MINISTRY OF POWER
GOVERNMENT OF INDIA

STATE ENERGY EFFICIENCY ACTION PLAN (SEEAP)

MADHYA PRADESH - ACTION PLAN

JUNE 2024

State Energy Efficiency Action Plan (SEEAP) for Madhya Pradesh

Report Prepared For:
Madhya Pradesh Urja Vikas Nigam Limited
Bus Stop, 5 No., Link Road Number 2, Shivaji Nagar,
Bhopal, Madhya Pradesh, 462016

Project Executed By:
Bureau of Energy Efficiency (BEE)
Ministry of Power, Govt. of India
4th Floor, Sewa Bhawan, R.K. Puram
New Delhi 110 066, India

Report Prepared By:
Associated Chambers of Commerce & Industry of India (ASSOCHAM)
4th Floor, YMCA Cultural Centre and Library Building,
01, Jai Singh Marg,
New Delhi, Delhi 110001

Design2Occupancy Services LLP (D2O)
A 75, D2O Road, Sitapura Industrial Area, Sitapura,
Jaipur, Rajasthan 302022

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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

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 ASSOCHAM team extends its profound thanks to Shri Pankaj Agarwal, Secretary, Ministry of Power, Government of India and Shri Srikant Nagulpalli, Director General, Bureau of Energy Efficiency (BEE), for their leadership and guidance during the execution of the assignment. The ASSOCHAM team recognizes and extends its sincere gratitude to Shri Milind Deore, Secretary, BEE, for his invaluable inputs provided during the execution of the assignment. The team acknowledges the co-operation and the support extended by Shri Abhishek Sharma, Director, BEE for supervising the assignment throughout the execution phase. The team appreciates Shri Vikash Kumar Jha, Project Engineer, BEE for his continuous support in coordination with various stakeholders.

The ASSOCHAM team extends its sincere gratitude to Shri Manu Shrivastava, IAS, Additional Chief Secretary, NRED, Government of Madhya Pradesh and Shri Amanbir Singh Bains, IAS, Managing Director, Madhya Pradesh Urja Vikas Nigam (MPUVN), Government of Madhya Pradesh for their valuable guidance towards the execution of the assignment. We also acknowledge the support provided by Dr. Surendra Bajpai, Chief Engineer, Madhya Pradesh Urja Vikas Nigam (MPUVNL) for successfully completing the project. The team also extends its sincere thanks to all state government departments and stakeholders of the state of Madhya Pradesh for their valuable input towards the completion of the earmarked project tasks.

The ASSOCHAM team extends its sincere gratitude to all government and private sector participants of the physical survey whose inputs have 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.

Finally, ASSOCHAM is grateful to the in-house team of ASSOCHAM for their consistent efforts in bringing this report to fruition.

Associated Chambers of Commerce and Industry of India (ASSOCHAM)

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

AAGR - Average Annual Growth Rate
ASSOCHAM - The Associated Chambers of Commerce and Industry of India
AgDSM - Agriculture Demand Side Management
AMRUT – Atal Mission for Rejuvenation and Urban Transformation
BEE - Bureau of Energy Efficiency
BLDC - Brushless Direct Current
CAGR - Compound Annual Growth Rate
CEA- Central Electricity Authority of India
DISCOM - Distribution Company
DSM - Demand Side Management
ECBC - Energy Conservation Building Code
ECSBC – Energy Conservation & Sustainable Building Code
EE - Energy Efficiency
EESL - Energy Efficiency Services Limited
EIA - Energy Information Agency
ENS – Eco Niwas Samhita
ESCO- Energy service companies
FY - Financial Year
GSDP - Gross State Domestic Product
KUSUM - Kisan Urja Suraksha Evam Utthaan Mahabhiyan
HRIDAY – Heritage City Development & Augmentation Yojana
LED - Light Emitting Diode
MPUVNL – Madhya Pradesh Urja Vikas Nigam Limited
MPPMCL – Madhya Pradesh Power Management Company Limited
MPPKVVCL – Madhya Pradesh Poorv Kshtra Vidyut Vitran Company Limited
MPPaKVVCL –Madhya Pradesh Paschim Kshtra Vidyut Vitran Company Limited
MPMKVVCL – Madhya Pradesh Madhya Kshtra Vidyut Vitran Company Limited
MEEP – Municipal Energy Efficiency Programme
MNRE - Ministry of New and Renewable Energy
MOSPI - Ministry of Statistics and Programme Implementation
Mtoe - Million Tonne of Oil Equivalent
MU - Million Unit of Electricity (in kWh)
MuDSM - Municipal Demand Side Management
NEMMP - National Electric Mobility Mission Plan
NHPC - National Hydroelectric Power Corporation
NMEEE - National Mission on Enhanced Energy Efficiency
PMKSY - Pradhan Mantri Krishi Sinchai Yojana
RBI – Reserve Bank of India
SLNP – Street Light National Programme

SEEAP - State Energy Efficiency Action Plan
SEEI - State Energy Efficiency Index
UNNATEE - Unlocking National Energy Efficiency Potential

Executive Summary

Increasing energy demand naturally strains the country's resources and impacts the environment. These warrants decoupling the country's economic growth and energy demand. This is also echoed through India's Intended Nationally Determined Contribution submitted in the run-up to the Paris Climate Conference, where the government has highlighted energy conservation as a key mitigation strategy. The Government of India in 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 in 2021, presented the five nectar elements (Panchamrit) of India's climate action including the target of net-zero emissions by 2070 and get 50% of its electric power installed capacity from non-fossil sources by 2030.

In meeting the national level targets, States/UT play a vital role in transitions to low-carbon development pathways. Bureau of Energy Efficiency under the guidance of Ministry of Power developed state specific energy efficiency action plan to ensure that the allocation of resources is as per the requirement of State that will help in meeting state-specific goals on sustainable development.

The State Energy Efficiency Action Plan for a particular State developed by identifying focus sectors of the State and estimating the potential of energy conservation in sectors which are predominant in the region. The State Energy Efficiency Action Plan is developed for short term-plan for a tenure of 5 years and a long-term plan targeting high-impact energy efficiency by the year 2031.
For the state of Madhya Pradesh, SEEAP was developed under the guidelines of Bureau of Energy Efficiency, Ministry of Power, GOI and Madhya Pradesh Urja Vikas Nigam (MPUVN) and inputs & suggestions from various government departments and sector experts were considered. The objective of the State Energy Efficiency Action Plan is to arrive at sector-specific approaches for energy efficiency for the state of Madhya Pradesh.

In FY 2020, Madhya Pradesh has total final energy consumption (TFEC) 29.71 Mtoe in which Non-power or Industrial coal consumption was 8.07%, followed by

25.49% oil consumption, 34.12% consumption in terms of coal in captive plants, 15.23% in terms of imported coal and 16.97% in terms of electricity.

Based on energy consumption and economic growth of state total final energy consumption of state is projected and it is estimated that TFEC of Madhya Pradesh in FY 2031 will be 70.02 Mtoe. On the basis of projected GSDP of the state and projected energy consumption, Industry, Building, Transport and Agriculture sectors were identified as focus sectors and sector specific strategies were analyzed. List of sector specific focused strategies to ensure that the allocation of resources is as per the requirement of the State is listed below:

Industry Sector:

- Deepening and Widening of PAT Scheme in (Textile & Fertilizers)
- Energy Efficiency Intervention in Power looms & Food Processing clusters

Transport Sector:

- Infrastructure development for EV charging stations and incentives to consumers for quick transition to EVs.
- Ethanol Blending program.
- Promotion of Standard and Labelling program of Tyres for Fuel Efficiency in Vehicles

Buildings Sector:

- Effective Implementation of Energy Conservation & Sustainable Building Code (ECSBC)
- Replacement program for inefficient appliances
- BEE Star Rating and Shunya Rating of Buildings

Agriculture Sector:

- Transition of conventional diesel pumps to Solar powered pumps

This action plan will result in a total energy consumption reduction of 4.28 Mtoe in the moderate scenario and 6.79 Mtoe in the ambitious scenario in FY 2031. This plan will also create awareness at the mass level and create a market potential of approximate rupees 12,489 Crore in the field of energy efficiency and reduce the CO2 emission 13.40 $MtCO_2$ in moderate scenario and 21.24 $MtCO_2$ in ambitious scenario by FY 2031.

1. Introduction

1.1. Background

India's economy is characterized by an emerging and developing market. In 2019, India became the fifth-largest economy in the world in nominal terms, surpassing United Kingdom and behind the United States, China, Japan and Germany. The size of the Indian economy in Fiscal Year (FY) 2019-20 was estimated to be INR 145 Lakh Crores at constant prices of 2011-12[1]. With the growth of the Indian economy, the demand for energy has increased significantly, resulting in high energy levels in some sectors and increase in the country's emissions.

As per International Energy Agency's (IEA) World Energy Outlook 2021 report, India currently has a share of 6.1% in the global primary energy consumption, which is projected to increase to 9.8% by the year 2050[2]. India's Final Energy Consumption in FY 2019-20 was recorded at 533.44 Mtoe (as per Domestic Conversion Factors) with coal and crude oil being the largest contributors to the total energy consumption. India's per capita energy consumption and per capita emissions are well below the global average per capita emissions. However, India continuously taking steps to reduce the energy consumption and emissions and ensure sustainable growth of nation.

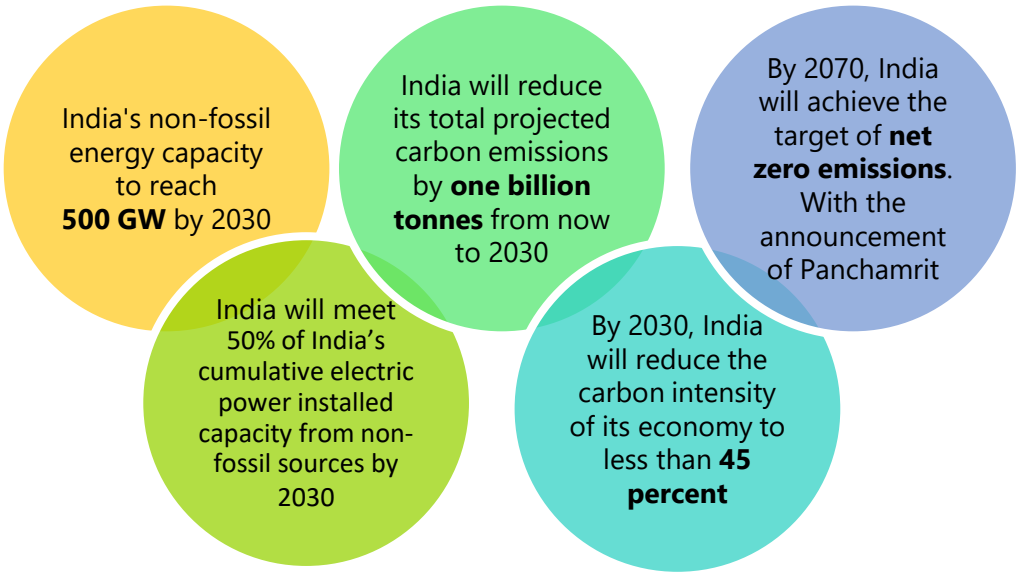
India has set ambitious economic goals for the future and achieving these goals is expected to result in significant increase in the country's energy demand and emissions. In view of this, India has also set ambitious goals for energy and climate performance. The country has also emphasized the importance of energy transition towards decarbonization of the economy and has recently emerged as one of the world leaders in Energy Transition. States and Union Territories of the country have a key role to play in the fulfilment of these goals. The key strategy adopted by the Government of India is the efficient use of energy resources and their conservation. This is essential since the efficient use of energy and its

[1] *https://mospi.gov.in/sites/default/files/press_release/PressNoteNAD_28feb23final.pdf*
[2] *https://iea.blob.core.windows.net/assets/4ed140c1-c3f3-4fd9-acae-789a4e14a23c/WorldEnergyOutlook2021.pdf*

conservation is the least-cost option to meet the increasing energy demand, reduce wasteful consumption and in leading the country's economic growth in sustainable manner.

1.2. India's Nationally Determined Contributions (NDCs)

In the 2016 Paris Climate Conference, India in its Nationally Determined Contributions (NDCs) had committed that it will reduce the emission intensity of its GDP by 33% to 35% by 2030 from 2005 level. In the recent Conference of Parties (COP -26) at Glasgow, UK, India announced the Panchamrit, which lists down five ambitions:



India's earlier target of 33% to 35% reduction in emission intensity from 2005 level by 2030 has been revised to approximately 45%. In view of the enhanced target under Panchamrit, India's energy efficiency efforts need to be increased and States have a vital role in India's energy efficiency policy implementation and in meeting state-specific goals on sustainable development in the most energy-efficient way. It is imperative that the States actively participate in the schemes to facilitate the achievement of the overall goal of reducing the energy intensity of the country.

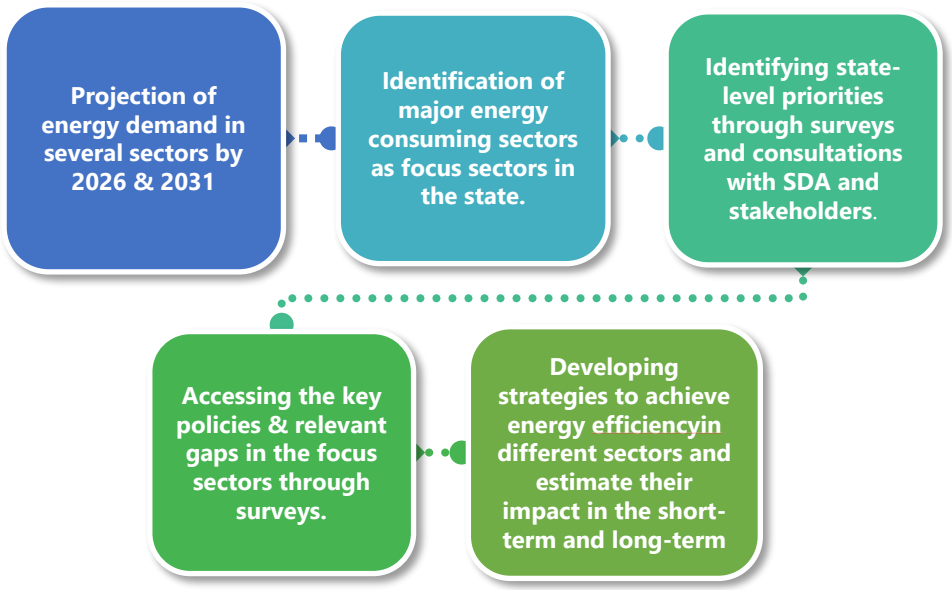
On 1st November 2021, during the 26th United Nations Climate Change Conference of the Parties (COP26) in Glasgow, Prime Minister Narendra Modi introduced the idea of 'Lifestyle for the Environment (LiFE)'. He urged individuals

and institutions across the world to support LiFE as a global movement, aimed at promoting mindful and deliberate utilization instead of mindless and destructive consumption to safeguard the environment. This means making choices that are better for the environment, such as using renewable energy sources, reducing waste, and conserving resources. The program aims to teach people about the impact their daily actions have on the environment and provide them with the tools and resources they need to adopt eco-friendlier practices.

1.3. About SEEAP

The State Energy Efficiency Action Plan for Madhya Pradesh is being developed by identification of focus sectors, to ensure that the allocation of resources is as per the requirement of Madhya Pradesh and estimate the potential of energy conservation in sectors that are predominant in Madhya Pradesh. The State Energy Efficiency Action Plan has been developed in two parts, a short term-plan for a tenure of 5 years and a long-term plan targeting high impact energy efficiency by the FY 2030-31 to achieve the targets committed in COP-26. This State Energy Efficiency Action Plan has been developed under the guidance and support of stakeholder departments/agencies of Madhya Pradesh and will be implemented by them in the state after its adoption.

Expected Outcomes of State Energy Efficiency Action Plan (SEEAP)



1.4. State Profile

The state of Madhya Pradesh is located in the central part of India geographically, extending between latitudes 21°6′ N and 26°30′ N, and longitudes 74°9′ E and 82°48′ E. It is the second-largest state in India after Rajasthan in terms of land area. The state is constituted of 55 districts spread across an area of 3,08,252 sq. km. Madhya Pradesh shares domestic borders with five states: Uttar Pradesh, Chhattisgarh, Maharashtra, Gujarat, and Rajasthan.

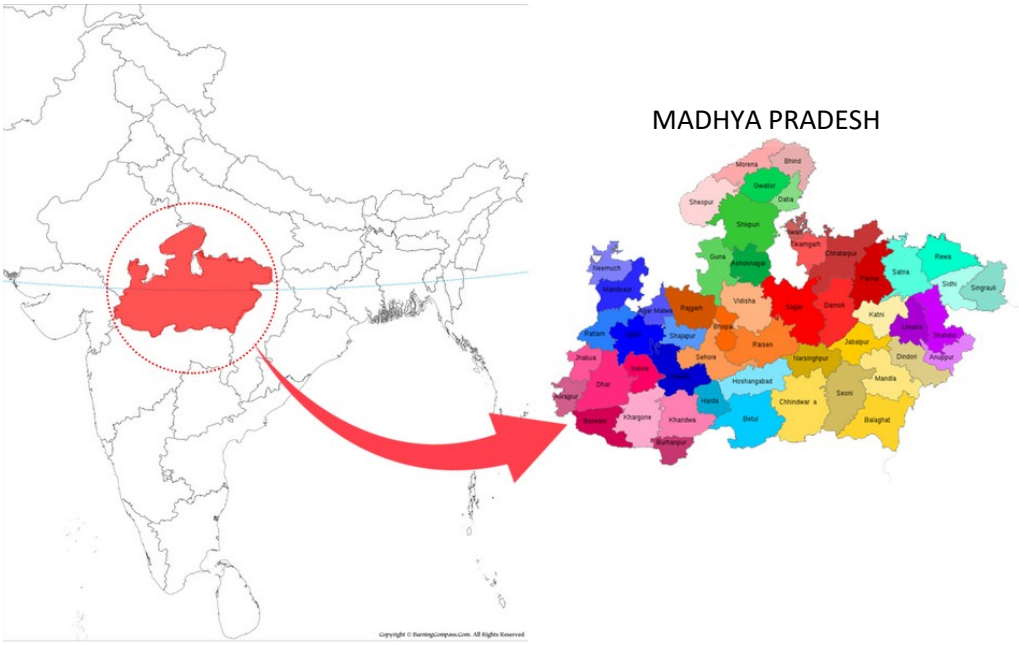


Figure 1: Geographical Location of Madhya Pradesh on the Map of India

Madhya Pradesh which is also known as "Heart of India", has many things to offer when it comes to the diversity of tourism destinations. It has been home to cultural and spiritual heritage of almost to all the religions. Innumerable monuments, intricately carved temples, stupas, forts, and palaces dotted all over the state. According to the 2001 Census of India, Madhya Pradesh had a population of 603 Lakhs [1]. With the population growth of 20.3 percent, it reached 726 Lakhs in the year 2011. Accordingly, the population is calculated to cross 800 Lakhs in the year 2021. This depicts the increment in demand for resources in all aspects including energy demand.

