Alliance for an Energy Efficient Economy

India's Energy Efficiency Landscape

A Compilation of Policies, Priorities and Potential

April 2021

India's Energy Efficiency Landscape

A Compilation of Policies, Priorities & Potential

April 2021

Suggested citation: Natarajan Bhaskar, Kumar Satish, Rajah Varun, Cherail Koshy. 2021. State of Energy Efficiency in India- A compilation of Policies, Priorities and Potential, Alliance for an Energy Efficient Economy, New Delhi.

Disclaimer: All the information in this report has been put together by the AEEE team from public sources, reports of various institutions, and correspondence with different government ministries and departments, multilateral and bilateral agencies. All references are given where taken from public sources. AEEE does not claim that this report is a complete and exhaustive list of the various ongoing and completed initiatives on energy efficiency in the Indian context. The views expressed in this report are those of the authors and do not necessarily reflect the views and policies of AEEE.

Organization: Alliance for an Energy Efficient Economy (AEEE), is one of the leading organizations in India that works on creating awareness about energy efficiency as a resource. It is a policy advocacy and energy efficiency market enabler with a not-for-profit motive. We advocate for data-driven and evidence-based energy efficiency policies and research.

We foster a culture of energy efficiency in India, working with industry, government and civil society organizations. AEEE advocates for Thermal Comfort for All, and a Lean-Mean-Green philosophy to design and construct net-zero energy-water-waste built environments, Sustainable Transportation and robust Energy Data Framework for better policy-making and implementation, to build a culture of energy efficiency in India. We are committed to achieve India's energy transition for a climate-resilient and energy secure future and meet India's commitments to the 2030 nationally determined goals (NDC) and UN sustainable development goals (SDG).

Foreword by DG, BEE

Shri Abhay Bakre
Director General, Bureau of Energy Efficiency
Ministry of Power, Government of India

India has set for itself a target for reduction of emission intensities by 33-35% by 2030 below 2005 levels. Several actions have been taken on all fronts and it is reported that India is well on its way to achieving these targets.

Energy efficiency is one among the key strategies for achieving the emission reduction targets. The Bureau of Energy Efficiency is the statutory body, set up under the Energy Conservation Act, 2001, to coordinate all actions for energy efficiency and launch national level programs to increase energy efficiency across all sectors of the Indian economy.

Over the last two decades the BEE has launched several impactful programs that has resulted in consumer benefiting from reduced energy bills arising out of these programs. The Standards & Labelling program for electrical appliances and the Perform Achieve and Trade programs for Energy Intensive Industries have contributed the largest share to reduce the Energy Intensity of the Indian economy.

BEE frames policies and regulations on Energy Efficiency in consultation with various stakeholders/NGOs and civil society organisations so as to ensure the consumers participation in govt. machineries.

The Alliance for an Energy Efficient Economy, which was established under one of the bilateral energy efficiency cooperation programs, over 10 years ago, has worked with industry, research institutions and financing institutions to put forth their views on the design and implementation of BEE's flagship programs.

AEEE's efforts to bring out a national level report on the 'India's Energy Efficiency Landscape- A Compilation of Policies, Priorities and Potential' documenting efforts of various government agencies, international institutions, is an important document that puts all information on energy efficiency in one document. This report has not only covered information from BEE's reports, but has also reached out to other government agencies such as NITI Aayog, DST, MoHUA, and others as well as international agencies such as World Bank, Asian Development Bank, UNIDO, SDC, Indo-German program among others.

This is a much-needed document and maybe disseminated widely among the stakeholders, receive feedback and try to make this an annual effort.

Abhay Bakre.

MARCH 5, 2021

(ABHAY BAKRE)

Foreword

by Dr. Winfried Damm, Cluster Coordinator Indo-German Energy Program

"Energy Efficiency first" acknowledges that the most important source of energy is energy efficiency. It was and will be the most cost-effective way of saving money for consumers and to reduce greenhouse gas emissions. Reducing greenhouse gas emissions does not mean to compromise on economic growth. Germany has successfully shown that energy consumption could be substantially decoupled from economic growth. Its economy continues to grow despite reduction in total energy consumption.

Germany´s official energy efficiency target is set. By 2050, Germany is to cut its primary energy consumption by 50% compared to 2008. Therefore, all parts of society must be encouraged to use energy more efficiently – whether it is municipalities, businesses or consumers. So far more than 200 new energy efficiency networks have already been formed, bringing together industry, trade and skilled crafts. Now, inefficient fossil fuel powered heating systems have to be replaced and building insolation has to be improved. The transport sector has to become almost fully electric and heavy industry has to be decarbonised. Great challenges not too different from the challenges faced here in India.

In India, we look back to great joint achievements and both our Governments are constantly in dialogue to identify new areas of collaboration with the aim to improve the energy supply for millions of Indians and to sustain cost effective and sustainable economic growth for our nations. GIZ on behalf of the Government of Germany is grateful for the trust put into our work so far by the Government of India and especially the Bureau of Energy Efficiency. Both countries have and will further profit from this close relationship. Many tasks are still waiting for us. With India's electricity demand expected to grow annually by approx. 4% over the course of the next decade, and with the peak demand expected to grow even faster with approx. 7% annually, it is clear that energy efficiency and demand shift will play a crucial role to assure a cost effective energy system for India. Municipalities and states will have to develop their own Energy Efficiency Action Plans with specific targets, for example regarding energy efficient cooling. New standards for energy efficient buildings and building materials such as steel, cement and bricks are being worked on. The steel industry may have to make use of hydrogen to produce green steel for export to Europe, when it starts its massive green procurement programs.

We strongly believe that existing international expertise has to be combined with Indian genuity and creativity to develop India specific, and very cost-effective, solutions to be adapted by millions. Therefore, we believe in international energy efficiency cooperation and appreciate the involvement of the many multilateral and bilateral technical and political organisations as well as financial institutions. We specifically thank AEEE and their members for the continuous effort to bring relevant stakeholders together. This document nicely lists the important energy efficiency activities in India, but also brings together organisations who believe in the principle of „Energy Efficiency first". It shall be of guidance to all who want to join this global energy efficiency alliance.

Dr. Winfried Damm
Cluster Coordinator, IGEN
winfried.damm@giz.de

Message, Chairperson, AEEE

The Alliance for an Energy Efficient Economy was established under a bilateral program to advance energy efficiency in India, over a decade ago. During this period, AEEE has been able to carve out a niche space for energy efficiency initiatives in India with activities ranging from EE in the built environment, thermal comfort for all, smart mobility initiatives, state actions and in the sphere of industrial energy efficiency.

AEEE has also drawn the interest of several large efficiency companies who are AEEE's core members as well as a wide spectrum of educational and research institutions, as well as smaller industries.

Over the years, AEEE has continuously attempted to foster a culture of energy efficiency in India through its policy advocacy, business enablement, and knowledge products. In the recent years, AEEE has joined forces with major foundations, bilateral and multilateral agencies, and peer organizations that have helped AEEE establish itself as a credible and effective platform in the field of energy efficiency in India.

AEEE is a convening platform bringing key energy stakeholders – industry, government, civil society, and professionals together to engage in a constructive dialogue to influence effective and impactful policies and build a robust ecosystem for effective implementation. This includes innovation in business models and easy access to financing that will lead to market transformation for energy efficiency technologies.

With a mission of 'transitioning to a resilient and energy secure future', AEEE is well on its way to playing a key role in India's transition to achieve the INDC targets.

The report is a one place for getting all information on energy efficiency from government ministries, departments, international agencies, bilateral and multilateral agencies. AEEE wishes to bring out updates of this report for use and review by all stakeholders in the energy efficiency space in India and globally.

AEEE would be happy to receive feedback on how this report can be made to add value to the EE stakeholder community.

Upendra Bhatt
Chairperson, AEEE

Acknowledgements President, AEEE

Alliance for an Energy Efficient Economy (AEEE), is one of the leading organizations in India that works on creating awareness about energy efficiency as a resource. It is a policy advocacy and energy efficiency market enabler with a not-for-profit motive. We advocate for data-driven and evidence-based energy efficiency policies and research.

We foster a culture of energy efficiency in India, working with industry, government and civil society organizations. AEEE advocates for Thermal Comfort for All, and a Lean-Mean-Green philosophy to design and construct net-zero energy-water-waste built environments, Sustainable Transportation and robust Energy Data Framework for better policy-making and implementation, to build a culture of energy efficiency in India. We are committed to achieve India's energy transition for a climate-resilient and energy secure future and meet India's commitments to the 2030 nationally determined goals (NDC) and UN sustainable development goals (SDG).

AEEE has received support from international philanthropies such as MacArthur Foundation, Oak Foundation, Shakti Sustainable Energy Foundation, to mention a few. AEEE has also partnered with key government ministries such as Ministry of Environment, Forests &n Climate Change, Department of Science & Technology, Ministry of Housing and Urban Affairs, and others to accelerate the path to adoption of energy efficiency and cleaner technologies to meet the goals of the Paris agreement.

This report is being brought out to put together all the information on energy efficiency carried out by various government departments, Bureau of Energy Efficiency and some key government agencies such as EESL. It is hoped that this report would be a good reference document for researchers and practitioners as well as officials in the government and NGO communities.

AEEE plans to expand the coverage of this report in the subsequent editions to possibly include state level actions, philanthropies and others.

AEEE wishes to acknowledge the assistance given by the Bureau of Energy Efficiency, EESL, the various government departments, ministries, as well as international agencies such as GIZ, UNIDO, BHC, GEF, USAID among others. Without their active support, this report would not have been possible. All information have been referenced and readers are requested to contact AEEE with updated information, that they come across.

Dr. Bhaskar Natarajan, Senior Advisor, has led the efforts in putting together this report, along with assistance from Varun Rajah and Dr Koshy Cherail, as well as the communications team at AEEE comprising Nitin Kesar, Sanjay Chaurasia and others in AEEE.

Happy referencing!

Dr. Satish Kumar
President & Executive Director

Dr. Satish Kumar
President & Executive Director

Table of Contents

List of acronyms

ADB	Asian Development Bank
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
BEE	Bureau of Energy Efficiency
BU	Billion Units
CAFÉ	Corporate Average Fuel Efficiency
DC	Designated Consumer
EC	Energy Conservation
ECBC	Energy Conservation Building Code
EE	Energy Efficiency
EEFP	Energy Efficiency Financing Platform
EESL	Energy Efficiency Services Limited
ERC	Electricity Regulatory Commission
ESCerts	Energy Savings Certificates
FEEED	Framework for Energy Efficient Economic Development
FY	Financial Year
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GW	Giga Watt
HCFC	Hydrochlorofluorocarbons
HPMP	Hydrochlorofluorocarbons Phase-out Management Plan
IGCC	Integrated Gasification Combined Cycle
MNRE	Ministry of New and Renewable Energy
MoEFCC	Ministry of Environment, Forest and Climate Change
MoHUA	Ministry of Housing and Urban Affairs
MoP	Ministry of Power
MTEE	Market Transformation for Energy Efficiency
MT	Million tonnes
Mtoe	Million tonnes oil equivalent
NAPCC	National Action Plan on Climate Change
NMEEE	National Mission for Enhanced Energy Efficiency
NMSH	National Mission on Sustainable Habitat
ODS	Ozone Depleting Substances
PAT	Perform, Achieve, & Trade
R&D	Research and development
RE	Renewable Energy
RPO	Renewable Purchase Obligation
S&L	Standards and Labelling
SDA	State Designated Agency
SDG	Sustainable Development Goals
SEC	Specific Energy Consumption
ULBs	Urban Local Bodies
UNIDO	United Nations Industrial Development Organization
USD	United States Dollar
UT	Union Territory
WB	World Bank

01 Energy Efficiency in the Context of India's Growth Strategy and International Commitments

India has made a number of international commitments on reducing the emission intensity of its Gross Domestic Product (GDP). While these are not binding, India has taken major initiatives to achieve the reductions to which it has committed, keeping in mind the overall impact on the Indian economy. Energy efficiency (EE) will play a crucial role in enabling India to achieve the targeted reduction in emissions intensity.

As of 2019, India had the fifth largest economy in the world, and it aspires to have the third largest by 2025.

1.1 The Beginnings of Energy Efficiency in India

As of 2019, India had the fifth largest economy in the world, and it aspires to have the third largest by 2025. The Economic Survey 2019-20 has attempted to craft a framework of policies to foster wealth creation in India. This is particularly critical at this stage, as India aspires to become a United States Dollar (USD) 5 trillion economy by 2025, an ambitious vision that should create wealth that extends to the lowest socioeconomic groups. India will continue on the path towards the USD 5 trillion economy, while simultaneously ensuring that impacts on the environment are limited, in line with the various international agreements to which India is a signatory.

Globally, long before renewable energy (RE) took centre stage, energy efficiency was considered a key strategy for reducing energy demand while maintaining economic growth. Developed countries implemented legislation, regulations, and minimum efficiency standards starting from the eighties and drew significant benefits from these policies.

India took similar steps, prompted by the oil shock in the seventies, setting up an Advisor, Energy Conservation at the highest level of government, followed by the launching of energy audits by the National Productivity Council. The Petroleum Conservation Research Association was set up in 1978 to develop programmes to conserve oil and related products. The Advisory Board on Energy was set up in 1983 to provide recommendations on the technical, financial, and institutional aspects of energy; it also made detailed projections of energy demand in different regions up through 2004, under different macro-economic scenarios. The Energy Management Centre was established under the Ministry of Power in the late eighties. The Energy Conservation Act, 2001 (EC Act) was passed, and the Bureau of Energy Efficiency became the statutory agency for energy conservation and efficiency in the country.

There are certain key drivers for the Indian economy in moving forward with energy efficiency. These include achieving the Sustainable Development Goals (SDGs), taking actions to reduce the impact of climate change in the growth process, and meeting the economic growth aspirations of the nation and the population. Climate change is inextricably linked to energy efficiency, as improvements in energy efficiency have a positive impact on climate change mitigation. India's major commitments related to sustainable development and climate change are briefly described below.

SDGs: India is a signatory to the SDGs, which were adopted by all United Nations members in 2015 as a universal call to action to end poverty, protect the planet, and ensure that all people enjoy peace and prosperity by 2030. India is committed to achieving the 17 SDGs and the 169 associated targets, which comprehensively cover the social, economic, and environmental dimensions of development and focus on ending poverty in all its forms and dimensions. At the central government level, the National Institution for Transforming India (NITI Aayog) has been assigned the role of overseeing the achievement of the SDGs in India. While countries around the world have been considering how to implement and measure success against the SDGs, NITI Aayog has taken the lead by developing the SDG India Index – Baseline Report 2018 and showing how progress towards the SDGs will be measured in India. The baseline report comprehensively documents the progress made by Indian states and Union Territories (UTs) towards meeting the 2030 SDG targets .[1]

1 https://niti.gov.in/sdg-india-index

Paris Agreement on Climate Change:

This is one of the most difficult challenges facing the world today, and its resolution requires concerted global action by all countries. EE-related actions, which could translate to Greenhouse Gas (GHG) reduction, are critical to addressing climate change. GHG reduction, which is typically quantified based on reduction in Carbon Dioxide (CO_2) or the carbon footprint of an industry, project, or building, is crucial at the local, state, and national levels. India has been working with other large economies to proactively adopt policies and programmes that reduce GHG emissions.

The Paris Agreement of 2015 defines the long-term goal of keeping the increase in global average temperature well below 2° Celsius (C) above pre-industrial levels, limiting the increase to 1.5°C, as this would substantially reduce the risks and effects of climate change. As of March 2019, 189 out of 197 countries have ratified the Convention[2], committing to protecting their people and nations from the negative impacts of climate change (through mitigation and adaptation measures). Each country must determine, plan, and regularly report on the actions/programmes that it undertakes to mitigate global warming. There is no mechanism that forces a country to set a specific target by a specific date. However, it is essential that each target goes beyond previously set targets.

India is faced with the challenge of sustaining its rapid economic growth while dealing with the global threat of climate change. The threat emanates from accumulated GHG emissions in the atmosphere generated through long-term and intensive industrial growth and high-consumption lifestyles in developed countries. While engaging with the international community to collectively and cooperatively deal with this threat, India has to have a national strategy, first to adapt to climate change, and, second, to further enhance the environmental sustainability of India's economic development.

Montreal Protocol:

Among the other international conventions, the Montreal Protocol on Substances that Deplete the Ozone Layer is an international treaty focused on the protection of the ozone layer. India became party to the Montreal Protocol in June 1992. Actions under this treaty have led to the global phase-out of production and consumption of several major Ozone Depleting Substances (ODSs), starting in January 2010. The Montreal Protocol has not only contributed to protecting the ozone layer, but has also reduced GHG emissions by about 11 Gigatonnes (Gt) CO_2 equivalent per year through its ODS phase-out activities so far. The Ozone Cell, in the Ministry of Environment, Forest and Climate Change (MoEFCC), in association with the implementing agencies, is currently engaged in the Hydrochlorofluorocarbons (HCFC) Phase-out Management Plan (HPMP), which has major impacts on the refrigeration and air-conditioning (AC) servicing sector[3].

2 https://unfccc.int/process/the-paris-agreement/status-of-ratification

3 http://www.ozonecell.com/viewsection.jsp?lang=0&id=0,1

1.2 National Action Plan on Climate Change

The National Action Plan on Climate Change (NAPCC) was prepared by the Prime Minister's Council on Climate Change in 2008, keeping in mind India's need to tap its natural resources without disturbing with the ecological balance. The Action Plan presents a unique approach to reducing the stress of climate change, using the poverty-growth linkage as the critical link to addressing the challenge. These national measures could be accelerated with assistance from developed countries and potentially enable India to achieve its targets earlier. India has pledged that per capita GHG emissions "will at no point exceed that of developed countries, even as we pursue our development objectives". India has committed itself to reduce the emission intensity of its GDP by 33 to 35% from 2005 level.

1.2.1 Guiding Principles

Climate change is manifesting itself more severely through its impact on the poor and marginalised sections of the population. Hence, the response has to address these issues on a priority basis, through the following:

- Inclusive and sustainable development strategy to protect the poor
- Qualitative change in the methods through which the national growth objectives are achieved, by, among others, enhancing environmental sustainability to mitigate the impact
- Cost-effective strategies for end-use demand-side management (end-use efficiency)
- Deployment of appropriate technologies for extensive and accelerated climate change adaptation and GHG emission reduction
- Innovative market, regulatory, and voluntary mechanisms to promote sustainable development
- Implementation through linkages with civil society, local governments, and public-private partnerships
- International cooperation, transfer of technology, and funding

1.2.2 Significant Features and Initiatives

The uniqueness of the NAPCC lies in the fact that there is a major focus on unified and coordinated planning and implementation. Until the adoption of the NAPCC, each Ministry set its own priorities and actions supporting climate change mitigation and adaptation, which were disparate and uncoordinated. The Prime Minister's Council on Climate Change is in charge of the NAPCC and provides oversight for the Ministries with lead responsibility for each Mission to develop objectives, implementation strategies, timelines, and monitoring and evaluation criteria. The Council will also be responsible for periodically reviewing and reporting on each Mission's progress. Progress will be quantified through appropriate indicators and methodologies, which will assess both avoided emissions and adaptation benefits. Three areas of significance are:

Power Generation: Aligning with the global objective to reduce CO_2 emissions from the burning of low calorific value coal, the Indian government is mandating the retirement of inefficient coal-fired power plants and supporting research and development (R&D) on coal gasification through the Integrated Gasification Combined Cycle (IGCC), wherein coal is gasified to produce electricity, along with other supercritical technologies.

Renewable Energy: Under the Electricity Act 2003 and the National Tariff Policy 2006, the Central and State Electricity Regulatory Commissions (ERCs) are required to purchase a certain percentage of grid-based power from renewable sources, known as the Renewable Purchase Obligation (RPO). This has created a greater demand for renewable energy-based power and has been a factor in bringing about parity in the cost of RE power with that of conventional power.

Energy Efficiency: Under the EC Act, and the strengthening of the Act through the Amendments in 2010, the Perform, Achieve, & Trade (PAT) scheme has gained momentum. The large energy consuming industries – Designated Consumers (DCs) – are required to undertake energy audits to identify potential areas for energy savings and work towards achieving the targets set under PAT. The trading of Energy Savings Certificates rewards companies that exceed their energy saving targets and allows under-performing companies to compensate for failing to meet their targets. This is akin to the Clean Development Mechanism, wherein carbon credits earned in developing countries are sold to entities in developed countries. Similarly, the appliance labelling programme is expected to play a major role in limiting an increase in national energy demand, keeping the demand relatively low despite growth in the stock of equipment and demand for appliances such as lights, fans, air-conditioners, and other appliances used in the residential and commercial sectors.

Under the NAPCC, eight National Missions were established and incorporated into the national plans and development objectives; these missions not only espouse the principles of the NAPCC but will also form the core of the overall national missions. Of the eight missions, two focusing overall or in part on EE were established—National Mission for Enhanced Energy Efficiency and National Mission on Sustainable Habitat—and are described below.

Owing to the various energy efficiency measures taken so far, India's energy intensity decreased from 65.5 toe per INR crore (2011-12) to 55.5 toe per INR crore (2018-19), a reduction of 15%. This will have direct impact on reduction of emissions intensity which is aimed at 33-35% reduction by 2030 under Paris commitment. Energy efficiency will contribute in achieving upto 56% of this target.

The National Mission for Enhanced Energy Efficiency (NMEEE)

NMEEE aims to look at ways to create market-based mechanisms to enhance the cost effectiveness of improvements in energy efficiency. Switching to cleaner fuels, making commercially viable technology transfers, strengthening capacity building, etc. is the way forward for this mission. The Bureau of Energy Efficiency (BEE) is responsible for coordinating all actions related to this mission.

The Ministry of Power had provided for grant-in-aid of Rs. 100 crores for the years 2019-20 and 2020-21. In addition, the BEE generates funds from the labelling programmes through labelling fees and has additional funding from bilateral cooperation programmes. The mission's scope, impact, and finances are detailed below.

National Mission for Enhanced Energy Efficiency			
Nodal Agency	**Scope**	**Results (as of 2019-20)[4]**	**Finance**
Bureau of Energy Efficiency, Ministry of Power	Promote EE using various approaches and incentives, in the context of providing an increasing amount of energy to meet the demands of a growing population	Total energy savings: 28.06 Mtoe (2019-20); monetary savings: INR 115,702 crores; CO_2 emissions reduction: 177.6 MT annually. During the years 2011-12 to 2018-19, India's energy intensity decreased from 65.5 toe per INR crore to 55.5 toe per INR crore	Ministry of Power grant-in-aid of Rs. 100 crores for the years 2019-20 and 2020-21.[5] In addition, BEE generates funds from their labelling programmes through labelling fees and has additional funding from bilateral cooperation programmes.

4 Impact of Energy Efficiency Measures for the year 2019-20, BEE, March 2021

5 MINISTRY OF POWER DEMANDS FOR GRANTS 2020-21

The National Mission on Sustainable Habitat (NMSH) aims to make cities sustainable through EE improvements in buildings, solid waste management, & a shift to public transport systems. This Mission will broadly cover the following aspects: extension of the energy conservation building code, which addresses the design of new and large commercial buildings to optimise their energy demand; better urban planning and a modal shift to public transport, developing long-term transport plans to facilitate the growth of medium and small cities to ensure efficient and convenient public transport; and recycling and urban waste management - a special area of focus will be the development of waste-to-energy technology. The nodal agency for implementing the National Mission on Sustainable Habitat is Ministry of Housing and Urban Affairs (MoHUA).

