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MINISTRY OF POWER

State Energy Efficiency Action Plan (SEEAP) for Tripura

Final Version

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State Energy Efficiency Action Plan (SEEAP): Tripura

Final version

Report Prepared For:

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Disclaimer:

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The development of “State Energy Efficiency Action Plan (SEEAP)” is an important step towards the Central-State collaboration for mainstreaming energy efficiency at the state level to achieve India’s climate commitments. This strategic document has been prepared based on collaboration of Bureau of Energy Efficiency, Ministry of Power, Government of India along with State Designated Agencies and different stakeholder and ministries in the State Level.

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Deloitte Touche Tohmatsu India LLP

Foreword

Energy efficiency is one of the most affordable tools towards achieving energy transition. Maximizing its potential can support the state with the same amount of energy currently being used, thereby contributing to energy savings and emission reduction, lowering energy bills, creating new jobs, improving industrial productivity, and strengthening energy security by decreasing fossil fuel imports. Unfortunately, energy efficiency is often not given the attention and resources it deserves, despite its impact and cost effectiveness. To fully realize the potential of energy efficiency, a comprehensive approach is needed that includes government policies, regulations, standards, and incentives, as well as education and awareness campaigns.

India is a diverse country with diverse energy consumption patterns in different states/UT's. The state priorities also vary significantly in terms of its demographics and economy. Although several initiatives have been made in the past both by central and state governments towards conserving energy and promoting clean technologies, it is important to raise the efforts. A combined effort by the central and state government can bring in transformational change across sectors leading to sustainable development for all.

The report presents a systematic approach to identify the sectors that need attention in terms of advancement for energy efficiency. The report also presents specific action plans which can be taken up for implementation. Good practices have been picked up from different states to showcase the benefits achieved through these action plans. While few of the policies are already in place, there are others which needs to be initiated in the state level. For effective implementation of the program, it is important that the state works closely with the concerned central departments. Also, inter-departmental coordination within the state is important for making a holistic approach to mitigate the climate related issues.

I am happy to present the report as a ready reckoner to the policy makers, developmental agencies, domain consultants and other relevant stakeholders to take up initiates towards meeting our climate commitments.

Shri. Abhishek Singh, IAS
Secretary (Power)
Government of Tripura

Preface

Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India has been engaged in several initiatives to design and implement energy efficiency programmes across sectors under the provision of the Energy Conservation (EC) Act 2001. As one of its key initiatives, BEE developed a national strategic plan for energy efficiency, which lays a roadmap for recognizing and unlocking India's energy efficiency potential in its demand sectors. Energy saving through adoption of new technologies, increasing the scope of the wide gamut of energy related policies and programmes and sensitizing the consumers towards the importance of saving energy in their day-to-day lives forms the pillars for carving an energy secure, resource efficient and climate resilient future for India.

In India, there is still an immense potential to be realized from large scale implementation of energy efficiency interventions in the various demand sectors like industry, buildings, agriculture, municipal corporation, transport, and DISCOMs.

To further strengthen the Central – State collaboration for mainstreaming energy efficiency in the economy, "State Energy Efficiency Action Plan (SEEAP): Tripura" has been developed. The strategy plan sheds light on the total final energy consumption of the state and the energy efficiency potential in the focus sectors today and in the long term. The plan lays out strategies and action plans laid down under the identified focus sectors and documents the estimated energy savings under different demand scenarios. The strategy plan also estimates the investment potential of the sectors and the key financing instruments that would play a bigger role in the future.

The findings of the report would benefit policy makers, developmental agencies, domain consultants and other relevant stakeholders for making programmatic interventions to achieve India's climate goals. The report will also facilitate knowledge sharing among the stakeholders and scale up the energy efficiency activities in the country in the long term.

I am happy to share this document with all stakeholders for kind perusal and seeking valuable inputs

New Delhi

March 2023

(Abhay Bakre)
Director General
Bureau of Energy Efficiency
(BEE)

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List of Abbreviations

ADI	Accelerated depreciation-based incentivization
BAU	Business as Usual
BEE	Bureau of Energy Efficiency
S&L	Standards and Labelling
C.S.S.	Centrally Sponsored Schemes
CAGR	Compound Annual Growth Rate
CGTMSE	Credit Guarantee Fund Trust for Micro and Small Enterprises
COP26	Conference of the Parties 2026
CS	Capital subsidy
DISCOM	Distribution Company
DSEE	Demand Side Energy Efficiency
DSM	Demand Side Management
DTTILLP	Deloitte Touché Tohmatsu India LLP
EC Act 2001	Energy Conservation Act of 2001
ECBC	Energy Conservation Building Code
ECSBC	Energy Conservation and Sustainability Building Code
ECMs	Energy conservation measures
ECO NIWAS	Energy Conservation – New Indian Way for Affordable & Sustainable homes
ESCerts	Energy Saving Certificates
ESCOs	Energy Service Companies
ESPC	Energy Saving Performance Contract
EV	Electric Vehicle
FY	Financial Year
GCV	Gross Calorific Value
GDP	Gross Domestic product
GoI	Government of India
GSDP	Gross State Domestic Product
IREDA	Indian Renewable Energy Development Agency

LDO	Light Diesel Oil
LPG	Liquefied Petroleum Gas
MNRE	Ministry of New and Renewable Energy
MTOE	Million Tonnes of Oil Equivalent
MoP	Ministry of Power
MSME	Micro, small & medium enterprise
NBFC	Non-Banking Financial Company
NDC	Nationally Determined Contribution
NEFA	North-east frontier agency
NEMMP	National Electric Mobility Mission Plan
NMEEE	National mission for enhanced energy efficiency
PFI	Participating Financial Institution
PPP	Public Private Partnership
RE	Renewable Energy
RLF	Revolving loan fund
SDA	State Designated Agency
SEEAP	State Energy Efficiency Action Plan
SERC	State Electricity Regulatory Commissioners
SGDP	State's Gross Domestic product
TFEC	Total Final Energy Consumption
TSECL	Tripura State Electricity Corporation Limited
UAD	Urban Affairs Department
UDAY	Ujwal DISCOM Assurance Yojana
UNFCCC	United Nations Framework Convention on Climate Change
UNNATEE	Unlocking National Energy Efficiency Potential

Executive Summary

With the energy efficiency agenda gaining traction and momentum in India, the objective for developing the State Action Plan for Energy Efficiency broadly envisages identification of focus sectors, undertaking gap analysis, adopting best practices followed in peer groups and providing strategical implementation plan for achieving the defined energy efficiency targets by FY 30-31

The energy requirements in India have significantly increased over the years, with primary energy demand rising from approximately 450 MTOE in 2000 to around 770 MTOE[1] in 2012. Experts from the International Energy Agency have estimated that this demand will further escalate to between 1250 to 1500 MTOE in 2030. This surge can be attributed to several factors, with the most prominent being the rise in incomes and economic growth, resulting in an amplified demand for energy services such as lighting, cooking, industrial production, mobility, space cooling, office automation, among others.

As per the updated Nationally Determined Contribution (NDC), India now stands committed to reduce Emissions Intensity of its GDP by 45 percent by 2030, from 2005 level and achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030[2]. Further to ensure a healthy and sustainable lifestyle, 'LIFE'– 'Lifestyle for Environment' as a key to combating climate change has been added to India's NDC. The vision of LIFE is to live a lifestyle that is in tune with our planet and does not harm it. India's updated NDC also captures this citizen centric approach to combat climate change.

The role of energy efficiency would be crucial in complying with the country's net-zero commitments. With India's GDP growth expected to be around 8% in coming years, the challenges regarding energy security, energy prices and the cost of living have intersected with the climate crisis to remind us that energy efficiency is more indispensable than ever. Accelerated action on energy efficiency can help in avoiding the energy demand scenarios in FY 30-31 as compared to the business-as-usual (BAU) emissions scenario. The elements of avoided energy demands include technology upgradation and retrofits, behavioral changes, fuel switching, penetration of electric vehicles (EV) etc.

The preparation of State Energy Efficiency Action Plans (SEEAP) is a key step towards achieving the national target of reducing energy intensity by 45% by 2030. The strategic report provides a roadmap for the states to implement energy efficiency measures in buildings, industry, agriculture, transportation, and other sectors. The SEEAP outline strategies, policies, and programmes that can be implemented at the

[1] https://powermin.gov.in/en/content/energy-efficiency
[2] https://pib.gov.in

state level to improve energy efficiency and serve as a framework for coordination between the central and state governments, utilities, and other stakeholders.

The report provides an overview of the current energy scenario in Tripura, outlining the challenges and opportunities for energy efficiency improvements. It highlights the importance of increasing awareness and promoting behavioral change, implementing energy-efficient technologies, and strengthening institutional capacity to achieve the targets set out for focused sectors in the State Energy Efficiency Action Plan (SEEAP).

The SEEAP for Tripura encompasses action point in the focus key sectors, including industries, buildings, and transportation. The plan identifies specific measures to enhance energy efficiency in these sectors. The report emphasizes the importance of stakeholder engagement in the successful implementation of the SEEAP. It highlights the need to create awareness about energy conservation practices and engage with consumers, industry, and utilities to promote energy-efficient practices.

The report also provides an overview of the financial mechanisms and policy frameworks required to support the implementation of the SEEAP in Tripura. It recommends measures such as incentivizing the use of energy-efficient technologies, providing financial support for energy audits, and establishing a dedicated energy efficiency fund to support energy-efficient projects.

The following is an outline of the overall methodology used to develop the energy efficiency action plan for Tripura and the key findings:

Establishing the state's current total final energy consumption (TFEC)

The development of state-specific energy efficiency action plans relies on rigorous analysis of available, accurate, reliable, and comprehensive data. The baseline year for this assignment is assumed to be FY 19-20, and the energy consumption data from various sources been streamlined. The total primary (thermal energy) and secondary (electrical) consumption in Tripura as of FY 19-20 is estimated to be 2.09 MTOE and 0.08 MTOE, respectively.

Table 1: State total electrical and thermal energy consumption as of FY 19-20[3]

Particular (FY 19-20)	Value
Primary energy consumption in MTOE	2.09
Secondary energy consumption in MTOE	0.08
Total final energy consumption (TFEC) in MTOE	2.17

In addition to the TFEC at state level, the sector-wise distribution of primary energy has been estimated based on the contribution of different primary energy source into

[3] The values are derived from author's internal calculations (the sources for primary energy consumption are taken from MOPNG Report and the secondary energy consumption from CEA annual report, please refer Chapter 10 (Annexure 1))

different demand sectors based on suitable assumptions. The estimated energy consumption as of FY19-20 for various economic sub-sectors in Tripura is as below:

Table 2: Sectorial total final energy consumption as of FY19-20[4]

Sector	Agriculture	Building	Industries	Transport	Municipal	Others	Total
Energy consumption in MTOE	-	0.12	1.86	0.16	0.01	0.01	2.17

Note: Total Final Energy Consumption for Agricultural sector in the state is negligible

Overview of Institutional Framework and Stakeholder Mapping

The foundation of any major intervention lies in robust institutions set-up. To carry out the intervention effectively, these institutions must possess adequate, skilled, and capable personnel. Additionally, they must have the requisite power and authority to collaborate with stakeholders and enforce the strategy.

Energy conservation institutionalization in India started in the mid-1980s when the government established an "energy conservation cell" within the Department of Power to coordinate an energy conservation strategy. An independent organization called the "Energy Management Centre" was formed in 1989 to assist with national energy conservation programs. The Energy Conservation Act 2001 was then introduced in 2001 to establish the Bureau of Energy Efficiency (BEE) as a nodal agency with specific powers and functions to regulate, facilitate, and promote energy efficiency across sectors of the economy.

At the state level in India, the institutional framework for energy efficiency includes the State Designated Agencies (SDAs), State Energy Conservation Funds (SECFs), State Electricity Regulatory Commissions (SERCs), and State Nodal Agencies (SNAs). The SDAs has been mandated in the state level to coordinate, monitor, and facilitate the implementation of the provisions of the Energy Conservation Act.

Overall, the institutional framework for energy efficiency at the state level in India is designed to facilitate the implementation of energy efficiency measures and achieve the national energy conservation goals.

Stakeholder mapping is an essential step in the preparation of a SEEAP, as it helps identify key stakeholders who can contribute to the development and implementation of energy efficiency policies and programs. Key stakeholders from different focus sector government departments and private players have been mapped as part of the assignment.

Identification of Focus Sectors

The identification of focus sectors is a crucial step in the preparation of the State Energy Efficiency Action Plan (SEEAP). The focus sectors include the economic sub-sectors where the potential for energy efficiency improvements is high, and the impact

[4] Please refer the Annexure 1 of Chapter 10 for more clarifications

of energy savings is significant. Identifying focus sectors shall enable policymakers to prioritize their efforts and resources towards the sectors that offer the most significant energy savings potential.

The process of identifying focus sectors begins with analyzing the energy consumption patterns and trends in different sectors of the economy. This analysis involves collecting data on energy use, identifying the drivers of energy consumption, and evaluating the energy saving potential through energy efficiency measures.

Based on the total final energy consumption (TFEC) data & stakeholder consultations across all the sectors, it is evident that the industrial sector, building sector (including both commercial building and residential building), and transport sectors are priority focus sector* for the state.

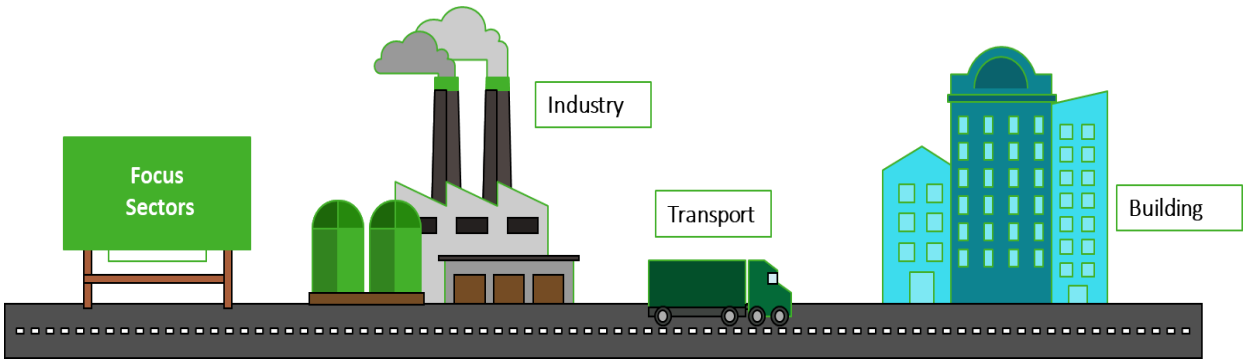


Figure 1: Identified energy intensive – focus sectors

*The identified focus sectors contribute to more than 85% energy consumption in the state.

Energy consumption projections for focus sectors under Business as Usual (BAU) scenario refer to the estimation of energy consumption in the identified sectors in the absence of any additional energy efficiency measures or policies. It provides a baseline for comparison with energy consumption levels with scenarios of moderate and ambitious implementation of energy efficiency measures and policies.

Energy consumption projections for the focus sectors till FY 30-31 under Business-as-usual BAU scenario are estimated as below:

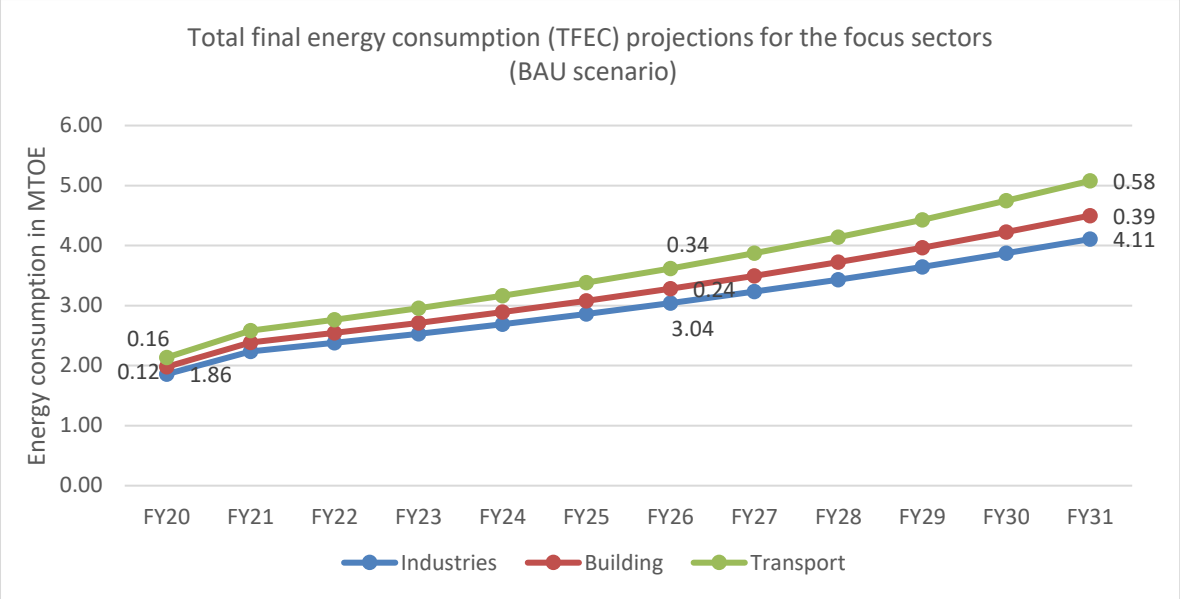


Figure 2: Focus sector: Total Final Energy Consumption (TFEC) projections (BAU scenario)[5]

Action plan to achieve the short-term and long-term target

Development of an action plan is crucial to achieving short-term and long-term energy efficiency goals. Effective implementation of the action plan can help in achieving significant energy savings, reducing greenhouse gas emissions, and promoting sustainable economic growth. This report outlines action plans outlining specific policies, programs, and measures to be implemented to achieve the set targets. The key energy efficiency action points formulated for each focus sector are summarized below:

Table 3: Sectoral energy efficiency action plan and estimated saving potential[6]

Sector	Action Plan	Energy Savings (MTOE)	
		MOD	AMB
Industry	Energy audits and implementation of energy-saving measures in MSME clusters	0.117	0.337
	Clean Energy Transition In industry	0.147	0.318
	Implementation of ISO 50001 in Industries	0.101	0.203
Building	Mandatory Energy Conservation and Sustainable Building Code implementation	0.003	0.006

[5] Please refer the Annexure 1 of Chapter 10 for more clarifications (Point 8)

[6] These are derived from author's internal calculations based on the energy consumption in the focus sectors and the penetration % of each action plan

	Mandatory sale and use of BEE star labelled (BEE S&L Program) electrical appliances in the state.	0.016	0.032
	Mandatory Implementation of "Energy Conservation – New Indian Way for Affordable & Sustainable homes" (ECO NIWAS) Scheme	0.004	0.005
	Behavioural change in building energy consumption	0.004	0.008
Transport	Infrastructure development for EV charging stations & Incentive schemes for consumers to promote quick transition	0.011	0.026
	Promotion of public transport through awareness and providing better infrastructure in public transport	0.00005	0.0001

Projection of Total Final Energy Consumption (TFEC) under different scenarios

The total final energy consumption (TFEC) under three scenarios i.e., BAU (business as usual), MOD (Moderate) and AMB (Ambitious) in MTOE has been estimated and drawn to understand the impact of energy saving interventions. As seen in figure below, in baseline year FY 19-20, the TEFC was 2.17 MTOE which could be increased to 3.67 MTOE in FY 25-26 and 5.15 MTOE in FY 30-31 in BAU scenario, as against 3.47 in FY 25-26 and 4.73 in FY 30-31 Furthermore, in case of the scenario where ambitious interventions are taken up, the growth in TFEC is likely to be restricted to 3.19 MTOE in FY 25-26 and 4.18 MTOE in FY 30-31, saving approximately 11.81% and 16.86% of total energy consumption in respective years, as compared to BAU.

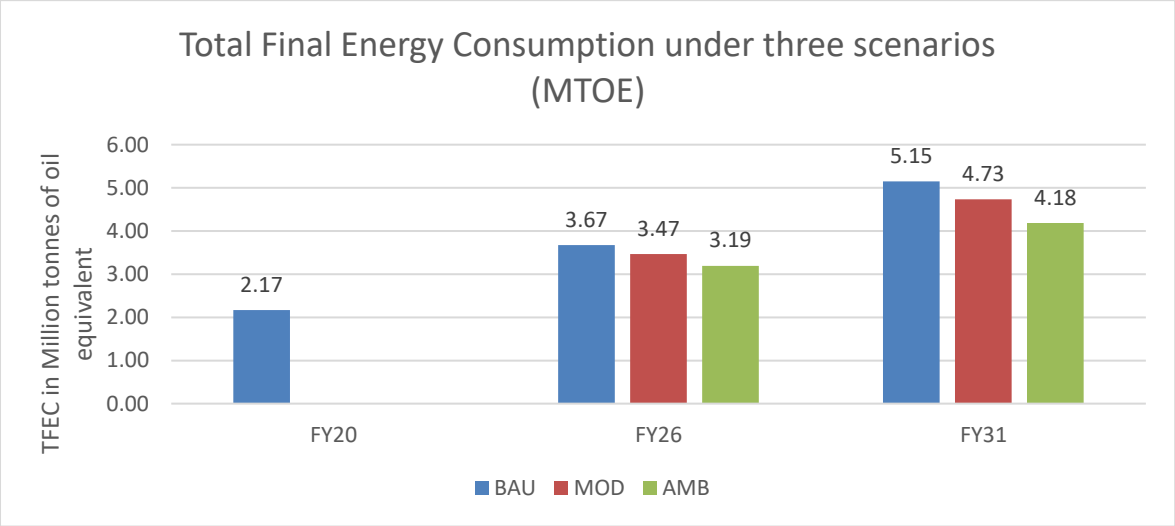


Figure 3: Total Final Energy Consumption (TFEC) projections (BAU, MOD, AMB scenarios)[7]

[7] The values for FY 26 and FY 31 are projected based on the FY 20 baseline.

1. Introduction

In the federal structure, states play a vital role in India's energy efficiency policy implementation and in achieving goals of sustainable development. India is a diverse country with different states and Union Territories (UTs) having unique energy consumption patterns. A need for a focused sector-based energy efficiency approach by states/UT's has been felt. Currently most states do not have targets for energy consumption reduction and these targets are only driven by central level government programmes/policies. Developing and executing state specific energy efficiency action plan can help the country achieve it climate commitment targets leading to a sustainable and climate resilient future.

1.1 Background

The world is in a climate emergency – "a code red for humanity" according to the UN Secretary-General. The concentration of greenhouse gas (GHG) emissions in the atmosphere is wreaking havoc across the world and threatening lives, economies, health, and food. As energy demand increases, the country's resources are increasingly strained, and the environment is adversely affected. In this regard, decoupling the country's economic growth and energy consumption is necessary.

India is one of the fastest growing economies globally and is characterized by its ever-evolving socio-economic trends such as rapid urbanization and growing aspirations for better living standards. This growing aspirations for better living standards are directly proportional to the purchasing power, which leads to increase in demand of goods and commodities and most importantly energy, as a resource.

India is a diverse country with diverse energy consumption patterns in different states/UT's. Broadly, the energy consumption is divided in a few major sectors i.e., Buildings, Transportation, Municipalities & DISCOMs, Agriculture and Industries. A need for a focused sector-based energy efficiency approach by states/UT's has been felt. Most states do not have targets for energy consumption and these targets are only driven by central level programmes.

The implementation of India's energy efficiency policy and the achievement of sustainable development goals specific to each state rely heavily on the involvement of the state governments. It is crucial to plan and execute energy efficiency programs at the state level to promote the sustainable development of the country and maximize resource utilization in an energy-efficient manner.

A state specific energy efficiency action plan can help the states in the following:

- Help drive energy efficiency (EE) policies and program implementation at the state and local level
- Highlight best practices and encourage healthy competition among states
- Track progress in managing the states and India's energy footprint

- Set a baseline for EE efforts and provide a foundation to set state specific EE targets
- Institutionalize data capture and monitoring of EE activities by states, especially by SDAs

1.2 India's Nationally Determined Contributions (NDCs)

As per the updated Nationally Determined Contribution (NDC), India now stands committed to reduce Emissions Intensity of its GDP by 45 percent by 2030, from 2005 level and achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030[8]. Further to ensure a healthy and sustainable lifestyle, 'LIFE'– 'Lifestyle for Environment' as a key to combating climate change has been added to India's NDC. The vision of LIFE is to live a lifestyle that is in tune with our planet and does not harm it. India's updated NDC also captures this citizen centric approach to combat climate change. The key targets envisioned as per India's updated NDC are as follows:

- To adopt a climate friendly and a cleaner path for economic development
- To reduce Emissions Intensity of its GDP by 45 percent by 2030, from 2005 level
- To achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030, with the help of transfer of technology and low-cost international finance including from Green Climate Fund (GCF)
- To create an additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent through additional forest and tree cover by 2030.
- To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change
- To mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions
- To build capacities, create domestic framework and international architecture for quick diffusion of cutting-edge climate technology in India and for joint collaborative R&D for such future technologies.

[8] https://pib.gov.in

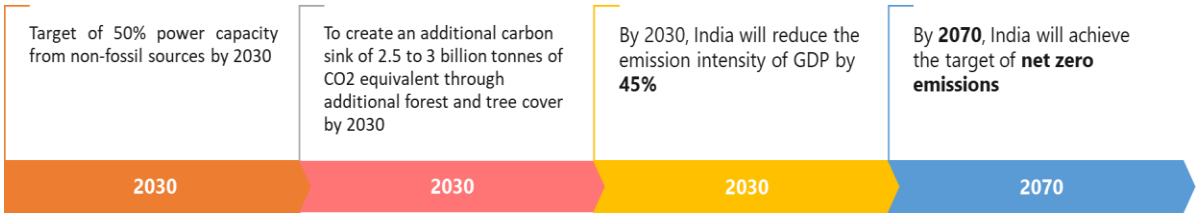


Figure 4: Extracts from India's updated NDC targets as per COP [26]

Therefore, to conserve energy and reduce emissions, energy efficiency is one of the key mitigation strategies that is to be followed to achieve the NDC targets.

