Bureau of Energy Efficiency
Government of India, Ministry of Power

STATE ENERGY EFFICIENCY ACTION PLAN

GOA

Prepared by
Confederation of Indian Industry

Supported by
Goa Electricity Department

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सत्यमेव जयते

Azadi Ka Amrit Mahotsav

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(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)

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PREFACE

The Bureau of Energy Efficiency (BEE) has been involved in numerous efforts aimed at developing and implementing energy efficiency programmes. As part of this initiative, BEE has proposed the above assignment, which aims to provide technical assistance for the identification of focus sectors for the “State Energy Efficiency Action Plan” in various states/UTs, to ensure that resources are allocated in accordance with state/UT requirements, and to estimate the potential of energy conservation in sectors that are prevalent in the region. The “State Energy Efficiency Action Plan” is sought in two parts: a 5-year short-term strategy and a long-term plan aimed at high-impact energy efficiency by FY 2030.

All states/UTs are grouped into six zones for this assignment: North-East, East, North-1, North-2, West, and South. In this context, the Bureau of Energy Efficiency (BEE), with the assistance of the Confederation of Indian Industry (CII), was involved in identifying major energy guzzling sectors in the West and South Zones, as well as reviewing all existing policies related to energy conservation, which will be presented in the form of this report "State Energy Efficiency Action Plan."

Policymakers, planners, domain consultants, and other important stakeholders would benefit from the State Energy Efficiency Action Plan. The report will also allow knowledge exchange among stakeholders and, in the long run, will help to scale up energy-efficiency programmes in their respective states.

ACKNOWLEDGEMENT

The Confederation of Indian Industry (CII) would like to express its sincere thanks to the Bureau of Energy Efficiency (BEE), Ministry of Power, Govt. of India for their role in guiding and steering this prominent assignment “State Energy Efficiency Action Plan” for Goa.

CII is grateful to Shri Srikant Nagulapalli, Director General, BEE, and Shri Milind Deore, Secretary, BEE, for their overall guidance and encouragement for the successful completion of this project.

We are also thankful to Shri Abhishek Sharma, Joint Director and Shri Vikash Kumar Jha, Project Engineer with whom the team regularly consulted during the project for assistance, feedback, and valuable input.

CII is grateful to the proactive management of Goa Energy Development Agency (GEDA), Goa Electricity Department for its role in guiding and steering tasks of this prestigious assignment. We would like to thank Shri. Mayur Hede, Superintendent Engineer, Shri Rajeev Naik, Executive Engineer, Paresh Sawaikar, Electricity Department Goa for their support in coordination throughout the study. We would also like to thank PAT Cell, ECBC cell, and Goa for their continuous support during the project.

CII team is also grateful to all the stakeholders, for showing keen interest and providing their wholehearted cooperation throughout the study.

EXECUTIVE SUMMARY

India's rapid economic expansion and urbanization have paved the way for a huge increase in energy demand. As the nation continues to evolve and urban areas expand, the need for energy to power industries, transportation, and households has grown steadily. This burgeoning demand poses a complex challenge, as it requires a delicate balance between providing access to affordable and reliable energy for all while addressing environmental sustainability and energy security. In response to these challenges, India, in its updated Nationally Determined Contribution submitted during the 26th session of the Conference of the Parties (COP26) to the United Nations Framework Convention on Climate Change (UNFCCC) in Glasgow, United Kingdom in 2021, unveiled a strategic framework for climate action. This framework, symbolized by the "Panchamrit" (five nectar) elements, signifies India's resolute commitment to achieve net-zero emissions by 2070 and secure 50% of its energy from renewable sources by 2030.

It is imperative to recognize the pivotal role that States and Union Territories (UTs) play in effecting a transition to low-carbon development pathways. To facilitate this vital transition, the Bureau of Energy Efficiency, operating under the aegis of the Ministry of Power, Government of India, has embarked on the development of State Energy Efficiency Action Plan (SEEAP). These plans are tailored to meet the distinctive requirements of each state, ensuring that resource allocation aligns with the state's sustainable development objectives. The SEEAP project aims to contribute to India's national targets and provide a comprehensive roadmap for enhancing energy efficiency across the state and the country.

For Goa, SEEAP was developed by the Confederation of Indian Industry (CII), under the guidelines of Bureau of Energy Efficiency, Ministry of Power, GOI, in consultation with the State Designated Agency viz. Goa Energy Development Agency (GEDA), with inputs & suggestions from various government departments and sector experts. The primary objective of the State Energy Efficiency Action Plan for Goa is to formulate sector-specific strategies in short-term 2025 and long-term 2030 goals for enhancing energy efficiency in the state.

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1 INTRODUCTION

1.1 Background

India is a diverse country with diverse energy consumption patterns in different states/UTs. Broadly, energy consumption is divided in six major sectors i.e., **Buildings, Transportation, Municipalities, DISCOMs, Agriculture and Industries**. A need for a focused sector-based energy efficiency approach by states/UTs has been felt. For instance, there may be states with less 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.

Similarly, Industry sector has 53% of total primary energy demand in India, and more than 30% in most States, however, the level of energy efficiency initiatives and programmes is not commensurate with the energy consumption in this sector. Most states are yet to set Energy saving potential for industry, apart from targets set for the PAT programme. Most states focus primarily on energy conservation for PAT Designated Consumers (DC) and monitor DCs for energy audits and compliance with specific energy consumption (SEC) targets. Only a few states have mandated energy audits for specific categories of industry other than PAT DCs and provision to provide financial incentives for implementing energy efficiency in industrial units.

In the transport sector, there is a need to include and promote energy efficient public transport besides policy level intervention for efficient or clean fuel vehicles. Several states have come forward with a state level incentivisation for Electric Vehicles. Policy and framework for electric vehicles at the state level needs further focus. Though energy efficiency is a multi-dimensional subject, defining key focus areas to bridge gaps is the need of the hour. While some states may have the potential to improve efficiency in a particular sector, there may be gaps in terms of identification of these sectors.

If, for instance, a state with many MSME industrial units may focus on energy efficiency in the industrial sector alone, a large potential of achieving energy efficiency may be unearthed. This may involve activities and resource mobilization to create awareness in industry, replacement of appliances and machinery with the help of ESCOs, setting up and utilization of Revolving Investment Fund, besides other.

1.2 India’s Nationally Determined Contributions (NDCs)

The ambitious NDC from India makes a substantial contribution to fulfilling the objectives of the Paris Agreement. Efforts to reduce carbon emissions and preserve the environment are the foundation of all of India's major economic sectors. India reiterates its support for the Paris Agreement on Climate Change and the UNFCCC. India submitted its Intended Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) on October 2, 2015, in accordance with resolution 1/CP.20. India’s existing NDC is a step forward towards long term goal of reaching net-zero by 2070.

Accordingly, India has updated its first NDC submitted earlier on October 2, 2015, for the period up to 2030, in conformity with the a fore mentioned provision of the Paris Agreement read with pertinent decisions, as follows:

- "India will put forward and propagate a healthy and sustainable way of living based on its traditions and the values of conservation and moderation, including through a mass movement for LIFE, as a key to combating climate change." Energy used, water saved, single use plastic reduced, sustainable food system adopted, waste reduced, healthy lifestyle adopted, and E-waste reduced, are the 7 actions fall under the Mission Life 2022-23[1].
- To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.
- To reduce Emissions Intensity of its GDP by 45[2] percent by 2030, from 2005 level.
- To achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030, with the help of transfer of technology and low-cost international finance including from Green Climate Fund (GCF).
- To create an additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent through additional forest and tree cover by 2030.
- To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health, and disaster management.
- To mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap.
- To build capacities, create domestic framework and international architecture for quick diffusion of cutting-edge climate technology in India and for joint collaborative R&D for such future technologies.

1.3 About State Energy Efficiency Action Plan

This assignment aims to provide technical assistance for the identification of focus sectors for the **State Energy Efficiency Action Plan for Goa** state to ensure that the allocation of resources is as per the requirement of state and estimate the potential of energy conservation in sectors which are predominant in the region. The State Energy Efficiency Action Plan is sought in two parts, a short term-plan for a tenure of 5 years and a long-term plan targeting high impact energy efficiency by the year 2030.

The above said objective will be achieved by completion of four tasks as given below.

[1] https://www.niti.gov.in/sites/default/files/2022-10/Brochure-10-pages-op-2-print-file-20102022.pdf

[2] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1987752#:~:text=In%20August%202022%2C%20India%20updated,enhanced%20to%2050%25%20by%202030.

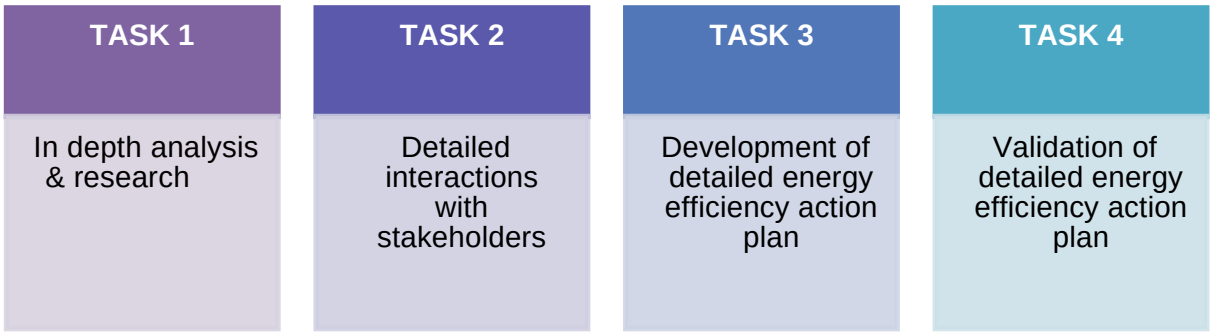


Figure 1 Key tasks in state energy action plan

Outcome

Task wise outcome of the study is as detailed in Figure 2.

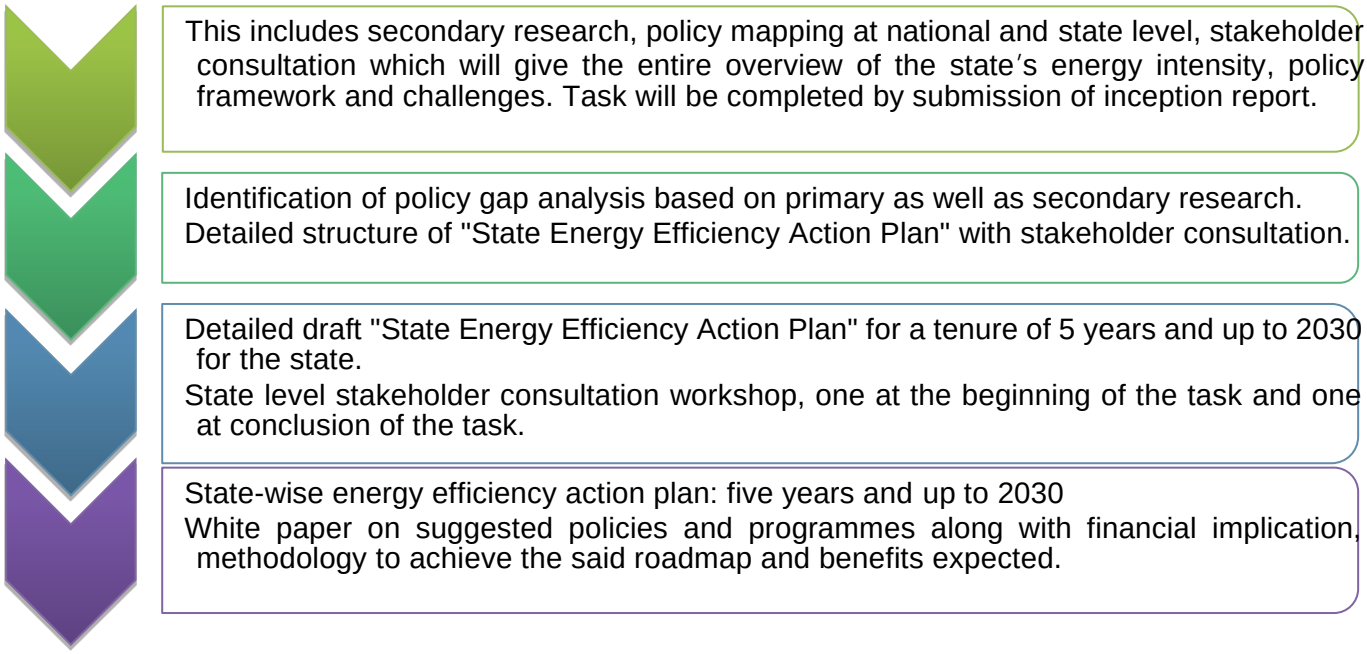


Figure 2 Task wise expected outcome of the study

Energy efficiency drivers for state

Goa which ranked 4th in the BEE state energy efficiency Index 2021-22 in group worked on various areas to upscale energy efficiency. Goa has done particularly well according to the index in the transport sector through its electric mobility policy. The above intervention is driven by key drivers.

- Cost reduction
- Advancement in Technology
- Customer stakeholders pull
- Sustainability factor
- New Investment opportunities
- Policy Push

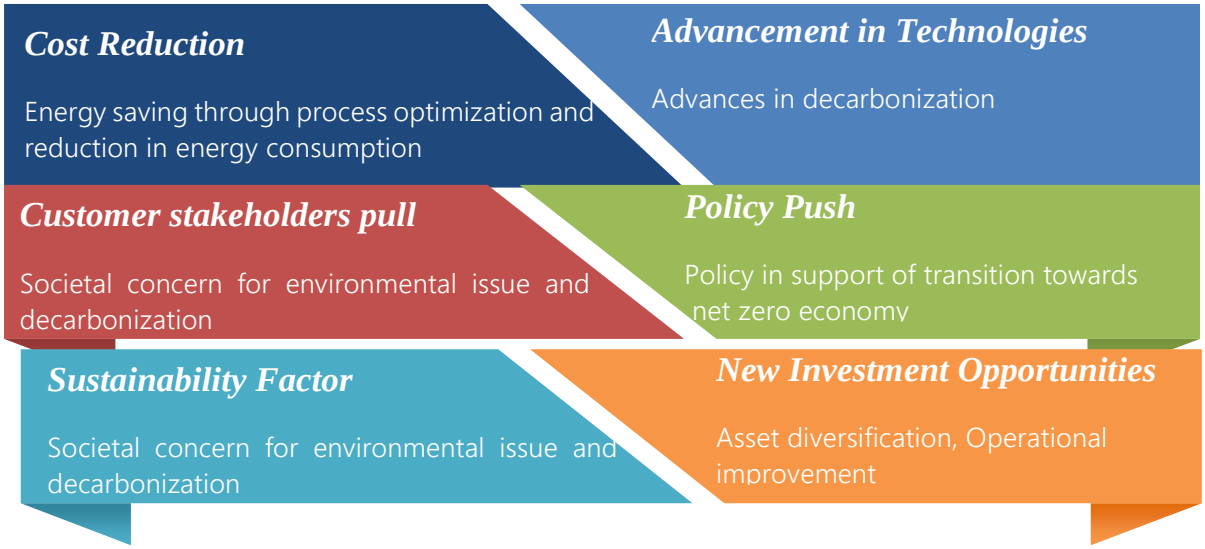
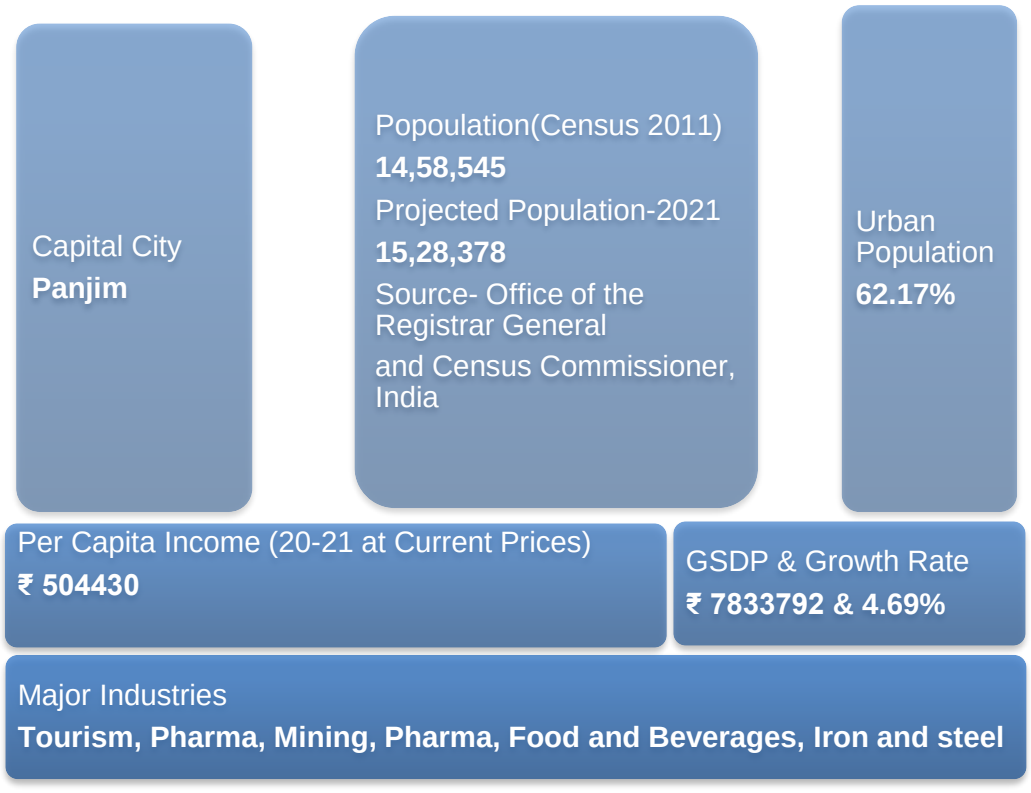


Figure 3 Energy efficiency drivers of the state

1.4 Goa State Profile



Goa is located in the western region of India. The state shares its border with the Arabian Sea to the west, Maharashtra to the north and Karnataka to the south and the east.

Goa's administrative headquarters are located at Panaji (the state capital) and Margao. The state has two districts: North Goa and South Goa. Goa has a tropical climate, with a monsoon lasting from June to September. Due to its long coastline, the weather is hot and humid for the rest of the year. The state is also well-connected through rail and road routes and offers a coastline of ~106 Km and 255 Km of inland waterways.

The state is traditionally known as a tourist paradise, but it also has a robust presence in agriculture and fisheries as well as mining (iron ore and manganese). Goa has 46,277 number of micro industries, 1,373 numbers of small and 127 numbers of medium industries as per Ministry of Micro small and medium enterprises (MSME dashboard)[3]. The industries includes pharmaceuticals, biotechnology, chemical, Iron and steel, Food and Beverages, Foundry, Glass etc.

The state is richly endowed with minerals such as iron ore, manganese, ferromanganese, bauxite, and silica sand. It has about 23 industrial estates established by Goa Industrial Development Corporation[4]. This opens the doors for many new business opportunities in

[3] https://dashboard.msme.gov.in/udyam_dist_wise.aspx?stid=30

[4] https://www.infomerics.com/admin/uploads/pr-goa-industrial-development-07jan22.pdf

Goa. The state offers a low crime rate and strong infrastructure, including seven formally approved and three notified special economic zones.

1.5 Current Energy Scenario of Goa

Energy is one of the major inputs for the economic development of any country. Energy, today, is considered crucial to achieve India's development ambitions, to support an expanding economy, to bring electricity to rural areas, to fuel the demand for greater mobility and to develop the infrastructure needed to meet the demands of what is soon expected to be the world's most populous country.

Energy consumption is directly linked to the advancement of manpower with an ever-increasing population, increase in humanity's living standards, and the industrialisation of developing countries. However, rising energy consumption has resulted in increased greenhouse gas emissions and has sparked severe environmental worries.

As an emerging economy, Goa has a huge opportunity to meet its development goals in minimal energy consumption.

Energy efficiency will be critical in choosing the best energy portfolio for Goa.

Clean energy system deployment is gaining traction in Goa as a result of policy initiatives. Adopting an energy-efficient lifestyle, on the other hand, is one of the most cost-effective options accessible.

Energy efficiency is gradually becoming a critical element of India's energy transformation strategy. Implementing comprehensive energy efficiency initiatives results in reduced air pollution, decarbonization, improved energy access, better resource utilisation, and increased energy security.

If energy efficiency measures are implemented, the transition to renewable energy will be speedier and less expensive.

As part of the Paris Agreement, India pledged to reduce its energy intensity (the amount of energy used per unit of GDP) by 45 percent by 2030 compared to 2005 levels. The Bureau of Energy Efficiency (BEE) has implemented numerous energy efficiency schemes, such as the National Mission for Enhanced Energy Efficiency (NMEEE), Demand Side Management (DSM), Energy Conservation Building Code (ECBC), and others, with positive outcomes.

In the following section, we will glance at Goa's energy scenario.

The Electricity Department was formed in January 1963 under the Government of Goa. It is the only licensee operating in the State of Goa for transmission and distribution of Electrical Energy. The Electricity Department of Goa does not have its own generation. Most of the power requirement for the State of Goa is met through its share from Central Power Stations of NTPC Ltd as allocated by the Central Government.

Allocated Capacity

The Electricity Department holds the sole license in Goa for transmitting and distributing electrical energy. The Department purchases power from the Central Sector Power Stations. In the fiscal year 2019-20, Goa procured power from NTPC with a capacity of 596.14MW.

Table 1 Purchase power scenario FY 2019-20

Power purchase 2019-20	Energy received by licensee (MU)
NTPC	**3,533.71**
NPIL	**232.4**
Banking of power	**8**
Short term power purchase/sale	**151.24**
State generation	
CO-gen	**169.50**
Vedanta Plant-1	94.96
Vedanta Plant-2	69.43
Goa Sponge and private limited	5.11
RPO Obligation	**415.14**
Non Solar (SECI+STOA)	227.23
NVVNL Solar	12.27
Solar STOA	128.09
SECI Solar	46.37
Hindustan waste treatment plant Goa	1.17
UI (Net Over-drawl)	**-20.01**
Total	4,489.98

The power purchased from NTPC, contributed to 78% followed by 9% contribution by RPO obligation, 5% by NPIL as shown in figure 4

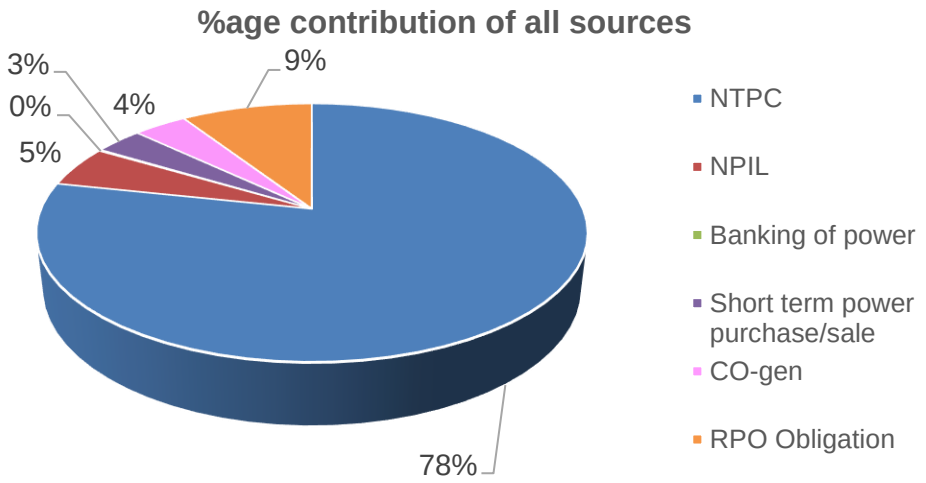


Figure 4 %age contribution of all sources (2019-20)

1.6 Renewable Energy Installed Capacity in the State

The state has 53.36 MW of solar installed[5] capacity in the state which contributes to 96.4% of the overall installed capacity as shown in below table and figure;

Table 2 Renewable energy installed capacity (MW) 31 Jan 2024

Source	Installed Capacity (MW)
Solar	53.36
Small-Hydro	0.05
Bio-Power	1.94
Total	55.35

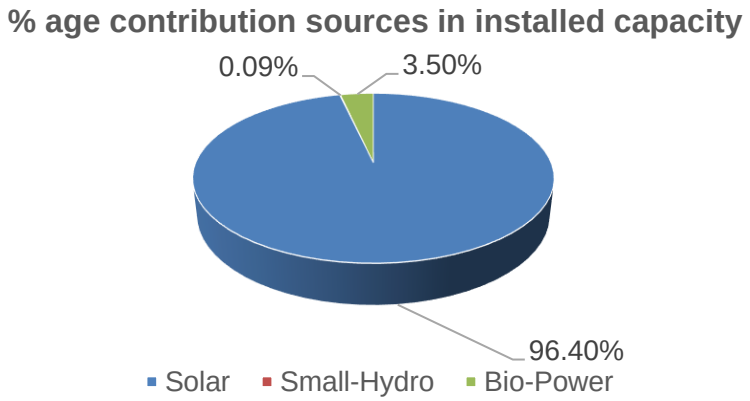


Figure 5 % age breakup of RE-installed capacity by sources (31 Jan 2024)

1.7 Total Final Energy Consumption (TFEC)

The Total Final Energy Consumption (TFEC), also known as gross final energy consumption, is the sum of all sources, i.e., electricity, gas, fuels like petrol, diesel, furnace oil, etc.

TFEC is a variable that was developed particularly to measure energy intensity of the state. It also aids in the analysis of the energy-saving target, which will lower the intensity of GHG

[5] Electricity department Goa

emissions, and it can be reached by improving energy efficiency and reducing the usage of fossil fuels.

The essence of progress towards a long-term sustainable economy is to benefit both people and the environment. To achieve economic growth and long-term development, we must significantly reduce our environmental footprint by altering how we create and use commodities and resources.

In the following section, we will examine the TFEC of Goa sector wise and analyze the trend from FY2015-16 to FY2019-20 which will help us understand and identify energy saving potential. The baseline year is 2019-20 for all the subsequent sections.

The Total Final Energy Consumption (TFEC) of Goa for the FY2019-20 is 1.67 million tonne of oil equivalent (MTOE). It accounts for the total energy consumed from electricity and fuel like coal, major petroleum products like LPG, diesel, ATF, furnace oil etc.

The below figure shows the final energy consumption by fuel type.

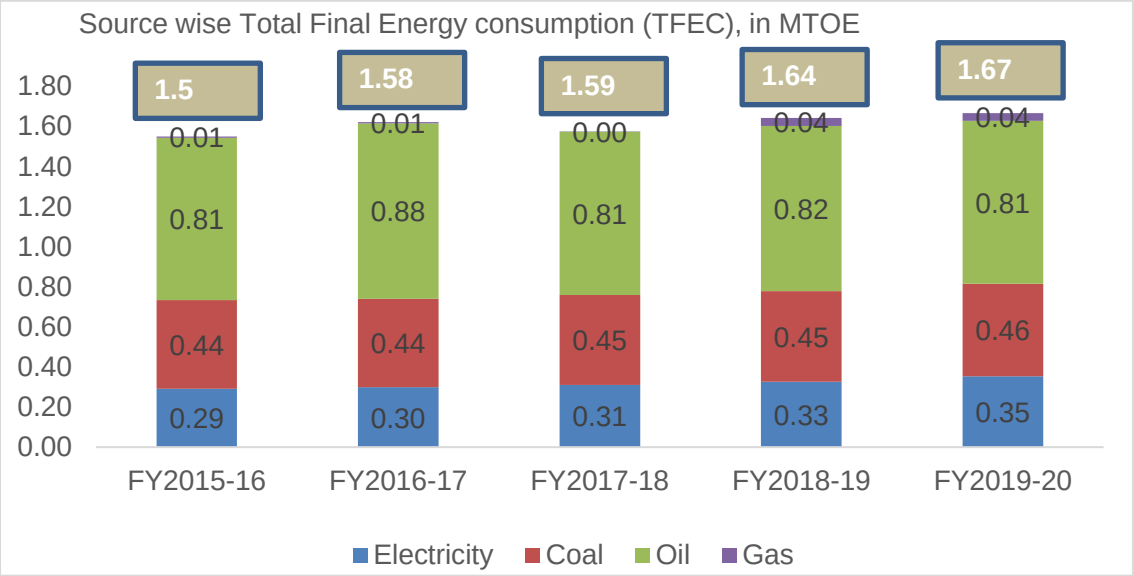


Figure 6 Total Final Energy Consumption in Goa (MTOE)

Below figure shows the TFEC of FY2019-20 by the fuel[6] type.

