GOVERNMENT OF INDIA
MINISTRY OF POWER

सत्यमेव जयते

STATE ENERGY EFFICIENCY INDEX

2020

ENERGY EFFICIENCY

Alliance for an Energy Efficient Economy™

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Disclaimer:

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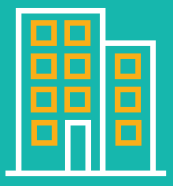
Accomplishment of India's NDC targets on emission intensity hinges heavily on a post-pandemic green economic recovery fuelled by incorporating the most energy-efficient products and services such as

electric vehicles

energy-efficient
consumer durables

a sustainable
cold chain
for
agriculture



ECBC-compliant
constructions and retrofits

EXECUTIVE SUMMARY

The year 2020 will be remembered for the disruption caused by the coronavirus disease of 2019 (COVID-19) pandemic. The pandemic has adversely affected human health, wellbeing, the economy, and our way of life. Consequently, the world is now grappling with the "new normal". 2020 was also the hottest year on record, a peak in the decade with seven of the hottest years on record[1]. While India and the rest of the world deal with the pandemic and focus on economic recovery, it is imperative to keep working towards our commitment to the Paris Agreement, considering how climate change can have an even more detrimental impact on human health and wellbeing. It is encouraging to note that, so far, India is on track to meet its Nationally Determined Contribution (NDC) target of reducing emission intensity by 33-35% (from 2005 level) and sourcing 40% of electric power from non-fossil fuel sources by 2030[2]. India reduced emission intensity by 21% between 2005 and 2014[3], which should provide the impetus to stay on track and pursue a green economic recovery. Energy Efficiency (EE), coupled with Renewable Energy (RE), is clearly the path to achieving our commitment to the Paris Agreement. The NDC target on emission intensity could be easily achieved if the economic recovery is fuelled by incorporating the most energy-efficient products and services – energy-efficient consumer durables, electric vehicles, a sustainable cold chain for agriculture, and Energy Conservation Building Code (ECBC)-compliant constructions and retrofits. Energy efficiency enables the same quality of service while reducing energy demand, which can then be met by renewable energy. It falls upon each state and union territory (UT) to take the green recovery path best suited to and aligned with the state's own socio-economic development goals. In a recent high-level meeting, Shri R K Singh, the Honourable Minister of Power and New & Renewable Energy, emphasised the need to focus on sectors with the highest emission intensity to minimise energy wastage and reduce carbon dioxide (CO_2) emissions. In the same meeting, a high-level committee was convened to implement the roadmap on energy efficiency and low-carbon technologies[4]. Therefore, the states must plunge into the energy transition underway in the country with deeper commitment and stronger strategies to help achieve India's ambitious climate goals.

STATE ENERGY EFFICIENCY INDEX 2020

The State Energy Efficiency Index (SEEI) 2020 provides each state and UT with insights on focus areas for energy efficiency (EE) and guidance for states on how to allocate the necessary resources to energy efficiency in the states' high priority sectors while planning and implementing a green recovery strategy. The SEEI has been developed by the Bureau of Energy Efficiency (BEE), in collaboration with Alliance for an Energy Efficient Economy (AEEE), in order to

- Help drive EE policies and programme 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 state-specific EE targets
- Institutionalise the state-level data capture and monitoring of EE activities, especially by State Designated Agencies (SDAs)

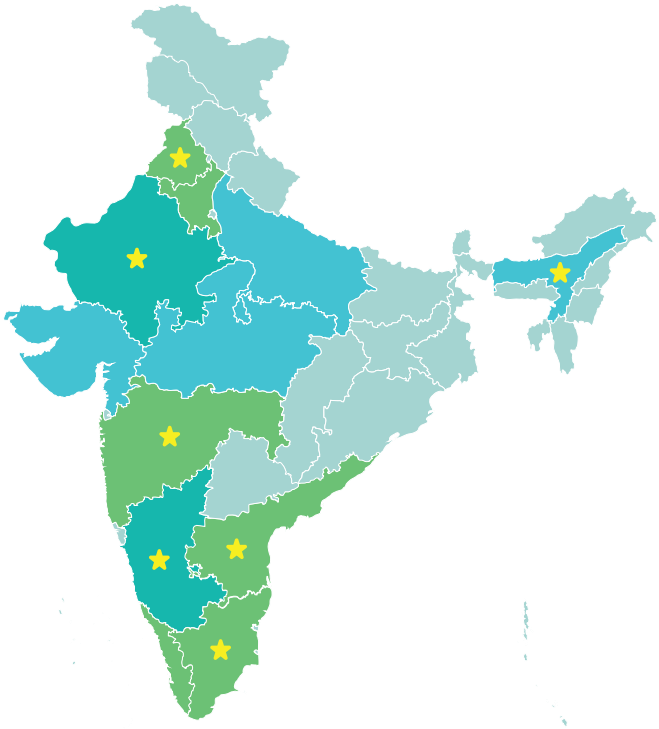
The SEEI 2020 follows the successful execution of the State Energy Efficiency Preparedness Index 2018 and the SEEI 2019, launched by the Honourable Union Minister of Power, Shri R K Singh.

A feedback survey on the State Energy Efficiency Index 2019 was conducted with SDAs. Twenty-two out of the 36 SDAs participated in the survey, and the key results were the following:

- 72% of SDAs indicated that the Index helps them improve data collection on energy efficiency.
- 77% said that the Index helps them track the state's progress in energy efficiency.
- 50% indicated that the SEEI enhances coordination with other state departments to get data and information on energy efficiency and energy conservation.
- 45% said that the Index helps in developing ideas for energy efficiency interventions and programmes.

SEEI 2020 uses the same indicator framework as the previous indices, assessing states' performance in energy efficiency through 68 indicators across six sectors: Buildings, Industry, Municipalities, Transport, Agriculture & distribution companies (DISCOMs), and Cross Sector initiatives. The indicators assess states' performance in Policy and Regulation, Financing Mechanisms, Institutional Capacity, Adoption of Energy Efficiency Measures, and Energy Savings. SEEI 2020 assesses states' performance in energy efficiency from April 2019 to March 2020. The SEEI hinges on objectivity, transparency, and consistency to assess states' performance and programmes.

The performance of the states in SEEI 2020 is shown below, with the states that have improved by more than 10 points from SEEI 2019 highlighted with a star.



Good progress in most states, 7 states improved their scores by >10 points

- **> 60** Front runner
- **50-60** Achiever
- **30-49.5** Contender
- **<30** Aspirant
- Most improved states

RESULTS AND FINDINGS

The SEEI 2020 assesses the performance of thirty-six (36) states and UTs. The UT of Ladakh is a new entrant in SEEI 2020. Dadra and Nagar Haveli and Daman and Diu, which now form a single UT, have been jointly assessed in SEEI 2020. The Index categorises states as 'Front runner', 'Achiever', 'Contender', and 'Aspirant' based on their EE-related efforts and achievements.

2
'Front Runner' states in SEEI 2020 versus none in SEEI 2019

The top-performing state is Karnataka, with a score of 70 out of 100, and is included in the 'Front runner' category. It should be noted that, in SEEI 2019, there was no state in the 'Front runner' category. Karnataka has undertaken various initiatives to upscale energy efficiency in the state, beyond notifications of relevant regulations. The Karnataka SDA carried out an assessment study of the EE initiatives across all sectors in the state. This study evaluated the impacts of these initiatives, in terms of the energy savings, economic savings, emission mitigation, social impacts, and percentage of fund utilisation against all input resources. As a result, the state was able to provide sufficient data on even the outcome-based indicators, which seem to be the Achilles' heel for most states. Other than that, it has developed multiple innovative programmes to promote energy efficiency in street lighting, water pumping, sewage treatment, electric mobility (e-mobility) and charging infrastructure, a smart grid pilot project, model energy-efficient village campaign programme, programmes to replace conventional fans, air conditioners (ACs), and light bulbs, and the "Hosa Belakhu" project, which entails providing light-emitting diode (LED) bulbs to consumers at an affordable rate. Incentives and subsidies are provided to promote green buildings, energy audits of industries, buildings and other facilities, electric vehicle (EV) charging infrastructure deployment, and energy-efficient technology adoption in industries. Karnataka also has a state water policy that includes water and energy savings in the agriculture sector. It has in place state targets on energy savings for its EE policies on buildings, non-PAT industries, and municipal, agricultural, and non-agricultural demand side management (DSM) programmes. Capacity building programmes to develop the core abilities of DISCOMs and transport staff on EE and awareness programmes on EE for citizens are reported to be conducted regularly.

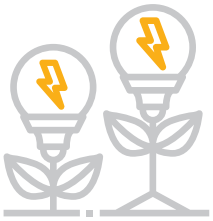
The second-highest performer, Rajasthan, scoring 61 out of 100, is another state in the 'Front runner' category. Rajasthan is the only state to have constituted an ECBC cell in its Public Works Department (PWD) from the state fund, which operates under guidance of the Chief Architect, PWD. It has also taken steps to set up energy saving targets for EE in street lighting, water & sewerage, and non-PAT industries. It is one of the few states that reported a measurement, reporting, and verification (MRV) mechanism for evaluating DSM programmes. The state has appointed dedicated agencies to conduct periodic energy audits of street lighting, water and sewerage infrastructure, and water treatment systems. The Rajasthan SDA organises the Rajasthan Energy Conservation Awards (RECA) every year for five (5) sectors and fifty (50) sub-sectors.

The other top performers are Haryana, Punjab, Maharashtra, Kerala, Tamil Nadu, and Andhra Pradesh, all in the 'Achiever' category. In SEEI 2020, as many as twenty-seven (27) states and UTs improved their scores compared to SEEI 2019. Out of these, seven (7) states, namely, Assam, Andhra Pradesh, Karnataka, Maharashtra, Punjab, Rajasthan and Tamil Nadu, improved by more than 10 points. States were more proactive this time around, providing more data, which has helped improve the scores of most states. States' increased efforts in data collection are a step towards institutionalising the data capture and monitoring of EE activities by SDAs.

6 'Achiever' states in SEEI 2020 versus 3 in SEEI 2019

The two most improved states in SEEI 2020 are Rajasthan and Maharashtra. The participation of these two states in SEEI 2019 was limited, which may have been

due to internal challenges. Rajasthan has especially outshone its 2019 scores in all sectors. Maharashtra, too, has scored better in all sectors than in SEEI 2019, except the cross sector category. It has reported significant energy savings through EE interventions in buildings, non-PAT industries, and municipal street lighting. Energy and water policies comprising mandates for the agriculture sector are also in place. Furthermore, fourteen (14) energy conservation demonstration projects in government buildings were financed by Maharashtra SDA in one year, i.e. fiscal year (FY) 2019-20.



States & UTs should step up to achieve & track energy savings

In SEEI 2020, the SDAs demonstrated high motivation to collect relevant energy data across sectors. This indicates the states' diligence in moving towards a more data-driven and scientific approach to EE implementation. The states also upscaled their efforts in executing EE policies and regulations. In the outcome-based indicators, too, e.g. the adoption of EE and energy savings, the states fared considerably better than in the last index. However, SDA data availability on the outcome-based indicators was limited. Most of the data on outcome-based indicators have been compiled from external sources such as NITI Aayog's India Energy Dashboard, Confederation of Indian Industry (CII), Energy Efficiency Services Limited (EESL), Indian Green Building Council (IGBC), Green Business Certification Inc. (GBCI) India, and Green Rating for Integrated Habitat Assessment (GRIHA). Nevertheless, the perseverance of the SDAs in collecting data has resulted in improved data quality in terms of relevance and accuracy. This, in turn, has yielded better scores for most of the states in SEEI 2020. With better-quality data, the SDAs are better placed to track the year-on-year progress of EE in their respective states through data-driven evidence, which may be the most impactful outcome of SEEI 2020.

In the buildings sector, the ECBC 2017, notified by the central government, was amended to suit local conditions and notified in six (6) more states in SEEI 2020, increasing the total number of states with official ECBC 2017 notification to twelve (12). Eight (8) more states incorporated ECBC 2017 into municipal building bye-laws in SEEI 2020, taking the total number of states and UTs with ECBC 2017 incorporated into municipal bye-laws to twelve (12). Out of these, in four (4) states, the ECBC 2017 notifications are in the final stages of official release but these states have already progressed to incorporate ECBC 2017 in their municipal bye laws. Six (6) states have reported taking steps towards adopting the ECO NIWAS Samhita 2018 - Energy Conservation Building Code for Residential Buildings. Nine (9) states in SEEI 2020, compared to seven (7) in SEEI 2019, have enforced periodic mandatory energy audits for specific categories of commercial buildings. An energy performance index (EPI) study to benchmark energy intensity in buildings was conducted in eight (8) states. No state was able to provide data on energy savings in commercial or public buildings. As per the annual CII Energy Conservation Award, sixteen (16) buildings across eight (8) states reduced their specific energy consumption (SEC). Most of the states have sufficient institutional capacity to provide technical advisory services on EE in buildings, but the financial support to these entities must be strengthened to facilitate the adoption and promotion of more robust EE initiatives.

In the industrial sector, 277 micro, small, and medium enterprise (MSME) units across five (5) states and seventy (70) non-MSME non-PAT industrial units across eighteen (18) states and UTs have implemented EE measures. Thirteen (13) MSME units across four (4) states and sixty-two (62) non-PAT industrial units across sixteen (16) states have reported a reduction in their specific energy consumption (SEC) through adoption of EE interventions. The data on outcome-based indicators, i.e. adoption of EE measures and energy savings, was primarily sourced from the CII EC Awards, BEE, and EESL. Four (4) states have energy savings targets for industries other than those designated under the PAT scheme. In SEEI 2019, two (2) states had such a target. Dedicated funds to the entities assigned to support and enforce EE in industries are allotted in only two (2) states. Based on the data obtained from BEE,

in only four (4) states have 100% of the PAT designated consumers achieved their SEC targets. Despite most states having policies and institutional capacities in place, the investment and EE implementation reported in the industrial sector in the states remain inadequate.

In the municipalities sector, seventeen (17) states have deployed energy-efficient technologies such as central control and monitoring systems (CCMS), sensors, and LEDs for street lighting in at least one urban local body. This is an improvement from SEEI 2019, where only eleven (11) states had CCMS for street lighting in some municipalities. Twenty-two (22) states have adopted energy-efficient technologies in water pumping and sewerage systems. Six (6) states have targets for energy savings in municipal services. Ten (10) states have a designated entity to support EE initiatives in municipalities, compared to only six (6) states in SEEI 2019. Only five (5) states could provide data on the energy savings achieved through energy-efficient street lighting. Similarly, only four (4) states provided the requisite data for energy savings achieved through EE implementation in water pumping and sewage treatment. The data on outcome-based indicators was primarily provided by EESL. The municipal EE programmes in many states were found to be a one-time exercise. States should allocate dedicated funds to improve the capacity within municipal bodies to regularly undertake EE programmes. Energy audits of municipal services should be deployed as periodic exercises.

In the transport sector, three (3) more states are reported to have notified the state EV policy, taking the total number of states with notified EV policies to nine (9) in SEEI 2020, up from six (6) in SEEI 2019. Draft EV policies have been newly issued in four (4) states, taking the total to six (6) states with draft EV policies. Twenty-nine (29) states and UTs have a State Notified Agency for the promotion of e-mobility. SEEI 2020 witnessed a significant rise in EV charging infrastructure across the country, with 321 charging stations installed in thirteen (13) states. In terms of the indicators related to energy savings, only four (4) states provided data on the fuel efficiency of their respective state road transport corporations (SRTCs). No state could provide data on the SRTCs' energy intensity (passenger-kilometres/litre). Eight (8) states reported the adoption of e-mobility in public transportation. In the nation's ambitious pursuit of a green vehicle transition, states must implement a holistic system to track the impacts of EE initiatives in the transport sector in terms of energy savings, energy intensity, fuel intensity, etc.

In the agriculture and DISCOMs sector, thirty-one (31) states and UTs have notified the DSM regulation, while fifty-eight (58) DISCOMs across thirty-four (34) states and UTs have set up DSM cells. Time of Day (ToD) tariffs for industrial/commercial consumers have been implemented in two (2) additional states in SEEI 2020, increasing the total number of states and UTs with such tariffs to twenty-six (26). ToD tariffs for residential consumers are in place in six (6) states. Although many states have agricultural and non-agricultural DSM programmes, only seven (7) states have set energy savings targets for these programmes. Nevertheless, this is still an improvement from SEEI 2019, where none of the states reported any such targets. Only eight (8) states provided data on consumer participation in these agricultural and non-agricultural DSM programmes. An MRV mechanism for DSM initiatives is reported to be in place in only three (3) states. Due to the lack of such a mechanism in the other states, they could not report on the energy savings resulting from implementing such programmes, as what is not measured cannot be monitored. The SDAs should initiate steps to have state notifications on well-structured MRV guidelines to be followed by the DISCOMs in their DSM programmes.

Two more states set up a State Energy Conservation Fund (SECF) in SEEI 2020, bringing the total number of states and UTs with established SECFs to thirty-two (32). Twenty-six (26) states have allocated matching contributions to the SECF. However,

only one (1) state has reported implementing energy efficiency projects through a Revolving Investment Fund using funds disbursed under the SECF. The SDAs of twelve (12) states and UTs reported conducting four (4) or more EE awareness campaigns. Awards for promoting energy efficiency and energy conservation activities in at least one sector are given in only nine (9) states. Eight (8) states have reported taking initiatives to promote innovation and research and development (R&D) in energy efficiency. Twenty-one (21) states and UTs have appointed inspecting officers, which is significant progress over the SEEI 2019 figure of nine (9). Limited in-house capacity makes it difficult for the state agencies to keep pace with the rapid technological changes and enable their adoption. Hence, the states should forge strong partnerships with research and academic institutions, industries, and think tanks.

The states should develop a systematic process to track EE initiatives across various sectors, especially in monitoring the resultant energy savings and reduced energy intensity. This would assist the states in energy performance benchmarking, setting realistic and optimal energy saving targets, identifying suitable EE programmes, and supervising the progress of ongoing programmes and achievement of the state's overall energy saving goals.

TAKEAWAYS FOR STATES

Based on the findings of SEEI 2020, a few recommendations are detailed below to assist the states in driving a step change in EE implementation:

- ### INSTITUTIONALISING END-USE ENERGY DATA COLLECTION AND ANALYSIS TO DRIVE EE

  It has been observed that adequate end-use energy data on the state EE initiatives are not available with the SDAs. The SDAs should collaborate with organisations such as CII, EESL, or certification bodies such as IGBC, GBCI India, and GRIHA to ensure regular updates on end-use energy data, energy intensity, and energy savings across various sectors. Such a database can become the cornerstone of an Energy Data Management (EDM) system in the states. A robust EDM system would make it possible for the SDAs to gain insights into the sector-wise energy consumption profile in the states. The EDM system would support data analysis and value-added insights, which would become the basis for regular EE interventions at the state and local levels.

- ### IMPROVING EE FINANCING AND BUDGET ALLOCATION

  There is no specific budget officially earmarked for the SDAs or other designated institutional entities to support EE across various sectors in most states. The lack of a specific budget restricts the EE initiatives that these entities can undertake independently. Every SDA should develop an annual action plan on proposed EE measures with the estimated financial requirement and submit it to the state energy/power department with a request for budgetary allocation. A yearly exercise like this would enhance communication among different departments and give much-needed attention to energy efficiency across all sectors at the state level.

- ### INCORPORATING ENERGY EFFICIENCY INTO STATE PROGRAMMES

  The SDAs can draw on the national policies of BEE and coordinate with the state government departments to incorporate EE into state development policy

States & UTs should enhance EE investment and SDA budgets

and various state schemes. For example, a scheme to improve the cold chain infrastructure in the agriculture sector should incorporate energy efficiency from the start to ensure a low-carbon cold chain. An investment in EE would benefit the scheme's primary beneficiaries, while also helping meet the state's EE targets and India's NDCs.

- ## COLLABORATING WITH THE PRIVATE SECTOR TO REALISE EE GAINS

In SEEI 2020, the role of the states in executing EE measures in the industrial sector was quite limited. The SDAs should collaborate with the private sector to learn about the latest energy-efficient technologies, discuss the need for amending existing policies and programmes to spur the implementation of financially viable EE projects, and develop models for EE financing. Such collaboration would help the states achieve their EE targets and provide business opportunities for original equipment manufacturers (OEMs) and companies offering energy-efficient products and services. An alliance with the private sector would help the state amp up EE implementation in several sectors, namely, industry, buildings and transport. Such collaboration could also help SDAs track end-use energy data and energy savings across all sectors.

- ## DRIVING EARLY EE ADOPTION IN SUNRISE INDUSTRIES

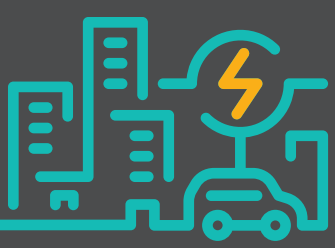
Two emerging sectors in the EE domain that will be beneficial to states in ensuring timely interventions for driving EE are discussed below:

Electric Vehicles

The central government has undertaken multiple ambitious initiatives to accelerate EV adoption. Transportation being a concurrent subject, the state governments must implement similar e-mobility initiatives to drive the EV transition. States have shown innovative leadership in drafting their respective policy measures, providing substantial financial benefits to early EV adopters. However, only when there is the required infrastructure in place will people be willing to switch to EVs en masse. Therefore, states must undertake policies and regulations which govern and support EV R&D, charging infrastructure, and skill development. Business models focusing on EVs should be developed and encouraged. The states must also develop schemes to encourage the adoption of electric goods carriers and shift to e-taxis, electric public transport systems, and e-rickshaws.

Cold Chain

The Government of India has been undertaking several measures to boost and expand cold chain infrastructure in India to prevent food loss and improve healthcare facilities, especially in rural areas. States must leverage policy interventions with government-supported investment and financing models to ensure the development of an energy-efficient cold chain from its very inception. An integrated cold chain policy with a strong focus on promoting energy-efficient end-to-end cold chain infrastructure must be developed and implemented in all states.



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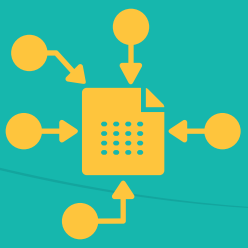
ABBREVIATIONS

AAC	Autoclaved Aerated Concrete
AC	Air Conditioner
ACEEE	American Council for an Energy-Efficient Economy
AEEE	Alliance for an Energy Efficient Economy
APEDA	Agricultural and Processed Food Products Export Development Authority
APSECM	Andhra Pradesh State Energy Conservation Mission
APSEEDCO	Andhra Pradesh State Energy Efficiency Development Corporation Limited
ASCI	Administrative Staff College of India
AT&C	Aggregate Technical and Commercial
BAR	Building Area Ratio
BEE	Bureau of Energy Efficiency
BLDC	Brushless Direct Current (Motor)
BYPL	BSES Yamuna Private Limited
CCMS	Centralised Control and Monitoring System
CEA	Central Electricity Authority
CEEW	Council on Energy, Environment and Water
CII	Confederation of Indian Industry
CNG	Compressed Natural Gas
CO_2	Carbon Dioxide
COVID-19	Coronavirus Disease 2019
CREDAI	Confederation of Real Estate Developers' Associations of India
DBTE	Direct Benefit Transfer for Electricity
DC	Designated Consumer
DISCOM	Distribution Company (Electricity)
DPMS	Development Permission Management System
DPR	Detailed Project Report
DR	Demand Response
DSM	Demand Side Management
EC	Energy Conservation
ECBC	Energy Conservation Building Code
ECBC-R	Energy Conservation Building Code for Residential Buildings
EDM	Energy Data Management
EE	Energy Efficiency, Energy-Efficient
EESL	Energy Efficiency Services Limited
EMC	Energy Management Centre
EPI	Energy Performance Index
ESCO	Energy Services Company
EV	Electric Vehicle
FAME	Faster Adoption and Manufacturing of Hybrid and Electric Vehicles
FAR	Floor Area Ratio
FPO	Farmer Producer Organisation
FSI	Floor Space Index
FY	Fiscal Year
GBCI	Green Business Certification Inc.
GDP	Gross Domestic Product

GHMC	Greater Hyderabad Municipal Corporation
GRIHA	Green Rating for Integrated Habitat Assessment
GSDP	Gross State Domestic Product
HAREDA	Haryana Renewable Energy Development Agency
HFC	Hydrofluorocarbon
ICAP	India Cooling Action Plan
IESS	India Energy Security Scenarios
IGBC	Indian Green Building Council
IGEA	Investment Grade Energy Audit
IIT	Indian Institute of Technology
INR	Indian Rupee
IoT	Internet of Things
IRES	Indian Residential Energy Survey
IT	Information Technology
J-PAL	Abdul Latif Jameel Poverty Action Lab
JERC	Joint Electricity Regulatory Commission
km	kilometre
KSEB	Kerala State Electricity Board
kTOE	Kilotonnes of Oil Equivalent
kVA	Kilovolt-Ampere
kWh/m^2	Kilowatt-Hour per Square Metre
L	Litre
LED	Light-Emitting Diode
LEED	Leadership in Energy and Environmental Design
LNG	Liquefied Natural Gas
m^2	Square Metre
MEDA	Maharashtra Energy Development Agency
MEEP	Municipal Energy Efficiency Programme
MIDC	Maharashtra Industrial Development Corporation
MJ	Megajoule
MNIT	Malaviya National Institute of Technology
MNRE	Ministry of New and Renewable Energy
MoPNG	Ministry of Petroleum & Natural Gas
MoRTH	Ministry of Road Transport and Highways
MoSPI	Ministry of Statistics and Programme Implementation
MoU	Memorandum of Understanding
MRV	Measurement, Reporting, and Verification
MSMEs	Micro, Small, & Medium Enterprises
MTOE	Million Tonnes of Oil Equivalent
NECA	National Energy Conservation Awards
NEHU	North-Eastern Hill University
NDC	Nationally Determined Contribution
NGO	Non-Governmental Organisation
NHB	National Horticulture Board
NIT	National Institute of Technology
NITI Aayog	National Institution for Transforming India
NRDC	Natural Resources Defense Council
OEM	Original Equipment Manufacturer
PAT	Perform, Achieve and Trade
PCRA	Petroleum Conservation Research Association

PEACE	Promotion of Energy Audit and Conservation of Energy
PEDA	Punjab Energy Development Agency
PNG	Piped Natural Gas
PSPCL	Punjab State Power Corporation Limited
PUF	Polyurethane Foam
PWD	Public Works Department
R&D	Research and Development
RBI	Reserve Bank of India
RECA	Rajasthan Energy Conservation Awards
REIL	Rajasthan Electronics & Instruments Limited
RIF	Revolving Investment Fund
ROSHANEE	Roadmap of Sustainable and Holistic Approach to National Energy Efficiency
S&L	Standards and Labelling
SAATHEE	State-wise Actions on Annual Targets and Headways on Energy Efficiency
SDA	State Designated Agency
SEC	Specific Energy Consumption
SECF	State Energy Conservation Fund
SEEI	State Energy Efficiency Index
SERC	State Electricity Regulatory Commission
SFAC	Small Farmer Agri-Business Consortium
SHG	Self-Help Group
SLNP	Street Lighting National Programme
SMEs	Small and Medium Enterprises
SNA	State Nodal Agency
SoR	Schedule of Rates
SRTC	State Road Transport Corporation
SRTU	State Road Transport Undertaking
T&D	Transmission and Distribution
TERI	The Energy and Resources Institute
TFEC	Total Final Energy Consumption
ToD	Time of Day
ToU	Time of Use
TPA	Third-Party Assessor
TPES	Total Primary Energy Supply
TV	Television
U.S.	United States
UIDAI	Unique Identification Authority of India
UJALA	Unnat Jyoti by Affordable LEDs for All
ULB	Urban Local Body
UNNATEE	Unlocking National Energy Efficiency Potential
UPERC	Uttar Pradesh Electricity Regulatory Commission
UREDA	Uttarakhand Renewable Energy Development Agency
UT	Union Territory
VRF	Variable Refrigerant Flow
VRV	Variable Refrigerant Volume
XPS	Extruded Polystyrene



72% of SDAs

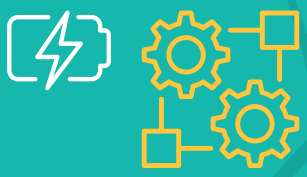
indicated that the State Energy Efficiency Index helps them improve data collection on energy efficiency

45% of SDAs

said that the Index helps in developing ideas for energy efficiency interventions and programmes

77% of SDAs

said that the Index helps them track the state's progress in energy efficiency



50% of SDAs

indicated that the Index enhances coordination with other state departments to get data and information on energy efficiency and energy conservation.

