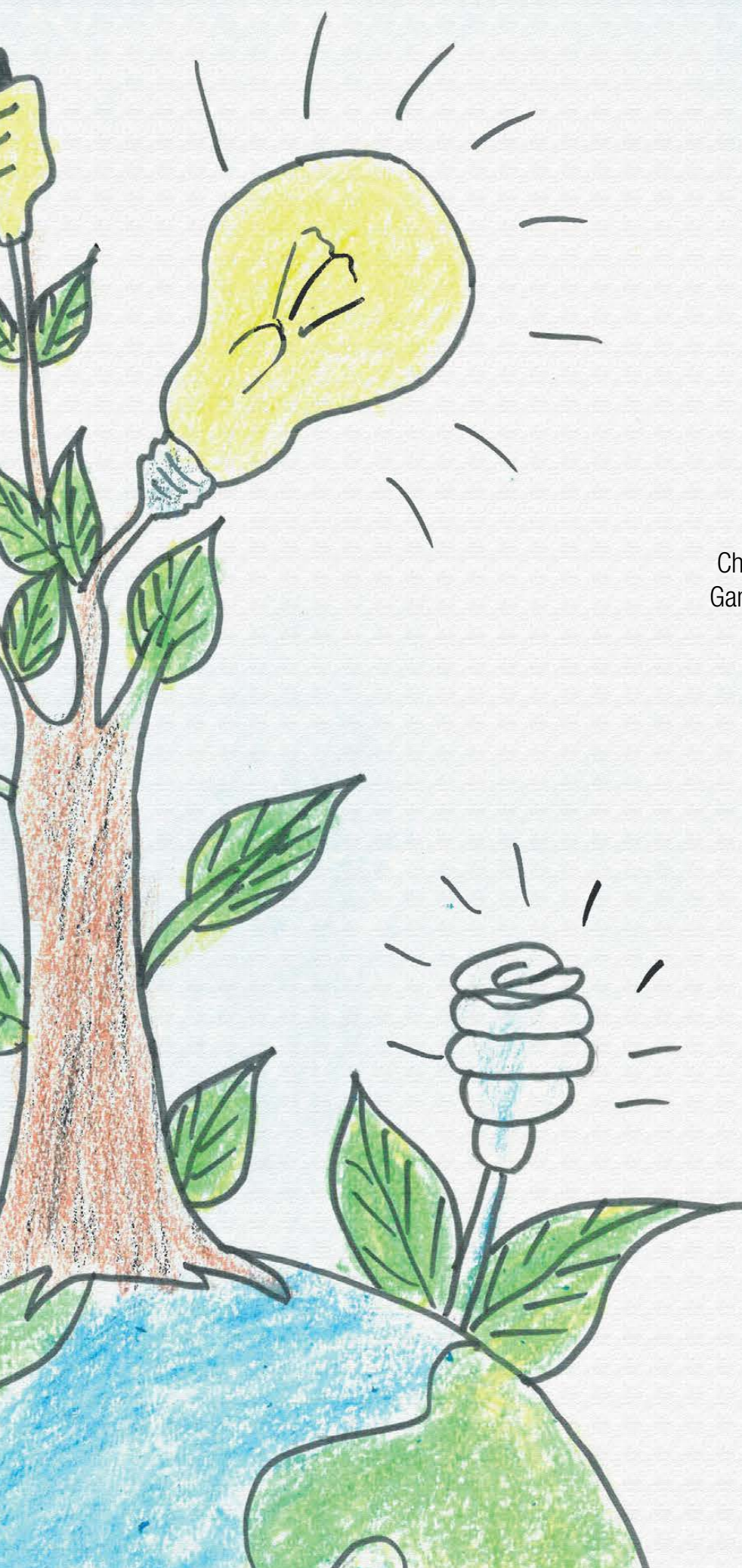
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Letter from the Chairman

Energy ambitions in India are at a turning point. The landmark Paris Agreement represents a collective global ambition to put energy and climate action on a transformational path. India is expected to play a key role in these efforts and is making steady progress in implementing new energy efficiency measures and smart grid technologies, while also driving a large-scale transition to renewable energy and electric mobility. More and more forward-looking businesses are recognizing their role in addressing climate change.

It is within this evolving energy landscape that Shakti works to drive policy solutions for clean and efficient energy by aligning stakeholders, moving agendas forward and enabling change. In 2018, Shakti entered its tenth year of operations. Shakti was originally set up as a small team in New Delhi, but with a deep understanding of where a difference could be made. I am pleased to see Shakti grow and mature over the years with a portfolio of critical interventions that find solutions to address the country's energy challenges.

The impact of Shakti's work can be seen through a number of tangible results: better informed policies, evidence-based research and the exchange of knowledge. In 2017, bright spots included the adoption of ambitious fuel efficiency standards for passenger cars, the transition to cleaner BS VI fuels and progress towards mini-grid policies and regulations at the state level.


Shakti's continued work in areas such as clean energy, sustainable cities, finance, energy efficiency and low-carbon development, brings a big-picture view for strategic alignment as well as weaves together a well-resourced field required for progressive policy developments.

I would like to take the opportunity here to extend my thanks to Shakti for its valuable contributions towards energy and climate action in India. I also thank all our stakeholders, both internal and external for their support.

Jamshyd Godrej
Board Chair
Shakti Sustainable Energy Foundation



Letter from the CEO



The context of our work is to enable the country to meet its development goals in a sustainable, low carbon manner. To do this, we need to de-couple economic growth from energy consumption and de-couple energy consumption from growth in fossil fuels. These aims have been captured by the country's NDCs by seeking to i) reduce energy intensity and ii) reduce the share of fossil fuel power in our energy mix. These must be achieved against the backdrop of India needing to grow its economy rapidly to pull its poorest out of poverty and to grow electricity supply to reach the nearly 250 million people currently without reliable access.

In recent years, the Government has dramatically raised ambitions on renewable power and has been a positive influencer in international climate agreements such as Paris and Kigali. Renewable energy efforts have been greatly aided by the significant drop in solar PV panel prices that has enabled the incremental cost of solar power to drop below that of thermal. Tangible progress has been made in progressing key initiatives like higher fuel quality standards, rolling out electric mobility, drafting a national cooling efficiency policy and starting work on implementing power plants emission standards. While supporting ongoing initiatives, Shakti continues to use the power of philanthropic funding to invest in high impact opportunities such as the creation of a distribution utility forum, introduction of sustainability norms in to the national housing scheme, establishing the country's first low-cost air quality sensor networks, and starting an incubator to promote non-profits in the clean energy space.

Climate is important for India and India is important for climate. India is key in the global effort on climate change mitigation as its economic and population growth will materially impact global climate trajectory. It also is most vulnerable to change in climate, with climate change estimated of having the potential to negatively impact GDP growth by 2.8% by 2050. Climate is changing faster than we are. Hence the work we do remains very urgent.

As we enter our 10th year of operations, we look forward to continuing to work on enabling the country's efforts towards sustainable development, thanks to the active support of our donors, our partners and stakeholders, and our Board and staff.

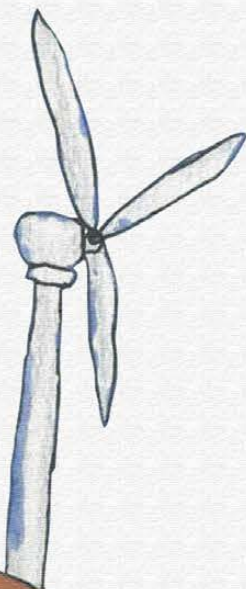
Krishan Dhawan
Chief Executive Officer
Shakti Sustainable Energy Foundation

