



State Energy Efficiency Index

2019



State Energy Efficiency Index 2019

BEE Team

Mr Abhay Bakre, Director General Mr Milind Deore, Director Mr Abhishek Sharma, Joint Director Mr Gautam Anand, Project Engineer

AEEE Team

Dr Satish Kumar, President and Executive Director Ms Sangeeta Mathew, Programme Lead Mr Sandeep Kachhawa, Senior Research Associate Mr R. Varun Rajah, Research Associate Mr Pramod Singh, Consultant

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 15 November 2019; and has subsequently been reviewed by SDAs and the Bureau of Energy Efficiency (BEE). Every attempt has been made to ensure the correctness of data. However, BEE does not guarantee the accuracy of the data or accept responsibility for the consequences of the use of such data.

December 2019

Acknowledgements

States have a vital role in India's energy efficiency policy implementation and in meeting state-specific goals on sustainable development in the most energy-efficient way.

The State Energy Efficiency Index 2019 has been developed by the Bureau of Energy Efficiency (BEE) and Alliance for an Energy Efficient Economy (AEEE).

BEE expresses its sincere gratitude to the Ministry of Power, Government of India for their support in publishing the State Energy Efficiency Index 2019.

We are grateful to the State Designated Agencies (SDAs) for their efforts towards data collection and review of data collected by BEE from additional sources.

BEE expresses its sincere gratitude to Alliance for an Energy Efficient Economy (AEEE) for their pertinent inputs, data analysis and support in coordinating with State Designated Agencies to make the State Energy Efficiency Index a reality.

We express our gratitude to Energy Efficiency Services Limited (EESL) for sharing data on the state level implementation of EESL programmes.

We would like to thank Confederation of Indian Industry (CII) for sharing information on Energy Conservation Awards presented during CII's Energy Efficiency Summit-2019.

We are grateful to Indian Green Building Council (IGBC), GBCI India and GRIHA for providing data on green buildings in states.

BEE expresses its sincere gratitude to the MacArthur Foundation for their generous grant to AEEE, which made State Energy Efficiency Index 2019 possible.

BEE is grateful to the American Council for an Energy-Efficient Economy (ACEEE) for sharing their technical expertise in developing the Index, analysing data and reviewing the project report.

We would like to thank IRCLASS Systems and Solutions for data on ISO 50001 certification.

We would like to thank GreenTree Global for their support with data review and analysis.

Last but not least, BEE is grateful to our own in-house teams handling various energy efficiency programmes.

Executive Summary

2019 saw the launch of the India Cooling Action Plan (ICAP) and the Bureau of Energy Efficiency's (BEE's) draft strategy plan for accelerating energy efficiency in India – UNNATEE (Unlocking NATional Energy Efficiency potential). ICAP aims to reduce cooling demand across sectors by 20% to 25% by 2037-38 and cooling energy requirements by 25% to 40% within the same period. UNNATEE provides a roadmap for meeting India's goals on climate change through energy efficiency. Both plans are a call to action to accelerate the implementation of energy efficiency initiatives to reduce energy demand and energy intensity in all sectors, while still powering growth in India. Energy Efficiency (EE) is the cleanest, fastest and cheapest way to achieve India's sustainable development goals - 7 (Affordable and Clean Energy), 12 (Responsible Consumption and Production) and 13 (Climate Action).

States have a vital role in India's energy efficiency policy implementation and in meeting state-specific goals on sustainable development in the most energyefficient way. A department/agency has been designated as the State Designated Agency (SDA) within each state. All the SDAs have been empowered by the Energy Conservation Act 2001 (EC Act) to co-ordinate, regulate and enforce the provisions of the EC Act in states. SDAs also play a vital role in promoting energy efficiency among energy consumers in all sectors of the state - agriculture, buildings,

industries, municipalities and transport, as well as in power generation, transmission and distribution.

STATE ENERGY EFFICIENCY INDEX 2019

The State Energy Efficiency Index has been developed by Bureau of Energy Efficiency (BEE) in association with Alliance for an Energy Efficient Economy (AEEE) to

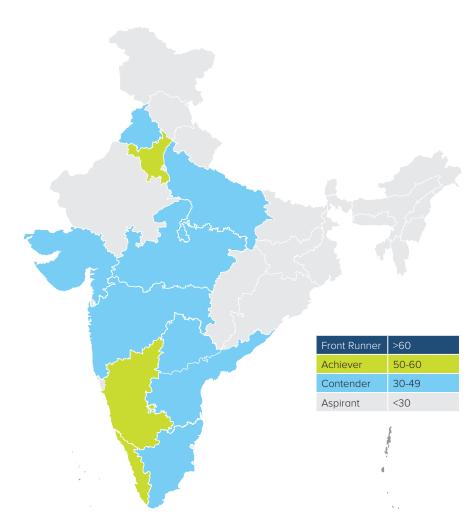
- Help drive EE policies and program implementation at the state and local level
- Highlight best practices and encourage healthy competition among states
- Track progress in managing the states' and India's energy footprint
- Set a baseline for EE efforts and provide a foundation to set statespecific EE targets
- Institutionalize data capture and monitoring of EE activities by states, especially by SDAs

The first such Index, the State Energy Efficiency Preparedness Index, was launched on August 1st, 2018. The State Energy Efficiency Index 2019 draws on the previous index and has enhanced the indicator framework to include ECBC 2017, adoption of e-mobility, energy efficiency in MSME clusters, energy savings and institutional reforms such as independent SDAs and collaboration between SDAs and state departments. This year's Index has 97 indicators covering all demand sectors - buildings, industry, municipalities, transport, agriculture - and DISCOMs. Thirty-six (36) states and union territories have been assessed in State EE Index 2019. In line with last year, the composition of the Index has been developed considering 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.

Most importantly, for State EE Index 2019, the points allocated to outcomebased indicators has increased to 30% compared to 24% last year, while also making the scoring criteria and the evaluation process more stringent. Outcome-based indicators, such as energy savings and reduced energy intensity, are the true measure of the success of energy efficiency implementation, and therefore the weightage of these indicators will be gradually increased in subsequent editions as well.

KEY FINDINGS

The State Energy Efficiency Index categorises states as 'Front Runner', 'Achiever', 'Contender' and 'Aspirant' based upon their efforts and achievements towards energy efficiency implementation. The top performing states for State EE Index 2019, Haryana, Kerala and Karnataka, are in the 'Achiever' category. Since there isn't any 'Front runner' state, it can be inferred that a lot more can be done at state level to realise energy savings from energy efficiency. A comparison of states' scores and performance between Index 2018 and Index 2019 has not been carried out, since the Index 2018 was a "Preparedness" Index assessina 29 states and the National Capital Territory of Delhi across 63 indicators, whereas the State Energy Efficiency Index 2019 assesses 36 states and



* For State EE Index 2019, unified Jammu & Kashmir and Ladakh have been considered.

union territories across 97 indicators. Further, the increased weightage for outcome-based indicators and more stringent scoring criteria and evaluation process would not make the comparison between 2018 and 2019 uniform.

Regarding Energy Conservation Building Code (ECBC) 2017, 6 states have amended the code to suit regional and local conditions and have notified the code in the state's official gazette. Four (4) states have incorporated ECBC 2017 in municipal building bye-laws. Nine (9) states have started making some progress on adoption of ECO Niwas Samhita 2018-Energy Conservation Building Code for Residential Buildings.

In the industrial sector, 35 industrial units across 13 states reduced their

energy intensity through the adoption of EE measures, based on data gleaned from energy conservation awards. For Perform Achieve & Trade (PAT) Cycle II, based on provisional data for designated consumers (DCs) who have submitted reports, there are 9 states in which more than 80% DCs have achieved the SEC target. However, the focus for energy efficiency in the MSME segment is still very low, despite several national programmes for this sector.

Efforts in municipal energy efficiency are still largely driven with the help of EESL. On a positive note, 11 states have installed centralised control and monitoring systems for street lighting in some municipalities within the state.

In the transport sector, 6 states have released Electric Vehicle (EV)

or e-mobility policies, and 4 have published draft EV policies. A few states have started incorporating electric vehicles in public transportation, primarily buses and e-autos or e-rickshaws.

Twenty-four (24) states have implemented Time of Day (ToD) tariffs for Industrial and/or Commercial consumers, whereas 5 states have ToD tariffs for residential consumers as well. Seven (7) states have reported taking initiatives for the promotion of innovation and R&D in energy efficiency.

The true measures of success of energy efficiency policies and programmes are energy savings achieved and reduction in energy intensity. However, data on these outcome-based indicators are by and large not available. While a few states provided some information on energy savings in specific buildings, industries or municipal programmes, there is no structured, comprehensive method for measurement, reporting and verification (MRV) of programmes and the resultant energy savings.

TAKEAWAYS FOR STATES

State EE Index 2019 shows that majority of the initiatives taken by states are related to Policies and Regulations. Most of the first-generation energy efficiency policies prepared by BEE under programmes on Standards & Labelling (S&L), ECBC, PAT, etc. are understood by states. However, states should now focus on ensuring complete compliance to realize actual savings. Based on the analysis of responses submitted by states this year, a three-point agenda is suggested for consideration by state agencies:

- 1. Proactive role by states in policy formulation and implementation: It is observed that states have confined their role towards customization of national policies and legislative approval. Now states must take an active authority to exercise powers under the EC Act and start formulating supporting policies and implementation rules to shift the focus from "policies in place" to "policies successfully implemented".
- 2. Strengthening the mechanism for data capture, management and public availability of data: Availability of updated and correct data has been the Achilles heel for states. The SDA is the competent authority within the state for all matters related to energy efficiency. For this year's Index, SDAs proactively contacted various state departments to gather data. However, SDAs should significantly enhance their engagement with state departments, DISCOMs and private sector organisations beyond one-time data collection. Doing so will enable effective implementation of EE programmes, enable SDAs to measure and monitor progress, and most importantly provide a feedback mechanism for modifications in EE programs and policies and setting of realistic targets. Building a robust system for demand side energy consumption data collection and analysis at local and state level will also contribute significantly towards a national Energy Data Management System
- **3.** Enhancing the credibility of EE schemes: Ensuring the integrity of programs that have direct or indirect linkage with common consumers is an important pillar of energy efficiency market transformation. To deal with this challenge, states must demonstrate an approach which includes enforcement and compliance checks. Rules related to mandatory energy audits, mandatory sale and purchase of BEE star labelled appliances will not be effective unless an inspection process is established and strengthened. States must also make independent monitoring and verification of savings integral to all EE policies and programs.

Contents

Ack	knowledgements	i
Exe	ecutive Summary	iii
List	t of Abbreviations	viii
1	Introduction	1
2	Approach	5
3	State Energy Efficiency Index	11
	3.1 Buildings	12
	3.2 Industry	17
	3.3 Municipalities	20
	3.4 Transport	23
	3.5 Agriculture & DISCOMs	27
	3.6 Cross Sector	30
4	Concluding Remarks	33
Ref	ferences	35

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
BYPL	BSES Yamuna Private Limted
CCMS	Centralised Control and Monitoring System
CEA	Central Electricity Authority
CII	Confederation of Indian Industry
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 Services Company
EV	Electric Vehicle
FAME	Faster Adoption and Manufacturing of Electric Vehicles
FAR	Floor Area Ratio
GHMC	Greater Hyderabad Municipal Corporation
GRIHA	Green Rating for Integrated Habitat Assessment
GSDP	Gross State Domestic Product
ICAP	India Cooling Action Plan
IESS	India Energy Security Scenarios
IGBC	Indian Green Building Council
IGEA	Investment Grade Energy Audits
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			
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			
ΜΤΟΕ	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			
RBI	Reserve Bank of India			
RIF	Revolving Investment fund			
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			
ТоD	Time of Day			
TPA	Third-Party Assessors			
TPES	Total Primary Energy Supply			
UIDAI	Unique Identification Authority of India			
ULB	Urban Local Body			
UREDA	Uttarakhand Renewable Energy Development Agency			
UT	Union Territory			





01 Introduction

India is marching on the path of energy transition, shifting away from fossil fuels and focusing on decentralized energy resources. Energy Efficiency (EE) will be central to this transition process as it helps to make the transition faster and more economical. Recognizing the importance of EE towards India's energy security, climate security, and overall development imperatives, the Government of India has made excellent strides in EE over the last 18 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) in 2002 and the State Designated Agencies (SDAs) in the states. It also put in place the much-needed institutional framework for the formulation and implementation of energy efficiency policies and programs.

Since 2002, BEE has developed norms and mandates to not only set up minimum energy performance requirements but also to encourage voluntary adoption of higher energy efficiency standards in different demand sectors. This approach is manifested in the Standards and Labelling Scheme for appliances and equipment, Energy Conservation Building Code (ECBC) for commercial buildings, the newly launched EcoNiwas Samhita for energy conservation in residential buildings and Perform Achieve and Trade (PAT) for large industries and hotels that BEE has been running successfully. Through capacity-building programs, financing programs and awards programs, BEE is also creating a demand-pull by addressing barriers related to awareness and financing.

While the EC Act empowers BEE to formulate policies and programs, it also empowers the states through State Designated Agencies to ensure implementation, compliance and enforcement. 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 Fund and the power to inspect compliance with specified energy consumption standards. The states are also empowered to specify energy consumption norms and requirements such as the provision of mandatory energy audits for facilities and mandatory purchase of BEE star labelled products in government procurement.