About 5.67 Lakh Crore Gross Domestic Product (GDP) was recorded for the Fiscal Year (FY) 2019-20, having an increase of INR 1.83 Lakh Crore in FY 2015 at a CAGR of 8.11%. The share of Madhya Pradesh's GDP in India's overall GDP is 3.91%.

The state had a total installed power plant capacity of 28.38 GW as of March 2020. In line with the country's goals and the increasing shift to clean energy sources, Madhya Pradesh also has a key focus on promoting renewable power in the state. The state's installed renewable energy capacity of 7.28 GW as of March 2020 constitutes 5.48% of India's installed renewable energy capacity of 132.73 GW during the same period. The main sources of renewable energy in the state are namely Wind, Hydro including both large and small hydro power plants, Solar, Bagasse and Waste to Energy.

1.5. State Energy Scenario

The state has seen a streamlined growth in power demand in the past years. The installed power plant capacity of the state inclusive of renewable and non-renewable sources has increased by 47.77% from FY 2015 to FY 2020. The state of Madhya Pradesh majorly depends upon the coal based thermal power plants to meet their energy demands, making up to 77.42% of the total installed capacity of the state. A significant growth has been recorded in past year in the installation of renewable capacity, state has a share of 13.79% of renewable capacity to the total installed capacity in FY 2020 state has an installed capacity of 5,046 MW from 1,647 MW in FY 2015 with CAGR of 25.09%.

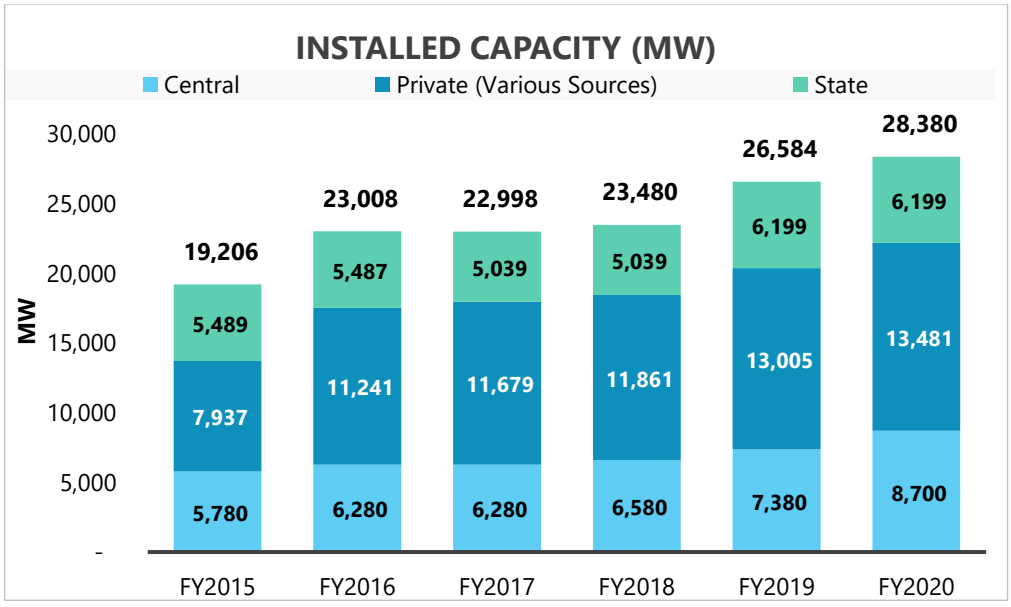


Figure 2: Ownership Wise Installed Capacity (MW)

The total generation is from various sources including centrally owned thermal and hydro power plants, state-controlled thermal power plants, Independent

Power Producers (IPPs), Open Access (OA), and Renewable Energy Sources (RES). Figure below shows the share of ownership by these stakeholders in the installed capacity of Madhya Pradesh. The largest share of installed capacity of power plants are center controlled, while the state has a 22% share in the total installed capacity catering to the electricity demand of Madhya Pradesh.

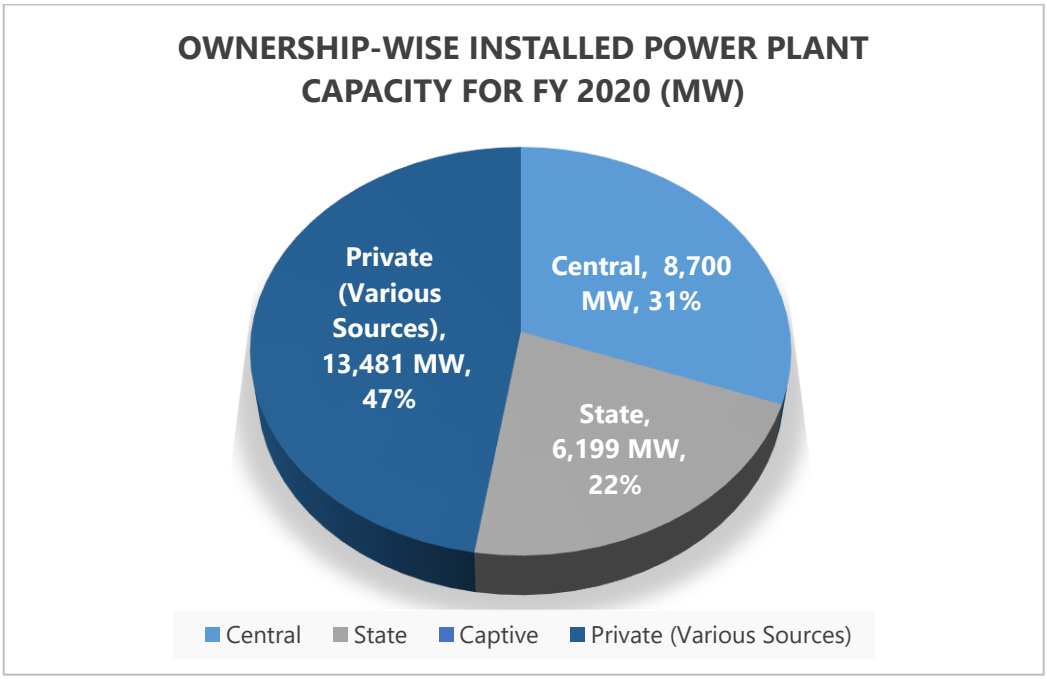


Figure 3: Ownership Wise Installed Power Plant Capacity

The state practiced different policies regarding solar, hydel, biomass etc. in past few years for the promotion of the renewable energy in the state. Recently, the state has also released a new renewable energy policy with an ambition to export renewable power outside the state.

- **Madhya Pradesh Renewable Energy Policy 2022**: The Madhya Pradesh government has set a target to promote the installation of renewable based energy parks and hybrid parks, with a goal of installing 10,000 MW of capacity by 2027. The state has also set a target of achieving a 20% renewable share in its energy mix by fiscal year (FY) 2024, which is expected to increase to 30% by FY 2027 and 50% by FY 2030. Additionally, the government aims to install 4,000 MW of renewable energy projects for exporting power outside the state, and 10,000 MW by FY 2027.

1.6. Energy Consumption Scenario (TFEC)

The state of Madhya Pradesh had 29.71 Mtoe total final energy consumption in FY 2020. TFEC is an energy consumption indicator which indicates the end use energy consumption in the respective energy guzzling sectors in the state and does not include the energy input in the power generation and transmission and distribution (T&D) losses. TFEC is a sum of total end-use primary energy and electricity consumption in the sectors. Coal has the largest share of TFEC at 57.42%, followed by oil at 25.49% and electricity at 16.97%. Gas consumption has the lowest share in the TFEC at 0.12%. The TFEC of the state has increased with a CAGR of 7.56% from FY 2015 to FY 2020.

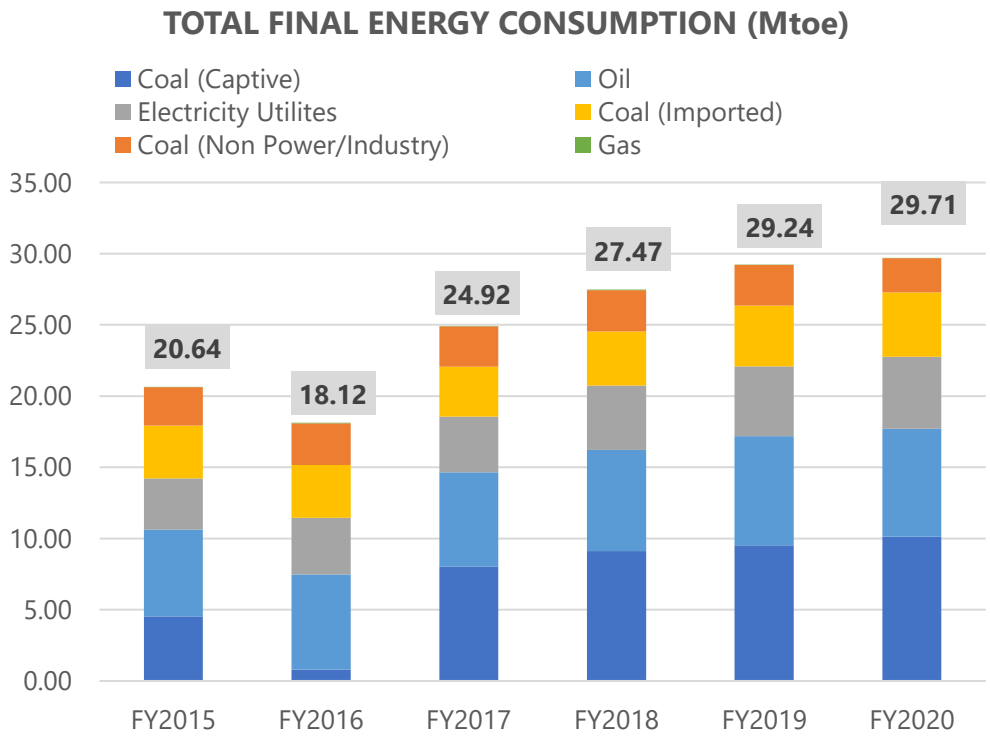


Figure 4: Source-Wise (TFEC) in Mtoe

The coal consumption is classified into three different categories based on the purpose and the source of the coal:

1. Captive coal consumption refers to the use of coal that is produced by the company for its power generation or for its manufacturing process, rather than selling it to others. This category of coal can be used in industries for their own processes, such as in steel manufacturing, cement

production, or chemical industries. The share of Captive coal in Madhya Pradesh is about 34.12%.

2. Coal consumption in non-power sectors refers to the use of coal mainly for its own industrial manufacturing process. This can include various industries, such as steel, cement, chemicals, and others. One of the major consumers of coal in the state are steel and cement sector.
3. Imported coal consumption refers to the use of coal that is brought into the country from other countries, rather than being produced domestically. The calculation of the imported coal consumption for Madhya Pradesh involves taking the average percentage of the Gross State Value Added (GSVA) of the industry sector in the state and multiplying it by the total coal import of India, which is 248 million tonnes. This method provides an approximation of the quantity of imported coal used by the industry sector in Madhya Pradesh. Imported coal forms about 3.28% of national imports and about 15.23% of MP state's total coal consumption.

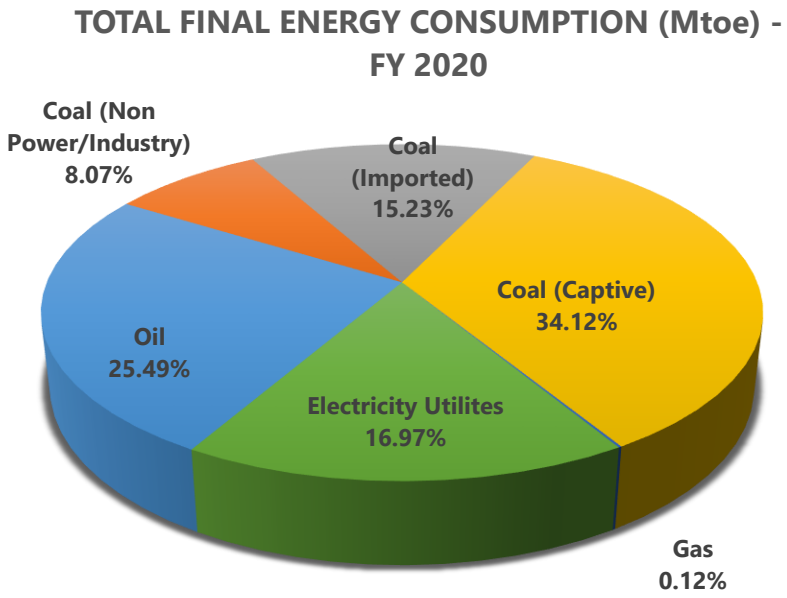
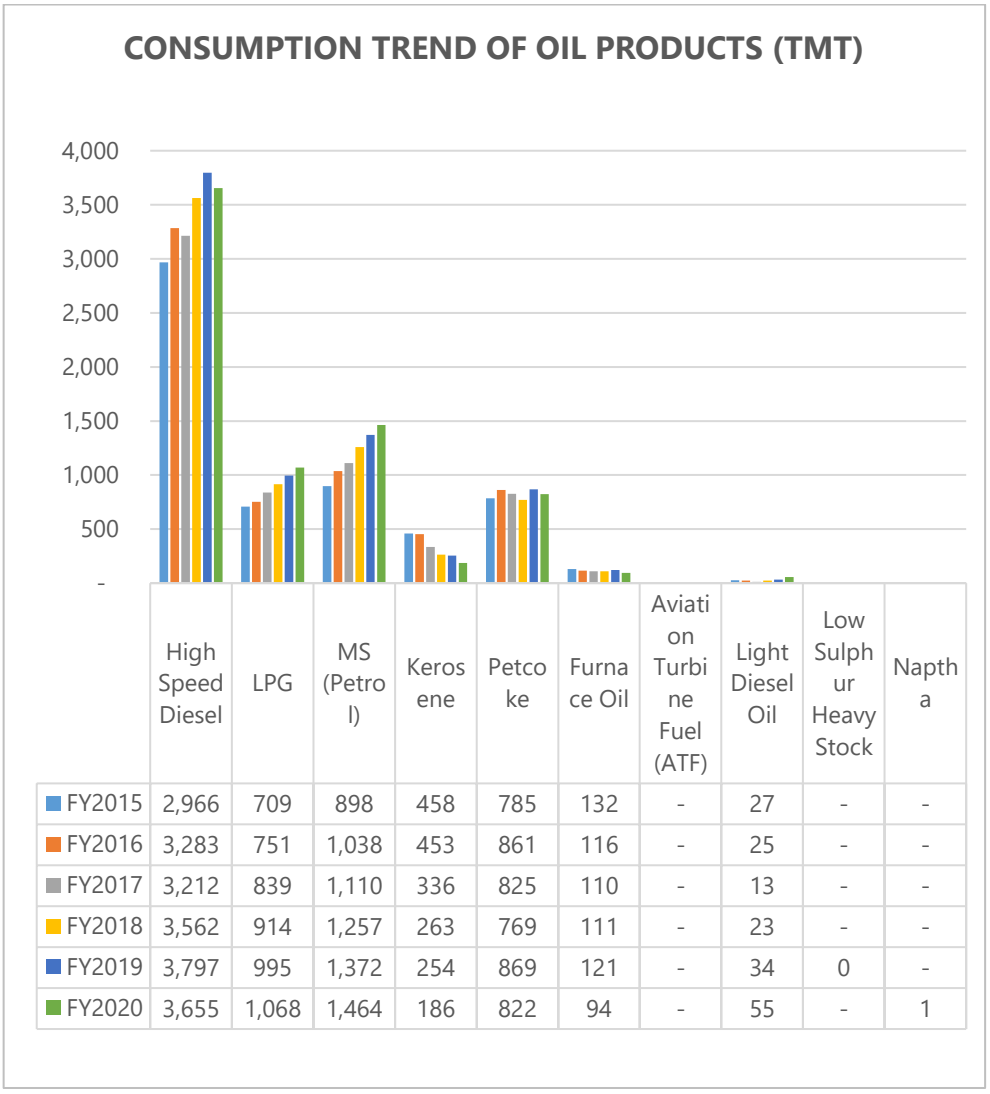


Figure 5: TFEC Break-Up for FY 2020

Oil consumption forms 25.49 percent of the total final energy consumption in the state. The majority of the oil consumption in the state is in the transport sector. The energy supplied from oil is in the form of different oil products, namely High-Speed Diesel Oil, Liquified Petroleum Gas (LPG), Petrol,

Kerosene, Petcoke, Furnace Oil, Aviation Turbine Fuel (ATF), Light Diesel Oil, Low Sulphur Heavy Stock and Naphtha. Oil consumption has seen an increased trend from FY2015-2020 with the majority of the consumption being High-Speed Diesel, LPG and MS (Petrol)[10]. Further, the use of clean cooking practice and aggressive outreach of LPG based cooking stoves leads to reduction in consumption of kerosene, petcoke and furnace oil from FY2015 to FY2020.



	High Speed Diesel	LPG	MS (Petrol)	Kerosene	Petcoke	Furnace Oil	Aviation Turbine Fuel (ATF)	Light Diesel Oil	Low Sulphur Heavy Stock	Naptha
FY2015	2,966	709	898	458	785	132	-	27	-	-
FY2016	3,283	751	1,038	453	861	116	-	25	-	-
FY2017	3,212	839	1,110	336	825	110	-	13	-	-
FY2018	3,562	914	1,257	263	769	111	-	23	-	-
FY2019	3,797	995	1,372	254	869	121	-	34	0	-
FY2020	3,655	1,068	1,464	186	822	94	-	55	-	1

Figure 6: Consumption Trend of Oil Products in the state

Increase in CNG fueling stations leads to increase in CNG vehicles in states which results in an increased rate of gas consumption in the state, with AAGR of 0.36% from FY 2015 to FY 2020.

