Bureau of Energy Efficiency
Government of India, Ministry of Power

STATE ENERGY EFFICIENCY ACTION PLAN

Lakshadweep

Prepared by
Confederation of Indian Industry

Supported by
LAKSHADWEEP ENERGY DEVELOPMENT AGENCY

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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 Lakshadweep.

CII is indebted to Shri Srikant Nagulapalli, Director General, BEE, and Shri Milind Deore, Secretary, BEE, for their overarching guidance and unwavering support, which were instrumental in the successful completion of this project. We would also like to express our appreciation to Shri Abhishek Sharma, Joint Director and Shri Vikash Kumar Jha, Project Engineer, who provided regular consultations, assistance, feedback, and invaluable insights throughout the project.

CII is grateful to the proactive management of Lakshadweep Energy Development Agency (LEDA) for its role in guiding and steering this first task of this prestigious assignment and their support in coordination throughout the study.

We would like to specifically mention the guidance and cooperation received from Shri. Vikranth Raja, Shri Amit Satija, Shri Shashank Mani Tripathi, Shri S Asker Ali, IAS, Secretary Lakshadweep Administration, who helped to complete the study in a timely manner.

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 Lakshadweep, 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. Lakshadweep Energy Development Agency (LEDA) with inputs & suggestions from various government departments and sector experts. The primary objective of the State Energy Efficiency Action Plan for Lakshadweep is to formulate sector-specific strategies in short-term 2025 and long-term 2030 goals for enhancing energy efficiency in the U.T.

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1 INTRODUCTION

1.1 Background

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

1.2 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 Lakshadweep** to ensure that the allocation of resources is as per the requirement of the UT 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.

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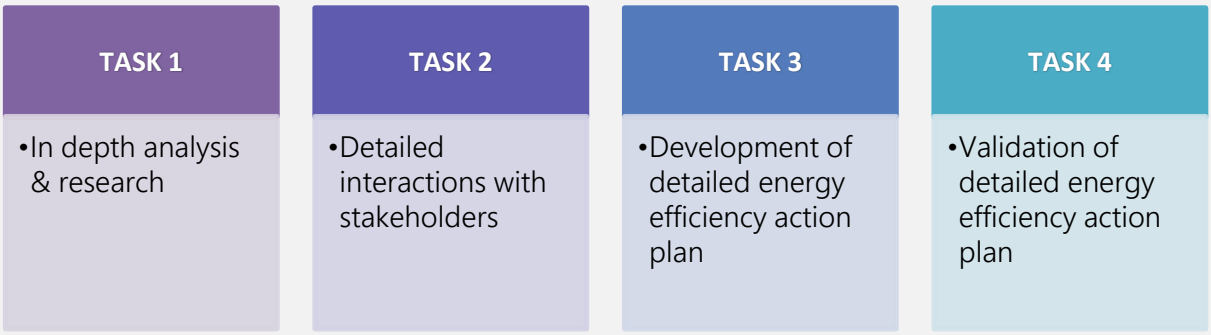
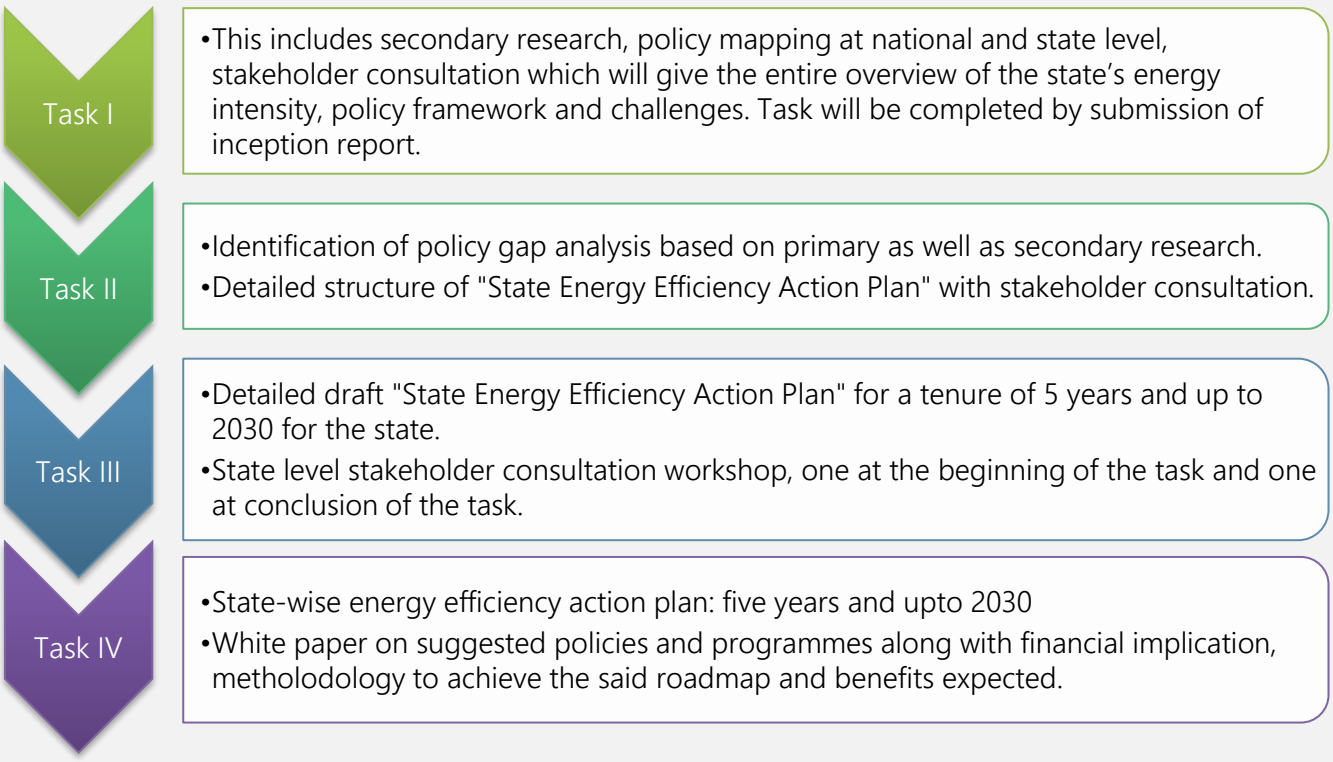
Figure 1 Key tasks in state energy action plan



Outcome

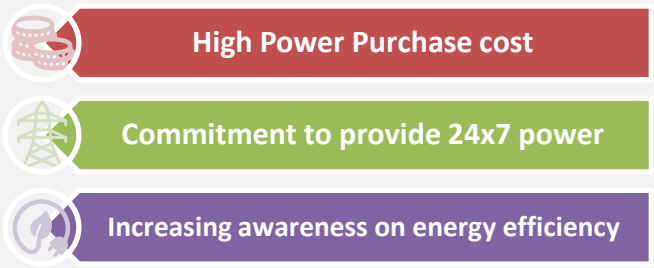
Task wise outcome of the study is as detailed in Figure 2.

Figure 2 Task wise expected outcome of the study



Energy efficiency drivers for state

As per the 'self-contained note of Lakshadweep on BEE Activities' the UT administration is taking up various initiatives to improve the energy efficiency. The key drivers of energy efficiency in the UT are shown below.



High Power Purchase cost : Lakshadweep's power generation cost for the last few years was varying between 12 to 13 Rs. /kWh. The high cost of Power Purchase is primarily due to use of Diesel generation. This high cost of supply makes it very difficult to recover all the cost in ARR and the present average recovery is around Rs 3.5/unit. As more than 99% power sales in Lakshadweep is at LT level, it is highly unforeseeable to recover the full cost through Tariff hikes. So, UT is interested in reducing the energy consumption by improving energy efficiency at demand side.
Lakshadweep's Commitment to provide 24x7 power : Lakshadweep is providing 24x7 power for their electricity consumers and it is important to the UT to reduce the energy consumption to become self-sufficient in power.
Increasing awareness on energy efficiency : Various agencies/ organisations are spreading the knowledge of energy efficiency in the UT through awareness programs which influenced the people's mindset towards energy efficiency.

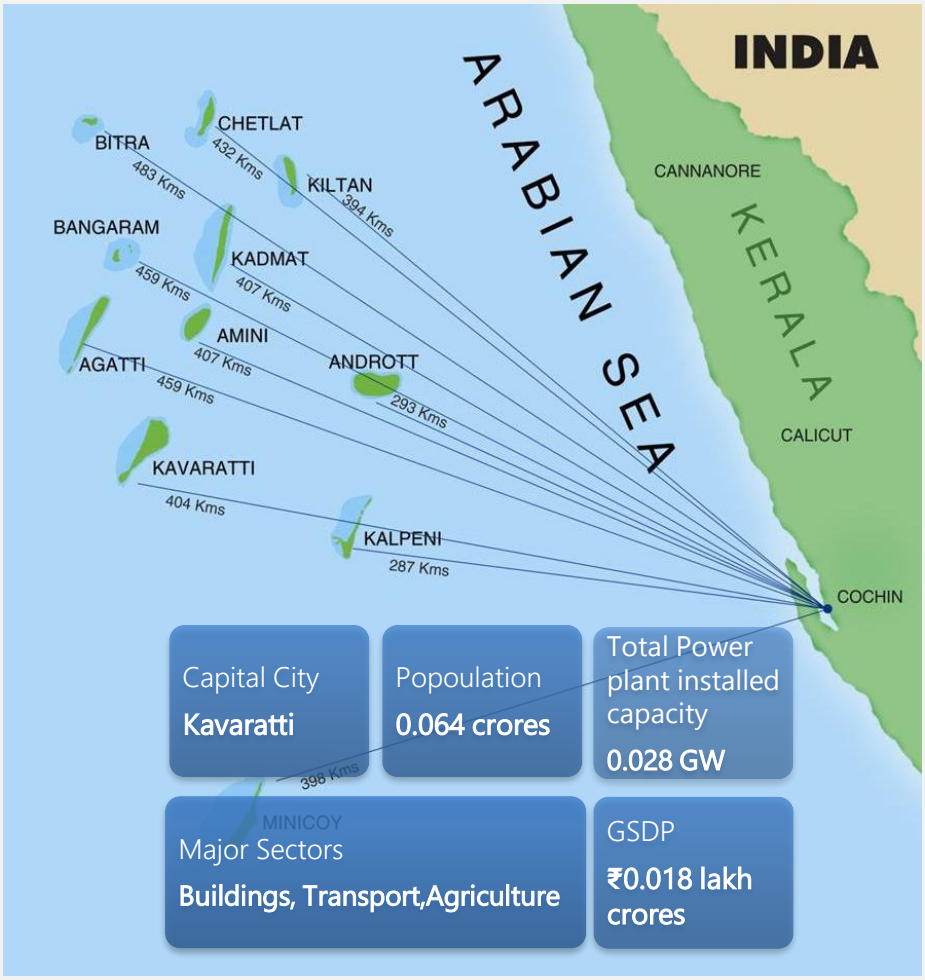
Some other major drivers include:

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

Figure 3 Energy efficiency drivers of the state

1.3 Lakshadweep State Profile

[1]



The name Lakshadweep in Malayalam and Sanskrit means 'a Hundred Thousand Islands'. Lakshadweep represent an Archipelago of around 36 islands in the Arabian sea of which only 10 islands are inhabited. Lakshadweep is the smallest of the seven union territories of India. Lakshadweep Islands spans around 32 sq. km. and the Islands are located 220 to 440 km away from the coastal city of Kochi in Kerala. The capital is Kavaratti and it is also the principal town of the UT. The natural landscapes, the sandy beaches, abundance of flora and fauna and the absence of a rushed lifestyle enhance the mystique of Lakshadweep. The entry to Lakshadweep islands is restricted and One requires an entry permit issued by Lakshadweep Administration to visit the islands.

Lakshadweep has a population of about 65,000 with a population density of 2,013 persons/sq km. The male and female population of the UT is 33,000 and 31,000 respectively. The UT has a sex ratio of 946 females per 1000 males and literacy rate of 92.28%.

In the SEEI 2020, Lakshadweep is in the Aspirant Category by scoring 5 points. SEEI 2020 assess the states' performance in energy efficiency through 68 indicators across six sectors: Buildings, Industry, Municipalities, Transport, Agriculture & distribution companies (DISCOMs), and Cross Sector initiatives. The indicators assess states' performance in Policy and Regulation, Financing

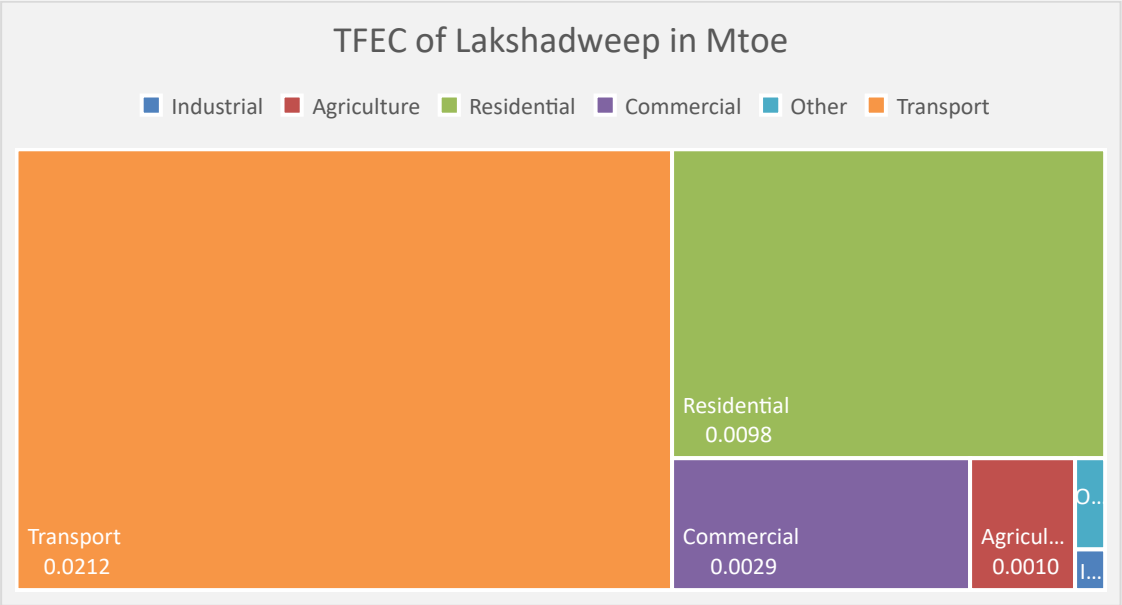
[1] ARR-ERC Petition of Lakshadweep 2020-21

Mechanisms, Institutional Capacity, Adoption of Energy Efficiency Measures, and Energy Savings.

