

MINISTRY OF POWER GOVERNMENT OF INDIA





STATE ENERGY EFFICIENCY ACTION PLAN (SEEAP)



CHHATTISGARH - ACTION PLAN



MARCH 2024

State Energy Efficiency Action Plan (SEEAP) for Chhattisgarh

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

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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)

स्वहित एवं राष्ट्रहित में ऊर्जा बचाएँ Save Energy for Benefit of Self and Nation



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Associated Chambers of Commerce and Industry of India (ASSOCHAM)

TABLE OF CONTENTS

EXECUTIVE SUMMARY

1.	INTRODUCTION	1
1.1.	BACKGROUND	1
1.2.	INDIA'S NATIONALLY DETERMINED CONTRIBUTIONS (NDCS)	2
1.3.	ABOUT SEEAP	3
1.4.	STATE PROFILE	3
1.5.	STATE ENERGY SCENARIO	5
1.6.	OVERVIEW OF INSTITUTIONAL FRAMEWORK AND STAKEHOLDER MAPPING	10
<u>2.</u>	IDENTIFICATION OF FOCUS SECTORS	13
2.1.	METHODOLOGY OF FOCUS SECTOR IDENTIFICATION	13
2.2.	IDENTIFIED FOCUS SECTORS	13
<u>3.</u>	PROJECTIONS AND FORECASTING	14
<u>4.</u>	FOCUS SECTOR 1: INDUSTRY	17
4.1.	CURRENT SCENARIO	17
4.2.	ENERGY EFFICIENCY STRATEGIES IN THE INDUSTRY SECTOR	18
4.3.	ENERGY SAVING TARGETS & MONITORING MECHANISM	26
<u>5.</u>	FOCUS SECTOR 2- BUILDINGS	29
5.1.	CURRENT SCENARIO	29
5.2.	ENERGY EFFICIENCY STRATEGIES IN THE BUILDINGS SECTOR	30
5.3.	ENERGY SAVING TARGETS & MONITORING MECHANISM	41
<u>6.</u>	FOCUS SECTOR 3: TRANSPORT	44
6.1.	CURRENT SCENARIO	44
6.2.	STRATEGIES IN THE TRANSPORT SECTOR	45
6.3.	ENERGY SAVING TARGETS & MONITORING MECHANISM	52
<u>7.</u>	FOCUS SECTOR 4: AGRICULTURE	55
7.1.	CURRENT SCENARIO	55
7.2.	ENERGY EFFICIENCY STRATEGIES IN THE AGRICULTURE SECTOR	55
7.3.	ENERGY SAVING TARGETS & MONITORING MECHANISM	57
<u>8.</u>	MARKET POTENTIAL IN FOCUS SECTORS	59
<u>9.</u>	WAY FORWARD	61
10.	REFERENCES	66

LIST OF FIGURES

Figure 1 : Chhattisgarh State Map	4
Figure 2 : GSDP Trend of Chhattisgarh	5
Figure 3: Chhattisgarh State Power Plant Capacity	6
Figure 4: Electricity Consumption Sector Wise	7
Figure 5: Electricity Consumption Trend (Mtoe)	8
Figure 6 : Oil Consumption Trend	9
Figure 7 : Total Final Energy Consumption (Mtoe)	9
Figure 8 : Energy Consumption Break-up FY 2020	
Figure 9 :Chhattisgarh Institutional Framework	11
Figure 10: GSDP Projection of Chhattisgarh	14
Figure 11: Projection of GSDP & TFEC for FY 2031	15
Figure 12: Major Industries scale in Chhattisgarh - FY2021	
Figure 13: Sub sector wise breakup of building sector	29
Figure 14: Growth in Contract Demand (MW)	
Figure 15: Increment in total registered vehicles in the state of Chhattisgarh	
Figure 16 : Share of vehicle types for no. of registered vehicles	45
Figure 17 : Total Energy Saving Potential	59

LIST OF TABLES

5
6
0
0
2
6
2
5
6
7
8
1
6
6
9
7
0

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 energy from renewable resources by 2030.

In meeting the national level targets, States/UTs play a vital role in transitions to lowcarbon 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/UT developed by identifying focus sectors of the State/UT and estimating the potential of energy conservation in sectors which are predominant in the region. The State Energy Efficiency Action Plan is developed for a short term-plan for a tenure of 5 years and a long-term plan targeting high-impact energy efficiency by the year 2030.

For the state of Chhattisgarh, SEEAP was developed under the guidelines of Bureau of Energy Efficiency, Ministry of Power, GOI and Chhattisgarh Renewable Energy Development Agency (CREDA) 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 Chhattisgarh. In FY 2020, Chhattisgarh has Total Final Energy Consumption (TFEC) 24.94 Mtoe in which Non-power or Industrial coal consumption was 42.70%, followed by 17.43% oil consumption, 16.20% consumption in terms of coal in captive plants, 15.61% in terms of imported coal and 8.05% 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 Chhattisgarh in FY 2030 will be 39.07 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 (Iron & Steel & Rice Mills)
- Energy Efficiency Intervention in Machinery & Food Processing clusters

Building Sector:

- Effective Implementation of Energy Conservation Building Code (ECBC) and Eco Niwas Samhita (ENS) or Energy Conservation & Sustainable Building Code (ECSBC – Once Notified)
- Replacement program for inefficient appliances
- BEE Star Rating and Shunya Rating of Buildings

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

Agriculture Sector:

• Replacement of old pumps (10 years old) or less efficient pumps (non-star rated) with 5 Star rated Pumps along with smart control panel.

This action plan will result in a total energy consumption reduction of 0.61 Mtoe in the moderate scenario and 1.0 Mtoe in the ambitious scenario in the FY 2030-31. This plan will also create awareness at the mass level and create a market potential of approximate rupees 1836 Crore in the field of energy efficiency and reduce the CO₂ emission 1.9 MtCO₂ in moderate scenario and 3.1 MtCO₂ in ambitious scenario by FY 2030-31.

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 Germany¹. The size of the Indian economy in Fiscal Year (FY) 2020 was INR 145 Lakh Crores at constant prices of 2011-12². 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 report³, 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. India's Final Energy Consumption in FY 2020 was recorded at 533.44 Mtoe (as per Domestic Conversion Factors)⁴, 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 on the importance of energy transition towards de-carbonization 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 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 Conference of Parties (COP -26) at Glasgow, UK, India announced the Panchamrit, which lists down five ambitions:



Along with the idea of 'Lifestyle for the Environment (LiFE)'. It is advised to 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.

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/UTs 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. To align with the ambitions of COP-26, long term low greenhouse gas emission development strategies (LT-LEDS) was presented in COP-27. India's LT-LEDS lays its low carbon

development pathway and challenges faced by India. It is imperative that the States/UTs actively participate in the schemes to facilitate the achievement of the overall goal of reducing the energy intensity of the country.

1.3. About SEEAP

The State Energy Efficiency Action Plan for the Chhattisgarh has been developed by identification of focus sector, to ensure that the allocation of resources is as per the requirement of Chhattisgarh and estimate the potential of energy conservation in sectors that are predominant in the state. The State Energy Efficiency Action Plan has been developed to estimate the saving potential for short term & long-term period, a short term-plan till FY 2026 and a long-term plan targeting high impact energy efficiency by FY 2030 to achieve the savings is outlined. This State Energy Efficiency Action Plan has been developed under the guidance and support of stakeholder departments/agencies of Chhattisgarh and will be implemented by them in the state after its adoption.





