State Energy Efficiency Action Plan - Jharkhand

JANUARY 2025

सत्यमेव जयते

विद्युत मंत्रालय
MINISTRY OF
POWER

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

सत्यमेव जयते

Azadi Ka Amrit Mahotsav

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

Foreword

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

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

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

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

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

October, 2024

(Dr. Srikant Nagulapalli)

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

RIGHT TO INFORMATION

Acknowledgement

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

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

The project team further extends its profound gratitude to Shri Avinash Kumar, Additional Chief Secretary, Department of Energy cum Chairman JREDA, Shri KK Verma, Director, JREDA, Shri Bijay Kumar Sinha, Project Director, JREDA, for their valuable guidance towards the execution of the assignment. We also acknowledge the support provided by Shri. Atilesh Gautam, SDA Incharge, JREDA , Government of Jharkhand, Shri Atul Nigam, Energy Expert, JREDA for their extended support for successfully completing the project. The team also extend its sincere thanks to all state government departments and stakeholders of the state of Jharkhand for their valuable inputs towards the completion of the earmarked project tasks.

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

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

PricewaterhouseCoopers Private Limited

State Energy Efficiency Action Plan – East Zone

Disclaimer

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

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

Each member firm is a separate legal entity

Table of Contents

List of Tables

List of Figures

Abbreviations

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

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

Executive Summary

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

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

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

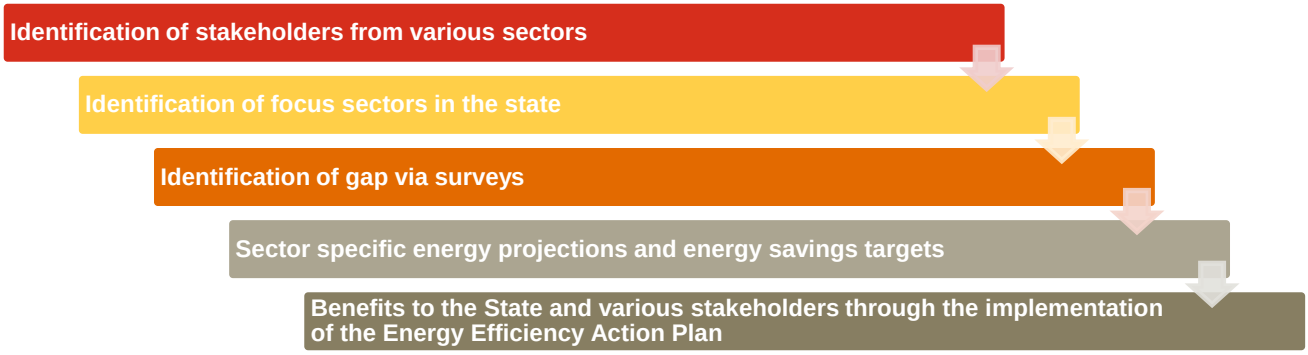

Figure 1: Broad scope of work

State context

Jharkhand is in the eastern part of India and has geographical area of 79,716 sq. km and population of 3.8 crore. The natural resources, policy incentives and location-specific advantages of Jharkhand support investments in sectors such as mining and metal extraction, engineering, iron and steel, and chemicals. In 2019-20, the gross domestic product of Jharkhand was INR 3,29,726 crore and per capita GDP was INR 87,1271.[23] Jharkhand is rich in mineral resources such as coal (27.3% of India's reserves), iron ore (26% of India's reserves), copper ore (18.5% of India's reserves), uranium, mica, bauxite, granite, limestone, silver, graphite, magnetite, and dolomite. Since Jharkhand has around 40% of the country's mineral wealth, its extensive mineral resources make mining, metals, and related sectors especially lucrative for investments. Jharkhand is the only state in India to produce coking coal, uranium, and pyrite. The state is also a leading producer of coal, mica, kyanite and copper. The state's coal reserves are estimated at around 83,151 million tonnes. Jharkhand accounts for 20-25% of the total steel produced in the country..[45]

2 Jharkhand Economic Survey 2020-21

3 State Domestic Product, Ministry of Statistics and Programme Implementation

4 Industrial Development and Economic Growth in Jharkhand, India Brand Equity Foundation

5 Indian Minerals Yearbook 2020, Indian Bureau of Mines

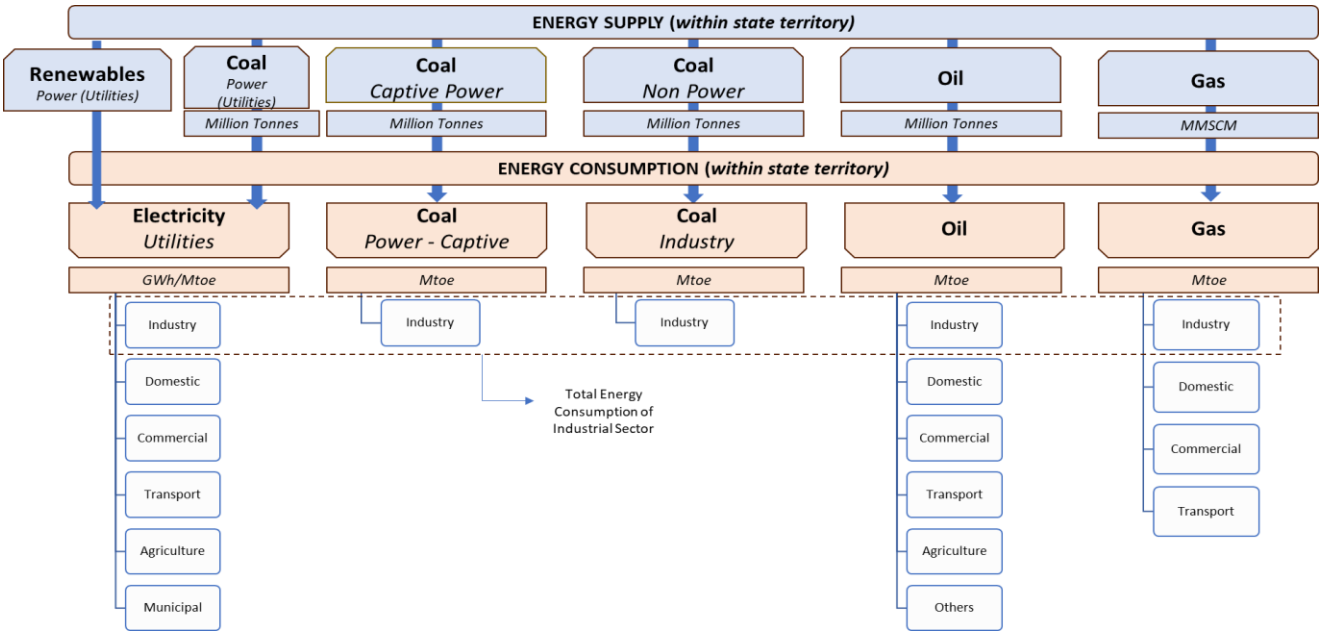

Figure 2: Energy flow in the state (supply and consumption)

From a consumption standpoint - the total energy consumption of Jharkhand for the year 2019-20 has been estimated to be approximately 15.55 Mtoe for the year 2019-20. It is pertinent to mention here that coal consumption is the major contributor to this estimate at 10.4 Mtoe followed by oil at 3.24 Mtoe and electricity at 1.89 Mtoe. Following figure illustrates the same: -

