MINISTRY OF POWER
GOVERNMENT OF INDIA

STATE ENERGY EFFICIENCY ACTION PLAN (SEEAP)

CHANDIGARH - ACTION PLAN

AUGUST 2024

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

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

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

Associated Chambers of Commerce and Industry of India (ASSOCHAM)

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ABBREVIATIONS

AAGR	Average Annual Growth Rate
AgDSM	Agriculture Demand Side Management
BEE	Bureau of Energy Efficiency
BLDC	Brushless Direct Current
CAGR	Compound Annual Growth Rate
CEA	Central Electricity Authority of India
CREST	Chandigarh Renewal Energy and Science & Technology Promotion Society
DISCOM	Distribution Company
DSM	Demand Side Management
ECBC	Energy Conservation Building Code
ECSBC	Energy Conservation & Sustainable Building Code
EE	Energy Efficiency
EESL	Energy Efficiency Services Limited
EIA	Energy Information Agency
ENS	Eco Niwas Samhita
ESCO	Energy Service Companies
FY	Financial Year
GSDP	Gross State Domestic Product
KUSUM	Kisan Urja Suraksha Evam Utthaan Mahabhiyan
LED	Light Emitting Diode
MEEP	Municipal Energy Efficiency Programme
MNRE	Ministry of New and Renewable Energy
MOSPI	Ministry of Statistics and Programme Implementation
Mtoe	Million Tonne of Oil Equivalent
MU	Million Unit of Electricity (in kWh)
MuDSM	Municipal Demand Side Management
NEMMP	National Electric Mobility Mission Plan
NHPC	National Hydroelectric Power Corporation
NMEEE	National Mission on Enhanced Energy Efficiency
PMKSY	Pradhan Mantri Krishi Sinchai Yojana
STCL	State Transmission Corporation Limited
RBI	Reserve Bank of India
SDA	State Designated Agency Chandigarh
SLNP	Street Light National Programme
SEEAP	State Energy Efficiency Action Plan
SEEI	State Energy Efficiency Index
TFEC	Total Final Energy Consumption
UNNATEE	Unlocking National Energy Efficiency Potential

Executive Summary

Increasing energy demand naturally strains the country's resources and impacts the environment. These warrants decoupling the country's economic growth and energy demand. This is also echoed through India's Intended Nationally Determined Contribution submitted in the run-up to the Paris Climate Conference, where the government has highlighted energy conservation as a key mitigation strategy. The Government of India in the 26th session of the Conference of the Parties (COP26) to the United Nations Framework Convention on Climate Change (UNFCCC) held in Glasgow, United Kingdom in 2021, presented the five nectar elements (Panchamrit) of India's climate action including the target of net-zero emissions by 2070 and get 50% of its energy from renewable resources by 2030.

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

The State Energy Efficiency Action Plan for a particular State/UT developed by identifying focus sectors of the State/UT and estimating the potential of energy conservation in sectors which are predominant in the region. The State Energy Efficiency Action Plan is developed for a short term-plan for a tenure of 5 years (2025-26) and a long-term plan targeting high-impact energy efficiency by the year 2030-31.

For the UT of Chandigarh, SEEAP was developed under the guidelines of Bureau of Energy Efficiency, Ministry of Power, GOI and SDA Chandigarh and inputs & suggestions from various government departments and sector experts were considered. The objective of the State Energy Efficiency Action Plan is to arrive at sector-specific approaches for energy efficiency for the UT of Chandigarh.

During FY 2020-21, the Union Territory of Chandigarh consumed a total final energy consumption (TFEC) of 0.58 million tonnes of oil equivalent (Mtoe), with oil accounting for 72.72% of the consumption, followed by electricity at 23.61%, and gas at 3.67%. Based on energy consumption and economic growth of the UT, total final energy consumption of UT is projected, and it is estimated that TFEC of Chandigarh in FY 2030-31 will be 0.97 Mtoe. On the basis of projected GSDP of the UT and projected energy consumption, Buildings, Transport and Industry sectors were identified as focus sectors and sector specific strategies were analyzed. List of sector specific focused strategies to ensure that the allocation of resources is as per the requirement of the UT is listed below:

Buildings Sector:

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

Transport Sector:

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

Industry Sector:

- Energy Efficiency Intervention in MSME clusters

Other Focus Area:

- Replacement of inefficient sewerage and water pumps with BEE 5-star rated pumps under all municipal corporations of the UT.
- Development of energy efficiency curriculum for school & college students
- All new transformers in Residential-Commercial Buildings and Industrial Buildings shall be BEE 3 Star Rated.

This action plan for UT of Chandigarh will result in a total energy consumption reduction of 0.091 Mtoe in the moderate scenario and 0.1630 Mtoe in the ambitious scenario in the FY 2030-31. This plan will also create awareness at the mass level and create a market potential of approximate rupees 299.89 Crore in the field of energy efficiency and reduce the CO_2 emission by 0.2848 $MtCO_2$ in moderate scenario and 0.51 $MtCO_2$ in ambitious scenario by FY 2030-31.

Annual Energy Saving Potential:

	2024		2025		2026		2027		2028		2029		2030		2031	
	Mtoe	$MtCO_2e$	Mtoe	$MtCO_2e$	Mtoe	$MtCO_2e$	Mtoe	$MtCO_2e$	Mtoe	$MtCO_2e$	Mtoe	$MtCO_2e$	Mtoe	$MtCO_2e$	Mtoe	$MtCO_2e$
Industries																
Energy efficiency in MSME Clusters	0.00013	0.00042	0.00033	0.00105	0.00040	0.00125	0.00051	0.00159	0.00065	0.00203	0.00083	0.00259	0.00105	0.00329	0.00134	0.00419
Transport																
Transition to electric vehicles	0.005	0.017	0.008	0.025	0.021	0.06573	0.025	0.07920	0.030	0.09544	0.037	0.11500	0.044	0.13858	0.053	0.16699
Ethanol blending	0.002	0.005	0.004	0.012	0.015	0.04695	0.018	0.05481	0.020	0.06400	0.024	0.07472	0.028	0.08723	0.033	0.10185
Building																
Effective implementation of ECSBC	0.0000073	0.00002	0.0000109	0.00003	0.0000288	0.00009	0.0000347	0.00011	0.0000417	0.00013	0.0000502	0.00016	0.0000605	0.00019	0.0000728	0.00023
Replacement program for inefficient appliances	0.0004	0.00116	0.0006	0.00173	0.0014	0.00439	0.0017	0.00532	0.0021	0.00646	0.0025	0.00785	0.0030	0.00953	0.0037	0.01157
BEE Star Rating and Shunya Rating of Buildings	0.0000001	0.00000	0.0000003	0.00000	0.0000008	0.00000	0.0000009	0.00000	0.0000011	0.00000	0.0000013	0.00000	0.0000015	0.00000	0.0000018	0.00001
Total	**0.007**	**0.023**	**0.013**	**0.040**	**0.038**	**0.118**	**0.045**	**0.141**	**0.054**	**0.168**	**0.064**	**0.200**	**0.076**	**0.239**	**0.091**	**0.285**

1. Introduction

1.1. Background

India's economy is characterized by an emerging and developing market. In 2019, India became the fifth-largest economy in the world in nominal terms, surpassing United Kingdom and behind the United States, China, Japan and Germany. The size of the Indian economy in Fiscal Year (FY) 2020 was estimated to be INR 145 Lakh Crores at constant prices of 2011-12.[1] With the growth of the Indian economy, the demand for energy has increased significantly, resulting in high energy levels in some sectors and increase in the country's emissions.

As per International Energy Agency's (IEA) World Energy Outlook 2021 report, India currently has a share of 6.1% in the global primary energy consumption, which is projected to increase to 9.8% by the year 2050.[2] India's primary energy supply in FY 2020 was recorded at 946.08 MTOE, with coal and crude oil being the largest contributors to the total primary energy. India's per capita emissions in FY 2020 were 1.82 tCO_2, having increased by 7% from its 2016 level of 1.7 tCO_2.[3] While India's per capita energy consumption and per capita emissions are well below the global average per capita emissions, it is greatly threatened by global warming and climate change.

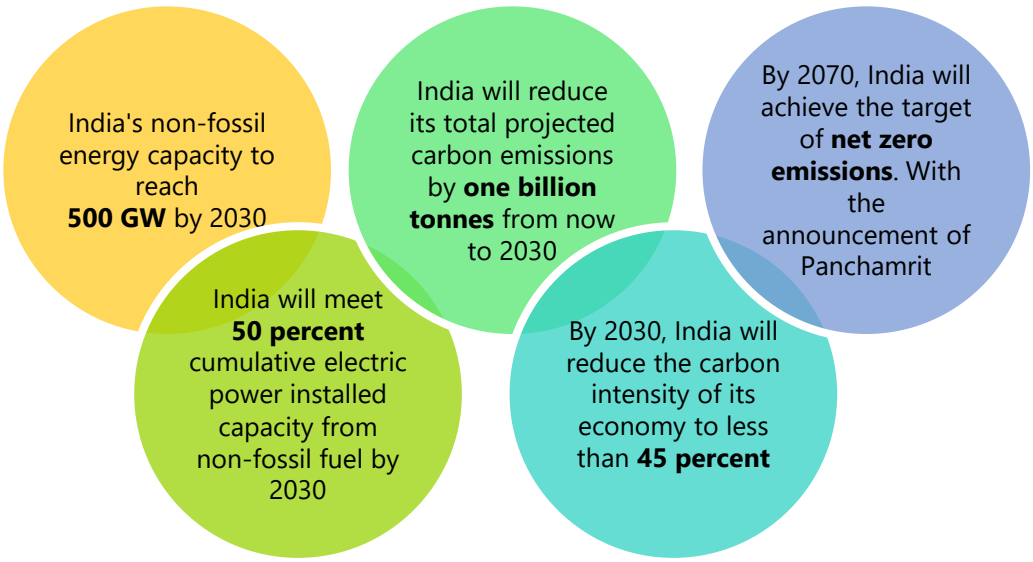
India has set ambitious economic goals for the future and achieving these goals is expected to result in significant increase in the country's energy demand and emissions. In view of this, India has also set ambitious goals for energy and climate performance. The country has also emphasized the importance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

[1] *https://mospi.gov.in/sites/default/files/press_release/PressNoteNAD_28feb23final.pdf*
[2] *https://iea.blob.core.windows.net/assets/4ed140c1-c3f3-4fd9-acae-789a4e14a23c/WorldEnergyOutlook2021.pdf*
[3] *Calculated using primary energy input data from NITI Aayog and population projection data from MoHFW*

adopted by the Government of India is the efficient use of energy resources and their conservation. This is essential since the efficient use of energy and its conservation is the least-cost option to meet the increasing energy demand, reduce wasteful consumption and in leading the country's economic growth in sustainable manner.