1.4. State Profile

Chhattisgarh is a landlocked state in Central India. It is the ninth largest state by area, and with a population of roughly 30 million, the seventeenth most populous. It borders

seven states – Uttar Pradesh to the north, Madhya Pradesh to the northwest, Maharashtra to the southwest, Jharkhand to the northeast, Odisha to the east, Telangana and Andhra Pradesh to the south. Formerly a part of Madhya Pradesh, it was granted statehood on 1 November 2000 with Raipur as the designated state capital.



Figure 1 : Chhattisgarh State Map

The state has immense mineral and forest resources. Substantial deposits of limestone, iron-ore, copper-ore, rock phosphate, manganese-ore, bauxite, coal, asbestos and mica exist in the newly formed state. Major industries of the state are iron and steel, power generation, and mining.

The state has a good network of roads and rail connecting every part. It also has lot of potential for power generation. Agriculturally it is a very productive area. The soil and climate here are suitable for rice, which is grown here in large quantities.

Major tourist centers in the state are Amarkantak, Banjari Baba, Bhoramdev, Champaranya, Chitrakoot, Dudhadharimath, Indrawati National Park, Kangerghati National Park, Jagdalpur, Bastar, Danteswari Temple, and many more.

S. No.	PARTICULARS	CHHATTISGARH
1	Total Area	135,192 sq.km
2	No. of Sub-Divisions	5
3	No. of Districts	33
	Total Population (in Lakhs) 2011 Census	255.45
4	% of Rural to Total Population	77%
	% Of Urban to Total Population	23%

Table '	1:	Basic	Statisti	cs of	Ch	hattisgarł	1 ⁶
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The GSDP of the State of Chhattisgarh has seen an increased with a CAGR of 5.7% from FY 2015 to FY 2020, as shown in the figure below:





1.5. State Energy Scenario

Chhattisgarh has seen strong growth in power demand in the past decade. However, Chhattisgarh has excellent power infrastructure, and is a power surplus state and power tariff is lower as compared to other states. With a potential to produce 50,000 MW¹⁷ of power, Chhattisgarh has the prospect to become the power hub of India. The total installed power generation capacity for Chhattisgarh is 28528.11 MW. It has several Captive as well as Independent Power Plant along with Renewable Energy sources power plant such as, Biomass, Solar and Hydel energy sources.

S. No.	Sector	MW			
1	CSPGCL	3224.7			
2	Captive Power Plant 5038.54				
3	IPP	19484			
4	Solar PV Power Plants (Off & On Grid)	501.13			
5	Bio Mass 193.7				
6	Co-generation	29			
7	Small Hydro Power Plants	56.95			
Total Power Plant Capacity28528.11					

 Table 2: Chhattisgarh State Power Plant Capacity in 2019-2018

Source- CEI, CREDA, CSPGCL



Figure 3: Chhattisgarh State Power Plant Capacity

Electricity Consumption:

Electricity production and distribution are well diversified in Chhattisgarh due to its high source of natural resources. With increase in demand state is ready to mitigate such surge in demand, new power plants are also under pipeline. To further understand its distribution, DISCOM of Chhattisgarh has monitored the data as per the sectors, such as, domestic buildings (residential), commercial (including government buildings, private buildings), industries, municipal usage, agriculture and transport. In the figure, the sector wise electricity usage share is shown for Chhattisgarh, which represents that the industry, agriculture and domestic sub sector of the state dominates within the sectors.



Figure 4: Electricity Consumption Sector Wise

In Chhattisgarh state, electricity consumption is increasing every year. In FY 2015, total units consumed⁹ in state was 18600.5 GWh, which increased by 4.66% and consumed 23361 GWh in financial year 2020. The below mentioned figure is showing trend of electricity consumption (in Mtoe) in state.





Coal Consumption (Captive): Chhattisgarh has total 5327 MW capacity of captive thermal power plants. The amount of coal consumed in these plants¹⁰ is 9.26 Million Tonnes in FY 2020. Increase in number of large industries in the state, increased the capacity of captive power plants to fulfill the demand of localized power generation sources.

Coal Consumption (Non-Power): Coal Consumption in this category includes the coal consumed in the boilers, furnaces and other process of manufacturing industries. Chhattisgarh has large number of Steel, Cement, Metal & Alloy and Paper which require large amount of coal in processing. In FY 2020, coal consumed under this category was 18.80 million Tonnes, which has 42.70% contribution in total final energy of the state.

Coal Consumption (Imported): India is importing large amount of coal which is being consumed in industries and thermal power plants. In FY 2020, India imported¹⁰ 248.54 MT from various countries. To include the consumption of imported coal in a state's overall final energy consumption, the weightage of industrial output in the national GDP is utilized as specific data on state-wise imported coal consumption is not available. Though this methodology it is estimated that 7.01 MT imported coal would be used in the Chhattisgarh in FY 2020.

Oil Consumption: Oil has second major share in total energy consumption in the state. It contributes around 17.43% of total energy consumption in Chhattisgarh. With the increment vehicles in the state, consumption of oil showing a continuous increment since 2015 to 2019.





Total Final Energy Consumption (TFEC):

The total final energy consumption of the state is 24.94 Mtoe in FY2020, In TFEC it is indicated that coal consumption is account approximately 74.51% of total final energy consumption of state followed 17.43% oil and 8.06% in electricity consumption in FY 2020.



Figure 7 : Total Final Energy Consumption (Mtoe)

The past historical total energy consumption has been analyzed including Coal, Oil and Electricity. Accordingly, above figure is showing the increment in energy demand. This chart also represents that the industry sector which is consuming majorly coal is the prominent sector, followed by Domestic, Transport and Agriculture sectors which are consuming electricity and oil. Gross Calorific Value (GCV) of coals for conversion in Mtoe has been considered as per the Energy Statistics of India 2023.



Figure 8 : Energy Consumption Break-up FY 2020

1.6. Overview of Institutional framework and stakeholder mapping

The Chhattisgarh State Electricity Board (CSEB - formed in November 2000) was reorganized into following five companies in accordance with the provisions of Electricity Act 2003 in December 2008:

- The Chhattisgarh State Power Holding Company Limited
- The Chhattisgarh State Power Generation Company Limited
- The Chhattisgarh State Power Transmission Company Limited
- The Chhattisgarh State Power Distribution Company Limited
- The Chhattisgarh State Power Trading Company Limited

The reforms during the initial years of the formation of the state in the year 2000 encouraged private players to set up Captive power plants. It allowed and facilitated third party sales to buyers outside the State. In addition to the Chhattisgarh State Power Generation Company Limited (CSPGCL), the power in the State is generated by Independent Power Producers (IPP), which includes LANCO and Jindal Power. Over 87 percent of private sector power capacity and over 93 percent of state - owned power capacity is from coal-based power plants.

The State has placed significant emphasis on renewable energy development. Chhattisgarh State Renewable Energy Development Agency (CREDA) is the State Nodal Agency of Ministry of New & Renewable Energy (MNRE), Government of India for development, deployment, and promotion of Renewable Energy (RE) in the state.