1.4 Current Energy Scenario of Lakshadweep

The Total Final Energy Consumption (TFEC) of Lakshadweep in Million TOE (MTOE) in FY 2020 is 0.019. It accounts for the total energy consumed from electricity[2] & fuels[3]. As electricity is generated primarily using Diesel, the amount of diesel used for electricity generation is subtracted from the overall consumption. The other fuels consumed in the UT are Petrol, LPG, ATF and SKO.
The TFEC of Lakshadweep for FY 2020 is shown in Figure 4

Figure 4 TFEC of Lakshadweep



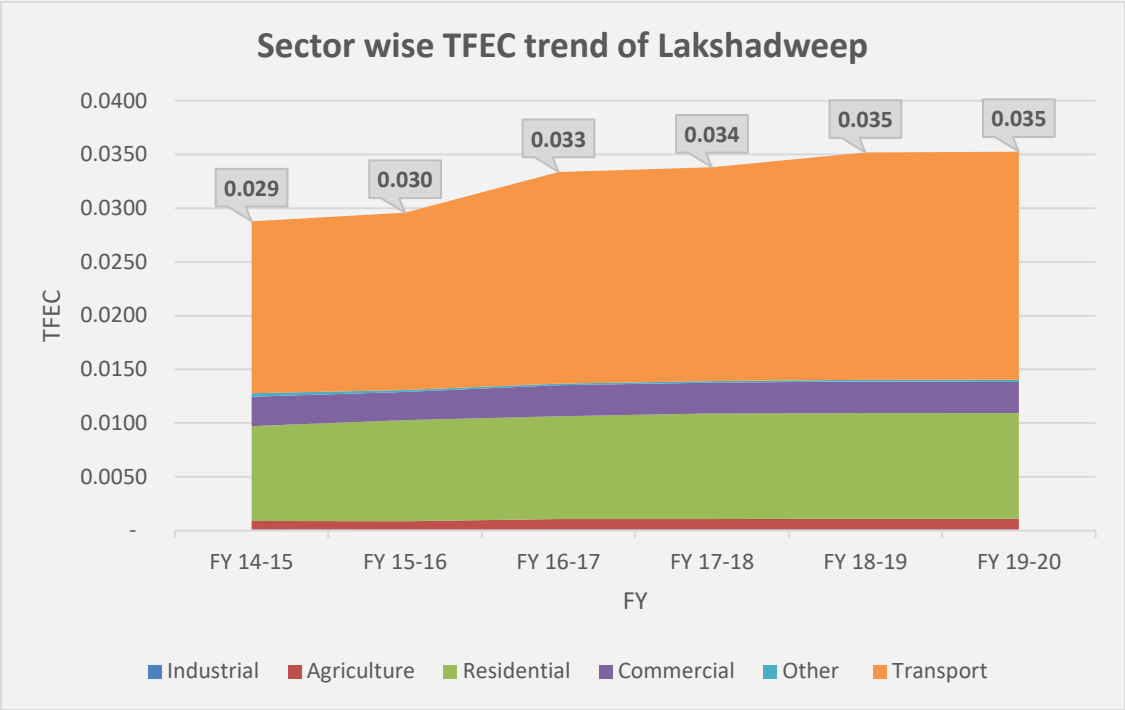
Transport is the largest energy consumer in the UT, contributing to 60% of TFEC of the State, equivalent to about 0.021 MTOE of energy; the main fuels consumed are petrol, diesel and ATF. Domestic sector is the second largest energy consumer and accounts for 0.0098 MTOE, which is nearly 28% of the total energy consumption.

The Commercial sector accounts for 8% of the TFEC of the state and consumes 0.0029 MTOE. Electricity and LPG are the major fuels consumed in Domestic & Commercial sectors.
Agricultural sector consumes 0.001 MTOE, which is nearly 3% of the total energy consumption.
The sector wise TFEC trend of Lakshadweep is shown in Figure 5.

[2]ARR-ERC Petition of Lakshadweep 2020-21

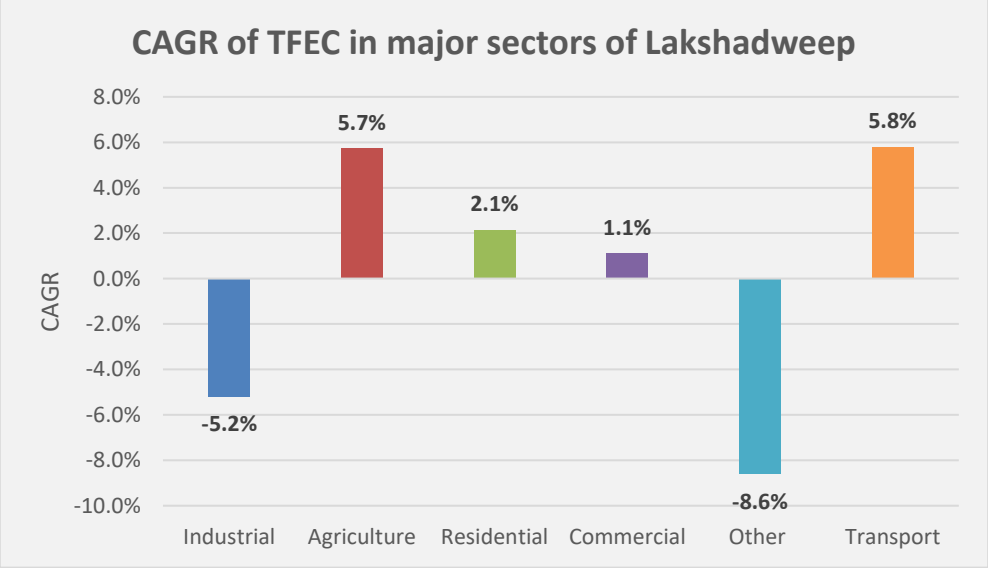
[3] Indian Petroleum & Natural Gas Statistics 2019-20

Figure 5 TFEC trend of Lakshadweep



The TFEC of Lakshadweep increased from 0.029 MTOE to 0.035 MTOE between the years 2015 and 2020 at a CAGR of 4.14%. The sector wise CAGR growth in TFEC from FY 2015 to FY 2020 is depicted in Figure 6

Figure 6 CAGR of TFEC in major sectors of Lakshadweep

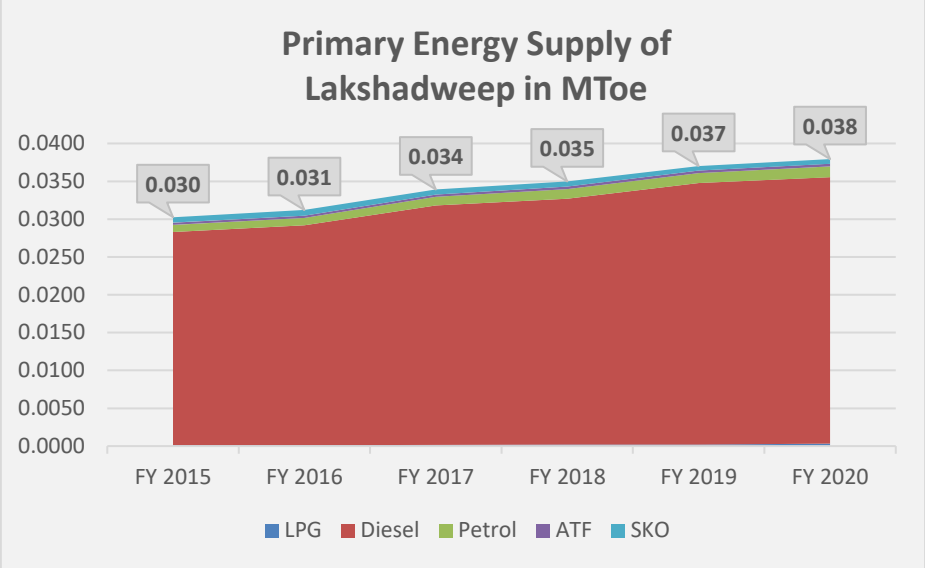


Transport sector shows the largest growth of 5.8%, which shows the increase in the vehicle use, including the sea transport (through ships). Agricultural sector TFEC is growing at a rate of 5.7% showing the increase in the agricultural & allied sector activities. Building sector shows a positive growth in 5 years, while the industrial sector shows a negative growth.

Primary Energy Supply

The Figure 7 shows the energy supplied by primary fuels from FY 2015 to FY 2020 in Lakshadweep[4]

Figure 7 Primary Energy Supply of Lakshadweep in MToe



The primary energy supply of the UT is almost same during the period considered and only increased from 0.03 to 0.038 MTOE between FY 2015 and FY 2020, at a CAGR of 4.62%.

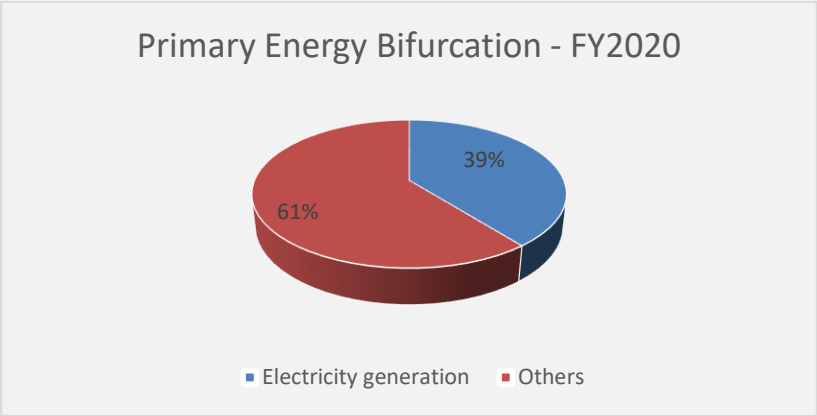
Diesel, Petrol, LPG, ATF, and SKO are the major fuels used in Lakshadweep. Diesel, at 0.035 MTOE, accounts for nearly 93% of primary energy supplied. Diesel is mainly used for electricity generation and Transportation purposes. Petrol accounts for 0.014 MTOE, which is around 4% of the primary energy supply. SKO contributes to 1.60% of the energy supply, which is equal to 0.0006 MTOE. All other fuels together account for less than 2% of the primary energy.

Primary Energy Consumption by Economic Sub-sectors

As mentioned before, diesel is the major fuel used for generating electricity in the UT. So the primary energy consumption can be divided briefly into electricity generation and others, and is shown in Figure 8.

[4] Indian Petroleum & Natural Gas Statistics 2019-20.

Figure 8 Primary energy bifurcation of Lakshadweep



The electricity generation accounts for 61% of the total primary energy and the remaining 39% of energy is consumed directly by the Economic subsectors. The direct use of primary energy by various sectors of Lakshadweep is shown in Figure 9.

Figure 9 Primary energy consumption profile of Lakshadweep in FY 2020

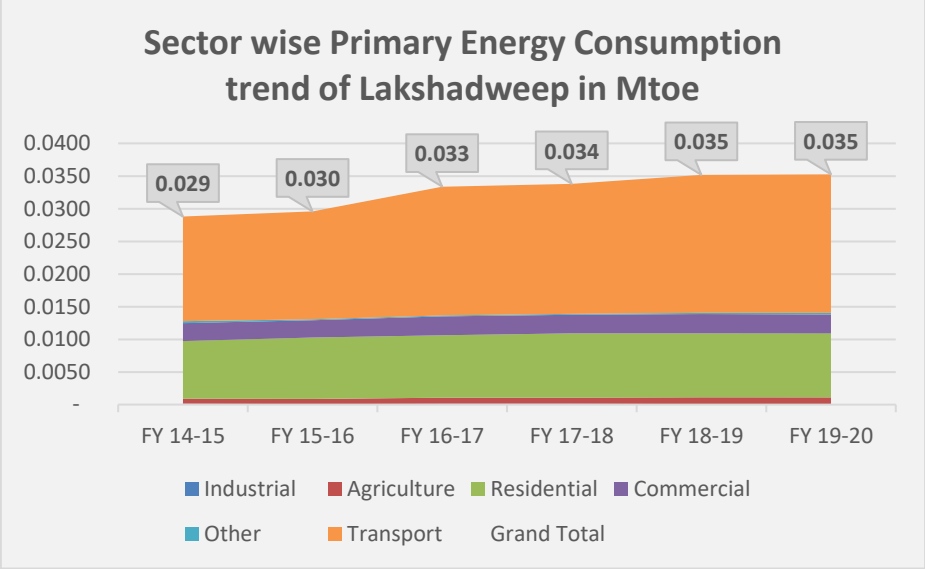
Transport Sector, the most dominating sector in primary energy consumption consumes 0.021 MTOE of Energy and accounts for almost 92% of energy consumption. In the Transport sector the major fuels consumed are Petrol and Diesel.