1.2. India's Nationally Determined Contributions (NDCs)

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



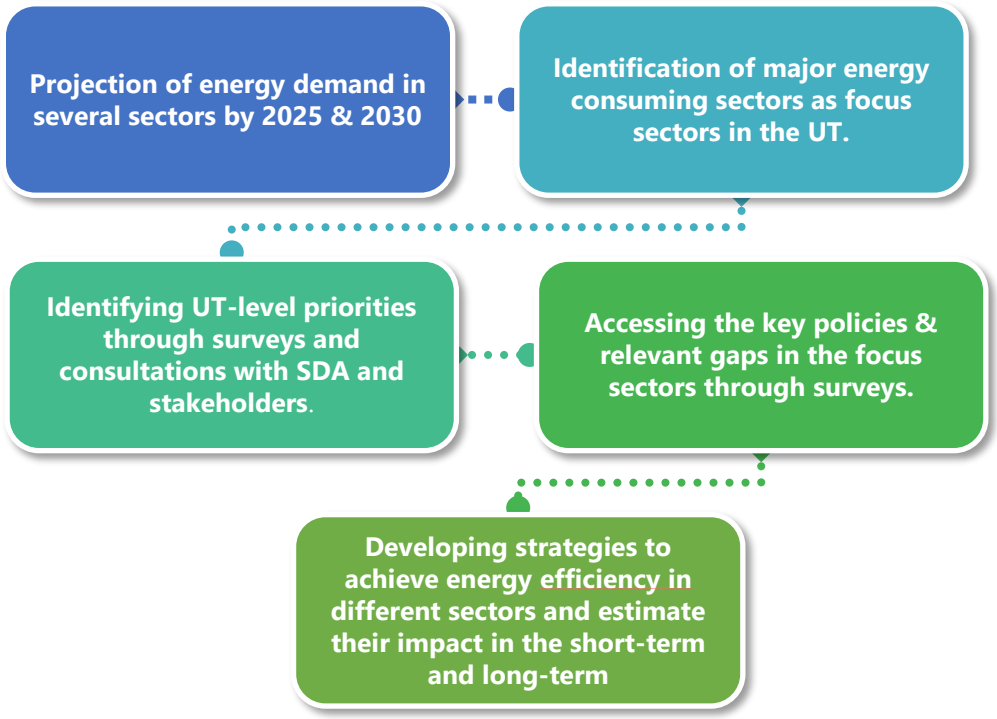
India's earlier target of 33% to 35% reduction in emission intensity from 2005 level by 2030 has been revised to approximately 45%. In view of the enhanced target under Panchamrit, India's energy efficiency efforts need to be increased and States and UTs have a vital role in India's energy efficiency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

On 1st November 2021, during the 26th United Nations Climate Change Conference of the Parties (COP26) in Glasgow, Prime Minister Narendra Modi introduced the idea of 'Lifestyle for the Environment (LiFE)'. He urged individuals and institutions across the world to support LiFE as a global movement, aimed at promoting mindful and deliberate utilization instead of mindless and destructive consumption to safeguard the environment. This means making choices that are better for the environment, such as using renewable energy sources, reducing waste, and conserving resources. The program aims to teach people about the impact their daily actions have on the environment and provide them with the tools and resources they need to adopt eco-friendlier practices.

1.3. About SEEAP

The State Energy Efficiency Action Plan for UT of Chandigarh is being developed by identification of focus sectors, to ensure that the allocation of resources is as per the requirement of Chandigarh and estimate the potential of energy conservation in sectors that are predominant in Chandigarh. The State Energy Efficiency Action Plan has been developed in two parts, a short term-plan till FY 2025-26 and a long-term plan targeting high impact energy efficiency by the FY 2030-31 to achieve the targets committed in COP-26. This State Energy Efficiency Action Plan has been developed under the guidance and support of stakeholder departments/agencies of Chandigarh and will be implemented by them in the UT after its adoption.

Expected Outcomes of State Energy Efficiency Action Plan (SEEAP)



1.4. State Profile

Chandigarh is a union territory in India that serves as the joint capital of Punjab and Haryana. Chandigarh is one of the first planned city of the independent India, internationally known for its architecture and urban design. During the last 6 decades (1951-2011), Chandigarh has witnessed a population increase of approximately forty-four times with the absolute population increasing from 24,261 in 1951 to 10,55,450 in 2011.

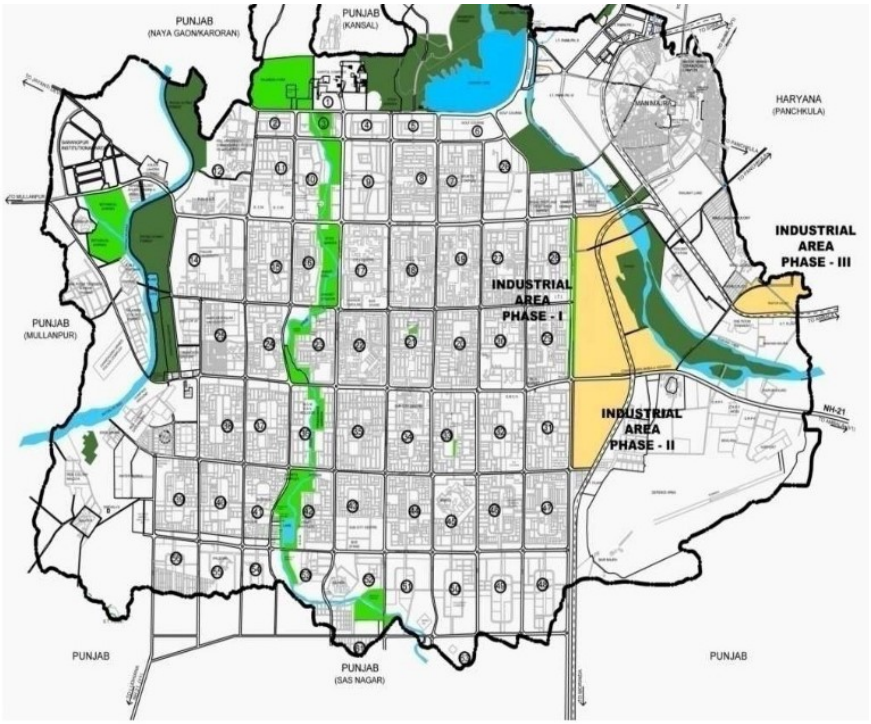


Figure 1: Political Map of Chandigarh

The major industries in the Union Territory of Chandigarh include tourism, information technology, and education. With a well-planned city layout and modern amenities, Chandigarh has become a popular tourist destination for both domestic and international travelers. The city is also home to several IT companies, which have contributed to the growth of the technology sector in the region. Additionally, the city has a strong focus on education, with prestigious institutions such as the Panjab University and Indian Institute of Technology.

As of 2020, the literacy rate of Chandigarh was reported to be 86%, which is higher than the national average of 74.04%. The city has a high concentration of educated professionals, making it a hub for research and development. Additionally, the per capita income in Chandigarh is reported to be one of the highest in India, indicating a high standard of living for its residents.

In terms of demographics, Chandigarh has a population of approximately 10.55 Lakh people, with a gender ratio of 818 females to 1000 males. The city has a diverse population, with Punjabi being the most spoken language. Chandigarh has a high Human Development Index (HDI), which takes into account factors such as

education, income, and life expectancy, further highlighting the city's emphasis on quality of life for its residents.

Table 1: Basic Statistics of Chandigarh[4]

S. NO.	PARTICULARS	UNIT	NUMBER
1	Area	Sq. Km	114
	(i) Rural Area		4.47
	(ii) Urban Area		109.53
2	(Population 2011 Census)		
	Total Population	Lakh	10.55
	Rural Population		0.289
3	% Of Rural to Total Population	%	2.7
4	% Of Urban to the Total Population	%	97.3
5	Municipal Corporations	Number	1
6	Density	People Per Sq. Km	9,258

1.5. State Energy Scenario

In the past decade, Chandigarh has witnessed a surge in its power demand; however, the Union Territory does not possess its own power generation capacity. A significant portion of the electricity supplied to Chandigarh is purchased from external sources, while the remaining is generated internally using diesel and renewable energy solar systems. The distribution of electric power is overseen by the Engineering Department of the Chandigarh Administration.

The power department of Chandigarh procures electricity from Central generating stations (CGS), such as National Thermal Power Corporation Limited (NTPC), National Hydroelectric Power Corporation (NHPC), Nuclear Power Corporation of India Limited (NPCIL), Satluj Jal Vidyut Nigam (SJVN) Bhakra Beas Management Board (BBMB), and Tehri Hydro Development Corporation Ltd (THDC). To cope with the escalating demand for power, especially during summers, the electricity

[4] *chandigarh.gov.in/sites/default/files/stat2020/stat20-bnutshell.pdf*

department sources un-requisitioned surplus power from various stations. The department has a power purchase agreement (PPA) for 247MW. Whenever there is a shortfall, un-requisitioned surplus power is typically purchased from power plants located at Dadri, Jhajjar, Unchahar-I, Unchahar-II, and other similar plants.