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. In Chhattisgarh, Chhattisgarh Renewable Energy Development Agency (CREDA) is the state designated agency for energy efficiency related policies and their implementation in state.

The identified key Stakeholders for State Energy Efficiency Action Plan in Chhattisgarh are listed in the table below:



2. Identification of Focus Sectors

The economic sectors of a state can be broadly classified into the sectors namely Industry, Building, Transport, Agriculture, Municipalities and DISCOMs, and Cross Sectors. 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 for energy savings and emissions reductions.

2.1. Methodology of Focus Sector Identification

The focus sectors of the state have been identified based on the energy consumption profile in the State/UT, inputs from stakeholder consultation, and priority areas of a state.

In Chhattisgarh major energy consumption is term of coal which is mostly consumed in the industrial sectors. Second largest consumption is in term of oil which is majorly consumed in the transportation sector and then electricity which is consumed in building sector. In addition to energy consumptions, Inputs and suggestions from stakeholders identified for the Chhattisgarh were taken at different stages in the development of the action plan. Feedback and inputs received from stakeholders play a key role in highlighting the areas of focus in their respective sectors going forward and helps understand the implementation of practices and the feasibility of proposed energy efficiency strategies within the sector.

2.2. Identified Focus Sectors

Based on the above parameters and other important considerations, the Industry, Buildings, Transport and Agriculture have been identified as the focus sectors for devising energy efficiency strategies in Chhattisgarh.

3. Projections and Forecasting

Economic and energy projections for the Chhattisgarh to the target year FY 2031 are performed in order 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 energy consumption projections form the basis of defining the actions for energy conservation in the state, which is important in developing the consumption reduction targets for the state and in aligning the state with the national goals.

Fiscal Year (FY 2020), 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 2021 and FY 2022 being pandemic years.

The Gross State Domestic Product (GSDP) of Chhattisgarh was recorded at INR 2.50 Lakh Crore⁷ in FY 2020 (at constant price of 2011-12) and is projected to reach INR 4.60 Lakh Crore in FY 2031, at constant prices of 2011-12. The GSDP for the period FY 2023 to FY 2031 is forecasted by taking weightage of the GSDP growth rate recorded in the years FY 2015 to FY 2020 and the projection of GSDP growth rate by economic survey document of state. The historic and forecasted GSDP for Chhattisgarh is shown in Figure below.



Figure 10: GSDP Projection of Chhattisgarh

The Total Final Energy Consumption (TFEC) has been projected for the state, up to FY 2031 considering the historic average energy intensity (Mtoe/ INR Lakh Crore) from FY 2015 to FY 2020 along with the historic and projected GSDP growth for Chhattisgarh. The methodology used to project the energy consumption takes into consideration economic aspects along with the total final energy consumption trend of the state.

The Total Final Energy Consumption of the state in the Business-As-Usual (BAU) scenario is projected to reach 39.07 Mtoe in FY 2031 from 24.94 Mtoe in FY 2020, with a projected CAGR of 4.16%.



GROSS STATE DOMESTIC PRODUCT (INR LAKH CRORE) AND FINAL ENERGY CONSUMPTION (Mtoe)

Figure 11: Projection of GSDP & TFEC for FY 2031

INDUSTRY

SECTOR

4. Focus Sector 1: Industry

4.1. Current Scenario

Chhattisgarh is generously bestowed with natural resources like forests, minerals and surface water. The State has undergone a radical change and is thriving with industrial activities. Chhattisgarh produces 100% of Tin and 15% of the Cement in the country. Over 30% of sponge iron, 30% of Aluminum also comes from the State. Many Governments of India Undertakings like Bhilai Steel Plant, National Mineral Development Corporation, South-Eastern Coal Field Limited, NTPC have presence in the state.

A number of large cement plants by groups like ACC, Ambuja, Grasim, Ultratech, Jaypee and Lafarge of France are in the State. Over 100 steel projects (sponge iron/pig iron) in private sector are also under different stages of implementation. Major investors in this sector are Tata, Jindal, NMDC, Essar, VISA, Neco, Prakash, Monnet, Surya, MSP, Godawari, SKS, Jai Balajee etc.

Major industries in Chhattisgarh fall under MSME at the micro level. Nearly 75 per cent of exports from Chhattisgarh emanate from Bhilai, and the remaining from Urla, Bhanpuri, Sirgitti etc. Major exportable products of the state are Iron & Steel, Aluminum, Cement, Minerals, Engineering Products, Rice Mills, dal mills, Poha Mills, Handicraft, Handloom, blended yarn, food/ agro products etc.

Chhattisgarh is also known as Rice Bowl of India due to large paddy cultivation area. To process this enormous amount of paddy produced, large number of rice mills have established in the state and promoted in various industrial policies of the states. As per the Industrial Policy 2014-19, Chhattisgarh has approximately 1500 rice mills, 200 dal mills and 200 poha mills are in operation¹². These industries are lacking in modernization and implementation of energy efficiency measures due to several issue like lack of awareness, technical expertise, available resources, and focus on energy efficiency etc.

Chhattisgarh has approximately 130 steel re-rolling mills and a number of mini steels plants¹². The state also boasts of 17 Ferro alloy units, Steel/ cast iron casting units,

engineering and fabrication units apart from large number of agro-based and food processing, chemical, plastic, construction material, forest produce based units.



Bifurcation of type on industries in Chhattisgarh state is given in figure given below-

Figure 12: Major Industries scale in Chhattisgarh - FY2021

The state has a number of active policies to promote investments in the industry sector and the growth of industries in the state. Under the Perform Achieve & Trade (PAT) program, there are total 81 Designated Consumers (DCs) in Chhattisgarh as on March 2021 notified by the Bureau of Energy Efficiency, Ministry of Power, Gol, under various PAT cycles in Chhattisgarh. 38 DCs under PAT cycle I, 44 DCs under PAT cycle II, 13 DCs under PAT cycle III, 11 DCs in PAT cycle IV and 13 DCs under PAT cycle V and no DCs in PAT cycle VI. Under this scheme, reductions in specific energy consumption targets are assigned to DCs in a period of three-year cycle to save energy in industrial sectors. Under PAT I cycle, 0.63 Mtoe energy has been saved against the energy saving targets of 0.61 Mtoe in the State.

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: Deepening and Widening of PAT Scheme

Implementation Timeline: Short Term (Till FY 2025) & Long Term (Till FY 2031)

In the proposed strategy, it is recommended that the state enhances 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. Introduction of new DCs from other sectors such as Rice Mills, Steel Rerolling and Foundry etc. can be targeted in the PAT scheme for Chhattisgarh.

In order to estimate the energy saving potential, Moderate and Ambitious SEC assigned to Iron & Steel non-PAT units, and to Rice Mill units. Baseline SEC for the Rice Mills is considered 15.5 kWh/ton¹³, this baseline SEC numbers is assumed based on the study conducted by Bureau of Energy Efficiency for of identifying the energy conservation measures in Rice Mill clusters. 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. As per the report as report of Ministry of Steel, Gol¹⁹, the national production of crude steel in India is growing at a CAGR of 5.3% and increased from 95.4 MT in 2016 to 111.34 MT in 2019 and after processing finished steel is produced 83.6 MT in 2016 to 102.6 MT in 2019. Production of finished steel is growing at a CAGR of 7.1%. Considering the factor of higher rate of finished steel, it is assumed that sector is growing at the rate of 6% CAGR and same will be applicable at the state level. However, Rice production²⁰ in Chhattisgarh is growing at the rate of 1.1% CAGR is last decade, it is assumed that in the upcoming decade rice production in the state will be grow at a rate of 1% CAGR. Estimated energy saving potential in Moderate scenario 0.0522 Mtoe and in ambitious scenario 0.0689 Mtoe can be achieved with this strategy.