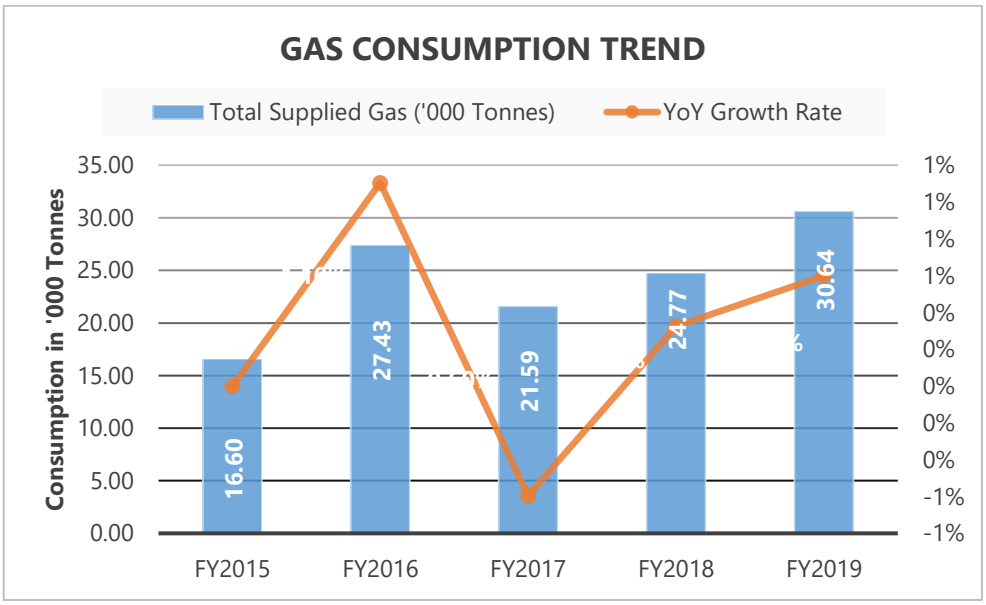


Figure 7: Gas Consumption Trend in State

Electricity demand continues to increase in the state as new industry and building projects are in development and accessibility of electricity to the population is enhanced. The electricity consumption has shown an increase of nearly 48% in FY 2020 from its FY 2015 level, going from 64.72 TWh in FY 2015 to 94.93 TWh in FY 2020[3], with a CAGR of approximately 8 percent.

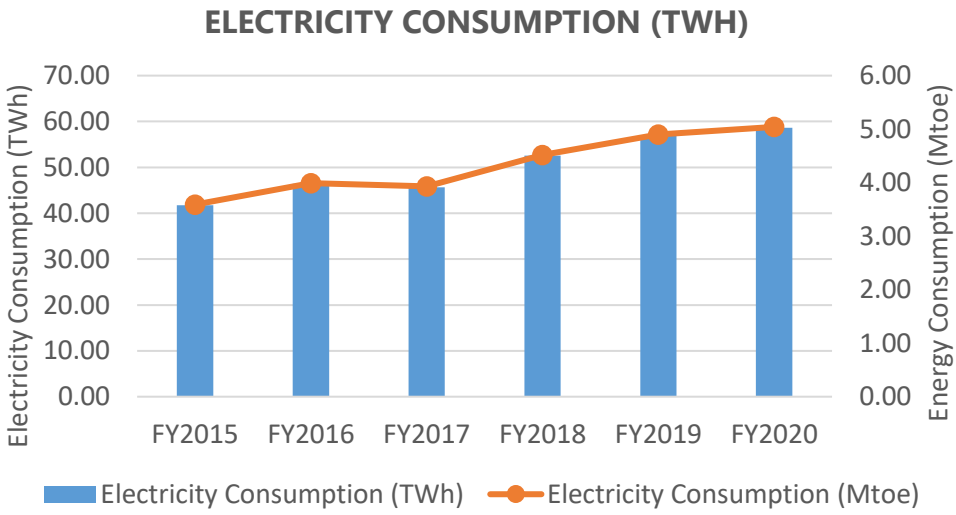


Figure 8 Electricity Consumption Trend in state

[3] *https://cea.nic.in/wpcontent/uploads/general/2020/General_Review_2021.pdf*

1.7. Overview of Institutional framework and stakeholder mapping

The Energy Conservation (EC) Act of 2001 establishes a legal framework for developing and executing energy efficiency (EE) policies and programmes.

The Act authorizes the Bureau of Energy Efficiency (BEE) to develop national policies and programmes, and State Designated Agencies (SDAs) to administer EE programmes and enforce EE norms and regulations at the state level.

The Madhya Pradesh New and Renewable Energy Department deals with the renewable energy projects such as energy generation through solar, wind, biogas, biomass, etc. and promotes technology and schemes related to renewable energy. Similarly, Madhya Pradesh Urja Vikas Nigam Limited deals in conserving the environment by promoting Energy Efficiency and Conservation measures/devices, administer EE programmes and enforce EE norms and regulations in the state.

The Madhya Pradesh Urja Vikas Nigam Limited was established in 1982 by the Government of Madhya Pradesh as a nodal agency to implement various programmes and policies initiated by Government of India as well as by the State Government for the renewable energy sector.

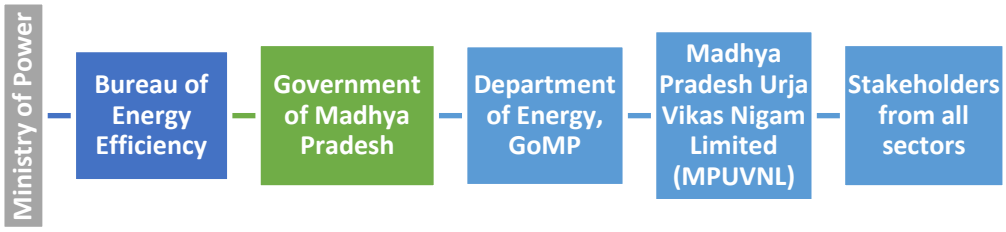
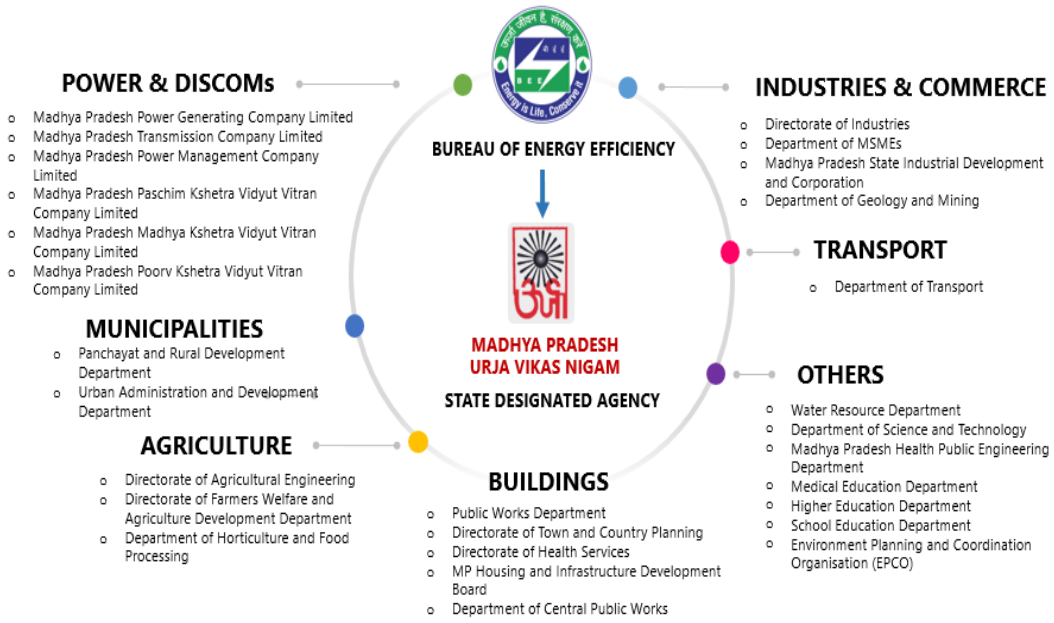
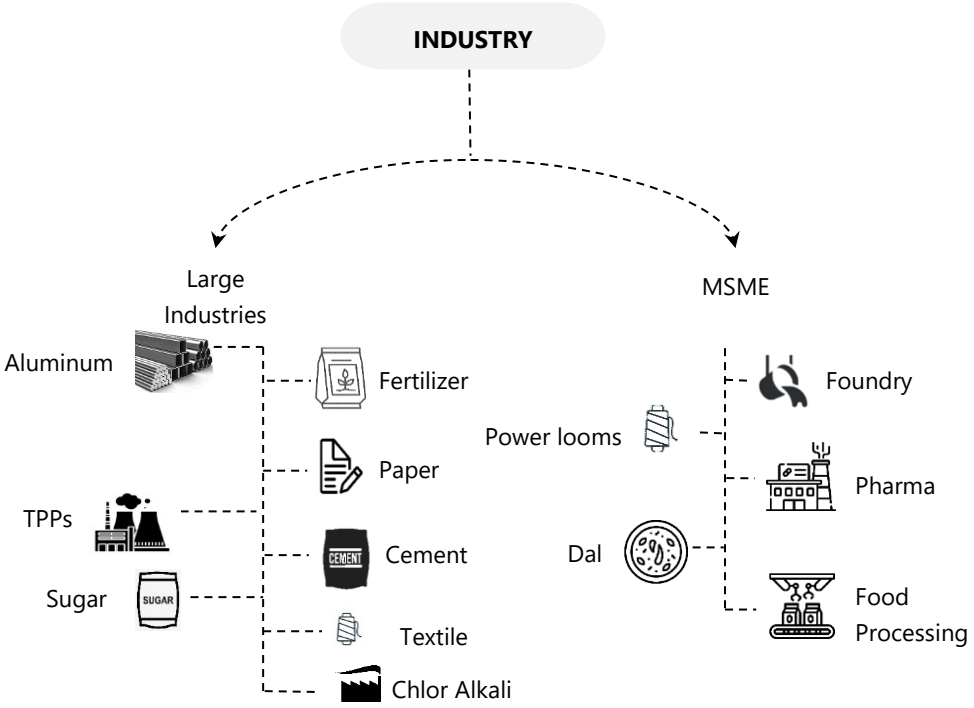


Figure 9: Institutional Framework for the state of Madhya Pradesh


POWER & DISCOMs
Madhya Pradesh Power Generating Company Limited
Madhya Pradesh Transmission Company Limited
Madhya Pradesh Power Management Company Limited
Madhya Pradesh Paschim Kshetra Vidyut Vitran Company Limited
Madhya Pradesh Madhya Kshetra Vidyut Vitran Company Limited
Madhya Pradesh Poorv Kshetra Vidyut Vitran Company Limited
MUNICIPALITIES
Panchayat and Rural Development Department
Urban Administration and Development Department
AGRICULTURE
Directorate of Agricultural Engineering
Directorate of Farmers Welfare and Agriculture Development Department
Department of Horticulture and Food Processing
BUREAU OF ENERGY EFFICIENCY
MADHYA PRADESH URJA VIKAS NIGAM
STATE DESIGNATED AGENCY
BUILDINGS
Public Works Department
Directorate of Town and Country Planning
Directorate of Health Services
MP Housing and Infrastructure Development Board
Department of Central Public Works
INDUSTRIES & COMMERCE
Directorate of Industries
Department of MSMEs
Madhya Pradesh State Industrial Development and Corporation
Department of Geology and Mining
TRANSPORT
Department of Transport
OTHERS
Water Resource Department
Department of Science and Technology
Madhya Pradesh Health Public Engineering Department
Medical Education Department
Higher Education Department
School Education Department
Environment Planning and Coordination Organisation (EPCO)

2. Identification of Focus Sectors

The economic areas of a state can be broadly classified into sectors namely Industry, Buildings, Agriculture, Municipalities, Power and DISCOMs and Cross Sectors. The sectors can be further divided into sub-categories, as shown in the figure below:



Identification of focus sectors or focus areas is important because it is a general characteristic of a state that a major portion of energy is being consumed by few energy-guzzling sectors. Focusing efforts towards these sectors is necessary to ensure that the allocation of resources is as per the state's priorities and towards sectors that have the highest potential of energy savings and emissions reductions.

The focus sectors of the state have been identified based on the share of energy consumption and emissions in the respective sectors, gap analysis of the respective sectors, inputs from stakeholder consultation, and priority areas of a state.

2.1. Methodology of Focus Sector Identification

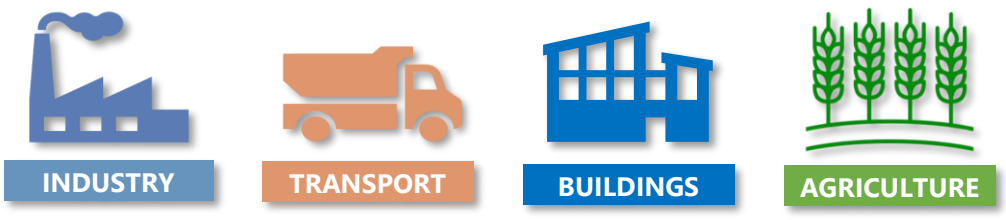
In order to arrive at the focus sectors, the various factors were analyzed namely the energy consumption, emissions, Gross State Value Addition (GSVA). Adding to that, gap analysis in respective sectors, potential for energy efficiency and emissions reduction, state has planned efforts in prioritized sectors, and SDA and stakeholder inputs have been considered to arrive at the focus sectors.

Gross State Value Addition (GSVA)

The Gross State Value Added (GSVA) of different economic categories was sourced from National Accounts Data, prepared by MoSPI. The GSVA sectors are not the same as the end use sectors used for the purpose of this report. However, these sectors have been used to deduce end use sectors for calculating imported coal and the same has been detailed in relevant sections. The GSVA sectors may also oftentimes not be representative of sectoral growth in terms of energy as the link between economic activity and energy use in several sectors is dependent on several factors, analyzing which is beyond the scope of this plan.

2.2. Identified Focus Sectors

Based on the TFEC, electricity consumption in the state and its sectoral distribution, focus sectors have been identified for the state. The focus sectors represent share of energy consumption through available data in Primary and Secondary Energy sources. It also reflects the views and recommendations of the stakeholders, existing and proposed policy infrastructure, and vision of the state Government for different sectors. Based on the above parameters and other important considerations, the following have been identified as the focus sectors for devising energy efficiency strategies in Madhya Pradesh. For the fiscal year 2020, the focus sectors including Industry, Transport, Buildings, and Agriculture are estimated to have the highest share of the total energy consumption in the state.



3. Projections and Forecasting

Economic and energy projections for the state up to the target year FY 2031 are performed to predict the future growth patterns of the respective sectors and to assess the impact of possible energy efficiency interventions in these sectors. The Gross State Domestic Product (GSDP) projections and the sectoral energy consumption projections form the basis of the expected emissions and emissions intensity of the state in the target year FY 2031, which is important in developing the emissions reduction targets for the state and in aligning the state with the national goals.

Fiscal Year (FY 2019-20), implying the period from April 2019-March 2020 has been selected as the base year for projections in this study keeping in view the years FY 2020-21 and FY 2021-22 being pandemic years.

The Gross State Domestic Product (GSDP) of the State of Madhya Pradesh was recorded at INR 5.67 Lakh Crore in FY 2020 and is projected to reach INR 13.49 Lakh Crore in FY 2031, at constant prices of 2011-12. The GSDP for the period FY 2023-FY 2031 is forecasted by taking weightage of the GSDP growth rate recorded in the years FY 2015-FY 2020 and the projection of GSDP growth rate by Madhya Pradesh Planning Commission Department[4]. The historic and forecasted GSDP for the State of Madhya Pradesh is shown in figure 10.

The Total Final Energy Consumption (TFEC) has been projected for all sectors up to FY 2031 considering the historic energy consumption trend from FY 2015 to FY 2020 along with the historic and projected GSDP growth for Madhya Pradesh.

Using the above-mentioned factors, the Business-as-Usual (BAU) growth rate factors are calculated for all the sectors to project the future energy demand by FY2031. The Total Final Energy Consumption of the state in the Business-as-Usual (BAU) scenario is projected to reach 70.02 Mtoe in FY 2031 from 29.71 Mtoe in FY 2020, with a projected CAGR of 8.10%.