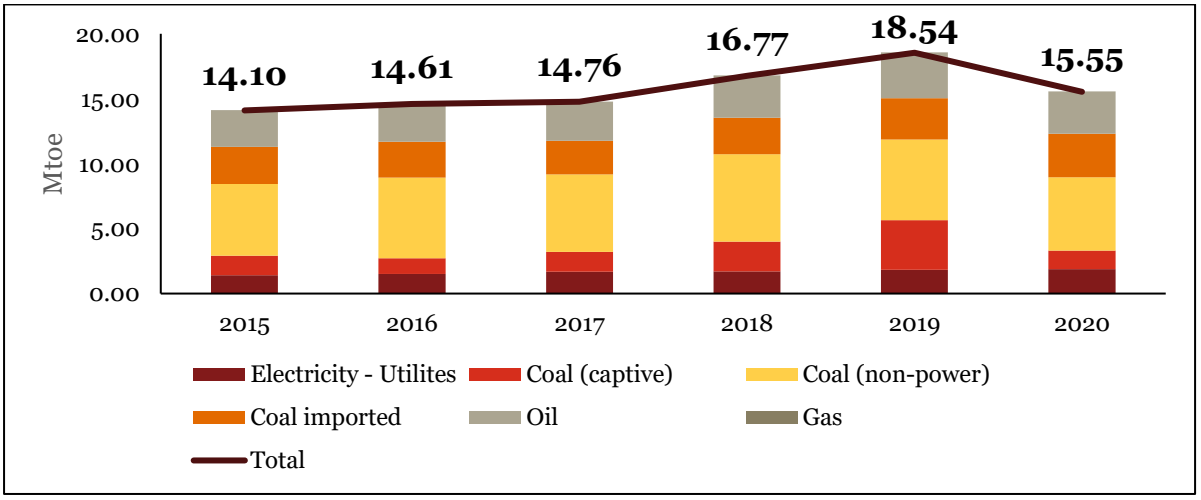

Figure 3: Final Energy Consumption trend for Jharkhand

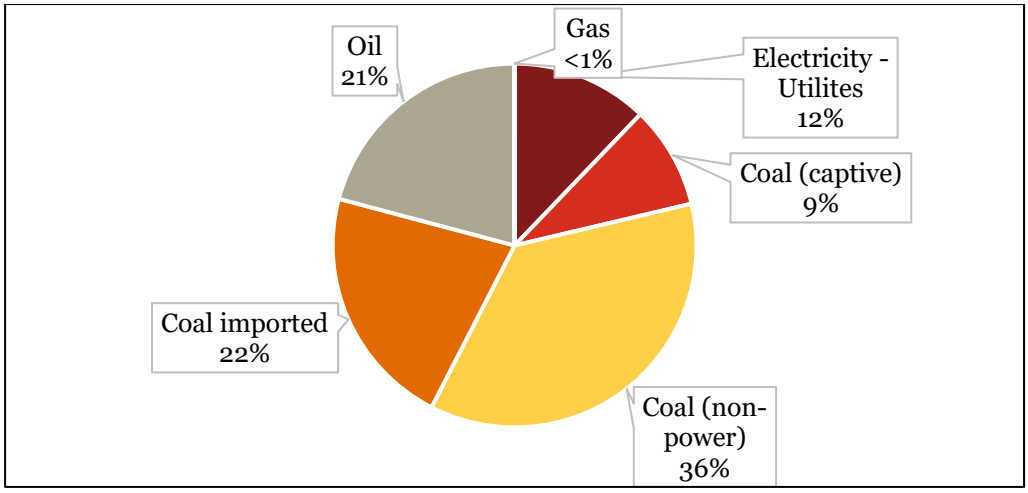

Figure 4: Fuel-wise split of total final energy consumption in Jharkhand

Identification of focus sectors

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

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

Figure 5: Identified focus sectors

Projection and forecasting

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

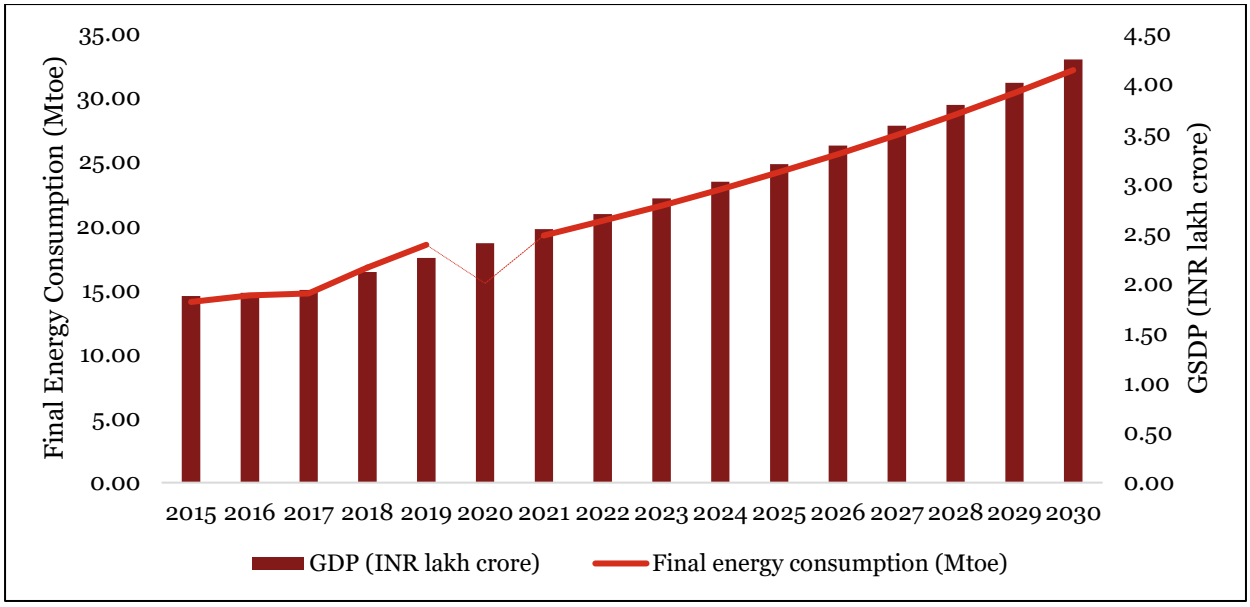

Figure 6: Energy consumption and GDP forecasting of Jharkhand

The baseline energy consumption intensity for FY2020 was calculated (7.62) and multiplied with forecasted GSDP to obtain final energy consumption trend till 2030.

Focus sector 1 - Industries

Current scenario

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

Energy efficiency potential in the sector

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

Table 1: Energy Savings potential in industries sector

Action Plan	Energy Savings in 2030 under moderate scenario (Mtoe)	Energy Savings in 2030 under ambitious scenario (Mtoe)
Deepening and Widening of PAT scheme	0.04	0.13
Energy efficiency in SME sector	0.02	0.06

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

Energy efficiency strategies in the sector

1. Action plan 1 - Deepening of PAT scheme: It is recommended that the threshold for the PAT criteria in terms of energy consumption may be lowered so as to accommodate more cement and sponge iron units present within the state. For widening, it is recommended that coal mining sector be added in PAT scheme. Following table illustrates the energy efficiency that can be achieved via this strategy:-

Table 2: Specific energy consumption used in Action Plan 1

Sector	Baseline SEC (toe/tonne)	Moderate SEC (toe/tonne)	Ambitious SEC (toe/tonne)	Production in 2030 (tonnes)	Energy saving in moderate scenario (toe)	Energy saving in ambitious scenario (toe)
Cement	0.0716	0.0708	0.0676	938103	**375**	**2626**
Sponge iron	0.514	0.447	0.380	1400533	**46,987**	**131,566**
Coal Mining	113.27 tonne/million tonnes	101.94 tonne/Million tonnes	90.62 tonne/Million tonnes	215.6	**549.7**	**1539.3**

(Note: For the moderate and Ambitious SEC assigned to cement, sponge iron and coal mining units - It is assumed that all the existing units will achieve the moderate SEC target in 50% units and achieve ambitious SEC target in 70% units.

2. Action plan 2 - **:** Manufacturing MSME may be looked at more carefully from the lens of energy efficiency. A number of MSME industry clusters are there in Jharkhand that are energy intensive. It is recommended that brick, refractory and coke oven sectors may be incentivized or prompted to adopt energy efficient technologies. Following table illustrates the energy efficiency that can be achieved via this strategy:-

Table 3: Specific energy consumption used in Action Plan 2

Sector	Baseline SEC (toe/tonne)	Moderate SEC (toe/tonne)	Ambitious SEC (toe/tonne)	Production in 2030 (tonnes)	Energy saving in moderate scenario (toe)	Energy saving in ambitious scenario (toe)
Bricks	0.04	0.036	0.032	6293371	12586.7	35242.9
Refractory	0.21	0.13	0.06	171731	6341.1	17755.3
Coke oven	0.22	0.20	0.19	1086253	5974.4	16728.3

(Note: For the moderate scenario it is assumed that 50% penetration of zig-zag in brick sector, tunnel kiln in refractory units and coke dry quenching in coke oven units will take place. For the ambitious scenario it is assumed that 70% penetration of zig-zag in brick sector, tunnel kiln in refractory units and coke dry quenching in coke oven units will take place)

Focus sector 2 – Commercial and domestic buildings

Current scenario

The buildings sector in encompasses different types of buildings present in Jharkhand i.e., domestic (households) and commercial (health facilities, commercial complexes, public buildings etc.). The

buildings sector of Jharkhand consumed 30% of electricity and 6% of final energy consumption in 2019-20.

Energy efficiency potential in the sector

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

Table 4: Energy Savings potential in buildings sector

Action Plan	Energy Savings in 2030 under moderate scenario (toe)	Energy Savings in 2030 under ambitious scenario (toe)
Replacement program for inefficient appliances	150,171	300,343
Effective implementation of Jharkhand ECBC 2022	5202	7282
Energy audit for public and commercial buildings	9363	18,727

Energy efficiency strategies in the sector

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

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

Table 5: Energy Savings by appliance in Action Plan 1

Appliance	Inefficient stock in FY2020	Energy saving in moderate scenario (Mtoe)	Energy saving in ambitious scenario (Mtoe)
Fan	8,535,825	**67,817**	**135,634**
Air conditioner	1,327,795	**27,172**	**54,345**
Refrigerator	5,026,653	**14,177**	**28,353**
Washing Machine	3,509,173	**4707**	**9414**
Television	6,259,605	**4952**	**9903**

Geyser	2,276,620	**5637**	**11,273**
LPG cookstove	8,820,353	**25,710**	**51,420**

(Note: In moderate scenario, it is assumed that 40% of appliances will be replaced with efficient appliances and 10% switch to electric cookstove. In ambitious scenario, it is assumed 70% appliance replacement with efficient appliance and there will be a 20% switch to electric cook stove)

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

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

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

(Note: In moderate scenario, it is assumed 15% buildings will have energy audit and in ambitious scenario, it is assumed 30% of buildings will get energy audit. In ambitious scenario, it is assumed that energy audit recommendations implementation will lead to 30% savings.)

Focus sector 3 – Transport

Current scenario

The transport sector is one of the major consumers of energy in Jharkhand and contributes to approximately 17% of the total energy consumption in the state from a sector perspective in 2019-20.

Energy efficiency potential in the sector

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

Table 6: Energy Savings potential in transport sector

Action Plan	Energy Savings in 2030 under moderate scenario (Mtoe)	Energy Savings in 2030 under ambitious scenario (Mtoe)
Deployment of electric vehicles in state	0.3	0.6
Ethanol blending	0.1 (as per policy)	

Energy efficiency strategies in the sector

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

(Note: As per Jharkhand EV Policy 2022, 10% of two-wheelers, 20% three-wheeler, 10% four-wheeler, 10% bus and 10% HDV to be electric by 2027. This has been considered moderate scenario. For ambitious scenario, 20% of two-wheelers, 40% of three-wheelers and 20% of four-wheeler, bus and HDV to be electric by 2030)

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

Focus sector 4 – Agriculture

Current scenario

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

Energy efficiency potential in the sector

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

Table 7: Energy Savings potential in agriculture sector

Action Plan	Energy Savings in 2030 under moderate scenario (toe)	Energy Savings in 2030 under ambitious scenario (toe)
Replacement of diesel pumps with solar	166,571 (as per national policy)	
Replacement of inefficient pumps (15 years old) with Star-Rated pumps	3551	5918

