सत्यमेव जयते

Ministry of Power

Government of India

ROSHANEE

Roadmap of Sustainable and Holistic Approach to National Energy Efficiency

DECEMBER 2022

BUREAU OF ENERGY EFFICIENCY

Imprint

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Revision Note

India is one of the fastest growing economies in the world. The accelerated growth involves rapid industrialization and also involves economic and social transformation of the human society. Energy is an important resource needed to support such rapid growth. On one hand economic growth requires large amount of energy and on the other hand the development needs to be sustainable in order to preserve for future generations.

Recognizing the need to maintain a high growth rate for increasing the living standards of the vast majority of people and reducing their vulnerability to adverse impacts of climate change, National Action Plan on Climate Change (NAPCC) was launched by the country with National Mission for Enhanced Energy Efficiency (NMEEE), as one of the key components focused on achieving energy efficiency in energy intensive sectors having substantial potential of energy efficiency improvement.

NMEEE has been quite successful in enhancing the energy efficiency in energy intensive sectors through adoption of best practices and deployment of low-carbon technologies. Ministry of Power and Bureau of Energy Efficiency has also taken significant steps for improving energy efficiency and conserving energy through other flagship programmes in the areas of appliances, buildings, transport, agriculture and demand side management for more than a decade

As Energy Efficiency has the potential to significantly contribute towards achieving the commitments pledged NDCs where India has committed to reduce its emission intensity by 33-35% by 2030 from 2005 levels. Achieving such committed targets requires an ambitious and visionary strategy that consolidates all the activities having climate change mitigation attributes. In line with the efforts of MoEFCC to align missions under NAPCC with NDC goals, activities having climate benefits requires consolidation and streamlining.

In order to align the Mission with the commitments made under the NDCs, the NMEEE has been expanded and takes into account all the potential areas of energy efficiency, covering macro level policies while further delineating the schemes. It includes all ongoing activities of BEE, new activities some of which have been identified and some which need to be crystalized. The activities included under "Roadmap of Sustainable and Holistic Approach to National Energy Efficiency" (ROSHANEE) are likely to result in mitigation of about 550 million tonnes of CO2 by 2030. The mission would also enhance access to finance for projects on energy efficiency and create huge business opportunities in the energy domain.

Perform, Achieve and Trade (PAT) scheme under NMEEE aimed at improving Specific Energy Consumption (SEC) in energy intensive sectors followed by translation of excess energy savings into instruments called Energy Saving Certificates (ESCerts) that are traded at Power Exchanges. The market of ESCerts during the PAT cycle I was over supply compared to the demand and also there was a large variation in prices as well. Experience of PAT

cycle –I indicated that the better uptake of ESCerts to get profitable returns, demand of the Market Based Instruments needs to be expanded to explore linking to carbon markets.

Hence, the ROSHANEE document was revised for inclusion of "Carbon Trading Scheme for Energy Sector". It is envisaged that since this new platform would derive its basic structure form the existing mechanism of PAT scheme with minor modification required. Upon development and full operationalization of such a market for carbon at domestic level, dovetailing with International market could also explored based on the contours that shapes the final outcome of Rules under Article 6 of the Paris Agreement.

Consequent to the announcement of enhanced ambitions towards achieving its climate goals by India at Conference of Parties (COP -26) held at Glasgow, UK, in November 2021, the ROSHANEE document was further revised to factor the required changes in light of the updated NDCs. As per the updated NDCs, India now stands committed to reduce Emissions Intensity of its GDP by 45 percent by 2030, from 2005 level and achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030.

In order to achieve the target of 45% emission- intensity reduction, preliminary estimation has been done by Bureau of Energy Efficiency which indicate that absolute emissions by 2030 are required to be limited around 4584 MtCO2e. This means that the overall emissions in the economy would have to be reduced by 3753 MtCO2e (over the baseline scenario of 2005 level) to successfully meet our revised NDC commitment. The detailed analysis capturing the broad emission reduction goals both from supply and demand sides, identification of executing Line Ministries/Departments and potential interventions to achieve the identified goals is included in the document as an Annexure to Chapter 15 (Outcomes and Way forward).

I would like to acknowledge the support from various Line Ministries/Departments in implementation of related activities having climate benefits specifically to Ministry of Environment, Forest and Climate Change (MoEF&CC) for providing consent to develop carbon market.

I hope that implementation of activities envisaged under ROSHANEE will be able to contribute significantly towards fulfilling the enhanced commitments made by India in the NDCs.

(Abhay Bakre)
Director General
Bureau of Energy Efficiency

9th December, 2022

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MESSAGE

The demand for energy in India will continue to increase due to rapid economic growth and the access to affordable energy in an expanding economy. Meeting this increased demand is constrained on two accounts- one due to the scarcity of the resources such as the dependency on fossil fuels and the other is increasing level of atmospheric Greenhouse Gases (GHGs). In such circumstances, to negotiate a sustainable growth trajectory, India has listed out its Nationally Determined Contributions (NDCs) which were submitted to United Nations Framework Convention on Climate Change (UNFCCC).

Given the fact that actions having climate benefits will be scrutinized in the post 2020 scenario, there is an urgent need to streamline and consolidate all such actions having climate impacts. As most of the energy efficiency and conservation activities have GHG mitigation potential, this document "Roadmap Of Sustainable and Holistic Approach to National Energy Efficiency" (ROSHNEE) is an effort to consolidate energy related mitigation actions and align them with the larger objectives of India's NDCs.

The document aims to capture all the Energy Conservation and Energy Efficiency activities related to areas such as Appliances, Industries including Small and Medium Enterprises (SMEs), Buildings, Transport and various other Demand Side Management (DSM) programs under Agriculture and Municipalities etc. This revised mission also includes the outcome and findings of similar studies conducted by BEE and partner agencies.

I congratulate BEE for publishing this document and hope that information contained will be useful to all stakeholders not only to assess present level of efforts but will also provide pathways for future course of action.

(A.K. Bhalla) 10/4/19

RIGHT TO INFORMATION

स्वच्छ भारत
एक कदम स्वच्छता की ओर

Preface

Energy is one of the key indicators that reflects the growth of a nation and efficient use of this important resource is the cornerstone of sustainable development. For a nation that has a substantial population with tremendous appetite for energy to improve the living standards, constrained both by resource limitation and usage liberty, energy efficiency comes as the first fuel.

In its bid to combat increasing energy consumption and related carbon emission, the National Action Plan for Climate Change (NAPCC) provided pathways for sustainable development of the country by promoting low-carbon and high resilience development. Under the action plan, the National Mission for Enhanced Energy Efficiency (NMEEE) focussed primarily on enhancing the energy efficiency of large energy intensive sectors by helping accelerated adoption of low-carbon technologies, appliances and equipment through innovative measures for market transformation enabled by appropriate financial instruments.

Bureau of Energy Efficiency under the Ministry of Power, has been spearheading this mission which has been successful in accelerating the enhancement of energy efficiency in large energy intensive sectors as the Perform, Achieve and Trade (PAT) scheme – the flagship program of the mission has contributed towards avoiding of about 37 million tonnes of CO2 in 2017-18. This scheme has also helped in creating a substantial pool of energy professionals, capacity building of several engineers and technicians of the designated consumers (DCs) and ESCOs, auditors, and financial institutions. Innovative business models and technological innovation under the market transformation initiatives of the mission.

In an increasingly warming world, the global community made a pledge to arrest the global temperature rise below 2 degree C from the pre-industrial level in Paris. In this endeavour, member nations made their commitments under respective Nationally Determined Contributions (NDCs). In order to gear towards the commitments made, related activities warranted consolidation and alignment with the NDC goals. As the erstwhile NMEEE did not include many of the activities implemented by BEE having climate mitigation attributes, in light of the alignment with NDC goals, it necessitated that all such activities to be consolidated.

The Roadmap of Sustainable and Holistic Approach to National Energy Efficiency (ROSHANEE) is a broader version of the Mission and includes all the current and potential areas of energy efficiency in each sector. The revised Mission includes all the existing activities of BEE as well as new activities which have been identified and some yet to be explored in a much more focussed way. For instance, expanding the scope of demand side management programs to cover the entire range of industry i.e. from large to small, agriculture to municipalities, commercial buildings to households towards a nationally aspired goal of energy efficiency support by dedicated eco-system such as technology and finance.

Date: 10.04.2019

Diector General
Bureau of Energy Efficiency

Content

Abbreviations

AEA	ACCREDITED ENERGY AUDITOR
AGDSM	AGRICULTURE DEMAND SIDE MANAGEMENT
BEE	BUREAU OF ENERGY EFFICIENCY
BU	BILLION UNIT
CEA	CENTRAL ELECTRICITY AUTHORITY
CERC	CENTRAL ELECTRICITY REGULATORY AUTHORITY
CFL	COMPACT FLUORESCENT LAMP
COP	CONFERENCE OF THE PARTIES
DC	DESIGNATED CONSUMER
DC	DESIGNATED CONSUMER
DISCOM	DISTRIBUTION COMPANY
DPR	DETAILED PROJECT REPORT
EC ACT	ENERGY CONSERVATION ACT, 2001
ECBC	ENERGY CONSERVATION BUILDING CODE
EE	ENERGY EFFICIENCY
EESL	ENERGY EFFICIENCY SERVICES LIMITED
EMAEA	EMPANELED ACCREDITED ENERGY AUDITOR
ESCERT	ENERGY SAVINGS CERTIFICATE
ESCO	ENERGY SERVICE COMPANY
EV	ELECTRIC VEHICLE
FI	FINANCIAL INSTITUTION
FY	FINANCIAL YEAR
GDP	GROSS DOMESTIC PRODUCT
IEA	INTERNATIONAL ENERGY AGENCY
IEX	INDIAN ENERGY EXCHANGE
INDC	INTENDED NATIONALLY DETERMINED CONTRIBUTION
IPPU	INDUSTRIAL PROCESSES AND PRODUCT USE
KGOE	KILOGRAM OF OIL EQUIVALENT
KWH	KILOWATT HOUR
LED	LIGHT-EMITTING DIODE
M&V	MONITORING & VERIFICATION
MOEFCC	MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE
MOP	MINISTRY OF POWER

MRV	MONITORING, REPORTING AND VERIFICATION
MSME	MICRO SMALL & MEDIUM ENTERPRISES
MTCO2	MILLION TONNE OF CARBON DI OXIDE
MTOE	MILLION TONNE OF OIL EQUIVALENT
MU	MILLION UNIT
MUDSM	MUNICIPAL DEMAND SIDE MANAGEMENT
MWH	MEGAWATT HOUR
NAPCC	NATIONAL ACTION PLAN ON CLIMATE CHANGE
NATCOM	NATIONAL COMMUNICATION
NDC	NATIONALLY DETERMINED CONTRIBUTION
NECA	NATIONAL ENERGY CONSERVATION AWARDS
NMEEE	NATIONAL MISSION FOR ENHANCED ENERGY EFFICIENCY
OECD	ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT
PAT	PERFORM ACHIEVE AND TRADE
POSOCO	POWER SYSTEM OPERATION CORPORATION LIMITED
PSU	PUBLIC SECTOR UNDERTAKINGS
PXIL	POWER EXCHANGE OF INDIA
S&L	STANDARD AND LABELLING
SAMEEEKSHA	SMALL AND MEDIUM ENTERPRISES ENERGY EFFICIENCY KNOWLEDGE SHARING
SDA	STATE DESIGNATED AGENCY
SEC	SPECIFIC ENERGY CONSUMPTION
SEEP	SUPER ENERGY EFFICIENT PROGRAMME
SERC	STATE ELECTRICITY REGULATORY AUTHORITY
SLNP	STREET LIGHTING NATIONAL PROGRAMME
TOE	TONNES OF OIL EQUIVALENT
TPP	THERMAL POWER PLANT
UJALA	UNNAT JYOTI BY AFFORDABLE LEDS AND APPLIANCES FOR ALL
UNNATEE	UNLOCKING NATIONAL ENERGY EFFICIENCY POTENTIAL

Executive Summary

Energy consumption in India across all sectors has increased over the years and with rapid increase in access, affordability and urbanization energy consumption is expected to increase further in the coming years. India's development path focusses on the need for rapid economic growth which is an essential precondition to poverty eradication and improved standards for living while at the same time focussing on sustainable growth for maintaining ecological balance.

Energy Efficiency is a key element that can contribute towards reducing the energy requirements and the associated environmental implications. The institutional framework in place for pursuing this agenda includes the Energy Conservation Act 2001 (EC Act) and the Bureau of Energy Efficiency (BEE) which is the nodal central statutory body to assist the Government in implementing the provisions of the EC Act. As a quasi-regulatory and policy making body, the Bureau helps in developing policies and strategies that emphasize self-regulation and market principles to achieve the primary objective of reducing the energy intensity of the Indian Economy. The EC Act also empowers the State Government to facilitate and enforce the efficient use of energy through their respective State Designated Agencies in consultation with BEE. It also empowers the Central Government to specify energy performance standards.

The National Action Plan on Climate Change (NAPCC) has eight national missions that represent multi-pronged, long-term and integrated strategies for achieving key goals in the context of climate change. The National Mission for Enhanced Energy Efficiency (NMEEE) is one of the key missions of NAPCC as energy efficiency has the maximum abatement potential of around 51% followed by renewables (32%), biofuels (1%), nuclear (8%),

carbon capture and storage (8%) as per the World Energy Outlook (WEO 2010). The mandate of NMEEE includes reduction in specific energy consumption of large energy intensive industries with a market mechanism for trading energy saving certificates issued in lieu of excess energy saved against targets, fiscal incentives, financing of public private partnerships to reduce energy consumption through demand side management programmes in municipalities, agriculture and buildings. NMEEE has been successful in enhancing energy efficiency in many energy intensive sectors. It has contributed to emission reduction of about 37 million tonnes of CO_2 in 2017-18. It has also contributed significantly to the development and capacity building of energy professionals, ESCOs and financial institutions and has succeeded in market transformation of efficient lighting despite that the mission did not include all the activities being implemented by BEE which actually contributed to the common goal of mitigation.

India had ratified the Paris Agreement on Climate Change in 2016 under which its member countries have given commitments to the agreement to keep global average temperatures rise below 2 degree C. India in its Nationally Determined Contributions (NDCs) has committed that it will reduce the emission intensity of its GDP by 33% to 35% by 2030 from 2005 level. To achieve the above, it would be necessary to continue with its ongoing interventions and enhance the existing policies. The Ministry of Environment, Forests and Climate Change has also requested that all the Missions under NAPCC be revised to ensure fulfilment of the commitments made by India under the NDCs. In view of the above, Bureau has developed a strategic plan to fulfil its commitment under the NDCs by 2030. This strategic plan 'Unlocking National Energy Efficiency Potential (UNNATEE)' lays a framework and implementation strategy, in the short, medium and long term, to establish a clear linkage between energy demand scenarios and energy efficiency opportunities. The national target for energy efficiency savings and implementable roadmap to be achieved in the next fourteen years has been established through the UNNATEE document. Building on the potential areas identified in the UNNATEE and taking into account the existing schemes of the Bureau, a detailed action plan till 2030 has been worked out. The revised proposed mission on enhanced energy efficiency is Roadmap of Sustainable and Holistic Approach to National Energy Efficiency (ROSHANEE).

The proposed mission has a broader vision and takes into account all the potential areas of energy efficiency in each sector, covering the macro level in policy and further delineating the respective schemes. The revised mission includes all existing activities of BEE that have contributed significantly towards enhancing energy efficiency and consequent CO2 mitigation and the activities proposed in future, some of which have been identified and others which need to be explored. The proposed programme will also have a dedicated component for the financing of energy efficiency activities in India. It shares its objective from the earlier mission with

enhancements. This programme targets the industrial sector in entirety ranging from large to small and medium enterprises. It also deals with the subject of demand side management. It clearly outlines the strategies that needs to be adopted for achieving India's Nationally Determined Contribution commitments.

Through this ROSHANEE document, the NMEEE is being strengthened with a review of existing approaches and planning a new portfolio of strategies to strengthen energy efficiency across all sectors in the country till 2030. ROSHANEE also aims to brings together seemingly disparate national initiatives however, having common climate benefits such as Zero Effect, Zero Defect, Smart Cities, India Cooling Action Plan etc.

The broad activities proposed under ROSHANEE are indicated below:

SN	Area	Programme	Broad Activity
1	Policy and Institutional framework	Energy Conservation Act (EC Act)	Propose amendment to the EC Act, 2001, for streamlining and enhancing the scope of the Act
		Strengthening institutional framework	Institutional set-up of the Bureau of Energy Efficiency
			Strengthening of State Designated Agencies/ establishment of Regional/State BEEs
			Cooperation with International Bodies
2	Industries	Perform Achieve and Trade (PAT)	Expanding coverage of the scheme to other sectors. Introducing a similar programme for Small and medium scale Enterprises (SME)
		Energy Conservation guidelines and manual	Preparing guide materials for industry for strengthening energy conservation through operational and maintenance practices
		Promoting energy efficient technologies	Promoting uptake of emerging technologies, e.g. Waste Heat Recovery/ co-generation/ trigeneration/micro turbine, etc.
		Benchmarking	Initiate periodic benchmarking and energy efficiency gap assessment for industrial sectors.
		Database of Energy Efficiency technology	Creation of a public database of Energy Efficiency technology suppliers, to be updated periodically

SN	Area	Programme	Broad Activity
3	Small & Medium Enterprise	SME cluster programme for Energy Efficiency	Promotion of innovative demo projects and capacity building of SMEs
		Low Carbon technologies	Promotion of innovative low carbon technologies in the SME cluster
		Brick Kilns	Market transformation for energy efficient bricks
		SAMEEEKSHA	Knowledge sharing and synergizing the efforts of various organizations and institutions
4	Equipment and appliances	Standards and Labeling Programme	Widen coverage of the current scheme, specify norms and standards for industrial processes, and digitization of S&L database
		Super Energy Efficient Programme	Market transformation for super-efficient equipment/appliances
5	Buildings	Energy Conservation Building Code	Strengthening states institutions to operationalize Commercial and Residential Building Codes
		Buildings under PAT	Improving energy performance index of buildings through mandatory targets
		Energy Efficiency label	Develop energy efficiency labels for buildings
		Financing incentives under buildings	Promoting Energy Efficiency in buildings through financial incentives
6	Demand Side Management (DSM) and Data analytics	DSM activities	Widen coverage of the current scheme for AgDSM and MuDSM
		Data Management	Develop a comprehensive official national energy database.
		Data Analytics and Digitalization	Integration of energy data basis to draw analytical outcomes
		Technology	Encourage uptake of energy efficient technology through development of norms and standardizing technology to aid development of business models viz, Cold Chains, farm machinery and agricultural pumping
		Knowledge sharing	Disseminating the knowledge on Energy Efficiency among users through relevant universities, demo projects, etc.
		Innovative financing	Developing/ integrating Innovative financing schemes focusing exclusively on energy efficiency in agriculture sector

SN	Area	Programme	Broad Activity
7	Sustainable Transporta-tion Network	Vehicle Fuel Efficiency Programme	Develop fuel efficiency norms and standards for vehicles
		Energy Efficiency in Railways	Improving energy efficiency in Railways through PAT scheme
		Electric vehicles	Develop market approaches to enhance EV affordability and promote public private partnerships
		Standards for EVs and charging station	Prescribing minimum energy performance standards for EVs and charging stations
		Labeling program for vehicles	Labeling of the vehicles on their fuel efficiency levels
		Alternative Fuel	Promoting the use of alternate technologies in the transport sector, e.g., hydrogen fuel cell
8	Capacity building and awareness	Capacity Building of DISCOMs	Promoting use of analytical tool to assess data for load management, demand shift, etc. to formulate DSM action plan and implementation of DSM activities
		Awareness in school Children	Module on Energy Efficiency for school children
			National level Painting competition for school children
			Energy Clubs in schools
		Certification Examination for Energy Managers and Energy Auditors	Enhancing the curriculum; accreditation and empanelment of auditors
		ESCO	Improving capacity through workshops, trainings etc.
		Energy Management System	Promoting Energy Management by encouraging ISO 50001 adoption
		National Energy Conservation Award (NECA)	Expand the scope of NECA to more sectors
		Capacity building of operators and supervisors	Dedicated training modules for the operators and supervisors of utilities, Massive Open Online Course
		Campaign for Optimum Space Cooling	Generating consumer awareness and benefits in maintaining air conditioning temperature at 24^{0}C or more

SN	Area	Programme	Broad Activity
9	Knowledge Management	Knowledge sharing/ Exchange Platform	Sectoral platforms to be operationalized for better and accelerated learning by the sectors including peer to peer learning, Massive Open Online Course
10	Finance	Mobilize energy efficient investment	Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE)
			Venture Capital Fund for Energy Efficiency (VCFEE)
			Partial Risk Sharing Facility (PRSF)
			Energy Efficiency Financing Facility (EEFF)
		Other initiatives	Capital subsidy scheme, Interest subvention scheme, Green bonds etc. to support energy efficiency financing for Industries, MSMEs, buildings and any other areas having substantial energy saving opportunities.
11	Research & Development (R&D) and Innovation	Research & Development and Innovation; Information Technology	Promote public/private partnerships, incubators and accelerators, basic R&D on energy efficient technology. Leveraging ICT tools for bringing in Energy Efficiency
12	Monitoring Reporting & Verification (MRV)	Monitoring, Reporting and Verification (MRV)	Standardized baseline establishment and assessment of savings for ESCO projects and further refinements in M&V guidelines under PAT

Estimated Expenditure

The estimated expenditure from 2020-21 to 2024 -25 is Rs. 4202.71 Crores, out of which the expenditure on Standards & Labeling of Rs. 152.63 Crores is to be met from the energy conservation fund maintained by BEE.

Projected outcome

While there are some programmes which could not be quantified in terms of CO_2 savings such as awareness and outreach activities, most of the other activities have tangible outcomes. It is expected that the savings from the activities in the proposed scheme will contribute significantly to the India's NDC commitments.

The expected thermal energy savings from this scheme is shown below:

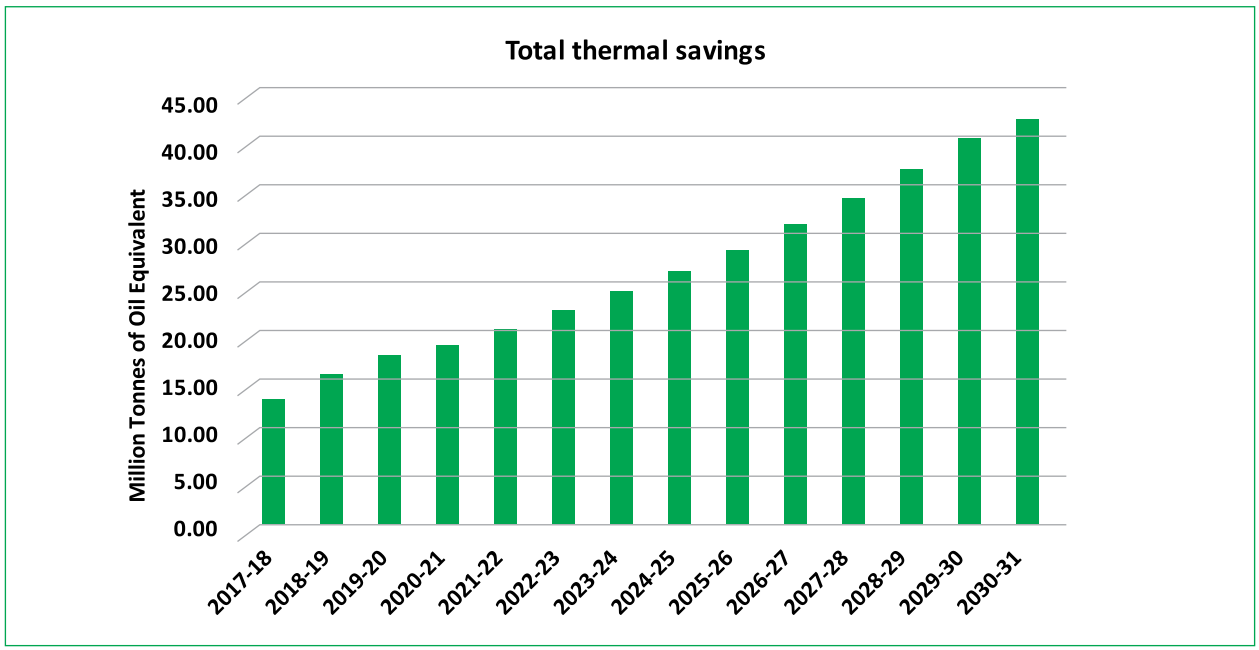


Figure 1 Total Thermal Savings (in million Tonnes of oil equivalent)

The contribution towards thermal savings are mainly from two programmes, i.e., Perform, Achieve and Trade (PAT) scheme and vehicle fuel efficiency programme (heavy duty vehicles).

The expected electrical energy savings from this scheme is shown below

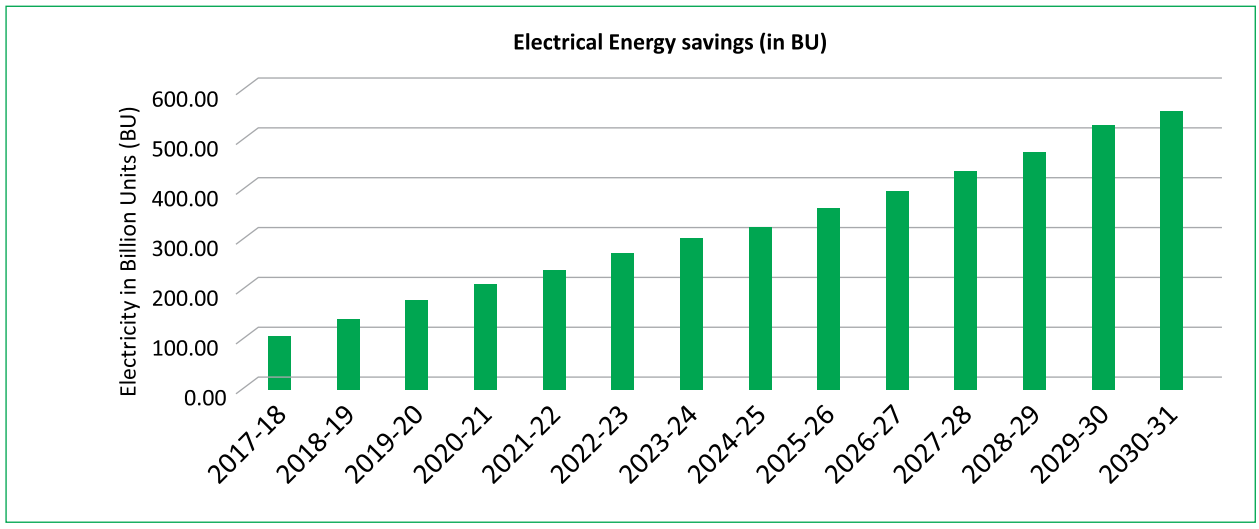


Figure 2 Total Electricity Savings at Generation end (in BU)

The programme wise projected electrical savings are as below:

Programmes/ Activities	2017-18	2020-21	2024-25	2030-31
Standards and Labeling program for appliances	54.53	78.15	122.97	242.73
Energy efficiency in Buildings	1.56	4.81	9.60	15.55
Industries (PAT Scheme _ Electrical savings)	0.29	0.37	0.50	0.78
DISCOMs (PAT Scheme)	0.00	22.66	46.23	76.69
National Energy Conservation Awards (NECA)	1.45	1.68	2.04	2.73
LED Ujala	28.05	65.71	92.68	132.12
LED Street Lighting National Program (SLNP)	0.71	2.51	5.61	12.67
Total savings at consumer end	**86.59**	**175.89**	**280**	**483.27**
T&D losses (Factor)	1.25	1.21	1.18	1.15
Total Savings at generation end	**108.05**	**213.43**	**331.00**	**557.85**

Table 1 Total Electrical Savings (in BU)

The CO2 mitigation from thermal and electrical energy savings potential from the activities under the mission is shown below:

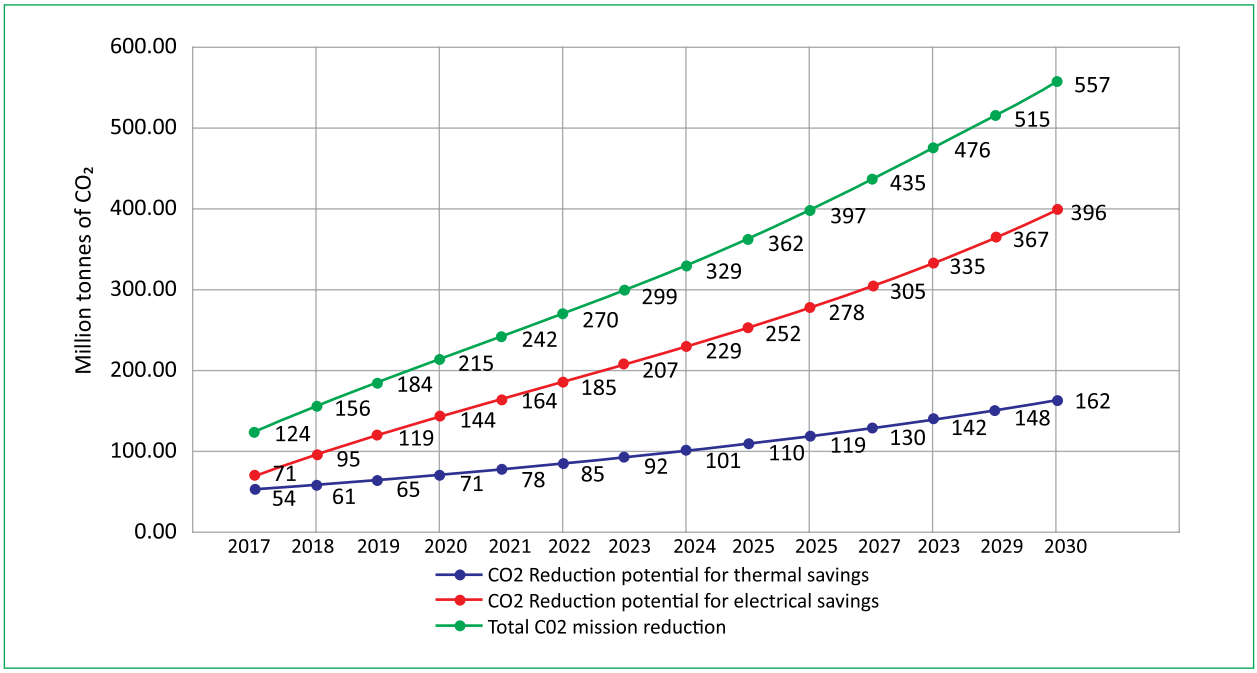


Figure 3: Total CO2 emission reduction from the scheme

Issues and Challenges

Like any other schemes, Bureau has faced many issues and challenges in the ongoing activities. While it has resolved some of them learning from the past experience and developing solutions to address them, some major challenges are still predominant in the energy efficiency sector which are as follows:

Energy Efficiency Financing

Financing still continues to be the grey area in this sector. Industries are hesitant to invest, banks are sceptical to lend and ESCOs are facing shortage of adequate funds thereby stalling the projects on ESCO mode and restricting their adequate institutionalization. Though various schemes are in place and picking up the required momentum, still awareness and capacity building on these are required in the first place.

Awareness among Financial Institutions

Energy Efficiency (EE) Financing through commercial banks and NBFCs is facing the lack of awareness and capacity to understand the EE Financing concepts like factors to be considered during appraisal process, technical risk appraisal considerations, etc. At the same time, ESCOs and Industries lack adequate understanding of project financial appraisal concepts.

Capacity Building and Awareness of end Users

Lack of awareness among end users necessitates the capacity building of consumers, industries, auditors, ESCOs etc.

