State Energy Efficiency Action Plan - Assam

JANUARY 2025

सत्यमेव जयते

विद्युत मंत्रालय
MINISTRY OF
POWER

श्रीकांत नागुलापल्ली, भा.प्र.से.
अपर सचिव, एमओपी एवं महानिदेशक, बीईई
SRIKANT NAGULAPALLI, IAS
Additional Secretary, MoP & Director General, BEE

सत्यमेव जयते

Azadi Ka Amrit Mahotsav

ऊर्जा दक्षता ब्यूरो
(विद्युत मंत्रालय, भारत सरकार)
BUREAU OF ENERGY EFFICIENCY
(Ministry of Power, Government of India)



Foreword

The Bureau of Energy Efficiency (BEE), under the Ministry of Power, Government of India, has been actively working to promote energy efficiency across various sectors of the Indian economy through initiatives like the National Strategic Plan for Energy Efficiency and the National Mission ROSHANEE. These efforts align with India's commitment to doubling its energy efficiency improvement rate by 2030, as declared at the G20 summit.

To harness the vast potential for energy efficiency in sectors such as industry, buildings, agriculture, and transport, the State Energy Efficiency Action Plan (SEEAP) has been developed. SEEAP aims to establish clear state-wise focus areas and develop actionable strategies to mainstream energy efficiency interventions.

This report provides valuable insights for policymakers, government agencies, and other stakeholders to implement effective programs and achieve India's climate goals. It also serves as a platform for knowledge sharing and scaling up energy efficiency activities nationwide.

I am pleased to announce that most States/UTs have formed State Level Steering Committees (SLSCs) under the leadership of Chief Secretaries. These committees will play a crucial role in developing mechanisms to implement the identified action plans.

I encourage all stakeholders to review this document and contribute their valuable feedback to further enhance its effectiveness in promoting energy efficiency at the state level.

October, 2024

(Dr. Srikant Nagulapalli)

चौथा तल, सेवा भवन, आर.के. पुरम, नई दिल्ली-110066 / 4th Floor, Sewa Bhawan, R.K. Puram, New Delhi-110 066
दूरभाष / Tel. : 91 (11) 26766701, 20867389, फैक्स / Fax : 91 (11) 20867396
ई-मेल / E-mail : dg-bee@nic.in, वेबसाईट / Website : www.beeindia.gov.in

RIGHT TO INFORMATION

Acknowledgement

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.

The project team extends its profound gratitude to Shri Pankaj Agarwal, Secretary of the Ministry of Power, Government of India, and Mr. Shrikant Nagulpalli, Director General of the Bureau of Energy Efficiency (BEE), for their exceptional leadership and guidance during the execution of the assignment. The team also recognizes and expresses its sincere appreciation to Mr. Milind Bhikanrao Deore, Secretary of BEE, for his invaluable contributions and insights throughout the assignment's execution. The team acknowledges the cooperation and unwavering support provided by Mr. Abhishek Sharma, Joint Director of BEE, for his supervisory role during the entire execution phase. The team also appreciates Mr. Vikash Kumar Jha, Project Engineer at BEE, for his continuous support and effective coordination with various stakeholders.

The project team further extends its profound gratitude to Shri Gautam Talukdar – IAS, Former Secretary to the Govt. of Assam, Power (Electricity) Department, Shri Saranga Pani Sarma ACS, Former Joint Secretary to the Govt. of Assam, Power (Electricity) Department for their valuable guidance towards the execution of the assignment. We also acknowledge the support provided by Shri Nilamani Sarma, Chief Electrical Inspector -cum-Adviser, (i/c) Government of Assam, Shri Kajal Kumar Singha Electrical Inspector (Sr. Grade), Nodal Officer, SDA Assam, Government of Assam, and Smt. Rashmi Phukan Electrical Inspector (Sr. Grade), Technical Officer SDA Assam Govt. of Assam for their extended support for successfully completing the project. The team also extends its sincere thanks to all state government departments and stakeholders of the state of Assam for their valuable inputs towards the completion of the earmarked project tasks.

Sincere gratitude to all government and private sector participants of the physical survey whose inputs has been considered as part of the report. The team also extends its gratitude to the industry associations, building sector professionals and other stakeholders who were extensively consulted as part of the project.

Lastly, we would like to thank internal team members for their hard work, dedication, and professionalism. Their collective efforts, expertise, and commitment to excellence have been the backbone of this project. In conclusion, this project stands as a testament to what can be achieved through collaborative efforts and shared goals.

PricewaterhouseCoopers Private Limited

State Energy Efficiency Action Plan – East Zone

Disclaimer

This document has been prepared solely for BEE should be documented, being the express addressee to this document. PwC does not accept or assume any liability, responsibility, or duty of care for any use of or reliance on this document by anyone, other than (i) BEE, to the extent agreed in the relevant contract for the matter to which this document relates (if any), or (ii) as expressly agreed by PwC in writing in advance.

This publication (and any extract from it) may not be copied, paraphrased, reproduced, or distributed in any manner or form, whether by photocopying, electronically, by internet, within another document or otherwise, without the prior written permission of PwC. Further, any quotation, citation, or attribution of this publication, or any extract from it, is strictly prohibited without PwC's prior written permission.

© 2025 PricewaterhouseCoopers Private Limited. All rights reserved.

In this document, PwC refers to PricewaterhouseCoopers Private Limited (a limited liability company in India) an India member firm and may sometimes refer to the PwC network.

Each member firm is a separate legal entity

Table of Contents

Acknowledgement	ii
Disclaimer	iii
Executive Summary	10
1. Introduction	19
1.1. Background and about State Energy Efficiency Action Plan	19
1.2. India's Nationally Determined Contributions and Mission LiFE	19
1.3. State profile	20
1.4 State Energy Scenario (including renewable)	21
1.5 Energy Consumption Scenario (TFEC)	23
1.6 Overview of Institutional Framework and Stakeholder Mapping	25
2. Identification of focus sectors	27
2.1 Methodology of Focus Sector Identification	27
2.2 Identified Focus Sectors	27
3. Projections and forecasting (methodology)	28
4. Focus Sector 1 - Industry	31
4.1 Current Scenario	31
4.2 Energy Efficiency Strategies in the industry sector	33
Deepening and Widening of PAT scheme	33
Energy efficiency interventions in SME sector	34
4.3 Energy Saving Targets & Monitoring Mechanism	36
5. Focus Sector 2 - Buildings	40
5.1 Current Scenario	40
5.2 Energy Efficiency Strategies in the buildings sector	41
Replacement program for inefficient appliances	41
Effective implementation of Assam ECBC	42
Energy audit for commercial and public buildings	44
5.3 Energy Saving Targets & Monitoring Mechanism	46
6. Focus Sector 3 - Transport	50
6.1 Current Scenario	50
6.2 Energy Efficiency Strategies in the transport sector	51
Deployment of electric vehicles in state	51
Ethanol blending in state	52
6.3 Energy Saving Targets & Monitoring Mechanism	53
7. Focus Sector 4 - Agriculture	56

7.1 Current Scenario 56
7.2 Energy Efficiency Strategies in the agriculture sector 57
Replacement of diesel pumps with solar 57
Replacement of inefficient pumps with efficient electric pumps 57
7.3 Energy Saving Targets & Monitoring Mechanism 57
8. Investment Potential 60
9. Investment sources: 61
10. Way Forward 62
11. References 63
12. Annexure 64

List of Tables

Table 1: Energy Savings potential in industries sector 13
Table 2: Specific energy consumption used in Action Plan 1 14
Table 3: Specific energy consumption used in Action Plan 2 14
Table 4: Energy Savings potential in buildings sector 15
Table 5: Energy Savings by appliance in Action Plan 1 15
Table 6: Energy Savings potential in transport sector 16
Table 7: Energy Savings potential in agriculture sector 17
Table 8: Energy Savings, Emission Reduction, and Investment Potential for Assam 18
Table 9: Key parameters of Assam 22
Table 10: List of DC 31
Table 11: Assumptions for SEC in Action Plan 1 of Industries Sector 37
Table 12: Energy Savings potential from Action Plan 1 of industries sector 37
Table 13: SEC assumptions for SME sector 38
Table 14: Energy Savings potential from Action Plan 2 of industries sector 38
Table 15: Existing stock of inefficient appliances 15 years old 47
Table 16: Energy Savings potential from Action Plan 1 of buildings sector 47
Table 17: Energy Savings potential from Action Plan 2 of buildings sector 48
Table 18: Energy Savings potential from Action Plan 3 of buildings sector 49
Table 19: Mileage and annual utilisation for each mode type 53
Table 20: Energy Savings potential from Action Plan 1 of transport sector 54
Table 21: Energy Savings potential from Action Plan 2 of transport sector 54
Table 22: Energy Savings potential from Action Plan 1 of agriculture sector 58
Table 23: Energy Savings potential from Action Plan 2 of agriculture sector 58
Table 24: Market potential calculation for Assam 60
Table 25: Weightage Matrix for Gross State Value Added 64
Table 26: Fuel Calorific Values 65
Table 27: Units of Conversion 65
Table 28: Emission Factors 65
Table 29 : List of primary and secondary sources 65
Table 30 : List of stakeholders 66

List of Figures

Figure 1: Broad scope of work 10
Figure 2: Energy flow in state (supply and consumption) 11
Figure 3: Final Energy Consumption trend for Assam 11
Figure 4: Fuel-wise split of total final energy consumption in Assam in 2019-20 12
Figure 5: Identified focus sectors 12
Figure 6: Energy consumption and GDP forecasting of Assam 13
Figure 7: Final Energy Consumption trends in 2025 and 2030 under three scenarios 18
Figure 8: :India's NDC 19
Figure 9: Key activities of project 20
Figure 10: Key sectors in Assam 21
Figure 11: Energy Flow 22
Figure 12: Renewable energy in Assam (2019-20) 23
Figure 13: : Final Energy Consumption in Assam 24
Figure 14: Final Energy Consumption for 2019-20 24
Figure 15: Overview of institutional framework of energy in Assam 26
Figure 16: GSDP forecasting for Assam 28
Figure 17: Forecast of final energy consumption for state of Assam 29

Abbreviations

Abbreviation List	Full Form
GDP	Gross Domestic product
PAT	Perform, Achieve and Trade
EE	Energy efficiency
ECSBC	Energy Conservation and Sustainability Buildings Code
EV	Electric Vehicle
DISCOM	Distribution Company
UJALA	Unnat Jyoti by Affordable LEDs for all
LPG	Liquified petroleum gas
HSD	High speed diesel
LDO	Light diesel oil
FO	Furnace oil
GSDP	Gross state domestic product
SEC	Specific energy consumption
MSME	Micro, small and medium enterprises
ICE	Internal combustion engine
HDV	Heavy duty vehicle
SEEAP	State energy efficiency action plan
NDC	Nationally determined contributions
COP	Conference of parties
MW	Megawatt
MU	Million units
INR	Indian Rupee
CAGR	Compound annual growth rate
FY	Financial Year
DPIIT	Department for Promotion of Industry and Internal Trade
FDI	Foreign direct investment
UNNATEE	Unlocking National Energy Efficiency Potential
DC	Designated Consumer
NTPC	National Thermal Power Corporation
BEE	Bureau of Energy Efficiency
SME	Small and medium enterprise
IIT	Indian Institute of Technology
ECM	Energy Conservation Measures
BEEP	Buildings Energy Efficiency Programme
DSM	Demand side management
ECBC	Energy Conservation Building Codes
ULB	Urban Local Bodies
SDA	State Designated Agencies
PWD	Public Works Department
EV	Electric Vehicle
PM	Prime Minister
ESCO	Energy Services Company
GCV	Gross Calorific Value
TOE	Tonnes of oil equivalent
MTOE	Million tonnes of oil equivalent
DSM	Demand-side management
ECSBC	Energy Conservation and Sustainability Building Code
EEFP	Energy Efficiency Financing Platform
EESL	Energy Efficiency Services Limited
ESCO	Energy Service Company
FEEED	Framework for Energy Efficient Economic Development
GCRT	Grid Connected Rooftop System

GDP	Gross Domestic Product
GST	Goods and Services Tax
NMRP	National Motor replacement Program
GWh	Giga-Watt Hour
HP	Horsepower
HPSV	High Pressure Sodium Lamp
PPP	Public Private Partnership
kW	Kilowatt
LED	Light-emitting diode
MNRE	Ministry of New and Renewable Energy
MSME	Micro, Small and Medium Enterprise
Mt	Mega-ton
SMNP	Smart meter national program
NAMA	Nationally appropriate mitigation actions
MTOE	Million tons of oil equivalent
MTEE	Market Transformation for Energy Efficiency
MU	Million Units
MuDSM	Municipal Demand-side management
MW	Mega-Watt
IEA	International Energy Agency
NMEEE	National Mission for Enhanced Energy Efficiency
PAT	Perform, Achieve and Trade
SDA	State-Designated Agency
SLNP	Street Lighting National Programme
SME	Small and Medium Enterprise
UJALA	Unnat Jyoti by Affordable LEDs for All

Executive Summary

India is a diverse country with diverse energy consumption patterns in different states/UTs. Broadly, the energy consumption is divided in five major sectors i.e., Buildings, Transportation, Municipalities and DISCOMs, Agriculture and Industries. Although India remains progressive and one of the front runners to achieve its Energy Efficiency (EE) potential, through innovative programmes such as the PAT scheme, Standards & Labelling, UJALA scheme, Energy Conservation Building Code, Electric Vehicle mission and Smart metering etc. However, at a state level, there is still an immense potential to be realized from large-scale implementation of EE interventions in various afore-mentioned demand sectors.

Therefore, there is a dire need for a focused sector-based energy efficiency approach by states/UTs. In view of this, the Bureau of energy efficiency has taken on this endeavour to state specific Energy Efficiency Action Plan through identification of focus sector, undertaking gap analysis, adopting best practices followed in peer group with implementation plan strategy; that can act as platform for developing State's Energy Policy and Programs.

The overall scope of work for this assignment is as follows:-

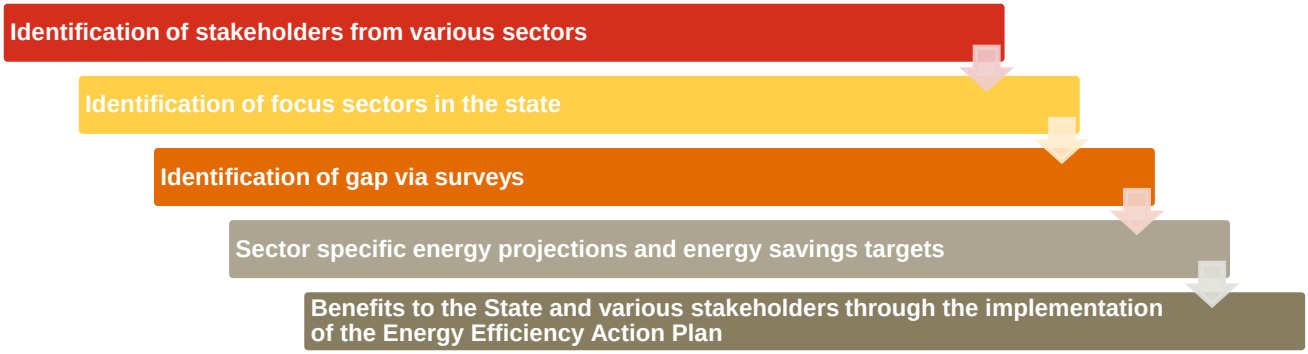


Figure 1: Broad scope of work

State context

Assam is in the north-eastern part of India and has geographical area of 78,438 sq. km and population of 3.4 crore. The natural resources, policy incentives and location-specific advantages of Assam support investments in sectors such as cement, petroleum refinery, fertilizer and pulp & paper. In 2019-20, the gross domestic product of Assam was INR 2.4 lakh crore and per capita GDP was INR 90,123.[1] Assam has the largest tea growing area in the world, constituting around one-seventh of the global tea production. In 2020-21, tea production in the state stood at ~503.46 thousand tonnes, which was 39.12% of the total tea production in India during the same period . It also has 20 industrial estates, three industrial growth centres, 11 Integrated Infrastructure Development Depots, 17 industrial areas, 12 growth centres, eight mini-industrial estates, one export promotion park and one food processing industrial park. Assam is also the most popular tourist destination among the northeast states.