Agricultural & Building sector contributes to 4% of primary energy individually, by consuming 0.001 MTOE of energy. The fuels consumed in the building sector are LPG[5] and SKO (Kerosene). Major consumption of LPG is in the Domestic/ Residential sector.

[5] Data provided by LEDA

The sector wise primary energy consumption trend of the UT is depicted in Figure 10.

Figure 10 Sector wise primary energy consumption trend of Lakshadweep



Building sector energy consumption is growing at the highest CAGR of 19.5%, majorly due to the increase in LPG consumption. It shows that the households in Lakshadweep are shifting towards gas stoves instead of the biomass chulas used before.

Transport sector energy consumption is increased at a CAGR of nearly 6%. It is primarily due to the increase in consumption of Petrol and Diesel used in ships.

Electricity Sub-sector

Lakshadweep Electricity Department (LED) is solely responsible for power supply in the Union territory. Power requirement of LED is met by own generating stations only.

LED started their journey with a modest capacity of 51.6 kW in 1962 from two Diesel Generating Sets, the generating capacity of the Department has grown over the years to meet the demand of the people in the Islands. As DGs are the only source of power, diesel has to be transported from Calicut (Kerala) in barrels. These barrels are transported in cargo barges to the Islands and stored for use. To alleviate this problem of transportation, oil storage facilities at Kavaratti and Minicoy Islands are currently under installation.

Due to geographical & topographical peculiarities of these islands including separation by sea over great distances there is no single power grid for the entire electrified Islands and instead separate generating units caters independently to power requirements of individual Islands.
LED is solely responsible for operating and maintaining the power generation, transmission & distribution system network in these islands for providing electric power supply to general public. It implements various Planned & Non-Planned schemes for augmentation of DG Generating Capacity, establishment of new power houses and Transmission & Distribution infrastructure. LED is also functioning as a Nodal Agency for implementing renewable energy program of the Ministry of New & Renewable Energy (MNRE) in the islands. Presently, LED is headed by an Executive Engineer.

The Installed Capacity of LED is nearly 22 MW from various generating stations. In Lakshadweep, the total power inflow is 56 MU, out of which 99% is from DG based powerplants. The T&D losses in the system are to the tune of 14%.

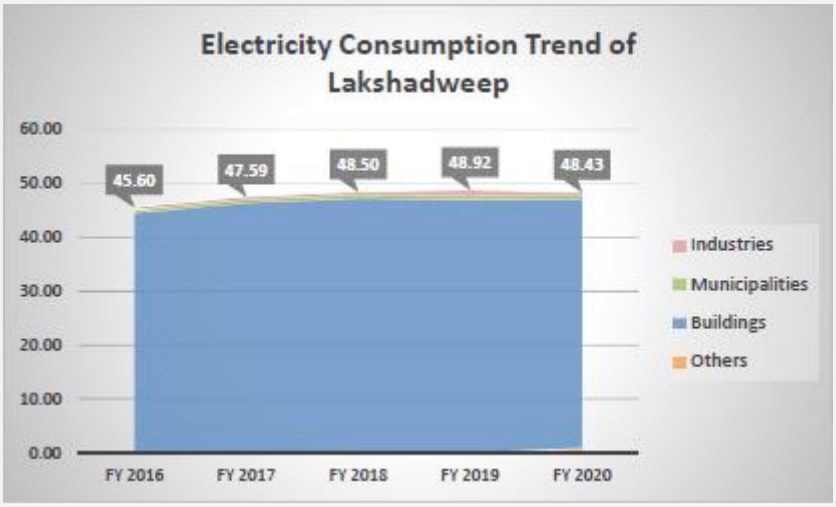
The electricity consumption in MU by the major sectors of Lakshadweep for FY 2020 is shown in Figure 11[6].

Figure 11 Sector wise Electricity Consumption of Lakshadweep

The building sector is the most significant consumer of electricity & consumes about 96% of total electricity. In buildings, both residential & commercial consumers are considered. Out of the total electricity consumed by the building sector, 92% is accounted by the domestic sector.
The Municipality sector consumes 1.6% of electricity, which is from the use of Streetlights/ Public lights.
The Industrial sector of Lakshadweep accounts for only 0.7% of the total electricity consumption. In Industries, there are no Designated Consumers in Lakshadweep.
In Others category, electricity consumption by HT consumers and temporary connections are included. The electricity consumption by HT category for FY 2020 is 0.81 MU. The details of HT consumers are not available.
Electricity Consumption Trend[7] of the UT in MU for the period FY 2016 and FY 2020 is shown in Figure 12.

[6] ARR – ERC Petition of Lakshadweep 2020-21
[7] https://cea.nic.in/dashboard/?lang=en

Figure 12 Electricity Consumption Trend of Lakshadweep

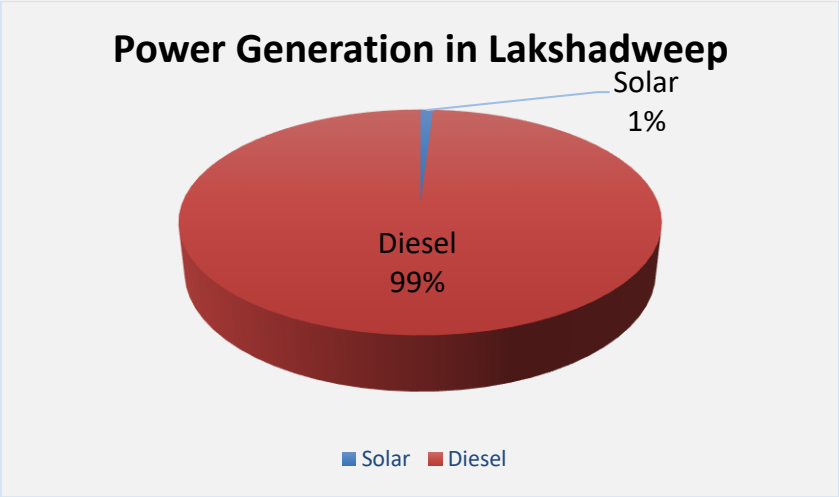


The electricity consumption of Lakshadweep is increased at a CAGR of 1.52% between FY 2016 and 2020. The largest contributor to electricity consumption, the building sector has a CAGR of 0.9% only. The Municipality and industrial sectors have a CAGR of 6.91% and 4.66% respectively. As mentioned before, HT consumers and Temporary connections are included in Others. These consumers started drawing power from FY 2018 only and showed a whooping CAGR of nearly 225% over the 2 years. But the electricity consumption by these consumers is still less than 1 MU.

Renewable Energy Scenario

The renewable power generating source of Lakshadweep is Solar. The Figure 13 shows the UT's net own power generation from various sources.

Figure 13 Power Generated from various sources



Lakshadweep Islands meet 1% of the energy requirement through renewable energy sources/ solar power plants in the region.
Apart from that, LED has RPO targets as per the regulation of JERC. For the FY 2020-21, the RPO target is 9.09 MU comprising of 4.28 MU Solar and 4.81 MU Non-Solar. However, the LED has only claimed to purchase the solar energy of around 0.64 MU, thereby resulting in a shortfall in RPO compliance.

As the islands are dependent on high-cost diesel generated power and with growing consumption requirements, adoption of low-cost sustainable renewable resources are required. As per the Stakeholders meeting in Lakshadweep, the UT is planning for privatization of the DISCOM, and look forward to shift the source of power generation from DGs to Renewables (primarily, solar) to cater for 80% of the energy requirements of the UT.

1.5 Overview of Institutional framework - Energy

In exercise of the powers conferred by the Electricity Act 2003 the Central Government constituted a Joint Electricity Regulatory Commission for all Union Territories except Delhi & known as "Joint Electricity Regulatory Commission for the state of Goa and Union Territories".

The Commission is a two-member body designated to function as an autonomous authority responsible for regulation of the power sector in the state of Goa and Union Territories of Lakshadweep, Lakshadweep, Chandigarh, Daman & Diu, Dadra & Nagar Haveli, and Puducherry. The Head Office of the Commission is located presently in the district town of Gurgaon, Haryana and falls in the National Capital Region.
Electricity Department of Lakshadweep (LED) under the JERC is responsible for the generation of power in the UT. As the islands are scattered, the generation & distribution of electricity is done by standalone powerhouses (mainly DGs).

Lakshadweep Energy Development Agency (LEDA) is the state designated agency formed in Lakshadweep for promoting energy conservation and energy efficiency through enforcing Energy Conservation Act, 2001 in the UT.

The institutional framework for energy efficiency in Lakshadweep is shown in Figure 14.

Figure 14 Institutional framework of Lakshadweep – Energy

2 IDENTIFICATION OF FOCUS SECTORS

2.1 Identified focus sectors

One of the key objectives of the State Energy Efficiency Action Plan (SEEAP) is the strategic allocation of resources. To ensure maximum impact and optimize energy savings, it's crucial to identify the sectors for intervention and improvement. The methodology for identifying focus sectors consisted of following factors:

Energy Consumption:

The first step in identifying the focus sectors involved analysing the state's energy consumption patterns. This analysis considered the overall energy consumption in Lakshadweep Islands, including both primary and secondary energy sources over a period of FY 2015-2020. Understanding the sectors responsible for significant energy consumption provided insights into areas where potential improvements could yield substantial benefits.

Carbon Dioxide Emissions:

Simultaneously, an assessment of emissions generated by different sectors was conducted. This analysis helped in identifying sectors with higher carbon footprints and those contributing significantly to air pollution and greenhouse gas emissions.

Gross State Value Addition (GSVA):

The GSVA study provided an understanding of the economic contribution of different sectors to the economy of Lakshadweep Islands. Sectors with high GSVA were given priority as improving energy efficiency and reducing emissions in these sectors could have a more significant impact on the union territory's overall economic growth.

Policy Gap Analysis:

A gap analysis of the union territory's schemes and policies was performed for sectors like transport, industry, buildings, and agriculture to identify existing challenges in these sectors. This step allowed identifying specific areas where targeted interventions and policies could yield the best results.

Stakeholder Inputs:

The inputs and feedback from various stakeholders and government agencies, were considered. This helped in understanding the priorities and concerns of key stakeholders in the state's energy and environmental landscape.

State Designated Agency (SDA) and Government Vision:

The focus sectors aligned with the state's long-term development agenda and the vision of the government of Lakshadweep Islands were given preference. This ensured that the selected sectors were in line with the overall strategic direction of the U.T.

The following sectors should be focused for the development of "State Energy Efficiency Action Plan" for Lakshadweep.

1. Transport and Maritime

2. Buildings

3. Fisheries

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. For setting priorities, account has to be taken of the measures applicable in a given sector (including cost implications) and on the means of promoting energy efficiency action.

3 PROJECTIONS AND FORECASTING

The methodology employed for estimating the TFEC projection for Lakshadweep 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 2030.

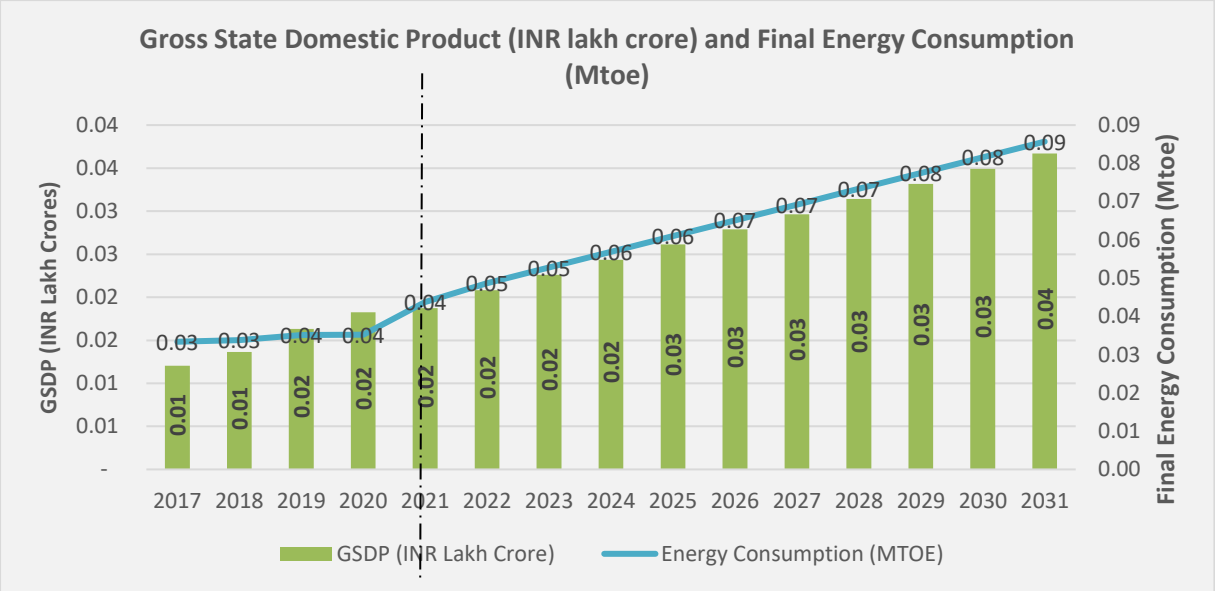
Base year determination: The base year for the projection was determined as FY 2017 from which TFEC values are available. FY 2017 had an actual TFEC of 0.03 MTOE.

Average intensity calculation: The average energy intensity was calculated by dividing the TFEC value by GSDP values for the years 2017-2020 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 2030.