Enforcement and Monitoring Reporting & Verification (MRV)

The verification system for various programmes needs strengthening to make it more robust in terms of quality of reporting coupled with strict enforcement of the provisions under EC Act.

State Designated Agencies (SDA)

Except for some SDAs which has a separate and exclusive state designated agency (SDA), in all other states mostly the renewable development agencies, electrical inspectorate or the DISCOMs have been given the additional responsibility of functioning as the SDA. However to make the SDAs more effective and responsive dedicated stand- alone SDA in each state with adequate and appropriate manpower and resources is required.

Energy Auditors

As Energy Auditors are a key stakeholder who are responsible for the verification for the activities, they need to be very competent. The quality of audit and verification has been a major concern. Efforts needs to be made to strengthen these auditors.

Implementation through ESCO Route

Implementation of EE projects through ESCO route is one of the tried and tested mechanisms to achieve scalability in many parts of the world. However, this

mechanism has not seen much success in India. This is primarily due to the difficulty to undertake M&V in a reliable manner based on a standard M&V protocol, along with lack of understanding and financing.

Energy Management Systems (EMS)

Most of the plants in India lack the EMS systems. Supporting various industries for establishing energy saving standards and practices like ISO 50001 and 50047 would help towards achieving PAT targets.

Way Forward

Most of the existing schemes were successful in creating institutional readiness and strong public awareness of energy efficiency in India. Technological advancement and project management capabilities have helped many industrial sector to achieve global benchmarks. India had been a fore-runner in implementing an exceptional scheme like PAT which has tremendous opportunities for regional synergies and its adaptation in different countries. Thus, ROSHANEE aims to align the country's energy efficiency measures with the commitments under Nationally Determined Contributions in particular and to strive for United Nations Sustainable Development goals.

1.0 Overview

1.1 Background

Global Warning is an anthropogenic phenomenon which is a result of carbon intensive activities since the industrial revolution. However, different countries are at different stages of development and have had different emission trajectories in the past. Although India is one of the lowest emitters of greenhouse gases in the world on a per capita basis, it is threatened by the impact of global warning and climate change.

Global energy demand increased by 2.1% in 2017[1], compared with 0.9% in the previous year and 0.9% on an average over the previous five years. More than 40% of the growth in 2017 was driven by China and India; 72% of the rise was met by fossil fuels, a quarter by renewables and the remainder by nuclear. Global energy-related CO_2 emissions grew by 1.4% in 2017, reaching a historic high of 32.5 gigatons (Gt), a resumption of growth after three years of global emissions remaining flat. The increase in CO_2 emissions, however, was not universal. While most major economies saw a rise, some others experienced declines, including the United States, United Kingdom, Mexico and Japan. The biggest decline drop came from the United States, mainly because of higher deployment of renewables.

Electricity generation increased by 3.1%, or 780 TWh, worldwide in 2017 as electricity demand rose faster than overall global energy demand growth. Electricity demand growth in emerging economies remains strongly linked to rising economic output. In China, robust economic growth of nearly 7% and a warm summer drove electricity demand up by 6% (or 360 TWh). In India, demand growth of over 12% (or 180 TWh) outpaced the 7% growth in economic activity. Together, China and India accounted for 70% of global electricity demand growth worldwide, with another 10% coming from other emerging economies in Asia. India has made significant strides in improving access to electricity, with half a billion people having gained electricity since 2000 and a near-doubling of the access rate, to 82% of the population now, up from 43% in 2000.

In India, economic growth bolstered rising energy demand and continued to drive up emissions, but at half the rate seen during the past decade. India's per-capita

1. As per IEA, GECO2017

emissions in 2016 was 1.7 tCO_2, well below the global per capita average of 4.3 tCO_2.

India's development path is based on the country's unique resource endowments, the overriding priority of economic and social development and poverty eradication, and India's adherence to the legacy of its civilization which places a high value on environment and maintenance of ecological balance. India's development agenda focuses on the need for rapid economic growth which is an essential precondition to poverty eradication and improved standards of living.

India's energy intensity, an indicator of the country's prudent use of energy, (0.15 kg of oil equivalent per dollar of GDP expressed in purchasing power parity terms, IEA data 2009) was not only lower than the OECD average(0.18kgoe/GDP-PPP), but also continued to decrease. However, in almost every sector in India, energy intensities vary substantially across different units, which range from almost the best in the world to those which are extremely inefficient. As a result, it offers substantial scope for improvement if current commercially available technologies and best practices are used. Increasing liberalization of global trade and the growing global competition have made improvements in productivity, which includes lowering the cost of energy, an important benchmark of economic success.

Given the formidable challenge of providing adequate energy of desired quality using a variety of energy resources to users sustainably and at reasonable costs, improving the efficiency of conventional and non-conventional energy, and conserving energy have become important components of an integrated energy policy.

The Energy Conservation Act, 2001, which came into force from 1st March 2002, integrate these elements as a measure of expressing legal intent and commitment. The Bureau of Energy Efficiency (BEE) was created in March 2002 as the nodal central statutory body to assist the government in implementing the provisions of the EC Act. As a quasi-regulatory and policy making body, the Bureau helps in developing policies and strategies that emphasize self-regulation and market principles to achieve the primary objective of reducing the energy intensity of Indian economy. The Energy Conservation Act, 2001 empowers the state government to facilitate and enforce efficient use of energy and energy conservation through respective state designated agencies in consultation with BEE. The Act also empowers the Government to specify energy performance standards for efficient use of energy.

1.2. India's Nationally Determined Contributions

Government of India submitted its INDC document to UNFCCC in 2015, endorsing country's commitment towards the issues related to climate change. India also played an active role during the climate change negotiations held in Paris at COP 21 in 2015. Subsequently, India ratified the Paris agreement on Climate Change in 2016, which requires the member counties to make binding commitments to curb CO_2 emissions to keep global average

temperatures rise below 2^{0}C as compared to the pre-industrial period. India in its Nationally Determined Contribution, in response to the CoP decision for the period 2021 to 2030, has stated that it will propagate a sustainable way of living by adopting climate friendly technologies and a cleaner growth path. It categorically stated that it will reduce the emission intensity of its GDP by 33 to 35% by 2030 from 2005 level. To achieve the above India would continue with its ongoing interventions and enhance the existing polices. One of the priority areas includes promoting energy efficiency in the economy, notably in industry including MSME, transportation, building and appliance.

1.3. Overall Projections for GHG Reduction

India's gross GHG emissions were 2.136 billion tonnes CO_2 equivalent in 2010. Of this, the Energy sector contributed about 71%, Industrial Processes and Product Use (IPPU) 8%, Agriculture 18% and waste sector 3%[2]. About 12% emissions were offset by carbon sink action of forests and croplands, such that net emissions were 1.884 billion tonnes CO_2 equivalent2. India's ambitious commitment of 33-35% reduction in emission intensity is based on a number of mitigation and adaption measures.

The total CO_2 emission of India was 1.43 billion tonnes in 2005[3]. Considering India's GDP as 0.8 trillion USD in 2005, the emission intensity was 1.7 kg of CO_2 per GDP in USD. Projecting 5% growth in GDP annually form the current scenario in 2016, and CO_2 emissions at 5.15 billion tonnes in 2030-31[4], estimated with the penetration of energy efficiency in the country, the projected emission intensity in 2030-31 is about 1.15 kg of CO_2 per GDP in USD. This emission intensity projection is 35% lower than the baseline of 2005. However, this estimation is inclusive of the ongoing and future anticipated activities on energy efficiency.

1.4. Need for a Focussed Mission on Energy Efficiency

Energy Efficiency is seen to be one of the key elements that can contribute towards reducing the energy requirements and the associated environmental implications. India's NDC also emphasize on energy efficiency as a key measure to manage energy demand. As per IEA Market Report Series, Energy Efficiency 2018, largest opportunities for energy saving is in industry (45%) followed by buildings (30%).

Improvements in global energy efficiency slowed down dramatically in 2017, because of weaker improvement in efficiency policy coverage and stringency as well as lower energy prices. Global energy intensity improved by only 1.7% in 2017, compared with an average of 2.3% over the last three years.

Although the Indian Govt. has taken several measures to improve the scenario in the energy sector, like accelerating the use of renewables and clean energy, improving infrastructure and services in the country,

2. Study on Energy Efficiency potential in India, GIZ- TERI, Aug 2017
3. The Final Report of the Expert Group on Low Carbon Strategies for Inclusive Growth, Planning Commission Government of India, April 2014
4. Study on Energy Efficiency potential in India, GIZ- TERI, Aug 2017

etc., it is important to spell out the role that energy efficiency can play in the decades to come. According a study , the major energy reduction potential exists in the following areas:

- Iron & Steel, Cement, Bricks and other industries including MSME
- Transport sectors- railways, aviation, electric and conventional vehicles
- Buildings-both commercial and residential
- Agriculture sector
- Lighting, space conditioning and appliances

The study suggests that as per the current use of energy efficient technologies, India could achieve the lower end of the NDC, i.e., 33% reduction. The study also suggests that with larger penetration of energy efficiency, India could achieve 41% emission intensity reduction.

The National Action Plan on Climate Change (NAPCC) recognized the need to maintain a high growth rate for increasing the living standards of the vast majority of people and reducing their vulnerability to adverse impacts of climate change. National Mission for Enhanced Energy Efficiency (NMEEE), being one of the key components of NAPCC focused on achieving energy efficiency in India from all sectors of economy having substantial potential of energy efficiency improvement. NMEEE aimed to strengthen the market for energy efficiency by creating conducive regulatory and policy regime and has envisaged fostering innovative and sustainable business models to the energy efficiency sector.

NMEEE was quite successful in pushing many energy intensive sectors to achieve energy efficiency with a global aim of reducing GHG emissions to meet India's Nationally Determined Contributions (NDCs) by 2030 and beyond. The desirability of continuing NMEEE is also recognized by Parliamentary Standing Committee on Energy, the Executive Committee on Climate Change (ECCC) under PMO as well as Group of Secretaries for Energy Conservation and Efficiency. The Mission contributed to more than 37 million tonnes of CO_2 mitigation till 2017-18.

The commitment made by India required a more extensive programme which could relate to goals of CO_2 mitigation by 2030, in a much more exhaustive way. The Ministry of Environment and, Forest and Climate Change (MoEFCC) has written to all line Ministries including Ministry of Power (MoP), to re-align the existing scheme as per our NDC commitment. It was also felt that the NMEEE did not include all the activities being implemented by BEE towards energy efficiency and energy conservation, which actually contributed to the common goal of mitigation. Hence, there is now a need to enhance the programme and take into account all the existing initiatives as well as new initiatives which will help in fulfilling the commitments made under the NDCs on a mission mode. The effort will help consolidate all activities and their consequent contribution towards meeting the NDC goals. The activities proposed in the subsequent chapters can lead to an estimated savings of 557 million tonnes of CO_2 by 2030.

Bureau of Energy Efficiency has also developed a National Strategy Plan for Energy Efficiency to address India's environmental and climate change commitments. The new document "Unlocking National Energy Efficiency Potential (UNNATEE)" lays a framework and implementation strategy, in the short, medium and long term, to establish a clear linkage between energy demand scenarios and energy efficiency opportunities. The national target for energy efficiency savings and implementable roadmap to be achieved in the next fourteen years has been established through the UNNATEE document.

The total energy consumption under the moderate scenario is 789.9 Mtoe and the share of different sectors is indicated in the figure below:

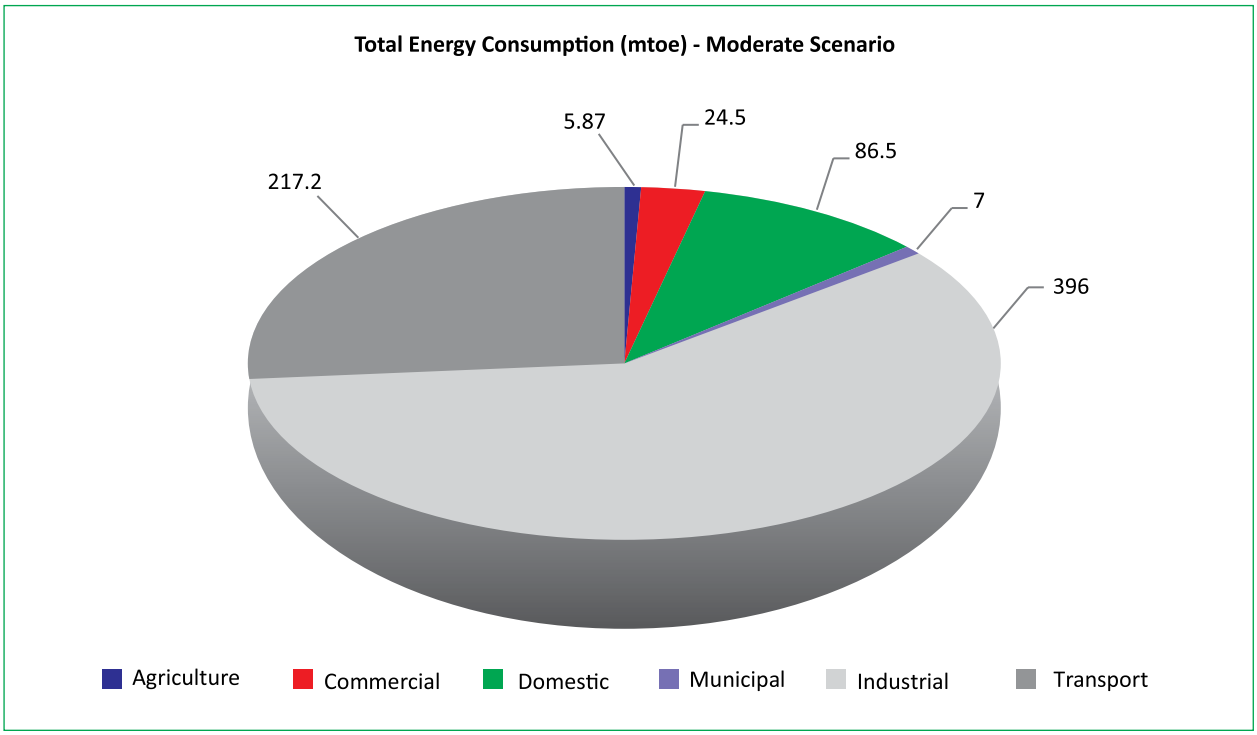


Figure 4: Total energy consumption under moderate scenario

The energy saving potential of the country is estimated to be 86.9 Mtoe by year 2031 with the highest saving potential in Industrial sector in the Moderate Savings Scenario and is depicted in the figure below:

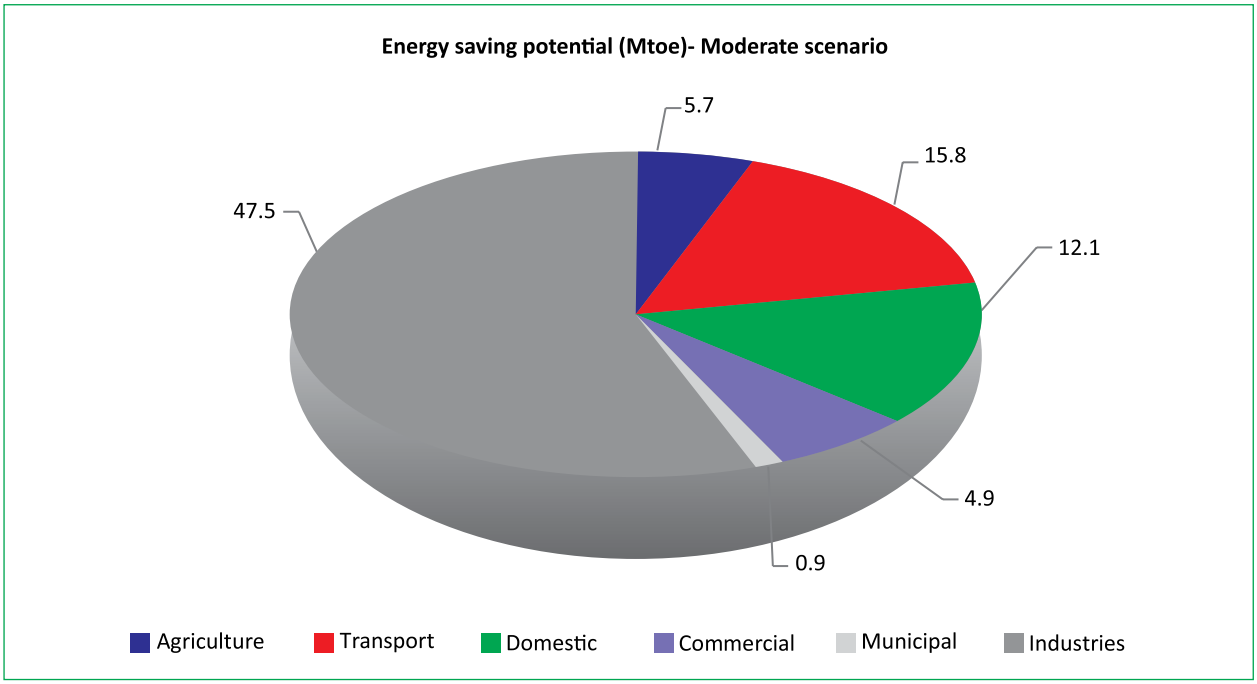


Figure 5: Total energy consumption under moderate scenario

The target for energy emissions in India for 2030, in absolute terms should be less than or equal to 6,807 MtCO2e. The achievement in emission intensity (energy and non-energy) reduction by 2030 is estimated to be 36%, under the moderate savings scenario, out of which the contribution of energy efficiency is 50%. Thus, it is deduced that India's NDC commitments would be met under Moderate scenario, which includes ongoing and future anticipated activities on energy efficiency. The emission reduction from various sectors in the Moderate and Ambitious scenarios are reflected in the following figure:

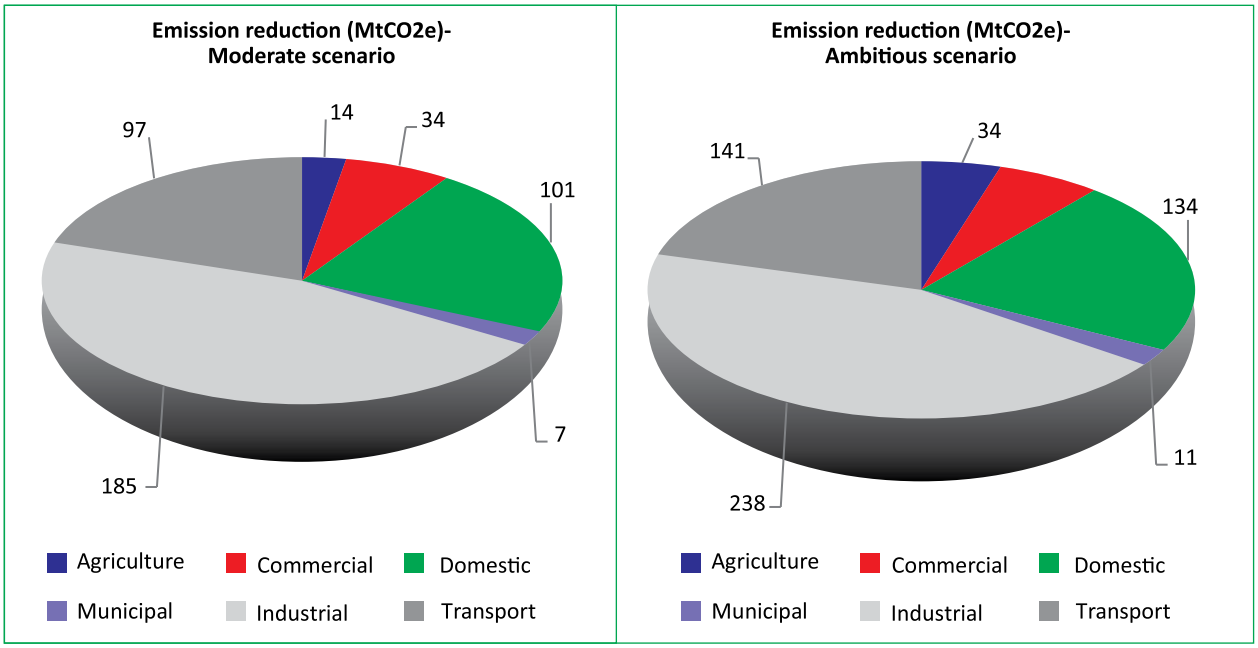


Figure 6: Emission reduction from various sectors in Moderate and Ambitious scenarios

Building on the potential areas identified in the UNNATEE and taking into account the existing schemes of the Bureau, a detailed action plan till 2030 has been worked out. The revised proposed mission on enhanced energy efficiency is Roadmap of Sustainable and Holistic Approach to National Energy Efficiency (ROSHANEE).

1.5. Proposed Mission on Energy Efficiency- ROSHANEE

The proposed Mission has a broader vision and takes into account all the potential areas of energy efficiency in most of the energy intensive sectors, covering the macro level in policy and further delineating the respective schemes. The new mission will include all the activities of past that have contributed significantly to CO2 mitigation as well as new activities in the fields that are un-explored or partially explored. The proposed programme will also have a dedicated component for the financing of energy efficiency activities in India. It shares its objective from the earlier mission with enhancements. This programme targets the industrial sector in entirety ranging from large to small and medium enterprises. It also deals with the subject of demand side management in more focussed manner. It clearly outlines the strategies that needs to be adopted for achieving India's Nationally Determined Contribution commitments.

Energy Efficiency is seen to one of the key elements that can contribute towards India's energy security and aid meeting international climate obligations. National Mission for Enhanced Energy Efficiency (NMEEE), one of the key components of the National Action Plan on Climate Change (NAPCC), focused on achieving energy efficiency in India from all sectors of economy having substantial potential of energy efficiency improvement.

The NMEEE successfully strengthened the market for energy efficiency by creating conducive regulatory and policy regime and has scaled up innovative and sustainable business models in the energy efficiency sector.

Through this ROSHANEE document, the NMEEE is being strengthened with a review of existing approaches and planning a new portfolio of strategies to strengthen energy efficiency across all sectors in the country till 2030. ROSHANEE brings together seemingly disparate national initiatives such as Zero Effect, Zero Defect, Smart Cities, India Cooling Action Plan etc.

The activities proposed are expected to mitigate over 557 million tonnes of CO2 (thermal energy savings of 42.71 million tonnes of oil equivalent and 557 billion units of electricity savings at generation end) by 2030 with co-benefits in employment generation, quality enhancement, energy security etc.

A summary of planned initiatives is indicated below:

ROSHANEE Roadmap of Sustainable and Holistic Approach to National Energy Efficiency	
Policy and Institutional framework	Energy Conservation (EC) Act, 2001 - Revision and increased devolution of EC activities to states
Industries	Penetration of Energy Efficiency in industries and creation of public database
Small & Medium EnterpriseSmall & Medium Enterprise	Promote innovative/ low carbon energy efficient technologies with capacity building
Equipment and appliances	Widen coverage of S&L and enhance performance benchmarks
Buildings	Promoting energy efficiency in building through Building Codes, labelling, PAT scheme
Demand Side Management and Data analytics	Widen coverage of the DSM through data analytics
Sustainable Transportation Network	Develop vehicle fuel efficiency norms and promote sustainable alternatives
Agriculture	Developing and promoting energy efficient technology eco systems
Capacity building and awareness	Capacity building and awareness of stakeholders
Knowledge Management	Creation of a knowledge sharing platform
Finance	Mitigating investment risk
Research & Development (R&D)	Public/Private partnerships
Measurement, Monitoring, Reporting and Verification (MRV)	Sectoral MRV

2.0 Policy and Institutional Framework

2.1. Existing Framework

India is one of the few economies in the world to have robust framework for promoting energy efficiency and energy conservation. The framework includes a statutory Act of Parliament, The Energy Conservation Act (EC Act) which came into existence in 2001, the salient features of which are as under:

The EC Act, 2001 empowered the central and state governments to:

- Specify energy consumption standards for notified equipment and appliances;
- Direct mandatory display of label on notified equipment and appliances;
- Prohibit manufacture, sale, purchase and import of notified equipment and appliances not conforming to energy consumption standards;
- Notify energy intensive industries, other establishments, and commercial buildings as designated consumers;
- Establish and prescribe energy consumption norms and standards for designated consumers;
- Prescribe energy conservation building codes for efficient use of energy and its conservation in new commercial buildings having a connected load of 500 kw or a contract demand of 600 kva and above;
- Direct designated consumers to-
  - Designate or appoint certified energy manager in charge of activities for efficient use of energy and its conservation;
  - Get an energy audit conducted by an accredited energy auditor in the specified manner and interval of time;

Furnish information with regard to energy consumed and action taken on the recommendation of the accredited energy

- Auditor to the designed agency;
- comply with energy consumption norms and standards;
- Prepare and implement schemes for efficient use of energy and its conservation if the prescribed energy consumption norms and standards

are not fulfilled;

- get energy audit of the building conducted by an accredited energy auditor in this specified manner and intervals of time;
- State Governments may-
  - Amend the energy conservation building codes prepared by the Central Government to suit regional and local climatic conditions;
  - Direct every owners or occupier of a new commercial building or building complex being a designated consumer to comply with the provisions of energy conservation building codes;
  - Direct, if considered necessary for efficient use of energy and its conservation, any designated consumer to get energy audit conducted by an accredited energy auditor in such manner and at such intervals of time as may be specified.

The objective of this Act was conservation and efficient use of energy. The Act provides scope for framing Missions such as NMEEE with an elaborate action plan to combat climate change under under NAPCC and well-defined goals in mitigation actions under the NDCs. In 2010 some features were amended to provide stringent compliance norms.

National Action Plan on Climate Change (NAPCC)

The NAPCC released in June 2008, recognized the need to maintain a high growth rate for increasing the living standards of the vast majority of people and reducing their vulnerability to adverse impacts of climate change. The Action Plan enunciated the following principles;

- Protecting poor and vulnerable sections of society through an inclusive and sustainable development strategy sensitive to climate change
- Achieving national growth objectives through a qualitative change in the direction that enhances ecological sustainability, leading to further reduction in emissions of GHGS.
- Devising efficient and cost-effective strategies for end-use demand size measures.
- Deploying appropriate technologies for both adaptation to and mitigation of the adverse effects of emissions of GHGs extensively as well as accelerated pace.
- Engineering new and innovative forms of market, regulatory, and voluntary mechanisms to promote sustainable development.

The National Action Plan for Climate Change outlined eight national missions that represent multi-pronged, long-term, and integrated strategies for achieving

key goals in the context of climate change.

The missions are listed below:

a) National Solar Mission
b) National Mission for Enhanced Energy Efficiency
c) National Mission on Sustainable Habitat
d) National Water Mission
e) National Mission for Sustaining the Himalayan Ecosystem
f) National Mission for Green India
g) National Mission for Sustainable Agriculture
h) National Mission for Strategic Knowledge of Climate Change

National Mission for Enhanced Energy Efficiency (NMEEE)

National Mission for Enhanced Energy Efficiency is built on the Energy Conservation Act 2001. Ministry of Power was entrusted with the responsibility of implementing the mission for which BEE was designated as a secretariat for the Mission. The Mission recommends mandating reduction in specific energy consumption of large energy intensive industries, with a market mechanism for trading energy-savings certificates; fiscal incentives, including reduced taxes on energy-efficient appliances; and financing of public-private partnerships to reduce energy consumption through demand-side management programs in the municipal, buildings and agricultural sectors. NMEEE is the key component of National Action Plan on Climate Change (NAPCC) which reflects the intention of Government of India on achieving energy efficiency in India from all sectors of the economy having substantial potential of energy efficiency improvement. NMEEE aimed to strengthen the market for energy efficiency by creating a conducive regulatory and policy regime and has envisaged fostering innovative and sustainable business models to the energy efficiency sector.

NMEEE was successful in pushing many energy intensive sectors to enhance energy efficiency. Many of the activities under this mission found prominent role in meeting NDC goals and also reducing GHG emissions. The desirability of continuing NMEEE has also recognized by the Parliamentary Standing Committee on Energy, the Executive Committee on Climate Change (ECCC) under PMO as well as the Group of Secretaries for Energy Conservation and Efficiency. The Mission contributed to more than 37 million tonnes of CO2 mitigation in 2017-18. The mission also contributed significantly towards development and capacity building of energy professionals, ESCOs and financial institutions. The mission has also helped in the market transformation for efficient lighting which transformed the face of lighting industry through initial introduction of CFLs, and subsequently LEDs.

2.2. State Policies on Energy Conservation

Maharashtra becomes the first state in the country to approve the State Energy Conservation Policy focusing on all the sectors in the State. The policy targets

a saving of about 1000 MW in next five years. Major highlights of the policy are:

1. ESCO will be promoted in big way by providing Viability Gap Funding up to 20 lacs per project.
2. Electric cars and scooters will be given 10% subsidy to consumers.
3. Mandatory purchase of 5-star pump for new agriculture connections.
4. Around Rs. 800 Crore expenditure expected on Energy Efficiency.
5. Mandatory ECBC in the coming years

Special focus has been given to the Industrial Sector, Commercial/ Residential/ Government Buildings, Demand Side Management in Municipalities, Agriculture and DISCOMs.

Many other states are in the process of formulating/finalizing their energy conservation policies.

2.3. Amendment to the Energy Conservation Act, 2001

Under the direction of Hon'ble Minister of State (IC) for Power and New & Renewable Energy, Govt. of India suggested in the 7th Governing Council of BEE in 2018 that a committee may be constituted to identify areas to be included/reviewed in the EC Act, 2001. In this regard, Ministry of Power has constituted a National Review Committee under the chairmanship of Additional Secretary, Ministry of Power to review the EC Act, 2001 and recommend the necessary amendments to Govt. of India with a view to enhance its scope to cover the domain of energy efficiency is a holistic manner.

This will bring more sectors and areas of energy efficiency under the umbrella of EC Act and will also strengthen the monitoring and verification, enforcement and other related activities. This will enable the Bureau of Energy Efficiency and the State Designated Agencies to implement and enforce the energy efficiency activities more effectively.

2.4. Institutional Set-up of the Bureau of Energy Efficiency

The Bureau of Energy Efficiency established and incorporated under the Energy Conservation Act, 2001 is tasked with providing policy and regulatory framework and promotion to National Energy Conservation activities in the country.

The Bureau of Energy Efficiency is presently operating from its head office at Delhi. With the many fold increase in the magnitude of the activities envisaged under the Act, and as the Nodal Agency for National Mission for Enhanced Energy Efficiency (NMEEE), the Bureau faces many operational difficulties as it has no regional offices. The activities of energy efficiency require regular interaction with the State Designated Agencies (SDAs), Designated Consumers (DCs), and other stakeholders. Absence of the regional offices of the Bureau adversely impacts the operational capacity of Bureau which has to perform as a national Statutory Organization.

Further, to meet the NDC commitments for reducing emission intensity of our GDP

by 33-35% by 2030 from 2005 levels, major Energy Efficiency initiatives are to be implemented. The Ministry of Power in its Vision, Strategy and Action Document has tasked the Bureau to make special efforts in this direction by undertaking activities such as energy efficiency in industries Perform, Achieve and Trade (PAT), appliances (Standards & Labeling), Market Transformation for Energy Efficiency (MTEE), Buildings and Financial Instruments such as Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) & Venture Capital Fund for Energy Efficiency (VCFEE).

Actionable Points- Institutional set-up

The Energy Conservation Act, 2001 has a provision empowering Bureau to establish offices at places other than Delhi. The Bureau is proposing to set up regional offices of the Bureau in other parts of the Country. To start with, it is proposed to create three more offices at Mumbai, Chennai and Kolkata to better serve the regional demands. Bureau is proposing to seek necessary administrative approvals/ financial approvals of the Ministry of Power.