Lifestyle For Environment

At the 2021 UN Climate Change Conference (UNFCCC COP26), Hon'ble Prime Minister of India announced Mission LiFE, to bring individual behaviors at the forefront of the global climate action narrative. LiFE envisions replacing the prevalent 'use-and-dispose' economy—governed by mindless and destructive consumption—with a circular economy, which would be defined by mindful and deliberate utilization. The Mission intends to nudge individuals to undertake simple acts in their daily lives that can contribute significantly to climate change when embraced across the world.

LiFE plans to leverage the strength of social networks to influence social norms surrounding climate. The Mission plans to create and nurture a global network of individuals, namely 'Pro-Planet People' (P3), who will have a shared commitment to adopt and promote environmentally friendly lifestyles. Through the P3 community, the Mission seeks to create an ecosystem that will reinforce and enable environmentally friendly behaviors to be self-sustainable.

Following are areas that are grouped under the three pillars of LiFE

- **Focus on Individual Behaviors**

Awareness about the harmful effects of single-use plastic; knowledge about sustainable modes of transportation such as bicycles, e-bikes, e-cars; consciousness about wastage of water; knowledge about environment related labels (organic, plastic-free, no harm, energy star labels, etc.); consumption habits and making them greener – assessing personal carbon footprint; use of natural energy (wind energy, solar power, hydraulic energy); knowledge about conscious dressing (giving up leather, fur, animal tested products) etc.

- **Co-create Globally**

Scalable ideas for change on a global level. For example, knowledge about adverse impacts of carbon-polluting industries, awareness about planet-friendly investments, implementing smart energy consumption etc.

- **Leverage Local Cultures**

Awareness about community gardens, knowledge about creating products from waste, literacy about clothes recycling, importance of urban farming (hydroponics farming), reducing food wastage, community strengthening activities, environment lessons to be taught at education institutions, youth involvement etc.

1.3 About State Energy Efficiency Action Plan (SEEAP)

The Bureau of Energy Efficiency (BEE), Ministry of Power (MoP), GoI has been engaged in several initiatives to design and implement energy efficiency programmes in the national level. As part of its initiative, BEE works on strategic plan for energy efficiency, which would lay a roadmap for recognizing and unlocking India's energy efficiency potential in its demand sectors. Energy saving through adoption of new technologies, increasing the scope of the wide gamut of energy related policies and programmes, and sensitizing the consumers towards the importance of saving energy in their day-to-day lives would go a long way in making India energy secure and resource efficient. As part of its strategic initiative, BEE developed a national strategic plan for energy efficiency, presented in the form of this report "Unlocking National Energy Efficiency Potential – UNNATEE, a strategy plan towards developing an energy efficient nation (2017-2031)".

Considering the increasing focus on energy efficiency in India, it is essential to continuously assess institutional capacity, policies, programmes, and markets on a state-to-state basis, to identify best practices and promote cross-learning. Therefore, with this being the cornerstone, at the national level it was recognized that setting national level energy efficiency targets for various sectors won't be enough and the baton must be passed at state level i.e., by setting state-level energy efficiency targets[9].

Hence, it was identified that developing State Energy Efficiency Action Plan (SEEAP), a sector-based energy efficiency approach by states/UTs—through the identification of focus sectors, undertaking gap analysis, and adopting best practices followed in a peer group with an implementation plan strategy, that can act as a platform for developing state's energy policy and programmes is the need of the hour.

With the above stated background being the foundation stone, this report aims to develop SEEAP for the state by recognizing and unlocking the state's energy efficiency potential in its demand sectors. This report will unveil the following aspects:

- Identification of focus sector in a state,
- Identification of stakeholders from various sectors,
- Identification of gaps in the sector,

[9] Ministry of Power (MoP), "Press Release - Power Minister calls for enhanced action on energy efficiency by States", 2021, https://pib.gov.in/PressReleasePage.aspx?PRID=1765860

- Suggesting best practices and identification of designated agencies/stakeholders to implement energy efficiency related programmes and schemes in the sector in consultation with state.

The above activities will lead to the preparation of a short-term plan (till 2026) & long-term plan (till 2030) with defined targets in the select sectors. The development of these action plans will be based on state-specific objective rational, scientific, and data-driven plans to support policymakers and state bodies of the respective state.

1.4 State Profile

Tripura is a state in the north-eastern part of India. It is the third-smallest state in the country which covers 10,491.69 km2 (4,050.86 sq. mi) and is bordered by Bangladesh to the north, south, and west, and the Indian states of Assam and Mizoram to the east. In 2011 the state had 3,671,032 residents, constituting 0.3% of the country's population. The state has 8-Districts, 23-Sub- Divisions, 58-Blocks, and 1-Tripura tribal areas autonomous district council (TTAADC) created under the sixth schedule of the constitution.

Tripura lies in a geographically isolated location in India, as only one major highway, national highway 8, connects it with the rest of the country. Five mountain ranges — boromura, atharamura, longtharai, shakhan and jampui hills — run north to south, with intervening valleys. Agartala is the capital of the state which is located on a plain to the west.

The profile of the state of Tripura is summarized below:

Table 4: State Profile of Tripura[10]

Name of State / UT	Tripura
Total Geographical Area	10,491.69 km²
Location/ Coordinates	23.84°N 91.28°E
Capital	Agartala
Population (as per 2011 census)	3,671,032
Population Density	350/km2
Literacy Rate	87.75 % (2011)
Religions	Hinduism, Islam, Christianity, Buddhism
Principal Language (s)	Bengali, English and Kokborok (Tripuri)

[10]https://ecostat.tripura.gov.in/Tripura_Economy.pdf,
Tripura Population Sex Ratio in Tripura Literacy rate data 2011-2022 (census2011.co.in)

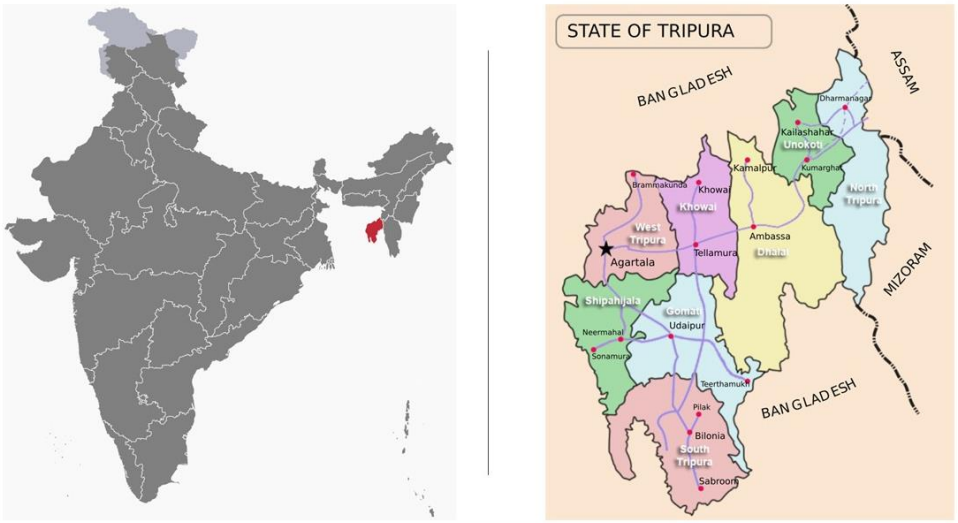


Figure 5: Map Tripura

The state has a tropical savanna climate and receives seasonal heavy rains from the south-west monsoon. Forests cover more than half of the area, in which bamboo and cane tracts are common. Tripura has the highest number of primate species found in any Indian state. Due to its geographical isolation, economic progress in the state is hindered. Tripura is primarily an agrarian State, with about 42% of the population depending on agriculture and allied activities. However, only about 26% of the land is cultivable, the rest being hilly and forested. Rice is the major crop in the state. The economic activities of the state are agriculture, animal resource, forests, fisheries, and industries.

According to the 2011 census, Tripura is one of the most literate states in India, with a literacy rate of 87.75%. The total forest area of the state was 6294.287 sq. km (2019-20).

The state of Tripura exhibits promising potential for the food processing industry. With its favorable climatic conditions and abundant natural resources, Tripura offers an ideal environment for the cultivation of various agricultural products, including fruits, vegetables, and spices. This presents ample opportunities for value addition through food processing activities such as canning, packaging, and preservation. It is rich in natural resources such as natural gas, rubber, tea, and medicinal plant and is endowed with rich and diverse bamboo resources. In the rubber industry, energy consumption is notably low, with a majority of units employing solar drying methods. The total area under rubber plantations is 85453.63 hectares. It is also the second-largest natural rubber producer in the country after Kerala. Around 21 of the 130 bamboo species known in India are grown in the state. The state holds a strong tea plantation base, with around 58 tea gardens.

To measure the economic status of the state in monetary terms, net state domestic product at current prices and constant prices are illustrated in the figure below:

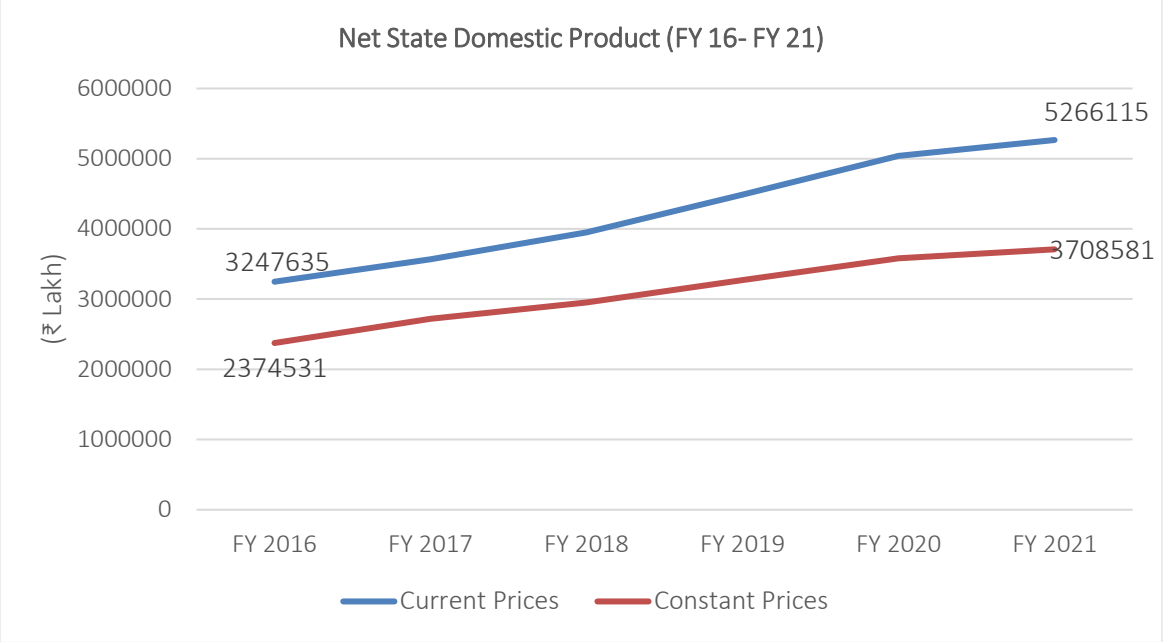


Figure 6: Net State Domestic Product at constant price of Tripura (FY16-FY20)[11]

To evaluate the state's economic condition, the per capita net state domestic product for current and constant prices is estimated and illustrated in the figure below:

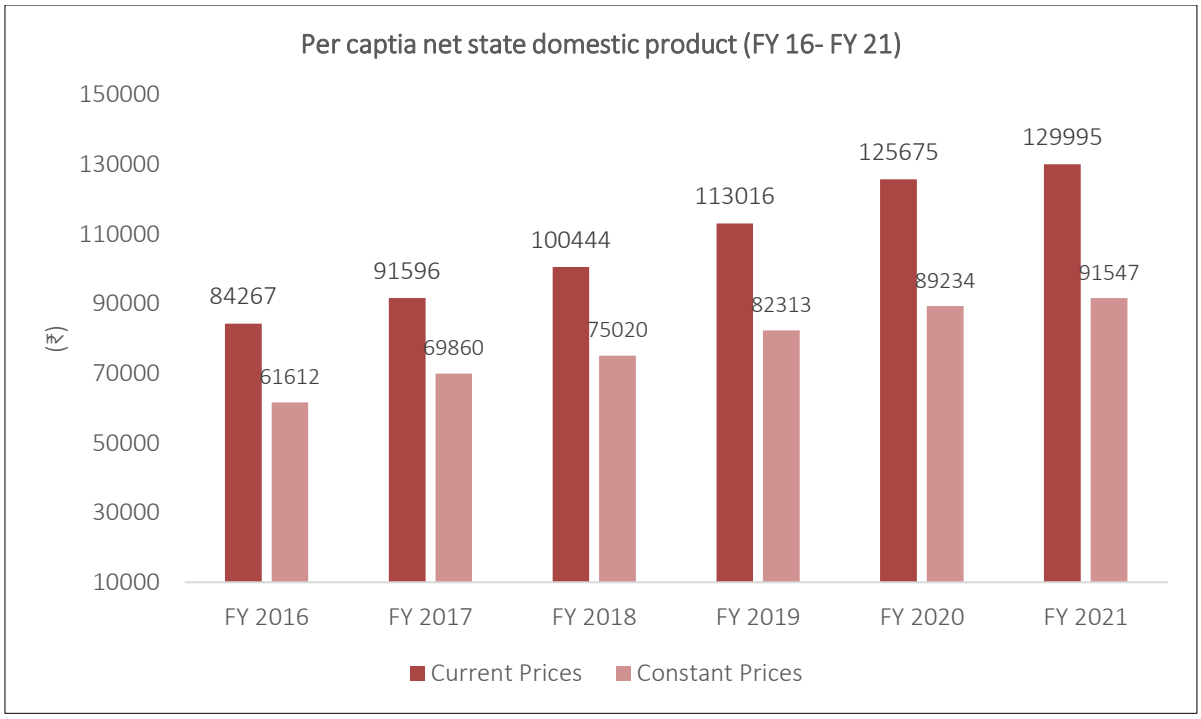


Figure 7: Per capita net state domestic product (FY16-FY20) [12]

[11] Reserve bank of India, Handbook of Statistics on Indian States, 2021, https://m.rbi.org.in/Scripts/PublicationsView.aspx?id=21416, https://m.rbi.org.in/Scripts/PublicationsView.aspx?id=21417

12 Reserve bank of India, Handbook of Statistics on Indian States, 2021, https://m.rbi.org.in/Scripts/PublicationsView.aspx?id=21412, https://m.rbi.org.in/Scripts/PublicationsView.aspx?id=21413

Tripura's per capita net domestic product shows a gradual increase over the years. Tripura reported a maximum per capita net (Current price) GDP of ₹ 1,29,9952 Lakh in FY 20-21.

1.5 State's Energy Scenario

The development of the power sector in the state of Tripura is presently moving in the right direction so that the availability of affordable, reliable, and quality power is ensured to the people of the state soon. Understanding the importance of power as a prime mover for the development of the state, the government of Tripura initiated several measures to develop the state power sector to its fullest potential for the prosperity the state and its people.

The state has implemented various initiatives to ensure 24X7 availability of reliable power to all households, industrial, commercial establishments, and other electricity-consuming entities. One such initiative implemented was "The Power for All (PFA) programme", which was a joint initiative of the Government of India and the Government of Tripura.

The state has many power-generating stations and is owned by Tripura State Electricity Corporation Ltd. (TSECL). The state has Natural gas-powered thermal power stations at Rokhia and Baramura and the ONGC Tripura power company in Palatana. The state also has a hydropower station on the Gumti river. With the newly added power generation capacity, Tripura has enough capacity to supply all seven sister states of northeast India, as well as export power to neighboring countries such as Bangladesh. With recent discoveries, the state has abundant natural gas reserves to support many more power generation plants.

As per the central electricity authority (load generation balance report FY 20-21), the energy requirement of the state is 1,484 MU, and the availability of the state is 1,481 MU. The peak demand of the state is 317 MW, and the availability is 315 MW in the year FY 20-21.

Hydro and gas are the two main sources of power generation in Tripura. The estimated reserves of crude oil and natural gas in the FY 21 were 0.07 MMT and 29.18 BCM respectively according to the reports of Indian Petroleum & Natural Gas Statistics (2020-21). The yearly trends of the estimated reserves of crude oil and natural gas are highlighted below in the figure.

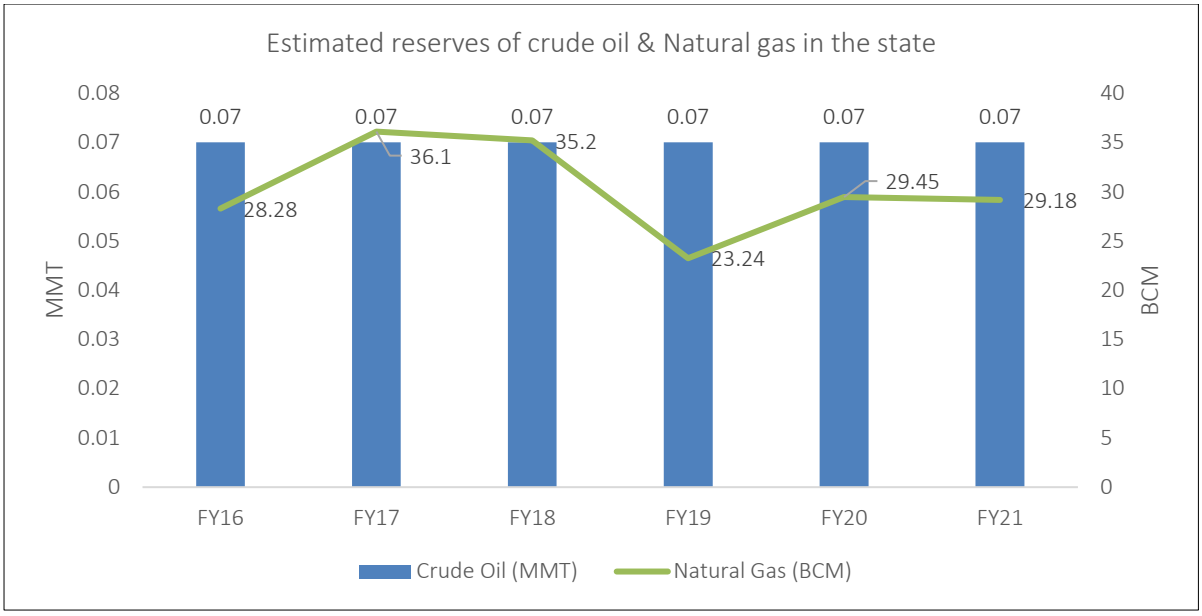


Figure 8: Estimated Reserves of Crude oil and Natural Gas year wise

As Tripura is a state with good availability of natural gas, the yearly trends of the gross production, flare, net availability and consumption of natural resources are highlighted below.

Table 5: Gross & Net Production of Natural Gas in Tripura (Figures in MMSCM) [14]

	FY17	FY18	FY19	FY20	FY21
Gross Production	1429.91	1440.37	1554.30	1472.75	1633.97
Flare	0.21	0.26	0.27	0.29	0.29
Net Availability/Net Production	1429.70	1440.12	1554.04	1472.46	1633.68

The primary energy consumption of the state of Tripura is collected from multiple sources ('Ministry of petroleum and natural gas' annual reports, 'CEA' Reports, and 'coal India' annual reports). The total primary energy consumption comprising thermal energy of the state has been estimated at 2.09 MTOE during FY20. Natural gas production is the major primary energy consumption source in Tripura contributing. Below is a breakdown of the primary energy consumption by fuel type.

The total energy consumption for the state of Tripura for FY 19-20 is estimated to be 2.17 MTOE. The fossil fuel consumption in the state includes solid fuel (including coal, coke, slate and other fuels) and petroleum products. In addition, electrical energy is consumed across sector. A summary of the energy consumption scenario of the state is tabulated below:

[14] Indian Petroleum & Natural Gas Statistics 2020-21.indd (mopng.gov.in), https://mopng.gov.in/files/TableManagements/Indian-Petroleum--Natural-Gas_2020-21.pdf

Table 6 Energy Consumption Overview of Tripura FY 19-20

Parameter	Original Unit	Original Unit Value	MTOE Value
Total population[15]	Crore	0.36	-
Gross domestic product (GSDP)[16]	INR Lakh crore	0.38	-
Total renewable energy installed capacity[17]	Gigawatt	0.02	-
Electricity consumption (utilities)[18]	Million Units	914	0.08
Domestic solid fuel consumption[19]	Million tonnes of oil equivalent	0.23	0.23
In coal consumption[20]	Million tonnes of oil equivalent	0.31	0.31
Oil consumption[21]	Million tonnes of oil equivalent	0.25	0.25
Gas consumption[22]	Million tonnes of oil equivalent	1.30	1.30
Total final energy consumption	Million tonnes of oil equivalent	2.17	2.17

The total energy is consumed across all economic sub-sectors in the state. The energy flow within the state territory is shown in the exhibit below:

[15] State-wise Total Population, https://www.rbi.org.in/Scripts/AnnualPublications.aspx
[16] Gross State Domestic Product (Constant Prices), https://www.rbi.org.in/Scripts/AnnualPublications.aspx
[17] State-wise installed capacity of Grid Interactive Renewable Power https://mnre.gov.in/img/documents/uploads/file_f-1597797108502.pdf
[18] CEA Dashboard, https://cea.nic.in/dashboard/?lang=en
[19] Assumptions has been taken, please refer Annexure 1 of Chapter 10
[20] Assumptions has been taken, please refer Annexure 1 of Chapter 10
[21] https://mopng.gov.in/files/TableManagements/Indian-Petroleum--Natural-Gas_2020-21.pdf
[22] Assumptions has been taken, please refer Annexure 1 of Chapter 10

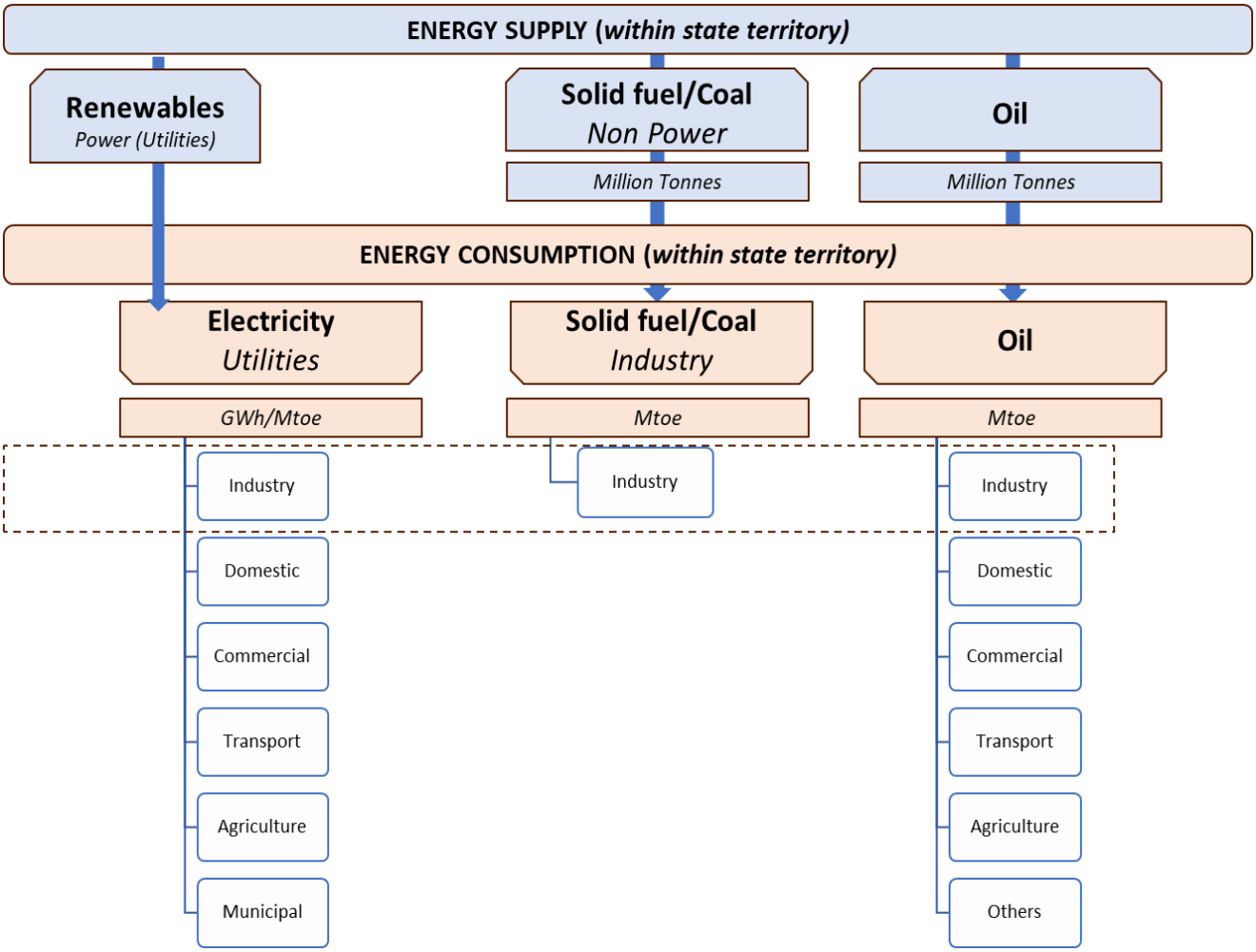


Figure 9: Energy Flow in State Territory

1.6 State's Total Final Energy Consumption (TFEC) – BAU Scenario

The Total Final Energy Consumption (TFEC) for the state includes both primary energy and secondary energy (electricity). In Tripura, major energy consumption is from Gas (used in Power plants, Domestic purpose, Transport etc.) and minimum use of solid fuel like coal in Tripura. Secondary energy (Electricity) includes energy generated from renewable sources and non-renewable sources. The TFEC from FY 14-15 to FY 19-20 is illustrated in the figure below:

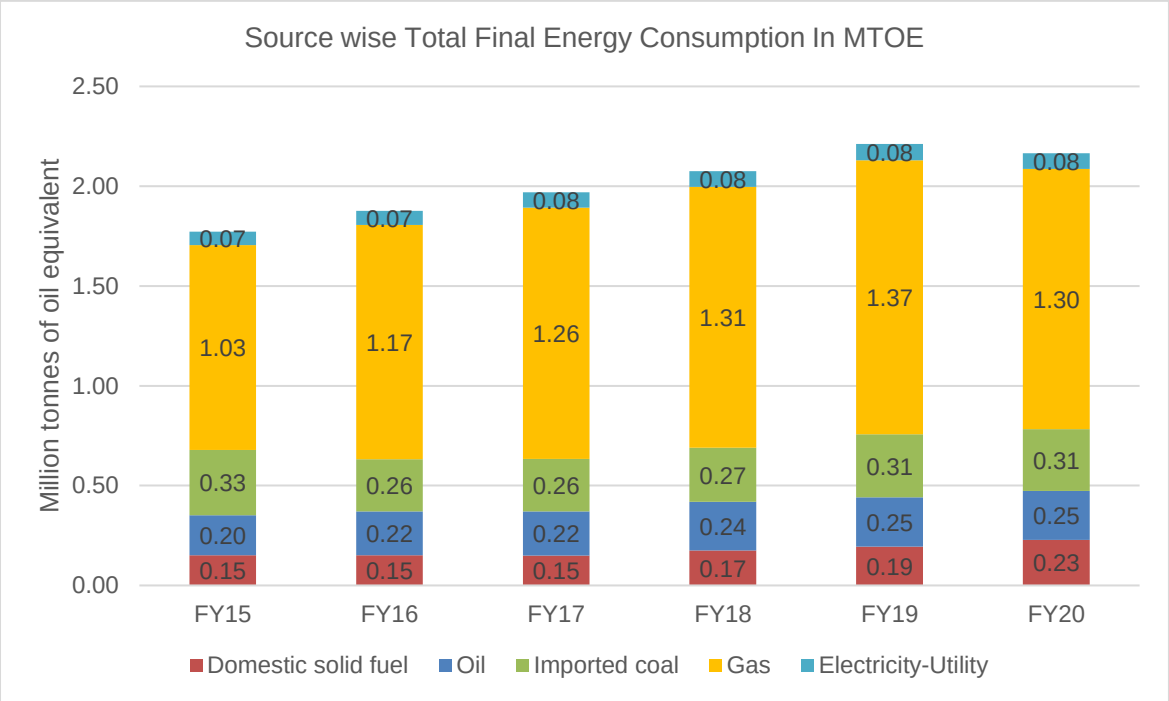


Figure 10: State's Total Final Energy Consumption (TFEC) in MTOE from FY15 to FY20[23]

It can be analyzed from the above figure that TFEC was increased by around 15% between FY 14-15 and FY 18-19, with a slight difference in the FY 19-20.