1 State Domestic Product, Ministry of Statistics and Programme Implementation

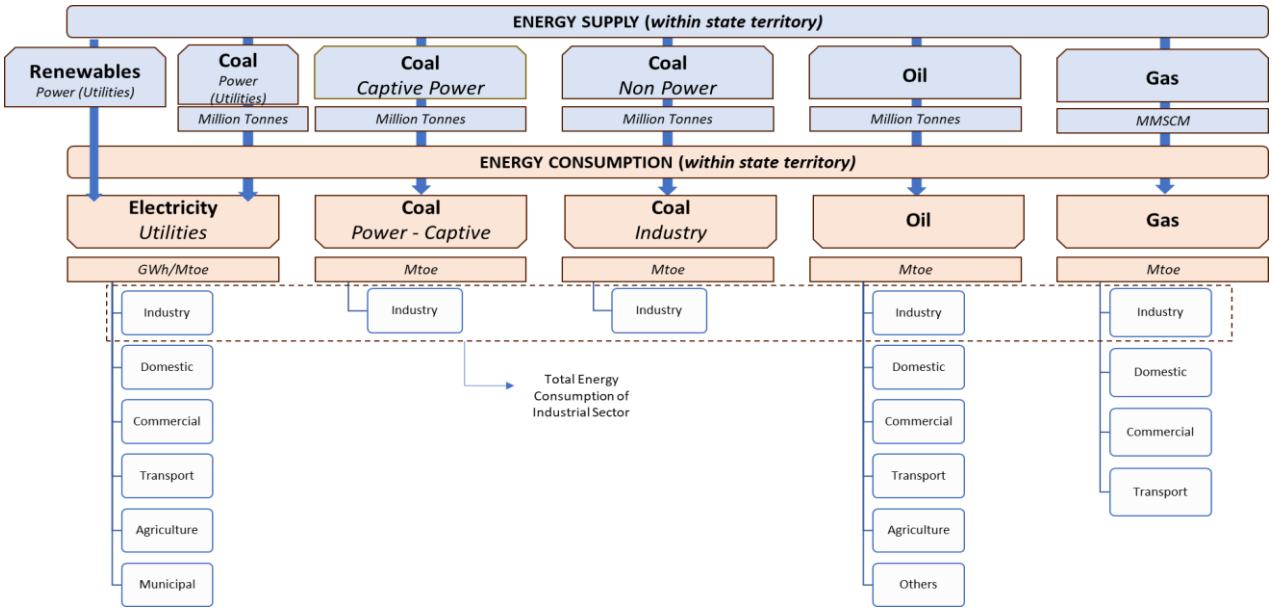


Figure 2: Energy flow in state (supply and consumption)

From a consumption standpoint - the total energy consumption of Assam for the year 2019-20 has been estimated to be approximately 6.42 Mtoe for the year 2019-20. It is pertinent to mention here that coal consumption is the major contributor to this estimate at 3.4 Mtoe followed by oil at 2.41 Mtoe and electricity at 0.61 Mtoe. Following figure illustrates the same: -

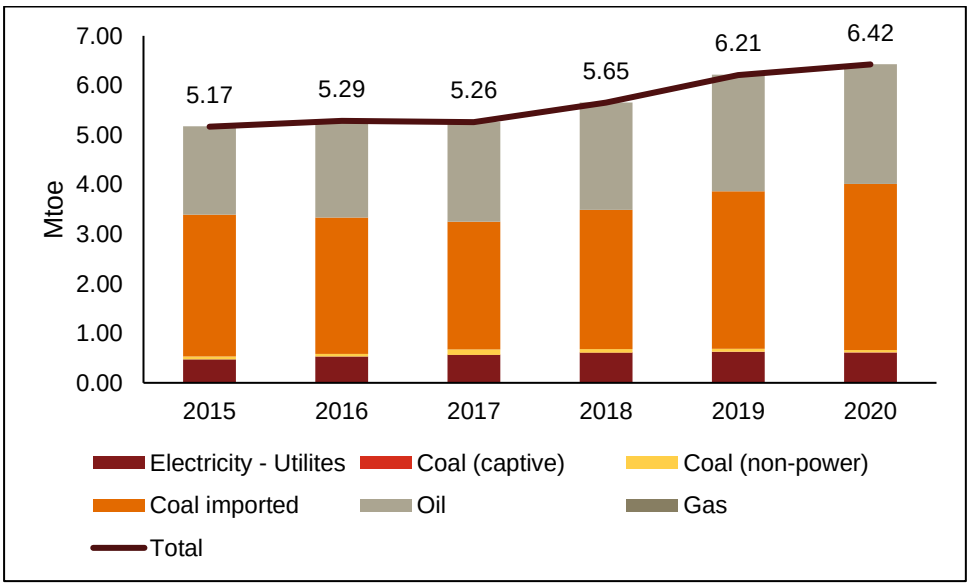


Figure 3: Final Energy Consumption trend for Assam

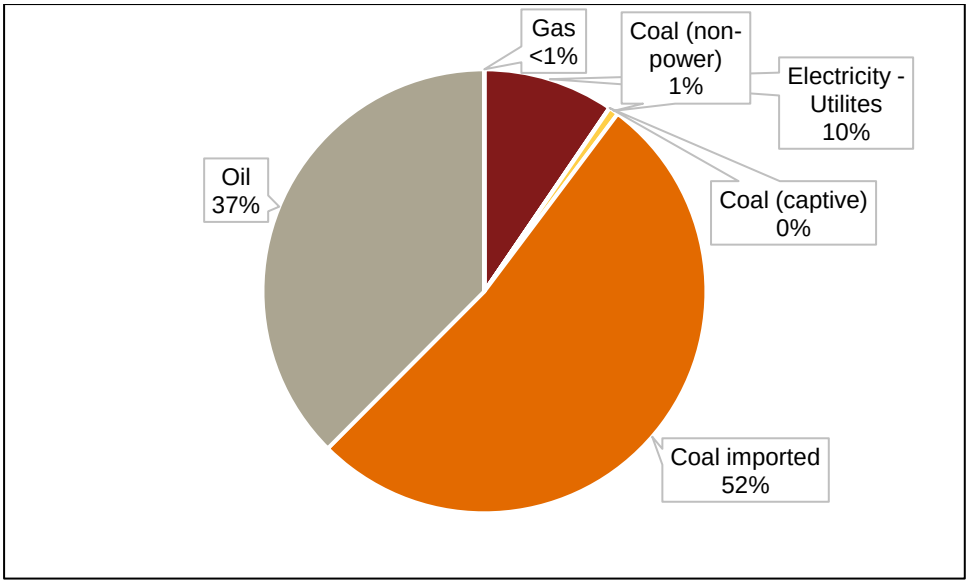


Figure 4: Fuel-wise split of total final energy consumption in Assam in 2019-20

Identification of focus sectors

For identifying the major energy guzzling sectors in the state, energy consumption data of a number of sectors was researched and analyzed. This data was gathered via primary consultations with the various stakeholders and through secondary domain research.

Based on this assessment, following sectors were identified as the most energy intensive in the state:



Figure 5: Identified focus sectors

Projection and forecasting

It has long been axiomatic that economic growth and energy demand are linked. As an economy grows – its energy demand increases; if energy is constrained, GDP growth pulls back in turn. Following graph forecasts Assam's GSDP and its energy consumption from 2015 to 2030:-

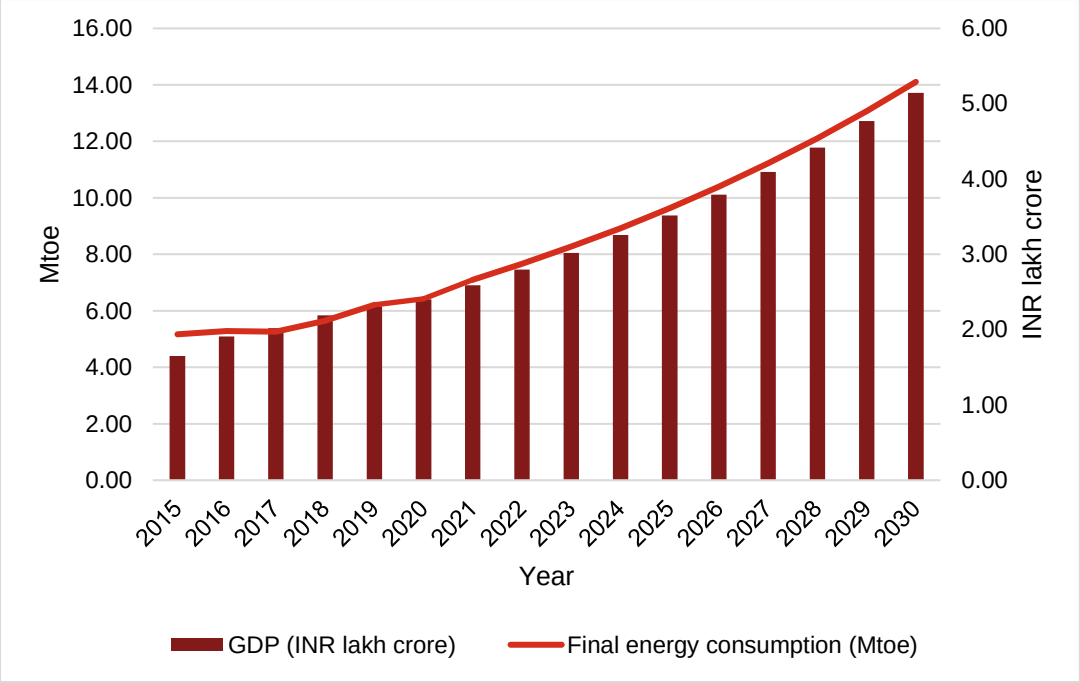


Figure 6: Energy consumption and GDP forecasting of Assam

The baseline energy consumption intensity for FY2020 was calculated (2.74) and multiplied with forecasted GSDP to obtain final energy consumption trend till 2030.

Focus sector 1 - Industries

Current scenario

From an energy perspective – industrial sector in Assam is one of the highest consumers in the state.

Energy efficiency potential in the sector

The estimated energy efficiency potential projected for the year 2030 in the industrial sector in Assam is as follows: -

Table 1: Energy Savings potential in industries sector

Action Plan	Energy Savings in 2030 under moderate scenario (toe)	Energy Savings in 2030 under ambitious scenario (toe)
Deepening of PAT scheme	1462	6173
Energy efficiency in SME sector	8297	23,232

The afore-mentioned moderate and ambitious scenarios have been discussed in detail in section 4.2 of the report.

Energy efficiency strategies in the sector

1. Action plan 1 - Deepening of PAT scheme: It is recommended that the threshold for the PAT criteria in terms of energy consumption may be lowered so as to accommodate more cement and petroleum refinery units present within the state. Following table illustrates the energy efficiency that can be achieved via this strategy:-

Table 2: Specific energy consumption used in Action Plan 1

Sector	Baseline SEC (toe/tonne)	Moderate SEC (toe/tonne)	Ambitious SEC (toe/tonne)	Production in 2030 (tonnes)	Energy saving in moderate scenario (toe)	Energy saving in ambitious scenario (toe)
Cement	0.0716	0.0708	0.0676	2477105	**990**	**6935**
Petroleum Refinery	89.36 (MBN/thousand barrels)	85 (MBN/thousand barrels)	81.8 (MBN/thousand barrels)	8572 MBBLS	**472**	**1145**

(Note: For the moderate and Ambitious SEC assigned to cement and petroleum refinery units - It is assumed that all the existing units will achieve the moderate SEC target in 50% units and achieve ambitious SEC target in 70% units. In cement sector, the zig-zag technology is considered and in petroleum refinery, the PAT notification target is considered as ambitious)

2. Action plan 2 - **:** Manufacturing MSME may be looked at more carefully from the lens of energy efficiency. The tea industry cluster of Assam is very energy intensive, and it is recommended that tea sector may be incentivized or prompted to adopt energy efficient technologies. Following table illustrates the energy efficiency that can be achieved via this strategy:-

Table 3: Specific energy consumption used in Action Plan 2

Sector	Baseline SEC (toe/tonne)	Moderate SEC (toe/tonne)	Ambitious SEC (toe/tonne)	Production in 2030 (tonnes)	Energy saving in moderate scenario (toe)	Energy saving in ambitious scenario (toe)
Tea	0.68	0.544	0.408	122019	8297	23,232

(Note: For the moderate scenario it is assumed that 50% penetration of VFD in hot air exhaust fan in dryer ,50%penetration of AFRC in stoker fired coal heater, 50% penetration of EE motors in withering and CTC sections. For the ambitious scenario it is assumed that 70% penetration of VFD in hot air exhaust fan in dryer, 70% penetration of AFRC in stoker fired coal heater, 70% penetration of EE motors in withering and CTC sections in tea producing units will take place)

Focus sector 2 – Commercial and domestic buildings

Current scenario

The buildings sector in encompasses different types of buildings present in Assam i.e., domestic (households) and commercial (health facilities, commercial complexes, public buildings etc.). The buildings sector of Assam consumed 15% of electricity consumption in 2019-20.

Energy efficiency potential in the sector

The estimated energy efficiency potential projected for the year 2030 in the buildings sector in Assam is as follows: -

Table 4: Energy Savings potential in buildings sector

Action Plan	Energy Savings in 2030 under moderate scenario (toe)	Energy Savings in 2030 under ambitious scenario (toe)
Replacement program for inefficient appliances	89939	145008
Effective implementation of Assam ECBC	1796	2515
Energy audit for public and commercial buildings	1862	3725

Energy efficiency strategies in the sector

1. Action plan 1 – Replacement programme for inefficient appliances: Replacement of inefficient appliances with their efficient counterparts can be considered as a low hanging fruit from and energy efficiency implementation standpoint. This strategy can be implemented in both domestic as well as commercial buildings. As part of the strategy, following appliances have been identified that can be in the contention for replacement:-



Following table illustrates the energy efficiency that can be achieved via this strategy:-

Table 5: Energy Savings by appliance in Action Plan 1

Appliance	Inefficient stock in FY2020	Energy saving in moderate scenario (Mtoe)	Energy saving in ambitious scenario (Mtoe)
Fan	7785000	27182	45304
Air conditioner	1211000	9416	15,694
Refrigerator	3892500	28,917	48,196
Washing Machine	3200500	2972	4953
Television	4498000	1253	2088
LPG cookstove	8044500	20,197	40,395

(Note: In moderate scenario, it is assumed that 30% of appliances will be replaced with efficient appliances and 10% switch to electric cookstove. In ambitious scenario, it is assumed 50% appliance replacement with efficient appliance and there will be a 20% switch to electric cook stove)

2. Action Plan 2 - it is recommended that the new and upcoming commercial and domestic buildings (having a connected load of minimum 100 kW) may be mandated as per the energy conservation buildings code (ECBC) in the state. Following table illustrates the energy efficiency that can be achieved via this strategy:-

(Note: In moderate scenario, it is assumed ECBC will be implemented in new commercial buildings more than 100 kW connected load and lead to 25% savings. In ambitious scenario, ECBC is assumed to be implemented in new commercial buildings more than 100 kW and lead to 35% savings)

3. Action plan 3 - Under this strategy, it is recommended that periodic energy audits may be carried out at public/commercial buildings on load basis. Directives may be issued to government departments to carry out detailed energy audits at their respective building facilities. Following table illustrates the energy efficiency that can be achieved via this strategy:

(Note: In moderate scenario, it is assumed 5% buildings will have energy audit and in ambitious scenario, it is assumed 10% of buildings will get energy audit. In ambitious scenario, it is assumed that energy audit recommendations implementation will lead to 30% savings.)

Focus sector 3 – Transport

Current scenario

The transport sector is one of the major consumers of energy in Assam.

Energy efficiency potential in the sector

Following table estimates the energy efficiency potential projected for the year 2030 in the transport sector in Assam:

Table 6: Energy Savings potential in transport sector

Action Plan	Energy Savings in 2030 under moderate scenario (Mtoe)	Energy Savings in 2030 under ambitious scenario (Mtoe)
Deployment of electric vehicles in state	0.6	1.1
Ethanol blending	0.1 (as per policy)	

Energy efficiency strategies in the sector

1. Action Plan 1: **Transition of existing fleet to electric vehicles:** Under this strategy, it is recommended to transition the existing ICE (Internal combustion Engine) fleet (two wheelers, three wheelers, four wheelers, bus and heavy vehicles) to electric vehicles. Following table encapsulates both the aforementioned scenarios and demonstrates the energy efficiency potential in the year 2030 as per this strategy of transition from ICE to electric vehicles :-

- *(Note: As per state policy 25% of two-wheelers, 25% three-wheeler, 25% four-wheeler, 100% bus and 25% HDV to be electric by 2027. This has been considered moderate scenario (Assam EV Policy 2021)*

  For ambitious scenario, 50% of two-wheelers, 50% of three-wheelers and 50% of four-wheeler, 100% of bus and 50% of HDV to be electric by 2030)

2. Action plan 2: **Ethanol blending programme:** Under this strategy - it is recommended that, as per the national target, ethanol blending in conventional fuels may be executed. The target already set in this segment is 20%. Following table encapsulates both the aforementioned scenarios and demonstrates the energy efficiency potential in 2030 as per this strategy: -

Focus sector 4 – Agriculture

Current scenario

Most of the energy consumption in agriculture sector of Assam is in irrigation pumps.

Energy efficiency potential in the sector

Following table estimates the energy efficiency potential projected for the year 2030 in the agriculture sector of Assam:

Table 7: Energy Savings potential in agriculture sector

Action Plan	Energy Savings in 2030 under moderate scenario (toe)	Energy Savings in 2030 under ambitious scenario (toe)
Replacement of diesel pumps with solar	46,404 (as per national policy)	
Replacement of inefficient pumps (15 years old) with Star-Rated pumps	517	862

Energy efficiency strategies in the sector

1. Action Plan 1 - **Transition of existing diesel pumps to solar based pumps:** Under this strategy, it is recommended that the existing stock of diesel-based pumps may be replaced by solar based pumps by 2025.

   Following table encapsulates both the aforementioned scenarios and demonstrates the energy efficiency potential in the year 2030 as per this strategy of transition from diesel pumps to solar based pumps :-

(Note: Only one scenario is considered since there is a national policy for zero use of diesel in agriculture. By 2025, 100% diesel pumps will be replaced with solar pumps)

2. Action plan 2 - **Replacement of inefficient electric pumps with efficient electric pumps:** Under this strategy, it is recommended that the existing stock of inefficient electric pumps (15 years old) may be replaced by Star-Rated electric pumps.

The final energy savings potential has been added and figure below shows the final energy consumption trends in Assam under the three scenarios in 2025 and 2030.

