GOVERNMENT OF INDIA
MINISTRY OF POWER

NITI Aayog

STATE ENERGY EFFICIENCY PREPAREDNESS INDEX

2018

Alliance for an Energy Efficient Economy

STATE ENERGY EFFICIENCY PREPAREDNESS INDEX

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Disclaimer

This report is based on data collected by Alliance for an Energy Efficient Economy (AEEE) from State Designated Agencies (SDA), and from data available in state and central government reports, as on 14 May 2018; and has subsequently been reviewed by SDAs and the Bureau of Energy Efficiency (BEE). Every attempt has been made to ensure correctness of data. However, AEEE does not guarantee the accuracy of the data or accept responsibility for the consequences of the use of such data.

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EXECUTIVE SUMMARY

India has made significant strides in energy efficiency over the last 15 years from the enactment of the ground-breaking Energy Conservation (EC) Act in 2001 to the ratification of the Paris Agreement in 2016. The EC Act was instrumental in the formation of the Bureau of Energy Efficiency (BEE) and the State Designated Agencies (SDA) in the states. It also put in place the much needed institutional framework for formulating energy efficiency policies and implementation. Since then, BEE has developed the Energy Conservation Building Code (ECBC) for mainstreaming energy efficiency in buildings, a Standards and Labelling programme for the most energy-intensive appliances and an ambitious & innovative industrial energy efficiency program, Perform Achieve and Trade (PAT). Another milestone is NITI Aayog's energy scenario modelling tool *India Energy Security Scenarios (IESS) 2047* which offers a platform to facilitate academic and policy discourse about potential pathways for the energy sector in India. Per IESS projections, there is substantial potential to impact energy efficiency and reduce energy demand by 2047 across various energy demand sectors.

ROLE OF STATES

Within the framework of Cooperative Federalism laid down by the Constitution of India, states have a vital role in India's energy efficiency policy implementation. The State Designated Agencies (SDAs) established to co-ordinate, regulate and enforce the provisions of the Energy Conservation Act 2001 in states, are state counterparts of the Government of India's central Bureau of Energy Efficiency (BEE). SDAs have contributed significantly towards creating awareness on efficient use of energy among consumers and manufacturers, implementing demonstration projects, and supporting execution of BEE's programmes in states. The SDAs, under the mandate of the EC Act, should be further empowered to gather data on energy efficiency indicators across all demand sectors in the states. States with strong SDAs, with robust energy data reporting and excellent track record of state energy efficiency initiatives, are poised to attract more investments for energy efficiency projects, thus leading the transformation of the energy efficiency landscape in India.

STATE ENERGY EFFICIENCY INDEX

Aligned with NITI Aayog's various state indices on health, education, water, etc., the Alliance for an Energy Efficient Economy (AEEE) under the leadership of the Bureau of Energy Efficiency has developed the first State Energy Efficiency Index for India to

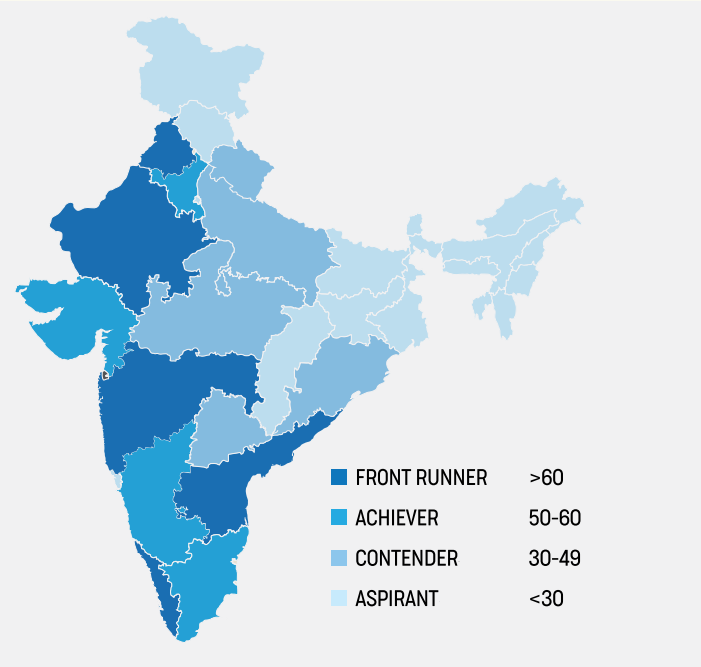
- Help drive EE policies and program implementation at state and local level
- Highlight best practices and encourage healthy competition among states
- Track progress in managing states' and India's energy footprint
- Set a baseline for EE efforts to date and provide a foundation to set state-specific EE targets

The first edition of the State Energy Efficiency Index assesses state policies and programmes aimed at improving energy efficiency in buildings, industries, municipalities, transportation, agriculture and electricity distribution (DISCOMs). The composition of the Index has been developed taking into account sector-wise energy consumption, energy saving potential and states' influence in implementing energy efficiency. It examines states' policies and regulations, financing mechanisms, institutional capacity, adoption of energy efficiency and the resultant energy savings achieved. The Index has 63 indicators in all, 59 across buildings, industry, municipalities, transport, agriculture and DISCOMs; and 4 cross-cutting indicators.

In each sector, energy efficiency indicators have been developed to measure the impact of state initiatives in driving energy efficiency in states. The indicators are both qualitative and quantitative, which include outcome-based indicators as well to signify realisation of the intended performance outcomes, to the extent possible, for various energy efficiency policies and programs.

KEY FINDINGS

The State Energy Efficiency Index categorises states based upon their efforts and achievements towards energy efficiency implementation as 'Front runner', 'Achiever', 'Contender' and 'Aspirant'. The 'Front runner' states in the inaugural edition of the State Energy Efficiency Index are Andhra Pradesh, Kerala, Maharashtra, Punjab and Rajasthan.



While most states have implemented one or more national programmes driven by BEE and EESL, the 'Front runner' and 'Achiever' states have several state initiatives as well. In the building sector, most states have implemented UJALA for energy efficient lighting, however less than half have notified the Energy Conservation Building Code (ECBC) and incorporated ECBC in municipal building bye-laws. A few states mandate energy audits for certain category of buildings and provide financial incentives for EE building construction and retrofits. In the industry sector, BEE's PAT programme is fairly well implemented, with SDAs supporting BEE's efforts. Programmes for driving

energy efficiency in Micro, Small and Medium Enterprises (MSME) and other non-PAT industries are few and far between. In the municipal sector, most states have utilised EESL's Street Lighting National Programme (SLNP) and a fair number have signed up for EESL's Municipal Energy Efficiency Programme (MEEP) for public water works and sewerage system retrofits. A few states have state-level municipal energy efficiency initiatives as well. With regard to energy efficient transportation, most states track the fuel efficiency of State Road Transport Undertakings (SRTU) which is published by MoRTH in its annual report on SRTU performance. Consumers in most states have utilised the FAME scheme to purchase hybrid/electric vehicles. In DISCOMs, the Transmission and Distribution (T&D) losses are still high in most states leading to enormous energy leakages, with only three states having T&D losses below 15%. Across all sectors, energy intensity and energy savings data are not properly tracked, owing primarily to non-existent data reporting frameworks and lack of mandates.

For 'Contender' and 'Aspirant' states, key baseline actions include notification and incorporation of ECBC in municipal building bye-laws; mandatory energy audits for buildings and industries; instituting state energy conservation awards for buildings and industries; financial incentives for ECBC compliant building construction and EE implementation in industries; implementation of projects utilising Revolving Investment Fund (RIF) under the State Energy Conservation Fund (SECF); reducing T&D losses; and notifying DSM regulations. The 'Front runner' and 'Achiever' states should further strengthen the energy reporting framework to track energy intensity and energy savings across all sectors. Additionally, all states should track and improve the energy efficiency of MSMEs, and support adoption of cleaner (switch to electric mobility), more efficient public transportation.

WAY FORWARD

Periodic release of the State Energy Efficiency Index shall help track progress in managing states' energy footprint and provide guidance in formulating data-driven, evidence-based policies and programmes at the state level. It will also contribute towards national energy data management by helping streamline energy efficiency data collection in states. The energy efficiency indicators shall be continuously revised and updated based upon the evolving EE landscape in India.

CONTENTS

LIST OF ABBREVIATIONS

ACEEE	American Council for an Energy Efficient Economy
AEEE	Alliance for an Energy Efficient Economy
APSECM	Andhra Pradesh State Energy Conservation Mission
ASCI	Administrative Staff College of India
AT&C	Aggregate Technical and Commercial
BEE	Bureau of Energy Efficiency
CEA	Central Electricity Authority
DC	Designated Consumers
DISCOM	Distribution Companies (Electricity)
DPMS	Development Permission Management System
DSM	Demand Side Management
EC	Energy Conservation
ECBC	Energy Conservation Building Codes
EE	Energy Efficiency
EESL	Energy Efficiency Services Limited
EMC	Energy Management Centre
ESCO	Energy Savings Company
EV	Electric Vehicles
FAME	Faster Adoption and Manufacturing of Electric Vehicles
GHMC	Greater Hyderabad Municipal Corporation
GRIHA	Green Rating for Integrated Habitat Assessment
IESS	India Energy Security Scenarios
IGBC	Indian Green Building Council
IGEA	Investment Grade Energy Audits
JVVNL	Jaipur Vidyut Vitran Nigam Limited
KSEB	Kerala State Electricity Board
LEED	Leadership in Energy and Environmental Design
MEDA	Maharashtra Energy Development Agency
MEEP	Municipal Energy Efficiency Program
MIDC	Maharashtra Industrial Development Corporation
MJP	Maharashtra Jeevan Pradhikaran
MNRE	Ministry of New and Renewable Energy
MoRTH	Ministry of Road Transport and Highways

MoSPI	Ministry of Statistics and Programme Implementation
MSME	Micro, Small & Medium Enterprises
MTOE	Million Tonnes of Oil Equivalent
NITI-AAYOG	National Institution for Transforming India
NRDC	Natural Resources Defense Council
PAT	Perform Achieve and Trade
PCRA	Petroleum Conservation Research Association
PEACE	Promotion of Energy Audit and Conservation of Energy
RIF	Revolving Investment fund
RISE	Regulatory Indicators for Sustainable Energy
S&L	Standards and Labelling
SDA	State Designated Agency
SEC	Specific Energy Consumption
SECF	State Energy Conservation Fund
SERC	State Electricity Regulatory Commission
SLNP	Street Lighting National Program
SRTC	State Road Transport Corporation
SRTU	State Road Transport Undertaking (same as SRTC)
T&D	Transmission and Distribution
ToD	Time of Day
TPA	Third Party Assessors
TPES	Total Primary Energy Consumption(TPES)
UJALA	Unnat Jyoti by Affordable LEDs for All
ULB	Urban Local Bodies
UREDA	Uttarakhand Renewable Energy Development Agency
UT	Union Territory

1 INTRODUCTION

Energy Efficiency (EE) is a vital pillar in sustaining the current growth of the Indian economy while also achieving development related goals. The Government of India has made excellent strides in Energy Efficiency over the last 15 years since the enactment of the ground-breaking Energy Conservation Act in 2001. This Act was instrumental in the formation of the Bureau of Energy Efficiency (BEE) and the State Designated Agencies (SDAs) in the states. It also put in place the much-needed institutional framework for formulating energy efficiency policies and implementing them. Since then, BEE has developed the Energy Conservation Building Code, a fairly successful Standards and Labelling programme for the most energy-intensive appliances, and an ambitious and innovative industrial energy efficiency program, Perform Achieve and Trade (PAT).

The EC Act empowers BEE to notify and coordinate with Designated Consumers to abide by specified norms of energy intensity across sectors. The EC Act empowers the states to notify Designated Agencies as an extension of BEE in the states to coordinate, regulate and enforce its provisions. The specific powers conferred to states under the EC Act may be broadly classified as notification of the provisions of the EC Act in the states, establishment of State Energy Conservation Funds and the power to inspect compliance with specified energy consumption standards.

The achievement of India's goals for Energy Efficiency hinges as much on the success of energy efficiency programmes in states, as in nation-wide programmes. However, an outcome-based framework to evaluate states' progress in reference to indicators like adoption of energy efficiency measures and actual energy savings achieved through these EE measures and policies across sectors has not yet been developed for states in India.

Alliance for an Energy Efficient Economy (AEEE), under the guidance and leadership of BEE and NITI Aayog, developed the State Energy Efficiency (EE) Index for each of the 29 Indian states and the National Capital Territory of Delhi. The State Energy Efficiency Index comprises 63 qualitative, quantitative, outcome-based indicators to assess energy efficiency initiatives, programmes and outcomes in 5 sectors – Buildings, Industry, Municipalities, Transport, Agriculture and Distribution Companies (DISCOMs).

The primary objectives of the State Energy Efficiency Index are to

- Help drive EE policies and program implementation at state and local level
- Highlight best practices and encourage healthy competition among states
- Track progress in managing the states' and India's energy footprint
- Set a baseline for EE efforts to date and provide a foundation to set state-specific EE targets

When performed on an annual/biennial basis the State Energy Efficiency Index will track progress in managing the states' energy footprint and provide guidance in formulating data-driven, evidence-based policies and programmes for energy efficiency in line with state-specific goals on development and sustainability.