[6] Source: Coal (BEE), Oil (Ministry of Petroleum & Natural Gas) and Gas (NITI Aayog: India Energy Dashboards).
Primary Energy shown is exclusive of coal consumption in Thermal Power Plants.
TFEC: Total Final Energy Consumption
Coal energy shown includes coal consumption in industries other than Thermal Power Plants.

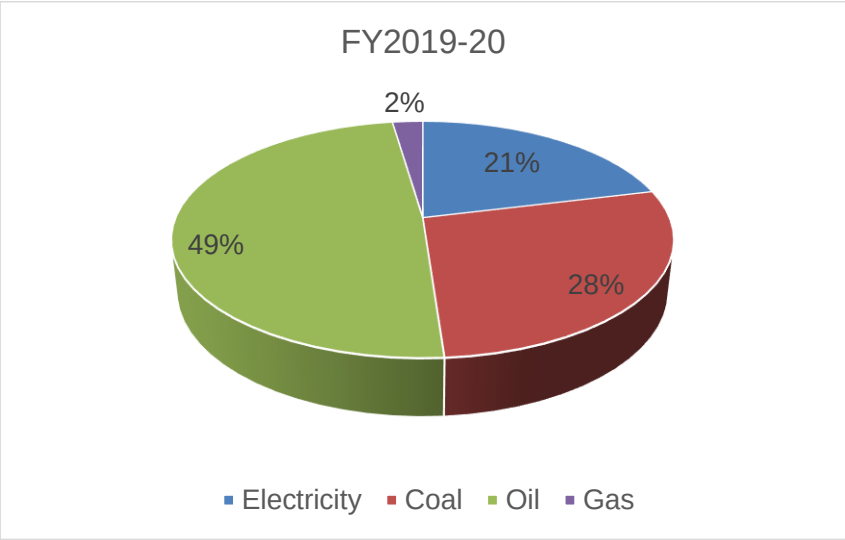


Figure 7 Share of different fuels - TFEC of Goa in 2019-20

Figure 8 shows the CAGR comparison of fuel consumption from the FY2015-16 to FY2019-20. Petcock and furnace oil are banned in the state, according to the state authorities. On or before December 31, 2020, all units using Pet Coke as fuel and furnace oil as fuel must stop using them. According to the Goa Environment and Climate Change Department, 16 fuels have been designated as "Approved Fuels" for the state. The state has accepted low-sulfur coal, coke, LDO, Petrol, Diesel, ATF, LPG, CNG, Kerosene, Naphtha, Firewood, Biogas, Biofuel, RDF, Charcoal, and Hydrogen/ Methane as fuels.

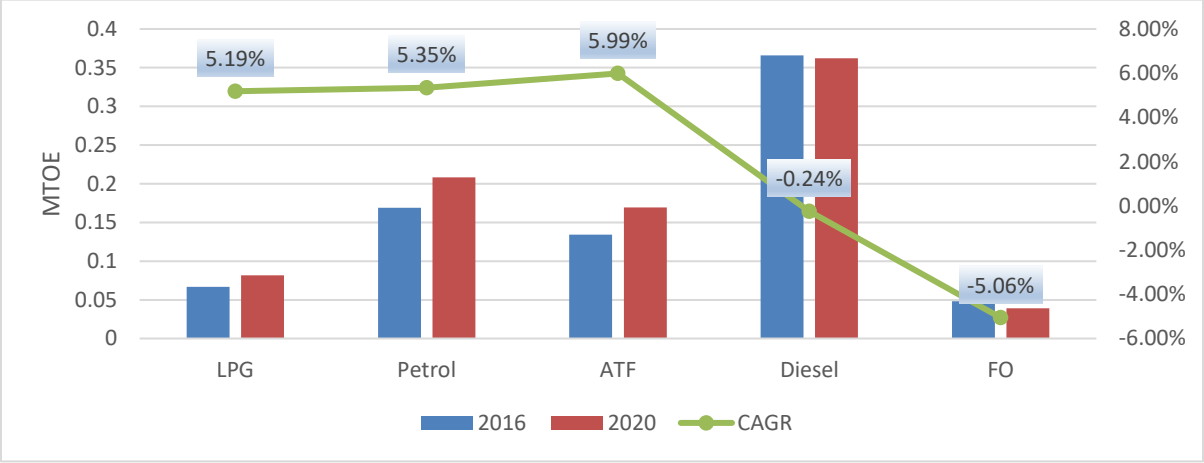


Figure 8 CAGR comparison of FY2015-16 vs FY2019-20[7]

Since LPG is a colorless and harmless gas, its usage in the home and industrial sectors has soared. LPG cooking gas use increased among PMUY recipients, who are largely impoverished rural households. Goa has a greater vehicle density in comparison to the state's population. All of these reasons lead to the rising CAGR of petrol in Goa. The rise in ATF can be attributed to the surge in Goa's tourism.

[7] MoPNG Annual Report

The decrease in CAGR of furnace oil could be due to the dissuasion by Goa Chamber of Commerce and Industry (GCCI) to state government for industrial units to transition from furnace oil to cleaner fuels.

Energy Demand

As shown in the table below, electricity consumption by various categories of consumers served by utilities during the year 2019-20 was 4104.19 GWh registering an increase of 8% over previous year.

Regarding the energy consumed by various classes of consumers, the Industrial category of consumers, as usual consumed the highest energy i.e., 58% of total energy sold by Utilities. The energy sales to Industrial consumers were almost similar compared to the previous year. The transport sector is the second largest category, consuming 26% of total energy sales in FY 2019-20. The building sector is third largest consumers, consumed 16% of the overall energy in FY 2019-20

Table 3 Energy consumption sector wise FY 2015-16 TO 2019-20

Sector	FY2015-16	FY2016-17	FY2017-18	FY2018-19	FY2019-20	CAGR Growth rate
Industry	0.9009	0.9424	0.9344	0.9447	0.9666	1.78%
Transportation	0.3907	0.4042	0.4113	0.4335	0.4269	2.24%
Residential	0.1814	0.1721	0.1711	0.1929	0.1968	2.06%
Commercial	0.0362	0.0391	0.0414	0.0558	0.0630	14.83%
Agriculture	0.0043	0.0052	0.0051	0.0051	0.0051	3.95%
Municipal & Other	0.0356	0.0584	0.0117	0.0096	0.0086	-29.92%
Total	1.55	1.62	1.58	1.64	1.67	1.85%

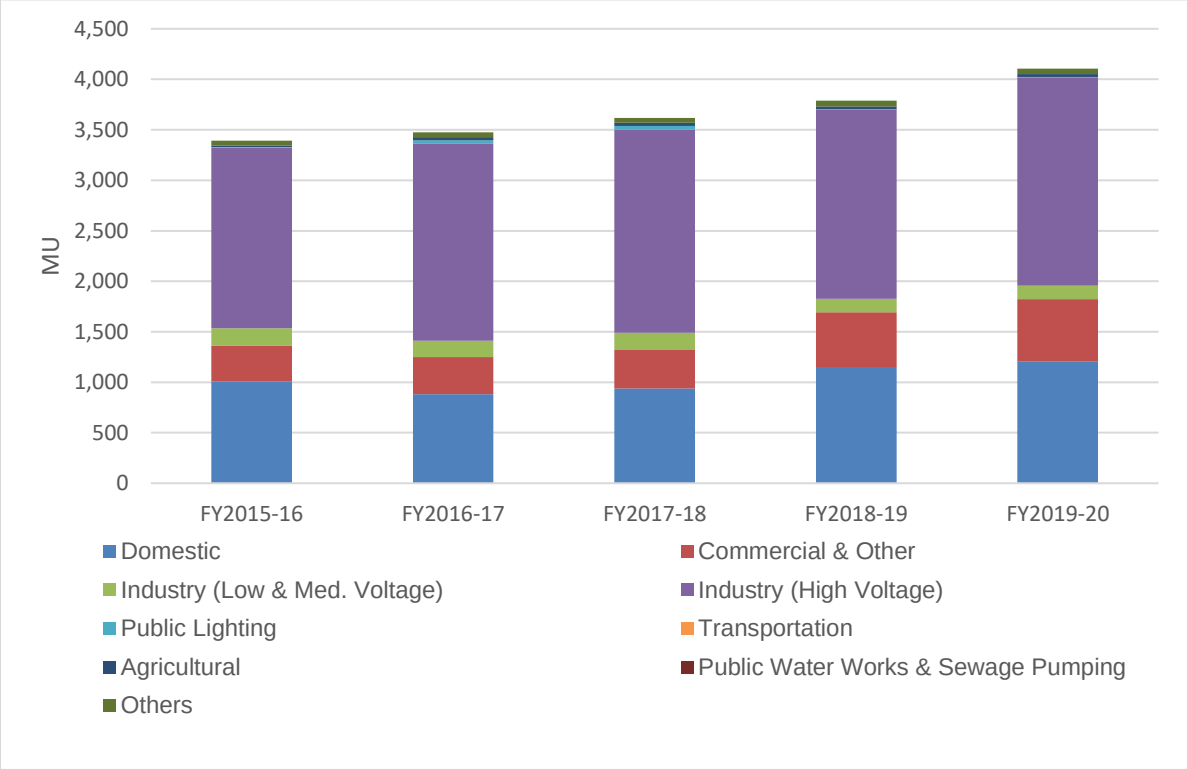


Figure 9 Sector-Wise Electricity Consumption 2015-20 (MU)[8]

Goa has been able to ensure the Energy Availability commensurate to the Energy Requirement with insignificant/zero gap.

According to CEA LGBR 2022 Report, Goa is likely to be surplus both in terms of Peak and Energy on annual basis for the year 2022-23.

As per the table below there has been a reduction in Energy Requirement in the state from FY 2015-2020 (-17.70%), which can be attributed to reduction in mining load.

However Peak Demand registered a growth of 6.72% during the year 2019-20 as compared to 2015-16 as seen in figure 10.

It may thus be seen that the growth in supply of electricity has been commensurate to the growth in demand during the year 2019-20. The below figures indicate that the state witnessed a marginal demand-supply gap in terms of Energy, however, there was no gap in Peak.

[8] CEA General Review Report 2021

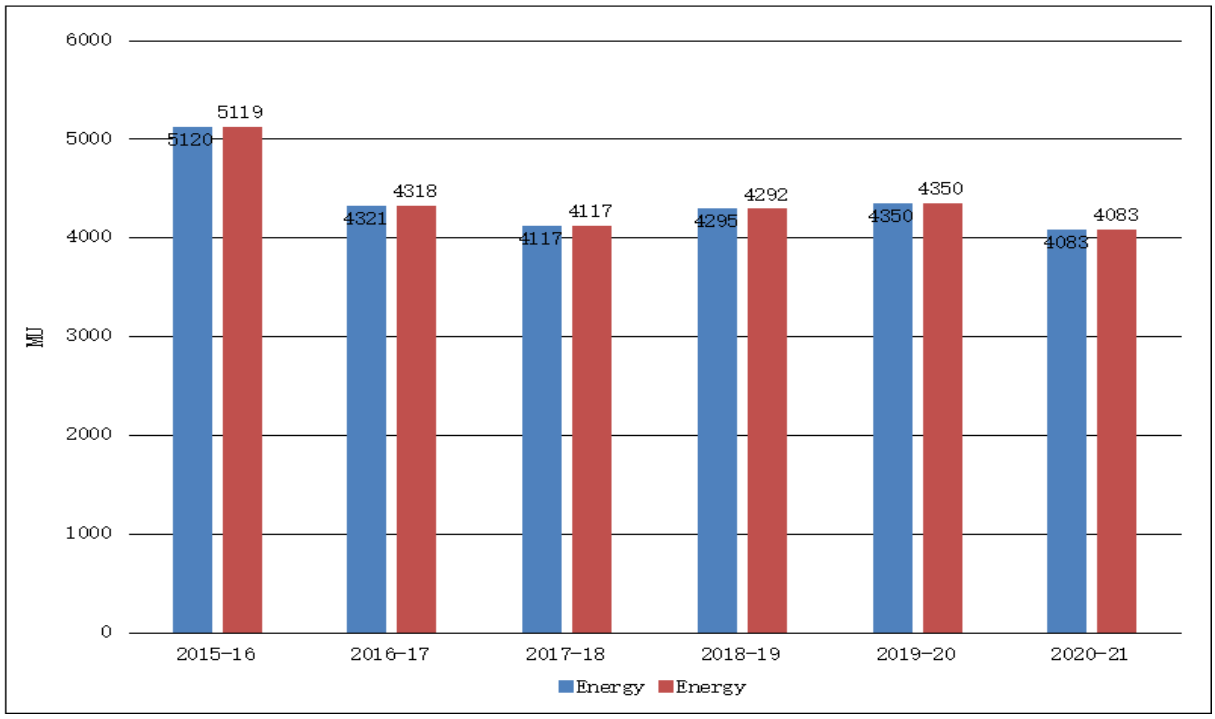


Figure 10 Actual Power Supply Position in terms of Energy during the FY2015 to FY2021

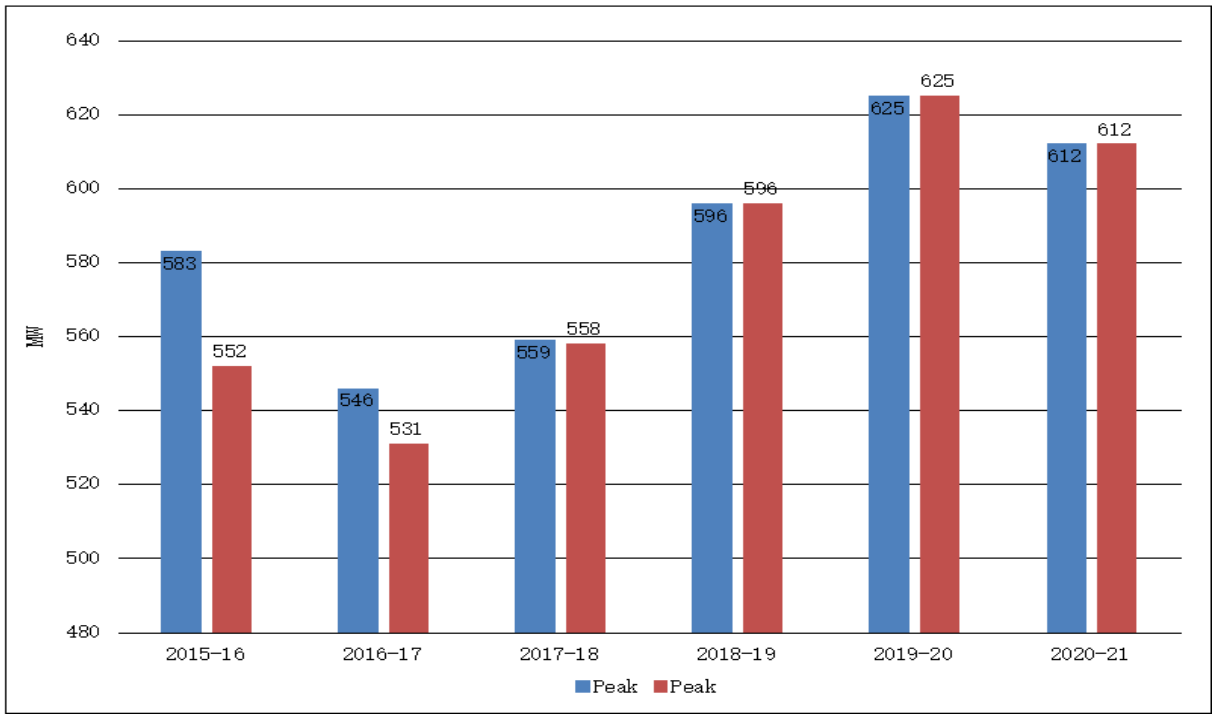
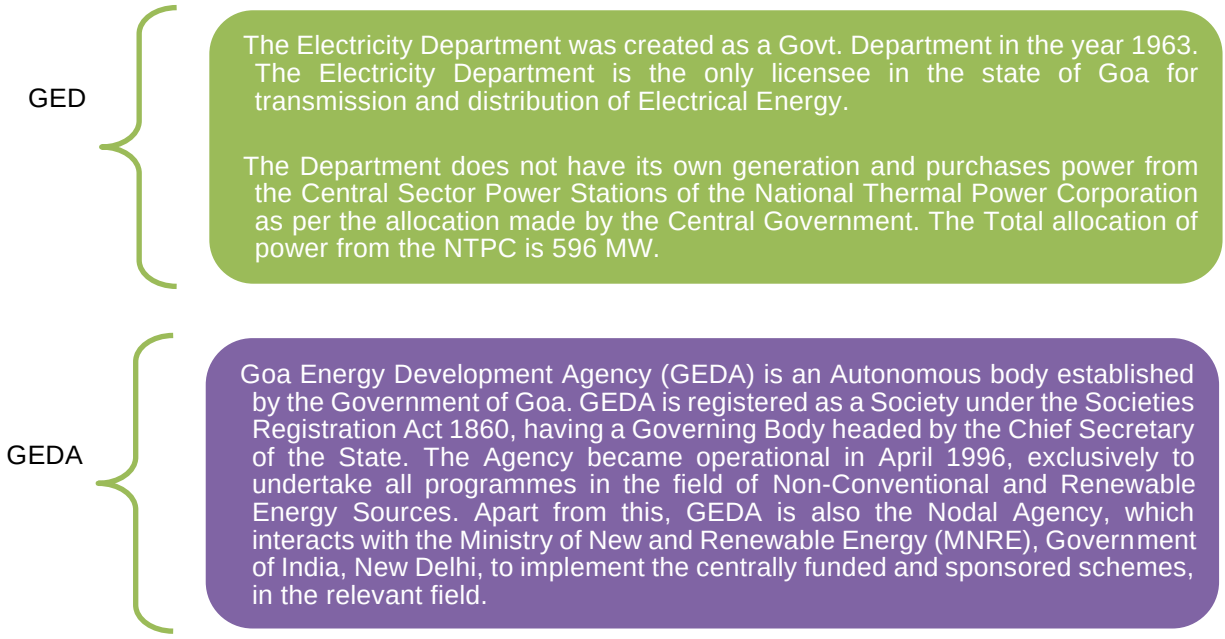


Figure 11 Actual Power Supply Position in terms of Peak during FY2015 to FY2021

1.8 Overview of Institutional framework

The following section covers the institutional infrastructure of power sector in Goa segregated based on area of function.

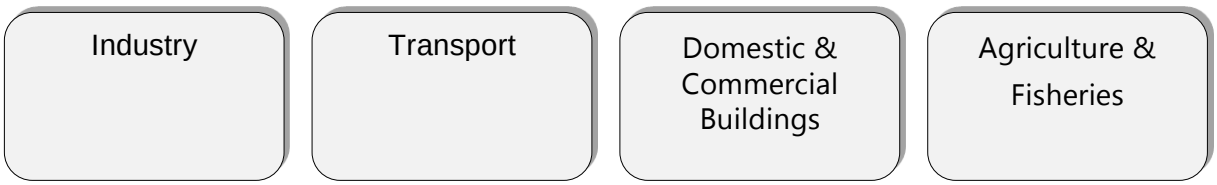


2 IDENTIFICATION OF FOCUS SECTORS

2.1 Identified focus sectors

Energy consumption data has been used to define target focus sectors and specific industries.

The following sectors should be focused for the development of “State Energy Efficiency Action Plan” for Goa.



Energy efficiency measures are thus becoming increasingly significant in these sectors, based not just on overall energy use but also on the potential for cost-effective improvements.

3 PROJECTIONS AND FORECASTING

The Kaya identity is a useful equation for calculating the total amount of anthropogenic carbon dioxide (CO2) emissions. The equation, which is based on information that is easily accessible, can be used to calculate current emissions as well as how the important variables must evolve through time in relation to one another in order to achieve a target level of CO2 emissions in the future. The identity has been utilized and is still crucial in the discussion of international climate policy choices.

The Kaya identity states the total emission level of CO2 as the product of four factors:

$F = P \times (G/P) \times (E/G) \times (F/E)$

where: F = Global CO2 emissions from human sources

P = Global population

G = Global Gross Domestic Product (GDP)

E = Energy consumption

The equation identity was developed by Yoichi Kaya, the identity is a specific application of the I = PAT identity, which relates human impact on the environment (I) to the product of population (P), affluence (A) and technology (T). On first inspection, the Kaya identity may appear to be a frivolous equation given its construction as cancelling terms leaves you with F = F. In practice, however, it is commonly used to calculate an absolute value for global CO2 emissions from anthropogenic activities. It is also helpful in understanding how the four factors need to change relative to each other over time to reach a target level of CO2 emissions in future, and to understand how the four factors have changed in the past.

The expression simply states that emissions of greenhouse gases are the product of the population, GDP per person, energy efficiency, and emissions intensity.

KAYA Equation usages in Policy making:

The Kaya identity underlies the Intergovernmental Panel on Climate Change's (IPCC) analysis of emissions scenario literature. The analysis provided a basis for current assessments of greenhouse gas emissions and possible response strategies. In the context of policy-making, the Kaya identity is often expressed as:

Global CO2 emissions from human resources = Global population X Global GDP per capita X Energy Intensity X Carbon Intensity

The expression simply states that emissions of greenhouse gases are the product of the population, GDP per person, energy efficiency, and emissions intensity.

Energy Intensity – varies by country and region with underlying factors such as economic structure, climate, geography and energy efficiency policies.

Carbon Intensity – is driven by the prevailing form of energy generation. Measured on a total life cycle basis, renewable energy sources have a lower Carbon Intensity than fossil fuels.

The methodology employed for estimating the TFEC projection for Goa involved analyzing trends in final energy consumption and energy intensity, calculating the average intensity, using time-series modelling to make projections, and estimating the TFEC projection for FY 2031.

Base year determination: The base year for the projection was determined as FY 2020 from which TFEC data was available. FY 2020 had an actual TFEC of 1.67 MTOE.

Average intensity calculation: The average energy intensity was calculated by dividing the TFEC value by GSDP values for the years 2015-2020 and taking the average of the obtained values. This was done to identify the energy intensity trend and estimate the energy consumption for the year 2031.

By examining energy consumption and intensity trends, it is possible to identify factors that influence energy demand, such as changes in economic conditions, shifts in technology, and alterations in government policy. Additionally, analyzing energy intensity trends can provide insights into the efficiency of energy usage and the effectiveness of energy-saving measures.

Projection estimation: Using the trends identified through the above steps, a projection was made for the TFEC for FY 2031. Based on the intensity calculation, the estimated TFEC projection for Goa for the fiscal year 2031 will be 3 MTOE.

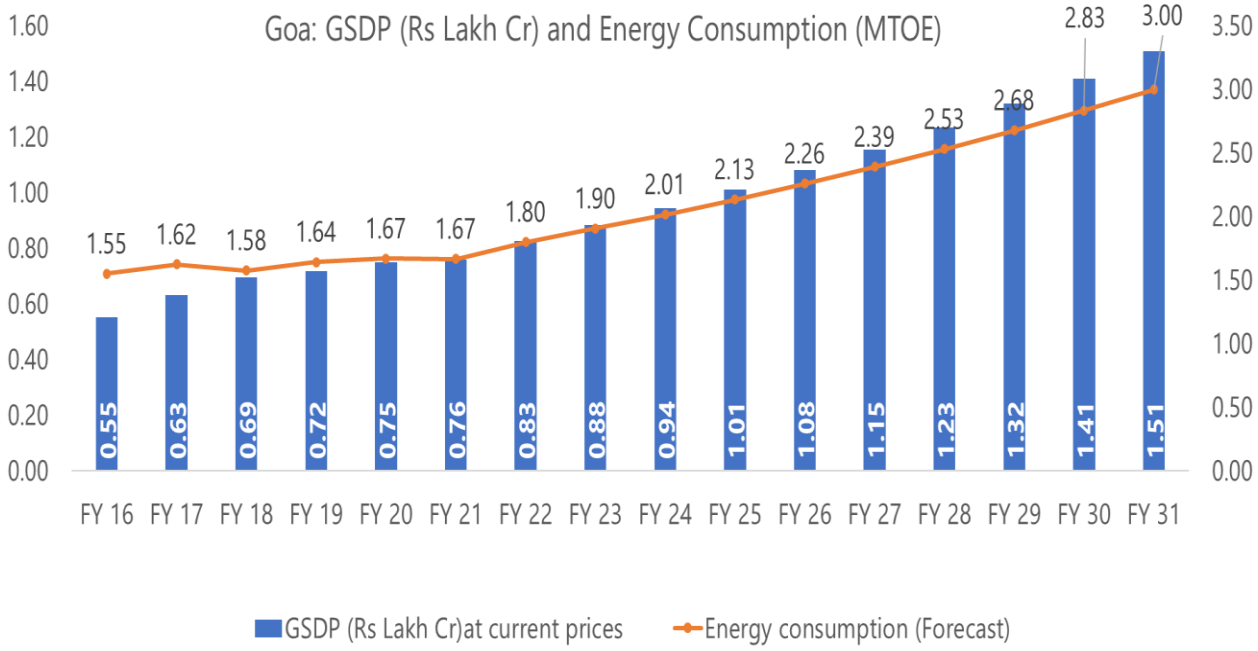


Figure 12 GSDP and TFEC OF Goa

4 FOCUS SECTOR 1: INDUSTRY

4.1 Overview

The industrial sector utilizes the most energy in Goa. In industry, fossil fuels are primarily employed to provide captive energy and meet process demands. Coal, lignite, natural gas, and naphtha are the most common fossil fuels. Goa imports industrial coal and lignite from surrounding states due to a lack of coal deposits in the state.

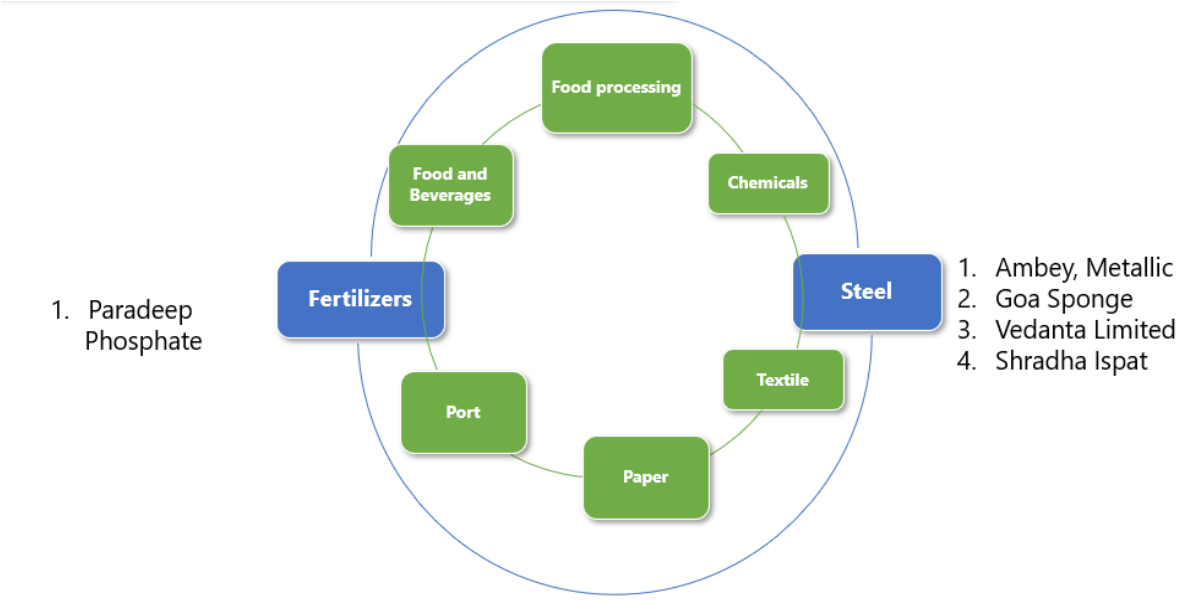


Figure 13 PAT and Non-PAT sectors in Goa

4.1.1 Strategy: Deepening and widening of PAT Scheme

The Perform, Achieve and Trade (PAT) scheme, launched by the Bureau of Energy Efficiency (BEE) in 2012, is aimed at improving energy efficiency and reducing greenhouse gas emissions in energy-intensive industries. Goa has only five designated consumers under BEE-PAT scheme

The deepening and widening scheme of the PAT can help Goa to achieve its energy efficiency and emission reduction targets by promoting energy efficiency, adoption of energy efficient technologies, and best practices.