Energy efficiency strategies in the sector

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

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

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

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

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

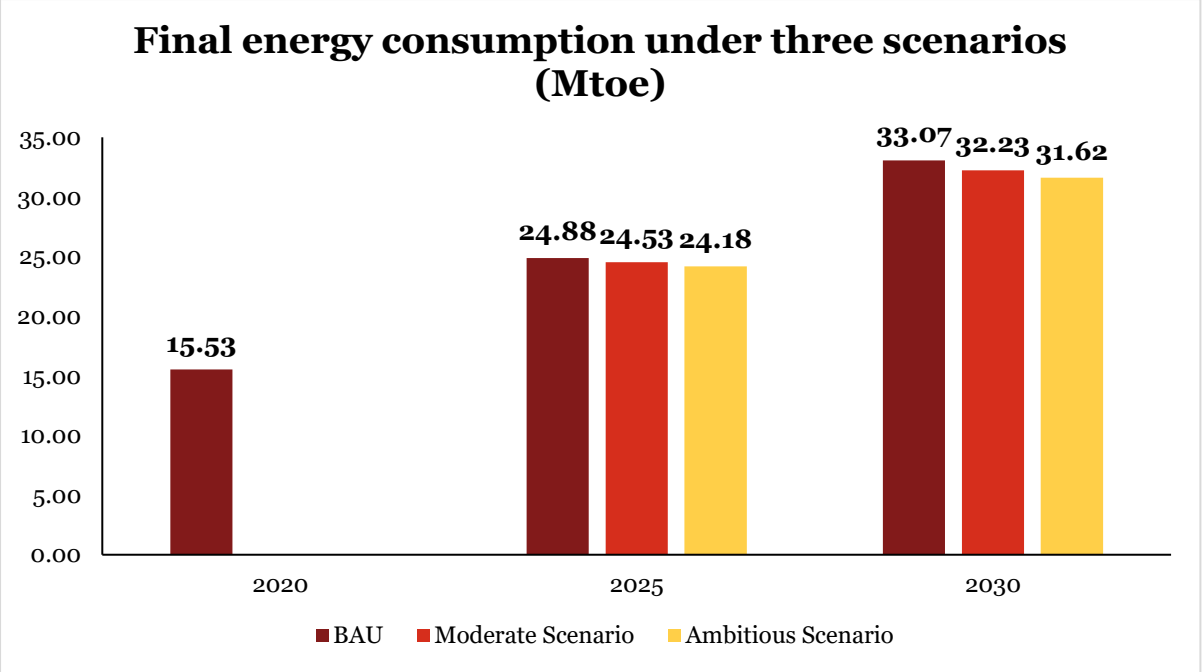

Figure 7: Final Energy Consumption trends in 2025 and 2030 under three scenarios

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

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

Sector	**Emissions Reduction (MtCO2) - FY2031**		**Energy Consumption Reduction (Mtoe) - FY2031**		**Investment Potential (INR Crores)**
	Moderate	**Ambitious**	**Moderate**	**Ambitious**	
	MtCO2 reduction	MtCO2 reduction	Mtoe Reduction	Mtoe Reduction	
Industry	0.23	0.64	0.07	0.21	378.1
Buildings	0.52	1.02	0.16	0.33	600.6
Transport	1.37	2.33	0.44	0.74	1369.9
Agriculture	0.53	0.54	0.17	0.17	317.4
Total	**2.65**	**4.53**	**0.85**	**1.45**	**2665.9**

The energy savings of 0.85 Mtoe and 1.45 Mtoe are calculated by savings from the four focus sectors. The emission reduction is calculated by multiplying the energy savings with a factor of 3.3 MtCO2/Mtoe. For market investment potential, 1 tonne of oil equivalent is taken as value of INR 18,402 and assuming payback period of 3 years.

1. Introduction

1.1. Background and about State Energy Efficiency Action Plan

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

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

1.2. India's Nationally Determined Contributions and Mission LiFE

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

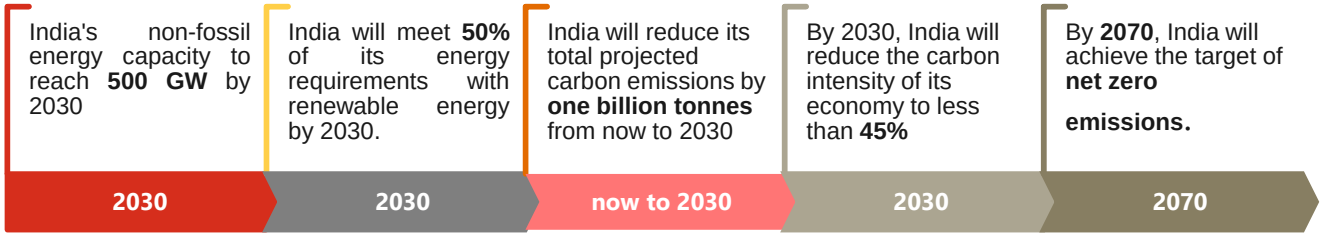

Figure 8: :India's NDC

What is Mission LiFE?

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

Need for this assignment

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

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

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

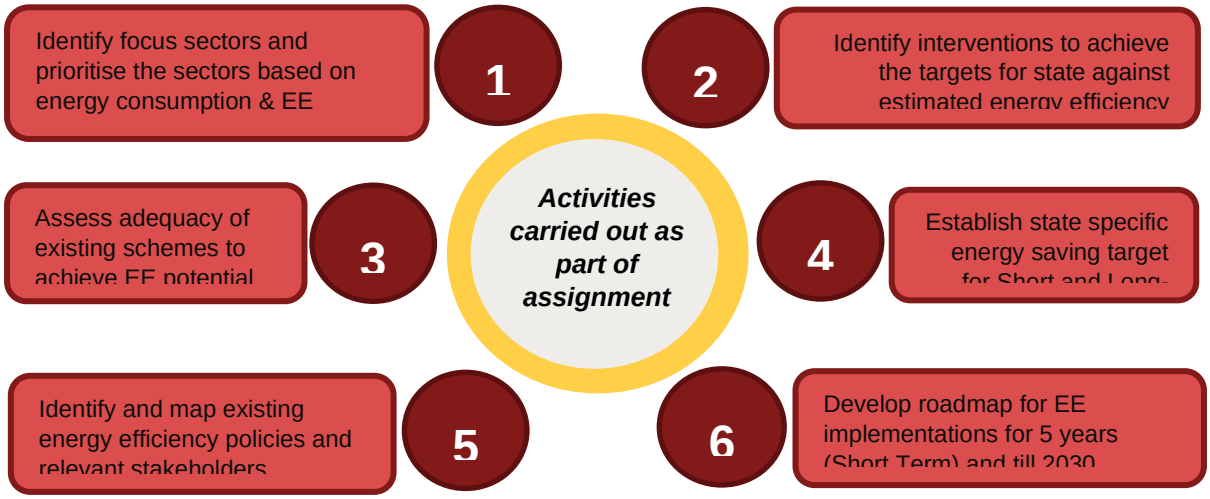

Figure 9: Key activities of project

1.3. State profile

Jharkhand is located in the eastern part of India. It has a geographical area of 79,716 sq. km and population of 3.8 crore. The natural resources, policy incentives and location-specific advantages of Jharkhand support investments in sectors such as mining and metal extraction, engineering, iron and steel, and chemicals. In 2019-20, the gross domestic product of Jharkhand was INR 3,29,726 crore and per capita GDP was INR 87,1276.[78]

Jharkhand is rich in mineral resources such as coal (27.3% of India's reserves), iron ore (26% of India's reserves), copper ore (18.5% of India's reserves), uranium, mica, bauxite, granite, limestone, silver, graphite, magnetite, and dolomite. Since Jharkhand has around 40% of the country's mineral wealth, its extensive mineral resources make mining, metals, and related sectors especially lucrative for investments. Jharkhand is the only state in India to produce coking coal, uranium, and pyrite. The state is also a leading producer of coal, mica, kyanite and copper. Value of mineral production (excluding fuel minerals) during 2018-19 stood at Rs. 2,510.99 crore. The state's coal reserves are estimated at around 83,151 million tonnes. Jharkhand accounts for 20-25% of the total steel produced in the country.

7 Jharkhand Economic Survey 2020-21

8 State Domestic Product, Ministry of Statistics and Programme Implementation

In 2018-19, 1,248 thousand tonnes of limestone were produced in Jharkhand with a total value stood at Rs. 42.91 crore.[9][10]

Figure 10: Key sectors in Jharkhand

The primary, secondary, and tertiary sectors represent various business types and the goods they procure and sell in an economic setup. The primary sector refers to agricultural and allied sector services, the secondary sector is the manufacturing sector, and the tertiary sector is known as the service sector. Jharkhand's main economic driver is the tertiary sector (like services, trade, transport etc.) which accounted for 45.76% of GDP in 2019-20. Also, even though primary sector of the economy (like agriculture, forestry, mining etc.) has a considerable contribution to the GSDP, the sector has been historically observed to be non-energy intensive.

1.4 State Energy Scenario (including renewable)

The energy consumption in the state is composed of primary energy and electricity. The primary energy is mainly derived from the use of coal and oil consumption. The electricity production is mainly done using coal from the coal-based thermal power plants. Jharkhand is net exporter of electricity, i.e., its power production is higher than its consumption. The energy flow in state of Jharkhand is shown below in figure below.

9 Industrial Development and Economic Growth in Jharkhand, India Brand Equity Foundation

10 Indian Minerals Yearbook 2020, Indian Bureau of Mines

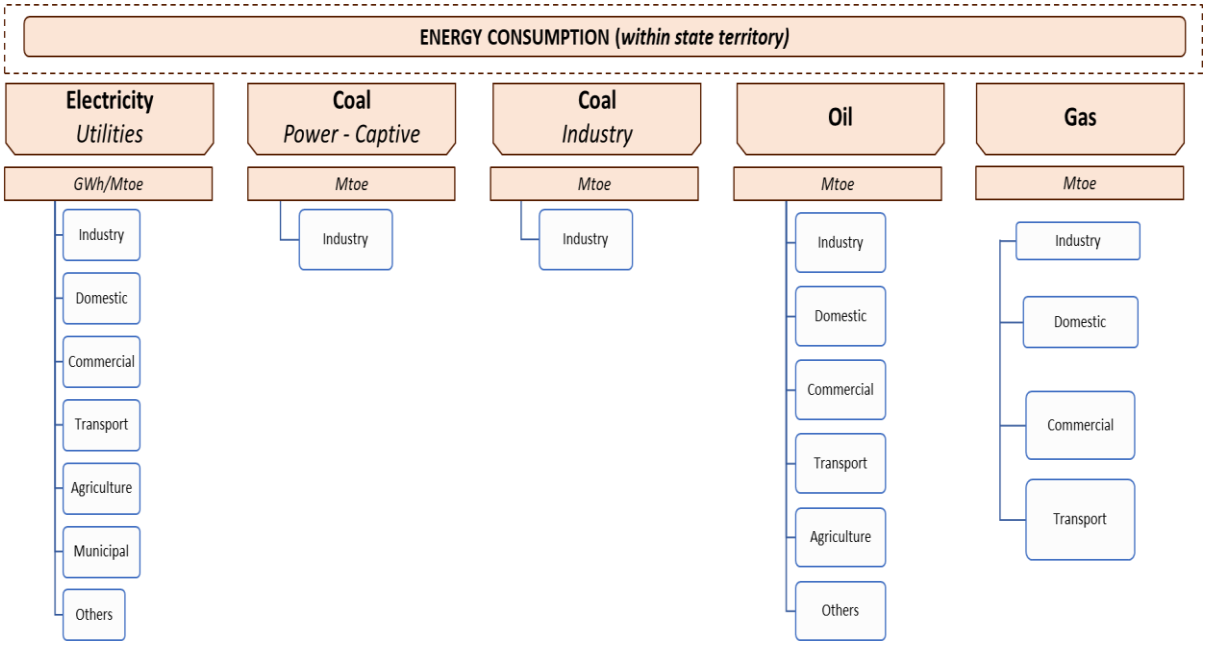

Figure 11: Energy Flow

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

Table 9: Key parameters of Jharkhand

Parameter	Unit	Value	Mtoe
Total population[11]	Lakhs	380	-
Gross State Domestic Product[12]	INR lakh crore	2.38	-
Total Power Plant Installed Capacity [13]	GW	2.4	-
Total Renewable Energy Installed capacity[14]	GW	0.17	-
Electricity consumption (utilities)[15]	TWh	21.9	1.89
Coal consumption (captive)[16]	Million Tonnes	3.15	1.42