**Based on the responses of 22 of the 36 SDAs surveyed in July 2020*

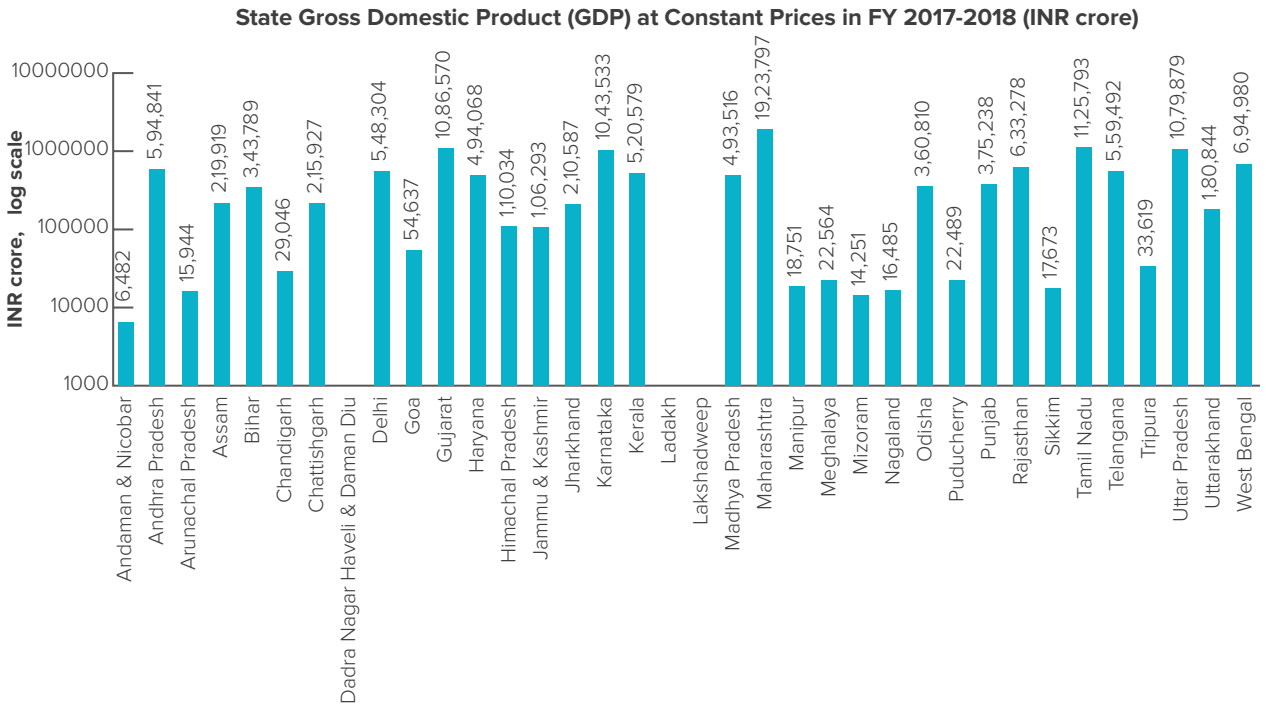
1 INTRODUCTION

Even as the coronavirus disease 2019 (COVID-19) pandemic-led disruption dominated 2020, India stayed on track to achieve its Nationally Determined Contribution (NDC) goal of reducing emission intensity by 30-35% from 2005 levels by 2030. Between 2005 and 2014, India had already reduced emission intensity by 21%, driven by the efforts of the central and state governments. As states recover from the harsh impact of the second wave of the COVID-19 pandemic this year, the focus should be on green economic recovery fuelled by the most energy-efficient products and services – energy-efficient consumer durables, electric vehicles (EVs), sustainable cold chain infrastructure for agriculture and Energy Conservation Building Code (ECBC)-compliant constructions and retrofits. Each state and union territory (UT) should strive for the best-suited green recovery path that aligns with its own socio-economic development goals. Coupling energy efficiency with renewable energy will help states cater to growing consumer aspirations while ensuring affordable energy access and reducing energy and emission intensity.

States & UTs should mainstream energy efficiency in their socio-economic development plans to achieve SDGs.

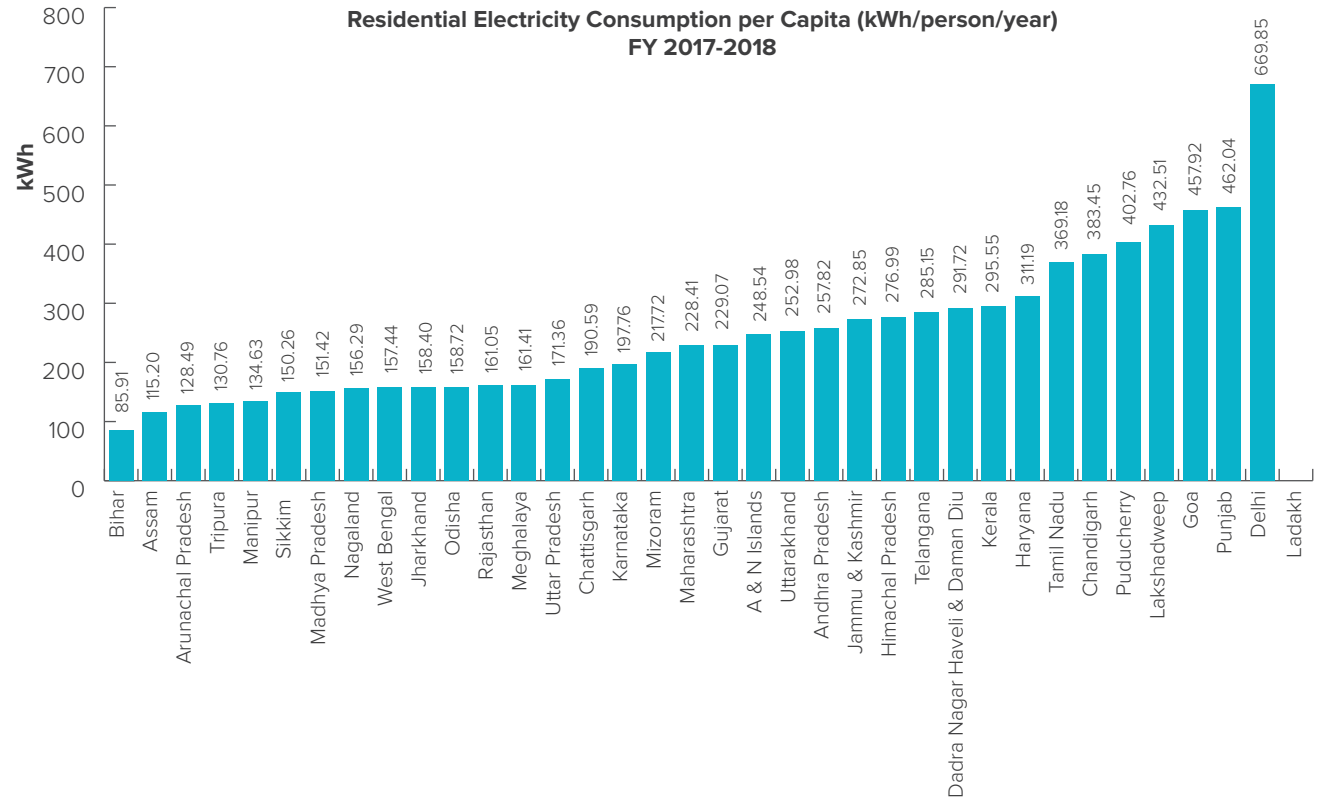
The Energy Conservation (EC) Act 2001 provides an institutional framework for formulating and implementing energy efficiency (EE) policies and programmes. The Act empowers the Bureau of Energy Efficiency (BEE) to formulate policies and programmes at the national level and State Designated Agencies (SDAs) to implement EE programmes and enforce EE norms and regulations at the state level. The real indicators of the effectiveness of the EC Act are energy savings and the reduction in energy intensity achieved at the national and state level through effective policy and programme implementation. The BEE has developed successful programmes to drive energy efficiency in India, namely, Standards and Labelling for appliances and equipment, ECBC, and Perform, Achieve and Trade (PAT) for energy-intensive industries and buildings. Two programmes, the Roadmap of Sustainable and Holistic Approach to National Energy Efficiency (ROSHANEE) and Unlocking National Energy Efficiency Potential (UNNATEE), have been developed by BEE to lay down the sector-wise action plan for the period 2021-2030. Mission ROSHANEE envisages various EE-related activities across all economic sectors to reduce national carbon dioxide (CO_2) emissions by over five hundred and fifty (550) million tonnes by 2030. UNNATEE is a working document, with short-term and long-term action plans for lowering energy intensity. States must draw on BEE's programmes to develop their own energy efficiency policies and programmes aligned with their sustainable development goals. The energy transition underway in the country requires the participation of all states, with deeper commitment and stronger strategies to help achieve India's ambitious climate goals. India's thirty-six states and UTs are diverse in terms of their economy (Figure 1), level of development, climate, and energy consumption (Figures 2 & 3). Therefore, each state's pathway in mainstreaming energy efficiency will naturally be different.

Figure 1 State GDP 2017-2018



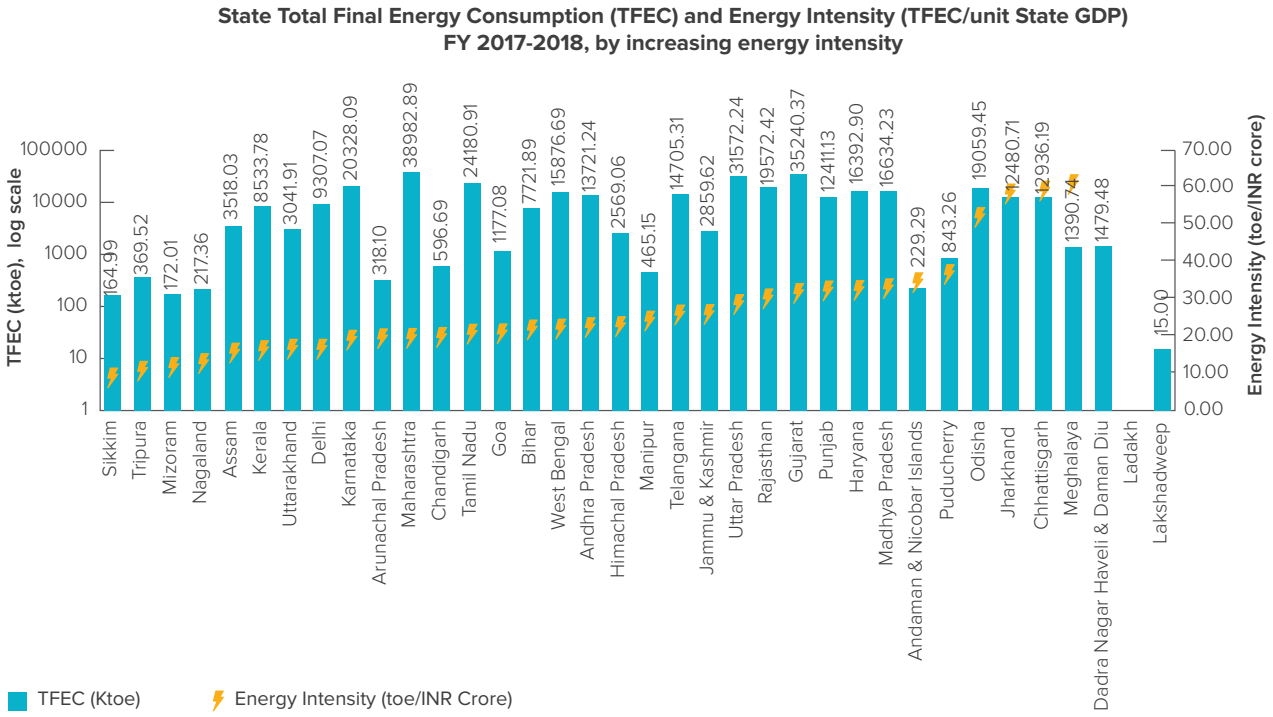
Source: RBI Handbook of Statistics on Indian States, GSDP at constant prices, base 2011-2012
Note: GDP FY 2017-2018 not available for Dadra Nagar Haveli and Daman Diu, Ladakh, & Lakshadweep

Figure 2 Per Capita Residential Electricity Consumption – 2017-2018



Source: CEA General Review 2019
NOTE: Data for Ladakh is not provided separately; it is included in the data for Jammu and Kashmir.

Figure 3 TFEC and Energy Intensity 2017-2018



Source: Ministry of Statistics and Programme Implementation (MoSPI), CEA General Review, Piped Natural Gas (PNG) Statistics, Coal Directory, NITI Aayog India Energy Dashboard, RBI

NOTE: The total final energy consumption (TFEC) is not available for Ladakh, and state GDP is not available for Dadra Nagar Haveli & Daman Diu, Ladakh, & Lakshadweep; therefore, TFEC energy intensity is not available for these UTs.

TFEC is derived from state-wise data in CEA General Review 2019 (electricity), MoPNG's PNG Statistics (oil, compressed natural gas (CNG)) and the Coal Directory (coal). TFEC per state includes final electricity consumption, electricity transmission & distribution (T&D) losses, and the use of coal, oil, and gas (CNG only) for energy other than that used for power generation.

There are data gaps in state-wise final consumption data for different fuels, particularly natural gas and biofuels.

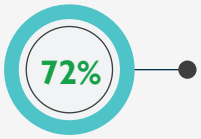
We have included only CNG consumption (not piped natural gas (PNG) and liquefied natural gas (LNG)) for natural gas, since there is no disaggregated state-wise data for PNG and LNG consumption. Biofuels and biomass have not been included, since the data is not available. The coal used for electric power generation has been deducted from the state-wise coal consumption, to avoid double counting.The conversion factors for toe (ton of oil equivalent) have been taken from NITI Aayog India Energy Dashboard.

The State Energy Efficiency Index (SEEI) is an effective tool to help each state mainstream energy efficiency into its development policies, plans, and investments. The SEEI has been developed by the BEE, in collaboration with Alliance for an Energy Efficient Economy (AEEE), to

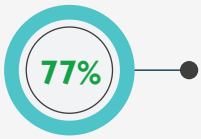
- help drive EE policies and programme implementation at the state and local level
- highlight best practices and encourage healthy competition among states
- track progress in managing the states' and India's energy footprint
- set a baseline for EE efforts and provide a foundation to set state-specific EE targets
- institutionalise the state-level data capture and monitoring of EE activities, especially by SDAs

SEEI helps SDAs institutionalise state-level data capture and monitoring of EE activities.

The first State Energy Efficiency Preparedness Index was launched in August 2018, followed by SEEI 2019 in January 2020. BEE and AEEE surveyed SDAs in July 2020 to capture their views on the SEEI. The key findings, based on the responses of 22 of the 36 SDAs, are as follows:



of SDAs indicated that the Index helps them improve data collection on energy efficiency.



said that the Index helps them track the state's progress in energy efficiency.

indicated that the SEEI enhances coordination with other state departments to get data and information on EE and energy conservation. However, SDAs also stated that there needs to be more cooperation between state departments and SDAs.

of SDAs said that the Index helps in developing ideas for EE interventions and programmes.

SDAs indicated that state departments are the most reliable source of data on sector-specific policies and programme implementation, further endorsing the need for effective collaboration between state departments and SDAs in mainstreaming EE in the state.

SEEI 2020 assesses states' performance in energy efficiency using 68 indicators across six sectors: buildings, industry, municipalities, transport, agriculture & distribution companies (DISCOMs), and cross sector. The indicators assess states' performance in policy and regulation, financing mechanisms, institutional capacity, adoption of EE measures, and energy savings. SEEI 2020 assesses states' performance in energy efficiency for the fiscal year (FY) 2019-2020, i.e. April 2019 to March 2020. The results are based on the latest data available on EE implementation in the states and UTs from the SDAs, BEE, central government sources such as Central Electricity Authority (CEA), National Institution for Transforming India (NITI) Aayog's India Energy Dashboard, Energy Efficiency Services Limited (EESL), Ministry of Road Transport and Highways (MoRTH), state government sources such as State Electricity Regulatory Commissions (SERCs), industry associations such as Confederation of Indian Industry (CII), and certification bodies such as Indian Green Building Council (IGBC), GBCI India, and Green Rating for Integrated Habitat Assessment (GRIHA). All data and associated references were initially reviewed and validated by AEEE and further reviewed and vetted by BEE. Commendable performance, therefore, is not only limited to the implementation of EE activities in the states, but is also characterised by the reporting of these activities.

The weightage for each sector in the Index is allocated based on

the sectoral share in
India's final energy consumption

energy savings
potential in the sector

the state's role
in promoting EE in different sectors

Indicators for the sectors have been selected based on their impact in driving EE implementation across sectors in states.

2 APPROACH

SEEI 2020 uses the same framework as the State Energy Efficiency Preparedness Index 2018 and SEEI 2019. As mentioned in the Introduction, BEE, in collaboration with AEEE, developed the SEEI framework, which hinges on objectivity, transparency, and consistency to assess states' annual performance and progress. The framework also draws on the United States (U.S.) State EE Scorecard, developed by the American Council for an Energy-Efficient Economy (ACEEE), which has published 14 editions of the U.S. State Energy Efficiency Scorecard and four editions of International Energy Efficiency Scorecard.

This chapter presents the approach taken in developing the SEEI framework, which has been followed for SEEI 2018[5], SEEI 2019[6], and SEEI 2020. The main steps in the process are as follows:

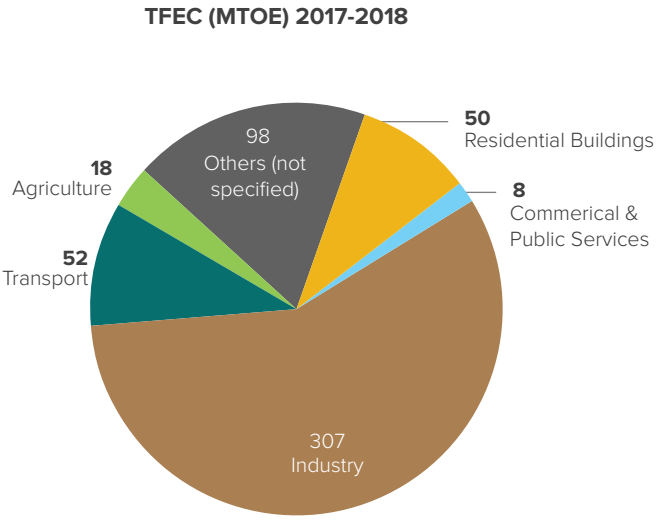
1. **The selection of performance indicators and allocation of maximum scores** reflects the state's role in promoting EE and the relative importance of demand sectors with respect to each sector's share in total energy consumption and energy savings potential.
2. **Categorisation of states based on their TFEC** enables peer-to-peer comparison among states.
3. **Data collection and validation** aim to comprehensively review each state based on the best available data, validated against credible references.
4. **Data analysis and scoring of states** assess states' performance and progress.

68 qualitative, quantitative & outcome-based indicators across sectors — buildings, industry, municipalities, transport, agriculture & DISCOMs, and cross sector initiatives.

1. SELECTION OF PERFORMANCE INDICATORS AND ALLOCATION OF MAXIMUM SCORES

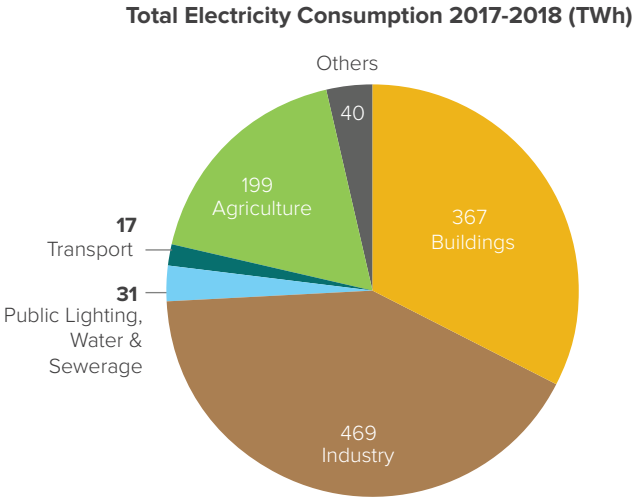
This is based on the sectoral share in India's final energy consumption, energy savings potential in a sector, and the state's role in promoting EE in different sectors. Figures 4 and 5 show the sector-wise annual total final energy consumption and electricity consumption in India in 2017-2018. Figure 6 shows the sector-wise energy savings potential. Table 1 summarises the state's role in energy efficiency in each of the sectors.

Figure 4 Sector-wise TFEC FY 2017-2018 in India



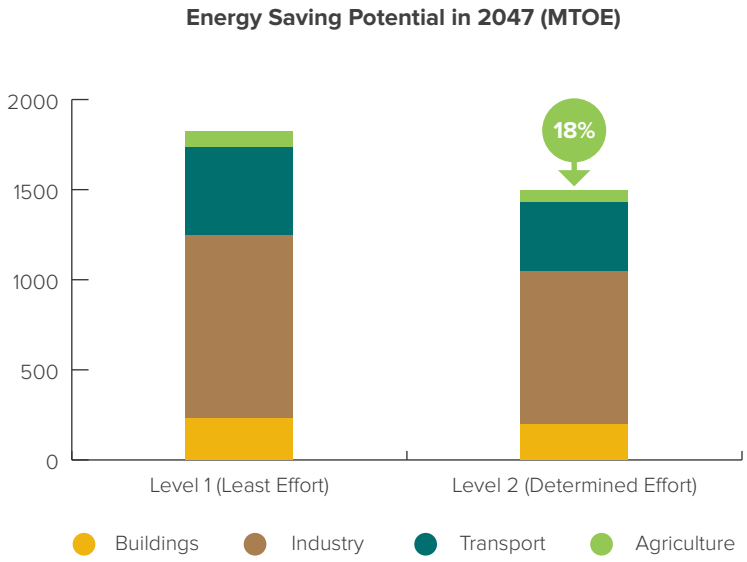
Source: MoSPI India Energy Statistics 2019; Excludes non-energy use of energy commodities

Figure 5 Sector-wise Electricity Consumption FY 2017-2018 in India



Source: CEA General Review 2019

Figure 6 India's Sector-wise Energy Savings Potential



Source: NITI Aayog IESS

Table 1 States' Role in Energy Conservation

Sector	States' (or the Designated Agencies') Role and Authority in Driving Energy Efficiency
 **Buildings**	**EC Act, Section 15:** Amend the energy conservation building codes to suit the regional and local climatic conditions. Notify energy conservation building codes with respect to the use of energy in the buildings. Direct the designated consumers (DCs) to comply with the code and energy audit requirements and furnish requisite data at the requisite time. **EC Act, Section 17:** Power of inspection of buildings to check compliance with requirements of the EC Act. **EC Act, Section 18:** Regulation of norms for energy consumption standards in any building. Regulation of the energy consumption standards for equipment and appliances. **EC Act, Section 26:** Impose penalties for non-compliance of either central or state government energy conservation regulations. **EC Act, Section 27, 28, 29:** Power to adjudicate the penalties imposed for non-compliance. **EC Act, Section 57:** Power of state government to make rules, by notification, for carrying out the provisions of this Act, if not inconsistent with the rules, if any, made by the central government.
 **Industry**	**EC Act Section 15:** Direct the DCs 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. **EC Act, Section 18:** Regulation of norms for process and energy consumption standards in any industry. Regulation of the energy consumption standards for industrial equipment and appliances, including motors. **EC Act, Section 26:** Impose penalties for non-compliance of either central or state government energy conservation regulations. **EC Act, Section 27, 28, 29:** Power to adjudicate the penalties imposed for non-compliance. **EC Act, Section 57:** Power of state government to make rules, by notification, for carrying out the provisions of EC Act, if not inconsistent with the rules, if any, made by the central government.
 **Municipalities**	**EC Act, Section 18:** Regulation of the energy consumption standards for street lighting, water pumping, and wastewater treatment. **EC Act, Section 26:** Impose penalties for non-compliance with 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, if not inconsistent with the rules, if any, made by the central government.
 **Transport**	Road transportation is a concurrent subject. The State Transport department defines policies and regulations. State Road Transport Corporations are operated by the state governments.
 **Agriculture**	**EC Act, Section 18:** Regulation of the energy consumption standards for agricultural pumping. **EC Act, Section 26:** Impose penalties for non-compliance with 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, if not inconsistent with the rules, if any, made by the central government.

Sector	States' (or the Designated Agencies') Role and Authority in Driving Energy Efficiency
DISCOMs	**Electricity Act, Section 23, 42, 61 and 181**: Empowers SERCs to make Demand Side Management (DSM) Regulations, which shall be applicable for all DISCOMs in the state. **EC Act, Section 17:** Power of inspection of concerned entities to check compliance with requirements of the EC Act. **EC Act, Section 26:** Impose penalties for non-compliance with 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, if not inconsistent with the rules, if any, made by the central government.
Cross Sector	**EC Act, Section 15:** Create awareness and disseminate information on energy efficiency and conservation. **EC Act Section 16:** Constitute State Energy Conservation Fund to cover the expenses incurred in EE project implementation.

Indicators have been defined for five (5) demand sectors: Buildings, Industry, Municipalities, Transport, Agriculture and DISCOMs, and Cross Sector initiatives. As depicted in Figure 7, Agriculture and DISCOMs have been combined in the SEEI framework, since the indicators defined for agriculture are primarily related to DSM strategies. Within each sector, indicators have been defined across five (5) categories to assess states' performance.

1. Do states have EE **policies and regulations** and related programmes?
2. Have states developed **financing mechanisms** and committed financial resources to implement EE programmes?
3. Do states have the **institutional capacity** to facilitate and enforce EE measures?
4. Have the above mentioned measures resulted in an increase in the **adoption of energy efficiency measures**?
5. What are the **energy savings** achieved through the implementation of EE programmes?