By increasing the coverage of industries under the PAT scheme, Goa can further unlock its potential for energy savings and emission reductions. This can not only contribute to meeting the state's climate change goals but also lead to cost savings for the industries involved. Therefore, the deepening of the PAT scheme can be an effective tool for sustainable industrial development in Goa.

By bringing more industries under the PAT scheme, the state can ensure that a larger number of energy-intensive industries are actively working towards improving their energy efficiency. This can help reduce the overall energy consumption of the state and reduce its carbon footprint.

The state has 5 designated consumers under PAT scheme;

Table 4 Designated consumers in the State under BEE-PAT scheme

Name	Registration no.	SEC	Production	SEC Target
Shraddha Ispat Pvt Ltd., Santona, Curchorem/Sanvordem, Sanguem, Goa, 403706	INS0015GA	0.5428	72392	0.5185
AMBEY METALLIC LIMITED, Plot No. 69-75, 143-160 Pissurlem Industrial Estate Pissurlem,City-Sattari, Goa	INS0017GA	0.7306	28482	0.634
Goa Sponge and Power ltd, Village Santona, Curchorem, South goa, Goa,403706	INS0028GA	0.4536	145545	0.4536
Vedanta Limited (Value Added Business -Iron Ore Business), Amona, Marcel, Bicholim, Goa, 403107	INS0073GA	0.541	683025	0.5176
Paradeep Phosphate	FTZ0016GA8			

Role of Prominent DCs in Goa:

The participation of 5 prominent Designated Consumers in the PAT scheme underscores their commitment to energy efficiency, sustainability, and responsible industrial practices. By setting and achieving specific energy consumption targets while meeting production goals, these companies not only enhance their own competitiveness but also contribute to the larger national agenda of energy conservation and environmental protection. Going forward, continued efforts and collaboration among industry stakeholders, government agencies, and civil society will be essential to realize the full potential of energy efficiency initiatives like the PAT scheme.

The energy saving effort by these industries have potential to save approximately 0.0387 MTOE of energy in moderate scenario and 0.0483 MTOE of energy in ambitious scenario as shown in below table;

Table 5 Energy saving potential by DC

Particulars	Moderate Scenario	Ambitious Scenario
Energy Saving Potential (MTOE) 2031	0.0387	0.0483
GHG Emission Reduction Potential ($MTCO_2$) 2031	0.1210	0.1512

Goa Electricity Department's PAT cell collected data of few energy intensive industries for consideration in PAT-Deepening and Widening scheme and shared with BEE recently. The list of these industries has been included at the end of the report as Annexure-1

PAT cell has shared the data of 37 companies with BEE for considering in PAT-deepening and widening scheme. The baseline energy consumption of these industries is 0.0864 as of June 2023. The historical data of Industrial energy consumption shows the CAGR growth rate of 1.78% over the period of FY 16 to FY 20. Taking the same growth rate of energy consumption, energy of these 37 companies expected to reach 0.10 MTOE by 2031. Energy saving potential is estimated as 5% in moderate scenario and 10% in ambitious scenario. The %age of energy saving of 5% and 10% is based on available technologies and its energy saving potential. BEE has provided list of 150+ technologies on ADEETIE portal [9] (Assistance in Deploying Energy Efficient Technologies in Industries and Establishment) and provided detail of brief of technology and energy efficiency potential.

Table 6 Energy (Electrical energy) consumption forecast of 37 companies considered for deepening and widening study

Year	Baseline energy consumption FY 2023	Forecasted energy consumption FY 2031	CAGR growth rate
Energy Consumption (MTOE)	0.09	0.10	1.78%

Sector wise breakup of industries proposed under deepening and widening is as follows;

Table 7 Sector wise breakup of 37 industries proposed for deepening and widening scheme

Sector	No of companies	Total TOE (Electrical Energy)
Cement	1	602
Chemical	22	34,349
Food & Beverages	4	10,378
Foundry	6	28,266

[9] https://www.adeetie.beeindia.gov.in/bee-facilitation-centre

Sector	No of companies	Total TOE (Electrical Energy)
Glass	1	8,123
Iron & Steel	1	2,719
Port	2	1,954
Grand Total	**37**	86,391

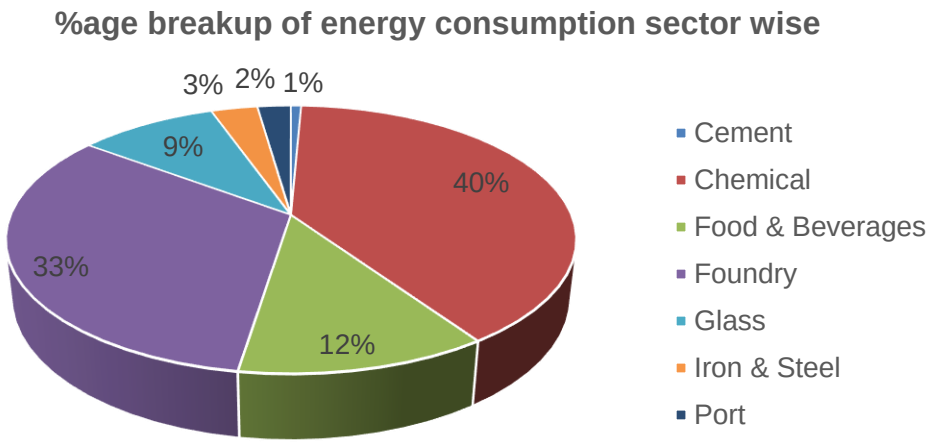


Figure 14 %age breakup of sector wise energy consumption June 2023

As shown in figure above, the major industries in Goa on basis of the energy consumption include Chemicals & Fertilizers, Iron & Steel, Food & Beverages, Glass and Port. The other industries in the state include manufacturing of electrical & electronic equipment, automobile, and other industries.

Scope Boundary

Deepening study for sectors under PAT namely Iron & Steel, Paper & Pulp and Chemicals
Widening of sectors like Pharmaceutical, Food and Beverages, Foundry, Glass, based on Industry's energy consumption.

Implementing Agency

Bureau of Energy Efficiency (BEE) and Goa Electricity Department,

Current Policy in Place

PAT Scheme

Energy Saving Potential

Energy saving potential under PAT-deepening and widening scheme is considered as 0.005 MTOE in moderate scenario and 0.010 MTOE in ambitious scenario.

Table 8 Energy saving potential

Particulars	Moderate Scenario	Ambitious Scenario
Energy Saving Potential (MTOE) 2031	0.005	0.010
GHG Emission Reduction Potential ($MTCO_2$) 2031	0.016	0.031

Action Plans

This section describes several action plans that can be implemented across the industry sector for this strategy. For each of the strategies, a short and long-term period has been taken into consideration for actionable instruments.

Table 9 Action plan for strategy deepening and widening under PAT scheme

Action Plan	Brief of Action Plan	Timeline
Awareness & Capacity Building	• Capacity Building of Energy Managers and Energy Auditors in PAT DCs and new probable sectors • Organize workshops at regular intervals to disseminate information to energy professionals like accredited energy auditors, energy managers, Designated Consumers, and ESCOs at regular intervals.	Short Term (within a year)
Green and sustainability Initiative	• Promotion of green rating of Industries (State has taken initiative signed MoU with GreenCo and IGBC)	Short Term (within a year) before 2026
Survey/ Data collection/study at state level	• Data collection for energy consumption of Industries in the state • Make a format and circulate to all companies • Identification of state-level designated consumers by identifying electrical and thermal energy consumption • Once sufficient data is available dashboard can be developed.	Short Term (1-2 years) Before 2026

	• State-level committee for monitoring energy efficiency in Industries	
Technology Intervention	• Waste Heat Recovery, Heat pump, Energy efficient motor, energy efficient compressor, IoT, Energy management system, Regenerative burner system • State-level energy demand and supply dashboard • *BEE has identified 150+ energy-efficient technologies and listed them on the BEE portal with a brief of technology and energy-saving potential. This is the ADEETIE (Assistance in Deploying Energy Efficient Technologies in Industries and Establishment) portal. SDA can spread awareness for energy saving opportunity	Short Term (1-2 years) Before 2026
Fuel Switching	• Uses of Hydrogen, electrification of industries (identifying potential for switching from fossil fuel-based energy to clean energy) • Bio mass utilization	Long Term After 2026 & Short-Term
Mandatory Audit	• Mandating audit for all HT consumers • Auditing first 20% of energy intensive industries (fee to be borne by SDA)	Short Term Within a year
Incentive (Financial)	• Incentive for energy audit, water audit for sector under widening of PAT scheme • Promotion of ESCOs	Short Term Within a year

Incentive (Recognition)	• The state has taken the initiative to recognize the energy-efficient units and given award to the following units: Energy Conservation award 2023-24
	  • Vedanta (Iron and Steel)
	  • Fertilizer (Paradeep Phosphate)
		Short Term
		Within a year

4.1.2 Strategy: Energy efficiency promotion and Decarbonization efforts in MSMEs

As per Ministry of Micro, Small & Medium Enterprise's Udyam registration portal, total no of MSMEs in Goa are 47,777 and only 3.1% of the total industries are under the category of small and medium enterprises.

Table 10 District wise MSME registration in Goa

Sr. No.	District Name	Total Udyam	Micro	Small	Medium

1	NORTH GOA	28,901	28,038	788	75
2	SOUTH GOA	18,876	18,239	585	52
Total:-		47,777	46,277	1,373	127

The baseline energy consumption of MSMEs in Goa is estimated as 0.41 MTOE by FY 2019-20 and estimated to grow at CAGR of 1.78% and reach 0.49 MTOE by 2031.

Scope Boundary

Small and Medium Industries. Clusters of Pharma and Cashew

Implementing Agency

Bureau of Energy Efficiency (BEE); State Designated Agency Goa, Industries Department

Current Policy in Place

Industrial MSMEs Policv

Table 11 Energy saving potential

Particulars	Moderate Scenario	Ambitious Scenario
Energy Saving Potential (MTOE) 2031	**0.025**	**0.049**
GHG Emission Reduction Potential ($MTCO_2$) 2031	**0.077**	**0.154**

Action Plans

This section describes several action plans that can be implemented across the industry sector for this strategy. For each of the strategies, a short and long-term period has been taken into consideration for actionable instruments.

Table 12 Action Plan

S. No.	Action Plans	Timeline
1	Carrying out of Energy and Resource Mapping Studies in MSMEs (cluster-wise annual)	Short Term

		(1-2 years), before 2026
2	Implementation of Demonstration projects on Energy Efficiency Technologies in SME clusters	Short Term (1-2 years), before 2026
3	Conduction of Vendor Technology workshops	Short Term (1-2 years), before 2026
4	Mandating the energy audit for MSMEs	Short Term (1-2 years), before 2026
5	Promotion of green rating of Industries	Short Term (1-2 years), before 2026

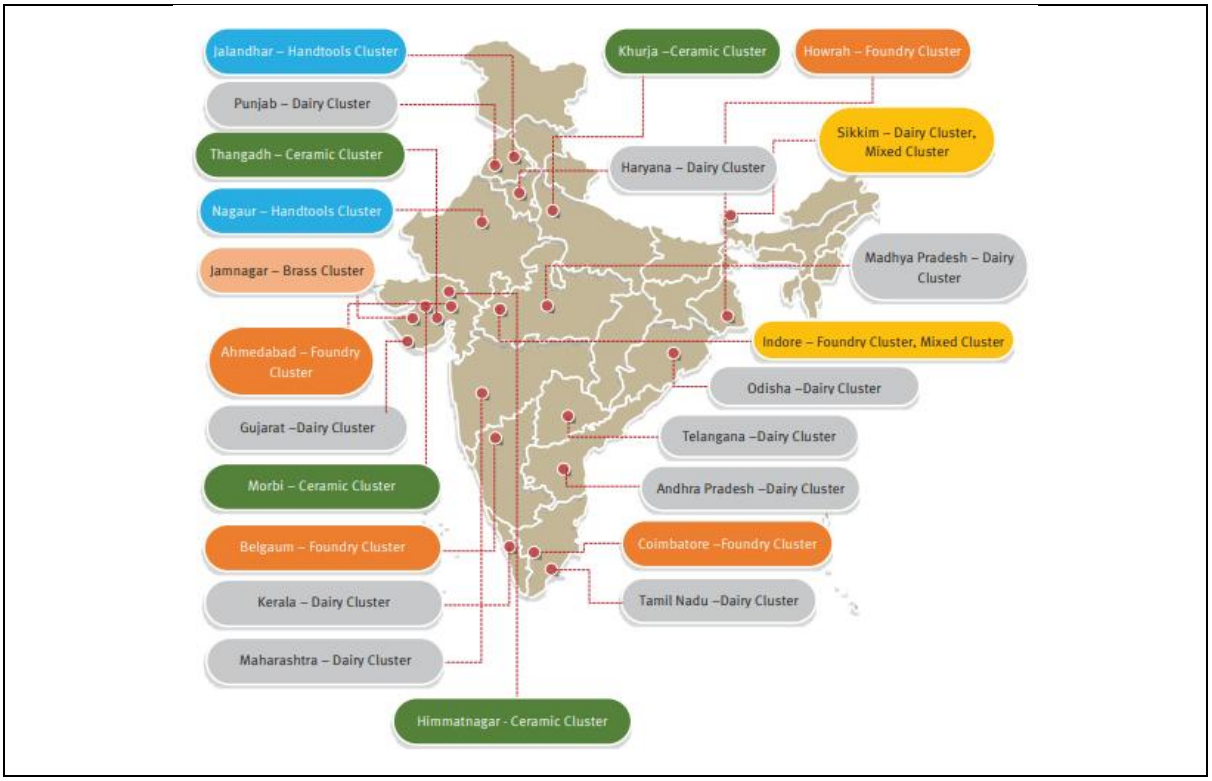
Case Study: Promoting energy efficiency and renewable energy in selected micro, small and medium enterprises (MSME) clusters in India[10]

The UNIDO-BEE project named "Promoting EE/RE in selected MSME Clusters in India", is to provide support to the MSME units in implementing EE & RE technologies. The major activities undertaken in the project are,

1. Organizing awareness programs and identification of potential enterprises
2. Conducting walk-through audits
3. Preparing cluster-specific EE & RE-based technology compendium and
4. Implementation support to participating units.

Through this project, more than 1800 EE & RE projects were facilitated in the MSMEs which are worth INR 250 crore and have a potential for annual GHG emission reduction of about 140,000 tCO2 across more than 1500 participating units.

[10] Promoting energy efficiency and renewable energy in selected micro, small and medium enterprises (MSME) clusters in India (isid4india.org)



Green Rating of Industries:

Company Rating System advocates a performance-based approach and 360 degree view of performance of the company. The rating system evaluates green features of companies against the following performance parameters: Energy Efficiency, Water conservation, Renewable Energy, GHG Mitigation, Waste Management, Material conservation & Recycling and Recyclability, Green Supply chain, Product stewardship, Life Cycle assessment and Green Building feature and biodiversity.

Rajasthan State Pollution Control Board has launched a system for Green Rating of Industries based on their environmental performance which may be evaluated based on their compliance of the prescribed format and their efforts to perform better than prescribed standard (No F14 (185) Corres/RSPCB/Plg/511-548, dated 27/7/21)[11]. To ensure maximum participation of industries in the scheme and to provide financial and other benefits of the green rated industries, Rajasthan State Pollution Control Board has decided to provide the following incentives and recognition to the Green Rated Industrial units;

A) Reduction in consent fee will be provided as per the below table;

Table 13 Reduction in consent fee according to Green rating category

Sr. No	Green Rating Category	Reduction in Consent Fee
1	Bronze	5%
2	Silver	10%

[11] https://www.greenco.in/doc/Greenrating-Officeorder.pdf

3	Gold	25%
4	Platinum	50%

B) Extension in consent period: Extension in consent period for 1 year beyond the prescribed period of industries securing rating in Bronze, Silver, Gold and Platinum categories will be provided subject to the condition that no non-compliance is reported within the consent period.

The Karnataka State Pollution Control Board (KSPCB):

Karnataka State Pollution Control Board (KSPCB) will promote green industries in Karnataka through the use of GreenCo Rating, a voluntary tool for enhancing the environmental performance of industries in the state. The programme is aimed at creating a green industry landscape in Karnataka where industries voluntarily have started to realize that both business and the environment can benefit together. Taking forward, the Karnataka State Pollution Control Board (KSPCB) envisages industries, service sector companies, and also government entities to be evaluated based on environmental performance as well as resource consumption and efficiency parameters. This will create an environmental management landscape where industries can improve their environmental performance voluntarily, set higher goals for improvement, and be rewarded for better results. perform better than the prescribed regulatory norms, set higher goals for improvement, and get suitably rewarded and motivated for better results.

Special Fee for KSPCB:

As a special case, discount of 10% will be provided to all the applicants enrolling for Green Rating through the KSPCB program

Incentives by KSPCB:

Implementation of the Green rating will facilitate industries to achieve multiple benefits in saving natural resources, reduce pollution and achieve cost benefits. It will also provide industries a credible recognition for enhanced green performance. KSPCB, in the process of encouraging the industries participating in the Green rating system and will provide incentive and recognition to the Green rated industries.

1. One time Incentive for Green certified Industries[12]

https://kspcb.karnataka.gov.in/sites/default/files/inline-files/KSPCB%20CII-Program_26%2003%2023%20Sp_19.05.2023_0.pdf

Size / Rating	Micro, Small & Medium	Large CI-10 to 50 Cr	Large CI-50 to 100 Cr	Large CI-100 to 250 Cr	Large CI-250 to 1000 Cr	Large CI > 1000 Cr
Platinum	Rs.50,000	3,00,000	4,00,000	5,00,000	7,50,000	10,00,000
Gold		2,00,000	2,50,000	3,00,000	5,00,000	7,50,000
Silver		1,50,000	2,00,000	2,00,000	2,50,000	5,00,000
Bronze		75,000	1,00,000	1,00,000	1,50,000	2,50,000

Note:

i. Capital Investment (CI) shall be as defined in Rule 32 of Karnataka Water Rules and Size of the industry shall be as per KSPCB norms.
ii. The Green rating incentive scheme is operational from the financial year 2023-24.
iii. The procedure and guidelines for availing the incentives will be published by the Board separately.

2. Annual recognition for best 3 units in each category as above will be given annual awards at State Level function to be organized by the State Board and State Government.

Tamil Nadu MSME Department supports Green Rating: MSME Department guides and supports Industries towards sustainability. Department of Industries and Commerce has approved the Q-Cert scheme incentive for all MSMEs for Green rating via RC No-33808/LC3/2022-2 dated 22.12.2022.

Energy Saving Potential and Monitoring Mechanism

As per the Green Co rating mechanism, Green rating have following parameters and also the points given for each parameter[13] have been given in below table;

Table 14 Green Co rating parameters with points given for each parameter

No	Parameter	Points	%age Contribution of each points
1	Energy Efficiency	150	15%
2	Water Conservation	100	10%
3	Renewable Energy	100	10%
4	GHG Emission Reduction	100	10%
5	Waste Management	100	10%
6	Material conservation, Recycling & Recyclability	100	10%
7	Green Supply Chain	100	10%
8	Product Stewardship & Life cycle aspects	125	13%
9	Innovation for Environment	50	5%
10	Green infrastructure & Ecology	75	8%
	Total points	1000	100%

[13] https://www.greenco.in/

Goa has also taken the initiative to promote green rating of industries and sign MoU between CII-GreenCo and Goa State Pollution Control Board (GSPCB). MoU copy has been given at the end of the report as annexure.

4.1.3 Strategy: Green hydrogen in DCs & other industries

A clean energy transition strategy is a solution to achieve economic growth and environmental sustainability. Green hydrogen is one of the clean energy and Goa have opportunities to promote green hydrogen in energy intensive industries like iron and steel, Fertilizer, Chemical etc.

The Government of India is also promoting the adoption of green hydrogen through the National Green Hydrogen (GH2) Mission. Although the technology is at nascent stage, the state can take advantage of the available incentives under the GH2 mission for R&D and pilot projects to facilitate the hydrogen consumption in large industries like Vedanta in the state.

Under the integrated approach described under the in the green hydrogen mission of India, Ministry of Steel would be responsible to drive adoption of green hydrogen in the steel sector. The Ministry will identify and facilitate pilot projects for use of Green Hydrogen in steel production and undertake policy measures to accelerate commercial production of green steel. This is a good opportunity for the state to proactively work collaboratively to promote green hydrogen for steel in the state.

Based on the coal consumption in industries included iron and steel, the state should target a shift of 5% and 10% of coal consumption to green hydrogen in these industries. To achieve these targets, the state must facilitate the RE capacity of about 30 MW and 40 MW respectively.

The neighboring state of Karnataka is envisaging to establish green hydrogen hub in the coastal side of the state targeting the export market. Karnataka with large RE capacities is well positioned to do so. Goa can take advantage of this and promote green hydrogen by collaborating with Karnataka for sourcing the green hydrogen.

The other way to improve the green hydrogen infrastructure in the state would be through sourcing the green power from the neighboring states. Ministry of Power through their Green Hydrogen Policy[14] has already relaxed the charges on ISTS transmission charges on renewable energy. “Green hydrogen” producers will now be able to buy green power from RE projects commissioned by 30 June 2025 without any ISTS transmission charges. The policy also assures green hydrogen producers open access to RE generators anywhere in the national grid. However, the JERC in Goa will play a key role in providing easy terms for all the stakeholders involved in open access.

[14] Green_Hydrogen_Policy.pdf (powermin.gov.in)

Scope Boundary

Switching to clean energy fuel i.e. hydrogen in large industry units of steel in the state potential end users in other industrial sector

Implementing Agency

GEDA, GED, State Designated Agency Goa Industries Department Directorate of Industries

Current Policy

National level policy on green hydrogen

Energy Saving Potential

Based on the coal consumption in industries included iron and steel, savings were derived considering a shift of 5% and 10% of coal consumption to green hydrogen in moderate and ambitious scenario respectively by 2031. The savings potential through this intervention would be about 0.003 MTOE in moderate scenario and 0.005 MTOE in ambitious scenario.

Table 15 Energy Saving Potential

Particulars	Moderate Scenario	Ambitious Scenario
Conventional Energy Offset (TOE) 2031	0.0025	0.0034
GHG Emission Reduction Potential ($MTCO_2$) 2031	0.008	0.011

Action Plans

This section describes several action plans that can be implemented across the industry sector for this strategy. For each of the strategies, a short and long-term period has been taken into consideration for actionable instruments.

Table 16 Action Plan

Sl. No.	Action Plans	Timeline
1	Formation of Green hydrogen policy and subsidy schemes through state green hydrogen policy Encouraging private investment in the state with state's level policy e.g.: Gujarat has land allocation policy for Green H2	Short term Within a year
2	Provide R&D support to the industries Provide technology support to the industries for transitioning to green hydrogen	Short term (1-2 Years) before 2026
3	Facilitate green hydrogen producers open access to RE generators across the national grid. Focus on incremental RE capacity required for green hydrogen	Long term (2-5) years, after 2026

Example of supporting policies for green H2:

Table 17 Green Hydrogen policies levers world-wide

Policy	Area	Example of policies world wide
Policy Support for electrolysis	Setting target for electrolyser capacity	European Union's goal of increasing electrolyser capacity to 80 GW (40 GW in Europe, 40 GW in neighboring countries) by 2030 (European Commission, 2020)
	Improving tax schemes forelectrolysers	The cost of green hydrogen production could be lowered by reducing the taxes and fees on the electricity used by electrolysers
	Increasing support for research	Improve electrolyser efficiencies and to optimise and standardise designs for large-scale electrolysers to bring down electrolyser cost
Policy Support for Industrial application	Adapting Industrial policy for green H2	
	Planning phase-out of high emission technologies	Governments are able to create plans to shift industries gradually. By employing a growing percentage of green hydrogen in the existing blast furnaces, the steel industry might start decreasing emissions. However, it would need to move to fluidized bed furnaces for that percentage to reach 100%.

4.1.4 Strategy: Energy efficiency in cold storage

Goa has 29 cold storages with capacity 7705 MT[15]. As per All India Cold Storage Capacity and Technology-baseline survey of 2014 conducted by M/s Hansa Research Group, 75% of the total cold storage capacity in the country was being used for the purpose of storage of horticulture crops including potato. Baseline energy consumption from cold storage is estimated as 90.36 TOE and estimated to reach 109.71 TOE by 2031.

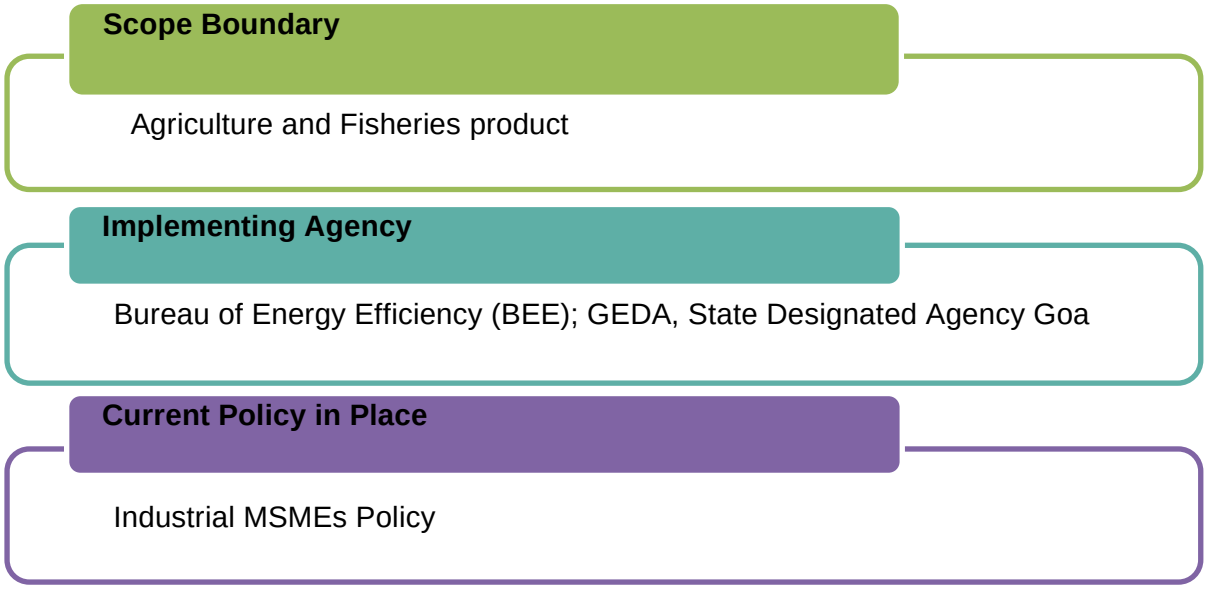


Table 18 Energy Saving Potential

Particulars	Moderate Scenario	Ambitious Scenario
Energy Saving Potential (TOE) 2031	10.97	16.46
GHG Emission Reduction Potential (TCO_2) 2031	34.34	51.51

Action Plans

This section describes several action plans that can be implemented across the industry sector for this strategy. For each of the strategies, a short and long-term period has been taken into consideration for actionable instruments.