2 APPROACH

AEEE developed the framework for the State Energy Efficiency Index under the guidance and technical leadership of NITI Aayog and BEE wherein it went through extensive review both at NITI Aayog and BEE. The composition of the Index has been developed taking into account energy consumption, energy saving potential and state influence in demand sectors – buildings, industry, municipalities, transport, agriculture – and DISCOMs.

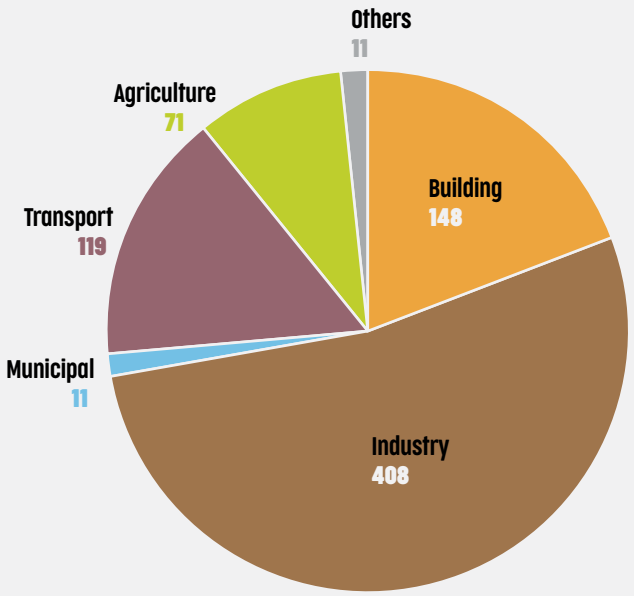
American Council for an Energy Efficient Economy (ACEEE), which has published 11 editions of the US State Energy Efficiency Scorecard and 4 editions of International Energy Efficiency Scorecard, provided technical support in developing the State Energy Efficiency Index.

The respective State Designated Agencies (SDAs) were nominated by BEE to help collect data from the concerned state departments. Apart from the data furnished by SDAs, AEEE also collected data from various central government sources such as Central Electricity Authority (CEA) General Review, Ministry of Road Transport and Highways (MoRTH) annual report on the performance of State Road Transport Undertakings (SRTU), BEE programme implementation reports, Petroleum Conservation Research Association (PCRA), Ministry of New and Renewable Energy (MNRE), and Energy Efficiency Services Limited (EESL). All the data collected from various sources was compiled and shared with the respective SDAs for their review.

The annual energy consumption in India in 2014-15 has been indicated in Figures 1 and 2. And the energy savings potential is indicated in Figure 3. Table 1 summarizes states' role in energy efficiency in each of the sectors. These data are the basis for the weightage in our scoring.

FIGURE 1.

TOTAL PRIMARY ENERGY SUPPLY 2014-15 (MTOE)

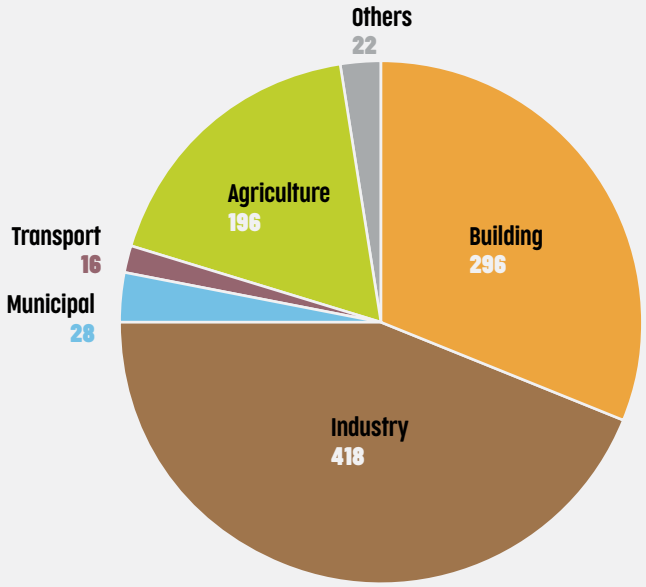


Source: Derived from MoSPI Energy Statistics 2016, and CEA General Review 2016

Note: The Total Primary Energy Supply (TPES) includes primary energy used for Electricity generation from all sources including Coal, Oil, Gas, Nuclear, Hydro, Solar, Wind, other renewables; and non-electricity generation utilisation (for energy) of Coal (in Industry), Oil products (in Building, Industry, Transport, and Agriculture), and Gas (in Industry, and Transport).

FIGURE 2.

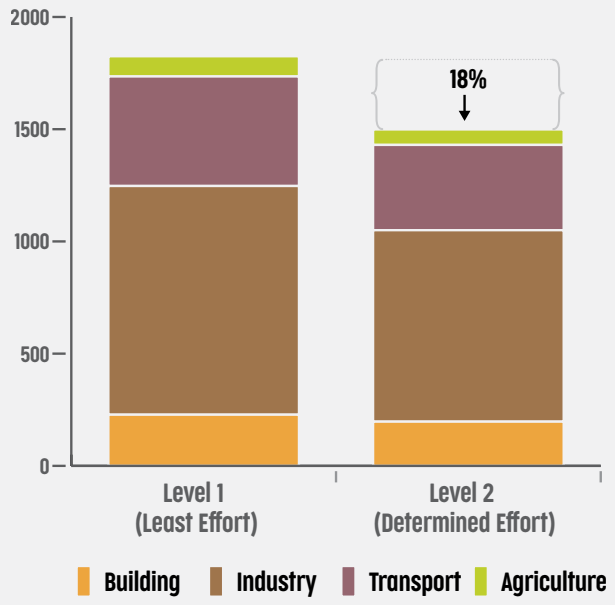
TOTAL ELECTRICITY CONSUMPTION 2014-15 (TWh)



Source: CEA General Review 2016

FIGURE 3.

ENERGY SAVING POTENTIAL IN 2047 (MTOE)



Source: Derived from NITI Aayog's IESS

Note: The graph shows the estimated energy consumption under different EE scenarios. Agriculture includes energy used for both pumps and tractors.

TABLE 1.

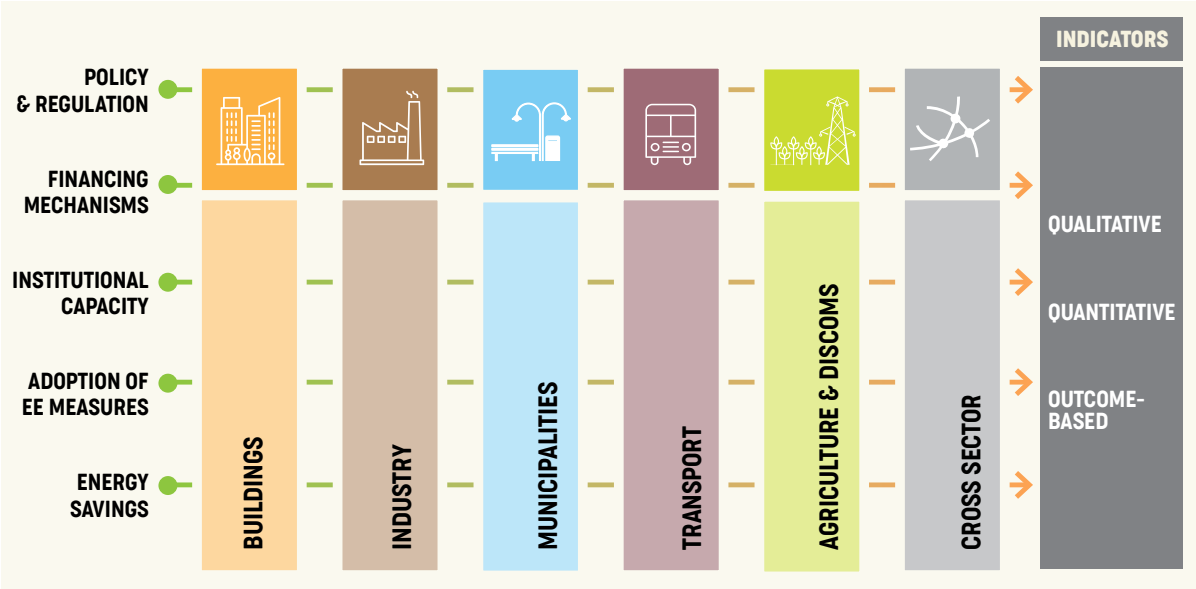
STATES' ROLES IN ENERGY CONSERVATION

Sector	States' (or the Designated Agency's) Role and Authority in Driving Energy Efficiency
Buildings	**EC ACT, SECTION 15:** Amend the energy conservation building codes to suit the regional and local climatic conditions. Notify energy conservation building codes with respect to use of energy in the buildings. Direct the designated consumers to comply with code and/or energy audit requirements and furnish requisite data at requisite time. **EC ACT, SECTION 17:** Power of inspection of buildings to check compliance with requirements of the EC Act **EC ACT, SECTION 18:** Regulation of norms for energy consumption standards in any building. Regulation of the energy consumption standards for equipment and appliances. **EC ACT, SECTION 26:** Impose penalties for non-compliance of either central or state government energy conservation regulations **EC ACT, SECTION 27, 28, 29:** Power to adjudicate the penalties imposed for non-compliance **EC ACT, SECTION 57:** Power of State Government to make rules, by notification, for carrying out the provisions of this Act and not inconsistent with the rules, if any, made by the Central Government.
Industry	**EC ACT SEC 15:** Direct the designated consumers to comply with energy audit requirements and furnish requisite data at requisite time. **EC ACT, SECTION 17:** Power of inspection of industries to check compliance with requirements of the EC Act

Sector	States' (or the Designated Agency's) Role and Authority in Driving Energy Efficiency
Industry	**EC ACT, SECTION 18:** Regulation of norms for process and energy consumption standards in any industry. Regulation of the energy consumption standards for industrial equipment and appliances including motors. **EC ACT, SECTION 26:** Impose penalties for non-compliance of either central or state government energy conservation regulations **EC ACT, SECTION 27, 28, 29:** Power to adjudicate the penalties imposed for non-compliance **EC ACT, SECTION 57:** Power of State Government to make rules, by notification, for carrying out the provisions of EC Act and not inconsistent with the rules, if any, made by the Central Government.
Municipalities	**EC ACT, SECTION 18:** Regulation of the energy consumption standards for street lighting and drinking and/or waste water pumping. **EC ACT, SECTION 26:** Impose penalties for non-compliance of either central or state government energy conservation regulations **EC ACT, SECTION 27, 28, 29:** Power to adjudicate the penalties imposed for non-compliance **EC ACT, SECTION 57:** Power of State Government to make rules, by notification, for carrying out the provisions of EC Act and not inconsistent with the rules, if any, made by the Central Government.
Transport	Road transportation under state purview State Road Transport Corporations State Transport department defines policies and regulations
Agriculture	**EC ACT, SECTION 18:** Regulation of the energy consumption standards for agricultural pumping. **EC ACT, SECTION 26:** Impose penalties for non-compliance of either central or state government energy conservation regulations **EC ACT, SECTION 27, 28, 29:** Power to adjudicate the penalties imposed for non-compliance **EC ACT, SECTION 57:** Power of State Government to make rules, by notification, for carrying out the provisions of EC Act and not inconsistent with the rules, if any, made by the Central Government.
DISCOM	**ELECTRICITY ACT, SECTION 23, 42, 61 AND 181:** Empowers State Electricity Regulatory Commissions (SERC) to make Demand Side Management (DSM) Regulations which shall be applicable for all DISCOMs in the state. **EC ACT, SECTION 17:** Power of inspection of concerned entities to check compliance with requirements of the EC Act **EC ACT, SECTION 26:** Impose penalties for non-compliance of either central or state government energy conservation regulations **EC ACT, SECTION 27, 28, 29:** Power to adjudicate the penalties imposed for non-compliance **EC ACT, SECTION 57:** Power of State Government to make rules, by notification, for carrying out the provisions of EC Act and not inconsistent with the rules, if any, made by the Central Government.
Cross Sector	**EC ACT, SECTION 15:** Create awareness and disseminate information for efficient use of energy and its conservation. **EC ACT SECTION 16:** Constitute State Energy Conservation Fund for meeting the expenses incurred for implementing EE projects

Indicators have been defined for each of the demand sectors and DISCOMs in five categories – policy and regulation, financing mechanisms, institutional capacity, adoption of energy efficiency measures and energy savings achieved. Since all the indicators for agriculture are related to DSM strategies, agriculture has been combined with DISCOMs in this first State Energy Efficiency Index.