Indicators assess policies & regulations, financing, institutional capacity, adoption of EE & energy savings.

The SEEI 2020 comprises 68 qualitative, quantitative, and outcome-based indicators to monitor the tangible progress made in implementing policies, programmes, and projects. 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 EE implementation in states. The outcome-based indicators have been chosen to quantify the adoption of EE measures (technology, processes, etc.), energy savings, and reduction in energy intensity.

The maximum score for the Index is 100. The sector-wise maximum scores are shown in Figure 8. The buildings sector accounts for 30% weight, as it has the second-highest share in energy use and states can play an influential role in buildings' energy efficiency. The industrial sector receives 25% of the weight, because it has the largest share in energy use, but states are currently doing less to improve EE in this sector, as is evident in the past two indices. Weights for the other sectors are based on similar reasoning. Many indicators are simple 'yes/no' indicators, but some involve data for which higher values receive more points and lower values, fewer points.

Figure 7 SEEI Framework

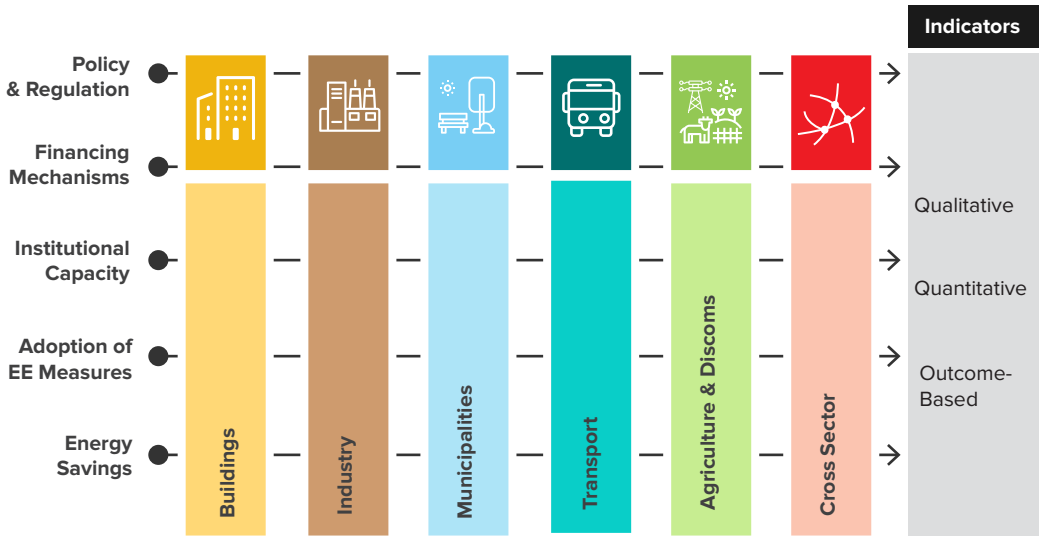
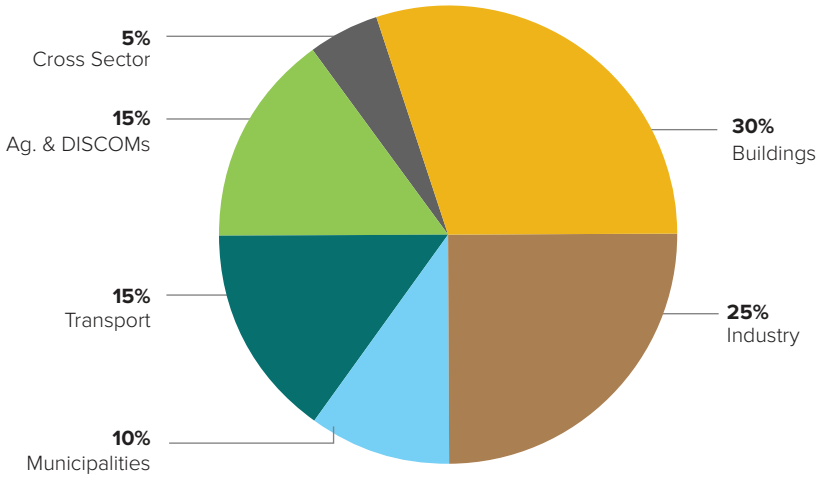


Figure 8 SEEI Score Allocation per Sector



2. CATEGORISATION OF STATES BASED ON TFEC

The grouping of states is based on the states' TFEC in FY 2017-2018 (the latest available state-wise final energy consumption data from central government sources). The purpose of grouping states is to bring together states with similar energy consumption levels for rational peer comparison. A few other parameters for grouping, such as the energy intensity of the Gross State Domestic Product (GSDP), energy savings potential, and per capita energy consumption, in isolation or combination, were also considered. However, given the lack of available data and for the sake of simplicity, the final grouping has been made solely based on TFEC, as depicted in Figure 9.

For peer comparison of SEEI results, states and UTs are categorised into 4 groups based on their total final energy consumption.

Figure 9 Grouping of States by TFEC

Group 1
(state TFEC >15 MTOE)

- Maharashtra (MH)
- Gujarat (GJ)
- Uttar Pradesh (UP)
- Tamil Nadu (TN)
- Karnataka (KA)
- Rajasthan (RJ)
- Odisha (OD)
- Madhya Pradesh (MP)
- Haryana (HR)
- West Bengal (WB)

Group 2
(state TFEC within 5-15 MTOE)

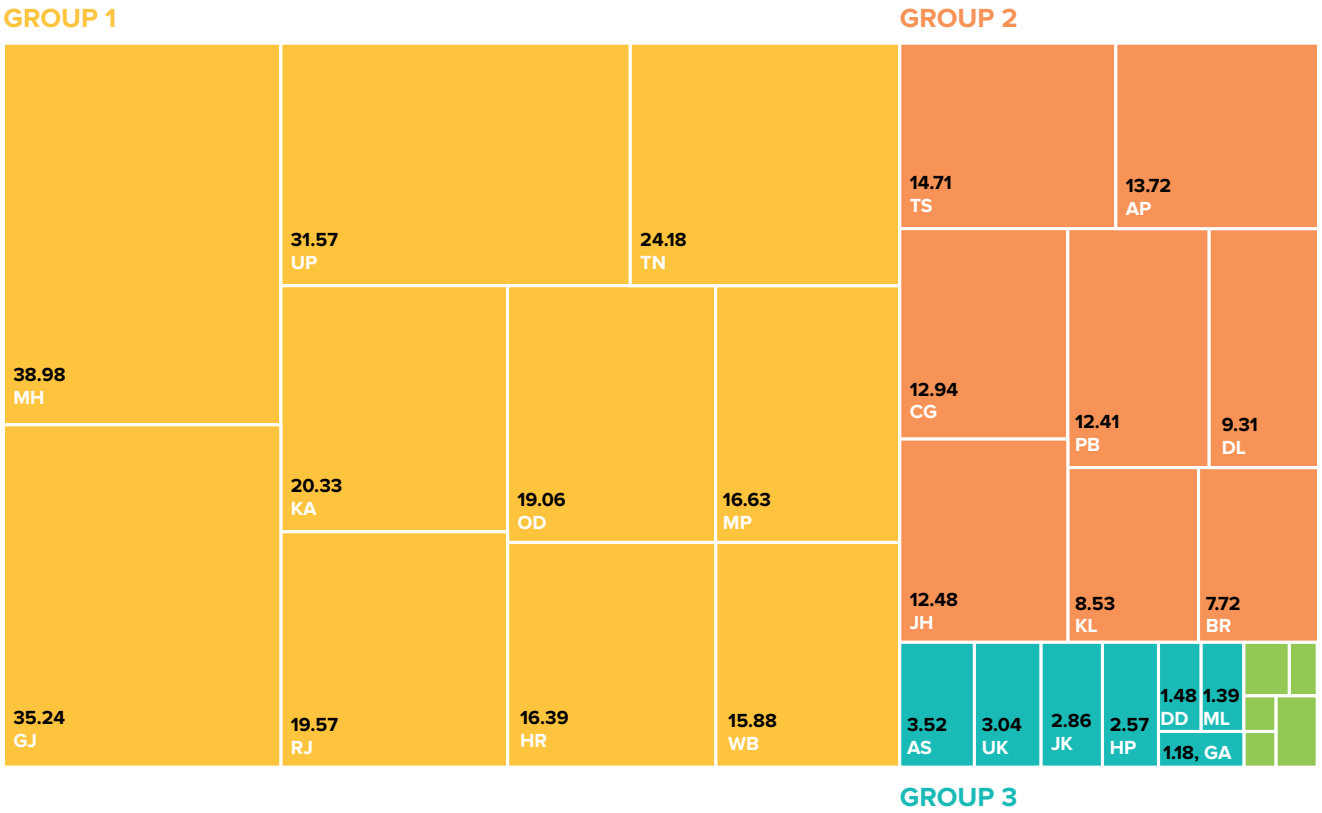
- Telangana (TS)
- Andhra Pradesh (AP)
- Chhattisgarh (CG)
- Jharkhand (JH)
- Punjab (PB)
- Delhi (DL)
- Kerala (KL)
- Bihar (BR)

Group 3
(state TFEC within 1-5 MTOE)

- Assam (AS)
- Uttarakhand (UK)
- Jammu & Kashmir (JK)
- Himachal Pradesh (HP)
- Dadra Nagar Haveli and Daman Diu (DD)
- Meghalaya (ML)
- Goa (GA)

Group 4
(state TFEC <1 MTOE)

- Puducherry (PY)
- Chandigarh (CH)
- Manipur (MN)
- Tripura (TR)
- Arunachal Pradesh (AR)
- Andaman & Nicobar Islands (AN)
- Nagaland (NL)
- Mizoram (MZ)
- Sikkim (SK)
- Lakshadweep (LD)
- Ladakh (LA)



Source: MoSPI, CEA General Review, PNG Statistics, Coal Directory, NITI Aayog India Energy Dashboard, Reserve Bank of India (RBI)
NOTE: TFEC is not available for Ladakh, and, GSDP is not available for Dadra Nagar Haveli & Daman Diu, Ladakh, & Lakshadweep.
The TFEC is derived from state-wise data in CEA General Review 2019 (electricity), MoPNG's PNG Statistics (oil, CNG), and the Coal Directory (coal). TFEC per state includes final electricity consumption, electricity T&D losses, and the use of coal, oil, and gas (CNG only) for energy other than that used for power generation.
There are data gaps in state-wise final consumption data for different fuels, particularly natural gas and biofuels.
We have only included CNG consumption (not PNG and LNG) for natural gas, since there is no disaggregated state-wise data for PNG and LNG consumption. Biofuels and biomass have not been included, since the data is not available. The coal used for electric power generation has been deducted from the state-wise coal consumption, to avoid double counting.The conversion factors for toe (ton of oil equivalent) have been taken from NITI Aayog India Energy Dashboard.

3. DATA COLLECTION AND VALIDATION

BEE nominated the SDAs to act as central coordinating bodies in the respective states to collect data from the concerned state departments. For SEEI 2020, a data collection portal was developed to streamline and help institutionalise SDA data collection for the SEEI. Apart from the data furnished by SDAs, BEE, in collaboration with AEEE, also collected data from various central government sources, such as Central Electricity Authority (CEA) General Review, NITI Aayog India Energy Dashboard, 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, 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 SEEI only uses data vetted by the SDAs and BEE.

The SDAs, the state-level authorities for EE, collected data from the concerned state departments.

4. DATA ANALYSIS AND SCORING OF STATES

In the final step, BEE and AEEE analysed the data collected for all the states and scored states based on the criteria for each indicator. The findings are presented in the next chapter.

27 states and UTs

improved their scores from SEEI 2019.

7 states

improved their scores by more than 10 points.

2

'Front runner' states

6

'Achiever' states

3 STATE ENERGY EFFICIENCY INDEX 2020 RESULTS

In SEEI 2020, the SDAs showed a strong ability to collect relevant data across various sectors. This determination and perseverance indicate the SDAs' significant efforts to adopt a scientific and data-driven approach towards EE implementation. As mentioned earlier, good results in SEEI are characterised by reporting EE activities in the states. SEEI may, in fact, be the springboard for the SDAs to institutionalise the practice of measuring and tracking the impacts of EE initiatives, instead of merely checking the boxes.

In SEEI 2020, twenty-seven (27) states and UTs improved their scores from SEEI 2019. Out of these, seven (7) states—Assam, Andhra Pradesh, Karnataka, Maharashtra, Punjab, Rajasthan, and Tamil Nadu—improved their scores by more than ten (10) points. The classification of the performance of states and UTs in SEEI 2020 is the same as that used for SEEI 2019. Each state/UT has been classified as a 'Front runner', 'Achiever', 'Contender', or 'Aspirant', based on their total score. Karnataka and Rajasthan are in the 'Front runner' category, having scored 70 and 61 out of 100, respectively. This is a significant improvement from SEEI 2019, where there was no state in the 'Front runner' category. The other top performers are Haryana, Punjab, Maharashtra, Kerala, Tamil Nadu, and Andhra Pradesh, all in the 'Achiever' category. The number of states in the 'Achiever' category has increased from three (3) in SEEI 2019 to six (6) in SEEI 2020. The increase in the number of states in the 'Front runner' and 'Achiever' categories is due to achievements in EE at both the state and local levels. The improvement in scores can be attributed to the states' growing inclination towards a methodical and data-driven approach in tracking EE progress. There are four (4) states in the 'Contender' category: Assam, Gujarat, Madhya Pradesh, and Uttar Pradesh.

The most improved states in SEEI 2020 are Rajasthan and Maharashtra. The participation of these two states in SEEI 2019 was limited, which may have been due to internal challenges. Rajasthan has especially outshone its 2019 scores in all sectors. Maharashtra, too, has scored better in all sectors than in SEEI 2019, except in the cross sector category.

Figure 10 shows the performance of states in SEEI 2020 with the most improved states, i.e. those that have increased their scores by more than 10 points from SEEI 2019, marked with a star.

Figure 11 highlights the TFEC group-wise state total scores for all six sectors. Figure 12 depicts the progress of each state in SEEI 2020 compared to SEEI 2019.

Figure 10 State-wise SEEI 2020 Performance

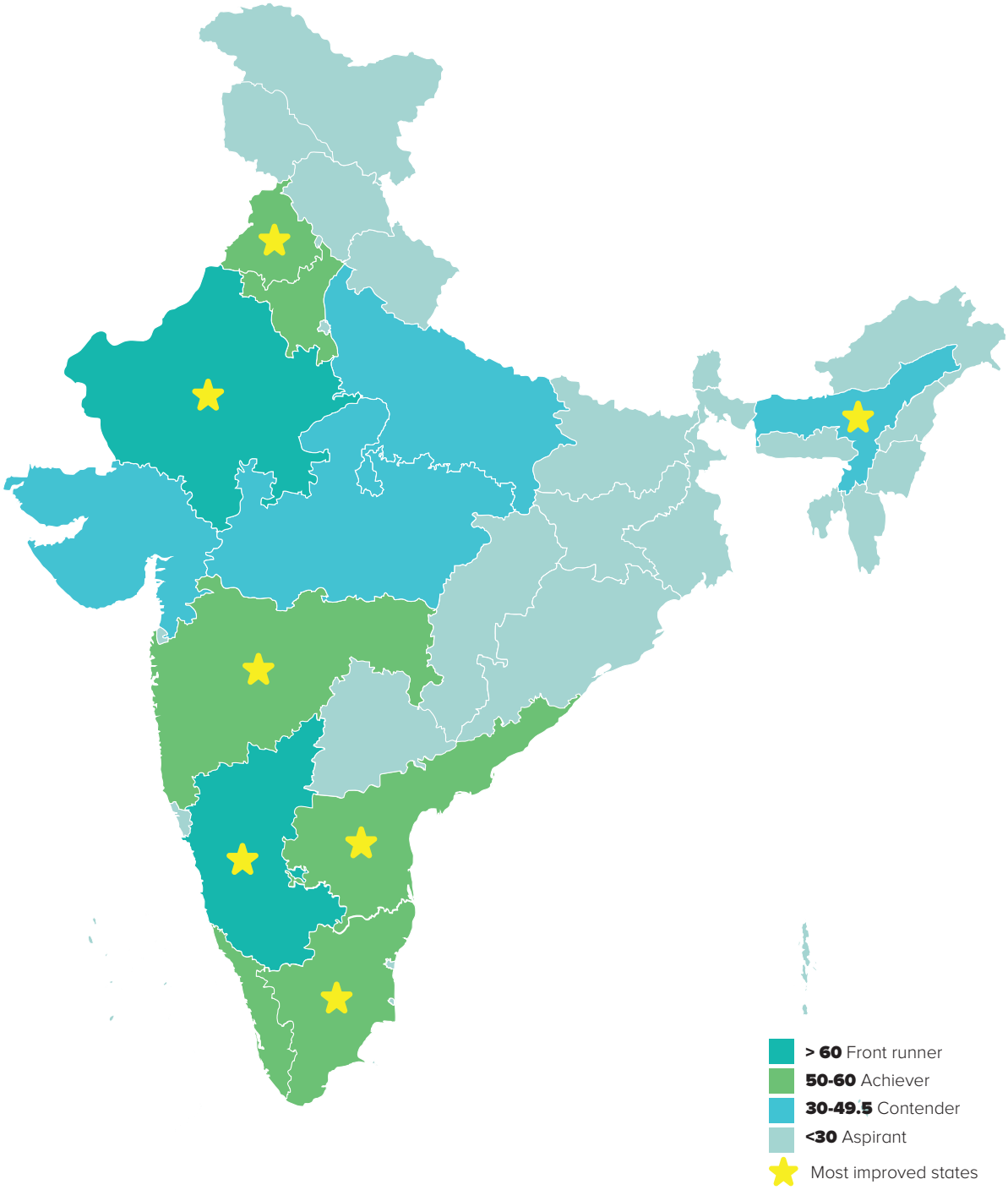


Figure 11 TFEC Group-wise State Total Scores (All Sectors)

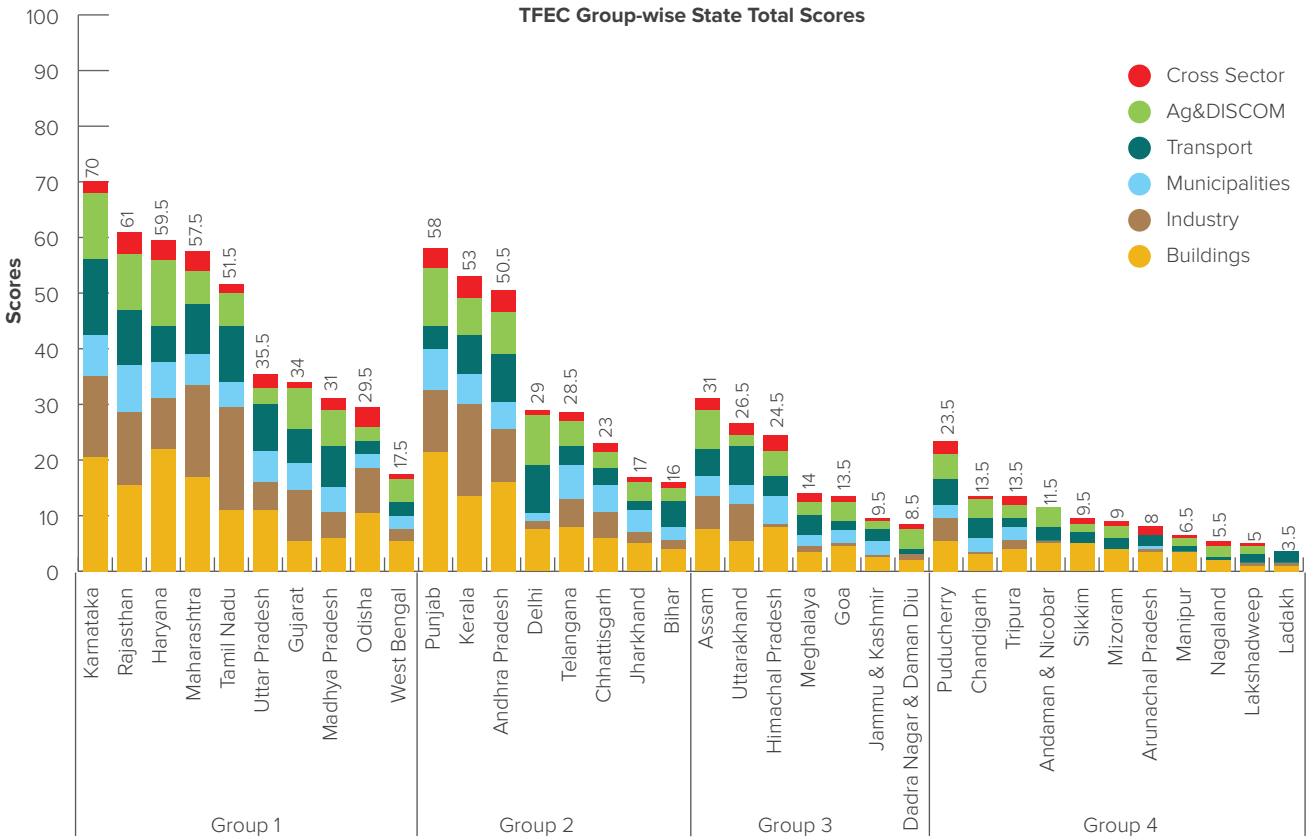
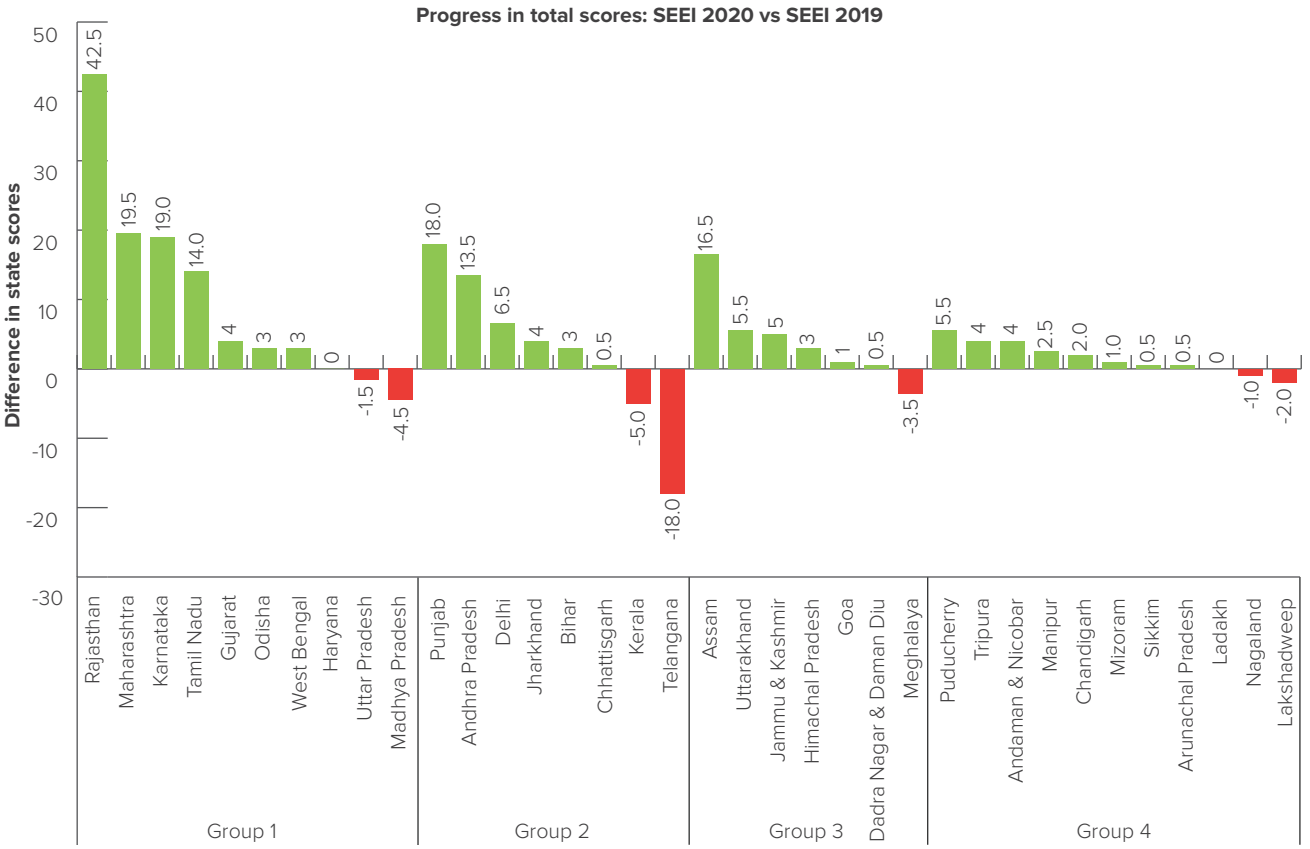


Figure 12 State Progress in Total Score - SEEI 2020 vs SEEI 2019



3.1 BUILDINGS

In India, the buildings sector is the second-highest in TFEC and is projected to grow by 45% up to 2027 from the 2017 baseline[7]. In light of the growing energy demand in the buildings sector, internalising EE in this sector is of paramount importance.

The SEEI 2020 has defined 16 indicators to evaluate EE initiatives in this sector. The number of indicators is less than that in SEEI 2019, as some related indicators have been clubbed together. However, the data points covered under the indicators remain the same. These data pertain to Energy Conservation Building Code (ECBC 2017), ECO Niwas Samhita 2018, mandatory energy audits of buildings, financial incentives for energy audits and ECBC 2017-compliant construction/retrofits, adoption of certified green buildings and BEE star-rated buildings, institutional capacity to support ECBC 2017 implementation and EE in buildings, and energy intensity reduction in buildings. The maximum score for this sector is 30. In the scoring criteria of these indicators, the highest weightage has been allotted to the indicators in the 'Policy and Regulation' category, with 12 points out of the total of 30, followed by 11 points for outcome-based indicators – 'Adoption of EE Measures' and 'Energy Savings.'

12
states & UTs have notified ECBC 2017, up from 6 in SEEI 2019

The overall score of 28 states is higher in this sector than in the last index, especially due to improvements in policy and regulation, financial mechanisms, and adoption of EE measures.

A summary of the indicators in the buildings sector is provided in Table 2. Figure 13 depicts each state's score for the buildings sector across the different indicator categories - Policy and Regulation, Financing Mechanisms, Institutional Capacity, Adoption of EE Measures, and Energy Savings, grouping states based on their TFEC. The states' progress in the SEEI 2020 compared to 2019 is shown in Figure 14.