2.5. Strengthening of State Designated Agencies (SDAs) to Promote Efficient Use of Energy and its Conservation

As per section 15(d) of Energy Conservation (EC) Act 2001, State Governments may designate any agency as State Designated Agency (SDA) to coordinate, regulate and enforce the provisions of this act within the State. Accordingly, all the States/ UTs have designated their respective SDAs. These agencies differ from State to State with the Renewable Energy Development Agency comprising 44%, Electrical Inspectorate comprising 17%, Distribution Companies comprising 19%, Power Departments comprising 14% and others comprising 6%.

Most of these organizations have limited experience in the field of energy efficiency / conservation. This has resulted in the need for building capacity, enhancing understanding and knowledge about energy efficiency and having a common action plan to implement measures to reduce energy intensity of the States. Therefore, it is crucial to build and strengthen institutional capacities and capabilities of SDAs for undertaking the energy conservation activities at the State level. BEE has been implementing the scheme on "Strengthening of State Designated Agencies (SDAs) to promote efficient use of energy and its conservation" since the XI plan. This scheme comprises of two components namely "Providing financial assistance to the State Designated Agencies to coordinate, regulate and enforce efficient use of energy and its conservation at the State level" and "Contribution to State Energy Conservation Fund (SECF)". The source of funding for the former has been primarily from BEE/ MoP while for the SECF the states are also required to provide matching contribution.

Major achievements realized through the strengthening of SDAs scheme are as follows:

- About 120 demonstration projects in the areas of street lighting, water pumping and waste heat recovery have been successfully completed by SDAs.
- The LED Village Campaign has been successfully implemented by 27 States.
- All the SDAs have established dedicated website highlighting energy efficiency measures undertaken in the State. The websites are linked with that of the Bureau of Energy Efficiency and with other SDAs to facilitate ease of information exchange.
- Establishment of State Energy Conservation Fund in 30 states, out of which, 25 states have provided matching contribution.

Key Deliverables under "Providing financial assistance to the State Designated Agencies to coordinate, regulate and enforce efficient use of energy and its conservation"

(i) **State Partnership for Energy Efficiency Demonstrations (SPEED):** The main objectives of these demonstration projects are:

- To showcase the effectiveness of the most energy efficient device / technology through a practical demonstration
- To furnish the SDAs with relevant documents including technical specification of the energy efficient device, techno-economic viability of the project, bidding document, monitoring protocol etc.
- To facilitate the State Governments in replicating these demonstration projects through various Departments / Agencies

These demonstration projects can be in the areas of heating ventilation & air conditioning systems of buildings, street lighting in remote locations, water pumping, municipality, agriculture pumpsets, smart controllers in water distribution system, intelligent data monitoring in industries and other areas, internet of things (IOT), electric vehicle charging infrastructure, smart metering, trigeneration, etc.

Energy Efficiency activities in Government schools include replacing existing old appliances (specifically, luminaries and fans) with energy efficient ones and simultaneously, creating awareness amongst school children by way of establishing energy clubs, organizing debates, quiz programs, etc. thereby encouraging participation of young ambassadors in the energy efficiency movement. From FY 2019-20 onwards, these activities are proposed to be carried out under the flagship programme titled **SEEKH – SCHOOL ENERGY EFFICIENCY KNOWLEDGE HUB**, wherein, target for covering a definite no. of schools would be assigned to each SDA. Implementation of this programme in around 25,000 nos. of schools is targeted to be completed during FY 2020-21 to FY 2024-25.

(ii) **Model Energy Efficient Village Campaign:** Model Energy Efficient Village Campaign is implemented in a village comprising of 200 – 250

households will be converted to energy efficient village by replacing existing inefficient equipment with star labeled appliances which may include water pumps, super-efficient fans, gas stoves, diesel generators, street lights and household lighting. While two to three villages in each state are likely to be covered under this campaign, more villages are likely to be benefitted with legislators push for similar interventions through other resources to showcase the effectiveness of energy efficient device / technology in villages falling under their constituencies. These campaigns are proposed to be implemented under flagship programme titled PANCHSHEEL – Panchayat Level Street and Home Energy Efficient Lighting & Appliances Programme from FY 2019-20 onwards. Implementation of this campaign in around 1,500 nos. of villages is targeted to be completed during FY 2020-21 to FY 2024-25.

(iii) Institutionalization of Enforcement machinery at state level: An effective enforcement mechanism is imperative for implementation of all the mandatory schemes. It is also very important that the defaulters identified through Inspection or Non-compliance may be taken into account through the adjudication process at the State Electricity Regulatory Commissions (SERCs) which involves appointment of Adjudicating Officers by the SERCs. There is a need to train the Adjudicating Officers as well, regarding various provisions of the Energy Conservation Act. Also, in order to file petition at SERCs against the defaulters and its subsequent proceedings at SERCs, the SDAs will be requiring legal support. Financial support towards the cost for conducting training programmes for Inspecting and Adjudicating Officers needs to be provided to the SDAs.

(iv) Manpower support to SDAs: It is observed that the SDAs lack physical and fiscal resources and share key facilities / staff / budget with the parent department. Lack of exclusive staff, HRD plan to augment, restructure, retain and upgrade skills adversely affect most SDAs.

(v) State Energy Efficiency Research & Outreach Programme: The objectives of this component are:

- To strengthen partnership between policy makers & educational institutions to forward energy efficiency drive
- To enhance the outreach activities undertaken by State Designated Agencies

(vi) Workshops / Capacity Building of energy professionals: Workshops are an important tool to disseminate information. It is important that SDAs organize workshops at regular interval to disseminate information to these energy professionals like accredited energy auditors, energy managers, Designated Consumers and ESCOs at regular intervals. These workshops can also be used as a platform to address the practical issues faced by these professional at ground, which can be subsequently

highlighted to the BEE by the SDAs for further corrective action.

Beyond FY 2019-20, activities under (v) and (vi) components are proposed to be implemented under flagship programme titled PRERNA – Programme on Energy Research and National Awareness.

(vii) Analysis and survey of the impact of energy conservation activities by SDAs: The outcome of the various energy conservation activities undertaken by the SDAs needs to be documented. This should be in the form of an annual year book where the benefits can be quantified on multiple dimensions including the monetary benefits based on the reduction in the number of units consumed by this sector, generation capacity that can be avoided by the generation utility because of the reduction in demand in this sector or can be used to satisfy the peak demands, emissions avoided by reducing the generation requirements.

(viii) Maintenance and updation of internet platform and other database created: Financial support to SDAs is also provided towards establishment of internet platform through creation of a separate website on energy efficiency by the states. Most of the SDAs have created their internet platform and the database created for EMs/ EAs/DCs and other stakeholders are available on the internet platform. The contents of the web portal established by the SDAs are needed to be updated regularly to have the desired impact.

Key Deliverables under "Contribution to State Energy Conservation Fund"

The Energy Conservation Act 2001 requires State Governments / U.T. Administrations to constitute a fund called State Energy Conservation Fund (SECF) for the purpose of promotion of efficient use of energy and its conservation within the State. The SECF is to facilitate overcoming the major barriers for implementation of energy efficiency projects. The funds disbursed under SECF is to be earmarked separately as Revolving Investment Fund (RIF).

The contribution under State Energy Conservation Fund (SECF) is made to those State Govt. / UT Administration who have created their SECF and finalized the rules and regulations to operationalize the same. The scheme is for contribution to all the State/UTs with a maximum ceiling of Rs. 4.00 crores for any State/UT provided in two instalments of Rs. 2.00 crores each. The second instalment of contribution to SECF is released only after the state has provided a matching contribution of Rs 2.0 crores (Rs 25 lakh for North eastern States and Union Territories) to BEE's first installment.

Establishment of Stand-Alone State Designated Agencies

All the States/UTs have designated their SDAs. However, in most of the cases, the existing agencies such as Electrical Inspectorates, Renewable Energy Development Agencies, Electricity Distribution Companies (DISCOMs) etc. have been assigned the additional responsibility of SDA for EC Act. Only two

states – Kerala and Andhra Pradesh have established Stand Alone SDA.

The role of States in implementing energy efficiency measures is crucial. It has been observed that the State Designated Agencies where, additional responsibilities of SDA are assigned are generally deprived of dedicated physical and fiscal resources for implementation of EC activities in the State. This dampens the pace and direction of EC initiatives within the States. It is also felt that, States where "Stand-Alone" SDAs exist, are working more aggressively for implementation of EC programmes and are in a better position to perform the mandated functions in comparison to States where SDA performs the additional responsibility.

Many SDAs are of the opinion that one-time budgetary support might be required from Central Government for setting up of a Stand Alone SDA in the States. This one-time financial support may have contribution from both Centre and State Governments. Energy Efficiency cess may be levied on end consumers for creation of a Sustainable Energy Conservation Fund for meeting the expenditure of the SDAs.

2.6. Cooperation with International Bodies

The Bureau of Energy Efficiency is moving forward the energy efficiency drive across various sectors with the support from various multilateral forums like International Partnership for Energy Efficiency Cooperation (IPEEC), Clean Energy Ministerial (CEM), G20 & BRICS and international cooperation has been instrumental in bringing up the much-needed experiences of various member countries for formulating effective policies and their implementation roadmap. Recently under the CEM framework, BEE has taken up EV30@30 initiative with an objective to reach a 30% sales share for Electric Vehicles (EVs) by 2030. The participation in the IPEEC task groups have benifited India's energy efficiency by reaching out to new avenues. BEE is also working with other multilateral partners namely GEF, World Bank, UNIDO, UNDP, and IEA to take up energy efficiency measures in SMEs, buildings sectors, data management and capacity building of policy makers/stakeholders.

Bureau is associated with many bilateral partners namely Germany, USA, Japan, Switzerland, UK, France and European Union. These collaboration have provided support towards successful implementation of Perform, Achieve and Trade (PAT) Scheme, updating Energy Conservation Building Codes for Commercial buildings and its enhancement for residential buildings, Development of Energy Conservation Guidelines and Energy Management Manual, Dissemination of cross – sectoral best practices within energy intensive industries (through Knowledge Exchange Platform), Waste heat utilization technologies, Space Cooling, Energy Efficiency Financing and Capacity Building for Financing Institution.

These international collaborations have been useful for learning from partner agencies and to showcase India's leadership towards implementing energy efficiency measures and contributing effectively in the climate change goals.

3.0 Industries

Rapid growth of any economy demands tremendous amount of energy. However, India largely depends on coal for meeting its energy needs, which is a major CO2 emitter. Considering this fact, Government of India (GoI) has undertaken several measures to cater to the energy demand along with minimum growth in carbon emissions. On the generation side, greater use of renewables has been pushed in the energy mix mainly through solar and wind power. Supercritical technologies for coal-based power plants have been mandated for all new installations of power plants beyond 2017. On the demand side, efforts are being made to efficiently use energy through various innovative policy measures under the overall ambit of Energy Conservation Act.

On the demand side, one of such initiative was Perform Achieve and Trade scheme under NMEEE which aimed to strengthen the market for energy efficiency by creating a conducive regulatory and policy regime. Various programmes under this mission have contributed significantly to the global objective of CO2 mitigation.

3.1 Perform, Achieve and Trade (PAT)

PAT is a regulatory instrument to reduce specific energy consumption in energy intensive industries, with an associated market-based mechanism to enhance the cost effectiveness through certification of excess energy saving which can be traded. It is an indigenously developed programme to enhance the cost effectiveness of improvements in energy efficiency in energy intensive large industries listed in schedule of EC Act, 2001. The energy savings is translated into tradable instruments called Energy Savings Certificates (ESCerts). Those industries which over achieve their targets are issued energy saving certificates and those who are not able to achieve are entitled to purchase energy saving certificates for compliance. The platform for trading is the existing power exchanges. However, those who do not achieve their target and do not adopt the option of buying ESCerts for compliance would be required to pay equivalent penalty as prescribed under the Energy Conservation Act.

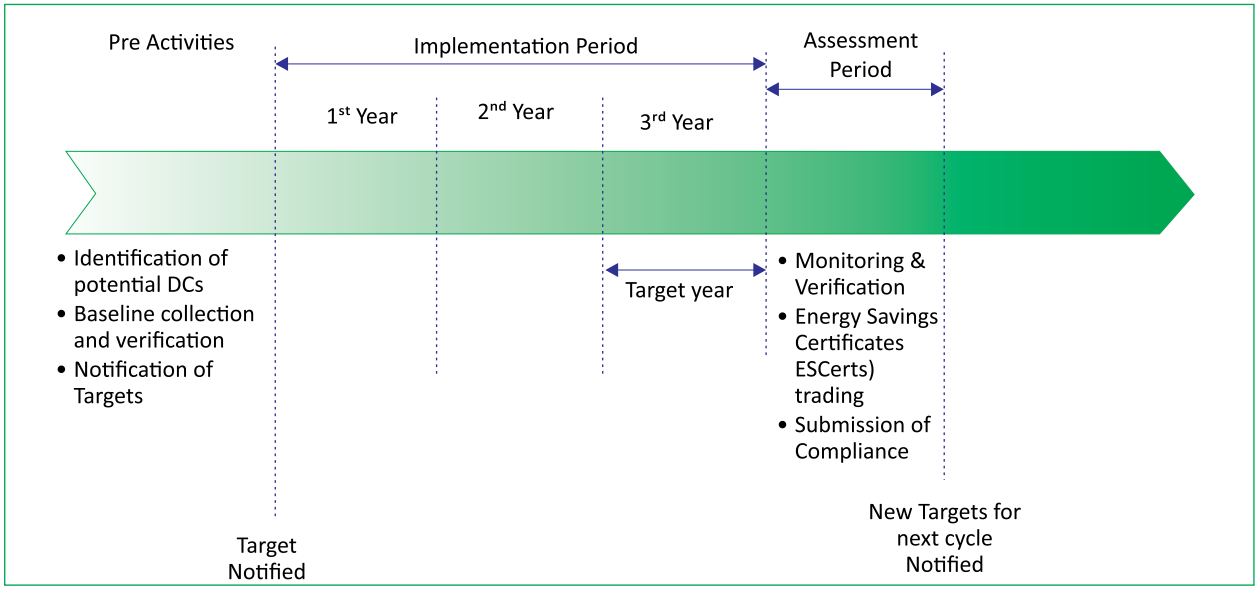


Figure 7: A typical PAT Cycle

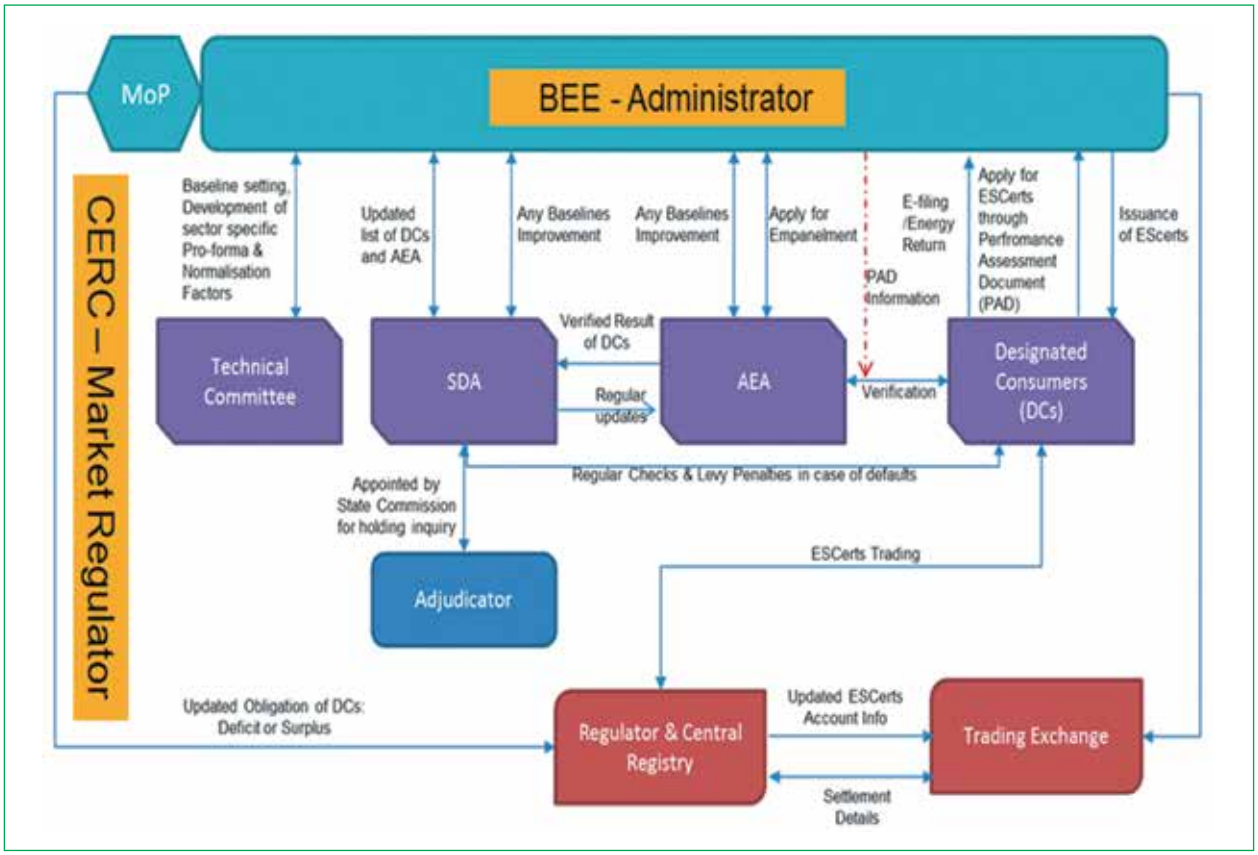
In a typical PAT Cycle, an individual plant known as Designated Consumers (DCs) gets three years for the implementation of energy efficiency projects for achieving the target. The zero date starts from the date of notification of the targets of individual DCs. The assessment is done only for the final year of the three-year cycle to establish whether the DC has achieved its target or not. This assessment is done by accredited energy auditor firm empaneled by the Bureau carrying out the Monitoring and Verification (M&V) exercise.

The scheme is unique in its approach as it focuses on the improvement of specific energy consumption rather than the total energy consumption of the plant. Furthermore, every DC gets a unique target based on its own specific energy consumption which makes it more practical. The scheme has gained much attention across the world and is under consideration for replication in some countries.

3.1.1. Energy Savings Certificate (ESCerts)

Section 14A (1) of Energy Conservation Act 2001 gives power to Central Government to issue energy savings certificate to the designated consumer whose energy consumption is less than the prescribed norms and standards.

Energy Conservation Rules, 2012 (PAT Rules 2012) notified on 30th March 2012 by Ministry of Power, has specified that the ESCerts to be issued/entitled to purchase will be in electronic form and tradable on Power Exchange. CERC is the market regulator and has notified Regulations for dealing in ESCerts in 2016, and also issued Procedure for transaction of ESCerts in Feb 2017. BEE, being the Administrator for ESCerts, has developed PATNet portal for all the DCs through which they upload their forms and ESCerts can be electronically issued/entitled to purchase. NLDC operating under Power System Operation Corporation Limited (POSOCO) is functioning as Registry for ESCerts. As per the PAT Rules, the Value of one ESCert is equal to one metric ton of oil equivalent of energy consumed. The value of per metric ton of oil equivalent of energy consumed shall be prescribed by Central Government, in consultation with BEE, under Section 14 B of the Energy Conservation Act 2001. However, the price of ESCerts is completely market driven as DCs are allowed to sell ESCerts through Power exchanges only.



3.1.2. PAT Cycle-I

The first cycle of PAT was started in April, 2012. To operationalize the scheme, the identified units were given targets to reduce the specific energy consumption (SEC) i.e. energy used per unit of production. In its first cycle, 478 industrial units of 8 sectors viz. Aluminium, Cement, Chlor-Alkali, Fertilizer, Iron & Steel, Paper & Pulp, Textile and Thermal Power Plant were included. The Energy saving targets were given to these industrial units called Designated Consumers (DCs) based on their baseline levels of energy efficiency. Among them, 30 % of the DCs were from thermal power plant sector followed by textile (19%), Cement (18%) and Iron and Steel (14%). The overall SEC reduction target in the eight sectors was about 4.05% with an energy saving of 6.686 million tonnes of oil equivalent (toe) and CO2 savings of around 24 million tonnes per annum. The first cycle came to end in March, 2015.

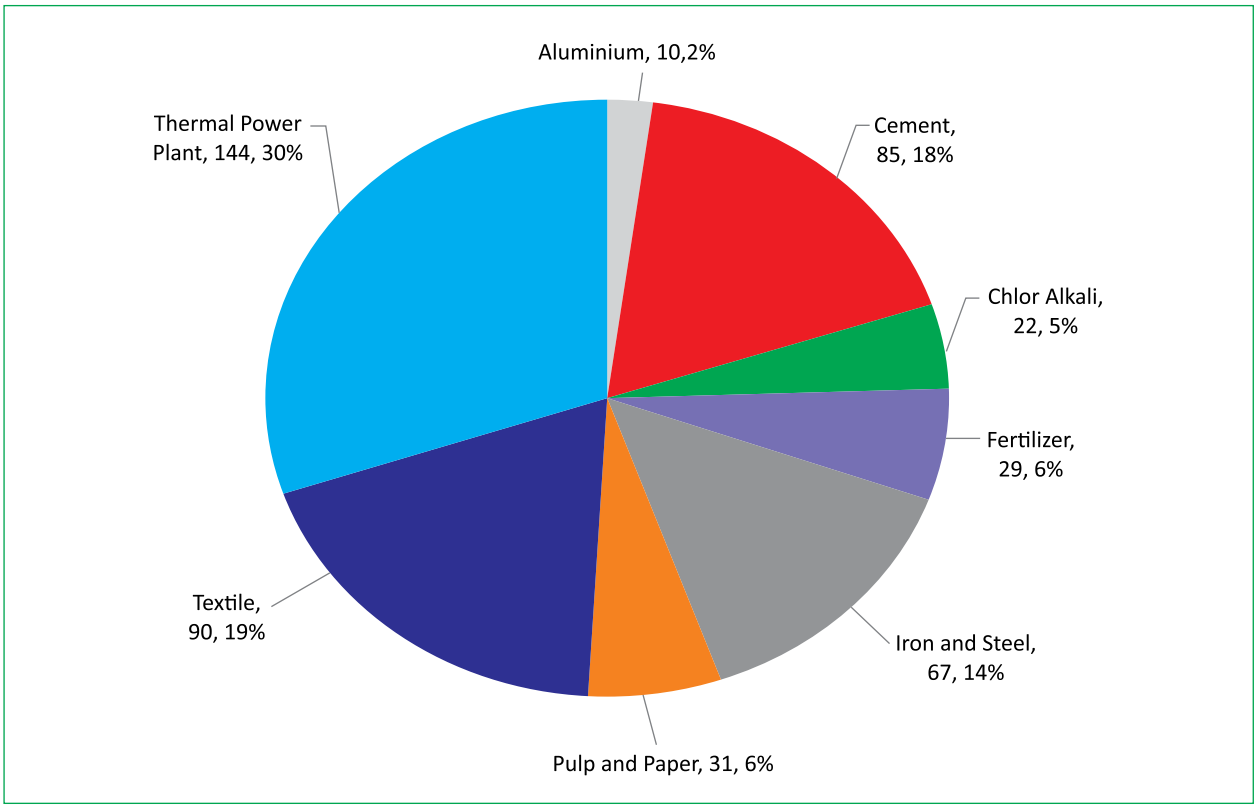


Figure 7: A typical PAT Cycle

Targets and Achievements

The achievement in PAT cycle –I was 8.67 MTOE (around 1.25% of total primary energy supply of India) which exceeded the target by around 30 percent. This energy saving also translates in to a coal savings of 20 million tonnes and about 31 million tonne of CO2 emission reduction (1.93% of India's total CO2 emission). The sectoral achievement in energy savings and other co-benefits is given as under:

S. No.	Sector	No. of DCs	Target Reduction (million toe)	Actual Savings (million toe)
1	Aluminium	10	0.46	0.73
2	Cement	85	0.82	1.44
3	Chlor-Alkali	22	0.05	0.13
4	Fertilizer	29	0.48	0.83
5	Iron & Steel	67	1.49	2.1
6	Paper & Pulp	31	0.12	0.26
7	Textile	90	0.07	0.12
8	Thermal Power Plant	144	3.21	3.06
	Total	**478**	**6.686**	**8.67**

Table 2: Target and Achievement of PAT cycle -I

The success of PAT cycle-I could primarily be attributed to the efforts of the DCs pushing an enormous amount of time and resources in various energy efficient projects. While some chose to tap the low hanging fruits, others invested in major and minor projects. The DCs also improved their O&M practices. Some of the measures were even inhouse, involving little or no investment, and hence could not be quantified. The reported investment figure from the DCs of PAT cycle - I is approx. Rs. 26100 Cr. PAT cycle-I not only witnessed huge investment, but also huge savings. These savings were in terms of coal, oil, gas, electricity and other fuel sources. The equivalent monetary value derived from these fuel savings comes to be about Rs. 9500 Cr. The realized impacts of PAT cycle –I are given in the figure below:

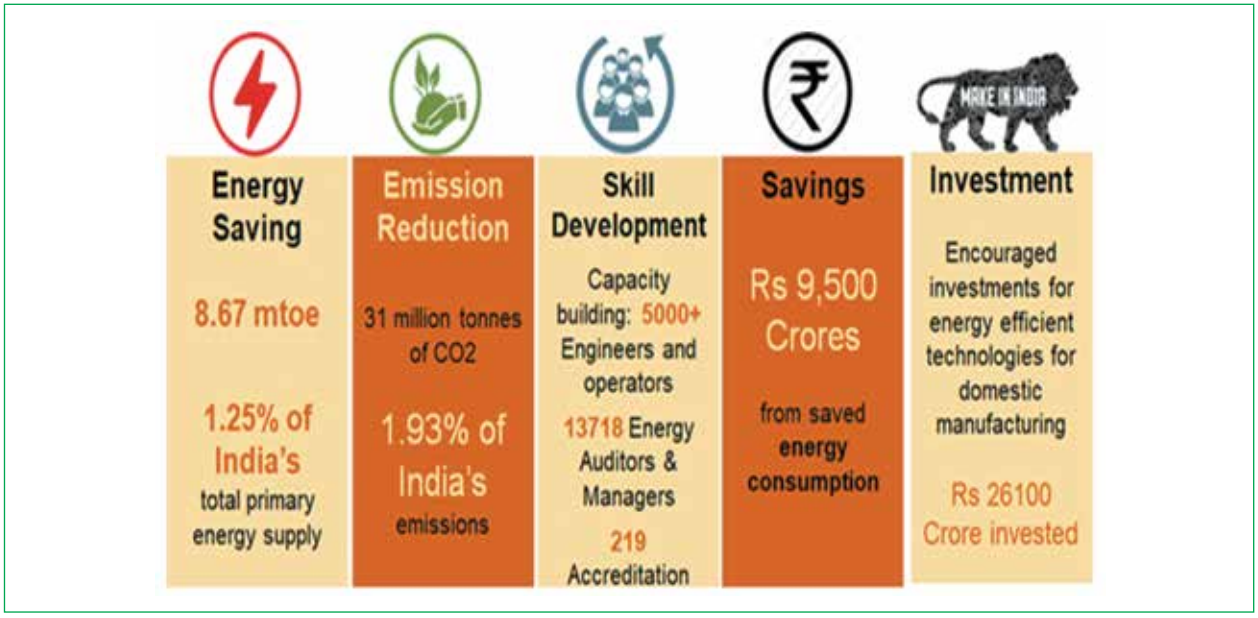


Figure 10: Realized Impacts – PAT 1 (2012-2015)

The real outcome of PAT scheme is not only the savings in terms of toe and CO2, but it is the change in behavior towards energy efficiency. The industries have put together significant amount of resources and concepts to achieve the target. Some state-of-the-art projects implemented are cross cutting and have significant potential across the sectors. Some of the positive outcomes of this were the utilization of waste heat in generation of steam and power, adoption of cogeneration, use of alternate fuel and raw material, etc., which has high replication potential. Highlights of the sectoral impacts are mentioned below:

Aluminium

The sector has achieved reduction of 0.73 million TOE in comparison to the target of 0.456 million TOE. This achievement has resulted in estimated GHG emission reduction of 3.1 million tonnes of CO2 equivalent exceeding the targeted emission reduction of 1.13 million tonnes of CO2 equivalent. Overall investment of 0.9 billion INR was reported by 90% of DCs in the sector against the implementation of energy conservation measures. Some of the significant energy-efficient technologies & best practices adopted by the sector are:

1. Implementation of slotted anode in pots
2. Reduction in Stub to Carbon voltage drop
3. Eco-contact to reduce voltage drop at conductor joints
4. Use of self-developed fuel "CRYSTAL" additive for dozing inside the furnace

Cement

The sector has achieved 1.48 million TOE in comparison to the target of 0.815 million TOE. This achievement has an estimated GHG emission reduction of 4.34 million tonnes of CO2 equivalent. Overall investment of 25.68 billion INR was reported by 76% of DCs in the sector against the implementation of energy conservation measures. Some of the significant energy-efficient technologies & best practices adopted by the sector are:

1. Installation of Vertical Grinding Mill
2. Installation of High efficient screw compressor
3. Increasing the usage of Alternate Fuel in the Kiln.
4. Increasing the number of stages of preheater
5. Installation of High Efficiency 3rd Generation Air-Separator

Chlor Alkali

The sector has achieved 0.09 million TOE in comparison to the target of 0.054 million TOE. This achievement has an estimated GHG emission reduction of 0.62 million tonnes of CO2 equivalent. Overall investment of 3.94 billion INR was reported by 68% of DCs in the sector against the implementation of energy conservation measures. Some of the significant energy-efficient technologies & best practices adopted by the sector are:

1. Upgrading to 6th Generation/ Zero gap type Cell in Electrolyser.
2. Installation of Back pressure turbine to

eliminate letdown from HP to LP steam and recover power.

3. Recovery of waste heat for process heat or power generation.
4. Feeding of 48% Caustic Soda Lye (CSL) at 90° C directly to Caustic Concentration Unit (CCU) from Caustic Evaporation Unit (CEU).
5. Installation of Vapor Absorption Machine (VAM) to recover heat from 48% CSL.
6. Optimization of Electrolysers for current consumption by monitoring cell voltages and replacing membranes in time.
7. Heat recovery by Provision of Brine and Chlorine re-cuperator for pre-heating the feed brine towards the Cell.