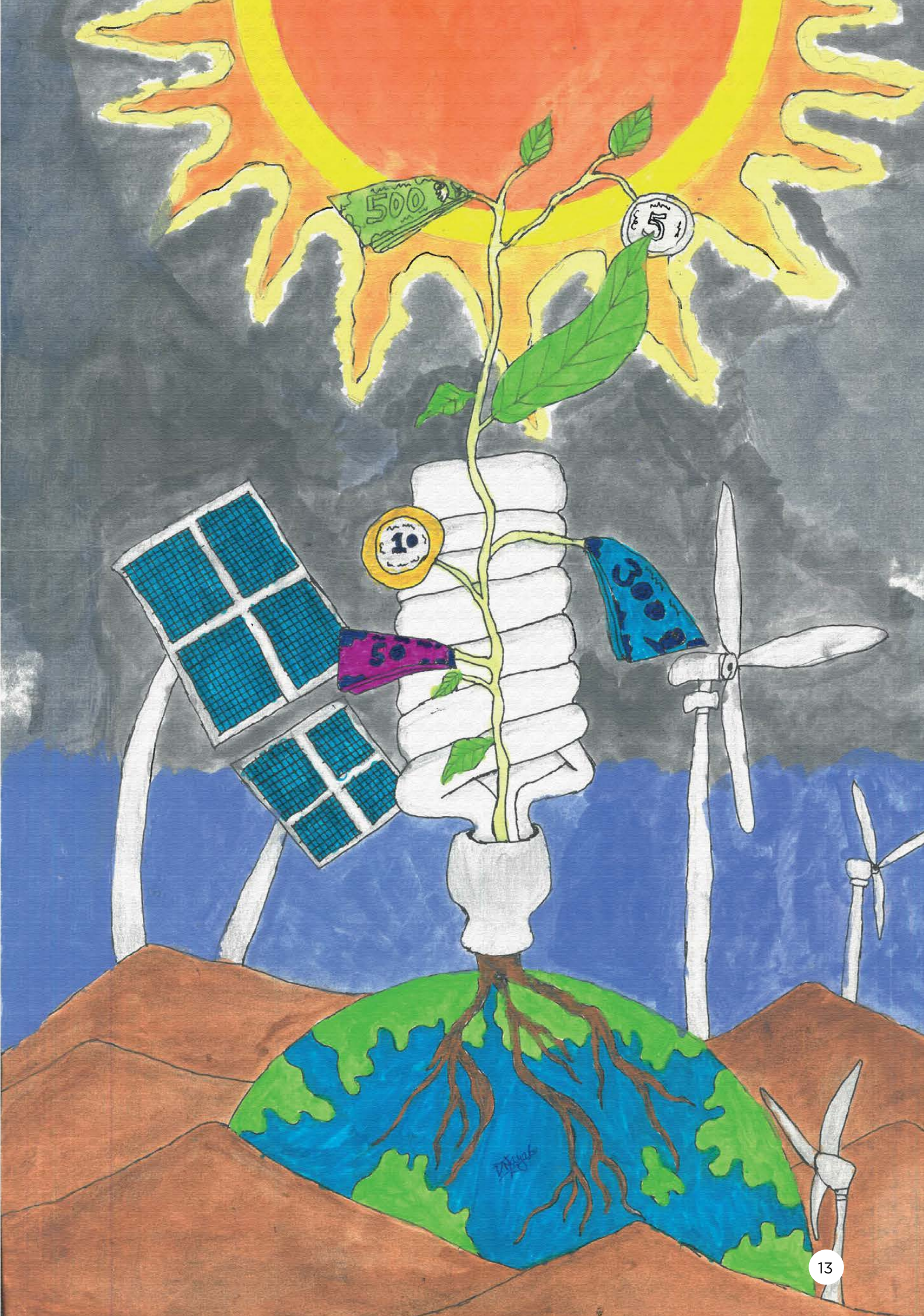
CLEAN POWER

India's power sector is continuously evolving, faster than ever before. A number of encouraging policies and developments are underway—the Pradhan Mantri Sahaj Bijli Har Ghar Yojana (SAUBHAGYA) for connecting all households to the electricity grid, the Ujjwal Discom Assurance Yojana (UDAY) for reviving distribution companies, the Unnat Jyoti by Affordable LEDs for All (UJALA) for distributing LED bulbs and the National Electricity Policy and Plan for better planning and operations. Several Indian states have made progress on these programs. Nonetheless, there is still much ground to cover before India arrives at a more transformed and efficient power sector. In line with India's ambitions, Shakti is working to facilitate the transition to a power system that delivers clean, reliable and affordable power to all. Throughout 2017, Shakti deepened state-level engagements and in parallel helped to strengthen policy and programmes at the national level.

Better convergence of solutions to drive energy access

India has witnessed progress in the area of rural electrification because of the Government's dual focus on extending the grid to un-electrified villages and providing connections to household consumers. But the grid alone may not always be able to deliver reliable, clean and affordable round-the-clock power. Increasingly, Decentralized Renewable Energy (DRE) solutions are being viewed as an additional solution. In fact, most DRE solutions are grid compatible and can continue to be used till after the grid arrives and becomes reliable. In the context of India's growing electricity needs, a more integrated approach combining the discom grid, DRE systems and energy efficiency can drive energy access. To foster such convergence, Shakti is enabling the development of practical solutions through data analysis, strategic pilots, policy research and discourse.







A more integrated approach bringing in the discom grid, DRE systems and energy efficiency can drive energy access and provide affordable, reliable, clean and resilient electricity to all.

An important area of focus is state-level interventions, which aim to build a better ecosystem for mainstreaming DRE solutions that can complement the grid. In Uttar Pradesh, Shakti supported the development of a comprehensive guidebook for mini-grids outlining policy, regulation, operational and technical aspects. Similarly, in Bihar, Shakti facilitated the development of mini-grid regulations and the adoption of an operational guidebook. In Odisha too, mini-grid regulations were finalized and notified. In Jharkhand, the draft mini-grid policy is under consultation. Supportive policy and regulatory developments such as these are paving the way for innovative business models, which are being validated through on-ground implementation and pilots. For instance, Shakti is currently supporting pilots in Uttar Pradesh and Bihar to test the technical operability and feasibility of interconnection between the mini-grids and the discom grid. The resultant findings will build confidence among discoms and developers, opening avenues for replicability.

Efforts facilitated by Shakti have shaped the policy and regulatory ecosystem for mini-grids in Uttar Pradesh, Bihar, Odisha and Jharkhand.

Building on learning gained, Shakti supported the development of an integrated mini-generation and distribution model, which aims to provide reliable power through locally available energy resources while leveraging community engagement and private sector expertise. The model proposes that discoms will leverage the expertise of private sector partners under a Public-Private Partnership (PPP) mode to reduce AT&C losses, enhance revenue collection and offer better electricity services. Going forward, this model will be piloted in Uttar Pradesh.

Just like DRE, the large-scale adoption of energy efficient appliances can enhance energy access. Shakti is working to deepen the market for energy efficient equipment in rural areas by exploring market-based interventions and establishing the technical feasibility for the interchangeability of AC and DC inputs for equipment. This will boost consumer confidence and the adaptability of efficient products.

Equally important has been Shakti's engagement in convening stakeholders to help build a systemic understanding of the

complementarity of DRE and the grid. Decision-makers, civil society groups, development partners and investors must fully appreciate the complementary role of the grid and DRE and work together to create a supportive framework for its rapid integration into electricity planning. Shakti is working with diverse stakeholders to drive a broader vision for DRE, which will not only unlock energy access but also lead to systemic impact.

Strengthening the Decentralized Renewable Energy (DRE) ecosystem

DRE offers a significant opportunity to close the electricity gap in India, and in cognizance of this, Shakti continues its efforts to strengthen the DRE ecosystem. Support provided by Shakti is helping DRE enterprises to build more scalable and profitable businesses. As part of a Shakti-supported incubation program, ten early-stage rural enterprises in Bihar, Odisha and the North-Eastern States have benefited from training, business plan development and mentorship.

In a similar effort, Shakti facilitated technical assistance to 13 mid-stage DRE enterprises across various states to help them expand their businesses. This has resulted in positive outcomes. For instance, Tarini Enterprise in Odisha secured a loan from the Odisha Grameen Bank for 23 solar home lighting systems, and Mlinda—an enterprise providing mini-grid services in Jharkhand—has now optimized the capital cost of its projects and is making a stronger case for seeking investments.

In addition, studies commissioned by Shakti provide some answers by assessing the nature and form of finance available, previous investment trends and future projections, with respect to evolving policy measures in both sectors. Findings from these studies can identify specific interventions required to unlock the greater capital inflow required.

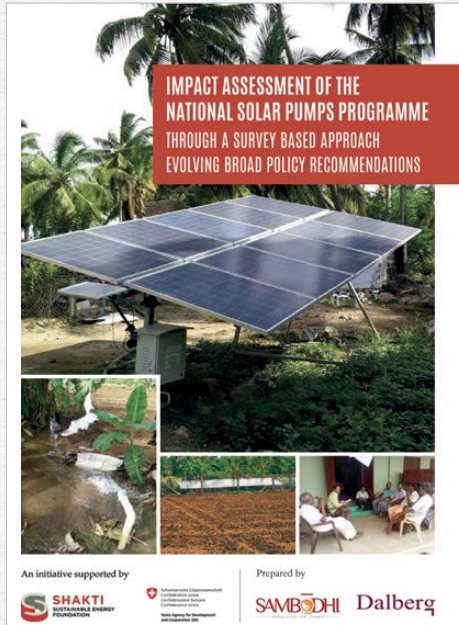
Solarizing agriculture pumps

The importance of Solar Photovoltaic (PV) powered water pumps is echoed in the Government's target to install nearly a million solar-powered water pumps for irrigation by 2020-21. With the announcement of KUSUM (the Kisan Urja Suraksha evam Utthaan

Support provided by Shakti is helping DRE enterprises to build more scalable and provided businesses.



Mahabhiyan) scheme for farmers, the installation of solar-powered pumps will be better incentivized.



Over the last two years, Shakti-supported a survey-based impact assessment in four states—Rajasthan, Uttar Pradesh, Bihar and Tamil Nadu—to assess the status and socio-economic impacts of solar-powered agriculture pump sets installed in the early phases of the program. The results were illuminating—there were significant gaps around socio-economic aspects stemming from non-targeted program implementation at the state-level, lack of awareness among low-income farmers and the lack of financial innovation. This highlighted the need for more targeted program implementation along with

increased awareness among low-income farmers. Based on these inputs, the Ministry of New and Renewable Energy has strengthened its program design and state-level programs continue to evolve towards meeting socio-economic outcomes. Going forward, Shakti will work towards strengthening the state-level implementation of the KUSUM scheme.

Mainstreaming rooftop solar in India

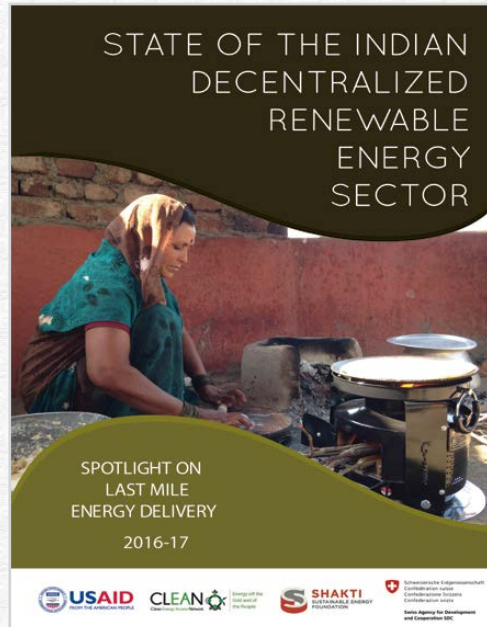
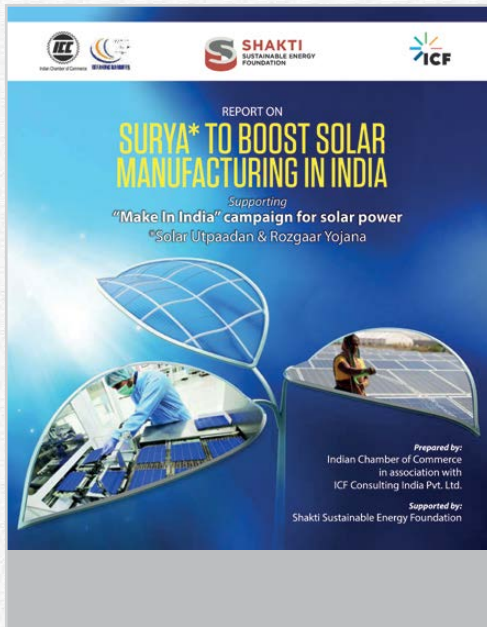
The uptake of solar rooftop in commercial and industrial consumer segments has increased in the last few years, but much more needs to be done in order to meet the national target. Greater adoption is required across all consumer categories including residential consumers. Shakti is supporting several initiatives aligned with this goal.

At the city level, Shakti has supported a five-city survey aimed at understanding residential consumer experiences and the barriers that prevent them from adopting solar rooftop. Shakti has also facilitated the development of discom-led business models for residential consumers of one utility in Delhi—BSES Yamuna—where a pilot will be conducted. Similar models for other states will be developed and implemented in other cities and states. The State Solar Rooftop Attractiveness Index (SARAL) is being developed to serve as a tool for states to strengthen the implementation environment for solar rooftop and build investor confidence. Shakti is also supporting efforts to assess the technical preparedness of the grid for solar rooftop, through the creation of a model that can quantify the impact of rooftop photovoltaics on distribution transformers. This in turn will help utilities and regulators to plan for the increasing penetration of rooftop solar.