National Mission on Sustainable Habitat		
Nodal Agency	**Scope**	**Impact**
Ministry of Housing and Urban Affairs	Focus on reducing greenhouse gas (GHG) emissions by increasing EE in buildings, improving municipal solid waste management, and encouraging people to use public transport	Under Atal Mission for Rejuvenation and Urban Transformation (AMRUT), the government has replaced 74 lakh inefficient lights with Energy Efficient Lights.[6] EE measures in Urban Local Bodies (ULBs): Government energy audits conducted on water pumps in 384 cities & 11,629 pumps identified for replacement[7]

Although the government has not mentioned any specific initiatives under NMSH, the present Union Government's flagship AMRUT (previously Jawaharlal Nehru National Urban Renewal Mission), Swachh Bharat Mission (Urban), Smart Cities Mission, and Urban Transport Programme have covered the broad objectives of NMSH through sector-specific interventions.

India has accorded high priority to energy efficiency and has launched several programmes focused on this topic over the past two decades. The results are very encouraging, and the emphasis on efficiency will continue. The overall strategy is to have a combination of regulation and market enablers to push energy efficiency to the forefront.

The following chapters give details of the Indian governmental structure of EE programmes, as well as the regulations, guidelines and programmes and the impact of these programmes on overall energy savings in the country. This is followed by an examination of the various governmental programmes and the role of partnerships with bilateral and multilateral agencies in these programmes.

6 STANDING COMMITTEE ON URBAN DEVELOPMENT REPORT ON DEMANDS FOR GRANT MoHUA

7 STANDING COMMITTEE ON URBAN DEVELOPMENT REPORT ON DEMANDS FOR GRANT MoHUA

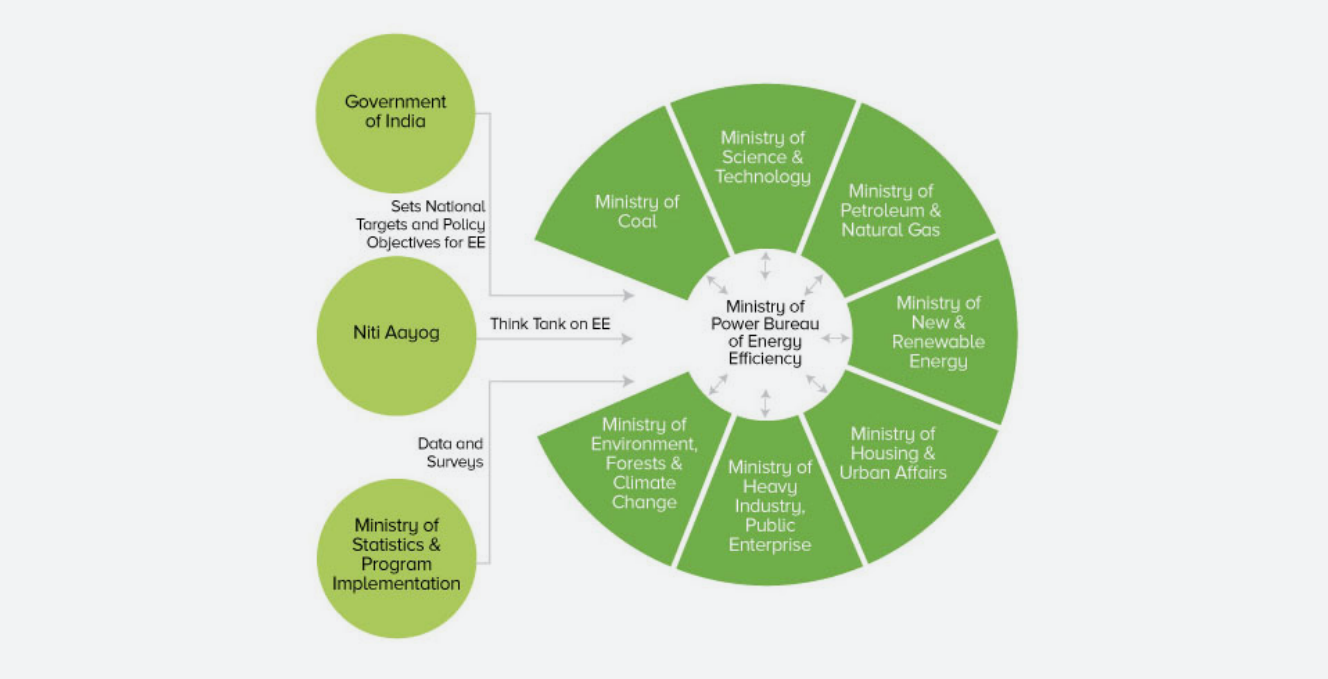

GOVERNMENT OF INDIA
MINISTRY OF POWER
सत्यमेव जयते
STATE
ENERGY EFFICIENCY
PREPAREDNESS
INDEX
2018
RAJ PAL
A.K. BHALLA

02 Indian Ministries' Energy Efficiency and Climate Change Initiatives

India enacted the Energy Conservation Act, 2001 to launch programs on energy efficiency and conservation in the country. The Bureau of Energy Efficiency was formed to regulate the various sections under the Act. The Ministry of Power is the nodal ministry responsible for energy efficiency in the country. In addition, various ministries such as industries, transport, agriculture, science & technology and others have identified programs that would move energy efficiency forward with funds from their budgets.

2.1 Central and State Level Agencies - Overview

In order to drive the NAPCC, the Government of India (GoI) has allotted budgets to various ministries to address the challenges of climate change and energy efficiency.



The endeavour of the NAPCC is to bring together the expertise and reach of each Ministry that has a role in the generation, distribution, and management of natural resources, such as energy in all its forms – electricity, coal, oil, and natural gas. Several public sector organisations fall within the purview of these ministries. These institutions have evolved and aligned their own growth, objectives, resources, and coverage to meet the NAPCC objectives.

Furthermore, through the Public Sector Undertakings (PSUs) of the Ministry of Power, the government can obtain significant additional amounts of funding to invest in clean energy and climate change mitigation programmes. For instance, India has played a significant role, along with France and the United Nations, in the formation of the International Solar Alliance (ISA).

2.2 Ministries of Power, Coal, Petroleum & Natural Gas, and New & Renewable Energy

The Ministry of Power (MoP) is responsible for developing and issuing directions on policy on the generation, transmission, distribution, and end-use of electricity.

This includes generation of electricity from coal, oil-based fuels, and water (hydropower). Nuclear power and renewable energy-based electricity generation come under the purview of their respective ministries. MoP is also responsible for the administration of legislation governing the electricity sector. MoP coordinates all matters concerning energy conservation and EE and has established the BEE as a statutory body for this purpose.

The Ministry of Petroleum & Natural Gas (MoP&NG) is responsible for matters related to the exploration and production of oil & natural gas and the refining, distribution and marketing, import, export, and conservation of petroleum products.

The Ministry of Coal (MoC) has the overall responsibility of developing policies and strategies related to the exploration and development of coal and lignite reserves in India.

The Ministry of New and Renewable Energy (MNRE) is the nodal GoI Ministry for all topics related to new and renewable energy. The overall objectives of the Ministry are to develop and deploy new and renewable energy to help meet the national energy requirement and increase the share of clean power at affordable costs. MNRE also aims to make the country a net foreign exchange earner in the sector and deploy indigenously developed technologies in the furtherance of national energy security.

In addition to the key energy ministries, GoI has also established the Department of Atomic Energy to coordinate all activities for the peaceful use of atomic energy, which includes building nuclear power stations.

2.3 Bureau of Energy Efficiency

Bureau of Energy Efficiency is a statutory body under the MoP, established under the provisions of the EC Act to promote EE and energy conservation. The BEE has been set up with the mission to develop EE policies and strategies, with a focus on self-regulation and market principles, and a primary objective of reducing the energy intensity of the Indian economy. It aims to achieve this through the active participation of all stakeholders, resulting in accelerated and sustained adoption of EE in all sectors. The BEE coordinates the financing, planning, and implementation of EE actions and programmes to reduce the carbon footprint of industries, buildings, and public and private sector facilities, enabling them to efficiently deliver services through adoption of EE technologies. A mapping of BEE programmes and schemes is given later in this section.

2.3.1 Objectives & Role

BEE's Objectives

- Provide a policy framework and direction regarding national energy conservation activities.
- Establish systems and procedures to measure, monitor, and verify EE improvements in individual sectors, as well as at the national level.
- Leverage multilateral, bilateral, and private sector support in the implementation of EE and energy conservation programmes and projects.
- Coordinate policies and programmes on EE and energy conservation with the involvement of all stakeholders.
- Plan, implement, and manage energy conservation programmes as envisaged in the Energy Conservation Act.
- Demonstrate EE delivery mechanisms, as envisaged in the EC Act, through public-private partnerships.

BEE's Role

BEE coordinates with SDAs, DCs (the energy intensive large industries), and other organisations working on energy efficiency and conservation. BEE implements its programmes by setting efficiency standards and recognising and utilising existing resources and infrastructure in performing its functions. The EC Act provides regulatory mandates for EE standards & labelling of equipment and appliances, energy conservation building codes (ECBCs) for commercial buildings, and energy consumption norms for energy intensive industries.

Promoting Energy Efficiency

The major promotional role of BEE includes:

- Creating awareness and disseminating information on energy efficiency and conservation
- Arranging and organising training of personnel and specialists on energy efficiency and conservation
- Strengthening consultancy services in the field of energy conservation
- Promoting research and development (R&D)
- Developing testing and certification procedures and promoting testing facilities
- Formulating and facilitating implementation of pilot projects and demonstration projects
- Promoting the use of energy efficient processes, equipment, devices, and systems
- Taking steps to encourage preferential treatment for the use of energy efficient equipment or appliances

- Promoting innovative financing mechanisms for EE projects
- Providing financial assistance to institutions for promoting energy efficiency and conservation.
- Preparing educational curriculums on energy efficiency and conservation
- Implementing international cooperation programmes on energy efficiency and conservation

2.3.2 NMEEE

As mentioned in Chapter 1, the MoP, through the BEE, is the nodal agency for implementing National Mission for Enhanced Energy Efficiency, one of the eight National Missions under the NAPCC. Strengthening the EE market through implementation of state-of-the-art initiatives is the basic aim of NMEEE. The focus of the NMEEE is on self-regulation and market principles, through the following four initiatives:

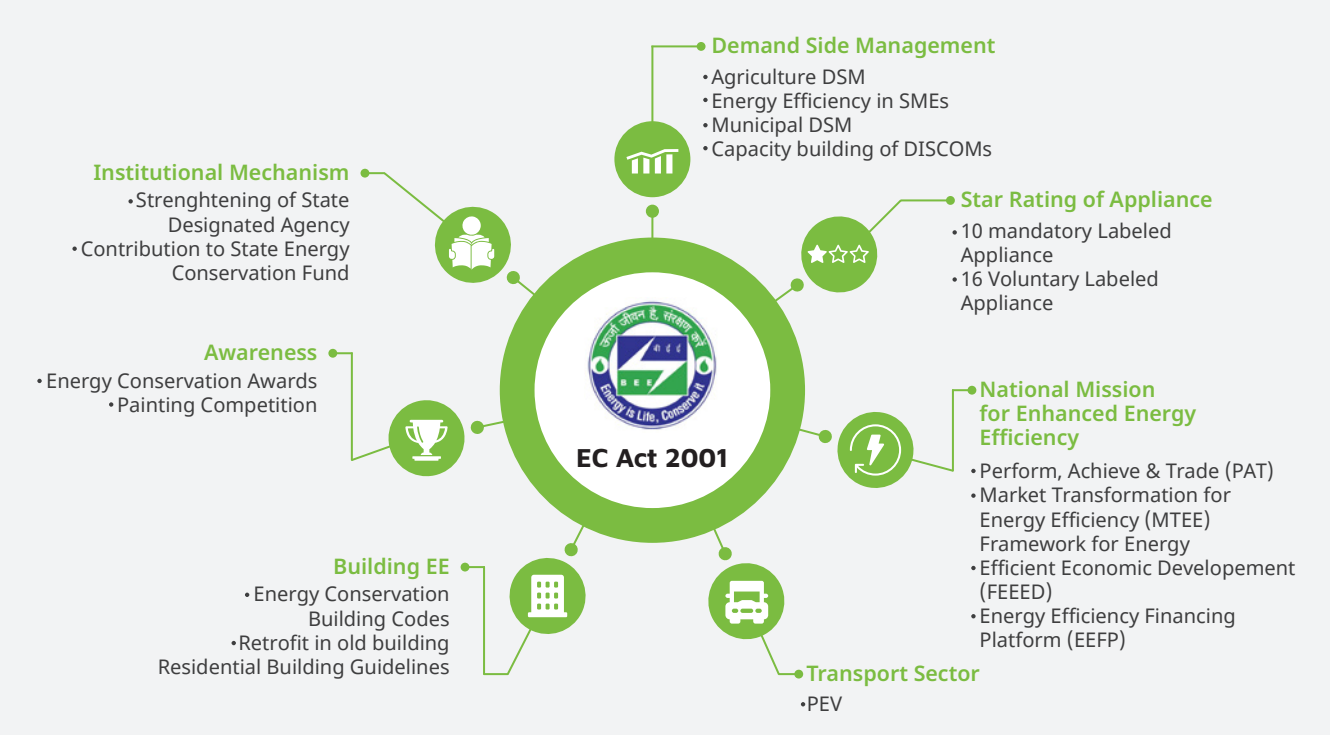
- Perform, Achieve and Trade (PAT) scheme – aimed at reduction of Specific Energy Consumption in energy intensive sectors.
- Market Transformation for Energy Efficiency (MTEE) – aiming to shift the market towards the use of energy efficient appliances
- Energy Efficiency Financing Platform (EEFP) –a platform for the capacity building of financial institutions and other stakeholders
- Framework for Energy Efficient Economic Development (FEEED) – developing fiscal instruments to leverage finance for EE projects.

BEE has been taking numerous steps in energy conservation through various flagship programmes in the areas of industries, appliances, buildings, transport, agriculture, and demand side management in order to fulfil the goals committed to in the Nationally Determined Contributions (NDCs) and foster long term sustainable development. The NDC goals are in line with the commitment made to the UNFCCC to work towards limiting temperature rise to less than 0.5o Celsius.

Strengthening the EE market through implementation of state-of-the-art initiatives is the basic aim of NMEEE.

2.3.3 Programmes and Schemes

The ongoing schemes of the BEE, as described in the BEE Annual Report, are detailed below.



demand reduction of over 15 GW in a year. This will be equivalent to expenditure savings of INR 35,000 crore and 250 million tonnes of CO_2 emission reduction.

Post its launch of ECBC in 2017, the code has been revised twice in April 2018 and November 2019 based on market feedback and technical committee approval. Also, to strengthen and regulate implementation of ECBC, guidelines for its enforcement and implementation was developed by BEE which was notified and published in the official gazette of India as ECBC Rules, 2018.

2.3.3.1 Energy Efficiency in Buildings

Given that the growth rate in the commercial building sector is amongst the highest across all consumer categories, BEE introduced the ECBC to set standards for energy consumption in new buildings. ECBC defines norms of energy performance for various building components, taking the climatic region into consideration. The emphasis has been on developing a standardised enforcement model for uniform implementation throughout the country.

To improve EE in the commercial building sector, the ECBC was updated in 2017 and sets minimum energy standards for new commercial buildings having a connected load of 100 kilowatts (kW) or contract demand of 120 kilo-volt-amperes (kVA) or more. ECBC 2017 is forward-looking, pragmatic, and easy to implement. ECBC 2017 has three levels of compliance: ECBC, ECBC+, and Super ECBC. The two additional levels have been defined to recognise buildings that exceed the basic ECBC standards.

Adoption of ECBC 2017 for new commercial building construction in India is estimated to lead to a 50% reduction in energy use by 2030 which would translate to energy savings of about 300 Billion Units and peak

Under the EC Act, the power to implement and enforce ECBC lies with the states, ULBs, and municipal bodies. To enable uniform implementation throughout the country, BEE has established ECBC cells in 35 states and UTs, and 80 identified professionals are working with the state teams to take ECBC forward. Under a pilot demonstration of ECBC buildings, over 100 buildings of different categories were supported to showcase ECBC compliance across the country. As of March 2020, 54 buildings are declared as ECBC compliant, 264 existing buildings have adopted BEE star ratings[8] and 15 States and 2 UTs have already notified ECBC.[9] A total of 75 buildings are at various stages of design and approval covering 1.89 million sq.m, while 54 buildings with an area of 1.63 million sq.m have already been completed. The total energy (electrical) saved under ECBC programme is 0.116 BU and total reduction in CO_2 emission is 0.095 Mtco2.[10] For existing buildings, BEE has put together a star rating programme, under which 225 buildings have been given star ratings through March 2019. A total of 86

8 1 MoP AR 2019-20 (Cover).cdr (powermin.nic.in) (accessed 19/01/2021)

9 1 MoP AR 2019-20 (Cover).cdr (powermin.nic.in) (accessed 19/01/2021)

10 Impact of Energy Efficiency Measures for the year 2019-20

number of buildings have received star rating from 2016-17 to 2019-20 and out of this, 44 buildings received the star rating in 2019-20, at various times of the year. The total energy savings for the star rated buildings for 2019-20 is estimated at 83 MU.

BEE also launched the Eco-Niwas Samhita (Part 1 Building Envelope), which is an Energy Code for Residential Buildings (ECBC-R) in December 2018. The "Energy Efficiency Label for Residential Buildings" was launched in February 2019, with the key objective of promoting the energy performance of houses, which could be a deciding factor in home purchases in the future. The estimated energy saving potential from the labelling programme is around 388 billion units (BU) by 2030. This code is applicable to all residential buildings with a plot area greater than 200 square metres (sqm). For monitoring of energy consumption pattern of all new and existing buildings, EMIS (Energy Management Information System) portal is developed. Pilot with Telangana and Maharashtra states is in process.[11]

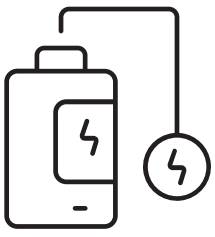
In order to increase energy conservation in buildings, buildings have been incorporated as a sector in PAT Cycles IV and V, as detailed below. PAT Cycle IV identified 37 hotels as DCs, while PAT V identified 31 additional hotels. The energy savings from these hotels is estimated at 1360 Toe by 2022.

2.3.3.2 Perform, Achieve and Trade

This scheme targets energy consumption in the large energy intensive industries, or DCs, by setting targets to reduce the Specific Energy Consumption (SEC), periodically evaluated every three years. Currently, 1073 DCs covering 13 sectors are mandated to adopt EE measures. The estimated energy saving is around 28 Mtoe till PAT Cycle–VI[12].

PAT is a multi-cycle programme with 3-year cycles in which SEC reduction targets are assigned to DCs. It is a market-based mechanism wherein excess energy savings are converted into an instrument called Energy Savings Certificates (ESCerts) that can be traded on the Power Exchanges. ESCerts are issued to overachieving DCs, and underachieving DCs have to purchase ESCerts if they fail to meet their SEC reduction targets. One ESCert is equivalent to one metric tonne of oil equivalent (toe).

Currently, 956 DCs from 13 sectors under the PAT scheme are adopting EE measures. This is expected to result in a reduction of 20 Mtoe of energy and 70 $MtCO_2$ by 2022



11 Impact of Energy Efficiency Measures for the year 2019-20

12 Impact of Energy Efficiency Measures for the year 2019-20

Details of the various PAT cycles, number of DCs, and target savings are given in the table below.

Cycle	Year	DCs	Target (Mtoe)	Achievement (Mtoe)
I	2012-13 to 2014-15	478	6.686	8.67
II	2016-17 to 2018-19	535	11.049	14.08 (542 DCs)
III	2017-18 to 2019-20	116	1.06	3.496 (90 DCs)
IV	2018-19 to 2020-21	109	0.7	
V	2019-20 to 2021-22	110	0.513	
VI	2020-21 to 2022-23	117		

The number of DCs and energy savings are taken from the BEE impact report, 2019-20. For cycle 2, a total of 621 DCs were notified and 542 DCs were analyzed for results. Since 2017 and onwards every year, PAT cycles are notified on a rolling basis. The number of DCs and target energy savings for Cycles III, IV, and V only cover the new DCs added. PAT VI was notified on April 13, 2020. The total number of DCs stand at 1073.

PAT Cycle I started with eight energy-intensive sectors: aluminium, cement, chlor- alkali, fertiliser, iron & steel, pulp & paper, thermal power plants, and textiles. When PAT I ended in 2015, the reported overall achievement was 8.67 Mtoe, exceeding the target for by almost 30 percent. These savings are equivalent to avoided emissions of about 31 $MtCO_2$.

PAT Cycle II, 89 DCs in the existing PAT sectors were added, along with three new sectors-refineries, railways, and DISCOMs. A total of 621 DCs were included in PAT II. The overall target was to reduce energy consumption by 13.633 Mtoe. Under PAT cycle II, 542 DCs were analyzed for the savings through M&V and the savings are reported at 14.08 Mtoe exceeding the target by 16 percent. Most of the sectors achieved the assigned targets, with aluminium, pulp & paper, and railways achieving more than twice their assigned energy savings.

There are 309 DCs that have been cumulatively issued about 38.50 lakh ESCerts for their excess energy savings against the targets and 110 DCs mandated to purchase about 14.50 lakh total ESCerts to meet their shortfall in achieving energy saving targets[13].

Trading on ESCerts started on 26 September, 2017 at the Indian Energy Exchange. During the period from September 2017 to January 2018, 86.11 lakh ESCerts were offered for sale, against 26.86 lakh ESCerts offered for buying. The traded volume was 12.99 lakh ESCerts, and the prices ranged from a low of Rs. 200 to a high of Rs. 1200 per ESCert. The total value of ESCerts traded during this period was Rs. 99.82 Cr. These values pertain to ESCerts issued and traded under PAT Cycle I[14]. It is reported that BEE is examining issues relating to trading and operating software, due to which ESCert trading is presently suspended.

2.3.3.3 Energy Efficiency in the Transport Sector

The transport sector, being the largest guzzler of petroleum products, needs to be monitored for the conservation of petroleum. Crude oil consumption is expected to grow at a Compound Annual Growth Rate (CAGR) of 3.60% to 500 Mt by 2040, from 221.76 Mt in 2017. Diesel demand in India is expected to double to 163 Mt by 2029-30[15]. This will not only cause increased pollution, but also increase the government's expenditure on petroleum imports. Therefore, it is imperative that steps are taken to reduce the consumption of petroleum products, by increasing the efficiency of vehicles. BEE has already notified Corporate Average Fuel Efficiency (CAFE) norms for passenger cars and Heavy Duty Vehicles (HDVs).

BEE and Vehicle Fuel Efficiency: In 2015, GoI established CAFE norms forM1 category of vehicles (having GVW of 3.5 tonnes or below) taking effect as two-phase targets in Fiscal Year (FY) 2017–2018 and FY 2022–2023 onward. Subsequently, CAFE Norms were established for HDVs in 2017 (effective from 1 April, 2018) and light and commercial vehicles in 2019. These norms give higher credits to electric vehicles (EVs) and hybrid vehicles to encourage original equipment manufacturers (OEMs) to sell more EVs. Fuel savings for the period 2017-20 are estimated at 1.2 Mtoe, and the emission reduction is estimated at 3.7 MtCO2 for the same period[16].

13 https://beeindia.gov.in/content/pat-cycle (29/5/2020)

14 https://www.iexindia.com/marketdata/ESCerts_Market.aspx (29/5/2020)

15 https://www.ibef.org/industry/oil-gas-india.aspx

16 Impact of Energy Efficiency Measures for the year 2019-20, BEE, March 2021

Constant Speed Fuel Consumption (CSFC) norms for Light & Medium Commercial Vehicles: The development of Fuel Economy norms for Light & Medium Commercial vehicles of Gross vehicle weight ranging from 3.5 tonnes to 12 tonnes has been completed and notified on 16th July 2019 vide S.O. 2540 (E). The norms are applicable to the Vehicles of M2, M3 & N2 category of vehicles having Gross Vehicle Weight (GVW) ranging between 3.5 tonnes and 12 tonnes both inclusive. The vehicles fuel consumption per 100 kms should be lower than the value obtained from the target values for the corresponding GVW. The first phase of norms will be implemented from 1st April 2020. The fuel saving of 0.06 MMT in a year and cumulative 0.25 MMT fuel saving in 3 years is anticipated by implementation of these norms. [17]

Tyres as an important component of vehicle has been identified for potential saving of fuels. BEE has initiated the programme to bring automobile tyres under the S&L programme. BEE has also initiated the development of a computer-based simulation tool (like VECTO in EU) for testing of the vehicle fuel efficiency prior to the launch of a model.