Time-series modelling: Time-series modelling was used to analyze the trends in energy consumption and energy intensity. Historical data was used to identify patterns and make predictions about future trends. In this case, the energy intensity from 2017 till 2020 was used to estimate the energy consumption for the year 2030.

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 2030. Based on the time-series modelling and average intensity calculation, the estimated TFEC projection for Lakshadweep for the fiscal year 2030 was 0.08 MTOE.



4 FOCUS SECTOR 1: TRANSPORT

4.1 Overview

Lakshadweep is a group of 36 islands located in the Arabian Sea, approximately 200-440 km off the west coast of India. The islands cover a total area of 32 sq. km. Due to their remote location, the islands are not well connected to the mainland, and the transport sector is limited.

Transport infrastructure involves core basic facilities and services that are essential for smooth economic activities. Major modes of transport in Lakshadweep are roads, waterways and airways. The water transport is gaining more importance in the Island and as per the 2015-30 Perspective Plan of Ministry of Home Affairs, 9 ships are allotted for the UT, out of which 6 are for passenger transport, 1 for LPG Cylinder transport and 2 for multipurpose cargo transport.

As per the inputs from stakeholder consultation meeting, the UT is going to ban the use of conventional fuel vehicles for promoting EVs. Currently, the ownership of the conventional vehicles can't be transferred to another person. That is, no one can sell their petrol/diesel vehicles within the UT. The UT also has a 'E-Rickshaw Sevan' Scheme, under which the residents of the islands can purchase a new E-Rickshaw with a subsidy of 50%.

In terms of vehicle categories, Lakshadweep has a significant number of two-wheelers, followed by three-wheelers and four-wheelers. As per the latest statistics, the UT has over 23 thousand registered vehicles, out of which 88% are two-wheelers, 6% are three-wheelers, and the remaining 6% are cars and commercial vehicles.

The diesel consumed by ships for passenger as well as goods transport is dominating in the UT, followed by petrol & ATF. In terms of vehicles on roads, the most commonly used fuel is petrol, followed by diesel.

4.2 Energy efficiency strategies in the transport sector

Strategy: Conversion of existing fleet into EVs by setting more aggressive target

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.

Figure 15 Classification of vehicles as on FY2022

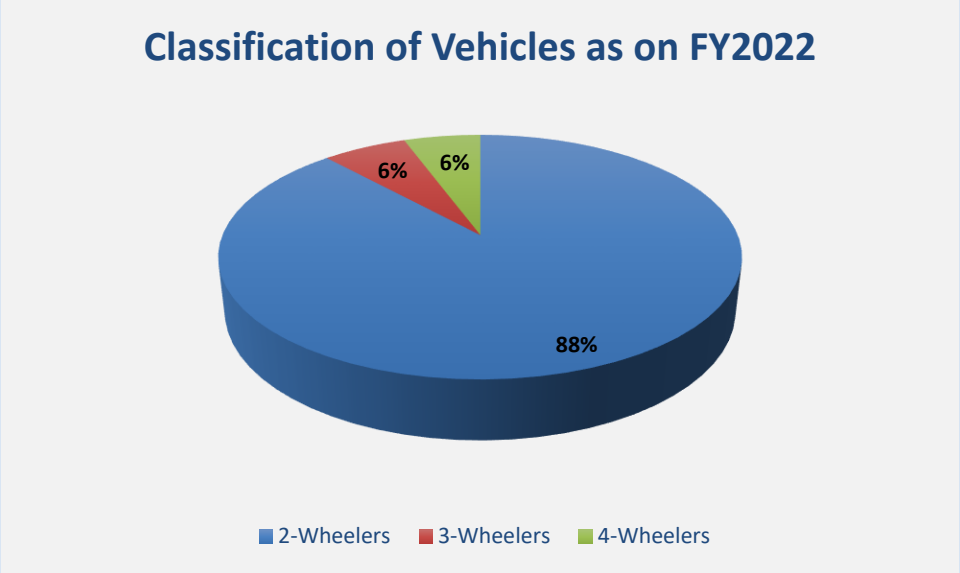
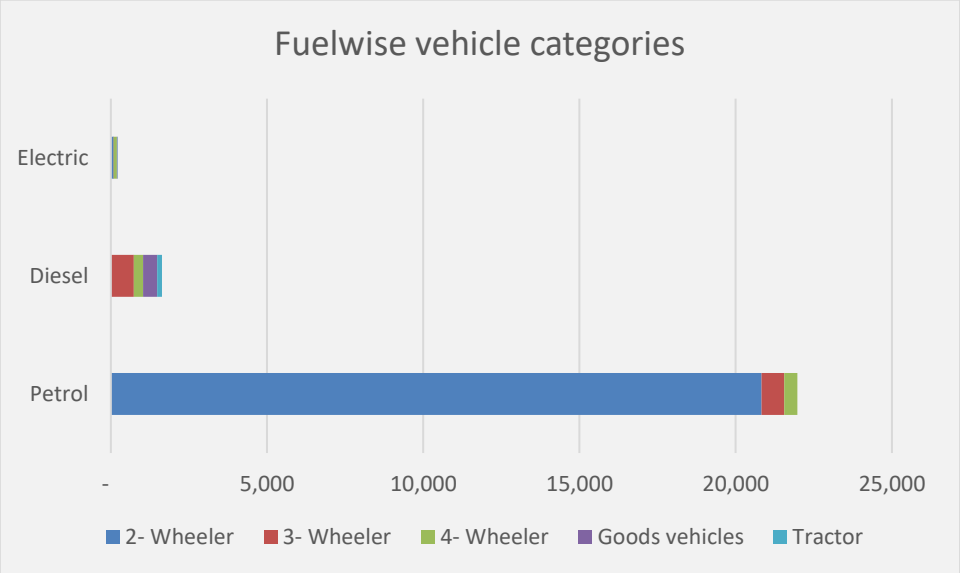
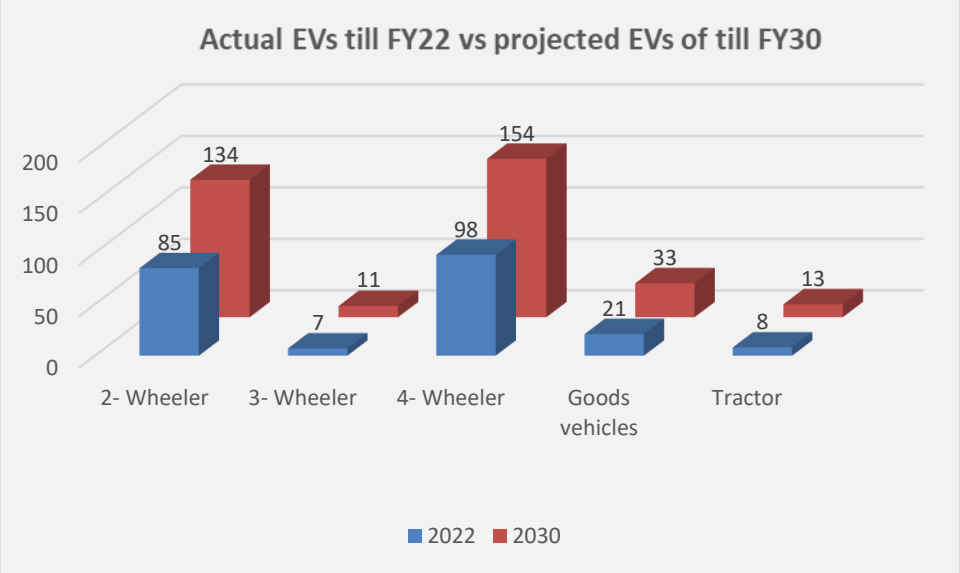


Figure 16 Fuel Wise Vehicle Categories as on FY2022



Projected number of vehicles for FY2030 is estimated by projecting electric vehicles currently present in the region.



The strategy and its implementation are explained below.

Scope Boundary

- 2-W, 3-W, 4-W, Goods Vehicles, Heavy Vehicles and Buses.

Implementing Agency

- State Transport Department, LEDA

Current Policy In Place

- Lakshadweep Electric Vehicle Policy
- National Electric

Saving Potential

By increasing the share of EVs in the vehicle stock of Lakshadweep with 3709 EVs in moderate scenario and 5564 EVs in ambitious scenario by 2031, additionally increasing charging stations and battery swapping infrastructure by 2031, with Level-1, Level-2 and Level-3 (DC) chargers across all cities will result into energy saving of 0.0024 MTOE by FY 2031.

Table 1 Energy Saving Potential

Particulars	Moderate Scenario for 2031	Ambitious Scenario for 2031
Energy Saving Potential (MTOE)	0.0016	0.0024
GHG Emission Reduction Potential ($MtCO_2$)	0.0051	0.0075

Action Plans

This section describes several action plans that can be implemented across the transport sector for this strategy.

1. Awareness
   a) Launch public awareness campaigns about the benefits of electric vehicles and the environmental impact of electrified road transport, following the model of Delhi's "Switch Delhi" campaign.

2. Setting target thresholds for ICE vehicles
   a) Setting target thresholds for ICE vehicles: The government can establish target thresholds for ICE vehicles in different categories, such as two-wheelers, sedans, hatchbacks, buses, etc.
   b) These targets can be based on emission levels, fuel efficiency, or other relevant criteria. The targets should gradually become more stringent over time to encourage a shift towards zero-emission vehicles.

3. Licensing restrictions for ICE vehicles
   a) Once the target thresholds are defined, the government can enforce licensing restrictions for ICE vehicles that exceed the established targets. Beyond a certain threshold, ICE vehicles would not be eligible for registration or license renewal in A & N Islands. This approach will create a clear market signal for manufacturers to prioritize the production and sale of zero-emission vehicles.

4. Adoption of Battery Swapping for 2 & 3 Wheelers
   a) Pilot Projects: Identify 2-3 model cities such as Kavaratti for launching pilot battery swapping projects. Collaborate with EV manufacturers and service providers.
   b) Infrastructure Investment: Allocate funds for the setup of battery swapping stations and ensure they meet safety and technical standards.
   c) Consumer Incentives: Offer incentives such as reduced swapping fees or subscription-based packages to encourage adoption.

5. State Govt Fleet Electrification
   a) Electrify the state government's fleet of vehicles, following the lead of Himachal Pradesh, which has announced electrification of all its official vehicles

6. Promoting Retrofitting
   a) Encourage vehicle retrofitting by providing incentives for retrofit kits. For instance, in Rajasthan, 15% of the retrofit kit cost (including taxes) is reimbursed, up to ₹10,000 per vehicle. This can motivate individuals and businesses to convert their existing vehicles into electric ones, reducing the carbon footprint.

7. Scrap Policy
   a) Establish a "Cash for Clunkers" program, modelled after Delhi's initiative, to provide incentives for replacing old, polluting vehicles with electric ones.

8. Mobile Maintenance Units

   a) Introduce mobile EV maintenance units equipped with essential tools and spare parts that can travel across islands to perform basic servicing and repairs on-site.

9. Local Skill Development

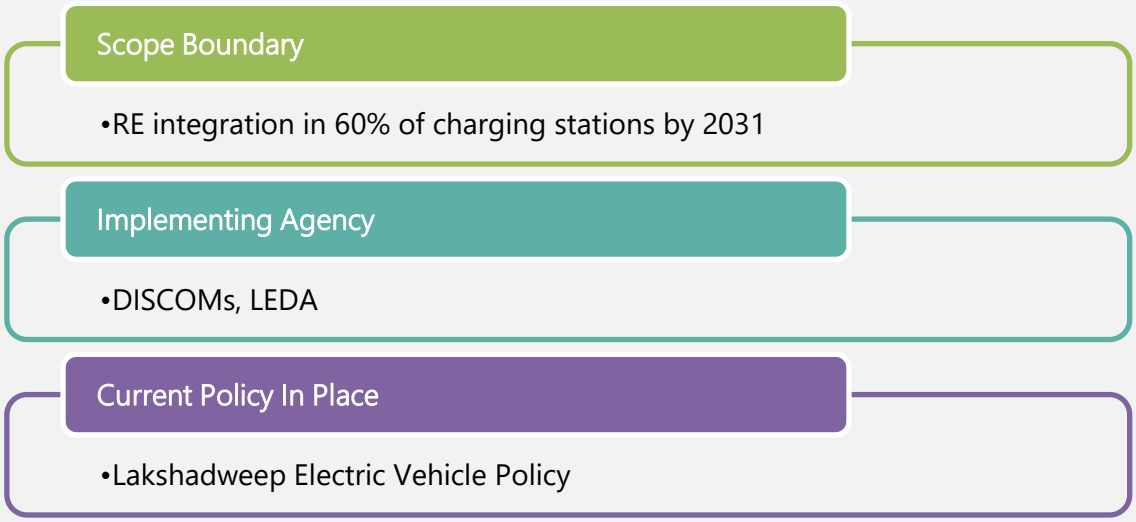
   a) Partner with vocational training institutes to train local technicians in EV maintenance and repair, ensuring they are equipped to handle common EV issues without needing mainland assistance.

10. Service Hub Agreement

   a) Establish a partnership with a mainland service hub (e.g., in Kochi) that provides scheduled island visits for more complex maintenance tasks that cannot be handled locally. This could be arranged quarterly or biannually depending on demand.

Strategy: Minimum RE integration for Charging stations

Lakshadweep, being an island territory, heavily relies on imported fossil fuels for meeting its energy requirements. To reduce its dependence on fossil fuels and to promote the use of electric vehicles (EVs), it is necessary to establish a network of charging stations powered by renewable energy sources (RES) like solar, wind, and biomass The strategy and its implementation are explained below.