Table 2 Buildings Sector Indicators

#	Indicator	Points (30)	Scoring Criteria
	Policy and Regulation		
1	Mandatory Energy Conservation Building Code (ECBC 2017)	2	Has the state notified mandatory compliance with norms in ECBC 2017? *If "Yes/Notification Complete", score = 2;* *If submitted to cabinet, score = 1.5;* *If code and rules amended, score = 1; else score = 0*
2	Incorporation of ECBC 2017 into municipal building bye-laws	2	Has ECBC 2017 been incorporated into the bye-laws of one or more corporations or municipalities in the state? *If "Yes/ECBC 2017 incorporated in at least 1 Urban Local Body (ULB)", score = 2;* *If amended rules sent to ULB/Town & Country Planning Department, score = 1; else score = 0*
3	Mandatory Energy Audits & Reporting	1	Are periodic energy audits & reporting mandatory for all buildings, or at least for a certain category of buildings, e.g. buildings with a connected load greater than 100 kilowatts (kW)? *If "Yes", score = 1; else score = 0*
	The proportion of buildings complying with the requirement for mandatory energy audits & reporting	1	Out of all buildings mandated to conduct an energy audit, how many completed the energy audit & report during the most recent audit cycle? *If the list of buildings to be audited and buildings actually audited are provided, score = 1;* *If only a list of audited buildings, score = 0.5; else score = 0*
4	Adoption of BEE star rating or green building rating systems for public buildings	2	Does the state mandate the BEE star rating system or any other rating system such as GRIHA, IGBC, Leadership in Energy and Environmental Design (LEED), or ECBC rating for government & public buildings? *If "Yes", score = 2; else score = 0*
5	Energy efficient lighting & appliances programmes	3	Does the state have at least one programme to increase the adoption/ penetration of energy efficient lighting in buildings (e.g. public buildings, hospitals, schools, residences, etc.)? *If building-specific state programme, score = 1.5; else score = 0* Does the state have at least one programme to increase the adoption/ penetration of energy efficient appliances in builidings (e.g. public buildings, hospitals, schools, residences, etc.)? *If building-specific state programme, score = 1.5; else score = 0*
6	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 formal government letter to start the process, or stakeholder discussions and workshops conducted, score = 1; else score = 0*

#	Indicator	Points (30)	Scoring Criteria
	Financing Mechanisms		
7	Incentives for energy audits	1.5	Does the state provide financial incentives for energy audits? *If "Yes", score = 1; else score = 0* What is the fund allocated and utilised? *If funds allocated and utilised, score = 0.5; else score = 0*
8	Financial incentives for ECBC 2017-compliant construction / retrofits	1.5	Does the state provide financial incentives for construction /retrofits of ECBC 2017-compliant or certified green buildings? *If "Yes", score = 1; else score = 0* What is the fund allocated and utilised? *If funds allocated and utilised, score = 0.5; else score = 0*
9	Financial incentives for energy efficient appliances	1.5	Does the state provide financial incentives for procuring energy efficient appliances, e.g. soft loans, electricity rebates, subsidies, etc.? *If "Yes", score = 1; else score = 0* What is the fund allocated and utilised? *If funds allocated and utilised, score = 0.5; else score = 0*
	Institutional Capacity		
10	Entity assigned for enforcing and certifying ECBC 2017 compliance	1.5	Is there an entity assigned for enforcing and certifying ECBC 2017 compliance? *If "Yes", score = 0.5; else score = 0* Is there an entity for providing technical advisory? *If "Yes", score = 0.5; else score = 0* Is there an entity assigned for checking compliance with mandatory energy audits and reporting? *If "Yes", score = 0.5; else score = 0*
11	Budget allocated for the entity to support EE in buildings	1	Is there a budget allocated for SDA by the state government for supporting & enforcing EE in buildings, such as an ECBC cell, workshops, ECBC 2017 enforcement, etc.? *If "Yes" and SDA / state entity uses some budget specifically for buildings, score = 1; else score = 0*
	Adoption of EE Measures		
12	Adoption/penetration of ECBC in new construction	2	Of all the new buildings completed in FY 2019-20, how many are ECBC-compliant? *If penetration of ECBC-compliant buildings is provided for the year FY 19-2020, score = 2;* *If only a list of ECBC-compliant buildings is provided, score =1; else score = 0*
13	Certified green buildings and BEE star-rated buildings	3	How many certified green buildings are there in the state? *Green buildings per million connected building (residential +commercial) electricity consumers: If >= 20, score = 2; if 11-19, score = 1.5; if 1-10, score = 1; else score = 0* How many certified BEE star buildings are there in the state? *BEE star-rated buildings per million connected building (residential +commercial) electricity consumers: If >=0, score = 1; else score = 0*

#	Indicator	Points (30)	Scoring Criteria
14	Benchmarking of energy intensity in commercial buildings	2	Has the state taken efforts to benchmark energy intensity in commercial buildings? *If recent (2016 onwards) baseline study (attempt at benchmarking), score = 2; else score = 0*
	Energy Savings		
15	Energy savings in commercial & public buildings	3	What is the number of buildings that have reduced their energy consumption or energy intensity? *Based on CII and SDA data with evidence,* *If> 2 buildings, score = 2; if 1-2 buildings, score = 1;* *If SDA has systematic process to measure energy savings from EC/EE against set targets for buildings sector in state, additional score = 1*
16	Energy intensity in commercial & public buildings	1	What is the energy intensity for commercial and public buildings in the state? *If available for the state, score =1; if available for even one city, score = 0.5; else score = 0*

Figure 13 TFEC Group-wise Buildings Sector State Scores

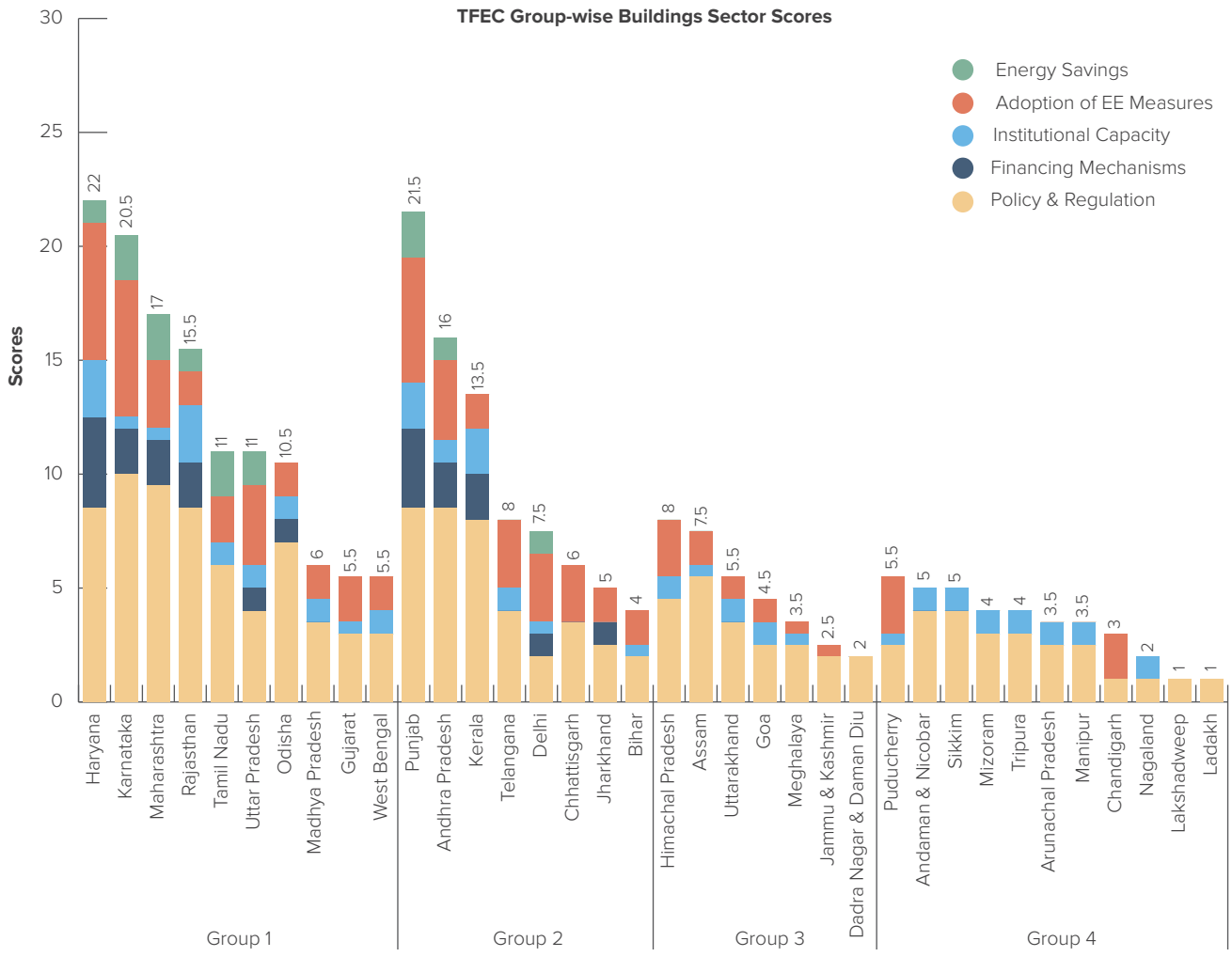
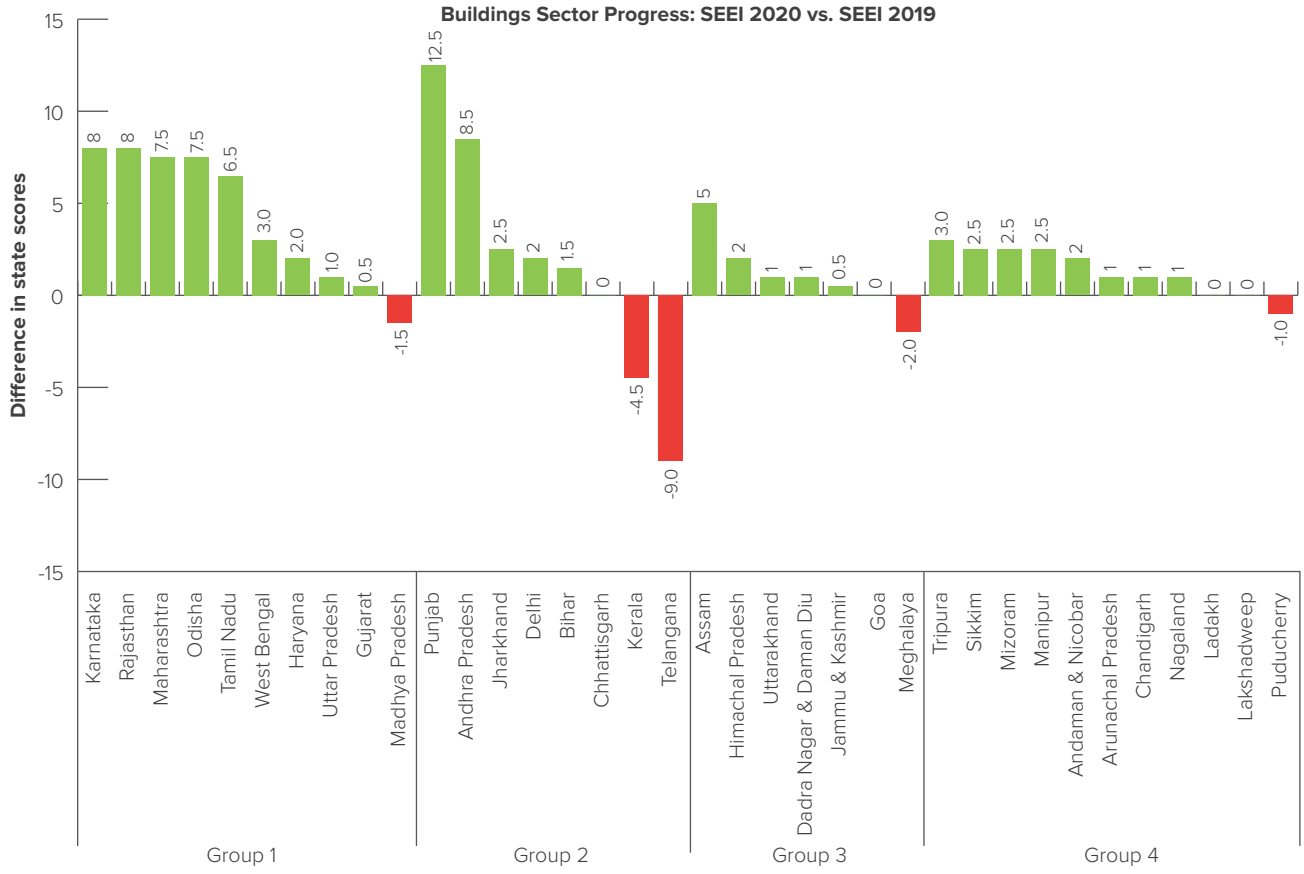


Figure 14 TFEC Group-wise State Progress in Buildings Sector – SEEI 2020 vs. SEEI 2019



DISCUSSION

With a score of 22 against a possible sector total of 30, Haryana is the top-performing state in the buildings sector. Other top performers include Karnataka, Punjab, Maharashtra, Andhra Pradesh, and Rajasthan. Tamil Nadu, Odisha, and Assam have also made considerable progress in SEEI 2020, and many other states have performed better than the last index. However, the scores of Telangana and Kerala, which performed better in SEEI 2018 and SEEI 2019, have declined. The decline in Telangana's performance can be attributed to the lack of data on outcome-based indicators and financial mechanisms. Kerala, too, did not provide adequate data on the outcome-based indicators.

POLICY AND REGULATION

The ECBC 2017, notified by the central government, was reported to have been amended to suit local conditions and notified in six (6) new states in SEEI 2020. Consequently, the ECBC 2017 is now notified in twelve (12) states and UTs: Andaman and Nicobar Islands, Andhra Pradesh, Haryana, Himachal Pradesh, Karnataka, Kerala, Mizoram, Sikkim, Telangana, Tripura, Uttar Pradesh, and West Bengal. In all other states and UTs, either the ECBC 2017 drafts have been sent to the respective state cabinets for approval, or the amendment process is in progress. The incorporation of ECBC 2017 into municipal building bye-laws also witnessed significant progress in SEEI 2020, with eight (8) new states incorporating the same in official gazettes. Hence, there are now twelve (12) states and UTs with ECBC 2017 incorporated into municipal bye-laws, namely, Andaman and Nicobar Islands, Andhra

12 states & UTs have incorporated ECBC 2017 in municipal bye-laws, up from 4 in SEEI 2019.

Pradesh, Haryana, Karnataka, Kerala, Odisha, Punjab, Rajasthan, Sikkim, Telangana, Uttarakhand, and Uttar Pradesh. In Odisha, Punjab, Rajasthan and Uttarakhand, although ECBC 2017 notifications are yet to be officially released, these states have already progressed to incorporate ECBC 2017 in their municipal bye laws. Andhra Pradesh, Karnataka, Maharashtra, Odisha, Punjab, and Rajasthan have taken steps towards the official adoption of ECO Niwas Samhita 2018 – ECBC-R. Furthermore, regarding energy audits, which are a useful tool to track and regulate energy usage, develop benchmarks, and integrate EE measures into buildings, many states — Andhra Pradesh, Gujarat, Haryana, Kerala, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, and Tamil Nadu — mandate periodic energy audits for specific categories of commercial buildings. Punjab has undertaken an initiative to carry out 100 walk-through energy audits in identified commercial buildings and SMEs with a connected load above 100 kW or contract demand of 120 kilovolt-amperes (kVA). Karnataka and Maharashtra have mandated the adoption of green building ratings or BEE star rating for public and government buildings. Andhra Pradesh, Assam, Chhattisgarh, Haryana, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Odisha, Punjab, Rajasthan, and Tamil Nadu have implemented energy efficiency programmes to increase the adoption of energy efficient lighting and energy efficient appliances through state-funded initiatives.

9
states mandate energy audits for commercial buildings.

FINANCING MECHANISMS

It is encouraging that in comparison to SEEI 2019, more states have adopted different types of financial instruments to promote various energy efficient applications in the buildings sector. Nevertheless, there should be more concerted efforts in all states and UTs towards investment in EE and tracking the outcomes of these investments in terms of reduced energy intensity in buildings.

Four states — Haryana, Maharashtra, Odisha, and Punjab — offer financial assistance for energy audits. Haryana government offers financial assistance to all private, semi-government, industrial, institutional, and commercial buildings, subject to a ceiling of Indian Rupee (INR) 50,000, released in two parts. The first instalment of 50% is released after acceptance of an energy audit report by the approved committee, and the remaining 50% is released after 50% implementation of the energy audit recommendations suggested by the energy auditor. Energy audits are conducted free of cost by the Department of New & Renewable Energy, Government of Haryana, for government buildings with a connected load above 100 kW and which commit to implementing at least 50% of the energy audit report recommendations. Punjab has allocated a sum of INR 10 lakh to conducting walk-through energy audits of 100 small and medium enterprises (SMEs)/buildings at a cost of INR 10,000 per consumer, and another INR 10 lakh for detailed energy audits and implementation of the audit recommendations in 20 selected SMEs/buildings at a cost of INR 50,000 or 50% of the total audit cost per consumer, whichever is less, through Punjab Energy Development Agency (PEDA)-empanelled energy auditors. Maharashtra offers financial assistance for energy audits to institutional buildings based on annual energy consumption bills. Odisha has provisions for reimbursement of energy audit costs for SMEs/buildings on successful implementation of energy audit recommendations, resulting in energy savings.

Financial incentives for ECBC-compliant constructions/retrofits, which were provided in only three (3) states in SEEI 2019, are now provided in ten (10) states — Andhra Pradesh, Delhi, Haryana, Jharkhand, Karnataka, Kerala, Maharashtra, Punjab, Rajasthan, and Uttar Pradesh. Andhra Pradesh offers a 20% reduction in permit fees and development charges, to be payable in four (4) equal instalments for buildings obtaining ratings from IGBC, LEED India, GRIHA by The Energy and Resources Institute (TERI). Rajasthan provides rebates in the Building Area Ratio (BAR) for

10
states provide financial incentives for EE in buildings, up from 3 in SEEI 2019.

green buildings. Maharashtra provides additional Floor Space Index (FSI) on basic FSI for star-rated and green buildings. Kerala offers soft loans for ECBC-compliant construction and retrofits in buildings. Haryana has state financing for ECBC-compliant and green buildings. Delhi, Karnataka, and Jharkhand provide Floor Area Ratio (FAR) incentives for green buildings. Karnataka also offers incentives by way of tax exemption for green buildings. Uttar Pradesh offers a financial incentive of 5% extra FAR for 4-star GRIHA/LEED or IGBC Gold rated buildings. The Department of Local Government in Punjab has made a provision for a 15% rebate in property tax for ECBC-compliant buildings.

Six (6) states, namely, Andhra Pradesh, Haryana, Karnataka, Kerala, Punjab, and Rajasthan, provide financial incentives for promoting energy efficient appliances in the buildings sector. These incentives include soft loans, interest-free financing schemes, rebates in electricity consumption tariff for energy efficient appliance installation, or a specific annual budget allocation for promoting energy efficient appliances, as in the case of Haryana.

Financial support is a must for EE promotion and penetration in the buildings sector. Therefore, the SDAs should put in place effective measures suitable to the local conditions to allocate adequate funds for EE measures in buildings.

3180
certified green buildings across 26 states & UTs

INSTITUTIONAL CAPACITY

Twenty (20) states and UTs — Andaman and Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Goa, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Manipur, Nagaland, Mizoram, Odisha, Punjab, Rajasthan, Sikkim, Telangana, Tripura, Uttar Pradesh, Uttarakhand, and West Bengal — have designated entities for certifying ECBC compliance. Twenty-eight (28) states and UTs, namely, Andaman and Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Nagaland, Mizoram, Odisha, Puducherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura, Uttar Pradesh, Uttarakhand, and West Bengal, have entities for providing technical advisory services on ECBC compliance. Although mandatory energy audits for specific categories of buildings have been implemented in a few states, only Haryana, Kerala, Rajasthan, and Tamil Nadu have an entity for checking compliance with mandatory energy audits. However, in terms of financial support, only four (4) states have reported allocating state budgets to the entities designated to support EE in buildings. Haryana has specific fund allocation in the annual budget of Haryana Renewable Energy Development Agency (HAREDA) to support EE building programmes. Kerala has allocated funds to the SDA for supporting and enforcing EE through workshops, while Rajasthan has allocated funds to the ECBC cell. Punjab has allocated a budget for EE projects in buildings through the Revolving Investment Fund. Since most states have sufficient institutional capacity to provide technical advisory on ECBC compliance, they need to ramp up the financial support to these entities to facilitate the adoption and promotion of more robust EE initiatives in the buildings sector.

269
BEE star buildings across 20 states & UTs

ADOPTION OF EE MEASURES

An optimal measure of green building penetration would be the ratio of green building built-up area to the total built-up area in the state. However, in the absence of data on the state-wise built-up area, we have normalised the indicator on green buildings as the number of certified green buildings and BEE star-rated buildings per million connected (i.e. electricity connections) building consumers in the state. IGBC, GRIHA, and GBCI LEED ratings have been aggregated for the total number of

certified green buildings. There is significant penetration of green buildings and BEE star-rated buildings in Chandigarh, Delhi, Gujarat, Haryana, Karnataka, Maharashtra, Tamil Nadu, and Telangana. Haryana has the highest number of certified green buildings per million connected building consumers, while the number of BEE star-rated buildings per million connected building consumers is highest in Chandigarh. Only Haryana, Karnataka, and Punjab provided a list of ECBC-compliant buildings in the state.

Energy intensity benchmarking for buildings helps to evaluate the buildings' energy performance based on typology. In SEEI 2019, none of the states had made any effort to benchmark commercial buildings' energy intensity, except Kerala, where a baseline study was conducted in 2009. It is, therefore, commendable that many states conducted an energy performance index (EPI) study to benchmark energy intensity in buildings in SEEI 2020. Andhra Pradesh conducted a benchmarking study on energy intensity in four building typologies – hospitality, shopping complexes, educational institutes, and assembly buildings – through Third-Party Assessors (TPAs). Haryana has conducted a benchmarking study on EPI in various categories of buildings, such as office buildings, hospitality buildings, information technology (IT) complexes, educational buildings, and shopping complexes. Similarly, Punjab has conducted an EPI benchmarking study of 50 buildings in the state across different categories. Himachal Pradesh has also conducted an EPI benchmarking study across the state in five different typologies of commercial buildings: healthcare, hospitality, educational institutes, assembly buildings, and business offices. Karnataka has conducted a detailed study on the energy profile of all commercial buildings to initiate energy intensity benchmarking. Uttar Pradesh has conducted its first EPI study on buildings for the Uttar Pradesh Electricity Regulatory Commission (UPERC) building, the first ECBC-compliant government building in the state. In Chhattisgarh, a benchmarking study to evaluate EPI was conducted in five (5) government buildings in Raipur. Puducherry also initiated an energy intensity benchmarking study in FY 2019-20 for buildings in five building typologies: assembly, health care, hospitality, educational, and business.

Considering the benefits that benchmarking the energy intensity of buildings offer, it is important that more SDAs undertake similar studies and that the benchmarking exercise is conducted periodically to step up EE in buildings.

ENERGY SAVINGS

None of the states could provide comprehensive data on energy savings in commercial or public buildings. The primary source of data on energy savings in buildings is the CII's annual Energy Conservation Awards. As per the CII EC Awards data, sixteen (16) buildings across eight (8) states — Andhra Pradesh, Delhi, Karnataka, Maharashtra, Punjab, Rajasthan, Tamil Nadu, and Uttar Pradesh — have reduced their Specific Energy Consumption (SEC). SDAs, especially those in states with mandatory energy audits for buildings, should effectively put a systematic process in place to capture and maintain data on energy savings in buildings. This would help SDAs keep track of the implementation of energy audit recommendations in various building categories and take suitable policy decisions on EE measures for pertinent categories. Furthermore, SDAs should work with the private sector in gathering data on EE implementation in buildings and the resultant energy savings. This would also provide a wealth of information on best practices for improving EE in buildings. Regarding the energy intensity (kWh per square metre (m^2)) of buildings, only Haryana, Karnataka, Punjab, and Uttar Pradesh provided data for certain categories of buildings. Periodically capturing and reviewing building energy intensity data will help SDAs analyse energy consumption trends and the impact of EE efforts in reducing energy intensity.

No state comprehensively tracks energy savings in the building sector.

BUILDINGS SPOTLIGHT

Energy-efficient materials such as autoclaved aerated concrete (AAC) blocks, fly ash bricks, hollow bricks, extruded polystyrene (XPS) insulation, polyurethane foam (PUF) insulation, efficient plumbing fixtures, variable refrigerant volume (VRV) systems, variable refrigeration flow (VRF) systems, chiller plants, brushless direct current (BLDC) fans, 5-star rated fans, LED lighting, and different types of sensors are required for construction of energy efficient buildings. These items are missing from the State Schedule of Rates (SoR) of most state Public Work Departments (PWDs). As a result, contractors, builders, and architects face various problems at different stages of energy efficient government building constructions/retrofits. For instance, there is a lack of clarity during the preparation of estimates/detailed project reports (DPR) and in rate analysis. With the implementation of ECBC 2017 in many states, it is crucial that the state SoR provide the rates for energy efficient building items. In this regard, Uttar Pradesh is incorporating a chapter into the Uttar Pradesh SoR on ECBC building products. A section on energy efficient electrical materials has already been included, and a section on energy efficient civil materials is being developed.

For more information, check out this site:
http://www.upsavesenergy.com/RecentActivitiesDetails.aspx?raId=46

3.2 INDUSTRY

The industry sector accounts for the highest final energy consumption in India [8]. As per NITI Aayog's India Energy Security Scenarios (IESS) model, this sector is projected to have the maximum energy savings potential in India up to 2047[9] through EE management and innovative technology deployment. The SEEI 2020 comprises 10 indicators in the industry sector. The number of indicators is lower than in 2019, as many correlated indicators have been clubbed together. The maximum score for this sector is 25. The scoring criteria are almost identical to those in SEEI 2019, with the maximum points (10) allocated to 'Policy and Regulation', followed by 8 points allocated to outcome-based indicators for 'Adoption of EE Measures' and 'Energy Savings'. The indicators encompass a wide range of areas, such as energy savings targets and mandatory energy audits for industries, proactive measures by the SDAs for PAT DCs and EE programmes for other industries, budget allocation for energy efficiency activities and energy audits, adoption of ISO 50001 and energy efficient equipment and processes, and industrial energy savings by MSMEs and large industries.

A few states and UTs have improved their overall score in this sector compared to the last index.

4
states set energy savings targets for non-PAT industries, up from 2 in SEEI 2019.

Table 3 provides an overview of the indicators for the industry sector in SEEI 2020. Figure 15 depicts each state's score in the industry sector across the different indicator categories - Policy and Regulation, Financing Mechanisms, Institutional Capacity, Adoption of EE Measures, and Energy Savings, grouping states based on their TFEC. The states' progress in SEEI 2020 compared to SEEI 2019 is shown in Figure 16.