2.3.3.4 Standards and Labelling Scheme[18]

The Standards and Labelling (S&L) scheme was initiated with the objective of providing consumers an informed choice regarding energy savings and thereby the cost saving potential of various energy-consuming appliances. S&L, also known as the Star Rating programme, is being implemented in the appliance sector. This initiative prescribes minimum energy performance levels for appliances, rated on a scale of 1 to 5, with 5 being the most energy efficient level. Currently, there are 26 appliances under this programme, out of which 10 appliances are under the mandatory regime, and the remaining 16 are under the voluntary regime.

Revision of energy consumption standards for Self-ballasted LED lamps, Air Conditioners, Pump sets, Ceiling Fans, Domestic LPG cook stoves have been done during the year 2019 with a view to bring more efficient appliances in the market. The revised energy consumption standards for Air Conditioners and for Self-ballasted LED lamps have been notified in October 2019.

The S&L programme resulted in electricity savings of 13.22 BU in FY 2019-20 resulting in reduction of 10.849 Mtoe. BEE report on impact measures indicates that direct cool and frost free refrigerator, room ACs, color TVs and pump sets contribute to 75% of the savings due to appliances under S&L programme. The energy consumption norms for certain appliances, frost-free refrigerators, direct cool refrigerators, tubular fluorescent lamps, and storage type electric water heaters are continually improved to reflect the improvement in the technologies in the industry.

To strengthen the market surveillance, BEE signed a Memorandum of Understanding (MOU) with National Accreditation Board for Certification Bodies (NABCB) as an Independent Agency for Monitoring & Evaluation (IAME). BEE has carried out an extensive awareness campaign through print and electronic media to inform the consumers of the benefits of the S&L programme. BEE has also carried out a training programme for appliance retailers to make them more aware of these benefits and pass the information on to consumers.

17 1 MoP AR 2019-20 (Cover).cdr (powermin.nic.in) (accessed 19/01/2021)

18 BEE Annual Report 2018-19

BEE carries out check testing of various appliances to ensure adherence to the S&L programme. Appliance check testing is carried out in a National Accreditation Board for Testing and Calibration Laboratories (NABL) accredited laboratory. BEE publishes results of the failed appliances in newspapers to keep consumers informed.

The S&L program resulted in savings of 69 BU, leading to monetary savings of Rs. 39,000 crores and emission reduction of 53.307 MT during 2019-20[19].

2.3.3.5 Municipal Demand Side Management Scheme[20]

The growing population, along with better employment opportunities, rising income levels, and aspiration for a better quality of life, are driving India's urban landscape. The rapid expansion of the urban population is creating huge pressure on infrastructure, housing, and other goods and services, which, in turn, results in greater demand for resources, including energy. BEE has launched a programme to identify EE opportunities in this sector and support municipalities in implementing the EE measures.

Identifying the immense energy saving potential in municipal sector, BEE initiated the Municipal Demand Side Management programme (MuDSM). MuDSM is expected to improve ULBs' overall EE, which could lead to substantial savings in electricity consumption, thereby resulting in cost reduction/savings for the ULBs. BEE has initiated the programme in 250 municipalities across the country, which entails conducting energy audits, preparing Detailed Project Reports (DPRs), and implementing EE measures through ESCOs.

The Municipal Energy Efficiency Program (MEEP) is being implemented in conjunction with Atal Mission for Rejuvenation and Urban Transformation (AMRUT) to unlock India's immense potential for savings in energy and cost of water supply by retrofitting Energy Efficient pump sets across 500 AMRUT cities. As of March 2020, agreement with 390 ULB in 22 states and 3 union territories have been completed. Investment grade energy audit (IGEA) are being conducted across the different ULB's.

2.3.3.6 Agricultural Demand Side Management (AgDSM) Scheme[21]

The AgDSM programme aims to enhance EE in the agriculture sector by reducing overall power consumption, improving ground water extraction efficiency, and reducing the subsidy burden on state utilities and investment in power plants through avoided additional capacity. Over 70% of rural households depend on agriculture. As per the available data, more than 2.1 Cr pumpsets are used in the sector, and the majority are inefficient. Statistics shows that 2.5 to 5 lakh new pump set connections are added every year to the sector. The average capacity of agricultural pumps in India is around 5 horsepower (HP), with efficiency levels hovering around 25-30 percent.

BEE, in association with various DISCOMs, has implemented four pilot AgDSM projects in Maharashtra,

19 Impact of Energy Efficiency Measures for the year 2019-20, BEE, March 2021

20 https://beeindia.gov.in/content/dsm (15/4/2020)

21 https://beeindia.gov.in/content/dsm (15/4/2020)

Karnataka, and Andhra Pradesh. In partnership with the Indian Council of Agricultural Research (ICAR), BEE is conducting an awareness campaign on energy efficiency and conservation in agricultural practices, particularly in terms of using energy efficient pumpsets, tractors, and other machinery and improving fuel and water resource use efficiency. Such equipment and practices will reduce the cost of cultivation and increase farmers' income, in harmony with the GoI "Per drop more crop" and "Doubling farmers' income" initiatives. BEE has also organised a number of training programmes with SDAs on energy and water conservation in the agriculture sector.

BEE and EESL implemented pilot pump replacement programmes in three states; a total of 5109 pumps were replaced, and the savings from the replacement was estimated at 25-35 percent. Up to 2018-19, the total number of pumpsets replaced was 63,615. In FY 2019-20, 10,784 inefficient pumpsets were replaced with 5-star efficient pumpsets, and the estimated savings is 0.18 BU for the year, along with reduction of 0.148 MT of CO_2.[22]

2.3.3.7 Small and Medium Enterprises (SMEs)

Micro, small, and medium enterprises (MSMEs) are typically characterised by a high degree of heterogeneity in the manufacturing processes across various geographic locations, even for similar product offerings. Compared to large enterprises, they have a smaller scale of operations and a smaller capital base and lack access to affordable finance and readily available technology solutions. Hence, they opt for low-cost sub-standard solutions, leading to inefficient production. Furthermore, enterprises engaged in energy intensive operations incur disproportionately higher costs. The vulnerability of MSMEs to increasing energy prices is also higher, as they pay more per unit of energy compared to larger industries.

Considering the urgent need to develop, demonstrate, and disseminate energy efficient technologies (EETs) at the cluster level, the "National Programme on Energy Efficiency and Technology Upgradation in SMEs" was developed by Bureau of Energy Efficiency to address the various challenges faced by MSMEs in India. The objective of the programme is to 'improve energy efficiency of SME sector in India through accelerating adoption of energy efficient technologies, knowledge sharing, capacity building and development of innovative financial mechanisms.' Notable achievements of the programme over the past two years are detailed below.

In 2017-18, five demo projects were implemented in the textile, brick, and food clusters. There was follow-up to measure post implementation savings and dissemination of results through case studies and audio visuals[23]. In 2018-19, 21 pilot projects were implemented in four clusters, with dissemination through audio visuals. There was also a financial scheme developed to support EE projects in the Pali textile cluster, multimedia tutorials were prepared for 10 EE technologies, and over 40 knowledge workshops were organised in 20 states with over 2000 SME participants[24]. Energy savings from BEE programs in Indore, Ludhiana, Varansi and Pali clusters is estimated at 1166 toe, with a reduction of 3934 tonnes of CO_2.

BEE also launched a knowledge portal for SMEs SIDHIEE (Simplified Digital Hands-on Information on Energy Efficiency in MSMEs) which hosts variety of knowledge resources including case studies, best operating practices, details of latest energy efficient technologies etc.

BEE also collaborated with the World Bank (WB) and United Nations Industrial Development Organisation (UNIDO) to accelerate implementation of EE projects in SMEs; more details are given in the section on international cooperation. EE technology interventions in 2018-19 in SMEs in Indore, Varanasi, Ludhiana, and Pali resulted in savings of 1166 toe and an estimated emission reduction of 3934 TCO_2[25].

Financing EE in MSMEs: A WB-Global Environment Facility project created a revolving fund to promote the financing of EE projects in the MSME sector. The fund is being used to provide financing at concessional interest rates to MSMEs for the implementation of EE interventions. To date, over 630 industries have benefitted from the revolving fund. Interventions carried out under the project (in 2015-19) led to total energy savings of 12,178 Toe[21] through FY 2018-19 across 13 states and UTs.

To boost the flow of funds for EE to the MSME Sector, BEE conducted a market assessment on potential funds for EE and prepared guidelines on financing EE projects in India. In this context, two programmes were initiated: the Partial Risk Guarantee Fund for Energy Efficiency and Venture Capital Fund for Energy Efficiency. In addition, the Framework for Energy Efficient Economic Development (FEEED) programme was launched, focusing on developing appropriate fiscal instruments to promote EE financing.

Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) addresses the debt-related issues in financing EE projects. PRGFEE is a risk sharing mechanism that provides Participating Financial Institutions (PFIs) with a partial coverage of the risk involved in disbursing

22 Impact of Energy Efficiency Measures for the year 2019-20, BEE

23 BEE Annual Report 2017-18

24 BEE Annual Report 2018-19

25 Impact of EE Measures for 2018-19, BEE, March 2020

loans to ESCOs for EE projects. PRGFEE guarantees a maximum 50% of the loan amount, up to Rs. 10 Cr per project. PRGFEE support can be provided to government buildings, private buildings (commercial or multi-storey residential buildings), municipalities, SMEs, and industries. The Ministry of Power has constituted a supervisory committee to monitor programme implementation, commissioned an operations manual for PRGFEE, and notified the rules and guidelines. Five banks and PFIs have been empanelled, namely, Andhra Bank, Yes Bank, Tata Cleantech Capital Ltd., IDFC Bank, and IndusInd Bank. Other banks are being targeted to come under PRGFEE. PRGFEE Rules have been notified. The Operations Manual for the PRGFEE has also been published.

BEE has institutionalised the **Venture Capital Fund for Energy Efficiency (VCFEE)** to encourage equity investment in EE projects in India. The fund will provide last mile equity support to specific EE projects, limited to a maximum of 15% of the total equity required or Rs. 2 Cr, whichever is less, through Special Purpose Vehicles. The support can only be provided to government buildings, private buildings (commercial or multi-storey residential buildings), and municipalities. The Board of Trustees for VCFEE has been constituted and the VCFEE Rules have been notified.

Both these funds are yet to take off, and the BEE is actively pursuing financial institutions, MSMEs, and ESCOs for uptake from these funds. BEE is also engaging with key stakeholders to redefine the boundaries and criteria for companies to participate in these two funds.

In addition to the above, BEE has also taken up initiatives to enable ESCOs to tap the EE markets. BEE empanels ESCOs through a process of grading carried out by Securities and Exchange Board of India (SEBI) accredited rating agencies on their capability in implementation of EE projects through performance contracting, based on availability of technical manpower, financial strength, market position, etc. ESCOs are graded from 1 to 5, with 1 being the highest rating, and 5, the lowest.

2.3.3.8 DISCOM Capacity Building[26]

Demand Side Management (DSM) measures in the power sector are a cost-effective tool to improve efficiency. As a customer strategy, DSM programmes encourage the installation of end-use technologies that consume less energy, thereby reducing the customers' overall electric bill. BEE has taken up a capacity building programme for DISCOMs to help them identify and launch DSM projects in their area of supply.

From 2012 to 2017, BEE selected 34 DISCOMs for this programme and provided the necessary support for the implementation of DSM related activities. In the second phase (2017-20), 28 DISCOMs are being targeted. The activities include load research studies and the development of DSM action plans, as well as DISCOM official training on DSM. About 1000 mid- and senior-level officials are to be trained as Master Trainers on DSM and EE, and about 4000 circle level officials of DISCOMs will be trained on these topics. DSM cells have been established and load research and DSM action plans prepared in the 34 DISCOMs. Project Management Consultants (PMCs) have been selected to implement capacity building activities in these DISCOMs and assist other DISCOMs in carrying out load research activities and preparing DSM action plans[27].

2.3.3.9 SDA Strengthening[28]

SDAs are responsible for coordinating, regulating, and enforcing various provisions of the EC Act at the state level. The BEE schemes comprise two major components: (i) Providing financial assistance to the SDAs to coordinate, regulate, and enforce energy efficiency and conservation; and (ii) Contributing to the State Energy Conservation Fund (SECF). In 2018-19, Rs. 11.64 Cr was transferred to 23 SDAs for the implementation of the following programmes under the State Partnership for Energy Efficiency Demonstrations (SPEED)[29]:

- Implementation of EE demonstration projects, mainly in the areas of street lighting, water pumping, waste heat recovery, and building retrofits
- Implementation of EE activities in government schools– replacement of existing conventional appliances with energy efficient appliances
- Model Energy Efficient Village Campaign, initiated to convert villages into model energy efficient villages by replacing existing inefficient electrical equipment and appliances with BEE star rated appliances, including household light bulbs, street lights, fans, & water pumps

26 https://beeindia.gov.in/content/capacity-building-discoms (15/4/2020)

27 BEE Annual Report 2018-19

28 https://beeindia.gov.in/content/sdas-0 (15/4/2020)

29 BEE Annual Report, 2018-19

- Financial assistance to SDAs for establishment of an enforcement mechanism at the state level and development of a robust mechanism to effectively enable discharge of duties and tasks
- State EE research & outreach programme and capacity building
- Survey and analysis of the impact of SDA energy conservation activities
- Maintenance and updating of internet platform and other created databases

As of March 2020, 31 states have constituted SECFs, out of which about 25 states have also provided matching contributions.

A web portal 'SAATHEE' (State-wise Actions on Annual Targets and Headways on Energy Efficiency) has been launched for State Designated Agency for state level activities. This portal will support BEE and SDAs for real-time monitoring of the progress of implementation of various energy conservation endeavors at state level. This portal will also support BEE in decision making, coordination, control, analysis, and implementation and enforcement of the compliance process for various energy consumers at the pan India level.

All the SDAs have established dedicated website highlighting energy efficiency measures undertaken in the state. The websites are linked with BEE and other SDAs to facilitate information exchange, and are updated regularly to incorporate recent developments and latest information pertaining to energy efficiency advancements within the states and the country, as whole.[30]

State Energy Efficiency Index

The achievement of India's EE goals hinges as much on state-specific EE programmes as it does on national programmes. States play a vital role in implementing EE policies. The national EE goals can only be realised if each state achieves its individual goals, keeping in mind the prevailing socioeconomic conditions. To enable data-driven evidence-based policy formulation and help drive EE policies & programme implementation at the state and local government level, BEE, in association with Alliance for an Energy Efficient Economy (AEEE) and with guidance from NITI Aayog, developed & launched India's first 'State Energy Efficiency Preparedness Index' for 29 states and the National Capital Region of Delhi in August 2018. The State Energy Efficiency Index (SEEI) is a useful tool to track the progress of states' EE programmes across the energy demand sectors. In 2019, a report was prepared for 36 Indian states and UTs, categorising them as 'Front runner', 'Achiever', 'Contender,' or 'Aspirant', based on their performance. In SEEI 2019, the top performing states, Haryana, Karnataka, and Kerala, are in the 'Achiever' category[31].

2.3.3.10 National Certification Examination for Energy Managers and Energy Auditors[32]

It is mandatory for all the DCs to ensure an energy audit is conducted by an Accredited Energy Auditor and to designate or appoint an Energy Manager. BEE has created a cadre of professionally qualified Energy Managers and Auditors with expertise in energy management, project management, financing and implementation of EE projects, and policy analysis. BEE has regularly conducted the National Certification Examination nationwide for Energy Managers and Energy Auditors since May 2004. As of March 2019, there are a total of 18,684 certified energy managers and auditors, out of which 10,049 are certified energy auditors from the 19 previous examinations conducted between 2004 and 2018.

In addition, under the EC Act, DCs have to get their units audited by Accredited Energy Auditors (AEA). BEE notified the 'Qualifications for Accredited Energy Auditors and Maintenance of their List Regulations' in March 2010 and has enabled accreditation of 263 AEAs across the country.

In addition to passing the BEE examination, to qualify for AEA, the auditor should have at least five years of experience, of which three years should be in energy intensive industries. The auditor has to submit five detailed energy audit reports and should possess a list of instruments prescribed for carrying out energy audits. The auditors are accredited as AEAs after an assessment by the Accreditation Advisory Committee. The list of AEAs can be accessed at https://beeindia.gov.in/content/accredited-energy-auditors.

2.3.3.11 Awareness and Outreach

Climate change and sustainability are linked to BEE endeavours to make people aware of their responsibilities towards building a sustainable world. BEE has undertaken

30 1 MoP AR 2019-20 (Cover).cdr (powermin.nic.in) (accessed 19/01/2021)
31 https://www.aeee.in/state-energy-efficiency-index-2019-portal/wp-content/uploads/2020/02/State-Energy-Efficiency-Index-2019-PAMPHLET_FINAL.pdf
32 BEE Annual Report, 2018-19

multimedia energy awareness campaigns to inculcate the principles of conservation and sustainability. People are also made aware of the quality and standard issues associated with energy intensive appliances. BEE carries out the campaign in print, electronic, and outdoor media, in Hindi and vernacular languages, across the country. As part of the campaign, on behalf of MoP, BEE hosts an annual painting competition for schools and awards consumers who have achieved significant successes in saving energy through the National Energy Conservation Awards. The competition is organised at the state level, and the winners participate in a national competition. Over 90 lakh students participated in the painting competition in 2018. December 14th is celebrated as National Energy Conservation day in India, and awards are given to the winning students on this day. In 2018, the Award Committee also awarded prizes to industries who collectively invested Rs. 1327 Cr in energy saving measures and saved energy equivalent to Rs. 2069 Cr. The participating units have saved 3917 million kilowatt-hours (kWh) of electricity.

2.3.4 Energy Savings Achieved in 2019-20

The 2019-2020 annual report of the Director General, BEE presented the achievements for EE in India in terms of energy savings, as described below.

During the years 2011-12 to 2018-19, India's energy intensity decreased from 65.5 toe per INR crore to 55.5 toe per INR crore. This decline is largely attributed to the deployment of energy efficiency programmes among other factors.

The adoption of energy efficiency schemes and programmes has led to the overall energy savings of 28.06 Mtoe for the year 2019-20. The findings of the report reflect that the adoption of energy efficiency schemes, programs has led to the overall thermal energy savings in the order of 15.59 Mtoe, while overall electricity savings are to the tune of 145.03 BU. The total energy savings was 28.06 Mtoe during 2019-20. Overall, these energy savings translated into monetary savings of worth INR 115,702 crores. The equivalent reduction in CO_2 emissions is around 177.6 MT annually.

PAT scheme contributed to 62.64% of the total energy savings, while S&L and UJALA accounted for 30.53% of the total energy saving from all major interventions carried out during the FY19-20. The industry sector has the highest contribution with share of 53.39% in total energy savings while the domestic sector contributed to 27.55% of total savings achieved during FY 2019-20.

The PAT program which began with cycle-I (2012-15) comprised of 478 DCs from 8 energy intensive sectors. PAT cycle 2 was launched in 2015 and added three more sectors (Refinery, Railways & DISCOMs). Under PAT-II, 542 DCs out of total 621 DCs were analyzed for M&V. PAT Cycle-III added 116 more DCs out of these M&V of 90 DCs have been completed. PAT Cycle IV, V & VI added 109, 110 and 117 DCs respectively, which brought the total number of DCs till PAT Cycle VI to 1073. The savings under the PAT program was estimated at 17.577 Mtoe, resulting in monetary savings of Rs. 49,109 crores, and 86.954 MT of carbon emission reduction during 2019-20.

A total 26 appliances were covered under the appliance labelling programme as of March 2020, 10 of which were for appliances under mandatory regime and 16 appliances under voluntary regime. The S&L program resulted in savings of 69 BU, leading to monetary savings of Rs. 39,000 crores and emission reduction of 53.307 MT during 2019-20.

For residential buildings, the ECO Niwas Samhita 2018, an Energy Conservation Building Code for Residential Buildings (ECBC-R) was launched. The estimated energy saving potential through ECBC-R is around 388 BU by year 2030.

As of March 2020, 54 buildings were approved as completed as ECBC compliant and 264 existing commercial buildings across India have adopted BEE Star ratings under the BEE – Star Rating Programme.

Apart from the above, the other major savings came from Ujala and municipal DSM programs which were estimated at 35 BU and 6.841 BU respectively. Cumulatively, the programs resulted in monetary savings of Rs. 25,133 crores and emission reduction of 34.349 MT annually.

BEE's National Strategic Plan on Energy Efficiency includes new technologies such as E-mobility, Fuel Cell Vehicles (FCVs), integration of renewables & storage, net zero buildings, district cooling, smart meters, internet of things, active appliance feedback, blockchain technologies etc. for decarbonizing various sectors of the economy.

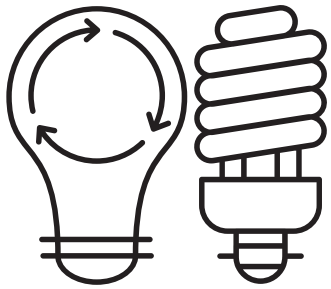
2.4 Energy Efficiency Services Limited

Energy Efficiency Services Limited (EESL) is a joint venture of NTPC Limited, Power Finance Corporation (PFC), Rural Electrification Corporation (REC), and Power Grid Corporation of India Ltd (PGCIL). EESL was formed under the MoP to facilitate investments in EE projects. EESL's goal is to develop innovative business models and implement EE projects to significantly reduce energy consumption and costs. EESL also acts as a resource centre for the capacity building of state electricity distribution companies (DISCOMs), state ERCs, state-designated agencies (SDAs), Energy Saving Companies (ESCOs), and financial institutions, among others.

EESL is a Super ESCO that enables consumers, industries, and governments to effectively manage their energy needs through energy efficient technologies. EESL is implementing the world's largest non-subsidised EE portfolio across sectors like lighting, buildings, electric mobility (e-mobility), smart metering, and agriculture at a scale no organisation had been previously able to achieve. EESL focuses on solution-driven innovations with no subsidy or capital expenditure (CAPEX). It is able to do so using its Pay-As-You-Save (PAYS) model, which obviates the need for any upfront capital investment by the consumer. The entire investment by EESL is recovered through monetised energy savings over a scheduled project period.

EESL's vision and mission are as below.

- **Vision-** Universal access to sustainable energy solutions to enable a low carbon future, with significant economic and social impact.
- **Mission-** To enable ecosystems for responsible energy adoption with innovations and market creation approaches.



EESL's EE programmes are briefly described below.

Unnat Jyoti by Affordable LEDs for All (UJALA) programme: EESL's flagship programme is UJALA, wherein Light Emitting Diode bulbs (LEDs) are purchased in bulk and distributed to residential consumers through state DISCOMs across the country. Consumers can either pay for the LEDs upfront or in instalments through their electricity bills. Bulk purchase of LEDs has resulted in a significant reduction in the purchase price, which has been passed on to consumers. EESL has sold 36.66 Cr LEDs, resulting in annual savings of 47.66 billion kWh of electricity, valued at Rs. 19,064 Crores, and avoided peak demand additions of 9,542 megawatts (MW). Emission reduction is estimated at 38.60 $MtCO_2$ annually[33].

Under the Gram Swaraj Abhiyan, EESL carried out a campaign supported by GoI to promote social harmony and spread its pro-poor initiatives across the country. Gram Swaraj Abhiyan was conducted in two phases. The first phase was between 14 April and 5 May, 2018, and the second, between 1 June and 15 August, 2018. As part of this campaign, EESL was entrusted with the task of reaching out to over 40,000 villages across the country to sell LED bulbs under its UJALA scheme. With a target of 4 million LEDs, EESL distributed a total of 6.59 million in two phases. LEDs were sold at Rs. 50 under this program.