[23] The values are derived on assumptions and baselines, please refer to the annexure 1 of the chapter -10 (Point 6)

The source wise TFEC break-up for FY 19-20 is shown in the exhibit below:

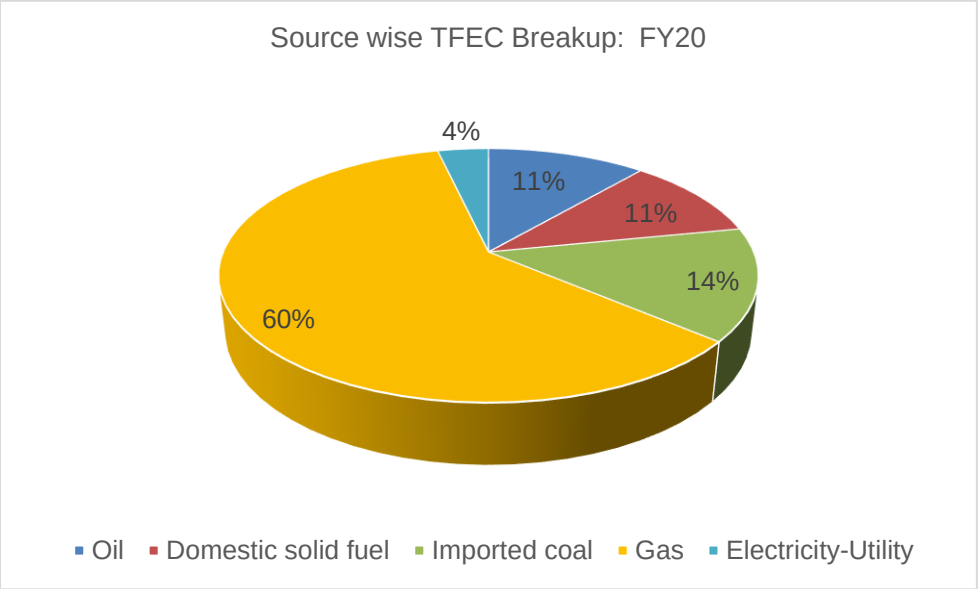


Figure 11: Source-wise energy consumption in MTOE (FY 19-20)[24]

The share of oil in the energy mix for Tripura is 11%, whereas that of domestic solid fuel and imported coal 11% and 14% respectively. Major share of electricity is generated from gas-based power plants with a share of 60% in Tripura.

The breakup of sector-wise energy consumption in FY 19-20 is also depicted in the table and pie chart below:

Table 7: Share of various sectors in total final energy consumption (FY 19-20)[25]

Sector	Energy (MTOE)	Percentage of Total (%)
Agriculture	0.00	0.18
Building	0.12	5.64
Industries	1.86	85.80
Transport	0.16	7.19
Municipal	0.01	0.52
Others	0.01	0.67
Total	**2.17**	

The industry remains the largest consumer of total final energy, with approx. 65 per cent share. The transport sector ranks second with approx.19 per cent share of total

[24] Please refer to the annexure 1 of the chapter -10 (Point 6)

[25] The values on the basis of percentage shared percentage, please refer to the Annexure 1 of Chapter 10 (Point 7)

final energy consumption. The building sector consists of commercial buildings and residential buildings rank third with approx. 14 per cent share.

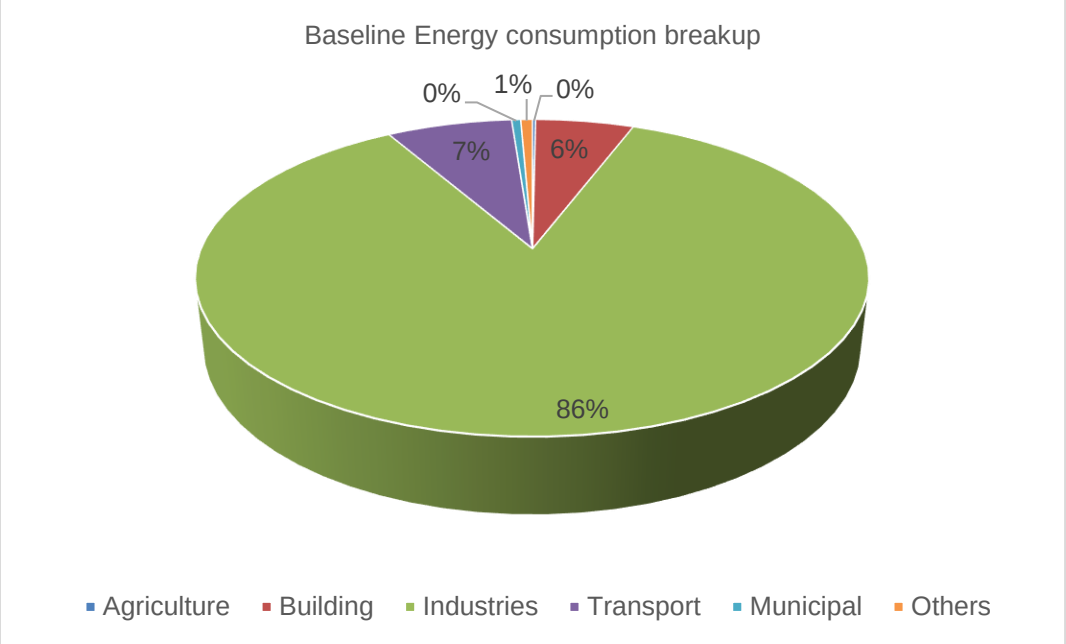


Figure 12: Breakup of sector-wise energy consumption in FY 19-20

1.7 Overview of Institutional Framework and Stakeholder Mapping

States have a vital role in India's energy efficiency policy implementation and in meeting state-specific goals on sustainable development in the most energy efficient way. Planning and driving the energy efficiency programmes in the state level is important for sustainable development of the state and for effective utilization of its resources.

At the state level in India, the institutional framework for energy efficiency includes State Designated Agencies (SDAs), State Energy Conservation Funds (SECFs), State Electricity Regulatory Commissions (SERCs), and State Nodal Agencies (SNAs).

SDAs are appointed by the Bureau of Energy Efficiency (BEE) and are responsible for implementing the provisions of the Energy Conservation Act in their respective states. They develop and implement state-level energy efficiency policies and programs, conduct capacity building programs, and promote the adoption of energy-efficient technologies and practices.

SECFs are set up in each state to finance and implement energy efficiency and conservation projects. The funds are managed by SDAs and are used to support energy efficiency initiatives in different sectors of the economy.

SERCs regulate the electricity sector in each state and are responsible for promoting energy efficiency and conservation measures. They develop and implement regulations and standards to improve energy efficiency in the electricity sector and encourage the adoption of renewable energy sources.

SNAs are established by state governments to promote and facilitate renewable energy and energy efficiency projects. They act as nodal agencies for implementing government policies and programs related to energy efficiency and renewable energy.

Overall, the institutional framework for energy efficiency at the state level in India is designed to facilitate the implementation of energy efficiency measures and achieve the national energy conservation goals.

Stakeholder mapping is an essential tool in the preparation of state energy efficiency action plans, as it helps to identify the key stakeholders and their roles in the implementation process. In the context of Tripura, where energy efficiency is a critical issue, stakeholder mapping can play a vital role in bringing together the relevant parties to achieve the desired outcomes. The stakeholders in this process include the state government, energy companies, industry associations, civil society organizations, and consumers. By mapping the stakeholders' interests and priorities, the state government can develop an effective energy efficiency action plan that takes into account the needs and concerns of all parties. This will ensure that the plan is implemented successfully and that the benefits of energy efficiency are shared across the state.

The key identified stakeholders/government departments in the state who will play pivotal role in driving the state energy efficiency action plan is exhibited in the figure below:

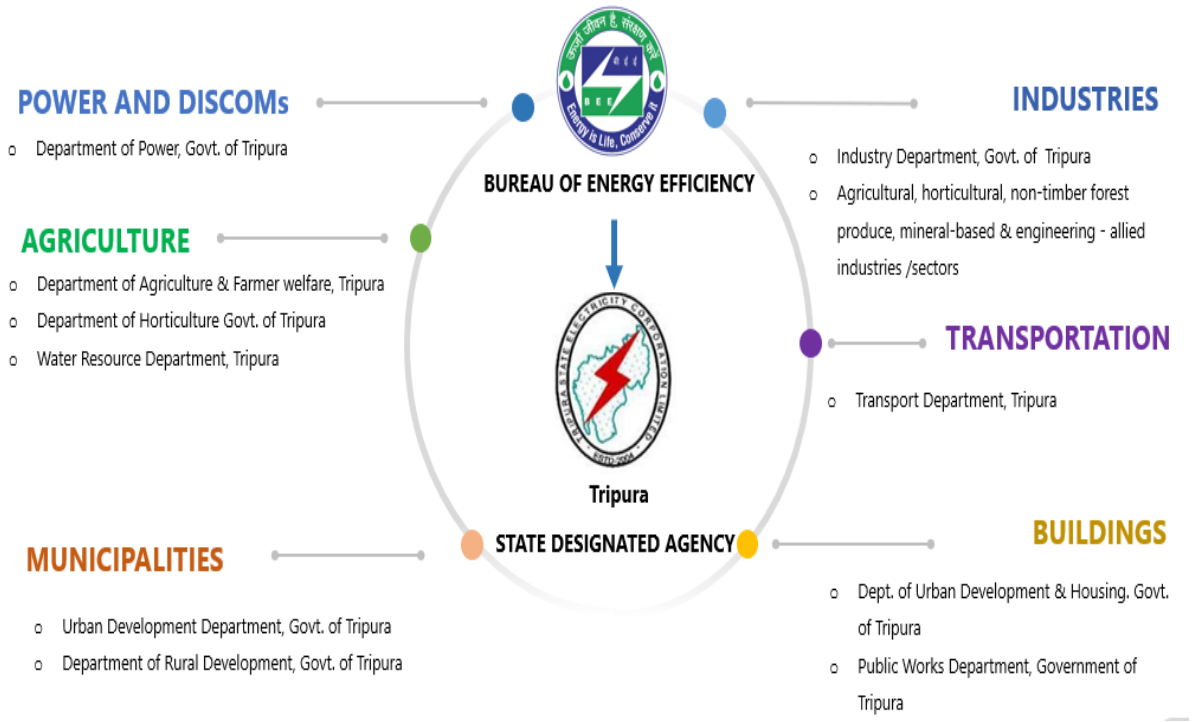


Figure 13: Identified stakeholders of preparation of SEEAP

2. Identification of Focus Sectors

The identification of focus sectors is a crucial step in the preparation of the State Energy Efficiency Action Plan (SEAP). The focus sectors include the economic sub-sectors where the potential for energy efficiency improvements is high, and the impact of energy savings is significant. Identifying focus sectors shall enable policymakers to prioritize their efforts and resources towards the sectors that offer the most significant energy savings potential.

2.1 Methodology for Focus Sector Identification

Tripura is home to a diverse set of energy-consuming sectors ranging from agriculture, transport, industries, residential and commercial buildings, DISCOMS. To prepare the SEEAP, it is essential to identify the focus sectors that consume the most energy and have the highest potential for energy savings. This requires a systematic methodology that considers various factors such as energy consumption patterns, growth projections, and technological potential.

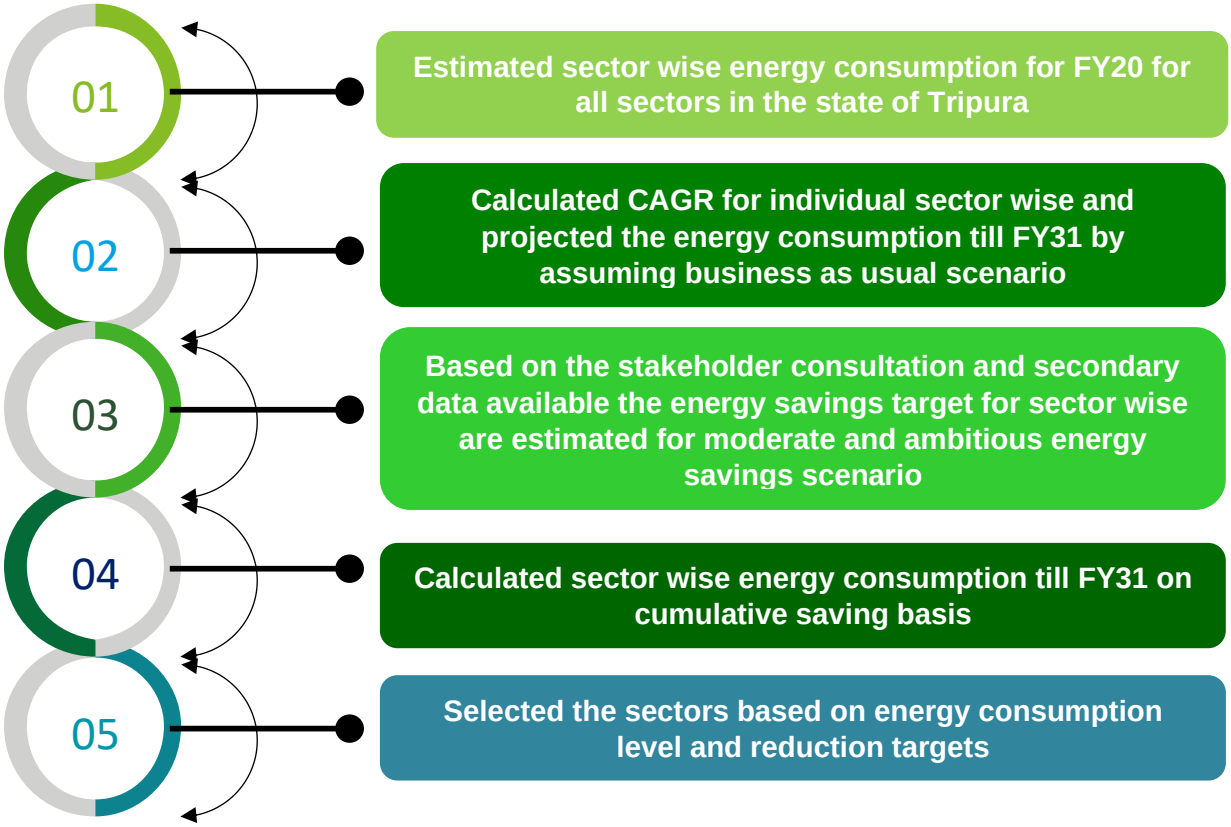
Methodology adopted for this report preparation is the bottom-up approach, which involves analyzing the energy consumption of each sector, identifying the key drivers of energy demand, and estimating the potential for energy savings through various measures such as retrofitting, technology upgrades, and behavior change.

The first step in the methodology is to collect and analyze data on energy consumption patterns for each sector. This includes analyzing energy consumption trends, identifying the major energy-consuming activities, and estimating the energy intensity of each activity. This data can be obtained from various sources such as energy audits, surveys, and secondary data sources.

Next, the key drivers of energy demand in each sector are identified. This includes factors such as population growth, economic development, technological advancements, and policy initiatives. The potential for energy savings is then estimated by considering various measures such as energy-efficient technologies, process optimization, and behavior change.

Finally, the sectors with the highest potential for energy savings are identified and prioritized based on their energy consumption patterns, growth projections, and technological potential. This prioritization helps in allocating resources and identifying specific measures to promote energy efficiency in each sector.

The methodology followed for the selection of focus sectors can be summarized as below:



The bottom-up approach provides a systematic and data-driven methodology to identify sectors with high potential for energy savings and promote sustainable development. Based upon the baseline energy consumption pattern and the methodology mentioned above, it is identified that the industrial, building and transport sector are the highly energy intensive sector in the state of Tripura. These sectors were considered as focus sectors for further analysis.

2.2 Identified Focus Sectors

After conducting a detailed analysis and stakeholder consultations it has been identified that the industrial, building, and transport sectors are highly energy-intensive in Tripura, India. This finding will be used to prepare the state's energy efficiency action plan to improve energy consumption and reduce energy-related costs. By implementing energy-efficient technologies and practices in these sectors, the state can significantly reduce its energy consumption, save costs, and contribute to the reduction of greenhouse gas emissions. The identified energy intensive Focus Sectors for the state of Tripura as below:

- Focus Sector 1: Industrial Sector
- Focus Sector 2: Building Sector (Both Commercial and Domestic Buildings)
- Focus Sector 3: Transport Sector

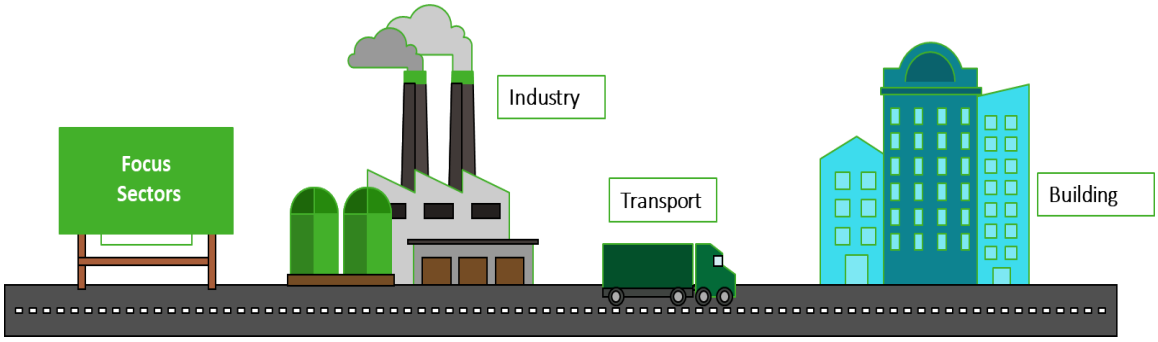


Figure 14: Identified Focus Sectors - Tripura

Based on collected data and demand projections It is estimated that the energy consumption in the identified focus sectors (Industry, Transport & Building) will be more than 85% of the total energy consumption by FY30-31

An overview of the focus sectors identified for the state of Tripura is discussed below:

Industry Sector

The major industries in Tripura are agro-based, handicrafts, bamboo and rubber-based industries. The state has a high potential for developing its horticulture, food processing, and fisheries industries. Tripura is also known for its handloom and handicrafts industry, which includes products like hand-woven cotton and silk fabrics, bamboo and cane handicrafts, and wooden furniture.

The energy consumption of industrial sector in FY 14-15 was 1.53 Mtoe and the consumption was increased to 1.86 Mtoe in FY20.

The state government has taken several measures to promote the industrial sector in Tripura. These include the formulation of a separate industrial policy for the state, setting up of industrial estates and clusters, and providing incentives to industries. The state has also initiated a single window system to provide all necessary clearances to investors in a time-bound manner.

The major flagship Industrial area is the Industrial Growth Centre complex at Bodhjungnagar and R.K. Nagar at Khayerpur in West Tripura District. This also includes food Park, Rubber Park, Export Promotion Industrial Park and a Bamboo Park. Also, a Tool Room and Training centre is being established in that area. Other industrial sites like Industrial Estate, IIDC's etc are located in different parts of the state. The state has also been promoting the development of the bamboo industry, which has immense potential due to the abundant availability of bamboo in the state. The Tripura Bamboo Mission has been set up to promote the bamboo sector in the state and create employment opportunities for the local population.

Tripura Industrial Development Corporation (TIDCL), formed in 1974 is the only PSU under the Department of Industries and Commerce which looks after the industrial infrastructure of the state and also act as a State Financial Corporation. Industrial Infrastructure at various locations in the state as described below:

- Bodhjungnagar Industrial Area
- R. K Nagar Industrial Area
- Dukli Industrial Area
- Tulakona Industrial Area
- Industrial Estates
- Integrated Infrastructure Development Centers (IIDCS) under Cluster Development Programme (CDP) of MSME

The state energy efficiency action plan should, therefore, prioritize initiatives aimed at promoting energy efficiency in the industry sector, such as awareness campaigns, capacity building, and financial incentives. The successful implementation of these initiatives can contribute significantly to achieving the state's energy efficiency and climate goals while creating a more sustainable and resilient economy.

Building Sector

The building sector in Tripura has been witnessing a significant growth over the past few years. The state's government has been investing heavily in the development of

infrastructure, including roads, bridges, and other facilities, which has led to a surge in demand for building construction and related services. The building sector in Tripura has become one of the key drivers of economic growth in the state, providing employment opportunities and contributing to the state's revenue.

The energy consumption in building sector in FY 14-15 was 0.103 Mtoe and the consumption was increased to 0.122 Mtoe in FY20.

The state has a well-established legal and regulatory framework, which makes it easier for investors to obtain necessary permits and licenses for building projects. The state government has also simplified the process of obtaining land and property registrations, which has helped to boost the overall construction activity.

In recent years, there has been a growing trend towards sustainable building practices in Tripura. Several builders are incorporating green building technologies, such as solar energy systems, rainwater harvesting, and waste management systems, in their building projects. This trend towards sustainable building practices has not only helped to reduce the carbon footprint of buildings but has also provided opportunities for local suppliers and manufacturers of sustainable building materials.

With a comprehensive understanding of the building sector's current status, policymakers and stakeholders can identify opportunities to enhance energy efficiency and reduce carbon footprint. It is vital to recognize that improving energy efficiency in buildings is not just about saving energy but also reducing energy costs and improving indoor comfort and air quality. Hence, a concerted effort is needed from all stakeholders to achieve the energy efficiency targets set forth in the state's Energy Efficiency Action Plan.

Transport Sector

The transport sector is a significant contributor to energy consumption and greenhouse gas emissions. Tripura, located in the northeast region of India, has a developing economy that heavily relies on the transport sector. As such, energy efficiency in the transport sector is of paramount importance for Tripura's sustainable development. Tripura shares its borders with Bangladesh on three sides and the state of Assam on the north. The transport sector plays a vital role in the development of

the state's economy by connecting it to other parts of the country and facilitating the movement of goods and people.

The energy consumption in transport sector in FY 14-15 was 0.117 Mtoe and the consumption was increased to 0.156 Mtoe in FY 19-20.

The transport sector in Tripura plays a significant role in the economic development of the state. The state government is making efforts to improve the road, rail, and air connectivity, which will help the state to become a hub of trade and commerce in the Northeast region of India.

Road transport is the primary mode of transportation in Tripura. The state has a network of national highways, state highways, and rural roads that connect various parts of the state to each other and the rest of the country. The National Highway 8 connects Tripura to the rest of the country, while the state highways and rural roads link the different parts of the state. The state-run Tripura Road Transport Corporation (TRTC) operates bus services throughout the state and also provides inter-state bus services to neighboring states.