The achievement of India's goals for Energy Efficiency hinges as much on the success of energy efficiency programmes in states, as in nationwide programmes. However, an outcome-based framework to evaluate states' progress on EE achievements was not developed until 2018 when the State Energy Efficiency Preparedness Index 2018 was developed for the first time. In 2018, 29 states and the National Capital Territory of Delhi were assessed on 63 indicators.

The primary objectives of the State Energy Efficiency Index are to

- Help drive EE policies and program implementation at the 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
- Institutionalize data capture and monitoring of EE activities by states, especially by SDAs

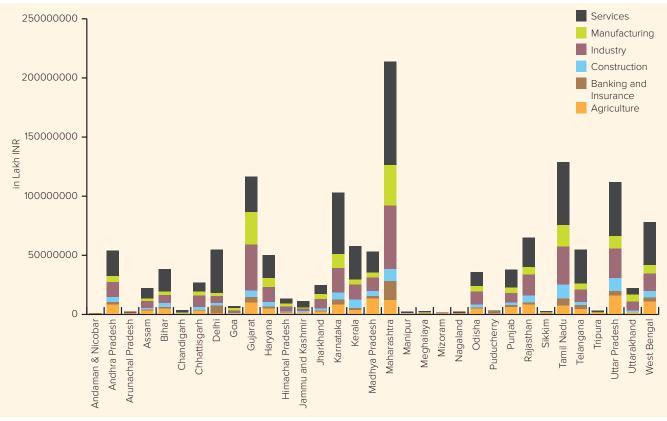
This year again, Bureau of Energy Efficiency (BEE) in association with Alliance for an Energy Efficient Economy (AEEE) has developed the State Energy Efficiency Index 2019 for 36 Indian states and union territories. Since the data collection for this year's index started before the bifurcation of the state of Jammu & Kashmir into two union territories of Jammu & Kashmir and Ladakh, unified state of Jammu and Kashmir has been considered. The State Energy Efficiency Index 2019 comprises 97 qualitative, quantitative, and outcome-based indicators to monitor the real progress made in the implementation of policies, programs and projects. The indicators are demand sector specific covering 5 major energy demand sectors -Buildings, Industry, Municipalities, Transport, Agriculture and Distribution Companies (DISCOMs). In addition to the five sectors, the indicators for this year also cover initiatives that have a cross-sector impact. The 97 indicators pertain to categories, namely Policies and Regulations, Financing Mechanism, Institutional Capacity, Adoption of EE measures, and Energy savings achieved.

The increase in the number of indicators this year is rendered to include newer focus areas such as ECBC 2017 and e-Mobility, as well as to lay greater emphasis on energy efficiency in MSME, energy savings in all sectors and institutional reforms such as independent State Designated Agencies (SDA). The State EE Index is a useful stock-taking tool to track progress in states' energy efficiency programmes, promote healthy competition among states and share best practices among states. When performed on an annual basis, the State Energy Efficiency Index will track progress in managing the states' energy footprint and provide guidance in formulating data-driven, evidencebased policies and programmes for energy efficiency in line with statespecific goals on development and sustainability.

STATE ENERGY PROFILE

Before moving on to the next chapters which describe the approach in developing the State EE Index 2019 and the key findings of this year's Index, a brief view on states' diverse economy and energy profile helps set the context. India has thirty-seven states and union territories, which vary widely not only in area and population but also in climate zone and economic activity (agriculture, industry, services, etc.), not to mention the level of development. These variations impact the energy profile of the states and union territories. Figure 1 depicts the GSDP of states for each sector. Figures 2 and 3 depict energy intensity (toe/ INR crore) and annual per capita domestic electricity consumption (kWh/person/year) for each state, respectively.

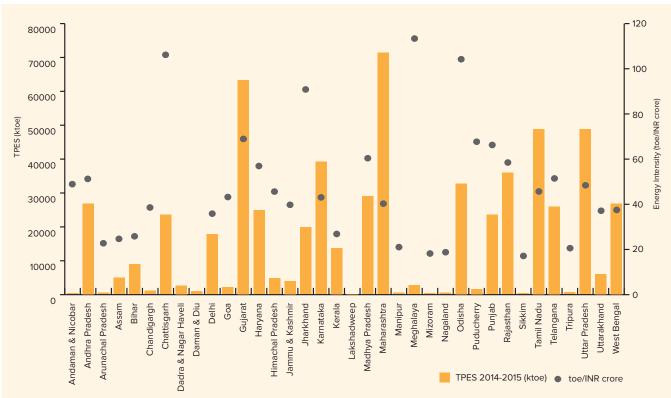
Figure 1. State GSDP 2014-2015



Source: RBI

Note: GSDP for 2014-2015 was not available for Dadra & Nagar Haveli, Daman & Diu, Lakshadweep





Source: Derived from MoSPI Energy Statistics 2016, CEA General Review 2016, RBI Note: GSDP for 2014-2015 was not available for Dadra & Nagar Haveli, Daman & Diu, Lakshadweep

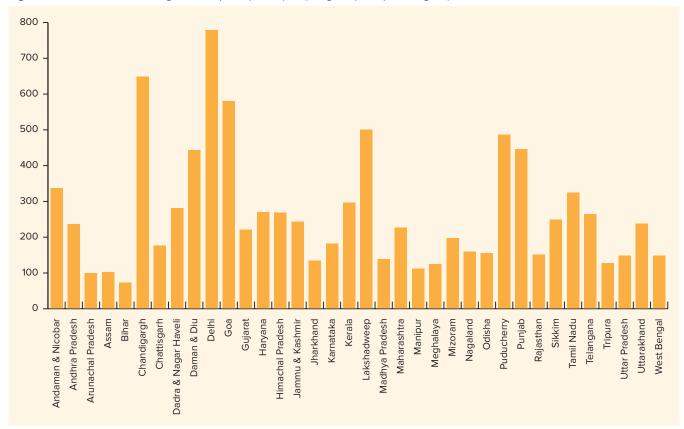


Figure 3. Residential Electricity Consumption per capita per year (kWh/person/year) 2016-2017

Source: Derived from CEA General Review 2018, UIDAI

02 Approach

Bureau of Energy Efficiency (BEE) in association with Alliance for an Energy Efficient Economy (AEEE) developed the framework for the State Energy Efficiency Index. The index is developed on lines similar to the one developed by American Council for an Energy Efficient Economy (ACEEE), which has published 13 editions of the US State Energy Efficiency Scorecard and 4 editions of International Energy Efficiency Scorecard.

The key steps followed in the process are:

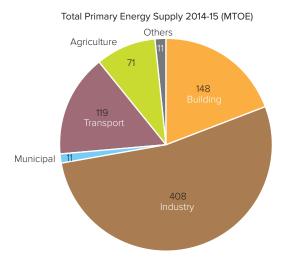
- Selection of sectors, performance indicators, and allocation of maximum scores
- 2. Categorization of states
- 3. Data collection and verification
- 4. Analysis of data received and scoring of states

Step 1 was to ensure that the indicators and weightages reflect the state's role in promoting energy efficiency and the relative importance of demand sectors with respect to each sector's share in total energy consumption and energy savings potential. Through Step 2, the aim was to ensure that the indexing exercise considers the differences in energy consumption between states. Steps 3 and 4 are focused towards increasing participation of the state bodies in this exercise and increasing the credibility through a proper validation of the information received, respectively. The approach followed for the key steps is described in detail below.

1. Selection of sectors, performance indicators, and allocation of maximum scores:

This was based on the sectoral share in energy consumption, energy savings potential in a sector and on the state's role in the promotion of energy efficiency. Figures 4 and 5 show the sector-wise annual energy consumption and electricity consumption in India in 2014-15, respectively. Figure 6 shows the sector-wise energy savings potential. Table 1 summarizes the state's role in energy efficiency in each of the sectors.

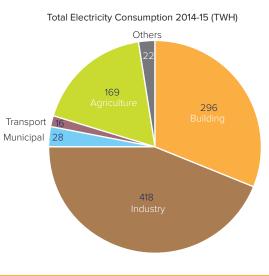
Figure 4. Total Primary Energy Supply (TPES) in Demand Sectors

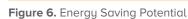


Source: Derived from MoSPI Energy Statistics 2016, CEA General Review 2016

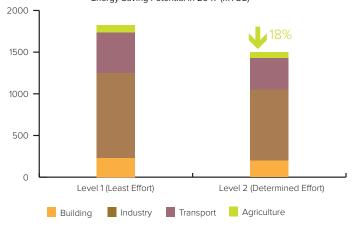
Note: The Total Primary Energy Supply (TPES) includes primary energy used for electricity generation from all sources including Coal, Oil, Gas, Nuclear, Hydro, Solar, Wind, other renewables; and non-electricity generation utilisation (for energy) of Coal (in Industry), Oil products (in Building, Industry,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







Source: CEA General Review 2016



Energy Saving Potential in 2047 (MTOE)

Source: Derived from NITI Aayog's IESS

Note: Agriculture includes energy used for both pumps and tractors

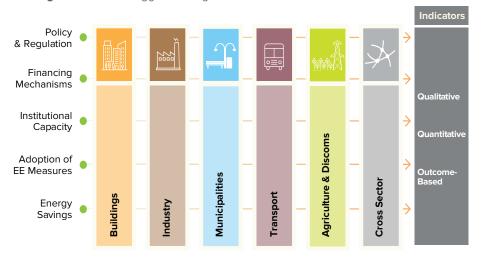
Table 1. S	States' Roles in Energy Conservation
Sector	States' (or the Designated Agency's) Role and Authority in Driving Energy Efficiency
	EC Act, Section 15: Amend the energy conservation building codes to suit the regional and local climatic conditions. Notify energy conservation building codes with respect to the 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
Buildings	EC Act, Section 18: Regulation of norms for energy consumption standards in any building. Regulation of the energy consumption standards for equipment and appliances.
ā	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.
	EC Act Sec 15: Direct the designated consumers to comply with energy audit requirements and furnish requisite data at the requisite time.
	EC Act, Section 17: Power of inspection of industries to check compliance with requirements of the EC Act
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.
lno	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.
s	EC Act, Section 18: Regulation of the energy consumption standards for street lighting and drinking and/or wastewater pumping.
Municipalities	EC Act, Section 26: Impose penalties for non-compliance of either central or state government energy conservation regulations
nicipe	EC Act, Section 27, 28, 29: Power to adjudicate the penalties imposed for non-compliance
W	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.
ort	Road transportation under state purview
Transport	State Road Transport Corporations
Ţ	State Transport department defines policies and regulations
	EC Act, Section 18: Regulation of the energy consumption standards for agricultural pumping.
ture	EC Act, Section 26: Impose penalties for non-compliance of either central or state government energy conservation regulations
Agriculture	EC Act, Section 27, 28, 29: Power to adjudicate the penalties imposed for non-compliance
Ag	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.
	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.
Σ	EC Act, Section 17: Power of inspection of concerned entities to check compliance with requirements of the EC Act
DISCOM	EC Act, Section 26: Impose penalties for non-compliance of either central or state government energy conservation regulations
۵	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.
-s.	EC Act, Section 15: Create awareness and disseminate information for efficient use of energy and its conservation.
Cross- Sector	EC Act Section 16: Constitute State Energy Conservation Fund for meeting the expenses incurred for implementing EE projects

7

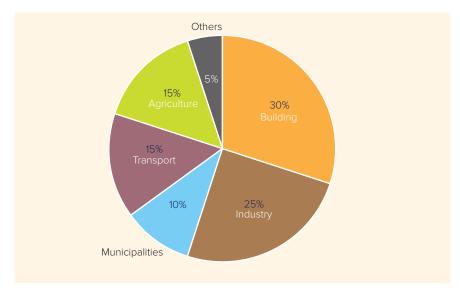
The above information became the basis for finalization of demand sectors, selection of indicators (higher the consumption means a greater number of indicators) and for assigning weightages for scoring. The sectors finally considered are Buildings, Industries, Municipalities, Transport, and Agriculture & DISCOMs. In addition to these sectors, the indicators also cover initiatives that have a cross-sector impact. Since the indicators for agriculture are related to DSM strategies, agriculture and DISCOMs have been merged into a single category.

The State Energy Efficiency Index 2019 comprises 97 qualitative, quantitative and outcome-based indicators to monitor the real progress made in the implementation of policies, programs and projects. The outcome-based indicators have been selected to signify adoption of energy efficiency measures (technology, processes, etc.), energy savings and/or reduction in energy intensity. Indicators have further been mapped in five dimensions – policy and regulation, financing mechanisms, institutional capacity, adoption of energy efficiency measures and









energy savings achieved. All the indicators have been structured to eliminate or reduce subjectivity due to State-specific conditions.