Street Lighting National Programme (SLNP): The second major national programme focused on replacing inefficient street lights with LED street lights across the country. The model entailed EESL investing upfront in the efficient lights and recovering the costs from a share of the electricity savings that the municipalities and ULBs accrued. As of January 2021, EESL had completed installation of 1.146 Crore LED street lights in the country, resulting in annual energy savings of 7.697 BU and an emission reduction of 5.3 $MtCO_2$, along with avoided generation capacity of 1282.84 MW[34].

33 http://www.ujala.gov.in/ (18/01/2021)

34 Screenshot, EESL SLNP dashboard (18/01/2021)

AgDSM: EESL has successfully implemented the AgDSM programme in three states—Andhra Pradesh (AP), Uttar Pradesh (UP), and Karnataka. This has entailed replacing farmers' inefficient pumps with efficient ones at no extra cost to the farmer. The savings in efficiency pay for the new pump, as the electric utility makes continuous savings on the avoided power purchase otherwise required to meet the farmers' power requirement. EESL has replaced 1,168 pumps in AP, 69,300 in UP, and 1,600 in Karnataka. In Phase 2, EESL plans to replace 900,000 pumps in UP and 70,000 pumps in AP[35]. EESL aims to replace 21 million inefficient pumps with BEE 5-star rated pumps with no upfront cost to the farmer, with cost recovery through reduction in state government subsidies over 5-10 years. This could result in 54 BU in energy savings, an Rs. 271.9 billion reduction in subsidies, and annual 40 Mt reduction in CO_2 emissions[36].

EESL has undertaken a retrofit of its office air-conditioning and ventilation system to address concerns about poor air quality and the risk of airborne transmission of COVID-19. This is a part of a larger initiative to "Retrofit of Air-conditioning to improve Indoor air quality for Safety and Efficiency" developed for healthy and energy efficient buildings in partnership with U.S. Agency for International Development's (USAID) MAITREE program. The retrofits focus on enhanced indoor air quality (IAQ), thermal comfort, and energy efficiency in the air conditioning system. The key measures taken as a part of the pilot are as follows:

- Increased ventilation for dilution and lower CO_2 levels
- Filtration to minimize particulate matter, pollutants, and pathogens
- Monitoring and display of IAQ and comfort parameters

The results of the retrofits have been encouraging. The air quality in the offices has dramatically improved with over 90-95% reduction in pollutants and constantly maintaining

35 https://www.eeslindia.org/content/dam/doitassets/eesl/pdf/Coffee%20Table%20Book/EESL_FinalBook_Print-compressed.pdf (15/5/2020)

36 https://www.eeslindia.org/content/raj/eesl/en/MEDIA-CORNER/corporate-brochure.html (15/5/2020)

healthy indoor environment. Along with proactive measures to clean and disinfect surfaces, maintaining social distancing and wearing masks, communicating the improved air quality in the office to the employees has also allayed their anxiety about COVID spread, and returning to the office.

EESL has also launched three other programmes:

- Super efficient air conditioner programme (SEAP), with a target of selling 50,000 ACs;
- Building Energy Efficiency Programme (BEEP), with a target of retrofitting 20,000 buildings with energy efficient appliances, including LEDs, ceiling fans, and ACs; and
- National Motor Replacement Programme (NMRP), with a target of selling 40,000 IE3 motors to the industry.

Programme	Target Achieved	Energy savings (MUs)	CO_2 reduction ($MtCO_2$)
UJALA	770 million (target) 366.6 million (achieved)	47,600	38.57
SLNP	11.344 million	7619	5.25
AgDSM (target)	21 million	54,000	40
BEEP	20,000 (target)	402	0.329
SEAP (target)	50,000	145.5	0.12
NMRP (target)	40,000	100	0.95

Under MOU signed with Petroleum Conservation Research Association (PCRA), EESL will implement the Energy Efficient PNG Cook Stove Program (EEPS) across India to distribute energy efficient PNG (piped natural gas) based cook stoves to prospective consumers. The EEPS programme, in its first phase, is expected to target 10 lakh energy efficient PNG based cooking stoves in select cities of the country. This is expected to lead to savings up to 25 per cent of gas consumption[37].

India's industrial sector consumes about 40% of the total electricity consumption, and electric motor- systems use 28% of total national electricity. EESL's National Motor Replacement Programme (NMRP) aims to stimulate supply for high efficiency motors (HEMs) in the country. EESL signed agreements with over 30 major industries to replace over 1,200 inefficient motors with IE3 motors, enabling energy savings of 48,16,535 kWh and emission reduction of 4,240 tCO2, annually[38].

EESL is currently the only company in India established exclusively to cater to the vast untapped EE potential.

37 https://www.business-standard.com/article/current-affairs/eesl-to-implement-energy-efficient-png-cook-stove-programme-across-india-121011600678_1.html (accessed March 5, 2021)
38 https://eeslindia.org/wp-content/uploads/2021/02/Newsletter-Jan-2021-FINAL-1.pdf (accessed March 5, 2021)

Since its establishment in 2009, it has generated a revenue of Rs. 1781.26 Cr from operations (1,837.65 Cr, 2018-19) and a net profit, after tax, of Rs. 34.51 Cr in 2019-20 (Rs. 74.64 Cr in 2018-19). [39]

EESL has faced serious challenges in recovering the investments from government entities. As of March 2020, the total receivables from the government entities stood at Rs. 1035.64 crores, up from Rs. 604.54 Cr as of March 2019 (a rise of 70%). The receivables were outstanding for a period of more than 360 days. If the efficiency business is to make inroads, then all stakeholders, including the government agencies, have to ensure that EESL gets their payments on time, in order for them to continue making the investments.

EESL has also been able to raise funds from bilateral and multilateral agencies, including USD 420 million from Asian Development Bank (ADB) and WB and euro (EUR) 100 million from Agence Française de Développement (AFD) and KfW, in addition to raising money from Indian sources to finance the EE projects.

EESL has expanded their activities beyond India's borders to the UK, Middle East, South Asia, and South-East Asia. EESL's energy efficiency initiatives have cumulatively led to energy savings of over 58 billion kWh and a reduction of over 46 million tonnes of greenhouse gas (GHG) emissions across the globe.

2.5 Ministry of Micro, Small and Medium Enterprises (MoMSME)

The MSME sector in India is highly varied in terms of products, firm size, processes, technological advancement, and volume and types of output. MSMEs that are engaged in manufacturing account for 45% of India's total industrial output and 8% of the national GDP, according to data published by MoMSME. This sector offers the widest range of opportunities in EE improvement and creation of green jobs, along with adoption of the concepts of the circular economy and supply chain efficiency.

The Micro, Small and Medium Enterprises Development (MSMED) Act was notified in 2006 to address policy issues affecting MSMEs, as well as the coverage and investment ceiling of the sector. The Act seeks to facilitate the development of these enterprises and enhance their competitiveness. It provides the first-ever legal framework for recognition of the concept of an "enterprise," which comprises both manufacturing and service entities. It defines medium enterprises for the first time and seeks to integrate the three tiers of the targeted enterprises, namely, micro, small, and medium.

As mentioned above, MSMEs are smaller than large enterprises, with less funding, and consequently lack access to affordable financing and EETs; MSMEs also pay higher per unit energy costs, leading to higher costs of operations, and are more vulnerable to energy price

39 EESL Stand-alone Financial Results, 2019-20

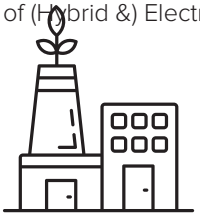
volatility. Such discrepancies lead to higher energy costs and lower profit margins for MSMEs, especially energy intensive ones. Energy efficiency is increasingly being recognised as a cost-effective way to not only increase economic productivity and competitiveness, but also mitigate climate change. Energy-efficient technologies can potentially result in lower energy costs, lower raw material costs, and higher productivity, thus improving the production quality. These improvements can generate cost savings and contribute to enterprise profitability, freeing up working capital that can be channelled into business expansion, R&D, and new products. MSMEs alone could potentially take up 16% of India's total EE market, according to a 2014 estimate quoted by CEEW[40].

MoMSME has the following programmes to assist MSMEs in improving their operational technology and competitiveness in the market.[41]

- Financial Support to MSMEs in Zero Defect Zero Effect (ZED) Certification Scheme to inculcate ZED practices in manufacturing processes
- Credit Linked Capital Subsidy for Technology Upgradation (CLCSS) for induction of state-of-the-art or near state-of-the- art technology
- Technology and Quality Upgradation Support to MSMEs for adoption of EETs in manufacturing units

2.6 Ministry of Heavy Industries and Public Enterprises (MHIPE)

The MHIPE includes the Department of Heavy Industry (DHI) and the erstwhile Department of Industrial Policy and Promotion (DIPP), which has been re-organised as the Department for Promotion of Industry and Internal Trade (DPIIT). The DHI oversees the public sector enterprises or undertakings, and the DPIIT is the policy-making wing of the Ministry, which supports the auto, heavy engineering, heavy electricals, and capital goods sectors. DPIIT is the nodal ministry for the development and implementation of industrial policies, including automotive policy, and gives directions for vehicle R&D, testing, and certification. Among DHI's programmes that have a direct impact on climate change and GHG emission reduction is its EV programme, entitled Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME).



40 CEEW 2017, Report on Factors Influencing the Uptake of Energy Efficiency Initiatives by Indian MSMEs, Shakti Sustainable Energy Foundation.

41 https://msme.gov.in/node/1765 (15/4/2020)

2.6.1 FAME India Scheme[42]

The National Electric Mobility Mission Plan (NEMMP) Scheme was launched in 2015 to promote the manufacturing of electric and hybrid vehicle technology and ensure their sustainable growth. Phase-I of this scheme was initially launched for a period of 2 years, commencing from 1 April, 2015, and was subsequently extended periodically, with the last extension up to 31 March, 2019. During 2017-18, the following amendments were made:

- "Mild Hybrid" technology was excluded from benefits under the scheme
- Electric three-wheelers (with maximum speed not exceeding 25 kilometres (km)/hour (hr)) were included for availing of incentives under the scheme
- Electric three-wheelers were also included in the retrofit category
- Fully electric buses were also included for demand incentives under the scheme

42 https://pib.gov.in/newsite/PrintRelease.aspx?relid=191377 (15/4/2020)

FAME-I was implemented through four focus areas: (i) Demand Creation; (ii) Technology Platform; (iii) Pilot Project; and (iv) Charging Infrastructure. FAME-I aimed to generate demand by providing incentives for the full range of vehicle segments, including private vehicles, light commercial vehicles, and buses.

Based on the experience gained during FAME-I and feedback from various stakeholders, including industry associations, DHI notified Phase-II in March 2019, with an outlay of Rs. 10,000 Cr for a period of 3 years, commencing from 1st April, 2019. The achievements under FAME I and II are given in the table below.

FAME scheme	Outlay (Rs. Cr)	Vehicles	Fuel saved (lakh litres)	Emission reduction (tonnes)
I	343	2,80,141*	494	131[43]
II	10,000	45,062[44]		

*FAME I includes 465 buses that were ordered for cities.[45]

The FAME Scheme is central to the government's objective to curb vehicular pollution and reduce CO_2 emissions. Other regulatory measures include early introduction of Bharat Stage-VI in 2020. Furthermore, fuel consumption standards for Indian vehicles came into force in India in April 2017 for passenger vehicles fuelled by petrol, diesel, liquefied petroleum gas (LPG), and compressed natural gas (CNG). These standards are based on CAFE norms and targets to bring about an 18% improvement in passenger vehicle fuel consumption by 2022, compared to 2012.

The dashboard of the Department of Heavy Industry shows that 3.25 lakh EVs have been sold, while 6690 electric buses and 3297 charging stations have been sanctioned as of January 2021.[46]

2.7 Ministry of Environment, Forest and Climate Change

The Climate Change Division of MoEFCC coordinates all issues related to climate change, including international negotiations and domestic policies and actions. The Division is also responsible for the submission of National Communications (NATCOMs) and Biennial Update Reports (BURs) to the United Nations Framework Convention on Climate Change (UNFCCC). In addition, India is a signatory to several key international conventions, such as the Montreal Protocol and the Kigali Amendment to the Montreal Protocol. India was also the first country to prepare a national Cooling Action Plan, in March 2019.

2.7.1 The Montreal Protocol

The Montreal Protocol on Substances that Deplete the Ozone Layer is the landmark multilateral environmental agreement that regulates the production and consumption of nearly 100 man-made chemicals referred to as Ozone Depleting Substances. Adopted on 15 September, 1987, the Protocol is to date the only UN treaty ever ratified by all 197 UN Member States. The Protocol phases down the consumption and production of different ODS in a step-wise manner, with different timetables for developed and developing countries. Developing and developed countries have equal but differentiated responsibilities, but, most important, both groups of countries have binding, time-specific, and measurable commitments.

2.7.1.1 Multilateral Fund

The Multilateral Fund for the Implementation of the Montreal Protocol was established in 1991 with the objective of providing financial and technical assistance to developing countries party to the Montreal Protocol whose annual per capita consumption and production of ODS is less than 0.3 kilogrammes (kg), to comply with the control measures of the Protocol. Since its inception, the Multilateral Fund has supported over 8,600 projects, including industrial conversion, technical assistance, training, and capacity building worth over USD 3.9 billion.

To date, the Parties to the Protocol have phased out 98% of ODS globally compared to 1990 levels. Because most of these substances are potent GHGs, the Montreal Protocol is also contributing significantly to the protection of the global climate system. From 1990 to 2010, the treaty's control measures are estimated to have reduced GHG emissions by the equivalent of 135 $GtCO_2$, or 11 Gt per year[47].

2.7.1.2 Kigali Amendment to the Montreal Protocol

The Kigali Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer entered into force on 1 January, 2019, following ratification by 65 countries. Action under the Amendment will help reduce the production and consumption of hydrofluorocarbons (HFCs), which are potent GHGs, and thus prevent global warming of up to 0.4°C in this century.

Under the Amendment, all countries will gradually phase down HFCs by more than 80% over the next 30 years and replace them with more environmentally friendly alternatives. A specified group of developed countries will begin the phase-down in 2019. Several developing

43 https://dash.heavyindustry.gov.in/dhiev (accessed 20/01/2021)
44 https://dash.heavyindustry.gov.in/dhiev (accessed 20/01/2021)
45 https://www.fame-india.gov.in/index.aspx (15/4/2020)
46 https://dash.heavyindustry.gov.in/ (accessed 20/01/2021)

47 https://www.unenvironment.org/ozonaction/who-we-are/about-montreal-protocol (6/5/2020)

countries will freeze HFC consumption levels in 2024, followed by additional countries in 2028[48].

2.7.2 India Cooling Action Plan

India was the first country in the world to develop a comprehensive Cooling Action Plan, which has a long-term vision to address the cooling requirement across various sectors and lists out actions to help reduce the cooling demand. The India Cooling Action Plan seeks to:

1 Reduce cooling demand across different sectors by 20-25% by 2037-38

2 Reduce refrigerant demand by 25-30% by 2037-38

3 Reduce cooling energy requirements by 25-40% by 2037-38

4 Recognise "cooling and related areas" as a thrust area of research under the national Science & Technology (S&T) Programme

5 Train and certify 100,000 servicing sector technicians by 2022-23, in synergy with the Skill India Mission.

The following benefits would accrue to society over and above the environmental benefits:

- Thermal comfort for all – provision of cooling for Economically Weaker Section (EWS) and Low Income Group (LIG) housing
- Sustainable cooling – low GHG emissions related to cooling
- Doubling Farmers' Income – better cold chain infrastructure and, thus, better value of produce to farmers and less wastage of produce
- Skilled workforce for better livelihoods and environmental protection
- Make in India – domestic manufacturing of air-conditioners and related cooling equipment;
- Robust R&D on alternative cooling technologies – to provide push for innovation in the cooling sector[49].

2.7.3 UNFCCC National Communication and Biennial Update Report:

India is a Party to the UNFCCC. The Convention requires all Parties to furnish information on implementation of the Convention in the form of periodic National Communications. India submitted its Initial National Communication to UNFCCC in 2004 and Second National Communication in 2012. In its 16th session (COP-16), the Conference of Parties to the UNFCCC decided that developing countries should also submit Biennial Update Reports (BUR) as updates to the most recently submitted National Communication. India's first Biennial Update Report (BUR-1) was submitted on 22 January, 2016.

BUR-1 contains information on the national scenario, national GHG inventory, mitigation actions, domestic monitoring, reporting, and verification (MRV) arrangements, finance, technology, and capacity building needs, and support received. India's first BUR highlighted the fact that 12% of India's GHG emissions were offset by the carbon sink action of forests and croplands. It also stated that India's per capita GHG emissions in 2010 was 1.56 tCO2 equivalent, which is less than one third of the average global per capita emissions and far below that of many developed and developing countries. In BUR-1, 137 national and 286 state policies and measures relevant to climate change were mapped on a non-exhaustive basis. BUR-1 stated that a reduction of GDP emission intensity of about 12% had been achieved between 2005 and 2010.

2.7.4 NAPCC

GoI is implementing the NAPCC with a focus on promoting understanding of climate change and establishing the linkage between climate change adaptation and mitigation and the national priority on sustainable development. It comprises eight National Missions—Solar Energy, Enhanced Energy Efficiency, Sustainable Habitat, Water, Sustaining the Himalayan

48 https://sdg.iisd.org/news/kigali-amendment-enters-into-force-bringing-promise-of-reduced-global-warming/ (6/5/2020)

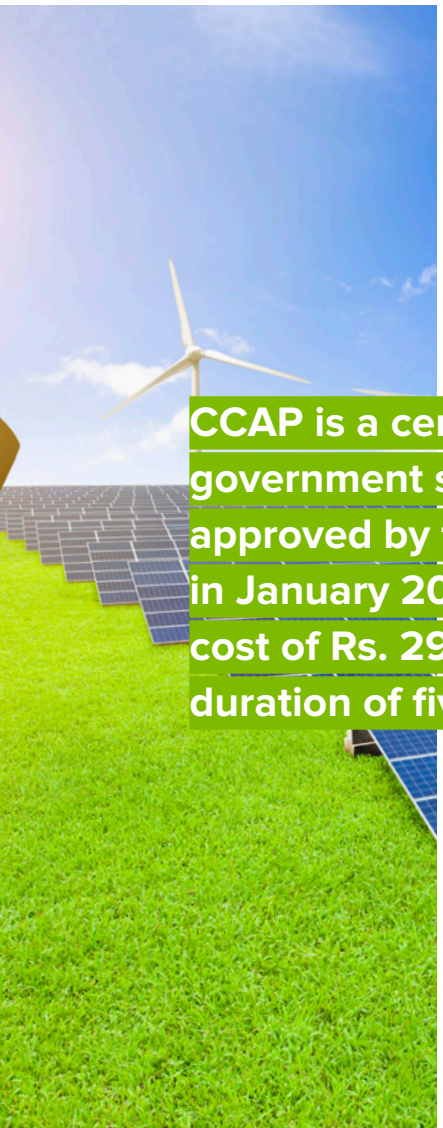
49 https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1568328 (6/5/2020)

Ecosystem, Green India, Sustainable Agriculture, and Strategic Knowledge for Climate Change, anchored by various Ministries—representing multipronged, long term, and integrated strategies for achieving key goals in the context of climate change.

All National Missions were approved by the Prime Minister's Council on Climate Change (PMCCC) and are currently being implemented. The Missions are under constant review by the PMCCC. An Executive Committee on Climate Change (ECCC) under the Chairmanship of Principal Secretary to the Prime Minister has been set up to assist the PMCCC in developing a coordinated response to climate change-related issues, with regular monitoring of the National Missions, along with other initiatives on climate change, and coordination with various agencies.

2.7.5 State Action Plan on Climate Change (SAPCC)

With the formulation of the NAPCC, the need to coordinate actions at the national and sub-national levels became apparent. Therefore, the MoEFCC motivated the state governments to prepare their SAPCCs in line with the strategies outlined in NAPCC; so far, 32 States/UTs have prepared these plans.



MoEFCC has also provided financial support to states to enhance their capacities to undertake climate change-related activities. A sum of Rs. 10 lakhs has been distributed to 19 states for the capacity strengthening of nodal agencies for SAPCC implementation. Projects on adaptation and mitigation measures are also funded as demonstration projects under the Climate Change Action Programme (CCAP). To date, three demonstration projects in Punjab, Madhya Pradesh, and Tamil Nadu have been sanctioned.

2.7.6 Climate Change Action Programme

CCAP is a central government scheme approved by the Cabinet in January 2014 at a total cost of Rs. 290 Cr for a duration of five years. Its objective is to create and strengthen the scientific and analytical capacity for climate change assessment in India, putting in place an appropriate institutional framework for scientific and policy initiatives and implementation of climate change-related actions in the context of sustainable development. The components of the CCAP scheme include the National Carbonaceous Aerosols Programme (NCAP), Long Term Ecological Observatories (LTEO), and Coordinated Studies on Climate Change for North East Region (CSCCNER).

2.7.7 India's Post-2020 Climate Goals

For the post-2020 period, as mandated by COP-21, India submitted the Intended Nationally Determined Contribution (INDC) to the UNFCCC on 2 October, 2015, outlining the climate actions intended to be taken under the Paris agreement. The eight goals specified in the INDC are:

1. To put forward and further propagate a healthy and sustainable way of living based on the traditions and values of conservation and moderation.
2. To adopt a climate friendly and cleaner path than the one followed hitherto by others at a corresponding level of economic development.
3. To reduce the emissions intensity of India's GDP by 33-35% by 2030, from 2005 levels
4. To achieve about 40% cumulative installed power generation capacity from non-fossil fuel-based energy resources by 2030 with the help of transfer of technology and low-cost international finance, including from the Green Climate Fund.
5. To create additional carbon sinks of 2.5 to 3 billion tonnes of CO_2 equivalent (tCO2e) through additional forest and tree cover by 2030.
6. To enhance investments in vulnerable sectors to mitigate climate change impact, particularly agriculture, water resources, Himalayan region, coastal regions, health, and disaster management.

7 To mobilise domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resources required and resource gap.

8 To enhance capacities and create a framework for quick diffusion of cutting-edge climate technology in India through collaborative R&D.

9 To prepare the roadmap for implementation of INDC in the post-2020 period, MoEFCC constituted an NDC Implementation Committee, chaired by the MoEFCC Secretary, and six thematic sub-committees involving key government ministries and departments. The committee and sub-committees identify specific policies and actions aimed at achieving the NDC goals, and the Committee specifies the financial outlays and technologies needed to achieve these goals.

2.8 Department of Science and Technology

Department of Science & Technology (DST) was established in May 1971 with the objective of promoting new areas of S&T and playing the role of a nodal department to organise, coordinate, and promote S&T activities in the country. Among other activities, DST undertakes coordination and integration of S&T areas having cross-sectoral linkages in which a number of institutions and departments have interest and capabilities. DST also undertakes or financially supports S&T studies and research design and development through partnerships with scientific research institutions and bodies, where necessary.

DST works in partnership with various countries, and bilateral meetings are held to foster the research cooperation in the fields of clean and renewable energy and sustainable agriculture, among others. Partner countries include the United States (US), Sweden, Denmark, Egypt, Korea, Mexico, United Kingdom (UK), and Uzbekistan. Several R&D projects are in progress in the domains of solar energy (concentrated solar thermal power, photovoltaic) and EE (motors, waste heat recovery), among others.[50]

The key initiatives of DST are:

- Clean Energy Research Initiative- Initiative to Promote Habitat Energy Efficiency (IPHEE)
- BHAVAN Fellowships
- Indo-US Joint Clean Energy Research & Development Centre
- Global Cooling Prize

50 https://dst.gov.in/document/annual-report/brief-statement-activities-2018-english (6/5/2020)

2.8.1 Clean Energy Research Initiative

DST has an ongoing programme called Clean Energy Research Initiative (CERI) that aims to enhance national capacities in developing research-led competitive and cost-effective clean energy and EE solutions for power and non-power applications. The research covers the entire gamut of clean energy, viz. smart grid, off-grid, energy storage, building EE, cleaner fuels, clean coal, and energy materials.