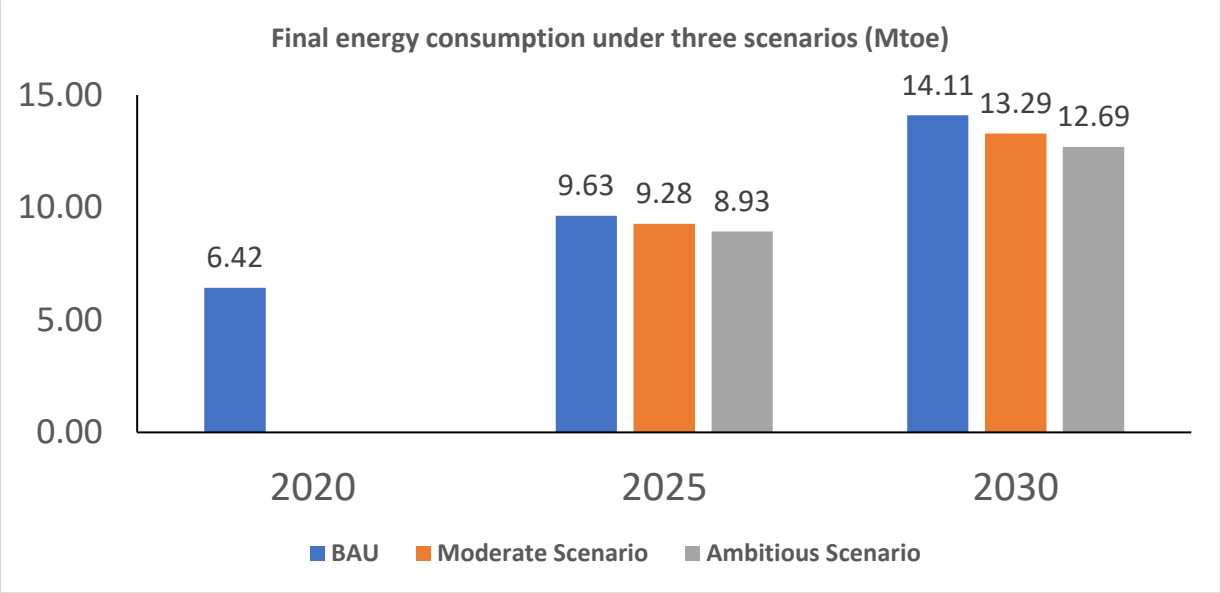


Figure 7: Final Energy Consumption trends in 2025 and 2030 under three scenarios

As observed from above, the energy savings potential is highest in ambitious scenario due to ambitious penetration of efficient technologies and equipment in this scenario. The overall energy savings, GHG emission reduction and investment potential for the state of Assam is shown below.

Table 8: Energy Savings, Emission Reduction, and Investment Potential for Assam

Sector	**Emissions Reduction (MtCO2) - FY2031**		**Energy Consumption Reduction (Mtoe) - FY2031**		**Investment Potential (INR Crores)**
	Moderate	**Ambitious**	**Moderate**	**Ambitious**	
	MtCO2 reduction	MtCO2 reduction	Mtoe Reduction	Mtoe Reduction	
Industry	0.03	0.08	0.01	0.02	44.9
Buildings	0.29	0.47	0.09	0.15	273.7
Transport	2.09	3.76	0.67	1.20	2208.7
Agriculture	0.15	0.15	0.05	0.05	87.0
Total	**2.55**	**4.45**	**0.81**	**1.42**	**2614.2**

The energy savings of 0.81 Mtoe and 1.42 Mtoe are calculated by savings from the four focus sectors. The emission reduction is calculated by multiplying the energy savings with a factor of 3.3 MtCO2/Mtoe. For market investment potential, 1 tonne of oil equivalent is taken as value of INR 18,402 and assuming payback period of 3 years.

1. Introduction

1.1. Background and about State Energy Efficiency Action Plan

The objective of the **State Energy Efficiency Action Plan (SEEAP)** is to ensure that the allocation of resources is as per the requirement of the state and to estimate the potential of energy conservation in sectors that are predominant in the region. The current assignment envisions the following:

- Identification of stakeholders from various sectors,
- Identification of focus sectors in a state,
- Identification of gaps through surveys,
- Sector-specific energy projections and energy savings targets
- Benefits to the State and various stakeholders through the implementation of the Energy Efficiency Action Plan

1.2. India's Nationally Determined Contributions and Mission LiFE

India's first NDC in **Paris Agreement on Climate Change - 2016** called for **33-35%** reduction of emissions intensity of GDP by 2030 compared to 2005. However, this target has been increased to **45%** in the recent COP26. The five ambitions, also known as **Panchamrit,** that India announced in the recent Conference of Parties (COP-26) at Glasgow, UK, are as follows:

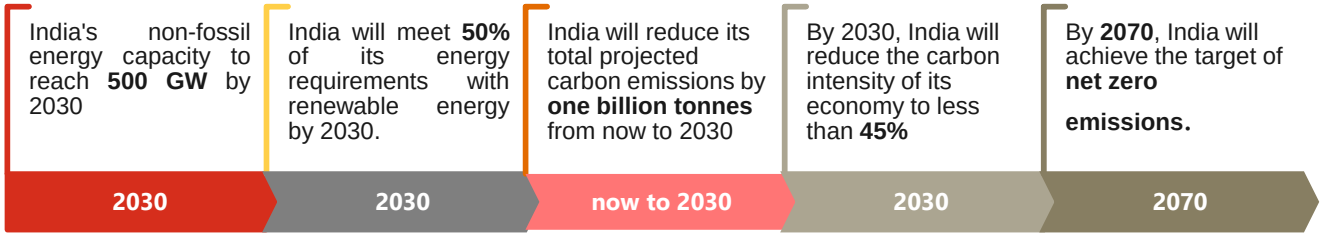


Figure 8: :India's NDC

What is Mission LiFE?

Mission LiFE is an India-led global mass movement to nudge individual and community action to protect and preserve the environment. At the 26th session of the Conference of the Parties (COP26) to the United Nations Framework Convention on Climate Change (UNFCCC) held in Glasgow, United Kingdom, India shared the mantra of LiFE - Lifestyle for Environment - to combat climate change. India is the first country to include LiFE in its Nationally Determined Contributions (NDCs).

Need for this assignment

With the energy efficiency agenda gaining traction and momentum in India, there is a need to continuously evaluate institutional capacity, policies, programs, and markets at the state level to identify best practices and promote cross learning. Developing State Specific Energy Efficiency Action Plan through identification of **focus sector**, **undertaking gap analysis**, **adopting best practices** followed in peer group with **implementation plan strategy**; that can act as platform for developing State's Energy Policy and Programs. This assignment aims to develop State Specific Energy Efficiency Action Plans for the state of Assam.

India is a diverse country with diverse energy consumption patterns in different states/UTs. Broadly, the energy consumption is divided in five major sectors i.e., **Industries, Buildings, Transportation, Agriculture, Municipalities and DISCOMs.**

Though energy efficiency is a multi-dimensional subject, defining key focus areas to bridge gaps is the need of the hour. For instance, there may be states with lesser urbanized areas and therefore lesser number of high energy consumption buildings. Such a state may need more focus on energy efficiency in sectors such as Transportation, Agriculture, or others. As a part of the assignment, there has identification of stakeholders from various sectors, identification of focus sector in the state of Assam, identification of gaps in the sector, providing best practices and identification of designated agency to carry out efficiency activity in the sector in consultation with state for preparation of a short-term plan till the year 2025 and a medium-term plan till the year 2030. The plan also highlights the benefits derived from these initiatives to the state.

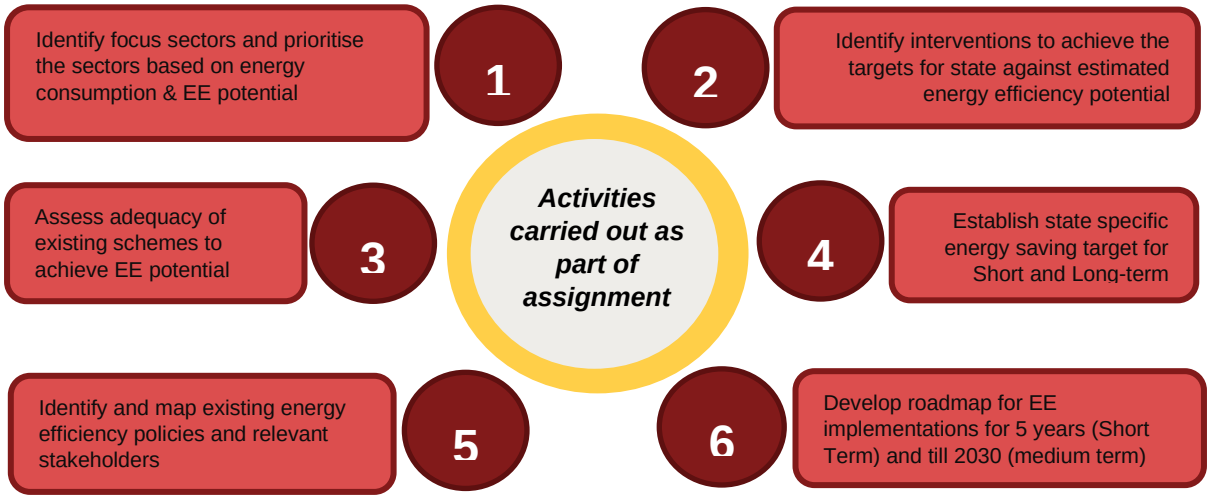


Figure 9: Key activities of project

1.3. State profile

Assam is in the north-eastern part of India and has geographical area of 78,438 sq. km and population of 3.4 crore. The natural resources, policy incentives and location-specific advantages of Assam support investments in sectors such as cement, petroleum refinery, fertilizer and pulp & paper. In 2019-20, the gross domestic product of Assam was INR 2.4 lakh crore and per capita GDP was INR 90,123.[2] Assam has the largest tea growing area in the world, constituting around one-seventh of the global tea production. In 2020-21, tea production in the state stood at ~503.46 thousand tonnes, which was 39.12% of the total tea production in India during the same period. It also has 20 industrial estates, three industrial growth centres, 11 Integrated Infrastructure Development Depots, 17 industrial areas, 12 growth centres, eight mini-industrial estates, one export promotion park and one food processing industrial park. Assam is also the most popular tourist destination among the northeast states.

2 State Domestic Product, Ministry of Statistics and Programme Implementation



Figure 10: Key sectors in Assam

The primary, secondary, and tertiary sectors represent various business types and the goods they procure and sell in an economic setup. The primary sector refers to agricultural and allied sector services, the secondary sector is the manufacturing sector, and the tertiary sector is known as the service sector. Assam's main economic driver is the tertiary sector (like services, trade, transport etc.) which accounted for 45% of GDP in 2019-20. Also, even though primary sector of the economy (like agriculture, forestry, mining etc.) has a considerable contribution to the GSDP, the sector has been historically observed to be non-energy intensive. [3]

1.4 State Energy Scenario (including renewable)

The energy consumption in the state is composed of primary energy and electricity. The primary energy is mainly derived from the use of coal and oil consumption. The electricity production is mainly done using coal from the coal-based thermal power plants. The energy flow in state of Assam is shown below in figure below

[3] Assam Economic Survey 2020-21

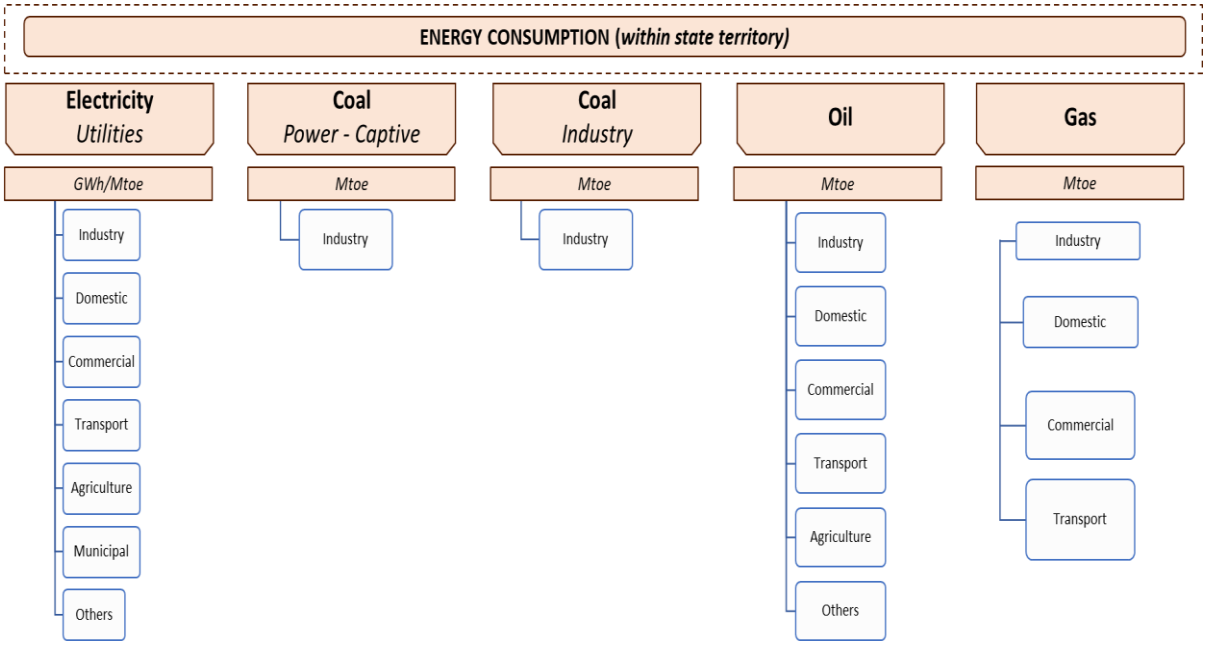


Figure 11: Energy Flow

The table below shows key economic and energy indicators of the state in 2019-20. Oil, gas and electricity consumption does not include imports-exports. Renewable capacity includes large hydro plants. The share of Assam's industrial output in India's industrial output is taken as basis for allocating imported coal. Assam's share of total imported coal in India is around 3% which has been accounted for below in the table.

Table 9: Key parameters of Assam

Parameter	Unit	Value	Mtoe
Total population[4]	Lakhs	346	-
Gross State Domestic Product[5]	INR lakh crore	2.4	-
Total Power Plant Installed Capacity [6]	MW	503	-
Total Renewable Energy Installed capacity[7]	MW	150	-
Electricity consumption (utilities)[8]	GWh	7109	0.61
Coal consumption (captive)[9]	Million Tonnes	0.004	0.002
Non-power coal consumption (industry)[10]	Million Tonnes	0.101	0.05

4 GSDP, RBI

5 GSDP, RBI

6 CEA, All India Electricity Statistics 2021

7 CEA, All India Electricity Statistics 2021

8 CEA, All India Electricity Statistics 2021

9 Coal Controller, Ministry of Coal (2019-20)

10 Coal Controller, Ministry of Coal (2019-20)

Imported coal attributable to Assam	Million Tonnes	7.5	3.4
Oil consumption[11]	Million Tonnes	2.06	2.41
Gas consumption[12]	Million metric standard cubic metre	1.31	0.001
Total Final Energy Consumption	Mtoe		**6.42**

Assam has 100 MW large hydro and 50 MW solar, wind and small hydro installed capacity as in 2019-20.[13] Figure below shows the installed capacity in Assam of solar, wind and hydro.

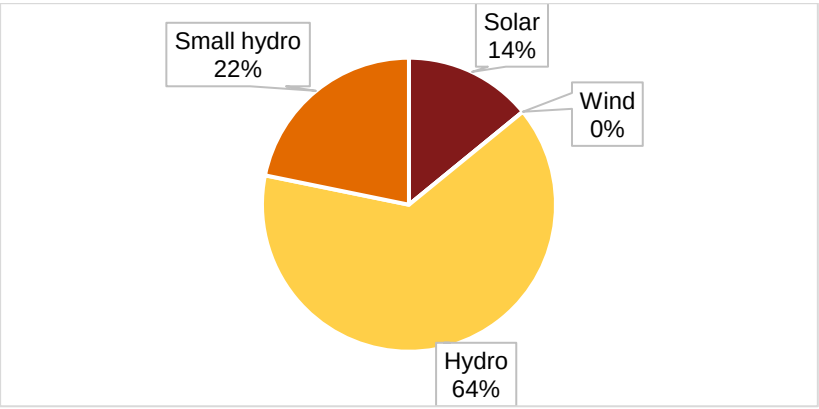


Figure 12: Renewable energy in Assam (2019-20)

1.5 Energy Consumption Scenario (TFEC)

The trends in final energy consumption for Assam are observed from 2014-15 to 2019-20. This includes coal imports by industry sector in Assam. This does not include aviation, DISCOM T&D losses, domestic navigation, Pet Coke, Paraffin waxes, petroleum jelly, LSWR, MTBE and reformate, BGO, Benzene, MTO, CBFS and Sulfur. This is observed in the figure below.

11 India PNG Statistics, MoPNG 2019-20 Pg 104

12 India's Oil and Gas Ready Reckoner (PPAC)

13 CEA All India Statistics 2021

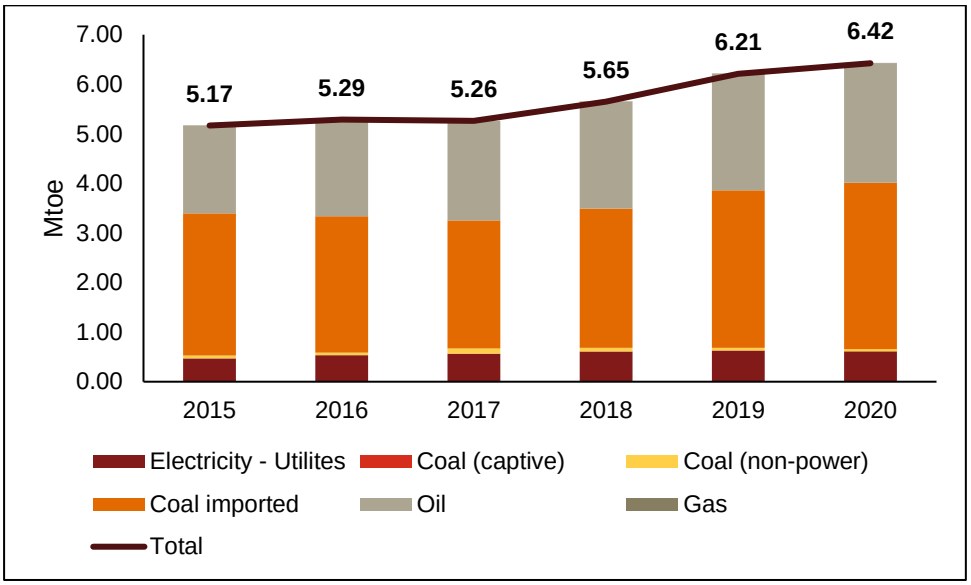


Figure 13: : Final Energy Consumption in Assam

The share of different fuels in final energy consumption for 2019-20 is shown below.