Renewable Energy

Under renewable energy sources, Chandigarh has major energy generation from Solar PV. The UT has space constraint for the installation of Windmills as a renewable power plant. Due to absence of river/stream, hydro power cannot be generated in the city. Chandigarh also doesn't have any energy generation by nuclear energy or geothermal energy, hence the only feasible option left out for Chandigarh is to utilize solar energy. Chandigarh has adopted a well-structured in the direction to adopt solar energy through various areas such as solar water heaters, Solar PV, Solar cookers etc.

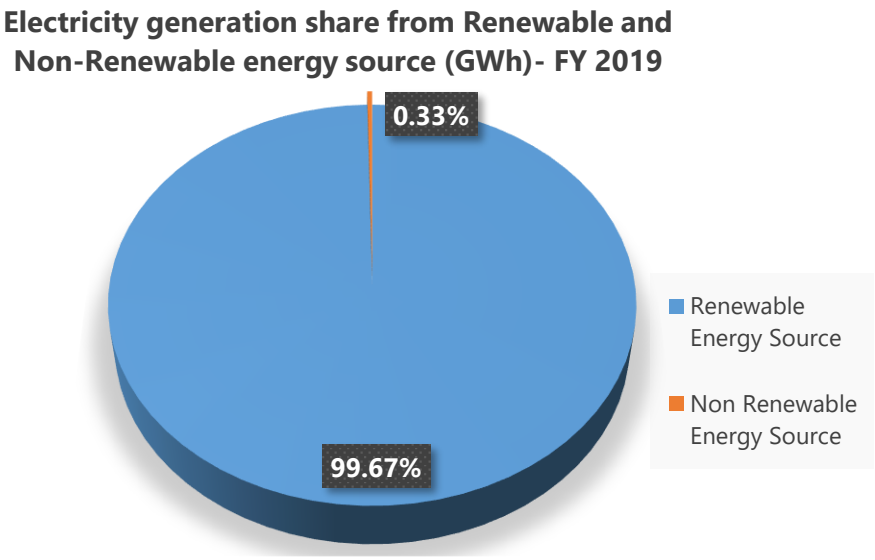


Figure 2. Electricity generated from Renewable and Non-Renewable source in Chandigarh for FY 2019

1.6. Energy Consumption Scenario (TFEC)

Total Final Energy Consumption

Table 2: Total Final Energy Consumption (Mtoe)

Total Final Energy Consumption - TFEC (MTOE)						
Source/Year	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
Oil	0.35	0.39	0.35	0.40	0.42	0.42
Coal (Non-Power/Industry)	0.00	0.00	0.00	0.00	0.00	0.00
Coal (Imported)	0.00	0.00	0.00	0.00	0.00	0.00
Coal (Captive)	0.00	0.00	0.00	0.00	0.00	0.00
Gas	0.00	0.00	0.00	0.01	0.01	0.02
Electricity Utilities	0.13	0.13	0.14	0.14	0.13	0.14
Total	**0.47**	**0.52**	**0.49**	**0.54**	**0.57**	**0.58**

Oil Consumption: Oil consumption in Chandigarh is primarily for transportation and industrial purposes. As per the data available from the Ministry of Petroleum and Natural Gas, the total consumption of petroleum products in Chandigarh was around 406 thousand metric tonnes in the financial year 2019-20 equivalent to 0.42 Mtoe, which includes LPG, Kerosene, Petrol, Diesel, Furnace Oil, Low Sulphur Heavy Stoke and Pet Coke.

LPG is a clean-burning fuel commonly used for cooking and heating, while Kerosene is mainly used as a fuel for heating appliances. Petrol and diesel are the primary fuels used in transportation, while Furnace Oil is used for heating and power generation. In Chandigarh, use of pet coke has been obsoleted in the industries for many years.

This consumption of petroleum products indicates the high level of energy usage in Chandigarh, which is essential for the UT's economic and social development. However, it also highlights the UT's dependence on fossil fuels, which has significant environmental and economic implications.

The continued reliance on fossil fuels can contribute to air pollution, climate change, and other environmental issues, while also making the state vulnerable to fluctuations in global oil prices. Therefore, there is a need to explore alternative

energy sources and promote energy conservation measures to reduce the UT's dependence on petroleum products.

Coal Consumption: Coal is not a significant source of energy consumption in Chandigarh as it does not have any coal-based power plants and industries.

Gas Consumption: Natural gas consumption in Chandigarh is primarily for domestic and commercial purposes. As per the data available from the NITI Aayog: India Energy Dashboards and MoPNG, the total consumption of natural gas in Chandigarh was around 21.05 thousand metric tonnes in FY 2019-20.

Natural gas is a clean-burning fuel that can be used in various applications such as power generation, heating, and transportation. However, the consumption of natural gas in Chandigarh seems to be very low, and the UT mainly relies on other sources of energy like petrol, diesel, LPG, and hydropower. CNG (Compressed Natural Gas) is a type of natural gas used as a fuel for vehicles. The supply of CNG in the UT of Chandigarh is relatively small amount compared to other states in India. This indicates that the use of CNG vehicles in the UT of Chandigarh is not very popular, and the majority of vehicles run on petrol or diesel.

Electricity Consumption: Electricity is the primary source of energy consumption in Chandigarh. The city is primarily dependent on the northern grid for electricity supply, and the majority of the electricity is generated from thermal power plants. As per the data available from the Central Electricity Authority (CEA), the total electricity consumption in Chandigarh was around 1,604 GWh in the financial year 2019-20.

In recent years, the government of Chandigarh has been promoting the use of renewable sources of energy, such as solar energy, to reduce the dependence on non-renewable sources. The city has installed 40.55 megawatts of solar energy as of FY2019-20. The government has also taken several measures to promote energy conservation and efficiency, such as the installation of LED streetlights and the promotion of energy-efficient appliances.

1.7. Overview of Institutional framework and stakeholder mapping

The Energy Conservation (EC) Act of 2001 establishes a legal framework for developing and executing energy efficiency (EE) policies and programmes. The Act authorizes the Bureau of Energy Efficiency (BEE) to develop national policies and programmes, and State Designated Agencies (SDAs) to administer EE programmes and enforce EE norms and regulations at the UT level.

The Electricity Department ensures continuous power supply to each resident of Chandigarh. All the sectors and villages of Chandigarh are electrified, and any desiring consumer can avail power supply by submitting requisition in the prescribed form to the appropriate office of the Department subject to fulfilment of the requisite conditions and payment of charges. The Electricity Operation Circle is headed by Superintending Engineer along with five Executive Engineers.[5]

Stakeholder Mapping for the UT of Chandigarh:

Stakeholders Departments for the Union Territory Chandigarh		
S. No.	**Sector**	**Department / Organization**
1	**SDA**	Superintending Engineer, Electrical UT
2	**DISCOM**	Electricity Department
3	**INDUSTRIES**	Department of Industries
		Chandigarh Industrial and Tourism Development Corporation Limited (CITCO)
4	**BUILDINGS**	Chandigarh Engineering Department
		Department of Architecture and Urban Planning
		Chandigarh Housing Board
		Estate Office Chandigarh
		Health Department, Chandigarh
5	**MUNICIPALITIES**	Municipal Corporation, Chandigarh
6	**AGRICULTURE**	Department of Agriculture
7	**TRANSPORTATION**	State Transport Authority
		Chandigarh Transport Undertaking
8	**OTHERS**	Department of Science & Technology
		Department of Environment & Forest
		Chandigarh Smart City Ltd.
		Chandigarh Renewal Energy and Science & Technology Promotion Society'(CREST)
		Department of Planning & Statistics
		Chandigarh Pollution Control Committee

[5] http://chdengineering.gov.in/electricity-dept/about-us

Oil Product Consumption

Oil Products Consumption (TMT)						
Source: https://mopng.gov.in/en/petroleum-statistics/indian-png-statistics (FY2020-21 Pg 116 onwards)						
Year	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
LPG	42.3	45.7	52.2	55.1	55.7	56.4
MTOE	0.048	0.052	0.059	0.062	0.063	0.064

Year	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
Naptha	0	0	0	0	0	0
MTOE	0.000	0.000	0.000	0.000	0.000	0.000

Year	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
Kerosene	2	0.7	0.1	0.2	0.2	0.1
MTOE	0.002	0.001	0.000	0.000	0.000	0.000

Year	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
MS (Petrol)	85.2	100.7	96.9	104.6	122.6	126.8
MTOE	0.091	0.108	0.104	0.112	0.131	0.136

Year	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
High Speed Diesel	83	115	102	130	192	198
MTOE	0.086	0.119	0.106	0.135	0.199	0.205

Year	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
Light Diesel Oil	0.4	0.4	0.6	0.7	0.5	0.4
MTOE	0.000	0.000	0.001	0.001	0.001	0.000

Year	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
Furnace Oil	40.2	62.2	11.9	8.9	4.4	2
MTOE	0.040	0.061	0.012	0.009	0.004	0.002

Year	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
Low Sulphur Heavy Stock	0	0	0	0.1	0.6	0
MTOE	0.000	0.000	0.000	0.000	0.001	0.000

Year	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
Lubes & Greases TMT						
MTOE	0.000	0.000	0.000	0.000	0.000	0.000

Year	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
Petcoke	97	59	88	94	28	22
MTOE	0.080	0.048	0.072	0.077	0.023	0.018

Year	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
Bitumin TMT						
MTOE	0.000	0.000	0.000	0.000	0.000	0.000

TOTAL OIL CONSUMPTION (TMT)	**350.10**	**383.70**	**351.70**	**393.60**	**404.00**	**405.70**
TOTAL ENERGY (Mtoe)	**0.35**	**0.39**	**0.35**	**0.40**	**0.42**	**0.42**
YoY Growth Rate		10%	-8%	12%	3%	0%

Primary Energy Consumption (MTOE)