Initiative to Promote Habitat Energy Efficiency (IPHEE): Under CERI, DST has initiated a programme to support R&D on habitat EE, to improve the energy performance of buildings and cities. IPHEE also aims to support the enhancement of knowledge and practices to save energy through efficient design, construction, and operation of manmade infrastructure. The programme envisages supporting India-specific outcome-based research in the areas of EE building technologies, low energy cooling systems, daylighting and electric lighting, and automation and controls for energy savings, along with research

that can provide scientific support in policy formulation and help policymakers devise procedures, codes, and standards. The focus is on research on scientific, engineering, design and technological solutions that can overcome barriers to achieving energy efficiency. DST encourages collaboration with industry organisations with domain expertise and the potential to support commercialisation of the research results.

Under this programme, DST is supporting two projects (as mentioned on their website):

A Smart Energy Management in Buildings (Indian Institute of Technology (IIT) Mumbai)[51]

B New model for minimising air-conditioning demand at airports in India (Airport Authority of India as the main stakeholder and C-DAC, Bengaluru as the implementing partner)[52].

51 http://seil.cse.iitb.ac.in/projects/iphee/ (7/5/2020)
52 https://dst.gov.in/new-model-minimizing-air-conditioning-demand-airports-india (7/5/2020)

2.8.2 BHAVAN Fellowships

Recognising that climate change, clean and efficient energy, and environmental protection are among the biggest challenges facing India and the United States and to address the need for human resource development and capacity building in the area of Building EE, DST and the Indo-US Science and Technology Forum (IUSSTF) have developed a dynamic exchange programme between Indian and US institutions and premier US universities. The Building Energy Efficiency Higher & Advanced Network (BHAVAN) Fellowships are envisaged to create a sustainable and vibrant relationship between the two nations, as well as establish long term Indo-American S&T cooperation[53].

The programme aims to:

- Provide opportunities to the best and brightest Indian students and scientists to gain exposure and access to world-class research facilities in US universities and labs;
- Promote research and capacity building in the pioneer area of Building EE; and
- Pave the way for the next generation of Indian scientists and technologists to interact with their American peers, thus helping establish long-term R&D linkages and collaboration.

Bhavan Fellowships have been offered to researchers from leading Indian universities, including CEPT University, IITs, and National Institutes of Technology (NITs), since 2016.

2.8.3 Indo-US Joint Clean Energy Research & Development Centre

Under the Partnership to Advance Clean Energy (PACE) umbrella, the US Department of Energy (DOE) and GoI signed an agreement to establish the Joint Clean Energy Research and Development Centre (JCERDC) on 4 November, 2010[54]. The overall aim of the JCERDC is to facilitate joint clean energy R&D to improve energy access and promote low-carbon growth. To achieve this objective, the JCERDC supports multi-institutional network projects using a public-private partnership funding model. In India, the programme receives funding from the Ministry of Science and Technology through DST and Department of Biotechnology (DBT) and is administered through the bilateral IUSSTF.

JCERDC was implemented in different phases, as described below:

53 https://iusstf.org/program/building-energy-efficiency-higher--advanced-network-fellowship (7/5/2020)
54 https://iusstf.org/program/indo-us-joint-clean-energy-research--development-centre

- Phase I: Solar energy, second generation biofuels, and building EE
- Phase II: Smart grids and energy storage for improving the reliability, flexibility, and efficiency of the electricity delivery system
- Phase III: Multi-institution project launched on 'Improving Building Energy Efficiency'

Under Phase I, the India Joint Centre for Building Energy Research and Development (CBERD)[55] was established at CEPT University (Ahmedabad), in partnership with Lawrence Berkeley National Laboratory.

JCERDC Phase II extended funding for the three existing research tracks for an additional five years and added smart grids and energy storage[56].

Under JCERDC Phase III, a multi-institution project was launched on 'Improving Building Energy Efficiency', with Central Building Research Institute (CBRI), IIT- Roorkee and Delhi, and Central Glass & Ceramic Research Institute (CGCRI) Kolkata as partners. The project had the following objectives:

- Development of Low-Energy Design Guides for Commercial Buildings in Indian Climatic Zones
- Modular Thermally Activated Solar Cooling and Ventilation Systems
- Identification, Study, and Development of Building Materials - Novel Insulation Systems and Components
- Energy Efficient Lighting Systems in Commercial Buildings
- Technology Integrated Design and Construction of an EE Demonstration Building
- Development of Technology Transfer, Training, and Sensitivity Plans for Generating Awareness on Energy Efficient Buildings

The total project budget was Rs. 6.68 Cr, and the project ended in January 2020[57].

2.8.4 Global Cooling Prize

DST and Rocky Mountain Institute (RMI) in the US are inviting global innovators to apply for the Global Cooling Prize and solve the critical climate threat that comes from growing demand for residential AC. This innovation challenge aims to shine a spotlight on a breakthrough residential cooling technology that has at least 5 times less climate impact than the standard technology in operation today (considering both energy and refrigerant impacts), costs no more than 2 times a standard AC unit on the market in India at assessed industrial scale, and operates under other constraints defined by the prize criteria. The Global Cooling Prize was launched in November 2018 and is now open for applications. The competition will run for two years and disburse at least USD 3 million in the interim, and final awards will be given to the best innovative, high-performing residential cooling technologies. Scaling up the winning technology could be one of the most effective technology-enabled steps to mitigate climate change, with the potential to prevent up to 0.5°C in global warming. The Global Cooling Prize is supported by GoI through DST, under Mission Innovation Challenge 7: Affordable Heating and Cooling Challenge. Other Indian government organisations, such as BEE, MoP, MoEFCC, and NITI Aayog, are also supporting the Global Cooling Prize[58].

Eight finalists were announced in November 2019, and prototype development is presently under way. Lab and real-world testing is expected to happen between September 2020 and January 2021, with the final award ceremony taking place in March 2021[59].

2.9 NITI Aayog

NITI Aayog was formed via a resolution of the Union Cabinet on 1 January, 2015 to be GoI's premier policy think tank, providing both directional and policy inputs. In addition to designing strategic and long-term policies and programmes for GoI, NITI Aayog also provides relevant technical advice to the Centre and States. Some of its major initiatives are briefly described below[60].

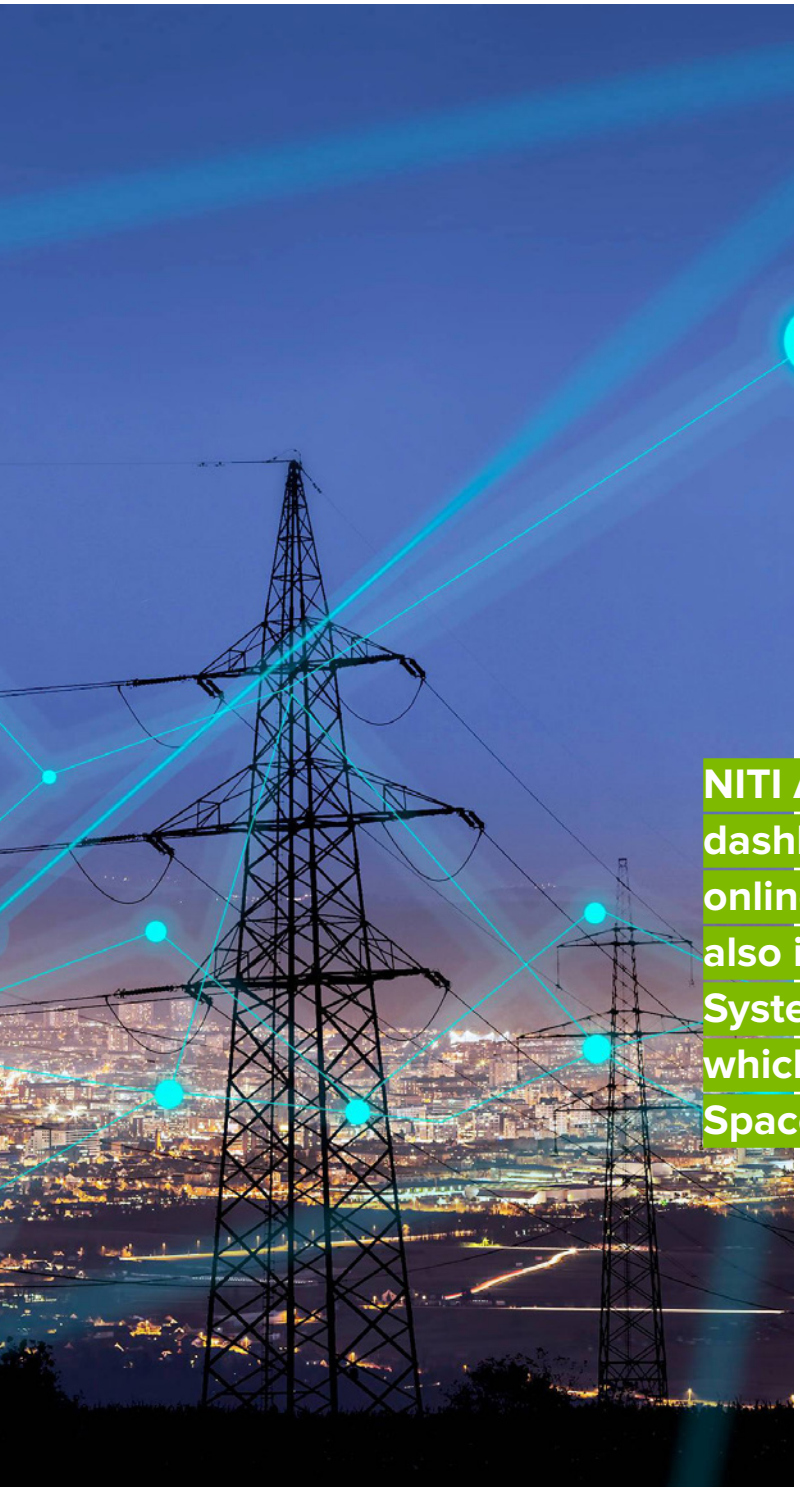
India Energy Dashboard[61]: This dashboard will contain time series data on the energy sector. In the second phase of the exercise, NITI Aayog is working to make the dashboard more robust and enable online updating of data. This will also include Geographic Information System (GIS) mapping of energy, which is being finalised by Indian Space Research Organisation (ISRO).

India Energy Security Scenario 2047 (IESS): The IESS Version 2.0 was launched in September 2015 and is hosted on the NITI Aayog website for use by all. The IESS 2047 has been built as a knowledge portal combining information technology (IT) applications, behavioural aspects, energy related emissions, local resource endowments, all sources of energy supply and demand, global and Indian technologies, and cost-time parameters. Potential users (e.g. policymakers, investors, energy specialists, and journalists) can choose from a range of assumptions with respect to policies, technologies,

55 www.cberd.org
56 https://dst.gov.in/pressrelease/award-announced-indo-us-smart-grids-and-energy-storage-program (7/5/2020)
57 https://cbri.res.in/rd/rd-programs/indo-us-project/
58 http://dst.gov.in/sites/default/files/GCP-Announcement%20Web%20Content.pdf (7/5/2020)
59 https://globalcoolingprize.org/ (7/5/2020)
60 NITI Aayog's reports can be accessed at: https://niti.gov.in/index.php/reports (8/5/2020)
61 https://niti.gov.in/edm/

and ambitions in different sectors, and the IESS 2047 generates predictions of corresponding energy needs[62].

Energy Data Management: NITI Aayog constituted working groups on energy supply and demand to examine what data is available for planning purposes and what needs to be additionally collected at various levels. On the demand side, four working sub-groups (Transport, Industry, Agriculture, and Buildings) have been formed. The broad mandate of the sub-groups is to assess the existing data maintained by different agencies/ government bodies, identify the gaps and frequency of collection of data, and recommend measures to fill the data gaps and enable online updating of data and an increase in the frequency of updating data. The sub-groups also specify the need of statutory requirements, if any, for collecting important data from the public and private sectors.



State Energy Index: NITI Aayog has initiated the development of the State Energy Index to compare energy accessibility, affordability, and sustainability across all Indian states and UTs. The index comprises 20 indicators under four broad categories - "access, affordability & reliability", "clean initiatives", "energy & efficiency", and "DISCOM viability & competition". It will provide the states and concerned central ministries/ departments a wealth of useful information, enabling them to formulate and implement suitable strategies. All the stakeholders have been consulted to get their feedback on the preliminary set of indicators, and, accordingly, requisite changes have been made[63].

E-mobility: NITI Aayog and the Rocky Mountain Institute launched a report on 'India's electric mobility transformation' in April 2019. The Cabinet approved the National Mission on Transformative Mobility and Battery Storage, which will drive clean, connected, shared, sustainable, and holistic mobility initiatives. The Mission aims to create a five-year Phased Manufacturing Programme (PMP) to support the establishment of large-scale, export-competitive integrated battery and cell-manufacturing giga plants in India, as well as localise production across the entire EV value chain.

FAME-I and FAME-II, as described in Section 2.6.1, have been launched to provide an enabling environment for EVs in the country. FAME II focuses on moving people through clean means of transport and prioritises public and shared transport, rather than individual vehicles. This meets multiple objectives, including reducing traffic congestion, improving urban quality, and reducing carbon emissions.

Increasing consumer awareness regarding EVs, collaboration for increased R&D on batteries and charging technologies, and identifying new business models are some of the key actions the EV industry is expected to take up to make e-mobility a national programme[64].

NITI Aayog is working to make the dashboard more robust and enable online updating of data. This will also include Geographic Information System (GIS) mapping of energy, which is being finalised by Indian Space Research Organisation (ISRO)

62 https://www.niti.gov.in/niti/content/niti%E2%80%99s-energy-sector-planning-tool-iess-2047 (21/07/2020)
63 https://niti.gov.in/verticals/energy/achievements-in-the-year-2018-19 (8/5/2020)
64 https://rmi.org/wp-content/uploads/2019/04/rmi-niti-ev-report.pdf (21/07/2020)

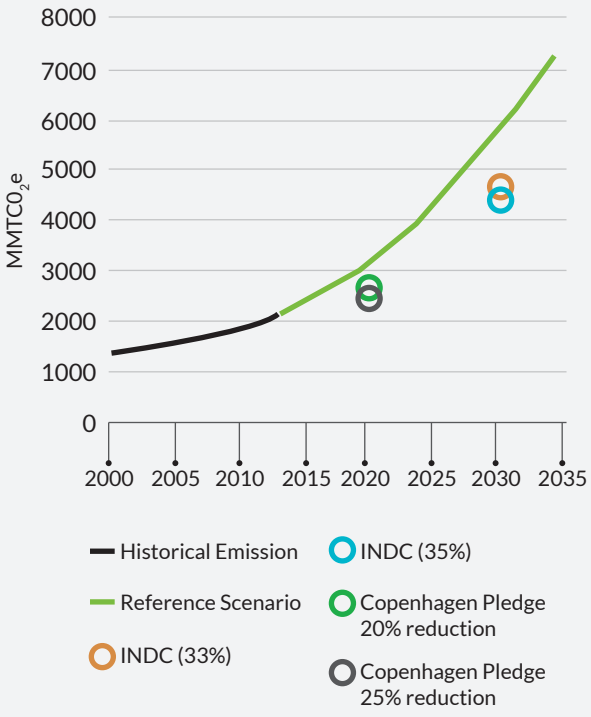
03 Energy Efficiency Through Bilateral and Multilateral Partnerships

India has set itself high targets to achieve low-carbon growth by deploying solar and wind energy capacity. As of January 15, 2021, out of a total installed generation capacity of 375 GW, 91 GW came from renewable energy sources, a share of 24% (excluding hydro) . Between 2010 and 2019, India has added about 62 GW of RE capacity, compared to 124 GW of thermal capacity. Between 2015 and 2019, the RE capacity addition was 38.6 GW, compared to a thermal capacity addition of 37.3 GW. Rapid ramp up of RE power plants saw a capacity addition of 20.3 GW between 2017 and 2019, compared to a 7.9 GW thermal capacity addition. Moreover, investments in the RE sector outnumbered those in fossil-fuel-based projects post 2017, further signalling a transition towards clean energy.

3.1 Tracking India's 2015 Climate Change Commitments

India is on track to meet, and likely exceed, its key commitments of cutting GHG emission intensity by 33-35% below 2005 levels by 2030 and achieving 40% non-fossil fuel-based installed power capacity by the same year. In September 2019, the Prime Minister of India committed to a target of 450 gigawatts (GW) of renewable energy installations by 2030 – equivalent to five times India's current installed RE capacity and greater than the capacity of India's entire electric grid in 2019[65]. India's solar power capacity has jumped from a mere 17 megawatts (MW) in 2010 to 39 GW as at the end of February 2021[66].

The graph below indicates the trajectory of emissions in the Business-As-Usual (BAU), i.e. Reference, Scenario and other scenarios where actions are taken.



India has set itself high targets to achieve low-carbon growth by deploying solar and wind energy capacity. As of January 15, 2021, out of a total installed generation capacity of 375 GW, 91 GW came from renewable energy sources, a share of 24% (excluding hydro)[67]. Between 2010 and 2019, India has added about 62 GW of RE capacity, compared to 124 GW of thermal capacity. Between 2015 and 2019, the RE capacity addition was 38.6 GW, compared to a thermal capacity addition of 37.3 GW. Rapid ramp up of RE power plants saw a capacity addition of 20.3 GW between 2017 and 2019, compared to a 7.9 GW thermal capacity addition. Moreover, investments in the RE sector outnumbered those in fossil-fuel-based projects post 2017, further signalling a transition towards clean energy.

65 https://www.nrdc.org/sites/default/files/india-progress-climate-pledge-2019-ib.pdf (16/4/2020)
66 https://mnre.gov.in/the-ministry/physical-progress (accessed April 5, 2021)
67 https://npp.gov.in/dashBoard/cp-map-dashboard (accessed 20/01/2021)

3.2 Climate Mitigation Policies

3.2.1 Renewable Energy

India aims to install 175 GW of renewable energy (100 GW solar, 60 GW wind, and 15 GW biogas) by 2022. As at the end of February 2021, India's total installed RE capacity was 93 GW.

3.2.2 Shaping an Energy Efficient Economy

The various components of NMEEE have been successful in delivering energy savings and emission reductions over the years (see Section 2.3.2 for the statistics)[68]. In addition to the NMEEE, MoHUA, DST, DHI, and several other ministries have initiated programmes to increase EE in the economy, as described in Chapter 2.

3.3 Climate Change Mitigation Programmes Through Bilateral Support

Many developed countries have directed and enhanced their funding and programmes to specific sectors to overcome barriers to scaling up EE in developing countries. India has partnered with several countries to launch EE programmes, to benefit from these countries' experiences. These programmes have been ongoing since the seventies and cover numerous topics, including industrial EE, standards and labelling, and building EE, among others.

3.3.1 Indo-German Energy Programme (IGEN)

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) is implementing the Indo-German Energy Programme (IGEN) on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ). It liaises with the KfW Development Bank and works with its Indian partners. The Energy Programme promotes measures to improve energy efficiency through the following programmes.

- **PAT programme:** This programme aims to reduce large industries' energy consumption by supporting the GoI PAT scheme. Around 1000 industries in 13

68 Impact of Energy Efficiency for the Year 2018-19, BEE

sectors are covered under this scheme, detailed in Section 2.3.4. Around 200 industry awareness-building workshops have been conducted since the start of the PAT scheme. Exhaustive documentation has been prepared for normalisation and monitoring-verification protocol across eight sectors, out of the total thirteen[69].

- **IGEN Energy Efficiency in Residential Buildings (IGEN-EERB) -** The programme aims at supporting the Govt. of India in the development of an Energy Conservation Building Code for Multi-Storey Residential Buildings (ECBC-R) and thereafter supporting the implementation in selected states and municipalities through a mix of bottom-up and top-down approaches. To further complement and enhance penetration of energy efficiency within the residential buildings sector, GIZ has supported Government of India in the development of a labelling mechanism for residential buildings. These energy labels will help consumers to make efficient decisions through the provision of direct, reliable and costless information. The estimated energy saving potential through the labelling programme is around 388 Billion Units by the year 2030 resulting in a reduction of carbon emission by 3 million tonnes. Overall, the development of the ECBC-R and its subsequent application through a labelling programme will lead to a win-win situation for developer and consumer in terms of reduced life cycle costs of buildings, where energy efficiency triggers the savings for both the parties while leading to climate change mitigation. Energy labels would effectively differentiate buildings in the marketplace. Labels provide information on the potential and actual energy use of buildings and will also be utilised as the base for further incentive programmes[70]. GIZ has also supported in establishing **Eco-Niwas Samhita (ENS) cells** in 5 states (Delhi, Karnataka, Maharashtra, Uttar Pradesh, Punjab) to implement and enhance residential building energy efficiency policies.

  With the aim to promote energy efficiency/ conservation in residential buildings, considerable amount of work has been done in different programs such as **Building Materials Directory** to create a national directory of energy efficient building materials to enhance energy efficiency in the residential sector. **Replicable Design** focuses to develop a design template for building energy efficient homes for different residential typologies and climatic zones. The Catalogue will consist of about 4000 Design Typology, considering each climate zone. The focus of the project is to enable the user/ builder/ designer to easily adopt energy efficiency measures into the construction with immediate impact. **Smart Home Program** is for understanding the technologies, application potential in terms of building energy efficiency policies in India. It also focuses on Machine Learning and Artificial Intelligence which helps in smart home infrastructure by gathering data from the home automated devices. Energy saving potential by adoption of smart home devices is expected to be 94 billion units in 2030, which will be about 15% of electricity consumption of residential sector in 2030.

  Under the **Thermal Comfort** program, a database and adaptive model for thermal comfort of occupants in residential buildings of Urban India will be prepared. Surveys have been conducted in 8 different cities of different climatic regions of India to develop the equation in order to improve indoor thermal comfort conditions of the occupants of urban India.