Scaling up clean energy markets

A Shakti-supported study has contributed to the national goal of promoting the domestic manufacturing of solar equipment. The study informed the concept note that the Ministry of New and Renewable Energy (MNRE) prepared to propose the capital subsidy required for

creating new manufacturing capacities. A robust solar manufacturing capacity is an important stepping stone towards India's ambitious renewable energy targets.



Shakti supported the development of a comprehensive knowledge portal on the renewable energy sector—allaboutrenewables.com. The portal is an effort to address data gaps and to provide insights to stakeholders for informed decision making. In a similar vein, the Shakti-supported State of the Sector report takes a deep dive into the progress of the DRE sector, serving as a useful reference point for the performance of over 100 DRE enterprises. It expands the sector's fact base to support the development of recommendations for enhancing energy access.

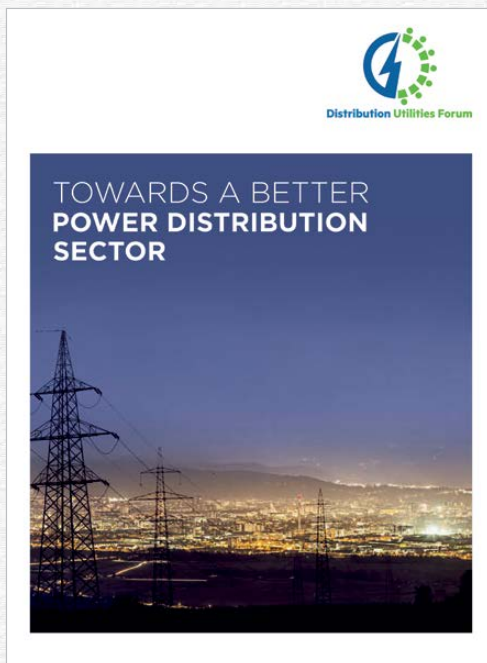
To solve the technical barriers along the value chain, Shakti is helping to identify appropriate operational protocols, institutional structures and market mechanisms for the smoother integration of renewable energy into the grid. The findings of a Shakti-commissioned study on this theme has demonstrated the value of power system modelling and informed the discourse on pathways to integrate renewable energy with the grid.

Convening for change

In 2017, Shakti helped to establish the India Energy Network of Scholars, which aims to improve the quality and relevance of research inputs that scholars provide to stakeholders in the power sector. Inputs from the network have informed the National Policy on Official Statistics, currently in the making. Once this policy is introduced, it is expected to ease data-related challenges faced by researchers.

Shakti is supporting the deepening and expansion of the high-level Working Group on Renewable Energy Policy and Finance comprising leaders from industry and civil society, as well as investors, lenders and other financial institutions. The Group is finding solutions to de-risk the renewable energy sector, increase investor confidence and ease the flow of finance. In 2017, the Group submitted a set of policy recommendations to key government and regulatory officials, which were well received.

In an effort to prioritise clean energy in electricity planning, Shakti is supporting the Energy Transitions Commission to develop 2030 transition pathways. In addition, the Energy Transformations Platform will soon be launched to develop pathways for a decarbonised energy sector by 2050.



The Distribution Utilities Forum is bringing together the top leadership of distribution utilities on a common platform. The Forum will enable the utilities to share views, experiences, best practices, and challenges as they make efforts to improve their financial and operational performance. The first meeting of the Forum, held in May 2018, saw participation from 21 distribution utilities from across the country.

In the DRE space, Shakti supported the India Energy Access Summit 2018, bringing experts together to identify opportunities, challenges and successes as well as

highlight ways in which the sector could deliver on India's Nationally Determined Contributions.

Deepening civil society engagement in the power sector

Efforts enabled by Shakti to build the capacity of civil society organizations (CSOs) have helped deepen and expand their engagement in the power sector, particularly at the state level. This has enhanced their contribution to decision-making processes.

In Uttar Pradesh, CSOs are engaging with institutions such as the Uttar Pradesh Power Corporation Limited (UPPCL) and the Uttar Pradesh Electricity Regulatory Commission (UPERC). As a part of this engagement, ongoing studies are assessing power procurement planning, retail tariff structures and the institutional structures of discoms. In addition, a detailed survey is underway to assess the causes of electricity theft.

In Bihar, CSOs have provided technical assistance to the Bihar Renewable Energy Development Agency for implementing the state's renewable energy policy. Implementation guidelines have been developed for solar parks, solar rooftop and the mini-grid sector. Efforts are underway to increase awareness on the policy. The Bihar Industry Association, the apex body of the state's industry and service sector, convened key stakeholders to aggregate experiences and learnings for increasing the adoption of renewable energy. Similar efforts have begun in Jharkhand.

In Karnataka, a strategic roadmap for implementing the UDAY scheme was presented to state discoms. The roadmap recommends ways for discoms to achieve the targets set under the UDAY scheme.

In addition, the implementation of the feeder level commercial accountability framework is underway, which will help to improve the overall financial performance of select discoms.

In Tamil Nadu, district level Electricity Consumer Cells are aiding consumers in the process of grievance redressal and spreading awareness on energy efficiency and renewable energy. So far, the cells have helped build the capacity of over 200 local consumer groups and civil society organizations. This model is slated to be expanded to more districts and as well as in other states.

Strengthening the distribution sector

Despite significant progress around distribution sector reforms aided by UDAY, discoms still need to address a few critical challenges—high AT&C losses, inefficient power procurement and revenue losses due to peak power deficits, and others. Ongoing studies enabled by Shakti aim to find solutions to make discoms more financially sustainable while also contributing to socio-economic goals. These studies are developing cost-reflective retail tariff structures including frameworks for tariff simplification and rationalization, assessing the true cost of supply,

assessing the affordability of tariffs and the economic cost of power outages.



In parallel, Shakti engaged with partners to draft a framework for utility-wide resource planning, which can help utilities get a clear sense of future demand and undertake procurement planning. One important effort in this direction is the ongoing development of an open-source demand forecasting tool that a utility can use to forecast both short and long-term demand.

In the first ever direct transfer of electricity subsidy made by an Indian utility, Shakti supported the design of Direct Benefit Transfer (DBT)

for the Holaspura feeder of Jaipur Vidyut Vitaran Nigam Ltd (JVNL), Rajasthan. JVNL now plans to scale-up the pilot to two more feeders.

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At the state level, Shakti-supported efforts are providing strategic inputs to the Uttar Pradesh Power Corporation Limited (UPPCL) and the Maharashtra State Electricity Distribution Company Limited (MSEDCL) for advancing power sector reforms. Shakti also engaged with state-level stakeholders to analyse resource planning and power procurement practices in Delhi, Punjab and Uttar Pradesh.

The Smart Grid Foundation Course, supported by Shakti, is helping disseminate information on smart grid principles and applications to regulators and distribution utilities.

TRANSPORT

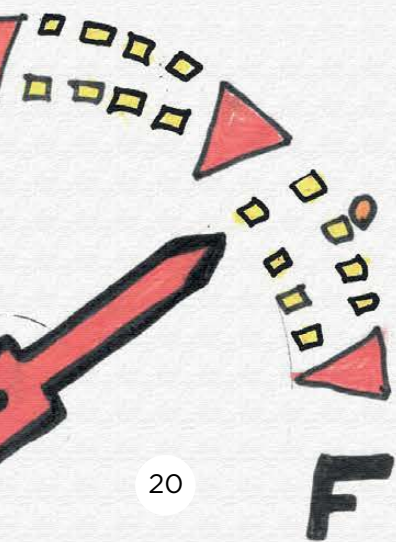
Across India, cities are dealing with the pressures of rapid urbanization and population growth. Ambitious urban renewal initiatives such as the Smart City Mission and the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) are changing the country's urban landscape. The growth of electric mobility will materially alter urban transportation.

These developments are reflective of India's urban future: by 2050, India's cities are expected to grow to 600 million from 377 million in 2011. Most cities in India are in the process of creating or modifying their urban plans. This is an opportune time to engage with cities to promote planning based on the principles of land use and transport sustainability. Against this backdrop, Shakti works to accelerate the transition to sustainable urban transport in cities.

India on the fast lane to cleaner fuels with BS VI norms

In 2016, India decided to implement stricter emission norms under Bharat Stage (BS) VI from April 1, 2020 by leapfrogging BS-V standards. Against the backdrop of rapidly escalating pollution levels in cities across India, the introduction of a higher grade and cleaner fuel is a step in the right direction.

Throughout the last two years, to inform this decision, Shakti helped to facilitate analysis as well as sustained engagement with policy makers and other stakeholder groups. With an eye to create a vision to leapfrog to BS VI norms, Shakti supported the development of clear and concrete emission norm roadmap. A fact sheet was published on the emerging concerns of diesel emissions from next generation diesel technologies and made the case for the timely implementation of Euro VI emissions standards by 2020. Several studies focus on the knowledge and design of measures to reduce emissions, while simultaneously identifying the role that stakeholders, particularly the auto industry, will play in the transition to BS VI norms.







Efforts supported by Shakti kept the spotlight on this complex policy debate to enable a steady flow of information to policy makers, the public and the media. Through engagement with the Environment Pollution Control Authority (EPCA), the stage was set for the timeline of 2020 being committed to by the government. This progressive development brings India at par with the US, European countries and other advanced automotive markets across the globe.

Fuel efficiency standards for Heavy Duty Vehicles

In August 2017, India notified fuel efficiency standards for Heavy Duty Vehicles (HDVs) with a gross vehicle weight of 12 tonnes or greater. Given that HDVs account for around 40% of India's diesel consumption, the standards have immense potential to reduce fuel use. Several efforts facilitated by Shakti contributed to the discourse on HDV standards as well as informed the development of the draft standards. Some of these include: the development of a roadmap for introducing HDV standards, research on the real-world characteristics and efficiency performance of HDVs, fleet characteristics of freight vehicles used for inter-state mobility, as well as theme-based policy papers on testing methods, standard setting and stakeholder perspectives. The standards have now been finalized and will be taken forward for implementation.