FIGURE 4.
STATE ENERGY EFFICIENCY INDEX FRAMEWORK

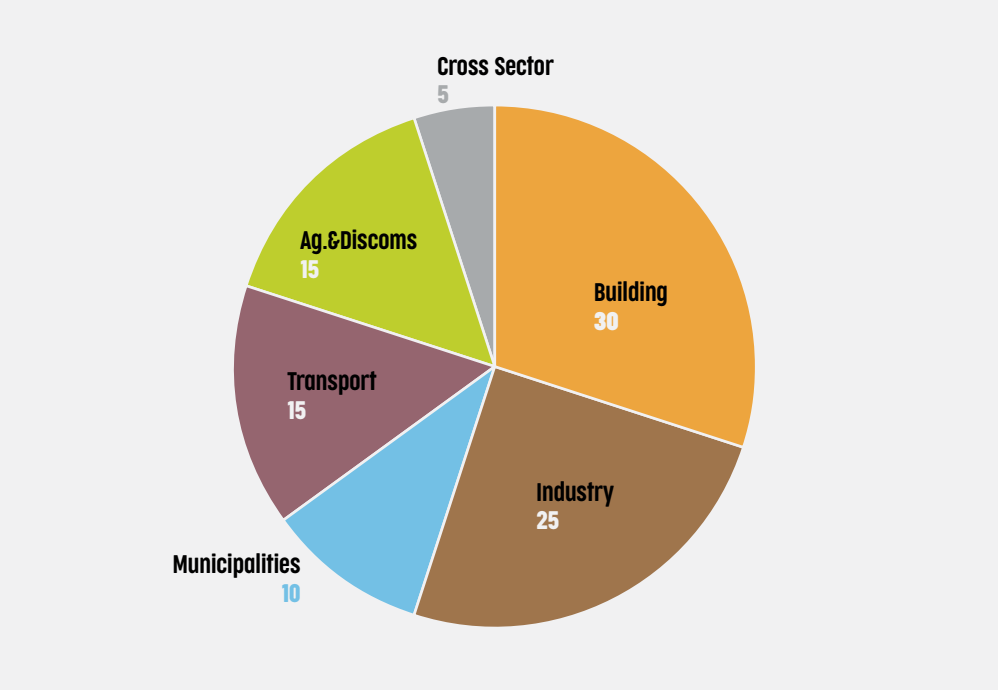


In each sector indicators have been selected based on their impact in driving energy efficiency implementation in states. The outcome-based indicators have been selected to signify energy savings and/or energy intensity. All the indicators have been structured so as to eliminate or reduce subjectivity due to State-specific conditions. Some indicators, especially those measuring energy intensity are crucial in setting a baseline for measuring progress in energy efficiency over time.

The Index was defined with a total of 80 indicators across all demand sectors taken together. SDAs were requested to provide data against these indicators, while AEEE also collected state-specific data from central government databases and reports. The latest data has been collected to the extent possible for the Index. The State Energy Efficiency Index only uses data vetted by SDAs and BEE, or data from central government databases and reports.

Of the 80 original indicators, 63 have been selected for the final Index. Indicators for which no State provided data have been removed from the State Energy Efficiency Index for this year. The sector-wise score allocation has been done taking into account energy consumption, energy saving potential and states' influence in each demand sector and DISCOMs. The number of indicators and points by sector are summarised in figure 5. The building sector receives 30% of the weight because it has many indicators, states can be very influential, and it accounts for the second highest share of energy use. The industrial sector receives 25% of the weight because it has the largest share of energy use, but there is less that states currently do for energy efficiency in this sector. Weights for the other sectors are based on similar reasoning. For most indicators, one or two points were allocated but because we have fewer industrial indicators a few of these indicators receive three points. Many indicators are simple 'yes' vs 'no' indicators but some involve data for which higher values receive maximum points and lower values less points. The detailed scoring criteria for each indicator are provided in sections for each sector.

FIGURE 5.
SCORE ALLOCATION

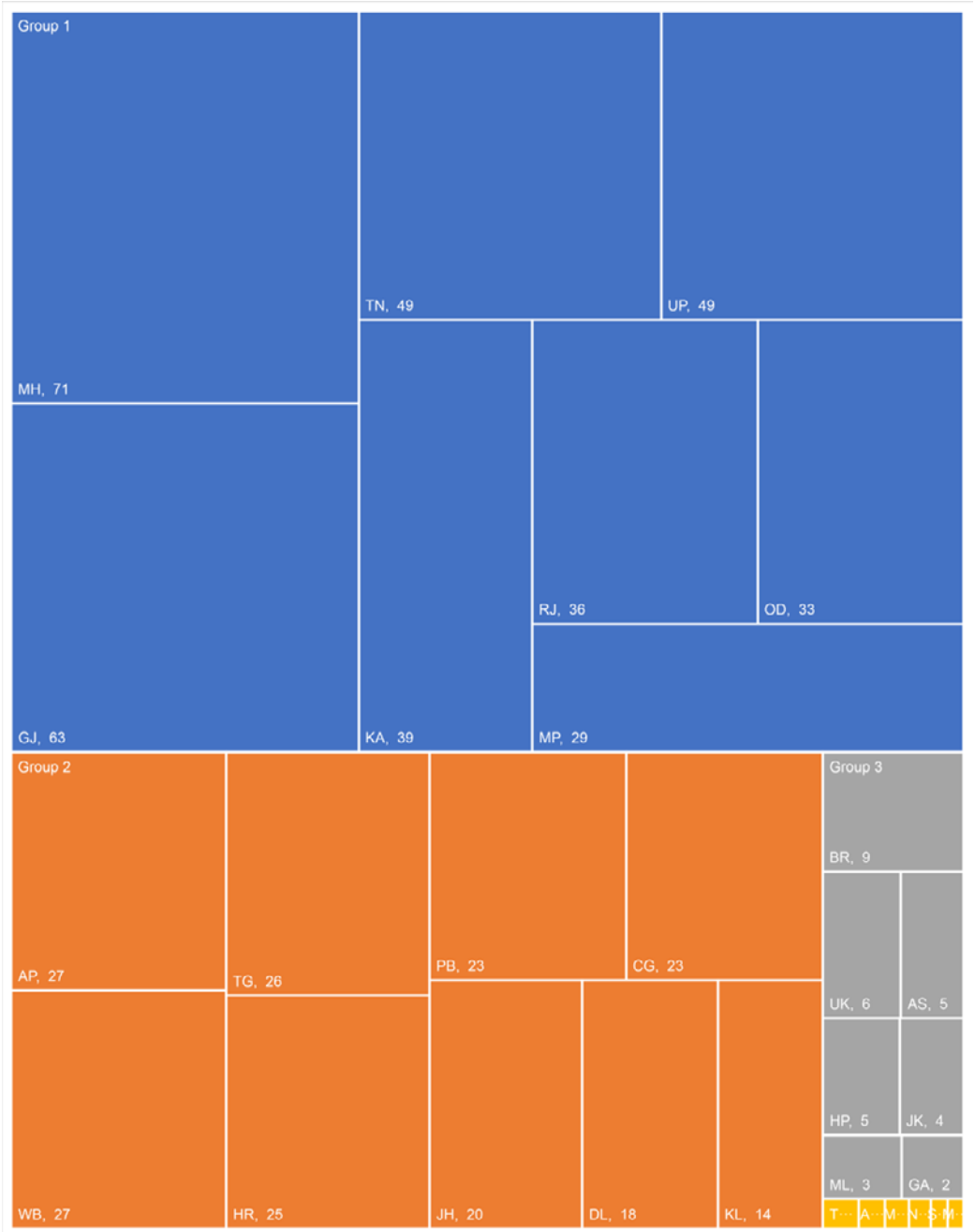


In presenting our results, we group states based on their total energy consumption, represented as Total Primary Energy Supply (TPES), as shown in figure 6. Thus, states such as Maharashtra and Tamil Nadu are compared to each other, while at the other end of the spectrum, many of the small eastern states are compared to each other.

FIGURE 6.

TOTAL PRIMARY ENERGY SUPPLY (MTOE) IN STATES 2014-2015

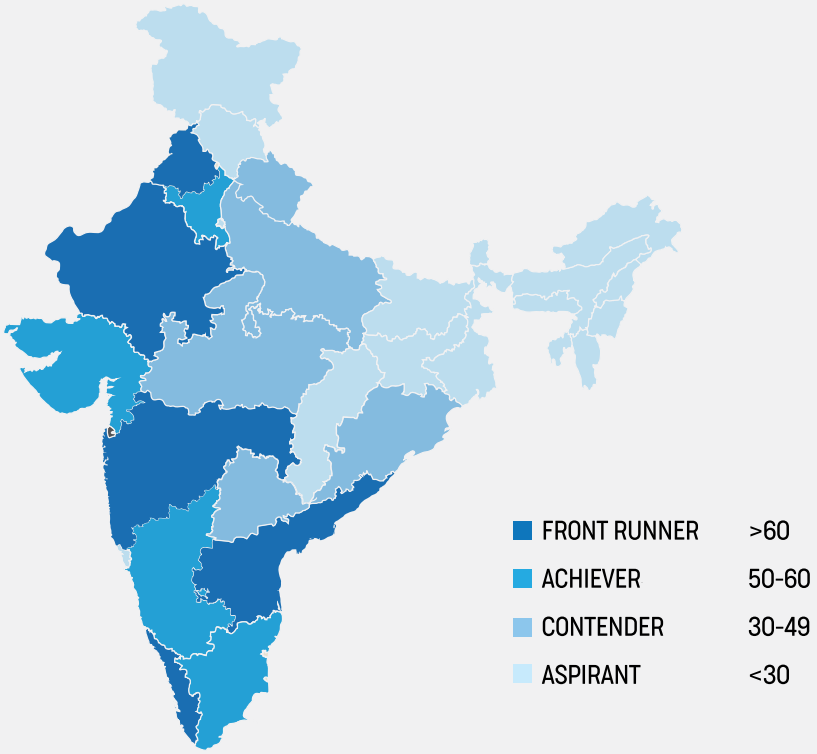
Group 1 368 MTOE (61%)	Group 2 202 MTOE (33.2%)	Group 3 33 MTOE (5.4%)	Group 4 2 MTOE (0.4%)
Maharashtra (MH)	Andhra Pradesh (AP)	Bihar (BR)	Tripura (TR)
Gujarat (GJ)	West Bengal (WB)	Uttarakhand (UK)	Arunachal Pradesh (AR)
Tamil Nadu (TN)	Telangana (TG)	Assam (AS)	Manipur (MN)
Uttar Pradesh (UP)	Haryana (HR)	Himachal Pradesh (HP)	Nagaland (NL)
Karnataka (KA)	Punjab (PB)	Jammu & Kashmir (JK)	Sikkim (SK)
Rajasthan (RJ)	Chhattisgarh (CG)	Meghalaya (ML)	Mizoram (MZ)
Odisha (OD)	Jharkhand (JH)	Goa (GA)	
Madhya Pradesh (MP)	Delhi (DL)		
	Kerala (KL)		



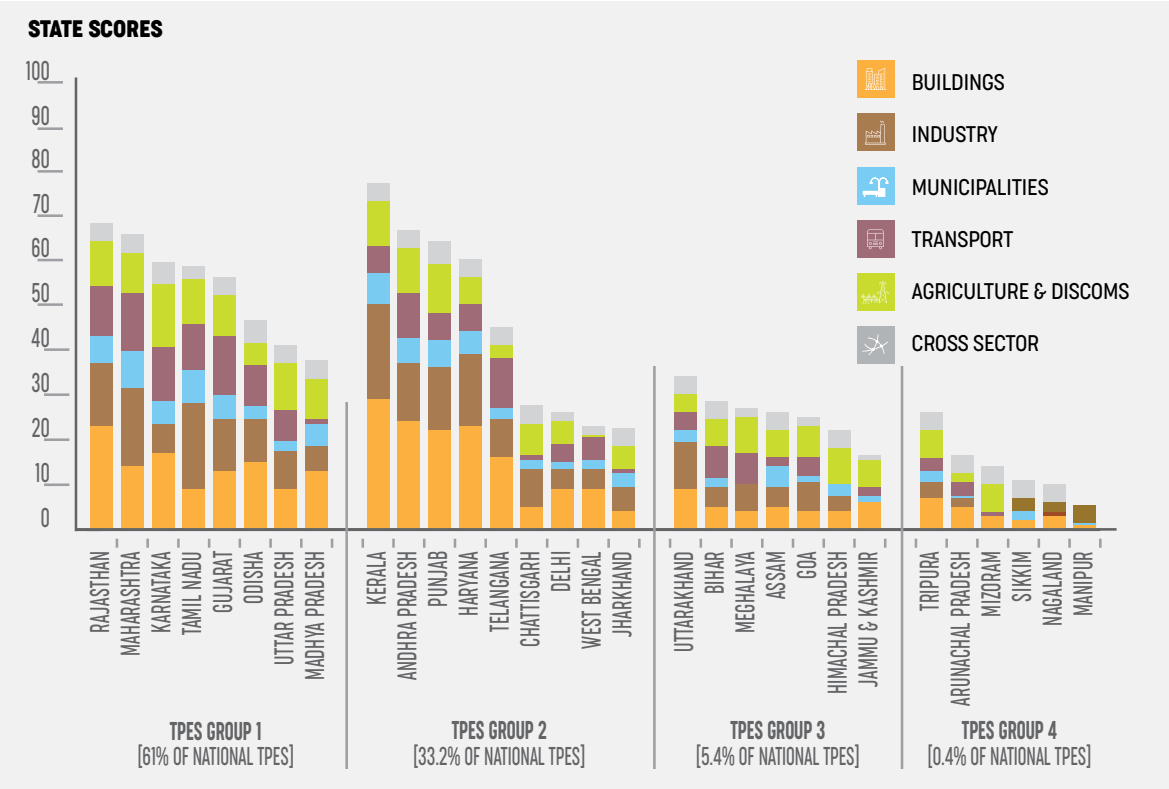
3 STATE ENERGY EFFICIENCY INDEX

States have been categorised as 'Front runner', 'Achiever', 'Contender' and 'Aspirant'. The top performing states, 'Front runner', are Andhra Pradesh, Kerala, Maharashtra, Punjab and Rajasthan. The graph presents state scores, grouping states according to their energy consumption in terms of Total Primary Energy Supply (TPES) as depicted in figure 7.