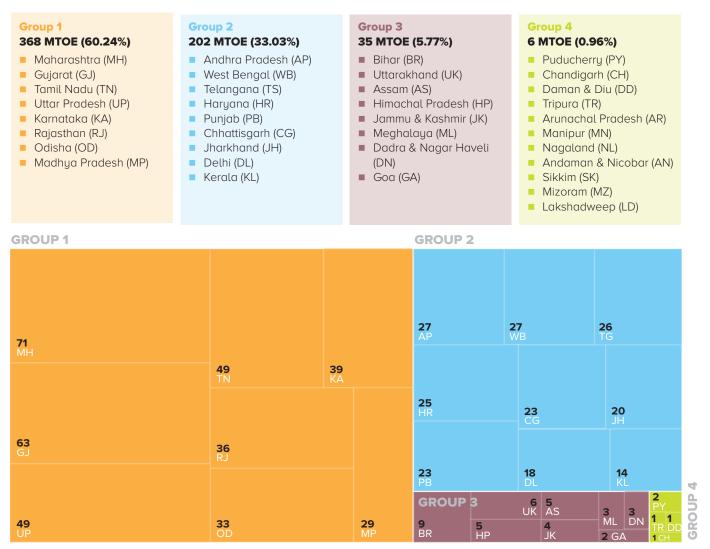
In each sector, indicators have been selected based on their impact in driving energy efficiency implementation in states. The outcome-based indicators have been selected to signify energy savings and/or reduction in energy intensity. Some indicators, especially those measuring energy intensity are crucial in setting a baseline for measuring progress in energy efficiency over time.

The building sector receives 30% of the weight because it has several indicators, states can play an influential role in energy efficiency in buildings, and it accounts for the second-highest share in 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 can do for energy efficiency in this sector. Weights for the other sectors are based on similar reasoning. Many indicators are simple 'yes' vs 'no' indicators, but some involve data for which higher values receive maximum points and lower values fewer points. The number of indicators and points by sector are summarised in Figure 8. The detailed scoring criteria for each indicator are provided in the specific sections for each sector. Compared to the State Energy Efficiency Preparedness Index 2018, the points allocated for outcome-based indicators have been increased and the scoring criteria and the evaluation process have been made more stringent.

2. Grouping of states based on energy consumption: For State EE Index 2018, the grouping of states was based on the state aggregated Total Primary Energy Supply (TPES) required to meet states' actual energy demand (electricity, coal, oil, gas, etc.) across sectors. The purpose of grouping states was to bring similar energyconsuming states together for a rational comparison. A few other parameters for grouping such as energy intensity of GSDP, energy savings potential, and per capita energy consumption, in isolation or in combination were also contemplated. However, considering the lack of data availability and for the sake of simplicity, final grouping in 2018 was made solely based on TPES. Hence, the same approach as last year for categorization based on Total Primary Energy Supply is followed for State EE Index 2019. The criteria for grouping are as follows:

TPES Group	TPES Threshold
Group 1	> 28 MTOE
Group 2	10 < MTOE <= 28
Group 3	2 <= MTOE <= 10
Group 4	< 2 MTOE

Figure 9. Total Primary Energy Supply (MTOE) in States 2014-2015



Source: NITI Aayog's India Energy Dashboard'; CEA General Review 2016, MoSPI Energy Statistics 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, Oil, and Gas (CNG and PNG). The state-wise data on TPES for Coal, Oil, and Gas is derived from the data available on India Energy Dashboard, which in turn is compiled from the limited disaggregated data gathered from multiple sources including Coal Directory of India, Indian Petroleum & Natural Gas Statistics and Data Bank, Department of Commerce's export-import database, etc. Only one-fifth of the total CNG and PNG consumption is accounted for due to non-availability of state-wise data for the remaining gas consumption. Uniform calorific value has been assumed for all oil products due to non-availability of oil product wise segregated data at state level.

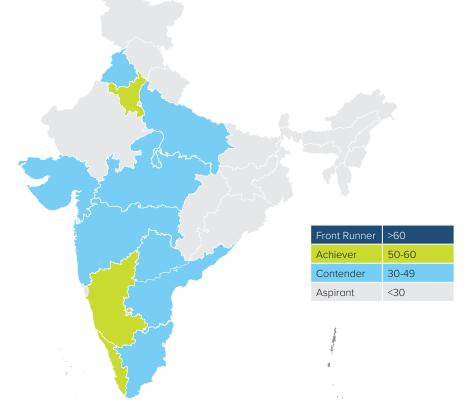
¹ India Energy Dashboards developed by Prayas (Energy Group) for NITI Aayog https://niti.gov.in/edm/

Figure 9 shows the grouping of states based on TPES. Thus, states such as Maharashtra and Tamil Nadu are compared with each other, while at the other end of the spectrum, many of the North-eastern states and UTs are compared with each other.

3. Data collection and verification: The respective State Designated Agencies (SDAs) were nominated by BEE to act as a central coordinating body in the state and collect data from the concerned state departments. Apart from the data furnished by SDAs, BEE in association with AEEE also collected data from various central government sources such as Central Electricity Authority (CEA) General Review, Bureau of Energy Efficiency and Energy Efficiency Services Limited (EESL), and Ministry of Road Transport and Highways (MoRTH). BEE and AEEE also collected publicly available information from the websites of State Electricity Regulatory Commissions and State Nodal Agencies, private sector business associations such as CII and certification bodies such as IGBC, GBCI India and GRIHA. The data provided by SDAs and collected by AEEE was compiled and shared with the respective SDAs for their review. The State Energy Efficiency Index only uses data vetted by SDAs and BEE, or data from central government databases and reports.

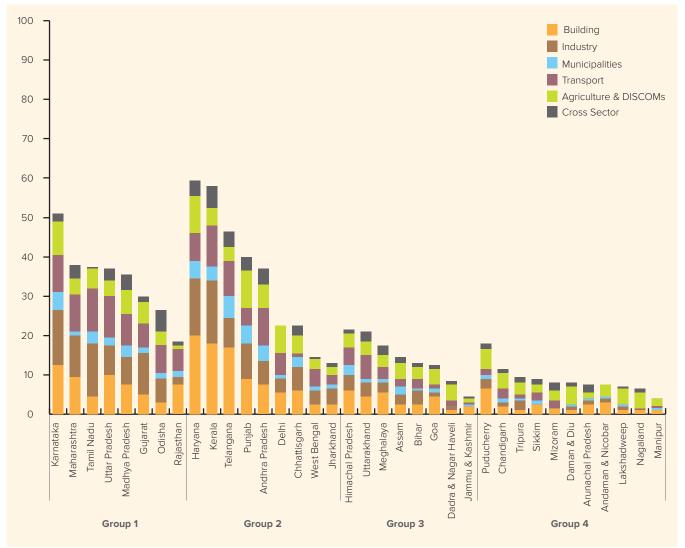
03 State Energy Efficiency Index

States and union territories have been categorised as 'Front Runner', 'Achiever', 'Contender' and 'Aspirant'. For State EE Index 2019 there are no 'Front Runner' states, and the top performing states Haryana, Karnataka and Kerala are in the 'Achiever' category, as indicated in the map. Figure 10 shows state scores TPES group-wise. States have scored lower this year, primarily due to the lack of data for outcome-based indicators, coupled with the increased weightage for outcome-based indicators and more stringent scoring criteria and evaluation process.



* For State EE Index 2019, unified Jammu & Kashmir and Ladakh have been considered.





Note: All data is as of 15 November 2019, subsequently reviewed by SDAs and BEE, and updated thereafter. No data was received from Andaman & Nicobar, Dadra & Nagar Haveli, Goa, Jammu & Kashmir and Lakshadweep.

3.1 BUILDINGS

The State Energy Efficiency Index in 2019 has 23 indicators to capture states' initiatives and progress in energy efficiency in buildings as this sector accounts for 33% of total electricity consumption in India. The indicators cover various aspects such as Energy Conservation Building Code-2017 (ECBC-2017), ECO Niwas Samhita 2018, programmes and incentives for ECBC-compliant construction and adoption of energyefficient appliances, institutional capacity for supporting energy efficiency in buildings, energy savings and reduction in energy intensity. The overall score for most states is lower in this Index compared to the Preparedness Index 2018, primarily due to the increase in allocated score and stringency in scoring criteria for outcome-based indicators, as these outcome-based indicators are the actual measure of the effectiveness of a state's policies, programmes and established institutional capabilities for energy efficiency.

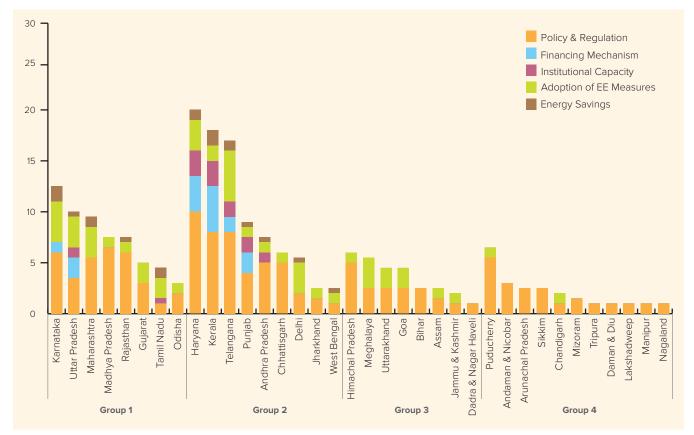
Table 2 provides an overview of the indicators and Figure 11 depicts the score for each state across the indicator categories - Policy and Regulation, Financing Mechanisms, Institutional Capacity, Adoption of EE Measures and Energy Savings, grouping states based on the total primary energy supply (TPES) in each state.

Table 2. Building Indicators

#	Indicator	Points	Scoring Criteria			
Polie	Policy and Regulation					
1	Mandatory Energy Conservation Building Code (ECBC 2017)	2	Has the state's Energy or Urban Development Department notified mandatory compliance with ECBC 2017 norms? If 'Yes/Notification Complete' score = 2, If submitted to cabinet score = 1.5, If code and rules amended score = 1, else score = 0			
2	Progress on incorporation of ECBC 2017 in municipal building bye laws	2	Has ECBC 2017 been incorporated in the bye-laws of one or more corporations and/or municipalities in the state? If 'Yes/Incorporated in at least 1 ULB' score = 2, If amended rules sent to ULB/Town & Country Planning score = 1, 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 a connected load greater than 100 kW? If 'Yes' score = 1, else score = 0			
4	Proportion of buildings complying with the 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 list of audited buildings & total mandated buildings provided score = 1, if only list of audited buildings score = 0.5, else score = 0			
5	Adoption of BEE star rating for existing buildings	1	Has the State adopted either the BEE Star rating or any other green building rating system for public buildings? If 'Yes' score = 1, else score = 0			
6	EE Lighting programmes	1	Does the state have at least one programme to increase the adoption / penetration of energy-efficient lighting, e.g. LED bulbs? If state initiative score = 1, else score = 0			
7	EE Appliance programmes	2	Does the state have at least one programme to increase the adoption / penetration of energy-efficient appliances? If state initiative score = 2, else score = 0			
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 cookstoves, to replace fuels such as biomass, firewood, etc.? If MNRE Program or state initiative score = 1, else score = 0			
9	Adoption of ECO Niwas Samhita 2018 Energy Conservation Building Code for Residential Buildings (ECBC-R)	1	Has the state taken any policy/regulatory measures for the adoption of ECO Niwas Samhita 2018 (ECBC-R)? If process has officially started score = 1, else score = 0			
Fina	ncing Mechanisms					
10	5 55	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	0.5	What is the quantum of funds allocated and utilised for building energy audits? If funds allocated & utilised score = 0.5, else score = 0			
12	Financial incentives for ECBC-compliant construction / retrofits	1	Does the state provide financial incentives for ECBC-compliant construction / retrofits, such as soft loan, tax rebates, subsidy, indirect financial benefits such as an increase in FSI allowance, or any others? <i>If 'Yes' score = 1, else score = 0</i>			

#	Indicator	Points	Scoring Criteria	
13	Funds allocated for ECBC 2017 compliant construction / retrofits; Fund utilised	1	What is the quantum of funds allocated and utilised for ECBC compliant construction / retrofits? If funds allocated & utilised score = 1, funds allocated score = 0.5, else score = 0	
14	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	
15	Funds allocated & utilised for EE appliances programmes	1	What is the quantum of funds allocated and utilised for EE appliance programmes? If funds allocated & utilised score = 1, funds allocated score = 0.5, else score = 0	
Insti	tutional Capacity			
16	Entity assigned for enforcing and certifying ECBC 2017 compliance	1	Is there a dedicated entity for enforcing and certifying ECBC compliance? If 'Yes' score = 1, else score = 0	
17	Entity assigned for checking compliance of mandatory energy audits and reporting	0.5	Is there a dedicated entity for ensuring and reviewing mandated energy audits and reporting? If 'Yes' score = 0.5, else score = 0	
18	Budget allocated for entity to support EE in buildings	1	Is there a budget allocated by the state 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? <i>If allocated score = 1, else score = 0</i>	
Ado	ption of EE Measures			
19	Adoption/Penetration of ECBC in new construction	2	Of all the new buildings completed in 2017-2018 or later, how many are ECBC compliant? If >0% penetration of ECBC-compliant buildings compared to all new buildings, score = 2, if only a list of ECBC-compliant buildings score = 1, else score = 0	
20	Certified green buildings	3	How many certified green buildings are there in the state? Green buildings per million connected consumers: If >= 20, score = 3, if 10-19 score = 2, if 1-9 score = 1, else score = 0	
21	Benchmarking of energy intensity in commercial buildings	1	Has the State taken efforts to benchmark energy intensity in commercial buildings? If recent (2016 or later) baselining attempt score = 1, If earlier baselining attempt score = 0.5, else score = 0	
Ener	rgy Savings			
22	Energy Savings in Commercial & Public Buildings	3	What is the reduction in energy consumption in commercial and public buildings, specifically due to the implementation of EE measures? SDA data with evidence: up to 2 buildings = 0.5, >2 buildings = 1; CII awards: up to 2 buildings = 0.5; >2 buildings = 1 If SDA has systematic process to measure energy savings from EC/EE against set targets for building sector in state, add 1	
23	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 systematic M&V to determine this score = 1, If available for at least one city score = 0.5, else = 0	





DISCUSSION

The Ministry of Power and the Bureau of Energy Efficiency have recognized energy efficiency in buildings to be critical for India's National Action Plan on Climate Change and global climate commitments like India's Nationally Determined Contribution. By focusing on the vast scope for energy efficiency in the building sector, states can significantly transform the building efficiency landscape and contribute to the Nationally Determined Contribution on climate change. States and local governments play a crucial role in the implementation and enforcement of energy-efficient measures and programmes in the building sector as it requires coordinated efforts of multiple stakeholders at different levels. The top-performing states in the building sector are Haryana, Kerala, Telangana and Karnataka.