Fertilizer

The sector has achieved 0.78 million TOE in comparison to the target of 0.478 million TOE. This achievement has an estimated GHG emission reduction of 0.93 million tonnes of CO2 equivalent. Overall investment of 87.33 billion INR was reported by 83% of DCs in the sector against the implementation of energy conservation measures. Some of the significant energy-efficient technologies & best practices adopted by the sector are:

1. Urea Stripper with Bi-metallic Stripper
2. Replacement of trays in Urea reactor with high efficiency trays
3. Suction cooling of CO2 Compressor
4. Installation of Medium Pressure Pre-decomposer for recovering heat from vapors of Decomposer
5. Installation of Pre-concentrator before Vacuum Concentration Section
6. High Pressure Urea Hydrolyser

Iron and Steel

The sector has achieved 2.1 mMTOE in comparison to the target of 1.486 mMTOE. This achievement has an estimated GHG emission reduction of 6.51 million tonnes of CO2 equivalent exceeding the targeted emission reduction by 2.69 million tonnes of CO2 equivalent. Overall investment of 61.75 billion INR was reported by 55% of DCs in the sector against the implementation of energy conservation measures. Some of the significant energy-efficient technologies & best practices adopted by the sector are:

1. Use of 100% pellets
2. High top pressure blast furnace, Top Recovery turbine (TRT)
3. Waste heat recovery from Direct Reduced Iron (DRI)
4. Direct Rolling of hot continuous cast billet to produce TMT (Thermo Mechanically Treated)

Pulp and Paper

The sector has achieved 0.289 million TOE in comparison to the target of 0.119 million TOE. This achievement has an estimated GHG emission reduction of 1.24 million tonnes of CO2 equivalent. Overall investment of 18.84 billion INR was reported by 55% of DCs in the sector against the implementation of energy conservation measures. Some of the significant energy-efficient technologies & best practices adopted by the sector are:

1. Chemical Lime Kiln Oxygen Enrichment,

Carbon Dioxide Washing Aid

2. Paper Use Dryers Bars and Stationary Siphons in Rimming Dryers
3. Utility Black Liquor in Recovery Boiler
5. Automatic Chip Handling and Thickness Screening
6. Recover Heat from Latency Chest vent

Textile

The sector has achieved 0.129 million TOE in comparison to the target of 0.066 million TOE in Cycle-I. This achievement has resulted in avoided emissions of 0.62 million tonnes of CO2 equivalent. Overall investment of 29.86 billion INR was reported by 71% of DCs in the sector against the implementation of energy conservation measures. Some of the significant energy-efficient technologies & best practices adopted by the sector are:

1. Elimination of 2 bath by combining bio-polish and Dyeing
2. Optimization of stenter using waste heat recovery and automation
3. Optimization of suction pressure of Pneumafil in open and ring frame.
5. Installation of energy efficient motor by replacing old/ rewinded motors; use of VFD
6. Installation solar water heating arrangements for yarn conditioning machine.

Thermal Power Plants

144 DCs from Thermal Power Sector were given a total target of 3.21 million TOE in PAT cycle-I. The overall achievement of this sector in PAT-I was 3.06 million TOE. According to this, the sector underachieved its overall target by around 5%. However, the achievement of 3.06 million TOE relates to only 120 DCs who carried out the Monitoring & Verification (M&V) exercise and the same submitted to BEE. These 120 DCs were given an energy reduction target of 2.58 million TOE. Under such a circumstance, the DCs have overachieved their target by 19%. This achievement has an estimated GHG emission reduction of 13.64 million tonnes of CO2 equivalent. Overall investment of 32.65 billion INR was reported by 48% of DCs in the sector against the implementation of energy conservation measures. Some of the significant energy-efficient technologies & best practices adopted by the sector are:

1. Use of washed coal
2. Dynamic coal balancing
3. Intelligent soot blowing system
4. Installation of Waste Heat Recovery (WHR) and Steam Turbine gas-based plants
5. Installation of Vapour Absorption Machines (VAM)

Energy Savings Certificate (ESCerts) trading under PAT-I

In lieu of the savings, over and above the target, the DCs were awarded with tradable Energy Saving Certificates (ESCerts). From the assessment of PAT-I, around 309 DCs achieved in excess to their targets, thereby, adding to a total of 38.25 Lakh positive ESCerts. On the other hand, 110 DC could not achieve their target and were entitled to purchase a total of 14.25 lakh ESCerts. For PAT-I, out of 110

DCs who failed to achieve their target, 96 complied by purchasing ESCerts. A trading worth around 100 Cr INR took place in 17 sessions where 12.9 lakh ESCerts were traded.

3.1.3. PAT Cycle-II

After the successful completion of PAT Cycle-I, Parliamentary Standing Committee on Energy, Executive Committee on Climate Change (ECCC) and the Group of Secretaries for energy efficiency and energy conservation, recommended to put PAT under rolling cycle. Hence, PAT cycles get notified on annual basis since 2016. This means, every year the new DCs in existing sectors will get notified, in addition to new sector as per the EC Act. Also, the existing will get its next PAT target every 4th year from the day of its 1st target notification

"Deepening" and "Widening" of PAT had been carried out with an objective of increasing the number of Designated Consumers under second cycle of PAT. Under the deepening initiative, 89 DCs that were identified from the existing sectors, notified under PAT Cycle II. Under widening initiative, three new sectors that is Railways, Petroleum Refineries, and Electricity DISCOMs have been notified in 2015. Total 84 Designated Consumers from these three notified sectors have been included under PAT cycle II.

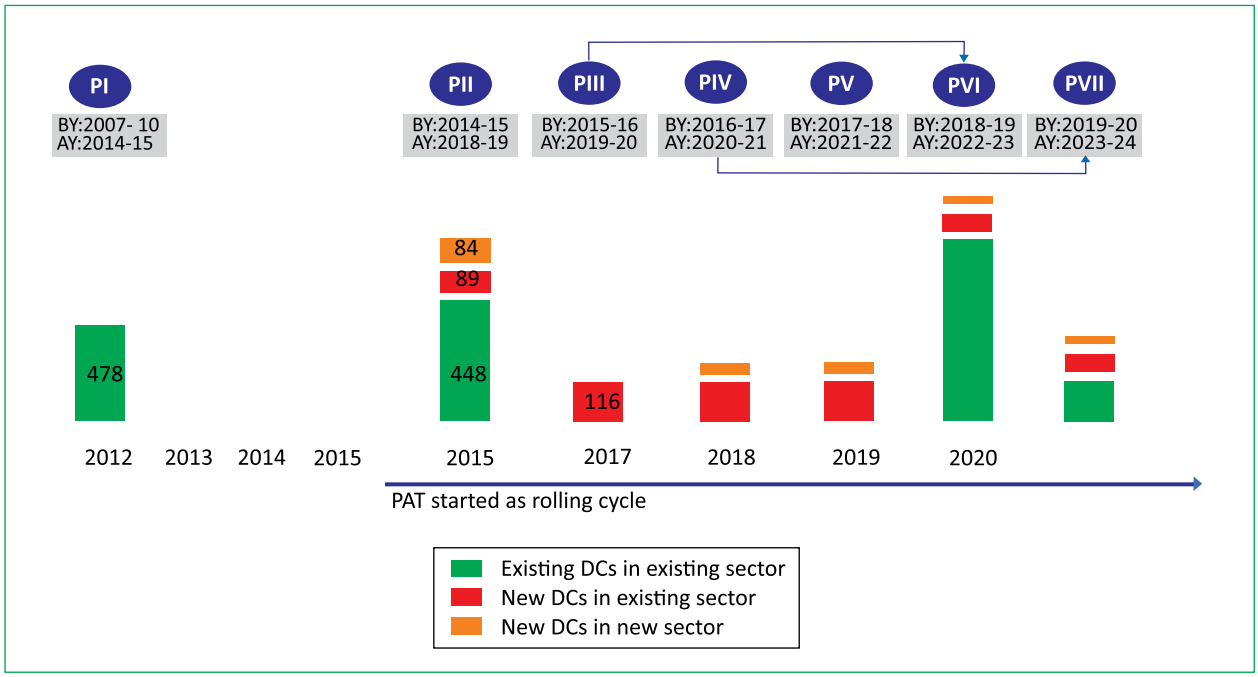


Figure 11: PAT as Rolling Cycle

S.No.	Sector	No. of DCs in PAT I	Additional DC in PAT Cycle-II	Total no. of DCs PAT -II
1	Aluminum	10	2	12
2	Chlor-Alkali	22	3	24
3	Textile	90	14	99
4	Pulp & Paper	31	4	29
5	Iron & Steel	67	9	71
6	**Fertilizer**	**29**	**8**	**37**
7	**Cement**	**85**	**27**	**111**
8	**Thermal Power Plants**	**144**	**22**	**154**
9	**Refinery**	**NA**	**18**	**18**
10	**DISCOMS**	**NA**	**44**	**44**
11	**Railway**	**NA**	**22**	**22**

Table 3: Sector Wise DCs in PAT-II

PAT in its second cycle seeks to achieve an overall energy consumption reduction of 13.38 MTOE for which energy reduction targets have been assigned and notified to DCs in these 11 sectors (eight existing sectors and three new sectors). This energy savings will translate in to avoiding of about another 30 million tonnes of CO2. The expected investment on energy efficient project and technologies, under PAT cycle-II is around 30,000 Cr. INR.

3.1.4. PAT Cycle -III

In continuation to the rolling cycles of PAT, the third cycle was notified on 31st March-2017.

S.No.	Sector	Number of DCs	Energy Savings Target (million Toe)
1	Aluminium	1	0.06
2	Cement	14	0.1
3	Iron & Steel	29	0.46
4	Pulp and Paper	1	0.03
5	Textile	34	0.04
6	**Thermal Power Plant**	**37**	**0.41**
	Total	**116**	**1.10**

Table 4: Sector wise DCs under PAT-III

The baseline year was taken as 2015-16, and the target year will be 2019-20. The total number of DCs notified was 116 from 6 sectors namely Thermal Power Plants, Iron & Steel, Cement, Aluminium, Pulp & Paper and textile. No new sectors were added in this cycle. The total target was given as 1.06 million tonnes of oil equivalent, which corresponds to a reduction of around 3 million tonnes of CO2.

3.1.5. PAT Cycle-IV

The fourth cycle of PAT has been notified on 28th March-2018.

S. No	Sector	No of DCs	Energy Savings (million toe)
1	Cement	1	0.004
2	Chlor Alkali	2	0.003
3	Commercial Buildings (Hotels)	37	0.0037
4	Iron & Steel	35	0.1926
5	Petrochemical	8	0.2293
6	Pulp & Paper	2	0.0098
7	Textile	7	0.0204
8	Thermal Power Plant	17	0.237
Total		**109**	**0.6998**

Table 5: Sector wise DCs under PAT-IV

The baseline year is taken as 2016-17 and the target year as 2020-21. A total of 106 DCs are likely to get a total reduction target of 0.6998 million tonnes of oil equivalent. These DCs are from 8 sectors consisting of 6 existing sectors and two new sectors. The new sectors are Petrochemicals and Buildings. Under building sector, hotels have been selected as the potential designated consumer sub-sector for this cycle. Other sub-sectors in the building sector may come up in future. Under Petrochemical, naphtha crackers and gas crackers has been considered under this cycle of PAT. The total expected CO2 emission reduction from PAT-IV is around 2 million tonne.

PAT i.e. Aluminum, Cement, Chlor-Alkali, Commercial Buildings (Hotels), Iron & Steel, Pulp & Paper, Textile and Thermal Power Plant have been notified. The total energy consumption of these DCs is about 15.244 million toe and it is expected to get a total energy savings of 0.5130 million toe through the implementation of PAT cycle –V.

S. No	Sector	No of DCs	Energy Savings (million toe)
1	Aluminium	1	0.0739
2	Cement	12	0.0870
3	Chlor-Alkali	2	0.0017
4	Commercial –Buildings (Hotels)	31	0.0013
5	Iron & Steel	23	0.1687
6	Pulp & Paper	8	0.0169
7	Textile	16	0.0135
8	Thermal Power Plant	17	0.1500
Total		**110**	**0.5130**

Table 6: Sector wise DCs under PAT-V

3.1.6 PAT Cycle-V

PAT cycle –V has commenced with effect from 1st April 2019. Under PAT cycle –V, 110 DCs from the existing sectors of

3.1.7. PAT- New Sectors

13 sectors have already been notified under the PAT scheme for mandatory target savings. More sectors are likely to be added in the scheme in upcoming cycles, as per those listed in the schedule of the EC Act 2001. Sectors like Transport, Port Trust, Sugar and Chemicals, etc. may be added in near future. Realizing growth in the energy consumption in other sectors such as Glass, Ceramics, etc., it would be worth including them under the purview of EC Act.

3.18 Expanding PAT to SME Cluster

PAT Cycle-I was a great success and the outcome speaks for its achievements and acceptance. Many countries are observing closely the success of this programme for developing a similar programme for their own countries. Realizing the potential benefits of the scheme, the Government is of the view that the scope of the scheme may be extended to the SME sector in the country. Disclosure of annual energy consumption and production may be initiated in the existing non-energy intensive sectors/industries.

3.2 Energy Conservation Guidelines and Manual

To encourage energy efficiency and its conservation in Industries and small and medium enterprises, it becomes imperative to optimize, maintain and monitor the operational performance of process equipment like Motors, Boilers, Furnaces, Pumps and Compressors for ensuring energy efficiency of a manufacturing process. This therefore needs guidelines to rationalize the use of energy consumption in the Industries and small and medium enterprises. The overall objective of the guidelines is to empower the management and operators engaged in the Industries and SMEs to comprehend and apply energy conservation principles and techniques in their daily routine. Consequently, there is a need to put in place energy conservation guidelines for the Industries and the SMEs which ensure the following:

1. Provide energy users a direction to utilize energy rationally and efficiently through implementation of energy conservation activities.
2. Act as a reference or a checklist for energy audit.
3. Encourage all levels in a factory management to associate preferential

treatment to energy efficiency and its conservation.

4. Act as a ground for government inspectors to investigate energy consumers.

The Energy Conservation guidelines (EC) shall be based on "Standards of Judgement for business operators "on rationale use of energy at factories. The overall objective of developing Energy Conservation guidelines for Large Industries and SMEs is to guide and encourage the large, small and medium Industries to manage energy consumption rationally by standardizing the functions of various energy consuming equipment deployed for manufacturing operations.

The Energy Conservation (EC) Guidelines is a comprehensive document for the industry with utility/ equipment-specific standards to promote energy conservation and improve energy performance in individual industrial units. The EC Guidelines shall guide individual industry to prepare its own "Energy Management Manual" for efficient operation of various energy consuming facilities. The development of the EC Guideline is undertaken by Bureau of Energy Efficiency in association with Energy Conservation Centre of Japan (ECCJ) under Indo-Japan Energy Dialogue.

3.3 Promoting Energy Efficient Technologies

There are various emerging technologies which could prove to be the game changer in the industrial market. BEE tries to disseminate the information on these technologies among the Indian industries through technology workshops, and publications.

Waste heat recovery, cogeneration, micro-turbine and other such processes, provides immense energy and cost savings in the industries. Optimal use of such processes brings down the payback period considerably. However, a policy intervention promoting such technologies would give adequate push to uptake of these processes in the industries.

Some of the identified technologies are mentioned below:

Fertilizer	Zirconium Coating
Chlor-Alkali	Zero Gap Electrolyser
Chlor-Alkali	Oxygen – Depolarized Cathodes (ODCs)
Chlor-Alkali	Hydrogen Fuel cell for caustic industry
Thermal Power plant	Pulverized Combustion Ultra Super Critical (PC USC)- Main steam and reheat temperature around / above 600 deg C
Thermal Power plant	Pulverized Combustion Advanced Ultra Super Critical (PC USC) - Main steam and reheat steam temperature more than 700 deg C
Thermal Power plant	Integration of Coordinated/ central Control System with Computation Fluid Dynamics (CFD) Analysis of Flue gas path in ducts
Thermal Power plant	Ammonia based Desulphurization
Aluminium	Drained cell technology with wet table cathodes
Aluminium	Zero Gap Electrolyser
Iron and Steel	Converter gas recovery
Pulp and Paper	Nansulate Coating of Dryer end of Paper machine for surface temperature reduction thereby lowering Radiation heat loss – Demonstration (Netherlands)
Pulp and Paper	Installation of Extended Delignification System for Cooking Of Wood
Pulp and Paper	Black Liquor Gasification
Pulp and Paper	Oxygen delignification and efficient screening to obtain low kappa
Pulp and Paper	Installation of Multi-Port Dryer in Paper Machine to reduce steam Consumption
Textile	Ultrasonic Assisted Wet Processing
Textile	Supercritical- CO2 Dyeing Technique
Textile	Closed condensate recovery pump
Textile	Free Float Steam Trap

Table 7: Identified Technologies in various sectors

The above table lists indicative technologies in various sectors which is expected to be updated periodically based on the latest technological developments periodically.

3.4 Database of International Technology Suppliers

One of the major hindrances in technology uptake is the lack of availability of relevant technology suppliers. A detailed list/ database of major indigenous and international suppliers of latest and energy efficient technology will enable better competition leading to the best rates and better performance guarantees. The database could be expanded periodically include to details of the latest technologies, demo projects, etc. This database may be linked to some platform wherein the vendors themselves could create and update the information.

3.5 Small and Medium Scale Industries

The MSME sector in India is characterized by the presence of many geographical clusters. Large number of Small and Medium Enterprises (SMEs) like foundries, brass, textiles, refractories, brick, ceramics, glass, utensils, rice mills, steel rolling, engineering, dyes and chemicals, brick, processed foods and so on are predominantly in the small scale. These clusters are said to have large potential for energy savings. Many of these units are in clusters located in various states of the country.

Indian MSME sector consumes energy equivalent to about 50 million tons of oil equivalent annually, which is about 20 to 25% of the energy consumption by large industries. The projected energy consumption in MSMEs in coming years is expected to increase to 68.2 MTOE with a projected annual growth rate of 6.0 percent.

A large number of MSMEs continue to depend on obsolete, low efficiency technologies that result in wasteful energy consumption and reduce profitability and competitiveness. Technology need assessment and technology development to suit the requirements of the local MSMEs at the cluster level has emerged as one of the most important aspects that needs to be addressed in the MSME sector especially in energy intensive sectors. Hence energy efficiency improvement through adoption of cleaner energy efficient (EE) technologies and practices offers great potential for reduction in CO2 emissions as well as improvements in product quality and profitability. Some of the major barriers faced by the sector include lack of knowledge about efficient technologies, financing, suppliers, demo projects, and trained workers.

3.5.1. BEE SME Programme

The aim of the programme is to accelerate the adoption of energy efficient technologies and practices in a few chosen industry clusters through focused studies, knowledge sharing, preparation of detailed project reports and facilitating in the process of developing innovative financing mechanisms. Keeping in mind the barriers and challenges, implementations of 100 technology demonstration projects in 5 SME sectors were conceptualized to facilitate large scale replication of intervened energy efficiency technologies.

GEF Funded programs in Indian SME Sector

Bureau of Energy Efficiency has also made interventions and implemented EE technologies in other energy intensive clusters of India with the support of UNIDO and World Bank, funded by the GEF, towards the common goal of facilitating the development of the SME sector in India through the promotion and adoption of clean, energy efficient technologies and practices.

(a) GEF UNIDO BEE Project

The project "Promoting Energy Efficiency and Renewable Energy in MSMEs in India" aims towards developing and promotion of market environment for introducing energy efficient technologies and enhancing the use of renewable energy technologies in process applications in energy-intensive MSMEs in 5 sectors (brass, ceramics, dairy, foundry and hand tools). The project further has scaled up the activities to the national level (in 12 Clusters) in order to reduce energy usage per unit of product, improve the productivity and competitiveness of units, thereby reducing overall carbon emissions and improving the local environment. Energy Management Centers have been established under this project in 12 clusters, which in turn are helpful for conducting regular energy audits in the SME units and capturing the potential of energy saving opportunities in the clusters.

(b) GEF World Bank BEE Project

The project "Financing of Energy Efficiency at MSMEs" is part of the Global Environmental Facility (GEF) Programmatic Framework for Energy Efficiency in India with an objective to increase demand for energy efficiency investments to target micro, small and medium enterprise clusters and to build their capacity to access commercial finance. The project aspires to address the current gap in understanding between energy auditors and bank loan officers and demonstrate a viable mechanism of establishing a synergy between SMEs, energy auditors, financial consultants/ chartered accountants, local industrial or MSME associations and local bankers.

Overall, the project created confidence among MSMEs, local banks and energy efficiency technology companies for carrying out energy efficiency projects in the SME sector. DPRs, Best Operating Practices, Common Monitorable Parameters and Case Studies were prepared for the selected MSME cluster which contains detailed information on technical and financial aspects of energy efficiency projects, so that the success of the pilot can be replicated elsewhere.

3.6 Energy Efficiency in Brick Kilns

Brick kilns are generally located in clusters that are spread throughout the country. However, the conventional brick kilns are not energy efficient and the emissions from the brickfields are severely polluting the environment. Therefore, a comprehensive strategy is necessary to foster sustainable development of brick manufacturing industries.

Mission Brick

A key reason is the lack of affordability of the energy efficient brick alternatives as reflected by the minuscule 5% market share of such bricks in India. From the perspective of energy efficiency (EE), interventions can be considered which either support the 'Creation of Demand' or the 'Creation of Supply'. If enhanced demand is created for the EE brick, existing players along with new ones shall shift and ramp up supply on their own. Recent EE initiatives in India suggest–Institutionalized financial/ technical capacity, sustained aggregation of demand can play an important role in enabling such a market transformation. This implies direct interventions at the brick kiln technology level are not required as higher demand would lead to economy of scale in supply, which implies adoption of efficient technology in the supply side.

BEE has already undertaken a cluster to upgrade the existing technology to a new efficient technology. However, uptake of technologies is an extremely slow process. Hence, a bouquet of initiatives may be planned to enhance the -Assurance, Availability and Affordability of energy efficient bricks under the Brick mission, pictorial description of which is as follows:

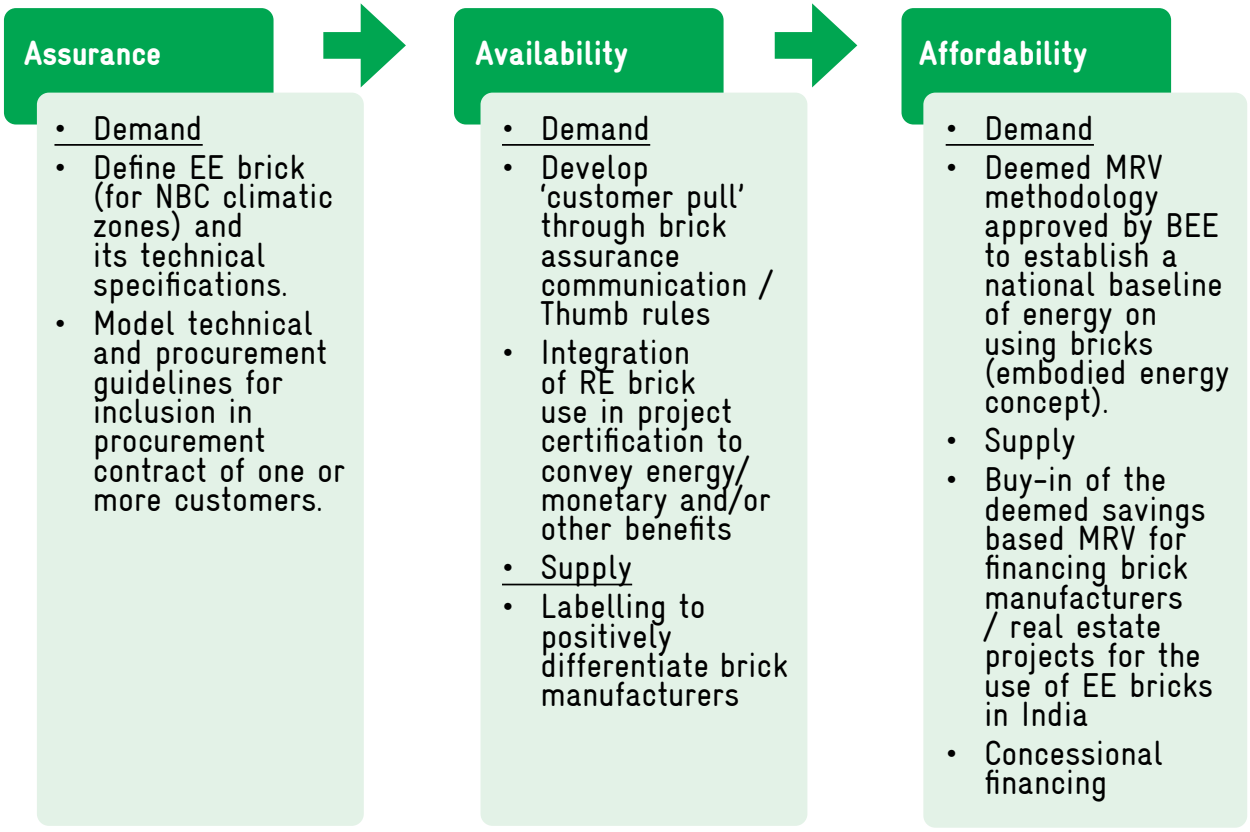


Figure 12: Description of activities planned under Brick Mission

3.7 Zero Effect, Zero Defect (ZED)

The Government of India urged the industry, especially the Micro, Small and Medium Enterprises (MSMEs) of India, to manufacture goods in the country with "zero defects" and to ensure that the goods have "zero effect" on the environment. The announcement of Make in India and Zero Defect Zero Effect put in perspective the governments' intent to change the course of economy by focusing on manufacturing as an engine to sustained growth.

The Bureau's schemes on the energy efficiency improvement in the SME cluster may contribute significantly to the "Zero Effect" part of the scheme. Enhancing energy efficiency has dual benefit. It reduces the cost of production while addressing the global issue of CO2 mitigation. The activities may further be enhanced covering the introduction of new energy efficient technologies as well as dissemination of same.

3.8 Low Carbon Technologies for SMEs

The Facility for Low Carbon Technology Deployment (FLCTD) is a 5-year, UNIDO-Global Environment Facility (GEF) supported project which aims to promote innovation of low-carbon technologies and its deployment in industrial and other related sectors of Indian economy. This project would facilitate and advance

technology transfer across sectors, industries, academia and countries to promote low carbon technologies including energy efficiency and other climate change mitigation measures.

The five-year project on FLCTD is designed to identify over a hundred-winning energy efficient cleantech innovations. The programme aims to locate and link critical connections between the stakeholders in the ecosystems with innovators, experts and investors. The project will conduct annual 'Innovation Challenge' competitions to identify innovative low carbon technologies and solutions to improve efficient end-use of energy in three key areas namely, low-grade industrial waste heat recovery (LG-WHR), Space Conditioning (HVAC, cold storage) and Pumping (agricultural).

The project is implemented through 3 main components: -

1. Innovation Ecosystem for selecting technology innovators and instituting competitive awards and policy incentives. The focus is mainly on low-grade industrial waste heat recovery (WHR), space-conditioning (HVAC, cold storage, etc.) and pumping (agricultural).
2. Technical assistance for Technology Transfer Support Facility
3. Project Monitoring and Evaluation

The 1st Innovation Challenge in the area of Waste Heat Recovery under the FLCTD programme was launched in 2017 followed by series of workshops and webinars. A total of 110 participants have applied for WHR category evaluation.

The programmes future activities includes:

- Announcement of Innovation Challenge for other two verticals i.e. space-conditioning and pumping (agricultural).
- Publicity of Programmes for more focused should be given to the challenge for more participation.
- Screening, Shortlisting and Technology Verification for other two verticals.
- Networking with Industry for technology Deployment with support of financial institutions.

3.9 Small and Medium Enterprises Energy Efficiency Knowledge Sharing (SAMEEEKSHA)

Small and Medium Enterprises Energy Efficiency Knowledge Sharing (SAMEEEKSHA) is a collaborative platform aimed at pooling the knowledge and synergizing the efforts of various organizations and institutions – Indian and international, public and private – that are working towards the common goal of facilitating the development of the SME sector in India through the promotion and adoption of clean, energy efficient technologies and practices. SAMEEEKSHA provides a unique forum where industry may interface with technology development specialists, R&D institutions, government bodies, training institutes, funding agencies and academia so as to facilitate this process.

Key features of this initiative are:

- It is a platform for pooling the

knowledge and experiences of various organizations that are engaged with the Indian SME sector.

- It enables like-minded organizations to coordinate and increase the impact of their activities in different areas in the SME sector.
- It is a clearing house for knowledge and information on the SME sector, including various state and non-state stakeholders and their interventions in/ interactions with the sector.
- Elaborate on the needs of a small-scale industrial sector/cluster in regard to improving energy efficiency, reducing fuel costs, exploring alternate energy sources, and so on.
- Point to possible options for exploring, developing, and introducing energy-efficient technologies and practices in the concerned industrial sector/cluster.
- Facilitate the formulation of project proposals and implementation of projects aimed at introducing and promoting energy-efficient technologies and practices.

Actionable Points- Industries	
Perform Achieve and Trade (PAT)	1. Deepening and Widening of the existing scheme. 2. Enhancing the robustness of the ESCerts market 3. Introducing a similar programme for Small and medium scale Enterprises (SME)
Energy Conservation guidelines and manual	Preparing guide materials for industry for strengthening energy conservation through operational and maintenance practices
Promoting energy efficient technologies	Promoting uptake of emerging technologies, e.g. Waste Heat Recovery/ co-generation/ trigeneration/micro turbine, etc.
Benchmarking	Initiate periodic benchmarking and energy efficiency gap assessment for industrial sectors.
Database of Energy Efficiency technology	Creation of a public database of Energy Efficiency technology suppliers, to be updated periodically
SME cluster programme for Energy Efficiency	Promotion of innovative demo projects and capacity building of SMEs
Low Carbon technologies	Promotion of innovative low carbon technologies in the SME cluster
Brick Kilns	Market transformation for energy efficient bricks
SAMEEEKSHA	Knowledge sharing and synergizing the efforts of various organizations and institutions

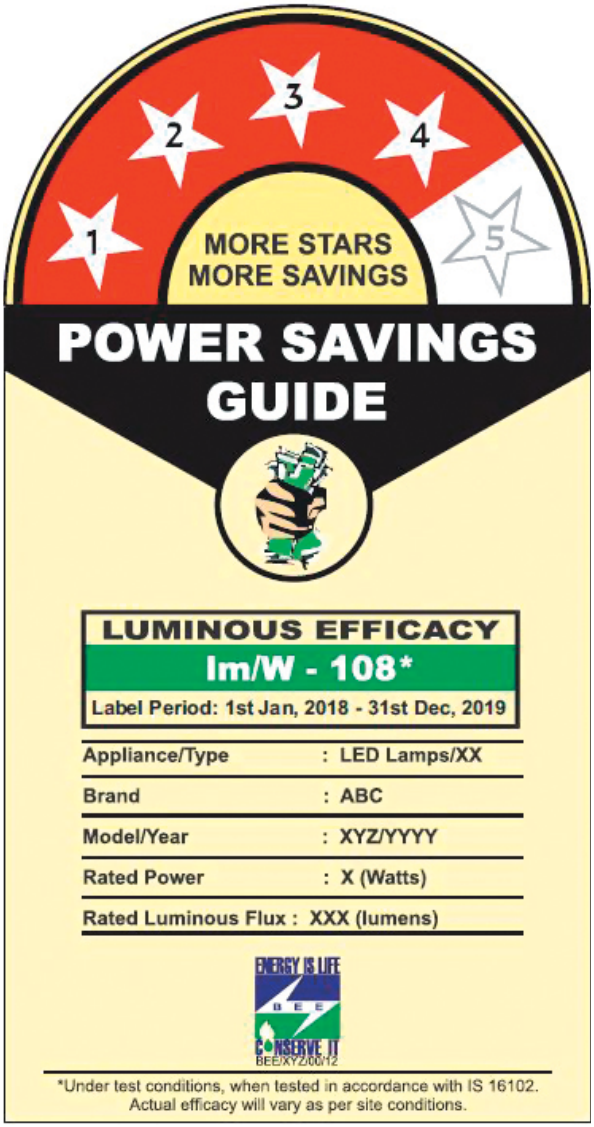
4.0 Equipment and Appliances

4.1 Standards and Labeling Programme (S&L)

The Standards and Labeling Scheme is one of the major thrust areas of BEE. This scheme was launched with the key objective of providing consumers an informed choice about the energy and cost saving potential of the labelled appliances/equipment being sold commercially. This scheme entails laying down minimum energy performance norms for appliances / equipment, rating the energy performance on a scale of 1 to 5 , 5 star being the most energy efficient one. Energy labeling is one of the cost-effective policy tools for improving energy efficiency and lowering associated energy cost of appliances or equipment. The program has been developed in a collaborative manner with a consensus driven approach of all the stakeholders.