Table 3 Industry Sector Indicators

#	Indicator	Points (25)	Scoring Criteria
	Policy and Regulation		
1	Energy saving targets for industries (other than PAT) set by state	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 for non-PAT industries	4	Does the state mandate energy audits for industries NOT covered in the PAT scheme? *If "Yes", score = 2; else score = 0* If so, indicate the number of such non-PAT industries audited in the most recent mandatory energy audit cycle *If % non-PAT industries audited in recent cycle >50%, score = 2; 1-49%, score = 1; else score = 0*
3	Mandate or programmes to promote EE in industries	4	Does the state promote the adoption of energy efficient equipment and processes in industries? *Targeted MSME programme: >2 programmes, score = 2; 1-2 programmes , score = 1; else score = 0* *Non-MSME programme: >2 programmes, score = 2 ; 1-2 programmes, score = 1; else score = 0*
	Financing Mechanisms		
4	Financial incentives for EE implementation	2	Does the state offer financial incentives for energy audits, implementing EE projects, or equipment replacement? *If "Yes", score = 1; else score = 0* What is the budget allocated for these financial schemes? What is the fund utilised? *For funds allocated & utilised, score = 1; if funds only allocated, score = 0.5; else score = 0*
	Institutional Capacity		
5	Entity to support EE in industry	2	Does the state have an agency designated to support EE implementation and enforce EC Act regulations? *If "Yes", score = 2; else score = 0*
6	Entity to support PAT in state	2	Does the state have an entity to support & enforce PAT scheme? *If "Yes", score = 1; else score = 0* Has the state appointed an adjudication authority for PAT in the SERC? *If "Yes", score = 0.5; else score = 0* Does the state have dedicated manpower to oversee PAT in the state? *If "Yes", score = 0.5; else score = 0*
7	Budget allocated to the entity to support EE in industry	1	What is the budget allocated for the entity assigned to support & enforce EE in industries? *For budget allocated to entity, score = 1; else score = 0*

#	Indicator	Points (25)	Scoring Criteria
	Adoption of EE Measures		
8	Industrial units (non-PAT & MSME) that have adopted EE Measures	3	MSME industries - max score = 1 How many MSME units have implemented EE measures (equipment, processes, ISO 50001, etc.)? *Based on EESL and SDA data: If >0 units, score = 1; else score = 0* Non-MSME, non-PAT industries - max score = 2 How many non-MSME, non-PAT units have implemented EE measures (equipment, processes, ISO 50001, etc.)? *Based on CII, EESL and SDA data: : If >3 units, score = 2; if 2-3 units, score = 1; if 1 unit, score = 0.5; else score = 0*
9	Designated Consumers that have met PAT SEC Target	1.5	What is the percent of Designated Consumers that have met the PAT SEC target in the most recent cycle? *If >= 80%, score = 1; if 60-79%, score = 0.5; else score = 0* What are the proactive measures taken by the SDA for DCs in the state? *For proactive measures taken by SDA for PAT industries, score = 0.5; else = 0*
	Energy Savings		
10	Industrial energy savings specifically due to implementation of EE/ EC measures in MSME & non-PAT industries	3.5	MSME industries - max score = 1.5 How many MSME units have reduced their SEC due to the implementation of EE/EC measures? *Based on EESL, SDA data: If >0 units, score = 1;* *If SDA has systematic process to measure energy savings from EC/EE against set targets in MSME, additional score = 0.5* Non-MSME, non-PAT industries - max score = 2 How many non-MSME, non-PAT units have reduced SEC due to the implementation of EE/EC measures? *Based on CII, EESL and SDA data: If >3 units, score = 1.5; if 2-3 units, score = 1; if 1 unit, score = 0.5* *If SDA has a systematic process to measure energy savings from EC/EE against set targets in non-MSME, non-PAT industries, additional score = 0.5*

Figure 15 TFEC Group-wise Industry Sector State Scores

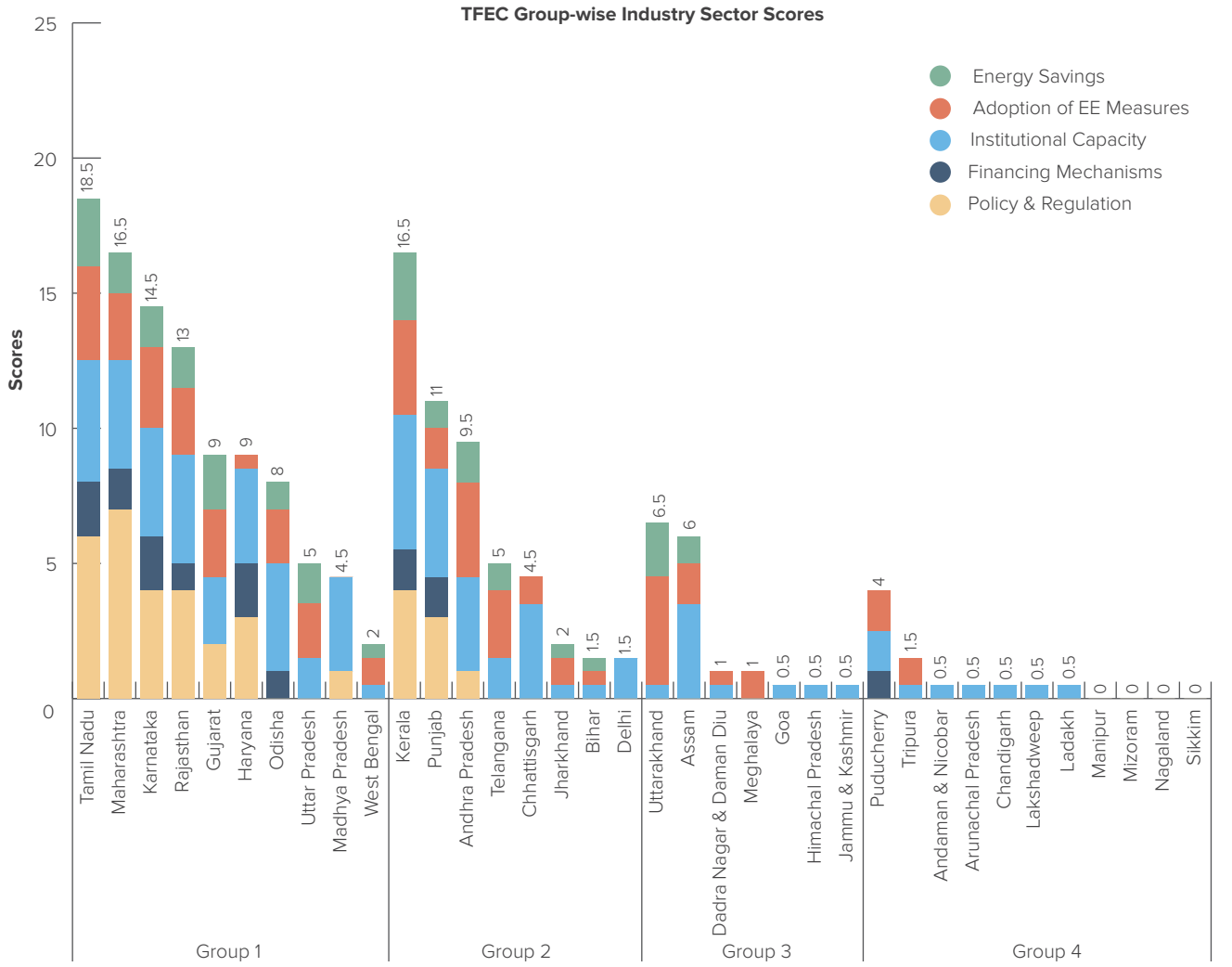
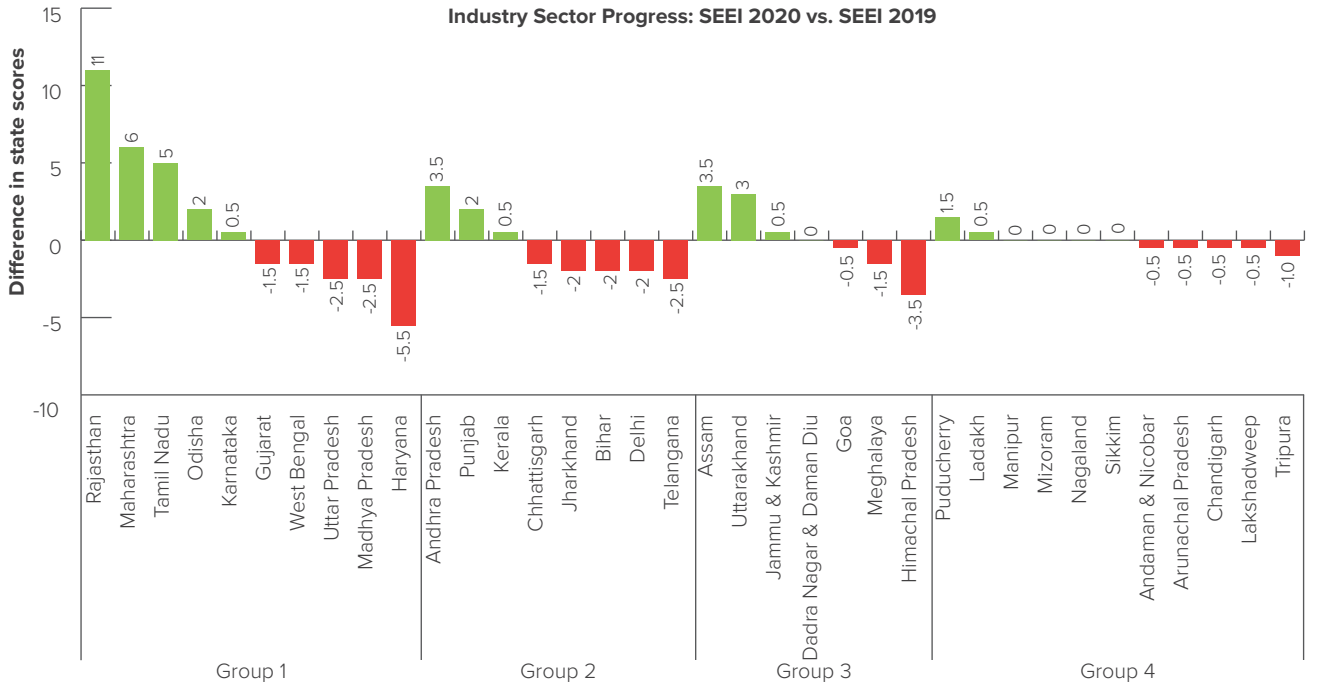


Figure 16 TFEC Group-wise State Progress in Industry Sector – SEEI 2020 vs. SEEI 2019



DISCUSSION

With a score of 18.5 against a total of 25, Tamil Nadu is the top performer in this category. The other top-performing states are Karnataka, Kerala, Maharashtra, Punjab and Rajasthan. All these states have scored uniformly across all indicator categories, with significant improvement in the outcome-based indicators. Andhra Pradesh, Assam, and Uttarakhand have also shown progress in their overall score in the industry sector in SEEI 2020.

POLICY AND REGULATION

This year, Maharashtra and Punjab issued notifications on state targets for energy savings for non-PAT industries. Such targets were already in place for Karnataka and Tamil Nadu, taking the total number of states with energy savings targets to four (4). No new state in SEEI 2020 reported issuing mandates for energy audits of industries other than those mandated under PAT. Gujarat, Haryana, Kerala, Maharashtra, and Tamil Nadu continue to mandate energy audits for industries. The states with mandatory energy audits for industries need to put to good use the information gathered from such audit exercises and accordingly set energy savings targets, particularly for non-PAT industries. Nine (9) states, namely, Andhra Pradesh, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, and Tamil Nadu, have at least one mandate on energy efficient equipment standards or other EE programmes in the industrial sector.

FINANCING MECHANISMS

Nine (9) states and UTs — Haryana, Karnataka, Kerala, Maharashtra, Odisha, Puducherry, Punjab, Rajasthan, and Tamil Nadu — have reported offering financial incentives for EE implementation in industries, including incentives for conducting energy audits and implementing energy audit recommendations, low-interest loans, and subsidies for the adoption of energy-saving equipment and facilities. Kerala has a dedicated budget for EC programmes for the industrial sector, such as capacity building and cost-effective replacement of motors damaged due to floods. Based on the data provided, EE investment in industry is a weak area. SDAs should collaborate with industry associations and the state departments for commerce and industry to identify and implement optimal investments to enhance business competitiveness, while also reducing energy intensity in industries.

INSTITUTIONAL CAPACITY

Thirteen (13) states, namely, Andhra Pradesh, Assam, Chhattisgarh, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, and Tamil Nadu, are reported to have designated an entity to support industries in EE implementation, e.g. through technical advisory support or enforcement of energy audits. Seventeen (17) states and UTs — Andhra Pradesh, Assam, Chhattisgarh, Delhi, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Puducherry, Punjab, Rajasthan, Tamil Nadu, Telangana, and Uttar Pradesh — have assigned an entity to support PAT scheme implementation in DCs. An adjudicating authority for PAT in the respective SERCs has been appointed in all the states, except Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tamil Nadu. Karnataka, Kerala, Maharashtra, Odisha, Punjab, Rajasthan, and Tamil Nadu have also deployed dedicated manpower to support PAT industries. Although the BEE periodically releases funds to the SDAs for various EE programmes, a specific annual budget allocation from the states to the designated entities would further

5
states mandate energy audits for non-PAT industries.

9
states and UTs offer financial incentives for EE implementation in industries.

assist them in their industrial EE initiatives. Only Kerala and Tamil Nadu provided dedicated funds to the entities assigned to support and enforce EE in industries.

ADOPTION OF EE MEASURES

Only Andhra Pradesh, Kerala, Tamil Nadu, and Uttarakhand have reported the number of industrial units that adopted EE measures. APSECM, the Andhra Pradesh SDA, collaborated with the National Productivity Council to implement internet of things (IoT)-enabled EE solutions in two MSME ceramic units. The unit heads are reported to have appreciated the project's usefulness and recommended the solutions to other MSME units to increase productivity with less energy. To improve EE amongst industrial consumers, Uttarakhand Renewable Energy Development Agency (UREDA), the Uttarakhand SDA, enabled energy audits and EE measures implementation in five (5) SME industries through RIF. Most SDAs do not have a structured approach to keeping track of the industrial units, whether MSME, non-MSME, or non-PAT units, in which EE measures such as equipment, processes, and ISO 50001 have been implemented. As such, the data for this indicator has primarily been obtained from CII and EESL. 277 MSME units across five (5) states and seventy (70) non-MSME non-PAT industrial units across eighteen (18) states and UTs have implemented EE measures. Based on BEE data, 100% of the PAT DCs in Meghalaya, Puducherry, Tripura and Uttarakhand have achieved their SEC targets. In Jharkhand, Karnataka, Odisha, and Telangana, over 70% of PAT DCs have met their SEC targets. The SDAs in Chhattisgarh, Karnataka, Kerala, Odisha, Puducherry, Rajasthan, and West Bengal undertook awareness workshops and training programmes for the DCs in the state. Due to the lack of requisite data on the adoption of EE measures in industries on the SDA end, the scoring criteria for this category have been defined based on available data, and no state has scored full points. SDAs must maintain a comprehensive database of EE implementation in industrial units, particularly in the non-PAT units. This could enable an organised system to mandate minimum energy performance standards and benchmarks for industrial equipment and processes, set targets for adoption of EE measures and energy savings, and monitor the overall progress of EE implementation in industries.

In 4 states & UTs 100% of the designated consumers achieved their PAT-II SEC targets.

ENERGY SAVINGS

The data is scant for energy savings, too, as there is no structured process for capturing industrial energy savings due to EE implementation. Only Kerala and Uttarakhand have furnished some data on energy savings in MSME and non-MSME units. As such, this data has been primarily sourced from CII and EESL. In the SEEI 2020 index, thirteen (13) MSME units across four (4) states and sixty-two (62) non-PAT industrial units across sixteen (16) states have reduced their SEC through EE measures. Due to the lack of a systematic method within the SDAs to evaluate energy savings in industries at the state level, the scoring criteria have been defined based on available data. Most states scored poorly, and no state received full points. The SDAs should establish a structured process to measure industrial energy savings and set industry-wise SEC benchmarks for all industrial units and an overall state energy-saving target for industry. This would enable states to periodically measure and monitor their progress towards meeting their energy savings targets. States with mandatory energy audit mechanisms for a specific 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 to meeting energy savings targets. Given the diversity and complexity in the industrial sector, the SDAs and state departments could collaborate with industry associations to identify priority areas for intervention and jointly set targets, develop programmes, and monitor outcomes.

Only 2 states provided data on EE projects and savings for industry.

3.3 MUNICIPALITIES

The index has evaluated EE activities in street lighting, water pumping, and sewage treatment in corporations, municipalities, and panchayats using eleven (11) indicators in the municipalities sector. EE measures in water pumping and sewage treatment have been combined. SEEI 2020 has a lower number of indicators compared to SEEI 2019 in this sector. However, the data for the indicators remain the same as in the last index. These indicators assess programmes, energy savings targets, energy audits, budget allocation for EE in street lighting and water pumping and sewerage systems, penetration of technology such as central monitoring systems, street lighting sensors, EE in water pumping and sewage treatment, and energy savings achieved. The maximum score for this sector is 10, of which 4 points are allocated for outcome-based indicators related to 'Adoption of EE Measures' and 'Energy Savings'.

Almost all the states, along with a few UTs, have improved their overall score in this sector in SEEI 2020. This is largely due to improvements in the adoption of EE, policy and regulations, and energy savings.

6
states set energy savings targets for municipal services, up from 4 in SEEI 2019.

An overview of the indicators for the municipality sector in SEEI 2020 is provided in Table 4. Figure 17 depicts each state's score in municipal services across the different indicator categories - Policy and Regulation, Financing Mechanisms, Institutional Capacity, Adoption of EE Measures, and Energy Savings, grouping states based on their TFEC. The states' progress in the SEEI 2020 compared to SEEI 2019 is shown in Figure 18.

Table 4 Municipalities Sector Indicators

#	Indicator	Points (10)	Scoring Criteria
	Policy and Regulation		
1	Energy savings target set by the state specifically for street lighting, water, and sewerage	1	Has the state notified an energy savings target for municipalities, or has it adopted the state target specified in UNNATEE? *If target set for at least one service, score = 1; else score = 0*
2	Energy efficient street lighting programme	0.5	Does the state have a programme for energy efficient street lighting? *If there is a programme (EESL or state), score = 0.5; else score = 0*
3	Energy efficient municipal water pumping & sewerage programme	1	Does the state have programmes on energy efficient water pumping and energy efficient sewerage systems? *If "Yes" for EESL programme, score = 0.5;* *If "Yes" for state programme, score = 0.5;* *else score = 0*
4	Energy audits for municipal services	1	Does the state conduct energy audits of street lighting *For periodic lighting audits, score = 0.5; else score = 0* Does the state conduct energy audits for water & sewerage? *For periodic audits of water & sewerage, or at least one recent state-led audit, score = 0.5; else score = 0*
	Financing Mechanisms		
5	Funds allocated for energy efficient street lighting; funds utilised	0.5	What is the quantum of funds allocated for energy efficient street lighting? *If funds allocated, score = 0.5; else score = 0*
6	Funds allocated for energy efficient water pumping and sewage treatment	1	What is the quantum of funds allocated for energy efficient water pumping? *If funds allocated, score = 0.5; else score = 0* What is the quantum of funds allocated for energy efficient sewage treatment *If funds allocated, score = 0.5; else score = 0*
	Institutional Capacity		
7	Entity to support EE measures in municipalities	0.5	Does the state have a designated entity to support & enforce EE implementation in municipalities? *If "Yes", score = 0.5; else score = 0*
8	Budget allocated to entity for municipal EE programmes	0.5	Is there a budget allocated for the functioning of this dedicated entity to support EE implementation in municipalities? *If budget is allocated to entity, score = 0.5; else score = 0*

#	Indicator	Points (10)	Scoring Criteria
	Adoption of EE Measures		
9	Penetration of energy efficient technologies in municipal services	2	List the number of ULBs where EE measures have been implemented in street lighting. *If no of ULB >0, score = 1; else score = 0* List the number of ULBs where energy efficient pumps for water and sewerage have been installed. *If no of ULB >0, score = 1; else score = 0*
	Energy Savings		
10	Energy savings from energy efficient street lighting	1	What are the energy savings due to the implementation of energy efficient street lighting? *For savings > 0 kWh, achieved in state or EESL programme, score = 1; else score = 0*
11	Energy savings from energy efficient water pumping & Sewage Treatment	1	What are the energy savings due to the implementation of energy efficient water pumping and sewage treatment? *For savings > 0 kWh, achieved in state or EESL programme, score = 1; else score = 0*

Figure 17 TFEC Group-wise Municipalities Sector State Scores

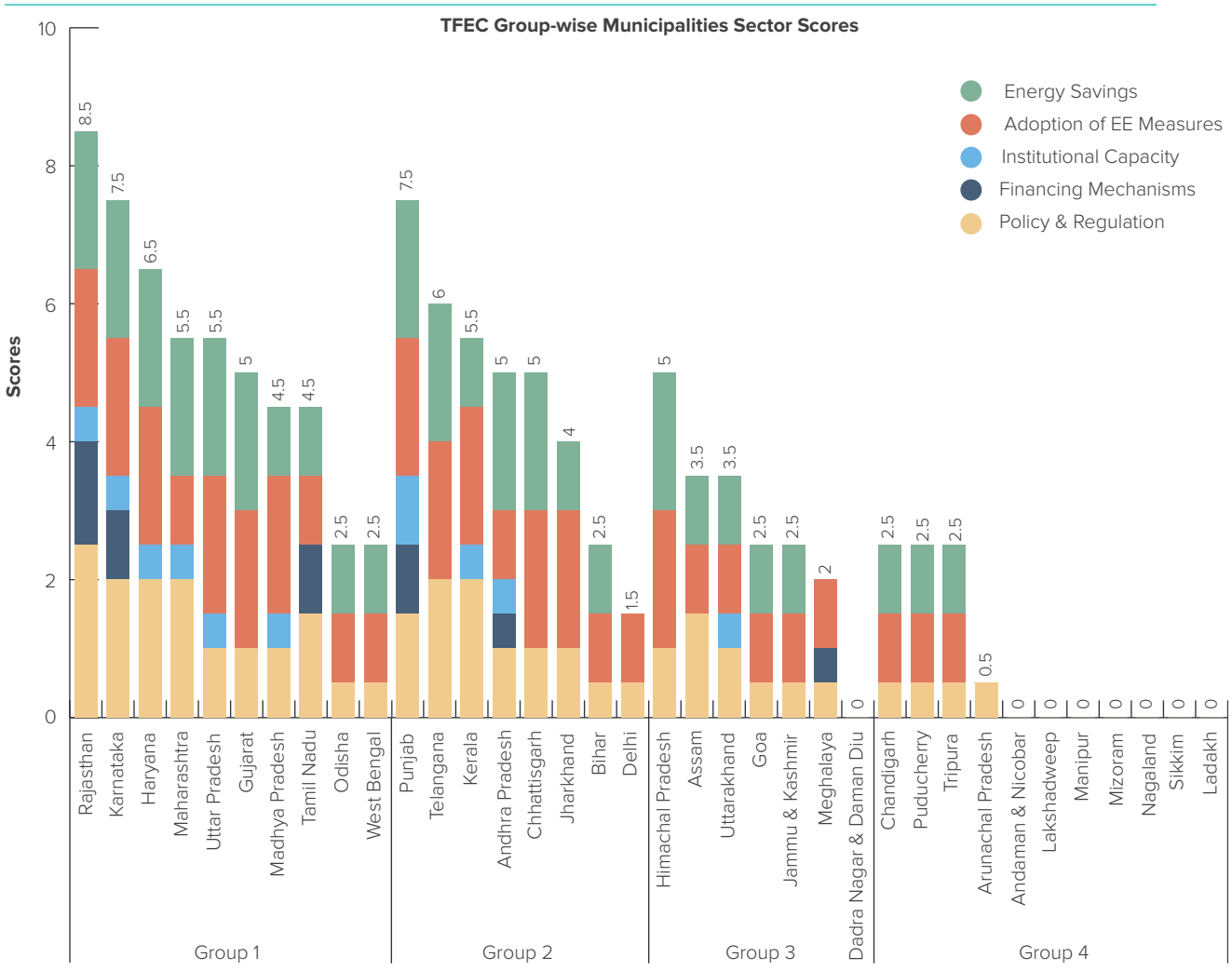
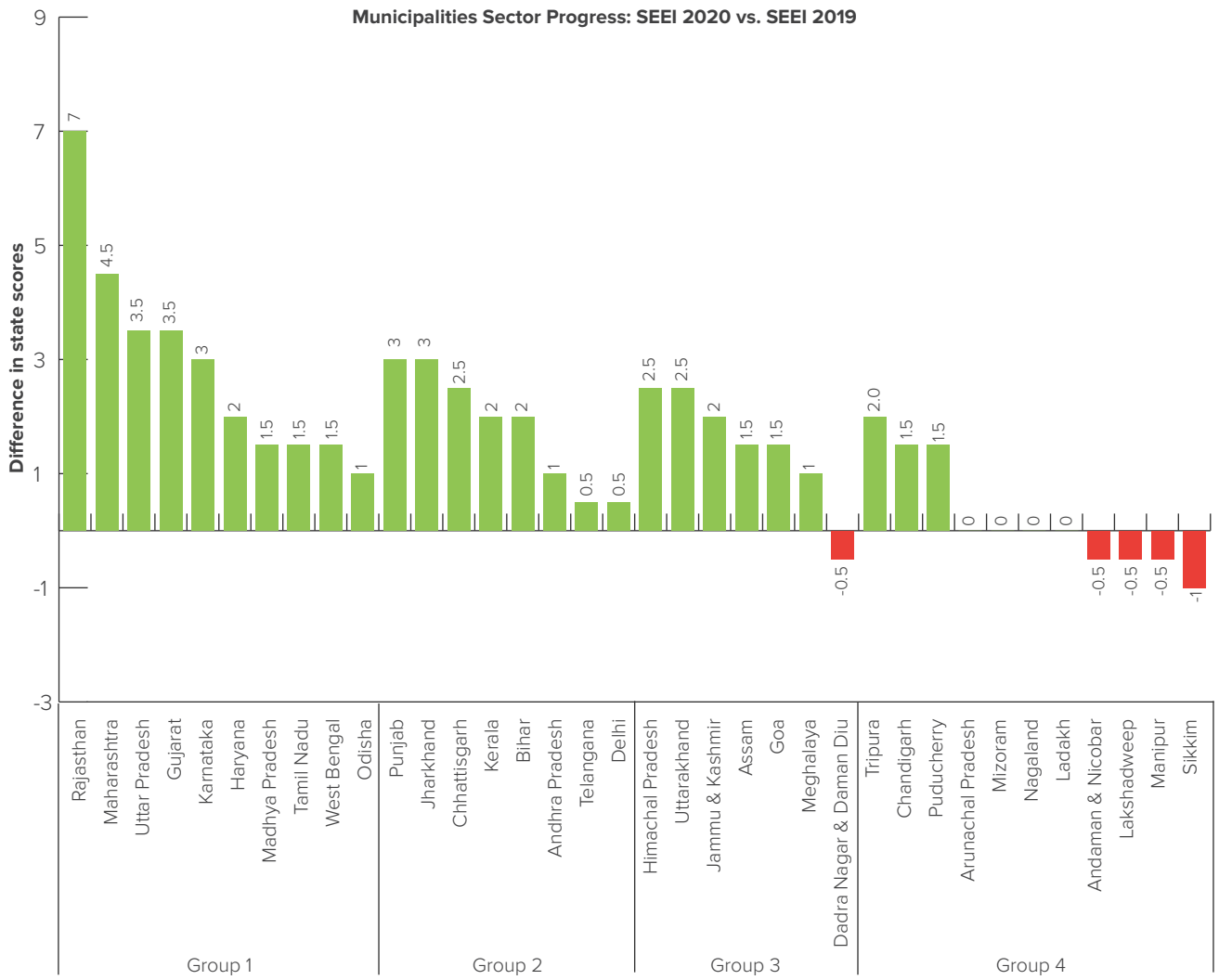


Figure 18 TFEC Group-wise State Progress in Municipalities Sector – SEEI 2020 vs. SEEI 2019



DISCUSSION

With a score of 8.5 against a total of 10, Rajasthan is the top performer in this category. It has scored high across all indicators in this sector. The other top-scoring states are Karnataka, Punjab, Haryana, and Telangana. The overall scores of almost all states in this sector are better in SEEI 2020 than they were in SEEI 2019. This is primarily due to the overall improvement in policy and regulation indicators and outcome-based indicators on energy savings and EE adoption.