- **Promoting energy efficient cooling in India (EE-Cool)** - The cooling of buildings is the main driver of India's electricity consumption. The country mainly uses small stand-alone systems, which consume a lot of energy and use climate-damaging refrigerants. The Indian government has developed the India Cooling Action Plan (ICAP) to come up with an integrated approach across all affected sectors over the next 20 years. Its aim is to reduce direct and indirect GHG emissions caused by cooling systems. The India Cooling Action Plan (see Section 2.7.2) has been drawn up to help achieve a more sustainable solution. Under this action plan, the country aims to switch to more energy-efficient systems that use natural refrigerants with little or no global warming potential. A strategic roadmap setting out clear political framework conditions and goals is to be developed and introduced into the political process by the BEE (Output 1). At the same time, business models are to be developed in cooperation with relevant actors, in particular the private sector together with the framework conditions required for their successful implementation (Output 2). If BEE brings the solutions developed as part of Output 1 and 2 into the political process and decides to apply for international funding (e.g. NAMA Facility, Global Environment Facility) for its implementation, then the project will also advise the Indian partners on the application process (Output 3). The project also promotes sustainable change in space cooling, which could lead to a potential reduction in GHGs and thushelp India achieve its NDCs[71] in relation to climate action.
- **Financing EE Projects in the MSME Sector** – KfW, in cooperation with the Small Industries Development Bank of India (SIDBI) and in the framework of the Indo-German Development Cooperation, was offering financial assistance in the form of a line of credit to SMEs for investment in EE projects until December

69 https://www.giz.de/en/worldwide/68984.html (5/3/2020)
70 https://www.giz.de/en/worldwide/70229.html (27/01/2021)
71 https://www.giz.de/en/worldwide/83313.html (27/01/2021)

2019. MSMEs can reduce their energy consumption by investing in equipment, technologies, or process improvements that increase the EE of their facilities. The minimum assistance under this scheme was Rs. 10 lakhs, and the interest rate was supposed to be 1% below the normal lending rate. The loan could be repaid over a maximum period of 7 years.[72]

- **EE Lines of Credit** are being implemented with GoI for energy efficient light bulbs, street lights, and other devices. The products are sold by EESL a government service provider in the field of energy efficiency. In providing a loan of EUR 50 million, KfW is supporting EESL projects, thereby making a contribution to the country's socially and environmentally sustainable energy supply. Almost all the funds have now been channelled into projects, and KfW plans to expand its financial cooperation with EESL; it has committed to a new credit line of EUR 200 million. KfW and EESL have agreed, in principle, that each of the projects co-financed by a KfW loan must result in measurable energy savings and, in turn, a corresponding reduction in CO_2 emissions of at least 20 percent[73].
- **Indo-German Energy Forum (IGEF)-** Established by the Indian Prime Minister and the German Chancellor in April 2006, the IGEF is a high-level political dialogue platform to promote an enabling environment for public and private entities to support EE and RE in India. The IGEF Support Office is implemented by staff from BEE, GIZ and KfW. In the area of District Cooling, IGEF Support Office in cooperation with ICLEI had organized a workshop on "District Cooling" with experts from Germany and India. This energy issue is seen as an area of high demand and interest for both countries. A proposal for Indo-German Energy Cooperation has been presented to the "Indo-German Working Group on Climate" led by the German Ministry of Environment (BMUB) and MOEFCC, financed by the Government of Germany through the International Climate Initiative. The implementing partner in this project will be MoP through BEE.

  The Subgroup III on 'Energy Efficiency' focuses on energy efficiency measures to achieve the energy goals of Germany and India. The following three priority issues were identified through the strategic review process:

A Achievement of Energy Goals in Germany and India through Energy Efficiency: A sector wise study should analyze and show case the full potential of energy efficiency measures for India.

B District Cooling

C Demand Side Management (shifting of electricity demand in different sectors)

- **Demand Side Management**- Flexibilisation of the Indian electricity system to adapt to fluctuating renewable energy power is one of the major topics for the current Indo-German Dialogue within all subgroups of the Forum involved. Demand Side Management with shifting of electricity demand in different sectors was identified as one future relevant energy issue within the dialogue in the IGEF. An analysis of demand side management potential especially in industries will be undertaken[74].

3.3.2 Indo-US Collaboration

United States Agency for International Development (USAID) has had a long history of collaboration with India, under which the Energy Conservation and Commercialisation project (ECO) was launched and ran for over 15 years. The ECO programme was initiated by GoI and USAID in January 2000 to enhance the commercial viability of the Indian energy sector and promote the utilisation of clean energy and EETs. Under this programme, support was provided to BEE to set up procedures and programmes leading to the development of BEE's action plans, including identification of thrust areas.

Under the ECO II project, support was provided in three areas: development of the ECBC, support to Maharashtra to develop strategies for energy conservation, and development of the DSM programme for energy efficient lighting and other programmes in Karnataka.

The ECO III project extended the cooperation to include areas identified in BEE's action plan for the Eleventh Five Year Plan. This included assisting in ECBC implementation and enhancing energy conservation in buildings, municipalities, small towns, and enterprises. But releasing a technical energy code is not enough to drive change[75]. Since the release of the ECBC in 2007, ECO III initiative and the BEE have launched a campaign to promote its use among builders and contractors. In addition, a suite of tools and supporting materials to make it easy to meet minimal EE criteria in new projects has been released under ECO III, including the following:

- User guide and tip sheets
- Workshops and seminars promoting the code
- Professional certification programme
- Software to verify code compliance
- Technical support and research on energy modelling

72 https://www.kfw.de/stories/environment/energy-efficiency/india-efficient-solutions-energy/

73 https://www.kfw.de/stories/environment/energy-efficiency/india-efficient-solutions-energy/

74 https://www.energyforum.in/home/about/the-subgroup-iii-energy-efficiency/ (27/01/2021)

75 https://www.beeindia.gov.in/sites/default/files/ECBC%20User%20Guide%20V-0.2%20%28Public%29.pdf (20/07/2020)

- Educational curriculum enhancement initiative to create awareness about ECBC among future architects and engineers

Under the most recent collaboration, the Partnership to Advance Clean Energy - Deployment (PACE-D), USAID is supporting MoP and MNRE in increasing the growth of clean energy in India. Launched in July 2012, the PACE-D programme is successfully assisting the GoI in the deployment of EETs and decentralised RE systems, such as distributed solar power, by strengthening policy and regulatory institutions, increasing access to finance, and enhancing institutional and human resource capacity.

In the domain of EE, USAID has supported MoP and the BEE in a range of initiatives, including assisting the National Smart Grid Mission in implementing and monitoring the GoI's smart grid pilots and updating the 2007 ECBC to support India's transition to a net zero energy building future. To this end, the PACE-D programme has assisted in creating a successful knowledge portal to promote net zero energy buildings in India. USAID is also providing assistance to states such as Rajasthan and Haryana in implementing the updated ECBC.

USAID also supported the development of a market driven approach for super-efficient buildings and Net Zero Energy Buildings (NZEB). A national NZEB vision and roadmap for India was developed through extensive consultation with the building industry. Subsequently, the NZEB Alliance and Knowledge Portal were launched to promote and support the programme implementation. USAID supported Indian Railways in developing a "Green and Net Zero" action plan for all future railway buildings. The new campus for Nalanda University is being developed as a net zero energy campus with USAID technical assistance. Nalanda is an international university, with linkages to several universities in the Asia Pacific region, and is advocating for application of the NZEB approach in these institutions.

Implementing ECBC as a minimum energy performance standard is expected to achieve energy savings of 317 BU by 2030. Implementing DSM in the selected utilities has led to significant energy savings, estimated at 497 MU annually[76]. Recognising the importance of energy consumption in AC in buildings, USAID programmes have also focused on reducing energy consumption in AC. The ECBC, as well as the green building ratings, mandates better building designs to reduce the demand for AC, while also specifying the EE levels for these systems. To take this agenda forward, USAID supported the first ever AC market research in India, out of which a comprehensive market transformation strategy for India was developed. This led to the design of a super-efficient air-conditioner programme in partnership with EESL. This programme resulted in procurement of 100,000 super-efficient ACs, which were 30% more efficient than the best product on the market at that time. This has spurred the industry to innovate in order to cater to this new market segment, with cheaper and more efficient ACs available to consumers today.

Market Integration and Transformation for Energy Efficiency (MAITREE), a bilateral programme between USAID and the MoP under the US government's Asia EDGE initiative, supports the uptake of cutting-edge technologies and innovative business models and promotes end-user engagement for large scale interventions to accelerate the adoption of EE strategies and technologies. The programme addresses the interlinked challenge of cooling and building energy efficiency through three components:

- **Energy Efficiency in Buildings** leverages public private partnerships to enhance EE in new and existing buildings.
- **Sustainable Cooling** induces building cooling technology market transformation through large-scale super energy efficient cooling technology deployment programmes.
- **Training, Consumer Engagement, and Outreach** advances integration of sustainable building technologies through professional skill development and consumer education about the benefits of energy efficiency.

MAITREE has enabled the creation and expansion of domestic markets for advanced EETs by scaling up consumer demand and market investment. The programme has mobilised nearly USD 190 million in investment in EETs and saves nearly 240 MU of electricity annually. MAITREE is also collaborating with partner organisations and the government to make public procurement more sustainable by integrating specifications for green technologies. Taking this forward, a Sustainable Public Procurement (SPP) framework developed for Ministry of Finance prioritises assessment of lifecycle environmental impact as an important evaluation criterion in public procurement. MAITREE has framed procurement specifications and evaluation criteria for incorporating green and energy efficient materials and technologies into affordable rural and urban housing. The Ministry of Rural Development will apply Green Rural Housing guidelines in over 1 million houses, to be constructed under Pradhan Mantri Awas Yojana-Gramin (PMAY-G). Lucknow Development Authority is integrating the proposed guidelines into the design of over 48,000 affordable houses, to be constructed under PMAY-Urban (PMAY-U); 4,000+ dwellings have already been constructed.

In June 2020, EESL, in partnership with the MAITREE programme, launched the "Healthy and Energy Efficient Buildings" initiative, which will develop ways to make

76 https://www.pace-d.com/wp-content/uploads/2018/06/Closeout-Brochure-May-5-2018.pdf (22/5/2020)

workplaces healthier and greener[77]. Poor air quality has been a concern in India for quite some time and has become even more important in light of the Coronavirus Disease 2019 (COVID-19) pandemic. As people return to their offices and public spaces, maintaining good indoor air quality is essential to occupant comfort, well-being, and productivity and overall public health. Most buildings in India are not equipped to establish and maintain healthy indoor air quality and need to be upgraded. Currently, there is no standardized approach to retrofitting for COVID-19 response. Responding to the COVID-19 pandemic and to U.S. -India Strategic Energy Partnership (SEP) dialogue to advance the strategic and economic interests of the U.S. and India, USAID and EESL jointly launched RAISE. "RAISE (Retrofit of Air-conditioning to improve Indoor Air Quality for Safety and Efficiency)" is a national level program for healthier and greener buildings. Technical assistance to "RAISE" is being provided under the MAITREE program. This initiative is aimed at making workplaces healthier and greener. The retrofits will focus on enhanced indoor air quality (IAQ), thermal comfort, and energy efficiency (EE) in the air conditioning system.

EESL corporate office in Scope Complex was implemented as a pilot to test the integrated approach. The retrofit measures implemented in the pilot projects were:

- Increased ventilation for dilution and lower CO_2
- Filtration to minimize particulate matter, pollutants, and pathogens
- Monitoring and display of IAQ and comfort parameters
- Based on the experience of the initial pilots; retrofit specifications have been developed, for nation-wide scale-up of this initiative[78].

77 https://pib.gov.in/PressReleasePage.aspx?PRID=1629597 (20/07/2020)

78 https://maitree.edsglobal.com/2020/10/21/raise-activity/ (accessed 27/01/2021)

The results of the retrofits have been encouraging. The air quality in the offices has dramatically improved with over 90-95% reduction in pollutants and constantly maintaining healthy indoor environment. Along with proactive measures to clean and disinfect surfaces, maintaining social distancing and wearing masks, communicating the improved air quality in the office to the employees has also allayed their anxiety about COVID spread, and returning to the office[79].

3.3.3 India-UK Collaboration

In June 2019, the UK Foreign and Commonwealth Office (FCO) provided support through the Prosperity Fund to scale up work under International Energy Agency's (IEA) flagship Clean Energy Transitions Programme (CETP) in India under three identified work areas: (i) energy efficiency; (ii) policy packages for climate change, air pollution, and energy access; and (iii) system integration of renewables at the state level in India. The interventions are structured around India's energy transition goals, as expressed in its NDC. The timeframe for this activity is July 2019 to December 2020.

The IEA CETP workstream on EE is being carried out in close cooperation with the BEE in the following thematic areas:

- **Cooling:** Focus areas include supporting activities that facilitate international experience exchange and dialogue on space cooling, analysis of the implications of cooling on power systems, and investigation of the role of EE and demand response in this sector.
- **Industrial EE:** State level capacity building, technical exchange, and/or analytical outputs (e.g. sectoral benchmarking, tech pathways)
- **Buildings:** Support in developing a National Roadmap for Energy Efficient Residential Buildings; state level training and capacity building to support the potential implementation of building codes and development of supportive policy frameworks
- **Energy services and leveraging private investment:** Energy services and strategies to leverage private investment will be covered as an integral part of the three thematic areas of cooling, industrial energy efficiency, and buildings.

The **Super-Efficient Equipment and Appliance Deployment Initiative (SEAD)** is a voluntary collaboration between 18 member governments that aims to address urgent global energy challenges and promote the manufacture, purchase, and use of energy-efficient appliances and lighting. Membership currently consists of three lead countries: the UK, European Commission, and India. The IEA is the secretariat of SEAD.

79 https://www.eeslindia.org/img/raise/RAISE_Program_EESL.pdf (accessed 27/01/2021)

Recognising the importance of driving ambitious energy efficiency standards, the UK, as COP-26 President, will help the IEA expand SEAD membership and seek greater commitments from members on increasing or implementing minimum energy performance standards (MEPS) in some of the highest energy-consuming product categories. These include room air-conditioners, refrigerators, lighting, and motors.

Through this collaboration, SEAD will focus on tracking and monitoring the progress of member countries and convene a facilitative dialogue to support the implementation of more effective and ambitious MEPS. SEAD will also lay the foundation for a group of countries seeking to work together to increase commitments for MEPS across borders and accelerate the pace of change.

The collaboration will also facilitate knowledge exchange and best-practice sharing on past successes and support further action. Additionally, this support could include high-level and technical engagement on increasing MEPS for key products and developing a facilitative dialogue within SEAD to address key challenges to improving energy efficiency.

3.3.4 Indo-Swiss Energy Efficiency Collaboration

Indo-Swiss Building Energy Efficiency Project (BEEP): BEEP intends to promote the Integrated Design Process (IDP) for designing energy-efficient and thermally comfortable (EETC) buildings. BEEP's approach primarily focuses on reduction of heat gains from the building envelope, improvement of natural ventilation, use of energy efficient space cooling, and application of renewable energy. At the national level, BEEP has assisted BEE in developing the Eco Niwas Samhita 2018, i.e. ECBC for Residential Buildings (ECBC-R Part I: Building Envelope). The project has also developed Design Guidelines for Energy Efficient Multi-Storey Residential Buildings. The design guideline document was highlighted in the INDCs in the run-up to the 2015 Paris Climate Change Conference.

BEEP supports state governments and city corporations in implementing EE measures in buildings; it has assisted several states in developing Design Guidelines for EETC Public Buildings. Between 2018 and 2021, BEEP will assist the states of Rajasthan, Gujarat, and Andhra Pradesh in developing similar guidelines. Currently, BEEP focuses on the following technologies: shading, natural ventilation, insulation, earth air tunnel, and radiant cooling. Part 1 of the guidelines focuses on minimum envelope performance standards, to limit heat gains (in hot climates) and heat loss (in cold climates), as well as to ensure adequate natural ventilation and maximum daylighting potential. The code resulted in a minimum 20% energy savings in cooling compared to a typical building. This is estimated to generate 125 billion kWh in electricity savings for the period 2018-2030, with about 100 $MtCO_2$ abated during the same period. The code is developed by BEE and is voluntary at present. BEE will assist states in implementing the code through partners. An online compliance tool for the code is available[80].

Low-Carbon Cement: In the production of cement, CO_2 is emitted through fossil fuel combustion and a chemical reaction of the raw materials. Because cement is used widely as a construction material, its production contributes significantly to global warming. In Phase 1 of the project, École Polytechnique Fédérale de Lausanne (EPFL), in collaboration with partner institutions in Cuba and India, conducted extensive research on a new cement type (LC3) that emits 10-30% less CO_2 than commercially available cements. Phase 2 of the project will focus on making preparations for large-scale production of the new cement, with a particular focus on India and Cuba.

The targeted medium-term outcomes are the following:

- The technical, economic, and environmental viability of LC3 is scientifically investigated and validated.
- LC3 is produced by pioneering cement companies and showcased in representative construction projects in India, Cuba and select other countries.
- A conducive regulatory environment is created for upscaling the production and application of LC3 through standards, policies, and certification.
- Detailed case studies confirmed the following promising results regarding LC3:
- LC3, with a clinker content of 50%, generates approximately 10% less CO_2 emissions than pozzolanic cements (PPC) and about 30% less than Ordinary Portland Cement (OPC).
- Extensive tests in the lab and field have shown that LC3 has equal or better characteristics than standard cements.
- Resource mapping has shown that suitable clays are widely available in India, partially even as waste materials from current mining activities. While the actual cost of producing LC3 depends on the specific circumstances of each cement plant, case studies indicate that, on average, the production costs are similar or slightly lower than those of standard plants.
- Cement companies have become increasingly interested in LC3. Two companies have undertaken industrial trial productions on their own. They have produced 200 tonnes of LC3 cement.

The project laid a good foundation for the standardisation of LC3. Nevertheless, more efforts are required to

80 (www.beepindia.org/ecbc-r)

develop and implement standards enabling the use of LC3 with a clinker content of 50% or less[81].

3.3.5 Other EE partnerships

In addition to the above major cooperation programmes, India has drafted a number of agreements with other countries, including France and Japan, for activities such as

- Development of sustainable mobility, with a focus on e-mobility
- Development of tools for the collection, use, and analysis of EE related data across selected sectors
- Development of tools for the collection, use, and analysis of CO_2 and GHG emission data for tracking global emissions under the INDCs
- Energy conservation guidelines for large energy intensive industries
- Energy management manuals for nine model PAT factories

3.4 Programmes Supported by Multilateral Development Institutions

3.4.1 Global Environment Facility (GEF)

GEF is a financial mechanism that provides grants to developing countries for projects that benefit the global environment and promote sustainable livelihoods in local communities. The Department of Economic Affairs within the Ministry of Finance is the political focal point, while MoEFCC is the operational focal point for the GEF Projects. In India, GEF has funded 110 projects (national & regional) with grant funding of USD 1.33 billion and additional co-financing of USD 13.277 billion[82].

GEF has two ongoing projects with BEE and EESL on EE, specifically targeting SMEs. The GEF-5 project, entitled "UNIDO-MSME-EESL Project on Promoting Market Transformation for Energy Efficiency in MSMEs", has 3 components:

1 Programme to identify energy-intensive clusters and replicable technologies

2 Demonstration projects and aggregation of demand for demonstrated technologies

3 Financing models to support replication of EE projects in MSMEs.

The expected outcome of the project is 1,10,000 toe of energy savings, with a 1 $MtCO_2$ emission reduction and market enablement of USD 150 million in potential investment. Budgeted at USD 31.3 million, the 36-month project has the primary objectives of promoting EET implementation in the MSME sector, creating and sustaining a revolving fund mechanism to ensure replication of sectoral EE measures, addressing the barriers for scaling up EE measures, and ultimately enabling a cleaner and more competitive Indian MSME industry.

The project has identified 10 SME clusters where 35 technologies will be demonstrated, while EESL will explore demand aggregation opportunities. To ensure that the replication of the EE projects in the MSME sector continues beyond the GEF project, a revolving fund will be set up to sustain the activity. The Energy Management Revolving Fund (EMRF) will be seeded with the GEF grant, disbursed to MSME units, and replenished with a portion of the returns that EESL receives from implementing the project. This model aims to reduce the transaction costs of MSME units; this will be done through the SME Implementation Plan by EESL (SMEIP-E). The model will work on the 'Pay-As-You-Save' principle, wherein regular payments to EESL/the relevant ESCO are made by the MSMEs after technology installation.

In terms of project achievements, 24 technologies have been identified and approved and implementation of demonstration projects. M&V of installed technologies have been carried out, and repayment to cover the project cost has started. As of January 2021, more than 50 equipments are operational in the demo phase and 25 ESCO agreements have been signed. Two technologies, namely, 600 FRP fans for Jorhat tea cluster and 500 units of PLC automation for Surat textiles cluster, have gone for bulk procurement. The activities in 2020 will continue to focus on further implementation and verification of savings achieved.

Key Achievements in the Project include Reduction in technology cost as a result of economy of scale, MSME demo units are following the repayment timelines and no payment default from MSME units yet. Capacity building of local vendors to participate in government procurement system is presently ongoing.

The GEF-6 project, 'Creating and Sustaining Markets for Energy Efficiency', is expected to leverage EESL's successful track record of deployment of large-scale EE programmes and fund its scale-up of EE programmes and new technology applications in the project. GEF-6 funding will be used in EESL EE initiatives to mitigate 60 MtCO2e in emissions. This project aims to further support and create enabling conditions for four of EESL's existing technologies: street lighting, domestic lighting, five-star

81 https://www.eda.admin.ch/deza/en/home/aktivitaeten_projekte/projekte-fokus/projektdatenbank.filterResults.html/content/dezaprojects/SDC/en/2013/7F08527/phase2?oldPagePath=/content/deza/en/home/aktivitaeten_projekte/projekte-fokus/projektdatenbank.html

82 https://www.thegef.org/country/india (accessed 27/01/2021)

rated ceiling fans, and agricultural pumps. Additionally, the funding will help EESL incorporate three new technologies into its portfolio: super-efficient ceiling fans, trigeneration, and smart meters[83].

3.4.2 Facility for Low Carbon Technology Deployment (FLCTD)

The Facility for Low Carbon Technology Deployment (FLCTD) project was launched in 2016 with an objective to address technology gaps through use of energy efficiency technologies and support the deployment and scale-up. The project is being implemented in collaboration withthe Bureau of Energy of Efficiency.

FLCTD is designed to identify over 100 energy-efficient cleantech innovations over a five-year period. The programme aims to locate and make critical connections between the stakeholders in the ecosystem - the innovators who provide the technical solutions, the experts and academia who fine-tune these solutions, and the investors who support the market-based dissemination of the new solutions - to facilitate deployment of these energy saving technologies in industry. The project will conduct annual 'Innovation Challenge' competitions that will identify innovative low-carbon technologies and solutions to improve efficient end-use of energy, which, in turn, will help to reduce GHG emissions in the long run. Project offers up to US$50,000 to demonstrate an innovative technical solution that addresses technology gap, contributed towards reduction in energy consumption and has a strong replication potential.

The areas of focus for the challenge are waste heat recovery (WHR), space conditioning, and pumps and pumping systems. The project provides the winners grants to demonstrate the technology in field conditions, which is validated by experts and the industry. In 2018 and 2019, the project identified 30 promising first-generation innovations with large-scale carbon emission reduction potential. FLCTD has earmarked Rs. 9.5 Cr for technology deployment and demonstration of these 30 innovations in the field over an 8-12 month period. An Acceleration Programme will be organised for shortlisted participants and will cover topics such as business plan development, marketing strategies, and patents. The programme will also include mentoring from industry experts.

- Deployment support will be offered through the identification of companies willing to install winning WHR technologies.
- Verification support to establish the efficacy of innovative technology after commissioning.The challenge scheme is currently open for 2020 in the areas of industrial Internet of Things (IoT) and resource efficiency, in addition to the existing categories.

GEF has funded 110 projects (national & regional) with grant funding of USD 1.33 billion and additional co-financing of USD 13.277 billion

83 https://www.eeslindia.org/content/raj/eesl/en/Programmes/Financial_Assistance_Programmes/gef.html (27/5/2020)

Technology Verification

The first innovation challenge under FLCTD was held over 2017-2018 and attracted 127 applications across the three technology verticals. Thirteen innovative solutions were selected by the expert panel and the project provided USD 504,728 for technology demonstration and validation.

The second innovation challenge was held in 2019 and attracted 88 applications in the three technology verticals. Fifteen winners were selected by the expert panel in the 3 technology verticals and approximately USD 750,000 have been committed from the project for technology demonstration and validation.

The third round which closed on May 31, 2020, received 178 entries. Thirteen winners were selected by the expert panel in the 3 technology verticals and approximately USD 500,000 have been committed from the project for technology demonstration and validation. Selected technologies that received grant support are summarised in the table below.