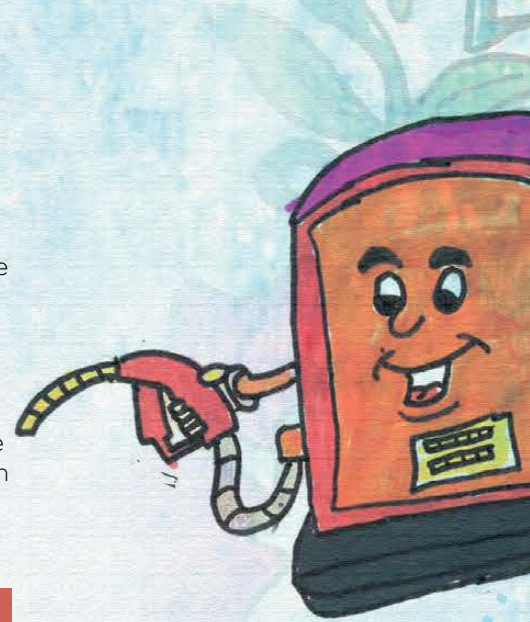
First ever inter-model comparison exercise leads to cohesive emission mitigation strategies for the transport sector

In 2016, Shakti supported the first ever inter-model comparison of various transport sector policies in support of NDC implementation. Shakti is working with the four Indian prominent think tanks that are



part the Sustainable Growth Working Group of the India-US bilateral Dialogue to carry out this analytic exercise, building on their respective energy models. The NITI Aayog, which serves as a thinktank for the Government of India, and a specially formed Advisory Committee provide leadership and guidance for this exercise.

The result of this exercise is a common modelling protocol, based on which technology and policy solutions have been developed to reduce energy consumption and emissions. This will inform emission reduction strategies for the transport sector as well as contribute to meeting India's climate mitigation targets.



Shakti supported the first ever inter-model comparison of various transport sector policies in support of NDC implementation.

Transforming the urban space through Transit-Oriented Development

Aiming to foster TOD in cities, Shakti supported a review of TOD plans in a few Indian cities as well as their ability to increase transit ridership. These learnings were shared with the Ahmedabad Urban Development Authority for TOD planning around the city's BRTS stations. Building on this effort, Shakti is now supporting the development of planning principles, such as housing mix, parking provisions and street design, which have a critical impact on transit ridership. An assessment of 'TODness' case studies of - Mumbai and Bengaluru are underway. With India gearing up to develop Smart Cities, Shakti is supporting efforts to identify and address the gaps in TOD plans prepared by various Smart Cities. One focus area is the Delhi-Ghaziabad-Meerut Rapid Rail Transit Corridor, which will soon have a framework for TOD action, developed in engagement with the NCR Transport Corporation (NCRTC). Findings from these efforts will help shape TOD planning across various Indian cities.

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Urban Local Bodies to catalyze investments for sustainable cities through better fiscal management

In the past, Shakti supported the development of a model framework for conducting the annual audits of Urban Local Bodies (ULBs). Using this framework, 188 ULBs of Rajasthan prepared their audited financial reports. In addition, model annual reports were developed for two ULBs—the Balotra Municipal Council and Udaipur Nagar Nigam—which provide an overview of their key accomplishments and audited annual accounts. These are now serving as model templates for other ULBs. Because of these efforts, last year, the Directorate of Local Bodies in Rajasthan received the HUDCO award for 'Best Practices to Improve the Living Environment' for its role in helping ULBs in Rajasthan to become more financially sustainable.

Going forward, similar efforts are being extended to Karnataka and Punjab, where roadmaps will be created to audit select ULBs, by working with policy makers within the respective state governments. Shakti is also supporting efforts to develop a broader municipal finance blueprint that cities can use to improve their financial

management practices. A Memorandum of Understanding will be signed with the Ministry of Housing and Urban Affairs, to develop and publish model frameworks and standards that state governments can use to institutionalize sound financial management in ULBs.

Creating the Smart Cities of the future

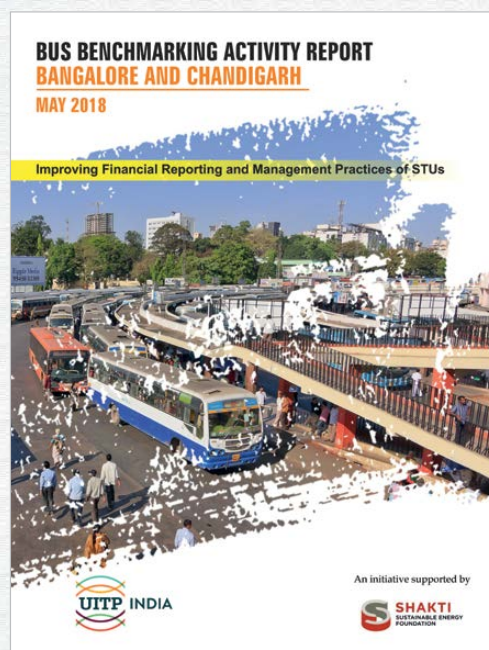
Shakti is currently facilitating technical and advisory support to five cities under the Smart City Mission to shape their aspirations—Udaipur, Vishakhapatnam, Gwalior, Ludhiana and Chennai. The importance of these urban centres as drivers of India's growth story cannot be underestimated, given that they are slated to receive funds worth ₹ 100 crores each year for five years under the Smart City Mission.

Efforts enabled by Shakti will help the cities to implement the sustainable mobility and built environment elements underscored in their Smart City Proposals. In putting these principles into action, the focus is on solutions for public transport, walking and cycling, regulations for para-transit and green building improvements—ingredients that can help build the Smart Cities of tomorrow.

Better public transportation in cities

The Shakti-supported 'Bus Benchmarking' model is helping bus operators understand their business better by benchmarking themselves against other operators. The model has been rolled out for Bengaluru and Karnataka and can be used as a business management tool to quickly identify the areas for improvement and opportunities. Shakti also continues to engage with Bus Karo, a national level forum comprising State Road Transport Undertakings (STUs) city bus operators and few private operators working to advance bus services in Indian cities. The forum is advancing its work on taxation reforms at the state level and for additional STUs in Gujarat and Uttar Pradesh. In addition, a study enabled by Shakti makes the business case for integrated transport budgeting in states. The transport sector has seen a significant amount of investment in road infrastructure, as compared to bus-based public transport systems. An integrated transport budget would lead to a balanced allocation of funds and enhance bus transport systems, which are more sustainable. The study looks

at the budgets of Andhra Pradesh, Maharashtra and Haryana mapping revenue and expenditure on buses and roads, and estimating returns in terms of economic and environmental impact.



On the road to electric mobility

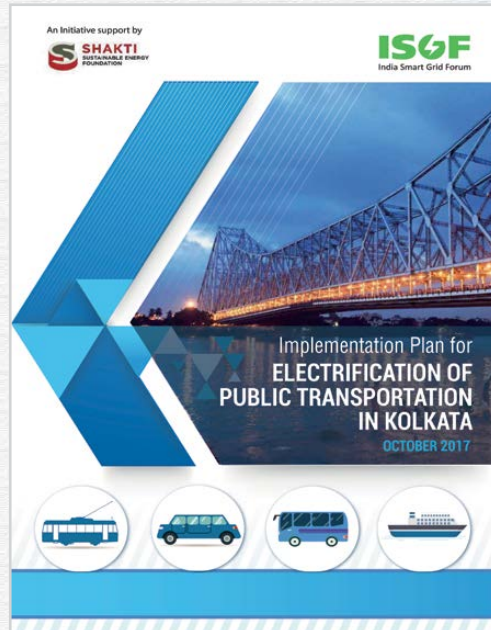
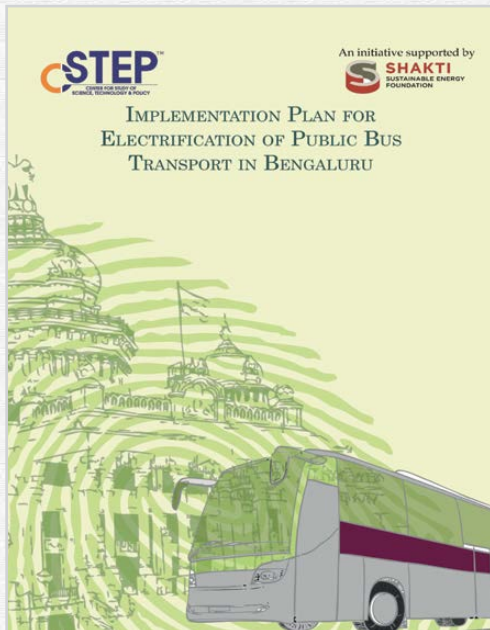
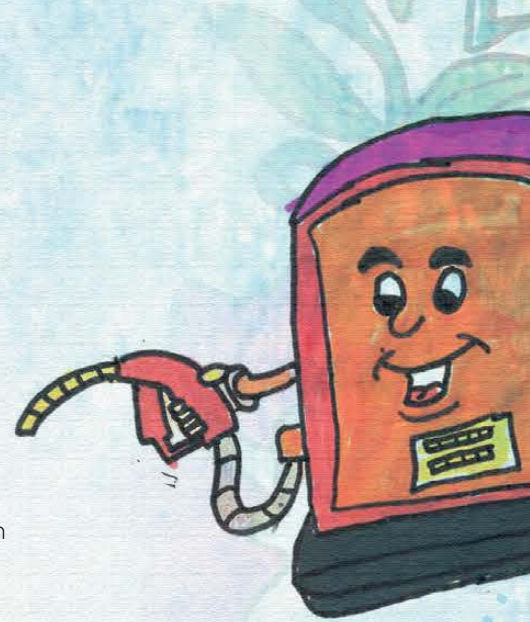
A steady momentum has been building up in India on the electric mobility front. Formal efforts to introduce electric mobility began in 2012 with the National Electric Mobility Mission Plan (NEMMP). Under this framework, in 2015, India introduced the

Faster Adoption and Manufacturing of (Hybrid and) Electric Vehicles scheme, which promised to provide subsidies for the manufacture of electric vehicles and hybrids.

But while the transformative push for electric mobility is a welcome development, it presents challenges along with opportunities. There are many reasons to encourage electric mobility in India - reduced oil imports, fuel savings, better air quality, better public health and job creation. But at the same time, issues like an effective charging infrastructure and supportive electricity grid, domestic battery manufacturing and manufacturer readiness need to be addressed. An enabling policy framework has to be created along with supportive fiscal policies.

In 2017, Shakti supported the development of roadmaps for the adoption of electric buses in two important Indian metros - Bengaluru and Kolkata. Both roadmaps have significantly informed efforts to promote electric buses in their respective cities.


Last year, Karnataka became the first Indian state to announce a policy for electric vehicles. Using key inputs from the roadmap,



In 2017, Shakti supported the development of roadmaps for the adoption of electric buses in two important Indian metros—Bengaluru and Kolkata. Both roadmaps have significantly informed efforts to promote electric buses in their respective cities.