The transport sector is also an energy-intensive sector in Tripura. This sector includes road, rail, and air transport, and it is one of the major sources of greenhouse gas emissions. Encouraging the use of public transport, promoting electric vehicles, and implementing fuel-efficient technologies in transportation can help reduce energy consumption and emissions.

In conclusion, the transport sector plays a crucial role in the overall energy consumption of Tripura. The state's transportation system is primarily dependent on fossil fuels, which not only contribute to greenhouse gas emissions but also lead to high energy costs. To address these challenges, it is imperative to develop an effective State Energy Efficiency Action Plan (SEEAP) that focuses on reducing energy consumption and promoting sustainable transportation solutions.

3. Tripura's Energy Demand Projection

3.1 Gross State Domestic Product

Gross State Domestic Product (GSDP) or State Income is the most important indicator for measuring the economic growth of a State. Gross State Domestic Product (GSDP) is a measure in monetary terms, the sum volume of all finished goods and services produced during a given period of time, usually a year, within the geographical boundaries of the State, accounted without duplication. These estimates of economy, over a period of time, reveal the extent and direction of the changes in the levels of economic development.

State's Gross Domestic product (GDP) (at constant price) for the state of Tripura is shown in the graph below:

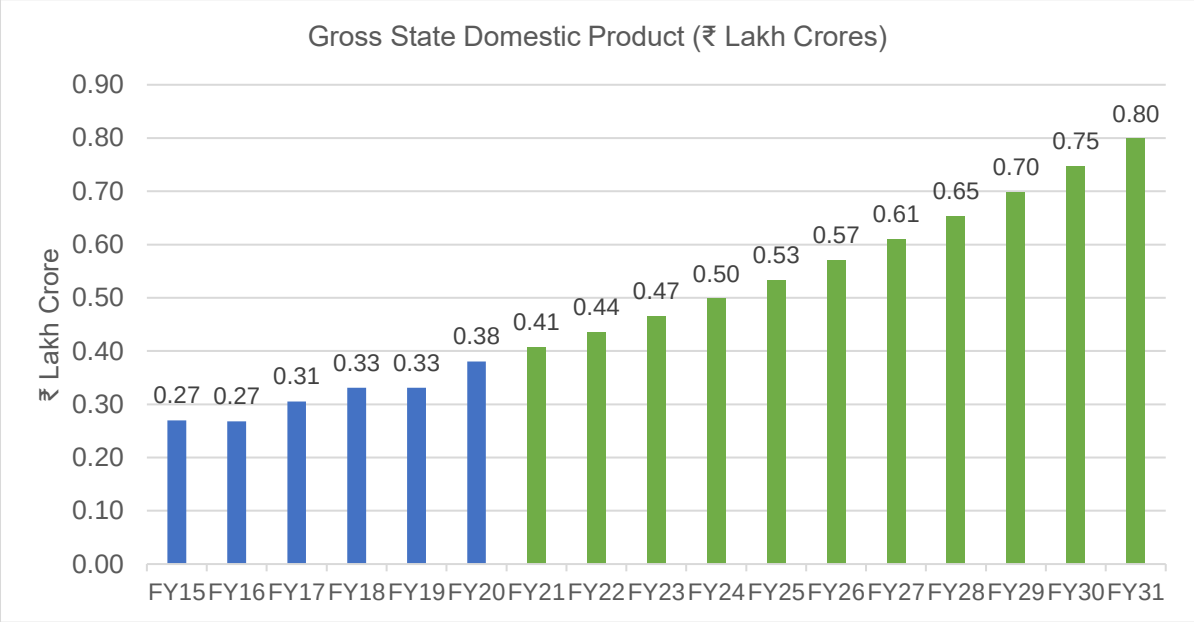


Figure 15: State gross domestic product projection till FY 31 (₹ lakh crore)[26]

The GDP at constant price is the GDP adjusted for the effects of inflation and known as the real GDP. The SGDP is projected till FY30-31 using historic SGDP growth rate from FY14-15 to FY19- 20 and National GDP growth rate projection with suitable weightage. The SGDP reported in FY20 is 0.38 ₹ Lakh Crore and in projected to 0.80 ₹ Lakh Crore by FY30-31.

3.2 Total Final Energy Consumption Projections (BAU)

Total Final Energy Consumption (TFEC) refers to the amount of energy consumed by end-users in a particular state or region. This includes energy used in transportation,

[26] The projection is done on the basis of the baseline data of FY 15-FY 20 from https://www.rbi.org.in/Scripts/AnnualPublications.aspx?head=Handbook%20of%20Statistics%20on%20Indian%20States

industry, commercial and residential sectors. TFEC is a critical indicator of a state's energy usage pattern and provides insights into its energy efficiency, sustainability, and environmental impact.

Based on the calculated Total Final Energy Consumption for period of FY 14-15 till FY 19-20, and sectoral energy demand growth rate the TFEC is projected from base year till FY30-31 under business-as-usual scenario. The energy consumption during FY 19-20 is 2.17 MTOE and is projected to be 3.67 MTOE by FY25-26 and 5.15 MTOE by FY30-31. This is also illustrated in the below figure:

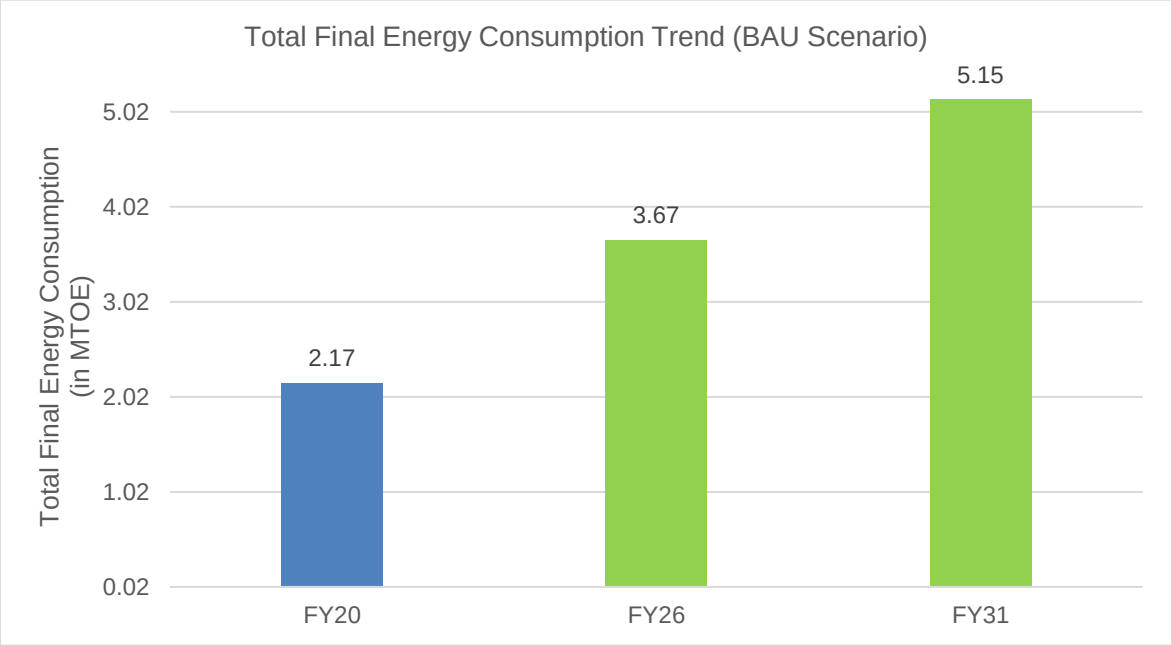


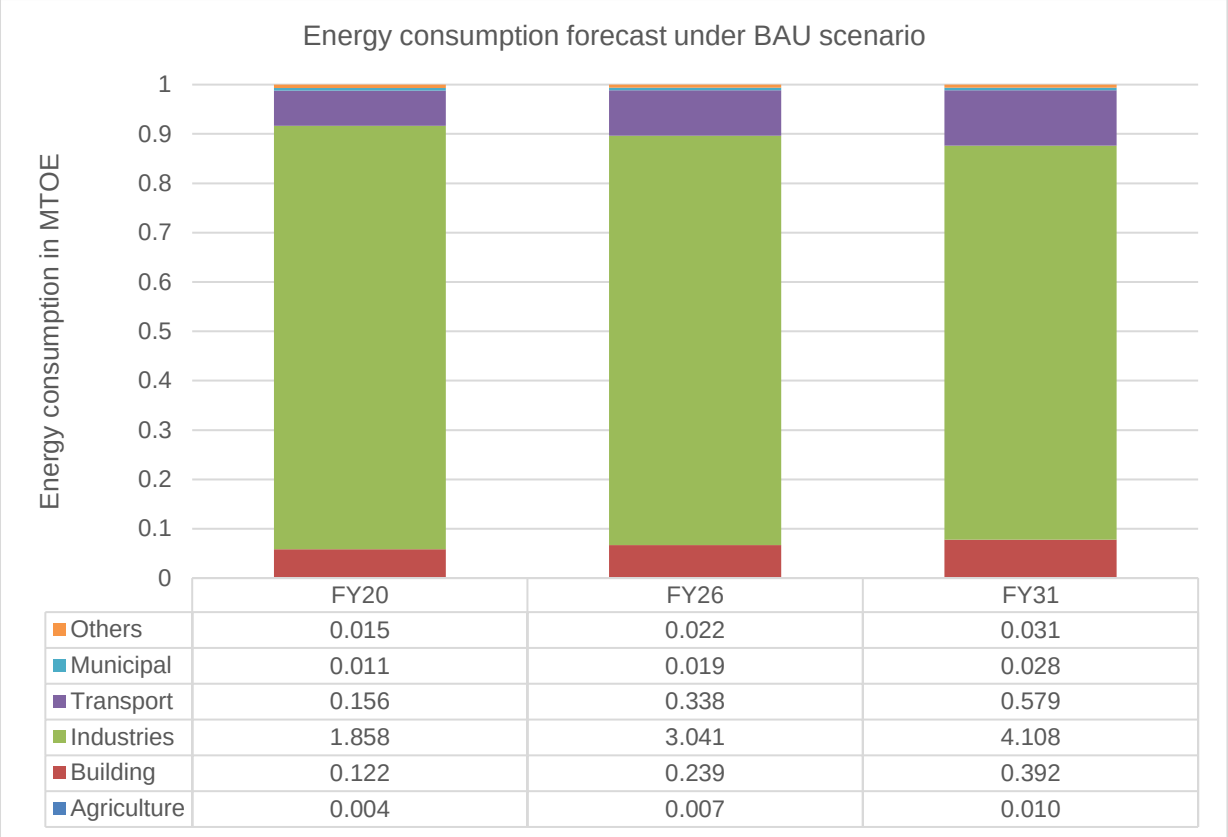
Figure 16: Total Final Energy Consumption (TFEC) projection till FY 30-31[27]

3.3 Sector wise Total Final Energy Consumption projections (BAU)

Total final energy consumption projections are essential for determining the future energy demand of various sectors. It is essential to understand how much energy is being consumed by each sector and how it will evolve over time. The projections can help policymakers, energy analysts, and investors to make informed decisions regarding the future energy mix and infrastructure investments.

Below figure represents the sector wise projection of the Total Final Energy Consumption under business-as-usual scenario till FY 30-31:

[27] Please refer to the annexure 1 of chapter 10 (Point 8)



	FY20	FY26	FY31
Others	0.015	0.022	0.031
Municipal	0.011	0.019	0.028
Transport	0.156	0.338	0.579
Industries	1.858	3.041	4.108
Building	0.122	0.239	0.392
Agriculture	0.004	0.007	0.010

Figure 17: Sector wise Total Final Energy Consumption projections projection till FY 30-31[28]

3.4 Energy Saving Scenarios

Energy-saving scenarios are crucial in identifying sustainable solutions to energy-related problems. They provide a basis for setting realistic and achievable energy efficiency goals, identifying appropriate strategies and actions, promoting stakeholder engagement, enhancing decision-making, and contributing to sustainable development. Therefore, energy-saving scenarios are essential for developing effective SEEAPs that promote energy efficiency and conservation. Among the popular scenarios, Business as Usual (BAU), Moderate (MOD), and Ambitious (AMB) scenarios were used for analysis.

Business As Usual (BAU) Scenario:

In this scenario, the consumption of energy remains the same as the current trend, with no significant changes. This scenario assumes that energy demand will continue to grow at the same rate as it has been over the last few decades. This approach is not sustainable in the long run, as it will lead to an increase in greenhouse gas emissions, energy costs, and environmental degradation.

Moderate (MOD) Scenario:

[28] Please refer to the annexure 1 of chapter 10 (Point 8)

This scenario assumes that some measures will be taken to reduce energy consumption, but not to a significant extent. It envisages a gradual shift towards energy-efficient technologies, along with the implementation of some policies to reduce energy consumption.

Ambitious (AMB) Scenario:

This scenario aims to achieve a significant reduction in energy consumption and greenhouse gas emissions. It envisages the implementation of aggressive policies and measures to achieve a significant reduction in energy consumption compared to BAU scenario. This scenario requires a significant shift towards renewable energy sources, energy-efficient technologies, and lifestyle changes.

These three scenarios developed for energy consumption forecasting includes the following main assumptions:

Table 8 Energy saving scenarios for demand projections

Scenario	Technology Interventions	Policies & programmes
Business as Usual	Current technology interventions and penetration	Current implementation of programmes
Moderate	Moderate technology interventions and penetration	Modification of policies and programmes
Ambitious	Ambitious low carbon technology interventions and deeper penetration	Implementing new policies & programmes

In conclusion, energy-saving scenarios play a crucial role in identifying sustainable solutions to energy-related problems. The BAU scenario is not sustainable in the long run, while the MOD scenario aims to achieve moderate reductions in energy consumption. The AMB scenario, on the other hand, aims to achieve significant reductions in energy consumption and greenhouse gas emissions. Therefore, policymakers, businesses, and individuals need to work together to implement sustainable energy-saving scenarios that prioritize environmental sustainability, economic development, and social welfare.

4. Energy Efficiency Action Plan for Focus Sector: Industry

Industrial energy efficiency (EE) is an indispensable pillar of sustainable production. Industrial energy efficiency includes technology upgradations, retrofits, fuel switch and improvement of operational parameters. Industries, particularly the MSMEs are characterized by low knowledge level, lack of access to credits, lack of skilled manpower, lack institutional set-up and high energy cost. Strategies for improving the energy efficiency in Industries involves identifying the most energy-intensive sector and developing a plan to optimize energy use customized to the sector. The plan includes implementing energy-efficient technologies and practices, conducting energy audits & ISO 50001 studies, setting energy-saving targets, and establishing energy management systems.

4.1 Current Scenario

The Industrial Growth Centre complex in Bodhjungnagar and R.K. Nagar at Khayerpur in the West Tripura District is the main flagship industrial area. Additionally, there is a food park, a rubber park, an industrial park for export promotion, and a bamboo park. A tool room and training centre is also being built there. Other industrial locations, including Industrial Estates, IIDCs, and others, are dispersed throughout the state.

1622 new units have been registered in DIC s and 5571 (8582) under Udyog Aadhar Memorandum and Udyam Registration websites increasing the total number of registered units to 8536 (11547) (1343+1622+5571 (8582) units (as on 31.03.2021). The total investment in industrial Sector is about 1,06,325 persons (as per MSME Register). Secondary sector contributes about 18% of state GSDP during 2013-14.

During last about a decade, a number of initiatives have been taken for significant growth in industrial sectors. As of now, there is one large-scale units (excluding power sector) in Tripura, namely Rubber Thread unit investment of which is about Rs 80 crores at Bodhjungnagar.

Tripura Industrial Development Corporation (TIDCL), formed in 1974 is the only PSU under the Department of Industries and Commerce which looks after the industrial infrastructure of the state and also act as a State Financial Corporation. Industrial Infrastructure at various locations in the state as described below:

- Bodhjungnagar Industrial Area
- R. K Nagar Industrial Area
- Dukli Industrial Area
- Tulakona Industrial Area
- Industrial Estates
- Integrated Infrastructure Development Centers (IIDCS) under Cluster Development Programme (CDP) of MSME

MSME

The State Nodal Departments of this sector are Urban Development Department (UDD), Agartala Municipal Corporation (AMC), PWD (R&B) and the transport department. Ministry of Micro, Small and Medium Enterprises envisions a progressive MSME sector by promoting growth and development of the Sector, including Village Industries, in cooperation with concerned Ministries/Departments, State Governments and other Stakeholders, through providing support to existing enterprises, adopting cutting edge technologies and encouraging creation of new enterprises.

4.2 Energy Efficiency Strategies: Industry Sector

The strategies identified in the state for advancement of energy efficiency in the industrial sector is summarized below:

Table 9 Proposed energy efficiency strategies - Industrial Sector

Aspects	Strategic Area	
	Moderate Scenario	Ambitious Scenario
Policy intervention	▪ Empanelment of energy audit firms & consultants ▪ Incentives for energy audits in MSME clusters ▪ Support for pilot demonstration (Implementation high-end energy efficient technologies) ▪ Introduction of a Market-Based Instruments to promote energy efficiency ▪ Introduction of innovative financing mechanics / Energy performance contracting	▪ Deeper penetration/ implementations of All recommendations as per moderate scenario ▪ Development of ESCO framework for energy efficiency investments ▪ Technology transfer support for high-end technologies ▪ Inclusion of MSMEs in PAT program ▪ Introduction of ISO 50001 (EnMS) Energy Management Systems
Awareness & capacity building	▪ Conducting outreach programs and public awareness campaigns to create awareness about energy efficiency and its benefits. ▪ Providing training and skill development programs to individuals and organizations on energy-efficient technologies and practices. ▪ Offering technical assistance and support to organizations to help them implement energy-efficient measures effectively.	

	▪ Providing access to financial and technical resources to support the implementation of energy-efficient measures.	
Technology intervention	▪ Use of high-efficiency (IE3, IE4 & IE5) motors and drives ▪ Energy-efficient lighting systems ▪ Use of efficient boilers and steam systems ▪ Energy-efficient screw compressors ▪ VFD for compressors, fans and pumps ▪ Energy-efficient pumps and blowers	▪ Deeper penetration/ implementations of all recommendations as per moderate scenario ▪ Adoption of Industry 4.0 technologies for energy management ▪ Implementation of advanced process control systems ▪ Oxy fuel combustion & Electric furnace ▪ Use of Internet of Things (IoT) devices for energy monitoring and management

4.3 Energy Efficiency Action Plan: Industry Sector

The energy efficiency action plan for the state has been devised encompassing the strategies identified for advancement of energy efficiency in the targeted sector. An increased penetration of energy efficiency measures through various existing schemes and policies which envisages a shift towards best available technologies and introduction of innovative energy efficiency measures in the industries is also considered. Furthermore, technological interventions have also been taken into consideration in the hard to abate MSME sector.

4.3.1 Action Plan - 1: Energy audits and implementation of identified energy-saving measures in MSME clusters

Description

The industrial sector in Tripura consists of Micro, Small and Medium enterprises. The MSMEs face challenges in terms of high energy costs, which can impact their competitiveness and sustainability. This can be addressed by implementation of energy efficiency technologies and practices.

Energy audits involve a comprehensive assessment of the energy consumption of a facility or cluster of facilities, including identifying areas energy saving opportunities. The energy audits can be conducted by trained professionals who use various tools and techniques to collect data on energy consumption and identify energy-saving opportunities.

In MSME clusters, conducting energy audits and implementation of energy-saving measures can have a multiplier effect. This can lead to significant energy and cost

savings for the MSMEs, as well as improving the overall competitiveness and sustainability of the enterprise. A cluster-based approach can be taken for fast tracking energy audits and energy efficiency improvements in the sectors. In addition to the economic benefits, energy audits and implementation of energy-saving measures can also contribute to environmental sustainability by reducing greenhouse gas emissions and mitigating climate change.

Scope Boundary

The scope boundary recommended for promoting energy efficiency in MSMEs sector in the state is to set at a minimum threshold of 50 kVA. MSMEs falling under the threshold is proposed to be taken up for the interventions. On the successful implementation of phase one, threshold limit can be further reduced to include a greater number of MSMEs.

Implementing Agency

Department of Industries & Commerce, Government of Tripura, with support from Tripura State Designated Agency, Tripura State Electricity Corporation Limited can jointly implement this action plan. The Department of Industries plays a developmental and facilitation role to attract industrial investments in the state. It also focuses on creating an industry-friendly environment and formulation of suitable policies in the state aimed at propelling fast-paced modernization and strengthening industrial units.

Current Policy/ Required Modification

Currently there are no active policies in place for the promotion of energy audits and implementation of energy-saving measures in the MSME clusters.

Industrial Policy of Government of Tripura can include special consideration for incentivization of energy audits and promotion of implementation of identified low-carbon technologies.

Institutional Framework

The implementation of ‘energy audit for MSMEs’ considers various institutions, the state level industrial policies and schemes and nodal agency for the execution of the project in the state. The organizations involved will be Department of Industries & Commerce, Government of Tripura with support from Tripura State Designated Agency, Tripura State Electricity Corporation Limited (TSECL). A cluster level institutional framework needs to be developed for the implementation of the policy.

The various policy /scheme which guides this program in state/central level are listed below:

- Industrial Policy of Government of Tripura can include special consideration for EE technology implementations
- Continuation of BEE SME Programme
- Interest subsidy / capital subsidy of energy efficiency investment

Modification required in existing policies

The State should develop scheme for the promotion of energy audit in MSMEs. To create enabling environment for advancement of energy efficiency in the state the following strategies are proposed:

Moderate Scenario	Ambitious Scenario
• Empanelment of energy audit firms & consultants • Incentives for energy audits in MSME clusters • Support for pilot demonstration • Capacity Building Program	• Deeper penetration/ implementations of All recommendations as per moderate scenario • Inclusion of ESCO framework • Introduction of innovative financing mechanics • Hi-end Technology transfer support • Market-based incentive scheme

Implementation Targets:

Conducting energy audits and implementation of identified energy saving measures are an important aspect to mainstream energy efficiency in the MSME sector. The following targets are proposed for implementation of the action plan in the state:

- Moderate Scenario: ~**160-170** energy intensive industries can be covered under the scheme (FY30-31)
- Ambitious Scenario**:** **~250-260** energy intensive industries can be covered under the scheme (FY30-31)

Energy and Emission Saving Potential

Through this implementation, it is estimated that around 0.117 MTOE and 0.337 MTOE energy consumption can be reduced through moderate and ambitious scenarios respectively till FY 30-31. Around 0.366 $MtCO_2$ and 1.056 $MtCO_2$ GHG emissions can be reduced through moderate and ambitious scenarios respectively.

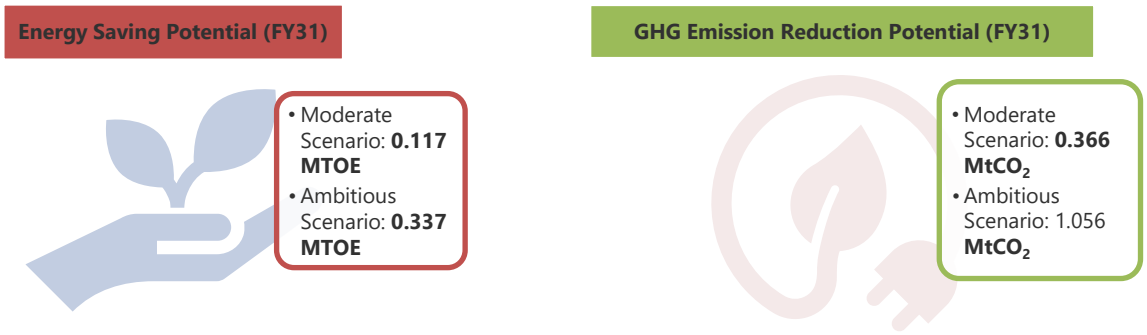


Figure 18: Energy and Emission Reduction Potential for Action Plan 1 (Industries)

4.3.2 Action Plan - 2: Clean Energy Transition in industry

Description

The transition to clean energy is a critical step in addressing climate change and achieving carbon neutrality. While the use of renewable energy in the power sector has gained significant traction in recent years, the industrial sector remains a significant source of greenhouse gas emissions. To achieve deep decarbonization, the industrial sector must also transit to clean energy sources.

Clean energy transition in industry involves transitioning from fossil fuels to non-fossil fuel-based energy sources such as solar, wind, geothermal, and biomass. Additionally, energy efficiency measures, such as process optimization and waste heat recovery, can reduce the energy demand of industrial processes.

In the pursuit of achieving carbon neutrality, it's imperative to incorporate solar thermal technology into the industrial sector, thereby promoting a clean energy transition. While renewable energy adoption in the power sector has made significant strides, the industrial sector remains a substantial contributor to greenhouse gas emissions. To achieve deep decarbonization, it's essential for industries to shift from fossil fuels to cleaner alternatives.

In Tripura industries use coal, coke, and slate as the major primary energy supply to industries. Diesel is also used in the industry to operate diesel generators.

These conventional fuels can be replaced by alternative fuel/ thermal energy sources like Biomass as fuel / gasifier, Biogas, Bio diesel, Waste as fuel and other clean fuels

Apart from using these conventional fuels, Industries can also replace fuel with electricity considering increasing share of renewable energy in the grid. (Example: Conventional foundry using cupola furnace (fuel as coal) can be replaced with induction furnace). The term “electrification” generally used for this transition of coal/solid as a fuel to electricity.

Scope Boundary

The scope boundary recommended for promoting clean energy transition in the industrial sector is all MSME industries using conventional solid and liquid fuels.

Implementing Agency

Department of Industries & Commerce, Government of Tripura with support from Tripura State Designated Agency, Tripura State Electricity Corporation Limited (TSECL)

Current Policy/ Required Modification

Currently there are no active policies in place for the promotion of clean energy transition at state level.