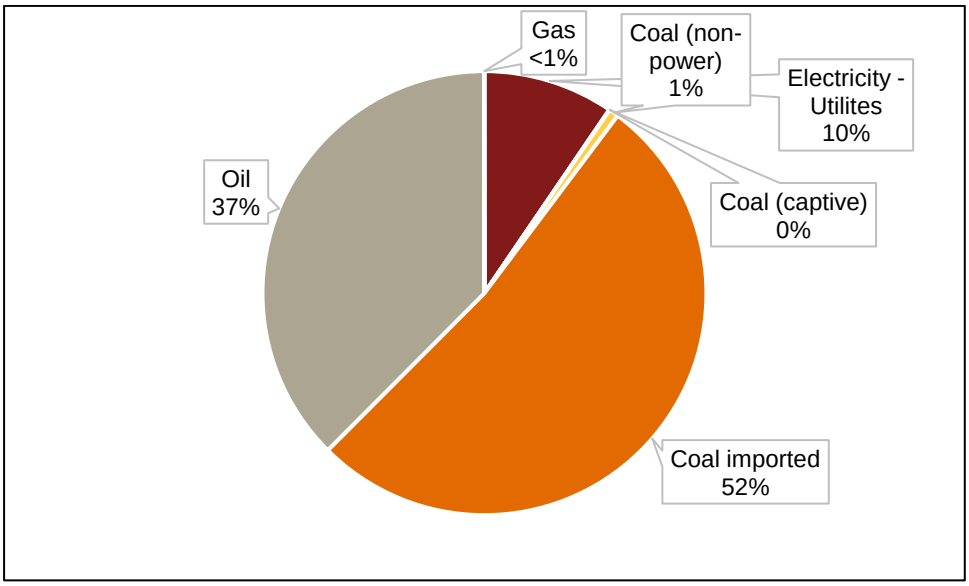


Figure 14: Final Energy Consumption for 2019-20

This signifies that the share of coal is dominant in total final energy consumption for Assam. Coal used in power plants and industry is either imported or sourced domestically. The electricity consumption is also majority coal-based and thus the share of coal in overall final consumption is around 53%.

1.6 Overview of Institutional Framework and Stakeholder Mapping

The overview of institutional framework of energy in the state of Assam is shown below:

Department of Power, Assam

Department of Power in Assam is the apex body responsible for providing energy to various sectors of the economy.

Assam State Designated Agency (ASDA)

Assam State Designated Agency (ASDA) is a state nodal agency which works to develop and deploy renewable energy and energy efficiency

Assam Power Distribution Company Limited (APCL)

APCL is the distribution company in Assam

Assam Power Generation Corporation Limited

APGCL is the state generation company and is authorized to operate and maintain a distribution system for selling electricity to the consumers in his area of supply at tariffs regulated by the State / Central Regulatory Authority, whichever is applicable.

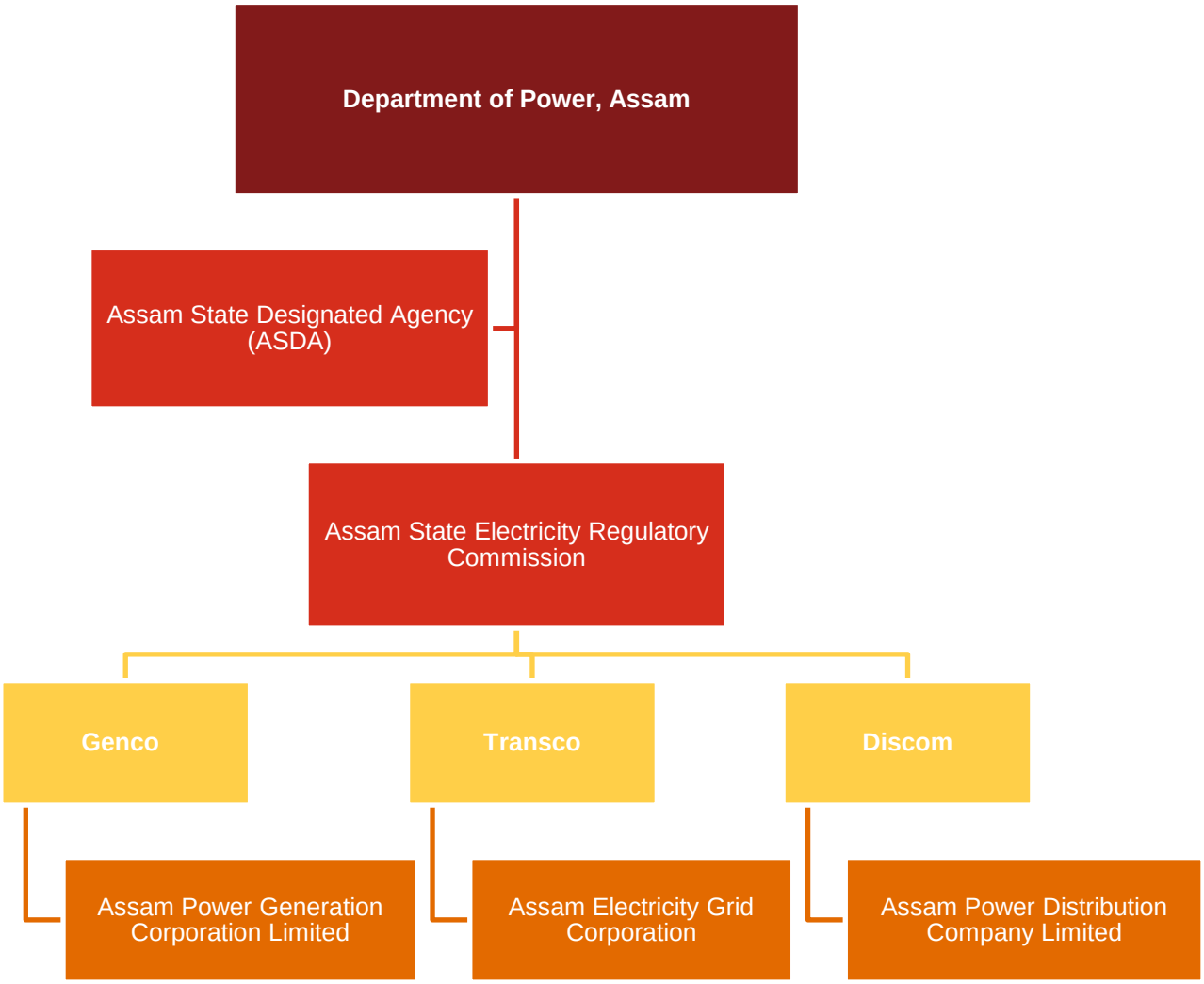


Figure 15: Overview of institutional framework of energy in Assam

2. Identification of focus sectors

2.1 Methodology of Focus Sector Identification

The four focus sectors selected for Assam are industry, buildings, transport and agriculture. Agriculture sector has been selected due to high potential with transition towards solar and ending diesel use in the sector.

Assam's industrial sector is the largest consumer of energy in the state followed by buildings, transport and agriculture sector. The industries sector is also a significant contributor to greenhouse gas emissions, making it an important target for energy efficiency measures. There is a significant potential for energy efficiency improvements in the industrial sector. The buildings sector has enormous potential for energy efficiency improvements, which can result in significant energy savings, cost savings, and environmental benefits.

2.2 Identified Focus Sectors

Industry Sector

The natural resources, policy incentives and location-specific advantages of Assam support investments in sectors such as cement, petroleum refinery, fertilizer and pulp & paper. Assam has 20 industrial estates, three industrial growth centres, 11 Integrated Infrastructure Development Depots, 17 industrial areas, 12 growth centres, eight mini-industrial estates, one export promotion park and one food processing industrial park.

Buildings sector

The buildings sector in Assam is an important component of the state's economy and infrastructure. The sector includes both residential and commercial buildings and plays a vital role in meeting the housing and infrastructure needs of the state's growing population. Assam is home to several major cities, including Guwahati, Dispur, Silchar, Dibrugarh and Jorhat. These cities have been experiencing rapid urbanization, leading to an increase in demand for housing and commercial spaces. As a result, the real estate sector in the state has been growing rapidly, with several major developers investing in the state. The construction of residential buildings is a significant part of the buildings sector in Assam. The commercial building sector in Assam is also expanding, with several new commercial spaces being developed in major cities. The state is home to several industrial hubs, which have attracted investments from major companies, leading to the construction of several commercial buildings and office spaces.

Transport sector

Assam has a well-developed transport sector that plays a vital role in connecting its people, businesses, and industries with the rest of the country. Road transportation is the dominant mode of transport in Assam, with the state having a vast network of roads connecting its cities and towns. In addition, the state government has been working on improving its road infrastructure by constructing new highways, bridges, and flyovers.

Agriculture sector

Assam's economy is fundamentally based on agriculture. Agriculture sector continues to support more than 75% of the state directly or indirectly by providing employment to 53% of the workforce. Assam occupies a geographical area of 7.8 million hectares of which total cropped area is 4.0 million hectares. However, only 5.4% of the gross cultivated area is irrigated and the average cropping intensity of the state is 145.9%. The cropping pattern in Assam has been more or less stable with only marginal changes in the importance of a few crops. Rice is the most important crop in Assam followed by rapeseed, mustard and tea. Wheat, pulses, jute and mesta, and sugarcane have witnessed a marginal decline in their shares while potato, banana, arecanut and chilies have gained importance over time. In Assam, the soil, topography, rainfall and climate in general are conducive for agricultural activities mainly for paddy cultivation.

3. Projections and forecasting (methodology)

Historic GSDP figures have been considered from 2014-15 to 2019-20 from RBI Handbook of Statistics. Gross State Domestic Product has been forecasted till 2030 using 80% weightage to historic trend of 7.78% and 20% weightage to the forecast of 8.5% as per Assam Economic Survey 2022-23. The figure below shows the historic and forecasted trends of GSDP for Assam.

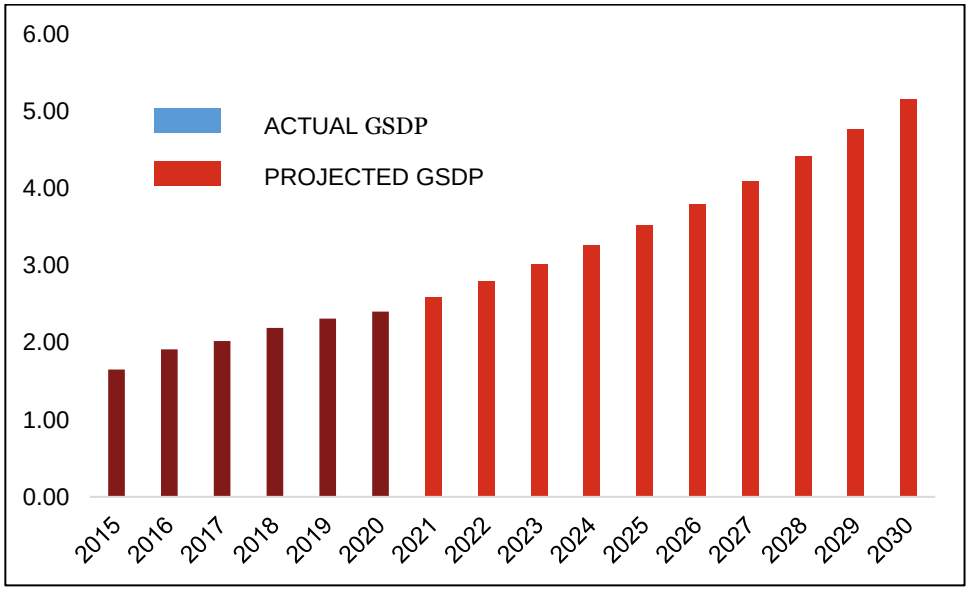


Figure 16: GSDP forecasting for Assam

Historic final energy consumption figures have been considered from 2014-15 to 2019-20 from various sources such as Coal Controller (Coal Directory of India), MoPNG India Statistics, PPAC Ready Reckoner and CEA All India Electricity Statistics.

Average Energy Intensity is the average of 5 years of energy intensity of GDP, calculated by dividing final energy consumption by GSDP. Final Energy Consumption is in Mtoe and GSDP in INR lakh crore. After taking average energy intensity of GDP from 2014-15 to 2019-20, the average energy intensity is calculated to be **2.74.** This is multiplied with each value of the forecasted GSDP to obtain the forecasted final energy consumption till 2030.

*Final Energy Consumption (forecasted) = Average Energy Intensity * GSDP (Forecasted)*

The final energy consumption in Assam varies from 5.17 Mtoe in 2014-15 to 6.42 Mtoe in 2020 and is projected to go up to 14.11 Mtoe in 2040. The baseline energy consumption intensity for FY2020 was calculated (2.74) and multiplied with forecasted GSDP to obtain final energy consumption trend till 2030. Following figure illustrates this information:

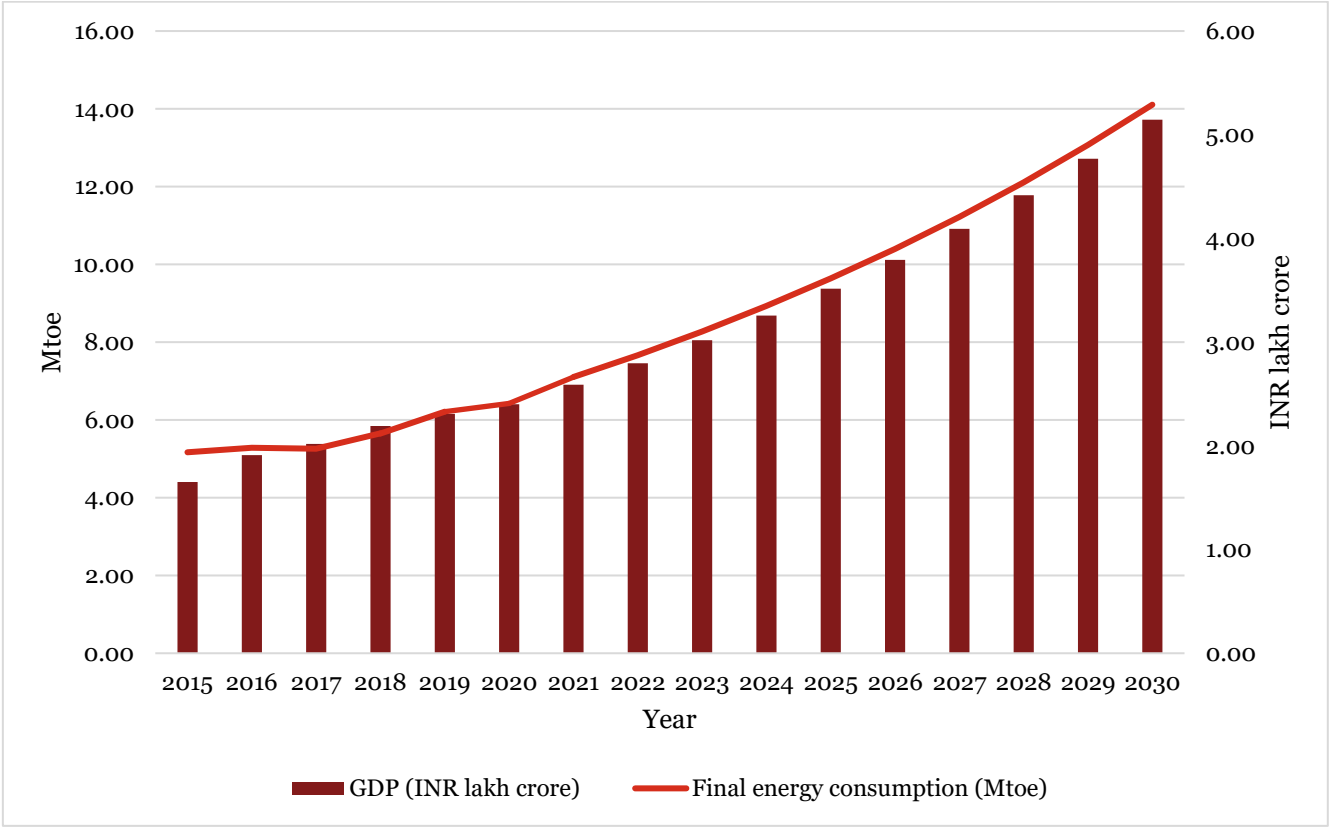


Figure 17: Forecast of final energy consumption for state of Assam

The GSDP for the state of Assam has been forecasted till 2030 and is estimated to become 14.11 INR lakh crore by FY2030.

4. Focus Sector 1 - Industry

4.1 Current Scenario

The industrial sector of Assam consists of cement, fertilizer, pulp paper and petroleum refinery sector.