Source/Year	Oil	Gas	**Total**
FY2015	0.35	NA	**0.35**
FY2016	0.39	NA	**0.39**
FY2017	0.35	NA	**0.35**
FY2018	0.40	0.01	**0.40**
FY2019	0.42	0.01	**0.44**
FY2020	0.42	0.02	**0.45**

Total Electricity Consumption

Total Electricity Consumption (GWh & MTOE)		
Year	Total Electricity consumption (GWh)	Total Electricity consumption (MTOE)
FY2015	1,472	0.13
FY2016	1,497	0.13
FY2017	1,589	0.14
FY2018	1,574	0.14
FY2019	1,535	0.13
FY2020	1,604	0.14

Total Electricity Consumption for Building Sector (Domestic + Commercial)				
Years	Domestic (GWh)	Commercial (GWh)	Domestic (MTOE)	Commercial (MTOE)
2015	689	468	0.059	0.040
2016	659	463	0.057	0.040
2017	722	499	0.062	0.043
2018	732	494	0.063	0.042
2019	705	473	0.061	0.041
2020	757	474	0.065	0.041
2021	772	476	0.066	0.041
2022	786	477	0.068	0.041
2023	801	478	0.069	0.041
2024	817	480	0.070	0.041
2025	832	481	0.072	0.041
2026	848	482	0.073	0.041
2027	864	484	0.074	0.042
2028	881	485	0.076	0.042
2029	898	486	0.077	0.042
2030	915	487	0.079	0.042
2030	932	489	0.080	0.042
Source: https://chandigarh.gov.in/sites/default/files/stat2020/stat20-energy.pdf				

CAGR for Commercial Buildings
0.27%
CAGR for Domestic Buildings
1.91%

Total Final Energy Consumption

Total Final Energy Consumption - TFEC (MTOE)				
Source/Year	**Oil**	**Gas**	**Electricity Utilities**	**Total**
FY2015	0.35	0.00	0.13	**0.47**
FY2016	0.39	0.00	0.13	**0.52**
FY2017	0.35	0.00	0.14	**0.49**
FY2018	0.40	0.01	0.14	**0.54**
FY2019	0.42	0.01	0.13	**0.57**
FY2020	0.42	0.02	0.14	**0.58**

TFEC Projections based on Energy Intensity

TFEC Projections based on Energy Intensity				
Years	GSDP (INR Lakh Crore)	TFEC (MTOE)	Energy Intensity (MTOE/INR Lakh Crore)	Average Historical Intensity (MTOE/INR Lakh Crore)
FY 2015	0.23	0.47	2.07	1.94
FY 2016	0.25	0.52	2.08	
FY 2017	0.27	0.49	1.82	
FY 2018	0.28	0.54	1.88	
FY 2019	0.30	0.57	1.90	
FY 2020	0.31	0.58	1.88	
FY 2021	0.29	0.56		
FY 2022	0.31	0.60		
FY 2023	0.34	0.66		
FY 2024	0.36	0.69		
FY 2025	0.37	0.72		
FY 2026	0.39	0.76		
FY 2027	0.41	0.80		
FY 2028	0.43	0.84		
FY 2029	0.45	0.88		
FY 2030	0.48	0.93		
FY 2031	0.50	0.97		

2. Identification of Focus Sectors

The economic sectors of the UT of Chandigarh can be broadly classified into the sectors namely Industry, Building, Transport, Agriculture, Municipalities and DISCOMs, and Cross Sectors. Identification of focus sectors or focus areas is important because it is a general characteristic of a state/UT that a major portion of energy is being consumed by few particular energy-guzzling sectors. Focusing efforts towards these sectors is necessary to ensure that the allocation of resources is as per the UT's priorities and towards sectors that have the highest potential of energy savings and emissions reductions.

2.1. Methodology of Focus Sector Identification

The methodology used to determine the focus sectors in the UT of Chandigarh includes multiple factors. The first factor is the energy consumption profile of the UT. This information provides a clear understanding of where energy is being used and which sectors are consuming the most. The analysis reveals that the Buildings and Transport sector are the largest energy consumer in the UT. The second factor is the input from stakeholders. Stakeholders include individuals, organizations, and communities that have a vested interest in energy consumption and production in the UT. Their inputs are valuable as they have a direct impact on the sector they represent. The third factor is priority areas of the UT. Priority areas are determined based on the UT's development goals, energy policies, and future aspirations. These priority areas help in identifying sectors that require immediate attention and support.

After considering these factors, the focus sectors are identified, which are the Buildings, Transport, and Industry sectors. The buildings sector is the primary focus sector as it is the largest energy consumer in the UT. The buildings sector is important as it accounts for a significant amount of energy consumption in the domestic and commercial sectors with 77% of the total electricity consumption in

FY2019-20. The Transport sector is also a critical focus as it is one of the largest energy consumers and relies heavily on fossil fuels (oil).

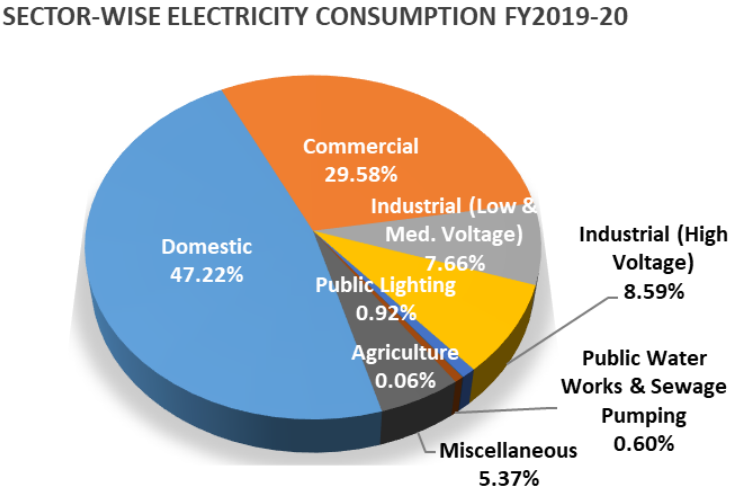


Figure 3: Electricity Consumption FY2019-20 (GWh)

Source: Central Electricity Authority (CEA) Dashboard

Stakeholder Consultation

Inputs and suggestions from stakeholders identified for the UT of Chandigarh were invited at different stages in the development of the action plan. Feedback and inputs received from stakeholders play a key role in highlighting the areas of focus in their respective sectors going forward and helps understand the implementation of practices and the feasibility of proposed energy efficiency strategies within the sector.

2.2. Identified Focus Sectors

Based on the above parameters and other important considerations, the following have been identified as the focus sectors for devising energy efficiency strategies in the UT of Chandigarh.

Buildings Transport Industry

Total Final Energy Consumption (TFEC) of the focus sectors Industry, Buildings & Transport is contributing major portion of the total energy consumption in the UT of Chandigarh for FY 2019-20.

3. Projections and Forecasting

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

Fiscal Year (FY 2020), implying the period from April 2019-March 2020 has been selected as the base year for projections in this study keeping in view the years FY 2021 and FY 2022 being pandemic years.

The Gross State Domestic Product (GSDP) of the UT of Chandigarh was recorded at INR 0.31 Lakh Crore in FY 2019-20 and is projected to reach INR 0.50 Lakh Crore in FY 2030-31, at constant prices of 2011-12. The GSDP for the period FY 2023 to FY 2031 is projected using a growth rate of 5.02% and the data provided, as directed by the Finance Department of the Chandigarh Administration. The historic and forecasted GSDP for the UT of Chandigarh is shown in the figure below.

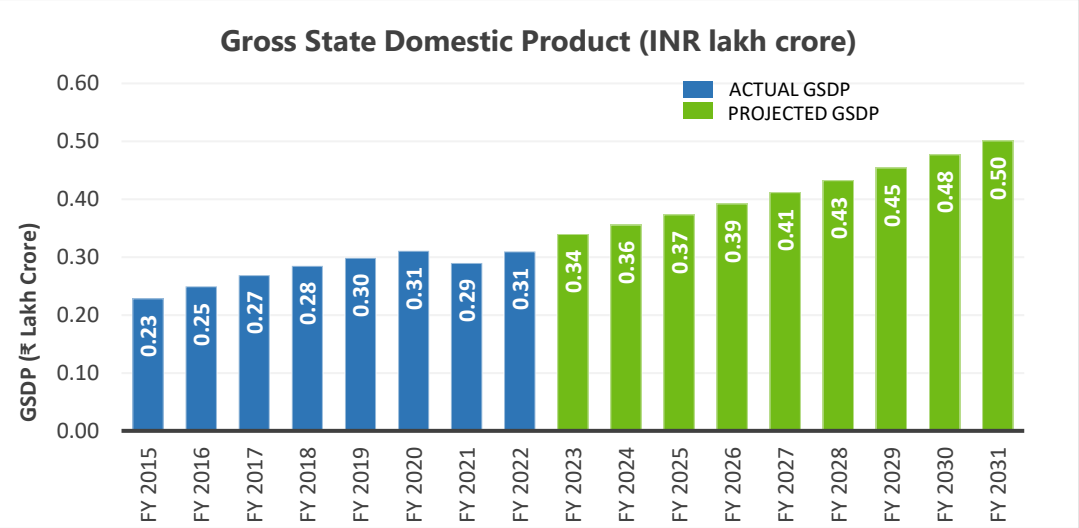


Figure 4: GSDP Projection of Chandigarh

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

The Total Final Energy Consumption of the UT in the Business-As-Usual (BAU) scenario is projected to reach 0.97 MTOE in FY 2031 from 0.58 MTOE in FY 2020, with a projected growth rate of 4.73%.