Institutional Framework

The organizations involved in the industry sector's development for the state of Tripura are as follows:

- Department of Industries & Commerce, Government of Tripura
- MSME cluster associations
- Branch MSME - Development & Facilitation Office

Modification required in existing policies

To create enabling environment for advancement of ECSBC in the state the following strategies are proposed:

Moderate Scenario	Ambitious Scenario
• Biomass policy (Mandatory use of biomass in place of conventional solid fuel) • Technical & financial support towards pilot demonstration projects	• All recommendations as per moderate scenario • Market based incentive schemes • Tax Rebate for initial few years to incentivize clean energy transition

Implementation Targets:

The implementation of clean energy transition is an important aspect to mainstream energy efficiency in the state. The following targets are proposed for implementation of the action plan in the state

- Moderate Scenario: Approximately 0.5% energy consumption to be met by clean energy by FY 30-31
- Ambitious Scenario: Approximately 1% energy consumption to be met by clean energy by FY 30-31

Energy and Emission Saving Potential

Through this implementation, it is estimated that around 0.147 MTOE and 0.318 MTOE energy consumption can be reduced under moderate and ambitious scenarios respectively till FY 30-31. Around 0.460 $MtCO_2$ and 0.995 $MtCO_2$ GHG emissions can be reduced under moderate and ambitious scenarios respectively.

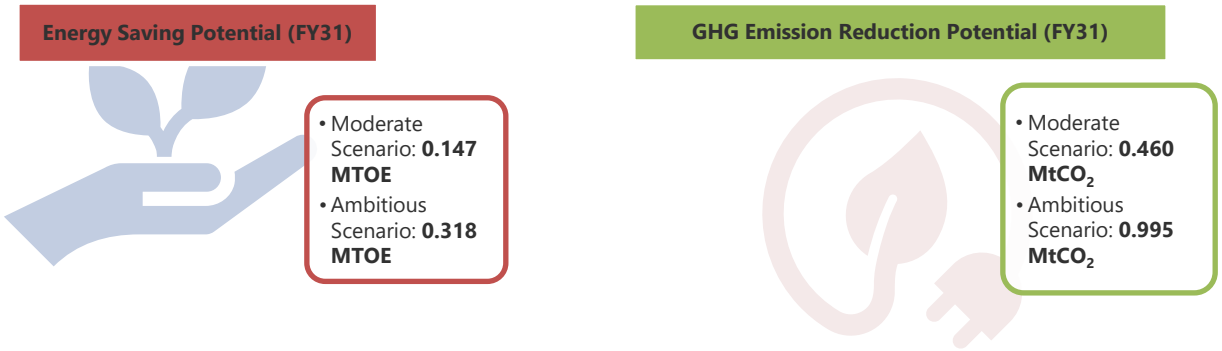


Figure 19: Energy and Emission Reduction Potential for Action Plan 2 (Industries)

4.3.3 Action Plan - 3: Implementation of ISO 50001 in Industries

Description

ISO 50001 is an international standard for energy management systems that provides a framework for organizations to manage and reduce their energy consumption and carbon footprint. The standard is designed to help organizations improve their energy performance, reduce energy costs, and demonstrate their commitment to sustainability. Implementing ISO 50001 in industries can be a powerful tool to achieve these goals.

The implementation of ISO 50001 in industries can bring a range of benefits, including reduced energy costs, improved energy efficiency, and enhanced sustainability. The standard also helps organizations to comply with environmental regulations, and to meet the expectations of customers and other stakeholders who are increasingly concerned about the environmental impact of their activities. The standard provides a framework for developing and implementing an energy management plan, which can bring a range of benefits to organizations, including cost savings, improved energy efficiency, and enhanced sustainability.

ISO 50001, the global energy management systems standard, specifies requirements for establishing, implementing, maintaining, and improving an EnMS. The standard is based upon the Plan-Do-Check-Act management system, which is familiar to many manufacturing plants that have implemented other ISO standards.

Scope Boundary

The scope boundary recommended for promoting adoption of ISO 50001 are all energy intensive industries and MSMEs

Implementing Agency

Department of Industries & Commerce, Government of Tripura with support from Tripura State Designated Agency, Tripura State Electricity Corporation Limited (TSECL)

Current Policy/ Required Modification

Currently there are no active policies in place for the promotion of adoption of ISO 50001 in industries.

Institutional Framework

The institutional framework within an organization for implementation of ISO 50001 in industries typically involves the following components:

- Energy management team
- Top management commitment
- Energy policy
- Energy performance indicators
- Energy performance monitoring and reporting
- Training and awareness
- Internal audit and management review

Modification required in existing policies

The State should develop scheme for the promotion of ISO 50001 in industries. To create enabling environment for advancement of implementation of ISO 50001 in the state the following strategies are proposed:

Moderate Scenario	Ambitious Scenario
• Policy to mandate the implementation of ISO 50001 for energy intensive industries (Above 50 kW)	• Policy to mandate the implementation of ISO 50001 for energy intensive industries (Above 20 kW)

Implementation Targets:

The implementation of ISO 50001 is an important aspect to mainstream energy efficiency in the industry sector. The following targets are proposed for implementation of the policy in the state:

- Moderate Scenario: Minimum 7-10 number of energy intensive industries can be covered by FY 30-31
- Ambitious Scenario: Minimum 15-20 number of energy intensive industries can be covered by FY 30-31

Energy and Emission Saving Potential

Through this implementation, it is estimated that around 0.101 MTOE and 0.203 MTOE energy consumption can be reduced under moderate and ambitious scenarios respectively till FY 30-31. Around 0.317 $MtCO_2$ and 0.636 $MtCO_2$ GHG emissions can be reduced under moderate and ambitious scenarios respectively.

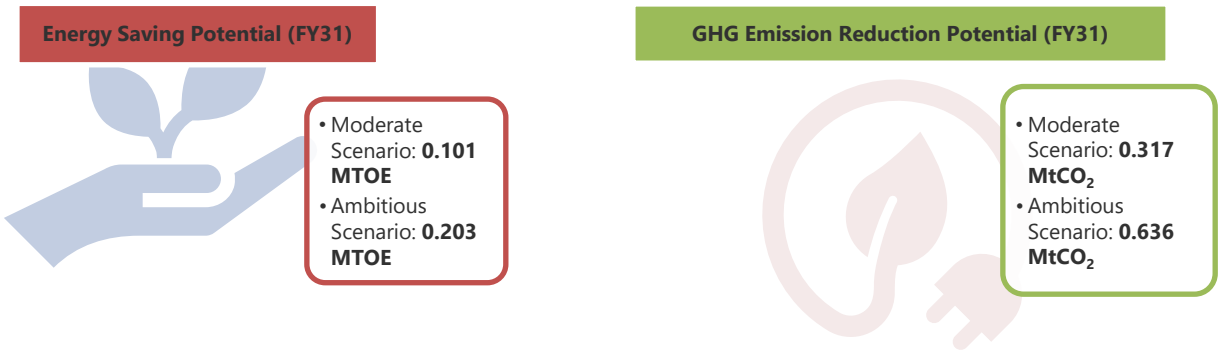


Figure 20: Energy and Emission Reduction Potential for Action Plan 3 (Industries)

4.4 Energy saving targets & monitoring mechanism

4.4.1 Industrial Sector Energy Consumption - Projections

The industrial sector is a major consumer of energy, accounting for a significant portion of states energy consumption and greenhouse gas emissions. Projections of future energy consumption in this sector are important for understanding the potential impacts of different policies and technologies aimed at reducing greenhouse gas emissions. Under a business-as-usual (BAU) scenario, industrial energy consumption is expected to continue to grow, driven by economic development and population growth. However, under a moderate (MOD) scenario, which includes some policy measures aimed at improving energy efficiency and increasing the use of clean energy sources, industrial energy consumption is projected to grow more slowly. Finally, under an ambitious (AMB) scenario, which includes more aggressive policies and technology interventions, industrial energy consumption is projected to decline, as energy efficiency measures, clean energy sources, and other low-carbon technologies are adopted aggressively. Overall, these projections suggest that significant reductions in industrial energy consumption and greenhouse gas emissions are possible but will require ambitious policy measures and technological innovation.

Based on the average energy intensity (energy per GDP), the energy consumption of the industrial sector is projected from FY 19-20 to FY 30-31. The energy consumption during FY 19-20 is 1.86 MTOE and the energy consumption is projected to be 3.04 MTOE by FY 25-26 and 4.11 MTOE by FY 30-31.

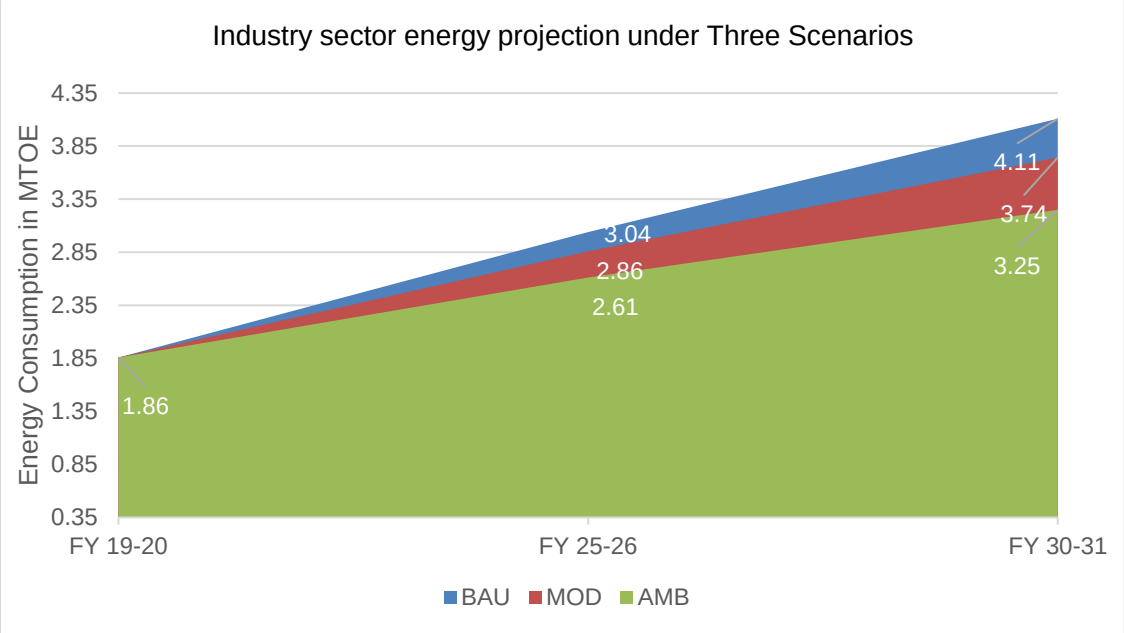


Figure 21: Energy Consumption Projections: Industry Sector

4.4.2 Monitoring Mechanism

The implementation of the action plan would require a strong monitoring and verification plan in place. While the overall ownership for monitoring the progress will lie with the SDA, due diligence and reporting needs to be done by the other stakeholders including the organizations involved in the department of Industries.

The proposed monitoring mechanism to check the advancement on the action points is presented below:

Table 10 Monitoring Mechanism for Industry Sector Interventions

Type of Monitoring	Frequency	Nodal Agencies	Responsible Agencies
Reporting, Monitoring and Review of the scheme advance and implementation status	Bi-monthly	State Designated Agencies	• Tripura State Designated Agency, Tripura State Electricity Corporation Limited (TSECL)
Review of the scheme advancement and course correction, if required.	Half-yearly	State Designated Agencies	• State Designated Agency • Department of Industries & Commerce, Government of Tripura

Review of the scheme advancement and policy interventions required	Yearly	State Designated Agencies	• State Designated Agency Department of Industries & Commerce, Government of Tripura
Progress reporting of scheme advancement	Monthly	State Designated Agency	• Bureau of Energy Efficiency

The implementation of energy efficiency action plans in the industrial sector requires monitoring mechanisms to ensure their success. Monitoring mechanisms allow for the tracking of progress towards energy efficiency goals, identification of areas that need improvement, and evaluation of the effectiveness of energy efficiency measures. Through the use of monitoring mechanisms, policymakers can identify areas of high energy consumption and implement strategies to reduce energy use. Regular monitoring can also help to identify any potential issues with the implementation of energy efficiency measures and allow for corrective action to be taken. By implementing effective monitoring mechanisms, the industrial sector can work towards achieving its energy efficiency goals, reducing energy consumption and emissions, and contributing to a sustainable future.

5 Energy Efficiency Action Plan for Focus Sector: Building

The value of reducing energy consumption in buildings has increased worldwide. Adoption of energy efficiency techniques during the construction and operation of buildings would play a crucial role in the creation of sustainable cities in the future. Energy efficiency is the use of less energy in a building to perform the same operation as buildings that consume energy inefficiently. It should be considered during the design stage, selection of construction materials, construction process, and operation of the building.

5.1 Current Scenario

The building sector comprising of residential and commercial buildings. Since the state is a popular tourist destination, many commercial establishments including hotels, restaurants, homestays, and resorts are operating in the state.

The Planning (P&C) Department, in the state plays an important role in urban and rural infrastructure development. Department was established at Tripura in the year 1973 with the main purpose of promoting planned physical development of urban and rural areas. The activities of the department have been multifarious[29]

Building sector was directly responsible for emitting (in FY20) 0.69 million tonnes of CO_2, Accounting for a 22% of state's emissions

Major Initiatives undertaken by state in building sector are as follows:

- The Tripura Energy Conservation Building Code Rules 2020(TRECBC Rules) has notified vide Notification No. F.1(35)/Power/2018/Vol-I/2831 dated 29.02.2020. The process of adoption in Building-by-laws is under progress. The Code is applicable to buildings or building complexes that have a connected load of 50 kW above or a contract demand of 60 kVA above or more are intended to be used for commercial purposes
- The Tripura government issue the memorandum vide No. F.1(35)/Power/2018/247 dated 01.06.2021 for the mandatory installation of LED based lighting and Energy Efficient 5 Star rated equipment /appliances in all new government buildings/installation.
- Draft ECO NIWAS (Energy Conservation – New Indian Way for Affordable & Sustainable homes) scheme was launched to raise awareness and make people interested in energy efficiency measures in buildings.

[29] Department of Town Planning, https://planning.tripura.gov.in/

5.2 Energy Efficiency Strategies: Buildings Sector

The strategies identified in the state for advancement of energy efficiency in the building sector is summarized below:

Table 11: Proposed energy efficiency strategies - Building Sector

Aspects	Strategic Area	
	Moderate Scenario	Ambitious Scenario
Policy intervention	• Inclusion of ECSBC code in building by laws • Mandate of new building plan sanction based on ECSBC code • Enforcement of policy for use & sale of higher star rated appliances • Market based financing mechanism for solar roof top panel installation • Notification and enforcement of ECONIWAS	• All recommendations as per moderate scenario • Market based incentive schemes for ECSBC buildings • Strict enforcement and compliance of ECSBC code and ECONIWAS • Market based incentive for higher star rated appliances • Energy efficiency rating for commercial buildings
Awareness & capacity building	• Enhance awareness of minimum set point temperature of air conditioners to 24 degrees Celsius. • Circulation of user-friendly guidelines on energy savings. • Publications of case studies on Super-ECSBC buildings on media platforms such as websites, social media	
Technology intervention	▪ Star-rated home appliances ▪ BLDC Fans ▪ Building Automation ▪ Air conditioners with permanent magnet (PM) motors ▪ Building envelope ▪ Smart Homes (Home Automation)	▪ Bi- facial Solar panels ▪ BEMS (Building energy management system) ▪ IOT for buildings ▪ Green Buildings ▪ Cool roof to reduce HVAC load ▪ Net Zero buildings ▪ Smart Homes (Home Automation)

By adopting these strategies, Tripura can reduce its greenhouse gas emissions and promote sustainable development in the building sector. In the building sector, particular attention shall be directed towards implementing energy efficiency measures in government buildings, laying the groundwork for future advancements. These measures encompass optimizing lighting systems, enhancing HVAC efficiency, improving insulation, and integrating sustainable design principles. Tripura's proactive energy efficiency efforts in government infrastructure set a lasting example for future development, aiming to minimize energy usage and environmental impact

5.3 Energy Efficiency Action Plan: Building Sector

The major areas of energy consumption in buildings are heating, ventilation, and air conditioning; lighting, major appliances (water heating, refrigerators and freezers, dryers); and a significant fraction remaining in miscellaneous areas including electronics. In each case there are opportunities both for improving the performance of system components and improving the way they are controlled as a part of integrated building systems. The building sector in Tripura is one of the key contributors to the state's total final energy consumption. Although the State Government has taken notable initiative to ensure use of efficient appliances in the state, much needs to be done for penetration of energy efficient building designs in both the commercial and domestic segment.

5.3.1 Action Plan - 1: Implementation of Energy Conservation and Sustainable Building Code

Description

The Energy Conservation Building Code (ECBC) was developed by the Government of India for new commercial buildings on 27th May 2007. The purpose of the ECBC was to provide minimum requirements for the energy-efficient design and construction of buildings and their systems. The building sector represents about 33% of electricity consumption in India, with the commercial sector and residential sector accounting for 8% and 25% respectively. Estimates based on computer simulation models indicate that ECBC-compliant buildings can use 40 to 60% less energy than conventional buildings. As per the Energy Conservation (Amendment) Bill 2022, the 'Energy Conservation Building Code (ECBC)' has been amended to 'Energy Conservation and Sustainable Building Code (ECSBC)'. This new code will provide norms for energy efficiency and conservation, use of renewable energy, and other requirements for green buildings.

Through ECSBC guidelines building, buildings can improve primarily on the followings:

- Heating, Ventilation and Air Conditioning Loads
- Lighting Loads
- Electric Power and Motors

Scope Boundary

Under the Energy Conservation Act, the energy conservation code applies to commercial buildings: (i) erected after the notification of the Code, and (ii) having a minimum connected load of 100 kilowatt (kW) or contract load of 120 kilo volt ampere (kVA). Under the Bill, the new Energy Conservation and Sustainable Building Code will also apply to the office and residential buildings meeting the above criteria. The bill empowers the state governments to lower the load thresholds.

The following scope boundary is recommended to mainstream 'Energy Conservation and Sustainable Building Code' in the state of Tripura.

- Moderate: Large new commercial buildings (Above 100 kW)
- Ambitious: Large new commercial buildings (Above 50 kW)

Implementing Agency

ECSBC has been launched by BEE at the national level and its effective implementation at state level has been mandated to the SDAs and other local bodies namely Urban Development Department (UDD) and Urban Local Bodies (ULBs).

Current Policy/ Required Modification

The proposed Tripura Energy Conservation Building Code Rules 2020 apply to buildings or building complexes with a connected load exceeding 50 kW or a contract demand of 60 kVA intended for commercial use. The implementation of the ECSBC under building bylaws is currently in progress.

Institutional Framework

The implementation of 'Energy Conservation and Sustainable Building Code' considers various institutions, the state level housing policies and schemes and nodal agency mandated by the EC Act to coordinate, regulate and enforce the EC Act in the state level. The organizations involved in the building sector's development and planning for the state of Tripura are as follows:

- Tripura Infrastructural Development Corporation Limited
- Department of Town Planning, Tripura
- Department of Urban Development and Housing, Tripura
- 'Tripura Housing Board

The various laws / enforcement which guides the housing policies, programs and schemes in state level is listed below:

- Land Acquisition, Rehabilitation and Settlement Act, (hereinafter referred as LARR Act), 2013
- Tripura (Land Settlement and Records) Act

The central government schemes which support the enforcement of ECSBC are as follows:

- Building Byelaws/Rules: Tripura Building Rules, 2017
- SmartCity Program
- PMAY: Department of Urban Development and Housing, Tripura

Modification required in existing policies

To create enabling environment for advancement of ECSBC in the state the following strategies are proposed:

Moderate Scenario	Ambitious Scenario
• Empanelment of ECSBC consultants • Development of case studies on Super-ECBC buildings	• Empanelment of ECSBC consultants • Inclusion of more building by reducing the current threshold limit of connected load from 100 kW to 50 kW

Implementation Targets:

The implementation of ECSBC is an important aspect to mainstream energy efficiency in the state. The following targets are proposed for implementation of the policy in the state:

- Moderate Scenario: ~**70-90** new buildings (Above 100 kW) can be covered under the scheme (FY31)
- Ambitious Scenario**: ~200-210** new buildings (Above 50 kW) can be covered under the scheme (FY31)

Energy and Emission Saving Potential

Through this implementation, it is estimated that around 0.003 MTOE and 0.006 MTOE energy consumption can be reduced through moderate and ambitious scenarios respectively. Around 0.047 $MtCO_2$ and 0.093 $MtCO_2$ GHG emissions can be reduced through moderate and ambitious scenarios respectively.

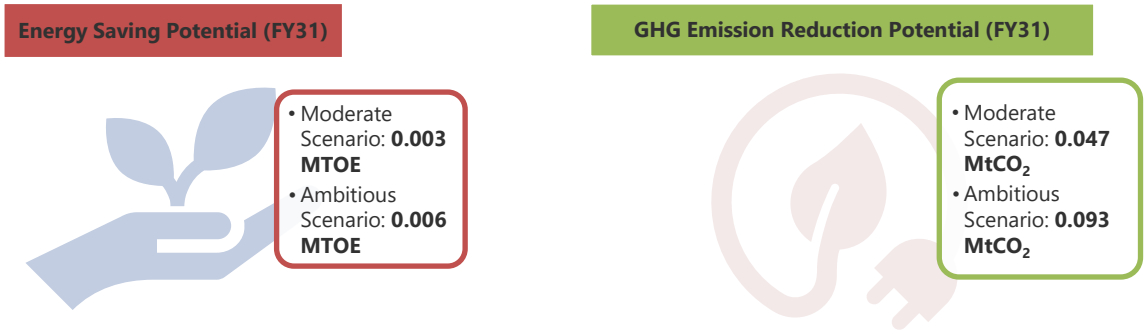


Figure 22: Energy and Emission Reduction Potential for Action Plan 1(Buildings)

5.3.2 Action Plan - 2: Mandatory sale and use of BEE star labeled (BEE S&L Program) electrical appliances in the state

Description

Standards and Labelling (S&L) scheme is a flagship initiative of Bureau of Energy Efficiency that was launched with the key objective of providing consumers an informed choice regarding the energy savings and thereby the cost-saving potential of various energy consuming appliances. This scheme prescribes minimum energy performance levels for appliances/ equipment, rated on a scale of 1 to 5 with 5 being the most energy efficient.

Scope Boundary

Presently, S&L scheme covers the star labelling program for 30 appliances, out of which 11 appliances are under mandatory regime and remaining 19 appliances are under voluntary regime. Major equipment's/appliances covered under the scheme are:

Mandatory scheme equipment's

- Frost Free Refrigerator
- Stationary Storage Type Electric Water Heater
- Color Television
- Room Air Conditioner (Variable Speed)
- TFL
- LED LAMPS
- Room Air Conditioner (Fixed Speed)
- RAC (Cassette, Floor Standing Tower, Ceiling, Corner AC)
- Distribution Transformer
- Direct Cool Refrigerator
- Ceiling Fan

Voluntary scheme equipment's

- Computer
- Domestic Gas Stove
- General Purpose Industrial Motor
- Submersible Pump Set
- Washing Machine (Semi/Top Load/Front Load)
- Ballast
- Solid State Inverter
- Office Automation Products
- Diesel Engine Driven Mono Set Pumps for Agricultural Purposes
- Diesel Generator Set
- Chillers
- Microwave Oven
- Solar Water Heater
- Deep Freezers
- Light Commercial AC Fixed Speed
- Ultra-High Definition (UHD) Televisions
- Air Compressors
- Tyres/Tires
- High Energy Li-Battery

Both Domestic & commercial building can replace existing old inefficient appliances with high star rated appliances (4 star and above)

Implementing Agency

The S&L programme was launched by BEE at the national level and its effective implementation at state level could be successfully done by the SDAs. As per Energy Conservation (Inspection) Rules, 2010, and Section 17 of the EC Act 2001, the SDA needs to appoint an inspecting officer to undertake market surveillance and check testing for ensuring proper implementation of the provisions and norms specified under the S&L programme for manufacturers.

The state DISCOM with support from Department of Power, Tripura can implement the policy to mandatory sale and use of higher star rated appliances in the state through an incentive scheme.

Current Policy/ Required Modification

The Tripura government issue the memorandum vide No. F.1(35)/Power/2018/247 dated 01.06.2021 for the mandatory installation of LED based lighting and Energy Efficient 5 Star rated equipment /appliances in all new government buildings/installation.

Institutional Framework

The implementation of 'Mandatory sale and use of higher star rated appliances' considers various institutions, the state level policies and schemes. The state level nodal agency for the implementation is Dept of power, Tripura with support from the SDA. The central government schemes which support the enforcement of mandatory use of higher star rated appliances are as follows:

- BEE star labelled program
- Procurement policy from Ministry of Finance, Department of Expenditure, for the procurement of higher star rated appliances

Modification required in existing policies

To create enabling environment for advancement of higher star labelled appliances in the state the following strategies are proposed:

Moderate Scenario	Ambitious Scenario
• Enforcement of policy for use & sale of higher star rated appliances	• Enforcement of policy for use & sale of higher star rated appliances • Inclusion of more appliances under mandatory (BEE S&L) category

Implementation Targets:

The implementation of this measure is an important aspect to mainstream energy efficiency in the state. The following targets are proposed for implementation of the policy in the state:

- Moderate Scenario: Penetration of 3 star and above star labelled appliances in 2 % buildings (FY31)
- Ambitious Scenario: Penetration of 3 star and above star labelled appliances in 4% buildings (FY31)

Energy and Emission Saving Potential

Through this implementation, it is estimated that around 0.016 MTOE and 0.032 MTOE energy consumption can be reduced through moderate and ambitious scenarios respectively. Around 0.131 $MtCO_2$ and 0.262 $MtCO_2$ GHG emissions can be reduced through moderate and ambitious scenarios respectively.