FIGURE 7.
STATE ENERGY EFFICIENCY INDEX



Note: All data is as of 14 May 2018, subsequently reviewed by SDAs and BEE, and updated thereafter. No data was received from Goa, Jammu & Kashmir and Manipur.



3.1 BUILDINGS

The State Energy Efficiency Index has 21 indicators to capture states' initiatives and progress on energy efficiency in buildings, covering various aspects such as Energy Conservation Building Code (ECBC), programmes and incentives for ECBC construction and energy efficient appliances, institutional capacity for supporting energy efficiency in buildings, energy savings and energy intensity.

Table 2 provides an overview of the indicators and Table 3 indicates the score for each state across the indicator categories – Policy and Regulation, Financing Mechanisms, Institutional Capacity, Adoption of EE Measures, Energy Savings. Figure 8 presents the state scores in this sector, grouping states based on the total primary energy supply (TPES) in each state.

TABLE 2.
BUILDING INDICATORS

#	Indicator	Points	Scoring Criteria
POLICY AND REGULATION			
1	Mandatory Energy Conservation Building Code (ECBC)	2	Has the state's Energy or Urban Development Department notified mandatory compliance with ECBC norms? *If 'Yes' score = 2, else score = 0*
2	Incorporation of ECBC in municipal building bye-laws	2	Has ECBC been incorporated in the bye-laws of one or more corporations and/or municipalities in the state? *If 'Yes' score = 2, else score = 0*
3	Mandatory Energy Audits & Reporting	1	Are periodic energy audits & reporting mandatory for all buildings, or at least for certain category of buildings, e.g. buildings with connected load greater than 100 kW? *If 'Yes' score = 1, else score = 0*

#	Indicator	Points	Scoring Criteria
4	Proportion of buildings complying with requirement for mandatory energy audits & reporting	1	Out of all buildings that are mandated to conduct an energy audit how many completed the energy audit & report during the most recent audit cycle? *If › 0% score = 1, else score = 0*
5	Adoption of BEE star rating for existing buildings	2	How many BEE star rated buildings are there in the state? *number of buildings* *If >=10 score = 2; if 1-9 = 1; else = 0*
6	EE Lighting programmes	2	Does the state have at least one programme to increase the adoption / penetration of energy efficient lighting, e.g. LED bulbs? *EESL UJALA (LED) = 1, State initiative or EESL BEEP = 1*
7	EE Appliance programmes	2	Does the state have at least one programme to increase the adoption / penetration of energy efficient appliances? *EESL UJALA (Fan, Tube light) = 1, State initiative or EESL BEEP = 1*
8	EE Cooking programmes	1	Does the state have at least one programme to increase the adoption / penetration of energy efficient cooking fuel or EE cook stoves, to replace fuels such as biomass, firewood, etc.? *MNRE Program or State initiative = 1, else = 0*
9	State Energy Conservation Awards for Buildings	1	Does the SDA or any other state organisation administer state level energy conservation awards to recognise outstanding performers under various building categories like Offices, Hotels, Hospitals, etc.? *If 'Yes' score = 1, else score = 0*
FINANCING MECHANISMS			
10	Subsidy for Energy Audits	1	Does the state provide subsidies for energy audits for buildings? *If 'Yes' score = 1, else score = 0*
11	Funds allocated & utilised for building energy audit	1	What is the quantum of funds allocated and utilised for building energy audits? *If >0 score = 1, else score = 0*
12	Financial incentives for ECBC-compliant construction / retrofits	2	Does the state provide financial incentives for ECBC-compliant construction / retrofits, such as soft loan, tax rebates, subsidy, indirect financial benefits such as increase in FSI allowance, or any others? *If 'Yes' score = 2, else score = 0*
13	Financial incentives for EE appliances	1	Does the state provide financial incentives for procuring EE appliances, such as soft loan, tax rebates, electricity rebates, subsidy? *If 'Yes' score = 1, else score = 0*
14	Funds allocated & utilised for EE appliances programmes	1	What is the quantum of funds allocated and utilised for procuring EE appliances? *If >0 score = 1, else score = 0*
INSTITUTIONAL CAPACITY			
15	Entity assigned for enforcing and certifying ECBC compliance	2	Is there a dedicated entity for enforcing and certifying ECBC compliance? *If 'Yes' score = 2, else score = 0*
16	Entity assigned for checking compliance of mandatory energy audits and reporting	2	Is there a dedicated entity for ensuring and reviewing mandated energy audits and reporting? *If 'Yes' score = 2, else score = 0*

#	Indicator	Points	Scoring Criteria
17	Budget allocated for entity to support EE in buildings	1	Is there a budget allocated for the functioning of this dedicated entity to support Energy Efficiency in buildings, such as ECBC compliance, mandatory energy audits, or other regulations for EE in buildings? *If >0 score = 1, else score = 0*
ADOPTION OF EE MEASURES			
18	Certified green buildings	2	How many certified green buildings are there in the state? *Green Buildings/million connected consumers: >= 50 = 2 points, 1-49 = 1 point, else = 0*
ENERGY SAVINGS			
19	Energy Savings in Commercial & Public Buildings	1	What is the reduction in energy consumption in commercial and public buildings, specifically due to implementation of EE measures? *If >0 score = 1, else score = 0*
20	Energy Intensity for Commercial & Public Buildings	1	What is the energy intensity for commercial and public buildings in the state? Year over year, this indicator will show whether energy consumption is in line to EE growth projections or BAU non-EE growth projections? *If kWh/m2 provided score = 1, else = 0*
21	Energy Intensity for Residential Buildings	1	What is the energy intensity for residential buildings in the state? Year over year, this indicator will show whether energy consumption is in line to EE growth projections or BAU non-EE growth projections? *If kWh/m2 provided score = 1, else = 0*

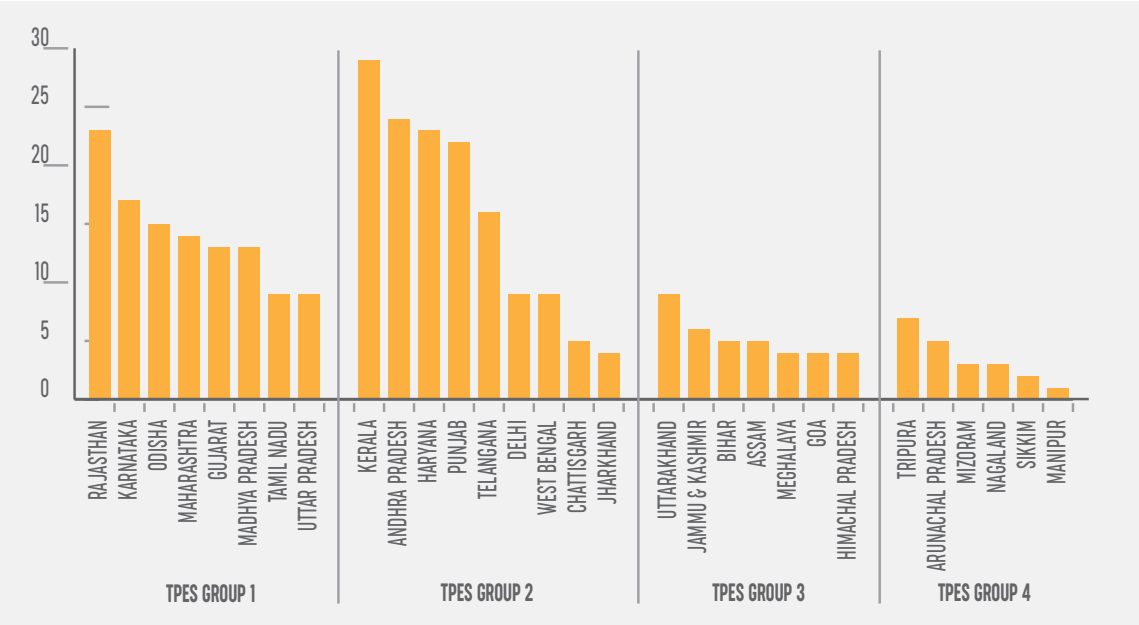
TABLE 3.
STATE SCORES

State	Total Score	Policy & Regulation	Financing Mechanisms	Institutional Capacity	Adoption of EE Measures	Energy Savings
Max Points	**30**	**14**	**6**	**5**	**2**	**3**
Andhra Pradesh	**24**	12	5	5	1	1
Arunachal Pradesh	**5**	3	0	0	0	2
Assam	**5**	4	0	0	1	0
Bihar	**5**	4	0	0	1	0
Chhattisgarh	**5**	4	0	0	1	0
Delhi	**9**	6	1	0	2	0
Goa	**4**	2	0	0	2	0
Gujarat	**13**	7	3	2	1	0
Haryana	**23**	13	2	5	2	1
Himachal Pradesh	**4**	3	0	0	1	0
Jammu & Kashmir	**6**	5	0	0	1	0
Jharkhand	**4**	3	0	0	1	0
Karnataka	**17**	11	2	2	1	1
Kerala	**29**	14	6	5	1	3
Madhya Pradesh	**13**	7	1	3	1	1
Maharashtra	**14**	8	3	1	2	0
Manipur	**1**	1	0	0	0	0

State	Total Score	Policy & Regulation	Financing Mechanisms	Institutional Capacity	Adoption of EE Measures	Energy Savings
Max Points	**30**	**14**	**6**	**5**	**2**	**3**
Meghalaya	**4**	3	0	0	1	0
Mizoram	**3**	3	0	0	0	0
Nagaland	**3**	3	0	0	0	0
Odisha	**15**	9	2	3	1	0
Punjab	**22**	11	3	4	1	3
Rajasthan	**23**	14	2	5	1	1
Sikkim	**2**	2	0	0	0	0
Tamil Nadu	**9**	6	0	2	1	0
Telangana	**16**	11	2	2	1	0
Tripura	**7**	4	1	0	1	1
Uttar Pradesh	**9**	8	0	0	1	0
Uttarakhand	**9**	8	0	0	1	0
West Bengal	**9**	7	0	0	1	1

FIGURE 8

TPES GROUP-WISE BUILDING SECTOR SCORES



DISCUSSION

The top performing states in the building sector are Andhra Pradesh, Haryana, Karnataka, Kerala, Punjab, Rajasthan, and Telangana. These states have notified ECBC and have incorporated ECBC in municipal building bye-laws. When a state notifies ECBC all new buildings above a specified contract demand or connected load or built-up area, have to comply with the minimum energy performance requirements of ECBC. As of May 14, 2018, 10 out of the 30 targeted states (UT of Puducherry which is not covered in the current State Energy Efficiency Index has also notified ECBC) have notified ECBC and only 9 states have covered significant ground to incorporate ECBC in municipal building bye-laws. The inclusion of ECBC in building bye-laws mandates code compliance check during the building approval process

leading to code enforcement. Telangana and Andhra Pradesh were the first states to incorporate ECBC in municipal building bye-laws, with Telangana being the first state to empanel Third Party Assessors (TPAs) for certifying ECBC compliance. Andhra Pradesh, Kerala, Punjab, and Telangana also provide financial incentives for ECBC-compliant construction and retrofits, with Punjab additionally giving 15% rebate in property tax for ECBC compliant buildings. Andhra Pradesh, Gujarat, Haryana, Kerala, Madhya Pradesh and Rajasthan have mandated energy audits for certain categories of building, based on size and/or connected load.

With increasing appliance ownership, affordability of EE appliances in the market is crucial to help manage the energy demand in both new and existing buildings. The government can lead by example by procuring EE appliances in all public buildings. EESL's UJALA programme for energy efficient lighting and fans has been a driving force in changing the market for EE appliances. All states have at least one programme for EE lighting and 27 out of the 30 states have at least one programme for EE appliances, primarily EESL's UJALA programmes for lighting and fans. Additionally, many states including Maharashtra, Meghalaya, Tamil Nadu, Telangana have mandated the use of BEE star appliances for all public buildings in the state.

25 out of the 30 states have certified green buildings, with Maharashtra leading the pack in terms of penetration of green buildings and BEE star rated buildings.

Institutional capacity in terms of technical know-how, authority and funds is essential for making energy efficient buildings and appliances the norm in any state. 11 states indicated that there is such an entity, primarily the SDA, with the expertise and authority to enforce ECBC or mandatory energy audits. And 7 states indicated the presence of funds for such entities.

The true measure of progress in building energy efficiency, is determined by outcome-based indicators such as energy intensity of buildings (kWh per m^2), energy savings (kWh or ktoe) achieved from EE initiatives, penetration of ECBC-compliant and green buildings and penetration of EE appliances in the market. In this first edition of the State Energy Efficiency Index, data on certified green buildings, energy savings in commercial buildings (kWh) and energy intensity of residential and commercial buildings (kWh/m^2) was requested to set a baseline for future indices. Over time, energy intensity and other indicators such as penetration of green buildings will help in measuring the effectiveness of EE measures and programmes for buildings. For this first Index, only Kerala and Punjab were able to provide energy intensity for commercial and residential buildings for the entire State. Arunachal Pradesh provided the energy intensity for the capital city Itanagar.