Bangalore will procure its first fleet of electric buses and Kolkata's transport department will procure 80 electric buses. The roadmaps hold immense potential for replication by cities and states across India and can help city authorities evaluate technology choices, assess the impact on distribution grids and analyze infrastructure requirements. In addition, a regulatory structure for electric vehicles was proposed to the Forum of Regulators, which is now available in the public domain serving as an important reference point.

To bridge the knowledge gap on EVs, Shakti facilitated a capacity building initiative for stakeholders, which facilitated data and



knowledge sharing and covered key themes of battery technologies, energy storage solutions and charging infrastructure. It saw participation from representatives of city authorities, municipal corporations, metros, bus operators (public and private), electricity distribution companies, mobility players and industry.

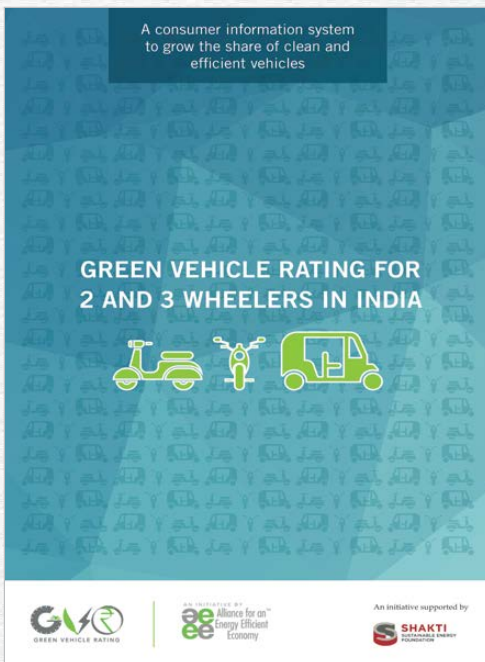
Paving the way to make freight more sustainable

Shakti has engaged with the Indian Railways to develop strategies for increasing the modal share of three important commodities in the railways system—Cement, Container Cargo and Automobiles. Key recommendations from the study have been shared with high-level decision makers and are now being taken forward for adoption. These efforts hold particular relevance because over the last few years, road freight, which is more emissions intensive has gradually been displacing rail freight. With Indian Railways announcing a target to triple its freight capacity by 2030, the study and its recommendations are providing the groundwork required to do so. Going forward, Shakti is supporting the development of strategies to increase the share of three more commodities—steel, fly ash and parcels.

Another focus area for Shakti is making urban freight more efficient and sustainable. In 2017, a Shakti-supported study assessed freight movements within Chennai and proposed measures to reduce the emission intensity of freight transport. Findings from this study helped to establish the Chennai Green Freight Partnership, which brought on board important stakeholders including the Municipal Corporation of Chennai, Chennai Metropolitan Development Authority, Madras Chamber of Commerce and Industry and Freight Operators Association of Chennai.

Better fuel efficiency for vehicles

Tyres contribute up to 20% of the total fuel efficiency performance of a vehicle. But existing Indian standards for tyres only measure their safety and durability, and not parameters like rolling resistance and wet-grip performance, which have a greater impact on fuel efficiency. Shakti recently commissioned a feasibility analysis for introducing a standards and labelling program in India for tyres across various vehicle types. This will be presented to the government and industry for consultation. Shakti is currently supporting a more detailed study that will generate the data required to test rolling resistance and wet-grip performance of tyres in Indian conditions. The test data along with other analyses, will be used to design a standards and labelling program for passenger car tyres in India.



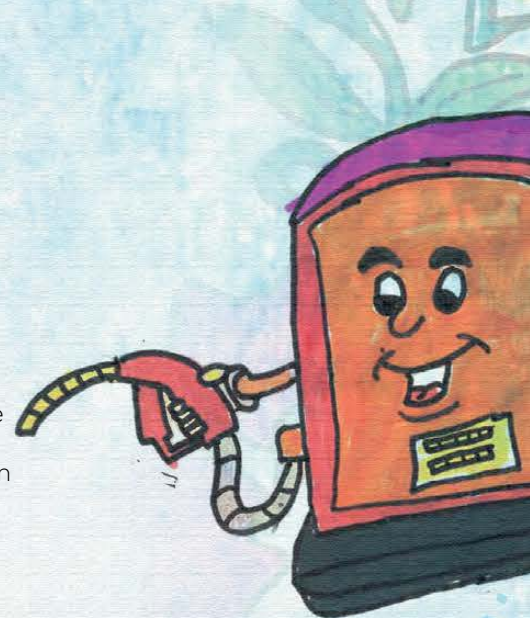
The green vehicle rating, supported by Shakti, for two-wheelers and three-wheelers in India lets consumers know about the overall environmental and emission performance of these vehicles. The rating provides information about the negative impact of GHG emissions and criteria pollutants released from tail pipes across vehicle models. Along with a comparative analysis of vehicle models, the rating also estimates the external costs of the impact of vehicle exhausts. With a rating such as this, consumers can take more informed decisions on opting for low-emission two and three wheeler

vehicle models. This in turn can nudge the transport sector towards an efficient and cleaner future.

The Sustainable Urban Mobility Network (SUM Net), supported by Shakti, is a network of grassroots level civil society organizations working to foster policy dialogue and action on urban transport issues.

Mobilizing action on sustainable urban mobility

The Sustainable Urban Mobility Network (SUM Net), supported by Shakti, is a network of grassroots level civil society organizations working to foster policy dialogue and action on urban transport issues. SUMNet is engaging with policy makers in Bihar and Jharkhand to draft a policy on non-motorised vehicles. Throughout 2017, the network collected data on urban transport investments in five cities Ahmedabad, Bangalore, Chennai, Nagpur and Pune to assess the share of expenditure on public transport. These findings are being used to inform stakeholders on the need to increase investment in sustainable transport as well as to adopt measures like parking management to dis-incentivise motorised private mobility. In addition, walkability audits are underway in ten Indian cities to develop specific recommendations for improving their pedestrian infrastructure.



CLIMATE POLICY

Signaling strong intent to meet the Nationally Determined Contributions (NDCs) set under the Paris Agreement, India is adopting an array of ambitious climate actions. At the national level and across states, new policy and implementation frameworks are being introduced that not only aim to meet India's climate commitments but also prioritize energy access and economic development. India is now taking steps to build a stronger transparency system for reporting and evaluating progress, as outlined in the Paris Agreement. Shakti seeks to build on these efforts to help India transition towards a low-carbon development pathway in support of the NDCs.

Meeting India's emerging MRV needs

With the NDCs committed to under the Paris Agreement, India will require robust Measurement, Reporting and Verification (MRV) systems to promote credible reporting and to build policy solutions. Throughout 2017, Shakti invested in efforts to strengthen domestic MRV systems with the goal of enhancing transparency around climate action.

Understanding the implications of the Transparency Framework

The transparency framework is an important element of the Paris Agreement. It includes obligations for countries to evaluate their mitigation efforts. But what are the implications of this framework for India? How can India play a greater role in giving shape to the enhanced transparency framework? As key parameters of the transparency regime are negotiated and agreed upon, India



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will have to strengthen its domestic institutional framework on the MRV of climate actions. Through research, analysis and stakeholder engagement at national and international platforms, a Shakti-supported initiative is informing India's position on the transparency framework. Currently, two position papers are being prepared on core aspects of the framework. They will consider the readiness of institutions in India to meet the requirements of the enhanced transparency framework and to facilitate the implementation of the NDCs.

A civil society platform for GHG estimation and analysis

Throughout 2017, the GHG Platform India developed and published national and state-level GHG estimates for the years 2005 to 2013. This is a follow up effort to the national GHG estimates prepared by the Platform for the years 2007 to 2012. The Platform represents the most substantial and comprehensive approach by civil society to improve GHG emissions data reporting in India. Data and analysis are hosted on the Platform website, <http://www.ghgplatform-india.org>, to support and track action on climate change.

Sikkim on the path of becoming India's first carbon neutral state

In 2017, Sikkim announced a vision of becoming the first carbon neutral state in India. To help the state achieve this objective, Shakti is facilitating the development of a web-based GHG inventory and Monitoring, Reporting and Verification System for climate action. The GHG emission inventory provides estimates for major GHG emitting sectors for the years 2005-2015 for carbon dioxide, methane and nitrous oxide gases. The system will help state officials take an

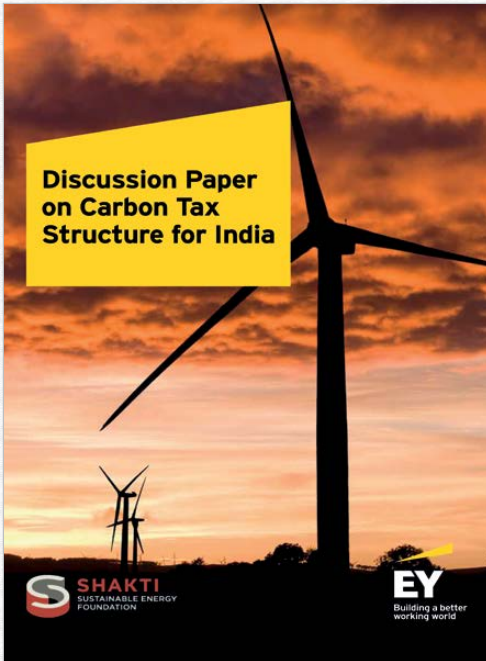
For Sikkim, Shakti is facilitating the development of a web-based GHG inventory and Monitoring, Reporting and Verification System for climate action.



informed approach towards adopting a low-carbon development trajectory as well seeking climate finance for the state. Sikkim will be the first state in India to host such a system setting an important precedent for other states to follow.

Carbon mitigation instruments in support of India's climate goals

In 2017, Shakti helped to shape the design and development of carbon mitigation instruments that can help reduce GHG emissions. A discussion paper commissioned by Shakti analyzes a carbon tax structure for India and assesses its merits and challenges. It covers



pertinent issues such as the level of GHG emissions in India and their sources, assessment of the current tax and non-tax measures for reducing carbon emissions, learnings from other countries which have implemented a carbon tax mechanism, and possible linkage of the carbon tax structure with the Goods and Services Tax (GST) in the country. Simultaneously, Shakti is helping to convene a high-level multi-stakeholder group that is working to identify the most suitable suite of GHG mitigation instruments for India to achieve its development and climate goals in a cost-effective and efficient manner.