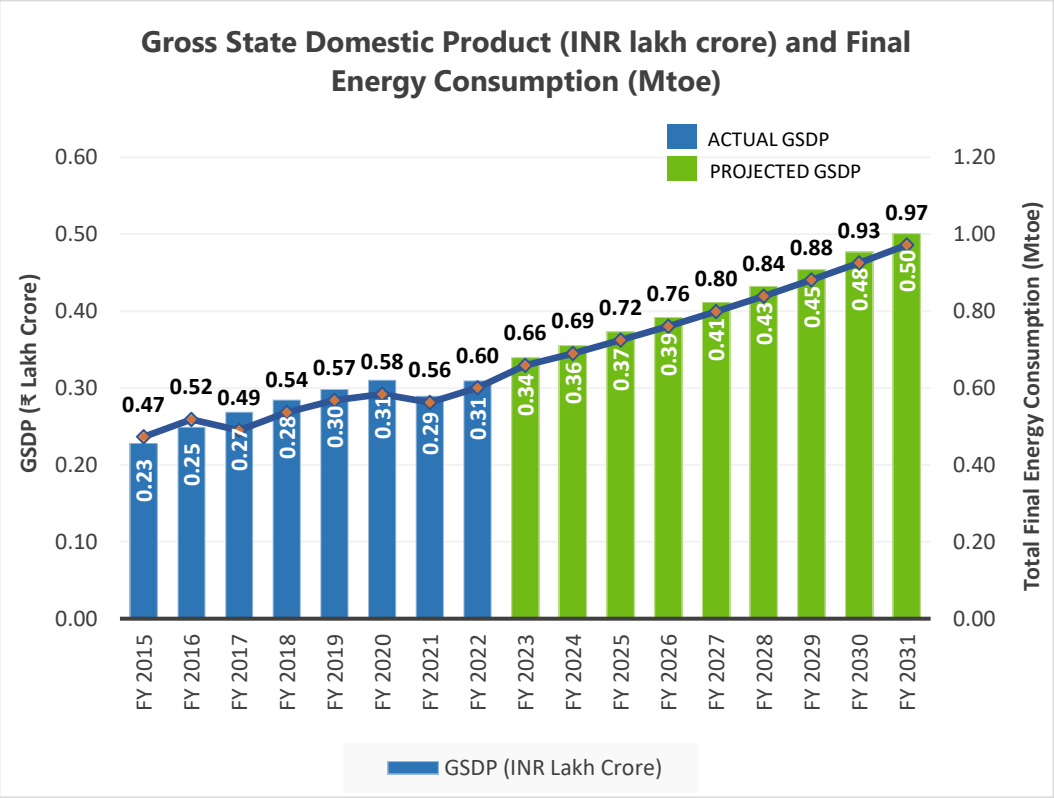


Figure 5: Gross State Domestic Product (INR lakh crore) and Final Energy Consumption (Mtoe)

BUILDINGS SECTOR

4. Focus Sector 1: Buildings

4.1. Current Scenario

Out of the total population of Chandigarh, 97 percent of the people live in the urban region. As a result, the power consumption in the buildings sector is gradually increasing. The energy consumption in the urban areas is significantly high due to the growing demand of energy in the building sector.

The UT Administration of Chandigarh has notified the Energy Conservation Building Code (ECBC). It will be applicable wherein the connected load of a building is equal to or more than 50 kW; or the contract demand of building is equal to more than 60 KVA; or the plot of the building is equal to or more than 1,000 sqm; or the built-up area of building is equal to more than 2,000 sq m excluding non-conditioned spaces in basement. The code enforces specific energy-efficient building design and construction practices, such as regulations for building envelopes, lighting, air conditioning, ventilation systems, and the usage of renewable energy sources. To facilitate the implementation of the ECBC, the administration of Chandigarh has established a State Designated Agency (SDA) for energy efficiency. The SDA is responsible for providing technical assistance to building owners and developers to ensure compliance with the ECBC provisions.

Further, Bureau of Energy Efficiency (BEE), GoI has also launched Eco-Niwas Samhita (ENS) for residential buildings and residential part of mixed land used projects build on plot area ≥ 500 square meters in 2018. In the first phase minimum standards for the building envelope were launched to limit heat gain or heat loss of the residential building comprising adequate day lighting potential and ventilation. BEE, GoI developed Eco-Niwas Samhita part–II for setting up minimum standards for the Electromechanical Equipment for efficient use of energy in residential buildings. The provisions of ENS must be incorporated in Unified Building Byelaws (UBBL). In Recent, The Energy Conservation (Amendment) Act, 2022. A unified code for the building sector "Energy

Conservation and Sustainable Building Code (ECSBC)" has been introduced. The ECSBC code will be applicable for both commercial and residential buildings.

The buildings sector is a major energy guzzling sector in Chandigarh. As per the graph below, it can be witnessed that the energy consumption in building sector is gradually increasing since FY 2015.

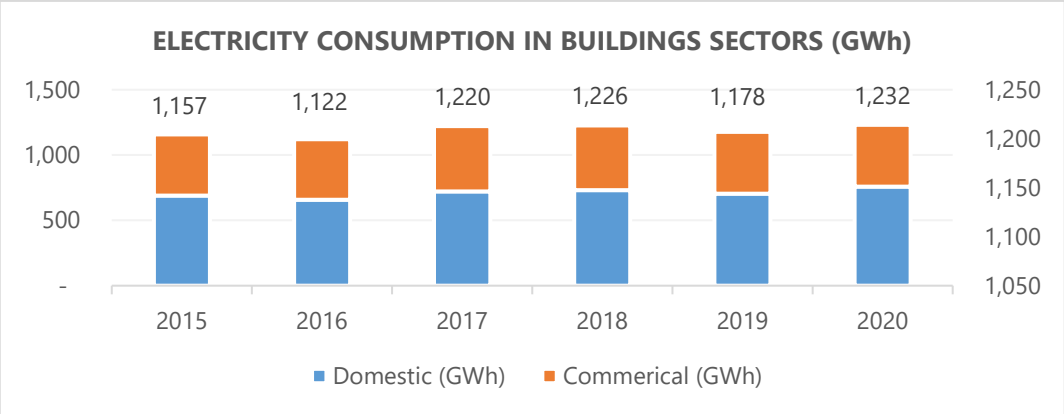


Figure 6: Electricity Consumption in the Buildings Sector (GWh)

The commercial sector supports urbanization in Chandigarh and caters to only 39% of the total electricity consumption in the building sector. The domestic sector on the other hand, retains 61% of the electricity consumption, this indicates that the UT requires a policy to encourage energy efficiency in the domestic sector, it may be noted that even if a fraction of the domestic sector is addressed by following energy efficiency plans, then a huge some of electricity consumption can be eradicated.

The sharing pattern of electricity consumption of the commercial and domestic sector for FY 2019-20 is represented in the following figure:

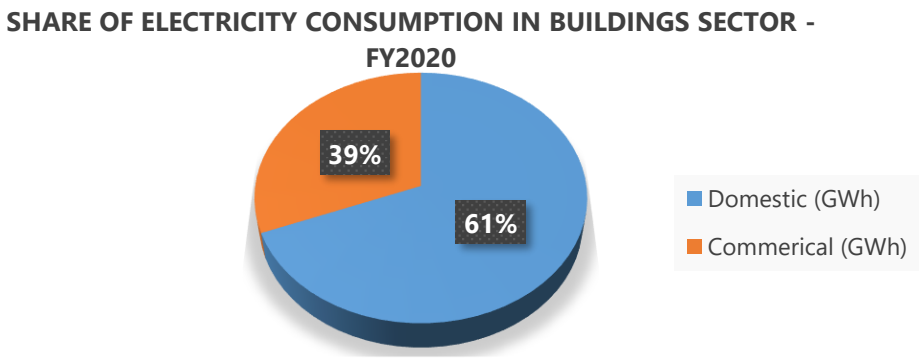


Figure 7 Share of Electricity Consumption in Buildings Sector - FY2020

4.2. Energy Saving Targets in Building Sector

In terms of energy consumption, the buildings sector is the dominant sector in the UT. It is necessary to channelize the resources to achieve energy efficiency in building sectors. Development of energy efficient buildings can provide energy saving for several years without any additional recurring cost. It is observed that multiple schemes and policies are available in building the sectors, but the time framed effective implementation is required to inline the UT targets with the national (Panchamrit) targets. Implementation of proposed strategies can target energy saving reduction of 1905.5 toe in the short term (till FY 2025-26) and 4945.5 toe in long term (till FY 2030-31) for the buildings sector under the ambitious scenario.

Table 3: Moderate and ambitious scenarios energy savings for buildings sector

Action Plan	Energy Savings (toe)			
	2025-26		2030-31	
	Moderate Scenario	Ambitious Scenario	Moderate Scenario	Ambitious Scenario
Effective implementation of ECSBC	28.8	36.5	72.8	92.9
Replacement program for inefficient appliances	1400.9	1867.8	3695.4	4850.2
BEE Star Rating and Shunya Rating of Buildings	0.8	1.1	1.8	2.5
Total	**1430.5**	**1905.5**	**3769.9**	**4945.5**

4.3. Energy Efficiency Strategies in the Buildings Sector

This section presents the proposed strategies in the domestic buildings and commercial buildings sector along with their impact in terms of energy saving

potential. The following strategies are proposed in the building sector, as part of the State Energy Efficiency Action Plan:

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

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

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

Chandigarh is in the process of adopting Eco-Niwas Samhita (ENS) for residential buildings, while ECBC has already been notified. However, in the recent EC Act Amendment 2022, unified code "Energy Conservation and Sustainable Building Code" (ECSBC) is introduced which will cover both commercial and residential buildings. Till the implementation of ECSBC in states/UTs, ECBC and ENS will work as energy efficiency building code.

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

In order to estimate the savings through ECBC, the electricity consumption of the commercial buildings sector was projected till FY 2030-31. After forecasting the energy demand in the commercial building sector from FY 2023 to FY 2030-31, the annual increment in the electricity consumption in the commercial buildings sector was projected. The total incremental electricity consumption of commercial buildings in the UT is projected to be 11.71 GWh between FY 2023 to FY 2030-31. This increment in electricity consumption accounts for all the categories of commercial buildings of varying loads.