[4] *https://mpplanningcommission.gov.in/CONTRIBTION.pdf*

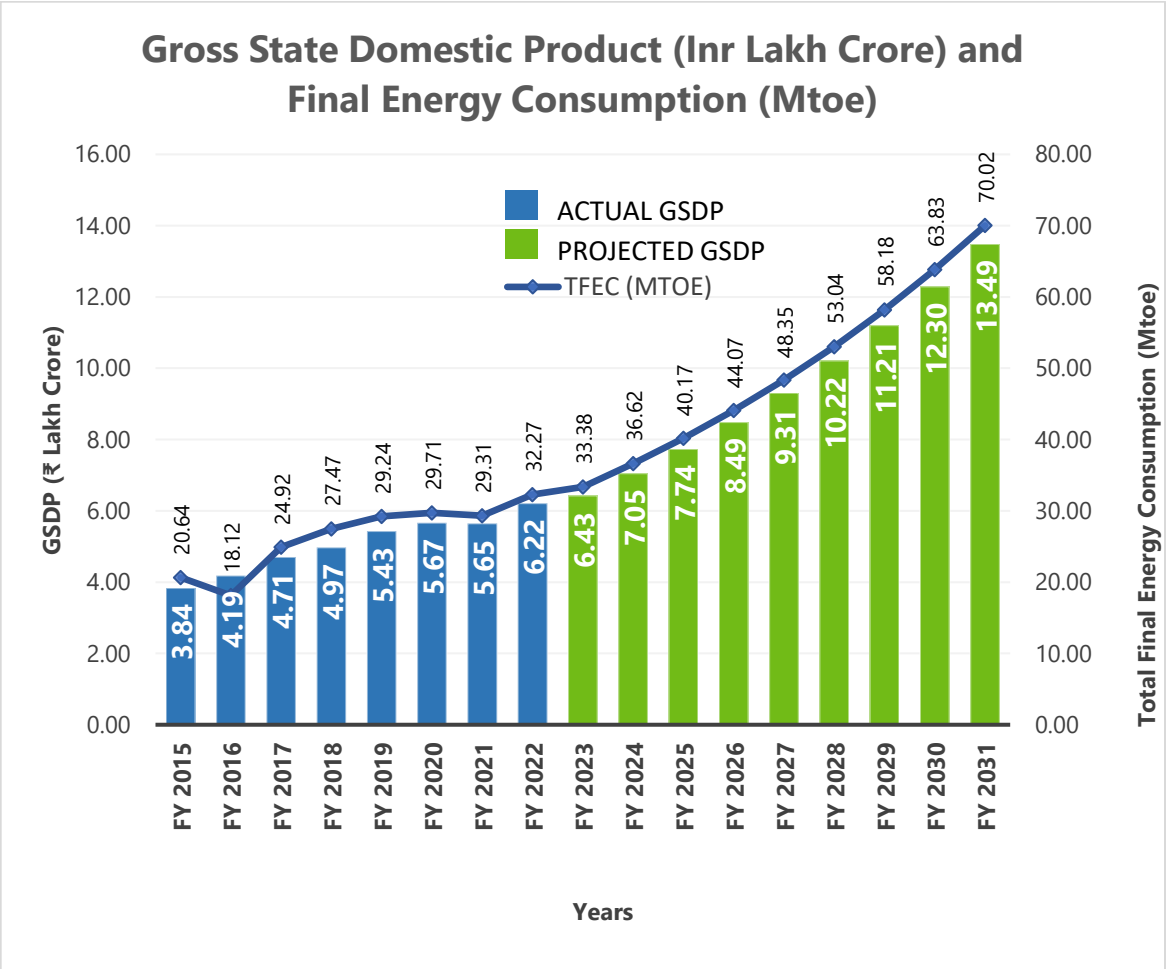


Figure 10: GSDP and TFEC Trend


INDUSTRY
SECTOR

4. Focus Sector 1: Industries

4.1. Current Scenario:

The industrial sector plays a major role in the state's economy. Although the agriculture sector contributes 35% of the state economy, the state is fast catching up with the industrial sector, an approximate 25% contribution to state GSDP. The good strength of manpower in the state is an added advantage for such increasing industrial development. Madhya Pradesh has observed significant growth in the industrial sector. Industrialization contributes a significant role in creating employment opportunities and endorsing the share of the industrial sector in the Gross State Domestic Products (GSDP). Gwalior, Sagar, Indore, Ujjain, Bhopal, Rewa, Jabalpur are some of the major industrial areas in the state. There are about 185 MSME industrial areas, 53 large industrial areas and 25 developing industrial areas. Some of the prominent and leading industrial sectors in Madhya Pradesh belong to the sectors such as automobile and auto parts, pharmaceuticals, textiles, cement, minerals, edible oil, food processing and Agri-business.

The state has a number of active policies to promote investments in the industry sector and the growth of industries in the state. The policies include policies such as Industrial Promotion Policy 2014, Madhya Pradesh IT, ITeS & ESDM Investment Promotion Policy, 2016, Madhya Pradesh MSME Development Policy 2021.

4.2. Energy Efficiency Strategies in the Industry Sector

This section presents the proposed strategies in the prominent sectors and focus areas identified in the industry sector along with their impact in terms of energy efficiency and emissions reduction. Strategies are proposed with their relevant action items.

Strategy #1: Deeping and Widening of Perform, Achieve and Trade Scheme

Implementation Timeline: Long Term (Till FY 2031)

The analysis performed to determine the coverage of Perform, Achieve, and Trade (PAT) in Madhya Pradesh revealed that as of FY 2019, the industries covered under the PAT scheme have a share of 22.82% in the total energy consumption in the industry sector.

In the proposed strategy, it is recommended that the state enhance coverage of energy consumption in PAT industries (DCs) by deepening and widening the PAT scheme in the state. Deepening and Widening of PAT scheme would imply notifying more industries as designated consumers under the current PAT sectors by lowering the threshold limit for eligibility (TOE/annum), as well as the inclusion of new sectors under the PAT scheme. The introduction of new sectors such as Dairy, Food Processing, Engineering, Auto Parts and Automobiles etc. in the PAT scheme can be targeted for Madhya Pradesh where these sectors are prominent.

Moderate and Ambitious SEC assigned to Fertilizers non-PAT units, and to Textile plants. It is assumed that the existing units of both sectors will achieve the moderate SEC target in 50% units and achieve the ambitious SEC target in 70% units.

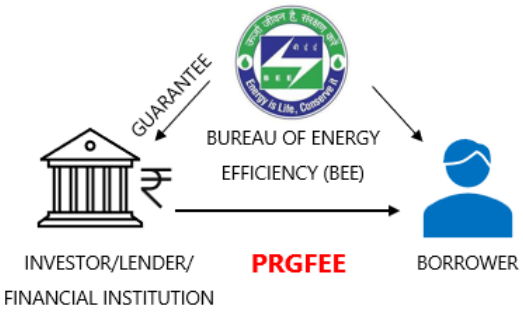
Table 1: Energy Savings in Moderate and Ambitious Scenario

Sector	Baseline SEC (toe/tonne)	Moderate SEC (toe/tonne)	Ambitious SEC (toe/tonne)	Production in 2031 ('000 tonnes)	Energy saving in moderate scenario (Mtoe)	Energy saving in ambitious scenario (Mtoe)
Textile	1.78	1.42	1.25	86703.40	**0.092**	**0.137**
Fertilizer	0.31	0.28	0.25	33293.95	**0.0014**	**0.0029**

Implementing Agency: Directorate of Industries, Madhya Pradesh State Industrial Development Corporation (MPSIDC), Madhya Pradesh Urja Vikas Nigam (MPUVN)

Actionable items:

1. **Partial Risk guarantee program to encourage implementation of latest energy efficient technologies in the sectors (Over and above existing schemes with state contribution):**



   A Partial Risk Guarantee (PRG) program can be an effective tool for encouraging the implementation of the latest energy-efficient technologies in various sectors. The program involves providing a guarantee to a lender or investor, which covers a portion of the risk associated with financing the adoption of energy-efficient technologies. Under the program, the lender or investor can provide financing at a lower cost, as the risk is partially covered by the guarantee. This helps to reduce the cost of financing for the borrower, making it more affordable to implement energy-efficient technologies.

   BEE, under its existing PRGFEE scheme has already released guidelines for partial risk guarantee that may be adopted by the state for effective implementation.

2. **Capacity Building of Energy Managers and Energy Auditors in PAT DCs and new probable sectors for compliance with scheme and new technologies:**

   Though its mandatory to go through a refresher training for all energy auditors and managers, it is important to attain knowledge of changing schemes and policies that could positively impact large consumers and help them implement schemes in their respective organizations.

3. **Mandatory Standardized Energy Audits in every three years for all units that have energy consumption below PAT threshold, in all notified PAT sectors, excluding MSMEs:**

   Though separate guidelines are issued for PAT industries, non-PAT, non-MSME industries could also benefit from energy audits. This shall not only

ensure their improved energy performance, but also, ensure that if brought under PAT scheme at a later stage, they would be accustomed and more willing to participate in it. The audits will also improve competitiveness of these industries. A monitoring mechanism may be developed to see the impact of energy audits and advise industries in a constructive way from time to time.

4. **Development of mechanisms for B2B interaction with global technology suppliers:**

   Global technologies are often beyond the reach of domestic industries due to several reasons. A platform to improve competitiveness and efficiency in energy may be provided under a structure to ensure advancement of manufacturing process and improvement in energy efficiency at the same time.

5. **Share of clean energy in total energy consumption:**

   Large industries are major consumers of energy, and their energy consumption has a significant impact on the environment. Clean energy can help large industries to reduce their environmental impact and save money on their bills. It will also enhance their reputation as responsible corporate citizens. Furthermore, it has been proposed that these industries should generate one-fifth of their own electricity from renewable sources.

Implementation Methodology:

1. Identification of Potential Sectors: The first step is to identify the sectors that have the potential to reduce their energy consumption significantly. This can be done by conducting a comprehensive study of the energy consumption patterns of various sectors and identifying the sectors that are energy-intensive and have a high potential for energy savings.
2. Setting Energy Targets: Once the sectors have been identified, the next step is to set energy targets for each sector. The energy targets should be set based on the energy consumption patterns of each sector and the potential for energy savings. The energy targets should be ambitious but

achievable and should be periodically reviewed and revised based on the performance of the industries.

3. Implementation of Energy Efficiency Measures: The implementation of energy efficiency measures is critical to achieving energy targets. The implementation methodology should include the identification of the most appropriate energy-efficient technologies and practices for each sector. The implementation methodology should also include training programs for the industries to help them understand the benefits of energy efficiency measures and to encourage their adoption.
4. Monitoring and Verification: Monitoring and verification of the energy consumption and savings achieved by the industries is critical to the success of the PAT scheme. The implementation methodology should include a robust monitoring and verification mechanism to track the energy consumption and savings achieved by the industries. The monitoring and verification mechanism should be independent and transparent to ensure the accuracy of the data.
5. Trading of Energy Saving Certificates: The final step in the implementation methodology is the trading of energy-saving certificates. The energy-saving certificates are issued to the industries that achieve their energy targets, and these certificates can be traded in the market. The trading of energy-saving certificates provides an incentive for industries to achieve their energy targets and promotes the adoption of energy-efficient technologies and practices.

Strategy #2: Energy Efficiency Interventions in MSME Clusters

Implementation Timeline: Short Term (Till FY 2026) for lower coverage; Long Term (Till FY 2031) for higher coverage.

The strategy is proposed for the Small and Medium Enterprises (SME) sector, which consists of MSMEs in identified prominent sectors such as Foundry, Dal, Pharma, Power looms, Engineering, Food Processing, Sandstone etc. A PAT-like scheme is proposed under this strategy for the unorganized and small industries sectors, which would not meet the threshold energy consumption under the

conventional PAT scheme. The strategy would involve the implementation of energy efficient technologies and new & innovative decarbonization technologies in the market in order to enable SMEs to meet their energy saving targets.

It was assumed that 50% of industries will be able to adopt the strategy in a moderate scenario and 70% industries will be covered in the ambitious scenario. The strategy is expected to result in energy savings of 0.714 Mtoe and 1.428 Mtoe in the moderate and ambitious scenarios respectively.

Table 2: Energy Savings in Moderate and Ambitious Scenario in MSME Clusters

Sector	Baseline SEC (toe/tonne)	Moderate SEC (toe/tonne)	Ambitious SEC (toe/tonne)	Production in 2031 ('000 tonnes)	Energy saving in moderate scenario (Mtoe)	Energy saving in ambitious scenario (Mtoe)
Power looms	1.78	1.60	1.42	2804.16	**0.706**	**1.411**
Food Processing	0.10	0.09	0.08	827.66	**0.008**	**0.017**

Implementing agency(s): Madhya Pradesh State Industrial Development Corporation; Department of MSME; MPUVN, MSME Associations.

Actionable items:

A number of action items will need to be adopted by the relevant departments and implementing agencies to achieve the energy savings estimated for this strategy. These action items include:

1. **Carrying out energy and resource-mapping studies in MSME clusters:** For the industries not covered under PAT, there is a challenge in reporting accurate energy consumption data for individual clusters or sub-sectors. Understanding of energy consumption patterns in the clusters in necessary to ensure optimized allocation of resources and assess the feasibility of technology implementation in a particular cluster. Energy and resource-mapping studies are comprehensive studies on MSME clusters and sub-sectors that can give insights into the current status of technology

implementation in the cluster, set benchmark energy consumption, design threshold limits for a PAT-like scheme, and analyze the future potential of technology implementation in terms of energy and cost savings. Energy and resource-mapping studies are proposed to be carried out in the prominent MSME clusters and industry sub-sectors of the state annually to set benchmarks and track progress in the implementation of this strategy.

2. **Implementation of Demonstration Projects on energy efficient technologies in SME clusters:**

   Demonstration projects are proposed to be carried out every year on a periodic basis in all prominent SME clusters to promote these technologies and make stakeholders aware about the monetary and energy performance impact of these technologies.

3. **Workshops on technology interventions for energy conservations in MSMEs:**

   It is proposed to organize cluster wise workshops for MSMEs on technology interventions that can be implemented in respective industries. It is important to disseminate technical information about new technologies among owners and maintenance team of MSMEs so that they can implement the latest technologies in their units. It was suggested that the energy department should consider collaborating with the Directorate of Industries for the training the industrial professionals in energy efficient technologies.

4. **Periodic standardized energy audits for MSMEs on load basis and reimbursement of energy audit cost with a maximum cap**:

   The government of Madhya Pradesh may develop a standard format of energy audit and issue notification for conducting mandatory periodic (in every 3 Years) energy audits by every unit above a certain limit of connected load. The government can also provide reimbursement of energy audit cost with a maximum cap of INR 75,000. Monetary support to small industries

and MSMEs can be provided to maintain the standard of conducted energy audit.

5. **Issuance of directives for implementation of ISO 50001, Energy Management System in organizations on load basis:**

   ISO 50001 is an international standard that outlines the requirements for an energy management system (EnMS). It provides a framework for organizations to establish, implement, maintain, and improve energy performance and efficiency. The State Government shall issue directive to all units in state which are above a limit of connected load, to implement ISO 50001 and adopt Energy Management System in organizations. Implementation of ISO 50001 can help organizations identify and address energy efficiency opportunities, reduce energy consumption and costs, and improve their environmental performance.

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

   A policy may be developed at state level to provide financial assistance for implementation of ECMs recommended in the energy audits. Policy development shall consider the sector specific requirements, energy saving potential of sector and its importance in state level GSDP.

7. **Phase wise plan to implement DSM scheme for replacement of existing inefficient (non-star rated) pumps through DISCOMS:**

   State government department may develop a demand side management (DSM) plan to replace all existing pumps which are lower than 3 stars rated or purchased/installed before 2015 with BEE 5-Star rated appliances. Phase wise plan can be executed through DISCOMs or listed ESCOs in the state.

8. **Share of Clean Energy in Total Energy Consumption:**

   MSMEs are a vital part of global economy, accounting for a significant share of employment and GDP. However, MSMEs are also major energy consumers and have a significant impact on the environment. It has been proposed these industries should generate 5% to 10% of their own electricity from renewable sources.

9. **Implementation of energy efficient equipment for new units:**

Implementing energy efficient equipment can help organizations to reduce their energy consumption, cost on their bills and reduce their environmental impact. This can be a significant investment, but the long-term savings on energy bills. The government offers financial incentives to help the organization to upgrade to energy efficient equipment. It has been proposed to make it mandatory for new upcoming MSME units to install energy efficient equipment.

Implementation Methodology:

1. The first step in the implementation methodology is the identification of energy intensive MSME clusters. The identification of clusters is based on the energy consumption data and the potential for energy savings. The clusters are selected based on their energy intensity, and the potential for energy savings is assessed by conducting preliminary energy audits.
2. The next step is to conduct energy audits of the MSMEs in the selected clusters. The energy audits are conducted to identify the energy consumption patterns and the potential for energy savings. The audits are conducted by certified energy auditors who use standardized methodologies and tools to assess the energy performance of the MSMEs.
3. Based on the energy audit findings, a list of energy efficiency measures is prepared for each MSME cluster. The energy efficiency measures can include both operational and capital investment changes. The energy efficiency measures are prioritized based on their energy savings potential and their cost-effectiveness. The MSMEs are required to implement energy efficiency measures within the stipulated time period.
4. The implementation of energy efficiency measures requires technical assistance and financial support for the MSMEs. Technical assistance can be provided by energy service companies (ESCOs) who are experienced in implementing energy efficiency measures. The ESCOs provide end-to-end solutions, including design, implementation, and monitoring of the energy efficiency measures. Financial support can be provided by banks

and financial institutions who offer loans and subsidies for energy efficiency projects.

5. The monitoring and verification of energy savings is a critical step in the implementation methodology for energy efficiency interventions. The monitoring and verification process involves the measurement of the energy consumption data before and after the implementation of energy efficiency measures.
6. The verification process is carried out by conducting an energy audit of the MSME after the implementation of energy efficiency measures. The energy audit is conducted using the same methodologies and tools as the initial energy audit. The energy savings achieved are calculated based on the difference between the pre- and post-implementation energy consumption data.
7. The implementation of energy efficiency interventions for MSME clusters has several benefits. The interventions help to reduce the energy consumption and improve the energy efficiency of MSMEs, resulting in cost savings and improved competitiveness. The interventions also help to reduce the carbon footprint of MSMEs, contributing to sustainable development. The interventions also create employment opportunities and promote economic growth.

4.3. Energy Saving Targets & Monitoring Mechanism

Based on the proposed strategies for the industry sector, the total energy saving estimated is 0.81 Mtoe in the moderate scenario and 1.57 Mtoe in ambitious scenarios. The potential savings under moderate and ambitious scenarios is the overall estimated savings from individual strategies under the respective scenarios and can be considered as the energy saving targets for FY 2031 for the Industry Sector.

Table 3 Moderate and ambitious scenarios energy savings for Industry sector

Strategies	Energy Savings in 2031 under moderate scenario (Mtoe)	Energy Savings in 2031 under ambitious scenario (Mtoe)
Deeping and Widening of Perform, Achieve and Trade Scheme	0.0934	0.140
Energy Efficiency Interventions in MSME Clusters	0.714	1.428
Total	**0.81**	**1.57**

Monitoring Mechanism:

To effectively carry out the action plan, it is essential to establish a robust monitoring and verification system. While the State Designated Agency (SDA) holds the primary responsibility for overseeing progress, it is imperative for other stakeholders, including organizations engaged in building sector development and planning, to actively engage in diligent monitoring and reporting. The suggested monitoring framework, outlining the steps to track the scheme's progress, is presented in the table below:

Type of Monitoring	Frequency	Nodal Agencies	Responsible Agencies
Reporting, Monitoring and Review of the scheme advance and implementation status	Quarterly	State Designated Agency	• Madhya Pradesh Urja Vikas Nigam Limited • Department of Industrial Policy and Investment Promotion

Type of Monitoring	Frequency	Nodal Agencies	Responsible Agencies
Review of the scheme advancement and course correction, if required.	Half-yearly	State Designated Agency	• Madhya Pradesh Urja Vikas Nigam Limited • Department of Industrial Policy and Investment Promotion
Review of the scheme advancement and policy interventions required	Yearly	State Designated Agency	• Department of Industrial Policy and Investment Promotion Madhya Pradesh Urja Vikas Nigam Limited • Bureau of Energy Efficiency
Progress reporting of scheme advancement	Monthly	State Designated Agency	• Madhya Pradesh Urja Vikas Nigam Limited

In conclusion, Monitoring mechanisms are essential for successful implementation of energy efficiency action plans, providing a way to track progress, identify areas for improvement, and evaluate energy efficiency measures. Moreover, monitoring mechanisms can also help to identify patterns and trends in energy consumption, allowing policymakers to develop effective energy efficiency strategies. Effective monitoring mechanisms are essential for achieving energy efficiency goals in the industry sector, leading to cost savings, improved comfort, and environmental benefits.