S. No	Mandatory Appliances		Voluntary Appliances
1.	Room Air Conditioners	1.	Induction Motors
2.	Frost Free Refrigerator	2.	Agricultural Pump Sets
3.	Tubular Florescent Lamp	3.	Ceiling Fans
4.	Distribution Transformer	4.	LPG-Stoves
5.	Room Air Conditioner (Cassette, Floor Standing)	5.	Washing Machine
6.	Direct Cool Refrigerator	6.	Computer (Notebook/ Laptops)
7.	Color TV	7.	Ballast (Electronic/ Magnetic)
8.	Electric Geysers	8.	Office Equipment (Printer, Copier, Scanner, Multifunctional Display)
9.	Variable Capacity Inverter Air Conditioners	9.	Diesel Engine Driven Mono-set Pumps, submersible and open-well
10.	LED Lamps	10.	Solid State Inverter
		11.	DG Sets
		12.	Chillers
		13.	Microwave oven

Table 8: List of appliances under voluntary and mandatory regime



Over the last five years, concerted efforts of BEE under its Standards & Labeling programme have led to an avoided generation capacity addition of 22,990 MW and successful revision of the energy performance standards for Refrigerators, Room Air conditioners, Distribution Transformers, Tubular Fluorescent lamps, Storage type electric water heaters, transition of five appliances namely the Direct Cool Refrigerator, Colour Television, Storage type Electric water heater, Variable Capacity Inverter Air Conditioners and LED Lamps from voluntary to mandatory regime and launch of voluntary star labelling program for Chillers in the year 2018, relaunch and launch of voluntary star labelling programme for washing machine and microwave oven in March 2019.

The programme presently covers 23 appliances out of which 10 appliances are under the mandatory regime while as the remaining 13 appliances are under the voluntary regime. List of these appliances is mentioned in table 8.

Additionally, BEE has been able to effectively engage with consumers through a well-planned awareness programme to make them aware about benefits of using star labeled products. This awareness programme is being administered through print, digital and electronic media. Moreover, BEE has initiated a training programme for retailers of equipment and appliances in various parts of the country under its National Retailers Training Programme.

Future plans:

BEE has initiated action to conduct a study for development of technical report on 24 appliances/equipment. The main objective of this techno-commercial assessment is to gain an insight into the market data related to these appliances. BEE is also developing documentary videos on the success stories of the Star labeling program & energy efficient appliances. BEE has empaneled 14 testing laboratories to check test the star labeled appliances on a yearly basis.

4.1.1. Capacity Building of Testing Laboratories

To ensure structured testing and quality assurance mechanism for Standard & Labeling program and to prohibit sale of compromised quality products in India, BEE with the support of Central Power Research Institute (CPRI) will establish testing laboratories at 25 centres across the country. BEE also proposes to establish a LED reference testing lab at National Physical Laboratory (NPL), Delhi.

4.1.2. Retailers Training Programme

Retailers Training Programme is an initiative to reach out to a large audience, to spread awareness on the energy and monetary savings accruing from star rated appliances. The programme aims at disseminating knowledge among the retailers to enable them explain and convince customers to choose energy efficient appliance. Under Phase -1 of retailer training programme,18 such programmes have been organized in 6 metro cities i.e. New Delhi, Kolkata, Bengaluru, Mumbai, Chennai and Hyderabad and around 2203 retailers have been trained in this programme while under Phase -2 of training programme, 34 workshops have been conducted wherein 1950 retailers were trained on the provisions of Standards & Labelling.

4.1.3. New Initiatives under S&L Programme

a) QR Code: S&L scheme is working on implementing QR code which will help customers in identifying and validating the authenticity of Label Particulars on appliances/ equipment directly from the registered data base of BEE using their phones. On the basis of the study report submitted by GS1, a QR code which can be scanned via a dedicated app to verify the label with the help of SMS or internet is presently being explored for implementation.

b) Migration from static server to cloud computing: The S&L portal is being revamped and being shifted to the Cloud Network, thus bolstering the reliability of the portal and mobile applications.

c) New Appliances like Deep freezers, Compressor, Solar Water Heaters and Solar PV are proposed to be covered under the scheme in the FY 2019 – 20 etc.

d) Energy performance benchmarks of the existing mandatory/voluntary appliances under Standards and Labeling program are being studied for further ratcheting up wherever necessary.

4.2 Standards and Benchmarks for Industrial Equipment and Processes

The Energy Conservation Act, 2001 advocates efficient use of energy and enlists certain activities to achieve this broader objective. One of the activities is providing standards and benchmarks for the industrial equipment and processes. This will enable the industry to calculate and compare the energy use in the equipment/ processes and calculate their profit/ payback, etc., thereby using the optimum

energy efficient equipment as per their use. This will also urge the manufacturers to undertake R&D activities to make their product most energy efficient. To begin with, Furnace, Boiler, Compressors, industrial fans, pumps and blowers are proposed to be taken up and the programme could be further expanded to encompass other industrial equipment subsequently.

4.3 Efficient Lighting in India

Lighting accounts for almost 20% of the total electricity demand in the country and contributes almost fully to the peak load as well. The vast amount of lighting in the country was provided by incandescent bulbs, which were extremely energy inefficient. Only about 5% of the electricity is converted into light, the rest is lost as heat. To make a market transformation in lighting sector, various programmes were launched which brought down the cost of energy efficient bulbs.

"Bachat Lamp Yojana" was a programme designed to utilize the Clean Development Mechanism (CDM) of UNFCCC and the Kyoto Protocol to bring-down the price of CFLs. This public-private partnership between the Government of India, Private sector CFL Manufactures /Traders (Project Developers) and State Level Electricity Distribution Companies would provide the framework to distribute high quality CFLs at about Rs.15 per piece to the households of the country. Under the scheme only 60 Watt and 100-Watt incandescent Lamps were planned to be replaced with 11-15 Watt and 20-25 W CFLs respectively. Under BLY, 29 million CFLs were installed and have annually saved around 1641 million kWh. A total of 2,000,120 CERs have been verified and issued under BLY project which amounts to about 2 million tons of verified CO2 emissions reductions.

Unnat Jyoti by Affordable LEDs for All (UJALA)

In 2015, the Government of India launched the National Programme for Energy Efficient Appliances. This opened doors for boosting the entire market and worked in tandem with the larger aim of cutting emissions significantly. With technology ushering future-ready solutions. Demand for electricity is growingand so areteh CO_2 related emissions. In this market scenario, simple, affordable and scalable solutions are required, that can help customers save more, while cutting down energy needs and emissions. EESL was proactive in addressing these issues of increasing adoption of energy efficient products across public, private and residential sector nationally.

Building on the success of the BLY scheme, the Unnat Jyoti by Affordable LEDs for All (UJALA) has a target to distribute 770 million LEDs by March 2019 across 100 cities. The scheme was designed to become the largest LED distribution program in the world. The scheme aimed to rectify India's high cost of electrification and the increased emissions from inefficient lighting, amidst the backdrop of electricity demand witnessing around 5-fold increase over the coming years. Under the scheme, 7 W and 9W LED bulbs, 20W LED tube lights and BEE 5-star rated energy efficient fans were distributed to the consumers at affordable prices.

The UJALA scheme is a great success. More than 295 Million LED lamps have been distributed in the Indian market by Energy Efficiency Services Limited (EESL). This has led to a savings of more than 38000 million units of electricity per year, with a monetary savings of more than 15000 Cr INR. This translates to CO2 reduction of more than 31 million tonnes per year. In addition, there are around 82.6 crore LEDs that were distributed upto March 2018 in the private market. The total impact of these LED bulbs in terms of electrical energy savings equals to 86.75 BU.

4.7 Super Energy Efficient Programme (SEEP)

Super-Efficient Equipment Program (SEEP) aims to bring market transformation towards super-efficient equipment/appliances. For this, provision of a time-bound financial incentive to manufacturers for producing and selling super-efficient appliances/ equipment that consume 50% less energy than market average consumption is proposed. Under this program innovative business models are also being explored to bring market transformation for super-efficient equipment/appliances.

SEEP for ceiling fan was developed and has helped to establish manufacturing base in the country as there are over dozen ceiling fan manufacturers who have market presence in super-efficient ceiling fans category.

The scheme may involve identifying potential appliances such as air conditioners, refrigerators and other appliances/ equipment which could be brought under this program through incentives based innovative business model.

4.8 India Cooling Action Plan (ICAP)

ICAP document was launched on 8th March 2019, with the objective of developing short, medium and long term interventions w.r.t. India's cooling requirements for over next 20 years, Ministry of Environment, Forest and Climate Change Ozone cell has constituted a committee under the chairmanship of Secretary (EFCC) for the preparation of the India Cooling Action Plan (ICAP), which would take an integrated long term vision on cooling needs of the country, dovetailing energy efficiency with referent transition and technologies in different sectors.

For execution of India Cooling Action Plan six thematic working groups have been constituted. Bureau of Energy Efficiency is a member of the first five groups. These working groups are:

1. Space cooling and cold chain,
2. Air Conditioning and Refrigeration Technology,
3. R&D and Production Sector – Alternative Refrigerants and Technologies,
4. Cross cutting policy regulation w.r.t Montreal Protocol, Kigali Amendment, Sustainable Development Goals and other international conventions,
5. Transport Air Conditioning (car, bus train and metro air conditioning) and
6. Servicing Sector.

The broad recommendations of ICAP include:

1. Adopting an integrated approach in building design of commercial buildings to minimize cooling needs.
2. Widespread adoption of ECBC codes for both commercial and residential building.
3. Mandatory star labeling of cooling appliances in industries.
4. Mandatory public procurement guidelines for highest efficiencies in ACs, ceiling fans etc.
5. All new construction should be 100% ECBC compliant.
6. Retrofitting of existing buildings to reduce cooling requirements.
7. Development of energy efficient cold chains.

Actionable Points – Equipment and Appliances	
Standards and Labeling Programme	1. Widen coverage of the scheme, specify norms and standards for industrial equipment. 2. Ensure structured testing and quality assurance mechanism for appliances/ equipment covered under Standard & Labeling. 3. to spread awareness on the star label particluars among the retailers and end users. 4. Using IOT to strengthen quality and reliability. 5. Enhanced enforcement at PAN India level. 6. QR codes for labels and other innovative steps to empower customers of labeled appliances. 7. Further strengthening of testing lab infrastructure and streamlining the check testing.
Standards and benchmarks	Providing standards and benchmarks for the industrial equipment.
Super Energy Efficient Programme	Market transformation for super-efficient equipment/ appliances.

5.0 Buildings

5.1 Energy Conservation Building Code (ECBC)

Building sector is very important for energy conservation in India. Buildings are being constructed in India at a rapid pace and still majority of buildings are yet to be constructed. If buildings are constructed with built-in efficiencies, then these inefficiencies will be locked in for at least the next 50 years. Even for existing buildings, potential for energy savings is more than 30-40%. Hence it is very important to frame policies for residential and commercial Buildings. The electricity saving potential through the various interventions has been estimated as under:

Commercial Buildings	Saving potential	Instruments
New	25 – 35%	Mandatory implementation of Building Codes (ECBC)
Existing	10 – 15%	Energy efficiency upgrades through retrofits and Star Labeling
Residential Buildings	20%	Through appliance efficiency and passive design features

Table 9: Energy Saving potential in Buildings

Based on the data provided in the Interim Report of the Expert Group on Low Carbon Strategies for inclusive Growth, the estimated commercial floor space in 2005 has been estimated as 425 million square meter (SQM) with the electricity consumption being 35.965 billion units (based on CEA data). Taking the figures of 2005 as the baseline and assuming a growth rate of 8% for office & retail spaces and 10% for hospitality sectors, the projected growth in floor space for the years 2012 and 2017 has been estimated to 746 million m^2 in 2012 and 1114 million m^2 in 2017. Consequently, the corresponding growth in the energy consumption for new & existing floor spaces is accordingly estimated to be 166 BU and 241 BU in 2012 & 2017 respectively, on the Business as Usual (BAU) scenario basis. The potential to reduce energy consumption through energy efficient design of new buildings

and retrofits in existing buildings would reduce the need for lighting, heating, ventilation and air conditioning. The Energy Conservation Building Code (ECBC), which sets minimum energy standards for new commercial buildings having a connected load of 100kW or contract demand of 120 KVA or more, was developed by the Government of

India to help in energy efficient design of up-coming commercial buildings.

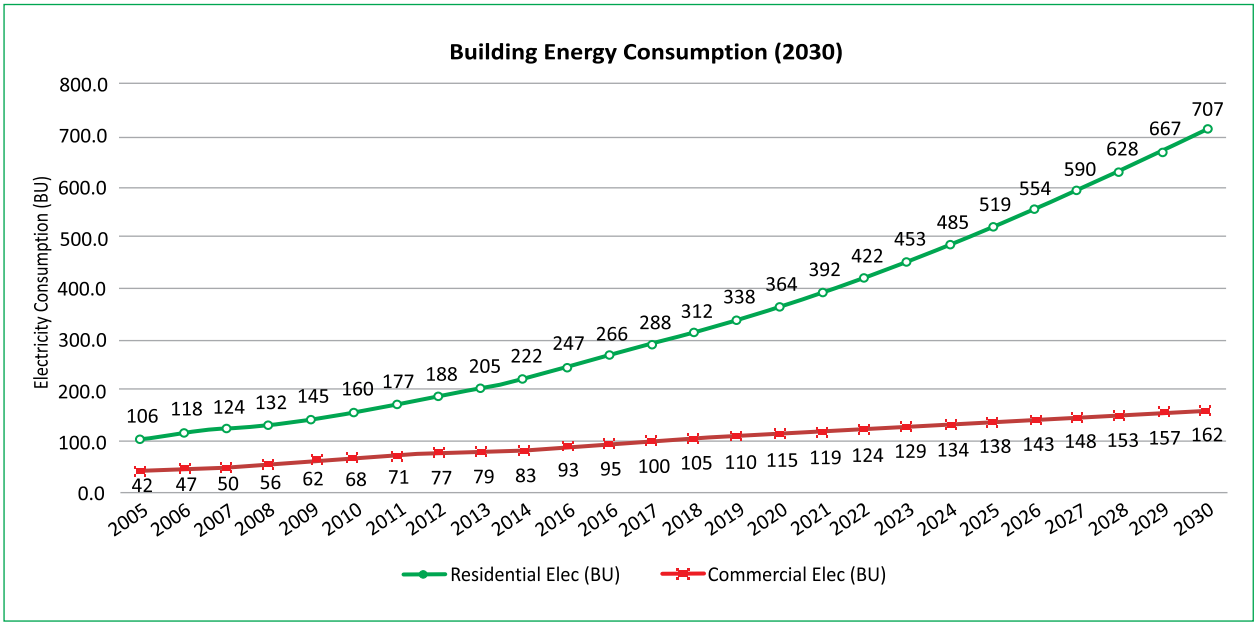


Figure 13: Building Energy Consumption scenario

From the above graph, electricity consumption will increase (business as usual scenario) for residential sector to about 707 BU from 247 BU in 2015, which is approximately 1.86 times of consumption in 2015. In case of commercial buildings, electricity consumption will increase to 162 BU in 2030 from 93 BU, which is about 74% of consumption in 2015. Together these sectors will consume about 850 BU by 2030. With implementation of policies like 24x7 and power for all, this consumption may further increase.

New Commercial Buildings:

The focus during this period would be more on wide scale implementation of ECBC. Hereunder are the major activities to be carried out by BEE for New Buildings:

a) ECBC Code will be updated to include building-integrated renewable and incorporate technological advancements to achieve Nearly Zero Energy Buildings.

b) Notification of ECBC Rules under Central notification.

c) Standardize procedures for notification of ECBC in states and also implementation procedures.

d) All States to mandate ECBC with the objective that 75% of all new commercial buildings are ECBC compliant.

e) Constitute High Powered Committee under the Chairmanship of Chief Secretary of the State to provide oversight to implementation mechanism.

f) Mandate States to adopt ECBC in their building bye-laws to avail benefits under Government National Missions such as Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Smart Cities Mission, etc.

g) BEE will provide support to States for training and capacity building of State Departments for adoption and enforcement of the code.

h) BEE will also develop website for compliance of ECBC by states on both modes i.e. Prescriptive method and whole building simulation.

i) Establishment of ECBC Cells in State Urban Development Departments / PWDs to support and monitor progress.

j) Super ECBC building will be supported in 5 states. Financial support of Rs 5 Crore or 50% of the total cost, whichever is lower will be provided to 5 states to develop Super ECBC compliant building which will be equivalent to near zero energy building.

New Residential Buildings:

The major activities to be carried out by BEE for New Residential Buildings are as follows:

a) Extend the coverage of ECBC to the multi-storey residential sector as well, with amendments to the EC Act.

b) Amendment of EC Act to extend the coverage of ECBC to the residential sector.

c) Labeling programme for Residential Buildings

d) Model designs for energy efficient houses for early adoption.

e) Constitute High Powered Committee under the Chairmanship of Chief Secretary of the State to provide oversight to implementation mechanism.

5.2 Buildings under PAT Scheme

Buildings have been identified as one of the energy intensive sectors under the EC Act 2001. Accordingly, building sector has been included under the PAT scheme. To start with, hotels among the building sub-sector has been covered under PAT cycle-IV. Other sub-sectors of the buildings are likely to be added in the coming cycles of PAT. These sub-sectors may be hospitals, 24-hour usage utility buildings, Govt. buildings, shopping malls, airports, etc.

5.3 Energy Efficiency Label For Residential Sector in India

To enhance energy efficiency and minimize energy consumption in residential buildings, energy efficiency labels for residential buildings has been developed. This will enable consumers to compare building performances from a sustainable energy point of view, and aid consumers making efficient decisions on the basis of direct, reliable and costless information provided in a label. Some other benefits which can emerge through the proposed labelling program are:

a. Choice for consumer to select EE homes
b. Encourage consumers to improve EE
c. Peer to peer comparison
d. Provide information on the potential and actual energy use of buildings

Working through the consumer end, it is expected that the proposed program would provide an opportunity for the developers

to make investments in energy efficiency in order to preserve their market value and credentials.

5.4 Net Zero Buildings

Net zero energy describes buildings whose energy consumption and emissions are fully offset by energy generation on site. The buildings would generate as much clean energy as they consume. Once considered as far-reaching, expensive goal only available to the technically advanced, net zero buildings are now well within the realm of possibility. The Net Zero Energy Buildings concept into commercial retrofits will improve the energy efficiency levels in existing buildings, exploring the possibilities of involving renewable energy sources in order to reduce their dependence on external energy sources. Ministry of Power has directed to make all administrative buildings of Ministry, sub-ordinate offices, attached offices and CPSUs including subsidiaries and Joint Ventures (JV's) as Net-Zero Buildings. It is estimated that adopting NZEB will help occupants enjoy 90% of comfort level with a 50% reduction in energy consumption and meeting the energy needs 100% through renewable sources. In India although the concept is in its nascent stage, the concept has been applied in Indira Paryavaran Bhawan, Ministry of Environment and Forest (MoEF), AkshayUrja Bhawan, HAREDA, Panchkula etc.

5.5 Smart Cities

Smart City Mission, is an urban renewal and retrofitting program by the Government of India with the mission to develop 100 cities across the country making them citizen friendly and sustainable. Further, many policies governing urban areas are old and need to be reviewed in view of the changing needs of the city. One of core infrastructure elements in a smart city also includes Energy Efficient buildings and affordable housing. The new upcoming commercial and residential buildings may be constructed as per Energy Conservation Building Code and Eco- Niwas Samhita 2018 (Part-I) respectively. Smart Cities Mission envisions developing an area within 100 cities in the country as model areas based on an area development plan, which is expected to have a rub-off effect on other parts of the city, and nearby cities and towns. Initially 5 model cities may be taken up under Smart City Mission for showcasing the compliance with the energy conservation building codes through the Urban Local Bodies (ULBs) or Urban Development Departments (UDDs).

Actionable Points- Buildings	
Energy Conservation Building Code	Strengthening states institutions to operationalize Commercial and Residential Building Codes
Buildings under PAT	Improving energy performance index of buildings through mandatory targets
Energy Efficiency label	Develop energy efficiency labels for buildings

Financing incentives under buildings	Promoting Energy Efficiency in buildings through financial incentives
Efficient Buildings	Synergizing of upcoming concepts such as net zero buildings, passive house, building aspects in smart cities, etc.
Material	to promote energy efficient building materials
Sample design	creating replicable model design for code compliance
Thermal Comfort	initiate and disseminate studies on thermal comfort
Demand Response	Study on building demand response with internet of things (IOT) and artificial intelligence (AI)
Comprehensive Database	Preparing comprehensive database on building materials, technologies, devices, processes, expert manpower, etc., and making them available in public domain

6.0 Demand Side Management and Data analytics

Demand Side Management (DSM) has been traditionally recognized as one of the major intervention to achieve reduction in energy demands while ensuring continuous development. In recent past, DSM has gained unprecedented importance and has become an integral part of almost all the central and state missions on promotion of EE. DSM interventions have helped utilities not only to reduce the peak electricity demands and but also defer high investments in generation, transmission and distribution networks.

6.1 Agriculture Demand Side Management (AgDSM)

The objective of the program is to reduce the energy intensity of agriculture pumping sector by carrying out efficiency up gradation of agricultural pump sets. It is estimated that there are about 19 million pump sets, and 2.5 to 5 lakh new pump sets are being added every year. Unfortunately, these pump sets are inefficient, largely because farmers have no incentive to invest in higher cost, higher efficiency pump sets due to low electricity tariffs for agriculture consumers. This has resulted in increased annual subsidy burden on State governments which has grown to more than Rs. 65,000 crores per annum. Studies reveal that about 30%-40% energy savings is possible in agriculture sector by adoption of Energy Efficient Star Labelled Pump Sets.

The approach for achieving sustainable energy efficiency was widespread replication through regulatory mechanism which will be coupled with the subsidy provided by the GoI for bridging the Energy Efficient Pump Sets (EEPS) higher cost, capacity building of all stakeholders, few demonstration projects in rural drinking water pumping systems and strategic approach for dissemination of results. More than 15 States have made mandatory use of star label energy efficient pump sets for new agriculture connections. Also, many states are providing incentives to the farmers for adoption of star label EEPS. BEE in association with various DISCOMs implemented four pilot AgDSM projects in Maharashtra, Karnataka and Andhra Pradesh. These projects reflected energy savings of around 25-40% by replacing the existing inefficient pump sets by star label EEPS. Various business models are demonstrated to implement above pilot projects.

An MoU was signed between Indian Council of Agricultural Research (ICAR) and Bureau of Energy Efficiency (BEE), Ministry of Power, to create awareness for energy efficient pumpsets and better operational practices. The MoU alsohas a focus to adopt energy and resource efficient approaches with an aim to create awareness on energy efficiency and conservation in agricultural practices. Further, the MoU has provisions to improve fuel and water resource use efficiency thereby reducing the cost of cultivation so as to increase farmer's income in harmony with strategies of "Per drop more crop" and "Doubling Farmers' income".

6.2 Technologies in Agriculture Sector

Energy demand can be reduced in all agricultural processes where energy is used, by appropriate technology changes, as well as by improved management and operations practices. It could be broadly separated as agricultural production and processing. Indirect inputs such as fertilizer or pesticides present significant energy saving potential at the level of agricultural production. Here, the so-called Conservation Agriculture offers effective approaches: This concept refers to measures helping to maintain and

improve soil quality. Thus, crop rotations, e.g. by planting legumes and the associated availability of nutrients, as well as plough less soil cultivation can improve soil fertility. On the one hand this leads to a decreasing demand for energy-intensive manufactured fertilizers, and on the other hand reduces direct energy inputs, e.g. due to the reduced diesel consumption. Another such example could be irrigation systems. Irrigated agriculture is a crucial part of global agriculture, increasing productivity significantly. However, it is under pressure to adopt best practices to improve efficiency in terms of water use and energy costs.

a. Standardizing Farm Machinery

Wide variety of machineries are used in the farming which has a direct energy consumption, mainly in the form of fossil fuel. The first steps could be to recommend standards for such machines which could be helpful in monitoring the energy use by them. Development of Energy Efficient Technology Guidelines and Standards could prove major breakthrough in reducing the energy consumption in this sector. However, such programme would not be successful without proper dissemination of this knowledge to the last mile consumers, and constant support to farmers through customer support centers etc.

b. Agri Pumping

A lot of work has been done in enhancing the uptake of energy efficient pumps in agriculture sectors through various programmes. However, the major hindrance of such programmes is the establishment and showcasing of savings to the customer and the monitoring agencies. Developing a simple deemed savings MRV approach for energy efficient pumps could help in showcasing the savings to all concerned. This would enable business models involving public private partnerships, and would prove more effective. Energy Efficiency could also be integrated into the existing schemes of Central and State Government on Agri pumping.

c. Cold Chains

India is the world's second largest producer of fruits and vegetables, but also accounts for one of the biggest food loss and waste with harvest and post-harvest losses in fruits, vegetables, and grains estimated over 30% every year due to lack of cold storage facilities.

One of the major reasons for this food waste and food loss is the lack of an efficient cold chain infrastructure[7] from the farm to the fork which includes refrigerated transport, pack houses, collection centers, and cold storages. Another reason for wastage is inadequate knowledge on how to handle the perishables and the skill levels required to take care of these at various stages.

India has around 6,300 cold storage facilities across the country, with an installed capacity of 30.11 million metric tonne, 75-80% of which is suitable for storing only potatoes, which contributes to only 20% of the agricultural revenue. On an average the energy expense contributes approx. 1/3 of total cold chain operating costs and thus a market enabling strategy

for cold chain uptake on a large scale can yield substantial energy savings.

Current cold chains are big in size (with high CAPEX/OPEX/management facilities) and thus largely owned by deep-pocketed corporates, leaving out the small and marginalized farmers. As the number of small/marginalized farmers in the country are high, they face multiple challenges on account of technology, electricity availability, financial and market barriers etc. Further, adopting proven technology solutions for an energy efficient cold storage infrastructure will help achieve the goals of improving overall agricultural output and revenues.

BEE may develop and test business models to enhance uptake of cold chain infrastructure for:

A. Small Farmer- farm step cold storage
   - Develop technology specifications for affordable modular cold storage
   - Baseline Monitoring, Reporting and Verification (MRV) for farm step cold storage.
   - Pilot -business model/rental scheme for a network of farm step cold storage.

B. Renovation & Modernization-Existing cold chains
   - Develop Energy baseline static and mobile cold chain technology
   - Set guidelines & standards for cold chain technology
   - Set Monitoring, Reporting and Verification (MRV) for business models

6.3 Knowledge Sharing

Integrating courses on Energy Efficiency in Agriculture in the curriculum of schools, colleges, universities could lead to widespread knowledge on the subject among students, teachers and professionals. Demonstration projects and the dissemination of successful energy and cost savings would motivate the end users to practice energy efficiency.

6.4 Innovative Financing

Despite being the most crucial sector of the economy, this sector lacks access, affordable and adequate finance. Innovative financing schemes could be developed or integrated to the existing schemes focusing exclusively on energy efficiency, such as:

a) Cashback to Jandhan account/ kisan credit account for using energy efficient equipment/ process
b) Develop business models to tap Long term green financing for Energy Efficient measures
c) Tapping CSR funds, especially of PSUs/ Corporates towards energy efficiency in this sector.
d) Support Innovation / R&D Funding for energy efficient farm technology

6.5 Municipal Demand Side Management (MuDSM)

The growing demand for public utilities due to rising population and improved standards of living of the population has increased the energy demand for the service provided by the urban local

bodies. The Municipality sector/urban local bodies (ULBs) consume electricity for various utility services like street lighting, water pumping, sewage treatment, and in various public buildings. Around 30% of Indian population lives in urban areas and continuous migration from rural areas is putting an additional burden on the urban local bodies. The energy consumption of the municipality sector is characterized by frequent changes and rising peaks in power load curves in the morning hours due to water pumping and evening hours for street lighting. The inefficient use of electricity due to limited diffusion of energy efficiency technology and Demand Side Management (DSM) initiatives, have considerably increased the energy spent by the municipalities. The Municipal Demand Side Management (MuDSM) programme can improve the overall energy efficiency of the Urban Local Bodies (ULBs) which could lead to substantial savings in the electricity consumption, thereby resulting in cost reduction/savings for the ULBs.

For large-scale energy efficiency projects in ULBs under MuDSM, Energy Efficiency Services Ltd (EESL) is implementing Street Lighting National Project (SLNP). Under this SNLP, more than 85 lakh conventional streetlights has been replaced by LED lamps till March 2019.

6.6 Data Management

One of the key reasons why investors have little confidence on energy efficiency

projects is the lack of credible information and data, which can make the difference between a bankable and a non-bankable project.

BEE can support in laying the foundation of comprehensive official national energy database to statistically measure and represent the amount of energy used and saved (e.g. in TOE/year) by energy efficiency and energy savings measures. BEE may support the initiative to enable a single organization to collect, collate and publish energy related statistical information.

meters only records the amount of energy consumed but does not usually record the time of usage. Advanced metering and other digitally-enabled platforms reduce the burden on consumers and simplify demand side activities, managing energy in response to real-time energy prices or other conditions specified by the user or the system - reducing unnecessary peak loads or by shedding loads.

Energy efficiency investments are typically front loaded even before a single rupee is saved. Further transactions costs are incurred on – searching for information,

6.7 Data Analytics and Digitalization

Digitalization is going to be the key for developing future policies and can trigger further the potential of DSM. Advanced metering is critical for any type of DSM since it allows the temporal dimension of energy consumption to be grasped. Traditional

negotiating deals, enforcing contracts etc. In an atmosphere of low consumer-vendor-financier contractual trust, energy efficiency makes for a high transaction cost business.

BEE and other agencies have access to data which are seemingly diverse – from retail consumers to large corporates pursuing energy efficiency, yet such data

is managed and analyzed – patterns, predictions and other insights can be obtained which may feed into lowering of transaction costs and formulating better policy.

Algorithms for monitoring of energy consumption data and indicators could be promoted for evaluating the impact of various policies and developing future roadmaps.

Actionable Points- Demand Side Management and Data Analytics	
DSM activities	1. Widen coverage of the current scheme for AgDSM and MuDSM 2. Develop a standard MRV and model projects
Data Management	Develop a comprehensive official national energy database.
Data Analytics and Digitalization	Integration of energy data basis to draw analytical outcomes
Technologies in Agriculture sector	Encourage uptake of energy efficient technology through development of norms and standardizing technology to aid development of business models viz, Cold Chains, farm machinery and agricultural pumping
Knowledge sharing	Disseminating the knowledge on Energy Efficiency among users through relevant universities, demo projects, etc.
Innovative financing	Developing/ integrating Innovative financing schemes focusing exclusively on energy efficiency in agriculture sector
Additional activities	BEE is playing a crucial role in all the demand-side management sub groups under the Energy Data Managemet initiative of NITI Aayog

7.0 Sustainable Transportation Network

7.1 Vehicle Fuel Efficiency Programme

The growing dependence on imported energy for transportation raises several concerns. Considering the growth of automobile sector, the vehicle population is growing at rate of over 5% per annum an presently the vehicle population is approximately 40 million (Source -SIAM). Given the limited domestic availability of oil and gas, the country is compelled to import over 75% of its domestic requirement and significant part of which is used for road transport. Thus, India's requirements of fossil fuel for the year 2030 are projected to rise to 486 Million tonnes of Oil equivalent. Although there are efforts by the government to augment sources of oil, there is a need to usher in policies and measures that could moderate the rising demand of fossil fuel.

Keeping in view the growing demand of fossil fuel and rapidly growing motor vehicle fleet, Bureau of Energy Efficiency (BEE) initiated development of motor vehicle fuel economy standards. Subsequently MoP and BEE developed the energy consumption standard for motor vehicle in consultation with Ministry of Road Transport & Highways and Department of Heavy Industries.