Policy and Regulation

Though the ECBC-2017 was developed by the Union Government, the effective implementation and enforcement of the code lie with states' Urban/Rural Development Departments and Local governments (Urban Local Bodies - ULBs) under the purview of EC Act 2001. Andaman & Nicobar Islands, Andhra Pradesh, Haryana, Himachal Pradesh, Karnataka and Telangana have amended the code to suit their regional and local conditions, and have notified the code along with ECBC Rules- 2018 in the state's official gazette. Most states have notified their draft version for public and stakeholder recommendations and are waiting for the respective state cabinet approvals. Andhra Pradesh, Karnataka and Telangana have gone one step ahead and incorporated ECBC 2017 in their municipal building bye-laws. Kerala too has incorporated ECBC 2017 in their municipal building

bye-laws, though the notification of the code is still in the final stages. Chhattisgarh, Haryana, Kerala, Madhya Pradesh, Odisha, Puducherry, Rajasthan and Telangana have incorporated energy efficiency norms in public procurement guidelines for lighting and appliances.

On enforcing mandatory energy audits and reporting in the building sector, Gujarat, Haryana, Kerala, Madhya Pradesh, Maharashtra, Rajasthan and Telangana have made energy audits mandatory for certain categories of commercial building consumers. This is a welcome step and states now need to ensure that energy audit doesn't remain a onetime activity, rather it is pursued as a periodic activity. States also need to ensure that the energy savings potential identified through energy audits are translated to actual savings through the implementation of energy efficiency measures. Andhra Pradesh, Delhi, Gujarat, Karnataka,

Maharashtra, Odisha, Punjab, Rajasthan and Uttar Pradesh have started making some progress in the adoption of ECO Niwas Samhita 2018 - Energy Conservation Building Code for Residential Buildings, with some of them receiving support from Indo-Swiss and Indo-German bilateral programs.

Financing Mechanisms

Haryana, Kerala and Punjab are the few states that offer a subsidy for energy audits. Haryana government offers a subsidy of 50 % on the total cost of the energy audit for private consumers and for government institution buildings. Further, whoever undertakes to implement at least 50% of the recommendations of the energy audit report would be facilitated with a 100% subsidy. The Kerala government's scheme on energy audit is only applicable for State and Central Public Sector Undertakings, and State Government and Central Government Institutions in the HT/ EHT consumer category (industries/ buildings). Punjab government has initiated walk-through energy audits through PEDA empanelled energy auditors / energy auditing firms and provides a walk-through energy audit fee of INR 10,000 per consumer.

Three (3) states provide financial incentives for ECBC-compliant construction and retrofits and green buildings. Kerala Finance Corporation provides soft loans for ECBCcompliant construction and retrofits. Punjab Municipal Green Buildings Incentives Policy-2016 provides for a 15% rebate in property tax for ECBCcompliant buildings. Uttar Pradesh provides a financial incentive of 5% extra FAR for the buildings having 4-star GRIHA, LEED-Gold or Gold rating from IGBC. Though Telangana does not provide financial incentives, the state prioritises permissions for ECBC-compliant buildings.

Institutional Capacity

Andhra Pradesh, Haryana, Kerala, Punjab, Telangana and Uttar Pradesh have assigned an entity such as Third-Party Assessors (TPAs) or others for enforcing and certifying ECBC 2017 compliance. States that have made energy audits mandatory for commercial building consumers have an entity assigned for checking compliance of mandatory energy audits and reporting, except in the case of Rajasthan. Only Haryana and Kerala have allocated state budget for the entity to support EE in buildings.

Adoption of EE Measures

In the adoption of ECBC, the Telangana government is the front runner as permissions for all new commercial buildings will be given through online Development Permission Management System (DPMS) where ECBC is a mandatory document certified by a TPA. None of the states has made any efforts on benchmarking energy intensity of commercial buildings, though Kerala has conducted a baselining study. Setting benchmarks for various building typologies (hotels, hospitals, data centres, etc.) will encourage consumers to improve their energy performance, while also providing guidance to SDAs on developing and tailoring programmes for energy efficiency in buildings. States that already mandate energy audits for certain categories of buildings should use data from the audit reports to develop benchmarks. Penetration of green buildings is picking up in a majority of the states. Delhi, Haryana, Karnataka, Maharashtra, Meghalaya and Telangana have a comparatively higher penetration of green buildings per connected electricity consumer.

Energy Savings

Data on energy savings in the building sector is not systematically collected, even in states where mandatory energy audit requirements are in place. Haryana, Kerala and Karnataka are the three states that were able to provide data on energy savings achieved for a few buildings at least.

Building Spotlight

Energy Audit Incentive Linked to Implementation: Haryana government has released guidelines and incentives for energy audits for both government and private buildings. Under the scheme, owners of private buildings shall be provided with financial assistance @50% of the energy audit cost with the maximum limit of INR 50,000. Government buildings above 100 kW connected load who undertake to implement at least 50% recommendations of the energy audit report, will be reimbursed 100% of the energy audit cost.

Online ECBC Compliance System: 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

Innovative Incentives for Premium Green Buildings: Department of Local Government (Town Planning Wing), Government of Punjab notified '*The Punjab Municipal Green Buildings Incentives Policy- 2016*' which specifies an additional 5% Floor Area Ratio (FAR) for green buildings certified under (4 / 5 star) GRIHA or (Gold / Platinum) LEED or (Gold / Platinum) IGBC rating systems. The notification also specifies 15% rebate in property tax for Punjab ECBC compliant buildings. The primary source of data on energy savings in buildings is from the CII awards for energy conservation, based on which, 24 commercial buildings across 11 states reduced their energy intensity. No state has scored full points for Energy Savings due to the lack of a structured process within the SDA to accurately and comprehensively capture energy savings in buildings at the state level.

No state was able to provide data on energy intensity (kWh/m²) in commercial buildings. Periodically capturing and reviewing energy intensity will help SDAs analyse energy consumption trends and the impact of EE efforts in reducing energy intensity. SDAs could start with capturing energy intensity in commercial buildings, collaborating with DISCOMs and Urban Local Bodies to get data on electricity consumption, building area and building characteristics for various building typologies (hotels, hospitals, data centres, etc.).

3.2 INDUSTRY

The State EE Index 2019 has 17 indicators for Energy Efficiency in the industrial sector. New indicators introduced this year include three indicators for energy efficiency in MSME clusters, with states given the option to identify one or more MSME clusters which the state is focussing on for energy efficiency programmes. Other new indicators include one for the adoption of ISO 50001 in industry and one for the performance of the state in PAT Cycle II* (provisional results). The score allocated for outcome-based indicators such as adoption of energy-efficient measures and actual energy savings has been increased compared to the previous index. Further, the criteria for scoring and the evaluation process have been made more stringent compared to the previous index. The overall score for most states is lower in this Index compared to the Preparedness Index 2018, primarily due to the increase in allocated score and stringency in scoring criteria for outcome-based indicators.

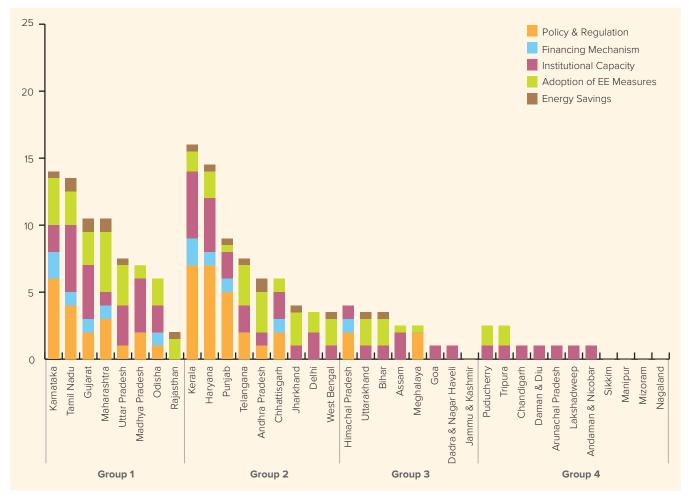
Table 3 provides an overview of the indicators for State EE Index 2019. Figure 12 indicates the score for each state across the indicator categories - Policy and Regulation, Financing Mechanisms, Institutional Capacity, Adoption of EE Measures, Energy Savings, grouping states based on total primary energy supply (TPES) in each state.

#	Indicator	Points	Scoring Criteria		
Polic	Policy and Regulation				
1	Energy Saving targets for industries set by the state (other than PAT)	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 notified by state	2	Are periodic energy audits mandatory for all industries, or at least certain category of industry, over and above those for PAT industries? <i>If 'Yes' score = 2, else score = 0</i>		
3	Number of non-PAT Industries audited in the most recent mandatory energy audit cycle	2	Out of all non-PAT industries that are mandated to conduct an energy audit how many completed the energy audit during the most recent audit cycle? If >50% score = 2; if 1-49% score = 1, else score = 0		
4	State policy / mandate to promote EE Equipment in Industries	2	Is there a state policy or regulation to promote EE equipment in industries? If 'Yes' score = 2, else score = 0		
Financing Mechanisms					
5	Financial incentives for implementing EE	1	Does the state provide financial incentives for implementing EE measures in industries? If 'Yes' score = 1, else score = 0		
6	Funds allocated & utilised for implementing EE	1	What is the quantum of funds allocated and utilised for implementing EE measures in industries? If funds allocated & utilised score = 1, if allocated = 0.5, else score = 0		
Institutional Capacity					
7	Entity to conduct and enforce 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		

Table 3. Industry Indicators

#	Indicator	Points	Scoring Criteria		
8	Entity to support PAT or other industry EE programs in state	1	Is there a dedicated entity to support PAT or other industry EE programmes in the State? If 'Yes' score = 1, else score = 0		
9	Adjudication authority for PAT in SERC	1	Has the state appointed an adjudication authority for PAT in the SERC? If 'Yes' score = 1, else score = 0		
10	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 allocated score = 1, else score = 0		
Adop	otion of EE Measures				
11	Industrial units (non-PAT & MSME) that have adopted EE measures	2	Provide the number of non-PAT industrial units that have adopted / implemented at least one EE measure If >= 1 industrial unit verified by SDA score = 0.5 Additional points: If 1-2 units verified via CII EC awards, add 0.5; If >2 units verified via CII EC Awards, add 1; If SDA has a systematic process to measure energy savings from EC/EE against set targets, add 0.5		
12	% DC that met PAT Cycle II SEC Target	1.5	What % of DC's in the state have met the SEC target set by PAT Cycle I? If >= 80% score = 1.5; 70-79% score = 1; 60-69% score = 0.5, else score = 0		
13	Adoption ISO 50001 (Energy Management System Standard) standards in industrial units in the State	0.5	How many industries in the State have adopted ISO 50001 standards? Please mention the number of units. If >= 1 industrial unit score = 0.5, else score = 0		
Ener	Energy Savings				
14	Industrial energy savings in kWh/ktoe specifically due to implementation of EE/EC measures	2	What are the energy savings (kWh/ktoe) in industrial energy use, specifically due to energy efficiency / energy conservation measures? If energy savings achieved in >= 1 industrial unit verified by SDA, score = 0.5 Additional points: If energy savings achieved in 1-2 units verified via CII EC awards, add 0.5; If energy savings achieved in >2 units verified via CII EC Awards, add 1; If SDA has a systematic process to measure energy savings from EC/EE against set targets, add 0.5		
MSME Cluster Initiatives for one or more MSME clusters identified by SDA					
15	Policy & Regulation: Specific EE programs or schemes for the chosen MSME cluster	2	Indicate which of the following programmes are in place: regular energy audits, EE technology identification, pilot project, technical workshops, financial support If 3-5 initiatives score = 2, if 1-2 initiatives score = 1, else score = 0		
16	Adoption of EE Measures: Units that have participated in EE programs	1	Number of units in the chosen MSME cluster that have participated in any of the EE programmes listed in Indicator 15 If >=1 MSME unit, score = 1, else score = 0		
17	Energy Savings: Energy savings in kWh /Ktoe specifically due to implementation of EE/EC measures	1	Energy savings in this MSME cluster (kWh/ktoe) specifically due to implementation of EE/EC measures If energy savings >0 kWh/ktoe, score = 1, else score = 0		





DISCUSSION

The top performers are Kerala, Haryana, Karnataka, and Tamil Nadu. All these states have scored across all indicator categories – policy and regulation, financing mechanisms, institutional capacity, adoption of EE measures and energy savings. However, as with all other states, the score in outcome-based indicators, i.e. adoption of EE measures and energy savings, is largely due to energy conservation efforts driven by the private sector.