[15] https://pib.gov.in/PressReleasePage.aspx?PRID=1658114

Table 19 Action Plan

S. No.	Action Plans	Timeline
1	Encourage development of cold chain infrastructure with use of low-GWP refrigerant based energy efficient cooling systems	Short Term (1-2 Years), before 2026
2	Investment by the state govt. in developing cold chain infrastructure and charge the customer based on their uses. It will reduce upfront cost (capex) burden on the end users and state will promote adoption of energy efficient cold storage infrastructure.	Long Term (2-4 Years), after 2026
3	Develop programme for retrofitting of existing cold storage to eliminate the usage of inefficient equipment and components to reduce demand in refrigeration and cooling. S&L and ECBC compliance	Short Term (1-2 Years), before 2026

Table 20 EE measures in cold storage

EE measures in Cold Storage	Efficiency Savings (%)
Energy Efficient compressors	10%
VFD for chillers with automatic feedback	5%
Install Energy Efficient Chillers	10%
Install VFD for water circulation pumps	10%
Install Energy Efficient Motors	5%
Install VFD for AHU's	5-10%
Install Compressor Capacity controller	10%
Replace multiple smaller chillers with a single large chiller	6%
Install Temperature controller	5%
Install IOT & Digitization controls for operation of cold storages	2-3%
Segregation of cold storage requirements based on commodity	3-5%
BLDC fans for Evaporative coolers	30%

EE measures in Cold Storage	Efficiency Savings (%)
Install Energy Efficient pumps	15%
Improve the insulation	15%
Install Energy Efficient lighting	40%

4.2 Energy saving potential & monitoring mechanism.

Energy saving potential of the industry sector is 0.0708 MTOE and 0.1109 MTOE for moderate and ambitious scenarios FY31 respectively as seen from below table

Table 21 Summary of energy saving from the strategies in Industry sector

Strategy	Energy Savings by 2030-31 moderate scenario (Mtoe)	Energy Savings by 2030-31 under ambitious scenario (Mtoe)	Emission reduction by 2030-31 moderate scenario (MtCO2)	Emission reduction by 2030-31 ambitious scenario (MtCO2)
Energy efficiency improvement in DC	0.0387	0.0483	0.1210	0.1512
Deepening and widening of PAT scheme	0.0050	0.0099	0.0156	0.0311
Decarbonization efforts in MSMEs	0.0246	0.0492	0.0770	0.1540
Energy Efficiency in Cold Storage	0.00001	0.00002	0.00003	0.00005
Green H2	0.0026	0.0035	0.0081	0.0108
Total	**0.0708**	**0.1109**	**0.2217**	**0.3472**

The following are the possible monitoring mechanisms for strategies in industry sector.

Table 22 Monitoring mechanisms for strategies in industry sector

Policy Type	Monitoring Mechanism
Regulatory	The Joint Electricity Regulatory Commission (JERC) is responsible for regulating the power sector in the state, including the implementation of energy policies for industries. The JERC can monitor compliance with these policies through inspections, audits, and other enforcement measures.
Industry associations	Industry associations can play a key role in monitoring energy policies for their members.

Monitoring Agencies	GED, SDA & GEDA can monitor industry compliance with energy policies through data collection and analysis, as well as through partnerships with industry associations and other stakeholders.
Audits	Energy audits can be conducted by independent third-party providers to assess the energy consumption and efficiency of industrial facilities. These audits can help identify areas for improvement and track progress towards energy policy goals.
Reporting	Mandatory reporting requirements or through voluntary reporting programs that incentivize companies to disclose their energy use and emissions data.

5 FOCUS SECTOR 2: TRANSPORT

5.1 Overview

Transport was the second largest energy consumer in the state, for FY2019-20, contributed to 26% of TFEC of the state, equivalent to about 0.43 MTOE of energy; the main fuels consumed were petrol and diesel.

In the transport sector, there is a need to promote electric vehicles as well as policy level intervention for clean fuel vehicles. Several states have come forward with a state level incentivisation for Electric Vehicles. Though energy efficiency is a multi-dimensional subject, defining key focus areas to bridge gaps is the need of the hour. The need to decarbonize our societies is critical in view of climate change. The transportation sector, and specifically the road transport sector within it, is unique. Rising transport demand due to a tourist place leading to an increase in the uses of petrol and diesel finally adding greenhouse gases to atmosphere.

There are many solutions for sustainable transport system such as use of biofuels, e-fuels, and other low carbon fuels. However, none of them will be able to address this massive problem on their own, and renewable transportation fuels play a critical role in closing the carbon emissions gap.

Over the next 30 years, the transportation sector will have to undergo structural changes to achieve significant emission reductions. To fully engage in the transformation of the transportation sector, market actors need strong policy signals to support the market uptake of zero-emission vehicles, increased production and use of sustainable fuels, and a significant rollout of infrastructure for recharging batteries and refueling with alternative fuels. Below figure shows the integrated approach in transport sector for unlocking the potential of initiatives in the field of decarbonizing the transport sector.

Figure 15 Integrated approach for decarbonizing Transport sector

By 2050, a variety of technology approaches and fuels might result in a 90% reduction in transportation-related emissions. While predicting the technology and fuel mix that will prevail in the transportation sector in the long run is speculative and uncertain, one thing is certain: meeting this ambitious goal in a cost-effective manner cannot be achieved through a single fuel or technology, but rather through an effective mix of policies and technologies tailored to the specificities of different transportation markets. Different decarbonization

strategies must be tailored to specific modes of transportation, travel habits, supply chains, and logistics. Transportation decarbonization also entails the adoption of sustainable mobility solutions such as the promotion of public transportation, soft transport modes (cycling, e-scooters), changes in mobility behavior/trip patterns (e.g. more teleworking), and modal shifts to less energy-intensive modes of transportation.

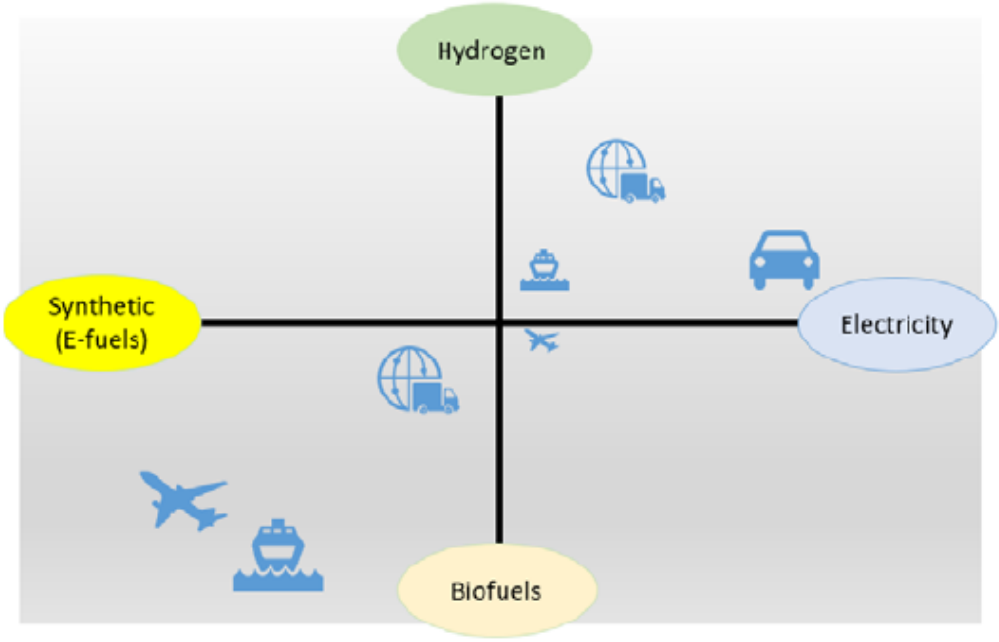


Figure 16 Multi-dimensional approach for Transport sector

India has vowed to cut carbon emission intensity of GDP by 45 percent below 2005 levels by 2030 as part of its Nationally Determined Contributions (NDCs). The NDCs demonstrate a distinct preference for mass transport systems such as buses and metros over private/low occupancy modes. It also recognises the need to move away from the road sector and toward more energy-efficient forms of transportation like rail and water. Electric vehicles, and biofuel mixing are all cited as ways to improve the road sector transportation.

Approach for Transport sector efficiency

The benefits of applying the ASI strategy to develop a sustainable transportation system are illustrated in the below figure.

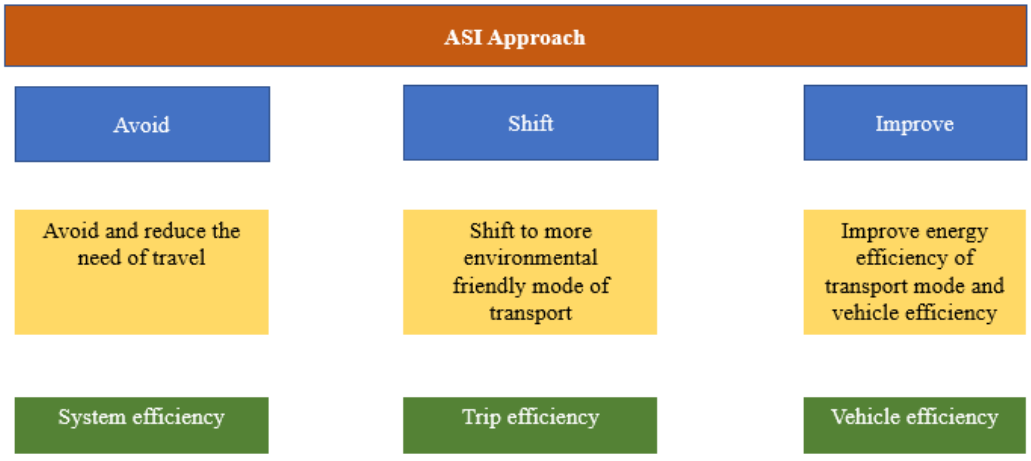


Figure 17 ASI approach for sustainable Transportation system

- **Policy framework for decarbonizing and energy efficiency in the transport sector:**

To reduce the gap between the India's climate goals and actual CO2 emissions, a mix of technology and policy alternatives will be required. As new and improved technology is introduced to the market, as well as the demands for passenger and freight transportation, this balance is projected to change.

Below Figure depicts the portfolio of drivers and intervention options for the transition to a decarbonized future transportation system.

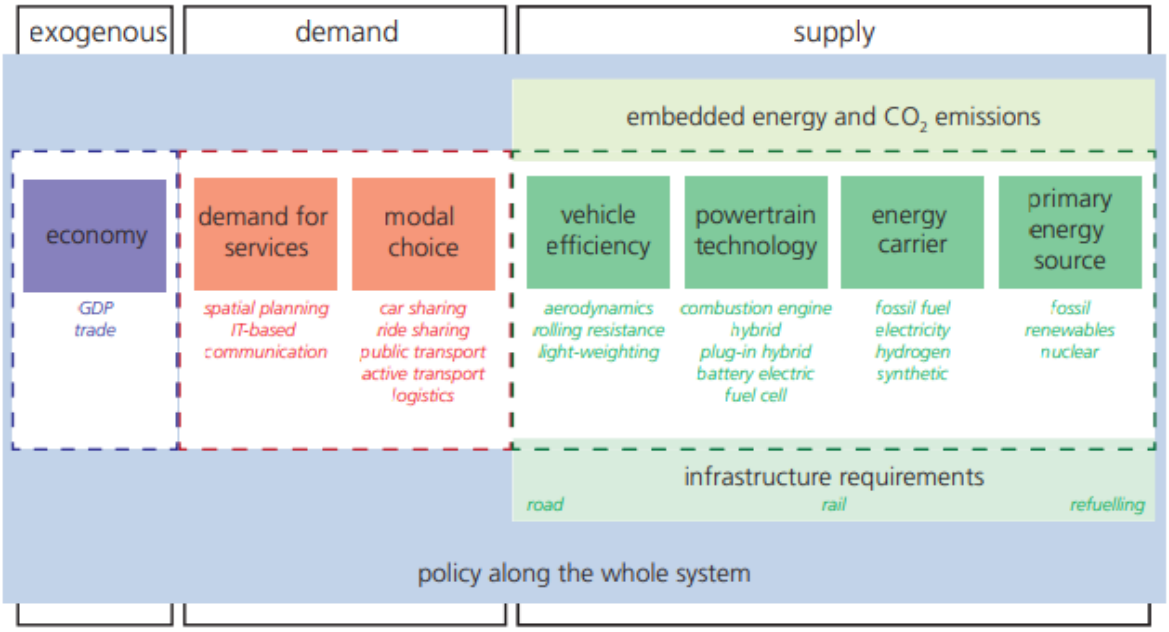


Figure 18 Drivers & intervention options for transitioning of transportation system

Transport Demand

- Encourage people to change their behavior (e.g., by facilitating walking, cycling, teleworking, teleconferencing, web-streaming of events, healthier lives, etc.) to reduce demand for passenger transportation services.
- Shift to modes of transportation that require fewer vehicle kilometers (kms) (e.g., shifting people and freight to vehicles with better specific load carrying capacity or boosting load factors of existing vehicles through sharing or pooling)

Transport Supply

- Enhance vehicle design (e.g., better aerodynamics, light-weighting to minimize vehicle energy demand, lower new vehicle fossil carbon footprint, etc.)
- Improve/deploy more efficient conventional powertrains as a transitional option, and maximise the potential of hybrid cars (hybridization);
- Improve/deploy vehicles using alternative energy carriers (e.g. low-carbon electricity, hydrogen, and synthetic fuels) that are powered by primary energy sources as long-term sustainable solutions.

Fuel efficiency:

Emission standards have long been enforced in India. In 1991/92, the first set of standards for gasoline and diesel automobiles were implemented. The National Auto Fuel Policy outlined a timeline for implementing Bharat Stage emission requirements. These standards are focused on reducing air pollution, which necessitates overall improvements in vehicle performance.

In terms of fuel efficiency, the Corporate Average Fuel Economy (CAFE) standards, which were implemented in 2017, have yielded positive improvements for passenger cars. The weighted average CO2 emission from a manufacturer's production line must be less than 130 gm/km by 2022, and less than 113 gm/km thereafter, according to these regulations. A fuel efficiency policy is also implemented in the EU which have resulted in improved fuel efficiency in transport sector.

5.2 Energy efficiency strategies in the transport sector

5.2.1 Strategy: Transition of conventional 2W, 3W, 4-W, Goods, Vehicles, Heavy Vehicles, Buses into EV fleet by 2031 in all cities

Electric vehicles are significantly more efficient than their petrol or diesel counterparts. While electric vehicles can convert around 60% of the electrical energy from the grid to power the wheels, petrol or diesel cars can only convert 17%-21% of the energy stored in the fuel to the wheels, resulting in a wastage of around 80%. Thus, electrification of road transport is a good way to reduce energy consumption and emissions, particularly as the grid becomes greener with increased use of renewables.

The strategy and its implementation are explained below.

The state has total 12.68 Lakh vehicles as of 13 Feb 2024 across various categories of vehicles;

Table 23 No of vehicles in the state (as of Feb 2024)

Vehicle Category	Petrol	Diesel	CNG	Electric
2- Wheeler	8,16,576	96	57	15,603
3- Wheeler	2,992	636	67	111
4- Wheeler	2,95,780	73,596	2,089	1,978
Goods vehicles	2,887	35,557	607	49
Heavy vehicles	45	18426	13	1
Buses	6	1111	2	102
Total	11,18,286	1,29,422	2,835	17,844

The majority share is from 2-W segment having share 65.62% followed by 4-W and Goods vehicles.

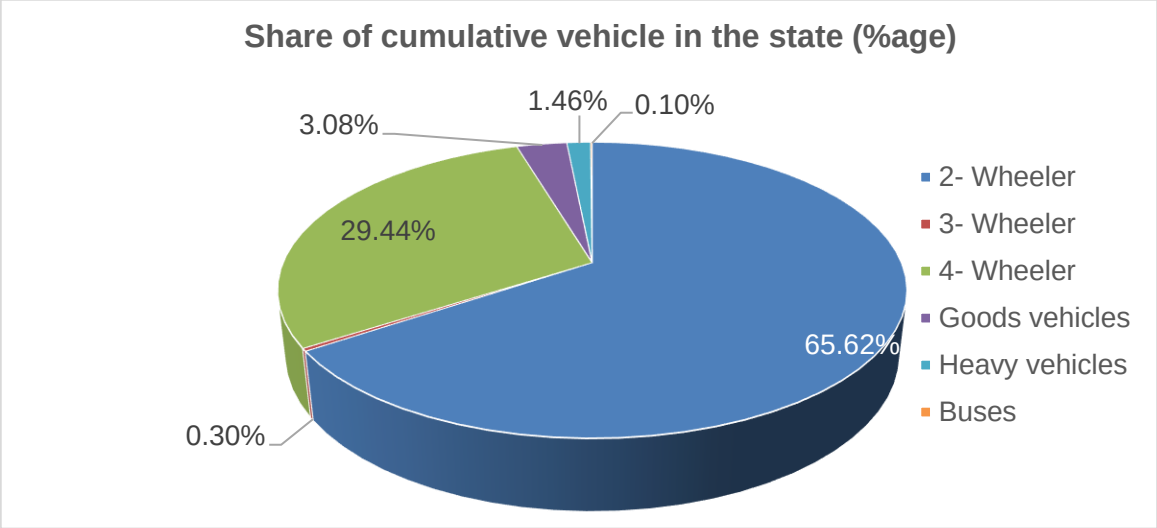


Figure 19 Share of cumulative vehicle in the state

The state had earlier notified the 'Scheme for the promotion of electric vehicles in the state of Goa in Dec 2021. The scheme was discontinued in July 2022. The cabinet on 5th Feb 2024 approved relaunch of schemes in Goa state to promote EV Vehicles.

Key policy highlights of EV new policy[16] are as follows:

- Government will provide a subsidy between Rs 8,000 and up to Rs 1 lakh to avail retrofitting benefits, scrapping, and de-registration of old internal combustion engine (ICE) vehicle for the purchase of new EVs. The subsidy will be applicable to purchase of 5,600 EVs
- This scheme's objective is to accelerate the pace of EV adoption across vehicle segments, especially in the mass category of two wheelers, public/shared transport vehicles and goods' carriers.
- The scheme seeks to drive rapid adoption of battery electric vehicles (BEVs) so that the segment accounts for 25% of all new vehicle registrations by 2024 and to bring about improvement in air quality by reducing greenhouse gas emissions, reduce noise levels, and also the use of fossil fuels by bringing down emissions from the transport sector.
- It is expected that the incentives provided in the scheme shall encourage delivery service providers (e.g. food delivery, e-commerce logistics providers, couriers) to switch to using electric two-wheelers.

[16] https://timesofindia.indiatimes.com/city/goa/to-bolster-adoption-of-evs-govt-relaunches-scheme/articleshow/107437912.cms

Table 24 Annual vehicle registration forecast

Annual registration of vehicles	Till Today	Actual annual vehicle registration				Forecasted annual vehicle registration							
		FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	FY 31
Nos	1268387	69920	44222	50648	76149	71000	62388	64259	66187	68173	70218	72325	74494

Table 25 EV registration percentage in annual registration across segment (Ambitious scenario)

Vehicle penetration in Ambitious scenario	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	FY 31
2- Wheeler	0.1%	0.5%	4.2%	12.5%	15.90%	25%	25%	25%	30%	30%	30%	30%
3- Wheeler	5.8%	3.2%	28.3%	37.7%	5.41%	25%	25%	25%	30%	30%	30%	30%
4- Wheeler	0.0%	0.4%	2.4%	3.1%	24.33%	25%	25%	25%	30%	30%	30%	30%
Goods vehicles	0.0%	0.0%	0.7%	0.8%	1.18%	25%	25%	25%	30%	30%	30%	30%
Heavy vehicles	0.0%	0.0%	0.0%	0.0%	0.00%	25%	25%	25%	30%	30%	30%	30%
Buses	0.0%	92.3%	35.5%	65.4%	0.00%	40%	50%	50%	70%	70%	70%	70%

Table 26 EV registration percentage in annual registration across segment (Moderate scenario)

Vehicle penetration in Moderate scenario	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	FY 31
2- Wheeler	0.06%	0.50%	4.18%	12.46%	15.90%	20%	20%	20%	25%	25%	25%	25%
3- Wheeler	5.77%	3.23%	28.30%	37.69%	5.41%	20%	20%	20%	25%	25%	25%	25%
4- Wheeler	0.02%	0.45%	2.39%	3.13%	24.33%	20%	20%	20%	25%	25%	25%	25%
Goods vehicles	0.00%	0.00%	0.67%	0.76%	1.18%	20%	20%	20%	25%	25%	25%	25%
Heavy vehicles	0.00%	0.00%	0.00%	0.00%	0.00%	20%	20%	20%	25%	25%	25%	25%

Vehicle penetration in Moderate scenario	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	FY 31
Buses	0.00%	92.31%	35.48%	65.38%	0.00%	30%	30%	30%	60%	60%	60%	60%

Energy Saving Potential

- Registration of 36,768 EV by 2026 in Moderate scenario and 46,752 EVs in ambitious scenarios by 2026
- Registration of 1.0 Lakh EV by 2031 in Moderate scenario and 1.24 Lakh EVs in ambitious scenarios by 2031

By considering the above vehicle forecast the energy saving potential estimation is as follows;

Table 27 Energy Saving Potential

Particulars	Moderate Scenario for 2030-31	Ambitious Scenario for 2030-31
Energy Saving Potential (MTOE)	0.232	0.287
GHG Emission Reduction Potential ($MTCO_2$)	0.727	0.898

Action Plans

This section describes several action plans that can be implemented across the transport sector for this strategy. For each of the strategies, a short and long-term period has been taken into consideration for actionable instruments.

Table 28 Action Plan

Action Plan	Brief of Action Plan	Timeline
Awareness & Capacity Building	• Awareness on Energy Efficiency Program on High Energy Lithium-Ion Traction Battery Packs and Systems.	Short Term (1-2 years), before 2026
Increase RE in the state	• Additional RE share from: Commercial buildings, Rooftop at home	Long Term (4-8 years), after 2026

Technology Intervention	• Combined Charging Systems (CCS Standard) • Charging stations based on open-access • Pilot projects on Hydrogen Fuel Cell Vehicles • Pilot projects on Battery Swapping stations in all 10 model Places	Short Term (1-2 years), before 2026 and Long Term (4-8 years), after 2026
S&L for Tire	• Awareness on Standard & Labelling Program for Tires • Increasing Demand for Low-Rolling-Resistance Tires: As EV manufacturers continue to seek ways to extend vehicle range, the demand for low-rolling-resistance tires is growing. These tires are critical in improving energy efficiency and are becoming standard in new EV models. • Tires can account for up to 20% of a vehicle's energy consumption due to rolling resistance. For EVs, reducing this resistance means that less battery power is used to travel the same distance, making the vehicle more efficient	Short Term (1-2 years), before 2026
Time-of-use pricing signals	• EV charging access at workplaces and shopping locations can encourage daytime, off-peak charging • EV policies of Uttar Pradesh, Punjab, Andhra Pradesh, and Kerala also provide for time-of-day metering for lower charges during off-peak hours.	Short Term (1-2 years), before 2026
	• Uses of Hydrogen, electrification from fossil-based process	Long Term (4-8 years), after 2026
Battery recycling policy)	• Government support is needed to encourage e-waste recyclers to focus on battery recycling. As per recent reports, the government is working on framing the policy	Short Term (1-2 years), before 2026
Battery recycling policy	**Government support is needed to encourage e-waste recyclers to focus on battery recycling.** • In Uttar Pradesh, large anchor and service units will be provided capital interest subsidy at 50% per annum up to Rs 10 million per year for 5 years, on loans taken for procuring equipment and machinery for battery recycling.	Short Term (1-2 years), before 2026

Road Tax Exemption	The road tax exemptions are a robust complement to the FAME-II purchase subsidies and should be implemented at the earliest by state transport departments. Fiscal allocations for road tax exemptions in state budgets can help in faster deployment of this incentive. Delhi, Maharashtra, Karnataka, Kerala, Bihar, Uttarakhand, Tamil Nadu, Andhra Pradesh and Punjab offer 100% road tax exemption for newly purchased EVs, for varying durations of time Uttar Pradesh provides a road tax exemption for the first 100,000 buyers of locally manufactured EVs, 100% exemption for e-2Ws and a 75% reduction for other EVs.	Short Term (1-2 years), before 2026
Scrapping and retrofit incentives	• Telangana offers a retrofitting incentive at 15% of the retrofitting cost, capped at INR 15,000 per vehicle, for 5,000 e-autos • Delhi offers a scrapping incentive of INR 5,000 and INR 7,500 for purchase of eligible electric two-wheelers and three-wheelers respectively, which can be availed upon proof of scrapping and de-registering old polluting ICE vehicles.	Short Term (1-2 years), before 2026
Educational courses	• Introduction of diploma and certification courses related to EVs in ITI polytechnic institute so that manpower is available for industries • Technician training	Short Term (1-2 years), before 2026
Green Zone	**Green zones, as referred to in state EV policies, are equivalent to low-emission or zero-emission zones, where the movement of polluting vehicles is restricted or penalized with an emission charge.** Ex: Kerala's policy encourages the establishment of EV zones in environmentally fragile regions such as Munnar. • Andhra Pradesh and Punjab have mandated green zones as a strategic measure in target cities for e-mobility.	**Short Term (1-2 years), before 2026**
Parking incentives	• Parking incentives include the waiver of parking charges for electric vehicles in public parking areas and/or the provision of reserved parking spots, often equipped with EV charging points. • Kerala and Madhya Pradesh provide an exemption from parking charges for EVs	Short Term (1-2 years), before 2026
Skill Development	• Punjab proposes skill development at various levels, ranging from 3- to 6-month-long industry-readiness courses to master's programs at universities within the state. The other states focus more on vocational courses through Industrial Training Institutes (ITIs) and skill development centers.	Short Term (1-2 years), before 2026

5.2.2 Strategy: Infrastructure development for EV charging station

The State Govt. has re-launched the EV policy in the state in Feb 2024. The policy aims to encourage start-ups and investments in the field of electric mobility and associated sectors such as mobility-as-a-service, autonomous vehicles, data analytics, and information technology.

As more EV will be on the road in coming years, a robust charging infrastructure is required in the state. An accessible and robust network of electric vehicle (EV) charging infrastructure is an essential pre-requisite to achieving this EV transition. Under the EV projection it has been assumed that 60% of the energy procured for charging EV will be from RE sources.

TASK 1	TASK 2	TASK 3	TASK 4
In depth analysis & research	Detailed interactions with stakeholders	Development of detailed energy efficiency action plan	Validation of detailed energy efficiency action plan

Action Plans

This section describes several action plans that can be implemented across the transport sector for this strategy. For each of the strategies, a short and long-term period has been taken into consideration for actionable instruments.