Based on the energy savings percentage from ECBC and ECBC+, the moderate and ambitious savings in the commercial building sector are found to be **0.15 GWh** and **0.20 GWh** respectively in FY 2030-31.

Table 4: Estimation of Incremental Electricity Consumption

Years	Electricity Consumption - Commercial (MTOE)	Electricity Consumption - Commercial (GWh)	Incremental Electricity Consumption (GWh)
FY 2015	0.040	468.13	-
FY 2016	0.040	463.34	-4.79
FY 2017	0.043	498.68	35.34
FY 2018	0.042	494.02	-4.66
FY 2019	0.041	472.98	-21.04
FY 2020	0.041	474.48	1.50
FY 2021	0.041	475.76	1.28
FY 2022	0.041	477.04	1.28
FY 2023	0.041	478.33	1.29
FY 2024	0.041	479.62	1.29
FY 2025	0.041	480.92	1.29
FY 2026	0.041	482.21	1.30
FY 2027	0.042	483.51	1.30
FY 2028	0.042	484.82	1.30
FY 2029	0.042	486.13	1.31
FY 2030	0.042	487.44	1.31
FY 2030	0.042	488.75	1.32

Table 5: Estimation of Energy Savings through ECBC

Particulars	2026	2030
Total Incremental Electrical Consumption (MUs)	5.17	11.71
Total Incremental Electrical Consumption (MUs) contributing to buildings having load >50kW	0.16	0.59
Moderate Scenario Savings through ECBC Compliance (MUs)	0.04	0.15
Moderate Scenario Savings through ECBC Compliance (TOE)	3.33	12.59
Ambitious Scenario Savings through ECBC+ Compliance (MUs)	0.05	0.20
Ambitious Scenario Savings through ECBC+ Compliance (TOE)	4.67	17.62

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

In the residential sector, by FY 2030-31, the electricity consumption is projected to be around 932.27 GWh. The overall incremental electrical consumption is estimated to be 146 GWh based on the anticipated household electricity demand by FY2030. In order to assess the savings that can be achieved from successful implementation of ENS, it is assumed that 4% of all the residential building stock would be ENS compliant by FY2030-31. The strategy is expected to result in electricity savings of 0.700 GWh in the moderate scenario and that of 0.875 GWh in the ambitious scenario. The cumulative energy savings expected from the enhanced implementation of ECBC and ENS in the UT is shown below:

Table 6: Moderate and ambitious scenarios for effective implementation of ECSBC

Particulars	Energy Saving Potential (toe)			
	2026		2030	
	Moderate Scenario	Ambitious Scenario	Moderate Scenario	Ambitious Scenario
Energy Saving Potential (toe) in ECBC	3.3	4.6	12.6	17.6
Energy Saving Potential (toe) in ENS	25.5	31.9	60.2	75.3
Total	**28.8**	**36.5**	**72.8**	**92.9**

Actionable Items:

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

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

   ### Implementation Strategy:

   - SDA Chandigarh with the support of ECBC Cell, shall expedite the process of ECBC Notification in UT and ensure its incorporation in local building by-laws before the end of year 2024.
   - SDA Chandigarh shall start the process of ENS notification in UT and target to complete it before 2025 and make amendments as and when requires adopting Energy Conservation & Sustainability Building Code (ECSBC).
   - Co-ordination with local authority to develop effective rule and regulations for proper implementation of buildings codes in UT.

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

Implementation Strategy:

Project Management Unit (PMU) or ECBC cell of Chandigarh SDA shall develop the specific portal for ECSBC Compliance and related services such as ECBC compliance procedure, technical support, energy efficient or innovative materials details and list of building professionals etc.

3. **Market Outreach for ECBC compliant Products, Radio Jingles, Social Media Awareness** – Market outreach for ECBC compliance products or products utilized in sustainable construction such as building materials used in passive building design would enable a conducive market for such materials which will promote construction practices necessary to comply with ECBC and ENS guidelines. The market outreach can take place through professional conventions and seminars, radio jingles and awareness campaigns on social media.

Implementation Strategy:

In Chandigarh, various awareness programs are conducting by SDA of Chandigarh. However, for better outreach radio adds, social media adds and frequency of awareness campaign can be increased to reach maximum people.

4. **Pilot projects for Super ECBC buildings as case studies**

It is proposed that the UT administration also undertake the development of Super-ECBC buildings in the UT and publish its case studies for the understanding of stakeholders. Initially upcoming government building can be taken as a pilot project and the best energy efficient technologies can be implemented to achieve the Super ECBC level. Case Study can be published in social media to encourage developers and other stakeholders to make Super ECBC compliant buildings.

Implementation Strategy:

SDA Chandigarh in collaboration with Architectural Department of Chandigarh and PWD shall develop at least 5 Super ECBC buildings in UT by the year 2030.

5. **Home Energy Auditor Training, compliance structure and incentive on energy savings for first few residential projects** – BEE has developed a Home Energy Auditing tool. SDA may run awareness and capacity

development programs in Chandigarh to train building professionals about the benefit of auditing and implementation of Energy Conservation Measures (ECMs) in residential houses. SDA may encourage RWAs by providing some incentive/rewards based on energy savings on implementation of ECMs in their societies. These action items will help in the promotion of ENS in Chandigarh and create technical capacity of the professionals.

Implementation Strategy:

- SDA Chandigarh shall empanel Energy Auditors and utilize that pool to conduct Home Energy Auditor Training program at mass level.
- SDA shall organize reward programs for RWAs based on energy savings on implementation of ECMs in their societies.

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

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

Implementation Strategy:

The Public Works Department (PWD) of Chandigarh shall update Schedule of Rates (SoR) on preodic basis to include the energy efficient materials and technologies in the SoR.

7. **Inclusion of curriculum on energy efficiency in Schools & Colleges**

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

Implementation Strategy:

Department of Education Chandigarh Administration shall include curriculum on energy efficiency in schools and colleges comes under the Chandigarh Administration.

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

Implementation Timeline: Long Term (Till FY 2030)

The Standards & Labelling (S&L) Programme of Bureau of Energy Efficiency (BEE) has seen a successful implementation across the country, leading to significant savings in energy through mandatory and voluntary use of energy efficient electrical appliances by consumers in a wide range of applications. The S&L programme encompasses appliances and equipment that have applications in multiple sectors, however the buildings sector is the most widely covered sector in terms of types and number of appliances. At present, the S&L Programme covers 38 appliances, with 19 appliances subject to mandatory regulation and the remaining 22 appliances subject to voluntary regulation.

Table 7: List of mandatory and voluntary appliances under S&L Programme

Mandatory Appliances	Voluntary Appliances
1. Room Air Conditioners	1. General Purpose Induction Motors
2. Frost-free refrigerators	2. Submersible Pump Sets
3. Tubular Florescent Lamps	3. Domestic Gas Stoves
4. Distribution Transformer	4. Office Equipment's (Printers & Copier)
5. Room Air Conditioner (Cassette, Floor Standing)	5. Ballast
6. Direct Cool Refrigerator	6. Computers (Laptop/Notebooks)
7. Color TV	7. Diesel Engine driven monoset pumps
8. Electric Geysers	8. Solid State Inverter
9. Variable Capacity Inverter Air Conditioners	9. Diesel Generator Sets
10. LED Lamps	10. Microwave Oven
11. Ceiling Fans	11. Solar Water Heater
12. Washing Machine	12. Commercial Beverage Coolers.
13. Chillers	13. High Energy Li Battery
14. Deep Freezers	14. Tires
15. Light Commercial AC	15. Pedestal Fan
16. Ultra-High Definition (UHD) TV	16. Induction Hob
	17. Grid Connected Solar Inverter
	18. Air Compressors

Mandatory Appliances	Voluntary Appliances
	19. Side By Side/Multidoor Refrigerator 20. Solar Photovoltaic 21. Table/Wall Fan 22. Packaged Boiler

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

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

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

Table 8: Appliances taken into consideration for the strategy

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

According to the study conducted by CLASP (Collaborative Labeling and Appliance Standards Program)[6] to assess consumer awareness of energy labelling, 48% of consumers are aware of the scheme and 15% have some knowledge of it. Appropriate number of 3-Star rated appliances have been taken from the calculation of total number of appliances. Saving strategies in the moderate scenario include replacement of 3-star rated equipment to 5-star rated appliances, whereas in the ambitious scenario, replacement of non-star rated to 5-star rated equipment has been considered as a saving strategy. The percentage savings achieved upon transitioning from non-star to 5-Star Labelled equipment's (efficiency) were taken into account for calculating savings in above mentioned scenarios.

The strategy is estimated to result in energy savings of 0.0037 MTOE in the moderate scenario and 0.0049 MTOE in the ambitious scenario till FY 2030-31

Actionable Items:

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

1. **Development of UT-specific implementation models and identification of relevant agencies-** A detailed phase-wise plan needs to layout based on consumer's priority and reachability. It is important to develop a transparent model that can reach out to every household in the UT. Financial implications will play a major role in the replacement scheme so ESCOs and PPA models can be analyzed in detail. UJALA scheme is a successful case study in this area, can be referred for the development of UT specific plan. Identification of

[6]https://www.clasp.ngo/wp-content/uploads/2021/01/2007-05_IndiaLabelingProgramImpacts.pdf

implementing departments and agencies and listing of ESCOs in the UT is required.

Implementation Strategies:

- SDA Chandigarh shall empanel ESCOs working on various demand side management programs.
- The Project Management Unit of SDA Chandigarh shall develop phase wise plan for equipment replacement.
- Engagement of ESCOs for execution of plan
- Collaboration with DISCOMs for executing demand side management plan.

2. **Issuance of directive to government offices and buildings in the UT to replace all existing inefficient appliances (lower than 3 Star Rated) with BEE 5-star rated appliances-** The UT administration shall issue directives to all THE offices and buildings owned by the it to replace all appliances which are lower than 3 star rated or purchased/installed before 2015 with BEE 5-Star rated appliances.