Assam has two main national level schemes specific to the industrial sector which are being administered through the Bureau of Energy Efficiency. This is detailed as below:

1. PAT Scheme or Perform, Achieve, Trade Scheme:

Under this scheme, acceleration of energy efficiency is targeted in energy intensive industries through the issuance of tradable instruments which are known as “Energy Saving Certificates” or “ESCerts”. As part of this scheme, the notified energy intensive industrial units (which are also known as designated consumers) are required to reduce their energy consumption by undertaking energy efficiency measures. The PAT scheme is presently looking after the energy consumption of 14 sectors. These include:

- Cement
- Aluminum
- Chlor alkali
- Pulp & paper
- Iron & steel
- Fertilizer
- Thermal Power Plants
- Petroleum Refinery
- Railways
- Petrochemicals
- DISCOM
- Railways
- Textile
- Commercial buildings

Assam has 17 designated consumers (DC), and they are given below in the table.

Table 10: List of DC

S.No.	Unit	Sector
1	Assam Gas Based Power Plant, Kathalguri	Thermal Power Plant
2	Lakwa Thermal Power Station	Thermal Power Plant
3	Namrup Thermal Power Station	Thermal Power Plant
4	Bongaigaon Thermal Power Project, NTPC Limited	Thermal Power Plant
5	Brahmaputra Valley Fertilizers Corporation Limited ,Namrup II	Fertilizer

6	Brahmaputra Valley Fertilizers Corporation Limited ,Namrup III	Fertilizer
7	North East Frontier Railway	Railway
8	Numaligarh Refineries Ltd	Refinery
9	Indian Oil Corporation Limited-Bongaigaon	Refinery
10	IOCL, Guwahati Refinery, Noonmati	Refinery
11	Calcom Cement India Limited	Cement
12	Star Cement Limited (Grinding unit), Guwahati	Cement
13	Calcom Cement India (Grinding unit), Hojai	Cement
14	Assam Power Distribution Company Limited (APDCL), Guwahati	DISCOM
15	Brahmaputra Cracker and Polymer Limited	Petrochemical
16	Hindustan Paper Corporation Ltd, Jagiroad, Nagaon	Pulp & Paper
17	Hindustan Paper Corporation Ltd, Panchgram, Cachar	Pulp & Paper

2. BEE SME Programme:

The BEE SME Programme has been initiated to carry out energy efficiency-specific activities in the SME sector in India including conducting an extensive study for specific sectors as well as generating energy-related data for the SME sector which is believed to be highly unorganised and fragmented. As part of this programme, 25 clusters have been selected from 35 clusters across the country where the adoption of energy efficiency practices will be undertaken through several steps like capacity building, development of financing mechanisms and knowledge sharing. In addition to the above national schemes, there are some state-level schemes and initiatives as well that are targeted to promote energy efficiency in the industrial sector. These are elaborated below:

- Assam Industrial and Investment Policy 2019 : As part of this policy, Investment in new and renewable source of energy : If a unit makes an investment of not less than Rs.5 cr. for generation of power through green technology i.e. renewable sources of energy like solar plant which results in substantial reduction of use of fossil fuels and such renewable source of energy results in replacement of conventional source of energy by at least 40% of regular consumption, such unit may make an application to the Finance (Taxation) Department for consideration of the investment for tax reimbursement. The Finance (Taxation) Department, after such examination and enquiry as may be deemed necessary, if it is satisfied that such investment qualifies for tax incentives, it may, by an order, declare the unit eligible for tax reimbursement, subject to the condition that the quantum of monetary ceiling and time limit of tax reimbursement shall not exceed those available for a medium and large-scale unit

4.2 Energy Efficiency Strategies in the industry sector

Deepening and Widening of PAT scheme

1. Mandatory Standardized Energy Audits in every three years for all units that have energy consumption below PAT threshold, in all notified PAT sectors, excluding MSEs.

The first action plan for industries sector is the mandatory energy audits in units in notified PAT sectors but not part of PAT scheme as a designated consumer. This is applicable to medium and large industries but not the micro and small industries. Mandatory energy audits every three years can be an effective way to promote energy efficiency and help businesses reduce their energy consumption and costs. Mandatory energy audits can help businesses comply with energy efficiency regulations and standards. Governments may need to provide incentives or financial support to help cover the costs of energy audits. The frequency of energy audits should be carefully considered, taking into account the size and type of businesses, as well as the potential energy savings. Overall, mandatory energy audits every three years can be an effective way to promote energy efficiency and help businesses reduce their energy consumption and costs. By identifying energy-saving opportunities, increasing energy efficiency, and complying with regulations, businesses can benefit from lower energy costs, reduced carbon footprint, and improved sustainability. However, governments should carefully consider the cost and frequency of mandatory energy audits and provide support and guidance to businesses to ensure that the audits are conducted effectively and efficiently.

2. Creating enabling environment through B2B forums with global technology suppliers

Creating an enabling environment through B2B forums with global technology suppliers can be an effective way to promote innovation, collaboration, and growth in various industries. Here are some steps to consider: Identify the technology suppliers: Research and identify global technology suppliers who can provide innovative solutions and products relevant to your industry. Overall, B2B forums with global technology suppliers can create an enabling environment that fosters innovation, collaboration, and growth in your industry. By bringing together the right people, creating opportunities for interaction and collaboration, and following up with participants, you can build valuable relationships and drive positive change

3. State-level energy efficiency roadmap for key sectors to be prepared

A state-level energy efficiency roadmap can be an effective way to promote energy efficiency in key sectors and help states achieve their energy goals. Overall, a state-level energy efficiency roadmap can help states achieve their energy goals, promote sustainability, and save costs for businesses and residents. By identifying key sectors, setting targets, assessing existing policies and programs, developing sector-specific strategies, identifying implementation mechanisms, and monitoring progress, states can create a roadmap that is comprehensive, realistic, and effective**.** For Assam, key energy-intensive sectors such as cement, refinery and pulp & paper to be prioritized.

4. Channelizing green/climate finance and leverage financing instruments including but not limited to risk guarantee programs

Channelizing green finance involves creating pathways or channels for investment capital to flow towards environmentally sustainable projects and initiatives. This can be done through various means, including the use of financial instruments such as green bonds, green loans, and sustainability-linked loans. Leverage financing instruments, on the other hand, refer to mechanisms that allow investors to use borrowed funds to increase the potential returns on their investments. This can be achieved through the use of financial tools such as options, futures, and swaps. Risk guarantee programs are designed to mitigate the risks associated with investing in green projects by providing guarantees to investors against potential losses. These guarantees can be provided by governments, international organizations, or private sector entities. By using these various financial instruments and programs, it is possible to encourage and support investment in environmentally sustainable projects and initiatives, thereby contributing to the transition towards a greener and more sustainable future.

5. Encouraging demonstration and pilot projects through technical institutions like IIT, IISc

Encouraging demonstration and pilot projects through technical institutions can help to promote and test new ideas and technologies in a controlled setting before they are scaled up and implemented more widely. Technical institutions such as universities, research institutes, and engineering firms are often well-placed to carry out such projects, as they typically have the necessary expertise and equipment to develop and test new technologies. There are several ways that technical institutions can encourage demonstration and pilot projects. These include providing funding, collaborating with industry, and offering expertise. By encouraging demonstration and pilot projects through technical institutions, it is possible to accelerate the development and adoption of new technologies, while also ensuring that they are safe and effective

Energy efficiency interventions in SME sector

1. Awareness on Energy conservations in tea cluster

Increasing awareness on energy conservation in tea clusters can help reduce energy consumption and costs, as well as promote sustainability in these industries. There should be development of training and educational materials that explain the benefits of energy conservation and provide practical tips and strategies for reducing energy consumption. Training sessions should be conducted for workers, managers, and other stakeholders in the clusters. Overall, increasing awareness on energy conservation in tea clusters can help reduce energy consumption, costs, and carbon footprint in these industries. By identifying energy-saving opportunities, developing training and educational materials, conducting training sessions, providing incentives, and monitoring progress, stakeholders can work together to promote sustainability and create a more energy-efficient future

2. Periodic standardized energy audits for MSMEs on load basis and reimbursement of energy audit cost

Standardized energy audits in the MSME (Micro, Small, and Medium Enterprises) sector can help identify energy-saving opportunities and promote energy efficiency in these businesses. Audits should be conducted in a systematic and comprehensive manner, and should include a review of energy bills, a site inspection, and an analysis of energy use patterns. Recommendations should be specific, actionable, and tailored to the needs of each business. The progress towards energy efficiency goals should be monitored and evaluated. This will help ensure that the standardized energy audits are effective in promoting energy efficiency in the MSME sector. Overall, standardized energy audits in the MSME sector can help businesses identify energy-saving opportunities and promote energy efficiency. By developing a standard audit protocol, training auditors, conducting audits, providing recommendations, following up and supporting businesses, and monitoring progress, stakeholders can work together to create a more energy-efficient future for the MSME sector.

3. Sector-specific policy development for financial assistance on implementation of ECMs suggested in energy audit.

Developing sector-specific policies for financial assistance for energy conservation measures can help incentivize businesses to adopt energy-efficient practices and reduce their carbon footprint. The first step is to identify sectors with the highest energy consumption: Identify sectors with the highest energy consumption and carbon emissions. This will help prioritize sectors that would benefit the most from financial assistance for energy conservation measures. Secondly, it is important to assess energy-saving opportunities. This will help identify the most effective energy conservation measures for each sector and estimate the potential energy savings. There should be develop of sector-specific policies for financial assistance for energy conservation measures. These policies should be tailored to the needs of each sector and provide incentives for businesses to adopt energy-efficient practices. Overall, developing sector-specific policies for financial assistance for energy conservation measures can help incentivize businesses to adopt energy-efficient practices and reduce their carbon footprint. By identifying sectors with the highest energy consumption, assessing energy-saving opportunities, developing sector-specific policies, providing financial incentives, monitoring progress, and providing technical assistance, stakeholders can work together to create a more sustainable future for each sector.

4. Demonstration projects on latest Energy Efficiency Technologies in SME clusters

Demonstration projects on the latest energy efficiency technologies in SME clusters can help businesses understand the potential benefits of adopting these technologies and encourage their wider adoption. The first step is to identify target SME clusters that would benefit the most from adopting energy-efficient technologies. This could include clusters that consume a high amount of energy, have high energy costs, or are located in regions with high electricity prices. It is important to plan demonstration projects that showcase the benefits of the selected energy-efficient technologies. The projects should be designed to show how the technologies can improve energy efficiency, reduce energy costs, and increase productivity. Overall, demonstration projects on the latest energy efficiency technologies in SME clusters can help businesses understand the benefits of adopting energy-efficient technologies and encourage their wider adoption. By identifying target SME clusters, selecting energy-efficient technologies, planning demonstration projects, providing funding and technical assistance, monitoring and evaluating performance, and promoting wider adoption, stakeholders can work together to create a more sustainable future for SME clusters.

5. Technical and financial assistance for transition to variable frequency drive in hot air exhaust fan in dryer in tea sector

Transitioning to VFD drive in tea sector can significantly improve energy efficiency and reduce carbon emissions. It is important to provide technical and financial assistance for this transition and conduct feasibility studies. Incentives should be offered, and awareness promoted through workshops and seminars. Overall, providing technical and financial assistance for the transition to energy efficient technologies can help businesses improve energy efficiency, reduce carbon emissions, and achieve sustainable growth. By providing technical assistance,

conducting feasibility studies, providing financing, offering incentives, and promoting awareness, stakeholders can work together to create a more sustainable future for these industries.

7. **ISO 50001 implementation in Assam**

ISO 50001 is an internationally recognized standard for energy management systems that provides organizations with a framework to manage and improve their energy performance. It specifies requirements for establishing, implementing, maintaining, and improving an energy management system, and can be applied to any organization, regardless of its size, sector or geographical location. In India, ISO 50001 has gained significant importance in recent years due to the country's growing energy demand and increasing awareness of the need for energy conservation and efficiency. The Indian government has launched several initiatives to promote energy efficiency and has made it mandatory for certain industries to implement energy management systems based on ISO 50001. ISO 50001 certification in India is handled by various accredited certification bodies, and organizations can choose to get certified to demonstrate their commitment to energy efficiency and sustainability. ISO 50001 certification can also provide organizations with various benefits such as reduced energy costs, improved energy performance, enhanced corporate image, and increased stakeholder trust. Overall, ISO 50001 is a valuable tool for organizations in India to manage their energy use and improve their energy efficiency, which can ultimately lead to reduced energy costs, increased competitiveness, and a more sustainable future.

4.3 Energy Saving Targets & Monitoring Mechanism

1. Deepening of PAT Scheme

Particulars	Details
Action Plan 1	Deepening of PAT Scheme
Scope Boundary	Existing cement & petroleum refinery units currently not in PAT scheme to be brought under PAT by lowering threshold limit
Implementing Agency	Bureau of Energy Efficiency (BEE); ASDA
Current Policy in place	Perform, Achieve & Trade (PAT)
Modification required	1. Lowering of threshold for Cement, Petroleum Refinery
Methodology Adopted	1. It is assumed that all the existing units will achieve the moderate SEC target in 50% units and achieve ambitious SEC target in 70% units. 2. It is assumed that moderate SEC target will be achieved in 50% units and ambitious SEC target in 70% units.
Implementation Period	Till FY 2030

For deepening of PAT scheme, the cement sector & petroleum refinery are considered. The non-PAT units in these two sectors are considered for Action Plan 1 which recommends lowering of threshold limit in cement and petroleum refinery units. The moderate scenario assumes that the 50% units will achieve the moderate SEC target and ambitious scenario assumes that 70% of units will achieve the ambitious SEC target.

The specific energy consumption (SEC) assumes for Action Plan 1 has been shown below.

Table 11: Assumptions for SEC in Action Plan 1 of Industries Sector

Sector	Baseline SEC (toe/tonne)	Moderate SEC (toe/tonne)	Ambitious SEC (toe/tonne)	Production in 2030 (tonnes)	Energy saving in moderate scenario (toe)	Energy saving in ambitious scenario (toe)
Cement	0.0716	0.0708	0.0676	2477105	**990**	**6935**
Petroleum Refinery	89.36 (MBN/thousand barrels)	85 (MBN/thousand barrels)	81.8 (MBN/thousand barrels)	8572 MBBLS	**472**	**1145**

As seen in the table above, the sector-wise SEC targets are given, and these are used to estimate energy savings.[14]

In deepening of PAT scheme, the 2030 cement & petroleum refinery production is estimated and aligned with Govt. of India targets of 2030 production. The energy consumption in cement sector and petroleum refinery sector is calculated for 2030 under three scenarios: BAU, moderate and ambitious. In moderate scenario, 50% production uses the moderate SEC target and in ambitious scenario, 70% production uses the ambitious SEC target. The difference between BAU energy consumption and moderate energy consumption gives energy savings in moderate scenario and the difference between BAU energy consumption and ambitious energy consumption gives energy savings in ambitious scenario.

The final energy savings from Action Plan 1 are shown below in the table:

Table 12: Energy Savings potential from Action Plan 1 of industries sector

Action Plan	Energy Savings in 2030 under moderate scenario (toe)	Energy Savings in 2030 under ambitious scenario (toe)
Deepening of PAT scheme	1462	8081

2. Energy Efficiency Intervention in tea cluster

Particulars	Details
Action Plan 2	Energy Efficiency Intervention in tea cluster
Scope Boundary	Tea clusters of the state

14 SEC for cement and petroleum refinery taken from BEE/GIZ reports in secondary domain and PAT notification in Gazette

Implementing Agency	Bureau of Energy Efficiency (BEE); ASDA
Methodology Adopted	Moderate Scenario: 50% penetration of Variable Frequency Drive in hot air exhaust fan in dryer, 50%penetration of AFRC in stoker fired coal heater, 50% penetration of EE motors in withering and CTC sections Ambitious Scenario: 70% penetration of Variable Frequency Drive in hot air exhaust fan in dryer. 70% penetration of AFRC in stoker fired coal heater, 70% penetration of EE motors in withering and CTC sections.
Modification required	Penetration of energy efficient technologies
Implementation Period	Till FY2030

Apart from tea clusters, Cottage processing clusters in Assam also hold significant potential in terms of energy efficiency and may be incentivized or prompted to adopt energy efficient technologies

For SME sector, the tea sector is considered. Action Plan 2 recommends implementation of energy efficiency measures in this sector. For each sector, the 2030 production is estimated. In moderate scenario, 50% switch to more efficient technology is considered and 70% switch is considered in ambitious scenario. The energy savings from transition to energy efficient technologies is shown below. The specific energy consumption (SEC) assumes for Action Plan 2 has been shown below in the table.

Table 13: SEC assumptions for SME sector

Sector	Baseline SEC (toe/tonne)	Moderate SEC (toe/tonne)	Ambitious SEC (toe/tonne)	Production in 2030 (tonnes)	Energy saving in moderate scenario (toe)	Energy saving in ambitious scenario (toe)
Tea	0.68	0.544	0.408	122019	8297	23,232

As seen above, the sector-wise SEC target is given, and this is used to estimate energy savings. [15]

In SME sector, the 2030 production is estimated. The energy consumption in tea sector is calculated for 2030 under three scenarios: BAU, moderate and ambitious. In moderate scenario, 50% switch to efficient technology using moderate SEC target and in ambitious scenario, 70% switch to efficient technology using ambitious SEC target. The difference between BAU energy consumption and moderate energy consumption gives energy savings in moderate scenario and the difference between BAU energy consumption and ambitious energy consumption gives energy savings in ambitious scenario. The final energy savings from Action Plan 2 are shown below in the table.