Saving Potential

Energy savings have been calculated by projecting the number of EVs for the year 2030 and considering 60% of the annual energy consumption will come from renewable energy. Energy savings of 0.00011 MTOE is estimated in moderate scenario and 0.00017 MTOE under ambitious scenario.

Table 2: Energy Saving Potential

Particulars	Moderate Scenario for 2031	Ambitious Scenario for 2031
Energy Saving Potential (MTOE)	0.00011	0.00017
GHG Emission Reduction Potential ($MtCO_2$)	0.00035	0.00053

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-, medium-, and long-term period has been taken into consideration for actionable instruments.

1. Gradually replace older, less energy-efficient autos with newer models that comply with energy conservation standards and adopt hybrid or electric autos where feasible.
2. Implement measures to ensure optimal fuel usage, such as fuel-efficient driving practices, fuel quality monitoring, and exploring the use of cleaner alternative fuels.
3. Establish necessary infrastructure, such as charging or refueling stations for electric, hybrid, autos

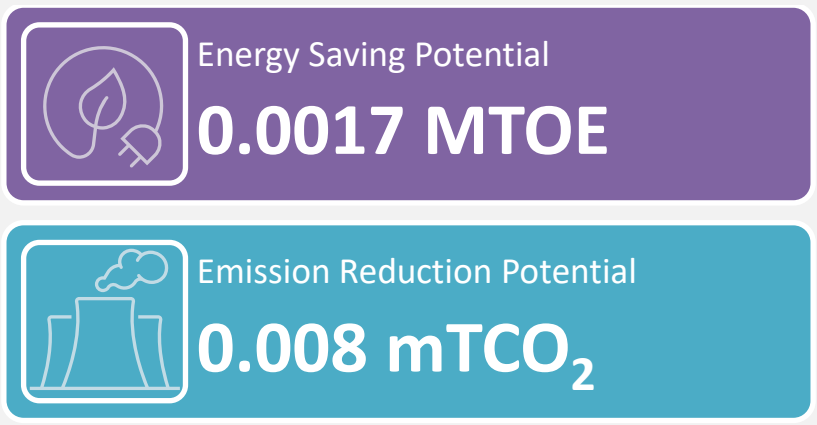
Policy Type	Action Plan	Timeline
Subsidy	Support incentive for installing RE based charging stations – 25% subsidy (Cap of 25 lakhs)	Long Term

4.3 Energy saving potential & monitoring mechanism

Energy saving potential of the transport sector is 0.0021 MTOE and 0.0035 MTOE for moderate and ambitious scenarios FY2030 respectively as seen from Table 4.

Table 3 Summary of energy saving from the strategies.

Strategy	Energy Saving (Moderate)	Energy Saving (Ambitious)
1. Electrification of Road Transport	0.0016	0.0024
2. Minimum RE integration for Charging stations	0.0001	0.0002



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

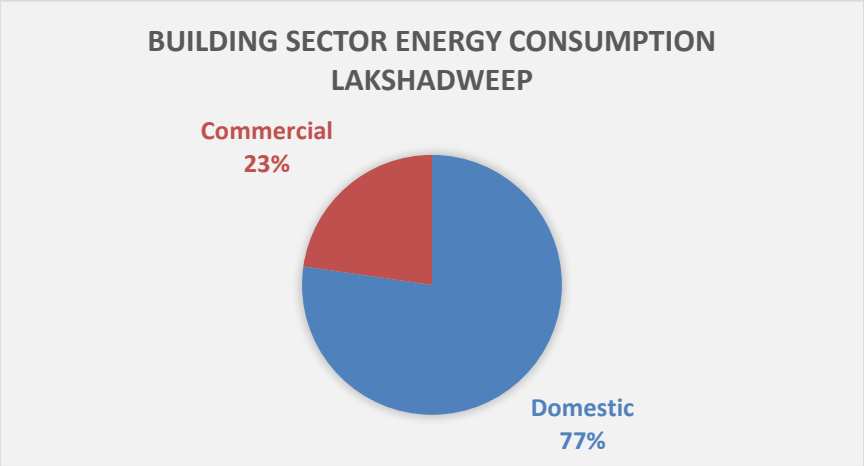
Policy Type	Monitoring Mechanism
Data Collection	Regular data collection and analysis can help track progress towards these targets and indicators. The state government can collect data on the number of electric vehicles on the road, the amount of fuel consumed, and the usage of public transportation. 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.

5 FOCUS SECTOR 2: BUILDINGS

5.1 Overview

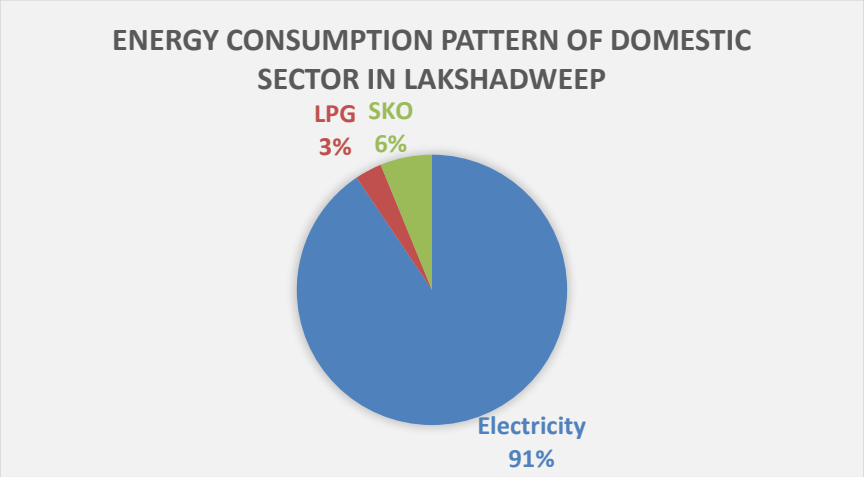
In Lakshadweep, the building sector is the largest consumer of electricity. In the building sector both domestic & commercial consumers are included. The Figure 17 shows the sector wise energy consumption in buildings.

Figure 17 Building sector energy consumption pattern



The major consumption in Domestic sector is from electricity & accounts for 91% of the total energy consumption. The consumption of SKO is more than LPG. However, the use of LPG is increasing, which is evident from the CAGR growth of 20% between FY 2015 & FY 2020. The Figure 18 shows the energy consumption pattern in the domestic sector.

Figure 18 Energy consumption pattern of the domestic sector

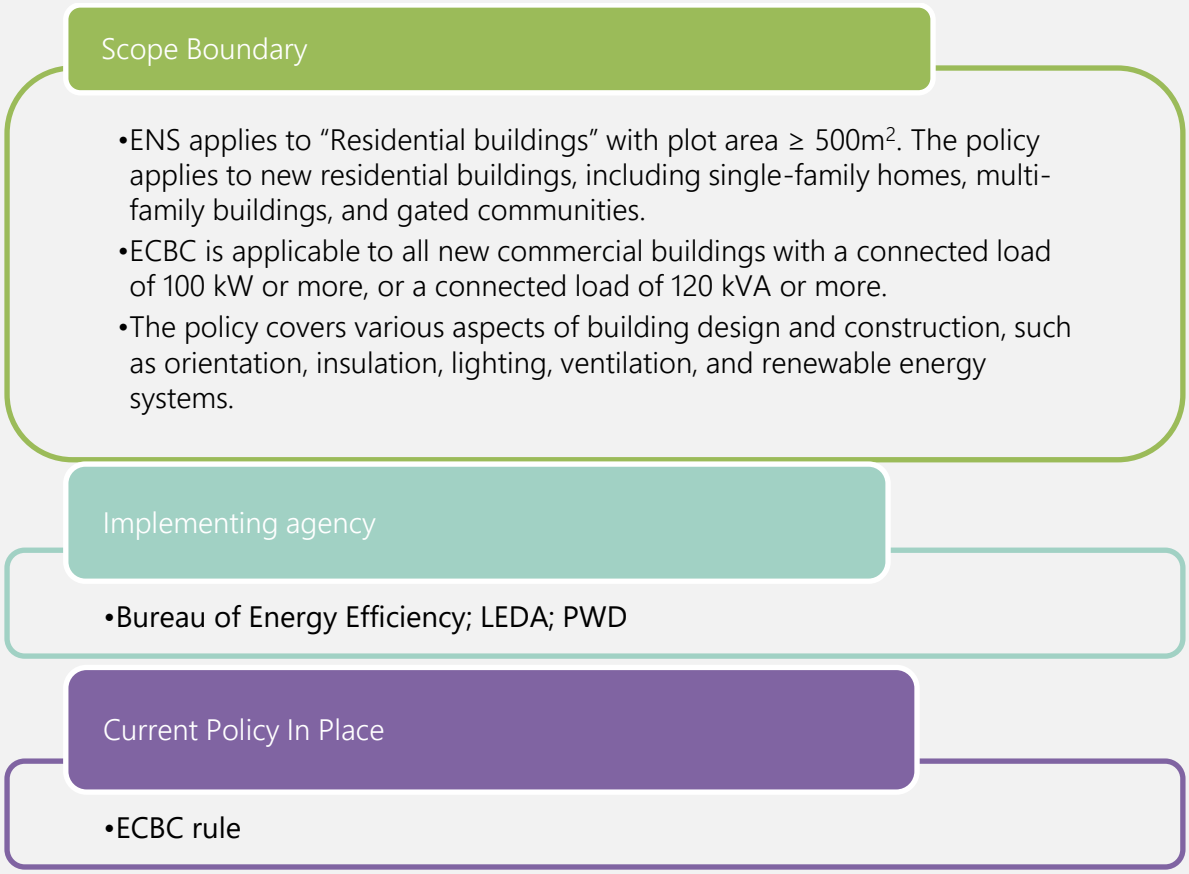


5.2 Energy efficiency strategies in the buildings sector

Strategy: Implementation of ENS– Residential Buildings and ECBC-Commercial Buildings

Eco Niwas Samithi (ENS) is a program launched by the Ministry of Power to promote energy efficiency in 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.

The Energy Conservation Building Code (ECBC) is applicable to all new commercial buildings with a connected load of 100 kW or more, or a connected load of 120 kVA or more. This includes buildings used for office, institutional, healthcare, retail, and other commercial purposes. ECBC is also applicable to major retrofits of existing commercial buildings, where the total connected load is increased by 50% or more, or where the conditioned area is increased by 50% or more. ECBC is mandatory for all the states and union territories of India, and compliance with the code is a legal requirement under the Energy Conservation Act, 2001



According to the housing Census 2011 of Lakshadweep, there are nearly 14,962 establishments which are further categorized into residence, offices, shops, schools, hotels, hospitals, factories, etc. Total number of households and commercial establishments were projected to 2031 as shown below:

Figure 19 Household Projection for 2030

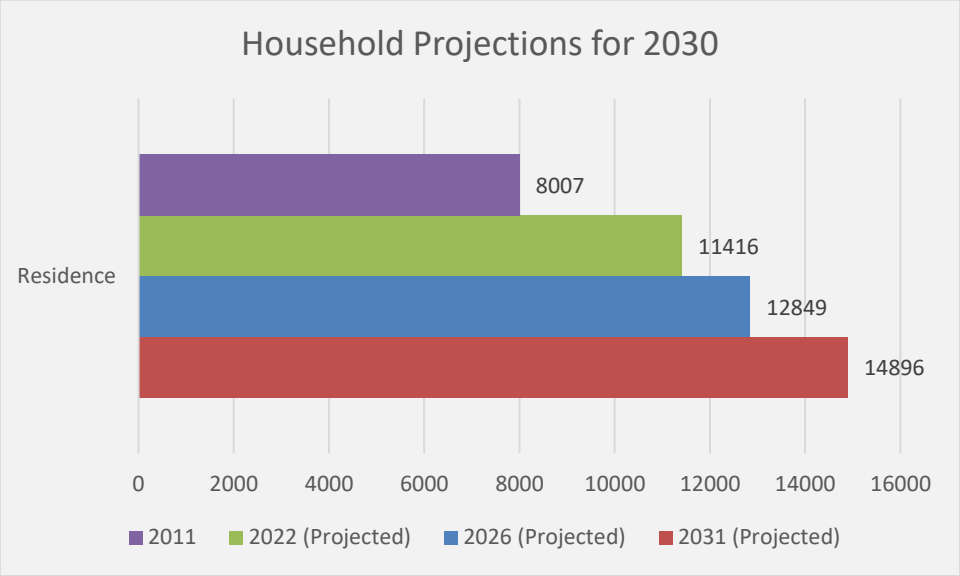
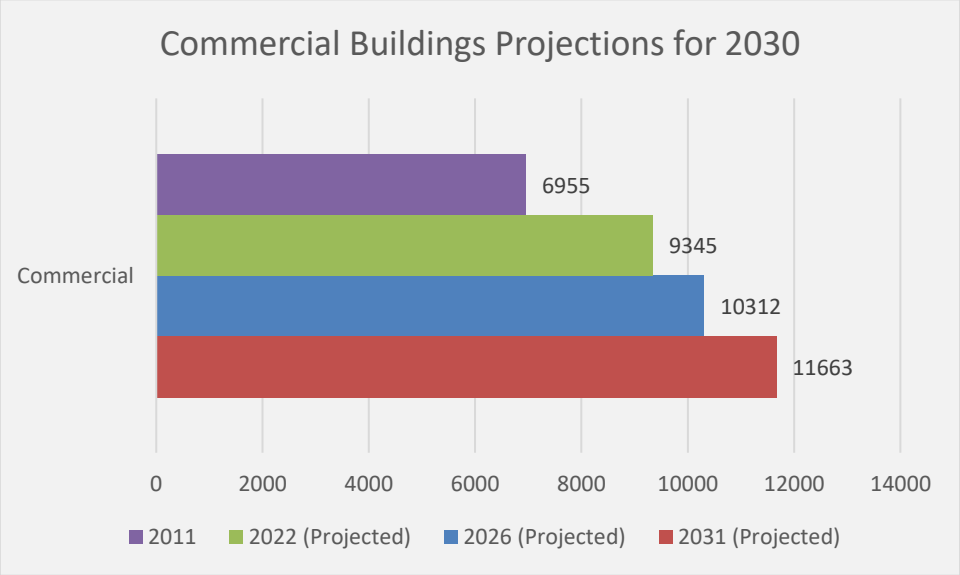


Figure 20 Commercial Buildings Projection for 2030



Energy Saving Potential

The saving potential for FY2030 is 0.0012 MTOE. This is estimated by calculating energy saving per household (kWh/household) and energy savings per commercial building which is then multiplied with 30%(moderate) & 35%(ambitious) of projected households and 5%(moderate) & 10%(ambitious) of projected commercial buildings respectively for FY2030. Similarly, the GHG saving potential for this strategy is 0.0033 $MtCO_2$.