Ministry of Power, issued average fuel consumption standards for cars in 2014 applicable for the motor vehicles using petrol or diesel or liquefied petroleum gas or compressed natural gas, used for the carriage of passengers and their luggage and comprising not more than nine seats including driver's seat, and of Gross Vehicle Weight not exceeding 3,500 kilograms tested on chassis dynamometer for the purpose of manufacturing or importing for sale in the country.

The fuel consumption standards are effective from 2016-17 onwards, and a second set of standards would come into force from 2021-22. The standards relates to the Corporate Average Fuel Consumption (in liters/100 km) to the Corporate Average Curb Weight of all the cars sold by a manufacturer in a fiscal year. According to the norms, the average fuel consumption and the average weight of all the manufacturers is 1037 kg in 2016-17, the Average Fuel Consumption Standard would be less than 5.49 km/100 liters. The second set of standards require that a manufacturer the car average weight is of 1145 kg in 2022, the average fuel consumption has to be less than 4.77 l/100km. It may be noted that the standards apply to the Corporate Average

Fuel Consumption i.e. the average of the standards fuel consumption of all vehicles sold by the manufacturers in the fiscal year, and not to the fuel consumption of an individual model. The fuel consumption notifies that this is measured under the standard conditions at the nationally accredited labs where the fuel consumption is measured over the nationally driven cycle.It is expected that these standards would lead to a reduction of 22.97 million tons of fuel consumption by 2025.

Under the fuel efficiency norms notified in 2017, from 1st April, 2018, diesel vehicles of particular category (M3 and N3) with gross vehicle weight of twelve tonnes and above, complying with BS-IV emission norms, shall be tested for constant speed fuel consumption as specified by the Ministry of Road Transport and Highways, till the time Bureau of Indian Standards notifies corresponding standards. Bureau has also notified the equation for deriving target fuel consumption for each segment of passenger cars. This is applicable to cars complying BS IV and BS VI.

7.2 Promoting Energy Efficiency in Railways

Indian Railways daily handles 3 million tonnes of freight and 23 million passengers and is the world's third largest network. Indian railways consume about 2% of electricity and about 3% of diesel of the country. Indian railways consumed 2894 Million liters of diesel, and 18.22 BU of electricity in 2015-16. Over the years, the electricity consumption of Indian Railways is growing at the rate of 4 percent and 3 percent in case of diesel consumption as per year on year basis. Simultaneously, the railways network being electrified at pace of 3.7 percent year on year basis to move towards low carbon emissions and proficient transport segment. Indian railways are one of the most efficient means of mass transport system. However, to achieve the NDC and reduce the carbon footprints in this sector, Indian Railways has been taken under the Perform, Achieve and Trade scheme. 16 Zonal Railways and 6 productions have got the mandatory reduction target under the PAT scheme.

7.3 EV Charging Infrastructure

India spends around 14.4% of its GDP on logistics and transportation sector and it is expected to grow from $115 billion to $360 billion by 2032[6], thereby contributing largely to GHG from this sector. Hence, there is a major potential in GHG emissions reduction from this sector. Accordingly, one of the areas in transportation where reduction potential of GHG emission is expected to reflect significantly is hybrid and electric vehicles. For long-term growth of electric and hybrid vehicles in India, encouragement is required in the areas of:

- Innovative plans for affordable electric/ hybrid technologies.
- Reducing the price gap between conventional vehicles and full hybrids by incentivizing the adoption of hybrids.
- Outreach and better awareness of hybrid/ electric technologies to stakeholders to alleviate concerns relating to safety and cost of ownership; and

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- Possible integration of technologies with help of stakeholders/ manufactures for investing in research and development for high-efficiency motors and low-cost battery packs considering economies of scale and industry consolidation.

The proliferation of electric vehicles without the necessary ecosystem in place would be undesirable and may not lead to the transformation to 30% electric vehicles by 2030 envisaged under the Government of India vision.

BEE may take up activities including a study on market approaches and technologies which enable accelerated deployment of Charging Infrastructure ecosystem in the country with focus on Charging, Battery and power train technologies and establishing Energy Performance standards for on and off board chargers.

Minimum energy performance standards for EVs and charging stations

With the growing market of the E-mobility sector, power demand will rise. India, with mostly fossil fuel dependent electricity generation, will have to give special emphasis to the energy efficiency in the e-mobility segment to keep a check on the energy demand. Performance standards for the Electric Vehicles (EVs) and their charging stations needs to be established and prescribed.

7.4. Labeling Program for Vehicles

Vehicles may be labeled based on their fuel efficiency levels. Labeling could be done in different segments, sub-segments and based on minimum energy performance. This may be a follow-on activity of the energy performance standards programme. This will ensure better competition in the market and will urge the manufacturers to bring more fuel-efficient vehicles in the market.

7.5. Alternative Fuel for the Transport Sector

Carbon-intensive energy, together with capital, ingenuity and cheap labour, has been a driving force of economic growth since the Industrial Revolution yet at the cost of the environment and climate.

Around a decade back, Scandanavian countries were the initial set of countries to make a shift towards decarbonization of transport sector by adopting electric vehicles. Currently, in some of these countries over 70% of the vehicles are electric. To maximize the benefit from such transformation would require vast quantities of low-cost, zero-carbon electricity. Making that available, along with batteries to electrify cars, is one of the most pressing priorities in the coming decade. But as the price of renewables falls, hydrogen is looking more attractive as a way to store electricity over longer periods and distances than batteries.

Further, hydrogen fuel-cell vehicles, would have a driving range and refuelling time similar to those of conventional vehicles, and an exhaust that is just water vapour. Infact the Scandinavian countries have already started commercially testing hydrogen fuel cells vehicles. Going forward

hydrogen could have a role in light and heavy transport, heating, steelmaking and synthetic fuels for jet aircraft, however, a lot would depend on government mandates and tax incentives to encourage the shift.

Actionable Points- Sustainable Transportation Network	
Vehicle Fuel Efficiency Programme	Develop fuel efficiency norms and standards for vehicles
Energy Efficiency in Railways	Improving energy efficiency in Railways through PAT scheme
Electric vehicles	1. Develop market approaches to enhance EV affordability and promote public private partnerships 2. Prescribing minimum energy performance standards for EVs and charging stations
Labeling program for vehicles	Labeling of the vehicles on their fuel efficiency levels
Alternative Fuel	Promoting the use of alternate technologies in the transport sector, e.g., hydrogen fuel cell

7.0(A) Carbon Trading Scheme for Energy Sector

Climate Change, an unwarranted consequence of carbon intensive activities has posed some of the severe and irreversible impacts on the ecosystem. It has also become an unmatched challenge to the sustainability of the entire human civilization.

Excess emission of Carbon dioxide (CO2) and other Greenhouse Gases (GHG) into the atmosphere mainly due to human activities has caused imbalanced concentrations of these gases. The burning of fossil fuels like coal, oil, and gas for electricity, heat, and transportation is the primary source of human-generated emissions followed by deforestation. These imbalances in the atmosphere are said to be largely responsible for the complex climate shifts. Thus, mitigation and adaptation towards the irreversible and ill-effects of climate change are the most discussed subjects at all National as well as International Forums.

Recognizing the need to mitigate the effects of climate change, India has made an impressive progress by strengthening the existing initiatives and bringing in new energy reforms. In addition to this, the Government of India has also laid down ambitious targets for its self in its Nationally Determined Contributions (NDCs), ratified and submitted to the United Nations Framework Convention on Climate Change (UNFCCC) thus fulfilling the requirements of the Paris Agreement.

The Paris Agreement adopted in December 2015, seeks to create a global framework to tackle climate change. Under the agreement, all the Parties to the UNFCCC acknowledged the need to contribute to achieving ambitious and collective goals to fight climate change namely-

- **Article 2,** to hold the increase in global average temperature to well below 2 degrees Celsius (°C) above pre-industrial levels and to pursue efforts to limit it to 1.5°C;
- **Article 4,** to reach a balance between anthropogenic emissions by sources and removals of sinks of greenhouse gases (GHG) in the second half of the century, sometimes referred to as net zero emissions or carbon neutrality;
- **Article 6,** to allow for voluntary enhanced ambition through cooperative market and non-market approaches, use of internationally transferred mitigation outcomes towards nationally determined contributions to deliver an over reduction in global emissions

Further, Article 6 under the Paris Agreement deals specifically with international cooperation, market and non-market approaches and thus offers a wide canvas to achieve cost-efficient emission reductions, and to deepen ambition levels.

Multiple co-benefits are anticipated for host countries such as:

- Carbon revenues
- Technology transfer, and
- Environmental and socioeconomic co-benefits, for example, local jobs, air emissions reductions etc.
- Attract additional finance streams to achieve and enhance their NDCs

Thus, low carbon industries and the carbon markets can act as new growth engines and a key policy tool to encourage investments towards green growth.

India is projected to meet its NDC targets with current policies in place for both public and private sectors. India's private sector, has been proactive in terms of engaging with the climate change debate, actions and putting out climate mitigation commitments. Several of Indian companies have already announced ambitious climate commitments. There is, therefore an opportunity to work with Indian companies/ associations to further enhance their participation for meeting future climate goals.

India can assume leadership through climate action internationally by pushing climate ambition within the government and in the private sector. Carbon markets represent an ideal instrument to pursue such an agenda cost effectively.

7(A).1 Clean Development Mechanism

Under the Kyoto Protocol's Clean Development Mechanism (CDM), India was a key participant, emission reductions were defined as –real, measurable and additional. The emission reductions achieved in the developing country were used to service the developed countries targets through the carbon market at least costs. The rules of this CDM market were however set by the buyer viz. Annex 1 countries.

The CDM created enough experience in India to suggest that regulation can support redirecting significant market investment towards low-carbon investment, develop market institutions and can play a vital role in helping meet ambitious GHG objectives.

Under CDM it had become clear that one common need for carbon markets is 'data availability and credibility' especially in public domain. In Developing Nations data and its availability is often work in progress. CDM tried to overcome data constraints through measures like -- 'Additionality arguments', Conservative baselines and discounts on issuance of emission reductions which became akin to double taxation. This kept Developing nations at a dis-advantage in tapping carbon revenues which they may otherwise been able to access.

On the other hand, Article 6 is based on the premise of 'National Determination' thus presumably leaving it to the concerned Nation and the defined entities who can participate. This is in sharp contrast to the CDM which was based on the premise that

- the means for enforcing 'Trust' necessarily would emerge from systems / agencies external to the 'Party' e.g. Designated Operational Entities, Assent of Party, Centralized UNFCCC etc. and
- emission reductions need to demonstrate three criteria: Real and Measurable, Conservative and Additional.

Article 6 offers Nations a genuine opportunity to pursue low carbon development suited to their governance style. This would entail piloting the concept of carbon markets making use of 'National Determination' from the perspective of 'Developing Country' and not necessarily that of the 'Developed nations'.

7(A).2 Energy Efficiency for Low Carbon Growth

Hon'ble Prime Minister of India has described climate change as the biggest challenge facing humankind and it is only natural to draw a corollary that India is ready to step up its efforts under climate discussions, reflecting a long-term strategy for development that is low on greenhouse gas emissions.

It would be in India's interest to pursue a low carbon path more vigorously, as most of the economic sectors are still developing (or yet to develop) providing an opportunity to re-imagine and refresh the development paradigm. Thus, key is to articulate proposals for raising ambition from India and develop actionable proposals.

India's Nationally Determined Contributions (NDC) submitted in 2015 under the Paris Agreement set targets that will have to be achieved by 2030. India set three major goals to be achieved for the period between 2020 and 2030–

1. Increase the share of non-fossil fuels to 40% of the total electricity generation capacity,
2. To reduce the emission intensity of the economy by 33 to 35% by 2030 from 2005 level, and
3. To create additional carbon sink of 2.5 -3 billion tonnes of CO2 equivalent through additional forest and tree cover.

A key area of intervention for low-carbon growth scenario is energy efficiency. It is projected that almost 86 % of the future emission mitigation shall arise from actions on the demand side to improve energy efficiency and only 14% from the renewable sources. This is because in the coming future, technologies shall be more efficient than today, and clearly the need is to fast track its adoption.

Bureau of Energy Efficiency (BEE), is responding to these developments by nudging several policy backed market initiatives to enable energy efficiency. Towards reduction in emission intensity, India has been undertaking various mitigation activities such as Standard & Labelling program for appliances/ households/business, Perform, Achieve and Trade (PAT) scheme for energy intensive sectors, Energy Conservation Building Codes for building, fuel efficiency norms for transport, and DSM activities related to municipalities, agriculture, and Urban Local Bodies (ULBs).

Public policies for energy efficiency often entail significant transaction costs which need to be reduced. Enabling markets is the best method to reduce such costs. Markets discover low cost options hitherto considered difficult to achieve. This is made possible because markets typically generate incentives for actors to efficiently direct technology and finance towards the energy use transition.

Scaling up energy efficiency is difficult and yet given the dynamic narrative playing around the use of energy in the past ,BEE has engendered transformational change in sectors such as on lighting, appliance labelling, industry, space cooling etc. through a consultative and collaborative approach with industry and other stakeholders.

Given the desirability to pursue low carbon scenario option with enhanced energy efficiency from both the energy security perspective and the sustainability perspective, it is imperative that India takes up on priority strong energy efficiency strategies across multiple sectors.

7(A).3 BEE: The Enabler of Markets

As a public institution, the Bureau of Energy Efficiency (BEE) in India has done much to leverage carbon markets to enable energy efficiency in India.

BEE piloted one of the largest Program of Activities (PoA) under the Clean Development Mechanism to enable efficient lighting in households. Under the Bachat Lamp Yojana (BLY) scheme, quality compact fluorescent lamps (CFL) were distributed by CFL investors to grid-connected residential households in exchange of an incandescent lamp (ICL) and INR 15. To bridge the cost differential between the market price of the CFLs and the price at which they are distributed to households, revenues from the Clean Development Mechanism (CDM) were harnessed.

This led to over 30 million replacements of incandescent bulbs with CFLs and energy savings of nearly 1450 million units. The role played by the BEE was that of a Public Private Partnership enabler and facilitator between private investors and public sector DISCOMs. The savings were achieved with a small budgetary grant from Government of less than Rs. 30 crore and was able to leverage private investment of nearly Rs. 40 million.

BEE also administers the flagship scheme Perform, Achieve and Trade (PAT) to reduce energy consumption and promote enhanced energy efficiency among specific energy intensive industries in the country. Designed to achieve energy intensity targets at lowest cost through trade in energy savings certificates, the scheme covers 1073 entities (across 13 sectors) with mandatory energy efficiency targets, comprising around 50% of India's energy consumption.

`BEE, given its prior successful carbon market experience and a portfolio of energy efficiency schemes, could be entrusted with the task of leveraging Article 6 to develop new carbon markets technically and administratively.

The role of BEE would be to support in co-developing Article 6 approaches for:

- Simple MRV's to obviate the need for complex data or its availability example 'Deemed Savings' based baseline and projected GHG mitigation
- 'Nationally Determined' methods for environmental integrity of upscaled activities using sustainable development impacts and co-benefits, eschewing concepts like CDM based additionality tests,
- Enabling capacity enhancement arrangements for potential Demand, Supply entrants, including learning from other markets like the Korean ETS, EU ETS and laying the institutional framework for a carbon market based out of India.

7(A).4 Emission Trading Schemes (ETS)

An ETS establishes a Cap on either

- Total emissions or
- Emissions intensity (Emissions per unit of GDP)

Emissions could be based on CO2 or other GHG gases. Firms either get the 'emission allowance' for free or through partial auction. Total allowances are equal to the Cap. Trading of the allowances is allowed during a 'compliance period'. The essential objective is that the firms with lower abatement costs sell their 'reductions or allowances' to firms with higher abatement costs and overall, emission reductions are achieved at least cost. The 'reductions or allowances' are named differently by each ETS and thus may be collective referred to as compliance instruments. The compliance instruments used to demonstrate compliance are then extinguished.

Five main criteria define an ETS

5 Criteria	Method	Key Requirement	Key Challenge
Environmental Effectiveness: Sets an absolute Cap (tonnes of GHG or tonnes GHG per unit GDP)	'Top down' viz. imposing emission reduction or Bottom up approach viz. Firms define emission reductions projections. Usually 100% economy wide Cap not imposed as only some GHGs or sectors are regulated. Cap is equal to BaU or less than BaU, which may become stringent with time.	Reliable estimate (data) of current and future emissions trajectory.	Emissions Inventory data often needs to be built up over time through mandatory reporting

Economic Efficiency Signal market stability through the marginal cost of abatement (MCA) and the cost of compliance (viz. MRV)	Usually the Govt. absorbs the administration costs. A one-time inclusion fee may also be charged on the participating entities.	Maintain low costs	Distribution of costs and benefits across stakeholders
Market Management Demonstrate transparency, stability, flexibility and long term commitment	Method of allocation (Free or partial Auction). Inclusion of difficult to abate sectors (usually via free allowances) leads to higher yet stable MCA. Banking; Reserves with Price/ Quantity triggers	Maintain Price stability and long term commitment	Price volatility; Creating adequate Reserves
Revenue Management Monies collected as fees or auction revenues which then are spent to administer the ETS or allocated for public good e.g. Innovation etc	Reduce free allocation and enhance auctions with time; Raise spends on enabling measures like 'Technology innovation' etc.		
Stakeholder Engagement	For identified stakeholders plan periodic interactions	Open to receiving stakeholder and Public inputs	Correlation between change outcome and stakeholder input

7(A).5 Design Framework of an ETS

Nations taking up carbon markets for mitigation under Article 6 need to address questions like–

Why to do	• Driver for carbon market? In other words, how is carbon market different from typical government tax-payer funded programmes (Unilateral), or from received overseas development assistance (Supported) • Assessment of Costs and benefits
Who shall do	• Degree of accountability envisaged by government ministries and departments or private sector • What is the degree of ownership in setting the rules? Will potential participants contribute to follow the rules or set the rules? • Institutional structure
What to do	• Market design including any linkages.

7(A).6 ETS Linking

ETS schemes can be linked together (or with an off-set scheme). Such linkages can be of two types:

- Unilateral- One ETS accepts the 'compliance instrument' of another ETS (or offset) for compliance purposes, but not 'vice-versa'. Example CDM for EU-ETS
- Bilateral- each ETS accepts the 'compliance instruments' of the other ETS for compliance purposes. Example EU-ETS and Swiss ETS

Linking requires synergy in-between the two ETS at three levels:

Political	Legal	Technical
Benefit of Linking (Costs, Price Stability, Market liquidity, Competitiveness)	Mutual recognition of each other system	MRV Rules, GHG gases covered, Allocation method etc.
Environmental Credibility (CAP and longer-term targets, Additionality)	Create enforceable rights and obligations	Market Oversight, Registries

The above three can also be viewed as the likely requirements for linking any future carbon markets from India. To illustrate a few potential linkage issues, the BEEs PAT scheme is discussed below as an example:

Technical

- The PAT compliance instrument called energy savings certificate (EScert) is designed for energy savings (measured in Tonnes of Oil Equivalent) where CO2 savings are at best an implied co-benefit.
- The PAT MRV does not offer a means to estimate the CO2 equivalent savings nor does it recognise GHG gases like CO2, HFCs, CH4 etc.

Political

- The EScert average price is around $ 10 and 4 million surplus EScert (for PAT 1 cycle). In future cycles, the EScert (over) supply is expected to increase and lower this price. Thus, PAT may be useful as an offset mechanism for an ETS where prices are high and/or liquidity is low.
- PAT does not prescribe a CAP and thus no allocations or auctions are required
- Additionality can be observed from the fact that EScert represent the voluntary over-achievement by the entity over the legally mandatory target. However, no entity level monitoring is performed for the measures undertaken.
- Bilateral linkage may need harmonization with the other ETS like tightening the SEC targets (to reduce ESCert supply) and adopting Market making methods like reserve funds

7(A).7 Comparison of the European Union and Korea ETS with BEE PAT Scheme

	EU ETS	Korean ETS	PAT
Background	The world's largest ETS, covering over 11,000 entities based across 28 EU member states (Plus 3 other countries). Begun in January 2005, currently in its third phase (2013-2020). Other phases were 2005-2007; 2008-2012. A cap and trade scheme.	The world's 2nd largest ETS, covers 610 firms in South Korea across 17 sectors. This cap and trade scheme is voluntary on part of Korea. The 1st phase started in January 2015-2017; Second phase (2018-2020). The third phase is announced from 2021-2025.	Designed to achieve energy intensity targets at lowest cost through trade in energy savings certificates. Covers 1073 entities (across 13 sectors) with mandatory energy efficiency targets, comprising around 50% of India's energy consumption.

	EU ETS	Korean ETS	PAT
ETS Administrator Body	EU Commission (Centralised for Supervision, Regulatory, Registry, Allowance auction etc) Member States Agency (to support Supervision)	Overall: Ministry of Environment the Korea Energy Management Corporation and the Korea Environment Corporation are responsible for supervising measurement, reporting, and verification (MRV) of emission data; Korea Exchange - single designated emission permits exchange. Greenhouse Gas Inventory & Research Center of Korea- Emission data and research	Overall: Ministry of Power Bureau of Energy Efficiency, India (Targets, Audits etc) Registry maintained by POSOCO Disputes Tribunal (CERC) ICX and Power Exchange- Trading
Environmental Effectiveness			
Cap	Mandatory Cap at country level reduced over time e.g. 2.2 % per annum in Phase 2. Top down approach	Mandatory Cap at Firm level reducing over time, 2% per annum in Phase 1. Bottom up approach, often political nature of allowance allocation recued confidence.	Mandatory Specific Energy Consumption (SEC) efficiency targets based on the trend of energy consumption and energy-savings potential of the entity. There is no Cap and GHG savings are a co-benefit. MRV does not estimate the GHG mitigation
Coverage	45% of EU emissions	70% of emissions	50% of energy consumption in India

	EU ETS	Korean ETS	PAT
GHG covered	CO2, N2O, PFCs Countries may add more GHGs	CO2, CH4, N2O, PFCs, HFCs, SF6	Nil
Economic Efficiency			
Marginal cost of abatement (per allowance)	$ 6.5 per tCO2e	$ 14.3 per tCO2e	$ 10 per ESCert (PAT cycle 1); (~ $ 2.85 per tCO2, 1 ESCert = 3.5 tCO2)
Liquidity	High	Low	High
Cost of Compliance (MRV cost per allowance)	$ 0.2	--	Sectoral studies borne by Govt; Entity level MRV borne by the Entity.
Cost of non-compliance	100 euros per tCO_{2e} plus obligated emission credits	Buy Emission credits or pay penalty three times the market price capped to 100,000 won per tCO_{2e}	Buy EScerts plus Rs 1 million per defaulting unit. Incase of continued failure to meet targets, further penalties would be levied.
Market Management			
Allowance allocation (Free/ Auction)	Partial Auction	Free	Not applicable
Allocation basis (Baseline/ Grandfather-ing)	Free and Auction (40%) (Phase 1: Grandfathering) (i.e. based on historical emissions)	Free (90%); 3% Auction (Phase 1: Grandfathering) (i.e. based on historical emissions)	Output based (i.e. based on a firm's Specific Energy Consumption (SEC), trend of energy consumption and energy-savings potential of the entity)

	EU ETS	Korean ETS	PAT
Price stability Commitment **(reduced price volatility)**	Commitment for Future periods; Defined Banking norms; Borrowing not allowed (i.e. current compliance using credits from future vintage years)	Unlimited banking; 10% borrowing allowed (i.e. current compliance using credits from future vintage years)	Banking for 1 additional cycle
Flexibility	Market Stability Reserve (MSR) with Price and Emission containment triggers	Emission Permits Allocation Committee initiates market stabilizing measures due to abnormal prices/ demand	Nil
Linkage	Unilateral with CDM; Bilateral with Switzerland	Nil (talks are underway with EU-ETS and regional markets like China)	Unilateral with CORSIA (Proposed)
Revenue Management	$ 17 billion till date; 50% used for Climate and Energy purposes.	Used for ETS operation expenses and offering supportive financial resources to industry sectors	Govt Administered, No revenues collected
Stakeholder Engagement			
Interactions	Yes	Yes	Yes
Public	Yes	Yes	Yes

7(A).8 Energy Saving Certificate Market in India

Bureau of Energy Efficiency is implementing a flagship programme under National Mission for Enhanced Energy Efficiency (NMEEE) i.e. Perform, Achieve and Trade (PAT) scheme. PAT scheme aims at reducing energy consumption and promote enhanced energy efficiency among energy intensive industries in the country. Designed to achieve energy intensity targets at lowest cost through trade in energy savings certificates, the scheme covers 1073 entities

(across 13 sectors) with mandatory energy efficiency targets, comprising around 50% of India's energy consumption. Each entity is given a mandatory target of Specific Energy Consumption (SEC) reduction with a time period of three years from the date of notification by the Central Government. Entities which can achieve the SEC level lower than their targets can receive Energy Savings Certificates (ESCerts) for their excess savings. Entities unable to achieve the given targets through their own actions need to demonstrate compliance by purchasing an equivalent amount of ESCerts or else are liable to financial penalty under the Energy Conservation Act, 2001. The ESCerts are traded at the power exchanges at the end of each PAT cycle of three years.

Trading of ESCerts under PAT cycle –I showcased that the price variance per ESCert ranged over Rs 200 to Rs 1200 over the 17-day trading window. This variance implies that the supply and demand gap varied unpredictably over each of the 17 trading sessions. Overall at the end of the 17 trading sessions, there was a surplus of over 2.4 million ESCerts which were banked for use in the next PAT cycle. The surplus ESCerts indicate that during PAT cycle I, entities have invested into energy efficiency pencilling in an indicative ESCert price (or the penalty price) into their investment calculations. However, continued future investments would depend on the price data from the previous PAT trading cycle. Such investments are likely to be directed towards the low hanging fruits with lower costs. Further, supply-demand projections for PAT cycle II indicate potential surplus of ESCerts for that cycle. This surplus overhang, over and above the banked ESCerts from PAT cycle –I, can potentially suppress ESCert prices even further than those achieved in PAT cycle –I trading cycle, impairing fresh investments.

7(A).9 BEE proposed ETS

Bureau of Energy Efficiency (BEE) has all the necessary capacity which is required to technically design and administrate an ETS due to its demonstrated acumen in operating a scheme like an ETS viz. the Perform Achieve and Trade (PAT) mechanism. BEE has also successfully enabled private investments by wielding a large coalition of Public Private Actors viz. Bachat Lamp Yojana (BLY) scheme.

The need thus is to understand and plan the requirements from a new carbon market from India. Experience of ETS from across the globe suggests that three things are essential and a pre-requisite to planning a new ETS:

I. Clarity on underlying asset– Emissions / Carbon / Energy Efficiency trading etc
   a. Data Availability, Credibility and Transparency
   b. Ambition/Targets to be commensurate with economic activity else 'over-achieved' easily
II. Long term signal for business to invest with Deep Pockets (inflation adjusted) for Market Stabilization
III. Mandatory targets tightened with time for policy driven Demand competition

Energy Efficiency, which is the core mandate of the BEE, allows BEE to straddle

diverse sectors of the economy with ease. If a carbon market is to be constructed, energy efficiency savings easily translate themselves into tonnes of CO2. Given the above, a potential market can be considered easily either from the supply side or the demand side.

PAT scheme is based on the premise that price of ESCert shall act as an incentive for entities to invest towards energy efficiency profitably or where unable to buy ESCerts cost effectively. The learning of PAT cycle –I indicate that since there is a surplus supply of banked ESCerts of PAT cycle –I available for trading in PAT cycle –II, it would also lead to lowering of prices of ESCerts when compared to PAT cycle –I. In order to stabilize the price of the ESCerts, it may be useful to address the supply-demand gap. BEE is exploring the possibility of tapping additional demand for EScerts through linking the PAT scheme with international carbon market. Thus a voluntary carbon market would be helpful in consuming the surplus ESCerts in the market and also be useful in helping towards larger uptake in adoption of energy efficiency projects/measures in the domestic market. Such a market will be critical for meeting the commitments under NDCs submitted in line with the Paris Agreement.

The Ministry of Environment, Forests and Climate Change (MoEFCC) had constituted a high level inter-ministerial Apex Committee for Implementation of Paris Agreement (AIPA) under the chairmanship of Secretary, MoEFCC. The purpose of AIPA is to generate a coordinated response on climate change matters that ensures India is on track towards meeting its obligations under the Paris Agreement including its Nationally Determined Contributions (NDC). Another key function of AIPA would be to operate as a National Authority to regulate carbon markets in India under Article 6 of the Paris Agreement, formulate guidelines for consideration of projects or activities under Article 6 of the Paris Agreement, issue guidelines on carbon pricing, market mechanism, and other similar instruments that have a bearing on climate change and NDCs. The first meeting of the AIPA under the Chairmanship of Secretary (Environment, Forest & Climate Change) was held on 24th March 2021 with an objective to review the National Missions under the National Action Plan on Climate Change. In the said meeting, the Chairman suggested for including Carbon Savings in the on-going Energy Efficiency scheme for Energy sector, by enhancing the scope of the existing Energy saving trading mechanism. The same framework may also be used for non-energy carbon savings at a later phase.

India, already has trading programmes such as Perform, Achieve and Trade (PAT) with a considerable infrastructure wherein trading of ESCerts is done on Power Exchanges. Thus, development of a carbon market based on the existing infrastructure can synthesize the different schemes followed by improving overall market liquidity and balance demand and supply of ESCerts ensuring better outcomes from existing mechanism.

Also, PAT scheme in its current form leaves out nearly 50% of energy savings potential from Industry side (especially Micro Small Medium Enterprises (MSME) and does not include residential households or other large energy users like urban local bodies etc. Thus, the proposed extension of PAT market framework under voluntary markets shall tap the initiatives of non-state and sub-national actors, through the existing framework of the Energy Conservation Act (with modifications).

Thus, such a voluntary market can also be broad-based to include international demand mechanisms like the Article 6 under the Paris Agreement to attract capital for infrastructure. Energy efficiency savings, with pre-defined protocols may support tapping GHG (CO_2), providing fungibility with other markets. Given the above, voluntary markets should be considered within the existing regulatory framework of the PAT scheme through limited modifications. In addition, such markets would provide valuable data on energy efficiency led GHG mitigation taking place and potentially support India in raising ambition of its NDC.

Carbon markets have been successful in reducing green-house gas emissions by setting a limit on emissions and enabling their trading. Trading enables entities that can reduce emissions at lower cost to be paid to do so by higher-cost emitters, thus lowering the economic cost of reducing emissions.

It is envisaged that this new platform would derive its basic structure form the existing mechanism of PAT scheme, the stakeholders involved would be also similar. In addition to this, an integrated registry would be developed for facilitating data management and transaction. Upon development and full operationalization of such a market for carbon, dovetailing with International market could also explored. Interaction of the domestic market with the international market could also drive towards realizing the emission reduction targets fulfilling the provisions of the Article 6 of the Paris Agreement that provides key provisions on mitigation, and development of carbon market which could help the countries in realizing their NDC targets.

BEE has demonstrated acumen in operationalization of the PAT trading scheme, and this could be easily extended to cover the design and operational requirements of a voluntary market mechanism namely- Demand mapping, Regulatory modifications and Market forecast.

BEE envisages development of a voluntary energy efficiency market in India in consultation with Ministry of Power. Limited regulatory and operational modifications to the existing PAT scheme mechanism are envisaged and the market can be extended to voluntary actors using the PAT framework. A broad outline of time duration for different stages of such a market development is given in the following table:

Progress Indicator	Timeline						
	Month 1 - Month 3	Month 4 - Month 6	Month 7 - Month 9	Month 10 - Month 12	Month 13 - Month 15	Month 16 - Month 18	Month 19- Month 21
Stage 1							
Concept Outline	X						
Policy and Regulatory outline	X						
Roadmap for operationalizing		X					
Blueprint document			X				
Stage 2							
Detailed Design Operating Plan							
Market I Regulatory I Participant				X	X		
Stakeholder consultation			X		X	X	
Development of Regulatory Framework					X	X	
Pilot Phase- voluntary market						X	X
Stage 3							
Scaling up Voluntary Market	One year from launch of pilot phase						

Globally ETS have worked for one and only one reason- mandated targets. This means that someone usually the target adopter would need to pay (or have access to funds) to avail themselves of the benefit of pursuing low carbon consumption.