Transport Sector

5. Focus Sector 2: Transport

5.1. Current Scenario:

In 2020, the total number of motor vehicles registered in Madhya Pradesh, including 2 Wheelers, 3 Wheelers, LMVs, 4 Wheelers, Buses, and Heavy Vehicles, amounted to 179.18 lakh, reflecting an 8.69% growth compared to the previous year. Buses, cabs, and autos are the primary modes of public transportation in the state, which operate on CNG, petrol and diesel. As the transportation sector in Madhya Pradesh continues to expand, the total electricity consumption has risen, prompting the state to introduce several policies aimed at reducing energy consumption in this sector.

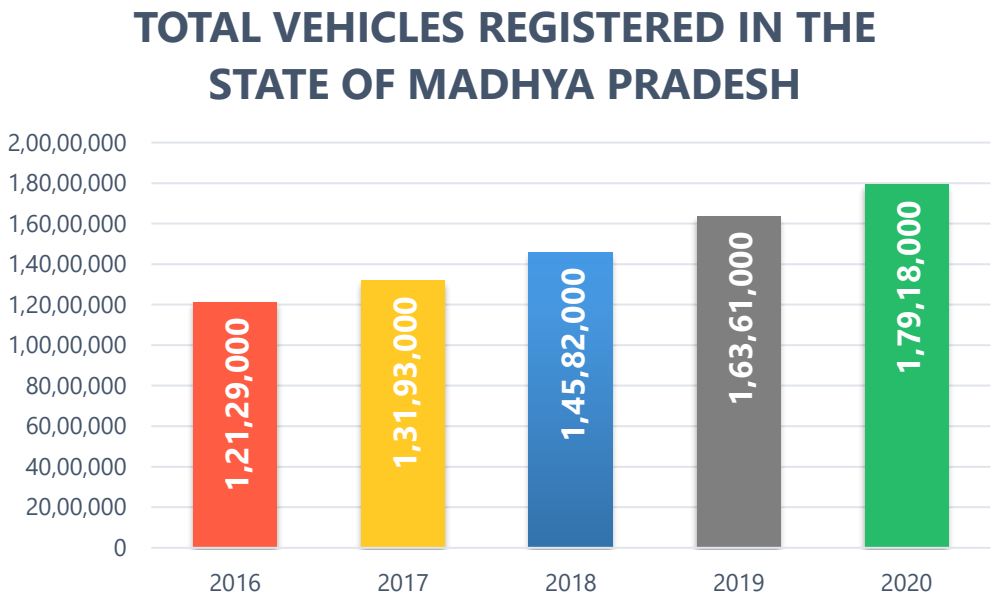


Figure 11: Total vehicle registered in Madhya Pradesh.

The breakdown of vehicle types reveals that two-wheelers constitute the largest share, accounting for 80.41% of all vehicles. LMVs come in at a close second, making up 7.42% of the vehicle category. The Madhya Pradesh EV Policy aims to target all types of vehicles and promote the transition of a significant percentage of vehicles into electric vehicles.

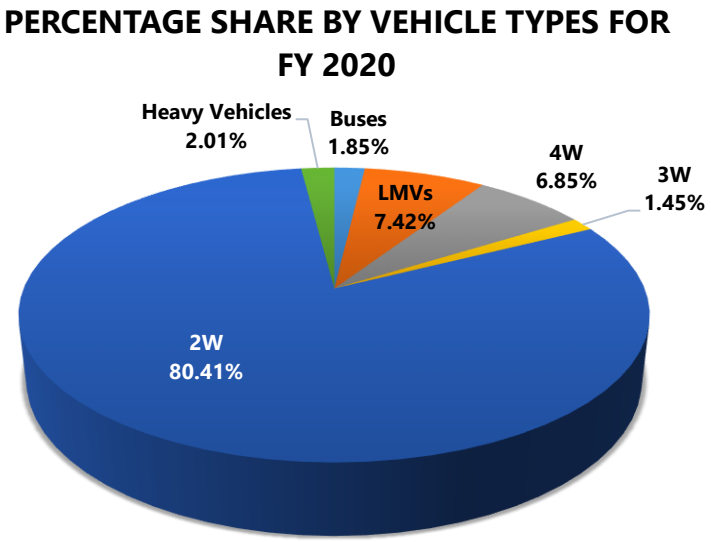


Figure 12: Percentage Share of Vehicle Types

Based on data from the Road Transport Yearbook (RTYB) of FY 2019, Madhya Pradesh has recorded a Compound Annual Growth Rate (CAGR) of 9.79% in the number of registered vehicles over the period of 2009 to 2019.

In 2019, the State government initiated an Electric Vehicles Policy, which includes the establishment of low or zero-emission zones where only electric vehicles will be allowed. As of April 2022, the Department of Transport reports that 346 electric four-wheelers, 11,549 electric two-wheelers, 7,500 E-Rickshaws, and 1,029 E-Goods Rickshaws have been registered.

The data on the number of registered vehicles in the state was obtained from the "MP at a Glance" report published by the Directorate of Economics and Statistics. From FY 2016 to FY 2020, the number of registered vehicles in Madhya Pradesh increased from 1.21 crores to 1.79 crores, representing an Average Annual Growth Rate (AAGR) of 10.25%.

The following figure depicts the projected number of registered vehicles for the years 2026 and 2031, calculated using the Average Annual Growth Rate (AAGR) using it as a Compound Annual Growth Rate (CAGR) with the base year being 2020. These estimates are based on the data from the report "MP at a Glance by Directorate of Economics and Statistics".

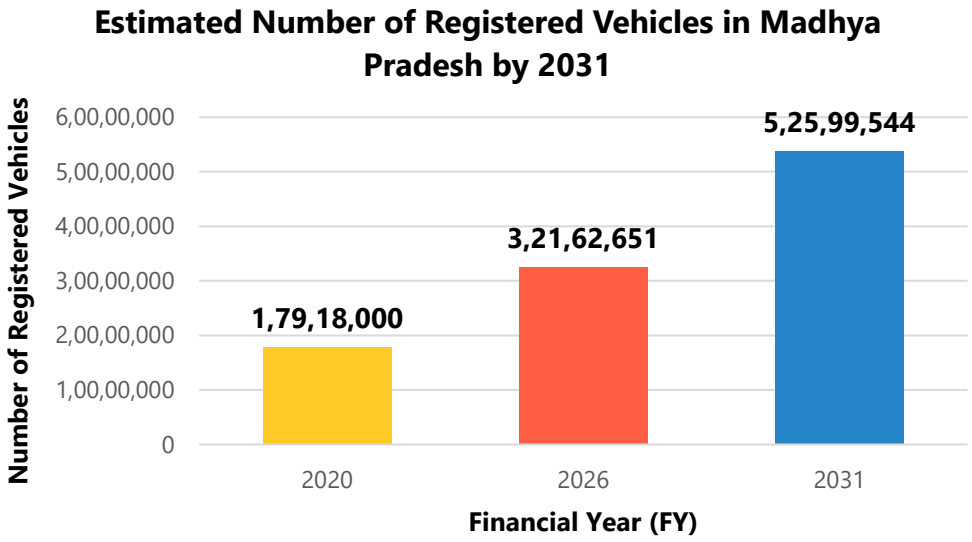


Figure 13 Estimated Number of Registered Vehicles by FY 2031

5.2. Strategies in the Transport Sector:

The Madhya Pradesh EV Policy 2019 has proposed a long-term strategy for the transition to electric vehicles in the state. The strategy covers various aspects of the transport sector, including providing incentives to consumers for transitioning to EVs, converting the state's different types of vehicles into electric vehicles, transitioning to electric logistics transport, and developing a network of charging stations across the state. Ethanol blending in petrol is proposed as another strategy to bring about emissions reduction in the transport sector. The strategy has been proposed in line with the national policy on ethanol blending.

Strategy #1 Infrastructure Development for EV charging stations and Incentives to Consumers for quick transition to EVs

Implementation Period: Long Term (Till FY 2031)

The transition to Electric Vehicles (EVs) across all segments of vehicles will be instrumental in decarbonization of the sector and in bringing significant savings in fossil-fuel based energy consumption. In this strategy, it is proposed to convert new vehicles registered in the state till FY 2031 to electric vehicles along two different scenario trajectories, namely moderate scenario, and ambitious scenario. The highest EV conversion rate is proposed for 2-wheelers because of

it having the highest share in registered vehicles and taking into consideration the availability and affordability of 2-Wheeler electric vehicles. The EV conversion considerations for moderate and ambitious scenarios are given in below table:

Table 4: EV transition considerations for moderate and ambitious scenarios

Moderate Scenario	Ambitious Scenario
• 25% of conventional 2-Wheelers convert to electric by 2031. • 15% of conventional 4-Wheelers convert to electric by 2031. • 50% buses in the state to transition to electric buses by 2031. • 25% of 3-Wheelers to convert to electric by 2031. • 25% of heavy vehicles (trucks and lorries) to convert to electric by 2031	• 35% of conventional 2-Wheelers convert to electric by 2031. • 20% of conventional 4-Wheelers convert to electric by 2031. • 80% buses in the state to transition to electric buses by 2031. • 35% of 3-Wheelers to convert to electric by 2031. • 35% of heavy vehicles (trucks and lorries) to convert to electric by 2031

The EV transition strategy can result in potential energy savings of 2.55 Mtoe and 3.68 Mtoe in the moderate scenario and ambitious scenario respectively.

Table 5: Energy Savings and Emission Reduction Potential of infrastructure development and incentives to consumers for EV transition

Particulars	Moderate Scenario	Ambitious Scenario
Energy Saving Potential (Mtoe)	2.55	3.68

Implementing Agency: Madhya Pradesh Urban Development & Housing Department (UDHD), Department of Transport

Actionable Items:

1. **Establishment of regulatory mechanism to develop EV charging Infrastructure**-

Several regulatory mechanisms can be put in place to develop EV charging infrastructure in the state of Madhya Pradesh. Some possible approaches are mentioned below:

- Incentives for private companies to install charging infrastructure: The government can provide incentives such as tax breaks or subsidies to private companies that install EV charging infrastructure in the state.
- Public-private partnerships: The government can enter partnerships with private companies to develop and operate EV charging infrastructure. This can include agreements on revenue sharing, investment, and maintenance.
- Zoning regulations: The government can zone certain areas of the city for EV charging infrastructure, such as near highways or in commercial areas, to ensure that the infrastructure is developed where it is most needed.
- Time-of-use pricing: The government can introduce time-of-use pricing for EV charging to encourage drivers to charge their vehicles during off-peak hours when electricity is cheaper.

By implementing some or all of these regulatory mechanisms, Madhya Pradesh government can encourage the development of a robust EV charging infrastructure that will help to support the transition to electric vehicles in the state.

2. Pilot projects on Battery Swapping stations -

The Madhya Pradesh EV Policy 2019 has proposed the establishment of battery swapping stations across the state. The state government aims to set up battery-swapping infrastructure at key locations such as public charging stations, commercial hubs, and along highways. The policy also proposes incentives for private players to set up battery-swapping infrastructure in the state. Establishing battery-swapping infrastructure is expected to increase the adoption of electric vehicles in the state by addressing range anxiety and reducing charging times.

The policy also includes the provisions for the development of charging infrastructure across the state. The policy aims to establish a network of charging stations in the state to support the growing number of electric vehicles. The policy also includes provisions for setting up charging stations at public places like malls, parking lots, and petrol pumps to ensure easy accessibility for EV owners. The state government is also incentivizing private entities to set up EV charging infrastructure by providing financial assistance and other incentives. Additionally, the policy encourages the development of renewable energy-based charging infrastructure to promote sustainable energy usage in the state.

To ensure a shorter period of return of investment (ROI), it is proposed that the EV chargers be installed in places with higher density of vehicles and commuting population such as public recreation places, malls and shopping complexes, public offices, Multi-Level Car Parking (MLCP), parking areas of bus stands, railway stations, metro stations and airports.

Other action items include awareness programs for energy conservation technologies in the transport sector, and the introduction of demonstration or pilot projects on alternative fuel vehicles. Pilot projects will build the readiness of the state in adapting to vehicles run by alternative fuels such as Hydrogen Fuel Cell Vehicles (HCV). The awareness programs and pilot projects include:

3. Pilot projects on Hydrogen Fuel Cell Vehicles (HCVs)

Pilot projects on hydrogen fuel cell vehicles (HCVs) can be an effective way to explore the potential of this technology and to identify any barriers or challenges to its widespread adoption. The results of the pilot project should be shared with stakeholders, including the public, to raise awareness of the potential of HCVs.

4. Pilot projects on renewable based charging infrastructure:

Initiating pilot projects focused on charging infrastructure powered by renewable energy sources presents a promising opportunity to seamlessly integrate clean energy into electric vehicle charging networks. These

endeavors will effectively showcase the viability of clean energy adoption in the realm of transportation, consequently mitigating carbon emissions and charting a course towards sustainable solutions. Through the amalgamation of intelligent grid systems, efficient battery storage solutions, and collaborative efforts between public and private entities, these trial initiatives yield valuable insights for enhancing energy utilization, refining grid dynamics, and understanding user engagement patterns. Undoubtedly, these initiatives play a pivotal role in shaping the landscape of future transportation systems, characterized by their eco-friendliness and economic feasibility. It was suggested that central government should take initiative in installing renewable energy-based charging stations.

5. **Training of skill labored for maintenance of charging infrastructure:** Training skilled labor for the maintenance of charging infrastructure is a pivotal step in advancing the electric vehicle (EV) ecosystem. This training equips individuals with essential skills to ensure the reliability, safety, and efficiency of EV charging stations. The program encompasses diverse areas such as electrical systems, hardware maintenance, software troubleshooting, safety protocols, and customer service. Through hands-on experiences and theoretical knowledge, trainees become adept at identifying and rectifying issues that arise in charging stations. This training not only supports the seamless operation of EV infrastructure but also contributes to job creation and the sustainable growth of the EV industry.
6. **Incentives on the development of charging infrastructure by the private sectors in the state:** Incentivizing private sector involvement in the development of charging infrastructure is a strategic move to accelerate the adoption of electric vehicles (EVs) and foster sustainable mobility solutions within the state. By offering attractive incentives, the government encourages private companies to invest in charging infrastructure, thereby expanding the charging network and addressing range anxiety for EV owners. These incentives can take various forms, such as tax benefits, subsidies, grants, and streamlined regulatory processes. By partnering with the private sector, the state not only facilitates the transition to cleaner

transportation but also stimulates economic growth, job creation, and technological innovation. This collaboration between public and private entities serves as a cornerstone for a greener, more accessible transportation future.

The government of Madhya Pradesh offers financial incentives for public charging stations development on government and private land.

Small Charging Stations: Capital subsidy: 25% of the value of the charging equipment/machinery, up to a maximum of INR 1,50,000 for the first 300 charging stations.

Medium Charging Stations: Capital subsidy: 25% of the value of the charging equipment/machinery, up to a maximum of INR 2,00,000 for the first 100 stations

Large Charging Stations: Capital subsidy: 25% of the value of the charging equipment/machinery, up to a maximum of INR 10,00,000 for the first 100 stations

All categories of charging stations are entitled to a capital subsidy of 25% or the maximum subsidy amount, whichever is less.

7. **Incentives on e-vehicles and spare part manufacturing:** The Madhya Pradesh EV Policy provides a variety of incentives for EVs, including two-wheeler, three-wheeler, four-wheeler, and buses. These incentives include Vehicle registration fee exemption, road tax exemption, parking charges exemption, interest subsidy on loans and subsides on the purchase. However, these subsidies are limited to a certain number of vehicles. To address this, it has been suggested that the state government introduce more incentives for EVs, as well as incentives for setting up plants to manufacture spare part for these vehicles.
8. **Disposal of electric vehicle batteries:** EV Battery Disposal: The responsible disposal of electric vehicle (EV) batteries is crucial for environmental sustainability. Lithium-ion batteries, commonly used in EVs, contain valuable and potentially hazardous materials. Proper recycling processes involve

dismantling, recovering valuable metals like lithium, cobalt, and nickel, and managing harmful components. This reduces resource depletion and minimizes environmental impact. Innovations in recycling methods aim to improve efficiency and decrease costs. Governments and industries are collaborating to establish regulations and infrastructure for safe and eco-friendly EV battery disposal, promoting a cleaner energy future.

Implementation Methodology:

1. Identification of Target Areas: The first step is to identify the target areas for the installation of EV charging stations. This can be done by conducting a survey of the current EV usage patterns and the availability of charging infrastructure. The survey should also identify the areas with high demand for EVs, such as urban areas and major highways.
2. Selection of Charging Technologies: The next step is to select the appropriate charging technologies for each target area. The selection should be based on factors such as the expected usage patterns, the charging time, and the availability of power supply. The most common charging technologies include Level 1, Level 2, and DC Fast Charging.
3. Procurement and Installation of Charging Stations: The procurement and installation of charging stations involve identifying the suppliers for the charging equipment and the installation contractors. This process should be carried out in a transparent manner, and all the procurement and installation processes should follow the relevant government guidelines and policies.
4. Operations and Maintenance: The operations and maintenance of the charging stations are critical to ensuring their reliability and availability. The implementation methodology should include a robust operations and maintenance plan that includes regular inspections, maintenance, and repairs.
5. Incentives to Consumers: The implementation methodology should include incentives to consumers to encourage the quick transition to EVs. This can be done by providing tax credits, subsidies, and other

financial incentives to EV buyers. The incentives can also include discounts on EV purchase prices and registration fees.

6. Awareness Campaigns: The implementation methodology should include awareness campaigns to educate consumers about the benefits of EVs and the availability of charging infrastructure. The campaigns should be designed to reach a broad audience and should include online and offline channels such as social media, television, and radio.
7. Monitoring and Evaluation: The implementation methodology should include a monitoring and evaluation framework to track the progress of the implementation and assess the impact of infrastructure development and incentives on the adoption of EVs.