POLICY AND REGULATION

In SEEI 2020, two more states, Karnataka and Maharashtra, have implemented energy saving targets, taking the total number of states with energy saving targets in municipal services to six (6). Seventeen (17) states have EE street lighting programmes in SEEI 2020, either by the state or EESL. Rajasthan and Tamil Nadu have flagship programmes at the state level in water pumping and sewerage systems, while Uttarakhand has state programmes for pump replacement with new energy efficient ones. Kerala conducted energy audits of twenty (20) Kerala Water Authority water pumping stations to increase EE in municipal water pumping systems. Twenty-one (21) states and UTs signed up with EESL to implement programmes on municipal water pumping and sewage treatment: Assam, Chandigarh, Chhattisgarh, Goa, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Maharashtra, Madhya Pradesh, Odisha, Puducherry, Punjab, Rajasthan, Telangana, Tripura, Uttarakhand, Uttar Pradesh, and West Bengal.

Andhra Pradesh has conducted investment-grade energy audits of water pumps and sewerage in ten (10) districts. Rajasthan has engaged EESL and Rajasthan Electronics & Instruments Limited (REIL) to conduct energy audits of water pumps and street lights, respectively. Maharashtra has mandated energy audits of street lights, while Kerala has conducted energy audits of its municipal water pumping stations. Punjab has conducted energy audits of rural drinking water pumping systems to identify inefficient submersible motors and pumping sets and replace them with energy efficient ones. Arunachal Pradesh has conducted an energy audit of the water treatment plant that supplies water to the capital city of Itanagar. It is also encouraging to see energy audits being taken up at the state level in a thinly populated state like Arunachal Pradesh. However, even though energy audits are essential for monitoring the progress of ongoing EE programmes, developing new programmes, and setting benchmarks and energy savings targets for upcoming programmes, the SDAs are found to be wanting in their efforts to promote periodic energy audits as a state mandate.

FINANCING MECHANISMS

Karnataka, Meghalaya, Punjab, Rajasthan, and Tamil Nadu are reported to have allocated state funds specifically to energy efficient street lighting, while Andhra Pradesh, Karnataka, Punjab, Rajasthan, and Tamil Nadu had funds earmarked for energy efficient water pumping and sewage treatment.

INSTITUTIONAL CAPACITY

There has been a marginal improvement in the states' institutional capacity in the municipal sector. Ten (10) states — Andhra Pradesh, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Uttar Pradesh, and Uttarakhand — have a designated entity to support EE initiatives in municipalities. In SEEI 2019,

EESL programmes for EE street lighting in progress in 15 states & UTs

EESL programmes for EE water & sewerage in 21 states & UTs

Only 6 states have allocated funds for EE in municipal services.

the number of such states was six (6). However, only Punjab reported allocating a specific budget to support EE in municipalities. Most EE programmes in the municipality sector in many states are a one-time exercise. The functional areas of municipalities, such as street lighting, water supply, sewerage systems, pumping stations, and waste management, have significant EE potential. Therefore, states should earmark adequate funds to improve capacity within municipal bodies so that EE programmes can be carried out regularly.

Only 4 states provided data on EE projects in municipal services.

ADOPTION OF EE MEASURES

Only Karnataka, Meghalaya, Rajasthan, and Tamil Nadu provided data on energy efficient technology penetration in municipal services. For all other states, EESL data have been used for this indicator.

Seventeen (17) states and UTs, namely, Andhra Pradesh, Bihar, Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Meghalaya, Punjab, Rajasthan, Telangana, and Uttar Pradesh, have deployed energy efficient technologies such as central control and monitoring systems (CCMS), sensors, and LEDs for street lighting in at least one ULB.

Likewise, twenty-two (22) states and UTs — Assam, Chandigarh, Chhattisgarh, Goa, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Puducherry, Punjab, Rajasthan, Tamil Nadu, Telangana, Tripura, Uttar Pradesh, Uttarakhand, and West Bengal — are reported to have adopted energy efficient technologies in water pumping and sewerage systems.

ENERGY SAVINGS

Chhattisgarh, Karnataka, Maharashtra, Rajasthan, and Tamil Nadu provided data on energy savings achieved through energy efficient street lighting. Due to the unavailability of the requisite data from most SDAs, pertinent EESL data was also considered. Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Punjab, Telangana, and Uttar Pradesh are reported to have achieved energy savings from energy efficient lighting measures in the last financial year, based on EESL data.

Only 8 states provided data on energy savings due to EE in municipal services.

Similarly, for energy savings achieved through EE implementation in water pumping and sewage treatment, only Andhra Pradesh, Karnataka, Kerala, and Rajasthan provided the requisite data. As per EESL data, Assam, Chandigarh, Chhattisgarh, Goa, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Puducherry, Punjab, Rajasthan, Telangana, Tripura, Uttar Pradesh, Uttarakhand, and West Bengal achieved energy savings in SEEI 2020 through EE measures in water pumping and sewerage system. A systematic record of energy savings attained through EE implementation in municipal services is crucial to setting energy savings targets, identifying suitable energy efficient technologies and programmes, and monitoring the progress of ongoing programmes and progress towards the state's overall energy savings targets.

MUNICIPALITIES SPOTLIGHT

Kerala is executing a state-driven programme, 'Nilaavu', to replace all conventional street lights under all local bodies with LED lights. The project's progress under all the local bodies, along with district-wise demand, can be accessed through the online dashboard, 'Nilaavu'.

For more information, check out this site:
https://nilaavu.lsgkerala.gov.in/mis/

3.4 TRANSPORT

In India, the transport sector is the third highest sector in terms of final energy consumption. [10]. As per NITI Aayog's IESS model, this sector is projected to have the second-highest potential for energy savings in India up to 2047 [11]. Hence, it is imperative for India to invest in astute policy-making and implementation to promote EE and zero-emission transport.

SEEI 2020 has attributed ten (10) indicators to this sector. The maximum score for this sector is 15, out of which a maximum of 5.5 is allocated to outcome-based indicators on 'Adoption of EE Measures' and 'Energy Savings'. The number of indicators is lower than in the last index, as correlated indicators have been clubbed together. However, there is no change in the data covered under the indicators. These indicators include EV policy, EV adoption in public transport, private transport, and government departments, SRTC fuel efficiency and energy intensity, charging infrastructure availability, and budget allocation for improving fuel efficiency and EE.

9
states have notified state EV policy, up from 6 in SEEI 2019.

The overall scores of a few states and UTs have improved modestly in the transport sector in SEEI 2020. This improvement is primarily due to an increase in the adoption of EE measures and enhanced institutional capacity.

An overview of the indicators for the transport sector in the SEEI 2020 is given in Table 5. Figure 19 depicts each state's score in the transport sector across the different indicator categories - Policy and Regulation, Financing Mechanisms, Institutional Capacity, Adoption of EE Measures, and Energy Savings, grouping states based on their TFEC. The states' progress in the SEEI 2020 compared to SEEI 2019 is shown in Figure 20.

Table 5 Transport Sector Indicators

#	Indicator	Points (15)	Scoring Criteria
	Policy and Regulation		
1	State transport policy to advocate higher fuel efficiency & procurement of fuel-efficient vehicles	1	Does the state transport policy advocate fuel efficiency? *If "Yes", score = 0.5; else score = 0* Does the state have a policy on procurement of fuel-efficient vehicles for government use? *If government circular indicating fuel efficiency as criteria in govt procurement policy or for State Road Transport Undertaking (SRTU), score = 0.5; else score = 0*
2	State electric mobility (e-mobility) policy & EV procurement/ hire	3	Does the state have an e-mobility policy? *If policy is implemented, score = 2;* *If draft policy is notified, score = 1;* *If there are auxiliary EV schemes, a city-specific e-mobility policy, or smart city e-mobility policy, score = 0.5* Does the state have a policy for EV procurement/ hire for government use? *If the policy/draft policy has a target for EV procurement for government use, score = 1;* *If EV policy/draft policy has a provision/clause for EV procurement for government use, score = 0.5*
	Financing Mechanisms		
3	State-initiated e-mobility incentives	2	Does the state provide incentives for private EVs, commercial EVs (taxi, auto, bus), and setting up charging infrastructure? *If "Yes" for all three (private, commercial, & charging), score = 2;* *If "Yes" for at least two, score = 1;* *If "Yes" for at least one, score = 0.5; else score = 0*
	Institutional Capacity		
4	SRTC personnel awareness on fuel saving	1	Does the state conduct programmes for SRTC personnel to increase their awareness and implementation of fuel saving? *For Petroleum Conservation Research Association (PCRA) or SRTU programme, score = 1; else score = 0*
5	State notified agency for EV promotion	2	Is there a state notified agency for the promotion of e-mobility? *For BEE-notified nodal agency for charging infrastructure or state EV policy notified agency, score = 1.5; else score = 0* Did the state conduct any campaign to promote EVs? *For any state EV campaign, score = 0.5; else score = 0*
6	Budget to improve fuel efficiency and EE in transport	0.5	What is the quantum of budget allocated to improve fuel efficiency and EE in transport? *If budget allocated, score = 0.5; else score = 0*

#	Indicator	Points (15)	Scoring Criteria
	Adoption of EE Measures		
7	EV adoption of in public transport	1.5	Has the state adopted EVs in bus fleets, taxi fleets, auto-rickshaws, and e-rickshaws? *If EVs adopted in two or more categories, score = 1.5;* *If e-buses adopted in public transport, score = 1;* *If EVs adopted only for taxis, autos, and/or e-rickshaws, score = 0.5;* *If tenders floated on e-bus adoption, score = 0.5;* *else score = 0*
8	Penetration of hybrid and electric passenger vehicles	1.5	What is the proportion of hybrid and electric passenger vehicles among passenger vehicles registered in FY 2019-20 in the state? *If >= 2%, score = 1.5;* *If >1% and <2%, score = 1;* *If >0% and <= 1%, score = 0.5*
9	Availability of EV charging infrastructure	1	What is the number of charging stations for all types of EVs that have been rolled out in the state in FY 2019-2020? *If no of installed charging stations >= 1, score = 1; else score = 0*
	Energy Savings		
10	SRTC fleet fuel efficiency & energy intensity	1.5	What is the fuel efficiency achieved by SRTCs in the state? *Fuel efficiency of SRTU in kilometres (km) per megajoule (MJ):* *If >= 0.13, score = 1;* *If >0.11 and <0.13, score = 0.5; else score = 0* *What is the energy intensity of the SRTC fleet in the state, taking into account all SRTCs?* *Passenger-km/litre (L): If >= 200, score = 0.5; else score = 0*

Figure 19 TFEC Group-wise Transport Sector State Scores

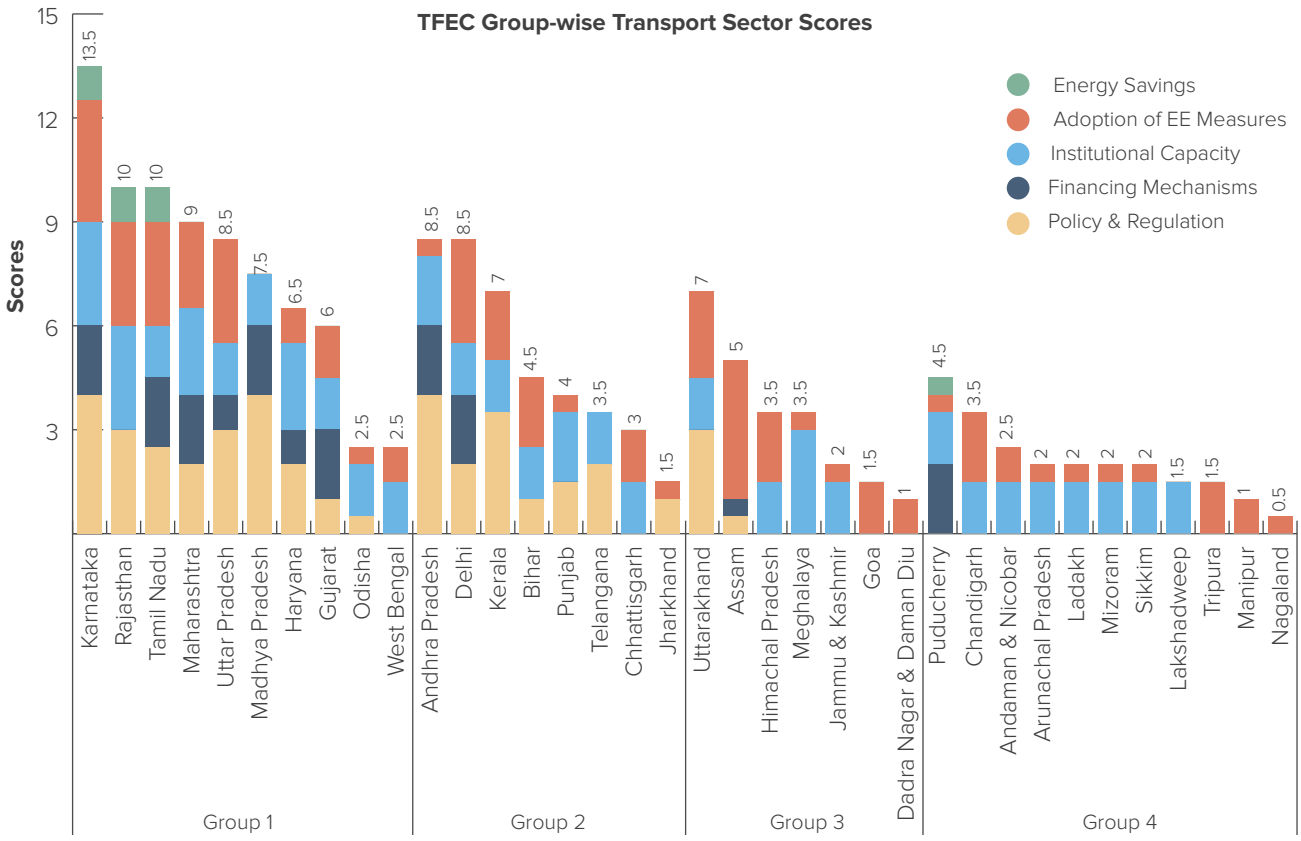
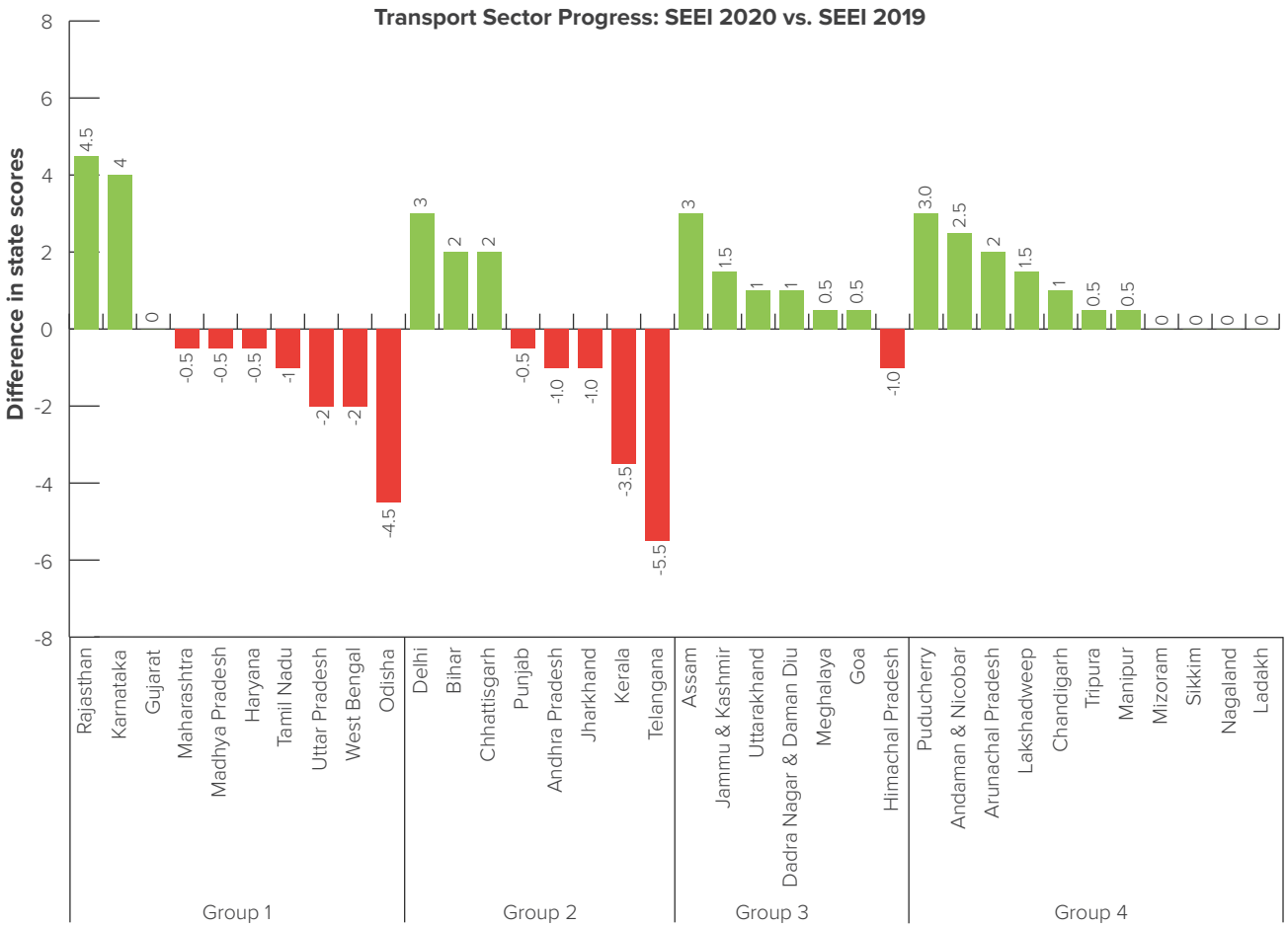


Figure 20 TFEC Group-wise State Progress in Transport Sector – SEEI 2020 vs. SEEI 2019



DISCUSSION

Karnataka is the top-performing state, with a score of 13.5 against a sector total of 15. The other top performers are Rajasthan, Tamil Nadu, and Maharashtra. Other states and UTs such as Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, and Puducherry have shown modest improvement in this sector over the previous index.

POLICY AND REGULATION

In SEEI 2020, three (3) more states are reported to have notified the state EV policy, bringing the total number of states with notified EV policies to nine (9), up from six (6) in SEEI 2019. These states are Andhra Pradesh, Delhi, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Tamil Nadu, Uttar Pradesh, and Uttarakhand. Four (4) states, namely, Gujarat, Haryana, Rajasthan, and Punjab have issued draft EV policies in SEEI 2020. This takes the number of states with a draft EV policy to six (6), including Bihar and Telangana, which already had a draft EV policy since SEEI 2019. All the above mentioned states, except Bihar, Delhi, Gujarat, Maharashtra, and Tamil Nadu, have incorporated a policy on EV adoption for government use into their respective EV policies. Jharkhand, which is yet to draft an EV policy, has initiated EV procurement from EESL for government use.

Andhra Pradesh, Karnataka, Kerala, Madhya Pradesh, and Rajasthan have a state transport policy that advocates fuel efficiency and procurement of fuel-efficient

29
states & UTs
have a State Notified agency for e-mobility promotion.

vehicles for government use or state transport. Assam, Odisha, and Tamil Nadu have stipulated guidelines for procuring fuel-efficient vehicles for government and public vehicles.

Adopting fuel-efficient vehicles or, better still, EVs for government purposes would provide a good example for the general public to switch to clean transport, which would expand the market for green vehicles.

321
charging stations were installed in 13 states.

FINANCING MECHANISMS

Andhra Pradesh, Delhi, Karnataka, Madhya Pradesh, Maharashtra, Puducherry and Tamil Nadu provide incentives for private EVs (electric two-wheelers /four-wheelers), commercial EVs (buses, taxis, and autos), and charging infrastructure. Uttar Pradesh provides incentives for private EVs and charging infrastructure. These incentives include tax rebates, exemption of registration fees, a capital subsidy on EVs, FAR incentive, land concession, or tariff capping on charging infrastructure, a duty rebate on EV components, etc. Although Gujarat has not yet notified its final EV policy, the state provides incentives for EVs and the establishment of charging infrastructure. Likewise, although Haryana's EV policy is in the draft stage, the state has a separate government gazette notification for offering tax rebates on the registration of battery-operated vehicles. Assam incorporates energy efficient vehicles into various public schemes for social welfare, such as employment and women's education.

It is encouraging to see that some states provide incentives in different innovative ways to promote electric vehicles. E-mobility is a sunrise industry in India, and the Government of India has been aggressively encouraging EV adoption through central schemes. Transportation being a concurrent subject, the states should also follow suit and work in collaboration with the central government and private sector to propel the nation's EV sector development forward.

INSTITUTIONAL CAPACITY

Except for Assam, Dadra and Nagar Haveli and Daman and Diu, Goa, Jharkhand, Manipur, Nagaland, and Tripura, all the remaining twenty-nine (29) states and UTs have a State Notified Agency for deployment of EV charging infrastructure. Four (4) states – Andhra Pradesh, Karnataka, Meghalaya, and Punjab — have conducted awareness campaigns through workshops, webinars, and relay campaigns using print, electronic, and social media to bolster EV adoption in the state, in line with the planned BEE "Go Electric" campaign. Haryana, Karnataka, Maharashtra, Meghalaya, and Rajasthan have conducted training for SRTC personnel to foster awareness on fuel savings and efficiency. However, only Rajasthan is reported to have a dedicated budget to support and improve fuel efficiency and EE in the transport sector.

8
states reported adoption of e-mobility in public transportation.

ADOPTION OF EE MEASURES

Only eight (8) states, namely, Andhra Pradesh, Assam, Himachal Pradesh, Karnataka, Maharashtra, Rajasthan, Tamil Nadu, and Uttar Pradesh, are reported to have adopted e-mobility in various modes of public transport, such as public buses, taxi services, autos, and e-rickshaws. Regarding the penetration of electric passenger vehicles (number of electric and hybrid vehicles sold in 2019-20 as a percentage of total vehicles registered during the same period), Tripura and Delhi are at the top, with 5.9% and 5%, respectively, against a national average of 1.3 percent. Eight (8) other states and UTs — Assam, Chandigarh, Dadra and Nagar Haveli and Daman and Diu, Goa, Manipur, Uttar Pradesh, Uttarakhand, and West Bengal — have an

electric passenger vehicle penetration higher than or equal to that of the national average. SEEI 2020 witnessed a significant expansion of charging infrastructure across the country, with 321 charging stations installed in thirteen (13) states through EESL or state initiatives. Deployment of e-mobility in public transport has excellent potential to mitigate GHG emissions and contribute to national climate goals. All the states should push for greater EV penetration in public transport with effective policy decisions and competent implementation, alongside adequate capacity building and fund allocation.

ENERGY SAVINGS

Only Karnataka, Puducherry, Rajasthan, and Tamil Nadu could provide data on the fuel efficiency of their respective SRTCs. None of the states could provide data on the SRTUs' energy intensity (passenger-km/litre). A robust process should be developed to track the status of EE initiatives in the transport sector on fuel efficiency, energy intensity, and energy savings. This would enable the setting of energy saving targets, identification of suitable EE programmes, and monitoring of progress towards the overall energy savings targets in the state's transport sector.

Only 4 states & UTs provided SRTC fuel efficiency data.

TRANSPORT SPOTLIGHT

As highlighted in the financing mechanisms section of the transport sector, Assam has incorporated EE into its public schemes for social welfare. ***First, the state provides free electric two-wheelers to meritorious girl students to promote the dual cause of sustainable transportation and higher education among women. Second, it provides e-rickshaws free of cost to operate as public transport to the unemployed youths of the Char areas.***

(Char areas usually refer to any areas of accretion in a river course or estuary. These areas emerge and submerge in the river bed of Brahmaputra and are uniquely vulnerable to disasters such as floods and cyclones.)

3.5 AGRICULTURE AND DISCOMS

The agriculture & DISCOMs sector consists of 14 indicators related to DSM regulations, utility-driven agricultural and non-agricultural DSM programmes, savings through DSM programmes, T&D losses, policies on integrated cold chain infrastructure, policies on integrated water and energy savings in the agriculture sector, implementation of Time of Day (ToD) tariffs for different customer categories, fund allocation for DSM programme implementation, and budget allocation for DSM cells. Related indicators have been clubbed together, reducing the number of indicators in SEEI 2020.

A few states have shown improvement in their overall score in this sector, primarily due to improvements in policy and regulation, adoption of EE measures, and energy savings.

DSM cells have been constituted in 58 DISCOMs across 34 states & UTs.

Table 6 provides an overview of the indicators for the agriculture & DISCOMs sector in the SEEI 2020. The maximum weightage has been allotted to indicators under 'Policy and Regulation', with 9 points out of the total 15.

Figure 21 depicts each state's score across the different indicator categories - Policy and Regulation, Financing Mechanisms, Institutional Capacity, Adoption of EE Measures, and Energy Savings, grouping states based on their TFEC. The states' progress in the SEEI 2020 compared to SEEI 2019 is shown in Figure 22.

12 states have DISCOM-driven DSM programmes, 7 of these have set energy saving targets.