Pathways to meet the Nationally Determined Contributions

Shakti is enabling efforts to create pathways for meeting the NDCs and identify opportunities for enhancing ambition. An ongoing modelling exercise is preparing energy and GHG emission trends for India until 2050. It is also assessing alternate policy scenarios that will inform India's long-term low carbon strategy. This exercise is in line with one of the provisions of the Paris Agreement where countries are invited to formulate and communicate by 2020 their mid-century strategy for deep decarbonization. To complement this effort, Shakti is supporting efforts to identify capacity-building constraints and strengthen India's institutional capacity on climate change actions as India transitions to a low-carbon growth pathway.

Shakti continues to help convene the India-U.S. Track II Dialogue on Climate Change and Energy, bringing together a diverse array of thought leaders from both countries—including former senior government officials, industry leaders, and heads of civil society organizations—to identify areas of joint action to tackle climate change. At its seventh meeting in New Delhi last year, the Dialogue prioritized NDC implementation and identified areas of concrete action in power distribution reforms, electric mobility and carbon pricing. It also emphasized engagement between states in India and the US to foster learning and cross collaboration.

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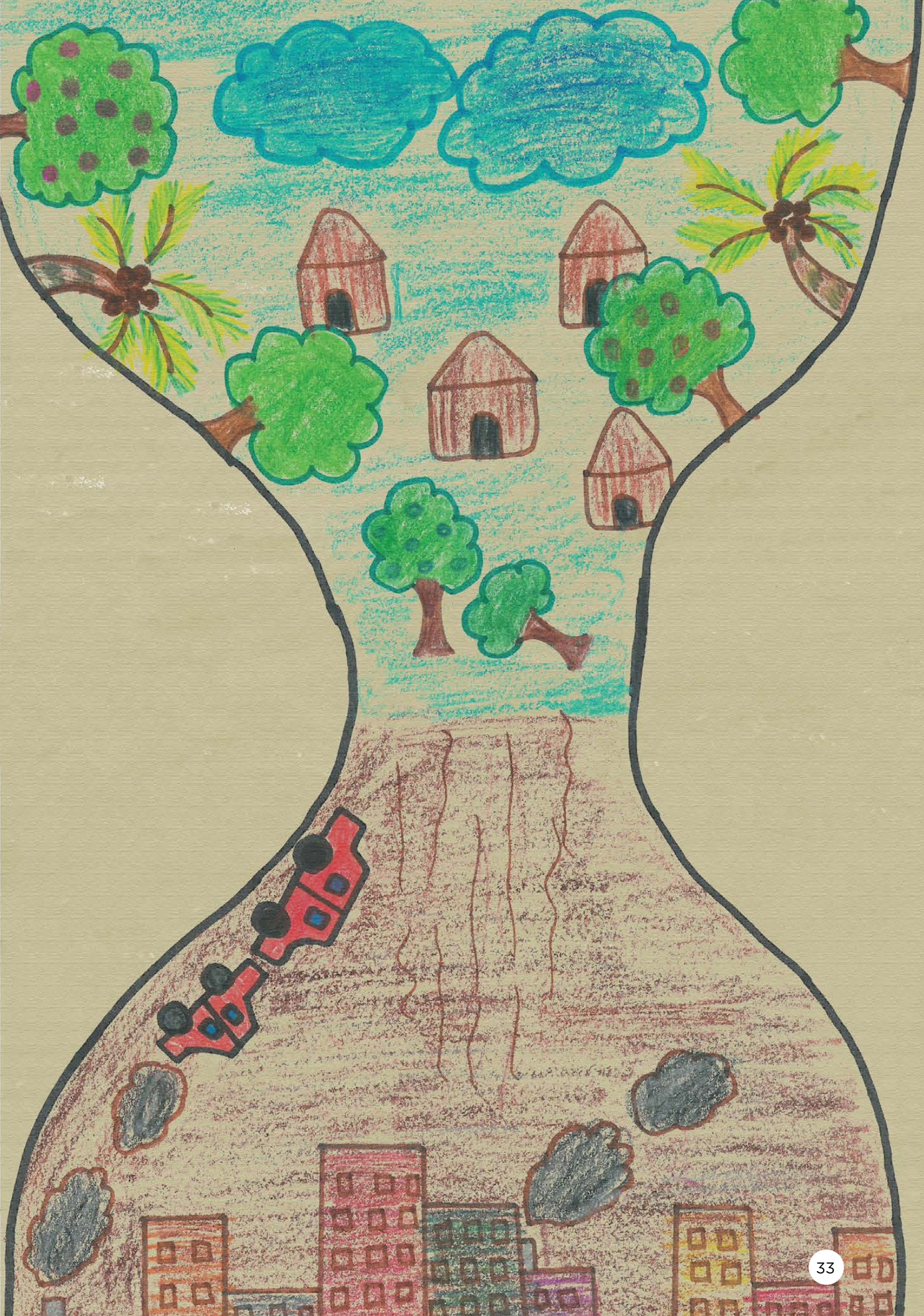
ENERGY EFFICIENCY

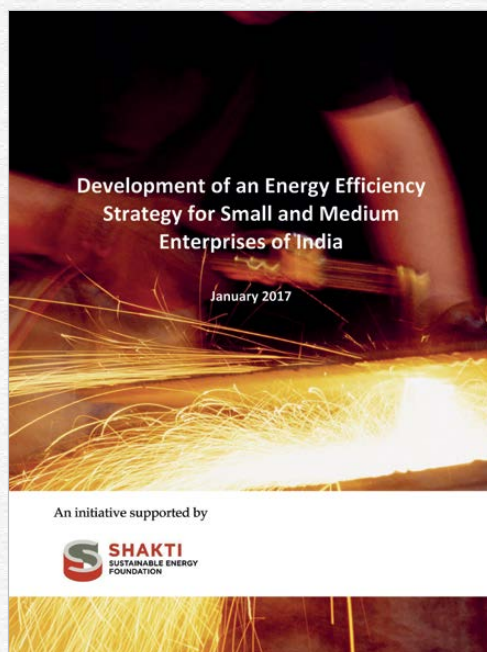
With rapid urbanization and the recent focus on electrification and e-mobility, the demand for energy is expected to increase significantly. Using energy more efficiently remains the least-cost option to meet this demand and to realize India's ambitious climate goals. The market for energy efficiency in India is pegged at over USD 23 billion with immense potential to grow. Despite many efforts to foster energy efficiency, a lot remains to be done. Shakti focuses on promoting the design and implementation of policies that lead to greater energy efficiency in industry, buildings and appliances.

Making the MSME sector more energy efficient

The Micro, Small and Medium Enterprises (MSME) sector plays a key role in driving the Indian economy. Manufacturing sector MSMEs employ over 36.4 million people and contribute to around 8% of India's GDP. However, many MSME units are highly energy intensive with energy use often accounting for a significant portion of production costs. In many of these units, the adoption of energy efficient technologies and interventions offer enormous potential for energy savings, reduction in emissions and increase in profits. But a few barriers will need to be addressed before this potential can be realized.

One such challenge is the dearth of cluster level data on baseline energy consumption pattern and energy efficiency potential for the MSME units. Another challenge is that MSME shop floor technicians often lack the knowledge to operate energy efficiency technologies





and equipment. In most cases, MSME units are part of a larger supply chain, where large manufacturers or retailers adopt energy efficient manufacturing processes, but this knowledge does not trickle down to the MSMEs.

Over the last year, Shakti worked with stakeholders to identify and implement cost-effective and scalable solutions to address these challenges. As a first step in this direction, Shakti supported the development of a forward-looking policy roadmap for the sector, which identifies impactful ways to grow the sector. Then, in collaboration with

leading banks, Shakti helped to develop tailor-made financial models for energy investment financing for MSME targeted at anchor MSME supply chain actors.

On the ground level, Shakti enabled technical assistance towards the setting up of an energy efficient motor rewinding center at the Faridabad cluster. To complement this effort, Shakti facilitated the design of short-term energy management curricula targeted at shop floor technicians in the cluster.

In addition to this efforts, Shakti is facilitating the development of a dedicated web-based knowledge and decision support platform for MSMEs. A Do it Yourself (DIY) energy efficiency assessment tool has been launched under the platform to help MSMEs assess information on benchmarking, technology options and other relevant parameters and thereby make informed decisions on energy saving opportunities. The tool is based on a master database of 849 MSME covering 30 MSMEs sectors for which around 5,000 energy efficiency recommendations have been prepared. It has been developed in collaboration with the Global Environment Facility (GEF), World Bank, Bureau of Energy Efficiency, Small Industries Development Bank of India and India SME Technology Services Limited.

Shakti is facilitating the development of a dedicated web-based knowledge and decision support platform for MSMEs.

Climate friendly cooling for India

With rapid urbanization and increasing temperatures, India is at the cusp of an exponential growth in the air conditioner (AC) market. Under a BAU scenario, by 2030, space cooling needs from commercial and residential buildings will increase peak power demand by 143 GW and base load from 62 GW to 77 GW. This will burden the grid and lead to higher fuel consumption by power plants. It will also exacerbate climate change caused by emissions from power generation and the

release of refrigerants, such as HFCs, which are high global warming potential gases used in ACs.

The stock of room ACs has doubled from 15 million units in 2010 to approximately 30 million units in 2017. Room AC sales are projected to continue their rapid rise, but even then there is still a vast majority of India's population having limited means for active space cooling. This has led to a sense of social inequity where those that contribute least to peak AC demand cannot access basic thermal comfort available through fans. The challenge then that emerges is how to provide thermal comfort to all in affordable and sustainable means.

As a key supporter of the ground breaking Kigali Amendment signed in October 2016, India is steadily taking steps to phase out HFCs—an important opportunity to stave off the worst effects of climate change. The focus on climate-friendly cooling to mainstream energy efficient and low Global Warming Potential (GWP) refrigerants has never been greater. In support of this, Shakti is engaging with key stakeholders to identify policy, regulatory and market solutions that will quicken this transition.

Shakti is supporting efforts to develop robust timely and comprehensive standards for such HFC alternatives, which are urgently required in order to allow for their greater uptake and commercialization.



Setting standards for HFC alternatives

HFCs, used significantly in AC equipment, have extremely high global warming potential. As an alternative, natural-refrigerants based ACs provide a huge opportunity for energy efficiency gains. Shakti is supporting efforts to develop robust, timely and comprehensive standards for such alternatives, which are urgently required in order to allow for their greater uptake and commercialization.

Advancing the National Cooling Action Plan

The Ministry of Environment, Forests and Climate Change (MOEFCC) is leading efforts to develop a National Cooling Action Plan (NCAP). This is expected to be a comprehensive vision document to develop sustainable and smart cooling strategies to meet India's cooling needs. Shakti, in collaboration with its grantee partners, is supporting the development of four of the six thematic areas being developed under this plan. In addition, Shakti-supported efforts are providing inputs to deliberations held by the Parties to the Montreal Protocol (MOP) and the Open-Ended Working Group to identify energy efficiency gains from low-GWP HFCs and natural refrigerants.