Policy and Regulation

Only 2 states, Karnataka and Tamil Nadu, have set state-specific targets for energy savings independent of the targets sent by BEE for PAT designated consumers. Though some

states have done energy audits and studies in previous years to determine energy saving potential in industry, this has not translated into setting targets for energy saving. Five (5) states, namely Gujarat, Haryana, Kerala, Maharashtra and Tamil Nadu have mandated energy audits for certain categories of industry over and above the PAT audits mandated by BEE. In these states too, the monitoring and follow up on energy audit findings and measures taken are not evident. These states could use information from these audits to set energy saving targets and benchmarks for industry. Eight (8) states, namely Chhattisgarh, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Meghalaya and Punjab, have a policy or regulation for minimum standards for EE equipment in industry. States could set mandates

for minimum efficiency standards for common industrial equipment such as motors, compressors, boilers, etc.

Financing Mechanisms

Ten (10) states, namely Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Odisha, Punjab and Tamil Nadu, have financing schemes for EE implementation in industry. These include subsidies for energy audit and low-interest loans. Only Karnataka and Kerala confirmed the allocation of funds towards support for EE in industry.

Institutional Capacity

State Designated Agencies (SDAs) support BEE in implementing and monitoring PAT in their respective state, and most states have an adjudicating authority appointed in the State Electricity Regulatory Commission (SERC). Though SDAs support non-PAT industries and MSME with audits, workshops and demo/pilot projects, these appear to be one-off programmes rather than a focussed effort to reduce energy intensity in these sectors. A dedicated cell for industrial EE, like the ECBC cell for buildings, could provide the necessary focus for EE in industry. Further, given the diversity and complexity in the industrial sector, experts from the industry department, trade associations and research institutions could collaborate with this cell. This is crucial for the MSME sector, which lags in energy efficiency despite several national programmes for MSME clusters.

Adoption of EE Measures

Data on outcome-based indicators such as the number of industrial units that have adopted EE measures is not captured in a comprehensive, structured way. Some SDAs provided data on industries that have applied for and won state energy conservation awards. Likewise, the Confederation of Indian Industry (CII) conducts an annual Energy Efficiency Summit at which CII awards enterprises (buildings, industry, DISCOMs) for achievements in energy conservation. For Index 2019, the primary source of data is from the CII awards for energy conservation, based on which, 35 industrial units across 13 states reduced their energy intensity through adoption of EE measures. Tamil Nadu has several industries that have adopted EE measures as per the CII awards. For PAT Cycle II, based on provisional data for DCs who have submitted reports, 100% DCs in Bihar, Delhi, Puducherru, Tripura and Uttarakhand have met the SEC target. In Jharkhand, Maharashtra, Odisha and West Bengal more than 80% DCs have met the SEC target. Since data on the adoption of EE measures is far

from complete or comprehensive, the scoring criteria have been defined based on the available data. No state has scored full points for Adoption of EE Measures due to the lack of a structured process within the SDA to accurately and comprehensively capture this data at the state level.

In conclusion, SDAs could put a structured process in place to mandate minimum energy performance standards (MEPS) for industrial equipment and processes, set targets for adoption of EE measures and energy savings, and monitor the progress of EE implementation in industries.

Energy Savings

For energy savings too, the available data is far from complete or comprehensive, since there is no structured process for capturing annual energy savings or energy intensity across all industrial sectors. For Index 2019, the primary source of data is from the CII awards for energu conservation, based on which, 35 industrial units across 13 states reduced their specific energy consumption (SEC). Comparing states based on energy savings as a % of the total industrial energy consumption in a state is not feasible since data on states' total energy savings in industry specifically due to energy conservation or energy efficiency measures are not available. Further, since the industrial sector is diverse and different in each state comparing energy intensity (toe/INR of state GSDP) has not been considered for the Index. Based on the available data for energy savings, for Index 2019 states have been scored based on the number of industrial units that have reduced their SEC. No state has scored full points for Energy Savings due to the lack of a structured process within the SDA to accurately and comprehensively capture this data at the state level.

In conclusion, SDAs should put a structured process in place to set industry benchmarks (SEC) for energy-intensive sectors, as well as an overall state energy saving target for industry. This would enable states to periodically measure and monitor their progress towards meeting their energy savings target. States who already have mandatory energy audit mechanisms for certain category of industries are well placed to develop benchmarks, set targets and monitor progress. Developing SDA capacity and providing adequate funds to measure and monitor energy savings is crucial and essential to meet energy savings targets.

3.3 MUNICIPALITIES

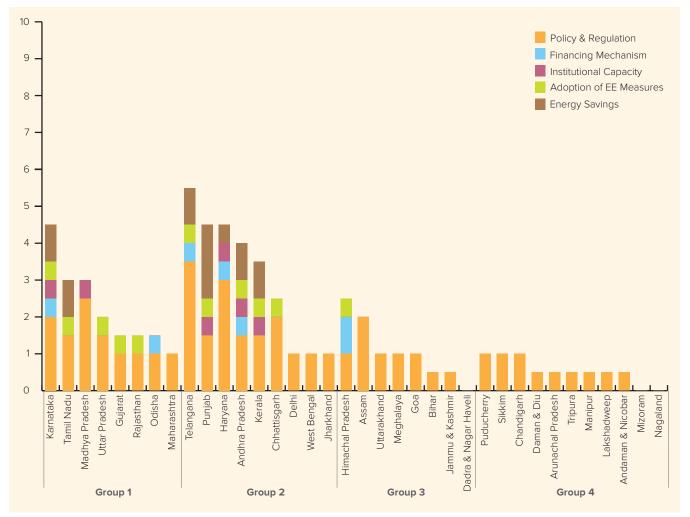
State EE Index 2019 has 16 indicators to measure the performance of EE municipal services, including street lighting, water pumping, and sewage treatment. New indicators introduced this year include regular energy audits for street lighting and water pumping, central monitoring systems for street lighting, and energy efficiency in sewage treatment and pumping. The allocated score for outcomebased indicators has been increased compared to State Energy Efficiency Preparedness Index 2018. Further, the scoring criteria have been made more stringent. The overall score for most states is lower in this Index compared to the Preparedness Index 2018, primarily due to the increase in the allocated score and stringent scoring criteria for outcome-based indicators.

Table 4 provides an overview of the indicators for State EE Index 2019. Figure 13 indicates the score for each state across the indicator categories - Policy and Regulation, Financing Mechanisms, Institutional Capacity, Energy Savings, grouping states based on total primary energy supply (TPES) in each state.

Table 4. Municipality Indicators

#	Indicator	Points	Scoring Criteria		
Polic	Policy and Regulation				
1	Energy savings target set by the State specifically for street lighting, water and sewage	1	Has the state government set energy saving targets for the specified municipal services? If 'Yes' for at least 1 service score = 1, else score = 0		
2	Programme for EE Street lighting	0.5	Does the state have at least one programme for energy-efficient street lighting, e.g. LED or equivalent? If 'Yes' score = 0.5, else score = 0		
3	Energy audits for street lighting	0.5	Does the state conduct regular energy audits for street lighting? If 'Yes' score = 0.5, else score = 0		
4	Programme for EE Municipal water pumping	0.5	Does the state have at least one programme for energy-efficient water pumping? If 'Yes' score = 0.5, else score = 0		
5	Energy audits for water supply (treatment & pumping)	0.5	Does the state conduct regular energy audits for water supply (treatment & pumping)? If 'Yes' score = 0.5, else score = 0		
6	Programme for EE Sewage treatment & pumping	0.5	Does the State have at least one programme to increase the adoption / penetration of energy efficiency in sewage treatment & pumping? If 'Yes' score = 0.5, else score = 0		
Fina	ncing Mechanisms				
7	Funds allocated for EE Street lighting; Fund utilised	0.5	What is the quantum of funds allocated for EE street lighting? If allocated and utilised score = 0.5, else score = 0		
8	Funds allocated for EE Water pumping; Fund utilised	0.5	What is the quantum of funds allocated for EE water pumping? If allocated and utilised score = 0.5, else score = 0		
9	Funds allocated for EE Sewage treatment & pumping; Funds utilised	0.5	What is the quantum of funds allocated for EE Sewage treatment & pumping? If allocated and utilised score = 0.5, else score = 0		
Institutional Capacity					
10	Entity for supporting EE measures in municipalities	0.5	Is there a dedicated entity to support EE programmes in municipalities? If 'Yes' score = 0.5, else score = 0		
11	Budget allocated for entity for municipal EE programmes	0.5	Is there a budget allocated for the functioning of this dedicated entity to support Energy Efficiency implementation in municipalities? If >0 score = 0.5, else score = 0		
Adop	otion of EE Measures				
12	Penetration of EE Street lighting	0.5	What is the penetration/adoption (%) of energy-efficient street lighting (LED or equivalent), measured as # EE lights / # total lights or as street length with EE lights / total street length in km? If data provided by SDA and >0%, score = 0.5, else score = 0		
13	Implementation of Centralised Energy Management System for Street Lighting	0.5	Have any urban local bodies installed centralised energy management systems for street lighting? If 'Yes' score = 0.5, else score = 0		
Energy Savings					
14	Energy Savings from EE Street lighting	1	What are the energy savings from implementation of EE street lighting? If >0 kWh, score = 1, else score = 0		
15	Energy savings from EE Water pumping	1	What are the energy savings from implementation of EE water pumping? If >0 kWh, score = 1, else score = 0		
16	Energy savings from EE Sewage treatment & pumping	1	What are the energy savings from implementation of EE sewage treatment & pumping? If >0 kWh, score = 1, else score = 0		





DISCUSSION

The top performing states are Telangana, Karnataka, Punjab and Haryana, all of these having scored in most indicator categories. Overall, states' performance in implementing energy efficiency in municipalities is low.

Policy and Regulation

Only 4 states, Assam, Haryana, Tamil Nadu and Telangana, have set an energy saving target for municipal services, all specifically for EE Street lighting, except in the case of Tamil Nadu which has set an overall target. All states have ongoing programmes for energy-efficient street lighting except Arunachal Pradesh, Dadra and Nagar Haveli, Manipur, Mizoram and Nagaland. Twenty-six (26) states have programmes for EE water pumping, mainly through EESL's Municipal Energy Efficiency Programme (MEEP). Only 6 states, Chhattisgarh, Haryana, Madhya Pradesh, Punjab, Telangana and Uttar Pradesh, have a programme for energy efficiency in sewage treatment and pumping.

NITI Aayog's Composite Water Management Index 2019 highlights wastewater management as a critical issue that needs to be addressed urgently. Several smart city missions have plans for developing infrastructure for 24x7 water supply and for wastewater treatment. It is crucial that SDAs, state urban development departments and municipalities collaborate to ensure that both water efficiency and energy efficiency are mandatory criteria in designing and developing infrastructure for water supply and wastewater treatment.

No state seems to have a process for periodic energy audits for municipal services. Delhi, Karnataka, Kerala, Madhya Pradesh and Telangana have recently conducted or are conducting audits for street lighting, and Andhra Pradesh, Chhattisgarh, Haryana, Karnataka, Madhya Pradesh and Telangana have recently conducted or are conducting audits for water pumping.

Financing Mechanisms

Only 6 states have funds specifically allocated for energy efficiency in municipal services, primarily for street lighting and water pumping. These are Andhra Pradesh, Haryana, Himachal Pradesh, Karnataka, Odisha and Telangana.

Institutional Capacity

Only 6 SDAs, namely those of Andhra Pradesh, Haryana, Karnataka, Kerala, Madhya Pradesh and Punjab, support EE programmes in municipalities. Given the importance of energy efficiency in critical infrastructure for water supply and wastewater management, SDAs should develop capacity in these areas, and adequate funds for EE in municipal services should be allocated.

Adoption of EE Measures

Eleven (11) states have deployed central control and monitoring systems (CCMS) for street lighting. Despite most states running an EE street lighting programme for a few

Municipality Spotlight

THE TELANGANA STATE STREET LIGHTING SYSTEMS DASHBOARD:

Telangana has set up a state-wide street lighting dashboard. The dashboard provides a real-time view of the number of lights that are on or off, CCMS that are on or off, the connected load and active load for the entire state and for each municipality. The dashboard also provides the monthly energy savings in kWh for each municipality. years, no state was able to provide data on the penetration of energyefficient streetlights, either by way of the number of lights or by the length of streets covered.

Energy Savings

Only 5 states, Haryana, Kerala, Punjab, Tamil Nadu and Telangana, provided data on energy savings achieved from energy-efficient street lighting. Andhra Pradesh, Karnataka and Punjab provided data on energy savings achieved from energy-efficient water pumping. Setting energy saving targets, identifying suitable technologies and programmes for energy efficiency in municipal services, and monitoring energy savings achieved is essential to meet goals on energy conservation and efficiency in municipalities.

3.4 TRANSPORT

The Transport sector comprises 13 indicators as compared to 5 indicators in 2018. The indicators are related to initiatives on electric mobility, energy efficiency of State Road Transport Corporations (SRTC) and concerning the overall energy efficiency in the sector. Specifically, the indicators are intended to cover the holistic approach towards energy efficiency in public transportation, government business, and private transportation. Accordingly, the scoring criteria focuses on recognizing states' efforts in improving overall fuel efficiency in transport, and implementation of electric mobility by facilitating

charging infrastructure, electric vehicles in public transportation and last mile connectivity.