11 GSDP, RBI

12 GSDP, RBI

13 CEA, All India Electricity Statistics 2021

14 CEA, All India Electricity Statistics 2021

15 CEA, All India Electricity Statistics 2021

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

Non-power coal consumption (industry)[17]	Million Tonnes	12.52	5.63
Imported coal attributable to Jharkhand	Million Tonnes	7.5	3.35
Oil consumption[18]	Million Tonnes	3.4	3.24
Gas consumption[19]	Million metric standard cubic metre	8.2	0.008
Total Final Energy Consumption	Mtoe		**15.55**

Jharkhand has 130 MW large hydro and 46 MW solar, wind and small hydro installed capacity as in 2019-20.[20] Figure below shows the installed capacity in Jharkhand of solar, wind and hydro.

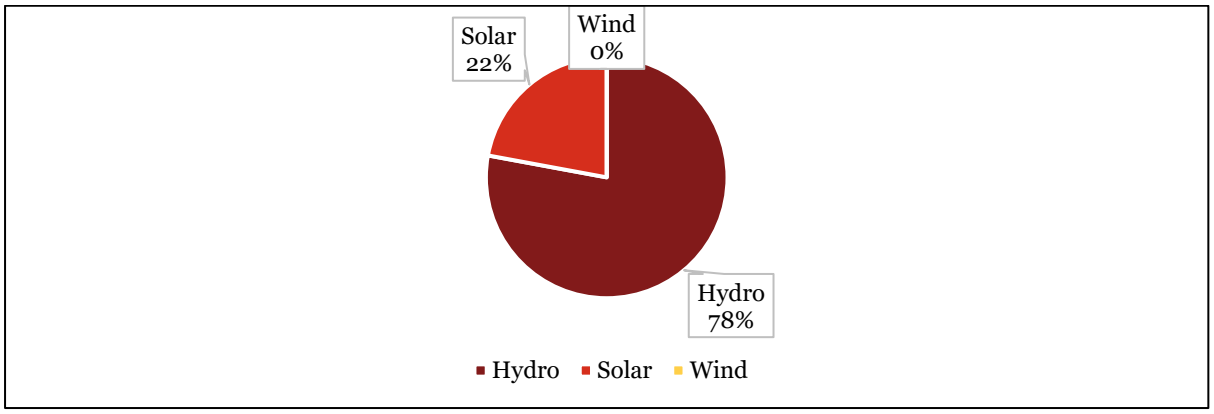

Figure 12: Renewable energy in Jharkhand (2019-20)

1.5 Energy Consumption Scenario (TFEC)

The trends in final energy consumption for Jharkhand are observed from 2014-15 to 2019-20. This includes coal imports by industry sector in Jharkhand. Final energy consumption falls from 2019 to 2020 due to decline in coal imports by Jharkhand industry sector. This does not include aviation, DISCOM T&D losses, domestic navigation, Pet Coke, Paraffin waxes, petroleum jelly, LSWR, MTBE and reformate, BGO, Benzene, MTO, CBFS and Sulfur. This is observed in the figure below.

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

18 India PNG Statistics, MoPNG 2019-20 Pg 104

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

20 CEA All India Statistics 2021

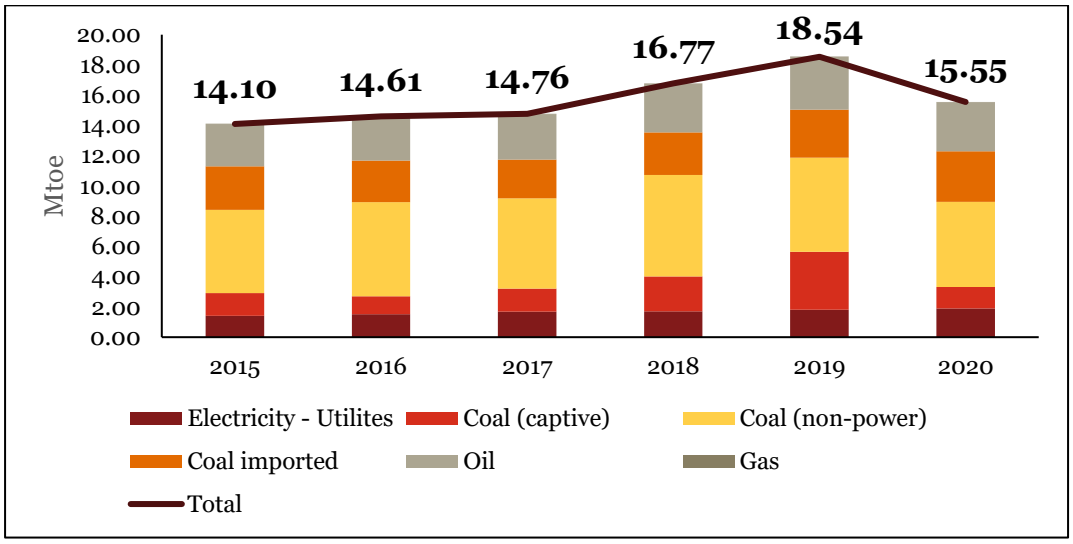

Figure 13: : Final Energy Consumption in Jharkhand

The figure below shows the spike in final energy consumption observed in 2018-19 is due to rise in imported coal by industries sector. The share of different fuels in final energy consumption for 2019-20 is shown below.

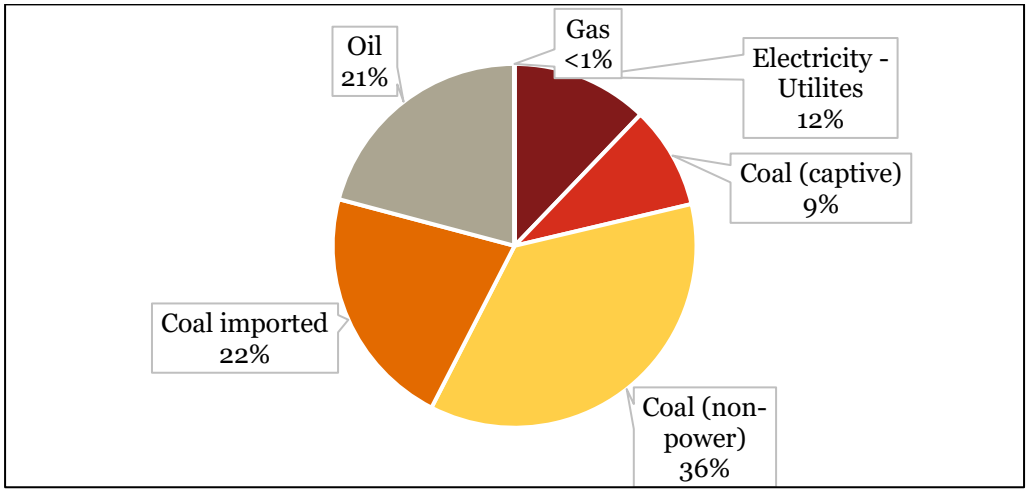

Figure 14: Final Energy Consumption for 2019-20

This signifies that the share of coal is dominant in total final energy consumption for Jharkhand. Coal used in power plants and industry is either imported or sourced domestically. The electricity consumption is also majority coal-based and thus the share of coal in overall final consumption is around 79%.

1.6 Overview of Institutional Framework and Stakeholder Mapping

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

Department of Energy, Jharkhand

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

Jharkhand Renewable Energy Development Agency (JREDA)

Jharkhand Renewable Energy Development Agency (JREDA) is a state nodal agency which works to develop and deploy renewable energy and energy efficiency

Jharkhand Urja Vikas Nigam Limited (JUVNL)

JUVNL is the holding company of electricity in Jharkhand and was established in 2014 when the Jharkhand State Electricity Board was classified into four institutions.

Jharkhand Urja Utpadan Nigam Limited (JUUNL)

JUUNL is the state generation company along with various private entities.

Jharkhand Bijali Vitran Nigam Limited (JBVNL)

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

Jharkhand Urja Sancharan Nigam Limited (JUSNL)

JUSNL is the state transmission company and is the sole authority for power transmission in Jharkhand.