Technology	Replication potential
Hot water generated from waste-heat in milk chilling centres and used for cleaning	Estimated 14,000 Milk Chilling Units retrofitted Annual electricity savings: 1,97,402 MWh Electricity cost savings: INR 12,831 lakhs Annual avoided emissions: 1,61,870 $MtCO_2$
Thermal energy storage to increase EE in chest freezers and coolers	Market opportunity: 250,000 Chest Coolers, 250,000 Chest Freezers Annual electricity savings: 85,500 MWh Annual diesel savings: 17,250 litres (L) Annual cost savings (electricity + unused diesel): INR 7,700 lakhs Annual avoided emissions: 70,156 $MtCO_2$
Mobile cold-storage solution for distribution of fresh farm produce	For 10,000 reefer vehicles that distribute perishable items and travel 100 km: Annual diesel savings: 166 lakh L Annual diesel cost savings: INR 12,300 lakhs Annual net emissions reduction: 27,700 $MtCO_2$
Instant Milk Chilling (IMC) systems for bulk milk coolers in villages	Retrofitting 14,000 bulk milk coolers: Annual diesel savings: 29,000 kilolitres (kL) Annual cost savings (electricity + unused diesel) INR 21,456 lakhs Annual avoided emissions: 16,670 $MtCO_2$
Improvements in pumps and motors to achieve 35-50% increase in pumpset efficiency	Tapping into 10% of pumps installed in India, which translates to: Replacing 5,76,000 agricultural pumps to generate 4147 GWh of electricity savings Replacing 189,000 pumps in buildings to generate 3449 GWh of electricity savings Replacing 114,000 pumps in industry to generate 4514 GWh of electricity savings Annual avoided emissions: 9,930,897 $MtCO_2$

Thermal storage-based reefer trucks and application of Phase Change Material (PCM) cartridges for daily distribution of frozen food	Retrofitting 16,000 reefer vehicles: Annual diesel savings: 47,170 L Annual diesel cost savings: INR 22,740 lakhs Annual avoided emissions: 49,675 $MtCO_2$
Regenerative and Recuperative burners	Adopting this technology in 662 furnaces Annual electrical savings: 9.9 GWh Value of annual electricity saved: INR 3,140 million Emissions avoided annually: 1,80,233 Mt CO_2

3.4.3 International Energy Agency

India became an IEA Associate member in 2017. The IEA and India benefit from a long, ongoing bilateral relationship built on cooperation in a broad range of areas, including energy security, statistics, efficiency, market analysis, implementation agreements, and technology. The cooperation was first formalised in 1998 with the signing of the Declaration of Cooperation, covering important issues related to energy security and statistics. Since then, the relationship has further developed through the endorsement of three Joint Statements, the last one in 2013. The most recent Joint Statement covers areas of mutual interest for the IEA and India and helps facilitate cooperation at different levels and under various topics within the energy sector. The IEA and India also have a long-standing collaboration in EE and have organised multiple joint workshops.

India became an IEA Associate member in 2017. The IEA and India benefit from a long, ongoing bilateral relationship built on cooperation in a broad range of areas, including energy security, statistics, efficiency, market analysis, implementation agreements, and technology.

In December 2018, IEA delivered its first country-focused EE training course in India in partnership with BEE. The training week consisted of four parallel courses on EE policy in buildings, appliances and equipment, industry, and municipal and utility services. Each course offered a mix of lectures, interactive discussions, and practical exercises. Throughout the week, participants also explored EE from creative perspectives, such as a photo competition to make EE more 'visible'[84]. In November 2019, IEA organised the International Workshop on Policy Framework to Deploy Electric Vehicle Charging Infrastructure in India. The objective was to identify opportunity areas for India to help fast track the deployment of EV charging infrastructure commensurate with EV growth and the fast changing power systems of today, drawing on global and domestic experiences[85].

IEA carried out the first in-depth review of India's energy policies in 2020, examining the country's achievements in developing its energy sector, as well as the challenges it faces in ensuring a sustainable energy future. This report provided insights into the rise of India in global

84 https://www.iea.org/events/energy-efficiency-training-week-for-india-2018 (17/4/2020)

85 https://www.iea.org/events/international-workshop-on-policy-framework-to-deploy-electric-vehicle-charging-infrastructure-in-india (17/4/2020)

energy markets. It analyses the full breadth of the country's energy sector and presents recommendations for strengthening energy policies in various areas[86]. The review concluded that India should continue to work with the IEA and expand international energy cooperation to benefit from international best practices and highlight India's energy-related successes.

IEA established the Energy Efficiency in Emerging Economies (E4) Programme in January 2014 to support emerging economies in their efforts to scale up energy efficiency activities that generate economy-wide benefits. The E4 Programme, part of the CETP, facilitates the sharing of experiences on effective EE policies with emerging economies by bringing in the IEA's well-established expertise in i) data collection, indicators and modelling; ii) EE policy design, implementation, and evaluation; and iii) training and capacity building in its partnerships with emerging economy governments. IEA is currently implementing E4 Phase 2 with BEE and is expected to provide in-depth analysis of:

- EE benefits
- industrial EE
- building EE
- energy efficient cooling
- market based mechanisms and the promotion of energy services
- relevant expertise to further develop IEA's work on EE in India

3.3.4 International Partnership for Energy Efficiency Cooperation (IPEEC)

The International Partnership for Energy Efficiency Cooperation (IPEEC) was set up as a high-level international forum with the purpose of enhancing global cooperation in the field of energy efficiency and facilitating policies that yield EE gains across all consuming sectors. The visibility of IPEEC significantly increased with the announcement of the G20 Energy Efficiency Action Plan[87]. India participated in the Action Plan's four work streams: Energy Efficiency Financing, Industrial Energy Management, Transport, and Electricity Generation[88].

3.3.5 Clean Energy Ministerial (CEM)

The CEM is a high-level global forum to share lessons learnt and best practices and facilitate the transition to a global clean energy economy. Initiatives are based on areas of

86 https://www.iea.org/reports/india-2020 (17/4/2020)

87 The G20 Energy Efficiency Action Plan (EEAP) is a practical plan to strengthen voluntary energy efficiency collaboration. It allows countries to share knowledge, experiences, and resources by choosing, preferred activities that best reflect the country's domestic priorities.

88 According to the IPEEC website, the forum's activities have ended, and the website is no longer being updated.

common interest among participating governments and other stakeholders. The CEM's initiatives and campaigns enable low-cost, high-impact technical work that amplifies each government's clean energy deployment efforts. They seek to catalyse public and private actions towards ambitious but realistic targets. The CEM presently has 25 participating countries and the European Commission as members. As of 2019, these members represent about 90% of global clean energy investment and 75% of the world's GHG emissions. The MoP has mandated that BEE participate in the CEM initiatives, with a long-term vision to make India the lead country in the forum.

CEM initiatives aim to achieve concrete results through smart policies, focused actions, and real commitments and primarily target governmental participation, although at times, they also include private sector participation. The Energy Demand Initiative focuses on increasing efficiency across end use sectors such as equipment, appliances, industry, buildings, and transport. The Super-Efficient Equipment and Appliance Deployment Initiative (SEAD), mentioned in Section 3.3.3., is described below.

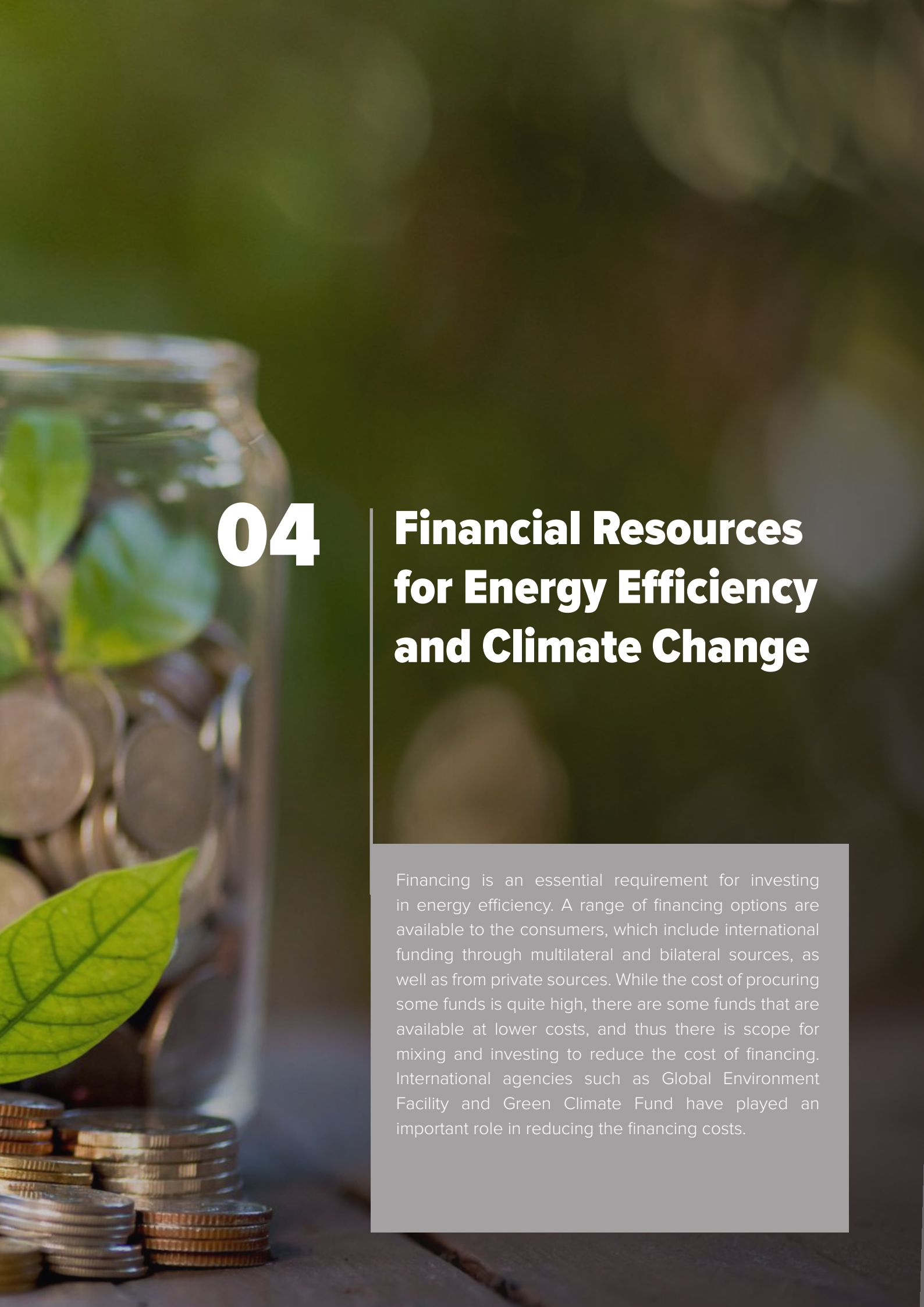
SEAD

SEAD is a voluntary collaboration among governments working to promote the manufacture, purchase, and use of energy-efficient appliances, lighting, and equipment worldwide. SEAD's 18 member governments engage with global initiatives, industry, civil society, and each other to identify and share best practices and promote policies and programmes that encourage, facilitate, and accelerate the pace of market transformation for energy efficient equipment and appliances.

Since 2012, the Global Efficiency Medal competition has identified innovative new technologies that push the boundaries of efficiency and slash energy consumption. In collaboration with BEE, SEAD developed a mobile app to give consumers on-demand access to the energy performance data in BEE's Star Label database[89].

Other CEM initiatives focus on EVs, hydrogen, sustainable cities and eco-towns, energy management working group, smart grids, and carbon capture, utilisation, and storage.

89 https://www.cleanenergyministerial.org/sites/default/files/2019-06/SEAD%20fact%20sheet%202019%20%28June%202019%29.pdf



04 Financial Resources for Energy Efficiency and Climate Change

Financing is an essential requirement for investing in energy efficiency. A range of financing options are available to the consumers, which include international funding through multilateral and bilateral sources, as well as from private sources. While the cost of procuring some funds is quite high, there are some funds that are available at lower costs, and thus there is scope for mixing and investing to reduce the cost of financing. International agencies such as Global Environment Facility and Green Climate Fund have played an important role in reducing the financing costs.

4.1 Climate Finance

Climate finance includes climate related financial flows both within and between countries dedicated to climate change mitigation and adaptation. Climate finance in India comes from multiple international (multilateral and bilateral aid agencies and multinational private firms) and national (domestic budgets and private funds) sources. These funds flow through the government budgets at the national and sub-national levels to be managed by the government departments and agencies, take "off budget" routes, or can even take the form of direct project funding to be managed by private players and non-government organisations at the project level. The funds are in the form of budgetary allocations, taxes, subsidies, private equity, loans, soft loans, and grants. It is important not only to mobilise climate finance, but also to build a robust, transparent, and accountable public finance system to ensure that both domestic and international funds are used more effectively and efficiently.

The term 'climate finance' is broadly used to describe finance available for the entire range of activities that lead to reducing or limiting the impact of activities on climate change. This could include RE, EE, clean technologies, and actions leading to environmental improvements. There are industry and non-government bodies that monitor the use of these funds and make this information public to all stakeholders. This chapter gives details on the availability of such financial resources for climate change and EE initiatives.

4.2 Climate Finance in India - Overview

In India, climate finance largely consists of budgetary outlays made towards climate missions under the NAPCC.

The institutions providing such finance include GoI, state governments, Civil Society Organisations (CSOs), international donor agencies, bilateral development agencies, private investors, and public and private banks. Climate finance in India can be divided into public and private. Public climate finance is in the form of budgetary outlays (both at the national and sub-national level), taxes, subsidies, and government-backed market mechanisms. Private climate finance comprises loans (local and foreign currency loans), private equity, venture capital, partial risk guarantees, green bonds, and the Clean Development Mechanism (CDM).

There are the following categories of climate finance:

National government funds:

- Various funds, such as NCEEF, NDRF, CAF, NAF, & budgetary support
- Tax-free and taxable bonds, mainly for government-owned companies

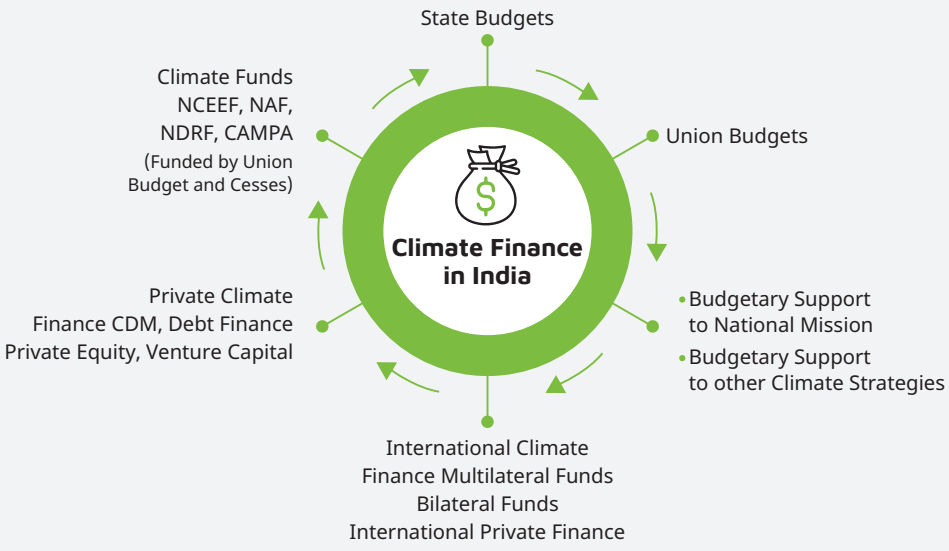
State government budgets: state resources, augmented by resources from the central government

Multilateral and bilateral funds: Mainly loans (from WB, International Finance Corporation (IFC), ADB, AFD, Japan International Cooperation Agency (JICA), KfW, Exim loans, Green Climate Fund, etc.) routed through GoI and then through national financial institutions and private sector finance institutions. Multilateral and bilateral equity (e.g. from IFC or ADB) is very limited and generally provided as equity in government and private companies.

International and national private finance: Private finance (from the US, Japan, and Singapore) is available in both equity and debt, along with blended finance—mainly for private companies operating in the clean energy space.

The different sources of climate finance are described in more detail in the following sections.

Climate Finance Architecture in India



4.3 Domestic Public Finance – National Climate Funds

GoI finances climate action through (1) Climate Funds (routed through the Union Budget); (2) Direct Budgetary Allocations; and (3) mechanisms aimed at leveraging private climate finance.

Climate funds support climate actions both under the national climate missions and outside them. There are four such funds:

1 National Clean Energy and Environment Fund[90]
2 National Adaptation Fund (NAF)
3 Compensatory Afforestation Funds (CAF)
4 National Disaster Response Fund (NDRF).

National Clean Energy and Environment Fund (NCEEF)

Through Finance Bill 2010-11, a corpus called National Clean Energy Fund (NCEF) was created out of the Clean Environment Cess (cess on coal produced and imported) for the purposes of financing and promoting clean energy initiatives, funding clean energy research, and any other purpose relating thereto. Subsequently, the scope of the fund was expanded to also include clean environment initiatives, and the fund was renamed the NCEEF. An Inter-Ministerial Group (IMG) chaired by the Finance Secretary approves the projects and schemes eligible for financing under the NCEEF. These projects include innovative schemes such as a Green Energy Corridor for enhancing clean energy applications in the transmission sector, Namami Gange, Green India Mission, and Jawaharlal Nehru National Solar Mission (JNNSM)'s installation of solar photovoltaic (SPV) lights and small capacity lights, water pumps, and power plants, along with grid-connected rooftop SPV power plants, among others. The Fund is designed as a non-lapsable fund under Public Accounts, Ministry of Finance. So far, 55 projects worth INR 34,811.19 Cr have been recommended by IMG to be financed by NCEEF.

The other funds (NAF, CAF, & NDRF) have been set up for specific relevant activities under their respective legislation.

4.4 Domestic Public Climate Finance – National Level

4.4.1 Budgetary Support for NAPCC Missions

The GoI supports a number of climate change adaptation and mitigation actions through the national missions under the NAPCC. In 2015, the Union Cabinet approved an increase in India's solar power capacity target under JNNSM to 1,00,000 MW by 2022, with an estimated investment of around Rs. 6,00,000 Cr. Much of this is expected to be raised from large PSUs and Independent Power Producers (IPPs).

4.4.2 Budget Support for Low-Carbon Strategies and Adaptation Interventions

The government also makes allocations for other low-carbon strategies and environmental policies pursued by the various line ministries through the budget. These climate interventions do not fall under the purview of the National Missions. These include the budgetary outlays to ministries such as MNRE, MoEFCC, and Ministry of Agriculture (MoA) for their various interventions, schemes, and policies related to climate objectives but not covered under the Missions.

4.5 Domestic Public Climate Finance – Sub-National Level

Funding sources for climate change policy implementation at the state level have not yet been identified. However, the states will receive some funds from the central government. The other major source of funding will be the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) budget. The scheme not only provides livelihood security, which is crucial in the face of extreme climate-aggravated events, but can also help in building climate resilient infrastructure, making the village communities more secure in combatting climate impacts. Given the SAPCCs' major focus on adaptation, MGNREGA funding will be an important source of climate finance at the state level.

While states have faced certain challenges in accessing climate funds from abroad in the past, some states are now looking at these funds for climate change-related activities. There is also a greater likelihood of private investment in climate action at the state level, especially in states that are well resourced and industrialised. However, the capacity or readiness of states to receive and utilise private finance still needs to be developed[91].

4.6 Domestic Public Finance – Other Sources

Apart from the making budgetary allocations, the government supports climate action through cuts in subsidies, increase in taxes on petroleum and diesel,

90 Earlier called National Clean Energy Fund

91 Climate Finance Architecture in India, CBGA report, September 2017

and mechanisms such as Renewable Energy Certificates (RECs) and RPOs.

4.7 Private Climate Finance in India

A broad range of institutions are involved in mobilising private climate finance in India. Private climate finance takes the form of venture capital for various private sector entities and is also available through debt. While a major portion of this finance goes towards solar projects, a small portion is available for EE and clean technology projects. Private sector financial institutions, as well as non-banking financial institutions, engage in raising and arranging finance for climate change mitigation projects. Debt finance is available in the form of local and foreign currency loans. The former is given by domestic (public and private banks) and Non-Banking Financial (NBF) institutions/agencies. Public banks lend to the RE and EE sectors in India. Foreign currency loans, on the other hand, are provided by development banks, export import banks, and foreign banks, including JICA, Exim Bank of China, Overseas Private Investment Corporation (OPIC) USA, WB, and ADB.

4.8 Clean Development Mechanism:

The CDM provided under Article 12 of the Kyoto Protocol enables developed countries to undertake their mitigation commitments in a flexible, cost-effective manner by financing mitigation projects in developing countries. In return, developing countries receive certified emission reduction certificates tradable on the carbon market. While investors profit from CDM projects by obtaining reductions at lower costs than those in their own countries, gains for the developing country host parties come in the form of finance, technology, and sustainable development benefits. GoI established a National Clean Development Mechanism Authority (NCDMA) to review the CDM proposals in India. The money is invested across the country in a range of sectors, including energy efficiency, fuel switching, industrial processes, municipal solid waste, renewable energy, and forestry. However, the price of carbon credits continues to be very low, and agencies are not considering CDM revenues as a major source of financing.

4.9 Green Bonds

India has the second largest green bond market, with bonds worth a total of USD 7.2 billion issued to date[92].

A number of government agencies have contributed significantly to issuance, including Indian Renewable Energy Development Agency (IREDA) and the Indian Railway Finance Corporation (IRFC). In 2018, the State Bank of India (SBI) entered the market with USD 650 million in bonds. In 2017, the Securities and Exchange Board of India released the Disclosure Requirements for Issuance and Listing of Green Debt Securities, which sets guidelines for issuing green bonds. To support the development of a green bond market, the India Green Bond Council was established by the Federation of Indian Chambers of Commerce and Industry (FICCI), with the support of the Climate Bonds Initiative.

4.10 Partial Risk Sharing Facility

The objective of the Partial Risk Sharing Facility for Energy Efficiency Project (PRSF) is to assist India in achieving energy savings through the mobilisation of commercial finance and promote ESCO participation in EE projects. PRSF was launched by SIDBI, with a risk-sharing corpus of USD 37 million and a technical assistance component of USD 6 million. The risk-sharing corpus funds come from GEF (USD 12 million) and are backstopped by a Clean Technology Fund (CTF) Guarantee, in the form of contingent finance, of USD 25 million. The project aims to stimulate and transform India's Energy Savings Performance Contracting (ESPC)-based ESCO market by promoting an increase in EE projects, create a banking ecosystem to finance ESCO projects in India[93].

The project provides partial credit guarantees to Participating Financial Institutions (PFIs) to cover a share of the default risk faced by them in extending loans for EE projects implemented by the host entities through ESCOs after entering into ESPC contracts.

EESL empanels financial institutions to access the PRSF fund corpus and lends to ESCOs or host entities implementing ESPC-based EE projects, based on eligibility criteria. The project is supported by the WB as the Project Implementing Entity. As the Technical Assistance Executing Agency, EESL works on developing a pan-India pipeline of ESCO projects. SIDBI (Project Executing Agency (PEA)) serves as a guarantor for loans given by banks, PFIs, and Non-Banking Financial Companies (NBFCs) to ESCOs and ESCO-implemented projects, thereby minimising the associated risk.

92 Chapter 6, Sustainable Development and Climate Change, Economic Survey of India 19-20 https://www.indiabudget.gov.in/economicsurvey/doc/vol2chapter/echap06_vol2.pdf

93 http://documents.worldbank.org/curated en/968091468048913492/India-Partial-Risk-Sharing-Facility-for-Energy-Efficiency-PRSF-Project

Category	No. of Projects	Project Financials		Annual CO_2 Savings (tonnes)
		Total Guarantee Amount (Rs. Lakhs)	Total Loan Amount (Rs. Lakhs)	
Building EE Projects	8	660.30	880.5	8,826
Industry EE Projects	7	1,227.8	1,637	17,209
Municipal EE Projects	9	6,926.5	29,696.6	49,911
Total	**24**	**8,814.6**	**5,486.6**	**75,946**

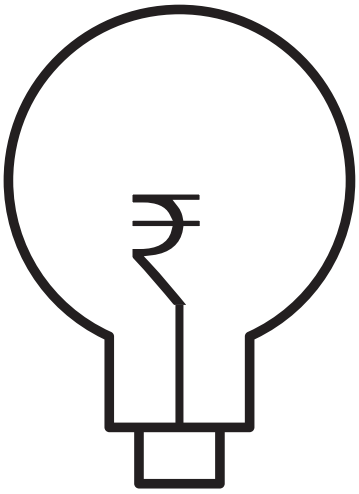
In addition to the PRSF, BEE has also established a Partial Risk Guarantee Fund for Energy Efficiency, along with a Venture Capital Fund for Energy Efficiency (for more details, see Section 2.3.3g). BEE is actively working with various financial institutions on the implementation of these funds[94].