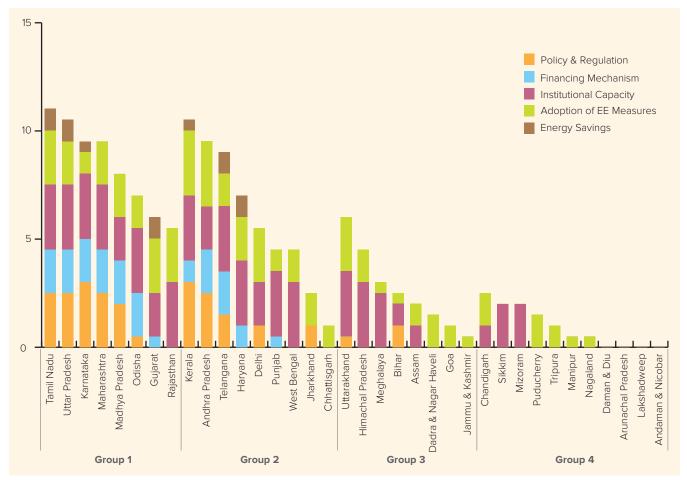
Table 5 provides an overview of the indicators for 2019. Four (4) new indicators related to Policy and Regulation have been introduced this year which relate to procurement and usage of energy-efficient vehicles and electric vehicles. There are 2 new indicators on Institutional Capacity to capture states' actions in setting up institutions, creating awareness and allocation of funds. Further, 2 new indicators on Adoption of EE measures have been included to track states' progress in achieving higher penetration of EV/Hybrid vehicles and the availability of EV charging infrastructure.

Figure 14 indicates the score for each state across the indicator categories - Financing Mechanisms, Institutional Capacity, Adoption of EE Measures, Energy Savings. The states are grouped based on the total primary energy supply (TPES) in each state. The overall score for most states is lower in this Index compared to the Preparedness Index 2018, primarily due to the increase in the number of indicators and allocated score for this sector. It is also worthwhile mentioning here that the response by states on Transport sector indicators have been poor and most of the information has been collected from publicly available sources.

Table 5. Transport Indicators

#	Indicator	Points	Scoring Criteria	
Pol	icy and Regulation			
1	State Transport Policy to advocate fuel efficiency and energy efficiency	0.5	Does the state transport policy advocate fuel efficiency and energy efficiency? If 'Yes' score = 0.5, else score = 0	
2	Policy for procurement of fuel- efficient public and government vehicles	0.5	Does the State have a policy for procuring or hiring fuel-efficient public and government vehicles? If 'Yes' score = 0.5, else score = 0	
3	State Electric Mobility Policy	2	Does the state have a policy for electric mobility? If policy is implemented score = 2, If draft policy is notified score = 1, If city-specific policy or e-vehicle schemes in smart city policy score = 0.5, else score = 0	
4	Policy for procurement of electric vehicles for government use	1	Does the state have a policy to procure electric vehicles for government use? If 'Yes' and e-vehicles are in use score = 1, If target to procure or agreement with EESL score = 0.5; else score = 0	
Fin	ancing Mechanisms			
5	State initiated incentives for Electric Mobility	2	Does the state provide incentives for private electric vehicles, commercial vehicle (taxi, auto, bus), charging infrastructure? If for all three score = 2, if for 2 score = 1, if for 1 score = 0.5, else score = 0	
Inst	titutional Capacity			
6	Awareness on fuel saving for SRTC personnel	1	Do the state conduct programmes for SRTC personnel to increase awareness and implementation of fuel saving? If 'Yes' score = 1, else score = 0	
7	State notified agency for promotion of EV	2	Is there a dedicated state entity to support and promote the adoption of electric vehicles? If 'Yes' score = 2, if notification of agency in draft policy score = 1, else score = 0	
8	Is there a budget to improve fuel efficiency and energy-efficient transport	0.5	Is there a budget allocated to improve fuel efficiency and energy- efficient transport? If budget allocated score = 0.5, else score = 0	
Add	option of EE Measures			
9	Adoption of Electric Vehicles in Public Transportation	1.5	Does the state have some number of e-vehicles in bus fleets, taxi fleets, autorickshaws and e-rickshaws? If adopted in 2 or more services score = 1.5, if in bus fleets score = 1, if in taxis, autos, e-rickshaws score = 0.5, if tenders for buses score = 0.5, else 0	
10	Penetration of hybrid and electric passenger vehicles	1.5	What is the proportion of hybrid and electric passenger vehicles of all passenger vehicles recently procured in the State (2017-2018)? If >.2% score = 1.5, If >.1% score = 1, If >.025% score = 0.5, else score = 0	
11	Availability of Charging Infrastructure for Electric Mobility	1	Has the state started rolling out charging infrastructure for all types of electric vehicles? If >10 public stations score = 1, 1-9 score = 0.5, else score= 0	
Ene	Energy Savings			
12	Energy intensity of SRTC fleet	0.5	What is the energy intensity (passenger-km/l) for the SRTC fleet in the state, considering all SRTCs? If >=75 score = 0.5, else score = 0	
13	Fuel Efficiency achieved by SRTC	1	What is the fuel efficiency achieved by SRTCs in the state? If km/MJ >0.13 score = 1, else-if >0.11 score = 0.5, else score = 0	

Figure 14. TPES group-wise Transport Scores



DISCUSSION

The top performing states in the transport sector are Tamil Nadu, Uttar Pradesh, Kerala, Andhra Pradesh, Maharashtra and Karnataka. These states have performed well on various state initiatives for electric mobility and energy efficiency measures in State Road Transport Corporations and government business.

Policy and Regulation

Based on the reported data, 10 states and UT's have either enacted an EV policy or have published a draft policy. Among the 10 states, 6 (Andhra Pradesh, Karnataka, Kerala, Maharashtra, Tamil Nadu, Uttar Pradesh) have notified EV Policy, and 4 (Bihar, Delhi, Madhya Pradesh, Telangana) have published a draft EV policy. In addition to adoption of Electric

Vehicles in public transportation and private fleets, states like Andhra Pradesh, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra and Uttarakhand have adopted using electric vehicles for government business and departmental uses at nascent levels. One of the state PSUs in Jharkhand have procured electric vehicles for its departmental use even though the state doesn't have an EV policy. No states reported having State Transport Policy that advocates fuel efficiency in transport sector. Likewise, apart from Kerala, Odisha and Tamil Nadu where guidelines related to procurement of fuel-efficient vehicles for government and public vehicles are in place, no other state has such a policy.

Financing Mechanisms

States which have notified/planned EV policies have announced

incentives for the purchase of electric vehicles, manufacturing, and for installation of charging infrastructure. It is encouraging to note that states like Odisha, Gujarat and Punjab are also providing incentives to electric vehicles despite not having a state-specific EV policy in place. The incentives in these three states are in the form of reduction of onetime registration tax, exemption of registration tax for e-rickshaws and e-carts, and rebate incentives for the purchase of two-wheelers and e-rickshaws.

Institutional Capacity

Twenty (20) States and UT's have notified establishment of Nodal Agencies for the promotion of charging infrastructure for electric vehicles. This is in response to the notification issued by Ministry of Power wherein all states are required to set up nodal agencies for facilitating the installation of charging infrastructure. Bureau of Energy Efficiency (BEE) has been nominated as the Central Nodal Agency. In addition, states like Maharashtra, Tamil Nadu have constituted a state level committee comprising of representatives from various state departments for implementation of their state EV policy. Seventeen (17) states have reported that they conduct programmes for SRTC personnel to increase awareness on fuel efficiency and savings.

Adoption of EE Measures

Adoption of electric vehicles in public transportation by the states is at an incipient stage. States like Gujarat, Himachal Pradesh, Kerala, Tamil Nadu, Telangana and Uttar Pradesh, have incorporated Electric buses in their SRTU fleet as a pilot initiative. On penetration of electric passenger vehicles (number of electric and hybrid vehicles sold between 2014-15 and 2018-19 as a percentage of total vehicles registered during the same period), Kerala tops the states at 2.3% compared to the national average of 0.3%. Chandigarh and Dadra & Nagar Haveli are two other UT's with EV penetration of more than 1%. The pioneer states of EV policy in India like Karnataka and Maharashtra have significantly lower penetration of electric vehicles.

Energy Savings

The most fuel-efficient SRTCs are in Gujarat, Haryana, Tamil Nadu, Telangana and Uttar Pradesh, with Tamil Nadu and Gujarat leading at 0.14 km/MJ. No state was able to provide data on the energy intensity (passenger-km/litre) of SRTU's in the state.

Transport Spotlight

Inland Water Transport: The inland water transport at present caters to about 4 percent of the total freight tonnage movement to and from the state. Cargo movement by inland waterways is not only cost-effective but is fuel-efficient and thus environment friendly mode of transport. It is estimated that the cost to transport one tonne of freight over 1 km through Railways, Highways and Waterways is Rs 1.41, Rs 2.28 and Rs 1.19, respectively. Recognizing the potential of inland water development in Assam, Government of Assam in November 2019 has taken up the Assam Inland Water Transport Project (AIWTP) to improve the quality of inland water transport services and integrate high-quality passenger and vehicle ferry services in the Brahmaputra and Barak rivers. The project will develop an efficient river transport system which will be safe and comfortable for the large volume of passengers and cargo carried by vessels by Inland Water Transport and also by private boat owners and operators. The World Bank has approved USD 110 million for AIWTP.

Solar-powered ferry: As the first of its kind initiative in India, State Water Transport Department, Kerala launched a solar-powered passenger vessel named "ADITYA" on 12/01/2017. The solar vessel has a carrying capacity of 75 passengers, and it has been serving Vaikom-Thavanakadavu route successfully for the last two years avoiding a wide range of air and water pollution. According to the manufacturers, ADITYA has helped save INR 40 lakh in diesel savings (58,000 litres) in a span of two years. The success of the ADITYA paves the way for scale up of solar-powered ferries that ply on diesel.

Non-motorised transport policy: The Corporation of Chennai has adopted a forward looking non-motorised (NMT) policy to encourage walking and cycling by creating a network of footpaths, cycle tracks, greenways and other NMT facilities. The policy pledges to allocate at least 60 per cent of its existing transport budget to NMT infrastructure. Increase in the share of NMT will intuitively lead to fuel savings through reduction in use of vehicles and increase in fuel efficiency of vehicles due to reduced vehicular congestion. As part of the policy, the goal is to achieve the following by mandating various policy measures:

- Increase the mode share for pedestrians and cyclists to at least 40 per cent.
- Reduce the number of pedestrian and cyclist fatalities to 0 per annum.
- Ensure that at least 80 per cent of streets have footpaths.
- Ensure that at least 80% of streets with a right-of-way (ROW) of over 30 m have unobstructed, segregated, continuous cycle track of 2m width.
- Increase public transport mode share to at least 60 per cent of motorised trips.
- Stabilise private motor vehicle kilometres travelled (VKT) so that there is 0 per cent annual growth in VKT.

Grid Integration of Electric Vehicles: Several Indian states have announced an EV policy that covers a target for EV penetration, financial incentives, and promotion of EV investments in the state. To support the achievement of targets with the necessary electricity supply infrastructure, DISCOMs will have to be well prepared as the expected rise in EVs will add complexity to the system. Low penetration of EVs may not cause any problem as is the case today. However, the future increase in EVs penetration could snowball to a complex grid planning and management issue and hinder the EV growth story. Hence, states and DISCOMs will have to estimate in advance the impacts of integrating charging infrastructure so that they can prepare for safe and reliable network operation or implement smart EV charging management strategies. BYPL has conducted such a study to analyse the impact of EVs in the operation and management of the distribution grid. Other DISCOMs and states can take a leaf from BYPL's study while planning for EV charging infrastructure and its techno-economic impact on the grid.

3.5 AGRICULTURE & DISCOMS

The 'Agriculture & DISCOMs' sector comprises 19 indicators related to DSM regulations, utility-driven Agriculture and non-Agriculture DSM programs, savings through DSM programs and Transmission and Distribution (T&D) losses in the State. New indicators introduced this year include a policy for Integrated Cold Chain Infrastructure in the State, a policy for Integrated Water and Energy savings in the Agriculture sector in the State and Implementation of Time of Day (TOD) tariffs for different customer categories on the Policy and Regulation side. Funds allocation for implementation of DSM programs and budget allocation for DSM cell are examples of other new indicators included this year related to Financing mechanism and Institutional Capacity, respectively.

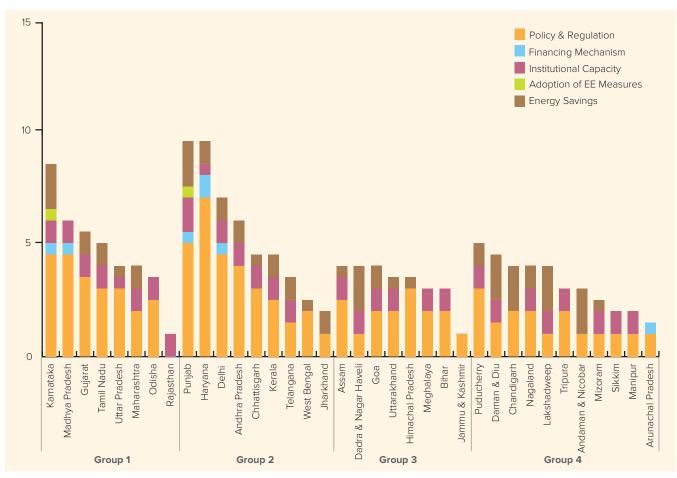
Table 6 provides an overview of the indicators for 2019. The allocated score for outcome-based indicators has been increased compared to State Energy Efficiency Preparedness Index 2018. Further, the scoring criteria have been made more stringent. Figure 15 indicates the score for each state across the indicator categories – Policy and Regulation, Financing Mechanisms, Institutional Capacity, Adoption of EE Measures, Energy Savings. The states are grouped based on the total primary energy supply (TPES) in each state. The overall score for most states is lower in this Index compared to the Preparedness Index 2018, primarily due to the increase in the allocated score and stringent scoring criteria for outcome-based indicators.