Table 4: Energy Saving Potential

Particulars	Moderate Scenario for 2030	Ambitious Scenario for 2030
Energy Saving Potential (MTOE)	0.0005	0.0012
GHG Emission Reduction Potential ($MtCO_2$)	0.0013	0.0033

Action Plans

This section describes several action plans that can be implemented across the residential and commercial sector for this strategy.

1. Development of Compliance Portal:

Develop and maintain an Energy Conservation Building Code (ECBC) compliance portal. This portal can serve as a resource for builders, architects, and contractors to access information on energy-efficient and green materials and technologies.

ECBC Cell and Standards: Energy Conservation Building Code (ECBC) cell should be established in Lakshadweep. This cell would be responsible for ensuring that new buildings, especially the upcoming hotels and resorts, comply with ECBC standards. Implementing these standards would significantly reduce energy consumption in the building sector

2. Market Outreach and Awareness:

Conduct market outreach campaigns to promote ECBC-compliant products. Utilize various communication channels such as radio jingles, social media, and awareness programs to educate the public about the benefits of energy efficiency.

3. Pilot Projects for Super ECBC and Net Zero Buildings:

Initiate pilot projects to showcase the of benefits of Net Zero (Energy) Rating. Select an initial set of 20 buildings as case studies to demonstrate the feasibility and advantages of higher energy efficiency standards.

4. Mandatory Labelling for New Construction:

Draft legislation to mandate BEE's Energy Efficiency Labelling for all new residential construction projects. Ensure that builders and developers comply with energy efficiency standards and obtain the appropriate label before occupancy permits are granted. Lakshadweep Islands can consider a threshold of 300 m2 and all residential buildings with a built-up area exceeding this threshold would be subject to mandatory labelling.

Mandate the integration of the Bureau of Energy Efficiency's (BEE) Energy Conservation Sustainable Building Code (ECSBC) and Energy Efficiency Labelling (EEL) for Residential Buildings into the building byelaws of Lakshadweep Islands.

5. Financial Incentive

It is imperative to motivate construction builders to prioritize energy efficiency and this can be achieved with effective structure financial incentive. For example, the state can offer a 10% discount in property tax for three years for residential buildings with a five-star rating.

6. Energy Efficiency Certification Rebate:

Introduce a rebate program for homeowners who obtain BEE's Energy Efficiency Labelling certification. The rebate could be a percentage of the energy-efficient equipment or building materials' cost, up to a predetermined limit.

7. Low-Interest Energy Efficiency Loans:

Collaborate with local banks to provide low-interest loans for homeowners undertaking energy-efficient renovations. These loans can cover expenses related to insulation, energy-efficient windows, and high-efficiency appliances.

8. Local Builder Incentives:

Offer incentives to builders who construct energy-efficient residential buildings. Incentives could include reduced permit fees, faster approval processes, or recognition for their sustainable construction practices.

9. Home Energy Efficiency Financing Program:

Establish a dedicated financing program that provides affordable loans for homeowners looking to improve the energy efficiency of their homes. Offer financial mechanisms, such as low-interest rates and flexible repayment options.

10. Local Government Demonstration Projects:

Encourage local government departments to undertake energy efficiency upgrades in their residential buildings as demonstration projects. Share the success stories and cost savings to inspire homeowners to follow suit.

11. Consumer Education Initiatives:

Develop and distribute educational materials and online resources about BEE's Energy Efficiency Labelling and its benefits in the local language.

Create a user-friendly online platform where homeowners can calculate potential savings and access information about energy-efficient products and services.

12. Awareness Campaigns:

Conduct regular workshops and training sessions in collaboration with local authorities and educational institutions. Offer these workshops to builders, architects, and homeowners to educate them on energy-efficient building practices and the significance of BEE's Energy Efficiency Labelling.

13. Behavioural Energy Efficiency Program (BEEP)

Behavioural interventions have the potential to achieve energy savings of 5-15% in households. Applying this to Lakshadweep Islands residential sector could translate to substantial energy cost reductions and emission reductions. Implementing a BEEP program based on the BRPL model holds immense potential for reducing energy consumption and promoting sustainable

behaviour in the union territory. By prioritizing affordability, localization, and community engagement, the program can empower residents, achieve energy savings, and contribute to the state's clean energy goals.

Case Study: Behavioural Energy Efficiency Program by BSES Rajdhani Power Limited (BRPL) in Delhi
BSES Rajdhani Power Limited (BRPL), one of the power distribution companies in Delhi, implemented a successful Behavioural Energy Efficiency Program. The program focused on providing personalized Home Energy Reports (HERs) and an integrated web portal to selected residential consumers, aiming to improve energy efficiency and reduce energy consumption.
Based on results in comparable markets, Home Energy Reports (HERs) have the potential to save 1-2% of BRPL‟s peak power demand. The program was rolled-out across South and West Delhi in the month of October 2018. Considerable saving has been observed under this program

Components:

- Home Energy Reports (HERs): Selected consumers receive personalized reports detailing their energy consumption patterns, comparisons with similar households, and energy-saving recommendations.
- Integrated Web Portal: An interactive online platform allows consumers to access their energy usage data, track their progress, and access energy-saving tips and resources.
- Behavioural Change Campaigns: Conduct awareness campaigns and programs to educate consumers about energy efficiency, energy-saving practices, and behavioural changes that lead to energy conservation.
- Incentives and Rewards: Provide incentives and rewards to encourage active participation and achievement of energy-saving targets.

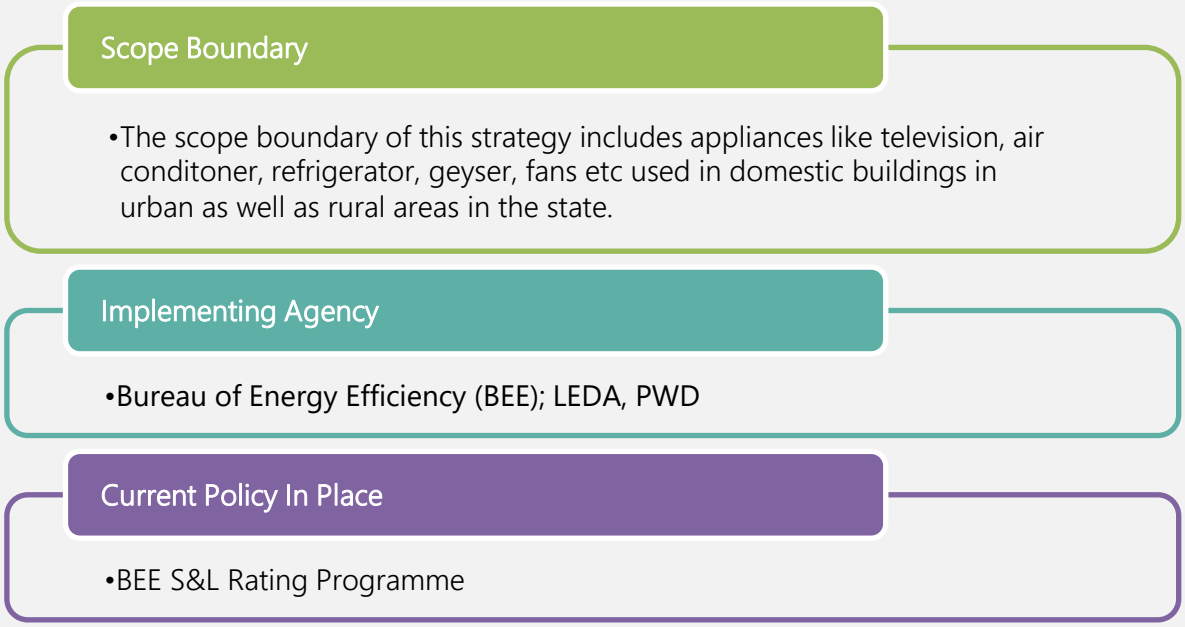
Benefits:

- Improved Energy Efficiency: Personalized HERs and access to energy data empower consumers to make informed decisions, adopt energy-saving practices, and reduce energy consumption.
- Energy Cost Savings: By implementing energy-saving recommendations and efficient usage of appliances, consumers can reduce their energy bills and achieve cost savings.
- Environmental Impact: Reduced energy consumption contributes to a decrease in carbon emissions and environmental footprint, promoting sustainability.

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 domestic buildings, the S&L Programme can significantly reduce energy consumption by promoting the use of energy-efficient appliances, lighting, and building materials. 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:



Saving Potential

The saving potential is estimated by assuming the application of standards and labelling in 45% and 50% of the projected households in the residential sector and 25% and 30% energy savings for moderate and ambitious scenario respectively. For commercial buildings, 20%(moderate) and 25%(ambitious) of the projected buildings are considered with 8% and 12% energy savings for moderate and ambitious scenario respectively.

Table 5: Energy Saving Potential

Particulars	Moderate Scenario for 2030	Ambitious Scenario for 2030
Energy Saving Potential (MTOE)	0.0013	0.0023
GHG Emission Reduction Potential ($MtCO_2$)	0.004	0.007

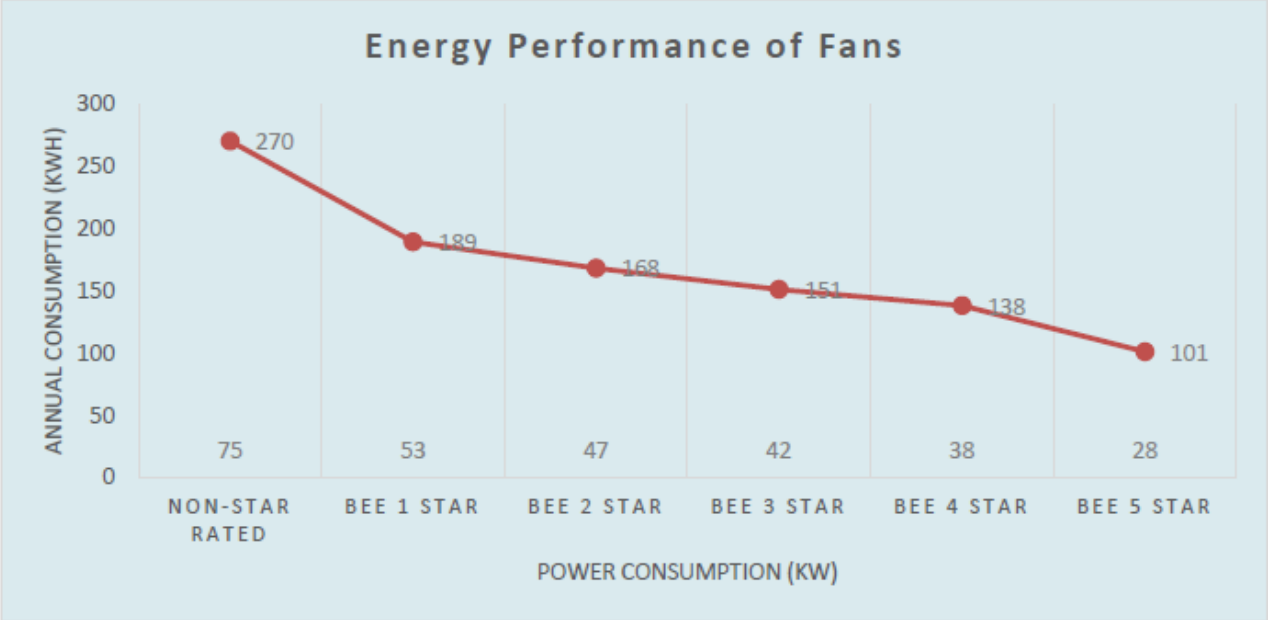
Action Plans

This section describes several action plans that can be implemented across the residential sector for this strategy.

1 **Bulk-purchase initiatives for energy efficient fan technologies**

a) Fans play a vital role in the daily lives of people across India, especially in a region like Andaman and Nicobar Islands with a tropical climate. However, it is also important to note that fans are one of the largest consumers of electricity in households and commercial spaces. In the U.T, the energy consumption by fans is estimated to be around 12% of the total energy consumption, which is significant.

To address this issue and promote energy-efficient fans, the government can initiate a bulk-purchase scheme for technologies like BLDC (Brushless Direct Current) fans. These fans are known for their energy efficiency and can save up to 50% of energy compared to traditional fans. This can significantly contribute to energy conservation efforts in U.T and reduce the energy consumption of fans.