Given the COVID-19 scenario the political bandwidth of the Indian Govt to mandate targets is currently difficult.

Thus, key is to identify constituencies of 'Target adopters' who shall undertake a

carbon target voluntarily. These could be for example corporates willing to spend a defined percentage of corporate CSR funds to create demand for carbon credits generated say from the manufacture of sustainable and thermally comfortable building materials with energy efficiency co-benefits. The energy efficiency co-benefits could then be monetised through the voluntary carbon markets. Globally, examples of Voluntary carbon markets exist to make such a mechanism for the Indian markets.

With maturity, India's voluntary carbon market may also support the mopping of GHG mitigation measures, which could be used to fulfil India's raised Paris Agreement ambitions.

7(A).10 Budget requirements for implementation of Carbon Trading Scheme for Energy Sector

Bureau of Energy Efficiency has prepared and submitted the SFC Memo to Ministry of Power "Energy Conservation Scheme-NMEEE revised to ROSHANEE for FY 2021-22 to 2025-26. For development of voluntary carbon market, fund requirement of Rs. 16 Crore has been sought.

8.0 Strategies for Capacity Building and Awareness on Energy Efficiency

The adverse impacts of climate change on the developmental prospects of the country are amplified enormously by the existence of widespread poverty and dependence of a large proportion of the population on climate sensitive sectors for livelihood. Hence, creating awareness and building capacities becomes an essential part among others.

Knowledge management and capacity building is one of the key areas to enhance energy efficiency. Creating awareness on the topic and inducing a behavioural change can play wonders in reducing the GHG emission. Many programmes are run and planned to be run by BEE, which includes capacity building and awareness activities in all the segments of the society ranging from school children to industries, banks, organization, etc.

8.1 Capacity Building of DISCOMs

A scheme on Capacity Building of DISCOMs has been initiated by BEE. Under this programme, 62 DISCOMs have been covered. The objective of the programme was capacity building of DISCOMs for carrying out load management programme; development of DSM action plan and implementation of DSM activities in their respective areas. The first phase of the scheme on capacity building of DISCOMs has been successfully completed and the achievements are listed below:

First Phase

- 34 DISCOMs were selected for participating as beneficiary DISCOMs and DSM Cell has been established by these DISCOMs.
- DSM regulation has been notified in 22 States for 34 DISCOMs.
- Load survey is completed for all 34 DISCOMs and their DSM action plans have been prepared.
- National Power Training Institute was engaged by BEE to conduct training programmes for the officials of DISCOMs to create Master Trainers on DSM and Energy Efficiency. Under this programme, 504 officials of senior/ middle-level management of these DISCOMs were trained as Master Trainers under Training of Trainers activity.
- About 5000 circle level officials of DISCOMs have been trained on DSM and Energy Efficiency.

The following activities were outlined to be carried out by BEE and DISCOMs under this programme during the second phase.

Second Phase

- 28 DISCOMs have been identified on PAN India level as beneficiary DISCOMs under this programme.
- About 1000 senior officials of these DISCOMs would be trained as Master Trainers on DSM & Energy Efficiency and capacity building programme for about 4000 circle level officials would be undertaken.

Many utilities are still in need of support for adoption of DSM measures primarily due to lack of expertise, finance and infrastructure to deliver DSM programs. Bureau has planned further activities in future to further support the DISCOMs:

- To consider DSM as a resource in the Integrated Resourse Planning of DISCOMs
- To ensure extensive participation of DISCOMs in DSM programs and address the identified barriers and challenges.
- Development of a Load Research Library for India.
- Involvement of State Regulatory Commission in DSM Process.
- Creation Green Initiative Fund.

8.2 Certification Examination for Energy Managers and Energy Auditors

As per the Energy Conservation Act 2001, it is mandatory for all the designated energy

consumers to get energy audit conducted by an Accredited Energy Auditor and to designate or appoint an Energy Manager. BEE engages an agency to conduct the National Level Certification Examination for Energy Managers & Energy Auditors every year. The 1st National Certification Examination was conducted in May 2004 and so far 19 examinations have been conducted and the results of exams are declared in January every year. There are 6910 Energy Managers and 9499 Energy Auditors up to 19th examination.

The certified Energy Auditors, upon fulfilling specified criteria, can apply for accreditation with Bureau, and become eligible for carrying out specific audits/ activities. The accreditation is done through an accreditation committee which analyses the eligibility and other criterion for the applicant. Bureau has accredited more than 260 Certified Energy Auditors till March 2019.

8.3 National Energy Conservation Award (NECA)

The Bureau of Energy Efficiency (BEE), under Ministry of Power, is mandated as per the Energy Conservation Act 2001, to regulate and promote energy efficiency and its conservation in India. The BEE is fulfilling its mandate by implementing flagship schemes such as Standards and Labeling (S&L) Programme for appliances and buildings, Perform, Achieve and Trade (PAT) for Designated Consumers, Demand Side Management (DSM) initiatives in Agriculture, Municipalities, DISCOMS, Micro, Small and Medium Enterprises (MSME), Strengthening State Designated Agencies (SDA), and Awareness and Outreach. BEE is also implementing the National Mission for Enhanced Energy Efficiency (NMEEE), one of eight missions under national Action Plan on Climate Change (NAPCC) under Prime Minister of India. Through all these schemes, BEE is encouraging to save energy, help reduce carbon footprint and bring down the energy intensity in the country. Ultimate objectives of all these endeavors are to save precious resources for the nation, mitigating climate change and promote sustainable life. One of the important endeavour under awareness and outreach programme has been the Energy Conservation Awards. To raise awareness on energy efficiency and its conservation, the BEE, under the guidance of Ministry of Power, recognizes and encourages endeavours of industrial units, institutions and establishments in reducing energy consumption by felicitating them with Energy Conservation Awards on the occasion of National Energy Conservation Day, celebrated on 14th December every year.

The awards were given for the first time on December 14, 1991, which was declared as the 'National Energy Conservation Day'. Since then, National Energy Conservation Awards (NECA) has been attracting the attention of all the stakeholders and has witnessed increasing participation level year after year. These awards are presented on EC day by eminent dignitaries and highest functionaries such as Hon'ble President, Hon'ble Prime Minister and Hon'ble Union Minister of Power.

The specific energy consumption of an applicant (or of the appliances sold by an applicant) compared to that of other applicants and the energy savings achieved due to implementation of energy efficiency project, in percentage of absolute energy consumption of the previous year are the two major parameters on which the award is based. Establishments having ISO 50001 Energy Management Systems are given extra weightage.

8.4 National Level Painting Competition for School Children

The Ministry of Power has launched the National Painting Competition in the year 2005 under the National Awareness Campaign to promote energy conservation in the country for students of 4th, 5th and 6th standards. Painting competition for students at the School, State and at National level has been included as one of the activities of the campaign, which would not only make aware the children about the need of conserving energy but at the same time would educate and involve their parents as well in the above cause. The identified activity is one of the measures, which can help in creating awareness in the domestic sector. In order to strengthen and for added cognizance, higher classes of 7th, 8th and 9th standards have been included from 2013 in addition to existing classes of 4th, 5th and 6th Standards. The competition is being held at three stages, namely, School, State and National Level. Students of 4th, 5th and 6th standards under Group 'A' and of 7th, 8th& 9th standards under Group 'B' are eligible to participate in the competition.

8.5 Development of Text Module on Energy Efficiency

BEE has initiated the inclusion of chapter on energy efficiency and conservation in school curriculum of State Education Boards and NCERT Books from 6th to 10th standards. A module was developed on energy conservation that first assessed the need of level of the information on energy conservation by reviewing the existing science syllabi and science text books of NCERT for classes 6th to 10th. The modules so drafted were placed before a committee called Guiding Committee. This committee was chaired by Director General, Bureau of Energy Efficiency having members from National Council of Educational Research and Training (NCERT), Central Board of Secondary Education (CBSE), School Principals (Govt. and Public Schools), teachers, and agencies working in the energy conservation area, and Representatives / officials from education departments. Draft text module were developed and submitted to NCERT for incorporation in the existing syllabus. Development of training module (English and Hindi versions), and Training of teaching staff on the new module / syllabus has to be taken up as future activities.

8.6 Energy Clubs in Schools

Ministry of Power initiated the scheme for formation of Energy Clubs in School. The scheme included Initiation/Replication/ Strengthening of Eco/Energy Clubs. Eco/ Energy Clubs which are already running at some schools. This success model needs to be adopted all over the country.

In order to attract school students and motivate school teachers in to energy efficiency and conservation, it was felt that it is essential to strengthen the existing and newly established Eco/ Energy clubs through the support of State Designated Agencies (SDAs). In order to support them, various activities such as development and preparation of mission pledge, posters, banners, home activity charts etc. were suggested for implementation. ECO/Energy Club activities also includes energy model making, awards to students and awards to teachers and celebration of Urja Divas (Energy Conservation Day) on 14th December. As per the report submitted by SDAs, a total of 198 districts of 14 states have been covered by establishing 2224 energy clubs in schools by 2018.

In the future, it is proposed that around 400 new clubs to be added to the existing clubs. The proposal also includes strengthening of existing clubs. Activities under energy clubs have been envisaged to continue throughout the year for which identification of nodal officers and volunteers have to be done by schools under supervision/guidance of SDAs/ BEE. In addition to above, the proposal also includes development of a common branding all over the country to establish uniformity. Creative concept, exclusive logo for the club and awareness material may be developed for use at energy clubs. Trainings of volunteers on Inter Personal Communication (IPC) are also proposed.

8.7 Space Cooling through Optimum Temperature Campaign

It is estimated that electricity consumption in commercial buildings, will increase to about 160 BU in 2030 from around 90 BU. With the objective to reduce energy intensity, in the area of space cooling, Bureau under Ministry of Power established various programs like Star Labeling of Air Conditioners to improve efficiency, also Energy Conservation Building Code has been published to reduce demand for space cooling.

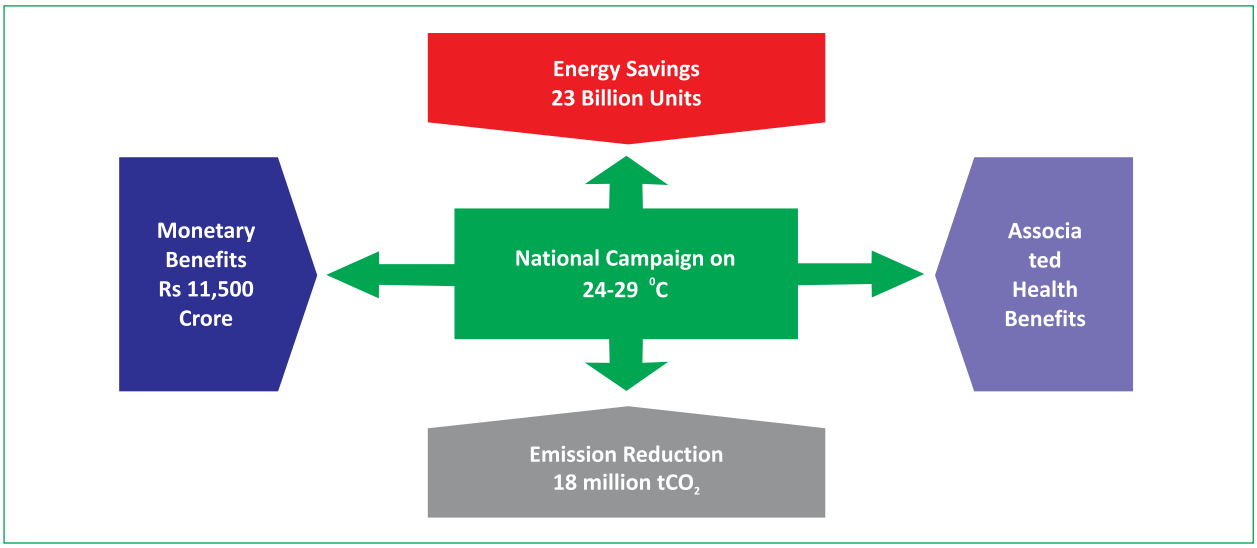

Figure 14: National Campaign on 24 degree C

One such unique initiative that Bureau of Energy Efficiency has started is to run a mass awareness national campaign to encourage the public to maintain temperature at 24 0C or more with appropriate comfort level to conserve energy. Proposal is to maintain residential homes with air conditioners, and all commercial buildings like Airports, Hotels, Shopping Malls, Offices and Government Buildings (Ministries & attached offices, State Government, and Public Sector Undertakings) at 24-260C to reduce electricity consumption similar to practice in Japan to maintain air conditioner temperature to 28 °C aftermath of Tohoku earthquake and tsunami.

It is estimated that by increase in room temperature by 1 degree Celsius, an average about 6% of electricity can be saved. Typically, room temperature is set between 20-22 0C whereas, as per recommended standards, ideal comfort temperature can be 24-26 0C. Considering change from 20 0C to 24 0C, there is potential to increase the setting by 4 degree Celsius that may result in savings of about 24% of electricity. Hence, India can save about 23 billion units of electricity only by simple measure of temperature setting to 24 0C.

8.8 Course / Module on Energy Efficiency for Technical Manpower

Dedicated training modules for the technical manpower, e.g., operators and supervisors of utilities such as Boilers, Furnaces, etc. may be developed with adequate trainings. This will ensure better operation and maintenance practices as these are the workforce directly involved in day to day business. While physical trainings are most effective and could be taken up region/ cluster wise, Massive Open Online Course (MOOC) could provide wider dissemination to the last mile in effective way.

8.9 Knowledge Management

The success of energy efficiency largely depends on the awareness by the users. More than any programme, creating awareness could largely bridge the gap between the demand and supply. Recognising the importance, BEE has initiated a number for programmes for creating awareness among all sections of the society, which are explained in this section.

Energy Management System

Energy is recognized as a key factor of production within an organization with direct correlation to firms bottom-line as well as GHG emissions. Industrial and commercial sectors potentially account for 60% of global energy use, offering tremendous energy reduction potential.

Yet, even with good returns, the wastage of energy is still extensively prevalent due to a variety of factors since too often energy and its management is characterized as:

- Decentralized
- Poorly-coordinated
- Focused on paying bills & running the powerhouse
- Reactive

- Undervalued
- Considered capital intensive

Often measuring, recording and reporting such energy use relies heavily on the presence of systems and personnel within the organization and their levels of influence. It is in this context that energy management is being increasingly viewed as a source of value and opportunities. Energy management system (abbreviated as EnMS) supports taking a strategic view on energy around cost, supply, reliability and environmental impacts of the required energy.

ISO 50001 Energy Management System

ISO 50001:2018 is an ISO standard that specifies requirements to create, implement, maintain and improve an energy management system, whose purpose is to enable an organization to follow a systematic approach in achieving continual improvement of energy performance, including: energy efficiency, energy use and consumption.

Enabling ISO 50001: A Strategy Outline

Globally, amongst key motivators to initiate energy management in the organizations, following two are key parameters:

- the price of energy
- the presence of a national policy

In the Indian context, while the above two factors are prevalent, yet the ISO 50001 standard uptake in India is un-even (just 608 till end-2017), due to a few additional reasons which can be considered inter-alia:

- High Transaction costs of establishing the ISO 50001 and continual monitoring of data
- Intent for energy performance improvement seen overlapping with ISO 9001 and ISO 14001
- Data transparency required on organizational data (this may improve due to reforms like GST)
- No immediate benefits boosting sales
  - o ISO 9001 and 14001 often seen 'required' under Government procurement
  - o access to Govt. subsidy or financial assistance

BEE can benefit and contribute to the Energy Management by encouraging ISO 50001 adoption. Globally, Governments have pursued various approaches to promote ISO 50001, which may be categorized into three:

	Incentive	Mandatory	Market based
Uptake speed	1-3 years	1-2 years	3-5 years
Prerequisite	Energy intensive sectors	Tight law enforcement	Compelling business case and/or rise in energy prices
Government Focus area	Tax reductions	Set reasonable targets	Capacity building of supporting infrastructure like technical assistance, tools, consultants etc.

Table 10: Approaches to ISO 50000

In the Indian context, the BEE can support initiatives to accelerate the adoption of ISO 50001 in industrial, commercial, and institutional facilities and national campaigns to expand the market for energy efficiency.

8.10 Knowledge Exchange Platform (KEP)

There is a need to accelerate knowledge transfer to facilitate peer to peer learning, exchange best practices and expose the Indian industry to innovative approaches to energy management and upcoming technologies in this area at the international level. This would not only help in better implementation of the existing schemes of BEE, but also create a forum for policy discussion and formulation as the schemes of Bureau moves forward.

Keeping this in view, a Knowledge Exchange Platform (KEP) was formed is partnership with Institute of Industrial Productivity (IIP), which has aggressively taken this motive further. Focusing on the PAT industries, the primary objective of this scheme included:

a) Encourage peer to peer learning and facilitate exchange of knowledge and information within a particular industry sector to help the lagging industrial units improve the e-fficiency of their operations
b) Facilitate exchange of energy management best practices across sectors in common areas like utilities, where there is a high possibility of replication
c) Facilitate sharing of information/ capacity building on upcoming approaches to energy management and to new and innovative technological choices for promoting energy efficiency available at the international level.
d) Create a vibrant platform for industry & BEE interface not only for smoother implementation of PAT but also for policy discussion to aid sustained actions on industrial energy management

KEP gained much appreciation with its achievements such as , Sector Learning Group (SLG), Sectoral Best Practice Workshops, Energy Auditor (EA) and Energy Manager (EM) Forum, Service Package for Advancing Resource Conservation, forum facilitating sustained periodic discussions and dialogue between BEE, Industry and other relevant stakeholders.

The success of KEP has showcased how such platforms provide excellent opportunity for learning and improvement. Taking the experience of KEP for PAT sectors, more programme specific platforms may be operationalized for better and accelerated learning by the respective sectors.

8.11 Platform for Peer to Peer Knowledge Sharing

A lot is being done is different capacities across the sectors which might or might not require considerable investment, but yield greater benefits. There are many technologies and practices which are free from Intellectual Property Rights (IPR) and are being implemented in industries. Sharing of experiences among

the industries and disseminating the knowledge will ensure better adoption of energy efficiency in the industries. Massive Open Online Course (MOOC) could also be an effective option for quick dissemination of relevant information.

8.12 Development and Capacity Building of ESCOs

The major barrier for implementing energy efficiency projects are upfront costs. An important goal of efficiency policies and programs is to help minimize these upfront project costs so owners are encouraged to invest in energy efficiency improvements and significant retrofits. Various entities offer these types of financing for energy efficiency upgrades, including utilities, central, state and local governments, and energy service companies (ESCOs). ESCOs are companies which offer energy demand reduction services, often financed through so-called 'performance contracting', where the energy savings generate cash flow which pays for the installation of the equipment and a margin.

The success and prevalence of the financing programs, however, has been low due to their complexity and challenges. In the field of dedicated energy efficiency finance via energy service companies (ESCOs), a range of well documented challenges are encountered. Another such challenge is the need for a stronger policy environment to establish the conditions that will attract large-scale ESCO activity.

To help the ESCOs on the financial front, BEE has come up with Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) and Partial Risk Sharing Facility (PRSF). BEE also does empanelment of ESCOs through a process of grading carried out by SEBI Accredited rating agencies CRISIL/CARE/ICRA indicating capability in implementation of energy efficiency projects through performance contracting based on availability of technical manpower, financial strength, market position etc. BEE has empaneled 125 ESCOs by BEE as of March 2019. The energy efficiency market in India is estimated to be worth around INR 150,000 Crore.

For capacity building of ESCOs, BEE in partnership with State Designated Agencies and other partner agencies in the future may involve:

- Capacity building of financial institutions and ESCOs by training workshop, international tour programme, web-based tool for assessment of Energy Efficiency projects and its savings, training manuals on viable and new Energy Efficiency technologies, guidelines for ESCO business model
- Pilot projects with few banks for financing Energy Efficiency projects.
- Study for introducing new financing mechanisms under Framework for Energy Efficient Economic Development (FEEED).

Actionable Points- Strategies for capacity building and awareness on energy efficiency	
Capacity Building of DISCOMs	Promoting use of analytical tool to assess data for load management, demand shift, etc. to formulate DSM action plan and implementation of DSM activities
Awareness in school Children	Module on Energy Efficiency for school children National level Painting competition for school children Energy Clubs in schools
Certification Examination for Energy Managers and Energy Auditors	Enhancing the curriculum; accreditation and empanelment of auditors
ESCO	Improving capacity through workshops, trainings etc.
Energy Management System	Promoting Energy Management by encouraging ISO 50001 adoption
National Energy Conservation Award (NECA)	Expand the scope of NECA to more sectors. Making the application and evaluation process online
Capacity building of operators and supervisors	Dedicated training modules for the operators and supervisors of utilities, Massive Open Online Course
Campaign for Optimum Space Cooling	Generating consumer awareness and benefits in maintaining air conditioning temperature at 240C or more
Knowledge sharing/ Exchange Platform	Sectoral platforms to be operationalized for better and accelerated learning by the sectors including peer to peer learning, Massive Open Online Course

9. Fiscal Instruments and Incentives for Low Carbon Growth

Finance is the key element for success of any programme. India's finance requirements largely depend on budgetary sources. The availability of funds for such purposes is largely guided by the overall resources and requirement of different sectors. However, India is not solely relying on budgetary resources and is experimenting with a careful mix of market mechanisms together with fiscal instruments and regulatory interventions to mobilize finance for climate change.

9.1 Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE)

It is a risk sharing mechanism to provide financial institutions (banks & NBFCs) with a partial coverage of risk involved in extending loans for energy efficiency projects. PRGFEE Rules have been notified by Ministry of Power in May 2016. PRGFEE guarantees 50% of loan amount or Rs. 10 crores per project, whichever is less. PRGFEE support has been provided to government buildings, private buildings (commercial or multi-storied residential buildings), municipalities, SMEs and industries. Financial Institutions namely Andhra Bank, YES Bank, IDFC Bank, Tata Cleantech Capital Ltd and IndusInd Bank have been empaneled by BEE.

Government of India has approved Rs 311.58 crore for Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) and it is expected to mobilize investment of more than Rs 800 crore.

9.2 Venture Capital Fund for Energy Efficiency (VCFEE)

VCFEE is a fund to provide equity capital for energy efficiency projects. The Fund shall provide last mile equity support to specific energy efficiency projects, limited to a maximum of 15% of total equity required, through Special Purpose Vehicles or Rs. 2 crores, whichever is less. Venture Capital Fund for Energy Efficiency (VCFEE) Rules were notified in March 2017.

The support under Venture Capital Fund for Energy Efficiency (VCFEE) has been provided to only government buildings, private buildings (commercial or multi-storey residential buildings) and municipalities. It is proposed to convert VCFEE into a revolving fund of Rs. 100 crores and to cover MSMEs and industries under VCFEE.

9.3 Partial Risk Sharing Facility (PRSF)

Similar to PRGFEE, BEE is supporting one more guarantee programme for energy efficiency. PRSF has been established by Clean Technology Fund (USD25m) per project and Global Environment Fund (USD12m).

Partial Risk Sharing Facility (PRSF) provides guarantees to the Participating Financial Institutions (PFIs) i.e. Banks/NBFCs for the Energy Efficiency loans extended by them to Energy Service Companies (ESCOs). The project provides partial credit guarantees to PFIs to cover a share of default risk faced by them in extending loans to Energy Efficiency (EE) projects implemented by the Host entity through Energy Service Companies (ESCOs) after entering into Energy Saving Performance Contracts (ESPC). The World Bank is the implementing entity of the project with SIDBI being the Project Executing Agency. Bureau of Energy Efficiency provides guidance in policy and prioritizing issues to SIDBI. The extent of guarantee coverage under PRSF is 75% of the loan amount or Rs 15 crore, whichever is minimum. The implementation of PRSF has resulted in energy saving of more than 34,000 MWh / year and GHG emission reduction of more than 31,000 t CO2/year.

9.4 Energy Efficiency Financing Facility (EEFF)

EEFF is a proposed financing initiative of Bureau of Energy Efficiency for creating a dedicated financing facility for taking care of financing requirements of large industries, project aggregation approach covering MSME clusters/ESCO projects, etc. It is proposed that this facility shall be anchored by a Public Financial Institution. Key characteristics of this facility would be:

- EEFF will support financing of projects for large industries, municipalities, ESCOs, OEMs and lenders (for re-financing).
- Project aggregation approach will be followed across industries or clusters or technologies to ensure that small sized projects can be financed under EEFF.
- It will also support other large energy efficiency related projects under smart grids and Electric Vehicles and Charging Infrastructure which are becoming important priorities for India. Such project financing will be subject to market testing and will be launched using aggregator model.

9.5 Framework for Energy Efficiency Financing

Under Energy Efficiency Financing Platform (EEFP), a platform has been developed to interact with financial institutions and project developers for implementation of EE projects. BEE signed MoU with Indian Banks' Association (IBA) for carrying out the Training Program on Energy Efficiency Financing for Financial Institutions with an objective "to build greater knowledge and confidence through training programme within the financial sector on EE financing". This training programme was launched in two phases. In Phase 1 BEE

completed 4 Training of Trainers (ToT) regional workshops and in phase 2 various individual training workshops have been organized since 2017 and till March 2019 more than 650 banking/NBFC officials have been trained from more than 60 banks and NBFCs. BEE has covered 100% of the Public sector banks, which is a major achievement in energy efficiency financing.

Total scheduled commercial banks	88
Total financial institutions (banks/NBFCs) covered under training programme till date	60 (46 banks + 14 NBFCs)
Banks covered under training programme	46 (52% of scheduled commercial banks)
NBFCs covered under training programme	14
Public sector banks covered	100% (all 21 public sector banks)
Private sector banks covered	50% (11 out of 22 banks)

BEE has also issued following publications under EEFP:

a) Training Manual for Energy Efficiency Financing in India
b) Success stories of Energy Efficiency Projects Financed in India
c) Market Assessment for Partial Risk Guarantee Fund for Energy Efficiency and Venture Capital Fund for Energy Efficiency.
d) Guidelines for Financing Energy Efficiency Projects in India

Future plans:

1. State level committees of financial institutions shall be formulated to address any challenge in seeking finance for any EE project. Most of the banks participated during the training programme shall be the members of these state level committees.
2. BEE shall create online structure for receiving willingness from industries and other stakeholders to seek finance for Energy Efficiency projects and will also create online database of all the 650 trained staff of FIs on EE financing. This will provide access to stakeholders for seeking finance from different financial institutions.
3. To organize conferences like "investment bazars" in various states through SDAs for bringing all lenders and borrowers (industries/ establishments/ OEMs) at one place.
4. To work towards including energy efficiency projects/ EE technologies under priority sector lending.

9.6 Other Financing Initiatives

In India it is noted that various Ministries as well as state governments are managing different financing initiatives

for supporting industries and weaker sections of the society. A few important financing initiatives under the Central and State Governments related to technology upgradation and development of specific sectors are as follows:

Central Government schemes:

1. Technology Upgradation Fund Scheme (TUFS), Ministry of Textiles.
2. Scheme for Technology Upgradation/ Establishment/ Modernization for Food Processing Industries, Ministry of Food Processing Industries.
3. Integrated Development of Leather Sector (IDLS), Ministry of Industries & Commerce.
4. Credit Linked Capital Subsidy Scheme for Technology Upgradation (CLCSS), Ministry of MSME.
5. Technology & Quality Upgradation Support for MSMEs (TEQUP), Ministry of MSME.

State Government schemes

1. Assistance of Capital and Interest Subsidy for MSMEs (except service enterprise) Industries Commissionerate, Government of Gujarat.
2. New Enterprise Cum Enterprise Development scheme (NEEDS), MSME - Govt. of Tamil Nadu.
3. Mukhya Mantri Yuva Udyam Yojana Department of MSME, Madhya Pradesh.
4. Margin Money / Subsidy Scheme – Seed Money Scheme, Government of Maharashtra
5. U.P. Micro and Small Industries Technology Upgradation Scheme, Ministry of Industries, Govt. of Uttar Pradesh
6. Investment Promotion Subsidy on Fixed Capital, Govt. of Karnataka
7. Tripura Industrial Investment Promotion Incentive Scheme-2012 (TIIPIS), Department of Industries & Commerce, Govt. of Tripura

Actionable Points- Fiscal instruments and incentives for low carbon growth	
Mobilize energy efficient investment	Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) Venture Capital Fund for Energy Efficiency (VCFEE) Partial Risk Sharing Facility (PRSF) Energy Efficiency Financing Facility (EEFF)
Other initiatives	Capital subsidy scheme, Interest subvention scheme, Green bonds etc. to support energy efficiency financing for Industries, MSMEs, buildings and any other areas having substantial energy saving opportunities.

10. Research & Development and Innovation

Research & Development is critical in advancing energy efficiency in a country and can be done by promoting the creation, development, and commercialization of new, energy-efficient technologies and practices. It has been recognized under the EC Act, 2001, that the BEE is empowered to promote Research & Development in the field of energy conservation. A diverse set of institutions, including central and state governments, universities, and utilities fund and implement R&D programs for the purpose of advancing energy efficiency. Such programs include basic research in the development of energy-saving technologies and their deployment through public/private partnerships.

R&D efforts can address a number of market failures that impede the diffusion of new, energy-efficient technologies and practices. Private industry investments, for example, may be too fragmented in a particular sector to fund significant energy efficiency R&D. Also, deployment time frames may be too long, or investment risk may be too great for any one business. The projected return for a particular energy application may be lower than for other non-energy investments. Finally, competitive and financial market pressures make it increasingly difficult for the private sector to take full responsibility for long-term R&D. However, industry can benefit from government and institutional R&D efforts that provide a nonproprietary knowledge base, specialized resources, and risk-sharing. Creation of regional incubators and accelerators for industry clusters may also help uptake of energy efficient technology.

Actionable Points- Research & Development and Innovation	
Research & Development and Innovation	Promote public/private partnerships, incubators and accelerators, basic R&D on energy efficient technology
Information Technology	Leveraging ICT tools such as I.O.T and A.I. to bring about energy efficiency

11. Institutional Arrangement

Bureau of Energy Efficiency currently works with a number of organizations that support the activities on Energy Efficiency. These organizations are:

Related Line Ministries

Some schemes, such as PAT involves a number of sectors which are under different ministries. These ministries are consulted in implementing the scheme. The role of Ministries is to provide support during the implementation process of a scheme. This may be through providing information on a subject/ topic, giving suggestions for modifications, giving guidelines and directives to their sectors, etc.

State Designated Agencies (SDA)

Under the EC Act, every state shall designate a nodal body for the implementation of the Act. This nodal body is known as the state designated agency. The role of SDA is to facilitate the implementation of the EC Act and other schemes of BEE in their respective state. Currently there are 35 SDAs, where in most of them are renewable energy development agencies, chief electrical inspectorate, and DISCOMs, with additional charge of being the SDA for the state. However, there are a couple of states which have a dedicated SDA for activities on energy efficiency.

Central Electricity Authority (CEA)

CEA being the chief advisory body of Ministry of Power, is one of the key stakeholder in undertaking the activities related to energy efficiency in Power Plant. CEA is one of the technical committee member for PAT scheme, the committee responsible for establishment of key indices like targets, baseline, etc., accreditation council, NECA, etc. CEA provides technical input to issues and concerns raised under PAT scheme, especially for Power Plants.

Central and State Electricity Regulatory Commission (CERC & SERC)

CERC is the market regulator for trading of ESCerts and is represented in the various technical committees of the Bureau. CERC issues directives for trading procedures. SERCs are responsible for the adjudication under the EC Act.