Building Spotlight

Telangana has developed a strong institutional framework to enable and enforce ECBC compliance. State and city officials collaborated with Administrative Staff College of India (ASCI) and Natural Resources Defense Council (NRDC) to develop Telangana's ECBC, and launched the Greater Hyderabad Municipal Corporation (GHMC) city-wide ECBC online compliance system to streamline and modernize code compliance. Highlights of Telangana's ECBC framework are captured in this fact sheet: https://www.nrdc.org/sites/default/files/ecbc-resource-guide_2017-12-19.pdf. Guidelines on the entire online approval system are available at the following link: http://www.ghmc.gov.in/Townplanning_Reports/TSECBCFAQs.pdf

Department of Local Government (Town Planning Wing), Government of Punjab notified 'The Punjab Municipal Green Buildings Incentives Policy- 2016' which specifies a host of incentives for the uptake of energy efficient green buildings in the state. The notification specifies 15% rebate in property tax for Punjab ECBC compliant buildings. Other incentives include additional 5% FAR for green buildings certified under (4 / 5 star) GRIHA or (Gold / Platinum) LEED or (Gold / Platinum) IGBC rating systems.

3.2 INDUSTRY

The Index has 13 indicators for Energy Efficiency in the industrial sector, covering programmes, institutional capacity and outcomes for large industry and MSME.

Table 4 provides an overview of the indicators and Table 5 indicates the score for each state across the indicator categories – Policy and Regulation, Financing Mechanisms, Institutional Capacity, Adoption of EE Measures, Energy Savings. Figure 9 presents the state scores in this sector, grouping states based on total primary energy supply (TPES) in each state.

TABLE 4.
INDUSTRY INDICATORS

#	Indicator	Points	Scoring Criteria
POLICY AND REGULATION			
1	Energy Saving targets for industries	2	Does the state government set energy saving targets for industries, over and above those for PAT? *If 'Yes' score = 2, else score = 0*
2	Mandatory Energy Audits	2	Are periodic energy audits mandatory for all industries, or at least certain category of industry, over and above those for PAT industries? *If 'Yes' score = 2, else score = 0*
3	Number of Industries audited in the most recent mandatory energy audit cycle	3	Out of all industries, PAT & others, that are mandated to conduct an energy audit how many completed the energy audit during the most recent audit cycle? *For >0 PAT DCs audited = 1.5;* *For >0 non-PAT units audited = 1.5*
4	Initiatives for EE in MSME Sector	3	What initiatives and programmes does the state have to advance EE in MSME Sector? For e.g. workshops, subsidy for energy audits, demo/pilot projects, other EE projects *If at least 1 initiative = 1.5; >1 initiative = 3*
5	State Energy Conservation Awards for Industries	2	Do the state SDA or other state organisations administer state level energy conservation awards to recognise outstanding performers under various industrial categories like Textiles, Forging, etc.? *If 'Yes' score = 2, else score = 0*
FINANCING MECHANISMS			
6	Financial incentives for implementing EE	2	Does the state provide financial incentives for implementing EE measures in industries? *If 'Yes' score = 2, else score = 0*
7	Funds allocated & utilised for implementing EE	1	What is the quantum of funds allocated and utilised for implementing EE measures in industries? INR *If >0 score = 1, else score = 0*
INSTITUTIONAL CAPACITY			
8	Entity responsible for overseeing mandatory energy audits	2	Is there a dedicated entity for ensuring and reviewing that mandated energy audits are completed? *If 'Yes' score = 2, else score = 0*
9	Budget allocated for entity to support EE in industry	1	Is there a budget allocated for a dedicated entity to support Energy Efficiency in industries? *If >0 score = 1, else score = 0*
10	Appointment of adjudication authority for PAT in SERC	2	Has the state appointed an adjudication authority for PAT in the SERC? *If 'Yes' score = 2, else score = 0*

#	Indicator	Points	Scoring Criteria
ADOPTION OF EE MEASURES			
11	% DC that met PAT SEC Target	3	What % of DC's in the state have met the SEC target set by PAT Cycle I? *If >= 80% score = 3; 60-79% score = 2; 30-59% = 1; else score = 0*
12	Number of industrial units that have adopted EE measures	1	How many industrial units have adopted / implemented at least one EE measure? *If >0 score = 1, else score = 0*
ENERGY SAVINGS			
13	Industrial energy savings in kWh/ktoe specifically due to implementation of EE/EC measures	1	What are the energy savings in industrial energy use, specifically due to energy efficiency / energy conservation measures? *If >0 score = 1, else score = 0*

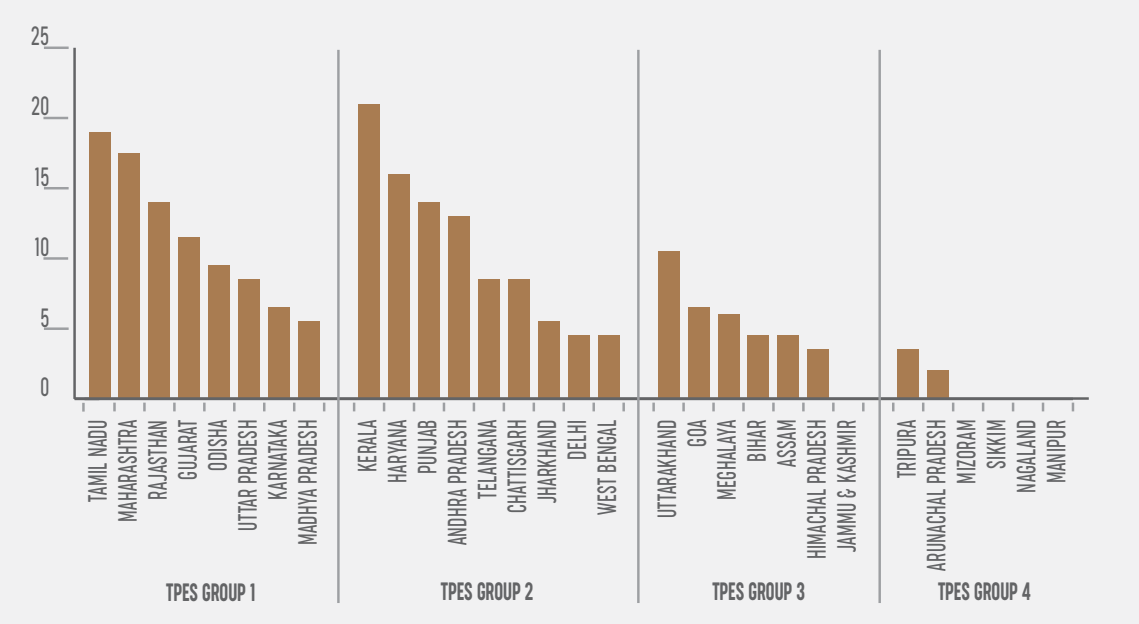
TABLE 5.

STATE SCORES

State	Total Score	Policy & Regulation	Financing Mechanisms	Institutional Capacity	Adoption of EE Measures	Energy Savings
Max Points	**25**	**12**	**3**	**5**	**4**	**1**
Andhra Pradesh	**13**	5	1	5	2	0
Arunachal Pradesh	**2**	0	0	2	0	0
Assam	**4.5**	1.5	0	2	1	0
Bihar	**4.5**	1.5	0	2	1	0
Chhattisgarh	**8.5**	1.5	0	4	3	0
Delhi	**4.5**	1.5	0	2	1	0
Goa	**6.5**	1.5	0	2	3	0
Gujarat	**11.5**	3.5	2	4	2	0
Haryana	**16**	7	2	4	3	0
Himachal Pradesh	**3.5**	1.5	0	0	2	0
Jammu & Kashmir	**0**	0	0	0	0	0
Jharkhand	**5.5**	1.5	0	2	2	0
Karnataka	**6.5**	1.5	0	3	2	0
Kerala	**21**	10	3	5	2	1
Madhya Pradesh	**5.5**	1.5	0	2	2	0
Maharashtra	**17.5**	10.5	2	3	2	0
Manipur	**0**	0	0	0	0	0
Meghalaya	**6**	3	0	0	3	0
Mizoram	**0**	0	0	0	0	0
Nagaland	**0**	0	0	0	0	0
Odisha	**9.5**	3.5	1	3	2	0
Punjab	**14**	5	0	4	4	1
Rajasthan	**14**	5	0	5	3	1
Sikkim	**0**	0	0	0	0	0
Tamil Nadu	**19**	10	3	5	1	0
Telangana	**8.5**	3.5	0	2	3	0
Tripura	**3.5**	1.5	0	2	0	0
Uttar Pradesh	**8.5**	3.5	0	2	3	0
Uttarakhand	**10.5**	1.5	2	2	4	1
West Bengal	**4.5**	1.5	0	2	1	0

FIGURE 9.

TPES GROUP-WISE INDUSTRY SECTOR SCORES



DISCUSSION

The top performing States in the industrial sector are Haryana, Kerala, Maharashtra, Punjab, Rajasthan and Tamil Nadu.

Though industry accounts for 53% of total primary energy supply in India, and more than 30% in most States, the level of energy efficiency initiatives and programmes is not commensurate with the energy consumption in this sector. Only 2 states, Maharashtra and Tamil Nadu, have set energy saving targets for industry, apart from targets set for the PAT programme.

Most states focus primarily on energy conservation for PAT Designated Consumers (DC), and monitor DCs for energy audits and compliance with specific energy consumption (SEC) targets. Only 5 states, Gujarat, Haryana, Kerala, Maharashtra and Tamil Nadu, mandate energy audits for specific categories of industry other than PAT DCs; and, Gujarat, Haryana, Kerala, Maharashtra, Tamil Nadu and Uttarakhand provide financial incentives for implementing energy efficiency in industrial units.

Industry Spotlight – PAT

Of the 25 states that have PAT DCs, Goa, Meghalaya and Uttarakhand are in the lead with 100% of DCs in these states meeting the SEC target in PAT Cycle I. In Haryana, Punjab, Telangana and Uttar Pradesh 80% or more DCs met the SEC target in PAT Cycle I.

The PAT scheme developed and led by BEE, with SDAs enforcing compliance for DCs in respective states, achieved energy savings of 8.67 mtoe in PAT Cycle I, 30% above the original target of 6.68 mtoe. PAT Cycle I included 478 DCs in 25 states, covering 8 sectors – aluminium, cement, chlor-alkali, fertilizer, iron & steel, paper & pulp, textile and thermal power plants. Pat Cycles II and III include 737 DCs covering the 8 sectors in PAT Cycle I and 3 additional sectors, i.e. DISCOM, Refinery and Railways.

PAT incorporates fundamental best practices in reducing energy demand through energy efficiency, i.e., 1) determination of energy intensity / SEC for each DC; 2) setting of SEC target for each sector; 3) energy audits and compliance checks for all DCs; 4) financial incentives linked to ESCerts trading. In addition to energy savings and reduction of emissions, PAT has resulted in developing a pool of certified energy managers and auditors, which states can utilise to further their energy efficiency goals.

No state was able to furnish data on energy savings specifically in the MSME sector. However, Kerala, Punjab, Rajasthan and Uttarakhand provided data on energy savings in the industrial sector as a whole.

The MSME sector in India accounts for about 45% of manufacturing output and is a significant part of the industrial sector in most states. Close to 200 energy-intensive MSME clusters account for about 25% of India's energy consumption. Just as the success of energy efficiency initiatives for PAT DCs is measured in terms of meeting the SEC target, energy efficiency in the MSME sector should be measured in terms of SEC for the specific MSME unit and/or MSME cluster. For the first State Energy Efficiency Index, states were requested to provide data on energy intensity in terms of toe/unit of production or kWh/unit of production for the top two MSME clusters in the state, in order to set a baseline for future State Energy Efficiency Indices. However, the data was not available in states or from any other source. Setting baselines for energy intensity in specific MSME clusters, similar to SEC for PAT industries, is essential for determining the need for EE intervention and also to track progress in achieving energy efficiency in the MSME sector.

Though there have been several cluster-based programmes in the MSME sector, very few states were able to provide data on these programmes or on any other energy efficiency initiatives specifically for MSMEs. Andhra Pradesh has conducted workshops for clay brick cluster and ice-making cluster. Kerala provides technical and financial support for energy audits in MSME, as well as training for specific clusters. Punjab provides technical and financial support for energy audits in MSME. Maharashtra has a cluster development programme, which includes energy audits, workshops and demonstration projects; Meghalaya has conducted workshops on energy efficiency measures for small and medium scale industries; and, Rajasthan has implemented fuel saving projects in five small scale industries in collaboration with PCRA. Tamil Nadu's PEACE scheme (Promotion of Energy Audit and Conservation of Energy) covers 50% of the cost for energy audit per unit, up to a maximum of INR 75,000, and 25% of the cost of implementing energy efficiency measures, up to a maximum of INR 2,00,000.

3.3 MUNICIPALITIES

The State Energy Efficiency Index has 9 indicators for capturing state's performance on enhancing Energy Efficiency in municipalities. The indicators are primarily focussed on public infrastructure such as street lighting and water pumping.