The scheme can be implemented in partnership with manufacturers, promoted through awareness campaigns, and made easily accessible to consumers with the help of local distribution companies.
The scheme can be implemented by partnering with manufacturers of BLDC fans and offering bulk purchase orders at discounted rates. The scheme can also be extended to government offices, public institutions, and commercial buildings. Additionally, the existing five-star rating for fans can be promoted to become the new one-star minimum. This will encourage manufacturers to produce more energy-efficient fans and drive down the prices of energy-efficient fans further.

b) To ensure the success of the scheme, the state designated agency (SDA) can collaborate with the Bureau of Energy Efficiency (BEE) to create awareness among the public about the benefits of energy-efficient fans and the importance of purchasing energy-efficient products. The SDA can also work with local distribution companies to ensure that energy-efficient fans are available and easily accessible to consumers.

c) This action plan can be modelled after Delhi's "BEE 5 star rated Super Energy Efficient Fan Replacement Scheme".

Case Study of Delhi: BEE 5 star rated Super Energy Efficient Fan Replacement Scheme
BSES Rajdhani Power Limited (BRPL) has launched a limited period 'FAN Replacement Scheme' in partnership with leading BLDC FAN manufacturers like R R Kabel Ltd, Halonix Technologies Private Ltd, Atomberg Technologies Private Limited. It will enable BRPL domestic consumers, to either exchange their old fans with the new BEE 5 star rated super energy efficient BLDC Fans (herein after referred as "BLDC Fans") or can directly purchase them. Consumers can avail discount up to 64%* on MRP under buyback mode and 62%* on MRP on new purchase of BLDC Fans.
Wattage of the BLDC Fans offered in the scheme is 28 Watts whereas average wattage of old non star rated ceiling fans is around 75 Watts. Hence replacing the non-star rated ceiling fan with BLDC Fans would result in savings to the tune of 63%. All the models in the scheme are Remote Controlled and has a sweep of 1200mm. Consumers can avail maximum 3 BLDC fans under buyback or maximum 2 BLDC fans under without buyback with an overall ceiling of 3 BLDC fans per CA. 50000 BLDC Fans are available on first come first serve basis valid till 20th March 2021 or till stocks last under which 40000 BLDC Fans are available for purchase under Buyback Mode and 10000 BLDC Fans are available for fresh purchase without any exchange of old fan.

2. Accelerating Access to Energy-Efficient Air Conditioners (ACs)

a) Andaman and Nicobar Islands, being a tropical region is experiencing rising demand for air conditioning due to increasing heatwaves and urbanization. However, this reliance on traditional, less efficient ACs leads to increased energy consumption, emissions, and strain on the electricity grid.
b) By adopting a multi-pronged approach combining policy, financial incentives, awareness campaigns, market development, and continuous monitoring, A & N Islands can effectively accelerate access to energy efficient ACs. With successful initiatives like BEE and CLASP, the union territory can pave the way for a future where efficient and sustainable cooling solutions are accessible to all.

Case Study: Energy Efficient Air Conditioners in India by BEE and CLASP
Objective The objective of the project is to accelerate access to energy-efficient air conditioners (ACs) in India, considering the country's growing middle-class population and rising disposable income. The focus is on creating awareness about energy-efficient schemes and interventions to influence purchase decisions and promote the adoption of high-quality and affordable AC products.
Project Activities: 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.

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.

3. Promote Energy-Efficient and Low-GWP Refrigerant-Based Cooling:

Launch awareness campaigns highlighting the benefits of energy-efficient and low-GWP refrigerant-based cooling systems for public and private stakeholders.

Introduce financial incentives, such as rebates or tax credits, for the purchase and installation of energy-efficient cooling systems.

Enforce regulatory measures that mandate the use of low-GWP refrigerants in cooling systems to reduce environmental impact.

3. Energy-Efficient Public Procurement:

Establishing a certification process for service technicians to ensure proper installation and maintenance of cooling systems.

Regularly update the Public Works Department (PWD) Schedule of Rates (SoR) to incorporate the latest energy-efficient materials and technologies in procurement projects.

4. Promotion of Heat Pumps:

Provide subsidies and financial incentives to consumers and businesses for the installation of heat pumps for space cooling and hot water supply.

Collaborate with manufacturers to promote research and development in heat pump technology and offer market-based incentives for adopting this technology.

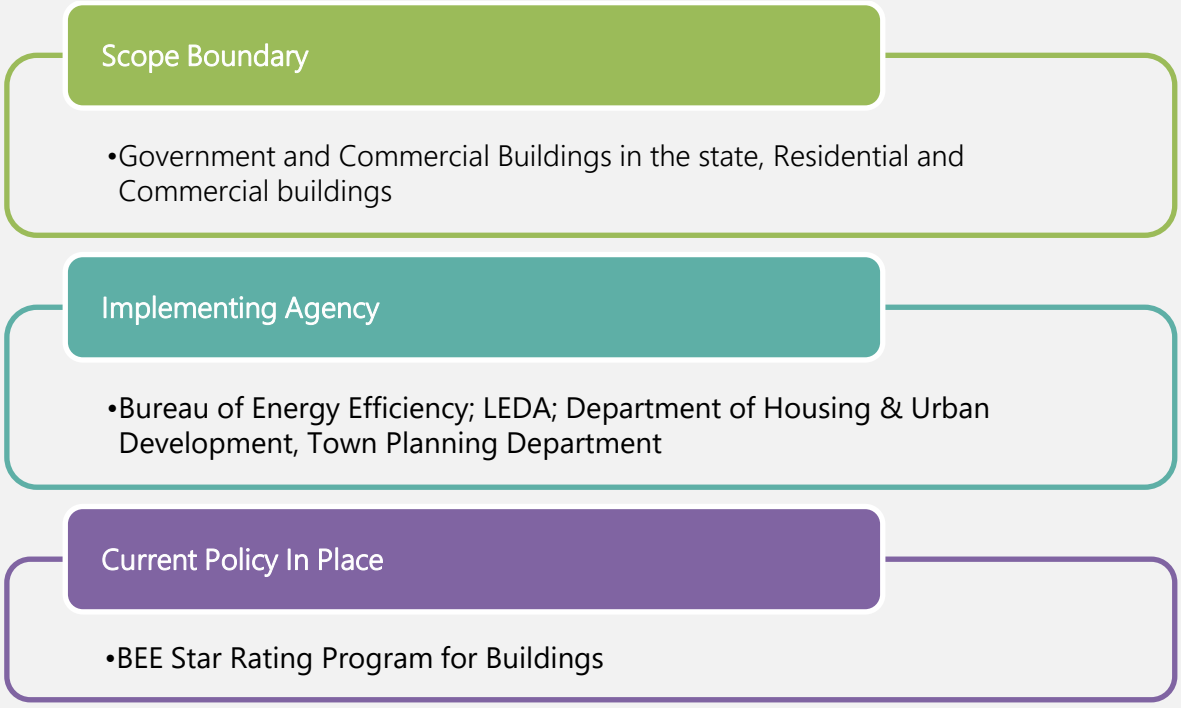
5. Mandatory Use of 4-Star Rated Appliances:

Enforce regulations requiring the use of 4-star rated appliances in all commercial and government buildings to reduce energy consumption and greenhouse gas emissions.

Establish a monitoring and enforcement mechanism to ensure compliance with the mandatory rating requirements.

Strategy: BEE Star Rating of Buildings, Green Buildings

BEE star rating program for buildings can help to promote energy efficiency and sustainability in Lakshadweep, offering benefits to building owners, residents, and the environment. Lakshadweep Government can promote the construction of green buildings by declaring incentives in the UT like in Kerala. In Kerala, the Local Self Government Department has approved up to 50% reduction in One time building tax, up to 1% reduction in Stamp duty and up to 20% reduction in Property tax for projects obtaining green building certifications like IGBC. The incentives can promote the green building construction in the UT and will help to have a large green building footprint.



Saving Potential

Residential Sector: A total of 40% and 45% of projected households have been considered with a saving potential of 25% and 30% respectively for moderate and ambitious scenarios.

Commercial Sector: A total of 3% and 5% of the projected households have been considered with a saving potential of 5% and 8% respectively for moderate and ambitious scenarios.

Table 6: Energy Saving Potential

Particulars	Moderate Scenario for 2030	Ambitious Scenario for 2030
Energy Saving Potential (MTOE)	0.0008	0.0017
GHG Emission Reduction Potential ($MtCO_2$)	0.0025	0.0053

Action Plans

Home Energy Auditor Training:

Establish training programs for home energy auditors. Create a compliance structure that rewards residential projects for energy savings achieved through energy-efficient measures, such as insulation and lighting upgrades.

Government Building Energy Audits and BEE Star Rating Target:

Issue directives to all government departments to conduct comprehensive energy audits of their buildings. Set specific targets for achieving BEE (Bureau of Energy Efficiency) Star Ratings for government-owned buildings. This will serve as a leading example for energy efficiency in the state.

Capacity Building for Professionals:

Develop training and capacity-building programs for architects, building professionals, and developers focused on energy-efficient building design and construction practices. Encourage them to incorporate energy-efficient technologies and designs into their projects.

Transformation of Iconic Government Buildings:

Identify and select iconic government buildings for transformation into Net-Zero energy buildings. Implement energy-efficient retrofits, renewable energy integration, and smart technologies to showcase the possibilities of sustainable construction and operation.

Building management system (BMS)

Mandate building management system (BMS) to centrally manage and monitor lighting, HVAC, and other building systems for optimized energy consumption.

LEDs & Occupancy Sensors

Accelerate adoption of all lighting to LED fixtures. Utilize occupancy sensors in public areas and daylight harvesting strategies (e.g., light shelves) to further reduce lighting energy use.

Mandatory Temperature Set Point for ACs:

Enforce a mandatory minimum set point of 24°C for air conditioners in all government buildings.

Cool Roof Programme:

Mandatory cool roofing for all the government, government-owned, non-residential and commercial buildings irrespective of site area/built up area.

Mandatory Rooftop Solar Installation:

Implement a phased approach for mandatory rooftop solar installation on all new commercial and residential buildings above a specific size threshold (e.g., carpet area).

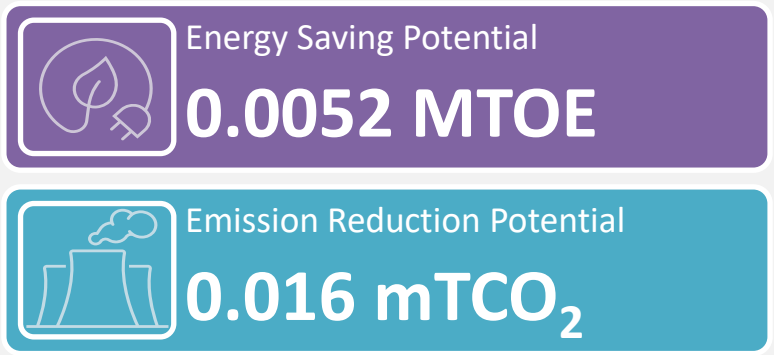
Existing buildings can be incentivized to install solar through subsidies, tax breaks, or low-interest loans. Collaborate with architects, developers, and builders to integrate solar design considerations into new construction projects.

5.3 Energy saving potential & monitoring mechanism

Energy saving potential of the building sector is 0.0026 MTOE and 0.0052 MTOE for moderate and ambitious scenarios FY2030 respectively as seen from Table 9.

Table 7 Summary of energy saving from the strategies.

Strategy	Energy Saving (Moderate)	Energy Saving (Ambitious)
1. Implementation of ENS-Residential buildings and ECBC-Commercial Buildings	0.0005	0.0012
2. Deepening of S&L in domestic buildings	0.0013	0.0023
3. BEE Star Rating	0.0008	0.0017



Following are the monitoring mechanisms that could be implemented to track the progress and effectiveness of the policies in the Building sector in Lakshadweep:

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.

6 FOCUS SECTOR 3: FISHERIES

6.1 Overview

Agriculture and allied sectors hold a major role in employing people, providing food, and ensuring food security in any development process. It also has a significant position in achieving the Sustainable Development Goals (SDG) of no poverty, zero hunger, and good health and well-being.

In Lakshadweep, the major agriculture allied sectors are Crops, Marine Fishery and Livestock. The major agricultural produce in the UT are Coconut, Fruits and Vegetables. The UT administration is in process of constituting 35 'Dweep Mahila Sangam' like the 'Kudumbashree of Kerala', to promote agricultural activities and women empowerment.

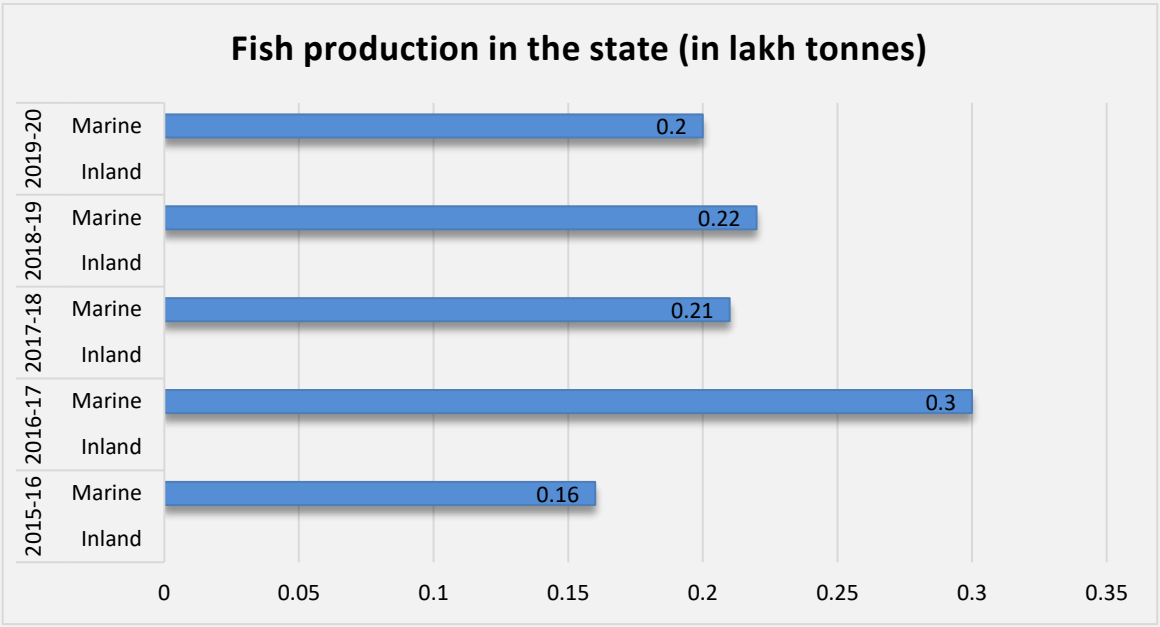
Speaking about the Fisheries sector of Lakshadweep, tuna-based fishery is predominant. Tunas are most economically underutilized fisheries in Indian waters with more than half of their potential located around the Lakshadweep waters. As per the IBEF report, the estimated potential of marine fishery resources in Lakshadweep is about one lakh tonnes of tuna and tuna such as fished and shark. In 2017-18, the fishery production in Lakshadweep was 21,000 tonnes against 29,800 tonnes in 2016-17. As of 2018, 100 GPS units were issued to the fisherman in the islands at 75% subsidy, to help fishermen in navigation purposes like reaching specific locations for fishing activities.