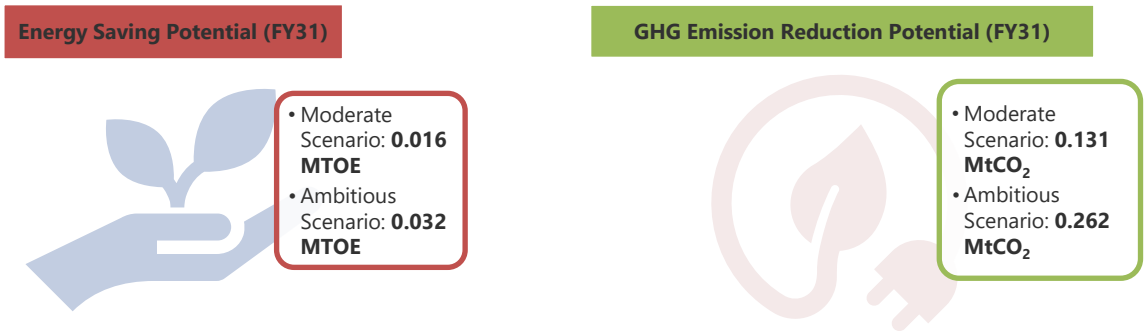


Figure 23: Energy and Emission Reduction Potential for Action Plan 2 (Buildings)

5.3.3 Action Plan - 3: Mandatory Implementation of "Energy Conservation – New Indian Way for Affordable & Sustainable homes" (ECO NIWAS) Scheme

Description

The residential-building sector in India consumes >25% of the total electricity and is the third-largest consumer of electricity. An increase of 400 % in the aggregate floor area of buildings and 20 billion m^2 of new building floor area is expected by 2030 (Satish Kumar, USAID ECO – III Project, 2011). Furthermore, due to the constant increase of Indian GDP, consumer purchasing power is predicted to grow leading to greater use of domestic appliances. Consequently, household electrical demand is expected to rise sharply in the coming decade. Out of the total electricity consumed in the building sector, about 75% is used in residential buildings

Energy Conservation Building Code – Residential (ECBC-R) (ECONIWAS) has been prepared to set minimum building envelope performance standards to limit heat gains

(for cooling dominated climates) and to limit heat loss, as well as for ensuring adequate natural ventilation and daylighting potential. Building envelope consists of walls, roof, and fenestration (openings including windows, doors, vents, etc.). Design of building envelope influences heat gain/loss, natural ventilation, and daylighting,5 which, in turn, determines indoor temperatures, thermal comfort, and sensible cooling/heating demand.

Scope Boundary

Eco Niwas Samhita applies to residential buildings and residential parts of mixed-use buildings with plot area 500 m^2 and above. However, states have the autonomy to redefine the applicability criteria for mandatory code compliance considering the locale requirements.

The following scope boundary is recommended to mainstream 'Eco Niwas' in the state of Tripura.

- Moderate scenario: Residential buildings built on a plot area of ≥ 500 m^2
- Ambitious scenario: Residential part of Mixed land-use building projects built on a plot area of ≥ 250 m^2

Implementing Agency

ECONIWAS was launched at the national level and its effective implementation at state level has been mandated to the SDAs and other local bodies namely Urban Development Department (UDD) and Urban Local Bodies (ULBs).

Current Policy/ Required Modification

Currently state is working on Draft Tripura ECO-NIWAS Samhita 2021. However, the scheme is still pending for notification in the state.

Institutional Framework

The implementation of 'ECONIWAS' considers various institutions, the state level housing policies and schemes and nodal agency mandated by the EC Act to coordinate, regulate, and enforce the EC Act in the state level. The organizations involved in the residential building sector's development and planning for the state of Tripura are as follows:

- Tripura Housing Board
- Tripura Infrastructural Development Corporation Limited
- Department of Urban Development and Housing, Tripura

The various laws / enforcement which guides the housing policies, programs and schemes in state level is listed below:

- Land Acquisition, Rehabilitation and Settlement Act, (hereinafter referred as LARR Act), 2013

- Tripura (Land Settlement and Records) Act

Modification required in existing policies

To create enabling environment for advancement of ECONIWAS in the state the following strategies are proposed:

Moderate Scenario	Ambitious Scenario
• Notification and enforcement of ECONIWAS	• Notification and enforcement of ECONIWAS • Lowering the threshold limit to 250 m^2 plot area

Implementation Targets:

The implementation of ECONIWAS is an important aspect to mainstream energy efficiency in the state. The following targets are proposed for implementation of the policy in the state:

- Moderate Scenario: ~**6700** new buildings (Above 500 m^2 Plot area kW) can be covered under the scheme (FY31)
- Ambitious Scenario**: ~13000** new buildings (Above 250 m^2 Plot area) can be covered under the scheme (FY31)

Energy and Emission Saving Potential

Through this implementation, it is estimated that around 0.004 MTOE and 0.005 MTOE energy consumption can be reduced through moderate and ambitious scenarios respectively. Around 0.032 $MtCO_2$ and 0.043 $MtCO_2$ GHG emissions can be reduced through moderate and ambitious scenarios respectively.

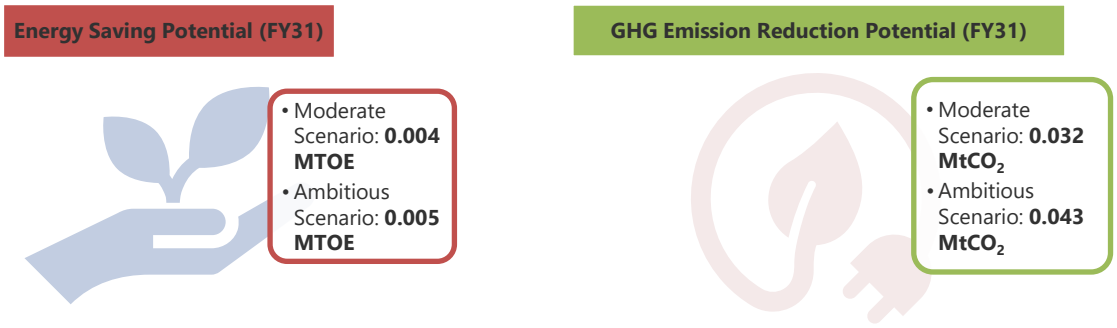


Figure 24: Energy and Emission Reduction Potential for Action Plan 3 (Buildings)

5.3.4 Action Plan 4: Behavioral change

Description

Individuals and households can adopt a variety of measures to optimize their energy consumption. Changes in our everyday habits can help to reduce home energy bills, lower carbon emissions and ease pressure on the power grid. Residential energy demand can be further reduced through “structural” investments, including upgrades to more energy-efficient appliances and retrofits to existing household equipment. Appropriate policy interventions and programmes can be designed to promote sustainable changes in behavior and encourage investments in structural improvements.

Behavioral interventions are policies and programmes designed to incorporate the insights of scientists who study human behavior. The aim of these interventions is to trigger socially desirable behaviors – either by removing barriers to such behaviors, or by creating disincentives to socially damaging ones

Scope Boundary

The action plan encompasses the entire community of consumers both from residential and commercial building sector.

Implementing Agency

The action plan involves changing the perspective domestic and commercial building consumers on building energy efficiency through higher level of awareness programs. The plan can be implemented through a series of awareness campaigns, road shows and digital media campaign in the state. The plan needs to be jointly executed by the SDA and the Department of Housing & Urban Development in the state.

Current Policy/ Required Modification

Currently there is no policy available to promote Behavioral change

Institutional Framework

The implementation of structured campaigns to bring in behavioral change considers various institutions, the state level housing policies and schemes and nodal agency mandated by the EC Act to coordinate, regulate, and enforce the EC Act in the state level. The organizations involved in the building sector’s development and planning for the state of Tripura are as follows:

- Tripura Housing Board
- Tripura Infrastructural Development Corporation Limited

Department of Urban Development and Housing, Tripura

Modification required in existing policies

To create enabling environment for advancement of the policy in the state the following strategies are proposed:

Moderate Scenario	Ambitious Scenario
• Policy to develop higher level of building energy efficiency knowledge to domestic and commercial consumers	• Policy to develop higher level of building energy efficiency knowledge to domestic and commercial consumers • Development of software tool/app for "Home Energy Report" to understand the home energy consumption pattern

Implementation Targets:

The following targets are proposed for implementation of the policy in the state:

- Moderate Scenario: Minimum 1% energy savings can be achieved (FY31)
- Ambitious Scenario**:** Minimum 2% energy savings can be achieved (FY31)

Energy and Emission Saving Potential

Through this implementation, it is estimated that around 0.004 MTOE and 0.008 MTOE energy consumption can be reduced through moderate and ambitious scenarios respectively. Around 0.032 $MtCO_2$ and 0.064 $MtCO_2$ GHG emissions can be reduced through moderate and ambitious scenarios respectively.

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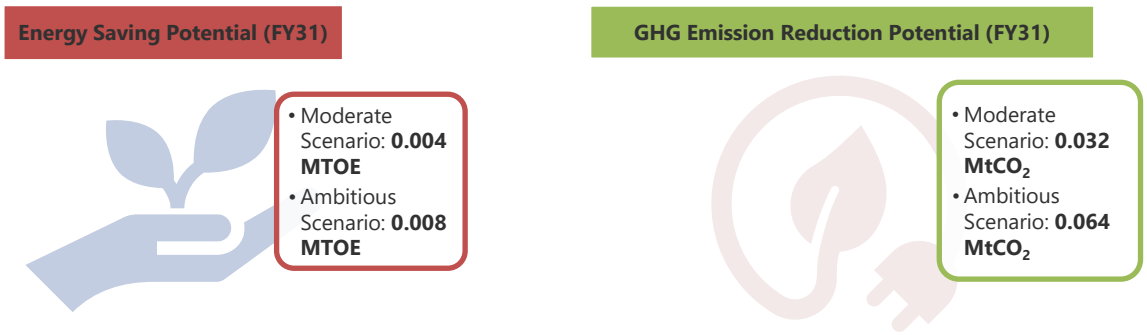


Figure 25: Energy and Emission Reduction Potential for Action Plan 4 (Buildings)

5.4 Energy Saving Targets & Monitoring Mechanism

5.4.1 Building Sector Energy Consumption - Projections

The building sector is a major consumer of energy, accounting for a significant portion of states energy consumption and greenhouse gas emissions. Projections of future energy consumption in this sector are important for understanding the potential impacts of different policies and technologies aimed at reducing greenhouse gas

emissions. Under a business-as-usual (BAU) scenario, building energy consumption is expected to continue to grow, driven by economic development and population growth. However, under a moderate (MOD) scenario, which includes some policy measures aimed at improving building energy efficiency, penetration of 'Energy Conservation and Sustainable Building Code' and 'ECONIWAS' and increasing penetration of higher rated appliance, building energy consumption is projected to grow more slowly. Finally, under an ambitious (AMB) scenario, which includes more aggressive policies and technology interventions, higher penetration of 'Energy Conservation and Sustainable Building Code' and 'ECONIWAS' through decrease in the threshold limit and increasing penetration of higher rated appliance Overall, these projections suggest that significant reductions in building energy consumption and greenhouse gas emissions are possible but will require ambitious policy measures and stricter enforcement.

Based on the average energy intensity (energy per GDP), the energy consumption of the building sector is projected from FY 19-20 to FY 30-31. The energy consumption during FY 19-20 is 0.12 MTOE and the energy consumption is projected to be 0.24 MTOE by FY 25-26 and 0.39 MTOE by FY 30-31.

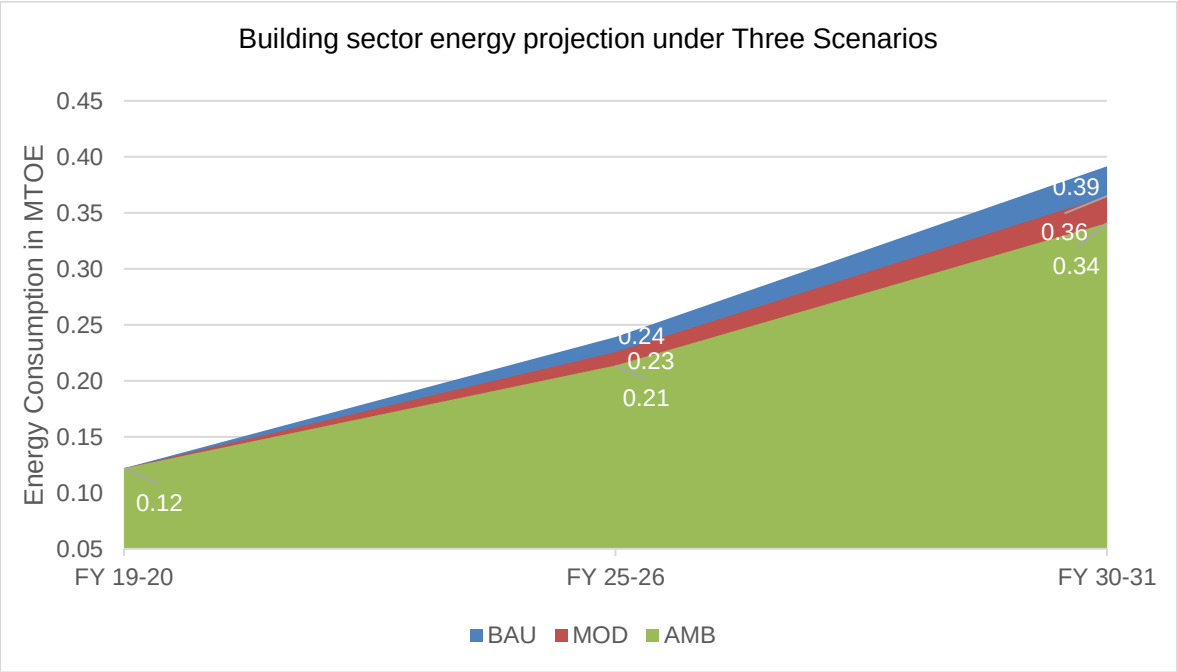


Figure 26: Energy Consumption Projections: Building Sector

5.4.2 Monitoring Mechanism

The implementation of the action plan would require a strong monitoring and verification plan in place. While the overall ownership for monitoring the progress will lie with the SDA, due diligence and reporting needs to be done by the other stakeholders including the organizations involved in the building sector's development

and planning. The proposed monitoring mechanism to check the advancement on the scheme is presented below:

Table 12: Monitoring Mechanism for Building Energy Efficiency Action Plan

Type of Monitoring	Frequency	Nodal Agencies	Responsible Agencies
Reporting, Monitoring and Review of the scheme advance and implementation status	Bi-monthly	State Designated Agencies	• Tripura Infrastructural Development Corporation Limited • Department of Town Planning, Tripura • Department of Urban Development and Housing, Tripura • 'Tripura Housing Board
Review of the scheme advancement and course correction, if required.	Half-yearly	Dept. of Urban Development & Housing. Govt. of Tripura	• State Designated Agency • Tripura Infrastructural Development Corporation Limited • Department of Town Planning, Tripura • Department of Urban Development and Housing, Tripura • 'Tripura Housing Board
Review of the scheme advancement and policy interventions required	Yearly	Dept. of Urban Development & Housing. Govt. of Tripura	• State Designated Agency
Progress reporting of scheme advancement	Monthly	State Designated Agency (through the ECSBC Cell)	• Bureau of Energy Efficiency

In conclusion, monitoring mechanisms are essential for the successful implementation of energy efficiency action plans in the building sector. These mechanisms provide a way to track progress towards energy efficiency goals, identify areas that need improvement, and evaluate the effectiveness of energy efficiency measures. Regular monitoring can help to identify areas where energy consumption is higher than expected, allowing for corrective action to be taken. Moreover, monitoring mechanisms can also help to identify patterns and trends in energy consumption,

allowing policymakers to develop effective energy efficiency strategies. Overall, effective monitoring mechanisms are crucial for achieving energy efficiency goals in the building sector and reducing energy consumption, which in turn can lead to cost savings, improved comfort, and environmental benefits.

6 Energy Efficiency Action Plan for Focus Sector: Transport

Transport sector is the largest user of oil – nearly half of the total consumption and is poised to make India's oil security even more precarious. Enhancing efficiency of transportation sources can improve energy independence and economic and functional resilience in the transportation sector while reducing greenhouse gas and other emissions Energy efficiency in the sector can be achieved through transition to E-mobility, enhanced use of public transport and increased awareness about energy efficient practices.

6.1 Current Scenario

Tripura, located in Northeast India, is a state that faces several challenges in the transport sector. With a hilly and mountainous terrain, the state has limited road connectivity and transportation infrastructure, making it difficult for people to travel between different regions of the state.

Road transport is the most popular mode of transport in Tripura. The state has a road network of approximately 12,000 km, with National Highways connecting it to other parts of India. The National Highway 8 connects Tripura to the rest of India through Assam. The state also has many state highways, district roads, and rural roads connecting it to various towns and villages within the state.

Despite these challenges, the state government has made efforts to improve transportation infrastructure and services in recent years. One of the key initiatives has been the introduction draft EV Policy, which will help to reduce air pollution and improve energy efficiency. The government has also worked to improve public transport in the state by introducing more buses and improving the efficiency of existing ones.

Tripura is mainly dependent on roadways for transportation. Buses are the primary modes of public communication in Tripura. The Department is also involved for up keeping of the existing infrastructure mainly roads and bridges within its jurisdiction in the State. Meanwhile, in Tripura, over 12,000 vehicles including around 8,000 private cars and 3,800 auto-rickshaws are run by the Compressed Natural Gas (CNG), provided by the state-owned Tripura Natural Gas Company Limited (TNGCL). The CNG is cheaper than petrol and diesel and entirely pollution free. The TNGCL, a joint venture between GAIL (India) Ltd, Tripura Industrial Development Corporation Ltd, and Assam Gas Company Ltd, is the first to set up CNG in 1990 in entire eastern India.

The state government has made significant strides in enhancing transportation infrastructure and services. Notably, Tripura has implemented a progressive 3-wheeler registration policy, permitted only CNG-based and electric vehicles while prohibited diesel and petrol-operated ones. Moreover, the introduction of the draft EV Policy

underscores the government's commitment to combatting air pollution and promoting energy efficiency.

Table 13: Present Road scenario in 2020-21 in the State:[30]

S No.	Category	Length (in km.)
i)	National Highway	853
ii)	State Highway	1057
iii)	Major District Road	0
iv)	Other District Road	461
v)	Village Roads (RD & ADC)	8,159 (P)
vi)	Village-Roads (PWD)	12,428
vii)	IBB Roads	834 (P)

The number of registered motor vehicles were 60,480 in the year 2018 and 46,232 in the year 2021. The year-wise trends for the number of registered vehicles are discussed below.

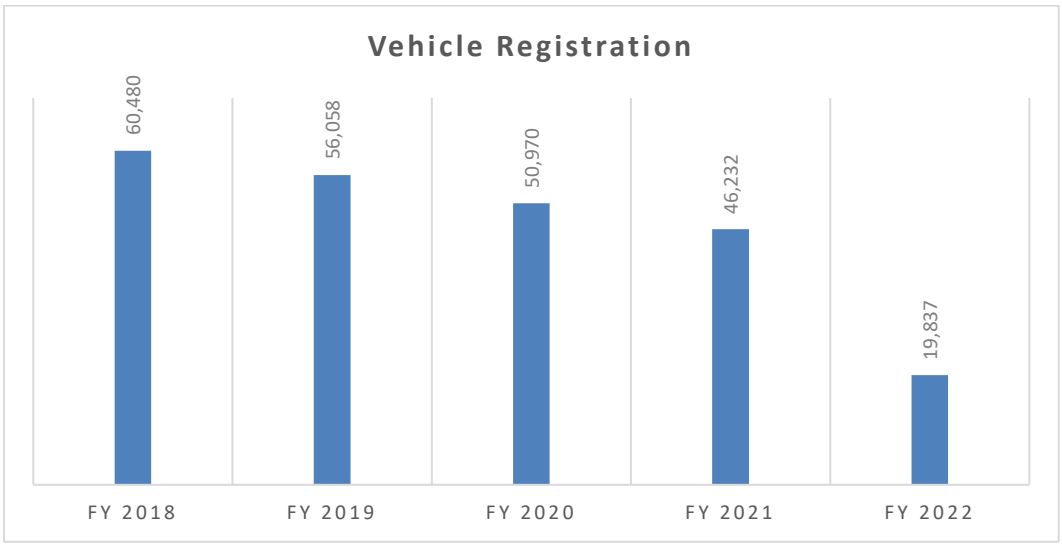


Figure 27: Number of registered motor Vehicles[31]

The state has developed an EV policy, “Tripura Electric Vehicle Policy, 2022” which aims to convert at least 42,000 two-wheelers, 10,000 three-wheelers, 7,500. the government has targeted to convert 10 percent of these 60,000 vehicles into electrically driven in the next five years.

In conclusion, while the state government has made some efforts to improve transportation infrastructure and services in Tripura, there is still a long way to go to achieve significant improvements in the sector. More concerted efforts are needed to

[30] eco-review-2020-21.pdf (tripura.gov.in) - PWD (R&B), Tripura
[31] VAHAN SEWA| DASHBOARD (parivahan.gov.in)

improve road connectivity, promote sustainable transportation systems, and address environmental challenges.

6.2 Proposed Energy Efficiency Strategies

Improving energy efficiency in the transport sector is essential to reduce greenhouse gas emissions and promote sustainable development. This section describes the various strategies that could be adopted by the state government and stakeholders to promote sustainable development in the transport sector, including promoting the use of electric and hybrid vehicles, developing public transport infrastructure, encouraging cycling and walking, improving fuel efficiency, adopting clean fuels, and implementing regulations and standards.

The strategies identified in the state for advancement of energy efficiency under MOD & AMB scenarios in the transport sector is summarized below:

Table 14: Proposed energy efficiency strategies - Transport Sector

Aspects	Strategic Area	
	Moderate Scenario	Ambitious Scenario
Policy intervention	• Notification of state EV policy • Converting existing conventional fuel stations to EV charging stations • Infrastructure development for EV charging stations through public DISCOMs, PSUs and private sector • Incentive schemes for consumers to promote quick transition to EVs. • Production-linked incentive (PLI) Scheme • Public Transport and low energy modes • Improving fuel efficiency	• Deeper penetration/ implementations of all recommendations as per moderate scenario • Market based implementation strategy for bulk procurement and implementation of EV charging stations • Transition of government owned conventional fuel-based vehicle fleet to Electric Vehicles • Higher penetration of EV buses as per public transport promotion strategy
Awareness & capacity building	• Awareness workshops for promotion of EV	

	• Awareness workshop for public sector for innovative procurement strategy • Awareness on Energy Efficiency Program on High Energy Lithium-Ion Traction Battery Packs and Systems	
Technology intervention	• Maintaining EV charging station in every 50 km distance • Charging stations based on open-access • Ethanol blending in petrol • Adoption of latest technology upgradation (Hybrid vehicles)	• Deeper penetration/ implementations of all recommendations as per moderate scenario • Pilot projects on Battery Swapping and Battery-as-a-Service • Post-mounted EV charger • Fast charging stations • Renewable energy-based EV charging station • Retrofit of IC to EV vehicle

By adopting these strategies, Tripura can reduce its greenhouse gas emissions and promote sustainable development in the transport sector.

6.3 Energy Efficiency Action Plan

6.3.1 Action Plan - 1: Infrastructure development for EV charging stations & Incentive schemes for consumers to promote quick transition

Description

Electric mobility is a rapidly growing trend in the transportation sector, driven by concerns over climate change, energy security, and urban air pollution. With the increasing availability and affordability of electric vehicles (EVs), many countries and regions around the world are adopting policies and initiatives to promote the transition towards electric mobility.

According to report published by IEA there were 10 million electric cars on the world's roads at the end of 2020, following a decade of rapid growth. Electric bus and truck registrations also expanded in major markets, reaching global stocks of 600 000 and 31 000 respectively.

The state has developed an EV policy, "Tripura Electric Vehicle Policy, 2022, which aims to convert at least 42,000 two-wheelers, 10,000 three-wheelers, 7,500 four-wheelers and 500 buses into electrically operated vehicles by 2027.

Scope Boundary

The policy could be designed/modified to cover specific types of EVs, such as battery electric vehicles, plug-in hybrid electric vehicles, or fuel cell electric vehicles. The proposed scope boundary for this action plan should include considerable percentage of all new vehicle registrations in the state which can potentially be EVs.

Implementing Agency

Currently The Tripura State Designated Agency, Tripura State Electricity Corporation Limited (TSECL) is promoting the use of electric vehicles (EVs) in the state. State Transport Department could play a crucial role in aggregating the demand for EVs at state level. The department could be the nodal department to monitor the demand and uptake of vehicles across state and could also extend their support to other state departments in hiring and leasing of EVs.

Current Policy/ Modification required

The Tripura Electric Vehicle Policy 2022 has been developed, However, for the policy can be modified for a faster transition to EVs.