Table 29 Action Plan

Action Plan	Brief of Action Plan	Timeline
Awareness & Capacity Building	• Awareness on Energy Efficiency Program on High Energy Lithium-Ion Traction Battery Packs and Systems.	Short Term (1-2 years), before 2026
Technology Intervention	• Combined Charging Systems (CCS Standard) • Charging stations based on open-access • Virtual net metering and group net metering for green power sourcing for EV charging	Short Term (1-2 years), before 2026

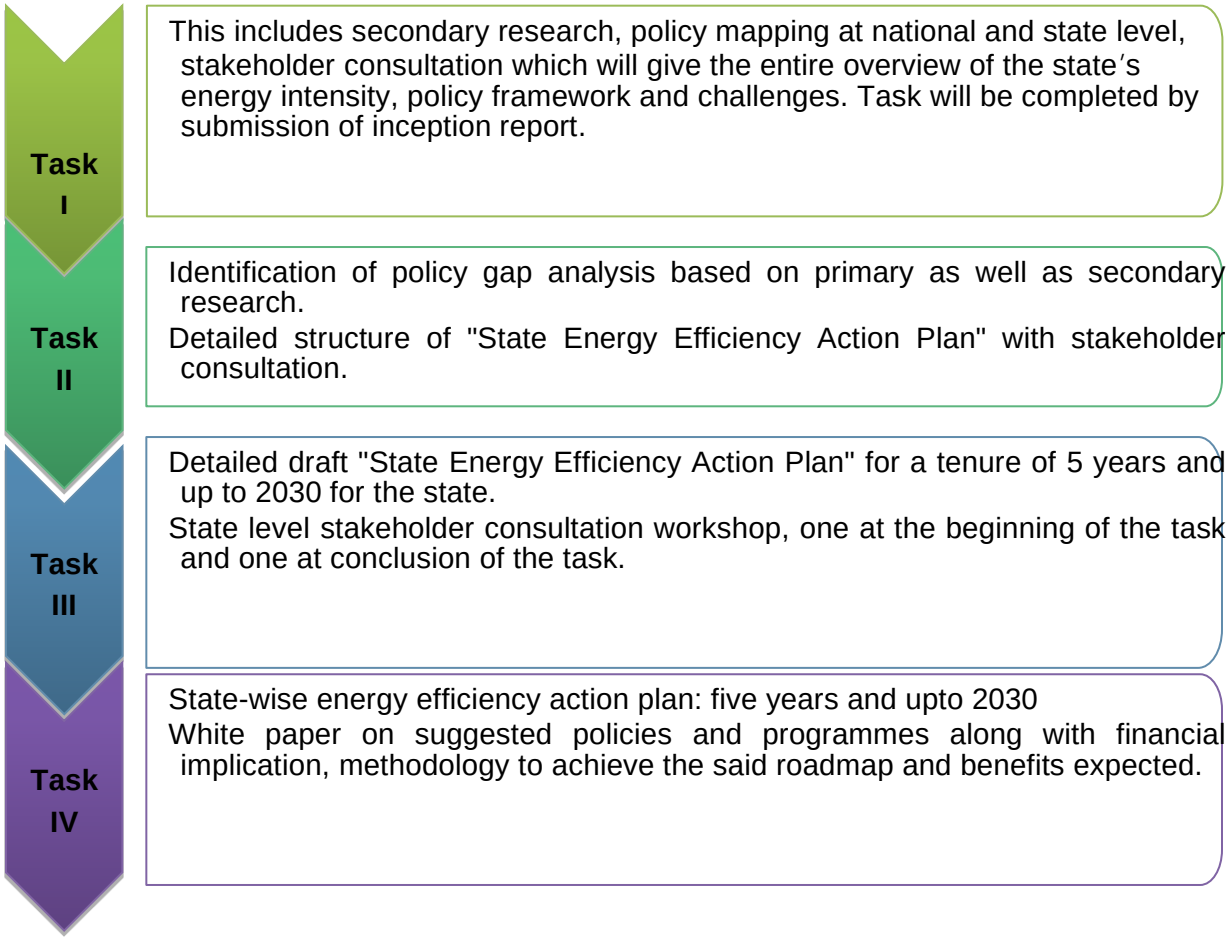
5.2.3 Strategy: Hybrid ferries in the state

Goa has two major rivers – Zuari and Mandovi along with smaller ones like Terekhol, Mapusa, Chapora, Sal, etc. The river navigation department of Goa has been developing the inland waterways to assist the local population and tourists. There are about 18 crucial ferry routes in Goa now. Currently around 41 ferry boats are plying on 18 routes across Goa.

The ferries currently being used are based on diesel as a fuel. There is potential for replacing the current diesel-based ferries to electric ferries. This will reduce the emissions from the ferries.

According to Captain of Ports, the River Navigation Department (RND) in Goa is planning on phasing out the old ferries plying in the state. They are following phased approach to replace the old ferries with newer ones.

This gives a huge opportunity for the department to introduce electric ferries as they phase out old ferries in the state.



The RND, Goa is recommended to add a solar powered hybrid ferries to their fleet to reduce carbon footprint and decarbonizing the river navigation in the state.

Energy Savings Potential

A typical diesel ferry which is plying in the river with an average trip distance of 2.8 kms would require 100 liters per day covering 22 trips[17]. When the same trip is done by an electric/solar ferry, it would require 73 kWh per day. It is assumed that 25 numbers and 35 numbers of hybrid model of ferries will be available in the state by 2031 in moderate and ambitious scenario respectively.

The energy saving potential resulting from the intervention would be 327 TOE and 457 TOE. The resulting emission reduction potential is about 0.001 MTCO2 and 0.0014 MTCO2 in moderate and ambitious scenarios respectively.

Table 30 Energy Saving Potential

Particulars	Moderate Scenario for 2030-31	Ambitious Scenario for 2030-31
Energy Saving Potential (MTOE)	0.0003	0.0005
GHG Emission Reduction Potential ($MTCO_2$)	0.001	0.0014

[17] icnl-18q3-v3 (sandith.in)

Case Study: Kochi water metro service in Kerala[18]

Kochi water metro is developed by Kochi Water Metro Limited formed as a Special Purpose Vehicle (SPV) with 74% of the shareholding being owned by the Kerala government and 26% by Kochi Metro Rail Limited (KMRL). It is operated and maintained by the KMRL.

Key features of the Kochi water metro include,

- Integrated Urban Water Transport System
- Holistic development of the areas being connected by waterways
- Augmenting ferry-based transport system as modal shift
- Reliable, safe, and environmentally friendly system
- Higher frequency and shorter headway
- Multi-modal integration with first and last mile connectivity
- Integrated Traffic Management System with dedicated Operations Control Centre (OCC)

Hybrid- Electric boats,

- 23Nos, 100 pax boats Design work completed
- First boat delivery on 15 February 2021.
- 30 Nos, 50 pax boats tender to be published in Jan'21

Key features of the Hybrid – Electric boats, (100 PAX boat specifications)

General		**PROPULSION SYSTEM**	
Hull Material	Aluminium	Type	Hybrid Twin Screw
Superstructure Material	FRP	Diesel Generators	2 x 40 KW
Vessel Type	Passenger Ferry	Propellers	Ni-Al bronze
Classification	Dual Class (DNV-GL & IRS)		
DNV	+1A, IN(1,2) METRO FERRY BATTERY POWER)	**BATTERY**	
		Type	LTO
IRS	+IWL, +IY, ZONE2, FERRY	Capacity ~	120 KWh
DIMENSIONS		**PASSENGERS**	
Length OA	24.8 m	Passengers	100
Beam (OA)	6.4 m	Wheelchairs	2
Depth (MLD)	1.7 m	Crew	4
Draft(MLD)	0.9m	HVAC	Fully Air conditioned Passenger space
PERFORMANCE		NAV EQUIP	Radar, Thermal Camera ABLS, Echo Sounder DMR, CCTV
Design Speed (Hybrid Mode)	10 Knots		
Service Speed (Electric Mode)	8 Knots		
Service Speed (Diesel)	8 Knots		

[18] https://mohua.gov.in/upload/uploadfiles/files/Water%20Metro%20Project.pdf

Case Study: high-speed A/c Speed boat Vega-120 between Vaikom – Ernakulam Kerala[19]

Inaugurated high-speed A/c Speed boat Vega-120 between Vaikom - Ernakulam on 04.11.2018 and launched "Vega 2" High speed Ac passenger (120 Pac) passenger cum boat on March 10, 2020 between Alappuzha-Kumarakom-Kottayam

- India's first water taxi Nirva was inaugurated on 15th October 2020. Kerala is the first State to roll out a water taxi in India.
- Inaugurated India's first solar boat Aditya, with 75 passenger capacity on 12/01/2017. In 2020, Aditya won the Gustave Award for Best Ferry in the World

Government Of Kerala: Kerala State Planning Board: Fourteenth Five-Year Plan (2022-2027): Recommendations:

The following administrative/ policy decisions may be explored for promoting Inland Water Transport (IWT)

1. IWT subsidy: Presently Re1/- per tonne- km has been given as subsidy for movement of cargo through inland waterways.

2. Subsidy for procurement of IWT vessels: 20% subsidy to be considered for procurement of new barges, boats, cruise vessels etc. which is being built in Indian yards. The vessel should be operated in Kerala inland waters or coastal waters for a minimum period of 5 years.

3. VGF for creating IWT facilities. For encouraging PPP projects in the field of IWT, 20% Viability Gap Funding may be considered by the State Govt. A corpus fund to the tune of INR 100 crores may be catered for this purpose.

5.2.4 Ethanol Blending

The ethanol blending policy of fuels can have a significant impact on the economy and environment of G. By blending ethanol with petrol, the state can reduce its dependence on imported crude oil and promote the use of cleaner fuels. According to the Ministry of

[19] https://mohua.gov.in/upload/uploadfiles/files/Water%20Metro%20Project.pdf

Petroleum and Natural Gas, India's ethanol blending program has resulted in a reduction of 7.9 million tonnes of CO2 emissions in 2020-21.
The state can leverage its agricultural resources to promote the production of ethanol and create new job opportunities. Government of India, with the aim to enhance India's energy security, reduce import dependency on fuel, save foreign exchange, address environmental issues and give a boost to domestic agriculture sector, has been promoting the Ethanol Blended Petrol (EBP) Programme. The 'National Policy on Biofuels' notified by the Government in 2018 envisaged an indicative target of 20% ethanol blending in petrol by year 2030. However, considering the encouraging performance, due to various interventions made by the Government since 2014, the target of 20% ethanol blending was advanced from 2030 to 2025-26.

A "Roadmap for Ethanol Blending in India 2020-25" was also released by the Hon'ble Prime Minister in June, 2021 which lays out a detailed pathway for achieving 20% ethanol

Scope Boundary

- Two-wheeler & four-wheelers

Implementing Agency

- State's Transport Department

Current Policy In Place

- National policy on biofuels
- Roadmap for Ethanol Blending in India 2020-25

Energy Saving Potential

Table 31 Energy saving potential through ethanol blending

Particulars	Moderate Scenario for 2030-31	Ambitious Scenario for 2030-31
Energy Saving Potential (MTOE)	0.0374	0.0459
GHG Emission Reduction Potential ($MtCO_2$)	0.1171	0.1438

Table 32 Action Plan

Policy Type	Action Plan	Timeline
Technological Intervention	Enabling infrastructure for ethanol availability for blending	Short Term (1-2 years), before 2026
Subsidy	State can ease storage, movement, and permit norms for industrial fuel-grade ethanol.	Short Term (already established in the state)
	Incentive to setup new distilleries to produce ethanol and to install any method approved by CPCB, Capital subsidy (technical civil works, Plant and machinery)	Short Term (1-2 years), before 2026

Unrestricted movement of denatured ethanol by State Governments

- The Government of India amended the Industries (Development & Regulation) Act, 195121 vide notification No. 27 dated 14th May, 2016. As per the amendment, the State Governments can legislate, control and/or levy taxes and duties on liquor meant for human consumption; but denatured ethanol, which is not meant for human consumption, can be controlled only by the Central Government. Accordingly, ethanol meant for blending in petrol, being denatured, should be allowed unrestricted movement and should be free from the control of the states. However, only 14 states have implemented these amended provisions (some states have only partially implemented). All states need to allow unrestricted movement of denatured ethanol meant for EBP
- Till date, twelve States, viz., Karnataka, Goa, Maharashtra, Gujarat, Bihar, Chhattisgarh, Tamil Nadu, Andhra Pradesh, Punjab, Madhya Pradesh, Himachal Pradesh, and Haryana have implemented the amended provisions.

Encouraging Ease of Doing Business through Technology:

The IDR Act implementation enabled State Governments to avoid complicated documentation procedures and conduct pro-business activities like e-approvals, online permits, electronic locking, GPS tracing of vehicles carrying ethanol etc. thereby shortening the overall process and reducing time to help the business

5.3 Energy saving potential & monitoring mechanism

Energy saving potential of the transport sector is 0.1413 MTOE and 0.1720 MTOE for moderate and ambitious scenarios FY2031 respectively which results in emission reduction potential of 0.4423 MTOE in moderate scenario and 0.5329 MTOE in ambitious scenario respectively.

Table 33 Summary of energy saving from the strategies in Transport sector

Strategy	Energy Savings in 2030-31 under moderate scenario (Mtoe)	Energy Savings in 2030-31 under ambitious scenario (Mtoe)	Emission reduction in 2030-31 under moderate scenario (MTCO2)	Emission reduction in 2030-31 under ambitious scenario (MTCO2)
Transition to EV	0.0873	0.1049	0.2733	0.3285
Hybrid electric ferries	0.0003	0.0005	0.0010	0.0014
Promotion of Ethanol Blending	0.0537	0.0649	0.1680	0.2030
Total	0.1413	0.1702	0.4423	0.5329

Following are the monitoring mechanisms that could be implemented to track the progress and effectiveness of the policies in the transport sector in Goa state:

Table 34 Monitoring mechanisms to track the progress and effectiveness of the policies in the transport sector

Policy Type	Monitoring Mechanism
Data Collection	Regular data collection and analysis can help track progress towards these targets and indicators. The state government can collect data on the number of electric vehicles on the road, the amount of fuel consumed, and the usage of public transportation. This data can be analysed to assess the effectiveness of policies and identify areas where improvements can be made.
Reporting	The state government can publicly report on progress towards climate change targets and indicators. This can be done through annual reports or other public documents. By making this information public, the government can increase accountability and transparency, and encourage public engagement and participation.
Stakeholder engagement	Engaging with stakeholders, including industry, civil society, and the public, can help ensure that policies are effective, and that progress is being made. The state government can establish stakeholder groups or committees to provide feedback on policies, identify potential challenges, and suggest improvements.

Technology Assessment	Regularly assessing emerging transport technologies and their potential impact on greenhouse gas emissions can help inform policy decisions and ensure that policies remain up to date with the latest developments.

6 FOCUS SECTOR 3: BUILDINGS

6.1 Overview

The building sector indeed has a large potential for energy efficiency improvements. Buildings consume a significant amount of energy for heating, cooling, lighting, and powering various systems and appliances. However, many buildings which are not energy efficient and consume more energy than necessary, resulting in higher energy bills and increased greenhouse gas emissions. Currently, India's buildings account for around one-fifth of total CO2 emissions and nearly 33 percent of the nation's energy use. In the absence of peremptory energy efficiency improvements and policy measures, the buildings sector is projected to emit seven times more CO2 by 2050, as compared with 2005 levels. Meanwhile, the residential sector's overall energy use could increase eightfold.

The adoption of energy-efficient building practices is critical for reducing energy consumption and greenhouse gas emissions in Goa. Energy conservation building code ECBC is notified in the state and state many pilot projects have started in the state. In residential sector, Eco Niwas Samhita (ENS) is yet to notified in the state.

There is a significant potential for energy savings through various strategies such as building envelope improvements, energy-efficient lighting systems, high-efficiency HVAC systems, and the use of renewable energy sources. The implementation of these strategies requires strong government support, stakeholder engagement, and effective policies to incentivize energy-efficient building practices.

According to the housing Census 2011 of Goa[20], total number of census houses are 5.77 Lakhs out of which 64% are in urban area and 36% are in rural area. The number of households projection is based on population growth and census data of 2011.

Table 35 Goa- Household census data 2011

Households census data-Goa	Urban	Rural	Total
Occupied census houses	2,82,000	169000	4,51,000
Vacant census houses	90,000	36000	1,26,000
Total	3,72,000	2,05,000	5,77,000
Total (Urban + Rural)	64%	36%	

[20] https://mohua.gov.in/upload/uploadfiles/files/Housing_in_India_Compendium_English_Version2.pdf

Table 36 Population growth projection in Goa

Particular	2011	%age breakup 2011	2020	2026	2031
Urban Population	906814	62%	9,46,188	9,73,382	9,96,641
Rural population	551731	38%	5,75,687	5,92,233	6,06,384
	1458545	100%	15,21,875	15,65,615	16,03,025

Table 37 Number of households projection

Use of occupied census houses (Urban)	(Urban + Rural)2011 (A)	Urban Occupied houses as per 2011 census (B)	household/ population (2011) C	Household projection 2020 (C* population 2020)	Household projection (C* population 2020)	2 Household projection (C* population 2031
Residence	3,14,000	194000	0.22	3,27,634	3,37,050	3,45,104
Residence cum other use	5,000	3000	0.00	5,217	5,367	5,495
Shop, offices, Hotel, Lodge, Guest houses etc	51,000	41000	0.03	53,214	54,744	56,052
School, colleges, Hospital, Dispensary etc	5,000	3000	0.00	5,217	5,367	5,495
Factory, Workshops	6,000	4000	0.00	6,261	6,440	6,594
Place of worship	6,000	3000	0.00	6,261	6,440	6,594
other non residential use	55,000	29000	0.04	57,388	59,037	60,448
No of occupied locked	8,000	6000	0.01	8,347	8,587	8,792
Total	**4,50,000**	**2,83,000**		**4,69,539**	**4,83,034**	**4,94,576**

6.2 Energy efficiency strategies in the buildings sector

6.2.1 Strategy: Implementation of ECBC for Commercial buildings.

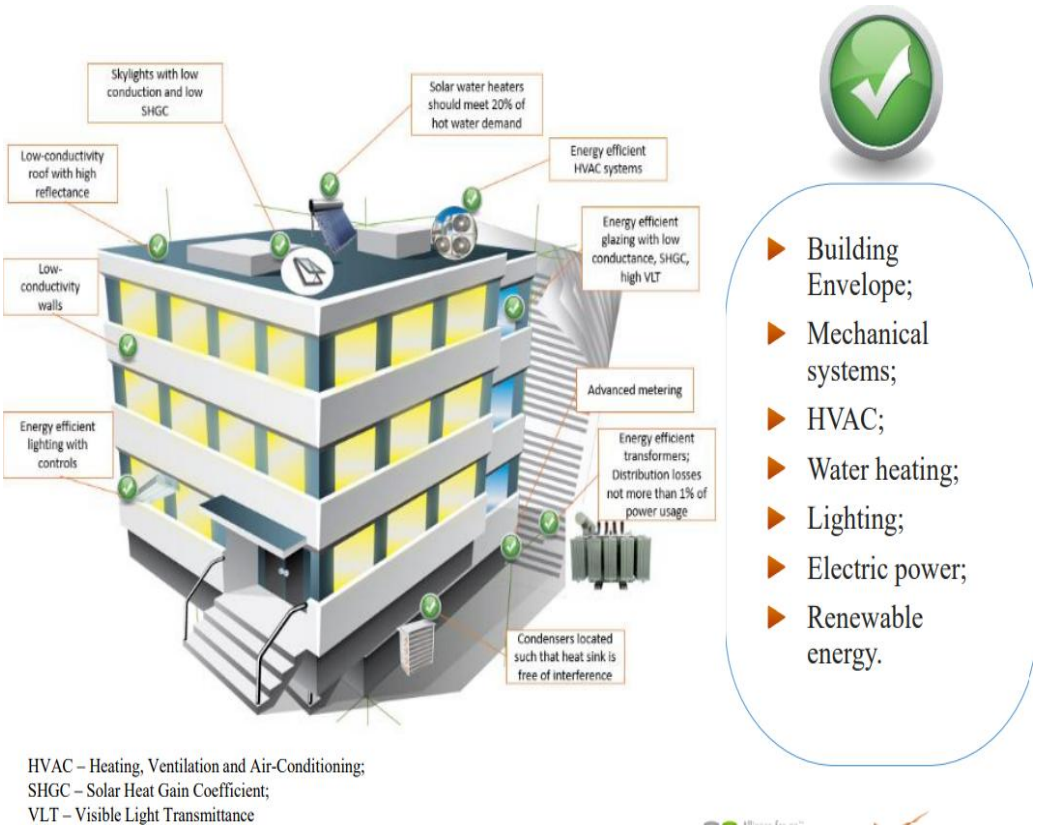
The state has notified the rules for ECBC in the state[21]. The successful implementation of the ECBC guidelines would result in energy savings in the building sector and will in turn help in reducing the GHG emissions in the state.

Key features of ECBC;

- Applies to new commercial buildings with a connected load of 100 kW & more or contract demand of 120 kVA or more; (State-specific)
- Introduces passive design features such as daylight requirements and shading provisions; Introduces provisions of installing Renewable Energy Systems;
- Sets minimum energy efficiency standards for design and construction; Encourages energy efficient design or retrofit of buildings;
- Pathway toward Near Zero Energy Buildings

Note:

1. *Govt has taken the initiative to include more sustainable aspects of buildings and ECBC will be converted to ECSBC*
2. *BEE has floated draft report for public comments*

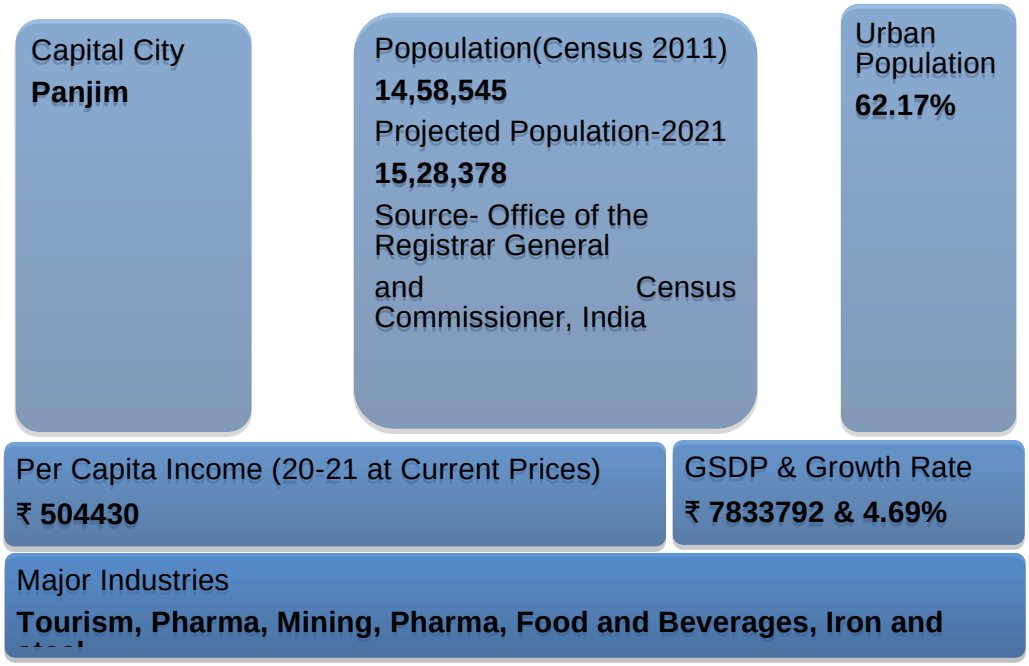


Source: AEEE

Goa-PAT cell has identified below projects under ECBC;

[21] https://www.goa.gov.in/wp-content/uploads/2020/11/Draft-Goa-ECBC-2020.pdf

- Rejuvenation of Campal Area of Panjim City as a green space with Recreation Centre, Panaji, Goa
- Canacona Municipal Council, Canacona, Goa
- MRT Bhavan, Margao, Goa
- Agricultural College, Ela Goa
- New Raj Bhavan, Dona Paula, Goa



- ECBC (Goa Amendment) Rules, 2022
- The Code is applicable to every building which is used or intended to be used for Non-Residential purposes having, -
- (i) connected load of 50 kilo watt (kW) or above; or
- (ii) contract demand of 60 kilo volt ampere (kVA) or above; or
- (iii) Building having total built up area of 1,000 Sq.mtrs or above

Energy Saving Potential

The energy saving potential is based on number of building considered under ECBC by 2031 and energy consumption across various type of building. Under ECBC it is assumed that building will be 20% more energy efficient in moderate scenario and 25% more energy efficient in ambitious scenario.

Total number of buildings considered under ECBC is as follows;

Table 38 No of commercial building in ECBC by 2031 in the state

Building Categories	No of Buildings considered under ECBC (2031)	No of Buildings considered under ECBC (2031)

	Moderate	Ambitious
Shop, offices, Hotel, Lodge, Guest houses etc	1,703	1,986
School, colleges, Hospital, Dispensary etc	167	195
Factory, Workshops	200	234
Total	2,070	2,415

Table 39 Electricity consumption by house type – Commercial buildings (assumptions)

Commercial sector	Unit	Energy Consumption per month
Shop, offices	kWh/month	2667
School colleges	kWh/month	2745
Hotel, Lodge and Guest house	kWh/month	90000
Hospitals, Dispensary	kWh/month	56619
Factory	kWh/month	18750

Based on above assumption of electricity consumption by various commercial establishment and projected no of building, total consumption by commercial building is estimated by 2031.

The saving potential in commercial sector is estimated as 0.018 MTOE in moderate scenario and 0.026 MTOE in ambitious scenario which is estimated by calculating energy saving per building (kWh/building) which is then multiplied with the estimated new buildings added by FY2031. Similarly, the GHG saving potential for this strategy is estimated as 0.057 MTCO2 in moderate and 0.083 MTCO2 in ambitious scenario.

Table 40 Energy Saving Potential – ECBC for commercial buildings

Particulars	Moderate Scenario for 2030-31	Ambitious Scenario for 2030-31
Energy Saving Potential (MTOE)	0.0181	0.0264
GHG Emission Reduction Potential ($MTCO_2$)	0.057	0.083

ECBC: Pilot Projects in Goa

Table 41 Pilot Project 1

Name of the Building	Rejuvenation of Campal Area of Panjim City as a green space with Recreation Centre
Building Type	Recreational
Location	Panaji, Goa
Climatic Zone	Warm and humid

Built-up Area, m^2	1975	
Conditioned Area, m^2	520	
Occupancy type	12 hours, 7 Days	
Estimated Connected Load, kW / Contract Demand, kVA **(Equipment, Lighting and HVAC only)**	Designed Case 52/75	Proposed Case 30/44
EPI of Standard case, kWh/m^2.year	78.6	
EPI of Conventional case, kWh/ m^2.year	103.4	
EPI of Proposed case, kWh/m^2.year	59.3	
Level of ECBC compliance achieved for Designed case	Not Compliant	
Proposed Solar PV power plant capacity, kWp	45	
Annual generation from Solar PV power plant, kWh/year	69,253	
INFERENCE		
	Without Solar PV	With Solar PV
EPI (Proposed Design), kWh/m^2.year	59.3	24.3
EPI Ratio	0.75	0.31
ECBC compliance achieved	Super ECBC	Super ECBC
Expected energy savings over Standard Design kWh/year	38,174	107,427
% savings over Standard Design	25 %	69 %
Estimated GHG reduction over BAU, tCO_2 per year	31	79

Table 42 Pilot Project 2

Building Name	**New Raj Bhavan**	
Building Type	Office	
Location	Donapaula, Goa	
Climatic Zone	Warm & Humid	
Built-up Area, m^2	2,554	
Conditioned Area, m^2	1,332	
Occupancy type	8hrs, 5 Days	
	Design case	Proposed case

Estimated Connected Load, kW / Contract Demand, kVA	202/ 318	176/ 253
Annual Energy Consumption in kWh	630,972	510,385
EPI of Standard Design, kWh/m².year	210.3	
EPI PWD Case, kWh/m².year	247.1	
EPI of Proposed Design, kWh/m².year	199.9	
Level of ECBC Compliance achieved by Conventional Case	Not Compliant	
Proposed Solar PV power plant, kWp	39	
Annual generation capacity of Solar PV power plant, kWh/year	59,962	
INFERENCE		
	Without Solar PV	With Solar PV
EPI of Proposed Design, kWh/m²/year	199.9	176.0
EPI Ratio	0.95	0.89000
ECBC compliance achieved	ECBC	ECBC
Expected energy savings over Standard Design kWh/year	26,656	86,618
% savings over Proposed design	5%	16%
Expected reduction in annual energy bills over PWD (@ INR 7/kWh), Lakh INR		1263843.35
Cost of energy efficiency interventions, Lakh INR		4,409,998
Simple payback period (in years)		3.5
Estimated GHG reduction over BAU, tCO_2 per year	22	70

6.2.2 Goa TCP initiative on sustainable and green building:

The Goa TCP Initiative on Sustainable and Green Building represents a strategic partnership between the Town & Country Planning (TCP) Department of the Government of Goa and the Confederation of Indian Industry's Indian Green Building Council (IGBC). The collaboration aims to integrate green concepts and measures into the state's development plans, policies, and programs. Through capacity building programs and advisory services, the initiative seeks to empower planners, engineers, architects, and relevant government

departments to incorporate sustainability principles into their practices. Additionally, CII-IGBC will contribute to the formulation of a comprehensive policy framework aligned with the state's sustainability goals. By fostering this partnership, Goa endeavors to promote environmentally conscious development and advance towards a greener future.

Figure 20 Signing of MoU between Goa TCP and IGBC for Sustainable and Green Building Initiatives

Focus Area

GED

The Electricity Department was created as a Govt. Department in the year 1963. The Electricity Department is the only licensee in the state of Goa for transmission and distribution of Electrical Energy.