Table 6. Agriculture and DI	SCOM Indicators
-----------------------------	-----------------

#	Indicator	Points	Scoring Criteria
Poli	cy and Regulation		
1	Notification of DSM regulation	1	Has the state government notified DSM regulation? If 'Yes' score = 1, 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	0.5	Has the state set a target for energy savings to be achieved through Ag DSM programmes? If >0 score = 0.5, 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 energy savings from Non-Agriculture DSM	0.5	Has the state set a target for energy savings to be achieved through non- Ag DSM programmes? If >0 score = 0.5, else score = 0
6	Target for T&D losses (technical losses)	0.5	Has the state set a target for T&D losses (technical losses only) within DISCOMs? If % defined score = 0.5, else score = 0
7	Penalties for non-compliance of DSM mandates	0.5	Has the state defined and enforced penalties for non-compliance of DSM mandates? If 'Yes' score = 0.5, else score = 0
8	Measurement, Reporting and Verification of DSM Programs	0.5	Do DISCOMs in the state have an MRV mechanism for evaluating DSM programs? If 'Yes' score = 0.5, else score = 0
9	Policy for Integrated Cold Chain Infrastructure in the State	0.5	Does the State have guidelines/regulations to incorporate EE/EC measures in the development of integrated cold chain infrastructure? <i>If 'Yes' score = 0.5, else score = 0</i>
10	Policy for Integrated Water and Energy savings in the Agriculture sector in the State	1	Does the State have a policy for integrated water and energy savings in the agriculture sector? If 'Yes' score = 0.5, else score = 0
11	Implementation of ToD /ToU tariff for Commercial and Industrial Consumers	1	Have DISCOMs in the state implemented ToD/ToU tariff for Industrial and/ or Commercial consumers? If 'Yes' score = 1, else score = 0
12	Implementation of ToD/ToU tariff for residential consumers	1	Have DISCOMs in the state implemented of ToD / ToU tariff for residential consumers? If 'Yes' score = 1, else score = 0

#	Indicator	Points	Scoring Criteria	
Fina	Financing Mechanisms			
13	Financial incentives for DSM measures	0.5	Does the state provide financial incentives for DSM? If 'Yes' score = 0.5, else score = 0	
14	Funds allocated for DSM	0.5	What is the quantum of funds allocated for DSM programmes? <i>If allocated score = 0.5, else score = 0</i>	
Insti	Institutional Capacity			
15	Dedicated DSM cell	1	Do DISCOMs in the state have a dedicated DSM cell to support and drive DSM programmes? If 'Yes' score = 2, else score = 0	
16	Budget allocated for DSM cell	0.5	Is there a budget allocated for the functioning of dedicated DSM cells by DICSOMs? If allocated score = 0.5, else score = 0	
Ado	ption of EE Measures			
17	Consumer participation in DSM programs	0.5	What is the participation level of DISCOM consumers in the state's various DSM programmes? If >0 score = 0.5, else score = 0	
Energy Savings				
18	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	
19	Energy savings from DSM	1	What is the total energy savings from all DSM programmes in the state? If >X score = 1, if >Y score = 0.5, else score = 0	

Figure 15. TPES Group-wise Agriculture & DISCOM Sector Scores



DISCUSSION

Against the total score of 15 for this category, the maximum score of 9.5 was achieved by Haryana and Punjab across all groups. The other top performing states are Karnataka and Delhi. The states with high scores have made advancements in Policies & Regulations, Institutional Capacity and in achievement of Energy Savings. The spread in scores between states is greater in the case of Group 1 and Group 2 when compared to Group 3 and Group 4, where the state scores are close by. Puducherry is the leading state in Group 4.

Policy and Regulation

On the policy front, states have come a long way in notification of DSM regulations, but progress on accompanying policies are still lukewarm in majority of the states. While 30 states and UTs have notified DSM regulations that enable DISCOMs to identify, design and implement DSM programmes, no state has specified any target for Aq-DSM programme. Likewise, no state has defined any penalty for non-compliance with DSM or defined any MRV mechanism for monitoring and evaluation of DSM programmes. No states have specified any target for energy savings from either Ag-DSM or non-Ag DSM program indicating poor progress on the operationalization of DSM regulations. BEE has supported the majority of states in conducting load research activities and preparation of DSM action plan. States could use findings from BEE supported work to specify targets for energy savings through DSM.

Eleven (11) states have reported having a target for T&D loss reduction in place. Ideally, all states should have reported this number as most of the government DISCOMs have been covered under the UDAY scheme and respective SERCs have implemented multi-year tariffs. Twenty-four (24)

states have implemented ToD tariffs for Industrial and/or Commercial customers whereas 5 states have ToD tariffs for residential customers. No state has specified any policy for integrated cold chain infrastructure in the state. Only Haryana has reported taking an integrated approach for water and energy savings in the agriculture sector at the policy level. Projects related to Aq-DSM have focused on the conventional approach of replacing inefficient pump sets with BEE star labelled pump sets. States are also promoting the use of solar pumps in agriculture. In an integrated approach for water and energy savings in agriculture, both demandside energy reduction strategies and supply-side solutions need to be covered. Energy consumption in agriculture is a function of the water required for irrigation, quality of power supply, and the efficiency of pump sets being used. Going forward, states can plan a holistic approach of Aq-DSM wherein they can focus on 1. promotion of innovative cultivation and irrigation techniques (e.g. micro-irrigation, crop rotation, laser-based levelling, zero-tilling, etc.) which reduces water requirements, 2. Improvement in quality of power supply through high voltage distribution systems, 3. Improvement in pump efficiency through retrofits, correct sizing and replacement with BEE star labelled pumps, 4. Use of solar energy either through solarization of agriculture feeder or solarization of pump sets.

Financing Mechanisms

On the financing front, states have left a lot to be desired. Apart from 7 states in total where there is either financial incentives for DSM measures or funds have been allocated for DSM, the states have not made any substantial progress. Only three states, namely Arunachal Pradesh, Haryana and Punjab, have allocated funds for DSM. A systematic and sustainable way to ramp up DSM activities in the states could be through a levy of DSM cess on electricity sales along the lines of system benefit charge. This would help states to garner the necessary budget every year towards DSM activities.

Institutional Capacity

Constitution of DSM cell is the first and foremost activity for implementation of DSM programs as per the DSM regulations. DSM cells have been set up in 49 DISCOMs across 30 states and UTs. While 28 states have DSM cells in all of their DISCOMs, there are 2 states where DSM cells are operating in part of the DISCOMs. Four (4) states namely Andhra Pradesh, Kerala, Rajasthan, Telangana have constituted DSM cells despite DSM regulations not in place indicating their proactiveness whereas equal number of states namely Andaman & Nicobar, Chandigarh, Himachal Pradesh and Jammu & Kashmir, are yet to constitute DSM cell despite the DSM regulations in place. Haryana and Uttar Pradesh do not have DSM cells in all of their DISCOMs despite having DSM regulations. Only one state, Punjab, has a dedicated budget allocated for the functioning of DSM cells.

Energy Savings

The indicators related to energy savings are a mix of savings achieved on the supply side through a reduction in T&D losses and savings achieved on the demand side through behindthe-meter utility-driven DSM programs. On T&D reduction, the T&D losses improved marginally by absolute 0.38% in 2017-18 (21.04%) at all India level compared to 2016-17 (21.42%). States in the Northern region have achieved the maximum percentage improvement whereas the T&D losses have gone up for states in the Southern region in aggregate. Five (5) UTs and only one of the states have achieved T&D loss of less than 15%. Thirteen (13) states and UTs have T&D loss between 15% and 20%.

Alarmingly, 7 states have T&D loss greater than 30% in 2017-18. Only 1 state, namely Punjab, has reported savings from behind-the-meter DSM program.

3.6 CROSS SECTOR

The State Energy Efficiency Index comprises of 9 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. New indicators introduced this year include activities related to creating awareness, promotion of R&D in energy efficiency, and Strengthening SDA Communication with other respective state departments in the state. Another indicator included this year is related to states' action towards making SDAs as standalone independent bodies without additional responsibilities of renewable/power/electrical inspection.

Table 7 provides an overview of the indicators. Figure 16 indicates the score for each state where the states are grouped based on the total primary energy supply (TPES) in each

DISCOM Spotlight

Integrated Energy and Water Savings: Gujarat Green Revolution Company (GGRC) was formed in 2005 as the Implementing Agency appointed by the Government of Gujarat and recognized by the Government of India for implementing the Micro Irrigation Scheme (MIS). It is aimed to bring 2nd Green Revolution in the state by saving of water, electricity and enhancing agriculture productivity resulting in the farmers' prosperity at large. Till 2018-19, the company has covered 11,00,556 farmers and 17,81,279 hectares under the MIS for both agriculture and horticulture crops.

Time of Day (TOD) tariff for Domestic category: TOD is believed to be one of the effective tools for peak load management. 24 states and UTs have TOD for at least one segment of commercial and/or industrial customers. However, for Residential customers, just 5 states have TOD tariffs in place. Out of these 5 states, 2 states have made it mandatory for some segments of the residential customer category, whereas it is optional in the remaining 3 states. Kerala has TOD compulsory for 3 phase domestic customers having monthly consumption >500 kWh. West Bengal has made TOD mandatory for domestic customers having connected load >50 kVA.

Demand Response Programs: Demand Response is a voluntary reduction of electricity demand by a consumer in response to DISCOM's signal to manage peak load. For this, consumers are given financial benefits for reducing demand. BYPL has successfully tested a demand response project as per DERC order no RA/BYPL/16-17/221 during peak summer months of 2017. 500 largest consumers of BSES Yamuna Private Ltd (BYPL) in east and central Delhi having a load of over 500 KW each were enrolled in this project and were requested to voluntarily reduce their electricity load as and when required for a financial incentive of INR 1/kWh. In the project, 19 industrial and commercial consumers voluntarily reduced their consumption for 1- hour duration. 8 events were carried out during the months of April – June 2017 which resulted in cumulative savings of around 17 MW.

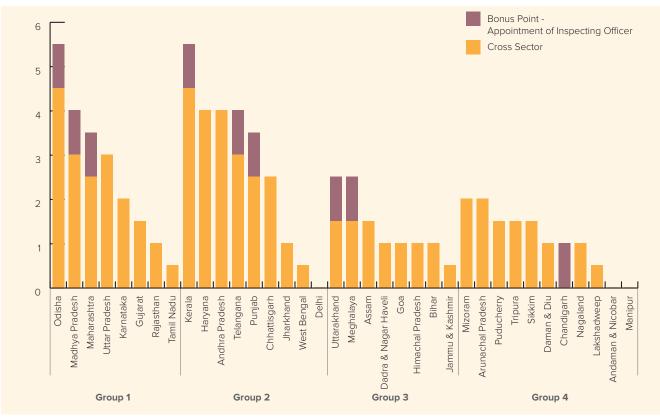
state. The overall score for most states is lower in this Index compared to the Preparedness Index 2018, primarily due to the increase in the number of indicators, changes in allocated score compared to last year, and stringent scoring criteria.

#	Indicator	Points	Scoring Criteria	
1	Establishment of SECF	0.5	Has the state established a State Energy Conservation Fund? If 'Yes' score = 0.5, else score = 0	
2	Allocation of funds for SECF by State Government	0.5	Has the state government allocated matching funds for SECF? <i>If 'Yes' score = 0.5, else score = 0</i>	
3	Projects implemented using the concept of revolving fund	0.5	Has the SDA or other state department implemented or initiated at least one project using the strategy of revolving fund? If 'Yes' score = 0.5, else score = 0	
4	Energy Efficiency and Energy Conservation Awareness Campaigns	0.5	Has the SDA conducted at least one awareness programme for schools and at least one for the general public? If SDA has done 4 or more campaigns in a year score = 0.5, else score = 0	
5	State Energy Conservation Awards	0.5	Do the SDA or other state organisations have organized State level energy conservation awards to recognise outstanding performers in building, industry and other sectors? If 'Yes' score = 0.5, else score = 0	
6	Reporting / Communication with respective State Energy / Power Departments	1	Does the SDA periodically report the status of its ongoing / planned energy efficiency activities and projects to the respective Energy / Power departments? If formal meeting with presentation & MoM score = 1, if written report sent score = 0.5, else score = 0	

Table 7. Cross Sector Indicators

#	Indicator	Points	Scoring Criteria
7	Promotion of Innovation and R&D in Energy Efficiency	0.5	Does the state have a policy or programmes for promotion of innovation and R&D in Energy-Efficiency? If 'Yes' score = 0.5, else score = 0
8	Standalone SDA	1	Has the state taken any initiatives for making SDA a standalone organization? If standalone score = 1, if steps have been initiated score = 0.5, else score = 0
9	Inspecting Office appointed in SDA		No point has been allocated for this indicator since it was introduced recently. However, states that have appointed an Inspecting Officer receive a bonus point.