Table 6 provides an overview of the indicators and Table 7 indicates the score for each state across the indicator categories - Policy and Regulation, Financing Mechanisms, Institutional Capacity, Energy Savings. Figure 10 presents the state scores in this sector, grouping states based on total primary energy supply (TPES) in each state.

TABLE 6.
MUNICIPALITY INDICATORS

#	Indicator	Points	Scoring Criteria
POLICY AND REGULATION			
1	Energy savings target	2	Has the state government set an energy saving target for municipalities? *If 'Yes' score = 2, else score = 0*
2	Programme for EE Street lighting	1	Does the state have at least one programme for energy efficient street lighting, e.g. LED or equivalent? *EESL-SLNP program = 0.5, State Initiative = 0.5*

#	Indicator	Points	Scoring Criteria
3	Programme for EE Municipal water pumping	1	Does the state have at least one programme for energy efficient water pumping? *EESL-MEEP program = 0.5, State Initiative = 0.5*
FINANCING MECHANISMS			
4	Funds allocated for EE Street lighting	0.5	What is the quantum of funds allocated for EE street lighting? *If >0 score = 0.5, else score = 0*
5	Funds allocated for EE Water pumping	0.5	What is the quantum of funds allocated for EE water pumping? *If >0 score = 0.5, else score = 0*
INSTITUTIONAL CAPACITY			
6	Entity for supporting EE measures in municipalities	2	Is there a dedicated entity to support EE programmes in municipalities? *If 'Yes' score = 2, else score = 0*
7	Budget allocated for entity for municipal EE programmes	1	Is there a budget allocated for the functioning of this dedicated entity to support Energy Efficiency implementation in municipalities? *If >0 score = 1, else score = 0*
ENERGY SAVINGS			
8	Energy Savings from EE Street lighting	1	What are the energy savings from implementation of EE street lighting? *If >0 score = 1, else score = 0*
9	Energy savings from EE Water pumping	1	What are the energy savings from implementation of EE water pumping? *If >0 score = 1, else score = 0*

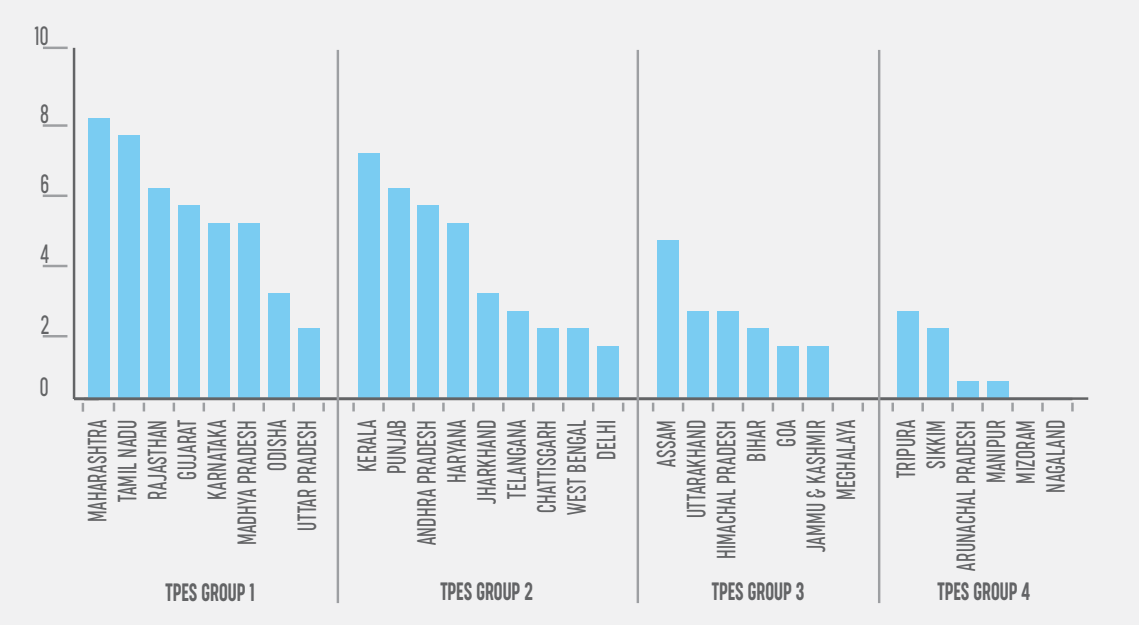
TABLE 7.

STATE SCORES

State	Total Score	Policy & Regulation	Financing Mechanisms	Institutional Capacity	Energy Savings
Max Points	**10**	**4**	**1**	**3**	**2**
Andhra Pradesh	**5.5**	2	0.5	2	1
Arunachal Pradesh	**0.5**	0.5	0	0	0
Assam	**4.5**	1.5	0	2	1
Bihar	**2**	1	0	0	1
Chhattisgarh	**2**	1	0	0	1
Delhi	**1.5**	0.5	0	0	1
Goa	**1.5**	0.5	0	0	1
Gujarat	**5.5**	2	0.5	2	1
Haryana	**5**	2	0	2	1
Himachal Pradesh	**2.5**	1.5	0	0	1
Jammu & Kashmir	**1.5**	0.5	0	0	1
Jharkhand	**3**	2	0	0	1
Karnataka	**5**	2	1	0	2
Kerala	**7**	2	1	3	1
Madhya Pradesh	**5**	1.5	0.5	2	1
Maharashtra	**8**	4	0	3	1
Manipur	**0.5**	0.5	0	0	0
Meghalaya	**0**	0	0	0	0

State	Total Score	Policy & Regulation	Financing Mechanisms	Institutional Capacity	Energy Savings
Max Points	10	4	1	3	2
Mizoram	0	0	0	0	0
Nagaland	0	0	0	0	0
Odisha	3	1.5	0.5	0	1
Punjab	6	2	1	2	1
Rajasthan	6	2	1	2	1
Sikkim	2	1	0	0	1
Tamil Nadu	7.5	3.5	1	2	1
Telangana	2.5	1.5	0	0	1
Tripura	2.5	1.5	0	0	1
Uttar Pradesh	2	1	0	0	1
Uttarakhand	2.5	1.5	0	0	1
West Bengal	2	1	0	0	1

FIGURE 10.
TPES GROUP-WISE MUNICIPALITY SECTOR SCORES



DISCUSSION

The top performing States in the municipalities sector are Kerala, Maharashtra, Rajasthan, Punjab, and Tamil Nadu. These states have their own programmes for EE street lighting and EE water pumping, in addition to utilising EESL's programmes. All these have designated entities specifically assigned to support EE in municipalities.

25 out of 30 states have at least one programme for EE street lighting, primarily EESL's Street Lighting National Program (SLNP), while 15 of these also have State-level programmes. 23 states have programmes for energy efficient water pumping, primarily EESL's Municipal Energy Efficiency Program (MEEP), and 12 have additional State-level programmes as well.

Both energy savings and energy intensity are essential to determine the success for energy conservation and energy efficiency initiatives and implementation. Energy savings from EE street lighting for the SLNP programme are available on EESL's SLNP dashboard. However, only Karnataka was able to furnish energy savings achieved from EE water pumping. Energy intensity indicators for street lighting (kWh/km), water pumping (kWh/million litres) and sewage treatment and pumping (kWh/m^3) were removed from this edition of the Index due to lack of data availability.

Municipality Spotlight

Under the Maharashtra Energy Conservation Policy, 2017 MEDA has launched a scheme to provide financial assistance for promoting ESCO projects in street lighting and water pumping of municipal councils/corporations. MEDA has proposed to give financial assistance of INR 50.00 lakhs per corporation/council for project implementation. Financial assistance will be released after agreement between the corporation and ESCO company. The Maharashtra Energy Conservation Policy, 2017 has also proposed mandatory installation of automatic timers in street lighting systems of municipal corporations/ councils and mandatory Investment Grade Energy Audits (IGEA) of water pumping systems of municipal corporations, councils, Maharashtra Industrial Development Corporations (MIDCs), and Maharashtra Jeevan Pradhikaran (MJP), having annual energy bill of Rs.25.00 lakhs or more.

3.4 TRANSPORT

The Index has 5 indicators for Energy Efficiency in the transport sector, 3 concerning energy efficiency of State Road Transport Corporations (SRTC) and 2 concerning electric and hybrid vehicles.

Table 8 provides an overview of the indicators and Table 9 indicates the score for each state across the indicator categories – Financing Mechanisms, Institutional Capacity, Adoption of EE Measures, Energy Savings. Figure 11 presents the state scores in this sector, grouping states based on total primary energy supply (TPES) in each state.

TABLE 8.
TRANSPORT INDICATORS

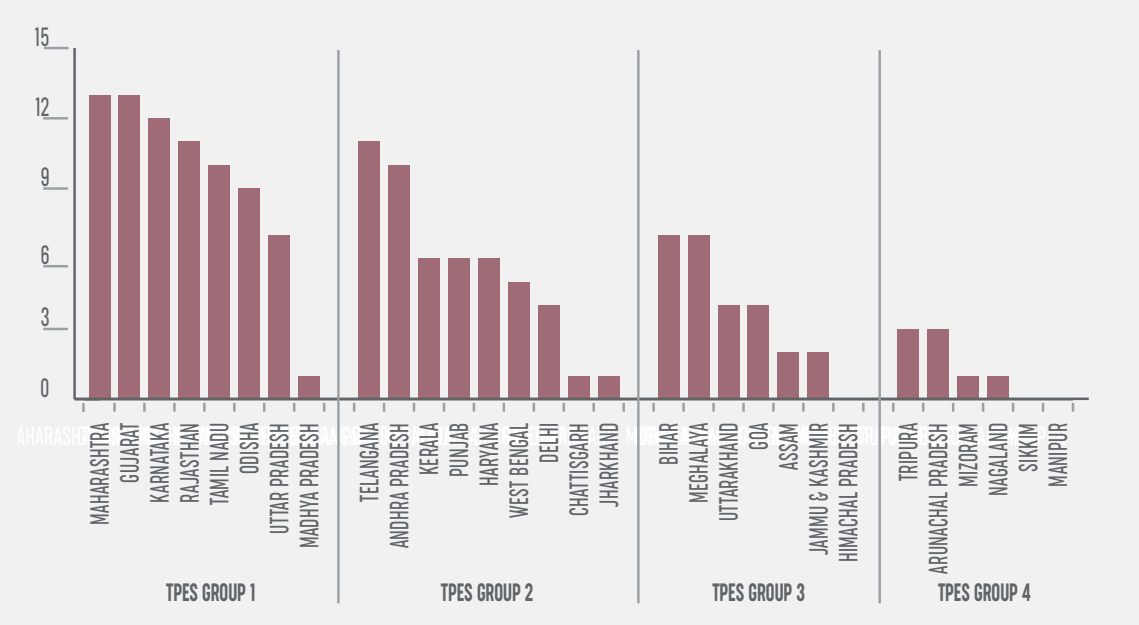
#	Indicator	Points	Scoring Criteria
FINANCING MECHANISMS			
1	Financial incentives for hybrid and electric vehicles	3	Does the state provide financial incentives for procuring hybrid and electric vehicles? *If 'Yes' score = 3, else score = 0*
INSTITUTIONAL CAPACITY			
2	Awareness on fuel saving for SRTC personnel	3	Does the state conduct programmes for SRTC personnel to increase awareness and implementation of fuel saving? *If 'Yes' score = 3, else score = 0*
ADOPTION OF EE MEASURES			
3	Penetration of hybrid and electric passenger vehicles	3	What is the proportion of hybrid and electric passenger vehicles of all passenger vehicles registered in state? *If >0.2% score = 3, else-if >0.1% score = 2, else-if >0.025% score = 1; else = 0*

#	Indicator	Points	Scoring Criteria
ENERGY SAVINGS			
4	Energy intensity of SRTC fleet	3	What is the energy intensity for the SRTC fleet in the state, taking into account all SRTCs? *If passenger-km/litre >=200 score = 3, else-if >=100 score = 2, else-if >=50 score = 1 point, else score = 0*
5	Fuel Efficiency achieved by SRTC	3	What is the fuel efficiency achieved by SRTCs in the state? *If km/MJ >0.13 score = 3, else-if >0.12 score = 2, else-if >0.1 score = 1, else score = 0*

TABLE 9.
STATE SCORES

State	Total Score	Financing Mechanisms	Institutional Capacity	Adoption of EE Measures	Energy Savings
Max Points	**15**	**3**	**3**	**3**	**6**
Andhra Pradesh	**10**	3	0	1	6
Arunachal Pradesh	**3**	0	3	0	0
Assam	**2**	0	0	1	1
Bihar	**7**	0	3	0	4
Chhattisgarh	**1**	0	0	1	0
Delhi	**4**	0	0	3	1
Goa	**4**	0	0	1	3
Gujarat	**13**	3	3	2	5
Haryana	**6**	0	0	2	4
Himachal Pradesh	**0**	0	0	0	0
Jammu & Kashmir	**2**	0	0	1	1
Jharkhand	**1**	0	0	1	0
Karnataka	**12**	3	3	1	5
Kerala	**6**	0	3	2	1
Madhya Pradesh	**1**	0	0	1	0
Maharashtra	**13**	3	3	2	5
Manipur	**0**	0	0	0	0
Meghalaya	**7**	0	0	3	4
Mizoram	**1**	0	0	0	1
Nagaland	**1**	0	0	0	1
Odisha	**9**	0	3	1	5
Punjab	**6**	0	3	1	2
Rajasthan	**11**	0	3	2	6
Sikkim	**0**	0	0	0	0
Tamil Nadu	**10**	0	3	1	6
Telangana	**11**	0	3	2	6
Tripura	**3**	0	0	0	3
Uttar Pradesh	**7**	0	0	1	6
Uttarakhand	**4**	0	0	2	2
West Bengal	**5**	0	0	2	3

FIGURE 11.
TPES GROUP-WISE TRANSPORT SECTOR SCORES



DISCUSSION

The top performing States in the transport sector are Gujarat, Karnataka, Maharashtra, Rajasthan and Telangana, having performed well on all five indicators.