Strategy #2 Ethanol Blending Program

Implementation Period: Long Term (Till FY 2031)

The Ethanol Blending Program is proposed to ensure mixing of ethanol in motor spirit (petrol) in a fixed ratio to offset a part of the energy consumed by petrol and bring about reduction in emissions. In the proposed strategy and in line with the country's target of 20% blending of ethanol blending in petrol by 2031, a 10% blending target is suggested in the moderate scenario and a 20% blending target is suggested in the ambitious scenario.

The ethanol blending can lead to potential fossil fuel energy savings of 0.46 Mtoe and 0.92 Mtoe in the moderate and ambitious scenarios respectively.

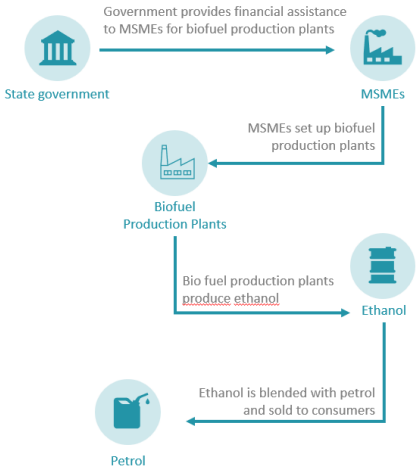
Table 6: Moderate and ambitious scenarios for Ethanol Blending Program

Particulars	Moderate Scenario	Ambitious Scenario
Energy Saving Potential (Mtoe)	0.46	0.92

Implementing Agency: Department of Transport & Individual Government Departments

Actionable Items:

1. **Financial Assistance on Biofuel production plants (Capital Subsidy for MSMEs)–**



To ensure a steady supply of ethanol for blending with petrol, it is recommended to offer financial assistance for the installation of biofuel production plants. Micro, small, and medium-sized enterprises (MSMEs) interested in setting up these plants could receive capital subsidies. The aim is to establish a strong supply chain for feedstock to meet production targets and create a supportive environment for ethanol blending in fuel. By promoting the growth of biofuel industries, new technologies can be introduced, and the market can be strengthened.

2. **Capacity Building for the investors:** Capacity building for investors in ethanol blending program aims to empower them with essential skills and insights to engage effectively in the ethanol industry. This initiative provides knowledge about regulatory aspects, market trends, technological advancements, and sustainability practices. By enhancing investors' understanding, the program encourages increased investment in renewable energy, supporting energy diversification and environmental goals.
3. **Monitoring mechanism for the supply of feedstock and production of ethanol:** The monitoring mechanism for feedstock supply and ethanol production establishes a robust system to oversee and manage these essential elements. This mechanism employs real-time tracking, data analysis, and reporting to ensure a steady supply of raw materials, prevent disruptions, and maintain efficient production processes. By keeping a vigilant eye on these aspects, the monitoring mechanism guarantees the smooth functioning of the ethanol production cycle, contributing to sustainability and resource optimization.

4. **Support for the research and development programs:** Support for research and development (R&D) programs in ethanol blending is a strategic investment that fuels innovation in the renewable energy sector. By allocating resources to R&D initiatives, governments and organizations encourage the exploration of advanced blending techniques, sustainable feedstock options, and efficiency improvements. These programs drive the evolution of ethanol blending technology, making it more cost-effective and environmentally friendly. Ultimately, R&D support enhances the growth of ethanol blending programs, aligning with energy diversification goals, and fostering a greener energy landscape.

Implementation Methodology:

1. Policy and Regulatory Framework: The first step is to develop a policy and regulatory framework that supports the implementation of the Ethanol Blending Programme. This framework should include guidelines for the production, storage, and distribution of ethanol, as well as standards for the blending of ethanol with gasoline.
2. Production of Ethanol: The next step is to encourage the production of ethanol from various sources such as sugarcane, corn, and other feedstocks. This can be done by providing incentives for ethanol production, such as tax breaks and subsidies.
3. Procurement and Storage: The procurement and storage of ethanol are critical to ensure the availability of ethanol for blending. The implementation methodology should include a robust procurement system that involves competitive bidding and transparent procurement processes. The storage facilities should be located strategically to ensure the timely supply of ethanol to blending facilities.
4. Blending of Ethanol: The blending of ethanol with gasoline should be carried out according to the established guidelines and standards. The implementation methodology should include a system for monitoring the blending process to ensure compliance with the blending ratios.
5. Distribution and Marketing: The distribution and marketing of blended fuel should be done through the existing network of fuel retailers. The

implementation methodology should include a system for tracking the distribution and sales of blended fuel to ensure compliance with the blending requirements.

6. Awareness Campaigns: The implementation methodology should include awareness campaigns to educate consumers about the benefits of blended fuel and to encourage them to use it. The campaigns should be designed to reach a broad audience and should include online and offline channels such as social media, television, and radio.
7. Monitoring and Evaluation: The implementation methodology should include a monitoring and evaluation framework to track the progress of the implementation and assess the impact of the Ethanol Blending Programme on the environment, the economy, and society.

Strategy #3 Promotion of Standard and Labelling program of Tyers for Fuel Efficiency in Vehicles

The Bureau of Energy Efficiency (BEE) in India has implemented a standard and labeling program for tyres to promote fuel efficiency in vehicles The promotion of a standard and labeling program for tyres with regard to fuel efficiency in vehicles can be an effective way to encourage the adoption of more fuel-efficient tyres by consumers.

Actionable Items:

1. **Awareness campaigns:** The first step is to create awareness among consumers about the importance of fuel-efficient tyres and the benefits of using them. This can be done through advertising campaigns, social media, and other public outreach efforts. The government can provide education to consumers on how to maintain their tyres for optimal fuel efficiency. This can include tips on proper inflation, regular rotation, and alignment.
2. **Capacity Building of Tyre Manufacturer and Vehicle OEMs-** Capacity building workshops shall be organized in the state to enhance the knowledge of Tyre Manufacturers and Vehicle OEMs about Star Rating of

Tyre and its benefits and compliance methodology to encourage them to produce or use star rated tyres.

By promoting a standard and labeling program for tyres with regard to fuel efficiency, consumers can make informed decisions about which tyres to purchase, and manufacturers can be encouraged to develop more fuel-efficient tyre technology. This can result in significant reductions in fuel consumption and greenhouse gas emissions, contributing to a more sustainable future.

5.3. Energy Saving Targets & Monitoring Mechanism

Based on the proposed strategies for the transport sector, the total energy saving estimated is 3.01 Mtoe in the moderate scenario and 4.60 Mtoe in ambitious scenarios. The potential savings under moderate and ambitious scenarios is the overall estimated savings from individual strategies under the respective scenarios and can be considered as the energy saving targets for FY 2031 for the Transport Sector.

Table 7 Moderate and ambitious scenarios energy savings for Transport sector

Strategies	Energy Savings in 2031 under moderate scenario (Mtoe)	Energy Savings in 2031 under ambitious scenario (Mtoe)
Transition to electric vehicles	2.55	3.68
Ethanol blending	0.46	0.92
Total	**3.01**	**4.60**

Monitoring Mechanism:

To effectively carry out the action plan, it is essential to establish a robust monitoring and verification system. While the Department of Transport, Madhya Pradesh holds the primary responsibility for overseeing progress, it is imperative for other stakeholders, including organizations engaged in building sector development and planning, to actively engage in diligent monitoring and reporting. The suggested monitoring framework, outlining the steps to track the scheme's progress, is presented in the table below:

Type of Monitoring	Frequency	Nodal Agencies	Responsible Agencies
Reporting, Monitoring and Review of the scheme advance and implementation status	Quarterly	Department of Transport	• Department of Transport, Madhya Pradesh
Review of the scheme advancement and course correction, if required.	Half-yearly	Department of Transport	• Madhya Pradesh Urja Vikas Nigam Limited • Department of Transport, Madhya Pradesh
Review of the scheme advancement and policy interventions required	Yearly	Department of Transport	• Department of Transport, Madhya Pradesh • State Designated Agency • Bureau of Energy Efficiency
Progress reporting of scheme advancement	Monthly	Department of Transport	• Department of Transport, Madhya Pradesh • State Designated Agency

In conclusion, Monitoring mechanisms are essential for successful implementation of energy efficiency action plans, providing a way to track progress, identify areas for improvement, and evaluate energy efficiency measures. Moreover, monitoring mechanisms can also help to identify patterns and trends in energy consumption, allowing policymakers to develop effective energy efficiency strategies. Effective monitoring mechanisms are essential for achieving energy efficiency goals in the transport sector, leading to cost savings, improved comfort, and environmental benefits.

BUILDING SECTOR

6. Focus Sector 3: Buildings

6.1. Current Scenario:

As per the population projection report by Ministry of Health and Family Welfare, Madhya Pradesh is estimated to have a population of 8.33 Lakh Crore out of which 2.86% of the population is residing in the urban areas.

In Madhya Pradesh, MPUVN has prepared and amended the Energy Conservation Building Code for the state. Furthermore, Bureau of Energy Efficiency, GoI has launched Eco-Niwas Samhita (ENS) for residential buildings and residential part of mixed land used projects build on plot area ≥ 500 square meters in 2018. In the first phase minimum standards for the building envelope was launched to limit heat gain or heat loss of the residential building comprising adequate day lighting potential and ventilation. BEE, GoI developed Eco-Niwas Samhita Part–II for setting up minimum standards for the Electromechanical Equipment for efficient use of energy in residential buildings. The provisions of ENS must be incorporated in Unified Building Byelaws (UBBL).

In Recent, the Energy Conservation (Amendment) Act, 2022. A unified code for the building sector "Energy Conservation and Sustainable Building Code (ECSBC)" has been introduced. The ECSBC code will be applicable for both commercial and residential buildings.

The building sector is one of the energy-guzzling sectors in the state of Madhya Pradesh. As per the graph below it can be witnessed that the energy consumption in the building sector is continuously increasing since FY 2015. The increase in urbanization is very rapid and the demand in the domestic sector is major in terms of buildings and electricity requirement.

The commercial sector plays a vital role in the urbanization of Madhya Pradesh, but it contributes only 17.98% to the total electricity consumption of the building sector. Meanwhile, the domestic sector accounts for 82.02% of the total electricity consumption, highlighting the need for a policy to promote energy efficiency in

households. Implementing energy efficiency plans in even a small fraction of the domestic sector could significantly reduce electricity consumption.

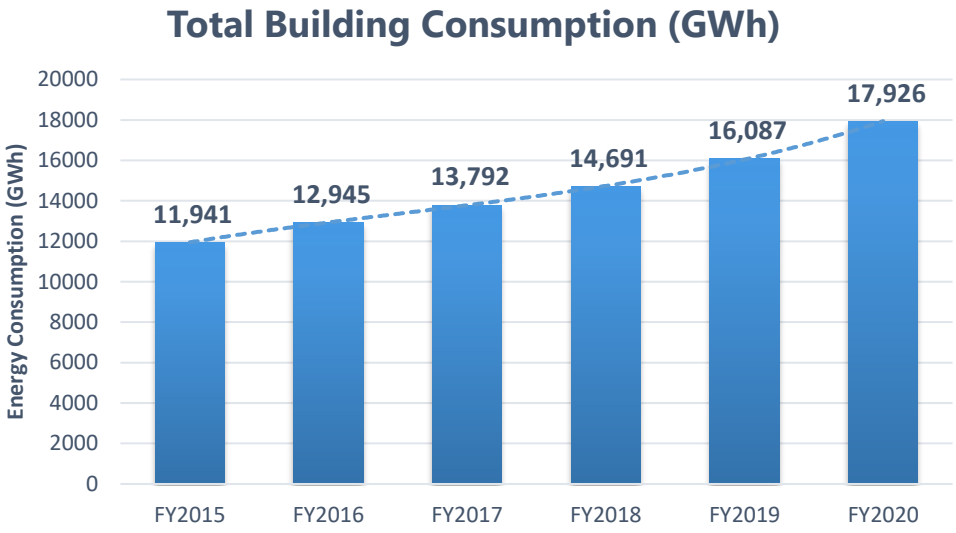


Figure 14: Electricity Consumption in Building Sector

The figure below illustrates the distribution of electricity consumption between the commercial and domestic sectors for the fiscal year 2020.

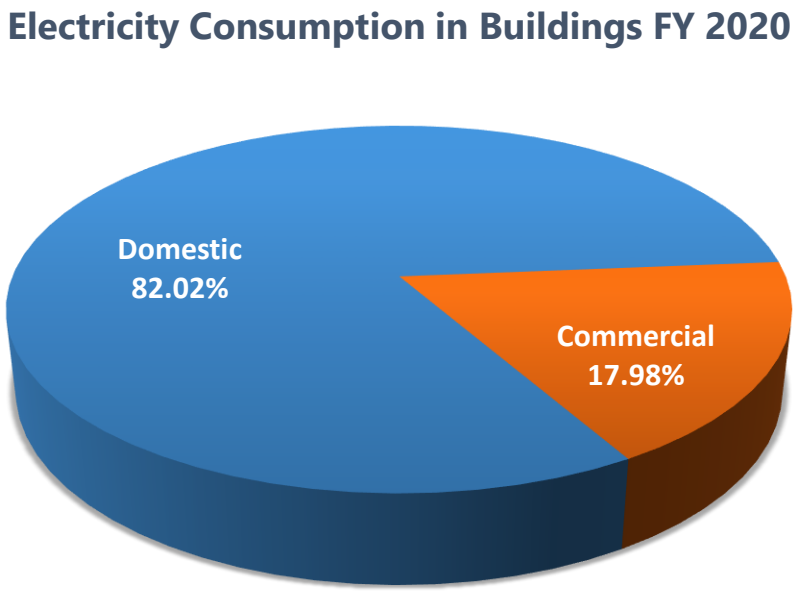


Figure 15: Share of Electricity Consumption in Building Sector

6.2. Energy Efficiency Strategies in the Building Sector:

This section presents the proposed strategies in the domestic buildings and commercial buildings sector along with their impact in terms of energy saving potential. The following strategies are proposed in the building sector, as part of the State Energy Efficiency Action Plan:

1. Effective Implementation of ECSBC.
2. Replacement Programme for inefficient appliances.
3. Promotion of BEE Star Rating and Shunya Rating of Buildings.

Although programs like Standards & Labelling and ECBC are prevalent in the state, the proposed strategies focus on enhancing the extent of their implementation by increasing the penetration of technology into the population and rate of implementation of these strategies.

Strategy #1 Effective Implementation of ECSBC (previously known as ECBC & ENS):

The state of Madhya Pradesh has already amended the Energy Conservation Building Code (ECBC) for commercial buildings and the state is in process of adopting ECO-Niwas Samhita (ENS) for residential buildings. However, in a recent EC Act Amendment 2022, unified code "Energy Conservation and Sustainable Building Code" (ECSBC) is introduced which will cover both commercial and residential buildings. Till the implementation of ECSBC in states, ECBC and ENS will be known as ECSBC.

Effective implementation of Energy Conservation and Sustainable Building Code (ECSBC) by increasing the penetration of ECBC and ENS compliant buildings in the state is proposed for upcoming commercial and domestic buildings in the state as a strategy for energy savings in the building sector.

To estimate the savings through ECBC, the electricity consumption of the commercial buildings sector was projected till FY 2031. After forecasting the energy demand in the commercial building sector from FY 2023 to FY 2031, the annual increment in the electricity consumption in the commercial buildings sector was projected.

The total incremental electricity consumption in the commercial sector of the state is projected to be 1849.02 GWh between FY 2023 to FY 2031. This increment in electricity consumption accounts for all the categories of commercial buildings of varying loads. The Energy Conservation Building Code (ECBC) sets minimum energy standards for commercial buildings having a connected load of 100 kW or more. It has been taken into consideration that around 5% of the buildings in the state have connected load of 100 kW or more. Considering this percentage, the Total Incremental Electrical Consumption contributing to buildings having load >100kW is estimated to be almost 92.45 GWh.

Based on the energy savings percentage from ECBC and ECBC+, the moderate and ambitious savings in the commercial building sector are found to be **23.11 GWh** and **32.36 GWh** respectively.

An effective approach to reduce long-term unnecessary electricity usage in residential buildings is by making them more energy efficient. Implementing Energy-saving measures as per Eco Niwas Samhita (ENS) can be helpful in achieving this goal in the residential sector.

In the residential sector, by FY 2031, the electricity consumption is projected to be around 38,952.16 GWh. The overall incremental electrical consumption is estimated to be 21,086.37 GWh based on the anticipated household electricity demand by FY2031. To assess the savings that can be achieved from successful implementation of ENS, it is assumed that 4% of all the residential building stock would be ENS compliant by 2031. The strategy is expected to result in electricity savings of 101.21 GWh in the moderate scenario and that of 126.51 GWh in the ambitious scenario.

The cumulative energy savings expected from the enhanced implementation of ECBC and ENS in the state is shown below:

Table 8: Moderate and ambitious scenarios for effective implementation of ECSBC

Particulars	Moderate Scenario	Ambitious Scenario
Energy Saving Potential (Mtoe) in ECBC	0.0020	0.0028
Energy Saving Potential (Mtoe) in ENS	0.0087	0.0109
Total	**0.0107**	**0.0137**

Implementing Agency: Bureau of Energy Efficiency, MPUVN, UADD, MP Housing and Infrastructure Development Board.

Actionable Items:

1. **Setting-up of effective enforcement plan with ULBs and SDA as monitoring agencies-** Effective implementation of ECBC and ENS depends on the effectiveness of rules & regulation adopted by the state. To ensure the same role & responsibility of all concerned departments, checkpoints, monitoring mechanism and penalties must be properly defined in ECSBC rules & regulations.

   SDA being an extended arm of Bureau of Energy Efficiency shall monitor the process of ECSBC compliance and record the data of total energy savings achieved through the implementation of ECSBC.

2. **Development and maintenance of ECSBC compliance portal, directory of energy efficient materials/technologies** – For effective and aggressive implementation, it is proposed that the state shall has its own ECSBC online portal to aid in quick ECBC & ENS approval and monitoring process online. The portal would ensure a faster process of compliance application, third party verification and certification. The portal may also contain educational resources, directory of materials and vendors and user-friendly guides for enhanced awareness and capacity building of developers and professionals. Investment would be needed in

the development and annual maintenance of the ECSBC portal for which MPUVN will be the implementing agency.