Power System Operation Corporation Limited (POSOCO)

POSOCO is the registry for the ESCerts trading mechanism under the PAT scheme. It facilitates the trading process by

verifying the number of ESCerts allotted to the individual designated consumers.

Power Exchanges

The two existing power exchanges in India namely IEX and PXIL provide a platform for ESCerts trading under the PAT scheme.

Industries

Industries are one of the key stakeholders under various schemes of the EC Act. Under PAT, large energy intensive industries are covered as designated consumers. Under the schemes for SME cluster the medium and small-scale industries are the stakeholders. Railways and distribution companies are also stakeholders under the PAT scheme. Manufacturing industries also form part of stakeholders as they come under the S&L programme.

Energy Auditors

The Energy Auditors forms one of the most crucial stakeholders. The Accredited Energy Auditors and The Empanelled Accredited energy auditor firms are responsible for carrying out various audits and verification exercises under different schemes of the BEE.

Industrial Associations

There are several associations of various industrial sectors that are part of technical committee for that sector. These associations provide valuable inputs on specific sector related issues. Some associations also carry out capacity building activities for industries and auditors.

Non-Profit Organizations/ societies/ other organizations

Various non-profit organizations and societies are working hand-in-hand with Bureau in the implementation of the EC Act. Some of such organizations are TERI, NPC, CII, FICCI, etc. These organizations have a role in various programmes ranging from providing advisory services, consultancy, technical guidance, capacity building, evaluations, etc.

Development Cooperation

There are several bilateral and multilateral development cooperation partnering specific programmes with Bureau of Energy Efficiency. These organizations are German Development Cooperation Programme (GIZ & KfW), USAID, United Nation Development Programme (UNDP), United Nations Industrial Development Organization (UNIDO), World Bank, Asia Development Bank(ADB), Swiss international cooperation agency, British Official Development Assistance, Japan International Cooperation Agency (JICA), etc.

Consultants

There are various organizations carrying out the activity of energy efficiency on consultancy basis, like impact assessment, need assessment, feasibility study, etc. for various programmes under the Act.

State Nodal Agencies (SNA)

SNA are usually central PSUs designated as SNA for carrying out the activity of national painting competitions for school

children. The function of SNA is to coordinate the activities of the painting competition.

Other Government bodies

There are several Government bodies which are roped into the activities of energy efficiency. These are Municipalities, Urban Local Bodies, State Education departments, Urban Development departments, etc.

Education board, schools and societies

These are stakeholders in the national painting competitions for school children. They are responsible for coordinating and conducting the painting competition.

12. Monitoring, Reporting and Verification (MRV)

Credible information is essential for arriving at any substantive regulatory and policy decisions. Such information enables assessment of the performance and effectiveness of plan and programmes implemented and to explore way forwards. Information can enhance policy performance and public accountability. Around the world, countries are increasingly adopting systems to monitor and evaluate information for both prospective policy assessment and retrospective policy evaluation.

For climate change policy, the quality of information is more crucial than ever. Any climate policy will need MRV to assess its effectiveness and impacts. A well-designed system of monitoring, reporting and verification (MRV) will be essential for the success of the evolving international climate regime. The new climate regime can make progress by designing MRV provisions that collect necessary, sufficient and accurate data in ways that countries find acceptable. Complex MRV may deter participation and ambition; low-cost but effective MRV may encourage participation and ambition. To succeed, a system of MRV will need to be designed in a way that enhances the benefits and reduces the costs of information.

MRV has been addressed in past climate agreements, such as the national communications and emissions inventories under the UNFCCC. The MRV system needs to be made more robust and customized with respect to sectors and regions.

The prospect of MRV (including its scope and cost) will have an important role in shaping the climate policies that countries adopt and implement. The successful implementation of any results-based programme will largely depend on the credibility of its measurement, monitoring, reporting and verification of performance. Best practices such as mid-term reviews, establishment of sectoral baselines/ databases will also aid implementation.

BEE has evolved with customized MRV systems including deemed savings based MRVs for specific programmes, e.g. PAT, BLY, S&L, etc. These MRV systems are robust and cost effective. A cadre of Energy Auditors has also been created with the specialization of carrying out the verification exercise. The learning from the implementation of such MRV systems needs to be broad based to other sectors and programmes of the BEE.

Actionable Points- Monitoring, Reporting and Verification	
Monitoring, Reporting and Verification (MRV)	Standardized baseline establishment, assessment of savings for ESCO projects and further refinements in M&V guidelines under PAT and other programmes

13. Resource requirement and Timelines

The activity wise fund requirement for the programmes till the year 2020-2025 are mentioned in the table below (all figures in crores INR):

S. No.	Sub-Head	2020-21	2021-22	2022-23	2023-24	2024-25	Total
1	Standards & Labeling*	25.00	27.50	30.25	33.28	36.60	152.63
2	Building Energy Efficiency	45.00	49.80	54.00	60.00	65.00	273.80
3	Providing financial assistance to the SDAs to coordinate, regulate & enforce efficient use of energy & its conservation at the State level	125.00	145.00	156.00	172.00	194.00	792.00
4	Demand Side management in Agriculture, Municipalities, SMEs and DISCOMs	75.00	85.00	93.50	102.85	113.14	469.49
5	Awareness and Outreach Campaign	155.00	170.50	187.55	206.31	226.94	946.29
6	BEE- External Aided Project	13.50	15.00	17.00	17.00	17.00	79.50
7	NMEEE - PAT	56.00	63.00	71.00	99.00	100.99	389.00
8	PRGFEE/VCFEE	250.00	200.00	200.00	200.00	250.00	1100.00
	Grand Total	**744.50**	**755.80**	**809.30**	**890.44**	**1002.67**	**4202.71**

* The expenditure for S&L scheme to be met from Energy Conservation Fund maintained by BEE

The details of the manpower requirement is attached as Annexure.

14. Issues and Challenges

Like any other schemes, Bureau has faced many issues and challenges in the ongoing activities. While it has resolved some of them learning from the past experience and developing solutions to address them, some major challenges are still predominant in the energy efficiency sector which are as follows:

Energy Efficiency Financing

Financing still continues to be the grey area in this sector. Energy efficiency financing is still considered to be loaded with high risks in most of the cases. Industries are hesitant to invest with the perception of larger return on investment period. Banks are also sceptical on the projects being undertaken on energy efficiency. ESCOs are facing shortage of adequate funds thereby stalling the projects on ESCO mode and restricting their adequate institutionalization. Though various schemes are in place and picking up the required momentum, still awareness and capacity building on these are required.

Awareness among Financial Institutions

Energy Efficiency Financing through commercial banks and NBFCs is facing the lack of awareness and capacity to understand the EE Financing concepts like factors to be considered during appraisal process, technical risk appraisal considerations, etc. At the same time, ESCOs and Industries lack adequate understanding of project financial appraisal concepts.

Capacity Building and Awareness of end users

Stepping up the efforts being made towards training and capacity building as well as experience and knowledge exchange across various stakeholder groups. Measures may also be considered towards augmenting the technical competence in the process side among AEAs / EmAEA.

Efforts on awareness for various programmes such as labels in appliances is required to be increased. In general, increasing awareness on energy efficiency will induce a behavioural change in the common masses.

Enforcement and Monitoring Reporting & Verification (MRV)

The verification system for various programmes needs strengthening. The M&V system of the PAT scheme in particular is

very exhaustive and the auditing agencies involved lack the required expertise. The system needs to be made robust in terms of the quality of reporting. Strict enforcement of the provisions under EC Act is one of the most crucial factor hindering the progress in energy efficiency.

State Designated Agencies (SDA)

Except for some SDAs which has a separate and exclusive state designated agency (SDA), in all other states mostly the renewable development agencies, electrical inspectorate or the DISCOMs have been given the additional responsibility of functioning as the SDA. Hence, it is difficult for them to implement the activities pertaining to the EC Act, effectively. Some of them do lack the required manpower support needed for this activity, despite BEE giving them the manpower and financial support. A lot of problems are being addressed by BEE, but the solution is perhaps a dedicated SDA in the state with adequate and appropriate manpower and resources.

Also, BEE need to establish its regional offices to guide and steer energy efficiency through SDA/ State BEE in concerned State/UT.

Energy Auditors

As Energy Auditors are a key stakeholder who are responsible for the verification for the activities, they need to be very competent. The quality of audit and verification has been a major concern in PAT Cycle-I. Efforts needs to be made to strengthen these auditors.

Implementation through ESCO route

Implementation of EE projects through ESCO route is one of the tried and tested mechanisms to achieve scalability in many parts of the world. However, this mechanism has not seen much success in India. This is primarily due to the difficulty to undertake M&V in a reliable manner based on a standard M&V protocol, along with lack of understanding and financing. All these factors in combination with the other sector deficiencies have been the major barriers to realization of the objectives of improving energy efficiency.

15. Outcomes and Way Forward

It is expected that the savings from the activities in the proposed schemes will contribute significantly to the India's NDC commitment.

15.1 Projected Outcome

The expected thermal energy savings from this scheme is shown below:

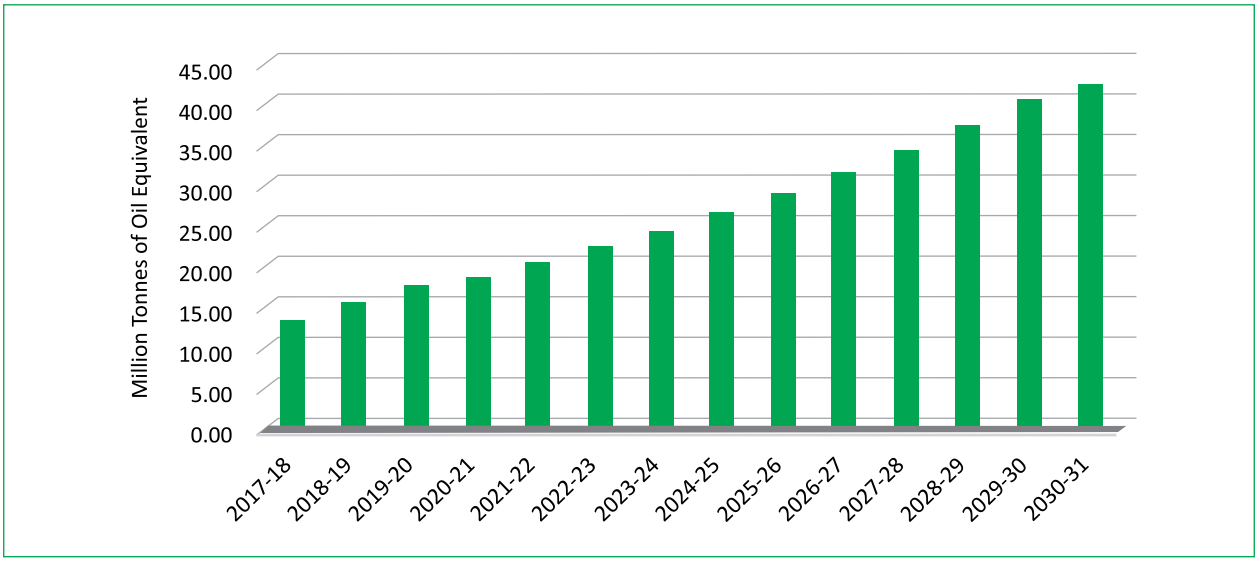

Figure 15: Total Thermal Savings (in million Tonnes of oil equivalent)

The programme wise projected thermal savings are as below:

Programmes/ Activities	2017-18	2020-21	2025-26	2030-31
Industries (Thermal savings in PAT)	13.02	18.49	28.46	42.07
Heavy duty vehicles	0.16	0.18	0.50	0.64
Total	**13.19**	**18.67**	**28.96**	**42.71**

Table 11: Total Thermal Savings (in million tonnes of oil equivalent)

The expected electrical energy savings from this scheme is shown below:

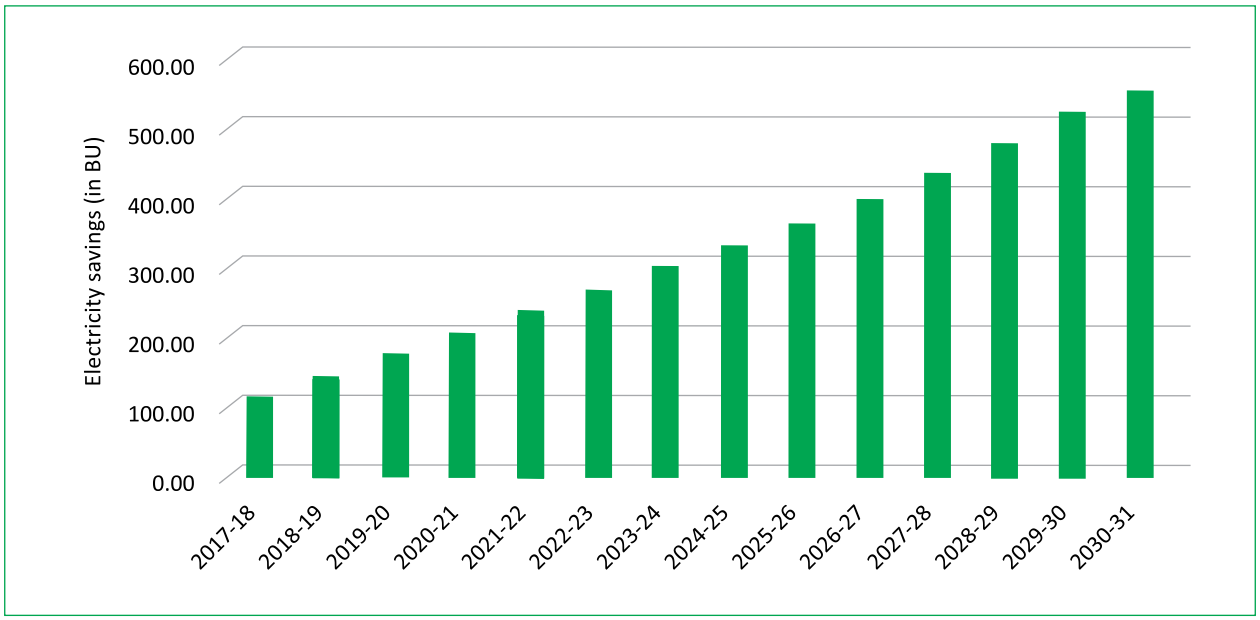

Figure 15: Total Electrical Savings (in BU)

The programme wise projected electrical savings are as below:

Programmes/ Activities	2017-18	2020-21	2025-26	2030-31
Standards and Labeling program for appliances	54.53	78.15	137.73	242.73
Energy efficiency in Buildings	1.56	4.81	10.71	15.55
Industries (PAT Scheme _ Electrical savings)	0.29	0.37	0.54	0.78
DISCOMs (PAT Scheme)	0.00	22.66	50.41	76.69
National Energy Conservation Awards (NECA)	1.45	1.68	2.14	2.73
LED Ujala	28.05	65.71	100.19	132.12
LED Street Lighting National Program (SLNP)	0.71	2.51	6.56	12.67
Total savings at consumer end	86.59	175.89	308.29	483.27
T&D losses (Factor)	1.25	1.21	1.18	1.15
Total Savings at generation end	**108.05**	**213.43**	**363.51**	**557.85**

Table 12: Electrical Savings (in BU)

The CO2 mitigation from thermal and electrical energy savings potential from the activities under the mission is shown below:

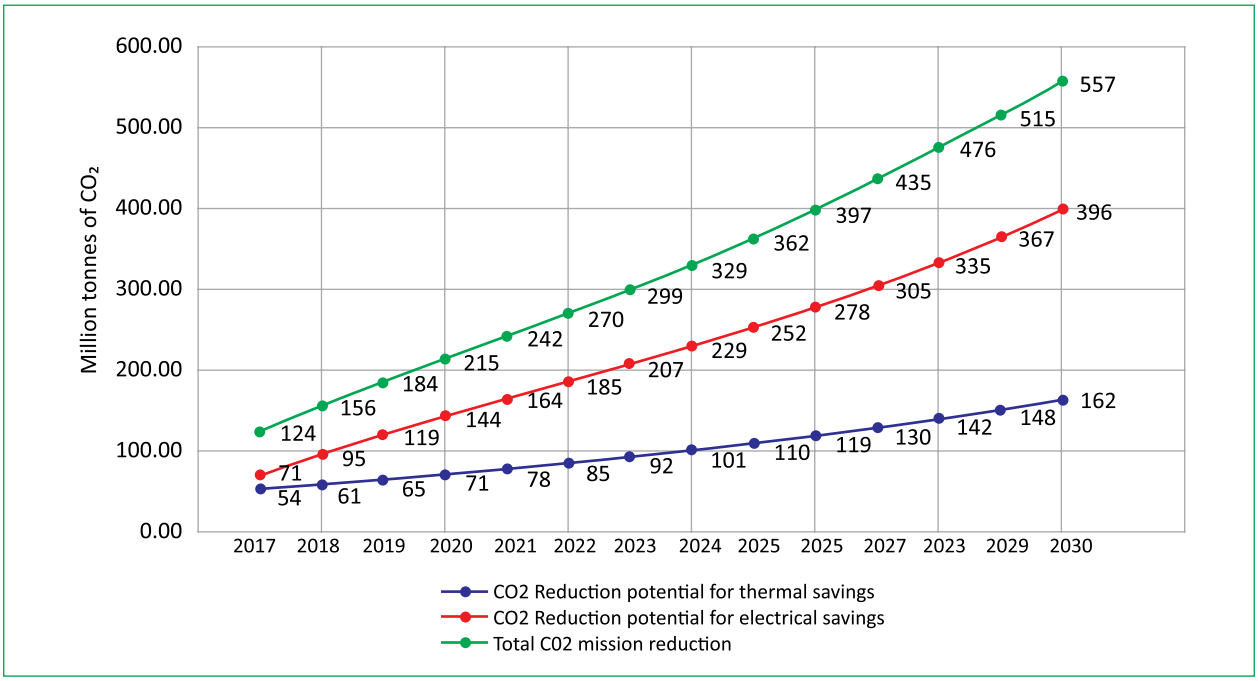

Figure 16: Total CO2 emission reduction from the scheme

15.2 Mission's Contribution to NDCs

As per a latest report by TERI, energy sector contributed to 71% of the total CO2 emissions in 2010. The study suggests that as per the current use of energy efficient technologies, India may be able to achieve the lower end of the NDC, i.e., 33% reduction in emission intensity against 2005 baseline. The study also suggests that with larger penetration of energy efficiency, India may achieve 41% reduction in emission intensity. The mission would aim to tap this enhanced potential through additional activities. The projected savings from the existing activities is anticipated to be around 557 Million tonnes of CO2.

In continuation to the above, Bureau of Energy Efficiency has also developed a National Strategy Plan for Energy Efficiency to address India's environmental and climate change commitments. The new document "UNNATEE" lays a framework and implementation strategy, in the short, medium and long term, to establish a clear linkage between energy demand scenarios and energy efficiency opportunities. The national target for energy efficiency savings and implementable roadmap to be achieved in the next fourteen years has been established through the UNNATEE document. The energy saving potential of the country is estimated to be 86.9 Mtoe by year 2031 with the highest saving potential in Industrial sector (in the Moderate Savings Scenario). The

estimation of energy savings potential sector-wise under the two scenarios i.e. moderate and ambitious scenarios are given in the following table:

Sector	Moderate Savings – 2031		Ambitious Savings - 2031	
	Mtoe	%	Mtoe	%
Agriculture	5.7	9%	9.9	15%
Transport	15.8	7%	23.8	10%
Domestic	12.1	12%	15.1	15%
Commercial	4.9	17%	6.4	22%
Municipal	0.9	12%	1.5	19%
Industries	47.5	11%	72.3	16%
Total (mtoe)	**86.9**	**10%**	**129.0**	**15%**

Table 13: Estimation of energy savings potential

Further, talking in terms of emissions reduction, the target energy emissions in India for 2030, in absolute terms should be less than or equal to 6,807 MtCO2e. The emission reduction by 2030 in the moderate savings scenario highlights that around 50% of the savings can be achieved through energy efficiency alone. Thus, it is deduced that India's NDC commitments would be met under Moderate scenario, which includes ongoing and future anticipated activities on energy efficiency. The estimate of emissions reduction sector –wise under the two scenarios i.e. moderate and ambitious scenarios are given in the following table:

Emission Reduction (MtCO2e) - 2030	Moderate Savings Emissions	Aggressive Savings Emissions
Agriculture	14	34
Commercial	34	44
Domestic	101	134
Municipal	7	11
Industrial	185	238
Transport	97	141
Total Reduction due to Energy Efficiency	**438**	**623**

Table 14: Estimation of emissions reduction

As reflected in the document, the existing schemes of BEE and the schemes proposed in the future are likely to meet the committed climate goals envisaged primarily from mitigation strategies.

15.3 Enhanced Ambitions of India in line with the Paris Agreement

India ratified the Paris Agreement on Climate Change in 2016 under which its member countries have given commitments to keep global average temperatures rise below 2-degree C by the end of century. India in its Nationally Determined Contributions (NDCs) has committed that it will reduce the emission intensity of its GDP by 33% to 35% by 2030 from 2005 level.

During the Conference of Parties (COP -26) held at Glasgow, UK, in November 2021, the Hon'ble Prime Minister of India announced enhanced climate ambitions towards achieving its climate goals. As per the updated NDC, India now stands committed to reduce Emissions Intensity of its GDP by 45 percent by 2030, from 2005 level and achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030.

In order to achieve the target of 45% emission- intensity reduction, preliminary estimation has been done by Bureau of Energy Efficiency which indicate that absolute emissions by 2030 are required to be limited around 4584 MtCO2e. This means that the overall emissions in the economy would have to be reduced by 3753 MtCO2e (over the baseline scenario of 2005 level) to successfully meet our revised NDC commitment.

The estimation of emissions reduction of 45% emission intensity by 2030 is given as below:

Projected Emissions In 2030 (in MT CO2)	2005 (Base year)	2016 (As per BUR-3)	2019 (Estimated)	Emissions on 33% reduction		Emissions on 45% reduction	
Emissions Intensity [gCO2e/INR GDP at 2011-12 prices]	**27.79 (Base)**	**21.12 (24%)**	**19.73 (29%)**	**18.62 (33%)**		**15.28 (45%)**	
GDP Projection (INR Lakh crore)		123	145	300	277	300	277
Emissions in 2030 as per base year		3418	4029	8337	7697	8337	7697
Net Emissions							
(Actual/Projected)		2597	2861	5586	5157	4584	4232
Emission reduction required (2030)				2751	2540	3753	3465
Emissions reduction achieved	-	821	1168	2418	2231	2418	2231
Additional emission reduction required 2020-30				333	309	1335	1234

As per the revised NDC commitments emissions reductions from various sectors has been identified. The emissions reduction from the supply side are estimated to be around 731 MtCo2 and that from the Demand side have been estimated to be around 740 MtCo2. The contribution to emission reduction from non-fossil based energy and energy efficiency efforts are as follows:

Emission in 2030		Emissions (MtCO2e)
Targeted Reduction (over baseline) For GDP-300/277 INR Lakh Crore		**3753 (8337 – 4584) 3465 (7697 – 4234)**
Reduction achieved (upto 2019-20)		2418/2231
Additional savings required (2020-30)		1335/1234
Energy emissions (Targeted reduction)	Power Generation (Supply Side)	731
	Energy Efficiency (Demand Side)	740/680
	Total	**1471/1411**

The sectoral break-up under the energy efficiency domain to achieve 2030 targets are given below:

Energy Emissions	Panchamrit Target Savings for 45% Emission Intensity Reduction (in MtCO2e)
Agriculture	33
Commercial	75
Domestic	116*
Municipal	17
Industrial (including	
MSME)	312
Transport	187
TPP Efficiency Improvement (to be included on supply side)	(86)
Total	**740**

* In the Domestic sector emission reduction includes contribution due to efficient appliances

The main sectors which will contribute in this regard are Industry, Transport and Buildings which together shares 90% of the estimated emission reduction of 740 MtCo2 to achieve 45% from 2005 level. For effective realization of desired goals, quantified targets to these key sectors is proposed as under.

(i) Industry:

In the Industry sector, Iron & Steel sector has the maximum potential while Cement, Aluminum, Petroleum Refinery and Pulp & Paper sectors also has substantial potential for emission reductions. The targeted emission reduction for these sub-sectors through key interventions and related programmes/schemes are given below:

Sector	Emission Reduction Targets (MtCO2)	Programme / Scheme	Nodal Ministry/ Department	Key Strategies
Iron & Steel	144	National Steel Policy, Perform, Achieve and Trade (PAT) Scheme	Ministry of Steel, Bureau of Energy Efficiency	Energy Efficiency improvement, Fuel substitution, clean technology
Cement	32	PAT Scheme	Department for Promotion of Industry and Internal Trade, Bureau of Energy Efficiency	
Aluminum	30.32	PAT Scheme	Ministry of Mines, Bureau of Energy Efficiency	
Petroleum Refinery	24.77	Refinery Improvement Programme & PAT Scheme	Ministry of Petroleum and Natural Gas, Bureau of Energy Efficiency	
Pulp & Paper	32.01	PAT Scheme	Department for Promotion of Industry and Internal Trade, Bureau of Energy Efficiency	

Textile	5.03	Technology Upgradation, PAT Scheme	Ministry of Textile, Bureau of Energy Efficiency	
Chlor Alkali	6.65	PAT Scheme	Department of Chemicals & Petrochemical, Bureau of Energy Efficiency	
Petrochemicals (Cracker units)	21.72	PAT Scheme		
Steel Re-rolling (SME)	9	Technology Upgradation, Fuel switching, RE deployment	Ministry of Medium, Small and Micro Enterprises, Bureau of Energy Efficiency	
Foundry (SME)	3.9			
Forging (SME)	2.6			
Total	**312**			

Estimation of emission reduction targets for industrial sectors

(ii) Transport:

In the transport sector, the activities identified are in three areas namely, efficiency improvement in the conventional fuel vehicles, adoption of electric mobility and modal shift to Railways. It is envisaged that the new sales of 2 and 3 wheeler segment will completely shift to electric and 4 wheeler is assumed to be 40% of total new vehicle sale by 2030. Sub-sector wise tentative emission reduction targets are given in the following table.

Area	Emission Reduction (MtCO2)	Nodal Ministry/ Department	Key intervention / Programme
Conventional fuel driven vehicle	8	Ministry of Road Transport and Highways, Bureau of Energy Efficiency	Enforcing fuel efficiency norms
Electric mobility	35	Department of Heavy Industries, Ministry of Power, Bureau of Energy Efficiency, Central Electricity Authority	Electric Vehicle (EV) policy, EV charging infrastructure
Modal shift & Net Zero Indian Railways	92	Ministry of Railways, Bureau of Energy Efficiency	Augmenting Rail Capacity & Net Zero (NZ) Rail Mission

Urban Mass transit system, Green Highways, Bio-fuels, Coastal Shipping and Inland Water Transport	52	Ministry of Road Transport and Highways, Ministry of Petroleum and Natural Gas, Ministry of Housing and Urban Affairs, Ministry of Ports, Shipping and Waterways, Bureau of Energy Efficiency	Alternate fuel technologies, low carbon infrastructure, fuel switching / Sagarmala
	187		

Estimation of emission reduction targets against transport sectors

(iii) Buildings:

The buildings sector is broadly categorized into Commercial and Residential buildings wherein implementation of Energy Conservation Building Code (ECBC) in the commercial buildings and Eco-Niwas Samhita (ENS) in residential sector is proposed to be taken up on priority. As ECBC is already notified in 22 States/UTs and expected to be notified in all the remaining states by 2025. Hence all the large new commercial buildings constructed by 2030 should be ECBC compliant.

The segregated estimates of emission reduction potential in both commercial and residential sector is as under.

Area	Emission Reduction (MtCO2)	Nodal Ministry/ Department	Key intervention
Commercial	50	Ministry of Housing and Urban Affairs, Bureau of Energy Efficiency	Adoption of ECBC in building bye-laws
Domestic (Residential)	25		Promoting Eco Niwas Samhita
Commercial	25	Bureau of Energy Efficiency	Star labelling programme for appliances
Domestic (Residential)	91		
Total	**191**		

Estimation of emission reduction targets in building sector

Annexure

Manpower Requirement

Sl. No.	Designation of Post	Scale of Pay	Sanctioned Strength	Existing Strength	Additional demands* (If any) pending over the sanctioned strength
	Group 'A'				
1.	Director General	Level -15 Rs.1,82,200 – 2,24,100	01	01	--
2.	Dy. Director General	Level -14 Rs.1,44,200 – 2,18,200	01	--	--
3.	Secretary	Level -13 Rs.1,23.100 – 2,15,900	01	01	--
4.	Senior Director/ Executive Director	Level -13A Rs.1,31,100 – 2,16,600.	--	--	04 Sr. Director
5.	Director	Level -13 Rs.1,23.100 – 2,15,900	09	06	--
6.	a) Joint Director	Level -12 Rs. 78,800 – 2,09,200	06	04	02
	b) Joint Director (Media)		0	01	01
7.	Dy. Director (Technical)	Level -11 Rs. 67,700 – 2,08,700	--	--	10
8.	Dy. Director (Media/ Fin./Admn)	Level -11 Rs. 67,700 – 2,08,700	--	--	03

Sl. No.	Designation of Post	Scale of Pay	Sanctioned Strength	Existing Strength	Additional demands* (If any) pending over the sanctioned strength
9.	PR & Media Manager	Level -11 Rs. 67,700 – 2,08,700	01	01	--
10.	Legal Officer	Level -11 Rs. 67,700 – 2,08,700	--	--	01
11.	Finance Officer	Level -11 Rs. 67,700 – 2,08,700	--	--	01
12.	Asstt. Director (Admn) Grade-I	Level -10 Rs. 56,100 – 1,77,500	--	--	03
13.	Asstt. Director (Tech) Grade-I	Level -10 Rs. 56,100 – 1,77,500	--	--	20
14.	Asst. Director (Economist) Grade -I		--	--	02
15.	Asst. Director (Economist) Grade -II		--	--	02
16.	Asstt. Director (Tech) Grade-II	Level -09 Rs. 53,100 – 1,67,800	--	--	24
17.	Asstt. Director Grade-II	Level -09 Rs. 53,100 – 1,67,800	--	--	03

Sl. No.	Designation of Post	Scale of Pay	Sanctioned Strength	Existing Strength	Additional demands* (If any) pending over the sanctioned strength
	Group 'B' (Non-Gazetted)				
1.	Sr. PS	Level -08 Rs. 47,600 – 1,51,100	01	--	--
2.	Accountant/Media Executive/ Executive Asstt.	Level -08 Rs. 47,600 – 1,51,100	--	--	06
3.	F&AO	Level -07 Rs. 44,900 – 1,42,400	01	01	--
4.	PS	Level -07 Rs. 44,900 – 1,42,400	01	01	--
5.	Accountant	Level -06 Rs. 35,400 – 1,12,400	02	02	--
6.	Accountant/ Media Executive/ Executive Asstt.	Level -08 Rs. 47,600 – 1,51,100	--	--	06
7.	Assistants (Accounts/ Media/ Administration)	Level -06 Rs. 35,400 – 1,12,400	--	--	11
8.	Stenographer	Level -06 Rs. 35,400 – 1,12,400	06	04	--
	Group 'C'				
1.	Driver	Level -02 Rs. 19,900 – 63,200	01	01	--
2.	Multi Tasking Staff	Level -01 Rs. 18,000 – 56,900	--	--	15
3.	Safaiwala/ Security Staff	Level -01 Rs. 18,000 – 56,900	--	--	10
	TOTAL		**31**	**22**	**113**

BUREAU OF ENERGY EFFICIENCY (BEE)

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