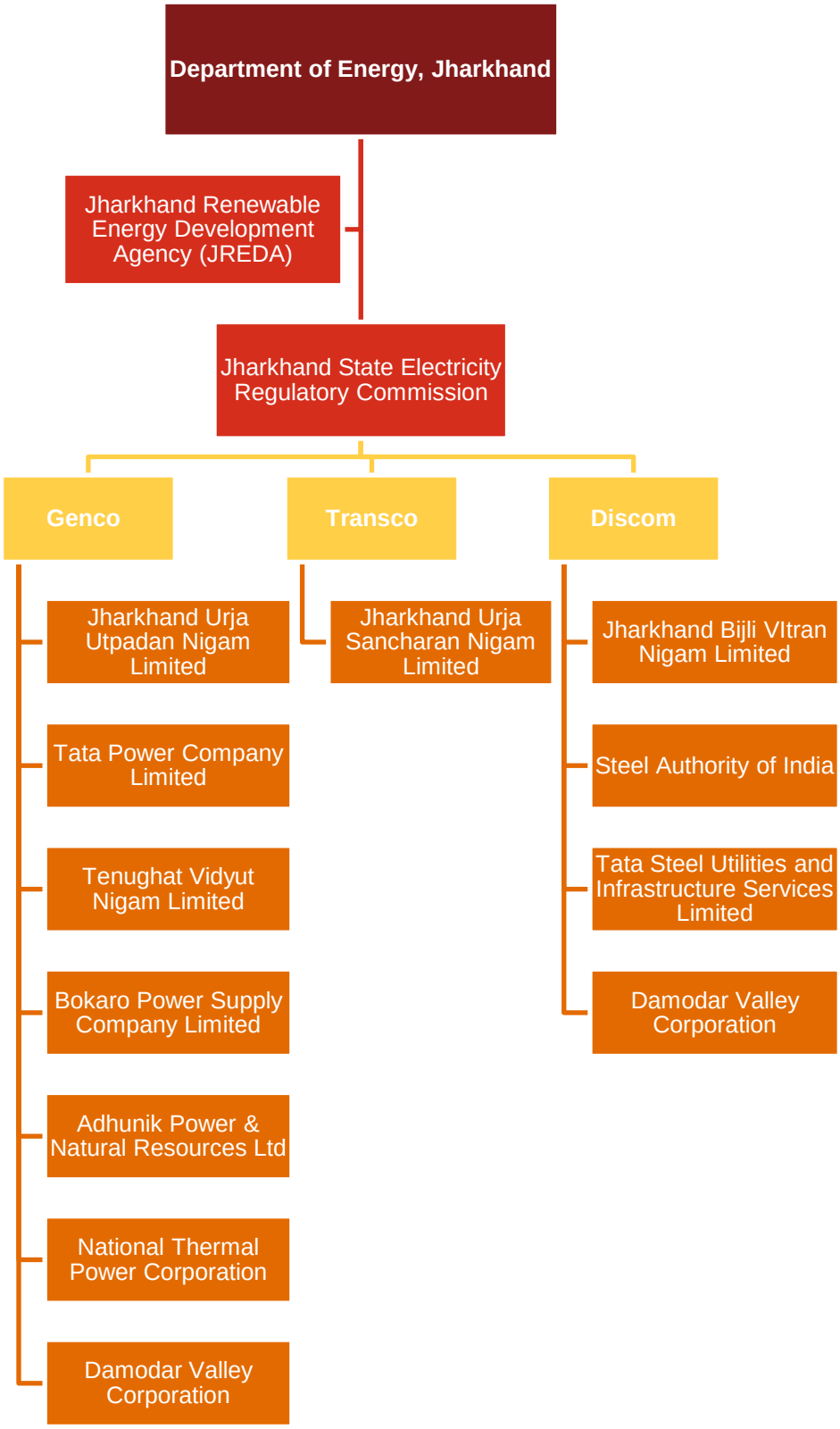

Figure 15: Overview of institutional framework of energy in Jharkhand

2. Identification of focus sectors

2.1 Methodology of Focus Sector Identification

Out of the total final energy consumption, the industry sector accounted for 73% of consumption with buildings sector accounting for 6% and transport sector accounting for 17%. The four focus sectors selected for Jharkhand are industry, buildings, transport and agriculture. Agriculture sector has been selected due to high potential with transition towards solar and ending diesel use in the sector.

Jharkhand's industrial sector is the largest consumer of energy in the state, accounting for approximately 73% of total energy consumption. The sector is also a significant contributor to greenhouse gas emissions, making it an important target for energy efficiency measures. There is a significant potential for energy efficiency improvements in the industrial sector. The buildings sector has enormous potential for energy efficiency improvements, which can result in significant energy savings, cost savings, and environmental benefits. In Jharkhand, the buildings sector consumed 6% of final energy consumption in 2019-20. The transport sector is another significant contributor to Jharkhand's energy consumption and consumed 17% of final energy consumption in 2019-20.

2.2 Identified Focus Sectors

Industry Sector

The industrial sector of Jharkhand consumed 60% of electricity consumption and 73% of final energy consumption (including coal, oil and gas) in 2019-20. Jharkhand, located in eastern India, is known for its rich mineral resources and is home to a variety of industries. The state has a diverse industrial base, with industries ranging from steel to information technology. Jharkhand is also one of the fastest-growing states in India, with a large pool of skilled labour and a favourable investment climate. The state's main industries are steel, power, mining, and agriculture. Jharkhand is one of the largest producers of steel in the country, and is home to major steel plants such as Tata Steel, Bokaro Steel Plant, and SAIL. These plants employ thousands of people and contribute significantly to the state's economy. The state is also a major producer of coal, which is used to generate power in thermal power plants. Jharkhand is home to the largest thermal power plant in the country, the Tenughat Thermal Power Station. The natural resources, policy incentives and location-specific advantages of Jharkhand support investments in sectors such as mining and metal extraction, engineering, iron and steel, and chemicals. Jharkhand is rich in mineral resources such as coal (27.3% of India's reserves), iron ore (26% of India's reserves), copper ore (18.5% of India's reserves), uranium, mica, bauxite, granite, limestone, silver, graphite, magnetite and dolomite. Since Jharkhand has around 40% of the country's mineral wealth, its extensive mineral resources make mining, metals, and related sectors especially lucrative for investments. Jharkhand is the only state in India to produce coking coal, uranium, and pyrite. Jharkhand accounts for 20-25% of the total steel produced in the country.

Buildings sector

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

Transport sector

Jharkhand has a well-developed transport sector that plays a vital role in connecting its people, businesses, and industries with the rest of the country. Road transportation is the dominant mode of transport in Jharkhand, with the state having a vast network of roads connecting its cities and towns. The National Highways passing through the state include NH-2, NH-6, NH-23, NH-33, NH-75, and NH-78. In addition, the state government has been working on improving its road infrastructure by constructing new highways, bridges, and flyovers. The Ranchi-Jamshedpur expressway, for instance, will significantly reduce travel time between the two cities and is expected to boost economic growth in the region. The state also has a well-developed rail network, with several major railway stations, including Ranchi, Dhanbad, Bokaro, and Jamshedpur. These stations are connected to major cities across the country, such as Delhi, Kolkata, Mumbai, and Chennai. Jharkhand is also home to the Chakradharpur Division of the South-eastern Railway, which is one of the largest divisions in India..

Agriculture sector

The agriculture sector is an essential component of the economy of Jharkhand, a state located in the eastern region of India. The state is predominantly rural, and agriculture is the main source of livelihood for a significant portion of the population. The agriculture sector in Jharkhand comprises both crops and livestock, and it plays a vital role in providing food and income to the people. The climate and topography of Jharkhand are conducive to the cultivation of a variety of crops. The state's fertile soil, moderate climate, and abundant rainfall make it ideal for growing rice, wheat, maize, pulses, and oilseeds. The state is also known for its fruit production, with mangoes, litchis, bananas, and papayas being the most commonly grown fruits.

3. Projections and forecasting (methodology)

Historic GSDP figures have been considered from 2014-15 to 2019-20 from RBI Handbook of Statistics. Gross State Domestic Product has been forecasted till 2030 using 80% weightage to historic trend of 5.1% and 20% weightage to the forecast of 8.8% as per Jharkhand Economic Survey 2020-21. The figure below shows the historic and forecasted trends of GSDP for Jharkhand.

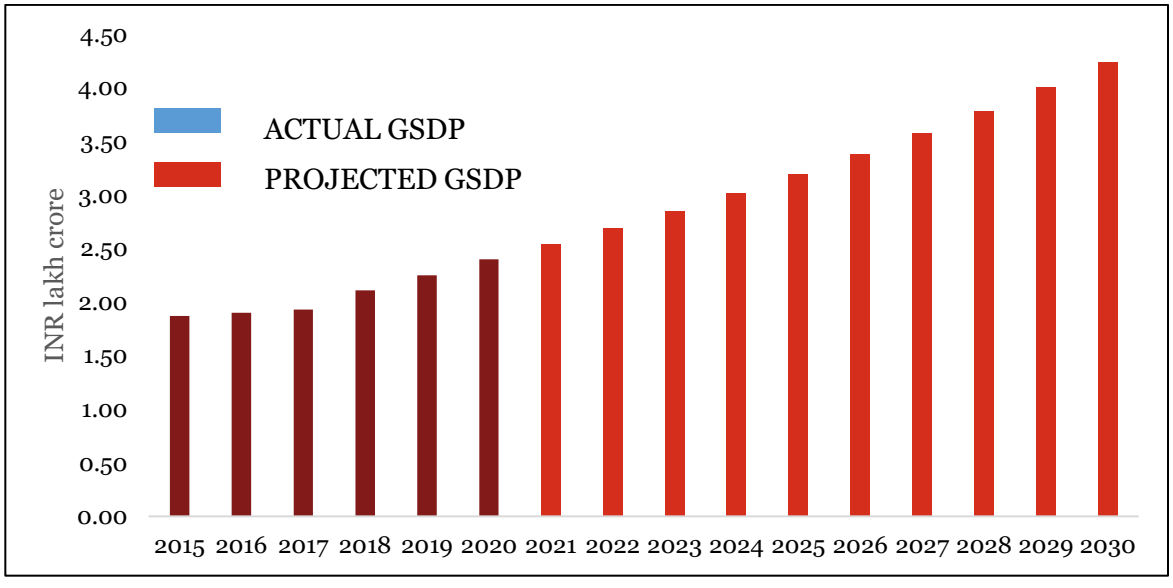

Figure 16: GSDP forecasting for Jharkhand

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

Average Energy Intensity is the average of 5 years of energy intensity of GDP, calculated by dividing final energy consumption by GSDP. Final Energy Consumption is in Mtoe and GSDP in INR lakh crore. After taking average energy intensity of GDP from 2014-15 to 2019-20, the average energy intensity is calculated to be **7.62.** This is multiplied with each value of the forecasted GSDP to obtain the forecasted final energy consumption till 2030.