The states with the best performance for energy intensity of the State Road Transportation Corporation (SRTC) fleet (passenger-km/litre), i.e. >200 passenger-km/litre, are Andhra Pradesh, Bihar, Odisha, Rajasthan, Tamil Nadu, Telangana and Uttar Pradesh, with Tamil Nadu leading at 277 passenger-km/litre. The most fuel-efficient SRTCs are in Andhra Pradesh, Gujarat, Tamil Nadu, Tripura and Uttar Pradesh, with Gujarat leading at 0.148 km/MJ.

Andhra Pradesh, Gujarat, Karnataka and Maharashtra are the only states that provide financial incentives for electric and hybrid vehicles. However, Delhi, Gujarat, Haryana, Meghalaya and Uttarakhand have the highest proportion of EV's (via the FAME scheme), with Meghalaya being the leader.

Transport Spotlight

Karnataka and Maharashtra are clearly the front runners in the race for electric mobility. Both states have already released policies for driving the adoption of electric vehicles. Karnataka announced the 'Karnataka Electric Vehicle and Energy Storage Policy 2017' in September 2017. The policy provides for incentives and concessions for the e-mobility eco-system covering EV manufacturing, charging infrastructure, EV ownership and R&D. Incentives to increase the penetration and use of EVs include 1) tax exemption for all EVs, both transport and non-transport; 2) introduction of 1000 electric buses by public transport corporations BMTC, KSRTC, NWKSRTC and NEKRTC; 3) 25% capital subsidy for EV charging service providers, both for fast charging and battery swapping. BMTC had conducted trials on electric buses as early as 2014, and will run 'EV Vaayu Vajra' as a pilot project in 2018, introducing electric buses on select routes of the Bengaluru airport shuttle. Maharashtra's 'Electric Vehicle Policy 2018' provides for incentives for EV manufacturing, charging infrastructure and EV ownership. In a move to increase penetration of EVs the Maharashtra government provides subsidies of INR 1 lakh on cars, INR 5,000 on two-wheelers, INR 12,000 on three-wheelers and INR 10 lakh on buses, as well as exemption from registration fees and road tax. The first 250 charging stations set up near bus depots, petrol pumps and public parking spots will receive a capital subsidy of 25%. Nagpur, Maharashtra, is the first city in India to have an electric mass mobility system, with Ola managing a fleet of 200 electric taxis, buses and rickshaws.

Two indicators that were originally included in the Index, i.e. the proportion of people using public transport and whether states have a policy for procurement of fuel-efficient vehicles for government organisations, were eliminated since no state could provide data on these. Indicators on adoption of various modes of public transport, initiatives in improving public transport, and indicators for private passenger vehicles and freight could be included in future indices.

3.5 AGRICULTURE & DISCOMS

The 'Agriculture & DISCOMs' sector comprises 11 indicators related to DSM regulations, programmes and savings, and T&D losses for DISCOMs in the State.

Table 10 provides an overview of the indicators and Table 11 indicates the score for each state across the indicator categories – Policy and Regulation, Financing Mechanisms, Institutional Capacity, Adoption of EE Measures, Energy Savings. Figure 12 presents the state scores in this sector, grouping states based on total primary energy supply (TPES) in each state.

TABLE 10.
AGRICULTURE AND DISCOM INDICATORS

#	Indicator	Points	Scoring Criteria
POLICY AND REGULATION			
1	Notification of DSM regulation	2	Has the state government notified CERC's DSM regulation? *If 'Yes' score = 2, else score = 0*
2	Ag DSM programme	1	Does the state have a programme for DSM in the agriculture sector? *If 'Yes' score = 1, else score = 0*
3	Target for energy savings from Ag DSM	1	Has the state set a target for energy savings to be achieved through Ag DSM programmes? *If >0 score = 1, else score = 0*
4	Non-Ag DSM programmes	1	Does the state have a programme for DSM in other demand sectors, excluding agriculture? *If 'Yes' score = 1, else score = 0*
5	Target for T&D losses (technical losses)	2	Has the state set a target for T&D losses (technical losses only) within DISCOMs? *If % defined score = 2, else score = 0*
6	Penalties for non-compliance of DSM mandates	1	Has the state defined and enforced penalties for non-compliance of DSM mandates? *If 'Yes' score = 1, else score = 0*
FINANCING MECHANISMS			
7	Financial incentives for DSM measures	1	Does the state provide financial incentives for DSM? *If 'Yes' score = 1, else score = 0*
INSTITUTIONAL CAPACITY			
8	Dedicated DSM cell	2	Do DISCOMs in the state or the SERC have a dedicated DSM cell to support and drive DSM programmes? *If 'Yes' score = 2, else score = 0*
ADOPTION OF EE MEASURES			
9	Consumer participation in DSM programs	1	What is the participation level of DISCOM consumers in the state's various DSM programmes? *If >0 score = 1, else score = 0*

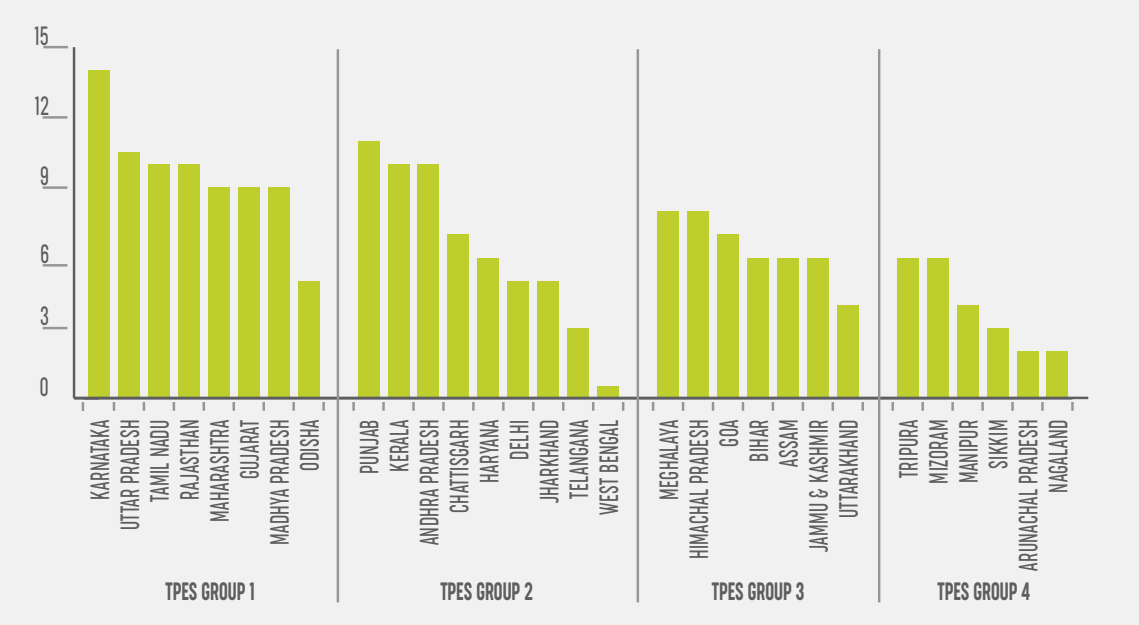
#	Indicator	Points	Scoring Criteria
ENERGY SAVINGS			
10	Low T&D losses (technical losses)	2	What is the level of T&D losses in the state's DISCOMs? *If T&D Losses <=15% score = 2, else-if <=20% score = 1, else-if <= 25% score = 0.5, else score = 0*
11	Energy savings from DSM	1	What is the total energy savings from all DSM programmes in the state? *If >0 score = 1, else score = 0*

TABLE 11.

STATE SCORES

State	Total Score	Policy & Regulation	Financing Mechanisms	Institutional Capacity	Adoption of EE Measures	Energy Savings
Max Points	**15**	**8**	**1**	**2**	**1**	**3**
Andhra Pradesh	**10**	6	1	2	0	1
Arunachal Pradesh	**2**	2	0	0	0	0
Assam	**6**	4	0	2	0	0
Bihar	**6**	4	0	2	0	0
Chhattisgarh	**7**	5	0	2	0	0
Delhi	**5**	2	0	2	0	1
Goa	**7**	4	0	2	0	1
Gujarat	**9**	6	0	2	0	1
Haryana	**6**	4	0	2	0	0
Himachal Pradesh	**8**	5	0	2	0	1
Jammu & Kashmir	**6**	4	0	2	0	0
Jharkhand	**5**	4	0	0	0	1
Karnataka	**14**	7	1	2	1	3
Kerala	**10**	3	1	2	1	3
Madhya Pradesh	**9**	6	1	2	0	0
Maharashtra	**9**	6	0	2	0	1
Manipur	**4**	4	0	0	0	0
Meghalaya	**8**	4	0	2	1	1
Mizoram	**6**	4	0	2	0	0
Nagaland	**2**	2	0	0	0	0
Odisha	**5**	3	0	2	0	0
Punjab	**11**	6	1	2	0	2
Rajasthan	**10**	5	1	2	1	1
Sikkim	**3**	3	0	0	0	0
Tamil Nadu	**10**	6	0	2	0	2
Telangana	**3**	2	0	0	0	1
Tripura	**6**	4	0	2	0	0
Uttar Pradesh	**10.5**	7	1	2	0	0.5
Uttarakhand	**4**	2	0	2	0	0
West Bengal	**0.5**	0	0	0	0	0.5

FIGURE 12.
TPES GROUP-WISE AG & DISCOM SECTOR SCORES



DISCUSSION

The top performing states are Andhra Pradesh, Karnataka, Kerala, Punjab, Rajasthan, Tamil Nadu and Uttar Pradesh. Karnataka has performed well in all indicators. Andhra Pradesh, Punjab, Rajasthan and Uttar Pradesh have the most DSM regulations and programmes in place. Karnataka, Kerala and Tamil Nadu have the lowest T&D losses, <15% for 2015-2016.

One of the primary objectives for DISCOMs across India is to reduce AT&C losses, and the Ministry of Power's UDAY programme is supporting states to achieve this. The UDAY dashboard tracks the performance of States in reducing AT&C losses, among other objectives. The State Energy Efficiency Index, being focussed on energy efficiency, focuses on T&D losses and DSM programmes. For the year 2015-2016, only 3 states have T&D losses less than 15%, whereas 12 states have T&D losses in the range of 15-25% and 15 states have T&D losses greater than 25%. Reducing T&D losses is crucial to improving electricity access and availability within the existing grid, and should remain a focus area for all DISCOMs.

DISCOM Spotlight

Pilicode gram panchayat in Kerala, along with the Energy Management Centre (EMC), Kerala's SDA, and Kerala State Electricity Board (KSEB) conducted a DSM programme spanning one year, resulting in a bimonthly reduction of 1,20,328 units power consumption in the panchayat. A team of 650 volunteers, trained in energy conservation, visited each household to create awareness on energy conservation, power consumption of various types of lighting and appliances, and usage of appliances during peak hours (6pm-10pm). The volunteers also conducted a survey of lighting and appliances in each household. The panchayat created a WhatsApp group to facilitate awareness on energy conservation, and also directed all government buildings to designate an energy manager to manage energy consumption. Lighting contributes significantly to power consumption during peak hours. The panchayat set a goal to be 'filament bulb free' and worked with EMC and KSEB to distribute subsidised LED bulbs to all households, shops and establishments. Street lights and lighting in all government buildings were replaced with LED fixtures. Government buildings also replaced inefficient ceiling fans with 5-star rated fans.

Under the Uttar Pradesh Kisan Uday Yojana 2018, UP Government is distributing Energy Efficient Pumps which will benefit around 10 Lakh farmers in the state by 2022. The Energy Efficient Pump sets of two different capacities, 5 Hp and 7.5 Hp, shall be distributed with smart kits which will assist farmers to optimally operate their pumps sets. It is estimated (24x7 Power for All, Uttar Pradesh) that by replacing the existing inefficient 10 Lakh pumps with BEE 5-star rated energy efficient pumps, approximately 3.5 billion units of electricity can be saved every year with resultant monetary benefits of 1350 crores (@3.80 INR/kWh).

To date EESL has been the leader in utility-scale DSM, though several DISCOMs have collaborated with EESL to implement its programmes in states. While several DISCOMs have introduced Time of Day (ToD) billing for at least certain categories of consumers, other DSM initiatives such as appliance replacement programmes have primarily been restricted to pilot projects.

3.6 CROSS SECTOR

The State Energy Efficiency Index comprises of 4 cross sector indicators including the State Energy Conservation Fund (SECF) and awareness programmes on energy efficiency as part of BEE's agenda to strengthen SDAs in the XII plan period.