4.11 Bilateral Development Agencies

A significant share of international public climate finance comes to India bilaterally through bilateral development agencies. Indian Government has signed bilateral agreements with Norway, Finland and France on issues such as clean technologies, including waste management, water, renewable energy, energy efficiency and sustainable forestry.

4.11.1 Agence Française de Développement

AFD supported EESL's installation of 45,000 low energy light bulbs in Jodhpur, resulting in an annual 16,000 tCO2 emission reduction (November 2017). AFD then focused on demonstrating the relevance of the ESCO model in the rest of India and supporting growth in this market. In July 2018, AFD launched one of its largest national projects—City Investments to Innovate, Integrate and Sustain (CITIIS)—in which 100 cities have been shortlisted by GoI to become the country's next smart cities. Of these, the 15 cities with the most innovative project proposals were selected at the end of 2018 through a national challenge. Over a period of three years, up to 2021, these 15 projects will receive funding and technical assistance from the AFD and European Union (EU) to achieve their vision across four themes: sustainable mobility, public open spaces, eGovernance and Information and Communications Technology (ICT), and social and organisational innovation for low-income settlements[95]



94 https://beeindia.gov.in/content/feeed

95 https://www.afd.fr/en/ressources/building-smart-sustainable-cities-citiis?origin=/en/rechercher?query=india&size=20&from=20&sort=_score%2Cdesc&filter[0]=source_k=afd&facetOptions[0]=country_k,size,200&facetOptions[1]=thematic_k,size,999&facetOptions[2]=publication_date_month,size,999 (22/4/2020)

4.11.2 Japan International Cooperation Agency

On March 27, 2020, JICA signed a 10 billion yen loan agreement with Indian NBFC Mahindra & Mahindra Financial Services Limited (Mahindra Finance) to help provide funds to MSMEs through private sector investment and finance. Mahindra Finance shall lend an equivalent amount in low-income and special category states. This loan will be provided through co-financing with the Sumitomo Mitsui Banking Corporation (SMBC) based on the Facility for Accelerating Financial Inclusion in Asia (announced 27 March, 2020)[96]. Although not specified upfront, this loan can also be used for related EE and RE projects.

On 27 March, 2020, the JICA signed an agreement with the GoI to provide Japanese Official Development Assistance (ODA) loans of up to a total of 374.44 billion yen to support well-balanced economic growth through the establishment of urban infrastructure and rural development with community participation (metro rail, dedicated freight corridors, rural water supply, and pollution abatement)[97].

4.11.3 KfW

EESL line of credit: KfW has partnered with Indian institutions to improve energy efficiency in India. To this end, KfW (on behalf of BMZ) signed a loan agreement in the amount of EUR 200 million with EESL in March 2017. EESL will use the development funds to invest in EE measures for private households, public buildings, street lights (LED technology), water supply systems, agriculture (pump replacement), and industry. EESL also offers its customers an array of other services to help save energy.

SBI Energy Efficient Housing: State Bank of India (SBI) has signed a loan agreement with KfW for $277 million dollars (about Rs 1,958 crore) for establishing an energy-efficient housing programme in India. The programme shall be a part of Indo-German Development Cooperation which is guided by the 2030 Agenda for Sustainable Development. Under the programme, both builders and home buyers will be financed for developing and purchasing energy-efficient residential projects that achieve at least 25 per cent energy savings in comparison to standard reference buildings. Hence, the programme will contribute to India's policy framework towards energy conservation in the residential building sector and reduction in greenhouse gas emissions. In addition to the $277 million dollar loan facility, KfW will also extend a grant of 1.5 million euros to SBI as a technical assistance package. The technical assistance funds will be used for supporting SBI in the preparation, implementation and monitoring of the programme. Further, an investment grant of 10 million euros has also been provided for incentivising builders to develop housing projects that achieve significantly higher levels of energy savings vis-a-vis standard reference buildings (that is at least 40 per cent savings)[98].

SIDBI Innovation Financing: This project provided loan and risk financing in local currency to innovative start-ups and SMEs. The contract was awarded via SIDBI and a financial intermediary (direct business and apex function). The major objectives of the project were to increase market-oriented research and the development activities of start-ups and SMEs in the key areas of climate and environmental and resource protection and, as a result, introduce innovative climate and environmentally friendly products, processes, and services into the Indian market. In addition, the project executing agency was tasked with creating a range of sustainable financing products specifically tailored to the needs of and used by innovative SMEs for environmentally friendly technologies. This was intended to contribute to environmentally sustainable economic growth in India and, hence, global climate and environmental protection and the development of the financial system. The target was to have at least 60 qualified companies in the clean-tech sector bring innovative products to the Indian market with the programme's help.

Following the successful implementation of the project in the first two years, external factors led to part of the funding line being cut. A programme promoted at the same time by the GoI, which served the same target group with the same intention and was more attractive from the point of view of SIDBI and the ultimate borrowers, resulted in a reduction of the project commitment. In the end, 54 companies brought innovative products to the Indian market under the KfW initiative. Projects with an investment volume of at least EUR 53 million were to be implemented, but only EUR 33.7 million was used for this purpose[99].

4.12 Multilateral Organisations

The UNFCCC stated that developed countries should provide "new and additional financial resources" to developing countries. International climate finance flows to India through a number of channels. The primary route is the multilateral climate funds established by the UNFCCC, such as the GEF, Adaptation Fund (AF),

96 https://www.jica.go.jp/english/news/press/2019/20200327_12_en.html
97 https://www.jica.go.jp/english/news/press/2019/20200330_31_en.html
98 https://www.kfw-entwicklungsbank.de/International-financing/KfW-Development-Bank/About-us/News/News-Details_557632.html (30/4/2020)
99 https://www.kfw-entwicklungsbank.de/PDF/Evaluierung/Ergebnisse-und-Publikationen/PDF-Dokumente-E-K_EN/Indien_SIDBI_2020_E.pdf (20/7/2020)

"Energy Savings and EE Market Transformation in the Residential Sector" aims to scale up EE delivery in the residential sector under UJALA, focusing on LED bulbs, tube lights, and ceiling fans

and Green Climate Fund (GCF). The GCF has been designated as the operating entity of the financial mechanism of the Convention. Climate Investment Funds (CIFs), established and operated by the World Bank, also finance climate action in India. In addition, funds also flow through bilateral development agencies or developed country climate initiative and funds.

Funding from the international sources is usually provided in the form of grants, loans, soft loans, technical assistance, and capacity building assistance. Many of the multilateral and bilateral agencies involved in climate finance not only provide funds, but also often get involved in the project design and implementation, together with national and sub-national government ministries and non–government organisations. In other cases, the funding agencies directly fund and implement climate projects. Each multilateral channel has its own structure and rules of access. The funding from the international agencies is usually piecemeal and project-based, making synergy with national climate goals rather difficult.

4.12.1 World Bank

EESL line of credit: The development objective of WB's Energy Efficiency Scale-up Programme Project for India is to scale up energy savings in residential and public sectors, strengthen EESL institutional capacity, and enhance its access to commercial financing. The programme consists of the following activities for FY 2018-2022, in EESL's overall corporate investments programme[100]:

- "Energy Savings and EE Market Transformation in the Residential Sector" aims to scale up EE delivery in the residential sector under UJALA, focusing on LED bulbs, tube lights, and ceiling fans;
- "Energy Savings and EE Market Transformation in Public Street Lighting" aims to deliver investments in energy efficient public street lighting under the SLNP;
- "Development of Sustainable Business Models in New EE Market Segments" aims to support upstream programme development and incorporation of technical, environmental, and social sustainability elements into the design of new initiatives, such as AC, AgDSM, and the Building EE Programme, which require additional preparatory work before sustainable scale-up; this excludes the actual capital investments for such new initiatives;
- "Institutional Strengthening for Sustainable EE Scale-Up" aims to strengthen and develop borrowers' institutional capacity, especially with respect to financial, technical, managerial, procurement, environmental, and social capacity and practices.

100 https://projects.worldbank.org/en/projects-operations/project-detail/P162849#results (accessed 27/01/2021)

Project Details

Project Status	Approval Date	Closing Date	Total Project Cost (USD)	Implementing Agency	Commitment Amount (USD)	Amount Disbursed (USD)
Active	May 17, 2018	September 30, 2022	1348.00 million	EESL	220.00 million	127.57 million[101]

Targets and Status

Indicator	Target (March 2022)	Status (December, 2019)
No. of LEDs and tube lights sold (lakhs)	4,370.0	3,444.0
No. of street lights installed (lakhs)	91.67	74.62
No. of energy efficient ceiling fans sold (lakhs)	64.08	22.15

SIDBI MSME EE Financing: The overall objective of this financing was to increase demand for EE investments in target MSME clusters and build their capacity to access commercial finance. Details of the financing are given in the table below.

WB financing (USD)	1,40,78,043
Indian financial intermediaries (USD)	5,19,33,417
Total project cost (USD)	6,00,12,160
SIDBI loan on commercial lending terms	65%
Interest-free GEF grant (USD 3 million)	25%
MSME promoter's contribution	10%
Loan period	28 October 2010 to 31 December 2014
Project closure date	4 May 2019

Financing from SIDBI's own funds, combined with the GEF grant, resulted in a 2.5% reduction in the interest rate for EE investments.

M&V services to 637 enterprises that implemented EE measures closed the operational loop and created verifiable evidence that "good environment can be good business too". Having a comprehensive reporting system to measure and verify the results of EE investments increased the confidence of the MSME entrepreneurs, energy professionals, lending institutions, and technology vendors involved in the project. The programme also assisted select MSMEs in establishing, documenting, and implementing an Energy Management System (EnMS) as per the ISO 5000122 standard. Adoption of EnMS allowed 48 enterprises, against the project target of 40 enterprises, to achieve ISO 15001 certification, while also deriving EE benefits on a sustained basis and institutionalising a culture of energy conservation. At the end of the project, SIDBI reported that interest subvention under 4E schemes had increased from 2.5 to 3.58% due to increased uptake of the RF over the past two cycles and increased competition from other financial institutions.

101 As of December 2020. https://projects.worldbank.org/en/projects-operations/project-detail/P162849 (27/01/2021)

The project originally targeted EE investments of Rs. 600 million, which was later revised to Rs 3,900 million. In the end, the project resulted in EE investments totalling Rs. 16,971 million.

4.12.2 Asian Development Bank

ADB previously approved a loan to EESL in 2016 for the Demand-Side Energy Efficiency Investment Project, which focuses on efficient lighting and appliances. EESL is also implementing similar projects with the support of KfW, AFD, and WB. The new ADB project, entitled Scaling Up Demand-Side Energy Efficiency Investments in India, includes a sector loan guaranteed by the GoI, allowing for implementation of subprojects with high readiness and inclusion of newer subprojects as they are developed. Activities to be undertaken by EESL in eligible states include implementation of EE technologies not targeted by traditional ESCO investments, such as smart meters, distributed SPV systems, and EVs. The project will also generate stakeholder awareness of the benefits of EETs. Awareness campaigns will engage local organisations in knowledge-sharing and training, with a focus on women electricity consumers. Capacity building for DISCOMs, regulatory agencies, and other government bodies will also be carried out.

The total project cost is USD 592 million, of which the Clean Technology Fund will provide USD 46 million, to be administered by ADB, and the EESL will contribute USD 296 million, with the remainder covered by Indian banks. Accompanying the loan will be technical assistance (TA) of USD 2 million to support EESL in implementing the project, including development of a gender action plan, mobilisation of private sector participation in EE services, identification of new business opportunities, and knowledge transfer regarding successful models. The TA will also support the identification and development of new subprojects and pilot testing of several technologies. The project is due for completion in September 2025. Based on the goal of the project—installation of 160 MW of distributed SPV power at distribution sub-stations, 5 million smart meters, and 10,000 EVs—, the annual reduction in CO_2 emissions is estimated at 579,725 tonnes.

4.13 Multilateral Climate Funds

In 2009, in Copenhagen and later Cancun, developed countries pledged to provide developing countries a total of USD 100 billion to meet their climate obligations by 2025. This finance is now routed through the GCF and will be the most important multilateral climate fund in the future. Climate finance through this route is in the form of grants, concessional loans, guarantees, and private equity. Developing countries, which are largely seen to be ill-equipped to receive and utilise these funds, have strengthened their efforts by forming national and regional funds in order to be able to effectively access these funds. The AF and GCF are two funds set up to assist countries in achieving their INDCs. MoEFCC is the National Designated Authority (NDA) for the AF, meaning proposals must be submitted with NDA endorsement. The National Bank for Agriculture and Rural Development (NABARD) was accredited as the National Implementing Entity (NIE) for AF in July 2012 and is the only NIE for India.

4.13.1 Climate Investment Funds

The international climate finance landscape also includes bilateral aid agencies and international development institutions that implement GEF projects and have set up their own climate finance initiatives. The CIFs were established in 2008 and are administered by the World Bank, in collaboration with regional development banks such as ADB, African Development Bank, European Bank for Reconstruction and Development, and Inter-American Development Bank. They include the CTF and Strategic Climate Fund (SCF). CIFs have a total budget of USD 8.14 billion, out of which USD 775 million is for CTF, as of April 2019.

05 Concluding Remarks and the Way Forward

India has come a long way since the enactment of the Energy Conservation Act and the establishment of the Bureau of Energy Efficiency to launch various programmes under the Act. BEE coordinates actions across all central government ministries and departments and key stakeholders such as industry associations, research bodies, and consumer groups.

Over the past two decades, BEE has launched programmes for the mandatory achievement of targets for specific categories of industries (PAT programme), appliance star rating (S&L programme), energy efficiency in buildings through ECBCs (both commercial and residential), EV charging programmes, and DSM initiatives with utilities. As of 2019, the programmes have resulted in energy savings of 136.37 BU or 23.73 Mtoe, valued at Rs. 89,122 Cr, resulting in a 151.74 MtCO2 emission reduction. BEE has also collaborated with multiple countries to launch specific EE programmes. BEE has robust ongoing multilateral and bilateral technical assistance programmes with GEF, WB, IEA, UNIDO, USAID, and GIZ, among others. In addition to these programmes, BEE disseminates information nationwide through print and electronic media, including active digital, print, and mass communication media campaigns.

Energy Efficiency Services Limited is another key EE institution in the country. Since it was established in 2009, EESL has already made significant inroads by launching and implementing the world's largest LED procurement programme and a national street lighting programme. In 2018-19, EESL generated Rs. 1,837.65 Cr in revenue and a net profit of Rs. 95.09 Cr. EESL has been able to attract financing from multilateral and bilateral lending institutions, as well as Indian financial institutions, as it has firmly established itself as the "go-to organisation" for implementing and scaling up large scale EE programmes.

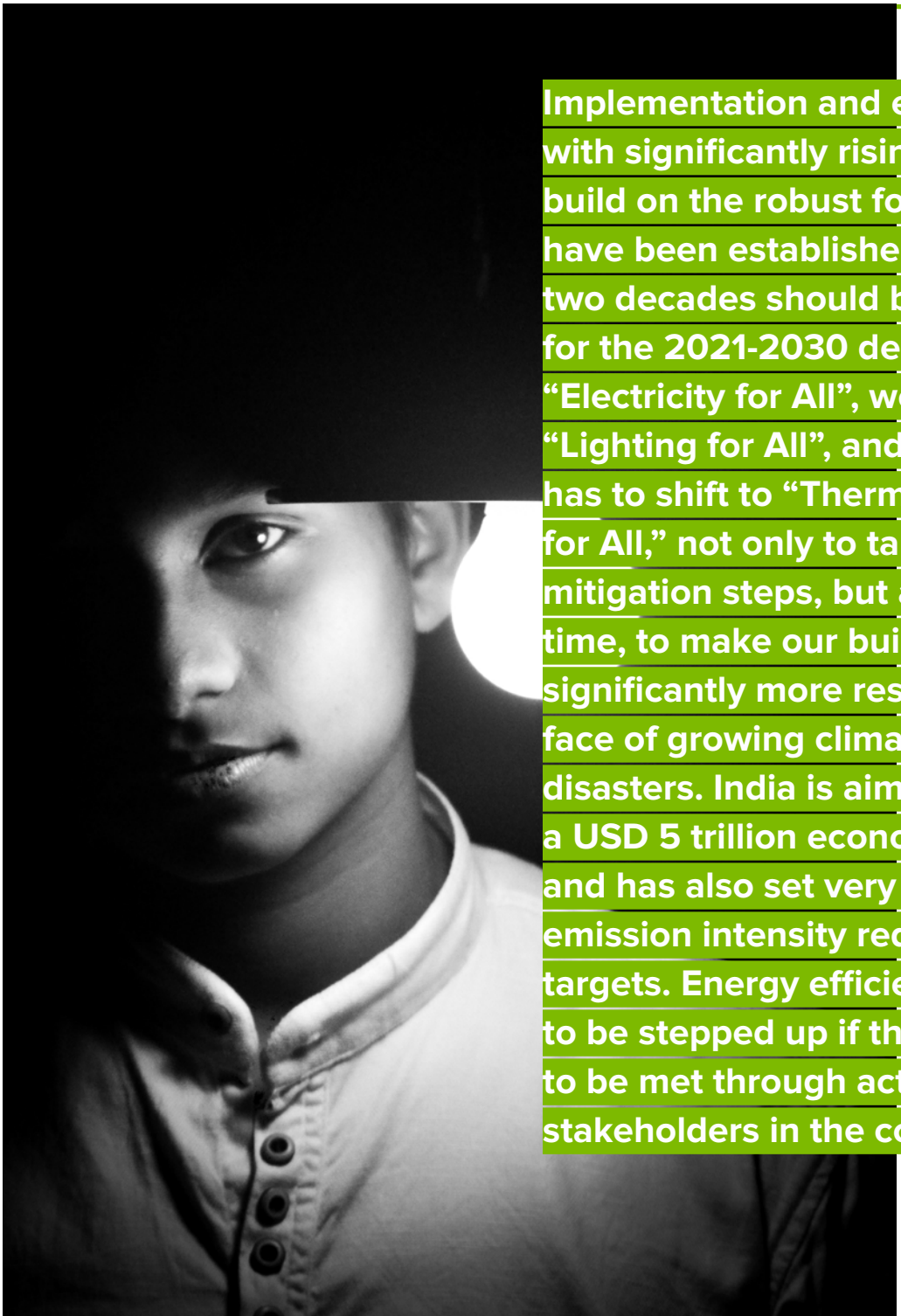
Notwithstanding the impressive gains made in India, largely thanks to BEE and EESL, there are a number of areas where the country needs to make significant progress to carry forward the energy efficiency success story in India. This will help achieve India's INDC emission reduction targets. Some of the key areas that need to be addressed are the following:

- **Expanding and maximising gains from the PAT programme:** The country has made substantial EE gains thanks to the PAT programme. The PAT programme must continue to bring in more industries under the mandatory target achievement program.
- **Implementation of new building codes:** While the ECBC 2017 and the EE label for residential buildings have been launched and notified, there is a need for these programmes to be taken up by the states, since the implementation and enforcement of these codes and labels lies in the state domain. Processes for ECBC applications for new buildings and building monitoring after construction need to be developed by the states. In addition, there is an urgent need to take action to improve the energy efficiency of the existing stock of buildings that are 30-40 years or older.
- **Thermal comfort for all:** India's demand for space cooling is rapidly moving away from ceiling fans to higher comfort air-conditioners. India is among the first countries to launch an Indian Cooling Action Plan. This will need to be followed up on, with discussions with key industries and stakeholders to ensure that this moves into the implementation phase. Passive cooling strategies should be required for all new buildings, as this will lead to large reductions in the cooling demand.
- **Push for higher appliance efficiency:** India has made great strides in introducing energy efficiency labels for a large number of appliances. These labels are mandatory for certain appliances and voluntary for others. The focus should now be on improving the standards and pushing for the manufacture and sale of higher star rated appliances through appropriate incentive schemes. The following actions need to be taken: implementation of technologies for dynamic display of power consumption in ACs and refrigerators, continued check testing of appliances, publishing of results to improve the programme's integrity, and the opening up of data disclosure. Furthermore, there is a need to examine retailer incentives, in order to increase the sales of 5-star rated appliances.
- **Accelerating energy efficiency in SMEs:** The pace of EE adoption in the SME sector needs to be accelerated through a combination of demonstration projects and demand aggregation to achieve EET price reduction. While BEE has taken up initiatives in several energy intensive SME clusters over the past two decades, these have not yet transformed into large scale adoption programmes.
- **Expansion of EE financing:** While most banks generally do not have any special schemes for energy efficiency, they do give loans for projects that have an EE element built into them. Hence, it is difficult for the banks to categorise how much of their portfolio has gone towards EE projects. Financing through the National Energy Conservation Fund or the National Clean Energy Fund needs to be taken up by BEE to encourage EE financing, particularly for the SME sector.
- **Improving data collection on end-use energy consumption:** Data collection and reporting is another area for BEE to take up in its interventions. End-use level data is not collected at a national level for both residential and commercial consumers. While NITI Aayog has taken the lead in setting up working groups for various sectors, national level data collection and dissemination is needed for planning and other purposes. The collaboration with IEA needs to be strengthened, in order to learn from the experiences of other IEA member countries.
- **Nationwide implementation of AgDSM:** Irrigation pumpsets are a major energy consumer, and most in operation are over fifteen years old and have undergone several motor rewinds. EESL is already

working on the replacement of the inefficient pumpsets in selected states, but initiatives in this area need to be taken up on a national level in order to maximise benefits, both to farmers and the nation as whole.

- **Promotion of Net Zero initiatives:** The world now has a new mantra, a future built on Net Zero in energy, water, waste, and, finally, carbon. Some large IT parks and office complexes are already Net Zero in energy and are planning to move towards Net Zero in water and waste as well. The important point is to bring Net Zero into policies and implementation frameworks and consider incentives for the first entrants. Net Zero must happen not just for our buildings and habitat, but at an ecosystem level, so that policies, technologies, business models, skilling, and green job creation happen in coordination, and energy efficiency can help India become a global leader in sustainable economic development.

Implementation and execution, along with significantly rising ambitions to build on the robust foundations that have been established over the past two decades should be the goals for the 2021-2030 decade. From "Electricity for All", we moved on to "Lighting for All", and now, the focus has to shift to "Thermal Comfort for All," not only to take significant mitigation steps, but at the same time, to make our built environment significantly more resilient in the face of growing climatic and natural disasters. India is aiming to become a USD 5 trillion economy by 2025 and has also set very ambitious emission intensity reduction targets. Energy efficiency needs to be stepped up if these goals are to be met through actions by all stakeholders in the coming years.



Implementation and execution, along with significantly rising ambitions to build on the robust foundations that have been established over the past two decades should be the goals for the 2021-2030 decade. From "Electricity for All", we moved on to "Lighting for All", and now, the focus has to shift to "Thermal Comfort for All," not only to take significant mitigation steps, but at the same time, to make our built environment significantly more resilient in the face of growing climatic and natural disasters. India is aiming to become a USD 5 trillion economy by 2025 and has also set very ambitious emission intensity reduction targets. Energy efficiency needs to be stepped up if these goals are to be met through actions by all stakeholders in the coming years.

37 Link Road, Ground Floor,
Lajpat Nagar III, New Delhi, 110 024
+91-11-41235600
info@aeee.in
www.aeee.in