Sector	Baseline SEC (toe/tonne)	Moderate SEC (toe/tonne)	Ambitious SEC (toe/tonne)	Production in 2030 ('000 tonnes)	Energy saving in moderate scenario (Mtoe)	Energy saving in ambitious scenario (Mtoe)
Iron & Steel	0.69	0.62	0.55	66542.77	0.0436	0.0579
Rice Mills	0.0013	0.0011	0.0009	7180.04	0.0086	0.0111

 Table 3: Moderate and ambitious scenarios for deepening and widening of PAT scheme.

Table 4 : Short Term & Long-Term Energy Savings Targets for Iron & Steel and Rice Mills

	Energy Savings (Mtoe)					
Action Plan	Short Term under Moderate scenario	Short Term under Ambitious scenario	Long Term under Moderate scenario	Long Term under Ambitious scenario		
Iron & Steel	0.0321	0.0336	0.0436	0.0579		
Rice Mills	0.0007	0.0013	0.0086	0.0111		
Total	0.0328	0.0349	0.0552	0.0690		

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. 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.

3. 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.

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 Machinery and Food Processing. 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 to enable SMEs to meet their energy saving targets.

It was assumed that 50% of industries will be able to adopt the strategy in moderate scenario and 70% industries will be covered in the ambitious scenario. The strategy is expected to result in energy savings of 3.1 ktoe and 6.2 ktoe in the moderate and ambitious scenarios respectively.

Sector	Baseline SEC (toe/tonne)	Moderate SEC (toe/tonne)	Ambitious SEC (toe/tonne)	Production in 2030 ('000 tonnes)	Energy saving in moderate scenario (ktoe)	Energy saving in ambitious scenario (ktoe)
Machinery	0.58	0.52	0.46	57980	3.0	6.0
Food Processing	0.10	0.09	0.08	11995	0.1	0.2

 Table 5 :Table showing key reduction potential in major MSMEs.

Implementing agency(s) – Department of Commerce & Industries, Chhattisgarh and CREDA

Actionable items:

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

- Demonstration projects on latest Energy Efficiency 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.
- 2. Periodic standardized energy audits for MSMEs on load basis and reimbursement of energy audit cost with a maximum cap 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. Tamil Nadu state government is providing reimbursement of 50% of the Energy Audit cost subject to a Maximum of Rupees 75,000 per energy audit per MSME unit. Similarly, Himachal Pradesh, Haryana and Gujarat have implemented the subsidy scheme for energy audits and implementation of measures recommended in energy audit of industrial units.
- **3.** Sector-specific policy development for financial assistance on implementation of ECMs suggested in energy audit- A policy shall be developed at state level to provide the 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.
- 4. 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 directives 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.

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

State government department shall develop a demand side management (DSM) plan to replace all existing pumps which are lower than 3 star 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.

6. Technical assistance for transition from inefficient (installed before 2010) boiler to EE boilers, use of EE motors with different drive and other ECMs-

State government departments through energy efficiency cell or ESCOs can provide technical support to MSMEs for transition from inefficient or old technology boiler with latest technology-based energy efficient boilers. In machinery clusters support in replacement of motors & drives along with Installation of energy saver for welding machines can be provided. These technology changes can reduce the energy consumption of MSME.

Energy Efficient Boilers for Food Processing Industries: Upgrading to energyefficient boilers in the food processing industry can bring significant benefits, including reduced energy costs and improved environmental sustainability. Types of energy-efficient boilers that can be used in the food processing industry are mentioned below:

 Condensing boilers: Condensing boilers are highly efficient and can achieve up to 98% thermal efficiency. They work by recovering heat from the exhaust gases that are typically lost in traditional boilers. This makes them an excellent option for the food processing industry, where high levels of hot water are required for various processes.
- Biomass boilers: Biomass boilers use organic materials like wood chips, sawdust, and agricultural waste to generate heat. They are a sustainable option and can help reduce greenhouse gas emissions. They are ideal for food processing plants located in areas with easy access to biomass fuel sources.
- **Electric boilers:** Electric boilers are highly efficient and can be a good option for food processing plants with limited space or those that require a small amount of hot water. They are also a good option for plants that want to avoid the use of fossil fuels.
- Solar thermal systems: Solar thermal systems use energy from the sun to heat water, which can then be used for various processes in food processing plants. They are a sustainable option that can help reduce greenhouse gas emissions and lower energy costs.

When selecting an energy-efficient boiler for the food processing industry, it is important to consider factors such as the amount of hot water required, the type of fuel available, and the size of the plant.

Use of EE motors with different drive in Machinery units: The use of IE-3 & IE-4 motors with different drive systems in machinery units can bring significant benefits, including reduced energy consumption, improved reliability, and increased productivity. Here are some types of drive systems that can be used with EE motors:

- Variable frequency drives (VFDs): VFDs are used to control the speed of the motor by adjusting the frequency of the power supplied to the motor. This can help reduce energy consumption by matching the motor speed to the required load. VFDs are particularly useful in applications where the load is variable, such as in pumps and fans.
- **Direct drive systems:** Direct drive systems eliminate the need for a gearbox and transfer power directly from the motor to the driven equipment. This can help improve energy efficiency by reducing mechanical losses associated with gearboxes. Direct drive systems are particularly useful in applications where high precision and efficiency are required, such as in machine tools and robotics.

 Hydraulic drives: Hydraulic drives use pressurized fluid to transmit power from the motor to the driven equipment. By using energy-efficient pumps and motors, energy losses can be minimized. Hydraulic drives are particularly useful in applications where a high degree of power density is required.

7. Renewable Energy Transition in Industries & MSMEs

India is making significant strides towards transitioning its industries to renewable energy sources. As per Panchamrit target, India's non-fossil energy capacity will reach 500 GW by 2030. In Chhattisgarh, industries have already begun adopting renewable energy technologies such as solar and biomass which not only help to reduce carbon emissions but also offer cost savings in the long run. Promotion of installation of renewable energy plants in the complete industrial sector will make a significant contribution in achieving the national targets.

4.3. Energy Saving Targets & Monitoring Mechanism

The proposed above-mentioned strategies can together achieve a maximum potential energy savings of 0.0584 Mtoe in moderate scenario and 0.0752 Mtoe in ambitious scenario by FY 2031. Strategy-wise savings are listed in the table given below:

Action Plan	Energy Savings in 2030 under Moderate scenario (Mtoe)	Energy Savings in 2030 under Ambitious scenario (Mtoe)
Deepening and Widening of PAT Scheme	0.0552	0.0690
Energy Efficiency Intervention in Machinery & Food Processing clusters	0.0031	0.0062
Total	0.0584	0.0752

Table 6: Moderate and ambitious scenarios energy savings for industry sector

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	 Chhattisgarh Energy Development Agency (CREDA)
Review of the scheme advancement and course correction, if required.	Half-yearly	State Designated Agency	 Chhattisgarh Energy Development Agency (CREDA) Directorate of Industries
Review of the scheme advancement and policy interventions required	Yearly	State Designated Agency	 Directorate of Industries Chhattisgarh Energy Development Agency (CREDA) Bureau of Energy Efficiency
Progress reporting of scheme advancement	Monthly	State Designated Agency	 Chhattisgarh Energy Development Agency (CREDA)

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.