Implementation Strategy:

UT Administration shall issue directions to all departments under UT Administration to replace inefficient appliances with BEE 5Star rated appliances.

3. **Phase-wise plan for replacement of existing inefficient appliances (lower than 3 Star Rated) with BEE 4 to 5-star rated appliances in all buildings, through DSM schemes and directives to procure new appliances and equipment's of minimum prescribed rating of 4 to 5 Star Rating in the Government buildings.**

Development of phase-wise Demand Side Management (DSM) plan based on the consumer's priority and market scenario shall be developed in consultation with DISCOMs. Implementation can be done with support of DISCOM's and various ESCOs listed with UT administration also a directive can be issued to all government departments to procure new appliances & equipment's of minimum prescribed rating of 4 to 5 Star Rating in the Government buildings.

Implementation Strategy:

The Electricity Department of UT Administration in collaboration with DISCOM can execute demand side management plan in building for replacement of appliances.

4. **Workshops & Campaigns on behavioral change interventions for energy conservation –** Capacity building of these stakeholders is key to develop a market environment for energy efficient appliances. The UT Administration shall organize workshops at various levels to encourage people for behavioral change and run mass campaigns to reach out maximum people to increase awareness about benefits of behavioral changes and promote Lifestyle for Environment (LiFE). Workshops and campaigns shall be carried out to target maximum people by organizing through online platforms, print media, social media, nukkad nataks, and radio jingles etc.

Implementation Strategy:

SDA Chandigarh shall organize frequent campaigns on behavioral change interventions for energy conservation under the LiFE mission.

5. **Transition of electronic metering to smart metering –** The transition from electronic metering to smart metering signifies an advancement in the methods used to measure and manage energy consumption. This transition encompasses several significant elements, including automated data collection, real-time monitoring, time-of-use pricing, enhanced billing accuracy, remote connection, and disconnection capabilities, as well as integration with renewable energy sources with the long terms benefits in terms of efficiency and sustainability. The successful implementation of this transition can be facilitated by the collaboration between Distribution Companies (DISCOMs) and Energy Service Companies (ESCOs) that are enlisted under the administration of the respective UT.

Implementation Strategy:

The Electricity Department of UT Administration in the collaboration with DISCOM can execute smart metering program in the UT.

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

Implementation period: Long Term (Till FY 2030-31)

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

Actionable Items:

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

   Government departments are required to perform energy audits on their buildings and assess the present energy usage. They should also evaluate the possibility of achieving BEE Star rating or Shunya Rating. The extent of energy savings and implementation of energy conservation measures hinges upon the existing energy consumption of buildings. It is essential for government departments to serve as role models for commercial and office buildings, promoting energy efficiency and striving for net-zero energy consumption.

   ### Implementation Strategy:

   Directives shall be issued from the Secretary (Engineering) or other higher authority of Chandigarh Administration to all government departments and buildings owned by it to conduct energy audit and implement energy conservations measures and target to achieve BEE Star Rating or Shunya Rating for their buildings.

2. **Periodic energy audits (5 years) for commercial buildings on load basis and incentives on achieving specific level of star rating for buildings**-

To promote energy efficiency in commercial buildings, it is advisable to conduct periodic energy audits on a five-year cycle (based on the energy load of the buildings). These audits should be performed to assess the current energy consumption patterns, identify areas of improvement, and develop strategies to optimize energy usage. In addition to energy audits, it would be beneficial to introduce incentives for commercial buildings that achieve specific levels of BEE star ratings. By providing incentives, such as tax benefits or recognition at UT level, the government can encourage building owners to invest in energy-efficient technologies and practices.

Implementation Strategy:

A notification from the UT Administration shall be issued for conducting mandatory energy audits of commercial buildings based on their connected load in every 5 years and incentives can be given on the achievement of star rated energy efficient buildings to encourage more building owners to reduce their EPI and save more energy. SDA Chandigarh shall empanel the energy auditing agencies to ensure the availability of energy auditors and quality of audits conducted.

3. **Capacity Building of Architects & Building Professionals and Developers** - Capacity building programs of Architects & Building Professionals and Developers will ensure to increase the technical capacity of and awareness about innovative technologies. Capacity building of these stakeholders is key to developing a market environment for energy efficient buildings. The capacity building programs can be taken up periodically, preferably quarterly.

Implementation Strategy:

SDA Chandigarh shall organize frequent capacity building programs for building professionals on innovative technologies. Capacity building workshops may be carried out either district-wise or zone-wise and target maximum stakeholder to participant in these programs.

4. **Market Outreach for Star & Shunya Rating by Radio Jingles, Social Media Awareness -** Promotion of the Star & Shunya Rating is an important part to promote energy efficiency in buildings. In order to increase awareness about these rating programs, promotion campaigns shall be carried to reach masses

by advertising in print media, social media, conduct nukkad nataks, plays and run radio jingles etc.

Implementation Strategy:

In Chandigarh, various awareness programs are conducting by SDA Chandigarh. However, there is a limited awareness on these initiatives. For better outreach radio adds, social media adds, and awareness campaign can be run on BEE star rating & Shunya Rating to increase the outreach of these programs.

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

Implementation Strategy:

Directives shall be issued from the Secretary (Engineering) or other higher authority of Chandigarh Administration to all government departments and buildings owned by it for mandatory minimum set point of 24 degrees for air conditioners in all government buildings.

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

Implementation Strategy:

Department of Engineering of UT Administration shall take initiatives to develop iconic government buildings into Net-Zero energy buildings.

7. Promotion of installation of Rooftop Solar Systems on buildings

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

Proposed SPV norms in the UT of Chandigarh:

S.No	Category	Short Term (by 2026)	Long Term (by 2030)	Capacity
1.	Residential	500 sq. yd. to 999 sq. yd.	250 sq. yd to 450 sq. yd.	1 kWp
		1,000 sq. yd. to 2999 sq. yd.	500 sq. yd to 1,500 sq. yd.	2 kWp
		3,000 sq. yd. and above	1,500 sq. yd. and above	3 kWp
2.	Educational Buildings having connected load of 30 KW and above	Minimum 5 kWp Or 5% of connected load, whichever Is higher	Minimum 10 kWp Or 5% of connected load, whichever Is higher	
3.	All Government Buildings having a connected load of 30 kW and above	Minimum 2 kWp Or 5% of connected load, whichever Is higher	Minimum 5 kWp Or 10% of connected load, whichever Is higher	
4.	Commercial Buildings having connected load of: 1. 50 KW to 1000 KW 2. above1000 KW	1. Minimum 10 kWp Or 5% of connected load, whichever is higher; 2. Minimum 50 kWp Or 3% of connected load, whichever is higher	1. Minimum 15 kWp Or 7.5% of connected load, whichever is higher; 2. Minimum 75 kWp Or 7.5% of connected load, whichever is higher	
5.	Housing Complexes on a plot size of: 1. 0.5 Acre to 1.0 Acre 2. More than 1.0 Acre to 2.0 Acres	1. Minimum 10 kWp 2. Minimum 20 kWp 3. Minimum 30 kWp 4. Minimum 40 kWp	1. Minimum 20 kWp 2. Minimum 40 kWp 3. Minimum 60 kWp 4. Minimum 80 kWp	

	3. More than 2.0 Acre to 5.0 Acres 4. More than 5.0 Acres		

Implementation Strategy:

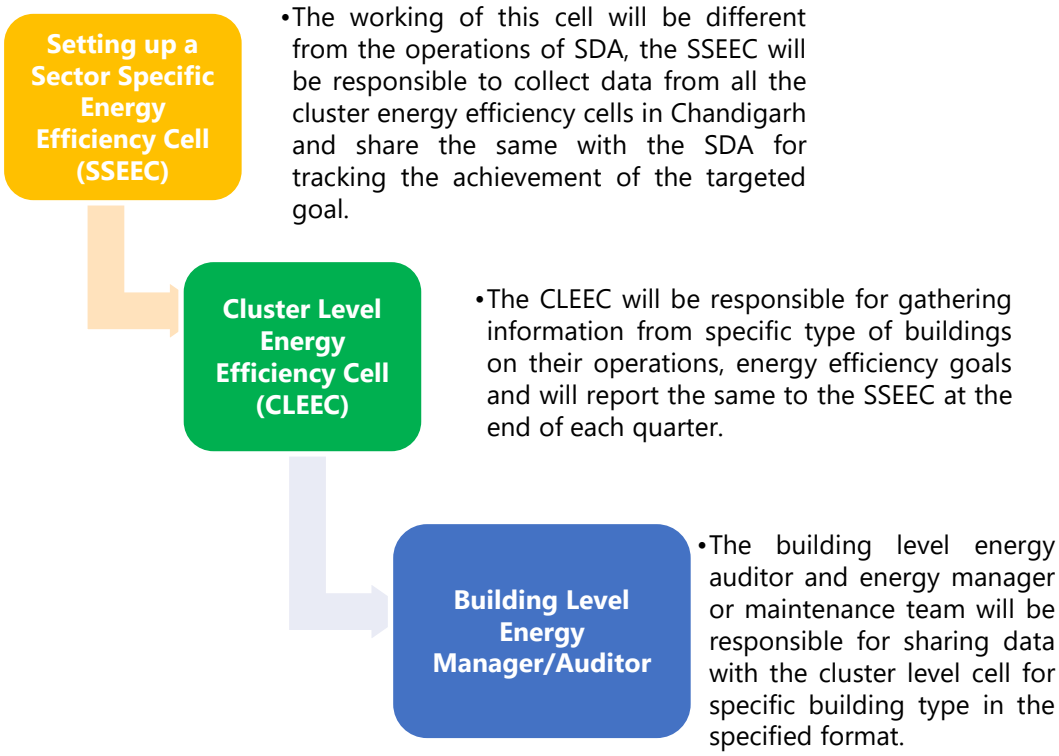
Chandigarh Renewable Energy, Science & Technology Promotion Society (CREST) is promoting renewable energy in the. CREST shall update the norms for solar PV in buildings as per market scenario on regular intervals.