Table 6 Agriculture and DISCOMs Sector Indicators

#	Indicator	Points (15)	Scoring Criteria
	Policy and Regulation		
1	Notification of DSM regulation	1.5	Has the state government notified the DSM regulation? *If "Yes", score = 1; else score = 0* Has the state defined and enforced penalties for non-compliance with DSM mandates? *If "Yes", score = 0.5; else score = 0*
2	DISCOM-driven agricultural DSM programme	1.5	Has the state set a target for energy savings to be achieved through Ag DSM programmes? *If "Yes", score = 0.5; else score = 0* Does the state have a DISCOM-driven programme for DSM in the agriculture sector? *If "Yes", score = 1; else score = 0*
3	DISCOM driven non-agricultural DSM/Demand Response (DR) programmes	1.5	Has the state set energy savings targets to be achieved through DISCOM-driven DSM/DR programmes in other demand sectors, excluding agriculture? *If "Yes", score = 0.5; else score = 0* Do DISCOMs in the state have DSM/DR programmes for other demand sectors, excluding agriculture? *If "Yes", score = 1; else score = 0*
4	Target for T&D losses	0.5	Has the state set a target for T&D losses (technical losses only) within DISCOMs? *If % target defined, score = 0.5; else score = 0*
5	Measurement, Reporting, and Verification (MRV) of DSM programmes	0.5	Do DISCOMs in the state have an MRV mechanism for evaluating DSM programmes? *If "Yes", score = 0.5; else score = 0*
6	Policy on integrated cold chain infrastructure in the state	0.5	Does the state have guidelines/regulations to incorporate EE/EC measures into the development of integrated cold chain infrastructure? *If "Yes", score = 0.5; else score = 0*
7	Policy on integrated water and energy savings in the agriculture sector in the state	1	Does the state have a policy on integrated water and energy savings in the agriculture sector? *If "Yes", score = 1; else score = 0*
8	Implementation of ToD / Time of Use (ToU) tariffs	2	Have DISCOMs in the state implemented ToD/ToU tariffs for industrial and commercial consumers and residential consumers? *If "Yes" for industrial/commercial consumers, score = 1; else score = 0* *If "Yes" for residential consumers, score = 1; else score = 0*

#	Indicator	Points (15)	Scoring Criteria
	Financing Mechanisms		
9	Financial incentives for DISCOM-driven DSM measures	1	Does the state provide financial incentives for non-agricultural DSM? *If "Yes", score = 0.5; else score = 0* Does the state provide financial incentives for agricultural DSM? *If "Yes", score = 0.5; else score = 0*
	Institutional Capacity		
10	Dedicated DSM cell	0.5	Do DISCOMs in the state have a dedicated DSM cell to support and drive DSM programmes? *If "Yes", score = 0.5; else score = 0*
11	Budget allocated to DSM cell	0.5	Is there a budget allocated for the functioning of dedicated DSM cells? *If budget allocated, score = 0.5; else score = 0*
	Adoption of EE Measures		
12	Consumer participation in DISCOM-driven DSM programmes	1	What is the number of consumers participating in DISCOM-driven agricultural DSM programmes? *If consumer participation >0, score = 0.5; else score = 0* What is the number of consumers participating in DISCOM-driven non-agricultural DSM programmes? *If consumer participation >0, score = 0.5; else score = 0*
	Energy Savings		
13	T&D losses (technical losses)	2	Indicate the % aggregate T&D losses across all DISCOMs in the state. *If T&D Losses <=15%, score = 2; if <=20%, score = 1; if <= 25%, score = 0.5; else score = 0*
14	Energy savings from DISCOM-driven DSM	1	What are the total energy savings in kWh from all DSM programmes in the state? *If kWh savings >0, score = 1; else score = 0*

Figure 21 TFEC Group-wise Agriculture & DISCOMs Sector State Scores

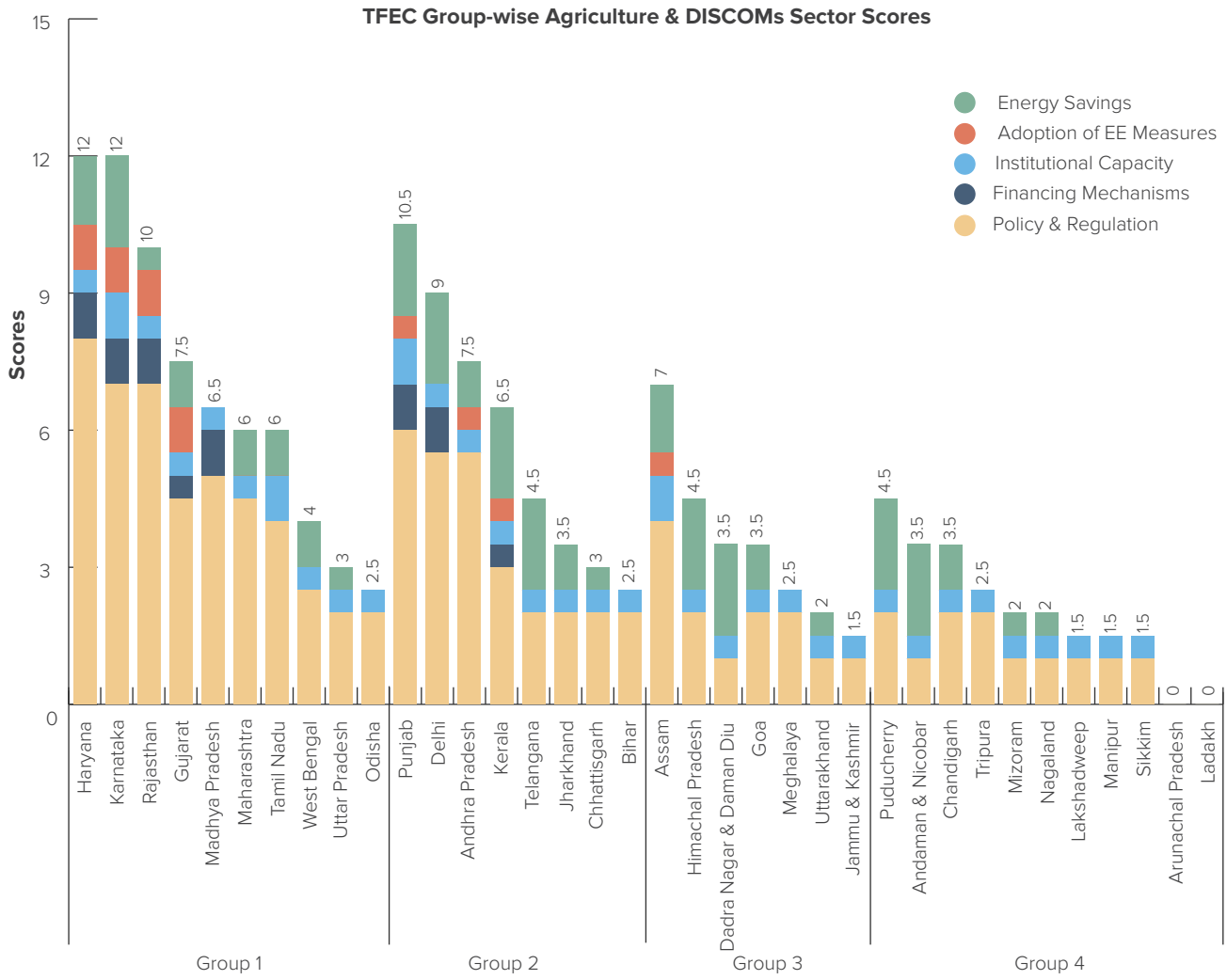
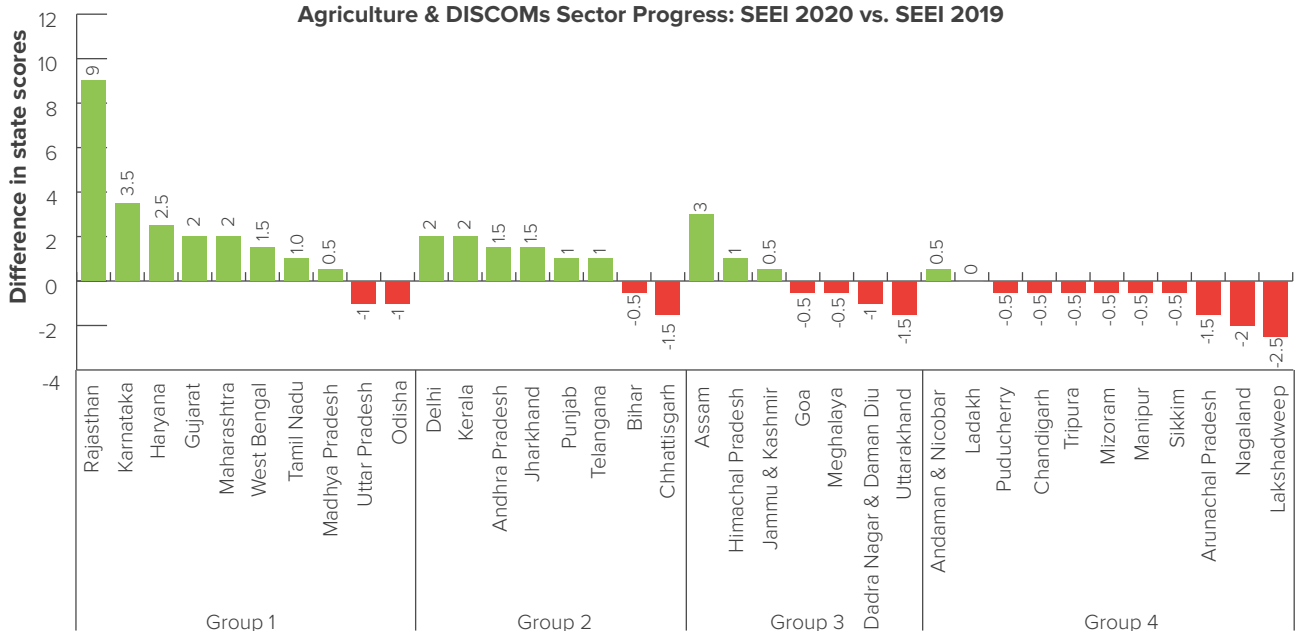


Figure 22 TFEC Group-wise State Progress in Agriculture & DISCOMs Sector – SEEI 2020 vs. SEEI 2019



DISCUSSION

Karnataka and Haryana are the top-performing states in this sector, each with a score of 12 against a total of 15. The other top performers are Punjab, Rajasthan and Delhi. These states have scored highly across indicators in policy and regulation, adoption of EE measures, and financing mechanisms. A few states, namely, Assam, Gujarat, Maharashtra, Kerala, West Bengal, and Jharkhand, have shown marginal improvement in their scores over SEEI 2019, primarily due to improvements in EE measures and progress in the indicators related to Policy and Regulation and Energy Savings.

8 states provided data on consumer participation in DSM programmes.

POLICY AND REGULATION

All states and UTs except Arunachal Pradesh, Kerala, Ladakh, Uttarakhand, and West Bengal have notified the DSM regulation. However, only Assam and Karnataka have levied penalties for non-compliance with DSM measures. DISCOMs in Andhra Pradesh, Delhi, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, and Tamil Nadu have undertaken DSM programmes in the agriculture sector, which include the use of energy efficient pumps, solarisation of off-grid and grid-connected agricultural pumps, agriculture feeder separation, and awareness campaigns on EE agricultural practices among farmers. Gujarat, Haryana, Karnataka, Punjab, Rajasthan, and Tamil Nadu have also set targets for energy savings from the agricultural DSM programmes. Non-agricultural DSM programmes have been implemented in Andhra Pradesh, Assam, Delhi, Gujarat, Haryana, Karnataka, Madhya Pradesh, Punjab, and Rajasthan. These programmes largely entail the promotion of LED tubelights and light bulbs, star-rated ACs, energy efficient fans, and solar water heating systems. Energy savings targets to be achieved through non-agricultural DSM programmes have only been set in Andhra Pradesh, Haryana, and Karnataka. However, this is an improvement from SEEI 2019, where no state reported any energy savings targets for either agricultural DSM or non-agricultural DSM programmes. Rajasthan and Tamil Nadu have either defined an MRV mechanism or shared an MRV report to monitor and evaluate DSM programmes. Haryana has notified guidelines on the framework for evaluating, measuring, and verifying DSM programmes by the DISCOMs. Energy savings targets for agricultural and non-agricultural DSM programmes in SEEI 2020 set by different states will facilitate the mainstreaming of EE in the DISCOM sector. As DISCOMs have the best connection with consumers, there should be a sustained effort to design DSM and DR programmes that help manage the state's energy footprint while also being viable for DISCOMs.

T&D losses are a measurement of inefficiency of the grid. India's T&D losses are reported to be over 20% of total generation, which is more than twice the world average[12]. Ideally, both actual and target T&D losses for the DISCOMs should be reported annually in the multi-year tariffs and/or annual tariffs issued by the respective SERCs and the Joint Electricity Regulatory Commission (JERC) for the DISCOMs. Nevertheless, in SEEI 2020, only eight (8) states have reported having a target for T&D loss reduction. ToD tariffs are another energy savings-related regulatory measure; they incentivise consumers to shift their loads from peak hours to off-peak hours, thereby improving the system load factor during the peak period by reducing the demand on the system. Two new states implemented ToD tariffs for industrial/commercial consumers in SEEI 2020. Thus, ToD tariffs for industrial/commercial consumers are now in place in twenty-six (26) states and UTs, excluding Andaman and Nicobar Islands, Arunachal Pradesh, Dadra and Nagar Haveli and Daman and Diu, Jammu and Kashmir, Ladakh, Lakshadweep, Manipur, Mizoram, Nagaland, and Sikkim. ToD tariffs for residential customers are in place in only six (6) states—Andhra Pradesh, Haryana, Kerala, Madhya Pradesh, and West Bengal, with Delhi having an optional ToD for residential consumers. With the central government's "Power for

Only 4 states have reported energy savings through the DSM programmes.

All" initiative, DISCOMs can effectively manage the peak load through a carefully designed ToD tariff structure for select consumers, especially the high-value ones. In terms of sector-specific policies, only Rajasthan has a policy on integrated cold chain infrastructure in place. Maharashtra and Karnataka have policies on integrated water and energy savings in the agriculture sector, while Haryana, Punjab and Rajasthan have integrated schemes on water and energy savings in the agriculture sector.

FINANCING MECHANISMS

Only six (6) states, namely, Delhi, Haryana, Karnataka, Madhya Pradesh, Punjab, and Rajasthan, provide state-wide incentives for both agricultural and non-agricultural DISCOM-driven DSM programmes. Kerala provides financial incentives for agricultural DSM programmes, while Gujarat provides similar incentives for non-agricultural DSM programmes. DSM, among other things, is instrumental in EE adoption at the end-user level. The DISCOMs should cooperate with all relevant stakeholders within the state to secure adequate funding for DSM activities.

INSTITUTIONAL CAPACITY

Under the clauses of the DSM regulations, a DSM cell acts as the nodal agency for systematising and implementing DSM activities in the state. Such cells have been constituted in 58 DISCOMs across 34 states and UTs. Kerala, Uttarakhand, and West Bengal have set up dedicated DSM cells despite having no DSM regulations in the state. In Arunachal Pradesh and Ladakh, neither the DSM regulations nor the DSM cell is in place. Uttar Pradesh and Haryana have DSM cells only in some DISCOMs, not all, despite having notified state DSM regulations. Out of all the states with DSM cells, only Assam, Karnataka, Tamil Nadu, and Punjab have specific budgets earmarked for the operation of these cells.

ADOPTION OF EE MEASURES

Consumer participation in the DISCOM-driven DSM programmes has been taken as an indicator of the adoption of EE measures in the agriculture and DISCOMs sector. Although many states have both agricultural and non-agricultural DSM programmes in place, only Gujarat, Haryana, Karnataka, and Rajasthan have provided data on the number of consumers who have participated in such programmes. Andhra Pradesh, Assam, Punjab, and Kerala have reported consumer participation in either agricultural or non-agricultural DSM programmes.

ENERGY SAVINGS

Energy savings in the agriculture and DISCOM sectors have been captured using a mix of savings achieved on the supply side, by reducing T&D losses, and savings achieved on the demand side, through behind-the-meter DISCOM-driven DSM programmes. T&D losses have been considered for FY 2018-19 as per data collated from NITI Aayog's India Energy Dashboard. Only seven (7) states and UTs, namely, Andaman & Nicobar Islands, Dadra and Nagar Haveli and Daman and Diu, Delhi, Himachal Pradesh, Puducherry, Punjab, and Telangana, have achieved T&D losses of 15% or less. Ten (10) states and UTs have reported T&D losses between 16% and 20%, while eight (8) states and UTs have T&D losses of 21-25%. Nine (9) states have reported T&D losses greater than 25%, of which seven (7) states have T&D losses exceeding 30%. Data on the T&D losses in Lakshadweep and Ladakh could not be obtained. Only Assam, Haryana, Karnataka and Kerala reported energy savings due to DISCOM-driven DSM programmes. Energy savings from DSM programmes need to be continuously monitored to measure the impact of ongoing programmes and design suitable programmes and policies at the state level.

26
states have ToD tariffs for industrial/ commercial consumers, up from 24 in SEEI 2019.

6
states have ToD tariff for residential consumers.

Only 7 states & UTs achieved T&D loss of 15% or less.

AGRICULTURE AND DISCOM SPOTLIGHT

After successfully implementing the pilot "Paani Bachao Paisa Kamao" scheme in June 2018 on six agriculture feeders in Fatehgarh Sahib, Jalandhar, and Hoshiarpur districts, Punjab extended the scheme, starting with 250 additional feeders in June 2019. The scheme aims to ensure that farmers limit the power used to pump water out of the ground. The farmers will get paid a "Direct Benefit Transfer for Electricity" (DBTE) for judicious use of groundwater. It is a significant agricultural reform in a state like Punjab, where the water level is decreasing. Moreover, the DBTE scheme will result in crop diversification, accurate energy accounting, the avoidance of wasteful energy consumption, and T&D loss reduction. Besides Punjab State Power Corporation Limited (PSPCL) and Agriculture Department, two agencies, the World Bank and Abdul Latif Jameel Poverty Action Lab (J-PAL), are supporting the implementation of this scheme across Punjab.

For more information, check out this site:

https://www.pspcl.in/2019/08/pspcl-launches-second-phase-of-paani-bachao-paisa-kamao-scheme/

3.6 CROSS SECTOR INDICATORS

The SEEI 2020 comprises seven (7) cross sector indicators. The indicators are related to the State Energy Conservation Fund (SECF), EE awareness programmes, energy conservation awards in the state, promotion of R&D in energy efficiency, communication of the SDA activities to the state power/energy departments, appointment of an inspecting officer, and initiatives towards making the SDA a standalone body.

The total score allotted to this sector is five (5). Most of the states have fared poorly in this sector, primarily due to a lack of requisite data on SDA reporting to the state power/energy department, awareness campaigns, promotion of R&D in EE, and implementation of Revolving Investment Fund (RIF) projects using the SECF.

State Energy Conservation Fund (SECF) has been established in 32 states & UTs.

An overview of the indicators is given in Table 7. Figure 23 depicts each state's score in cross sector initiatives, grouping states based on their TFEC. The states' progress in the SEEI 2020 compared to SEEI 2019 is shown in Figure 24.

Table 7 Cross Sector Indicators

#	Indicator	Points (5)	Scoring Criteria
1	Establishment of State Energy Conservation Fund	1.5	Has the state established an SECF and finalised the rules and regulations to operationalise the same? *If "Yes", score = 0.5; else score = 0* Has the state allocated matching funds for the SECF? *If "Yes", score = 0.5; else score = 0* Has the state implemented EE projects through the RIF as part of the funds disbursed under SECF? *If "Yes", score = 0.5; else score = 0*
2	Awareness campaigns	0.5	Does the state conduct awareness campaigns on energy efficiency and energy conservation? *If "Yes", score = 0.5; else score = 0*
3	State Energy Conservation Awards	0.5	Does the SDA or other state organisations organise state-level energy conservation awards to recognise outstanding performers in the building, industry, and other sectors? *If "Yes" for at least one sector, score = 0.5; else score = 0*
4	Reporting / communication with respective state energy / power departments	0.5	Does the SDA periodically report the status of its ongoing / planned EE activities and projects to the respective energy / power departments? *For formal reporting via meeting or formal report, score = 0.5; else score = 0*
5	Promotion of innovation and R&D in EE	0.5	Does the state have a policy, programmes, or financial instruments to promote innovation and R&D in EE? *If "Yes", score = 0.5; else score = 0*
6	Appointment of inspecting officer	0.5	Has the SDA appointed an inspecting officer? *If "Yes", score = 0.5; else score = 0*
7	Standalone SDA	1	Has the state taken any initiatives towards making the SDA a standalone organisation? *If SDA is a standalone organisation, score = 1; if any steps have been initiated, score = 0.5; else score = 0*

Figure 23 TFEC Group-wise Cross Sector State Scores

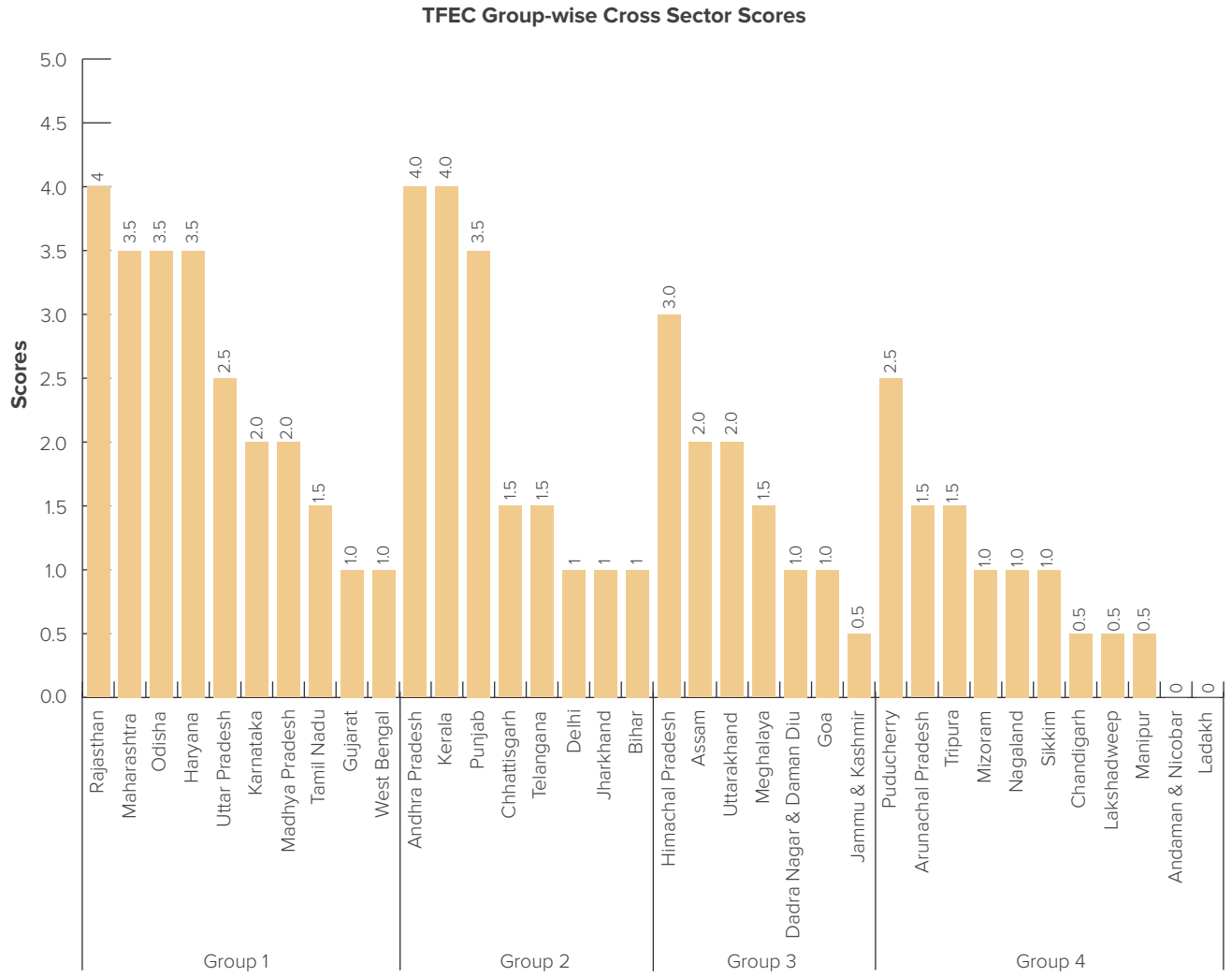
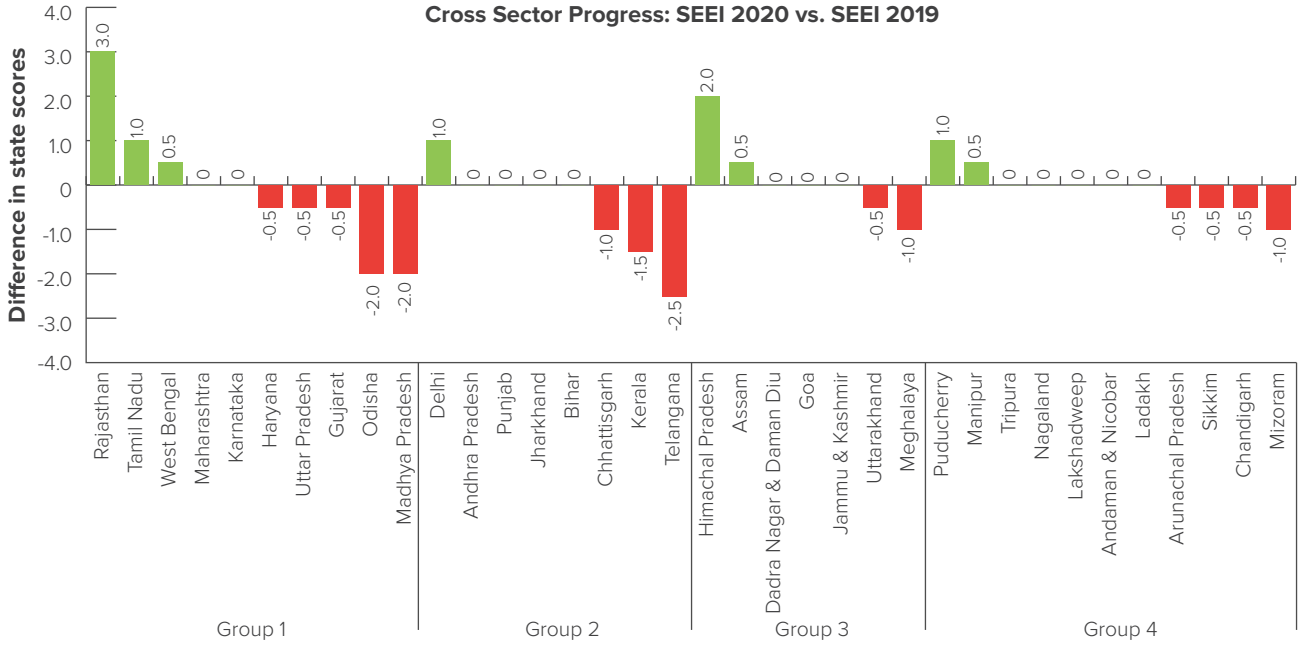


Figure 24 TFEC Group-wise State Progress in Cross Sector – SEEI 2020 vs. SEEI 2019



DISCUSSION

Andhra Pradesh, Kerala, and Rajasthan are the top-performing states in this sector, each with a score of 4. They are closely followed by Haryana, Maharashtra, Odisha and Punjab, with a score of 3.5 each. An SECF, as per Section 16(1) of the EC Act, 2001, has been established in 32 states and UTs with initial seed funds from BEE. Andaman and Nicobar Islands, Chandigarh, Ladakh, and Meghalaya are yet to establish an SECF. Twenty-six (26) states have allocated matching contributions to the SECF, demonstrating the state's commitment to promoting EE activities. One requirement of the SECF is to earmark a significant part of the budget as an RIF to finance EE project implementation. However, apart from Uttarakhand, no other state has reported any projects implemented using RIF during FY 2019-20.