BUILDING SECTOR



5. Focus Sector 2- Buildings

5.1. Current Scenario

In Chhattisgarh, around 23% population reside in urban area as per census 2011. The cultivated land area is around 35.2% however, the state is majorly dependent upon agriculture for its economy. After the formation of Chhattisgarh, the number of tourists has been increasing every year. Accordingly, the domestic and commercial building sectors are also expected to be affected and the number of buildings is expected to be increased.

The increase in urbanization is very rapid and the demand in the domestic sector is major in the terms of buildings and electricity requirement.

It is expected that after effective implementation of ECBC and ENS in the state, the energy consumption may decrease and the rate of increment of electricity usage will

be dropped down. In recent, the Energy Conservation Building Code (ECBC) is notified in the state and become mandatory for commercial buildings to comply the code.

The building sector is divided into two sub sectors, i.e., commercial, and domestic. Below is the sharing pattern of commercial and domestic sector electricity consumption averagely.



The domestic sub-sector is predominant to the commercial sub-sector. The domestic



sub-sector is further expected to grow with the same rapid increment as the technologies, comfort and increment in the number of buildings are the major factor. Based on this it is understood that the ENS compliance for residential building is very necessary to adopt in the bye laws, which will help to make buildings more energy efficient.



Figure 14: Growth in Contract Demand (MW)

5.2. Energy Efficiency Strategies in the Buildings 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 ECBC and ENS.
- 2. Replacement program 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 ECBC and ENS (will be known as ECSBC once notified)

Chhattisgarh has notified the Energy Conservation Building Code (ECBC) for commercial buildings and the state is in process of notification of 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/UTs, ECBC and ENS will comes under 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 building in the state is projected to be 25 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 50 kW or more. It has been taken into consideration that around 5% of the buildings in the State have connected loads of 50 kW or more. Considering this percentage, the Total Incremental Electrical Consumption contributing to buildings having load >100kW is estimated to be almost 1.3 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 **0.32 GWh** and **0.44 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 11872 GWh. The overall incremental electrical consumption is estimated to be 4668 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 22.41 GWh in the moderate scenario and that of 28.01 GWh in the ambitious scenario.

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

Table 7: Moderate and ambitious scenarios for effective implementation of ECSBC

Particulars	Moderate Scenario (Mtoe)	Ambitious Scenario (Mtoe)
Energy Saving Potential (Mtoe) in ECSBC	0.0020	0.0024

Implementing Agency: Bureau of Energy Efficiency, CREDA, ULBs, Urban Administration and Development Chhattisgarh (UAD)

Actionable Items:

 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, check points, 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 CREDA will be the implementing agency.

- 3. 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.
- 4. 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 Chhattisgarh 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. Incentives can be provided in terms of Rebates and Tax Credits, Green Loans, and subsidies. For example, the Delhi government offers a rebate of up to 30% of the cost of implementing energy-saving measures, while some utility companies offer a discount on electricity bills for households that implement energy-saving measures. Some banks in India offer green loans to households for implementing energy-saving measures. These loans have lower interest rates and longer repayment periods compared to traditional loans.
- 5. 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 the latest energy efficient materials and technologies is required as technologies in the field of energy efficiency are developing on some very regular intervals. Adoption of new innovative technologies becomes easier if it is mentioned in PWD Schedule of Rates (SoR) document.

6. 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 Chhattisgarh.

7. Best practices from other States may be included for implementation of ECBC in buildings sector.

Several states are effectively implementing ECBC rules in their states and achieving great energy savings in the buildings sector. The Chhattisgarh Government has already notified the Energy Conservation Building Code in the state, the state can also include some best practices from other states for effective implementation of ECBC in building sectors. Some examples of best practices for ECBC implementation are-

- Telangana model for Online ECBC Compliance system
- Empanelment of third-party assessors or auditors similar like Punjab
- Forms, Templates, or checklists for compliance checks are like Kerala.
- Online Directory of ECBC Energy Efficient Materials / Vendors Details like Karnataka.
- Publications of Case Studies on ECBC Implementation Experience similar like Uttar Pradesh

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

Implementation Timeline: Long Term (Till FY 2031)

The Standards & Labelling (S&L) Programme²⁸ 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. At present, the S&L Programme covers 38 appliances, with 16 appliances subject to mandatory regulation and the remaining 22 appliances subject to voluntary regulation. The list of mandatory and voluntary appliances is given in table below.

Ma	andatory Appliances	Vo	luntary 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,	5.	Ballast
	Floor Standing)	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	10.	Solar Water Heater
	Conditioners	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

Table 8: List of mandatory and	nd voluntary appliances	under S&L Programme
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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.

STATE ENERGY EFFICIENCY ACTION PLAN

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 is mentioned in this table below.

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

Table 9: Appliances taken into consideration for the strategy.

According to the study conducted by CLASP (Collaborative Labeling and Appliance Standards Program)¹⁴ 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 0.05 Mtoe in the moderate scenario and 0.07 Mtoe in the ambitious scenario till FY 2031.

Particulars	Moderate Scenario (Mtoe)	Ambitious Scenario (Mtoe)
Replacement program for inefficient appliances	0.05	0.07

 Table 10: Moderate and ambitious scenarios for Replacement program for inefficient appliances

Implementing Agency- CREDA, 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 stars 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 support of DISCOM's and various ESCOs listed with the state government.

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' based on 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.

Implementing Agency: Bureau of Energy Efficiency; CERDA; Department of Housing & Urban Development

The strategy is estimated to result in energy savings of 0.004 ktoe in the moderate scenario and 0.005 ktoe in the ambitious scenario till FY 2031.

Particulars	Moderate Scenario (ktoe)	Ambitious Scenario (ktoe)
BEE Star Rating and Shunya Rating of Buildings	0.004	0.005

Table 11: Moderate and ambitious scenarios for BEE Star Rating and Shunya Rating of Buildings

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. Incentives can be provided in terms of Partial Funding from states, Tax Incentives, Green Load and Recognition & Awards etc.

- Partial Funding from States: The State Government may provide partial funding to commercial building owners for conducting energy audits and obtaining BEE star ratings. The funding may cover up to 50% of the cost of the audit and rating process.
- Tax Incentives: The government of Chhattisgarh may provide tax incentives to commercial building to conduct energy audits and implement energysaving measures. The incentives can be in the form of deductions from taxable income or accelerated depreciation on energy-efficient equipment.
- Green Loans: Some banks in India offer green loans to commercial building owners for implementing energy-saving measures. These loans have lower interest rates and longer repayment periods compared to traditional loans.
- Recognition and Awards: State Government may recognize and award buildings on achievement of high BEE star ratings. These awards can increase the market value and appeal of the buildings.
- 3. Market Outreach for Star & Shunya Rating by Radio Jingles, Social Media Awareness-

STATE ENERGY EFFICIENCY ACTION PLAN

Promotion of the Star & Shunya Rating is an important part of promoting energy efficiency in buildings. To increase awareness about these rating programs, 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.