Table 12 provides an overview of the indicators and Table 13 indicates the score for each state across these indicators. Figure 13 presents the state scores in this sector, grouping states based on total primary energy supply (TPES) in each state.

TABLE 12.
CROSS SECTOR INDICATORS

#	Indicator	Points	Scoring Criteria
1	Establishment of SECF	1	Has the state established a State Energy Conservation Fund? *If 'Yes' score = 1, else score = 0*
2	Allocation of funds for SECF by State Government	1	Has the state government allocated funds for SECF? *If 'Yes' score = 1, else score = 0*
3	Projects implemented using Revolving Investment fund (RIF)	1	Has the SDA or other state department implemented at least one project using the RIF strategy? *If 'Yes' score = 1, else score = 0*
4	Energy Efficiency and Energy Conservation Awareness Campaigns	2	Has the SDA conducted at least one awareness programme for schools and at least one for the general public? *School programme = 1* *General public awareness = 1*

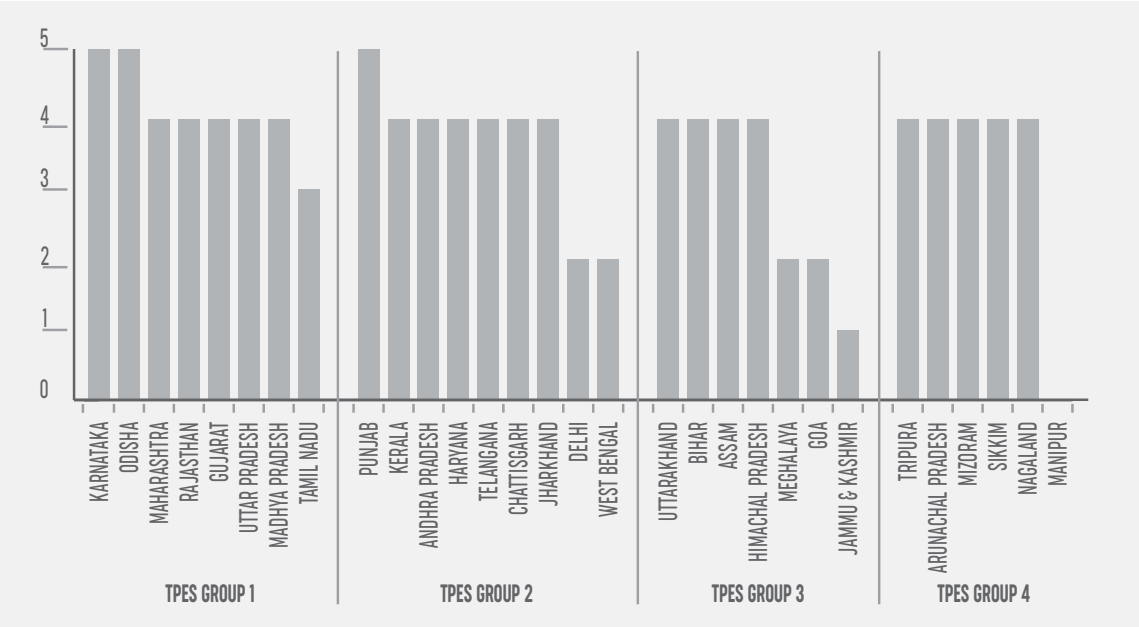
TABLE 13.
STATE SCORES

State	Total Score	Establishment of SECF	Allocation of funds for SECF by State Government	Projects implemented using Revolving Investment fund (RIF)	Energy Efficiency and Energy Conservation Awareness Campaigns
Max Points	5	1	1	1	2
Andhra Pradesh	4	1	1	0	2
Arunachal Pradesh	4	1	1	0	2
Assam	4	1	1	0	2
Bihar	4	1	1	0	2
Chhattisgarh	4	1	1	0	2
Delhi	2	0	0	0	2
Goa	2	1	1	0	0

State	Total Score	Establishment of SECF	Allocation of funds for SECF by State Government	Projects implemented using Revolving Investment fund (RIF)	Energy Efficiency and Energy Conservation Awareness Campaigns
Max Points	5	1	1	1	2
Gujarat	4	1	1	0	2
Haryana	4	1	1	0	2
Himachal Pradesh	4	1	1	0	2
Jammu & Kashmir	1	1	0	0	0
Jharkhand	4	1	1	0	2
Karnataka	5	1	1	1	2
Kerala	4	1	1	0	2
Madhya Pradesh	4	1	1	0	2
Maharashtra	4	1	1	0	2
Manipur	0	0	0	0	0
Meghalaya	2	0	0	0	2
Mizoram	4	1	1	0	2
Nagaland	4	1	1	0	2
Odisha	5	1	1	1	2
Punjab	5	1	1	1	2
Rajasthan	4	1	1	0	2
Sikkim	4	1	1	0	2
Tamil Nadu	3	1	0	0	2
Telangana	4	1	1	0	2
Tripura	4	1	1	0	2
Uttar Pradesh	4	1	1	0	2
Uttarakhand	4	1	1	1	1
West Bengal	2	1	0	0	1

FIGURE 13.

TPES GROUP-WISE CROSS SECTOR SCORES



DISCUSSION

27 of the 30 states have established an energy conservation fund, and in 24 of these states the state government has allocated matching funds.

Karnataka, Odisha, Punjab and Uttarakhand have implemented projects with Revolving Investment Fund (RIF) mechanism from their SECFs.

27 states regularly conducted general awareness programmes from BEE funding with 25 of them having school awareness programs as well.

Cross Sector Spotlight

Uttarakhand SDA, Uttarakhand Renewable Energy Development Agency (UREDA), has introduced interest free loans from RIF Fund for implementation of EE projects in 5 industries with an estimated energy saving potential of 2.156 GWh. UREDA has also initiated replacement of 4 existing inefficient pump sets with energy efficient pumps at Srinagar and Mussoorie pumping scheme of Uttarakhand Jal Sansthan under Revolving Investment Fund (RIF) mechanism from the SECF, thereby realising energy saving potential of 1.3 million units of electricity. Additionally to improve energy efficiency amongst the industrial consumers, energy audit and subsequent implementation of EE measures funded through interest free loan from RIF is also underway. 20% of the total amount is for energy audit and remaining 80% is for implementation of the energy audit recommendations.

Odisha SDA, to promote energy conservation in the dairy sector has taken up energy efficiency implementation in Orissa State Cooperative Milk Producers' Federation OMFED Bhubaneswar Plant through RIF mechanism. About INR 1 crore has been allocated to OMFED to improve their energy performance by implementing the recommendations of Investment Grade Energy Audit (IGEA).

4 OUTCOMES

4.1 ENABLING EVIDENCE-BASED POLICY FORMULATION

The primary outcome of the State Energy Efficiency Index shall be to help enable a data-driven culture to assess and fast-track energy efficiency implementation in states. Monitoring outcome-based indicators such as energy intensity across sectors shall help set a baseline for EE efforts and enable setting state specific EE targets. BEE's PAT scheme is a stellar example of a data-driven culture – energy intensity measured in terms of Specific Energy Consumption (SEC), target setting for specific categories of Designated Consumers (DCs), and achievements determined for each DC in terms of SEC improvements. EESL's dashboards for UJALA, SLNP, BEEP, and MEEP schemes and National Automotive Board's FAME India dashboard for electric vehicles are other notable examples for data disclosure, providing real time energy (electricity or fuel) savings data. In the first State Energy Efficiency Index an attempt has been made to include several quantitative outcome-based indicators to measure energy intensity, energy savings and adoption of EE technologies across all demand sectors. Though states provided data for some of these indicators, some other indicators had to be removed from the Index since no state could provide data for them. For example, one indicator that was removed is energy intensity (kWh/ktoe per unit of production) for the top two MSME clusters in each state.

4.2 HIGHLIGHT BEST PRACTICES AND HELP DRIVE EE POLICIES & PROGRAM IMPLEMENTATION AT THE STATE AND LOCAL LEVEL

The State Energy Efficiency Index would highlight best practices and facilitate cross learning among states. It would help identify which sectors and areas need more focused attention within a state. In the short term, the State Energy Efficiency Index can lead to identification of potentially successful programmes (based upon best practices), and increase awareness amongst SDAs and other state entities. This would

eventually lead to more budget allocation and monitoring of programmes at the state level, thereby fostering development of the entire ecosystem, including increased staff dedicated to energy efficiency in the states.

4.3 TRACKING PROGRESS IN MANAGING INDIA'S ENERGY FOOTPRINT

Publishing the State Energy Efficiency Index on an annual basis will help determine states' and ultimately India's progress in managing our energy footprint, whose criticality cannot be overstated especially against the backdrop of India's commitment to the Paris Agreement. With each successive Index, additional and, if required, alternative indicators would be added based on the EE landscape in the states. In the long run the State Energy Efficiency Index can help institutionalise energy data management and reporting in states.

5 WAY FORWARD

5.1 STREAMLINING DATA COLLECTION FROM STATES TOWARDS NATIONAL ENERGY DATA MANAGEMENT

This being the first State Energy Efficiency Index in India, there were significant challenges in collecting data, primarily due to non-availability of data and/or lack of access to state level data. Further, lack of digitalisation may also have impacted the ease of retrieving data. Yet, SDAs and AEEE were able to collect some quantitative data from various state departments as well as central government databases. However, the process took significant time and effort. This could be improved for future State Energy Efficiency Indices. Building a robust system for demand side energy consumption data collection and analysis at state level will contribute significantly towards a national Energy Data Management System for India.

5.2 UPGRADING EE INDICATORS

The State Energy Efficiency Index indicators shall be continually modified to reflect the evolving landscape of EE in the country. For subsequent editions of the State Energy Efficiency Index, indicators on energy intensity, energy savings and adoption or penetration of energy efficient appliances, equipment, technologies, processes shall be included for all sectors – buildings, industry, municipalities & public infrastructure, transport, agriculture and DISCOMs. This shall be extremely useful to set a baseline to measure progress on an annual basis. For this edition of the State Energy Efficiency Index, the energy intensity indicator was included only for Building and Transport sectors due to lack of data availability in remaining sectors. For Transport and Municipality sectors in general, more rigorous data collection is required.

5.3 STRENGTHENING OF SDAS WITH INDEPENDENT CHARGE OF ENERGY EFFICIENCY

SDAs have already contributed significantly towards creating awareness on Energy Efficiency, conducting workshops, supporting energy audits and implementing demonstration projects. SDAs should be further empowered to gather EE related data and provide guidance to other key entities in the state in all sectors. It has been observed that most of the SDAs have been given the portfolio of energy efficiency as an additional responsibility. This sometimes leads to digression of the SDA's focus from energy efficiency to the mainstream functioning of the parent department, which could be renewable energy development agencies or power departments of state governments or electrical inspectorate offices or electricity DISCOMs. It is worth noting here that only the SDA of Andhra Pradesh (State Energy Conservation Mission (SECM)) has been constituted with the sole mandate of promoting energy efficiency in the state. Another notable example is Kerala's SDA, the Energy Management Centre (EMC), which was constituted as an autonomous body under the state Department of Power in 1996, even before the enactment of the Energy Conservation (EC) Act in 2001. Although EMC Kerala is also responsible for development of small hydro projects, its primary mandate is promotion of energy conservation in the state, with small hydro being an additional portfolio added much later. It is recommended that each state have a dedicated agency with adequate authority and budgetary allocations, and expertise for steering and upscaling energy efficiency implementation in the state. Till the time such a dedicated entity is instituted, the current SDAs irrespective of the nature of their parent department are recommended to draft and subsequently adopt a State Energy Efficiency Policy similar to the Maharashtra Energy Conservation Policy, 2016 adopted by Maharashtra SDA, the Maharashtra Energy Development Agency (MEDA) to lay down a charter for policies and programs pertaining to energy efficiency in line with the states' responsibilities under the EC Act.

5.4 PROGRAM AND POLICY RECOMMENDATIONS FOR THE SDAS

This index contains much data on what the different states are doing. Each state should examine its situation and what nearby or similar states are doing and identify at least a few additional actions to take in the next year. For states in the 'Contender' and 'Aspirant' categories, key baseline actions include notification and incorporation of ECBC in municipal building bye-laws, mandatory energy audit and subsidy for energy audits, instituting state energy conservation awards for buildings and industry, financial incentives for ECBC compliant buildings, implementing projects utilising Revolving Investment Fund (RIF) under the State Energy Conservation Fund (SECF), and notifying DSM regulations. For states that are 'Front runner' or 'Achiever', the next steps could be becoming a leader in some emerging areas such as energy data disclosure across all sectors, to effectively track the state's energy and carbon footprint. Additionally, all states could consider focussing on driving energy efficiency in the top two MSME clusters in the state and promoting EVs.

5.5 ACCELERATED COORDINATION AMONG KEY STAKEHOLDERS

Lack of coordination, or sometimes, delays in communication within different government departments responsible for different aspects of the same intervention, are often cited as a bottleneck for smooth flow of information and subsequent implementation of various government schemes. With SDAs at the epicentre of all matters related to energy efficiency across sectors in the state, the State Energy Efficiency Index in the near term shall enable enhanced coordination, pertaining to design and implementation of EE policies, among key stakeholders both within the state as well as between the centre and the states.

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