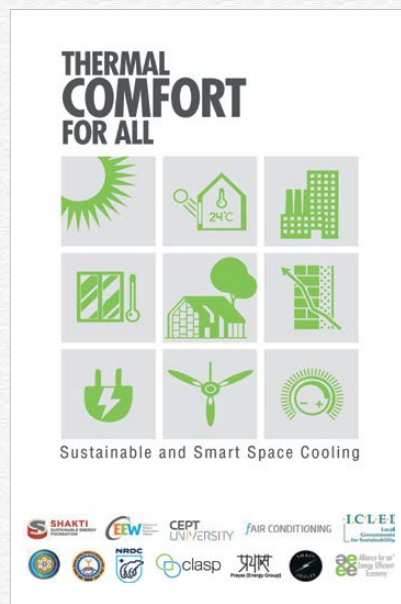
Addressing knowledge gaps in the AC servicing sector

It is critical to address skill and knowledge gaps in the AC servicing sector particularly with respect to good service practices and safety concerns. Without a well-trained service sector, many of the gains from such technological improvements may be lost. A study supported by Shakti has provided insights on the present state of the AC servicing sector, underscoring the crucial role played by service technicians in minimising emissions. The study lays the ground work for further research and recommends ways to guide policy development for the service sector.

Developing a public procurement mandate for appliances

On the demand side, Shakti is facilitating conversations between stakeholders to develop a public procurement mandate for appliances that are based on technologies that use HFC-free refrigerants.

Convening the Sustainable and Smart Space Cooling Coalition



Shakti convenes a coalition of leading civil society organizations and think tanks working in sustainable habitat and comfort conditioning. The coalition aims to drive India's transition to a sustainably cooled built environment by supporting advanced research, analysis, policy recommendations and market transformation. Kickstarting its first year, the coalition released a report on Thermal Comfort for All, a comprehensive overview of the interrelated key aspects of space cooling—Lean (building envelop), Mean (Energy efficient Appliances), and Green (Refrigerant use)—that together can meet thermal comfort needs in a holistic manner.

Energy efficient and sustainable affordable housing

With India's urban population growing at a fast pace, the housing gap has considerably widened. The report by the Technical Group on Urban Housing Shortage 2012-17 estimated existing shortages of 18.78 million residential units in urban areas and 43.67 million units in rural areas. The Pradhan Mantri Awas Yojna (PMAY) or Housing for All scheme is a welcome development to bridge this gap. The scheme seeks to provide housing to every family by 2022 with the goal of 12 million homes in urban areas and 30 million in rural areas. Of the housing need in urban areas, 70% is in the affordable segment.

If conventional construction practices are followed, the houses constructed under the PMAY will consume significantly higher

amounts of energy, especially due to poor choice of building material and building envelope design. Over the next decade or so, this will create long-term lock-in in energy and emissions intensive infrastructure that will generate electricity peak demand of around 20-30 GW. The massive build out planned under the PMAY is an excellent opportunity to introduce building energy conservation principles in the design and construction of millions of new homes.

Shakti is convening a broad spectrum of stakeholders all centred on the common objective of finding solution to make affordable housing in India more efficient and sustainable.

As an important starting point to this process, Shakti is convening a broad spectrum of stakeholders all centred on the common objective of finding solution to make affordable housing in India more efficient and sustainable. The series of targeted discussions brought together government housing boards, real estate industry, financial institutions, architects, manufacturers and policy makers to propose a suite of measures and actions towards this goal. A draft policy note has been prepared which offers specific guidance on building envelop design, building materials and policy changes to support the faster adoption of environment-friendly and low-carbon building materials.

Widening the coverage of the Perform, Achieve and Trade (PAT) scheme

Over the last few years, Shakti has helped to shape the design and implementation of India's Perform, Achieve and Trade (PAT) scheme, a market-based mechanism to enhance energy efficiency in industries. Under PAT, large industrial consumers of energy (called designated consumers or DCs) are given energy efficiency targets. Those who exceed their targets are awarded energy savings certificates, or ESCerts, which they can sell to those who fail to meet theirs.

In 2017, Shakti facilitated efforts to identify and add two critical energy-intensive sectors under the PAT scheme—commercial buildings (hotels) and the petrochemical sector. These efforts

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laid the groundwork for a more informed discussion on the issue, and in March 2018, the Ministry of Power notified 37 buildings and 8 petrochemical units as designated consumers. Bringing more industries under the ambit of PAT can help meet India's NDC targets as the industrial sector consumes around 57% of the country's final commercial energy consumption.



AIR QUALITY MANAGEMENT


Several Indian cities are in the throes of a major air pollution problem, which is affecting health, economic growth and quality of life. The WHO database on global air pollution lists 14 Indian cities as the most polluted in the world. High air pollution levels and air emergencies have garnered significant media attention in the last two years. It is widely acknowledged that poor air quality is a challenge for cities across India. These issues are driving action to combat air pollution at the national, state and city level. Better air quality management systems are the need of the hour, and Shakti is working on several fronts to promote policy and technological solutions for cleaner air.

The Delhi-NCR region: The Graded Response Action Plan

In 2017, the Ministry of Environment, Forest and Climate Change notified the Graded Response Action Plan to control air pollution in the Delhi-NCR region. Shakti supported technical assistance for the development of this plan, which sets an important precedent for air quality management—it is designed to implement anti-pollution measures based on categories of pollution levels.

In late 2017, when pollution levels spiked during the winter season reaching 'very poor' levels, several emergency response measures recommended by the plan were enforced. The Badarpur thermal power plant was shut down, and polluting brick kilns were ordered to stop





production. Diesel generators were banned and stricter action taken on waste burning and construction. Polluting diesel trucks were not allowed in the city, and parking charges were significantly hiked. These actions brought some respite and are good first steps toward building more comprehensive action to clear the air.

Making air quality data more robust and accessible

Cities need good quality data on pollution levels, affected areas, sources and related information to be able to design strong air quality management plans. Shakti is prioritizing two critical efforts to develop and disseminate data for cities to be able to understand and address their air pollution challenges.

Low-Cost Air Quality Sensor networks: Shakti is facilitating the establishment of two independent networks of low-cost air quality sensors across all major Indian cities, particularly those with a population that exceeds one million. The networks will lead to an increase in the volume of real time air quality data available in the public domain and enhance public awareness on the issue.

Air Pollution Knowledge Assessment (APnA) city programme: The Programme is providing air pollution data for 20 Indian cities from relevant sources, surveys, mapping and atmospheric modeling. The cities are: Patna, Raipur, Ranchi, Bhubaneswar, Kanpur, Agra, Varanasi, Dehradun, Chandigarh, Amritsar, Ludhiana, Jaipur, Nagpur, Pune, Indore, Bhopal, Bengaluru, Kochi, Coimbatore, Chennai. Capitalizing on this data repository, emission sources can be identified, and abatement measures proposed. Similar assessments will be carried out for 30 more cities over the next few months.

Mitigating air pollution in the Indo-Gangetic plain

It is estimated that 14 of the world's 20 most polluted cities are in India, some of them lying in the Gangetic plain and grappling with hazardous levels of air pollution. In 2017, during the peak pollution season in the Indo-Gangetic plain, Shakti facilitated a comprehensive stakeholder engagement and knowledge sharing programme targeted at the states Bihar, Jharkhand and Uttar Pradesh. The idea behind the programme was to bring key stakeholders across all three states to identify solutions for mitigating air pollution as well as areas of collaboration.

An important highlight of the programme was a national conference on healthy air, which focused on the need for regional cooperation for a clean air action. Mr. Sushil Modi, the Deputy Chief Minister of Bihar, in his keynote address at the conference, underscored how affordable technology could help address air pollution. More than 100 delegates, including representatives from state pollution control board, took part, and contributed to sessions on curbing air pollutions from sources like brick kilns, private vehicles and industries. The conference and other convenings contributed to an important milestone—Patna recently announced that it would develop a clean air action plan for Patna, a first of its kind comprehensive strategy to improve air quality in the city.

Bridging the knowledge gap at the city level

Under an ongoing effort, Shakti is helping to bridge the knowledge gap on air quality management in four Indian cities—Dehradun,

Chandigarh, Bhopal and Jabalpur. In all four cities, the burden of air pollution is high, and as the pace of urbanization increases, these cities will need to take action. Capacity building workshops organized under this initiative are aimed at strengthening and prioritizing efforts to address air pollution at the city level. The workshops bring together key government officials, subject matter experts and civil society organizations to facilitate the exchange of information on the current status of air pollution in the city and state, as well as possible policy solutions.

Enhancing CSO communications and engagement

Shakti commissioned the development of a robust communication strategy targeted at Indian CSOs to help them play a greater role in informing policy measures for curbing air pollution. The groundwork for this strategy was laid through a city-level survey on air pollution conducted across 11 Indian cities to gauge public awareness on air quality. Over the years, media attention on air pollution and its health risks has increased, strengthening people's concerns. The survey revealed that while most respondents claimed to be reasonably aware about air pollution, the actual of knowledge appears to be lower. A similar gap was seen between awareness and understanding of the health concerns associated with air pollution. Findings from this survey received considerable media attention, with coverage across most national English and Hindi dailies. They also fed into the larger communications strategy by helping to develop clear and targeted messaging—a key requirement to increase public awareness on air pollution.

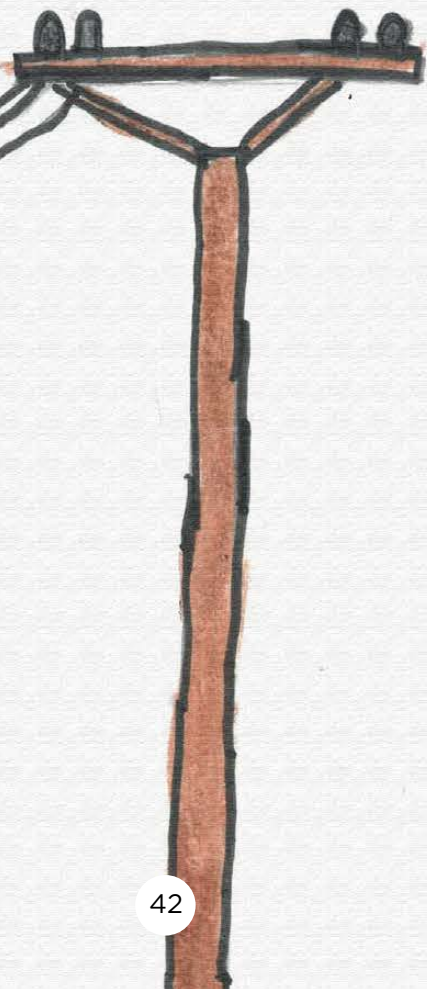
Addressing the divergence between petrol and diesel prices

There continues to be a difference between the prices of diesel and petrol due to the differential rates of taxes levied on them, resulting in diesel being a cheaper fuel. This has inclined consumer preference towards diesel vehicles, which are excessively polluting as compared to petrol vehicles. In 2017, Shakti supported a study to assess the impact of rationalizing taxes on diesel and petrol on central and state government finances and on stakeholder groups like truck freight, farmers, car manufacturers, bus operators and passengers. The study found that this move would not pose a major cost hurdle to any group of stakeholders. Rather, it will help eliminate some perverse incentives. It builds upon an earlier Shakti-supported report on the macroeconomic implications of the diesel subsidy.