- 4. 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.
- 5. 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.

6. Promotion of installation of Rooftop Solar Systems on buildings

The promotion of the installation of solar PV rooftop systems on buildings is an important strategy to increase the adoption of renewable energy sources to meet the optimized energy demand of buildings and achieving the Net-Zero targets. Government of Chhattisgarh has already launched several initiatives to promote rooftop solar, such as providing financial incentives and creating a favorable regulatory environment and people are taking benefits of those schemes. Promotion of these schemes in rural and sub-urban areas will create a robust infrastructure for energy access in the state.

5.3. Energy Saving Targets & Monitoring Mechanism

The proposed strategies can together achieve maximum potential energy savings of 71.76 ktoe by FY 2031.

Action Plan	Energy Savings in 2030 under moderate scenario (ktoe)	Energy Savings in 2030 under ambitious scenario (ktoe)
Effective implementation of ECSBC	1.954	2.447
Replacement program for inefficient appliances	52.810	69.313
BEE Star Rating and Shunya Rating of Buildings	0.004	0.005
Total (ktoe)	54.768	71.765

Table	12: Moderate an	d ambitious	s scenarios	enerav	savings	for building	sector
IUNIC		a ambitiou.	section	chergy	Savings	ioi bananig	Sector

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	 Chhattisgarh Road and Infrastructure Development Corporation Limited Department of Town Planning Department of Urban Development and Housing Chhattisgarh Housing Board

STATE ENERGY EFFICIENCY ACTION PLAN

Type of Monitoring	Frequency	Nodal Agencies	Responsible Agencies
Review of the scheme advancement and course correction, if required.	Half-yearly	Dept. of Urban Administration & Development	 Chhattisgarh State Renewable Energy Development Agency Chhattisgarh Road and Infrastructure Development Corporation Limited Department of Town Planning Department of Urban Development and Housing Chhattisgarh Housing Board
Review of the scheme advancement and policy interventions required	Yearly	Department of Housing and Urban Development	 Chhattisgarh State Renewable Energy Development Agency
Progress reporting of scheme advancement	Monthly	State Designated Agency (through the ECSBC Cell)	• Bureau of Energy Efficiency

In conclusion, Monitoring mechanisms are essential for 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.

TRANSPORT SECTOR

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6. Focus Sector 3: Transport

6.1. Current Scenario

In Chhattisgarh, the number of registered motor vehicles has shown a persistent rise over the years. As per the data received from dept. of Transport an average increment of 9.7% is observed when compared with the FY 2016. Further, there has been a steady increase in private vehicles under four wheelers and two-wheeler category which exhibits a potential of positive EV transition in Chhattisgarh, however considering the market availability of EVs for categories, this transition will require some time and can be a part of the long term strategy towards achieving the desired target of Panchamrit.



Figure 15: Increment in total registered vehicles in the state of Chhattisgarh

In Chhattisgarh, two wheelers are 81.53%, 4 wheelers are 6.60% and Goods Vehicles are 3.68% of total registered vehicle in 2021. Hence, targeting two and four wheelers for transition to electric vehicles can bring about significant reduction in energy consumption in the transport sector of Chhattisgarh.



Figure 16 : Share of vehicle types for no. of registered vehicles

6.2. Strategies in the Transport Sector

In line with the Chhattisgarh State Electric Vehicle Policy 2022, the long-term strategy for Electric Vehicle Transition has been proposed for Chhattisgarh. The policy and the proposed strategy encompass a number of aspects of the transport sector ranging from incentives to consumers to undergo EV transition, electric transition in commercial and non-commercial vehicles, and development of charging station across the State. State EV Policy offers purchase incentives on 2-wheelers, 3-wheelers, 4-wheelers, buses, and goods & other vehicles, manufacturing related incentives, incentive for proliferation of charging infrastructures along with the scrapping incentives in Chhattisgarh. 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

STATE ENERGY EFFICIENCY ACTION PLAN

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. Incentives can be offered to consumers as per the Chhattisgarh State EV Policy 2022. The EV conversion considerations for moderate and ambitious scenarios are given in table below.

	Moderate Scenario		Ambitious Scenario		
•	10% of conventional 2-Wheelers	•	15% of conventional 2-Wheelers		
	convert to electric by 2030.		convert to electric by 2030.		
•	10% of conventional 4-Wheelers	•	15% of conventional 4-Wheelers		
	convert to electric by 2030.		convert to electric by 2030.		
•	10% buses in the state to transition	•	20% buses in the state to transition		
	to electric buses by 2030.		to electric buses by 2030.		
•	45% of 3-Wheelers to convert to	•	60% of 3-Wheelers to convert to		
	electric by 2030.		electric by 2030.		
•	5% of heavy vehicles (trucks and	•	10% of heavy vehicles (trucks and		
	lorries) to convert to electric by 2030		lorries) to convert to electric by 2030		

Table 13: EV transition considerations for moderate and ambitious scenarios

The EV transition strategy can result in potential energy savings of 0.28 Mtoe and 0.41 Mtoe in the moderate scenario and ambitious scenario respectively.

Table 14: Energy Savings Potential though EV Transition

Particulars	Moderate Scenario (Mtoe)	Ambitious Scenario (Mtoe)	
Infrastructure development for EV charging stations and incentives to consumers for quick transition to	0.28	0.41	
EVs.			

Actionable Items:

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

There are several regulatory mechanisms that can be put in place to develop EV charging infrastructure in Chhattisgarh. Some possible approaches are mentioned below:

- Incentives for private companies to install charging infrastructure: The government is providing incentives such as tax breaks or subsidies to private companies that install EV charging infrastructure in State.
- Public-private partnerships: The government can enter into 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 offpeak hours when electricity is cheaper.

By implementing some or all of these regulatory mechanisms, the Chhattisgarh 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. Promotion of Renewable Energy based EV charging stations.

The promotion of renewable energy-based EV charging stations is a crucial step towards the electrification of transportation in India. The government has set an ambitious target for electric vehicle adoption, the promotion of renewable energy-based charging infrastructure can accelerate this transition. The Ministry of Power has issued guidelines for the installation of EV charging stations, and the government is providing financial incentives to encourage the deployment of renewable energy-based charging infrastructure. By promoting quality and energy-based charging stations, State can reduce its dependence on fossil fuels, improve air quality, and contribute to its climate goals.

3. Pilot projects on Battery Swapping stations -

Establishment of a wide network of charging stations and swappable battery station is a key of success for EV infrastructure in the state. However, charging station infrastructure is developing at a rapid rate but battery swapping option need bit more focus. State shall install approximately 5,000 EV charging stations and battery swapping stations by 2025 and 8,000 EV charging stations and battery swapping stations by 2030 across the state. In the short term (till FY 2026), out of the 5,000 chargers, it shall have 3,000 chargers of Level-1 type for 2-wheelers and 2,000 chargers shall be of Level-2 and DC type for 4-Wheelers and heavy vehicles along with pilot projects on battery swapping stations shall be established. Large number of charging stations recommended for 2 wheelers, keeping in view the high share of 2-Wheelers in the overall registered vehicles in the state and the conversion of 15% 2-Wheelers to electric under the ambitious scenario. The installed EV charging stations are proposed to have a part of their charging load to be catered by renewable energy systems which would lead to savings in the upstream costs of the charging infrastructure.