The Department does not have its own generation and purchases power from the Central Sector Power Stations of the National Thermal Power Corporation as per the allocation made by the

GEDA

Goa Energy Development Agency (GEDA) is an Autonomous body established by the Government of Goa. GEDA is registered as a Society under the Societies Registration Act 1860, having a Governing Body headed by the Chief Secretary of the State.The Agency became operational in April 1996, exclusively to undertake all programmes in the field of Non -Conventional and Renewable Energy Sources. Apart from this, GEDA is also the Nodal Agency, which interacts with the Ministry of New and Renewable Energy (MNRE), Government of India, New Delhi, to

Capacity building programs for planners, engineers, architects in TCP, PWD, PCB Departments, Urban local bodies, and other relevant departments of Government of Goa, associated consultants & project teams on sustainability concepts

CII-IGBC to be a member of advisory council involved in development of short, medium and long term Plans for infrastructure and development projects and offer advisory for incorporating sustainability measures by design and planning.

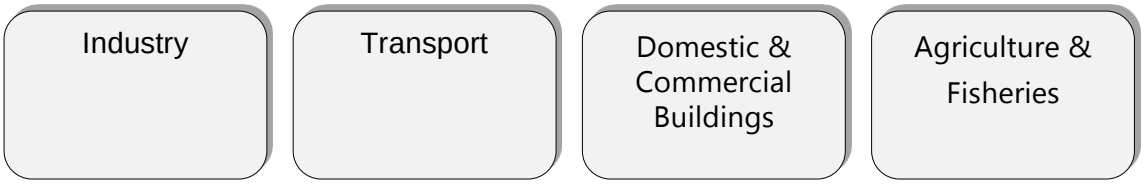
CII-IGBC will facilitate development of a coherent policy framework in line with the State's sustainability goals.

6.2.3 Strategy: Notification and Implementation of ENS-Residential buildings

The importance of ENS for energy efficiency lies in its potential to reduce energy consumption and greenhouse gas emissions, which are major contributors to climate change. By promoting energy-efficient practices in residential buildings, ENS can help reduce the demand for energy and promote the use of renewable energy sources. This, in turn, can help in achieving the country's goal of reducing its carbon footprint and mitigating the impact of climate change.

Table 43 Key features of ECO-Niwas Samhita

Eco Niwas Samhita: ENS Key Features	
Sustainable site management	Landscaping, Mitigation of Urban Heat Island
Building Envelope	Roof, Building envelope (except roof)
Building Services	common area and exterior lighting, Elevator, Pumps, Electrical systems
Indoor electrical use	Indoor lighting, Comfort system
Renewable Energy Systems	Solar Water Heating, Solar Photo Voltaic
Water Conservation & management	Site Water Use Reduction, Building Water use Reduction
Indoor Environmental Quality (IEQ) Cross ventilation	Daylight availability Air quality in car parking
Waste management	Construction waste management Post construction waste management



According to the housing Census 2011 of Goa, there are nearly 3.2 lakhs urban households and projected number of urban households by 2031 is shown below:

Table 44 Number of census houses - Residential buildings

Use of occupied census houses	2011	2020	2026	2031
Residence	3,14,000	3,27,634	3,37,050	3,45,104
Residence cum other use	5,000	5,217	5,367	5,495

Energy Saving Potential

The energy saving potential is based on estimation of new households added between 2020 to 2031. From above table it is found that 17,1748 new residential households is projected to add by 2031. The households which are projected to add by 2031, 70% are considered under ENS under moderate scenario and 80% considered under ENS ambitious scenario.

Average household consumption is considered as 206 kWh/month and energy saving potential through ENS is considered as 15% in moderate scenario and 20% in ambitious scenario while projecting potential of energy saving by 2031. The saving potential in residential sector is estimated as 130 TOE in moderate scenario and 149 TOE in ambitious scenario which is estimated by calculating energy saving per household (kWh/household) which is then multiplied with the estimated new houses added by FY2031. Similarly, the GHG saving potential for this strategy is estimated as 407 TCO2 in moderate and 465 TCO2 in ambitious scenario.

Table 45 Energy Saving Potential – ENS for Residential buildings

Particulars	Moderate Scenario for 2030-31	Ambitious Scenario for 2030-31
Energy Saving Potential (MTOE)	0.00013	0.00015

GHG Emission Reduction Potential ($MtCO_2$)	0.0004	0.0005

Action Plans

This section describes several action plans that can be implemented across the residential sector for this strategy. For each of the strategies, a short-, medium-, and long-term period has been taken into consideration for actionable instruments.

Table 46 Action Plan

Policy Type	Action Plan	Timeline
Awareness & Capacity Building	• Market Outreach for ENS/ ECBC compliant products, radio jingles, social media awareness.	Short Term (1 year), before 2026
	• Empanelment of Energy Auditors for buildings • Building Energy Auditor Training.	Short Term (1-2 years), before 2026
Subsidy	• Subsidies and incentive (state's example given in subsequent slide)	Short Term (1-year), before 2026
Technology Intervention	• Development and maintenance of ECBC and ENS compliance portal.	Short Term (1-2 years), before 2026
	• Pilot project investment for Super-ECBC buildings as case studies.	Short Term (1-2 years), before 2026
Energy Audit of Buildings	• The Energy Department, Government of Rajasthan has released a notification to conduct an energy audit once every three years for all commercial buildings having a connected load ≥ 100 kW, contract demand ≥ 120 kVA, or conditioned area ≥ 1000 square meter (Source: State Energy Efficiency Index 2022) • In Sikkim, energy audits and reporting has been made mandatory for all commercial buildings defined under the scope of ECBC 2020 with a connected	Short Term (1-year), before 2026

	load greater than 40 kW/50 kVA once every two (2) years. (Source: State Energy Efficiency Index 2022)	
Incentive from State Govt	• Government of Punjab: • Department of Local Government (Town Planning Wing): • Offers an additional 5% Floor Area Ratio (FAR) free of charge for projects which are rated Gold or above by IGBC • Department of Housing and Urban Development, Government of Punjab: Offers an incentive of additional 5%, 7.5% and 10% FAR free of charge with 100 % exemption of building scrutiny fee for projects which are rated Silver, Gold and Platinum respectively by IGBC. • Government of Andhra Pradesh: • The Industries & Commerce Department: offers 25% subsidy on total fixed capital investment of the project (excluding cost of land, land development, preliminary and preoperative expenses and consultancy fees) for buildings which obtain green rating from IGBC. This incentive is applicable for MSME and large industries. • Tourism Policy 2022-2032: offers reimbursement of 50% of IGBC Certification fee, with a maximum limit of INR 10.0 lakh, to hotel/wellness resorts obtaining green rating from Indian Green Building Council (IGBC).	Short Term (1-year), before 2026

6.2.4 Strategy: Deepening of Standard & Labelling Programme

The Bureau of Energy Efficiency (BEE) in India has implemented a standard and labelling program to promote the use of energy-efficient appliances. Under this program, old and inefficient appliances are encouraged to be replaced with new ones that meet the minimum energy performance standards (MEPS) set by the BEE. The labels help consumers make informed choices, thereby reducing energy consumption and costs. In the context of residential and commercial buildings, the S&L Programme can significantly reduce energy consumption by promoting the use of energy-efficient appliances.

This, in turn, will help in mitigating greenhouse gas emissions, reducing energy bills for consumers, and promoting sustainable development. The implementation of the strategy is explained below:

Scope Boundary

Deepening study for sectors under PAT namely Iron & Steel, Paper & Pulp and Chemicals
Widening of sectors like Pharmaceutical, Food and Beverages, Foundry, Glass, based on Industry's energy consumption

Implementing Agency

Bureau of Energy Efficiency (BEE) and Goa Electricity Department.

Current Policy in Place

PAT Scheme

Energy Saving Potential

The energy saving potential is estimated by assuming 30% of appliances will be replaced with efficient appliances in moderate scenario and 40% appliances will be replaced under ambitious scenario by 2031.

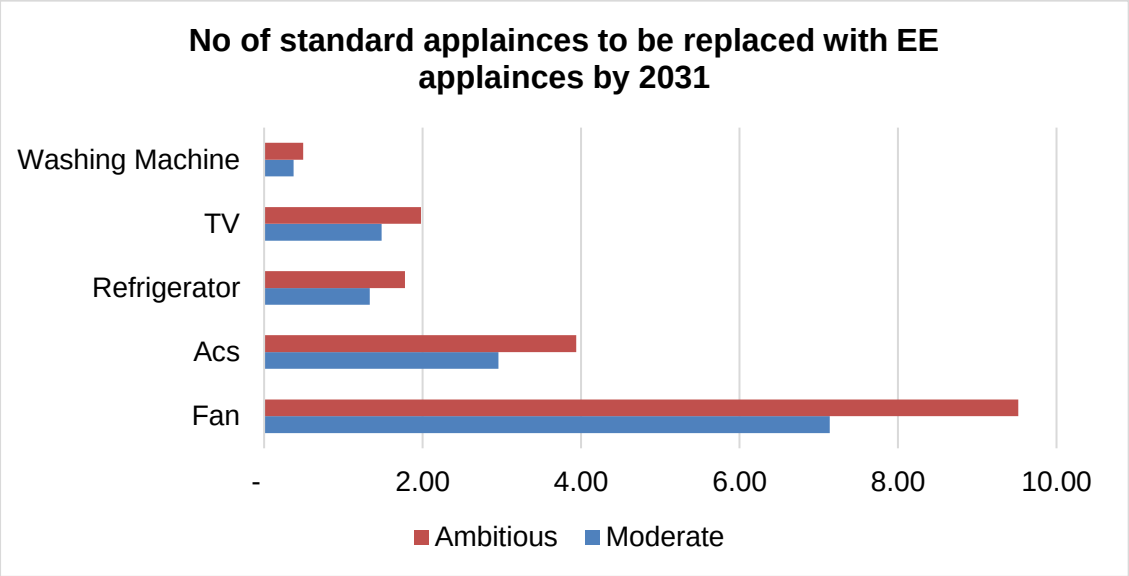


Figure 21 No of standard appliances to be replaced with EE appliances by 2031

By considering replacement of appliances as shown in above figure, 0.0447 MTOE and 0.0596 MTOE saving potential can be achieved in moderate and ambitious scenario. This intervention has GHG emission reduction potential of 0.1399 & 0.1866 $MTCO_2$.

Table 47 Energy Saving Potential

Particulars	Moderate Scenario for 2030-31	Ambitious Scenario for 2030-31

Energy Saving Potential (MTOE)	0.0447	0.0596
GHG Emission Reduction Potential ($MTCO_2$)	0.1399	0.1866

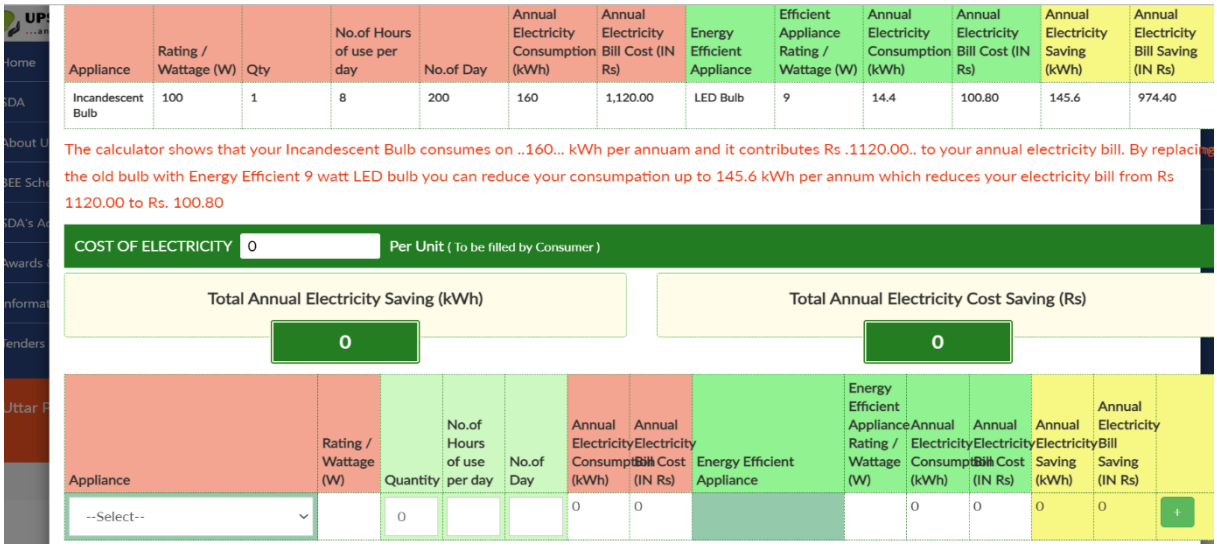
Action Plans

This section describes several action plans that can be implemented across the residential sector for this strategy. For each of the strategies, a short and long-term period has been taken into consideration for actionable instruments.

Table 48 Action Plan

Policy Type	Action Plan	Timeline
Awareness & Capacity Building	• Energy Efficient Technology Workshops for capacity building of Technology Suppliers and Professionals	Short Term (1-2 year), before 2026
	• Awareness campaigns, S&L Dashboard for the common public to analyze energy saving (ex- Development of Dashboard by UP Govt.)	Short Term (1-2 years), before 2026
Subsidy	• DSM Schemes through DISCOM for energy efficient appliances such as BLDC fans, AC • Ex: In **Telangana**, under the Energy Efficiency in Residential Buildings (EERB) programme, the SDA distributed one 28 W BLDC fan each to 7204 households in FY 2021-22	Short Term (1-2 years), before 2026

The purpose of web-portal or dashboard is to increase the consumer awareness for energy saving and verifying the appliances which they are buying. Example: Uttar Pradesh Govt has developed a portal for end users to calculate how much energy and money they can save if they are buying energy efficient appliances compared to old appliances.



Appliance	Rating / Wattage (W)	Qty	No.of Hours of use per day	No.of Day	Annual Electricity Consumption (kWh)	Annual Electricity Bill Cost (IN Rs)	Energy Efficient Appliance	Efficient Appliance Rating / Wattage (W)	Annual Electricity Consumption (kWh)	Annual Electricity Bill Cost (IN Rs)	Annual Electricity Saving (kWh)	Annual Electricity Bill Saving (IN Rs)
Incandescent Bulb	100	1	8	200	160	1,120.00	LED Bulb	9	14.4	100.80	145.6	974.40

Figure 22 Energy saving calculator by UP SDA

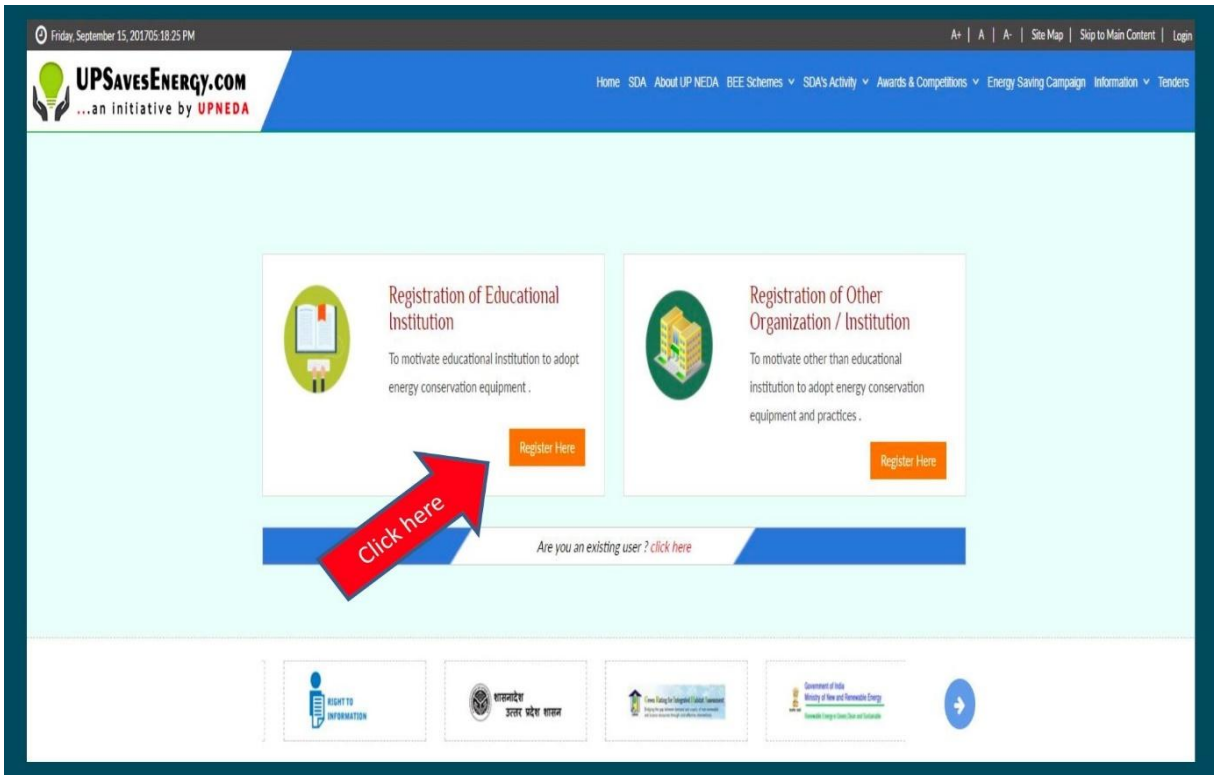


Figure 23 UP energy savings calculator web portal

Case Study: Energy Efficient Air Conditioners in India by BEE and CLASP[22]

[22] Increasing Access to Air Conditioners in a Heating India, CLASP

India is a developing country with a rising disposable income for a growing middle-class family. Low prices of ACs and availability and financing have grown rapidly over two decades.

The government of India expects that 300 million ACs will be purchased in India. Awareness of energy-efficient schemes and intervention campaigns will be key to purchase decisions.

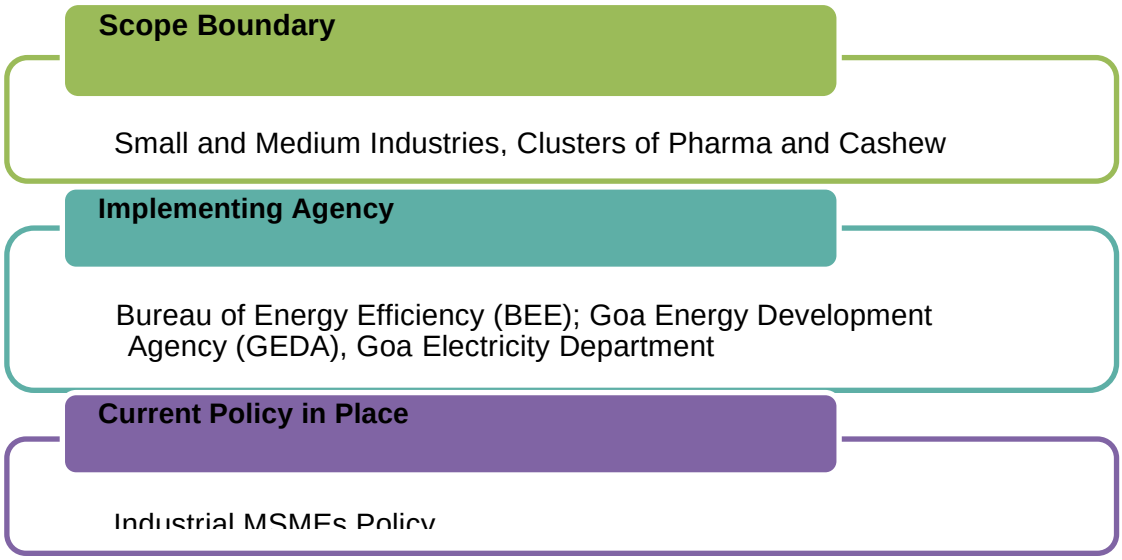
CLASP collaborated closely with BEE by providing technical and institutional support to accelerate access to ACs in India. Efficiency policies play a crucial role in energy efficiency and high-quality and affordable products. Standards and labelling programs help consumers to take correct decisions at the time of purchasing to save money and time. AC efficiency policies were launched in 2006 in India, seeing an increase in energy efficiency by 47 %. The introduction of Minimum Energy Performance Standards (MEPS) and revised star rating plan are some policies by BEE with the support of CLASP.

Over the past 15 years, India has manufactured more than 63 million efficient AC units that reduced the country's electricity consumption by 85 TWh. Efficient ACs have also lowered electricity bills by an estimated USD 5.6 billion

6.2.5 Strategy: BEE Star Rating of Buildings & Green buildings

The Star Rating of Commercial Buildings initiative, which was started by the Indian Ministry of Power in 2009, is based on the energy consumption of the building relative to its size, expressed in kWh/sqm/year. Buildings are rated in this programme on a range of 1 to 5, with 5 stars denoting the most efficient ones.

The implementation of the strategy is explained below:



Energy Saving Potential

As of now state has 11 Green building projects under India Green Building Council (IGBC) under various level of certification. Total built-up area certified as green projects is 14,96,780 Sq. Ft. as of Dec 2023. TCP department has taken imitative for sustainable building in the

state. As a conservative estimate total number of green building in the state is considered as 50 by 2031.

Table 49 List of IGBC certified projects in Goa State

Sr. no	Project Name	Parent Organization	Built up Area (Sq Ft)	Certification Level
1	Vicente Greens	Acron Developers Pvt Ltd.	48,420	Gold
2	Encube Ethicals Pvt Ltd.	Encube Ethicals Pvt Ltd.	12,917	Platinum
3	Siemens Ltd (ED EA)	Siemens Ltd	85,272	Gold
4	Siemens Ltd (ED MV2)	Siemens Ltd	57,372	Silver
5	Viva (Kadamba)	Inorbit Malls (India) Pvt Ltd.	1,26,000	Certified
6	Nivim	Turiya Living	2,691	Gold
7	THDCL Agueda	Tata Housing Development Company Ltd	4,19,032	Gold
8	Navo Vado	Grounded	4,446	Platinum
9	Club Mahindra Resort - Varca	Mahindra Holidays & Resorts India Limited	1,29,166	Platinum
10	ALL INDIA INSTITUTE OF AYURVEDA	ALL INDIA INSTITUTE OF AYURVEDA	5,36,047	Gold
11	Club Mahindra - Emerald Palms, Goa	Mahindra Holidays & Resorts India Limited	75,417	Platinum
	Total Built-up area		14,96,780	

PAT cell department has also identified star rated project as given below;

1. Forest Headquarters, Forest Dept (Althino)
2. Goa International Airport (Mopa)
3. Rajyakar Bhawan, Office of Commissioner & State Tax (Althino)
4. Asilo, North Goa District Hospital (Mapusa)details
5. Dept.of water resources, Porvorim
6. Ravindra Bhawan (Art & culture dept)
7. Goa Institute of Public Admin and rural development
8. High Court of Bombay in Goa

By considering the green building is 30%-40% more energy efficient than conventional building, the energy saving potential is 0.0017 MTOE in moderate scenario and 0.0023 MTOE in ambitious scenario respectively. This intervention has GHG emission reduction

potential of 0.0053 $MTCO_2$ & 0.0070 $MTCO_2$ in moderate and ambitious scenario respectively.

Table 50 Energy Saving Potential – Star rating of buildings

Particulars	Moderate Scenario for 2030-31	Ambitious Scenario for 2030-31
Energy Saving Potential (MTOE)	0.0017	0.0023
GHG Emission Reduction Potential ($MTCO_2$)	0.0053	0.0070

Action Plans

This section describes several action plans that can be implemented across the commercial sector for this strategy. For each of the strategies, a short and long-term period has been taken into consideration for actionable instruments.

Table 51 Action Plan

Policy Type	Action Plan	Timeline
Awareness & Capacity Building	1. Encouraging Green Education in school/ college curriculum	Short Term (1-years), before 2026
Subsidy	1. Incentives (Rebate in property Tax Additional FAR, reduction in stamp duty and faster environmental clearance for upcoming, green-rated building projects) 2. Incentive policy support to encourage net zero buildings	Short Term (1-2years), before 2026
Sustainability Initiative	1. Transformation of government buildings to Net-Zero	Long Term (3-5 years), after 2026

IGBC's expert's recommendations for Targeting Net-Zero Buildings

1. **Incentives and Policy support to encourage Net Zero Energy Buildings**
   - Reduce / Waive off fee related to electrical infrastructure or development for such projects.
   - Charge customers a small CO2 tax per unit consumption and use this to install Cleaner Power plants / offsetting revenues
   - Encourage open-access and remove the limit on purchase of green power for buildings and built environment aspiring to achieve Net Zero Energy Status. There should be no restriction on on-site and off-site green power. 100% procurement of green power through wheeling within and outside the state should be allowed.

- Remove the cap on installed capacity of onsite renewable power generation system (roof top, Building Integrated Photovoltaic system or any other RE installation) in buildings and built environment projects
- Encourage net metering or in case of gross metering, the power purchase tariff to be set in a way that Return on Investment (ROI) is not more than 2 - 3 years

2. **Promoting Sustainable Industrial Infrastructure**
    - Few of the proposed incentives for green-rated logistics parks, warehouses and factory buildings are as follows:
        - Allow higher ground coverage
        - Enable Single window faster clearance
        - Subsidy on capital investment for implementing key sustainability measures - RWH, LED lighting, RE systems, etc
        - Provide Power at concessional rate
        - Concession in stamp duty and registration fee
        - Exemption in payment of development charges
        - Road tax exemption or concession in vehicle registration fees for e-vehicles and other low-emitting service vehicles
        - Facilitate green loans
3. **Encourage PWD to adopt eco-friendly certified products by implementing a Sustainable Procurement Policy**
    - Certified Green Product enables the end users of the building sector and manufacturing sector to choose sustainable products, materials and technologies for reducing the environment impacts during the construction, operation and maintenance of their buildings and factories.
    - A certified green product has lower environment impact and contributes significantly for enhancing the performance of Green Buildings and Green Companies.
4. **Encouraging Green Education**
    - Architectural and Engineering colleges should offer specialized courses on green buildings, energy efficiency and the students should be encouraged to get professionally accredited on these subjects. This would create industry-ready professionals who can be involved in green and net zero energy projects in the future.
    - Similarly, officials from PWD, Urban Development, Town and Country Planning and other concerned departments must be encouraged to get trained and accredited by professional agencies on green and net zero energy buildings and built environment.

6.3 Energy saving potential & monitoring mechanism

Energy saving potential of the buildings is 0.011 MTOE and 0.015 MTOE for moderate and ambitious scenarios FY2030 respectively as seen from

Table 52 Summary of energy saving from the strategies in Building sector

Strategy	Energy Savings in 2030-31 under moderate scenario (Mtoe)	Energy Savings in 2030-31 under ambitious scenario (Mtoe)	Emission reduction in 2030-31 under moderate scenario (MtCO2)	Emission reduction in 2030-31 under ambitious scenario (MtCO2)
Implementation of ENS and ECBC	0.0182	0.0265	0.0570	0.0830
Standard & Labeling in residential and commercial building	0.0447	0.0596	0.1399	0.1866
Star rated and Green Building	0.0017	0.0023	0.0053	0.0070
Total	0.0646	0.0884	0.2022	0.2766

Following are the monitoring mechanisms that could be implemented to track the progress and effectiveness of the policies in the transport sector in Goa state:

Table 53 Monitoring mechanisms to track the progress and effectiveness of the policies in the transport sector

Policy Type	Monitoring Mechanism
Reporting & Disclosure	Establishing a system for enforcing compliance with energy efficiency codes and standards under operating conditions every few years can help ensure that buildings are meeting the required standards for reducing carbon emissions.
Performance contracting	The government can encourage performance contracting, where third-party contractors are responsible for implementing energy efficiency measures in buildings. The contractors can be required to report on energy savings achieved and the government can monitor these savings.

7 FOCUS SECTOR 4: AGRICULTURE & FISHERIES

7.1 Overview

Agriculture is one of the most significant sector in the country, accounting for 18% of GDP and employing about half of the country's workforce. As per provisional estimates of State income, the share of agriculture and allied sectors in Gross Value Added (GVA) at current

prices is INR 550600 lakh for the year 2021-22(A) as against INR 496003 lakh for the year 2019-20(P)[23].

7.2 Energy efficiency strategies in the agriculture sector

7.2.1 Strategy: Solarization of Pumps and replacement of standard pumps with energy efficient pumps

Ministry of New and Renewable Energy (MNRE) has launched the Pradhan Mantri Kisan Urja Suraksha evem Utthan Mahabhiyan (PM KUSUM) Scheme for farmers for installation of solar pumps and grid connected solar and other renewable power plants in the country.

The scheme aims to add solar and other renewable capacity of 25,750 MW by 2022 with total central financial support of Rs. 34,422 Crore including service charges to the implementing agencies. The scheme has been extended up to 31.03.2026.