Institutional Framework

The implementation of this energy saving action point considers various institutions, the state level EV policies and schemes. The organizations involved in the EV development and planning for the state of Tripura are as follows:

- Tripura State Designated Agency, Tripura State Electricity Corporation Limited (TSECL)
- Energy department, DISCOMs
- Transport department
- Municipal corporations (public parking facilities)

The various laws / enforcement which guides the policies, programs and schemes in national level is listed below:

- Faster Adoption and Manufacturing of (Hybrid and) Electric Vehicles (FAME)
- National Electric Mobility Mission Plan (NEMMP)
- National Mission on Transformative Mobility and Storage

Modification required in existing policies

To create enabling environment for higher EV penetration in the state, the following strategies are proposed:

Moderate Scenario	Ambitious Scenario
• Notification of state EV policy • Converting existing conventional fuel stations to EV charging stations • Infrastructure development for EV charging stations through public DISCOMs, PSUs and private sector • Incentive for early adoption of electric vehicle	• Deeper penetration of all recommendations as per moderate scenario • Market based implementation strategy for bulk procurement and implementation of EV charging stations

Implementation Targets:

The following targets are proposed for implementation of the action plan in the state:

- Moderate Scenario: **8%** sales of total new (All light duty vehicles and heavy-duty passenger vehicles (Buses)) registered vehicles should be EV by FY30-31
- Ambitious Scenario: **15%** sales of total new registered vehicles should be EV (All light duty vehicles and heavy-duty passenger vehicles (Buses)) by FY30-31

Energy and Emission Saving Potential

Through this implementation, it is estimated that around 0.011 MTOE and 0.026 MTOE energy consumption can be reduced through moderate and ambitious

scenarios respectively. Around 0.035 $MtCO_2$ and 0.080 $MtCO_2$ GHG emissions can be reduced through moderate and ambitious scenarios respectively.

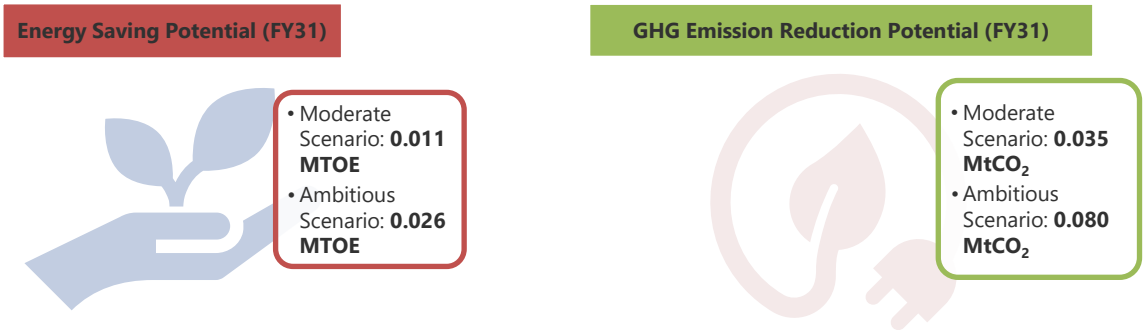


Figure 28: Energy and Emission Saving Potential for Action Plan 1 (Transport)

6.3.2 Action Plan - 2: Promotion of public transport through awareness and providing better infrastructure in public transport

Description

As per the 2011 Census, 36% Indians either walk or cycle to work while 30% live in close proximity of their workplace and do not need to travel. Additionally, 18% use public transport and the balance 16% use personal vehicles to travel to work — 3% by car and 13% use two-wheelers. The need for promoting public transport through awareness and providing better infrastructure in the state is critical to address the challenges of traffic congestion, air pollution, and energy consumption. Increasing the use of public transport will not only improve the overall efficiency of the transport sector but also help to reduce the carbon footprint and enhance sustainability.

The experience of using public transport depends on convenience, comfort, safety, and affordability which is directly proportional to the adequacy of the transport system. Promoting public transport is a keyway to reduce transport fuel and related emission.

To reduce emissions from private cars, more must be done to promote safe public transport and encourage its use,

- Improve bus frequency: Riders want the assurance that their bus will arrive soon, preferably in less than 15 minutes.
- Improve bus ticketing systems: Streamlined ticketing systems are essential for transportation efficiency
- Increase passenger comfort and safety: Safety and comfort have always been a concern for transit riders, and a post-pandemic public will have to be convinced that it is safe to return

Scope

The scope boundary recommended for public transport through awareness and providing better infrastructure in public transport should include commuters, businesses, local governments, and other stakeholders with aim to create awareness among the target audience about the benefits of public transport and encourage them to use it.

Implementing Agency

State Transport Department & local government departments could play a crucial role in promoting the use of public transport by generating awareness and sensitizing public about the advantages associated with the use of public transport through awareness generation workshops and providing better infrastructure for this sector at state level.

Current Policy/ Modification required

Currently there are no active policies in place for the promotion of public transport through awareness and providing better infrastructure in public transport.

Institutional Framework

The organizations involved in the transport sector's development and planning for the state of Tripura are as follows:

- Transport Department
- Public Works Department
- Finance Department

Modification required in existing policies

The State should develop scheme for the promotion of public transport through awareness and providing better infrastructure in public transport. To create enabling environment for awareness in the state the following strategies are proposed

Moderate Scenario	Ambitious Scenario
• Procurement of EV buses as per public transport promotion strategy • Policy for promotion of carpooling, sharing taxis, and use of cycles	• Higher penetration of EV buses as per public transport promotion strategy • Transition of government owned conventional fuel-based vehicle fleet to Electric Vehicles

Implementation Targets:

The following targets are proposed for implementation of the action plan in the state:

- Moderate Scenario: Introduction of **~5-10** new EV buses for public transport by FY31
- Ambitious Scenario: **~10-20 buses** of EV buses in public transport by FY31

Energy and Emission Saving Potential

Through this implementation, it is estimated that around 0.00005 MTOE and 0.0001 MTOE energy consumption can be reduced through moderate and ambitious scenarios respectively. Around 0.0001 $MtCO_2$ and 0.0002 $MtCO_2$ GHG emissions can be reduced through moderate and ambitious scenarios respectively.

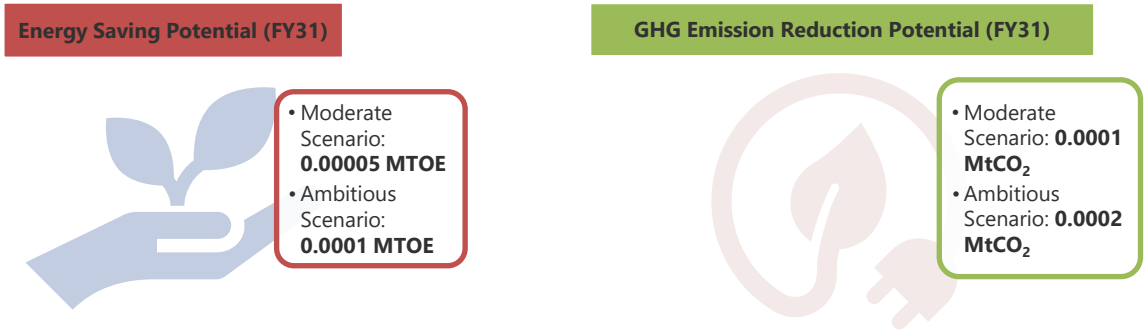


Figure 29: Energy and Emission Saving Potential for Action Plan 2 (Transport)

6.4 Energy Saving Targets & Monitoring Mechanism

6.4.1 Transport Sector Energy Consumption - Projections

Transportation is a critical aspect of modern society, connecting people, goods, and services across vast distances. Demand for transportation is projected to increase, along with energy consumption and carbon emissions. Therefore, it is essential to understand and project future energy consumption trends in the transport sector to develop effective strategies and policies to mitigate the environmental impact. This section will analyze the projections of energy consumption in the transport sector, with a particular focus on the factors driving the increase in energy consumption, the impact on greenhouse gas emissions, and potential solutions to reduce energy consumption and improve sustainability.

Below figure illustrates the projection of the energy consumption of the transport sector from FY 19-20 to FY 30-31. The energy consumption during FY19- 20 is 0.16 MTOE

and the energy consumption is projected to be 0.34 MTOE by FY25- 26 and 0.58 MTOE by FY30-31.

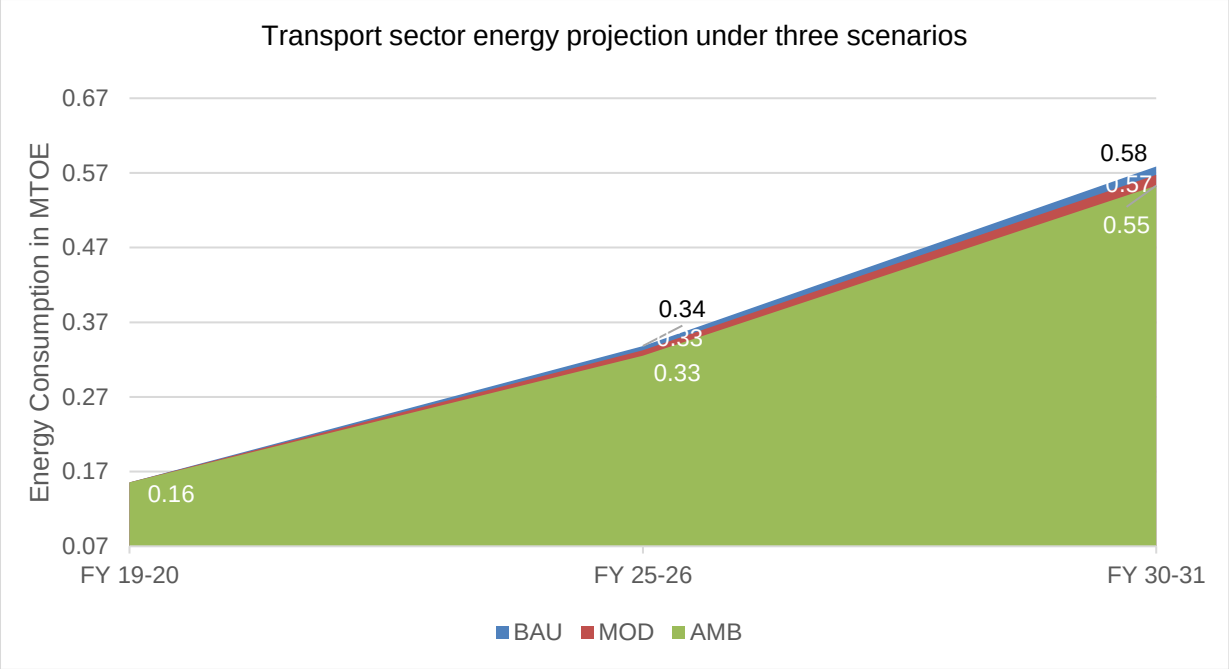


Figure 30 Energy Consumption Projections: Transport Sector

6.4.2 Monitoring Mechanism

The implementation of the action plan would require a strong monitoring and verification plan in place. While the overall ownership for monitoring the progress will lie with the SDA, due diligence and reporting needs to be done by the other stakeholders including the organizations involved in the building sector's development and planning. The proposed monitoring mechanism to check the advancement on the scheme is presented below:

Type of Monitoring	Frequency	Nodal Agencies	Responsible Agencies
Reporting, Monitoring and Review of the scheme advance and implementation status	Bi-monthly	SDA, TSECL & Department of Transport	• Tripura transport department
Review of the scheme advancement and	Half-yearly	SDA, TSECL & Department of Transport	• State Designated Agency • Tripura transport department

course correction, if required.			
Review of the scheme advancement and policy interventions required	Yearly	SDA, TSECL & Department of Transport	• State Designated Agency • Bureau of energy efficiency • Tripura transport department
Progress reporting of scheme advancement	Monthly	SDA, TSECL & Department of Transport	• State Designated Agency

In conclusion, monitoring mechanisms play a crucial role in ensuring the successful implementation of energy efficiency action plans in the transport sector. They provide a means to track progress towards energy efficiency goals, identify areas for improvement, and evaluate the effectiveness of energy efficiency measures. Regular monitoring helps policymakers to take corrective actions and make necessary adjustments to achieve energy efficiency targets. Therefore, it is important to establish a robust monitoring system that can provide reliable data and information to support decision-making processes and achieve sustainable energy goals.

7. Energy Efficiency Market Potential

Energy efficiency measures typically require significant upfront investments, but these investments can lead to long-term cost savings and environmental benefits. Investment in energy efficiency can lead to environmental, economic, and social benefits. However, to achieve these benefits, adequate investment is needed in various sectors. Governments, private sector, and international organizations all have a role to play in promoting investment in energy efficiency.

India, as one of the world's fastest-growing economies, has a growing demand for energy. This demand is expected to continue increasing in the future, as the country's population and economy continue to grow. However, with the increasing demand for energy, there is also an urgent need to improve energy efficiency to reduce greenhouse gas emissions and mitigate the impact of climate change.

Investing in energy efficiency measures in the states/UTs can have several benefits. First, it can help to reduce energy bills for consumers, which can lead to cost savings for both households and businesses. Second, it can help to create jobs in the energy efficiency sector, which can provide economic benefits to the states. Third, it can help to reduce the country's reliance on fossil fuels, which can have environmental benefits and help to mitigate the impact of climate change. Fourth, it can improve energy security by reducing reliance on fossil fuels.

To realize the potential of energy efficiency in the states of India, there is a need for significant investment. This investment can come from both public and private sources. Public investment can come from the government, which can provide incentives and subsidies for energy efficiency measures. Private investment can come from companies that provide energy efficiency services, such as energy audits, retrofits, and renewable energy installations.

Below table show the estimated market potential for implementation of identified energy efficiency action plans in different sectors:

Table 15: Energy Efficiency Market Potential[33]

Sector	Energy Savings (MTOE) – FY 30-31				Market Potential (₹ Crore)	
	Moderate		Ambitious			
	MTOE Savings	% Savings	MTOE Savings	% Savings	Moderate	Ambitious
Industry	0.37	**8.9**	0.86	**20.9**	1973	4636
Buildings	0.03	**6.8**	0.05	**12.9**	144	274
Transport	0.01	**1.9**	0.03	**4.4**	60	139

[33] Please refer to the annexure 1 of chapter 10 (Point 9)

Total	**0.40**	**7.8**	**0.93**	**18.2**	**2177**	**5048**

There are several challenges to investing in energy efficiency projects. One challenge is the lack of awareness and information about the benefits of energy efficiency measures. Another challenge is the lack of financing options for energy efficiency projects, especially for small and medium-sized enterprises. Additionally, there is a need for capacity building and training on energy efficiency for Bankers/FIs.

Despite these challenges, the investment potential for energy efficiency action plan implementation in the states is significant. By unlocking this potential, India can achieve its energy efficiency targets, reduce greenhouse gas emissions, and mitigate the impact of climate change. Additionally, investment in energy efficiency can lead to cost savings, job creation, and economic development, which can benefit the states and the country.

A list of the financial instruments available for financing energy efficiency in the state has been listed in ***Annexure 4.***

8 Way Forward

The "State Energy Efficiency Action Plan (SEEAP)" draws a strategic plan towards advancement of energy efficiency in the state level. The combined efforts of the state and the central government through execution of these strategies can help the country achieve its long-term climate commitments. One of the important steps in the process of estimating energy savings goals is to predict energy consumption under different scenarios. Three scenarios have been established for estimating energy savings goals i.e., Scenario 1: Business as Usual, Scenario 2: Moderate and Scenario 3: Ambitious.

To achieve the energy saving goals, a comprehensive approach is required that includes government policies, regulations, standards, and incentives, as well as education and awareness campaigns. The effective execution of the plan calls for effective utilization of financial and human resources, devising innovative business models, leveraging financing, and supporting technology interventions across clusters. The private sector plays a key role in the advancement of energy efficiency considering the market dynamics of rapidly declining costs of clean and efficient energy technologies and services, and the development of innovative new business delivery models. Comprehensive approaches combine different strategies to mobilize private sector investment and know-how, and to encourage technology transfer that will help drive the energy efficiency advancement.

The effective execution of the SEEAP calls for a strong institutional set-up in the state level along with active coordination between different government departments and the private sector. While the SDA has been mandated by the EC Act to implement and monitor the provisions of the act, it is important that other stakeholder departments and the private sector bodies are roped in to jointly execute the plan. Access to finance is also an important aspect which requires systematic planning and execution.

Some of the pre-requisites to effectively plan and execute the provisions of the SEEAP has been summarized below:

Table 16: Way Forward for Implementation of SEEAP

Strategy	Actionable Instruments	Timeline
Strengthening Institutional set-up for execution of the plan	Evaluation and strengthening the capacity of the State Designated Agency (SDA)	Short Term
	Setting up of state empowered committee on energy efficiency for effective inter-departmental communication	Short Term

	Creating a network of communication between the focus sector departments and stakeholders	Short Term
Capacity Building of stakeholders	Leading capacity building programs for different sets of stakeholders in the focus sectors	Medium Term
	Dissemination of information about SEEAP among the focus sector stakeholders	Short Term
Policy Advocacy	Evaluation of policies to support execution of strategies	Short to Long Term
	Coordination with center for execution of state specific policies	Short to Long Term
	Strategic policy advocacy	Short to Long Term
Creating Enabling Environment	Creating resource pool of consultants, domain experts, technology suppliers and energy auditors in the state	Short to Medium Term
	Capacity building of state level stakeholders for procurement, legal and execution departments	Short to Medium Term
	Exposure to policies and schemes from other states/UTs/Centre	Short to Long Term
Access to Finance	Coordination for state budget earmark for energy efficiency	Short to Medium Term
	Mobilizing funds / programs for advancing EE in different sector	Short to Long Term
	Mobilizing programs around energy efficiency with support from international agencies / donor agencies	Short to Long Term
Monitoring & Evaluation	Drafting and execution of a robust M&E plan	Short Term
	Baseline and Impact Analysis of Interventions	Short to Long Term

Tripura is a state in India that is blessed with a diverse range of natural resources, including hydropower, wind, and solar energy. The state has great potential for energy efficiency and implementing state energy efficiency action plans can help to unlock this potential. To move forward, Tripura needs to prioritize energy efficiency and develop a comprehensive action plan that includes specific targets, timelines, and

strategies. The action plan should also consider the unique challenges faced by the state, such as its mountainous terrain, remote communities, and limited infrastructure.

The state government should work with stakeholders, including local communities, industry associations, and energy efficiency experts, to develop and implement the action plan. In addition, the government should provide incentives and support to promote energy efficiency measures, such as energy audits, retrofits, and renewable energy installations. With the right policies and investments, Tripura can achieve its energy efficiency targets, reduce energy bills for consumers, create jobs, and contribute to the global effort to mitigate climate change.

9 References

- BEE, Ministry of Power, “Roadmap of Sustainable and Holistic Approach to National Energy Efficiency”, 2019, https://beeindia.gov.in/sites/default/files/Roshanee_print%20version%282%29.pdf
- Bureau of Energy Efficiency (BEE), “Unlocking National Energy Efficiency Potential – UNNATEE, Strategy plan towards developing an energy efficient nation (2017-2031)”,2019, https://beeindia.gov.in/sites/default/files/UNNATEE_0.pdf
- Bureau of Energy Efficiency, “Unlocking National Energy Efficiency Potential (UNNATEE)”, 2019, https://beeindia.gov.in/sites/default/files/UNNATEE%20Final%20Report.pdf
- Central Electricity Authority, "All India Electricity Statistics (2019-2020)", 2021, https://cea.nic.in/wp-content/uploads/general/2020/General_Review_2021.pdf
- Central Electricity Authority, "CEA Annual Report (2020-2021)", 2021, https://cea.nic.in/wp-content/uploads/annual_reports/2021/CEAAnnualReport_final.pdf
- Central Electricity Authority, “Dashboard”, 2022, https://cea.nic.in/dashboard/?lang=en
- Department of Town Planning, Tripura, https://planning.tripura.gov.in/
- Economic Review of Tripura 2020-21, https://ecostat.tripura.gov.in/sites/default/files/Eco-Review-2020-21.pdf
- Government Of India - Ministry of Road Transport & Highways, Parivahan Sewa "Vahan Dashboard", 2022, https://vahan.parivahan.gov.in/vahan4dashboard/
- MNRE Annual Report, https://mnre.gov.in/knowledge-center/publication
- Department of Industry, Tripura_ (Offline Documents)
- Udyam Registration Publication, https://www.dcmsme.gov.in/UDYAM_Publication_with_tables_final20220622.pdf
- MSME dashboard, “District Wise Udyog Aadhaar Registration Details”, 2023, https://dashboard.msme.gov.in/uam_dist_wise.aspx?stid=17
-
- Mohua Report 2020-21, https://mohua.gov.in/upload/uploadfiles/files/Annual_Report_2020_21_MoHUA_EnglishVersion%20(Final).pdf
- Govt. of Tripura, “Power for All: Tripura”, https://powermin.gov.in/sites/default/files/uploads/Tripura_MoU.pdf
- Ministry Of Micro, Small & Medium Enterprises, "dashboard", 2022, https://dashboard.msme.gov.in/uam_dist_wise.aspx?stid=12

- Ministry of Power (MoP), "Press Release - Power Minister calls for enhanced action on energy efficiency by States", 2021, https://pib.gov.in/PressReleasePage.aspx?PRID=1765860
- NITI Aayog, "Renewable Electricity Capacity", 2022, https://www.niti.gov.in/edm/#reCapacity
- Niti Aayog, 'India Energy Dashboards', 2022, https://niti.gov.in/edm/
- Organisation for Economic Co-operation and Development, "Clean Energy Finance and Investment Roadmap of India", 2022, https://www.oecd.org/environment/cc/policy-highlights-clean-energy-finance-and-investment-roadmap-of-india.pdf
- Reserve bank of India, Handbook of Statistics on Indian States, "Table 100: State-wise Number of Factories", 2021, https://m.rbi.org.in/Scripts/PublicationsView.aspx?id=20759
- Reserve bank of India, Handbook of Statistics on Indian States, "Table 49: State-wise Pattern of Land Use - Net Irrigated Area", 2021, https://m.rbi.org.in/Scripts/PublicationsView.aspx?id=20708
- Reserve bank of India, Handbook of Statistics on Indian States, 2021, https://m.rbi.org.in/Scripts/Tripura.aspx?head=Handbook%20of%20Statistics%20on%20Indian%20States

10 Annexures

Annexure 1: Assumptions

1. Split Matrix for State Gross Domestic Product

Sector	Industrial	Commercial	Domestic	Agricultural	Transport	Municipal
	SGDP distribution share in %					
Agriculture, forestry and fishing	-	0	-	90	10	-
Mining and quarrying	100	-	-	-	-	-
Manufacturing	100	-	-	-	-	-
Electricity, gas, water supply & other utility services	70	-	-	-	-	30
Construction	30	30	40	-	-	-
Trade, repair, hotels and restaurants	-	100	-	-	-	-
Railways	-	-	-	-	100	-
Road transport	-	-	-	-	100	-
Water transport	-	-	-	-	100	-
Air transport	-	-	-	-	100	-
Services incidental to transport	-	80	-	-	20	-
Storage	-	100	-	-	-	-
Communication & services related to broadcasting	-	100	-	-	-	-
Financial services	-	100	-	-	-	-
Real estate, ownership of dwelling & professional services			100%			
Public administration						100%
Other services	30%	30%	20%			20%

2. Split Matrix for Primary Energy

Sector	Share	LPG	Petrol	Kerosine	ATF	HSD	LDO	FO	Pet coke	Bitumen	Coal
Agriculture	%	0	0	0	0	0	0	0	0	0	0
Building	%	80	0	100	0	0	0	0	0	0	5
Industry	%	0	0	0	0	15	100	100	100	100	90
Transport	%	0	100	0	100	80	0	0	0	0	0
Municipal	%	15	0	0	0	0	0	0	0	0	0
Others	%	5	0	0	0	5	0	0	0	0	5

3. Electricity Emission factor

Emission factor	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
Electricity ($kgCO_2/kWh$)	0.8	0.79	0.78	0.77	0.76	0.76	0.75	0.74	0.73	0.72	0.71	0.71
Primary Energy (Tons of CO_2/toe)	3.13											

4. Calorific Value table

Product	Calorific value (kcal/kq)
Kerosene	11100
MS Petrol	10800
ATF	10800
HSD	10800
LDO	10700
FO	10500
Lube & Greases	9000
Pet coke	7800
Bitumen	6300
Coal	4500

5. Coal consumption Projection

The coal consumption data in state of Tripura is not separately available in ministry of coal database therefore we have calculated the coal/solid fuel consumption for FY 14-15 till FY 19-20 based on historical coal consumption data with suitable assumptions.

6. TFEC calculations - Total Final Energy consumption (Figure no. 10)

a) Domestic solid fuel

	FY 2019	FY 2020
Type of Brick Kilns	Coverage	Coverage
Fixed chimney BTK	1	1
Specific coal consumption (tons/100,000 bricks)	17.5-24	17.5-24
Average Specific coal consumption (tons/100,000 bricks)	20.75	20.75
No. of Bricks produced by one brick kiln per day	20,000- 50,000	20,000-50,000
Average No. of Bricks produced by one brick kiln per day	35000	35000
TOE	601317	601317
Coal TOE	420921.9	420921.9
1 TOE = 10^7		
No. of Days	180	180
Number of Brick Kilns in the state	263	308
No. of Bricks produced by in an annual year	1656900000	1940400000
Tonnes of Coal used	343806.75	402633
	0.34380675	0.402633
Source 1: http://trpenvis.nic.in/test/doc_files/Brick_book.pdf Source 2: http://trpenvis.nic.in/test/doc_files/state_action_plan.pdf Source 3: Department / SDA		

GDP GROWTH RATE	
FY15-FY16	-0.7%
FY16-FY17	14.0%
FY17-FY18	8.4%
FY18-FY19	11.1%

	FY15	FY16	FY17	FY18	FY19	FY20	CAGR
	0.273	0.273	0.271	0.315	0.344	0.403	5%
Since solid fuel consumption is not reporting, we have considered the calculation keeping FY 19 and FY 20 base with a CAGR of 5% (GDP growth)							

This part covers the methodology employed for calculating domestic fuel consumption in Tripura, with a specific focus on coal usage in brick kilns within the state's industrial sector. Our approach incorporates data from reputable sources and integrates GDP growth rate considerations, ensuring robust and credible results.

Data Source Selection:

Our primary data sources are state brick kiln reports, providing comprehensive insights into coal consumption in Tripura's brick kilns.

- Source 1: http://trpenvis.nic.in/test/doc_files/Brick_book.pdf
- Source 2: http://trpenvis.nic.in//test/doc_files/state_action_plan.pdf

Reference Year and Benchmark:

The reference year for our analysis is FY 2019-20, derived from the brick kiln reports. This year serves as the benchmark for subsequent calculations.