To ensure a shorter period of return of investment (ROI), the EV chargers shall 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, 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:

4. 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.

5. 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.

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 2030, 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 0.22 Mtoe and 0.43 Mtoe in the moderate and ambitious scenarios respectively.

Particulars	Moderate Scenario	Ambitious Scenario
Energy Saving Potential (Mtoe)	0.22	0.43

Table 15: Moderate and ambitious scenarios energy saving potential through Ethanol Blending

Implementing Agency: State Transport Department & 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.

Strategy #3 Promotion of Standard and Labelling program of Tyres 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.
- Capacity Building of Tyre Manufacturer and Vehicle OEMs- Capacity building workshops shall be organized in the Chhattisgarh 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.

6.3. Energy Saving Targets & Monitoring Mechanism

On the basis of the two strategies proposed for the transport sector, the total energy saving estimated is 0.50 Mtoe in the moderate scenario and 0.85 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.

Strategies	Energy Savings in 2030 under moderate scenario (Mtoe)	Energy Savings in 2030 under ambitious scenario (Mtoe)
Transition to electric vehicles	0.28	0.41
Ethanol blending	0.22	0.43
Total (Mtoe)	0.49	0.84

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, Chhattisgarh 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:

STATE ENERGY EFFICIENCY ACTION PLAN

Type of Monitoring	Frequency	Nodal Agencies	Responsible Agencies
Reporting, Monitoring and Review of the scheme advance and implementation status	Quarterly	CREDA & Department of Transport	 Department of Transport, Chhattisgarh
Review of the scheme advancement and course correction, if required.	Half-yearly	CREDA & Department of Transport	 Chhattisgarh State Renewable Energy Development Agency Department of Transport, Chhattisgarh
Review of the scheme advancement and policy interventions required	Yearly	CREDA & Department of Transport	 Department of Transport, Chhattisgarh Chhattisgarh State Renewable Energy Development Agency Bureau of Energy Efficiency
Progress reporting of scheme advancement	Monthly	CREDA & Department of Transport	 Department of Transport, Chhattisgarh Chhattisgarh State Renewable Energy Development 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.

AGRICULTURE SECTOR



7. Focus Sector 4: Agriculture

7.1. Current Scenario

Agriculture is the main occupation for the people of the Chhattisgarh. Nearly, 80 % population of the state is dependent on agriculture. In the state out of 37.46 Lakhs farmer households, 76% comes under small & marginal class. At present, around 35% of Land is having irrigation facility considering all source of irrigation, out of all irrigation facility available, maximum 52% of land is irrigated from reservoirs and canals, 55% arable land is having less water retention for which second crop is not possible from this land without irrigation facility.

After the formation of the state, highest priority is being given to Agriculture development. The sustained effort of the state govt. towards agriculture-oriented plan/ schemes resulted in the higher pace of growth in the agriculture. The state govt. has been making effective and continuous stride for the economic development of the farmers.

Against all these odds, the farmers of Chhattisgarh are constantly endeavoring to fully utilize the agricultural potential of the state to increase food production and to supplement the income by producing quality cash crops. The main sources of electricity consumption in this sector are agricultural machinery/ equipment and pump sets in the state. Different forms of energy are used for different purposes, which includes the use of diesel, electricity, and renewable fuels for activities on the farm.

Since majority of the power consumption in agriculture is due to the pumps used in irrigation, replacing old pumps (10 years old) or less efficient pumps (non-star rated) with 5 Star rated energy efficient pumps affects the power consumption in sector to a great extent.

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:

Strategy #1 Replacement of old pumps (10 years old) or less efficient pumps (non-star rated) with 5 Star rated Pumps along with smart control panel

Implementation period: Long-term (Till FY2031)

This strategy aims to reduce energy consumption and increase the efficiency of the pumps used in irrigation. The implementation period for this strategy is long-term, until FY2031. During this period, two scenarios have been proposed. The first scenario is the moderate scenario, which aims to replace 50% of the inefficient electric powered pumps with BEE 5 Star rated pumps by FY2031. This scenario aims to achieve significant energy savings and improve the efficiency of pumps used in irrigation.

BEE Star rated pumps are designed to consume less energy and operate efficiently, resulting in cost savings for farmers in terms of lower electricity bills and reduced maintenance costs.

The second scenario is the ambitious scenario, which aims to replace 70% of the inefficient electric-powered pumps with BEE Star rated pumps by FY2031. This scenario is the ideal goal and aims to achieve maximum energy savings in the Agriculture sector by replacing the majority of inefficient pumps with energy-efficient ones.

Overall, this strategy will lead to a total saving of 0.006 Mtoe in moderate scenario and 0.008 Mtoe in ambitious scenario.

Actionable items:

Development of a phase-wise plan to implement Demand Side Management (DSM) scheme for replacing existing inefficient pumps through DISCOMs or Energy Service Companies (ESCOs) and Promotion of PM-KUSUM Scheme in the state.

- The plan should include the identification of inefficient pumps, the assessment of the feasibility of the replacement of these pumps with energy-efficient ones, and the selection of ESCOs for the implementation of the DSM scheme.
- 2. The plan should be developed in consultation with relevant stakeholders, including farmers, pump manufacturers, and ESCOs, to ensure that the

implementation of the DSM scheme is feasible, cost-effective and leads to energy savings.

3. PM KUSUM Scheme includes the installation of solarization of grid-connected agriculture pumps and installation of solar panels on barren land, which can be used to generate additional income for farmers. This will improve the livelihood of farmers and provide reliable and cost-effective irrigation systems to farmers and promote the use of renewable energy in agriculture sector.

7.3. Energy Saving Targets & Monitoring Mechanism

On the basis of the above strategy proposed for the agriculture sector, the total energy saving estimated is 0.006 Mtoe in the moderate scenario and 0.008 Mtoe in ambitious scenarios can be considered as the energy saving targets for FY 2031 for the Agriculture Sector.

Particulars	Moderate Scenario (Mtoe)	Ambitious Scenario (Mtoe)	
Replacement of old pumps (10 years			
old) or less efficient pumps (non-star	0.006	0.008	
rated) with 5 Star rated Pumps along	0.000	0.008	
with smart control panel			

Table 16: Energy Savings from Agriculture Sector

Monitoring Mechanism:

To effectively carry out the action plan, it is essential to establish a robust monitoring and verification system. While the Directorate of Agriculture, Chhattisgarh 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:

STATE ENERGY EFFICIENCY ACTION PLAN

Type of Monitoring	Frequency	Nodal Agencies	Responsible Agencies
Reporting, Monitoring and Review of the scheme advance and implementation status	Quarterly	Directorate of Agriculture	• Directorate of Agriculture
Review of the scheme advancement and course correction, if required.	Half-yearly	Directorate of Agriculture	 Chhattisgarh State Renewable Energy Development Agency Directorate of Agriculture
Review of the scheme advancement and policy interventions required	Yearly	Directorate of Agriculture	 Directorate of Agriculture Chhattisgarh State Renewable Energy Development Agency Bureau of Energy Efficiency
Progress reporting of scheme advancement	Monthly	Directorate of Agriculture	 Directorate of Agriculture Chhattisgarh State Renewable Energy Development 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. Market Potential in Focus Sectors

The energy saved as a result of the proposed strategies in all sectors will lead to avoided generation of equivalent amount. In order to implement the suggested strategies, there will be need for investments in energy efficiency projects, development of new policies, and modification of existing policies. In order 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 only for the year 2018-19. The same amount has been applied to energy savings under ambitious scenario for the estimation of maximum investment potential. Total energy saving potential by implementing various strategies in Chhattisgarh is shown in the graph below:



Figure 17 : Total Energy Saving Potential

STATE ENERGY EFFICIENCY ACTION PLAN

It is estimated that with the implementation of various proposed strategies of Industry, Building, Transport and Agriculture Sectors, energy saving of 0.61 Mtoe in moderate scenario and 1.00 Mtoe in ambitious scenario can be achieved. In moderate scenario 1.6% energy saving and in ambitious scenario 2.6% savings of total final energy consumption can be achieved.