The Scheme consists of three components:

- Component A: 10,000 MW of Decentralized Ground Mounted Grid Connected Renewable Power Plants of individual plant size up to 2 MW.
- Component B: Installation of 17.50 lakh standalone Solar Powered Agriculture Pumps of individual pump capacity up to 7.5 HP.
- Component C: Solarization of 10 Lakh Grid-connected Agriculture Pumps of individual pump capacity up to 7.5 HP.

Scope Boundary

Switching to clean energy fuel i.e. hydrogen in large industry units of steel in the state.
potential end users in other industrial sector

Implementing Agency

GEDA, GED, Directorate Of Industries

Current Policy

National level policy on green hydrogen

***State has following scheme under Irrigation[24]**

[23] State Economic Survey-2021-22

[24] Schemes & Services Implemented by Directorate of Agriculture, Government of Goa

Table 54 Schemes for Irrigation Facility

Sr. No.	Type of Assistance	Criteria for assistance	Name of the Scheme & Component
1	Assistance for installation of new Pump set, replacement of existing pump sets with upgradation of irrigation system .	Min. area of 0.125 ha with 0.1ha net area under crops 90% subsidy on standard cost for pump sets upto 5 Hp and 50% subsidy for pump set above 5 HP.	Assistance for Creation of Irrigation Infrastructure (Central & State)
2	Assistant for replacement of old pump set	50% subsidy on standard cost.	Assistance for Creation of Irrigation Infrastructure (Central & State)
3	Assistance for pump set above 5 HP	50% subsidy on standard cost.	Irrigation Infrastructure

Energy Saving Potential

Based on the scenario in the state about 200 pumps will be solarized by 2026 under PM KUSUM, the state can target to implement the similar scheme further till 2031. By considering similar growth in a moderate scenario and an accelerated growth in ambitious scenario it is considered that the state will have 500 & 700 pumps grid connected solar pump in moderate and ambitious scenario by 2031. Further Installation of 1500 energy efficient pumps under moderate scenario, 2000 pumps under ambitious scenario by 2031.

Through the above strategies, 0.0002 & 0.0003 MTOE energy saving potential can be achieved in moderate and ambitious scenario by 2031.

Table 55 Energy Saving Potential

Particulars	Moderate Scenario 2030-31	Ambitious Scenario 2030-31
Energy Saving Potential (MTOE)	0.0003	0.0004
GHG Emission Reduction Potential (MtCO2)	0.0009	0.0013

Action Plans

This section describes several action plans that can be implemented across the commercial sector for this strategy. For each of the strategies, a short, and long-term period has been taken into consideration for actionable instruments.

Table 56 Action Plan

Action Plan	Timeline
Create awareness and help farmers realize the need for solarization of pumps	Short Term (1-year) before 2026
Incentive for pump replacement (already in place in the state)	Already in the state
Steps to integrate other agriculture loads like flour mills, hullers, shredders with solar pumps for increased utilization of solar power and restrict over pumping of water	Long Term (2-4 years), after 2026

Case Study: Strategies to Boost Components A and C Under PM-KUSUM Scheme

A study was carried out by CEEW with support of Shakti Sustainable Energy Foundation where the status of PM-KUSUM across 7 states has been evaluated through discussion with key stakeholders involved. The study findings as recommendations to State Nodal Agencies (SNAs) for boosting the component A and C of the scheme include,

1. Adopt innovative models to overcome financing challenges with farmer-owned power plants: Usual means of project financing for developers are inadequate for farmer-owned power plants for two reasons.
    a. Farmers are not able to raise/contribute 30 per cent equity for the power plant.
    b. In the absence of any track record as a developer, they cannot access loans from banks without collateral. Banks do not take agricultural land as collateral for non-agricultural purposes.

    State nodal agencies (SNAs) need to work with financial institutions to try innovative models such as the farmer-developer special purpose vehicle (SPV) piloted in Karnataka.
2. Ensure inter-departmental coordination to mitigate any issues in the planning and implementation phases:

    Multiple agencies like the DISCOMs, SNAs and revenue departments have roles to play at different stages of implementing this component. States should form a PM-KUSUM steering committee, led by the implementing agency, with state-level representatives from all the concerned departments. Such an arrangement can

anticipate any inter-department coordination issues in the planning and implementation phases and address them.

3. Discoms should lead the component's implementation:

   The study makes it abundantly clear that the implementation of the component will throw up many challenges that only the discoms can tackle. The discoms' role in Component-C is pre-eminent, and all the states should appoint the discoms as the implementing agency for the component.

4. Pilot the model in different contexts:

   The outcome of Component-C depends on an array of localised factors like the current cropping pattern, the existing power supply conditions, and alternative options with surplus power. Given that these factors vary immensely even within states, states must carry out pilots in different agroeconomic contexts before scaling up the model. The pilots should specifically test out the following aspects:

   a. Different combinations of financing structure and metering options acceptable to farmers and assess their economic viability.
   b. Use of surplus power and impact on groundwater
   c. Comprehensive infrastructure assessment in the pilot projects to assess the infrastructure challenges and costs.

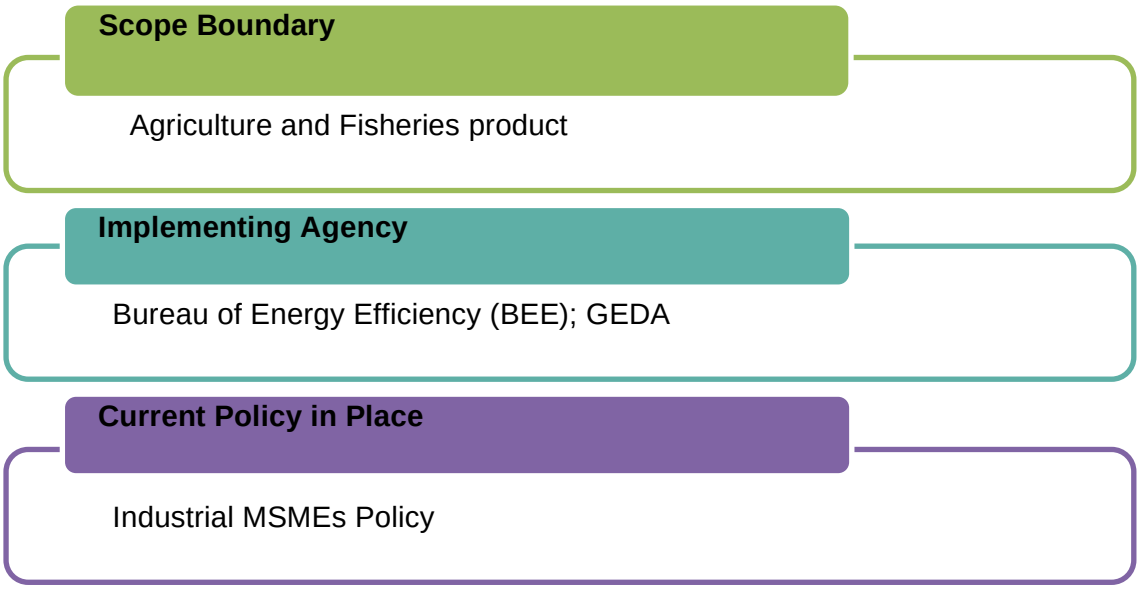
5. Complement the component with other key measures to make it viable:

   The states along with the MNRE could take some essential steps to make Component-C more feasible and sustainable with,

   a. Component C to be implemented in consonance with subsidy and tariff reform measures
   b. Testing out the overall benefit from pump replacement (efficient ones with inefficient ones) through pilot studies
   c. Framework for determining FiT (Feed in Tariff)

7.2.2 Strategy: Energy efficiency across value chain of fisheries

The fisheries sector in India encompasses a wide range of activities, from fishing to processing, marketing, and distribution of fish and fish products. Improving energy efficiency across all value chains in the fisheries sector can lead to significant environmental and economic benefits, including reduced greenhouse gas emissions, decreased energy consumption, and cost savings for fishers and processors.



In the processing and packaging stages, energy is mainly consumed for cooling, freezing, and drying of fish products. The use of energy-efficient refrigeration and drying equipment can significantly reduce energy consumption and associated costs. Additionally, adoption of renewable energy sources such as solar and wind can further reduce energy consumption and greenhouse gas emissions.

The transportation and distribution of fish and fish products also require significant energy input, mainly in the form of fuel for vehicles and refrigeration systems. The use of energy-efficient vehicles and refrigeration systems, as well as improved logistics and distribution systems, can reduce energy consumption and transportation costs.

Overall, improving energy efficiency across all value chains in the fisheries sector in the state can bring numerous benefits, including reduced greenhouse gas emissions, cost savings for fishers and processors, and increased competitiveness in the global market.

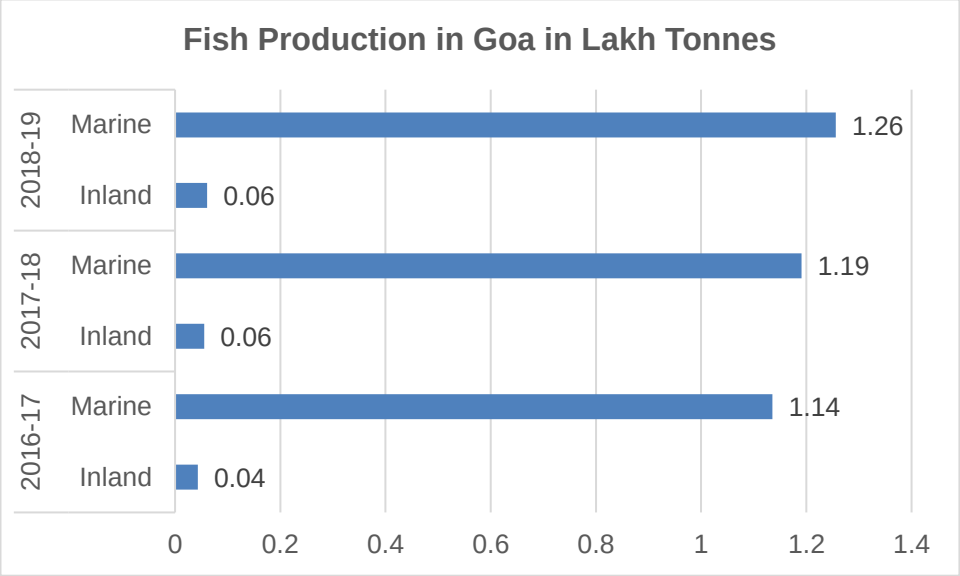


Figure 24 Fish production in Goa

In Goa, the fish production between 2016-2019 is shown in **Error! Reference source not found.**. The growth rate of production in the state historically is about 5.6% CAGR. Considering a similar growth rate for the next few years, the production of fish is expected to reach about 2.42 Lakh tonnes by 2031.

Savings potential

Energy savings has been considered across the fisheries value chain by projecting the fish production as 1.30 lakh tonnes of fish by 2031.

The energy saving potential has been estimated by accounting for both thermal and electrical consumption across harvest, land transport, processing and cold chain.

Table 57 Energy Saving potential - EE interventions in fishery value chain

Particulars	Moderate Scenario 2030-31	Ambitious Scenario 2030-31
Energy Saving Potential (MTOE)	0.0153	0.0229
GHG Emission Reduction Potential (MtCO2)	0.0478	0.0718

Action Plans

This section describes several action plans that can be implemented across the fishery sector for this strategy. For each of the strategies, a short, and long-term period has been taken into consideration for actionable instruments.

Table 58 Action plan

Policy Type	Action Plan	Timeline
Awareness & Capacity Building	1. Provide skill development support. 2. Promotion of resource efficiency and cleaner refrigerant usage 3. Interventions and incentives needed to promote improved designs for fish transportation, transportation of live fish, mobile kiosks for street vendors under Make in India	Short Term (1-2 years), before 2026
Policy Intervention	4. Guidelines for usage of BEE star-rated products. 5. Partial support for conducting Energy audits in the value chain in line with the facility available for DC MSME. 6. Mandatory Collection and submission of basic data from processing units on energy consumption and emissions - facilitating data collection procedures 7. Standardization of cold chain technologies and practices covering investment, RoI, energy specifications, vendor names and other operational benefits	Short Term (1-2 years), before 2026
Technological Interventions	**First and last mile transportation:** • Phase Changing Materials (PCM) technology in Coolers/ Freezers • Energy Efficient Aerators • Adoption of EV (State has implemented, 150 electric 3-wheelers in Bangalore for selling the fish as per information received from Fisheries dept.)	Short Term (1-2 years), before 2026 & Long Term (2-3 years) after 2026
	Cold storage & Processing: • Solar PV System for Fishery/cold storage • Efficient Ammonia / CO2 Brine system in Cold storage • Use of Evaporative condenser for cooling • Low charge Ammonia refrigeration system	Short Term (1-2 years), before 2026
	Reefer Transport: • Mobile Chilling for Reefer trucks • Swapping the PCM material	Long Term (2-4 years), after 2026
	Multiple Areas • Variable Frequency drive solution for Refrigeration systems	Short Term (1-2 years), before 2026

	• Electronic Level Control for Refrigeration system • IOT for Refrigeration systems • Solar aerator for aquaculture farms	

Case Study: Energy Efficiency in fisheries value chain

Energy & GHG Audit of selected Fisheries Sector Value Chains + Recommendations of Best/ Appropriate Transformation. Facilitating adoption of best energy efficiency and GWP + ODS reducing practices in fisheries sector cold chain and encouraging private sector participation

Project activities:

- Understanding the need and appraisal of local/ national and international best practices in existing cold chain processes towards energy efficiency (EE), and reduction of use of refrigerants with high global warming potential and ozone depleting substances
- Detailed energy audit of fisheries sector value chains in India
- Recommendations for improvement of the value chains.
- National Design Challenge for newer ideas – Mobile Kiosk for Fish Vending & Live fish transport.
- Stakeholder consultations to facilitate the adoption of best practices in the fisheries sector cold chain and encourage private sector participation.

Impact: The purpose of the energy & GHG audit of selected value chains is to establish mass balance and estimate benchmarks of SEC, GHG emissions and energy consumption and to know the best practices in the value chain

Value Chain	Elements	Resource savings (%)				GHG
		Electrical energy	Thermal energy	Water	Ice	
Aquaculture shrimp	Farm	16%	-	-	-	15%
	Processing	7%	43%	3%	40%	10%
IMC	Farm	20%	-	-	-	19%
	Processing	8%	24%	18%	40%	13%
Finfish	Processing	11%	-	-	-	11%

Crab and Lobster	Processing	6%	-	-	-	5%

Some of the findings on major technologies practiced in the cold chain are Phase change material technology in coolers to avoid delivery issues, solar PV systems for cold storage and EV to reduce emissions, Reefer trucks, aerators to Improve the quality of water, VFD for refrigeration systems, etc.

National Design Challenge for newer ideas is conducted, where more than 150+ participants under each category from college students, innovators, start-ups, associations and practicing officials in the sector. The main objective of the challenge was to get the best mobile kiosk for fish vending while maintaining the safety and hygiene of fish, and facilitate a circular economy based on reducing fish waste and energy efficiency.

The fishery value chain has been analysed through stakeholder consultation to help increase the private sector participation. It is recommended to,

1. Develop a compendium for investment potential & highlight current best practices in the fisheries sector that can be created across different supply chains and value chains
2. Organise B-to-B workshops and Matchmaking for the fisheries sector along with financing institutions
3. Implement pilot projects that can be replicated and case studies can be published to attract private investors to the sector

Case Study: Solar aerator

A solar aerator catering to a two-acre pond can increase the production of an aquaculture pond by up to 20 per cent. A system consisting of a 1/3 HP, 300 Watt solar panels and a 12 V battery, 150Ah can potentially save 125-150 liters of diesel leading to a 350 to 400 kg decrease in CO, emissions annually133. However, as a thumb rule, each HP of solar aerator is estimated to impart 1.1 kg of oxygen per hour to the water body.

A solar-powered aerator has been designed and commercialized in USA. The aerator called 'Solar Bee' is being manufactured by Medora Corporation. The system consists of 240 watts of solar panels, 0.5 HP pump with a brushless motor of 90 per cent efficiency. The system also includes an electronic control box, distribution dish, battery and an impeller. The system is designed to operate at 80 RPM which may be changed according to requirements.

Parameter	Specification
Cost	INR 80,000
Indicative pond size	2 acres
Solar Panels	300 watt
Battery	12V, 150 Ah
Inverter	12V, 800VA
Pump Capacity	1/3 Hp
Daily hours of use	3 hours

Energy-efficient fishing vessel in Goa:

- *The Sagar Haritha vessel was constructed at the Goa Shipyard by CIFT under a public-private partnership model*

A hull made of marine grade steel to reduce weight and improve carrying capacity; a 400HP engine power, which is 20% lower compared with a regular vessel; a 600-watt solar panel for lighting; and bulbous bow, which reduces wave resistance on the sea, improving energy efficiency.

The Sagar Haritha designed by Central Institute of Fisheries Technology is an energy efficient fishing vessel

Figure 25 Sagar Haritha designed by Central Institute of Fisheries Technology

7.3 Energy saving potential & monitoring mechanism

Energy saving potential of the agriculture and fisheries sector is 0.016 MTOE and 0.031 MTOE for moderate and ambitious scenarios FY2030 respectively as seen from Table 16.

Table 59 Summary of energy saving from the strategies.

Action Plan	Energy Savings in 2030 under moderate scenario (Mtoe)	Energy Savings in 2030 under ambitious scenario (Mtoe)
Transition of electrical pumps to Solar powered pumps by 2031	0.0003	0.0004
Energy efficiency in post-harvest value chain of fisheries	0.0153	0.0229
Total	**0.0156**	**0.0233**

Following are the monitoring mechanisms that could be implemented to track the progress and effectiveness of the policies in the fisheries sector in Goa state:

Table 60 Monitoring mechanisms to track the progress and effectiveness of the policies in the fisheries sector

Policy Type	Monitoring Mechanism
Awareness Programs and skilling of manpower (fisherman)	• There is a need for awareness in the new innovations arising in the cold chain that can aid to reduce the overall GHG emissions of the sector like PCM (Phase change material) looks to be a promising technology to reduce emissions of the cold chain sector and aid in the productivity of the sector. • Awareness creation through capacity building programs amongst fishery cold chain supply and operations staffs on best practices and available technologies along with implementation methodologies • Improving awareness and skill levels • Leverage existing boat associations to raise awareness on productivity using available technologies

8 FINANCING MODELS FOR ENERGY EFFICIENCY

Energy efficiency is one the most effective strategies to meet rising energy demand, reduce greenhouse gas emissions and provide socio-economic benefits. Unlocking the potential of

energy efficiency requires investments which can spur the technology availability in the market and adoption of energy efficiency among the end consumers. Many developed country has unlocked energy efficiency financing potential through innovative financing models and some of such models are also being explored in India such as the Energy Service Companies (ESCOs) model. The present study analysed few popular financing models which can be helpful in commercial, residential as well as Industrial sector. Few financing strategy which are generally common in India are as given below;

- Financial Institutions (Credit, leasing)
- Microfinance Institutions (Credit)
- Dealer finance
- Financial Incentive (rebate/subsidy programs)

However, there are few other financing strategies which are being used world-wide and adopted in foreign countries are.

1. On Bill Financing Model
2. ESCOs
3. Leasing Model
4. Bulk Procurement

8.1 On bill financing model

On-bill financing can aid in increasing the household sector's adoption of climate-friendly and energy-efficient appliances (such as lighting, air conditioners, and refrigerators). Because it lowers monthly electricity costs and hence boosts purchasing power, it provides homes with a host of important advantages.

It has been demonstrated that basic energy efficiency measures like insulation, air sealing, heat pumps, and lighting upgrades produce an average energy savings of 25%. Through on-bill initiatives, an electric company or a third-party financier can cover the initial cost of energy-saving upgrades and equipment. Ratepayers can use a percentage of the savings realised as a consequence of the upgrades to pay down the cost of these investments through a monthly payment on their electric bill. On-bill financing makes energy-saving upgrades more accessible and affordable for consumers of all sorts and income levels by moving the initial costs to the utility.

Figure 26 Major common energy consuming appliances and equipment in Building sector

Energy efficiency is frequently the fastest-acting alternative to reduce the consumption of fossil fuels. The plan of delivering EE appliances to consumers may be more significant in order to offer them significant benefits. With the OBF model, consumers won't be put at a financial disadvantage because the payback is mostly funded by savings on electricity costs. The only party having an interest in the suggested model for using energy-efficient equipment will be the consumer.

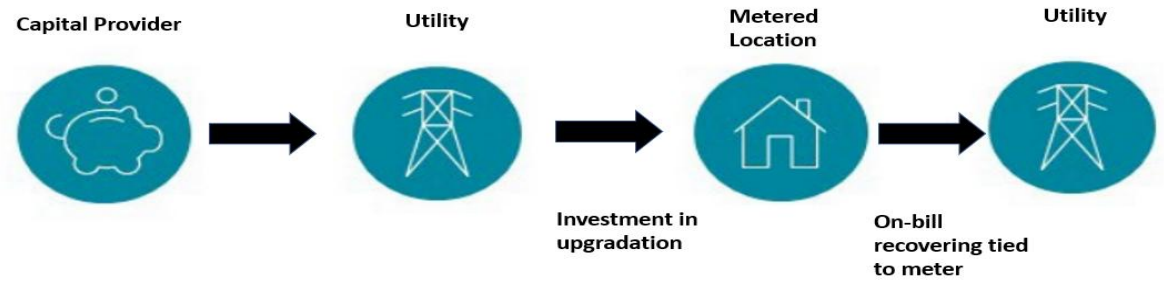


Figure 27 Modality of financing energy efficiency projects through on bill financing model

Improvements in efficiency of houses and buildings are treated by tariffed on-bill programmes as an investment in system dependability and as the creation of less expensive distributed energy resources. The utility makes investments and seeks cost recovery through tariffs using its recognised authority while utilising the current systems for sending bills and collecting money. The investment in energy savings is linked to the location rather than a specific customer up until the point at which the utility's investment is recouped. A tariffed investment does not increase the owner's debt profile the same way a bank loan would.

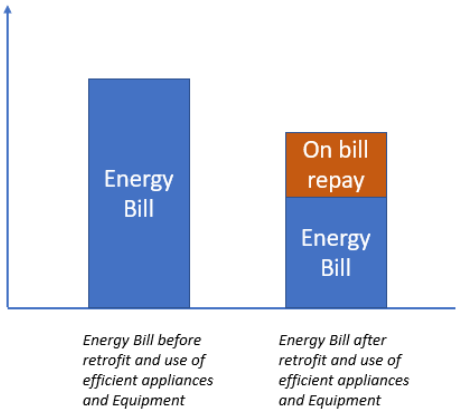


Figure 28 On bill financing structure

With adjustment of cost of appliances in monthly payment of electricity bills, this business model enables clients to access a wider choice of energy services, including demand response, electrification of transportation and heating systems, and efficiency enhancements.

Case Study: ECOFRIDGE-On bill financing

The government of Senegal (in 2020), in association with African Development Bank, United4Effciency, Renewable Energy and Energy Efficiency (ECREEE) &BASE offered efficient refrigerator and cooling product on EMI basis which was repaid through utility bills. The credit assessment of customer was done through their track record of payment of utility bill. As of Nov 2022, ECOFRIDGE GO model has achieved;

- Selling of 2527 new energy efficient ACs and emission reduction of 18824 MTCO2
- Total energy of 22,836 MWh energy saving
- Financing of 1 million USD

8.2 Energy service companies (ESCOs) Model of financing

Energy service companies (ESCOs) design, plan, construct, and secure funding for initiatives that lower energy use, energy expenditures, and maintenance and operations expenses at their clients' facilities. A project's technical and performance risks are typically assumed by ESCOs, who also serve as project developers for a wide variety of energy conservation measures (ECMs) (Energy Efficiency and Renewable Energy,). Due to the fact that they employ the performance-based contracting model, ESCOs set themselves apart from other businesses that provide energy-efficiency solutions. The payment made to an ESCO for a project is closely correlated with the real energy cost savings.
The utility might be able to reach economies of scale that would further reduce costs with strong user acceptance and bundling that offers a kind of "mass customisation." To guarantee programme success, the utility would keep handling billing, quality control, monitoring, and reporting. Customers' invoices would show the improvement measures' net energy cost reductions versus service fees. Customers may think about upgrading for extra services like new windows or a refrigerator when the initiative starts to show benefits.

- **ESCO in Industry**

Energy service companies (ESCOs) are becoming one of the most popular off-balance-sheet methods of financing in the energy efficiency sector. Depending on the needs of the client, ESCOs engage in a variety of activities, including, but not limited to, conducting energy audits of existing facilities, designing and implementing energy efficiency projects, locating opportunities to save energy, outsourcing energy infrastructure and technology, and directly funding or arranging the financing of energy projects (Ablaza 2019c).

Ownership of the energy asset or infrastructure may lie with the ESCO (or even a third party) rather than the energy end user, depending on the contracting arrangement. Energy performance contracting (EPC), which aids in reducing the financial and performance risk associated with energy efficiency projects, is being used by an increasing number of ESCOs. Although equipment replacement or retrofit tries to lower total energy consumption, the energy savings that the end user actually experiences may differ from what was anticipated or promised for a variety of technical reasons.

In an EPC, the ESCO guarantees energy savings as long as predetermined operational and maintenance guidelines are followed. Processes for measurement and verification are also put in place to make it easier to calculate the actual energy savings. The ESCO reimburses the energy end user with an amount equal to the gap if the project doesn't achieve the guaranteed energy savings. Because utility rate volatility is a market-based risk that should

be managed separately from the energy efficiency project, performance guarantees are usually linked to energy savings (e.g., kWh) rather than monetary savings. There are two models in Energy Efficiency.

- **Guaranteed Saving Model of ESCO**

The energy savings promised by the ESCOs carrying out the projects equate to cost savings. The host facility's owner pays the ESCO a predetermined amount based on the guaranteed energy savings from the project.

The ESCO covers the shortfall if savings fall short of the guarantee. The ESCO may receive (but is not guaranteed) a bonus payment if the savings are greater. The M&V protocol and the ESCO's payment terms will be laid forth in the ESPC. According to this concept, the host facility or facility owner may raise equity capital, and the FI will cancel the ESCO's debt. The host facility or facility owner then offers a loan. The facility owner/host facility then uses its savings to pay the FI's interest and loan repayments.

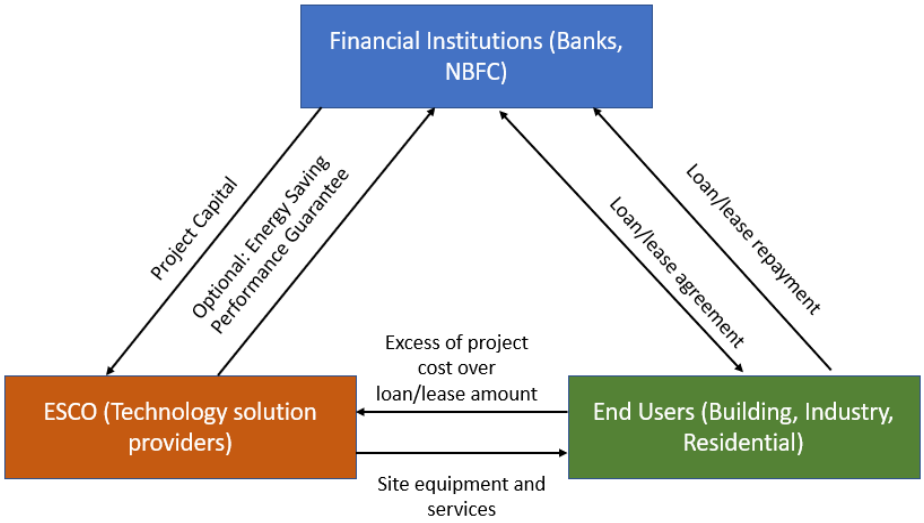


Figure 29 Guaranteed Saving Model

- **Shared Saving Model of ESCO**

Energy services companies deploy the Energy Savings Performance Contracting (ESPC) strategy in a turnkey manner. Design, engineering, construction, installation, commissioning, measurement, and verification are all part of ESCO services. Additionally, ESCOs handle training, financing, and operations and maintenance. The main criterion in this situation is to share the value of the energy savings, and this is what makes up the ESCOs' revenue stream. Beyond the duration of the contract, any savings are retained by the facility owner/host facility.