Table 14: Energy Savings potential from Action Plan 2 of industries sector

Action Plan	Energy Savings in 2030 under moderate scenario (toe)	Energy Savings in 2030 under ambitious scenario (toe)
Energy efficiency in SME sector	8297	23,232

15 SEC for tea sector taken from BEE SAMEEKSHA portal reports in secondary domain

Monitoring Mechanism

Implementing an energy savings monitoring mechanism is an important step for industries to track and measure their progress in reducing energy consumption and associated costs. This can involve a number of different steps, including

Establishing a baseline: The first step in monitoring energy savings is to establish a baseline of energy consumption. This can involve reviewing energy bills or conducting an energy audit to identify areas of high energy use. Identifying energy-saving opportunities: Once a baseline has been established, industries can identify areas where energy savings can be made. This may involve implementing energy-efficient technologies, optimizing processes or equipment, or changing behaviors.

Setting energy-saving targets: Based on the energy-saving opportunities identified, industries can set specific, measurable, and time-bound targets for reducing energy consumption.

Monitoring and measuring progress: Once targets have been set, industries can monitor and measure progress towards meeting these targets. This can involve tracking energy consumption and costs over time, analyzing data to identify trends, and comparing actual performance against targets.

Reporting and communicating results: Regular reporting and communication of energy savings results can help to build momentum and engagement within an organization. This can involve sharing results with key stakeholders, such as management, employees, and customers, and celebrating successes along the way. In addition to these steps, it is also important to establish a culture of continuous improvement around energy management. This can involve training and awareness-raising programs, setting up energy teams or champions within an organization, and ensuring that energy-saving initiatives are integrated into wider business strategies. By implementing an energy savings monitoring mechanism and establishing a culture of continuous improvement around energy management, industries can make significant progress in reducing energy consumption, lowering costs, and improving sustainability performance.

5. Focus Sector 2 - Buildings

5.1 Current Scenario

The buildings sector of Assam consists of public, commercial and residential buildings.

1. **Energy Conservation Buildings Standards**

Assam Energy Conservation Building Code 2018 is applicable for buildings with a connected load of 100 kW or more and is intended for commercial buildings while not covering residential buildings. It includes buildings for hospitality, health care, assembly, business, education, shopping complexes and mixed-use buildings. This code sets minimum performance standards for building envelope-like roofs and windows, lighting system, air-conditioning system, electrical distribution system, water heating and pumping.[16]

2. Unnat Jyoti by Affordable LEDs for All (UJALA) Scheme

UJALA, launched in 2015, is a Central Government scheme which aims to increase uptake of energy efficient appliances by households. It started with the distribution of the LED bulbs and has now expanded to LED tube light and energy efficient fans.

3. Guwahati Smart City

Guwahati has incorporated a special purpose vehicle (SPV) – Guwahati Smart City Limited (GSCL) (the 'Authority') to plan, design, implement, coordinate and monitor the smart city projects in Guwahati. GSCL is a company incorporated under Indian Companies Act 2013 with equal shareholding from Govt. of Assam. The basic objective of the assignment is to support GSCL to Development of proposed ABD Modules and PAN City proposal. TCE will provide strategic, advisory, liaising, consultancy and project management services to support GSCL in planning, designing, implementing and monitoring Area Based Development Project under the Guwahati smart city proposal. The SPV has been established on 11th May 2016. Also, Total authorized capital of SPV has proposed Rs. 400.00 Crore and total paid up capital of the SPV is Rs. 378.00 Crore. As per the Government of India, the total proposed cost for Guwahati smart city is around Rs. 2296 Crore, which includes Area Based Development (ABD) cost is approx. Rs. 1579 Crore and Pan City cost are approx. Rs. 622 Crore.

4. Other National Level Initiatives

HVAC systems consume significant amount of energy (around 65% consumption of commercial building is from HVAC). In order to effectively manage the energy consumption in cooling, the Ministry of Environment, Forest, and Climate Change (MoEFCC), Government of India has published draft India Cooling Action Plan in September 2018 which provides recommendations to optimize energy consumption for cooling under multiple sectors including buildings. India has also participated in District Energy in Cities Initiative of United Nations Environment Programme (UNEP) which aims to develop modern district energy systems, utilizing renewables, waste heat, thermal storage, power grids, thermal grids and heat pumps, which can provide heating and cooling requirements of buildings across a neighborhood or entire city. Amravati is the 1st city in India which will receive funding for installation a district cooling system under the UNEP initiative. A district cooling system is already operational in Gujarat International Finance Tec-City (GIFT City) since April 2015 and the greenfield smart city Raiya in Gujarat will witness deployment of such a system under India's Smart City Mission.[17]

---

[16] Assam Energy Conservation Building Code 2018

17 Smart Cities Council - India, 2017

5.2 Energy Efficiency Strategies in the buildings sector

Replacement program for inefficient appliances

1. Development of state-specific implementation models and identification of relevant agencies for replacing all existing inefficient appliances (15 years old) in government offices and buildings with BEE Star Rated appliances

The development of state-specific implementation models to replace inefficient appliances (15 years old) with BEE Star-Rated appliances involves a few key steps. The first step is to conduct an energy audit to identify the most energy-intensive appliances and the potential energy savings from replacing them with BEE Star-Rated appliances. This audit will help to determine the most effective and efficient appliances to target. Once the audit is complete, the next step is to set targets for the replacement of inefficient appliances (15 years old) with BEE Star-Rated appliances. This can be done at the state level, with specific targets for each district or locality. State governments can work with manufacturers to increase the availability of these appliances and to provide information on their benefits to consumers. Monitoring and evaluation: Finally, it is important to monitor and evaluate the implementation of the program to determine its effectiveness and to identify areas for improvement. This can be done through regular surveys and data analysis. Overall, the development of state-specific implementation models to replace inefficient appliances (15 years old) with BEE Star-Rated appliances requires a comprehensive approach that involves collaboration between government agencies, appliance manufacturers, and consumers. By working together, we can create a more energy-efficient and sustainable future for all.

2. Phase-wise plan for replacement of existing inefficient appliances with BEE Star rated appliances in all buildings, through DSM schemes

A phase-wise plan for the replacement of inefficient appliances (15 years old) with BEE Star Rated appliances through DSM (Demand Side Management) schemes could involve the following steps: Phase 1: Planning and Assessment Conducting a baseline survey: The first step is to conduct a baseline survey to identify the number and types of inefficient appliances (15 years old) in use in the target area. Identifying target consumers: Based on the survey, the next step is to identify the target consumers who are most likely to benefit from the DSM schemes. This may include households with low-income, high-energy consumption, or both. Developing a database: A database can be created for the target consumers, which includes their energy consumption patterns, appliance types, and other relevant information. Developing an implementation plan: Based on the survey and target consumer identification, an implementation plan can be developed for the DSM schemes. This plan should include the types of appliances to be replaced, the target areas, the funding required, and the timelines. Phase 2: Outreach and Awareness Launching awareness campaigns: An outreach and awareness campaign can be launched to educate the target consumers about the benefits of using BEE Star-Rated appliances, the DSM schemes, and how to avail them. Organizing energy efficiency workshops: Energy efficiency workshops can be organized to provide hands-on training and demonstrations of the use of BEE Star-Rated appliances. Collaborating with local NGOs: Local NGOs can be collaborated with to facilitate the outreach and awareness programs and to provide access to the target consumers. Phase 3: Implementation Identifying the most effective BEE Star-Rated appliances: Based on the survey and assessment, the most effective BEE Star-Rated appliances for replacement can be identified. Procuring BEE Star-Rated appliances: The procurement of the BEE Star-Rated appliances can be done through bulk purchases or tie-ups with appliance manufacturers. Distributing the BEE Star-Rated appliances: The distribution of the BEE Star-Rated appliances can be done through local distribution centres or door-to-door delivery. Phase 4: Monitoring and Evaluation Conducting energy audits: Energy audits can be conducted periodically to assess the energy savings achieved through the DSM schemes. By following this phased approach, the replacement of inefficient appliances (15 years old) with BEE Star-Rated appliances can be done efficiently and effectively through DSM schemes. This will help to reduce energy consumption, promote sustainability, and benefit the target consumers through energy cost savings.

Effective implementation of Assam ECBC

1. Integrate ECBC in new building approval process

Integrating the Energy Conservation Building Code (renamed as ECSBC" as per EC Act Amendment 2020). in the new building approval process can help to ensure that new constructions are energy-efficient and sustainable. The initial course of action is to launch awareness campaigns to inform builders, architects, and other stakeholders about the benefits of using ECBC and the requirements for compliance. A very important step is to incorporate ECBC into Building Approval Process as a mandatory requirement for obtaining building permits. Builders and architects should be required to provide an ECBC compliance certificate as part of the building approval process. The ECBC compliance certificate can be issued by accredited energy auditors or qualified professionals who are trained in ECBC compliance. The certificate should include details of the building's energy performance and compliance with the ECBC requirements. By integrating ECBC into the new building approval process, we can promote energy efficiency and sustainability in the construction sector.

2. Setting-up of effective enforcement plan with ULBs and SDA as monitoring agencies

Setting up an effective enforcement plan with urban local bodies for Energy Conservation Building Code (renamed as ECSBC" as per EC Act Amendment 2020). It can help to ensure that new constructions are energy-efficient and sustainable. Chief step is capacity building and training for urban local bodies to equip them with the necessary knowledge and skills required for enforcing ECBC requirements. This can include training on ECBC compliance, building energy audits, and inspection procedures. It is important to establish a monitoring and enforcement mechanism to ensure compliance with ECBC requirements. This can include regular inspections and audits of buildings to check for compliance with ECBC requirements. There can be imposing penalties for non-compliance. These penalties can be imposed on builders or building owners who fail to comply with ECBC requirements. A very important aspect is offering Incentives for Compliance to builders or building owners who comply with ECBC requirements. These incentives can include tax breaks, expedited approvals, or other benefits. By establishing an effective enforcement plan with urban local bodies, we can ensure that new constructions are energy-efficient and sustainable.

3. Development and maintenance of ECBC compliance portal, directory of energy efficient materials/technologies

The development and maintenance of an ECBC (renamed as ECSBC" as per EC Act Amendment 2020). ECBC compliance portal can help to streamline the process of enforcing compliance with the Energy Conservation Building Code (renamed as ECSBC" as per EC Act Amendment 2020) and make it more transparent and efficient. The ECBC compliance portal needs proper design and development to be done by a team of web developers. Portal should be user-friendly and easy to navigate. A database should be developed to store information on buildings that are ECBC compliant or non-compliant. This database should be updated regularly to reflect the latest information on building compliance status. The ECBC compliance portal should be integrated with other systems such as the building permit system, energy audit system, and monitoring and enforcement system. This integration will ensure that all relevant information on building compliance is available in one central location. Builders or building owners should be able to submit their ECBC compliance certificate online through the portal. This will make the process of submitting compliance certificates more efficient and reduce the need for manual submission. The ECBC compliance portal should be regularly maintained and upgraded to ensure that it remains up-to-date and meets the changing needs of users. This can be done through regular updates and improvements to the portal. By developing and maintaining an ECBC compliance portal, we can streamline the process of enforcing compliance with ECBC requirements and ensure that the process is transparent and efficient.

4. Empanelment of building experts at the state level

Empanelment of building experts at the state level in India can help to promote energy efficiency and sustainability in the construction sector, as well as support the implementation of the Energy Conservation Building Code (renamed as ECSBC" as per EC Act Amendment 2020). Key step is to identify building experts who have the necessary knowledge and skills to support the implementation of ECBC requirements. These building experts can include architects, engineers, energy auditors, and other building professionals. A formal empanelment process can be established to select building experts for the empanelment. This process can include an application process, review of qualifications and experience, and an interview process. Once the building experts are empaneled, training and capacity building programs can be conducted to equip them with the latest knowledge and skills on ECBC compliance, building energy audits, and inspection procedures. Regular monitoring and performance evaluation of the empaneled building experts can be conducted to ensure that they are complying with ECBC requirements and providing high-quality services. Regular communication and feedback mechanisms can be established to ensure that empaneled building experts are aware of the latest developments in ECBC compliance and enforcement and receive feedback on their performance. By empaneling building experts at the state level, we can ensure that building professionals have the necessary knowledge and skills to support the implementation of ECBC requirements and promote energy efficiency and sustainability in the construction sector.

5. Market Outreach for ECBC compliant Products, Radio Jingles, Social Media Awareness

Market outreach is crucial for promoting the use of ECBC(renamed as ECSBC" as per EC Act Amendment 2020) compliant products and increasing awareness of energy efficiency in the building sector. Radio jingles and social media awareness campaigns are effective tools that can be used to reach a wide audience and promote ECBC compliant products. The first crucial step is to identify the target audience for the radio jingles and social media awareness campaign. This can include builders, architects, engineers, building owners, and other stakeholders in the building sector. The message for the radio jingles and social media awareness campaign should be clear, concise, and focused on the benefits of using ECBC compliant products. The message should also be tailored to the target audience to ensure that it resonates with them. The jingles should be catchy and memorable, and they should highlight the benefits of using ECBC compliant products. The radio jingles can be aired on local radio stations to reach a wider audience. The jingles can also be shared on social media platforms to increase their reach. By promoting ECBC compliant products through radio jingles and social media awareness campaigns, we can raise awareness of the benefits of energy efficiency in the building sector and encourage the use of ECBC compliant products.

6. Pilot project investment for Super ECBC as case studies (initial 20 Buildings)

A pilot project investment for a Super ECBC (renamed as ECSBC" as per EC Act Amendment 2020). would involve implementing a comprehensive energy conservation strategy in a building, with the goal of reducing its energy consumption and carbon footprint. Overall, a pilot project investment for Super ECBC can provide valuable insights into the effectiveness of energy conservation strategies in buildings and serve as a case study for future projects.

7. Periodic upgradation of PWD Schedule of Rates (SoR) to incorporate latest energy efficient materials and technologies

Periodic upgradation of Public Works Department (PWD) Schedule of Rates for energy-efficient materials and technologies is crucial for promoting the use of energy-efficient products and technologies in public infrastructure projects. It is essential to identify the energy-efficient materials and technologies that can be included in the PWD Schedule of Rates. This can be done by conducting research on the latest energy-efficient products and technologies available in the market. The existing PWD Schedule of Rates can be reviewed to identify areas where energy-efficient materials and technologies can be included. This can be done by analyzing the current rates for materials and technologies and identifying areas where energy-efficient alternatives are available. A cost-benefit analysis can be conducted to determine the financial and environmental benefits of using energy-efficient materials and technologies. This analysis can help to identify the most cost-effective options for inclusion in the PWD Schedule of Rates. The PWD Schedule of Rates can be upgraded to include the energy-efficient materials and technologies that have been identified through the review process. The rates can be revised to reflect the

cost of using these materials and technologies, considering any cost savings that may be achieved through energy efficiency. By periodically upgrading the PWD Schedule of Rates for energy-efficient materials and technologies, we can encourage the use of energy-efficient products and technologies in public infrastructure projects.

8. Inclusion of curriculum on energy efficiency in buildings, in state universities and education boards

Inclusion of curriculum on energy efficiency in buildings in universities is crucial for creating awareness among students and professionals in the building sector about the importance of energy efficiency and sustainable building practices. It is crucial to develop a curriculum on energy efficiency in buildings that can be included in the university syllabus. The curriculum should cover topics such as building design, energy-efficient materials and technologies, energy audits, and building retrofitting. Faculty members who will be teaching the curriculum should be provided with training on energy efficiency in buildings to ensure that they are equipped to teach the course effectively. The curriculum on energy efficiency in buildings can be integrated into existing courses such as architecture, engineering, and construction management.

Energy audit for commercial and public buildings

1. Issue directives to all government departments to conduct energy audits and target to achieve BEE Star Rating for public buildings more than 100kW connected load

The first important action is to create awareness among government departments about the importance of energy audits and BEE Star Rating for public buildings. This can be done through workshops, seminars, and other outreach programs. The government can set targets for government departments to conduct energy audits and achieve BEE Star Rating for public buildings more than 100kW connected load. This can be included in the department's annual performance targets. Providing incentives such as tax credits, rebates, and subsidies can encourage government departments to conduct energy audits and achieve BEE Star Rating for public buildings more than 100kW connected load. Conducting training programs for government officials on energy audits and BEE Star Rating can help them to understand the importance of these measures and how to achieve them. The government can mandate compliance with energy audits and BEE Star Rating for public buildings more than 100kW connected load. This can be done through legislation or regulations. By implementing these measures, the government can promote the conduct of energy audits and the achievement of BEE Star Rating for public buildings more than 100kW connected load. This will help to reduce energy consumption, save costs, and promote sustainable building practices.

2. Periodic energy audits for commercial buildings on load basis and incentives on achieving star rating for buildings

Periodic energy audits for commercial buildings in Assam are crucial for identifying opportunities to improve energy efficiency, reduce energy consumption, and save costs. The first step is to identify commercial buildings that are eligible for energy audits. The government can mandate energy audits for buildings that have a certain level of energy consumption or connected load. An auditing firm that has experience in conducting energy audits for commercial buildings can be selected. The firm should be accredited by the Bureau of Energy Efficiency (BEE). The auditing firm can conduct a detailed energy audit of the commercial building to identify energy consumption patterns, areas of energy wastage, and opportunities for energy efficiency improvements. This can be done using energy meters, thermal imaging cameras, and other equipment. The results of the energy audit can be analyzed to identify opportunities for energy efficiency improvements. The auditing firm can provide a detailed report on the energy consumption patterns, areas of energy wastage, and recommendations for energy efficiency improvements. The recommendations provided by the auditing firm can be implemented to improve energy efficiency and reduce energy consumption. This can include measures such as retrofitting lighting systems, upgrading HVAC systems, and improving insulation. The energy savings achieved through the implementation of energy efficiency measures can be monitored and verified. This can be done through regular energy audits to ensure that the building is performing as expected. By conducting periodic energy audits for commercial buildings in India, we can identify opportunities for energy efficiency improvements and reduce energy consumption.