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

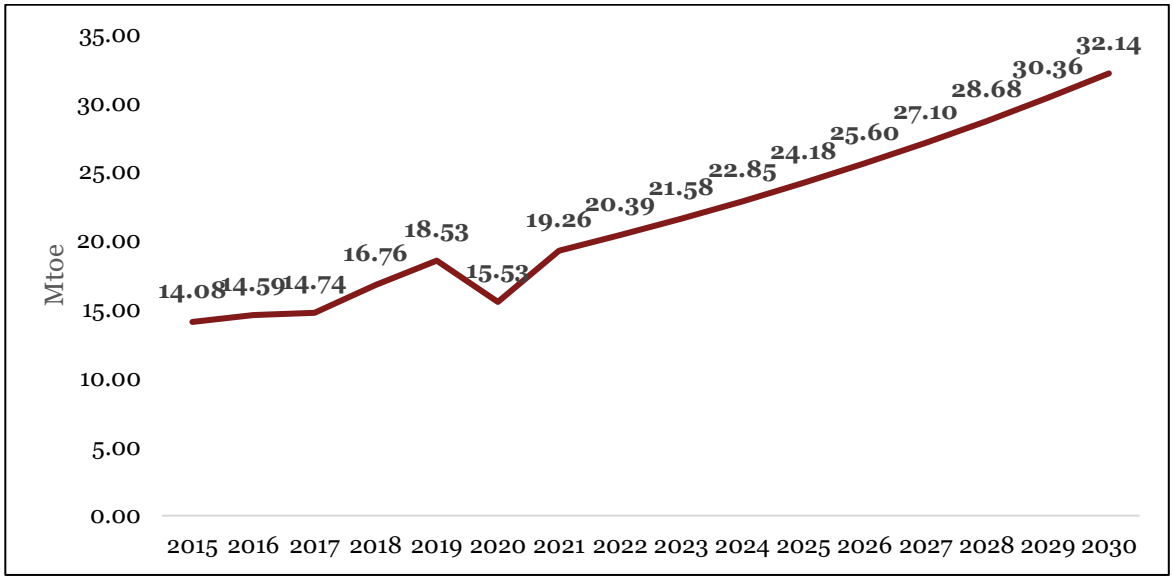

Figure 17: Forecast of final energy consumption for state of Jharkhand

The figure above shows the forecasted values of final energy consumption. It is observed that there is a spike in 2019 and dip in 2020 due to impact of Covid.

4. Focus Sector 1 - Industry

4.1 Current Scenario

The industrial sector of Jharkhand consumed 60% of electricity consumption and 73% of final energy consumption (including coal, oil and gas) in 2019-20.

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

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

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

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

Jharkhand has 27 designated consumers (DC) and they are given below in the table.

Table 10: Designated consumers under BEE-PAT scheme for Jharkhand

S.No.	Name of DC	Sector
1	Hindalco Industries Limited	Aluminum
2	ACC Limited Chaibasa	Cement
3	Aditya Birla Chemicals India Limited	Chlor Alkali
4	SAIL Bokaro Steel Plant	Iron and Steel
5	Tata Steel Limited	Iron and Steel
6	Usha Martin Limited	Iron and Steel
7	Bokaro Thermal Power	Thermal Power

8	Chandrapura Thermal Power	Thermal Power
9	Jojobera Power Plant	Thermal Power
10	Patratu Thermal Power Station	Thermal Power
11	Tenughat Thermal Power Station	Thermal Power
12	Maithon Right Bank Thermal	Thermal Power
13	Koderma Thermal Power Station	Thermal Power
14	Jharkhand Bijli Vitran Nigam Limited	DISCOM
15	Jojobera Cement Plant Nuvoco	Cement
16	Dalmia Cement East Limited	Cement
17	Adhunik Power and Natural	Thermal Power
18	Aloke Steel Industries	Iron and Steel
19	Atibir Industries	Iron and Steel
20	Jharkhand Ispat Private Limited	Iron and Steel
21	Nilachal Iron and Power	Iron and Steel
22	Sai Sponge India	Iron and Steel
23	ACC Limited Sindri	Cement
24	Tata Steel Utilities and Infrastructure Limited	Iron and Steel
25	Bharmaputra Metallics Limited	Iron and Steel
26	Shivam Iron & Steel Company Ltd	Iron and Steel
27	ESL Steel Limited	Iron and Steel

2. BEE SME Programme:

The BEE SME Programme has been initiated to carry out energy efficiency-specific activities in the SME sector in India including conducting an extensive study for specific sectors as well as generating energy-related data for the SME sector which is believed to be highly unorganised and fragmented. As part of this programme, 25 clusters

have been selected from 35 clusters across the country where the adoption of energy efficiency practices will be undertaken through several steps like capacity building, development of financing mechanisms and knowledge sharing. In addition to the above national schemes, there are some state-level schemes and initiatives as well that are targeted to promote energy efficiency in the industrial sector. These are elaborated below:

- Jharkhand Industrial and Investment Promotion Policy 2021 : As part of this policy, a reimbursement up to 75% of the cost, subject to a limit of Rs. 3 lakhs of Energy and Water Audit conducted by the units shall be made to the eligible units.

4.2 Energy Efficiency Strategies in the industry sector

Deepening and Widening of PAT scheme

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

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

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

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

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

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

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

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

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

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

Energy efficiency interventions in SME sector

1. Awareness on Energy conservations in brick, refractory and coke oven clusters

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

2. Periodic standardized energy audits for MSMEs on load basis and reimbursement of energy audit cost to include key units such as petrol pumps, goods carriers, restaurants, mining activity, brick units

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

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

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

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

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

5. Technical and financial assistance for transition from Bull Trench Kiln to Zig-Zag Kilns, tunnel kiln in refractory and coke dry quenching in coke oven units

Transitioning from bull trench kiln to zig zag kiln, tunnel kiln in refractory and coke dry quenching in coke oven units can significantly improve energy efficiency and reduce carbon emissions. It is important to provide technical and financial assistance for this transition and conduct feasibility studies. Incentives should be offered, and awareness promoted through workshops and seminars. Overall, providing technical and financial assistance for the transition from bull trench kiln to zig zag kiln, tunnel kiln in refractory and coke dry quenching in coke oven units can help businesses improve energy efficiency, reduce carbon emissions, and achieve sustainable growth. By providing technical assistance, conducting feasibility studies, providing financing, offering incentives, and promoting awareness, stakeholders can work together to create a more sustainable future for these industries.

6. Encouragement of biomass blending in coal-fired brick kilns by strengthening the supply chain

Encouraging biomass blending in coal-fired brick kilns can significantly reduce greenhouse gas emissions and promote sustainable growth in the brick industry. It is important to provide technical assistance to help brick kiln owners understand the benefits of biomass blending and the technical requirements for blending biomass with coal. This could include training on biomass handling and combustion, as well as providing technical support during the blending process. Incentives should be offered and conduct feasibility studies to assess the technical and economic viability of biomass blending in coal-fired brick kilns. Overall, encouraging biomass blending in coal-fired brick kilns can help reduce greenhouse gas emissions, promote sustainable growth, and improve air quality in brick-producing regions. By providing technical assistance, conducting feasibility studies, providing financing,

offering incentives, and promoting awareness, stakeholders can work together to create a more sustainable future for the brick industry.

7. **ISO 50001 implementation in Jharkhand**

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

4.3 Energy Saving Targets & Monitoring Mechanism

1. Deepening and Widening of PAT Scheme

Particulars	Details
Action Plan 1	Deepening and Widening of PAT Scheme
Scope Boundary	Existing cement & sponge iron units currently not in PAT scheme to be brought under PAT by lowering threshold and existing coal mining units to be added in PAT scheme as a new sector
Implementing Agency	Bureau of Energy Efficiency (BEE); JREDA
Current Policy in place	Perform, Achieve & Trade (PAT)
Modification required	1. Lowering of threshold for Cement, Sponge Iron 2. Inclusion of Coal Mining sector in PAT.
Methodology Adopted	1. It is assumed that all the existing units will achieve the moderate SEC target in 50% units and achieve ambitious SEC target in 70% units. 2. It is assumed that moderate SEC target will be achieved in 50% units and ambitious SEC target in 70% units.
Implementation Period	Till FY 2030

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

In widening of PAT scheme, the coal mining sector is considered. It is recommended that coal mining sector be included in PAT scheme. For this, a moderate and ambitious SEC target has been assigned and assumption is that 50% units will achieve moderate SEC target in moderate scenario and 70% units will achieve ambitious SEC target in ambitious scenario. The specific energy consumption (SEC) assumes for Action Plan 1 has been shown below.

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

Sector	Baseline SEC (toe/tonne)	Moderate SEC (toe/tonne)	Ambitious SEC (toe/tonne)	Production in 2030 (tonnes)	Energy saving in moderate scenario (toe)	Energy saving in ambitious scenario (toe)
Cement	0.0716	0.0708	0.0676	938103	**375**	**2626**
Sponge iron	0.514	0.447	0.380	1400533	**46,987**	**131,566**
Coal Mining	113.27 tonne/million tonnes	101.94 tonne/Million tonnes	90.62 tonne/Million tonnes	215.6	**549.7**	**1539.3**

As seen in the table above, the sector-wise SEC targets are given, and these are used to estimate energy savings.[21]

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

In widening of PAT scheme, the 2030 coal production of India is used and energy consumption is calculated for 2030 under three scenarios: BAU, moderate and ambitious. In moderate scenario, 50% coal production uses the moderate SEC target and in ambitious scenario, 70% coal production uses the ambitious SEC target. The difference between BAU energy consumption and moderate energy consumption gives energy savings in moderate scenario and the difference between BAU energy consumption and ambitious energy consumption gives energy savings in ambitious scenario.

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

21 SEC for cement and sponge iron taken from BEE/GIZ reports in secondary domain and PAT notification in Gazette. For coal mining SEC, Coal Controller source is used

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

Action Plan	Energy Savings in 2030 under moderate scenario (Mtoe)	Energy Savings in 2030 under ambitious scenario (Mtoe)
Deepening and Widening of PAT scheme	0.04	0.13

2. Energy Efficiency Intervention in Bricks, Refractory and Coke Oven clusters

Particulars	Details
Action Plan 2	Energy Efficiency Intervention in Bricks, Refractory and Coke Oven clusters
Scope Boundary	Brick, refractory and coke oven clusters of the state
Implementing Agency	Bureau of Energy Efficiency (BEE); JREDA
Methodology Adopted	Moderate Scenario: 50% penetration of zig zag technology in brick kilns; 50% penetration of tunnel kiln in refractory and 50% penetration of coke dry quenching in coke oven units Ambitious Scenario: 70% penetration of zig zag technology in brick kilns; 70% penetration of tunnel kiln in refractory and 70% penetration of coke dry quenching in coke oven units (200 brick kiln units, 100 coke oven units, 144 refractory units)
Modification required	Penetration of energy efficient technologies
Implementation Period	Till FY2030

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

Table 13: SEC assumptions for SME sector

Sector	Baseline SEC (toe/tonne)	Moderate SEC (toe/tonne)	Ambitious SEC (toe/tonne)	Production in 2030 (tonnes)	Energy saving in moderate scenario (toe)	Energy saving in ambitious scenario (toe)
Bricks	0.04	0.036	0.032	6293371	12586.7	35242.9
Refractory	0.21	0.13	0.06	171731	6341.1	17755.3

Coke oven	0.22	0.20	0.19	1086253	5974.4	16728.3

As seen above, the sector-wise SEC targets are given, and these are used to estimate energy savings. [22]

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

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

Action Plan	Energy Savings in 2030 under moderate scenario (Mtoe)	Energy Savings in 2030 under ambitious scenario (Mtoe)
Energy efficiency in SME sector	0.02	0.06

Monitoring Mechanism

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

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

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

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

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

22 SEC for brick, refractory, coke oven taken from BEE SAMEEKSHA portal reports in secondary domain

5. Focus Sector 2 - Buildings

5.1 Current Scenario

The buildings sector of Jharkhand consumed 30% of electricity and 6% of final energy consumption in 2019-20.