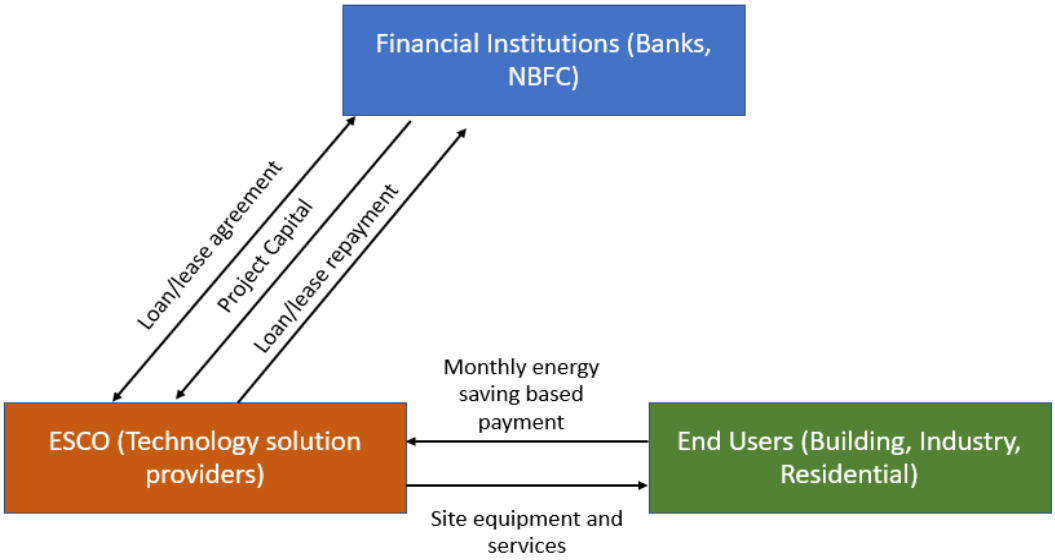


Figure 30 Shared ESCO saving Model

Various risk have been identified in the ESCO model through one of the research papers (Muhammad Ery Wijaya, et.al., 2021)

Table 61 Various Risk in ESCOs Models

Risk category	Impact	Likelihood
Economic and Financial	High	Medium
Finance resources	High	Medium
Operational and Behavioral	Medium	Low
Awareness	Medium	Medium
Measurement and verification	Medium	Medium
Technical solution and services	Medium	Medium
Technology	Medium	Low
Regulatory	High	Medium

Source: Climate Policy Initiative, 2021

8.3 Dealer or retailer financing model

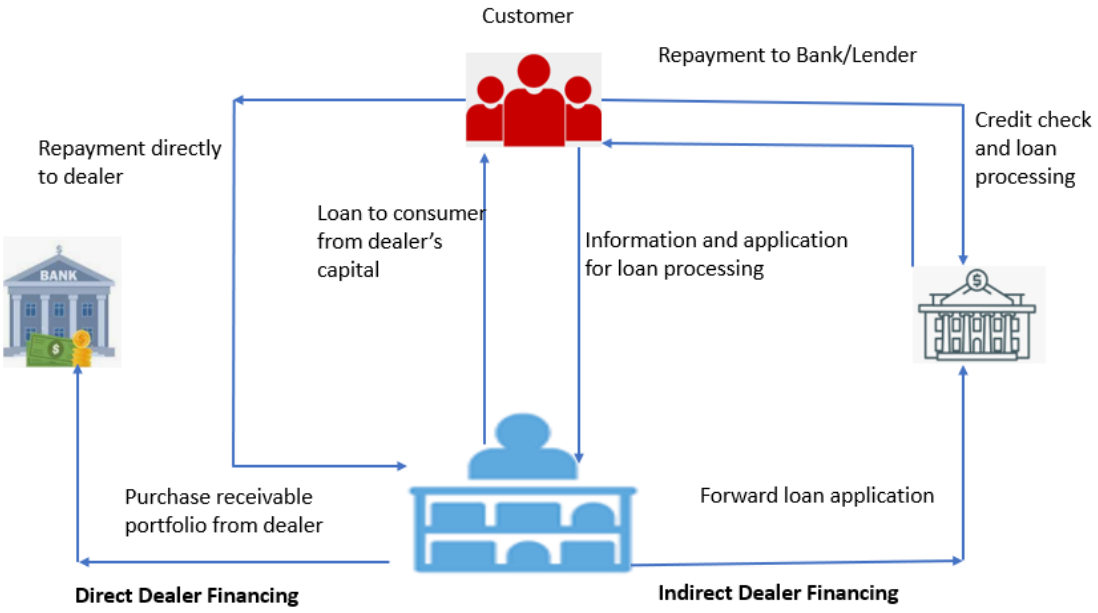


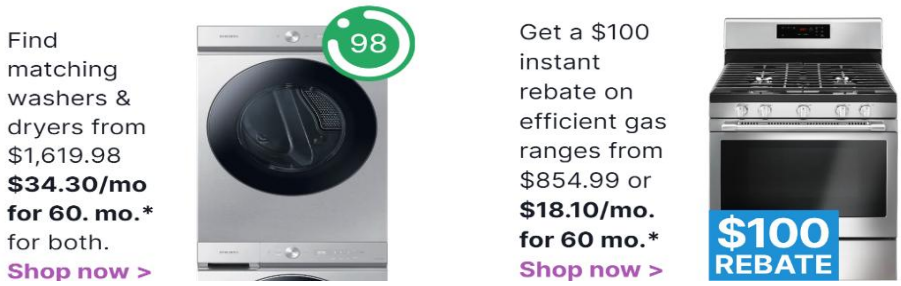
Figure 31 Dealer and retailer financing model

In direct dealer financing, dealer directly provide loan to consumer or through partnership with third party financing institutions. Dealer can get access to finance by selling its purchase receivable portfolio to Bank. In indirect financing arrangement, dealer forward the consumer loan application form and other information to bank and bank access the credit worthiness of consumer before processing the loan. Consumer's repayment is directly to Bank and Dealer works as intermediary or facilitator.

Dealer financing lowers the cost of loan for consumers and easier access to credit facility. Dealer also helps the consumer to do all paper work, credit risk assessments etc. Dealer can negotiate with multiple finance provider for lending at discounted interest rates.

Case study: ECO-Financing Model by Enervee

Los Angeles based Enervee company, a provider of energy efficient appliances through online market place announced the ECO-Financing model for making energy efficient appliances affordable. The program was launched in collaboration with lenders Southern California Gas Company & the Sate of California. Enervee also partnered with best buy to provide end to end consumer services such delivery and installation. ECO-Financing model provided consumer favorable loan terms, low cost EMI, no down payment facility and instant rebate. Consumer could buy the product upto $ 5000. Initially it was targeted to reach 5.7 million consumers of SOCalGas and expansion later. Under this program consumer could purchase Clothes washers/dryers, dishwashers, kitchen appliances etc.



8.4 Leasing financing model

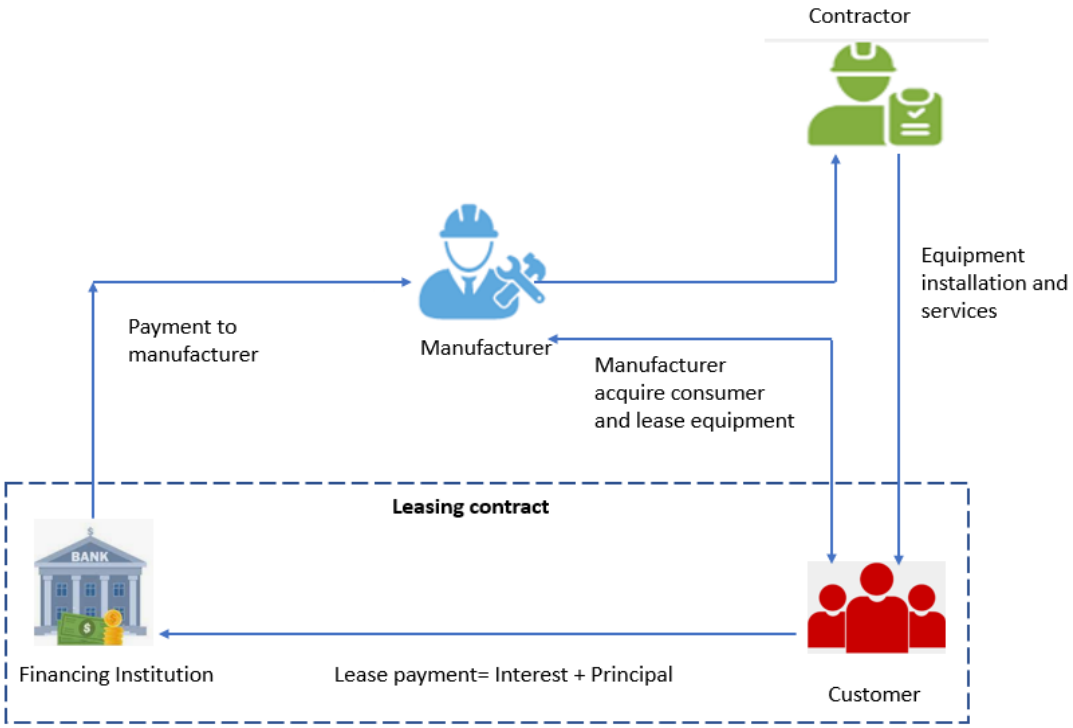


Figure 32 Leasing financing model

Leasing an asset-based financing where the financier (lessor) finances its assets to customer (lessee) for a fixed period of time through an agreement between lessor and lessee (IFC, 2009). In such model leasing is managed by partnership between financing institution, technology provider and contractor or service vendor. Manufacturer install equipment through contractor or service provider at the customer end. Equipment is financed by banking or financing institution where the customer pays fixed monthly instalment to Bank and Bank pays fixed monthly payment to manufacturer. Manufacturer takes liability for services, maintenance.

Case Study: Ultimate Home Comfort by York: A leasing model by Johnson Control

Johnson Control provides smart and sustainable cooling and heating solutions for buildings. It launched 10 years leasing program for HVAC system for residential buildings under its brand YORK. This industry led program provided owners a new, energy efficient system with no down payment and service warranty for 10 years and even at low monthly payment. It provided stress free cooling and heating services to homeowners with 53% saving in energy.

Financing was provided by a third party - Fundient Capital LLC and YORK covered its cost from customer through fixed monthly payment. York initially piloted leasing program in United State for three years and made many contractors its partners which increased its profit. At the expiry of the contract the customer had following options.

- Lease to own and pay balance pending amount of loan to financier
- No-renew and handover the equipment to financier
- New 10-year lease with new equipment
- Extension of lease for 2 years without maintenance and parts facilities

8.5 Utilization of green finance

Any structured financial activity that is intent to improve environmental outcome and enhance the access of finance for environmental benefit can be referred to as green finance (World Economic Forum, 2020). Green finance is directly linked with Environment Social and Governance (ESG) factor. Green finance benefits the broader context of the business rather than traditional source of finance which look at the profitability and cashflow. Grant is also a part of green finance generally provided by either Government or Internationally established institutions (Non-profit). Example: Government Environmental Facility (GEF) fund. GEF is an independent operating financing organization that provides grants for projects under climate change, biodiversity, land degradation etc. Grants have big role for enhancing energy efficiency adoption at large scale.

Case Study: CII's Dairy Project- Promoting Energy Efficiency and Renewable Energy in Selected MSME Clusters in India" initiated by GEF, BEE and UNIDO

In 2020 dairy cluster received grants for promotion of energy efficient technology under a program- "Promoting Energy Efficiency and Renewable Energy in Selected MSME Clusters in India" initiated by GEF, BEE and UNIDO.

The main objective of the project was to facilitate the implementation of energy efficient and renewable energy technologies in Rajasthan dairy clusters of India. The project of scaling up and expanding activities in Rajasthan dairy cluster had four major components:

- Component 1: Increasing capacity of suppliers in the category of Renewable and Energy efficient products.
- Component 2: Facilitate the implementation of energy efficient and Renewable energy technologies, best practices in MSMEs cluster of India.
- Component 3: Scaling up the project at national level.
- Component 4: Strengthening of policy, Institutional and decision-making frameworks.

And key outcome of the project is as given below.

TASK 1	TASK 2	TASK 3	TASK 4
In depth analysis & research	Detailed interactions with stakeholders	Development of detailed energy efficiency action plan	Validation of detailed energy efficiency action plan

Figure 33 Key outcome of GEF funded Dairy Project

8.6 Bulk Procurement model

Procurement of appliances and equipment in large volume helps in achieving economies of scale and bulk procurement brings down the cost significantly and makes it more affordable to end consumer. Bulk procurement model brings buyer and seller at a common platform where the manufacturer is able to generate profit through large volume and consumer gets product at lower price than market. Bulk procurement model providers negotiate with manufacturer and bring down the product price in multiple bidding round. The procurement costs are also down because of the elimination of middle parties for selling the product in the market.

Bulk procurement model does not cover the financing requirements of consumer for purchasing the product rather brings down cost of the product.

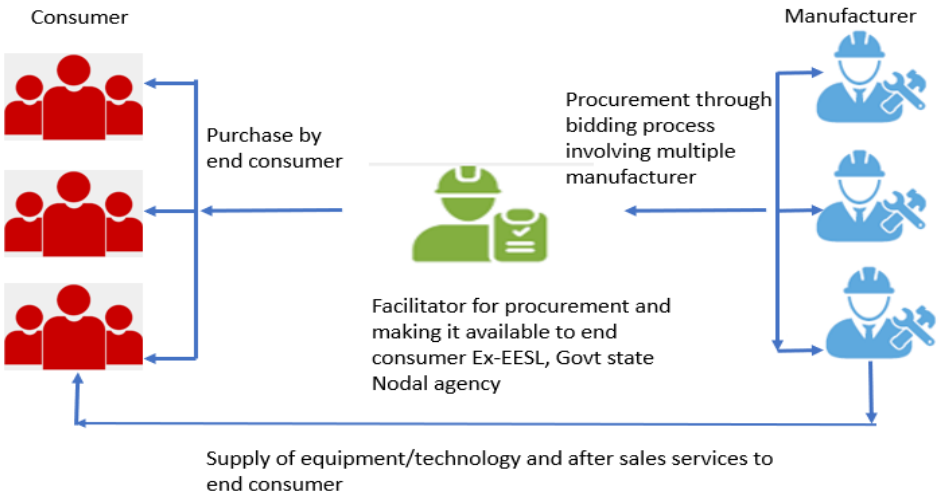


Figure 34 Bulk procurement model

Case study: Bulk Procurement model of EESL

Energy Efficiency Services Ltd. (EESL), targeted a program for replacement of standard motors with energy efficient motors for end consumers (PAT Industries and SMEs). The additional benefit of such bulk procurement model through EESL was the extend warranty of motors, Motor price reduction, information sharing on best practices and training to industries on operation and maintenance.

As shown in below table EESL, procured IE-3 motors, in bulk at price less than the market price and helped industries to save energy consumption and money.

Table 62 Bulk Procurement model by EESL

Motor specification (IE-3)	No of motors procured. (Nos Lakh)	Market price of Motor (Rs Lakh)	EESL Procured price (Rs Lakh)
1.10	0.15	0.08	0.05
1.50	0.15	0.08	0.06
2.20	0.15	0.11	0.07
3.70	0.15	0.14	0.09
5.50	0.15	0.20	0.13
7.50	0.15	0.23	0.16
11	0.10	0.47	0.25
15	0.10	0.49	0.31
22	0.10	0.65	0.40

9 INVESTMENT POTENTIAL

This chapter outlines the sectoral investment potential for each of the demand sectors.

Table 63 Sectoral Investment Potential

Sector	Energy Reduction (Mtoe) - FY2031		Energy Reduction (MtCo2) - FY2031		Investment Potential[25]	
	Moderate	Ambitious	Moderate	Ambitious	Based on moderate scenario	Based on ambitious scenario
	Mtoe reduction	**Mtoe reduction**	**MtCo2 Reduction**	**Mt Co2 Reduction**	**INR Crores**	**INR Crores**
Industry	0.0708	0.1109	0.2217	0.3472	130	204
Buildings	0.0646	0.0884	0.2022	0.2766	119	163
Transport	0.1413	0.1702	0.4423	0.5329	260	313
Agriculture & Fisheries	0.0156	0.0234	0.0488	0.0731	29	43
Total	0.2923	0.3929	0.9150	1.2298	538	723

The energy saving investment potential of the state is estimated to be INR 538 Crores by the year 2031, under the moderate scenario, and INR 723 Crores under ambitious scenario with the transport sector constituting highest investment potential followed by industry sector.

10 WAY FORWARD

The “State Energy Efficiency Action Plan” report for Goa provides a roadmap for the state to achieve its energy efficiency goals. The report covers various sectors, including industry, buildings, transportation, and agriculture, and identifies opportunities for energy savings and greenhouse gas emissions reductions. Moving forward, it is essential that the state prioritizes the implementation of the action plan's recommendations.

One of the first steps in moving forward is to create a task force or working group that will oversee the implementation of the action plan. This group should include representatives from government, industry, and non-governmental organizations, as well as energy experts and other stakeholders. The task force should be responsible for identifying priorities, establishing timelines, and monitoring progress.

[25] Market Potential calculated using cost of 1 tonne of oil equivalent as INR 18,402 and assuming a payback of 3 years.

Another critical step in moving forward is to secure funding for the implementation of the action plan. The state should explore various funding options, including grants, loans, and public-private partnerships, to ensure that adequate resources are available to support the implementation of the plan. Additionally, the state should consider developing innovative financing mechanisms, such as energy efficiency bonds, to attract private investment in energy efficiency projects. By taking these steps, states can ensure that they are on track to achieving their energy efficiency goals and contributing to a more sustainable future.

In conclusion, the State Energy Efficiency Action Plan report for Goa provides a comprehensive framework for achieving energy efficiency goals in the state. The successful implementation of the plan will require the involvement of various stakeholders and the allocation of sufficient resources. By adopting the above ways forward, the state can achieve its energy efficiency goals, reduce greenhouse gas emissions, and contribute to a sustainable future.

11 REFERENCES

Sr No.	Description
1.	CEA General Review Report
2.	Indian Petroleum & Natural Gas Statistics
3.	Coal Directory of India
4.	Energy Statistics India 2021, Ministry of Statistics and Programme Implementation (MoSPI)
5.	NITI Aayog: India Energy Dashboards
6.	Goa Statistical Abstract
7.	Annual Survey of Industries
8.	BEE PAT Cycle
9.	Vaahan Dashboard
10.	Census of India 2011

12 ANNEXURE

Annexure-1: List of Industries for deepening and widening study

Name of plant	Address of Plant	Sector	Plant Head Email ID	Plant Head Mobile No.	Plant Head Mobile No.	Total TOE with Biomass as on June 2023	Total TOE without Biomass
GLENMARK PHARMACEUTICALS LTD	Plot No.57 Colvale Goa 403513	Chemical	Tablets & Ointments	Pareen.Dashottar@glenmarkpharma.com	–	3986	3986
MARKSANS PHARMA LTD.	PLT NO. L-82/83 PHASE IIE, VERNA IND ESTATE, VERNA. 403722 VERNA INDUSTRIAL ESTATE	Chemical	Tablets & Capsules	varddhaman.jain@marksanspharma.com	7888047819	2566	1366
UNICHEM LABORATORIES LTD	Plot Nos-15-18, Pilerne, Industrial Estate Pilerne, Bardez, Goa-403511	Chemical	Tablets & Capsules	utkarsh.patil@unichemlabs.com	9689945252	2853	2853
DECCAN FINE CHEMICALS (INDIA)PVT.LTD	Santa Monica Works, Corlim Ilha Corlim, Corlim, Goa, 403110	Chemical	Tablets & Capsules	kiran.desai@deccanchemicals.com	9930081441	13177	5701
Lupin Limited	15-B Verna Industrial Estate Verna Goa 403722	Chemical	Tablets & Capsules	srinivaskalakuntla@lupin.com	9959096677	4122	2624
CIPLA LTD.	Plot No-HN5A , Verna Industrial Estate, Verna Goa 403722	Chemical	Tablets & Capsules	Mangesh.Kulkarni@cipla.com	9822597821	8532	6443
INDOCO REMEDIES LTD PLANT II	Plant ll, Plot no L32,33,34,	Chemical	Eye Drops	atish.desai@indoco.com	9765493295	2530	1055
Puniska Injectables Private Limited	Plot No.1,Phase-III,Honda Industrial Estate,	Chemical	LVP	Jayvant.Sonawane@puniska.com	9890586889	4398.84	767.18
Goa Glass Fiber Ltd.	218/220, NH-17, COLVALE VILLAGE, BARDEZ, COLVALE, GOA 403513	Glass	Chopped Strand Mat, Rovings	Pvvs.Rao@3b-fibreglass.com	-	8123	8123
South West Port Limited	First-floor substation building, Berth No. 5A & 6A, Mormugao harbour, Goa 403803	Port		anurag.bhagauliwal@jsw.in	7659047774	1263	1263
Adani Murmugao Port Terminal Pvt Ltd	Substation Building, Near Gate No.2 Mormugao Port Trust,Harbour 403 803, Goa	Port		Jeyaraj.Thamburaj@adani.com	9099900994	691	691

Name of plant	Address of Plant	Sector	Plant Head Email ID	Plant Head Mobile No.	Plant Head Mobile No.	Total TOE with Biomass as on June 2023	Total TOE without Biomass
NESTLE INDIA LIMITED	PLOT NO. 294-297,USGAO IND AREA USGAO, PONDA, GOA 403406	Food & Beverages	Chocolate	Manmohan.Dhar@in.nestle.com	8130011424	3410	3410
Global Ispaat Pvt.Ltd	M-18,19, Cuncolim Industrial Estate,Cuncolim, Salcete,South Goa ,Goa 403703	Foundry	M.S.Billet, T.M.T	rameshgupta262@gmail.com	9823611006	8291	8291
MOHIT ISPAT PVT.LTD	PLOT NO.1, NAVELIM VILLAGE, BICHOLIM, GOA 403505	Foundry	TMT BARS	accounts@mohitispat.com	9158886807	10216	10216
HINDUSTAN COCA COLA BEVERAGES PVT LTD	PLOT NO. M-2 -M-11 PH-III/B, VERNA INDUSTRIAL ESTATE, VERNA 403722	Food & Beverages	RGB, PET	npuranik@coca-cola.in	9632545492	407	407
UNITED BREWERIES LIMITED	BETHORA, PONDA GOA 403409	Food & Beverages	Breweries	swapnilg@ubmail.com	9922415178	1176	393
NESTLE INDIA LIMITED	PO Box No 1, Village Maullinguem (North), Bicholim Taluka, Goa 403504	Food & Beverages	Noodles, Sauces	Amit.kumar3@in.nestle.com	-	6168	6168
ALCON CEMENT CO PVT LTD	Surla, Bicholim,	Cement	PSC, ALCOFINE	jude.dsouza@alcongoa.com	9607954312	602	602
Mohit Steel Industries Pvt. Ltd	PLOT NO.342, KUNDAIM IND. ESTATE KUNDAIM, GOA 403115	Iron & Steel	M.S.Billet	mohitaccounts@harekrishnagroup.co.in	9146831725	2719	2719
Shivam Ispat Pvt.Ltd.	Plot no.333-335 ,Kundaim Industrial Estate,Kundaim 403115 Goa	Foundry	M.S.Billet	sipl6300@gmail.com	9225904000	3076	3076
BALAJI METALS	E-6 & E-7, Madkaim Industrial Estate,	Foundry	INGOT	accounts@goaispat.com	9225909105	2783	2783
Mandovi Casting Pvt. Ltd.	Plot No.341,Kundaim Industrial Estate	Foundry	M.S.Billet	mandoviaccounts@harekrishnagroup.co.in	9146831725	1872	1872
KARTHIK INDUCTIONS LTD.	PLOT NO. 120-121, KUNDAIM IND. ESTATE KUNDAIM, 403115	Foundry	M.S.Billet	karthikgoa2@yahoo.co.in	9822485648	2028	2028
Abbott India Limited	L-18 Verna Industrial Estate	Chemical	Tablets & Liquids	munish.prashar@abbott.com	9805030064	897	632

Name of plant	Address of Plant	Sector	Plant Head Email ID	Plant Head Mobile No.	Plant Head Mobile No.	Total TOE with Biomass as on June 2023	Total TOE without Biomass
UNICHEM LABORATORIES LTD	Plot Nos-12-14, Pilerne, Industrial Estate Pilerne, Bardez, Goa-403511	Chemical	Pharma Research & Devlopment	utkarsh.patil@unichemlabs.com	9689945252	304	304
FDC Limited	L56/57 Verna Industrial Estate,Verna Salcete Goa 403722	Chemical	Tablets, Capsules	nitin.haldankar@fdcindia.com	9850699484	463	463
COLORCON ASIA PVT LTD	PLOT NO. M-14 - M-18 VERNA INDUST. ESTATE VERNA 403722	Chemical	Opadry	apatil@colorcon.com	7028012743	278	278
VERGO PHARMA RESEARCH LABS PVT. LTD.	Plot No B5, Phase 1A, Verna Industrial Estate, Verna, Goa	Chemical	Tablets, Capsules	sanjeevkumar.shet@vergolabs.com	9970024074	360	360
FDC LIMITED Plant III	PLOT NO L 121-B Verna PHASE IIIA 403722 VERNA INDUSTRIAL ESTATE, Goa	Chemical	Tablets, Capsules	shaileshgovekar@fdcindia.com	-	383	383
Watson Pharma Pvt Ltd.	Unit No.-IV, Plot no. A-3 To A-6 Ph-I/A, Verna-I, Est, Verna, Goa-403722	Chemical	Tablets, Capsules	Michiel.Wisbrun@teva.co.in	8956990394	1333	1333
Pfizer Limited	L 137, III A	Chemical	Tablets	P.Rengan@pfizer.com	-	458	458
CIPLA LTD.	PLOT NO PLOT NO M-61,M-62, M-63,N-5 VERNA INDUSTRIAL ESTATE, VERNA, Goa 403722	Chemical	Vaccines	Mangesh.Kulkarni@cipla.com	9822597822	1011	1011
GOPALDAS VISRAM CO. LTD	B-56 KUNDAIM IND. ESTATE KUNDAIM, Ponda GOA 403115	Chemical	H.D.P.E Bottles	plantheadgoa@gopaldasvisram.org	9136977459	404	404
INDOCO REMEDIES LTD PLANT I	L-14, Verna Industrial Area, Verna- Goa 403722	Chemical	Tablet & Capsule	vidyasagar.wayal@indoco.com	-	1269	702
COLGATE PALMOLIVE LTD	Plot 154, 158 & 160, Kundaim Industrial Estate, Kundaim Goa 403115	Chemical	Dental Cream	rangaswamy@colpal.com	7389943558	1050	1050
ENCUBE ETHICALS PVT. LTD	C/1, Madkaim Industrial Estate, Madkaim, Ponda, Goa - 403404	Chemical	Skin Cream and Gel	lalasaheb.j@encubeethicals.com	9326120214	1615	1615
Medispray Laboratories Unit II & III	Plot No 346-348, Kundaim Ind. Estate, Kundaim, Goa- 403115	Chemical	Tablet & Capsule	tanaji.pawar@cipla.com	9833236345	560.82	560.82

Name of plant	Address of Plant	Sector	Plant Head Email ID	Plant Head Mobile No.	Plant Head Mobile No.	Total TOE with Biomass as on June 2023	Total TOE without Biomass
						105375.66	86391
						0.1054	0.0864

Annexure-2: MoU between CII and GSPCB

Goa State Pollution Control Board
गोवा राज्य प्रदूषण नियंत्रण मंडळ

Confederation of Indian Industry

MEMORANDUM OF UNDERSTANDING

BETWEEN

GOA STATE POLLUTION CONTROL BOARD
(GSPCB)

and

CONFEDERATION OF INDIAN INDUSTRY
(CII)

FOR

PROMOTING GREEN INDUSTRIES IN GOA

SALIGAO - BARDEZ GOA

FEBRUARY 2023

Bureau of Energy Efficiency

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