NOTE: The maximum score for Cross-sector indicators is 5 points. However, the graph also includes a bonus point given to states where the SDA has appointed an Inspecting Officer (indicated by brown colour)

DISCUSSION

The maximum score of 5 was achieved by Kerala and Odisha. The other top performing states are Andhra Pradesh, Haryana, Madhya Pradesh and Telangana. While Karnataka and Punjab have a relatively higher score in other sectors, they have not managed to score high in this category. Overall, states belonging to Group 3 and Group 4 have scored low in this category compared to Group 1 and Group 2 states. The main differentiators in the top performing states are initiatives taken with respect to strengthening of communication with the state energy department, a greater focus on creating awareness, and focus on R&D activity related to energy efficiency.

It is encouraging to note that 31 states and UTs have established State Energy Conservation Fund (SECF) as per Section 16(1) of the EC Act, 2001 and have received initial seed funds from BEE. Out of these 31 states, 26 states have also allocated matching contribution to the SECF demonstrating the state's commitment towards the promotion of EE activities. One requirement of the SECF is to earmark a major part of the budget as a revolving fund to finance implementation of energy efficiency projects by providing debt/ equity financing. However apart from a very few states, no state has made progress on this front, and the SECF is mainly utilized for non-financing purposes such as for awareness activity, energy audits, demonstration project and capacity building. Seven (7) states have reported taking initiatives for the promotion of innovation and R&D in energy efficiency. For instance, the Haryana government has signed an MoU with NIT Kurukshetra for R&D and capacity building in the state. This is one indicator where states need to perform better. Because of rapid technological changes, it is inconceivable for state agencies to possess the complete in-house capacity to be able to comprehend the technological advancements and enable their adoption. Hence, forging collaboration with research and academic institutes, industries, and think tanks requires a greater focus by the states.

While all the State Governments / UT Administrations have designated an agency as State Designated Agency (SDA), but in a majority of the SDAs are functioning as a part of other government departments such as with State Nodal Agencies (SNAs) for renewable energy, Electrical Inspectorate and Power Departments. To accord greater importance to EE activities and avoid any conflict and competition of priorities, BEE is advising states to make the SDAs as independent entities. One of the newly added indicators this year is related to the existence of stand-alone SDAs in the state and whether states are taking any actions to make SDAs as standalone independent bodies in the near future. Only 2 states (Kerala and Andhra Pradesh) have confirmed the existence of independent SDAs in the state. Andhra Pradesh State Energy Conservation Mission (SECM) is the one SDA that 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. Both

the states have scored high in this year's EE index as well alluding the correlation between a state's EE performance and independence of the SDA. It is worth recognizing here that Odisha has initiated the process to make its SDA as an independent body. 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.

While BEE at the central level is involved in the formulation of mandatory standards and norms for energy efficiency, the power of inspection to check compliance with the mandatory schemes (e.g. S&L, ECBC, PAT) is vested at the state level. Without compliance mechanisms, the integrity of schemes cannot be enhanced. States need to appoint inspection officers (or agency) to carry out this role and to ensure that all schemes on EE is implemented across all energy demand sectors in the state. 9 states so far have appointed inspection officers and remaining states need to follow suit. Also, all states have to make sure that the inspection officers are dedicatedly available for this role.

Cross Sector Spotlight

State Energy Conservation Fund: While the majority of the states rely on annual budgetary allocation from BEE and state for energy conservation fund, Kerala is exploring an innovative way to raise funds for SECF. On the lines of system benefits charge which are followed in the developed countries to fund EE programs, Kerala has proposed levy of 'Energy Efficiency Cess' on electricity customers to ramp up EE activities in the state. The money so mobilized will be transferred to Kerala State Energy Conservation Fund (KSECF). The petition submitted by the Energy Management Centre, Kerala is now under the consideration of the Kerala State Electricity Regulatory Commission. The petition recommends a cess of one paise for every unit of electricity sold. The cess is expected to raise at least Rs 20 crore annually.

Energy Efficiency campaign for school children: Recognizing the necessity to inculcate the importance of energy conservation at an early stage, several states have conducted awareness training programmes for school children. Uttar Pradesh government took an innovative initiative where energy awareness campaigns for schools do not end with training, in fact it is the beginning of the process. After joining the campaign, all participating schools have to perform the activities related to: Activities of Students Energy Club, Updates on Energy Survey of the school, Implementation of Energy Saving measures, Celebration of Important Days/Events, and Social Media Posting. The schools are rated based on these activities and the best performing schools are awarded on the Energy Conservation Day.

State energy calculator for energy planning: The State Energy Calculators are built on the lines of IESS 2047 prepared by NITI Aayog. The State Energy Calculator 2050 is a scenario-building tool, which generates the energy demand and supply scenarios for the state up to 2050. These scenarios are generated considering the economic growth, structural changes, and adoption of energy-efficient technologies. The calculator comprehensively covers all sectors that impact energy – either as demand sector or as supply sector. Using the calculator, states can analyse the impact of future energy demand on energy security, emissions, energy cost and land requirement. State Energy Calculators have been developed by Andhra Pradesh, Gujarat, Assam, Karnataka, Maharashtra and Tamil Nadu. The demand sectors covered by these states include transport, cooking, buildings, agriculture, and industry and states envisage using the calculator to project sector-wise long-term energy demand for the state and make policies and programs related to energy, energy efficiency and climate change.

04 Concluding Remarks

State EE Index 2019 shows that majority of the initiatives taken by states are related to Policies and Regulations. Most of the firstgeneration energy efficiency policies prepared by BEE (S&L, ECBC, PAT, etc.) are understood by states. However, states should now focus on ensuring complete compliance to realize actual savings. Based on the analysis of responses submitted by states this year, a three-point agenda is suggested for consideration by state agencies. The three-point agenda will need to be done in a time-bound manner if states have to significantly improve their scores next year.

1. Proactive role by states in policy formulation and implementation: It is observed that states have confined their role towards customization of national policies and legislative approval. Now states must take an active authority to exercise powers under the EC Act and start formulating supporting policies and implementation rules to shift the focus from "policies in place" to "policies

successfully implemented". The design of policies and mandates should have a clear goal in mind. For example, smart meters are just a means to an end. Unless smart meters are installed with a complete backend IT integration and the data analytics are used in areas such as improvement of billing efficiency, load management and tariff modifications, energy efficiency monitoring, smart meters will serve no purpose. States should also be cognizant that EE is not a one-time activity; thus, a culture of continuous improvement should be in place. For example, notifications that were published a decade back might have lost relevance today in light of the progress in technologies. Likewise, notification of mandatory energy audits is meaningless unless a timeline for periodic audit is specified.

2. Strengthening the mechanism for data capture, management and public availability of data: Availability of updated and correct data has been the Achilles heel for states. The SDA is the competent authority within the state for all matters related to energy efficiency. For this year's Index, SDAs proactively contacted various state departments to gather data. However, SDAs should significantly enhance their engagement with state departments, DISCOMs and private sector organisations beyond one-time data collection and beyond the sole purpose of annual Index calculation. Doing so will enable effective implementation of EE programmes, enable SDAs to measure and monitor progress, and most importantly provide a feedback mechanism for modifications in EE programs and policies and setting of realistic targets. Building a robust system for demand side energy consumption data collection and analysis at local and state level will contribute significantly towards a national Energy Data Management System. With the proper data management at the state level, Government of India (GoI) will have a more robust basis for estimating the energy savings achieved by the scheme. The initiatives such as IESS 2047, Dashboards and portals of national programs, and even State Energy Calculators 2050 are right steps but meaningless unless states provide updated data. The data, if available for public consumption, can be used by DISCOMs and ERCs in the aggregate revenue requirement exercise to estimate the demand growth for supply side planning. This can also be useful to allocate more budget for EE and DSM activities and even modify electricity tariff. The energy savings potential and data from energy audit reports can be used by industry bodies

and civil societies to promote EE implementation business.

3. Enhancing the credibility of EE schemes: Ensuring the integrity of programs that have direct or indirect linkage with common customers is an important pillar of energy efficiency market transformation. To deal with this challenge, states must demonstrate an approach which includes enforcement and compliance checks. Rules related to mandatory energy audits, mandatory sale and purchase of BEE star labelled appliances will not be effective unless the inspection process is established and strengthened. For example, customers will have greater reliability on the star labelled products if the authenticity of the star label is guaranteed. This will also build the confidence of the genuine manufacturers in the schemes.

States must also make independent monitoring and verification of savings integral to all EE policies and programs. Energy audit leads to an estimate of the savings potential contingent to use of energy savings measures and onsite usage conditions. Post-implementation audit (or M&V) determines the actual savings. Hence, a digression from the conventional wisdom of "Potential equals Savings" is required for a true measure of actual energy savings achieved. In order to integrate M&V with program design, a simple step could be to start allocating budget towards M&V at the program inception stage itself. The budget could range anywhere between 2% to 5% of the program cost depending on the complexity and the scale.

The main objectives of the State Energy Efficiency Index are to drive the implementation of EE policies and programmes, set targets, track progress in managing the state's and India's energy footprint and sharing best practices across states. While policies, regulations and programmes are important to drive EE in states, energy savings and reduced energy intensity measure the success of these policies and programmes. To that extent, the State EE Index aims to incorporate more outcome-based indicators and increase the weightage of outcome-based indicators in subsequent editions, which will also help assess a state's progress in achieving energy savings targets in each sector. While the State EE Index help states share best practices, SDAs can use the State EE Index to measure their own state's progress from one year to the next and collaborate with other state departments and private sector organisations to tailor EE programmes accordingly.

References

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, BEE in association with AEEE also collected data from various central government sources and other organisations.

General

- 1. MoSPI Energy Statistics 2016
- 2. CEA General Review 2016 (FY 2014-2015)
- 3. CEA General Review 2017 (FY 2015-2016)
- 4. CEA General Review 2018 (FY 2016-2017)
- 5. NITI Aayog India Energy Portal
- 6. NITI Aayog India Energy Security Scenarios
- 7. Reserve Bank of India Handbook of Statistics on Indian States https://www.rbi.org.in/Scripts/AnnualPublications.aspx?head=Handbook+of+Statistics+on+Indian+States
- 8. State Energy Efficiency Preparedness Index 2018
- 9. UIDAI State-wise Aadhaar: https://uidai.gov.in/images/state_wise_aadhaar_saturation_as_on_22052017.pdf

Buildings

- 10. Bureau of Energy Efficiency: BEE star-rated buildings in states
- 11. Cll Awards for Energy Management 2019 http://www.greenbusinesscentre.com/energyawards/enepresent19.php
- 12. GRIHA https://www.grihaindia.org/
- 13. GBCI, India https://gbci.org/india
- 14. EESL UJALA http://www.ujala.gov.in/
- 15. EESL UJALA LED Tube light http://ledtubes.ujala.gov.in/
- 16. EESL UJALA Fan http://fan.ujala.gov.in/
- 17. Indian Green Building Council https://igbc.in/igbc/

Industry

- 18. Bureau of Energy Efficiency: PAT Cycle II (provisional data)
- 19. CII Awards for Energy Management 2019 http://www.greenbusinesscentre.com/energyawards/enepresent19.php

Municipalities

- 20. EESL SLNP http://slnp.eeslindia.org/
- 21. EESL MEEP http://meep.eeslindia.org/dashboard/

Transport

- 22. FAME http://www.fame-india.gov.in/
- 23. Motor Vehicle Registration https://vahan.nic.in/nrservices/
- 24. PCRA annual report 2017-18
- 25. Spotlight sources:

Assam Inland Water Transport: https://advantageassam.com/assets/front/pdf/Inland-Water-Transport.pdf https://projects.worldbank.org/en/projects-operations/project-detail/P157929?lang=en&tab=map

Kerala Solar-powered Ferry:

https://www.swtd.kerala.gov.in/pages-en-IN/solar-boat.php

https://www.newindianexpress.com/cities/kochi/2019/jan/16/aditya-emerges-money-energy-saver-for-govt-1925614.html

Tamil Nadu Non-motorised transport policy:

http://www.chennaicorporation.gov.in/images/nmt%20tamil.pdf

Agriculture and DISCOM

- 27. CEA General Review 2019 (FY 2017-2018)
- 28. Power for All: https://powermin.nic.in/en/content/power-all
- 29. Spotlight Sources:

Integrated Energy and Water Savings: https://ggrc.co.in/webui/Content.aspx?PageId=31

ToD for Domestic Consumers: http://www.erckerala.org/orders/ARR%20ERC%20-%202018-19%20to%202021-22.pdf http://www.wberc.gov.in/sites/default/files/WBSEDCL%202017-18.pdf

Demand Response Programmes

https://www.bsesdelhi.com/web/bypl/demand-response

https://www.business-standard.com/article/news-ians/bses-consumers-save-17-mw-power-via-demand-response-117081700859_1.html

Cross Sector

30. Spotlight Sources:

Kerala SECF:

http://www.erckerala.org/petitions/634763991092650000_OP28%20Petition%20of%20EMC%20for%20Energy%20 Efficiency%20Cess.pdf

https://www.deccanchronicle.com/nation/current-affairs/150517/kerala-energy-efficiency-cess-in-pipeline.html

Energy Efficiency campaign for school children: http://www.upsavesenergy.com/

State Energy Calculators: www.apeasternpower.com www.kptclsldc.com www.guvnl.com