Energy Savings & Emission Reduction Potential FY 2031									
Sectors	Energy Savi	ings (Mtoe)	Emission (Mt	Investment					
	Moderate	Ambitious	Moderate	Ambitious	Potential				
Industry	0.06	0.08	0.17	0.24	138				
Buildings	0.05	0.07	0.17	0.22	132				
Transport	0.49	0.84	1.55	2.64	1,552				
Agriculture	0.006	0.008	0.018	0.025	14				
Total	0.61	1.00	1.9	3.1	1,836				

Table 17: Energy Savings & Emission Reduction Summary	Table [*]	17	:	Energy	Savings	&	Emission	Reduction	Summary
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9. Way Forward

The state energy efficiency action plan, through the research and interaction with various stakeholders, identifies the need, opportunity, and the potential of energy efficiency in the State of Chhattisgarh. While addressing the key focus sectors – Industry, Building, Transport and Agriculture, the action plan envisages to analyze 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.

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.

Department-wise proposed action and policy interventions required are summed up in the table mentioned below:

Proposed Actions / Policy Interventions Required

Strategies	Actionable Items	Proposed Action/Policy Intervention	Concern Department		
INDUSTRY					
Deeping and Widening of Perform, Achieve and Trade (PAT) Scheme	1. Financial support to industries for implementation of new technologies	Provision of financial support in Industrial Policy to promote implementation of new or innovative technology in a sector	Directorate of Industries		
	 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. 	Inclusion of Mandatory Energy Audit provision in Industrial Policy for other than PAT DCs.	Directorate of Industries		
	3. Establish B2B interaction with global technology suppliers.	Inclusion of agenda point on "Innovative Technologies for Energy Efficiency" in state level events	Directorate of Industries & CREDA		
	1. Demonstration projects on latest Energy Efficiency Technologies in SME clusters	Industrial department shall work on Demonstration projects on new & innovative technologies	Directorate of Industries		
Energy efficiency in MSME clusters	 Periodic standardized energy audits for MSMEs on load basis and reimbursement of energy audit cost with a maximum cap Sector-specific policy development for financial assistance on implementation of ECMs suggested in energy audit- 	Inclusion of periodic energy audits with some incentives on audit cost and ECM implementation for MSMEs in industrial policy.	Directorate of Industries		
	 Issuance of directives for implementation of ISO 50001, Energy Management System in organizations on load basis 	Issuance of directives to MSMEs (above a connected load thresholds level) to implement ISO 50001, Energy Management System	Directorate of Industries		

Strategies	Actionable Items	Proposed Action/Policy Intervention	Concern Department		
	 Phase wise plan to implement DSM scheme for replacement of existing inefficient (non-star rated) pumps through DISCOMS 	Issuance of directives to DISCOMS to conduct mapping & develop a plan for replacement of existing inefficient pumps	DISCOMS		
BUILDINGS					
Effective Implementation of ECBC	1. Effective Enforcement plan with ULBs and SDA.	Revision of Building Bye-laws and inclusion of ECBC Norms & develop stringent ECBC rules	UADD, Town & Country Planning Department, NRANVP		
	 Development and maintenance of ECSBC compliance portal, directory of energy efficient materials/technologies 	ECBC & ENS portal development	CREDA		
	 Pilot projects for Super ECBC buildings as case studies (initial 20 Buildings) 	Identification of buildings for development of Super ECBC buildings	CREDA		
	 Periodic upgradation of PWD Schedule of Rates (SoR). 	Issuance of directives to PWD to revise the SoR on periodic basis and include all energy efficient technologies and materials	PWD		
	5. Inclusion of curriculum on energy efficiency in buildings, in universities and Schools	Issuance of directives to State education board to develop curriculum on energy efficiency	State Education Board		
Replacement program for inefficient appliances	 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- 	Issuance of directives to all departments to develop a plan for replacement of inefficient appliances installed in their offices and execute in a time bound manner	Energy Department, Respective Departments		
	 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 scheme for replacement of inefficient appliances (Similar like UJALA scheme for LEDs)	Energy Department, CREDA		

Strategies		Actionable Items	Proposed Action/Policy Intervention	Concern Department	
BEE Star Rating or Shunya Rating of Buildings	1.	Issuance of directives to all government departments to conduct energy audits and target to achieve BEE Star Rating for their buildings	Issuance of directives to all departments to conduct energy audit and target BEE star rating for their office buildings	Energy Department, Respective Departments	
	2.	Periodic energy audits for commercial buildings on load basis and incentives on achieving specific level of star rating for buildings	Issuance of directives to commercial buildings (above a connected load thresholds level) to conduct energy audits and provision of incentive for achieving BEE Star rating for buildings	Energy Department, DISCOMS	
	3.	Mandatory minimum set point of 24 degrees for air conditioners in all government buildings	Issuance of directives to all govt. departments to follow the 24 degree set points rule in air conditioned area	Energy Department, All Govt. Development	
	4.	Transformation of iconic government buildings to Net-Zero energy buildings	Development of plan to transform iconic buildings like State Assembly, Secretariat etc. as a Net-Zero Buildings	Energy Department	
TRANSPORT					
EV Transition and Charging Infrastructure	1.	Promotion of Renewable Energy based EV charging stations.	Inclusion of targets for development of Renewable Energy based EV charging stations in EV Policy	Transport Department	
	2.	Pilot projects on Battery Swapping stations and Hydrogen Fuel Cell Vehicles.	Development of plan for Battery Swapping and HCV demo projects	Energy Department	
	3.	Disposal of electric vehicle batteries	Inclusion of framework for Disposal of electric vehicle batteries in EV Policy	Transport Department	
Ethanol Blending	1.	Strengthen the framework for supply of feedstock and production of ethanol in State			

Strategies	Actionable Items	Proposed Action/Policy Intervention	Concern Department		
Program	Support for the research and development programs	Issuance of directive to develop a robust plan for	Renewable Energy		
		system for ethanol production units	Agriculture Department		
	AGRICULTURE				
Replacement of old pumps or less efficient pumps (non-star rated) with 5 Star rated Pumps along with smart control panel	 Phase-wise DSM plan to replace inefficient pumps & promote PM- KUSUM Scheme. 	Issuance of directives to irrigation department to develop a plan for replacement of inefficient pumps with the BEE 5 Star rated pumps along with smart control panel and promotion of PM- KUSUM scheme	Irrigation Department, CREDA		

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