Only Uttarakhand implemented EE projects using the Revolving Investment Fund of SECF.

The SDAs of twelve (12) states and UTs — Assam, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Puducherry, Punjab, Rajasthan, and Uttar Pradesh — have conducted four (4) or more EE awareness campaigns each. These campaigns mainly include organising webinars, training, and workshops on ECBC, energy efficient technological interventions, the role of Energy Service Companies (ESCOs) in EE, financial risk mitigation, agricultural DSM, municipal DSM, conducting awareness programmes on EC in government offices, Public Sector Undertakings (PSUs), and residential areas, and observation of an EC day/week through electronic, social, and print media, including debates, quizzes, and model exhibitions, especially for students. Public awareness is integral to the successful implementation of various EE schemes and programmes at the state level. The SDAs should organise several awareness campaigns relevant to people of different strata and backgrounds throughout the year. A portion of the annual budget must be allocated for the same.

9

states have energy conservation awards in at least one demand sector.

Nine (9) states, namely, Andhra Pradesh, Haryana, Himachal Pradesh, Kerala, Maharashtra, Odisha, Punjab, Rajasthan, and Uttar Pradesh, have energy conservation awards in at least one sector.

Regular communication between the SDAs and the energy/power department is imperative to generate the desired interest and funds for EE activities at the state level. Ideally, all SDAs should submit a formal report on the status of their ongoing / planned EE activities and projects to the respective energy / power departments. However, only nine (9) states and UTs, namely, Andhra Pradesh, Haryana, Maharashtra, Meghalaya, Puducherry, Punjab, Rajasthan, Tamil Nadu, and West Bengal, have reported periodic communication with the respective energy / power departments.

The power of inspection to check compliance with the mandatory regulations and schemes (e.g. Standards & Labelling (S&L), ECBC, and PAT) is vested in the state government. Without compliance mechanisms, the integrity of schemes cannot be ensured. States need to appoint inspecting officers to carry out this role to ensure that all EE regulations and schemes are implemented across all energy demand sectors in the state. So far, twenty-one (21) states and UTs have appointed inspecting officers, which is significant progress over the SEEI 2019 figure of nine (9). In addition, all states need to ensure that the inspecting officers are exclusively available for this role.

21

states & UTs appointed inspecting officers, up from 9 in SEEI 2019.

Eight (8) states have reported implementing initiatives to promote innovation and R&D in energy efficiency. PEDA signed Memorandums of Understanding (MoUs) with 12 reputed technical institutions and universities to undertake research & demonstration activities in EE. The Odisha SDA facilitates the funding of innovative research projects to conserve energy through EE measures by educational institutions and individual researchers. In this regard, the first proposal from Indian Institute of

Technology (IIT), Bhubaneshwar, is ongoing with the SDA. Similarly, Meghalaya is also taking initiatives to carry out state EE research programmes with pioneering institutes such as North-Eastern Hill University (NEHU) and National Institute of Technology (NIT), Meghalaya. An MoU has been signed between NIT, Kurukshetra and the New and Renewable Energy Department, Haryana, to implement various activities in EE. Kerala has allocated a budget to the Energy Management Centre, Kerala, to support EE R&D schemes for technical institutions. Rajasthan has tied up with Malaviya National Institute of Technology (MNIT), Jaipur, to execute research activities related to EE under the State Energy Efficiency Research and Outreach Programme, approved by BEE. Andhra Pradesh State Energy Conservation Mission is setting up an Energy Museum Science Centre, Category - 1 and Fab Lab - Innovation Hub at Visakhapatnam. Maharashtra has several clauses in its EC policy to maximise R&D and innovation in EE, that include implementing courses in energy efficiency, energy management, and energy testing in the state industrial training institutes, initiating Bachelor of Science (BSc) courses in energy management in all non-agricultural universities at subsidised rates, and enacting legislation for including EC in school curricula. Due to rapid technological changes, it is unlikely for the state agencies to possess the required in-house capacity to comprehend the technological advancements and enable their adoption. Hence, forging partnerships with research and academic institutes, industries, and think tanks is imperative for the states.

While all state governments / UT administrations have SDAs, most of them are functioning as part of other government departments, such as the State Nodal Agencies (SNAs) for renewable energy, electrical inspectorates, DISCOMs and power departments. To avoid any conflict and competition between priorities and accelerate the implementation of EE activities, BEE has been advising states to make the SDAs independent entities. However, no new state reported the formation of the SDA as a standalone entity in SEEI 2020. Kerala and Andhra Pradesh continue to be the only two states with independent SDAs. Andhra Pradesh State Energy Conservation Mission (APSECM) is the only SDA constituted with the sole mandate of promoting EE in the state. Kerala SDA, the Energy Management Centre (EMC), was notably constituted as an autonomous body under the state Department of Power in 1996, even before the enactment of the EC Act in 2001. However, a few other states — Rajasthan, Odisha, Himachal Pradesh, and Karnataka — have taken some initiative and are in the process of setting up the SDAs as independent bodies.

8 states undertook initiatives for promotion of innovation and R&D in energy efficiency.

Only Kerala and Andhra Pradesh have constituted SDAs as independent entities.

CROSS SECTOR SPOTLIGHT

- In the 6th Annual General Body meeting of APSECM, held on October 27, 2020, all the government departments were directed to set up an EE cell with the support of APSECM, Andhra Pradesh SDA, and Andhra Pradesh State Energy Efficiency Development Corporation Limited (APSEEDCO), a joint venture of Andhra Pradesh power utilities and the Energy Department. This is a unique and crucial step towards ensuring EE penetration in each sphere of government policymaking and should go a long way in effective EE programme implementation and achieving associated energy and monetary savings across the state.

- The Indian Residential Energy Survey (IRES) [13] is a nationally representative survey conducted by Council on Energy, Environment and Water (CEEW) to assess the impact of the existing EE initiatives on household awareness, preferences, and behaviour regarding efficient electricity use.

  Some of the findings in the survey concerning consumer awareness of energy efficiency are indicated below:

  1. After almost a decade and a half (May 2006) since the launch of BEE's S&L programme, only 25% of electrified households in India have heard of BEE's star label. The awareness is comparatively lower among the rural population than their urban counterparts. This is likely due to lower appliance ownership among rural households and limited awareness campaigns in rural areas.
  2. Over 75% of AC users have star-labelled ACs. However, one-sixth of the AC users do not even know about the star labels on their ACs.
  3. Only 40% of AC users run ACs at a temperature setting of 24 degrees Celsius or above, only 20% always use a ceiling fan with AC, and only 55% get their AC serviced by a technician every year.
  4. Adoption of labelled refrigerators and awareness about the labels is lower in comparison to AC.

  The adoption of EE ceiling fans is dismally low, which could be due to their relatively high cost and limited availability on the market, as they are not part of the mandatory labeling scheme.

  Some comments on the survey findings are further discussed below:

  - To increase awareness on appliance star labeling, particularly among the rural population, there should be sustained year-round awareness campaigns by the SDAs in the regional language and through diverse media across rural and small-town areas. Furthermore, the cost difference between energy efficient appliances and unlabeled products is often relatively high, which is only offset by electricity bill savings over time. Consumers generally perceive such investments to be risky and are therefore reluctant to pay the higher upfront cost. With 97% of Indian households already electrified and the rising aspirations of the general public, awareness of star labeling is a must to ensure effective EE interventions.
  - Adoption of star-rated appliances is greater for items under BEE's mandatory labeling programme. Manufacturers and buyers are mostly unaware of star labeling under the voluntary S&L programme. In the low-income consumer market, many poor-quality items that fall under voluntary S&L programmes are very popular. Hence, it is desirable to bring more and more electrical items within the ambit of mandatory labelling. Furthermore, a minimum standard for all items may be effective in shifting consumer preferences towards energy efficient appliances. Every SDA should push for mandates on such minimum standards for all items provided by in-state manufacturers and retailers.
  - In India, the purchase of electrical appliances is mainly driven by affordability and durability. Demand aggregation and bulk procurement are the keys to making energy efficient appliances affordable. The states may undertake subsidy programmes through an ESCO to increase the adoption of more expensive star labelled items such as ACs, televisions (TVs), refrigerators, and fans, etc. The massive penetration of energy efficient LEDs in Indian households is directly attributable to Unnat Jyoti by Affordable LEDs for All (UJALA) and similar flagship programmes at the state level.
  - While the adoption of energy efficient appliances is a crucial first step, it does not automatically ensure energy savings, for which changes in user behaviour are also essential. Relentless efforts are needed to educate consumers about practices to optimise energy use. For instance, in the case of ACs, such practices include periodic servicing, optimal temperature setting, and the use of fans with ACs.
  - Consumer financing can be leveraged to incentivise price-sensitive households to buy energy efficient products. SDAs must work proactively to ensure adequate financial mechanisms in the form of tax rebates, soft loans, subsidies, etc. to drive the adoption of energy efficient appliances at the state level.

Participation of all states & UTs is instrumental to achieve India's ambitious climate goals.

SDAs and state departments should collaborate to incorporate energy efficiency into state development policies and schemes.

4 CONCLUDING REMARKS

The most valuable takeaway from SEEI 2020 is that the SDAs have made significant efforts to collect data and enact EE policies at the state level. As many as twenty-seven (27) states have shown improvement in their overall scores. Out of these, seven (7) states have improved their scores by more than 10 points from SEEI 2019.

The improvement in states' scores can be attributed to the following:

- The states have increased in their efforts in formulating EE policies and regulations. In the outcome-based indicators like the adoption of EE and energy savings, the states fared considerably better than in the last index. However, SDA data availability for the outcome-based indicators is still a challenge, and most of the data have been compiled from CII, EESL, IGBC, GRIHA, GBCI, and NITI Aayog's India Energy Dashboard.
- Nevertheless, most SDAs have exhibited strong motivation to collect relevant data, which is the foundation of the SEEI. Several SDAs were proactive in initiating data collection early this year.
- Due to the determination and persistence of the SDAs in collecting data, the data quality was better in terms of relevance and accuracy. Moreover, this resulted in better scores for most of the states in SEEI 2020. With better-quality data, the SDAs are better placed to track the annual progress of EE in the states through data-driven evidence, which may be the most impactful outcome of SEEI 2020.

There is still scope to further improve the SDAs' capability to identify areas for EE intervention through a data-driven approach. Moreover, as the SDA is the competent authority within the state for all EE-related matters, it should more actively work with all the associated government departments and the private sector to effectively implement EE initiatives and periodically monitor the progress of ongoing measures.

Based on the findings of SEEI 2020, a few recommendations are detailed below to assist the states in enabling a step change in EE implementation, which can significantly contribute to achieving state-level sustainable development goals and fulfilling India's NDC commitment to reduce emissions intensity:

INSTITUTIONALISING END-USE ENERGY DATA COLLECTION AND ANALYSIS TO DRIVE ENERGY EFFICIENCY

In SEEI 2020, the states have scored better compared to SEEI 2019. This shows that the states are doing more in terms of customising national EE policies for state notifications and designating specific entities to oversee EE implementation across sectors such as buildings, industry, transport, and agriculture and DISCOMs, albeit at varying levels of progress in each sector.

However, the success of various EE initiatives can be assessed only through the timely collection and analysis of end-use energy data from these initiatives. This is where the states still have a long way to go. For example, in the buildings sector, ECBC notification is the first step to integrate EE in buildings, but that in and of itself is not sufficient. The SDAs must also have a record of the yearly penetration of ECBC-compliant buildings in the state. Likewise, the SDAs must have a systematic process to measure energy savings due to EE implementation in buildings. Similarly, the energy intensity of various categories of buildings must be evaluated periodically to set realistic and optimum energy savings targets for these buildings. Several states have mandates for energy audits of specific categories of buildings, and many states have designated entities to oversee the implementation of mandatory energy audits. The wealth of data collected through mandatory energy audits should be used to set energy performance benchmarks, identify areas for EE intervention, and assess progress in improving the energy performance of buildings.

The SDA is the nerve centre of EE implementation in the state. It is authorised to undertake EE initiatives across various sectors as needed to achieve state energy savings targets. The SDAs must therefore engage with the pertinent government departments more organically and regularly, beyond the data collection for the annual State Energy Efficiency Index.

As stated earlier, the data for the outcome-based indicators have been sourced from other organisations such as CII, EESL and certification bodies like IGBC, GBCI India, and GRIHA. The SDAs must forge partnerships with these organisations to ensure regular updates on EE projects, end-use energy data, energy intensity, and energy savings across various sectors. Such a database can become the cornerstone for an Energy Data Management (EDM) system in each state. A robust EDM system would enable SDAs to better understand the state's energy consumption profile. Data from various sources would be collected for this system and analysed to gain insights into sector-wise final energy use and energy intensity at a more granular level. These insights could serve as the foundation for regular EE interventions across the sectors at the state and local levels. The EDM system also aims to facilitate the implementation of effective EE policies and programmes with realistic targets, regular monitoring of the progress of ongoing programmes, coordination among different departments, and enforcement of compliance with various EE policies. Given the launch of the State-wise Actions on Annual Targets and Headways on Energy Efficiency (SAATHEE) portal by BEE this year at the National Energy Conservation Awards (NECA) ceremony, an EDM system would enable the SDAs to conform to the SATHEE portal requirements, and this, in turn, would enable the Government of India to have a more robust mechanism to monitor the energy savings achieved by various policies, programmes, and schemes.

IMPROVING EE FINANCING AND BUDGET ALLOCATION

With the exception of a few states, there is no budgetary allocation at the state level for the operation of SDAs or other institutional entities designated to support EE across various sectors. The institutional entities are the nodal agencies tasked with implementing government policies and programmes, but the lack of a specific budget restricts the EE initiatives that these entities can undertake independently. In some cases, the SDAs were unaware of any state budgetary allocation. Being at the EE command post in the state, the SDAs should move beyond driving government schemes and policies and proactively develop EE initiatives in the state. Every SDA should develop an annual action plan encompassing proposed EE measures and the estimated financial requirement and submit it to the state energy/power department with a request for budgetary allocation. A yearly exercise like this would enhance

communication among different departments and give much-needed attention to EE across different sectors at the state level. A blueprint of the EE initiatives to be undertaken would also arm the SDAs with a roadmap to set and achieve the state energy footprint and sustainable development goals. Annual budgetary utilisation may be subjected to internal and external audits to measure the state's annual progress in EE. This will also garner the confidence of the civil society and the private sector to take part in the EE market transformation.

INCORPORATING ENERGY EFFICIENCY INTO STATE PROGRAMMES

The states generally run a number of social welfare schemes for the economically backward, socially deprived, or marginalised and the weaker sections of society. The states are recommended to incorporate EE objectives into such schemes. One state, Assam, has done this; for example, the state government provides EE two-wheelers to meritorious girl students to encourage them to pursue higher education. While the primary goal is women's education, the state has effectively incorporated EE and clean transport to drive the primary goal. The capital cost for the scheme may be somewhat high, but the long-term impact extends to various stakeholders involved in EE, not only the direct beneficiaries. The SDAs can draw on BEE's national policies and coordinate with the state government departments to develop schemes and programmes along similar lines. Incorporating EE into state programmes requires enhanced collaboration between the SDA, state departments, and the BEE. The adaptation of ECBC 2017 by the SDAs based on the state's context is one such example of collaborative effort. Such collaboration results in better coordination among policymakers, which leads to smoother implementation of effective policies.

COLLABORATING WITH THE PRIVATE SECTOR TO REALISE ENERGY EFFICIENCY GAINS

Given the active participation of the private sector in the Indian economy, it has a key role to play in mainstreaming EE. Therefore, a synergy between the public and private sectors is crucial to realising EE gains. The SDAs should facilitate regular dialogue with the private sector. Such interactions would pave the way to understanding the business community's interests, the viability of deploying EE policies and programmes, the need for amendment in existing policies and programmes, EE financing, the latest energy efficient technologies, and best practices in industry. Such collaboration would also provide business opportunities for original equipment manufacturers (OEMs) and companies offering energy efficient products and services.

In SEEI 2020, the role of the states and UTs in executing EE measures in the industrial sector was quite limited, despite the presence of a dedicated entity to support EE in industries in many states.

The SDAs may collaborate with local state CII chapters, state chambers of commerce, or state-specific trade organisations for better outreach of state EE initiatives, especially for the non-PAT and MSME industries. Similarly, in the buildings sector, the SDAs should hold dialogues with Confederation of Real Estate Developers' Associations of India (CREDAI) to facilitate the spread of EE interventions in the private real estate sector. SDAs can also engage in joint efforts with IGBC to drive EE implementation in the buildings sector, a booming sector in the country today.

An alliance with the private sector would amp up EE implementation in domains that are not entirely within the ambit of government policymakers, e.g. industries, buildings, transport, etc. Such collaborations would also help SDAs to collect more robust end-use energy data.

DRIVING EARLY ADOPTION OF ENERGY EFFICIENCY IN SUNRISE INDUSTRIES

In the global effort to attain energy security and a climate-resilient planet, energy efficiency stands as a robust pillar to mitigate climate change while ensuring sustainable development. Therefore, the SDAs should be exploring new domains in the EE sector. Two such emerging domains are discussed below and will benefit the states by including and ensuring timely initiatives that drive EE.

ELECTRIC VEHICLES

India has ambitious plans to electrify transport, with an emphasis on public transport and commercial fleets. The government has taken multiple initiatives to accelerate EV adoption. These include schemes like Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME), which budgetary support of Rs. 10,000 crores[14] for EVs and EV charging infrastructure. As transport is a concurrent subject, the respective state governments should simultaneously drive EE efforts through policies and programmes to nudge consumer adoption of EVs. The states have demonstrated innovative leadership in drafting their respective policy measures, providing substantial financial benefits to early EV adopters. However, only when there is the necessary infrastructure in place will people be willing to switch to EVs. Therefore, states must undertake policies and regulations which govern and support EV R&D, charging infrastructure, and skill development. States must make the provisions of fiscal and non-fiscal incentives to increase the viability of EVs in the long run. Regulations may be framed wherein petrol pumps are allowed to set up charging stations freely. Business models focusing on EVs should be developed and encouraged. Venture capital funding initiatives for research in the EV sector must be promoted. The states must also encourage the adoption of electric goods carriers through incentives such as the waiving of parking fees, registration charges, road tax, etc. Incentives and schemes must be put in place to shift corporate fleets, cabs, public transport systems, and auto-rickshaws to EVs.

COLD CHAIN

India is the largest producer of multiple agricultural commodities, producing over 400 million tonnes of perishables every year (horticultural produce + dairy + meat + poultry + fish). However, the wastage levels of perishables in India are alarmingly high, ranging from 4.6% to 15.9% for fruits, 5.2% for inland fish, 10.5% for marine fish, 2.7% for meat, and 6.7% for poultry[15]. The estimated annual losses of agricultural produce currently stand at Rs. 92,651 crores, whereas the estimated annual losses of fruits and vegetables, meat, fish, and milk equate to Rs. 50,473 crores[16]. In the health sector, at least 25% of vaccines reportedly go to waste before reaching the doctors and patients[17]. Therefore, efficient cold chain infrastructure and refrigeration solutions are needed to prevent losses in the supply chain of perishables and increase the accessibility of proper healthcare facilities. The government has undertaken several measures to boost and expand the cold storage industry in India, including Small Farmer Agri-Business Consortium (SFAC) assistance for cold storage, Agricultural and Processed Food Products Export Development Authority (APEDA) assistance for the cold chain, and National Horticulture Board (NHB) Scheme of Capital Investment subsidy for construction/ expansion/ modernisation of cold storage for horticulture produce. These integrated cold chain projects are being established through partnership or proprietorship firms, companies, corporations, cooperatives, self-help groups (SHGs), farmer producer organisations (FPOs), NGOs, central and state PSUs, etc., subject to fulfilment of the eligibility conditions of the scheme guidelines. However, 60% of India's total cold storage capacity is

concentrated in Uttar Pradesh and West Bengal, whereas 75% of the cold storage is for a single commodity – potatoes [18].

Furthermore, India Cooling Action Plan (ICAP) studies show that India's refrigerant-based annual cooling demand across all sectors is likely to grow nine times between 2018 and 2038[19].

As most of India's cooling demand is latent, states should steer the cooling requirements from Business-As-Usual towards a sustainable market scenario through targeted policy interventions. An integrated cold chain policy incorporating EE and climate-friendly refrigerants must be developed and implemented in all states. Furthermore, the states should not limit attention to rolling out cold storage, but should also focus on promoting energy efficient end-to-end cold chain infrastructure in line with ICAP recommendations. With India's recent ratification of the Kigali Amendment to phase out hydrofluorocarbons (HFCs), states should shift focus to promote low cost, low energy refrigerants and refrigeration technologies. Government-supported investment and financing models may be provided to ensure that this industry grows in the direction of energy efficient cooling technologies from its very inception.

ANNEXURES

ANNEXURE 1 - DATA SOURCES

The SDAs are the primary data source for SEEI 2020. In addition to SDA data, AEEE used data from the following sources:

General

1. Reserve Bank of India Handbook of Statistics on Indian States
2. CEA General Review 2019
3. MoSPI India Energy Statistics 2019
4. NITI Aayog IESS
5. RBI -https://www.rbi.org.in/home.aspx
6. UIDAI -https://uidai.gov.in/images/StateWiseAge_AadhaarSat_24082017.pdf

Buildings

1. Bureau of Energy Efficiency: BEE star-rated buildings in states
2. CII Awards for Energy Management 2020 http://www.greenbusinesscentre.com/energyawards/enepresent20.php
3. GRIHA https://www.grihaindia.org/
4. GBCI, India https://gbci.org/india
5. IGBC https://igbc.in/igbc/

Industry

1. BEE
2. EESL
3. CII Awards for Energy Management 2020 http://www.greenbusinesscentre.com/energyawards/enepresent20.php

Municipalities

1. EESL Streetlighting Programme (SLNP)
2. EESL Municipal EE Programme (MEEP)

Transport

1. BEE
2. Motor Vehicle Registration https://vahan.nic.in/nrservices/
3. EESL

Agriculture and DISCOMs

1. NITI Aayog India Energy Dashboard
2. Applicable state tariff orders for FY 2019-20 issued by SERCs & JERC

Cross Sector

1. BEE
2. CEA General Review 2019
3. MoSPI India Energy Statistics 2019

ANNEXURE 2 - REFERENCES

1 Thompson, A. NASA Says 2020 Tied for Hottest Year on Record. Scientific American. (2021). Retrieved 23 April 2021, from https://www.scientificamerican.com/article/2020-will-rival-2016-for-hottest-year-on-record/.

2 Ministry of Environment, Forest and Climate Change. India's Intended Nationally Determined Contributions – Towards Climate Justice. Moef.gov.in. (2018). Retrieved 1 July 2021, from http://moef.gov.in/wp-content/uploads/2018/04/revised-PPT-Press-Conference-INDC-v5.pdf.

3 Ministry of Environment, Forest and Climate Change. India Second Biennial Update Report to the United Nations Framework Convention on Climate Change. Moef.gov.in. (2018). Retrieved 23 April 2021, from http://moef.gov.in/wp-content/uploads/2019/04/India-Second-Biennial-Update-Report-to-the-United-Nations-Framework-Convention-on-Climate-Change.pdf.

4 Shri R K Singh, Minister of State (Independent Charge) for Power reviews progress of energy transition and energy efficiency measures in the context of Climate Change. Pib.gov.in. (2021). Retrieved 7 July 2021, from https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1727776.

5 Alliance for an Energy Efficient Economy. State Energy Efficiency Preparedness Index 2018. Aeee.in. (2018). Retrieved 23 April 2021, from https://www.aeee.in/state-energy-efficiency-index-2019-portal/state-index-2018/.

6 Alliance for an Energy Efficient Economy. State Energy Efficiency Index 2019. Aeee.in. (2019). Retrieved 23 April 2021, from https://www.aeee.in/state-energy-efficiency-index-2019-portal/

7 Kumar, S., Yadav, N., Singh, M., & Kachhawa, S. (2018). Estimating India's commercial building stock to address the energy data challenge. Taylor & Francis. Retrieved 23 April 2021, from https://www.tandfonline.com/doi/abs/10.1080/09613218.2018.1515304

8 Ministry of Statistics & Programme Implementation. Energy Statistics 2019. Mospi.nic.in. (2019). Retrieved 23 April 2021, from http://mospi.nic.in/sites/default/files/publication_reports/Energy%20Statistics%202019-finall.pdf?download=1.

9 India Energy Security Scenarios, 2047. Iess2047.gov.in. (2015). Retrieved 23 April 2021, from http://iess2047.gov.in/pathways/22202222222222220222222222012222202222222211202220222022222/primary_energy_chart.

10 Ministry of Statistics & Programme Implementation. Energy Statistics India, 2021. Mospi.nic.in. (2021). Retrieved 5 July 2021, from http://mospi.nic.in/sites/default/files/reports_and_publication/ES/Energy%20Statistics%20India%2020211.pdf.

11 India Energy Security Scenarios, 2047. Iess2047.gov.in. (2015). Retrieved 23 April 2021, from http://iess2047.gov.in/pathways/22202222222222220222222222012222202222222211202220222022222/primary_energy_chart.

12 The Economic Times. Economic Survey flags high T&D losses in power sector. (2021). Retrieved 23 April 2021, from https://economictimes.indiatimes.com/industry/energy/power/economic-survey-flags-high-td-losses-in-power sector/articleshow/80585965.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.

13 Council on Energy, Environment and Water. Awareness and Adoption of Energy Efficiency in Indian Homes Insights from the Residential Energy Survey (IRES) 2020. Ceew.in. (2020). Retrieved 23 April 2021, from https://www.ceew.in/sites/default/files/CEEW-IRES-Awareness%20and-adoption-of-EE-in-Indian-homes-07Oct20.pdf.

14 FAME India Scheme Phase II. Fame2.heavyindustry.gov.in. (2019). Retrieved 23 April 2021, from https://fame2.heavyindustry.gov.in/content/english/1_1_AboutUs.aspx.

15 Ministry of Food Processing Industries. Opportunities in Cold Chain Sector in India. (2020). Retrieved 23 April 2021, from https://fdocuments.in/document/opportunities-in-cold-chain-sector-in-india-a-92-of-cold-storages-in-india-are.html.

16 Ministry of Food Processing Industries. Opportunities in Cold Chain Sector in India. (2020). Retrieved 23 April 2021, from https://fdocuments.in/document/opportunities-in-cold-chain-sector-in-india-a-92-of-cold-storages-in-india-are.html.

17 The Times of India. News, I. (2016). 25% of vaccines go waste due to lack of cold chain. Retrieved 23 April 2021, from https://timesofindia.indiatimes.com/india/25-of-vaccines-go-waste-due-to-lack-of-cold-chain/articleshow/52999274.cms.

18 Ministry of Food Processing Industries. Opportunities in Cold Chain Sector in India. (2020). Retrieved 23 April 2021, from https://fdocuments.in/document/opportunities-in-cold-chain-sector-in-india-a-92-of-cold-storages-in-india-are.html.

19 Alliance for an Energy Efficient Economy. India Cooling Action Plan- A Guided Graphical Tour. (2019). Retrieved 23 April 2021, from https://aeee.in/data_analysis/india-cooling-action-plan-a-guided-graphical-tour/.