Projection Methodology:

- Back Calculations: To estimate coal consumption for other years, we applied back calculation techniques, utilizing the reference data from FY 2019-20.
- Incorporating GDP (GDP Growth Rate) CAGR:
- FY 2019-20 Data: We identified figures for FY 2019-20 based on brick kiln coal consumption data and solid fuel consumption.
- Calculation of CAGR: The Compound Annual Growth Rate (CAGR) of the state's GDP growth per year was considered when extrapolating consumption values for other years.

b) Oil Consumption:

Our data on oil consumption originates from the Ministry of Petroleum and Natural Gas, India.

- **Source**- Indian Petroleum & Natural Gas Report (2020-21): https://mopng.gov.in/files/TableManagements/Indian-Petroleum--Natural-Gas_2020-21.pdf

c) Imported coal:

(includes manufacturing, mining & quarrying and electricity, gas & water supply)

Year	India's industrial output (INR crore)	Tripura's industrial output (INR crore)	% share
FY15	2186670	6312	0.29
FY16	2445981	5662	0.23
FY17	2650508	6535	0.25
FY18	2831391	6595	0.23
FY19	2958272	7140	0.24
FY20	2981793	6684	0.22

Source : RBI

Year	Imported coal (million tonnes)
FY15	212.1
FY16	203.9
FY17	191
FY18	208.2
FY19	235.3
FY20	248.5
Source: Ministry of Coal	

Year	Usage of imported coal in (Million tonnes)	MTOE
FY15	0.6	0.33
FY16	0.5	0.26
FY17	0.5	0.26
FY18	0.5	0.31
FY19	0.57	0.31
FY20	0.6	0.31
Assuming this coal is used in industry		

Our approach relies on authoritative data sources and the proportional share of the state's industrial output compared to India's industrial output.

Data Sources:

- Imported Coal Data: We obtained data on the import of coal and coke from the official government source.
  Source:
  https://coal.gov.in/sites/default/files/2021-01/Import-of-Coal-and-Coke-last-ten-years.pdf

- India's Industrial Output: Data on India's industrial output (INR crore) was sourced from the Reserve Bank of India (RBI) publication.
  Source:
  https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/0HBS202024D4CA0CC03F4674B040F7DEDE7E5360.PDF

Calculation Methodology:

We calculated Tripura's proportional share of India's industrial output by considering multiple sectors, including manufacturing, mining & quarrying, and electricity, gas & water supply.

To estimate the annual consumption of imported coal (in million tonnes) in Tripura's industries, we applied this proportional share to the total import of coal data.

d) Gas:

The methodology is explained here which is used to calculate gas consumption in Tripura's gas-based power stations, providing an example calculation for the fiscal year 2015-2016. The approach is based on data from authoritative sources and involves the conversion of gas consumption into Million Metric Standard Cubic Meters (MMSCMD) and similar approach has been taken for rest of the years.

Data Source:

Gas Consumption Data: We obtained gas consumption data for Tripura's gas-based power stations from the Central Electricity Authority (CEA) annual fuel consumption report.

Source: CEA Annual Fuel Consumption Report (https://cea.nic.in/annual-fuel-consumption-report/?lang=en)

Calculation Methodology:

- Gas Consumption Units: Gas consumption in MMSCMD (Million Metric Standard Cubic Meter per Day) was provided in the source data.
- Conversion to MSCM: We converted MMSCMD to MSCM (Metric Standard Cubic Meter) by multiplying by the number of days in the fiscal year.
- Conversion to MTOE: To assess energy consumption, we converted MSCM to MTOE (Million Tonnes of Oil Equivalent) using a standard Gross Calorific Value (GCV) of 10,000 Kcal/SCM.

Sample Calculation for FY 15-16 (Gas-based Power Stations):

- Monarchak (NEEPCO): Gas Consumption = 0.08 MMSCMD
- Agartala GT+ST (NEEPCO): Gas Consumption = 0.7 MMSCMD
- Tripura CCPP (ONGC): Gas Consumption = 1.91 MMSCMD

- Baramura GT (TSECL): Gas Consumption = 0.29 MMSCMD
- Rokhia GT (TSECL): Gas Consumption = 0.58 MMSCMD

Total Gas Consumption in MMSCMD = 3.56 MMSCMD

Year FY 15-16					
Gas based Power station	**Gas Consumption (MMSCMD)**	**MSCMD**	**Annual Gas Consumption in MSCM**	**GCV (Kcal/SCM)**	**MTOE**
MONARCHAK (NEEPCO)	0.08	80000	26400000	10000	0.0264
AGARTALA GT+ST (NEEPCO)	0.7	700000	231000000	10000	0.231
TRIPURA CCPP (ONGC)	1.91	1910000	630300000	10000	0.6303
BARAMURA GT (TSECL	0.29	290000	95700000	10000	0.0957
ROKHIA GT (TSECL)	0.58	580000	191400000	10000	0.1914
Total	**3.56**	**3560000**	**1174800000**	**10000**	**1.1748**

MMSCMD	Million Metric Standard Cubic Meter per Day
MSCMD	Metric Standard Cubic Meter per Day
MSCM	Metric Standard Cubic Meter
MTOE	Million Tonnes of Oil Equivalent

Source:	https://cea.nic.in/annual-fuel-consumption-report/?lang=en

e) Electricity Utility:

The methodology for calculating electricity utility consumption in Tripura, with a focus on using data from the Central Electricity Authority (CEA) dashboard. We convert electricity consumption from Giga-Watt Hours (GWh) to Million Tonnes of Oil Equivalent (MTOE) for a comprehensive analysis.

Data Source:

Electricity Utility Consumption Data: We obtain electricity consumption data from the CEA dashboard, which provides values in Giga-Watt Hours (GWh).

Source: CEA Dashboard- https://cea.nic.in/dashboard/?lang=en

Conversion Methodology:

- GWh to TOE Conversion: We first convert GWh to Tonnes of Oil Equivalent (TOE) using the conversion factor: 1 GWh = 85.984522785899 toe.
- TOE to MTOE Conversion: To express consumption in MTOE (Million Tonnes of Oil Equivalent), we divide the TOE values by 10^6.

Calculation Example:

- Electricity Utility Consumption in GWh (from CEA Dashboard): [Insert GWh value from the dashboard]
- Conversion to TOE: Electricity Consumption (TOE) = [GWh value from the dashboard] × 85.984522785899
- Conversion to MTOE: Electricity Consumption (MTOE) = Electricity Consumption (TOE) ÷ 10^6

Our methodology for calculating electricity utility consumption in Tripura utilizes data from the CEA dashboard and involves a two-step conversion process, first from GWh to TOE and then from TOE to MTOE. This approach provides a standardized measurement of energy consumption in MTOE, allowing for meaningful comparisons and analysis of electricity usage in the state.

7. Primary and Secondary Energy Share

i) Primary Energy shares

Share of Primary Energy		LPG	Petrol	Kerosine	ATF	HSD	LDO	FO	Pet coke	Bitumen	Coal
Agriculture	%	0%	0%	0%	0%	1%	0%	2%	0%	0%	0%
Building	%	88%	0%	91%	0%	0%	0%	0%	0%	0%	0%
Industry	%	10%	0%	4%	0%	4%	100%	81%	100%	100%	100%
Transport	%	1%	100%	0%	100%	93%	0%	1%	0%	0%	0%
Municipal	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Others	%	2%	0%	6%	0%	3%	0%	16%	0%	0%	0%
% share for each sector for primary energy is assumed here											

Sector wise distribution of primary energy																	
Sector	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
Agriculture	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building	0.06	0.06	0.06	0.07	0.07	0.07	0.09	0.10	0.11	0.13	0.14	0.16	0.17	0.19	0.22	0.24	0.27
Industries	1.52	1.60	1.69	1.77	1.89	1.85	2.23	2.37	2.53	2.69	2.86	3.03	3.22	3.43	3.64	3.86	4.10
Transport	0.12	0.13	0.14	0.15	0.16	0.16	0.20	0.22	0.24	0.27	0.30	0.34	0.38	0.42	0.47	0.52	0.58
Municipal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Others	0.00	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total	1.70	1.81	1.89	2.00	2.13	2.09	2.53	2.70	2.89	3.09	3.31	3.54	3.78	4.05	4.33	4.63	4.95

Note: The shares from FY 15- FY 20 are derived from the consumption (data taken from MOPNG report) and the share of Primary energy assumed, rest are projected till FY 31.

ii) Secondary Energy shares

Sector wise share of electrical energy consumption												
Electrical	FY15	Percentage	FY16	Percentage	FY17	Percentage	FY18	Percentage	FY19	Percentage	FY20	Percentage
	GWh	%	GWh	%	GWh	%	GWh	%	GWh	%	GWh	%
Agriculture	33	4	34	4%	41	5%	39	4%	40	4%	38	4%
Building	502	64	515	63%	580	65%	593	64%	611	64%	584	64%
Industries	41	5	43	5%	51	6%	48	5%	50	5%	48	5%
Transport	0	0	0	0%	0	0%	0	0%	0	0%	0	0%
Municipal	113	14	119	15%	121	13%	133	14%	137	14%	131	14%
Others	98	12	102	13%	103	12%	115	12%	119	12%	113	12%
Total	786		813		895	100%	928	100%	956	100%	914	100%

Source : https://cea.nic.in/dashboard/?lang=en

Note: Sector wise electrical energy breakup is available only for 4 financial years (FY 15- FY18) for FY 19 & FY 20 same % distribution is considered as that in FY 18

Sector wise share of electrical energy consumption (Forecasted)																				
FY21		FY22		FY23		FY24		FY25		FY26		FY27		FY28		FY29		FY30		FY31	
GWh	%	GWh	%	GWh	%	GWh	%	GWh	%	GWh	%	GWh	%	GWh	%	GWh	%	GWh	%		%
45	4%	48	4%	51	4%	55	4%	59	4%	63	4%	67	4%	72	4%	77	4%	88	4%	94	4%
688	64%	736	64%	787	64%	842	64%	901	64%	964	64%	1031	64%	1103	64%	1179	64%	1350	64%	1444	64%
56	5%	60	5%	64	5%	69	5%	73	5%	78	5%	84	5%	90	5%	96	5%	110	5%	118	5%
0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
155	14%	165	14%	177	14%	189	14%	202	14%	217	14%	232	14%	248	14%	265	14%	303	14%	324	14%
134	12%	143	12%	153	12%	163	12%	175	12%	187	12%	200	12%	214	12%	229	12%	262	12%	280	12%
1077	1.00	1152	100%	1232	100%	1318	1.00	1410	100%	1508	100%	1613	100%	1726	100%	1846	100%	2112	100%	2260	100%

8. TFEC calculations

The following calculations of the TFEC is based on our internal calculations, taking references from Ministry of Petroleum and Natural gas (Reports) for Primary energy consumption and Central Electricity Authority (Reports) for secondary energy consumption.

Total energy consumption																	
Year		FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
Secondary energy (Electrical)	MTOE	0.07	0.07	0.08	0.08	0.08	0.08	0.09	0.10	0.11	0.11	0.12	0.13	0.14	0.15	0.16	0.18	0.19
Primary Energy		1.71	1.81	1.89	2.00	2.13	2.09	2.53	2.70	2.89	3.09	3.31	3.54	3.78	4.05	4.33	4.63	4.95
TFEC		**1.773**	**1.876**	**1.969**	**2.076**	**2.21**	**2.17**	**2.62**	**2.80**	**3.00**	**3.20**	**3.43**	**3.67**	**3.92**	**4.20**	**4.49**	**4.81**	**5.15**

Energy Consumption (Mtoe)																		
BAU energy consumption scenario																		
		FY15	**FY16**	**FY17**	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**	**FY23**	**FY24**	**FY25**	**FY26**	**FY27**	**FY28**	**FY29**	**FY30**	**FY31**	
Agriculture	MTOE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	2.7%
Building		0.103	0.11	0.11	0.12	0.12	0.12	0.15	0.16	0.18	0.20	0.22	0.239	0.26	0.29	0.32	0.36	0.392	3.4%
Industries		1.53	1.61	1.69	1.77	1.90	1.86	2.24	2.38	2.53	2.69	2.86	3.04	3.23	3.43	3.65	3.87	4.11	4.0%
Transport		0.117	0.134	0.136	0.155	0.159	0.156	0.196	0.219	0.244	0.272	0.304	0.338	0.377	0.420	0.47	0.52	0.58	5.9%
Municipal		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.028	3.1%
Others		0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	2.1%
Total		1.77	1.88	1.97	2.08	2.21	2.17	2.62	2.80	3.00	3.20	3.43	3.67	3.92	4.20	4.49	4.81	5.15	4.1%

9. Summary

Sector	Energy consumption in FY31 (Mtoe)	Energy savings through ECMs (FY31) in Moderate Scenario (Mtoe)	Percentage	Energy savings through ECM (FY31) in Ambitious Scenario in Mtoe	Percentage	Investment under moderate scenario (INR CR)	Investment under Ambitious scenario (INR CR)
Industry	4.11	0.37	**8.9**	0.86	**20.9**	1973	4636
Building	0.39	0.03	**6.8**	0.05	**12.9**	144	274
Transport	0.58	0.01	**1.9**	0.03	**4.4**	60	139
Total	5.15	0.40	**7.8**	**0.93**	**18.2**	**2177**	**5048**
** Total includes all sectors							

Sector	emission reduction in FY31 (MtCO2)	Emission in (FY31) in Moderate Scenario (MtCO2)	Percentage	emission reduction through ECM (FY31) in Ambitious Scenario in MtCO2	Percentage
Industry	12.910	1.14	**8.9**	2.69	**20.8**
Building	1.856	0.22	**11.8**	0.42	**22.4**
Transport	1.811	0.03	**1.9**	0.08	**4.4**
Total	17.10	1.40	**8.2**	3.18	**18.6**

Annexure 2: Development of Dynamic Tool

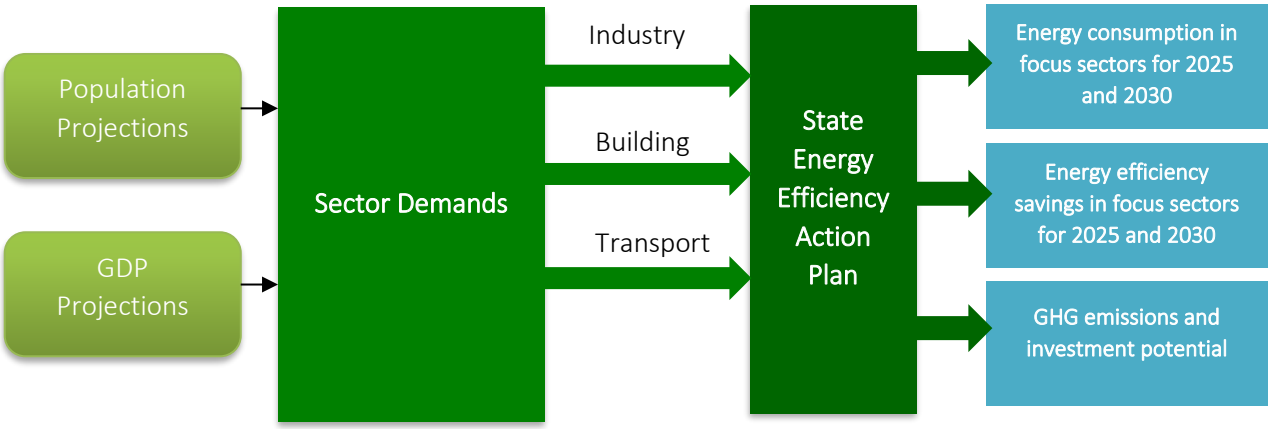
The development of a dynamic tool for state energy demand calculation and forecasting future demand is a critical component of effective energy planning and management. A flexible model was designed to adapt to the unique aspects and data availability of each of the demand sectors in the SEEAP. To carry out this analysis, three pivots were used:

Multiple input sources (reports available in public domain and stakeholder

Bottom-up analysis and top-down validations to the extent data allowed

Assumptions based on discussion with SDAs and sector reports

For this study, the model database extends from the base year of FY 2015-16 to FY 2019-20 and is extrapolated based on the assumption from historical data and stakeholder consultations. To determine which end-use options could be improved in terms of efficiency and to incorporate insights into the level of improvement, discussions have been conducted with sector experts. The secondary data was collected from reports in the public domain, government sources, SDAs and national independent organizations that regularly publish reports on energy consumption and efficiency in the country. The tool uses different energy efficiency levers to develop scenarios for demand reduction.



A comprehensive view of the state's energy profile would be provided to the beneficiaries, as well as the potential scenarios that could emerge depending on the various pathways incorporated into the model.

Annexure 3: Potential Technologies for Advancing Energy Efficiency in Select Sectors

This section briefly highlights the potential technologies[34] for select sectors namely agriculture, transport, buildings, municipal and MSMEs, which might act as a catalyst for mainstreaming energy efficiency.

1. Transport Sector

Technologies	Brief Description
Road Transport	
Alternative fuel vehicles	The state emission profile and energy mix would be impacted with the gradual increase of alternative fuel vehicles such as electric vehicles (EVs), biodiesel vehicles and fuel cell vehicles.
Alternative combustion	Alternative combustion is another way for achieving energy efficiency. It uses Use of Homogenous Charge Compression Ignition (HCCI), Premixed Charge Compression Ignition (PCCI) and other alternative combustion techniques along with computational fluid dynamics (CFD) and chemical kinetic modelling.
Fuel efficiency	With better fuel efficiency same task can be carried out with less amount of fuel and emissions.
Improvement in battery technology and infrastructure	New generation lithium ion/Ni-MH (nickel metal hydride)/ lithium air batteries with high capacity, fast charge, very low self-discharge, and long lifetime and cycling performances. Infrastructure development – construction of public charging stations and quick battery change stations

2. Domestic and commercial sector/Building Sector

Technologies	Brief Description
Induction Cook Stoves	This technology cooks the food in the vessel kept over it through the principle of electrical induction. Thus, unlike the gas-based stoves, the induction-based stoves work on the basis of electricity, being the mail fuel/resource.
Net Zero Energy Buildings	As the name suggests, the net zero buildings consume no or low energy. They are self-sufficient in terms of generating energy for their consumption and use renewable energy to meet its energy demand. In order to be net zero, these buildings first reduce their energy demand

https://wri-india.org/blog/five-ways-promote-public-transport-indian-cities [34] Bureau of Energy Efficiency, "Unlocking National Energy Efficiency Potential (UNNATEE)", 2019, https://beeindia.gov.in/sites/default/files/UNNATEE%20Final%20Report.pdf

	by using state of the art energy efficient technologies and then meet their energy demand through renewable energy.
Smart home automation systems	As the name suggests, a smart home is the one where the occupants can monitor and control the installed HVAC technologies and other installed technologies for better accessibility and thermal comfort.

3. MSMEs

The MSME sector could enhance their energy efficiency by adapting various state of the art technologies or components such as by installing variable-frequency drive (VFD) in motors, energy-efficient pumping, energy-efficient boilers, compressed air systems, Energy-efficient cooling towers, Waste heat recovery in furnaces, making improvement of insulation in thermal systems, etc. Apart from this, once all the possible retrofitting and installation of the state of art technologies has been done, installation of a few futuristic technologies could also be considered such as rapid prototyping, artificial intelligence/machine learning, robotics, and digital traceability, etc.

Technologies	**Brief Description**
Energy-efficient equipment	MSMEs can replace old and inefficient equipment with energy-efficient models. For example, replacing an old air conditioner with a new, energy-efficient model can significantly reduce energy consumption and costs.
Energy management systems	MSMEs can implement energy management systems to monitor and control their energy consumption. These systems can help identify areas where energy can be saved and optimize energy use.
Smart home automation systems	As the name suggests, a smart home is the one where the occupants can monitor and control the installed HVAC technologies and other installed technologies for better accessibility and thermal comfort.

Annexure 4: Potential Fiscal Instruments and Incentives for implementing Energy Efficiency Projects

This section provides an overview of the market and fiscal instruments[35] available in India for mainstreaming energy efficiency in various sectors, as mentioned below:

S.No.	Types of Fiscal Instruments	Brief Description
1.	Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE)	**About:** It's a finical instrument, notified by MoP in May 2016, where the financial institutions (FIs) such as banks and Non-Banking Financial Company (NBFC) are provided with partial risk coverage associated with extending loan for the energy efficiency related projects. It has been estimated that this fund will mobilize investment of more than Rs 800 crores in the nation. Thus, would acts as a catalyst in mainstreaming energy efficiency in various energy intensive sectors in India. **Fund guaranteed:** It guarantees 50% of loan amount or Rs.10 crores per project, whichever is less.
2.	Partial Risk Sharing Facility (PRSF)	**About:** As the name suggest, this financial instrument, supported by BEE and established by Clean Technology Fund and Global Environment Fund, provides partial credit guarantee to Participating Financial Institutions (PFIs) to cover their risk associated with extending loans for energy efficiency related projects. The energy efficiency projects should have been implemented via an Energy Service Companies (ESCOs) post entering into an Energy Saving Performance Contract (ESPC). **Fund guaranteed:** It guarantees 75% of the loan amount or Rs 15 crore, whichever is minimum.
3.	Venture Capital Fund for Energy Efficiency (VCFEE)	**About:** As the name suggests, this financial instrument was established by the BEE, provides access to funds in the form of equity for the last mile financial support for the projects related to energy efficiency. This has been established under the Framework for Energy Efficient Economic Development of NMEEE. As of now, this has been leveraged only by government buildings, private buildings (commercial or multi-story residential buildings) and municipalities.

[35] BEE, Ministry of Power, "Unlocking National Energy Efficiency Potential (UNNATEE)", 2019, https://beeindia.gov.in/sites/default/files/UNNATEE%20Final%20Report.pdf; BEE, Ministry of Power, "Roadmap of Sustainable and Holistic Approach to National Energy Efficiency", 2019, https://beeindia.gov.in/sites/default/files/Roshanee_print%20version%282%29.pdf and Organisation for Economic Co-operation and Development, "Clean Energy Finance and Investment Roadmap of India", 2022, https://www.oecd.org/environment/cc/policy-highlights-clean-energy-finance-and-investment-roadmap-of-india.pdf

		Fund guaranteed: It provides a maximum of 15% of total equity required, through Special Purpose Vehicles or Rs. 2 crores, whichever is less.
4.	Energy Efficiency Financing Facility (EEFF)	This financing initiative has been established by BEE specifically for the financing requirement of large-scale industries, project aggregation approach covering ESCO projects, MSME clusters, etc. This facility will be anchored by a Public Financial Institution. The facility will also follow a project aggregation approach across industries or clusters or technologies, for ensuring the inclusion of the small sized projects.
5.	Framework for Energy Efficiency Financing	This unique platform offers interaction between FIs and project developers to foster the implementation of energy efficiency projects.
6.	Energy-saving certificates (ESCerts)	On over achievement of set energy savings target, the designated consumers receive ESCerts. These ESCerts can be then traded and sold to the designated consumers who have under-performed i.e., who were not able to achieve their energy saving targets.
7.	On-bill financing (OBF)	As the name suggest, in this type of financing mechanism, being done in partnership with a utility company, the consumer pays back based on the monthly utility bill generated.
8.	Capital subsidy (CS)	As the name suggest, in this financial instrument capital subsidy is granted by the state government towards the energy efficiency related projects/investments, to cover capital expenses incurred for during incorporating the energy efficiency improvement mechanisms.
9.	Revolving loan fund (RLF)	This financial instrument aids in increasing the availability of funds in the market which in turn would fast-track mainstreaming of energy efficiency in the select sectors. The borrower can take loan in line with standard prudent lending practices which allows the money to be returned to the RLF for make additional loans, on the loan repayment being done by the borrower.

10.	Accelerated depreciation-based incentivization (ADI)	In this instrument, the project developers get the opportunity to take the advantage of the higher depreciation during the initial years, which acts as a catalyst for incentivizing industries to implement energy efficiency schemes.
11.	Loan loss recovery/partial risk guarantee fund (PRGF)	As the name suggest, this financial instrument provides a partial guarantee over the associated risk, a pre-specified percentage of loan loss is covered.
12.	Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE)	This market instrument established by MoMSME, SIDBI, provides collateral-free credit guarantee of up to 85% on loans up to INR 200 lakh, to micro and small enterprises.
13.	Promoting market transformation for energy efficiency in MSMEs	This initiative, established by GEF, EESL, UNIDO, BEE, MoMSME, SIDBI act as a catalyst in increasing the availability of funds for MSMEs by setting up revolving fund mechanism, which would also ensure replicability of the project.
14.	SIDBI Venture Capital Limited (SVCL)	Under this funding mechanism, an investment management company under SIDBI extends equity capital to early-stage SMEs and start-ups for select sectors namely in manufacturing, agricultural and service.
15.	Other Central government financing schemes by government	• Production Linked Incentivization (PLI) scheme by Department for Promotion of Industry and Internal Trade • Technology Upgradation Fund Scheme (TUFS) by Ministry of Textiles. • Scheme for Technology Upgradation/Establishment/ Modernization for Food Processing Industries by Ministry of Food Processing Industries.

In addition to the above mentioned list of financing mechanisms for mainstreaming energy efficiency, a few globally used financing Mechanisms could also be adopted in India namely Carbon finance (CF), Energy-savings insurance (ESI), Energy improvement mortgage (EIM), Securitization of loans for energy-efficient appliances (SLEE), Revenue decoupling models for DSM (RD), Energy conservation bonds (ECB), Interest rate buys down fund (IRBDF), Property assessed clean energy (PACE), Cross-border technology transfer and energy-efficiency financing facility (CBTT), Green receivables fund (GRF), Peer-to-peer lending (PPL), Operation lease/vendor financing (OL), Stranded project financing facility (SPFF), etc.

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