3. Capacity Building of Architects & Building Professionals and Developers

Capacity building of architects and building professionals for green building and energy conservation building code is crucial for promoting sustainable building practices and achieving energy efficiency goals. The first action is to conduct training programs for architects and building professionals on green building practices and energy conservation building code. This can be done through workshops, seminars, and other outreach programs. A

curriculum should be developed which will cover topics such as building design, energy-efficient materials and technologies, energy audits, and building retrofitting. There can be established certification programs for architects and building professionals who have completed the training programs and have demonstrated proficiency in green building practices and energy conservation building code.

4. Market Outreach for Star & Shunya Rating by Radio Jingles, Social Media Awareness

Market outreach is crucial for promoting the adoption of BEE Star and Shunya ratings for appliances and buildings in Assam. Awareness campaigns and outreach programs should educate consumers about the benefits of using BEE Star-rated appliances and living in Shunya-rated buildings. There should be incentives and rebates to consumers who purchase BEE Star-rated appliances or live in Shunya-rated buildings. This can include discounts on utility bills, tax incentives, and other financial incentives. The government can provide support by mandating the use of BEE Star-rated appliances and Shunya-rated buildings in public buildings and offering financial incentives to manufacturers and builders who produce and promote energy-efficient products. By conducting market outreach for BEE Star and Shunya ratings, we can promote the adoption of energy-efficient appliances and buildings in Assam.

5. Transformation of iconic government buildings to Net-Zero (10 no.s)

The transformation of iconic government buildings to net-zero energy consumption is a crucial step towards promoting sustainable building practices and achieving energy efficiency goals. Firstly, there must be energy audits conducted and areas should be identified where there can be energy savings such as lighting, heating, cooling, and ventilation systems. These iconic buildings should use energy-efficient materials such as insulation, windows, and roofing materials to reduce heat loss and gain. There can be installed building automation systems to control the lighting, heating, cooling, and ventilation systems. This can help to optimize energy consumption and reduce waste. By transforming iconic government buildings to net-zero energy consumption, we can promote sustainable building practices and achieve energy efficiency goals.

6. Mandatory minimum set point of 24 degree for air conditioners in all government buildings

The implementation of a mandatory minimum temperature of 24 degrees Celsius for air conditioners in Assam can be beneficial in promoting energy conservation and reducing the state's carbon footprint. Setting a mandatory minimum temperature of 24 degrees Celsius can help to reduce the overall energy consumption of air conditioning units, leading to significant energy savings. By reducing energy consumption, this measure can also result in cost savings for consumers who use air conditioning. This can be especially beneficial for lower-income households who may struggle to afford high energy bills. By reducing energy consumption, this measure can also help to reduce the carbon footprint of air conditioning units, which can have significant environmental benefits. This can help to mitigate climate change and promote environmental sustainability. Therefore, it is important to conduct extensive awareness campaigns and engage with stakeholders to ensure that this measure is effectively implemented and accepted by all parties involved.

5.3 Energy Saving Targets & Monitoring Mechanism

Replacement program for inefficient appliances

Particulars	Details
Action Plan 1	Replacement program for inefficient appliances
Scope Boundary	1. Public buildings 2. Commercial buildings 3. Domestic buildings
Implementing Agency	ASDA, DISCOM, ESCO
Current Policy in Place	• UJALA scheme
Methodology Adopted	In moderate scenario, it is assumed that 30% of appliances will be replaced with efficient appliances. In ambitious scenario, it is assumed 50% appliance replacement with efficient appliance. For LPG cookstove, a 10% switch to electric cookstove in moderate and 20% switch to electric cookstove in ambitious scenario has been taken
Implementation Period	Till FY2030

For buildings sector, the existing stock of inefficient appliances 15 years old is calculated by using total number of households in Assam and multiplying with ownership rates of different appliances. [18] After calculating inefficient stock of appliances 15 years old, moderate scenario assumes 30% replacement with Star-Rated appliances and ambitious scenario assumes 50% replacement with Star-Rated appliances. For LPG cookstove, moderate scenario assumes 10% switch to electric cookstove and 20% switch to electric cookstove in ambitious scenario has been taken.

Energy savings has been calculated from number of appliances switched to Star-Rated. The existing stock of inefficient appliances 15 years old and energy savings in each appliance is shown in the table below:

Table 15: Existing stock of inefficient appliances 15 years old

Appliance	Inefficient stock in FY2020	Energy saving in moderate scenario (Mtoe)	Energy saving in ambitious scenario (Mtoe)
Fan	7785000	27182	45304
Air conditioner	1211000	9416	15,694
Refrigerator	3892500	28,917	48,196
Washing Machine	3200500	2972	4953
Television	4498000	1253	2088
LPG cookstove	8044500	20,197	40,395

The energy savings from Action Plan 1 of building sector is shown in the table below. The savings are all electricity savings.

Table 16: Energy Savings potential from Action Plan 1 of buildings sector

Action Plan	Energy Savings in 2030 under moderate scenario (toe)	Energy Savings in 2030 under ambitious scenario (toe)
Replacement program for inefficient appliances	**89939**	**145,008**

18 **Source:** Penetration of household appliances taken from CLASP Impact Assessment of BEE Standard and Labelling 2015

2. Effective implementation of Assam ECBC 2018

Particulars	Details
Action Plan 2	Effective Implementation of Assam ECBC 2018
Scope Boundary	Upcoming new commercial buildings
Implementing Agency	Bureau of Energy Efficiency; ASDA Urban Development and Housing Department
Current Policy in Place	Assam Energy Conservation Building Code 2018
Methodology Adopted	In moderate scenario, it is assumed ECBC will be implemented in new commercial buildings more than 100 kW connected load and lead to 25% savings. In ambitious scenario, ECBC+ is assumed to be implemented in new commercial buildings more than 100 kW and lead to 35% savings
Implementation Period	Till FY2030

For buildings sector, the electricity consumption in new commercial buildings more than 100kW load is assumed to be 5% of incremental electricity consumption in the commercial buildings sector. Due to Assam ECBC 2018 there are 25% savings in ECBC (now ECSBC) and 35% savings in ECBC+. Thus, the moderate scenario assumes that ECBC will be implemented in new commercial buildings more than 100 kW connected load and lead to 25% savings. In ambitious scenario, ECBC+ is assumed to be implemented in new commercial buildings more than 100 kW and lead to 35% savings. The energy savings potential is shown below in the table.

Table 17: Energy Savings potential from Action Plan 2 of buildings sector

Action Plan	Energy Savings in 2030 under moderate scenario (toe)	Energy Savings in 2030 under ambitious scenario (toe)
Effective implementation of Assam ECBC 2018	**1796**	**2515**

3. Energy audits for commercial and public buildings

Particulars	Details
Action Plan 3	Energy audit for commercial and public buildings
Scope Boundary	Commercial and Government Buildings in the state
Implementing Agency	Bureau of Energy Efficiency; ASDA Urban Development and Housing Department

Current Policy in Place	-
Modification Required	Energy audits for 5% of commercial and public buildings in moderate scenario and 10% of commercial and public buildings in ambitious scenario
Methodology Adopted	In moderate scenario, it is assumed 5% buildings will have energy audit and in ambitious scenario, it is assumed 10% of buildings will get energy audit. It is assumed that energy audit recommendations implementation will lead to 30% savings
Implementation Period	Till FY2030

For buildings sector, the moderate scenario assumes 5% of total buildings in commercial and public sector will get energy audit and ambitious scenario assumes that 10% of buildings will get energy audit. Assuming 30% savings, the energy saving potential is calculated and shown in the table below.

Table 18: Energy Savings potential from Action Plan 3 of buildings sector

Action Plan	Energy Savings in 2030 under moderate scenario (toe)	Energy Savings in 2030 under ambitious scenario (toe)
Energy audit in public and commercial buildings	1862	3725

Monitoring Mechanism

Implementing an energy savings monitoring mechanism is an important step for building owners and managers to track and measure their progress in reducing energy consumption and associated costs. This can involve a number of different steps, including

Establishing a baseline: The first step in monitoring energy savings is to establish a baseline of energy consumption. This can involve reviewing energy bills, conducting an energy audit, or using building energy management systems (BEMS) to track energy consumption. Z

Identifying energy-saving opportunities: Once a baseline has been established, building owners and managers can identify areas where energy savings can be made. This may involve implementing energy-efficient technologies, optimizing heating, ventilation, and air conditioning (HVAC) systems, or changing behaviors.

Setting energy-saving targets: Based on the energy-saving opportunities identified, building owners and managers can set specific, measurable, and time-bound targets for reducing energy consumption. Monitoring and measuring progress: Once targets have been set, building owners and managers can monitor and measure progress towards meeting these targets. This can involve tracking energy consumption and costs over time, analyzing data to identify trends, and comparing actual performance against targets.

Reporting and communicating results: Regular reporting and communication of energy savings results can help to build momentum and engagement within a building. This can involve sharing results with key stakeholders, such as tenants, employees, and customers, and celebrating successes along the way. In addition to these steps, it is also important to establish a culture of continuous improvement around energy management. This can involve training and awareness-raising programs, setting up energy teams or champions within a building, and ensuring that energy-saving initiatives are integrated into wider business strategies. By implementing an energy savings monitoring mechanism and establishing a culture of continuous improvement around energy management, building owners and managers can make significant progress in reducing energy consumption, lowering costs, and improving sustainability performance. Additionally, it can lead to a more comfortable and healthier indoor environment for building occupants.

6. Focus Sector 3 - Transport

6.1 Current Scenario

The state has undertaken multiple initiatives in energy efficiency for transport sector:

1. EV charging infrastructure

Assam Electric Vehicle Policy 2021 aims to embrace and accelerate the pace of adoption of electric mobility as a tool to promote clean transportation to ensure environmental sustainability and to create an ecosystem for manufacturing EV components in Assam. The policy shall serve as a rationale to attain rapid adoption of Battery Electric Vehicles and to bring about improvement in the air quality in Assam and the major cities in particular. [19]

2. Introduction of electric vehicles in public transport

Assam Electric Vehicle Policy 2021 targets to convert 100% of public transport bus fleet into electric buses (Battery Electric Vehicles) by 2030.

3. Other initiatives

Going ahead in future, the state has a strong vision of increasing penetration of electric vehicles and promoting ride sharing as well. While announcement of the FAME scheme by Government of India has provided financial stimulus to uptake of electric vehicles, state level efforts shall also help reduce carbon footprint of transport sector as well as reduce dependency on imported fossil fuels. In order to streamline implementation EV charging infrastructure, the Department of Power, Government of India has published guidelines and standards for charging infrastructure for EVs in December 2018. In February 2019, the Ministry of Housing and Urban Affairs (MoHUA), Government of India has made amendments in Model Building Byelaws (MBBL) 2016 and Urban Regional Development Plans Formulation and Implementation (URDPFI) Guidelines 2014 to make provisions for establishing Public Charging Stations (PCS) for EV charging.

Assam's inland water transport heavily relies on diesel-powered vessels for navigation. Diesel engines are commonly used in boats, ferries and vessels that operated on the Brahmaputra River and its tributaries. Efforts to reduce reliance on diesel and promote sustainable transportation may include exploring alternative fuels, such as biodiesel or electric propulsion systems, or investing in more fuel-efficient vessels.

[19] Assam Electric Vehicle Policy 2021

6.2 Energy Efficiency Strategies in the transport sector

Deployment of electric vehicles in state

1. Establishment of regulatory mechanism to develop EV charging infrastructure

The establishment of a regulatory mechanism for developing electric vehicle (EV) charging infrastructure is an essential step towards the widespread adoption of EVs. A regulatory framework can create a supportive environment for private players to invest in the development of charging infrastructure, which will encourage more people to switch to electric vehicles. The government should establish standards for charging infrastructure to ensure that all charging stations meet certain minimum requirements in terms of safety, quality, and performance. The government can provide incentives to companies that invest in charging infrastructure, such as tax breaks or subsidies. This will encourage private players to invest in the development of charging infrastructure. The government can collaborate with stakeholders such as utility companies, charging station manufacturers, and EV manufacturers to develop a comprehensive plan for the development of charging infrastructure. By establishing a regulatory mechanism for developing EV charging infrastructure, the government can create a supportive environment for the widespread adoption of EVs and help reduce carbon emissions from transportation.

2. Set up Charging stations based on open-access

Setting up electric vehicle (EV) charging stations based on open access is a crucial step towards making EVs more accessible to everyone. Open-access charging stations allow EV drivers to charge their vehicles regardless of the brand or model of the car they own. It is essential to identify locations for charging stations based on factors such as proximity to major highways, public parking areas, and commercial centers. The government should install charging infrastructure that is compatible with all types of EVs, including AC and DC charging stations. By setting up open-access EV charging stations, state can create a more accessible and convenient charging experience for EV drivers, which will help to accelerate the adoption of EVs and reduce carbon emissions from transportation.

3. Pilot projects on Battery Swapping stations in 3 model cities

Battery swapping is a technology that allows EV drivers to exchange their depleted battery with a fully charged one at a charging station, which can significantly reduce the time required to charge an EV. India has been exploring the feasibility of battery swapping stations for EVs, and several pilot projects have been launched in different parts of the country. Pilot projects on battery swapping stations are still in the early stages, and their success will depend on factors such as the availability of charging infrastructure, cost-effectiveness, and consumer acceptance. However, they have the potential to significantly reduce the charging time for EVs and make electric mobility more accessible and convenient for the general public.

4. Pilot projects on Hydrogen Fuel Cell Vehicles

Hydrogen fuel cell vehicles (FCVs) are a promising technology that can help reduce carbon emissions from transportation. In India, several pilot projects have been launched to explore the feasibility of hydrogen fuel cell vehicles. Pilot project aims to demonstrate the feasibility of hydrogen fuel cell technology for transportation and promote the use of hydrogen as a clean fuel. These pilot projects on hydrogen fuel cell vehicles are still in the early stages, and their success will depend on factors such as the availability of hydrogen fueling infrastructure, cost-effectiveness, and consumer acceptance. However, they have the potential to significantly reduce carbon emissions from transportation and promote the adoption of clean energy technologies in India.

Ethanol blending in state

1. Encourage establishing biofuel production plants

Ethanol biofuels have emerged as a viable alternative to fossil fuels in India, and the government has launched several initiatives to encourage their production. The Indian government has launched an ethanol blending program to promote the use of ethanol as a fuel. Under this program, oil marketing companies are required to blend a certain percentage of ethanol with petrol. The government has set a target of blending 20% ethanol with petrol by 2025. The Indian government offers various incentives to encourage the production of ethanol biofuels, including tax exemptions, subsidies, and grants. These incentives can help reduce the cost of production and make ethanol biofuels more competitive with fossil fuels. Ethanol biofuels are primarily produced from sugarcane in India. The government can provide support to sugarcane farmers, such as minimum support prices, to ensure a steady supply of raw material for ethanol production. Overall, encouraging ethanol biofuel production in India requires a coordinated effort between the government, industry, and farmers. By promoting the use of ethanol biofuels, India can reduce its dependence on fossil fuels.

6.3 Energy Saving Targets & Monitoring Mechanism

1. Deployment of electric vehicles in state

Particulars	Details
Action Plan 1	Deployment of electric vehicles in state
Scope Boundary	Two-wheelers, three-wheelers, four-wheelers, bus, and heavy vehicle
Implementing Agency	Department of Transport, DISCOMs, PSUs and private sector
Current Policy in Place	Assam Electric Vehicle Policy 2021
Methodology adopted	As per policy 10% of two-wheelers, 20% three-wheeler, 10% four-wheeler, 100% bus and 10% HDV to be electric by 2027. This has been considered moderate scenario. For ambitious scenario, 20% of two-wheelers, 40% of three-wheelers and 20% of four-wheeler, 100% of bus and 20% of HDV to be electric by 2030.
Additional Support Required	Capacity building of stakeholders Private investments
Implementation Period	Till FY2030

For transport sector, total vehicle fleet of Assam by mode type is considered from 2014-15 to 2019-20. [20] The moderate scenario considers Assam Electric Vehicle Policy 2021 and its targets: 25% of two-wheelers, 25% three-wheeler, 25% four-wheeler, 100% bus and 25% HDV to be electric by 2027.

The ambitious scenario considers double of this target: 50% of two-wheelers, 50% of three-wheelers and 50% of four-wheeler, 100% of bus and 50% of HDV to be electric by 2030..

We first consider the mileage and annual utilisation for each mode type in electric and petrol/diesel variant as shown below in the table.

Table 19: Mileage and annual utilisation for each mode type

	2W	3W	4W	Bus	HDV
Average utilisation (km)	6300	7000	12,600	50,000	75,000
Mileage (kWh/km)	0.033	0.061	0.15	1.15	1.15
Mileage (litre/km)	0.014	0.025	0.05	0.16	0.33

Both the scenarios are only for new vehicle registrations. After forecasting each mode type in vehicle fleet till 2030, we calculate new vehicle registrations for each mode type i.e. two-wheeler, three-wheeler,

20 Road Transport Year Book, Ministry of Road Transport and Highways

four-wheeler, bus and heavy-duty vehicle. Our targets in both scenarios are for new vehicle registrations and on the basis of this, we obtain number of vehicles in each mode type which will be electric. First, we calculate the fuel savings if the targeted share of each mode type becomes electric e.g. 10% two-wheelers in 2030 new vehicle registrations will be electric. We calculate energy savings by first calculating fuel savings from these two-wheelers and subtracting the electricity consumption in these two-wheelers. Table 20 below shows energy savings potential.