The energy consumption in the agricultural sector of Lakshadweep is not available as the energy consumption in the sector is very less.

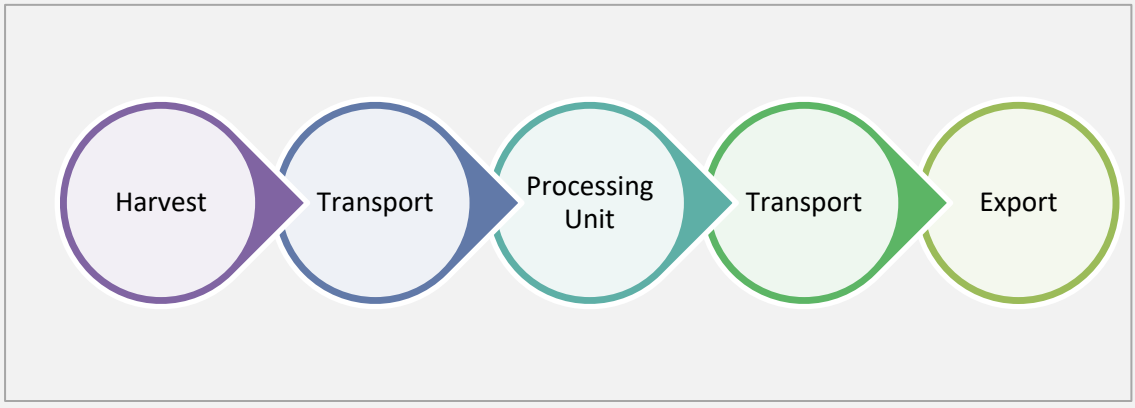
6.2 Energy efficiency strategies in the fisheries sector

Strategy: Energy efficiency across value chain of fisheries

According to Handbook on Fisheries Statistics 2020 by Department of Fisheries, Lakshadweep produced 0.2 lakh tonnes of marine fishes as seen in the figure below:



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.

Scope Boundary

- Energy efficiency across value chain like harvest, transport, processing etc.

Implementing Agency

- Dept of Fisheries
- LEDA

Current Policy In Place

- The state has schemes like "Hire Purchase System" in which mechanized boats are supplied on subsidy, however they are no policies centred around energy efficiency.

Saving Potential

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

Table 8: Energy Saving Potential

Particulars	Moderate Scenario for 2030	Ambitious Scenario for 2030
Energy Saving Potential (MTOE)	0.0015	0.0025
GHG Emission Reduction Potential ($MtCO_2$)	0.0049	0.0079

Action Plans

This section describes several action plans that can be implemented across fisheries sector for this strategy.

1. Skill Development:

Launch training programs for boat operators on fuel-efficient navigation through route optimization software, gear selection based on catch data and weather forecasts, and proper engine maintenance techniques.

Partner with ICAR to develop and deliver state-specific training modules on efficient fishing practices and gear selection for Lakshadweep Islands' diverse fishing grounds.

2. Awareness Campaigns:

Conduct workshops in major fish processing centres focusing on energy-efficient equipment like variable-speed drives for compressors, LED lighting upgrades, and automated cleaning systems.

Develop and distribute technical manuals in Hindi detailing best practices for optimizing cooling systems, waste heat recovery, and water management in fish processing plants.

3. Financial Incentives:

Offer subsidies for replacing traditional engines with Bureau of Indian Standards (BIS)-approved energy-efficient models.

Implement a "scrap and replace" scheme for outdated vessels, incentivizing lightweight fiberglass designs with higher fuel efficiency.

4. Pilot Projects:

Collaborate with local fishing communities in Visakhapatnam and Kakinada harbours to pilot energy-efficient fishing vessels with advanced navigation systems and automated gear deployment.

5. Energy Efficient Fishing Vessels:

In the islands, there are around 2,000 motorized fishing boats, which consume a considerable amount of diesel fuel. By adopting energy-efficient engines and reducing vessel weight, fuel consumption can be reduced. According to a study -efficient engines in fishing vessels can reduce fuel consumption by up to 40%.

Promote the adoption of solar-powered accessories like navigation lights, bilge pumps, and onboard refrigeration units to reduce reliance on diesel generators.

Develop and disseminate guidelines for safe and efficient installation and operation of solar panels on fishing vessels, considering marine environment and safety regulations.

6. Guidelines for BEE Star-Rated Products:

Develop and distribute state-specific guidelines highlighting the benefits and availability of BEE Star-rated equipment for fishing vessels, processing units, and cold storage facilities.

Organize awareness campaigns in fishing communities and processing centers to educate stakeholders on identifying and choosing energy-efficient equipment.

Collaborate with equipment manufacturers and distributors to promote and stock BEE Star-rated products in the A & N Islands.

7. Partial Support for Energy Audits

Offer partial financial support or subsidies for conducting energy audits in fishing vessels, processing units, and cold storage facilities, similar to the program available for MSMEs.

Mandatory Data Collection and Reporting

Consider mandating ISO 50001 energy management system certification for larger processing units to ensure effective data collection and continuous improvement in energy efficiency.

Standardization of Cold Chain Technologies

Develop and maintain a state-specific database of standardized cold chain technologies for fisheries, covering investment costs, Return on Investment (ROI), energy specifications, vendor information, and operational benefits.

Regularly update the database with new technologies and best practices, disseminating information through industry workshops and technical manuals.

Collaborate with research institutions and industry experts to evaluate and endorse energy-efficient cold chain technologies.

8. First and Last Mile Transportation:

Phase Changing Materials (PCM) Technology: Encourage the adoption of PCM coolers/freezers for transporting fish, reducing reliance on ice and maintaining consistent cool temperatures during transport.

Energy-Efficient Aerators: Promote the use of energy-efficient aerators in aquaculture farms to optimize oxygen levels and reduce energy consumption.

EV adoption: Collaborate with fisheries departments and EV manufacturers to explore expanding the use of electric three-wheelers or small cargo EVs for fish transportation within cities and urban areas.

9. Cold Storage and Processing:

Solar PV Systems: Incentivize the installation of rooftop solar PV systems for fisheries and cold storage facilities through subsidies, net metering policies, and technical assistance programs.

Ammonia/CO2 Brine Systems: Promote the adoption of efficient Ammonia/CO2 brine systems in cold storage facilities, offering higher cooling efficiency compared to traditional systems.

Evaporative Condensers: Encourage the use of evaporative condensers for cooling in processing units and cold storage facilities, utilizing ambient air and water evaporation for heat rejection.

Low Charge Ammonia Systems: Consider exploring the feasibility and safety of adopting low charge Ammonia refrigeration systems in suitable scenarios, minimizing refrigerant use and potential leaks.

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 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 practised 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 practising 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

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.

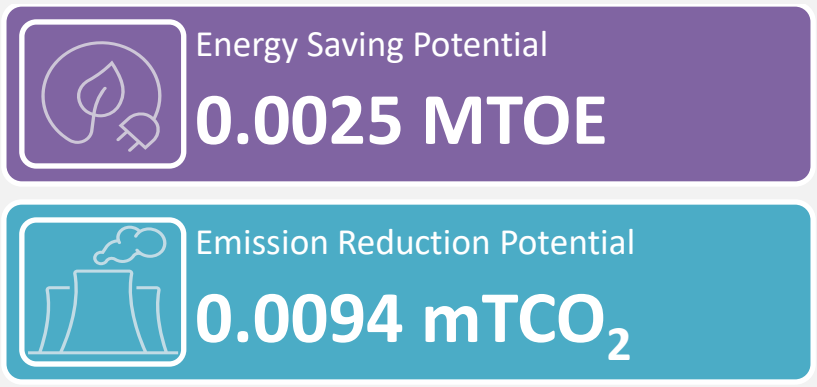
Figure 21: Sagar Haritha designed by Central Institute of Fisheries Technology

Energy saving potential & monitoring mechanism

Energy saving potential of the fisheries sector is 0.0015 MTOE and 0.0025 MTOE for moderate and ambitious scenarios FY2030 respectively as seen from Table 12

Table 9 Summary of energy saving from the strategies

Strategy	Energy Saving (Moderate)	Energy Saving (Ambitious)
Energy efficiency across all value chain in fisheries sector	0.0015	0.0025



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

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
Data Reporting	Remote sensing and GIS mapping: Remote sensing and GIS mapping can be used to monitor changes in ocean temperatures and salinity, which can affect fish distribution and abundance. These tools can also help identify areas where vulnerable fish species are concentrated.

7 Opportunity for DISCOM

7.1 Overview

Lakshadweep currently relies entirely on diesel generators for its electricity generation. This dependency on diesel not only results in significant carbon emissions but also places a burden on resources and operational efficiency due to the high costs and logistical challenges of transporting diesel fuel to the islands. The Lakshadweep Electricity Department ensures round-the-clock power supply to consumers across the islands, but the current energy scenario remains unsustainable in the long term. The Indian government has taken a strategic initiative to promote the use of natural gas, aiming to increase its share in the primary energy mix to 15% in the coming years.

Under the 12th City Gas Distribution (CGD) Bidding Round, substantial progress has been made in expanding the gas pipeline network across the country, with over 23,500 km of gas pipelines operational. However, the pipeline infrastructure has not yet extended to remote regions such as Lakshadweep. The government's vision of "One Nation, One Gas Grid" by 2030 highlights the importance of expanding access to cleaner fuels such as Piped Natural Gas (PNG) and Compressed Natural Gas (CNG) to all parts of the country, including the islands.

Extending natural gas infrastructure to Lakshadweep and other remote areas could significantly reduce the region's carbon footprint by transitioning away from diesel-based power generation. This would involve transporting liquefied natural gas (LNG) via cargo ships to these islands, where it could be converted to PNG and CNG to fuel generators and other applications.

Strategy: Gas based dual Fuel for Diesel Gensets

One potential solution to reduce emissions and improve energy efficiency in Lakshadweep is the deployment of PNG-based Dual Fuel Kits for diesel generators. This innovative technology integrates Piped Natural Gas (PNG) into the combustion process, working in tandem with the existing diesel fuel. The Dual Fuel Kit injects PNG into the generator's combustion chamber, where it combines with air and diesel vapor to create an optimal mixture for combustion.

The system's control unit monitors and adjusts the ratio of PNG to diesel based on factors such as engine load, speed, and temperature. This ensures efficient operation across varying conditions, allowing operators to minimize diesel consumption while maximizing the use of PNG. The flexibility of the system enables it to replace up to 80% of the diesel fuel with PNG, significantly reducing emissions and operational costs.

By leveraging PNG-based Dual Fuel Kits, Lakshadweep could see a reduction in carbon emissions, lower fuel costs, and improved operational sustainability. This strategy aligns with the broader national objectives of increasing natural gas usage and reducing reliance on more polluting fuels.

Strategy	Reduction in emissions (tCO_2)
Gas based dual Fuel for Diesel Gensets	4937

8 INVESTMENT POTENTIAL

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

Sector	Emissions Reduction (tCO2) - FY2031		Energy Consumption Reduction (toe) - FY2031		Investment Potential[8]
	Moderate	Ambitious	Moderate	Ambitious	
	tCO2 reduction	tCO2 reduction	toe Reduction	toe Reduction	INR Crores
Transport	5,490	8,235	1,754	2,631	₹4.8
Buildings	8,388	16,367	2,680	5,229	₹9.6
Fisheries	4,972	7,955	1,588	2,541	₹4.67
Total	18,850	32,557	6,022	10,401	₹19

The energy saving investment potential of the state is estimated to be ₹19 crores by the year 2031, under the ambitious savings scenario, with the building sector constituting highest energy saving investment potential followed by transport sector.

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

9 WAY FORWARD

The “State Energy Efficiency Action Plan” report for Lakshadweep provides a roadmap for the state to achieve its energy efficiency goals. The report covers various sectors, including 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.

The task force should prioritize increasing RE in the UT. Instead of relying on large centralized solar farms, smaller micro-grids and distributed solar systems can be installed across multiple locations, reducing strain on land availability. Conduct an assessment to determine the rooftop space available across the islands. Highlight the potential for installing solar panels on these rooftops to generate significant amounts of power and leverage Govt schemes like PM-Surya Ghar: Muft Bijli Yojana.

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 Lakshadweep 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.

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