1. **Energy Conservation Buildings Standards**

Jharkhand Energy Conservation Building Code 2022 is applicable for buildings with a connected load of 100 kW or more and is intended for commercial buildings while not covering residential buildings. It includes buildings for hospitality, health care, assembly, business, education, shopping complexes and mixed-use buildings. This code sets minimum performance standards for building envelope-like roofs and windows, lighting system, air-conditioning system, electrical distribution system, water heating and pumping.[23]

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

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

3. Ranchi Smart City

Ranchi is one of the 100 smart cities under the Smart City Mission of the Government of India. The focus of this ABD area shall be to create a city with latest state of art infrastructure to create a vibrant economy while addressing the socio-economic needs of residents and Ranchi city as a whole. The solution shall aim at moving people and not vehicles, improving the livability by leveraging ICT. The smart features executed successfully in the ABD area shall be replicated to the rest of the city in phased manner through strategic projects taken up by the Ranchi Smart City Corporation Ltd., the SPV formed to implement Ranchi Smart City Project

4. Other National Level Initiatives

HVAC systems consume significant amount of energy (around 65% consumption of commercial building is from HVAC). In order to effectively manage the energy consumption in cooling, the Ministry of Environment, Forest, and Climate Change (MoEFCC), Government of India has published draft India Cooling Action Plan in September 2018 which provides recommendations to optimize energy consumption for cooling under multiple sectors including buildings. India has also participated in District Energy in Cities Initiative of United Nations Environment Programme (UNEP) which aims to develop modern district energy systems, utilizing renewables, waste heat, thermal storage, power grids, thermal grids and heat pumps, which can provide heating and cooling requirements of buildings across a neighborhood or entire city. Amravati is the 1st city in India which will receive funding for installation a district cooling system under the UNEP initiative. A district cooling system is already operational in Gujarat International Finance Tec-City (GIFT City) since April 2015 and the greenfield smart city Raiya in Gujarat will witness deployment of such a system under India's Smart City Mission.[24]

23 Jharkhand ECBC Code, Department of Energy, Govt. of Jharkhand

24 Smart Cities Council - India, 2017

5.2 Energy Efficiency Strategies in the buildings sector

Replacement program for inefficient appliances

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

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

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

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

be done efficiently and effectively through DSM schemes. This will help to reduce energy consumption, promote sustainability, and benefit the target consumers through energy cost savings.

Effective implementation of Jharkhand ECBC

1. Integrate ECBC in new building approval process

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

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

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

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

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

4. Empanelment of building experts at the state level

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

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

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

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

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

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

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

and technologies that have been identified through the review process. The rates can be revised to reflect the cost of using these materials and technologies, considering any cost savings that may be achieved through energy efficiency. By periodically upgrading the PWD Schedule of Rates for energy-efficient materials and technologies, we can encourage the use of energy-efficient products and technologies in public infrastructure projects.

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

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

Energy audit for commercial and public buildings

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

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

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

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

3. Capacity Building of Architects & Building Professionals and Developers

Capacity building of architects and building professionals for green building and energy conservation building code is crucial for promoting sustainable building practices and achieving energy efficiency goals. The first action is to conduct training programs for architects and building professionals on green building practices and energy conservation building code. This can be done through workshops, seminars, and other outreach programs. A curriculum should be developed which will cover topics such as building design, energy-efficient materials and technologies, energy audits, and building retrofitting. There can be established certification programs for architects and building professionals who have completed the training programs and have demonstrated proficiency in green building practices and energy conservation building code.

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

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

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

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

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

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

5.3 Energy Saving Targets & Monitoring Mechanism

Replacement program for inefficient appliances

Particulars	Details
Action Plan 1	Replacement program for inefficient appliances
Scope Boundary	1. Public buildings 2. Commercial buildings 3. Domestic buildings
Implementing Agency	JREDA, DISCOM, ESCO
Current Policy in Place	• UJALA scheme
Methodology Adopted	In moderate scenario, it is assumed that 40% of appliances will be replaced with efficient appliances. In ambitious scenario, it is assumed 70% appliance replacement with efficient appliance. For LPG cookstove, a 10% switch to electric cookstove in moderate and 20% switch to electric cookstove in ambitious scenario has been taken
Implementation Period	Till FY2030

For buildings sector, the existing stock of inefficient appliances 15 years old is calculated by using total number of households in Jharkhand and multiplying with ownership rates of different appliances. [25] After calculating inefficient stock of appliances 15 years old, moderate scenario assumes 40% replacement with Star-Rated appliances and ambitious scenario assumes 70% replacement with Star-Rated appliances. For LPG cookstove, moderate scenario assumes 10% switch to electric cookstove and 20% switch to electric cookstove in ambitious scenario has been taken.

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

Table 15: Existing stock of inefficient appliances 15 years old

Appliance	Number of Inefficient appliances in FY2020	Energy saving in moderate scenario (toe)	Energy saving in ambitious scenario (toe)
Fan	8,535,825	67,817	135,634
AC	1,327,795	27,172	54,345
Refrigerator	5,026,653	14,177	28,353
Washing Machine	3,509,173	4707	9414
Television	6,259,605	4952	9903
Geyser	2,276,620	5637	11,273
LPG cookstove	8,820,353	25,710	51,420

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

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

Action Plan	Energy Savings in 2030 under moderate scenario (toe)	Energy Savings in 2030 under ambitious scenario (toe)
Replacement program for inefficient appliances	150,171	300,343

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

2. Effective implementation of Jharkhand ECBC 2022

Particulars	Details
Action Plan 2	Effective Implementation of Jharkhand ECBC 2022
Scope Boundary	Upcoming new commercial buildings
Implementing Agency	Bureau of Energy Efficiency; JREDA Urban Development and Housing Department
Current Policy in Place	Jharkhand Energy Conservation Building Code 2022
Methodology Adopted	In moderate scenario, it is assumed ECBC will be implemented in new commercial buildings more than 100 kW connected load and lead to 25% savings. In ambitious scenario, ECBC+ is assumed to be implemented in new commercial buildings more than 100 kW and lead to 35% savings
Implementation Period	Till FY2030

For buildings sector, the electricity consumption in new commercial buildings more than 100kW load is assumed to be 10% of incremental electricity consumption in the commercial buildings sector. Due to Jharkhand ECBC 2022, there are 25% savings in ECBC (now ECSBC) and 35% savings in ECBC+. Thus, the moderate scenario assumes that ECBC will be implemented in new commercial buildings more than 100 kW connected load and lead to 25% savings. In ambitious scenario, ECBC+ is assumed to be implemented in new commercial buildings more than 100 kW and lead to 35% savings. The energy savings potential is shown below in the table.

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

Action Plan	Energy Savings in 2030 under moderate scenario (toe)	Energy Savings in 2030 under ambitious scenario (toe)
Effective implementation of Jharkhand ECBC 2022	5202	7282

3. Energy audits for commercial and public buildings

Particulars	Details
Action Plan 3	Energy audit for commercial and public buildings
Scope Boundary	Commercial and Government Buildings in the state
Implementing Agency	Bureau of Energy Efficiency; JREDA Urban Development and Housing Department
Current Policy in Place	-
Modification Required	Energy audits for 15% of commercial and public buildings in moderate scenario and 30% of commercial and public buildings in ambitious scenario
Methodology Adopted	In moderate scenario, it is assumed 15% buildings will have energy audit and in ambitious scenario, it is assumed 30% of buildings will get energy audit. It is assumed that energy audit recommendations implementation will lead to 30% savings
Implementation Period	Till FY2030

For buildings sector, the moderate scenario assumes 15% of total buildings in commercial and public sector will get energy audit and ambitious scenario assumes that 30% of buildings will get energy audit. Assuming 30% savings, the energy saving potential is calculated and shown in the table below.

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

Action Plan	Energy Savings in 2030 under moderate scenario (toe)	Energy Savings in 2030 under ambitious scenario (toe)
Energy audit in public and commercial buildings	9363	18,727

Monitoring Mechanism

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

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

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

Setting energy-saving targets: Based on the energy-saving opportunities identified, building owners and managers can set specific, measurable, and time-bound targets for reducing energy consumption. Monitoring and measuring progress: Once targets have been set, building owners and managers can

monitor and measure progress towards meeting these targets. This can involve tracking energy consumption and costs over time, analyzing data to identify trends, and comparing actual performance against targets.

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

6. Focus Sector 3 - Transport

6.1 Current Scenario

The transport sector of Jharkhand consumed 17% of final energy consumption in 2019-20. The state has undertaken multiple initiatives in energy efficiency for transport sector:

1. EV charging infrastructure

Jharkhand Electric Vehicle Policy 2022 aims to make Jharkhand an electric vehicle manufacturing hub of India. The target is 10% share of Electric Vehicle in overall new vehicle registration in the State by 2027 (All vehicles: 10%, 2 wheelers: 10%, 3 wheelers: 20%, 4 wheelers: 10%). It also target setting up of at least one public charging station in a 3 km x 3 km grid or minimum of 50 charging stations per million population, whichever is higher and setting up of public charging station on highways at 25 km distance (on both sides of all National highways and major State Highways). Finally, it targets for conversion of 15 years old Government owned/leased vehicles with Electric Vehicle

2. Introduction of electric vehicles in public transport

Ranchi Smart City Corporation Limited (RSCCL) has drawn up two circular routes for the shuttle services initially. Electric buses in Jharkhand have been started in the state and the state targets 150 electric buses. As per Jharkhand Electric Vehicle Policy 2022, the state targets conversion of 15 years old Government owned/leased vehicles with Electric Vehicle.