3. **Market Outreach for ECBC compliant Products, Radio Jingles, Social Media Awareness** – Market outreach for ECBC compliance products or products utilized in sustainable construction such as building materials used in passive building design would enable a conducive market for such materials which will promote construction practices necessary to comply with ECBC and ENS guidelines. The market outreach can take place through professional conventions and seminars, radio jingles and awareness campaigns on social media.
4. **Pilot projects for Super ECBC buildings as case studies (initial 20 Buildings)** – It is proposed that the state government also undertake the development of Super-ECBC buildings in the state and publish its case studies for the understanding of stakeholders. Initially upcoming government building can be taken as a pilot project and the best energy efficient technologies can be implemented to achieve the Super ECBC level. Case Study can be published in social media to encourage developers and other stakeholders to make Super ECBC compliant buildings.
5. **Home Energy Auditor Training, compliance structure and incentive on energy savings for first few residential projects** – BEE has developed a Home Energy Auditing tool. SDA may run awareness and capacity development programs in the state of Madhya Pradesh to train building professionals about the benefit of auditing and implementation of Energy Conservation Measures (ECMs) in residential houses. SDA may encourage RWAs by providing some incentive based on energy savings on implementation of ECMs in their societies. These action items will help in the promotion of ENS in the state and create technical capacity of the professionals.
6. **Periodic upgradation of PWD Schedule of Rates (SoR) to incorporate latest energy efficient materials and technologies.**

Regular upgradation of PWD Schedule of Rates (SoR) to incorporate latest energy efficient materials and technologies is required as technologies in the field of energy efficiency is developing on some very regular intervals. Adoption of new innovative technologies becomes easier if it is mentioned in PWD Schedule of Rates (SoR) document.

7. **Inclusion of curriculum on energy efficiency in buildings, in universities and Schools**

   Raising awareness about energy conservation among children is crucial. To instill a fundamental understanding of this concept and promote a behavioral shift in children, it is suggested that the curriculum on energy efficiency and conservation be developed and integrated into schools and universities in the state of Madhya Pradesh.

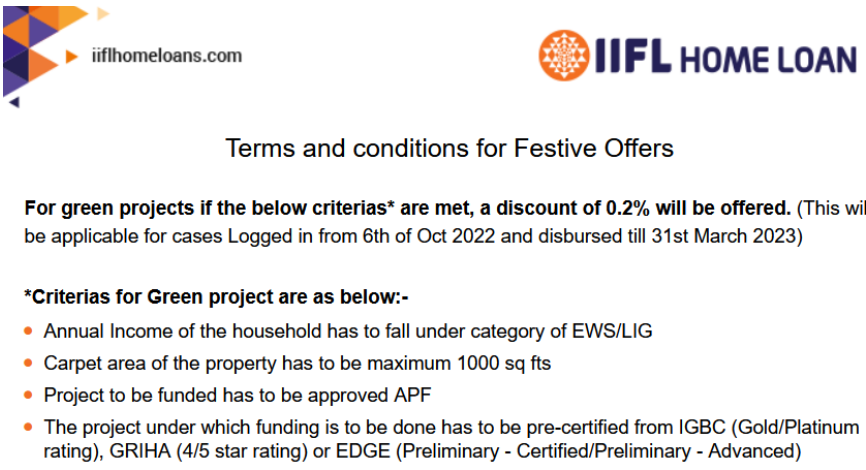
8. **Incentives on Green Building Certified and ECBC+/SuperECBC Buildings:**

   As of now, there are no such incentives provided by the councils or government for getting green building certifications. Additional rating systems should also be added such as GEM, EDGE, etc. for better transparency and inclusion of more organizations in the movement of sustainable buildings. Certified energy managers/auditors and accredited professionals should be empaneled to spread mass awareness and adoption of green buildings. Incentives for ECBC+ and SuperECBC may be provided based on the per square footage of the building area or rebate in property tax may be offered to encourage the adoption of higher energy efficiency levels in the building design.

   There are other programs which may be adopted for incentives:

   - **Low-Interest Rate Loans:** Banks and Financial Institutes may provide loans at lower interest rates to the developer willing to develop ECBC+ and SuperECBC buildings in the state.

Example – A recent program successfully completed for green buildings. Similar programs may be introduced for ECBC+ and SuperECBC in association with financial institutions.



- **Grants and Rebates:** Financial incentives in the form of grants or rebates can be provided for energy-efficient retrofits, renewable energy installations, or green building certifications.
- **Utility Rebates or Lower Tariff:** DISCOM may provide electricity at lower rates on ECBC+ and SuperECBC Buildings for some time.

Implementation Methodology:

1. Establishing Guidelines: The first step in implementing any code is to establish the guidelines for energy-efficient buildings that code meet minimum requirements. The guidelines would provide details regarding the design, materials, systems, and equipment necessary in the building and in accordance with the code standards.
2. Awareness and training programs: Once the code is established, awareness and training programs must be conducted for educating the concerned stakeholders, explaining the standards of the code and their benefits.
3. Code Adoption: After the awareness and training program, the state or the local government will adopt the code which can be proceeded with the notification or legislative process, making it necessary for all the upcoming new commercial and residential building to comply with the ECSBC standards.

4. Compliance and Enforcement: To ensure the compliance of the ECSBC standards, compliance and enforcement mechanisms are to be put in place. This will include the developing the procedure to review and approval of the building design, material selection procedure, site inspection during the construction and inspection after the completion of the building.
5. Performance Evaluation: The evaluation of the building should be done on the periodic basis to check the effectiveness of the code. This step will also result in identification of any gaps which will be necessary improvements in the code and will result in successful implementation.
6. Incentives and recognition: To encourage compliance of the ECSBC standards, incentives and recognition programs must be implemented. These can be tax credits, rebates, extra FAR or awards to achieve energy efficiency in their buildings.

Strategy #2 Replacement program for inefficient (below than 3 Star Rated) appliances.

Implementation Timeline: Long Term (Till FY 2031)

The Standards & Labelling (S&L) Programme of Bureau of Energy Efficiency (BEE) has seen a successful implementation across the country, leading to significant savings in energy through mandatory and voluntary use of energy efficient electrical appliances by consumers in a wide range of applications. The S&L Programme encompasses appliances and equipment that have applications in multiple sectors, however the buildings sector is the most widely covered sector in terms of types and number of appliances.

Currently, the S&L Programme encompasses a total of 38 appliances, of which 16 are subject to mandatory regulation while the other 22 are regulated on a voluntary basis. The following table provides a detailed list of appliances that fall under mandatory and voluntary regulation.

Table 9: List of mandatory and voluntary appliances under S&L Programme

Mandatory Appliances	Voluntary Appliances
1. Room Air Conditioners	1. General Purpose Induction Motors
2. Frost-free refrigerators	2. Agriculture Pump Sets

3. Tubular Florescent Lamps	3. LPG Stove
4. Distribution Transformer	4. Office Equipment's (Printers & Copier)
5. Room Air Conditioner (Cassette, Floor Standing)	5. Ballast
	6. Computers (Laptop/Notebooks)
6. Direct Cool Refrigerator	7. Diesel Engine driven mono set pumps
7. Color TV	8. Solid State Inverter
8. Electric Geysers	9. Microwave Oven
9. Variable Capacity Inverter Air Conditioners	10. Solar Water Heater
	11. Diesel Generator Set
10. LED Lamps	12. Grid Connected solar Inverter
11. Ceiling Fans	13. Commercial Beverage Coolers
12. Light commercial AC	14. Air Compressor
13. Deep Freezers	15. High Energy Li-Battery
14. Washing Machine	16. Side by Side/Multi Door Refrigerator
15. Chillers	17. Pedestal Fan
16. UHD Color TV	18. Induction Hob
	19. Tires
	20. Solar Photovoltaic
	21. Table/Wall Fan
	22. Packaged Boiler

The current strategy has been proposed for the complete buildings sector covering both Domestic and Commercial Buildings. However, a majority of the mandatory and voluntary appliances have a significantly higher penetration in the domestic buildings sector than in the commercial buildings sector.

The electricity consumption pattern varies greatly between urban and rural areas. This is due to the variation in type and number of appliances being used by urban and rural residents. This entails the inclusion of the number of urban and rural households in the savings calculation. Based on the estimated population of the state as per the report "Population Projections for India and States 2011 – 2036" and Household Size as per census, the number of households were estimated out for urban and rural regions. Different categories of appliances have different

penetrations among the urban and rural households, based on the usage pattern. Some appliances viz. Fans, refrigerators, washing machines, LEDs, air-conditioners and microwaves have higher penetration as compared to other appliances. Considering the study given in the report "Impact Assessment of BEE's Standard & Labeling Program", penetration of different appliances among urban and rural areas was estimated. List of appliances considered in strategies is mentioned in the table below-

Table 10: Appliances taken into consideration for the strategy.

Window AC	Color TV - LCD/Plasma/LED
Split AC	Washing Machines
Refrigerator-DC	TFL (Tubular Fluorescent Light)
Refrigerator-Frost Free	Electric Geysers
Ceiling Fans	Cooking Stoves
Color TV CRT	Computer/Laptop/Notebooks

According to the study conducted by CLASP (Collaborative Labeling and Appliance Standards Program)[31] to assess consumer awareness of energy labelling, 48% of consumers are aware of the scheme and 15% have some knowledge of it. Appropriate number of 3-Star rated appliances have been taken from the calculation of total number of appliances. Saving strategies in the moderate scenario include replacement of 3-star rated equipment to 5-star rated appliances, whereas in the ambitious scenario, replacement of non-star rated to 5-star rated equipment has been considered as a saving strategy. The percentage savings achieved upon transitioning from non-Star to 5-Star Labelled equipment's (efficiency) were considered for calculating savings in above mentioned scenarios.

The strategy is estimated to result in energy savings of 0.15 Mtoe in the moderate scenario and 0.20 Mtoe in the ambitious scenario till FY 2031.

Table 11: Moderate and ambitious scenarios for deepening of S&L Programme

Particulars	Moderate Scenario	Ambitious Scenario
Energy Saving Potential (Mtoe)	0.15	0.20

Implementing Agency- MPUVN, UADD**,** DISCOMs, ESCOs

Actionable Items:

The action items to be carried out to implement the strategy at ground level mainly involve dissemination of the scheme's guidelines and specification amongst stakeholders such as manufacturers, retailers and consumers in a way that can ensure meeting the implementation timeline proposed for the strategy. The following action items are suggested to ensure effective implementation:

1. **Development of state-specific implementation models and identification of relevant agencies-** A detailed phase-wise plan needs to layout based on consumer's priority and reachability. It is important to develop a transparent model that can reach out to every household in the state. Financial implications will play a major role in replacement schemes so ESCOs and PPA models can be analyzed in detail. UJALA scheme is a successful case study in this area, can be referred for the development of state specific plan. Identification of implementing departments and agencies and listing of ESCOs in the state is required.
2. **Issuance of directive to government offices and buildings in the state to replace all existing inefficient appliances (lower than 3 Star Rated) with BEE 5-star rated appliances-** State Government shall issue directives to all government offices and buildings owned by state government to replace all appliances which are lower than 3 star rated or purchased/installed before 2015 with BEE 5-Star rated appliances.
3. **Phase-wise plan for replacement of existing inefficient appliances (lower than 3 Star Rated) with BEE 5-star rated appliances in all buildings, through DSM schemes** Development of phase-wise Demand Side Management (DSM) plan based on the consumer's priority and market scenario shall be developed in consultation with DISCOMs. Implementation can be done with the support of DISCOM's and various ESCOs listed with the state government.
4. **Workshops & Campaigns on behavioral change interventions for energy conservation –** Capacity building of these stakeholders is key to develop a market environment for energy efficient appliances. State

Government shall organize workshops at various levels to encourage people for behavioral change and run mass campaigns to reach out maximum people to increase awareness about benefits of behavioral changes and promote Lifestyle for Environment (LiFE). Workshops and campaigns shall be carried out to target maximum people by organizing through online platforms, print media, social media, nukkad nataks, and radio jingles etc.

Implementation Methodology:

1. Identification of inefficient appliances: The first step is to identify the inefficient appliances that need to be replaced. This can be done by conducting a survey or an audit of the appliances in use. The survey should focus on appliances that consume a lot of energy and are old or outdated.
2. Selection of energy-efficient appliances: The next step is to select energy-efficient appliances that will replace the inefficient ones. The selection should be based on the energy efficiency rating of the appliance, its cost, and its suitability for the intended use.
3. Procurement of energy-efficient appliances: The energy-efficient appliances selected in the previous step should be procured from manufacturers or distributors. The procurement process should be transparent and based on competitive bidding to ensure that the appliances are obtained at the best possible price.
4. Distribution of energy-efficient appliances: Once the energy-efficient appliances are procured, they should be distributed to the users. This can be done through various channels such as government agencies, private sector distributors, or NGOs.
5. Installation of energy-efficient appliances: The energy-efficient appliances should be installed by trained technicians to ensure that they are installed correctly and work efficiently. The installation process should also include educating the users on the proper use and maintenance of the appliances.

6. Disposal of old appliances: The old and inefficient appliances that are replaced should be disposed of properly. This can be done through recycling or by sending them to authorize disposal centers.
7. Monitoring and evaluation: The last step is to monitor and evaluate the impact of the replacement program. This can be done by measuring the energy savings achieved, the reduction in greenhouse gas emissions, and the cost savings for the users. The feedback obtained can be used to improve the program and make it more effective.

Strategy #3 Promotion of BEE Star Rating and Shunya Rating of Buildings

Implementation period: Long Term (Till FY 2031)

The Star Rating and Shunya Rating of buildings is currently at a voluntary stage which is used as a benchmarking system for buildings to classify them in terms of 'Star-Rating' & 'Shunya Rating' on the basis of their energy performance. It is proposed that to promote Star Rating & Shunya Rating in all government & commercial buildings and conduct an assessment for their energy performance along with the ECBC Compliance process. Assessment of buildings on a scale of 1-5 stars or Shunya Rating will promote the development of energy efficient buildings in the state. Certification of Star Rating or Shunya Rating can be provided based on this assessment.

Table 12: Moderate and ambitious scenarios for BEE Star Rating and Shunya Rating

Particulars	Moderate Scenario	Ambitious Scenario
Energy Saving Potential (Mtoe)	0.0003	0.0004

Implementing Agency: Bureau of Energy Efficiency; MPUVN; MP Housing Infrastructure and Development Board; Urban Administration and Development Department (UADD)

Actionable Items:

1. **Issuance of directives to all government departments to conduct energy audits and target to achieve BEE Star Rating for their buildings**-

   State Government shall issue directives to all government departments and buildings owned by state government to conduct energy audit and implement energy conservations measures and target to achieve BEE Star Rating or Shunya Rating for their buildings.

2. **Periodic energy audits for commercial buildings on load basis and incentives on achieving specific level of star rating for buildings**-

   A notification from State Government shall be issued for conducting mandatory energy audits of commercial buildings based on their connected load and incentives can be given on the achievement of star rated energy efficient buildings to encourage more building owners to reduce their EPI and save more energy.

3. **Capacity Building of Architects & Building Professionals and Developers**-

   Capacity building programs of Architects & Building Professionals and Developers will ensure to increase the technical capacity of and awareness about innovative technologies. Capacity building of these stakeholders is key to developing a market environment for energy efficient buildings. The capacity building programs can be taken up periodically, preferably quarterly. Capacity building workshops may be carried out either district-wise or zone-wise and target maximum stakeholder to participant in these programs.

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

   Promotion of the Star & Shunya Rating is an important part of promoting energy efficiency in buildings. To increase awareness about this rating program, promotion campaigns shall be carried out to reach masses by advertising in print media, social media, conduct nukkad nataks, plays and run radio jingles etc.

5. **Mandatory minimum set point of 24 degrees for air conditioners in all government buildings –**

   The Bureau of Energy Efficiency has been raising awareness on the energy savings and cost benefit of lowering the operating set point of air conditioners and have advised consumers across the country to maintain set point on or above 24 degrees Celsius to ensure optimal temperature and energy consumption from the use of air conditioners. It is recommended that government departments take the lead in the implementation of this practice across the state.

6. **Transformation of iconic government buildings to Net-Zero energy buildings -**Transforming government buildings to net zero will ensure maximum energy performance of these buildings. It will further boost the market and professional environment of sustainable construction products, energy efficient appliances, and energy audit and consulting services. The SOR of government construction projects can be regularly updated with energy efficient and climate responsible materials through the help of this strategy.

Implementation Methodology:

1. The first step in implementing this program would be to identify the buildings that are eligible for BEE Star Rating and Shunya Rating. This would involve conducting a comprehensive energy audit of the buildings to assess their energy performance and identify areas where improvements can be made.
2. Once the eligible buildings have been identified, the next step would be to create a comprehensive plan for promoting the BEE Star Rating and Shunya Rating systems. This could include outreach campaigns to raise awareness among building owners and occupants about the benefits of energy efficiency, the rating systems, and the incentives available for improving energy performance.
3. Incentives could be offered to building owners who achieve higher ratings under the BEE Star Rating and Shunya Rating systems. These

incentives could take the form of tax breaks, subsidies, or other financial incentives that would help offset the cost of energy-efficient upgrades.

4. To encourage more widespread adoption of the rating systems, the government could also require that new buildings meet certain energy performance standards and obtain a minimum rating under the BEE Star Rating or Shunya Rating systems.
5. Monitoring and evaluation would be critical to the success of the program. Regular audits of buildings would be necessary to track progress and ensure that the rating systems are achieving their energy savings targets. Feedback from building owners and occupants would also be important to refine the program and address any issues that arise during implementation.