Getting to more stringent standards for thermal power plants

Thermal power plants contribute significantly to emissions in India and can lead to severe health and environmental impacts. In cognizance of this, the Ministry of Environment, Forest and Climate Change released emission standards for thermal power plants, which aim to reduce particulate matter, SO₂ and NO_x emissions as well as water use. While the standards are a welcome step, they need to be effectively enforced in order to see results. Shakti supported a comprehensive cost-benefit analysis of the emission standards, which has assessed the cost of compliance to the standards as well as the benefits in terms of avoided human impacts. This analysis has advanced the case for implementing more stringent emission standards. Shakti is also convening stakeholders in few Indian states to help generate perspective on the implementation of the standards.

CLIMATE & BUSINESS



With the Paris Agreement underway, businesses can play a key role in enabling India to achieve its climate goals. As a major source of GHG emissions, businesses can help deliver emissions reductions at scale. More and more Indian businesses are harnessing climate action as a driver of innovation, operational effectiveness, risk management and growth. But for lasting impact, it is necessary to enhance the speed and scale of this transition. At the same time, corporate action needs to be reinforced by sound policy interventions. This is why Shakti is working to catalyze business leadership in order to drive the transition to a low-carbon economy.

CEO Forum on Air Quality

Shakti supports a high-level CEO forum bringing together India's leading corporate groups to leverage high-level engagement and action in support of India's ambient air quality goals. To facilitate decision making, the forum has released the CEO Communique, which outlines specific recommendations, policy asks and voluntary commitments that businesses can make to achieve the vision of "Clean Air for All". The Communique underscores the importance of concrete actions aimed at building capacity within existing set-ups, driving



voluntary business action and collaborating across segments to build air action plans as well as mainstream control measures. These efforts are an important step ahead by businesses to respond to the air pollution challenge.

Helping businesses track and measure GHG emissions

The need for India's corporate sector to play a greater and more proactive role in addressing climate change has never been more critical. An increasing number of businesses operating in India are emphasizing good governance and recognizing the incentives of sustainable

business practices. To support this process, the Shakti-supported India GHG Program is helping businesses track and manage their GHG emissions. The program provides businesses with the wherewithal and technical know-how to measure their emissions, identify reduction opportunities, and establish short and long-term voluntary emission reduction goals.

So far, the India GHG Program has garnered the voluntary participation of roughly 50 businesses that collectively contribute to about 15% of India's total GHG emissions each year. With support from the Program, a majority of these businesses are now tracking and compiling their GHG inventories on a regular basis. Businesses that have signed up include the National Thermal Power Corporation Limited, Indian Railways, Godrej & Boyce Manufacturing Company Limited, Ambuja Cements Limited, Ford India Private Limited, Mahindra Sanyo Special Steel Private Limited, Infosys, ITC Limited, Jet Airways and ACC Limited.

Green Power Market Development Group

The Green Power Market Development Group (<https://gpmdg.org/>) works with large commercial and industrial energy consumers in India to rapidly scale up the use of renewable energy in the overall energy consumption. It promotes this goal by sharing best practices and engaging with government, technology providers and financiers to develop a stronger business case for diversifying the energy mix with clean energy. The group has formally established chapters in Karnataka, Tamil Nadu, Telangana, Maharashtra, and more recently the NCR. Last year, it facilitated a large-scale solar power procurement by the Kempegowda International Airport in Bengaluru.

CLEAN ENERGY FINANCE



One of the key imperatives for India is to mobilize high financial flows to meet its global climate commitments. It is estimated that USD 2.5 trillion is required for the implementation of the Nationally Determined Contributions up to 2030. Leveraging private finance along with public finance, both international and national, will be critical. While investment in clean energy is growing, the scale of investment does not yet match the capital needed. Shakti Sustainable Energy Foundation works to enhance the investment required for meeting India's clean energy targets as well as to find solutions for catalyzing clean investment instruments.

Scaling up finance for green infrastructure - India Innovation Lab

The India Innovation Lab for Green Finance is providing solutions to the financing challenges to investment in green infrastructure. Since its inception, the Lab has launched ideas that can be replicated and scaled up quickly, by driving more private finance and also by leveraging public finance.

In 2017, the Lab selected three new investment ideas:

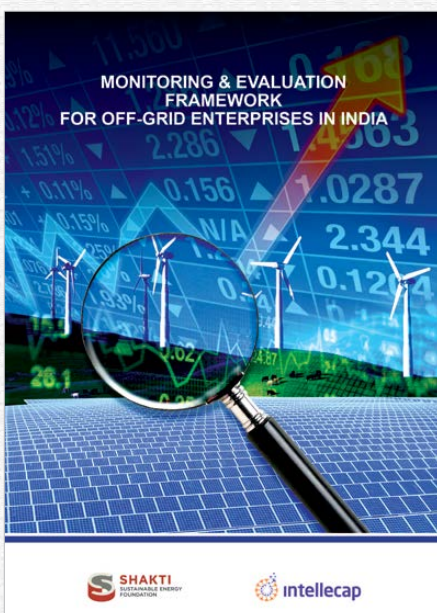
- **The Residential Rooftop Solar Accelerator** aims to increase residential rooftop solar power in India by leasing solar rooftop systems to households that do not have the required credit history to purchase them, and by leveraging data and technology to achieve scale and lower customer acquisition costs.
- **Financing for Low-Carbon Auto Rickshaws** aims to increase sustainable transit in India, by financing asset loans for low carbon and electric auto-rickshaw drivers that leverage financial and digital technologies, such as real time information and payment systems.
- **The Long-Term Debt Facility for Traction Batteries** aims to reduce the ownership cost of electric buses in India, by generating additional revenue from repurposing traction batteries as energy storage batteries after the end of the traction period, which would maximize the use of the battery for another 5-10 years

Now the Lab is taking these instruments forward for further refining and development.

Catalyzing Finance for Clean Energy Access in India

Decentralized Renewable Energy (DRE) enterprises have the potential to bridge India's energy gap. But they often face challenges in accessing finance due to high-risk perception and longer paybacks. To address this challenge, Shakti commissioned the development of a multi-pronged programme aimed at driving investments in the DRE sector.

As a part of these efforts, 2017 saw the launch of the Decentralized Renewable Energy Evaluation and Monitoring (DREEM) tool, an online evaluation platform (www.dreemtool.com) relevant for both enterprises and financial institutions. Access to capital is important for DRE enterprises to achieve scale, but due to risk perceptions and other challenges, mainstream finance for DRE is yet to take off. The DREEM tool is an important step towards unlocking finance for DRE. With this information, stakeholders can track the performance of DRE enterprises and make informed investment decisions. In addition, a robust alternate financing solution has been designed to help support the inflow of foreign sources of capital for DRE enterprises as well as seal the gaps in the prevailing scenario.



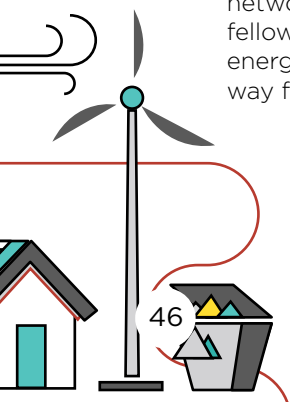
The CLEAN ENERGY LAB



An active and vibrant civil society is essential for balanced and sustainable change. The clean energy and climate change sectors are underrepresented in civil society in India. In order to foster the establishment of new civil society organizations in these sectors, Shakti and The Indian School of Business (ISB) have joined hands to launch the Clean Energy Lab, India's first incubation program for early stage civil society organizations (CSOs) in clean energy and climate.

In 2018, Clean Energy Lab is incubating five Fellows with exceptional ideas to work across various clean energy themes. The Fellows were chosen from a large pool of applications working in the areas of renewable energy, climate change and energy efficiency, after a rigorous selection process, which concluded in late 2017.

Early this year, the fellows began a year-long incubation program consisting of mentorship with domain and technical experts, capacity building and training as well as opportunities to network and partner with potential collaborators. This suite of resources is designed to help the fellows refine their ideas and get them off the ground. It is also intended to broaden the clean energy ecosystem to help turn more big ideas into real-world solutions. With this support, the way forward for the Fellows and their start ups becomes more concrete.



The Shakti Dialogues 2018

Recognizing the importance of open dialogue to share ideas, formulate solutions and foster cooperation around these developments, Shakti Sustainable Energy Foundation has been convening the Shakti Dialogues, bringing together policymakers, academics, industry, non-profits and thought leaders across the energy landscape. The fourth annual Shakti Dialogues 2018, held from Feb 26-28th 2018, delivered rich perspectives on the critical transitions underway in India's clean energy sector.

Drawing from insights gained from Shakti's on-going programme work and from emerging priorities and developments in the country, the Dialogues focused on six critical themes:

- Framing a national vision on electric mobility
- Catalyzing financing frameworks for clean energy
- Addressing air quality challenges in a rapidly urbanizing India
- Integrating energy efficiency in the national affordable housing programme
- Driving reforms in the power sector
- Engaging business leadership in climate mitigation

India needs to adopt a pathway for charging infrastructure adoption. This could begin with clarifying the standards to be adopted

Air pollution is a nationwide problem. There is a need to advance policy action beyond Delhi

It is necessary to improve the data regime and granularity across the power sector value chain, e.g., collate data for energy demand including captives, generation, transmission and distribution

One of the principal issues in businesses addressing climate change is that businesses do not know if their efforts are adequate

There is a need for standards that universalize the definition of "green finance" across various lending and investing communities. These standards should seek to find mechanisms that incentivise green finance and reward those who opt for raising finance for clean energy infrastructure over conventional infrastructure

A clear definition of energy efficient material is an immediate requirement of the sector. An inclusive method for defining green materials should be developed, one that encompasses various facets of energy resource efficiency



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