3. Other initiatives

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

6.2 Energy Efficiency Strategies in the transport sector

Deployment of electric vehicles in state

1. Establishment of regulatory mechanism to develop EV charging infrastructure

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

2. Set up Charging stations based on open-access

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

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

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

4. Pilot projects on Hydrogen Fuel Cell Vehicles

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

Ethanol blending in state

1. Encourage establishing biofuel production plants

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

6.3 Energy Saving Targets & Monitoring Mechanism

1. Deployment of electric vehicles in state

Particulars	Details
Action Plan 1	Deployment of electric vehicles in state
Scope Boundary	Two-wheelers, three-wheelers, four-wheelers, bus and heavy vehicle
Implementing Agency	Department of Transport, DISCOMs, PSUs and private sector
Current Policy in Place	Jharkhand Electric Vehicle Policy 2022
Methodology adopted	As per Jharkhand EV Policy 2022, 10% of two-wheelers, 20% three-wheeler, 10% four-wheeler, 10% bus and 10% HDV to be electric by 2027. This has been considered moderate scenario. For ambitious scenario, 20% of two-wheelers, 40% of three-wheelers and 20% of four-wheeler, bus and HDV to be electric by 2030.
Additional Support Required	Capacity building of stakeholders Private investments
Implementation Period	Till FY2030

For transport sector, total vehicle fleet of Jharkhand by mode type is considered from 2014-15 to 2019-20. [26] The moderate scenario considers Jharkhand Electric Vehicle Policy 2022 and its targets: 10% of two-wheelers, 20% three-wheelers, 10% four-wheeler, 10% bus and 10% HDV in new vehicle registrations be electric by 2027.

The ambitious scenario considers double of this target: 20% of two-wheelers, 40% of three-wheelers and 20% of four-wheeler, bus and HDV new vehicle registrations to be electric by 2030.

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

Table 19: Mileage and annual utilisation for each mode type

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

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

Mileage (litre/km)	0.014	0.025	0.05	0.16	0.33

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

Energy Savings = Fuel Savings – Electricity Consumption in EV

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

Action Plan	Energy Savings in 2030 under moderate scenario (Mtoe)	Energy Savings in 2030 under ambitious scenario (Mtoe)
Deployment of electric vehicles in state	0.3	0.6

2. Ethanol blending in state

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

For transport sector, the ethanol blending target of 20% by 2025 has been considered as per Govt. of India target.[27] Only one scenario has been considered and the savings have been calculated only for petrol consumption where there will be 20% energy savings. The table below shows the energy savings potential**.**

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

Action Plan	Energy Savings in 2030 (Mtoe)
Ethanol Blending	0.1 (as per national policy)

Monitoring Mechanism

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

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

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

Monitoring and measuring progress: Once targets have been set, transport companies can monitor and measure progress towards meeting these targets. This can involve tracking fuel consumption and costs over time, analyzing data to identify trends, and comparing actual performance against targets. Reporting and communicating results: Regular reporting and communication of energy savings results can help to build momentum and engagement within an organization. This can involve sharing results with key stakeholders, such as management, employees, and customers, and celebrating successes

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

along the way. In addition to these steps, it is also important to establish a culture of continuous improvement around energy management. This can involve training and awareness-raising programs, setting up energy teams or champions within an organization, and ensuring that energy-saving initiatives are integrated into wider business strategies. By implementing an energy savings monitoring mechanism and establishing a culture of continuous improvement around energy management, transport companies can make significant progress in reducing energy consumption, lowering costs, and improving sustainability performance. Additionally, these improvements can lead to cost savings, improved air quality, and increased energy security.

7. Focus Sector 4 - Agriculture

7.1 Current Scenario

The agriculture sector of Jharkhand consumed less than 1% of electricity in 2019-20.

1. AgDSM

Agriculture Demand Side Management is being implemented by EESL and the aim is to distribute BEE 5-star energy efficient agricultural pumps and ensures a minimum of 30% reduction in energy consumption with smart control panels which can be remotely operated to enhance the ease of operation of pumps by the farmers. In Jharkhand, the Jharkhand Renewable Energy Development Agency has conducted Energy Audits and preparation of DPRs at four number of Rural Drinking water pumping system sites (Chandil R.W.S.S, Hazari- Khudgadha R.W.S.S, Kapli R.W.S.S and Konbir R.W.S.S Jharkhand) under AgDSM Scheme.

2. PM KUSUM Scheme

The PM-KUSUM Scheme was launched in 2019 with 3 components. Component A aims to set up 10,000 MW of Decentralized Grid Connected Renewable Energy Power Plants on barren land. Component B aims to install 17.50 Lakh stand-alone solar agriculture pumps. Component C aims for solarization of 10 Lakh Grid Connected Agriculture Pumps. Under this Component, individual farmers having grid connected agriculture pump will be supported to solarize pumps. 1649 solar water pumps have been installed in Jharkhand as of 2021.[28]

28 Jharkhand Economic Survey 2020-21

7.2 Energy Efficiency Strategies in the agriculture sector

Replacement of diesel pumps with solar

1. Effective implementation of PM KUSUM Yojana

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

Replacement of inefficient pumps with efficient electric pumps

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

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

7.3 Energy Saving Targets & Monitoring Mechanism

1. Replacement of diesel pumps with solar

Particulars	Details
Action Plan 1	Replacement of diesel pumps with solar
Scope Boundary	Transition from diesel pumps
Implementing Agency	Department of Agriculture
Current Policy in Place	• PM KUSUM Yojana • Jharkhand State Solar Policy 2022
Methodology Adopted	By 2025, 100% replacement of diesel pumps with solar pumps
Implementation Period	Till FY2030

For agriculture sector, the first strategy aims for zero-diesel use in agriculture sector by 2025 and all diesel pumps to be replaced with solar pumps. For this, the number of diesel pumps in 2019-20 has been estimated using government sources such as Ministry of Agriculture Input Survey. The diesel consumption in agriculture pumps has been calculated using 515 litres/year diesel consumption in each pump. Assuming 5 HP pump and 250 days of operation and 2.75 hours/day of use, the energy savings have been calculated and shown below in the table. Only one scenario has been considered since the Ministry of Power has a target for zero diesel use in agriculture by 2025.[29]

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

Action Plan	Energy Savings in 2030 (Mtoe)
Replacement of diesel pumps with solar	0.16 (as per national policy)

2. Replacement of inefficient electric pumps with efficient electric pumps

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

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

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

Action Plan	Energy Savings in 2030 under moderate scenario (toe)	Energy Savings in 2030 under ambitious scenario (toe)
Replacement of inefficient pumps (15 years old) with Star-Rated pumps	3551	5918

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

Monitoring Mechanism

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

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

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

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

Other Action items for non-focus sectors

1. Replacement of inefficient sewerage and water pumps with BEE 5-star rated pumps under all municipal corporations of the state
2. Recommendations to be designed taking into account the Panchayat Extension to Scheduled Areas (PESA) Act, 1996
3. Jharkhand Scrap Policy 2022 and replacement program for transformers and generators to be emphasised as means of achieving energy savings
4. Development of energy efficiency curriculum for school students

8. Investment Potential

The energy savings of 0.85 Mtoe and 1.45 Mtoe are calculated by savings from the four focus sectors. The emission reduction is calculated by multiplying the energy savings with a factor of 3.3 MtCO2/Mtoe. For market investment potential, 1 tonne of oil equivalent is taken as value of INR 18,402 and assuming payback period of 3 years.

Table 24: Market potential calculation for Jharkhand

Sector	**Emissions Reduction (MtCO2) - FY2031**		**Energy Consumption Reduction (Mtoe) - FY2031**		**Investment Potential (INR Crores)**
	Moderate	**Ambitious**	**Moderate**	**Ambitious**	
	MtCO2 reduction	MtCO2 reduction	Mtoe Reduction	Mtoe Reduction	
Industry	0.23	0.64	0.07	0.21	378.1
Buildings	0.52	1.02	0.16	0.33	600.6
Transport	1.37	2.33	0.44	0.74	1369.9
Agriculture	0.53	0.54	0.17	0.17	317.4
Total	**2.65**	**4.53**	**0.85**	**1.45**	**2665.9**

9. Way Forward

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

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

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

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

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

10. References

References provided in footnote

11. Annexure

Table 25: Weightage Matrix for Gross State Value Added

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

Table 26: Fuel Calorific Values

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

Table 27: Units of Conversion

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

Table 28: Emission Factors

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

Table 29 : List of primary and secondary sources

Primary Source	Secondary Source
Department of Agriculture, Animal Husbandry & Co-operative, Jharkhand	Central Electricity Authority
Department of Transport, Jharkhand	Jharkhand Economic Survey
Department of Energy, Jharkhand	Ministry of Statistics and Programme Implementation
Department of Industries, Jharkhand	*Jharkhand Renewable Energy Development Agency*
Jharkhand Bijli Vitran Nigam Limited	Ministry of Road Transport and Highways
MSME Development Institute Ranchi	Bureau of Energy Efficiency
Jharkhand State Housing Board	Energy Efficiency Services Limited

Housing and Urban Development Corporation Limited	NITI Aayog (Energy Dashboard)
Urban Development and Housing Department, Jharkhand	Ministry of Micro, Small and Medium Enterprises
Jharkhand State Building Construction Corporation Limited	Ministry of Steel
Building Construction Department	Ministry of Power
Municipal Corporations (ULB)	Ministry of New and Renewable Energy
Damodar Valley Corporation	India Brand Equity Foundation
Steel Authority of India (SAIL)	World Bank/ Asian Development Bank
Directorate of Municipal Administration (DMA)	Indian Bureau of Mines, Ministry of Mines

Table 30 : List of stakeholders

Stakeholder
Department of Agriculture, Animal Husbandry & Co-operative, Jharkhand
Department of Transport, Jharkhand
Department of Energy, Jharkhand
Department of Industries, Jharkhand
Jharkhand Bijli Vitran Nigam Limited
MSME Development Institute Ranchi
Jharkhand State Housing Board
Housing and Urban Development Corporation Limited
Urban Development and Housing Department, Jharkhand
Jharkhand State Building Construction Corporation Limited
Building Construction Department
Municipal Corporations (ULB)
Damodar Valley Corporation
Steel Authority of India (SAIL)
Directorate of Municipal Administration (DMA)