Energy Savings = Fuel Savings – Electricity Consumption in EV

Table 20: Energy Savings potential from Action Plan 1 of transport sector

Action Plan	Energy Savings in 2030 under moderate scenario (Mtoe)	Energy Savings in 2030 under ambitious scenario (Mtoe)
Deployment of electric vehicles in state	0.6	1.1

2. Ethanol blending in state

Particulars	Details
Action Plan 2	Ethanol Blending program
Scope Boundary	20% ethanol blending target by 2025
Implementing Agency	State Transport Department & Individual Government Departments
Current Policy in Place	Roadmap for Ethanol Blending in India 2020-25
Methodology Adopted	20% savings by 2025
Additional Support Required	Capacity Building of stakeholders R&D on commercial level ethanol production
Implementation Period	Till FY2030

For transport sector, the ethanol blending target of 20% by 2025 has been considered as per Govt. of India target.[21] Only one scenario has been considered and the savings have been calculated only for petrol consumption where there will be 20% energy savings. The table below shows the energy savings potential**.**

Table 21: Energy Savings potential from Action Plan 2 of transport sector

Action Plan	Energy Savings in 2030 (Mtoe)

21 https://www.niti.gov.in/sites/default/files/2021-06/EthanolBlendingInIndia_compressed.pdf

Ethanol Blending	0.1 (as per national policy)

Monitoring Mechanism

Implementing an energy savings monitoring mechanism is an important step for the transport sector to track and measure their progress in reducing energy consumption and associated costs. This can involve a number of different steps, including:

Establishing a baseline: The first step in monitoring energy savings is to establish a baseline of energy consumption. This can involve reviewing fuel consumption data or conducting an energy audit to identify areas of high energy use.

Identifying energy-saving opportunities: Once a baseline has been established, transport companies can identify areas where energy savings can be made. This may involve implementing energy-efficient technologies, optimizing routes, or changing behaviors. Setting energy-saving targets: Based on the energy-saving opportunities identified, transport companies can set specific, measurable, and time-bound targets for reducing energy consumption.

Monitoring and measuring progress: Once targets have been set, transport companies can monitor and measure progress towards meeting these targets. This can involve tracking fuel consumption and costs over time, analyzing data to identify trends, and comparing actual performance against targets.

Reporting and communicating results: Regular reporting and communication of energy savings results can help to build momentum and engagement within an organization. This can involve sharing results with key stakeholders, such as management, employees, and customers, and celebrating successes along the way. In addition to these steps, it is also important to establish a culture of continuous improvement around energy management. This can involve training and awareness-raising programs, setting up energy teams or champions within an organization, and ensuring that energy-saving initiatives are integrated into wider business strategies. By implementing an energy savings monitoring mechanism and establishing a culture of continuous improvement around energy management, transport companies can make significant progress in reducing energy consumption, lowering costs, and improving sustainability performance. Additionally, these improvements can lead to cost savings, improved air quality, and increased energy security.

7. Focus Sector 4 - Agriculture

7.1 Current Scenario

The agriculture sector of Assam is being transformed towards ending diesel usage.

1. AgDSM

Agriculture Demand Side Management is being implemented by EESL and the aim is to distribute BEE 5-star energy efficient agricultural pumps and ensures a minimum of 30% reduction in energy consumption with smart control panels which can be remotely operated to enhance the ease of operation of pumps by the farmers. [22]

2. PM KUSUM Scheme

The PM-KUSUM Scheme was launched in 2019 with 3 components. Component A aims to set up 10,000 MW of Decentralized Grid Connected Renewable Energy Power Plants on barren land. Component B aims to install 17.50 Lakh stand-alone solar agriculture pumps. Component C aims for solarization of 10 Lakh Grid Connected Agriculture Pumps. Under this Component, individual farmers having grid connected agriculture pump will be supported to solarize pumps. Govt. of Assam accorded sanction for installation of STW under Projects – "Installation of 1 Lakh Shallow Tube Wells" and "10,000 Solar PV Powered STW" under RIDF(STW Scheme) commencing from 2016-17.[23]

[22] EESL AgDSM scheme

[23] PM KUSUM scheme

7.2 Energy Efficiency Strategies in the agriculture sector

Replacement of diesel pumps with solar

1. Effective implementation of PM KUSUM Yojana

The objectives of the Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM) include de-dieselisation of the farm sector. Under Component B, the existing diesel pumps can be replaced with solar pumps. Individual farmers can replace their existing diesel pumps with solar pumps. And this will reduce irrigation costs and lead to energy savings. This will also benefit farmers in Assam where there is no source of electric power for irrigation. It will also help in increasing the farmer's income and living conditions.

Replacement of inefficient pumps with efficient electric pumps

1. Phase wise plan to implement DSM scheme for replacement of existing inefficient (15-year-old) pumps through ESCOs

The campaign for energy-efficient agricultural pumpsets is being implemented by Energy Efficiency Services Ltd (EESL) but is limited currently to Andhra Pradesh and Uttar Pradesh. The programme is aimed at replacing 15-year-old agriculture pumps with energy-efficient, IoT-enabled pumps, free of cost to farmers with free maintenance for five years. Such an AgDSM scheme implemented in Assam will lead to huge cost savings and energy savings. Replacement of old inefficient pumpsets 15 years old with BEE Five Star-Rated pumps has tremendous potential for energy savings.

7.3 Energy Saving Targets & Monitoring Mechanism

1. Replacement of diesel pumps with solar

Particulars	Details
Action Plan 1	Replacement of diesel pumps with solar
Scope Boundary	Transition from diesel pumps
Implementing Agency	Department of Agriculture
Current Policy in Place	• PM KUSUM Yojana
Methodology Adopted	By 2025, 100% replacement of diesel pumps with solar pumps
Implementation Period	Till FY2030

For agriculture sector, the first strategy aims for zero-diesel use in agriculture sector by 2025 and all diesel pumps to be replaced with solar pumps. For this, the number of diesel pumps in 2019-20 has been estimated using government sources such as Ministry of Agriculture Input Survey. The diesel consumption in agriculture pumps has been calculated using 515 litres/year diesel consumption in each pump. Assuming 5 HP pump and 250 days of operation and 2.75 hours/day of use, the energy savings have been calculated and shown below in the table.

Only one scenario has been considered since the Ministry of Power has a target for zero diesel use in agriculture by 2025.[24]

Table 22: Energy Savings potential from Action Plan 1 of agriculture sector

Action Plan	Energy Savings in 2030 (toe)
Replacement of diesel pumps with solar	46,404 (as per national policy)

2. Replacement of inefficient electric pumps with efficient electric pumps

Particulars	Details
Action Plan 2	Replacement of inefficient electric pumps (15 years old) with efficient electric pumps
Scope Boundary	Replacement of inefficient electric pumps (15 years old) with efficient electric pumps
Implementing Agency	State Agriculture & Irrigation Department, ASDA, EESL
Current Policy in Place	Agriculture Demand Side Management (AgDSM)
Methodology Adopted	Moderate scenario assumes 30% replacement with efficient Star-Rated pumps Ambitious scenario assumes 50% replacement with efficient Star-Rated pumps
Implementation Period	Till FY2030

For agriculture sector, the second strategy aims to replace the inefficient electric pumps 15 years old with BEE Star-Rated pumps. By using CEA Power Survey, the total electricity consumption in pumps in 2030 was obtained and this was used to calculate total stock of electric pumps in 2030. The moderate scenario assumes 30% replacement with Star-Rated pumps. The assumptions were 5 HP pump and 250 days of operation and 2.75 hours/day of use. The inefficient pump consumes 5 kWh whereas efficient pump consumes 3.73 kWh. Accordingly, the energy savings have been calculated and shown below in the table.

Table 23: Energy Savings potential from Action Plan 2 of agriculture sector

Action Plan	Energy Savings in 2030 under moderate scenario (toe)	Energy Savings in 2030 under ambitious scenario (toe)
Replacement of inefficient pumps (15 years old) with Star-Rated pumps	517	862

24 https://pib.gov.in/PressReleseDetailm.aspx?PRID=1797488

Monitoring Mechanism

Implementing an energy savings monitoring mechanism is an important step for the agriculture sector to track and measure their progress in reducing energy consumption and associated costs. This can involve a number of different steps, including:

Establishing a baseline: The first step in monitoring energy savings is to establish a baseline of energy consumption. This can involve reviewing energy bills, conducting an energy audit to identify areas of high energy use, or using energy monitoring tools to track energy consumption. Identifying energy-saving opportunities: Once a baseline has been established, farmers and agricultural businesses can identify areas where energy savings can be made. This may involve implementing energy-efficient technologies, optimizing irrigation systems, or changing behaviors.

Setting energy-saving targets: Based on the energy-saving opportunities identified, farmers and agricultural businesses can set specific, measurable, and time-bound targets for reducing energy consumption. Monitoring and measuring progress: Once targets have been set, farmers and agricultural businesses can monitor and measure progress towards meeting these targets. This can involve tracking energy consumption and costs over time, analyzing data to identify trends, and comparing actual performance against targets.

Reporting and communicating results: Regular reporting and communication of energy savings results can help to build momentum and engagement within an organization. This can involve sharing results with key stakeholders, such as management, employees, and customers, and celebrating successes along the way. In addition to these steps, it is also important to establish a culture of continuous improvement around energy management. This can involve training and awareness-raising programs, setting up energy teams or champions within an organization, and ensuring that energy-saving initiatives are integrated into wider business strategies. By implementing an energy savings monitoring mechanism and establishing a culture of continuous improvement around energy management, farmers and agricultural businesses can make significant progress in reducing energy consumption, lowering costs, and improving sustainability performance. Additionally, it can lead to improved crop yields, reduced water usage, and increased profitability.

8. Investment Potential

The energy savings of 0.81 Mtoe and 1.42 Mtoe are calculated by savings from the four focus sectors. The emission reduction is calculated by multiplying the energy savings with a factor of 3.3 MtCO2/Mtoe. For market investment potential, 1 tonne of oil equivalent is taken as value of INR 18,402 and assuming payback period of 3 years.

Table 24: Market potential calculation for Assam

Sector	**Emissions Reduction (MtCO2) - FY2031**		**Energy Consumption Reduction (Mtoe) - FY2031**		**Investment Potential (INR Crores)**
	Moderate	**Ambitious**	**Moderate**	**Ambitious**	
	MtCO2 reduction	MtCO2 reduction	Mtoe Reduction	Mtoe Reduction	
Industry	0.03	0.08	0.01	0.02	44.9
Buildings	0.29	0.47	0.09	0.15	273.7
Transport	2.09	3.76	0.67	1.20	2208.7
Agriculture	0.15	0.15	0.05	0.05	87.0
Total	**2.55**	**4.45**	**0.81**	**1.42**	**2614.2**

9. Investment sources:

Energy efficiency plays a crucial role in India's sustainable development and climate change mitigation efforts. State-designated agencies in India are at the forefront of driving energy efficiency initiatives, including demonstration projects, pilot projects, and loan programs. However, financing these projects can be a significant challenge. The various energy efficiency financing sources available for State designated agencies are described below:

Here are more specific examples of funding sources for energy efficiency projects for Assam State Designated Agency (SDA) in India:

Grant from Central Government: Assam SDA can explore grants from the central government of India, such as the Ministry of Power or the Ministry of New and Renewable Energy. For example, the agency can apply for a grant from the Ministry of New and Renewable Energy's Energy Efficiency and Renewable Energy Program to support a demonstration project on energy-efficient irrigation systems in Assam's agricultural sector.

Concessional Loans from Multilateral Institutions: Assam SDA can seek concessional loans from multilateral institutions like the World Bank, Asian Development Bank (ADB), or the New Development Bank (NDB). For instance, the agency can secure a concessional loan from ADB's Sustainable Energy Fund to implement a large-scale energy efficiency retrofit program in public buildings across Assam.

Green Bonds: Assam SDA can explore the issuance of green bonds to raise funds for energy efficiency projects. The agency can work with financial institutions or engage in partnerships to issue green bonds specifically dedicated to financing energy efficiency initiatives in Assam. The funds raised can be used to implement demonstration projects or loan programs.

Bank Loans for Energy Efficiency (EE): Assam SDA can collaborate with banks and financial institutions to secure loans for energy efficiency projects. For example, the agency can partner with a bank to offer low-interest loans to industries in Assam for energy efficiency retrofits or to commercial building owners for energy-efficient upgrades.

Equity Investment under Energy Savings Performance Contracts (ESPC): Assam SDA can explore equity investment opportunities under Energy Savings Performance Contracts (ESPCs). In an ESPC, a private company invests in energy efficiency projects and is repaid through the resulting energy savings. Assam SDA can enter into an ESPC with a private investor who provides equity investment for an energy efficiency project in exchange for a share of the savings generated.

Climate Finance under Green Climate Fund (GCF): Assam SDA can tap into climate finance provided by the Green Climate Fund (GCF). The agency can develop proposals aligned with GCF's objectives to receive funding for energy efficiency initiatives. For example, Assam SDA can submit a proposal to GCF for financial support to implement a pilot project on energy-efficient biomass utilization in rural communities of Assam.

It's important for Assam SDA to carefully assess the eligibility criteria, requirements, and application procedures for each funding source, ensuring that their project proposals align with the specific objectives and guidelines of these financing options.

10. Way Forward

The way forward for energy efficiency involves several strategies, including:

Improving awareness and education: Increasing public awareness and education about the importance of energy efficiency is critical for encouraging individuals and businesses to act. Governments and organizations can play a key role in educating and raising awareness through campaigns, training programs, and other initiatives.

Implementing policies and regulations: Governments can create policies and regulations that encourage or mandate energy efficiency measures. This can include building codes, appliance standards, and energy efficiency labeling programs. These policies can incentivize individuals and businesses to invest in energy efficiency measures and help drive innovation in the industry.

Investing in research and development: Research and development into energy-efficient technologies and practices can help drive innovation and improve the efficiency of energy use. Governments, businesses, and academic institutions can all contribute to research efforts in areas such as building materials, transportation, and renewable energy.

Encouraging energy efficiency investments: Governments and financial institutions can offer incentives and financing options to encourage individuals and businesses to invest in energy efficiency measures. This can include tax credits, rebates, and low-interest loans. Collaborating and sharing best practices: Sharing best practices and collaborating across industries and sectors can help drive energy efficiency improvements. Governments, businesses, and other organizations can work together to share knowledge, resources, and experiences to identify and implement energy efficiency solutions. Overall, a comprehensive and collaborative approach is necessary to drive energy efficiency improvements. By raising awareness, implementing policies and regulations, investing in research and development, encouraging investments, and sharing best practices, we can make significant progress in reducing energy consumption, lowering costs, and improving sustainability.

11. References

References provided in footnote

12. Annexure

Table 25: Weightage Matrix for Gross State Value Added

Weightage Matrix (%) for GSVA								
S.No.	Sectors	Industry	Commercial	Domestic	Transport	Agriculture	Municipality	Others
1	Agriculture, forestry and fishing				10%	90%		
2	Mining and quarrying	100%						
3	Manufacturing	100%						
4	Electricity, gas, water supply & other utility services	70%					30%	
5	Construction	30%	30%	40%				
6	Trade & repair services		100%					
7	Hotels & restaurants		100%					
8	Railways				100%			
9	Road transport				100%			
10	Water transport				100%			
11	Air transport				100%			
12	Services incidental to transport		80%		20%			
13	Storage		100%					
14	Communication & services related to broadcasting		100%					
15	Financial services		100%					
16	Real estate, ownership of dwelling & professional services			100%				
17	Public administration						100%	
18	Other services	40%	30%					30%

Table 26: Fuel Calorific Values

Fuel	Gross Calorific Value (GCV)	Unit of GCV
Coal	4,500	kcal/kg
Natural Gas	10,200	kcal/kg
Diesel	10,350	kcal/kg
Electricity	860	kcal/kWh

Table 27: Units of Conversion

Units	
1 tonne of oil equivalent (TOE)	1,00,00,000 kcal
	0.000001 MTOE
	11,630 kWh

Table 28: Emission Factors

Fuel	Emission Factor	Unit of Emission Factor	Source
Coal	1.52	kgCO2/kg	BEE
Electricity	0.79	kgCO2/kWh	CEA
Oil	3.13	kgCO2/kg	BEE

Table 29 : List of primary and secondary sources

Primary Source	Secondary Source
Directorate of Agriculture, Assam	Central Electricity Authority
Department of Transport, Assam	Assam Economic Survey
Department of Power, Assam	Ministry of Statistics and Programme Implementation
Department of Industries and Commerce, Assam	Assam State Designated Agency (ASDA)

Assam Power Distribution Company Limited	Ministry of Road Transport and Highways
MSME Development Institute Guwahati	Bureau of Energy Efficiency
Assam State Housing Board	Energy Efficiency Services Limited (EESL)
Department of Housing and Urban Affairs, Assam	NITI Aayog (Energy Dashboard)
Public works Department, Assam	Ministry of Micro, Small and Medium Enterprises
Assam Government Construction Corporation Limited	World Bank/ Asian Development Bank
Department of Urban Development, Assam	Ministry of Power
Municipal Corporations (ULB)	Ministry of New and Renewable Energy
Guwahati Smart City Limited	India Brand Equity Foundation
Directorate of Municipal Administration (DMA)	Indian Bureau of Mines, Ministry of Mines

Table 30 : List of stakeholders

Stakeholders
Directorate of Agriculture, Assam
Department of Transport, Assam
Department of Power, Assam
Department of Industries and Commerce, Assam
Department of Housing and Urban Affairs, Assam
MSME Development Institute Guwahati
Assam Power Distribution Company Limited
Directorate of Municipal Administration (DMA), Assam