6.3. Energy Saving Targets & Monitoring Mechanism

Based on the proposed strategies for the buildings sector, the total energy saving estimated is 0.165 Mtoe in the moderate scenario and 0.217 Mtoe in ambitious scenarios by FY 2031. The energy saving and emissions reduction targets for the short term (till FY 2026) and long term (till FY 2031) for the buildings sector under the two scenarios are shown in below table:

Table 13: Moderate and ambitious scenarios energy savings for Building sector

Action Plan	Energy Savings in 2031 under moderate scenario (Mtoe)	Energy Savings in 2031 under ambitious scenario (Mtoe)
Effective implementation of ECSBC	0.0107	0.0137
Replacement program for inefficient appliances	0.15	0.20
BEE Star Rating and Shunya Rating of Buildings	0.0003	0.0004
Total	**0.165**	**0.217**

Monitoring Mechanism:

To effectively carry out the action plan, it is essential to establish a robust monitoring and verification system. While the SDA (State Designated Agency) holds the primary responsibility for overseeing progress, it is imperative for other stakeholders, including organizations engaged in building sector development and planning, to actively engage in diligent monitoring and reporting. The suggested monitoring framework, outlining the steps to track the scheme's progress, is presented in the table below:

Type of Monitoring	Frequency	Nodal Agencies	Responsible Agencies
Reporting, Monitoring and Review of the scheme advance and implementation status	Quarterly	State Designated Agencies	• Urban Administration Development Department
Review of the scheme advancement and course correction, if required.	Half-yearly	Urban Administration Development Department	• Madhya Pradesh Urja Vikas Nigam • Urban Administration Development Department
Review of the scheme advancement and policy interventions required	Yearly	Urban Administration Development Department	• Madhya Pradesh Urja Vikas Nigam
Progress reporting of scheme advancement	Monthly	State Designated Agency (through the ECSBC Cell)	• Bureau of Energy Efficiency

In conclusion, Monitoring mechanisms are essential for successful implementation of energy efficiency action plans, providing a way to track progress, identify areas for improvement, and evaluate energy efficiency measures. Moreover, monitoring mechanisms can also help to identify patterns

and trends in energy consumption, allowing policymakers to develop effective energy efficiency strategies. Effective monitoring mechanisms are essential for achieving energy efficiency goals in the building sector, leading to cost savings, improved comfort, and environmental benefits.

AGRICULTURE SECTOR

7. Focus Sector 4: Agriculture

7.1. Current Scenario:

Like most parts of India, agriculture plays a significant role in the economy of Madhya Pradesh. Agriculture and agriculture occupations in Madhya Pradesh are mainly the main occupations of the state economy. About 72% of the population of the state lives in the rural areas.

In 2019-20, agriculture sector contributed to about 35% of the economy in the State of Madhya Pradesh.[5] Owing to its diverse agro-climatic endowments, the state is divided in the 11 climatic zones and 5 crop areas. The soybean crop is the highest sowing crop in the state during Kharif season. Crops such as Soybean, Gram, Tur, Urad, Masoor, Linseed, Maize, Sesame, Ramtil, Moong are widely grown in Madhya Pradesh.

Table 14: Agriculture Statistics

Particulars		Units	Values
TOTAL REPORTED AREA (2019-20)		In '000'Hectare	**30,756**
Forest Area		In '000'Hectare	**1,080**
Culturable Waste Land		In '000'Hectare	**875**
A	Fallow Land	In '000'Hectare	775
	Current Fallow	In '000'Hectare	374
	Fallow Land Other than Current Fallow	In '000'Hectare	401
B	Net Area Sown	In '000'Hectare	15,512
A+B	**Land Available for Cultivation**	In '000'Hectare	16,287
Source: https://des.mp.gov.in/Portals/0/MP_At_AGlance_2021.pdf			

The state benefits from ample irrigation facilities, with the majority of the cropped area receiving irrigation from major rivers flowing through the state. The primary sources of energy consumption in the state are electricity used in pump sets and diesel used in agricultural equipment.

[5] *https://prsindia.org/budgets/states/madhya-pradesh-budget-analysis-2021-22*

Farmers use a variety of energy sources for different purposes, including direct and indirect consumption of energy from fossil resources. Direct energy consumption involves the use of electricity, propane, natural gas, diesel, and renewable fuels for farm-related activities. Indirect energy consumption, on the other hand, refers to the use of fuel and feedstock in the production of agricultural chemicals like fertilizers and pesticides, particularly natural gas.

7.2. Energy Efficiency Strategies in the Agriculture Sector

This section presents the proposed strategies in the agriculture sector along with their impact in terms of energy saving potential. The following strategies are proposed as part of the State Energy Efficiency Action Plan:

1. Transition of conventional diesel pumps to Solar powered pumps

Strategy #1 Transition of conventional diesel pumps to Solar powered pumps

Implementation period: Till FY2031

The proposed strategy in the agriculture sector is to transition from conventional diesel pumps to solar-powered pumps by FY2031. This strategy is in line with the country's target to replace diesel with renewable energy sources in the agricultural sector to achieve the goal of zero diesel in the agriculture sector. This transition is necessary to reduce the sector's dependence on fossil fuels and move towards a more sustainable and environmentally friendly energy source.

The first scenario is the moderate scenario, which aims to transition 75% of diesel-powered pumps to solar pumps by 2026. This scenario aims to achieve a significant reduction in the energy consumption of pumps used in irrigation, leading to significant energy savings.

The second scenario is the ambitious scenario, which aims to transition 100% of diesel-powered pumps to solar pumps by 2031. This scenario is the ideal goal and aims to achieve maximum energy savings in the agriculture sector by eliminating the use of diesel-powered pumps. This scenario will not only lead to energy savings but will also contribute to reducing carbon emissions, improving air quality and environmental sustainability.

It is also essential to note that the transition to solar-powered pumps will reduce the operational and maintenance costs as solar pumps do not require regular fuel refilling and have fewer moving parts, resulting in less wear and tear. Moreover, the installation of solar pumps will also provide an additional source of income for farmers, as they can sell excess electricity generated by the solar panels back to the grid.

In addition to the benefits mentioned above, the transition to solar-powered pumps will also lead to increased reliability and stability of power supply, as solar energy is available throughout the day and is not subject to disruptions in fuel supply.

Overall, the transition from conventional diesel pumps to solar-powered pumps will lead to a total savings of 0.30 Mtoe in moderate scenario and 0.40 Mtoe in ambitious scenario.

Table 15: Energy Savings Potential in Transition of conventional diesel pumps to Solar powered pumps

Particulars	Moderate Scenario	Ambitious Scenario
Energy Saving Potential (Mtoe)	0.30	0.40

Implementing Agency: MPUVN, Department of Agriculture and Farmers Welfare, Directorate of Agricultural Engineering.

Actionable items:

1. **Modification in financial incentive model of PM-KUSUM:** In the current context, the PM-KUSUM scheme extends financial support from governmental entities, covering 60% of the total expenses for pumps. This contribution is divided equally between the central government (30%) and the respective state government (30%). The beneficiaries are responsible for the remaining portion of the costs.

   After extensive consultations with various departments and a comprehensive assessment of the challenges encountered during the implementation, it is strongly recommended that the subsidy percentage be revised to 90% (with

a 60/40 distribution ratio between central and state governments) from the existing 60% (with a 50/50 distribution ratio).

Furthermore, in instances where additional solar photovoltaic (PV) systems are integrated, a 50% subsidy should be granted, with the central government covering 60% of the cost and the state government covering the remaining 40%. This arrangement would greatly benefit from the integration of net metering systems, enhancing the overall effectiveness and sustainability of the initiative.

2. **Greater outreach to relevant stakeholders:** It is crucial to engage and inform all relevant stakeholders, including farmers, Panchayat officials, and other key players in the agriculture sector, about the benefits of the PM KUSUM Yojana. This can be done through awareness campaigns, workshops, and meetings at the local level. This will help ensure that everyone is aware of the program and its benefits and can work together to implement it effectively.
3. **Capacity building of Panchayat/Block level officials:** It is important to provide training and capacity building programs to Panchayat and Block level officials to ensure effective implementation of the program. This can include training on the technical aspects as well as on the administrative aspects of the program. This will enable officials to provide the necessary support and guidance to farmers and other stakeholders in their respective areas and ensure the successful implementation of the program.

Implementation Methodology:

1. Access feasibility: Conduct a feasibility study to assess the viability of transitioning from conventional diesel pumps to solar powered pumps. Also, evaluate the parameters such as the availability of sunlight, water requirements, energy needs and financial viability.
2. Awareness and capacity building: Carry out awareness and capacity building programmes in the village areas to educate the farmers about the benefits of the solar pumps, including the reduction in operational

costs, energy savings. Carry out the training programmes to provide the knowledge about solar powered irrigation systems.

3. Financial incentives and support: Incentives, subsidies and loans to farmers can be offered to facilitate the installation and adoption of solar power pumps. Government schemes and programs can provide the financial assistance to make the transition more affordable for farmers.
4. Vendor selection and procurement: Identify reliable vendors or suppliers of solar-powered pump systems. Ensure that the selected vendors provide high-quality equipment, warranty, and after-sales service. Facilitate the procurement process by establishing partnerships with recognized vendors and negotiating favourable terms and prices.
5. Installation and commissioning: Ensure proper installation of the solar-powered pump systems by trained technicians. Coordinate with vendors, farmers, and technical experts to install the equipment correctly, including solar panels, inverters, storage systems, and pumping mechanisms. Conduct commissioning tests to verify the functionality and performance of the system.
6. Monitoring and maintenance: Establish a system for monitoring the performance of solar-powered pumps, including regular maintenance and troubleshooting. Educate farmers on basic maintenance practices and provide them with access to technical support for any issues that may arise.
7. Knowledge sharing and best practices: Promote knowledge sharing among farmers who have successfully transitioned to solar-powered pumps. Encourage the exchange of experiences, challenges, and best practices through workshops, farmer networks, and online platforms.
8. Evaluation and impact assessment: Periodically evaluate the impact of the transition to solar-powered pumps in terms of energy savings, cost savings, water conservation, and environmental benefits. Use this data to refine and improve the implementation methodology and inform future policies and programs.

7.3. Energy Saving Targets & Monitoring Mechanism

Based on the two strategies proposed for the agriculture sector, the total energy saving estimated is 0.30 Mtoe in the moderate scenario and 0.40 Mtoe in ambitious scenarios. The potential savings under moderate and ambitious scenarios are the overall estimated savings from individual strategies under the respective scenarios and can be considered as the energy saving targets for FY 2031 for the Agriculture Sector.

Table 16: Moderate and ambitious scenarios energy savings for Agriculture sector

Strategies	Energy Savings in 2031 under moderate scenario (Mtoe)	Energy Savings in 2031 under ambitious scenario (Mtoe)
Transition of conventional diesel pumps to Solar powered pumps	0.30	0.40
Total	**0.30**	**0.40**

Monitoring Mechanism:

To effectively carry out the action plan, it is essential to establish a robust monitoring and verification system. While the Directorate of Agricultural Department holds the primary responsibility for overseeing progress, it is imperative for other stakeholders, including organizations engaged in building sector development and planning, to actively engage in diligent monitoring and reporting. The suggested monitoring framework, outlining the steps to track the scheme's progress, is presented in the table below:

Type of Monitoring	Frequency	Nodal Agencies	Responsible Agencies
Reporting, Monitoring and Review of the scheme advance and implementation status	Quarterly	Directorate of Agricultural Engineering	• Directorate of Agricultural Engineering
Review of the scheme advancement and course correction, if required.	Half-yearly	Directorate of Agricultural Engineering	• Madhya Pradesh Urja Vikas Nigam • Directorate of Agricultural Engineering
Review of the scheme advancement and policy interventions required	Yearly	Directorate of Agricultural Engineering	• Directorate of Agricultural Engineering • Madhya Pradesh Urja Vikas Nigam • Bureau of Energy Efficiency
Progress reporting of scheme advancement	Monthly	Directorate of Agricultural Engineering	• Directorate of Agricultural Engineering State Designated Agency

In conclusion, Monitoring mechanisms are essential for successful implementation of energy efficiency action plans, providing a way to track progress, identify areas for improvement, and evaluate energy efficiency measures. Moreover, monitoring mechanisms can also help to identify patterns and trends in energy consumption, allowing policymakers to develop effective energy efficiency strategies. Effective monitoring mechanisms are essential for achieving energy efficiency goals in the agriculture sector, leading to cost savings, improved comfort, and environmental benefits.

8. Financial Mechanisms

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

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

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

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

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

9. Market Potential in Focus Sectors

The energy saved because of the proposed strategies in all sectors will lead to avoided generation of equivalent amount. To implement the suggested strategies, there will be a need for investments in energy efficiency projects, development of new policies, and modification of existing policies. To estimate the investment potential generated from the suggested strategies in the focus sectors, the equivalent cost of the saved energy in terms of metric tonnes of oil equivalent has been calculated. The Ministry of Power, Government of India, in consultation with the Bureau of Energy Efficiency (BEE) has notified the price of per metric tonne of oil equivalent as INR 18,402. The same amount has been applied to energy savings under ambitious scenarios for the estimation of maximum market potential. Total energy saving potential by implementing various strategies in the state of Madhya Pradesh is shown in the graph below:

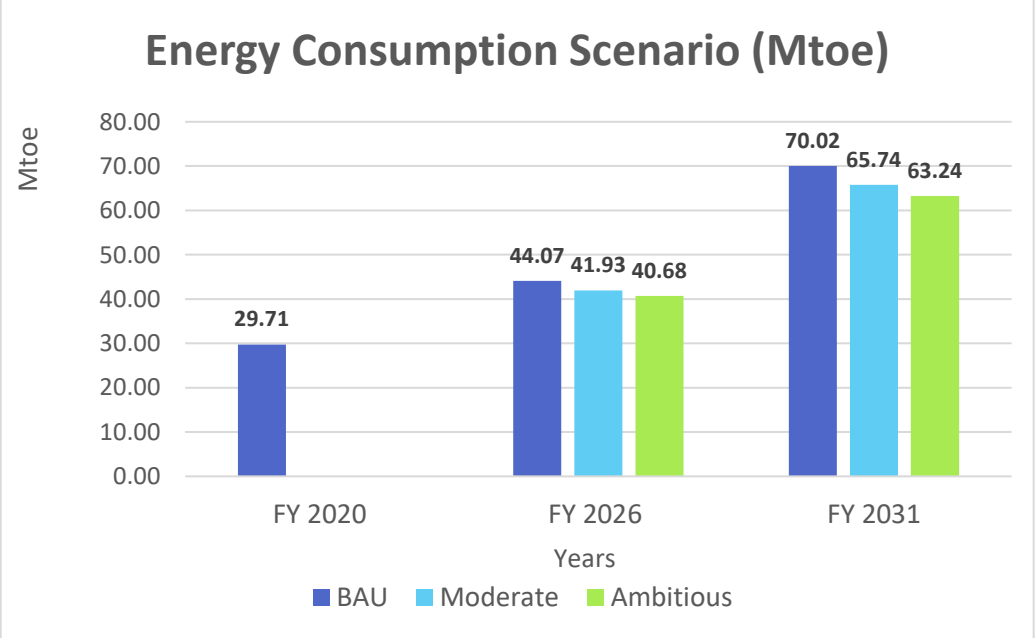


Figure 16 Energy Consumption Scenario (Mtoe)

It is estimated that with the implementation of various proposed strategies of Industries, Transport, Building and Agriculture sector, the energy saving of 4.28 Mtoe in moderate scenario and 6.97 Mtoe in ambitious scenario can be achieved. In the moderate scenario 6.12% energy saving can be achieved and in ambitious scenario 9.69% can be achieved.

Table 17: Energy Savings Summary and Investment Potential

Sector	Energy Saving Potential (Mtoe) - FY2031		Emissions Reduction ($MtCO_2$) - FY2031		Market Potential (INR Crores)
	Moderate	Ambitious	Moderate	Ambitious	
	Mtoe Reduction	Mtoe Reduction	$MtCO_2$ reduction	$MtCO_2$ reduction	
Industry	0.81	1.57	2.53	4.91	2886
Transport	3.01	4.60	9.42	14.40	8464
Buildings	0.17	0.22	0.52	0.68	399
Agriculture	0.30	0.40	0.95	1.26	741
Total	4.28	6.79	13.40	21.24	**~ 12,489**

10. Way Forward

The state energy efficiency action plan, through research and interaction with various stakeholders, identifies the need, opportunity, and the potential of energy efficiency in the State of Madhya Pradesh. While addressing the key focus sectors – Industry, Transport, Buildings and Agriculture, the action plan envisages analyzing consumption pattern, growth rates in alignment with GDP growth rate of the state and potential strategies for achieving savings.

The action plan lays out a plan for the state to implement the strategies, while at the same time being able to monitor implementation. It is imperative that implementation is carried out in the state through various stakeholders.

A market-based mechanism is anticipated to be developed through the implementation of the action plan which drives energy efficiency through better availability of energy efficiency products, financial instruments for improving the product reach and a wider adoption of energy efficiency schemes and policies curated by both state and central governments.

Public participation plays a crucial role in promoting energy efficiency measures for any state. By promoting and educating the citizens of the state can contribute to reducing energy consumption and achieving sustainable development goals. There are some key aspects of public participation in energy efficiency initiatives:

1. Awareness and Capacity Building: The participation from the public begins with educating and creating awareness among the individuals about the benefits of energy efficiency. This can be exercised through campaigns, workshops, seminars, training sessions etc., through which we can train the individuals with the knowledge of skills needed to adopt energy efficiency practices. Through these sessions we can focus on topics such as energy-saving techniques, efficient appliances use, sustainable building design, and renewable energy technologies. We can also highlight the environmental, economic, and social advantages of energy conservation.

2. Incentives and Rewards: By implementing the incentives and rewards program, we can encourage public participation in adopting energy efficiency measures; these can be carried out by offering the financial incentives such as rebates, tax credits, or credits.
3. Audits and Home Assessments: Conducting the energy audits and home assessments will allow the individuals to understand their energy consumption pattern; also, this will help them to identify the improvement areas. Public participation can be encouraged by providing access to subsidized energy audits or facilitating energy assessment programs.
4. Energy Conservation and Energy Efficiency Campaigns: Launching campaigns can raise awareness and encourage behavioral changes in the individual. To enhance the public engagement, additional sectors should also be targeted such as industrial and commercial building sectors, encouraging them to adopt energy efficient technologies, implement energy management systems. Public participation in these campaigns will boost the momentum and the targeted savings can be achieved easily. The public may encourage and promote government programs through social media, in their families, offices, so that the campaign can reach to maximum people. Block wise volunteers can come forward and make structured campaigning with support of NGOs.
5. Feedback and Consultation: Public feedback and involving stakeholders in the decision-making processes related to energy efficiency policies and programs can enhance their effectiveness and acceptance. Public consultations, surveys and feedback mechanisms provide an opportunity for individuals to express their opinions, concerns, and suggestions.

A collaborative approach, on the part of the government, industry and academia is the ideal way forward to implement the vision and targets of this action plan and continue to put the country on a high pedestal of energy efficiency achievements at the global platform.

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