4.4. Monitoring Mechanism

The monitoring framework for achieving the target of the building sector can be easily set up by defining annual reduction targets of the sectoral reduction goal. Monitoring of points mentioned below through the dashboard will support in monitoring of energy efficiency initiatives in the UT.

- Development of strategy-specific dashboards to monitor the impact and track progress of ECBC buildings, ENS buildings, Net Zero buildings in the UT and the energy savings achieved from these strategies.
- Regular reporting and updating of dashboard can be done with the support of SDA Chandigarh or ECBC/ENS cell.
- Development of dashboard to monitor the sale of different star-labelled appliances sold in a year categorized according to star rating level.

Mechanism for data collection and reporting from various clusters and various energy efficiency initiatives may be done through Setting up a Sector Specific Energy Efficiency Cell (SSEEC), Cluster Level Energy Efficiency Cell (CLEEC) and Building Level Energy Manager/Auditor.



Calculations

Domestic Buildings (Savings from Standard & Labeling)

Population Projection	
Year	Persons
2011	10,55,000
2012	10,72,000
2013	10,88,000
2014	11,04,000
2015	11,20,000
2016	11,36,000
2017	11,51,000
2018	11,65,000
2019	11,79,000
2020	11,93,000
2021	12,08,000

Source:
https://main.mohfw.gov.in/sites/default/files/Population%20Projection%20Report%202011-2036%20-%20upload_compressed_0.pdf

	Persons	Share	Households
Urban	6,40,000	54.28%	2,34,033
Rural	5,39,000	45.72%	7,140
Total	**11,79,000**	**100.00%**	**2,41,173**

Source: https://chandigarh.gov.in/sites/default/files/stat2020/stat20-bnutshell.pdf

APPLIANCES									
Appliance	Label	Urban				Rural			
		% ownership	No. of hh	Avg ownership	No. of appliances	% ownership	No. of hh	Avg ownership	No. of appliances
Window AC	Mandatory	0.22	51487.26	1.25	64359.075	0.05	357	1.05	374.85
Split AC	Mandatory	0.23	53827.59	1.08	58133.7972	0.02	142.8	1	142.8
Refrigerator-DC	Mandatory	0.66	154461.78	1.01	156006.398	0.34	2427.6	1.01	2451.876
Refrigerator-Frost Free	Mandatory	0.45	105314.85	1.1	115846.335	0.17	1213.8	1	1213.8
Ceiling Fans	Mandatory	1	234033	2.62	613166.46	0.84	5997.6	1.84	11035.584
Coulor TV CRT	Mandatory	0.68	159142.44	1.05	167099.562	0.56	3998.4	1.01	4038.384
Colour TV - LCD/Plasma/LED	Voluntary	0.47	109995.51	1.03	113295.375	0.17	1213.8	1.03	1250.214
Washing Machines	Voluntary	0.59	138079.47	1.02	140841.059	0.32	2284.8	1.02	2330.496
TFL (Tubular Flourescent Light)	Mandatory	1	234033	3.11	727842.63	0.68	4855.2	2.09	10147.368
Electric Geysers	Mandatory	0.28	65529.24	1.03	67495.1172	0.08	571.2	1	571.2
LPG Stoves	Voluntary	0.98	229352.34	1.1	252287.574	0.67	4783.8	1.01	4831.638
Computer/Laptop /Notebooks	Voluntary	0.47	109995.51	1.08	118795.151	0.17	1213.8	1	1213.8

Mandatory (Urban)								
A	B	C	D	E	F	G	H	I
S.No.	Appliances	Validity	Efficiency	Appliances	3 Star	5 Star	% Reduction	E x G
1	Windows AC	2021-23	COP	64,359	3.1	3.5	0.13	8,304
2	Split AC	2021-23	COP	58,134	3.8	5	0.32	18,358
3	Frost Free		CEC	1,15,846			0.15	17,377
4	Stationary Storage Type Electric Water	2019-20	SL	67,495	1.321	1.088	0.18	11,905
5	Colour Television			1,67,100			0.15	25,065
6	TFL	2018-23	Efficacy (lm/W)	7,27,843	85	110	0.29	2,14,071
9	Direct Cool	2022-24	CEC	1,56,006			0.15	23,401
10	Ceiling Fan (<1200 mm sweep size)	2022-24	RSV (cum/m/W)	6,13,166	4.1	5.1	0.24	1,49,553
Vol	Domestic Gas Stove		TE	2,52,288	60	75	0.25	63,072
Vol	Washing Machine (Semi/Top Load/Front Load)		kWh/kg/cycle	1,40,841	0.02	0.0145	0.28	38,731
	Total			**23,63,078**				**5,69,838**

Mandatory (Rural)								
A	B	C	D	E	F	G	H	I
S.No.	Appliances	Validity	Efficiency	Appliances	3 Star	5 Star	% Reduction	E x H
1	Windows AC	2021-23	COP	375	3.1	3.5	0.13	48
2	Split AC	2021-23	COP	143	3.8	5	0.32	45
3	Frost Free Refrigerator		CEC	1,214			0.15	182
4	Stationary Storage Type Electric Water Heater	2019-20	SL	571	1.321	1.088	0.18	101
5	Colour Television			4,038			0.15	606
6	TFL	2018-23	Efficacy (lm/W)	10,147	85	110	0.29	2,985
7	Direct Cool Refrigerator	2022-24	CEC	2,452			0.15	368
8	Ceiling Fan	2022-24	RSV (cum/m/W)	11,036	4.1	5.1	0.24	2,692
Vol	Domestic Gas Stove		TE	4,832	60	75	0.25	1,208
Vol	Washing Machine (Semi/Top Load/Front Load)		kWh/kg/cycle	2,330	0.02	0.0145	0.28	641
	Total			**37,138**				**8,875**

Electricity Consumption of Domestic Buildings (MTOE) - FY 2026	0.0729
Estimated Electricity Savings (MTOE)	0.0047
Estimated Savings with 30% Awareness (MTOE)	0.0014
Estimated Savings with 10% Awareness (MTOE)	0.0005
Moderate Scenario Savings (MTOE)	**0.0014**
Ambitious Scenario Savings (MTOE)	**0.0019**

Electricity Consumption of Domestic Buildings (MTOE) - FY 2030	0.0802	
Estimated Electricity Savings (MTOE)	0.0077	
Estimated Savings with 48% Awareness (MTOE)	0.0037	*As per CLASP Report*
Estimated Savings with 15% Awareness (MTOE)	0.0012	*As per CLASP Report*
Moderate Scenario Savings (MTOE)	**0.0037**	
Ambitious Scenario Savings (MTOE)	**0.0049**	

Domestic Buildings (Savings from Eco-Niwas Samhita (ENS))

Electricity Consumption - Domestic Buildings			
Particulars	Electricity Consumption - Domestic (MTOE)	Electricity Consumption - Commercial (GWh)	Incremental Electrical Consumption (GWh)
FY 2015	0.06	689	-
FY 2016	0.06	658.50	-30
FY 2017	0.06	721.70	63
FY 2018	0.06	731.94	10
FY 2019	0.06	704.67	-27
FY 2020	0.07	757.26	53
FY 2021	0.07	771.71	14
FY 2022	0.07	786.44	15
FY 2023	0.07	801.44	15
FY 2024	0.07	816.73	15
FY 2025	0.07	832.32	16
FY 2026	0.07	848.20	16
FY 2027	0.07	864.39	16
FY 2028	0.08	880.88	16
FY 2029	0.08	897.69	17
FY 2030	0.08	914.82	17
FY 2030	0.08	932.27	17

Particulars	2026	2030
Total Incremental Electrical Consumption (MUs)	61.77	145.84
Total Incremental Electrical Consumption (MUs) contributing to ENS Savings	2.47	5.83
Moderate Scenario Savings through ENS (MUs)	0.30	0.70
Moderate Scenario Savings through ENS (MTOE)	0.00003	0.00006
Ambitious Scenario Savings through ENS (MUs)	0.37	0.88
Ambitious Scenario Savings through ENS (MTOE)	0.00003	0.00008

Commercial Buildings (Savings from ECBC)

Electricity Consumption - Commercial Buildings			
Particulars	Electricity Consumption - Commercial (MTOE)	Electricity Consumption - Commercial (GWh)	Incremental Electrical Consumption (GWh)
FY 2015	0.040	468.13	
FY 2016	0.040	463.34	-4.79
FY 2017	0.043	498.68	35.34
FY 2018	0.042	494.02	-4.66
FY 2019	0.041	472.98	-21.04

Electricity Consumption - Commercial Buildings			
Particulars	Electricity Consumption - Commercial (MTOE)	Electricity Consumption - Commercial (GWh)	Incremental Electrical Consumption (GWh)
FY 2020	0.041	474.48	1.50
FY 2021	0.041	475.76	1.28
FY 2022	0.041	477.04	1.28
FY 2023	0.041	478.33	1.29
FY 2024	0.041	479.62	1.29
FY 2025	0.041	480.92	1.29
FY 2026	0.041	482.21	1.30
FY 2027	0.042	483.51	1.30
FY 2028	0.042	484.82	1.30
FY 2029	0.042	486.13	1.31
FY 2030	0.042	487.44	1.31
FY 2030	0.042	488.75	1.32

Particulars	2026	2030
Total Incremental Electrical Consumption (MUs)	5.17	11.71
Total Incremental Electrical Consumption (MUs) contributing to buildings having load >50kW	0.16	0.59
Moderate Scenario Savings through ECBC Compliance (MUs)	0.04	0.15
Moderate Scenario Savings through ECBC Compliance (TOE)	3.33	12.59
Ambitious Scenario Savings through ECBC+ Compliance (MUs)	0.05	0.20
Ambitious Scenario Savings through ECBC+ Compliance (TOE)	4.67	17.62

Commercial Buildings (Savings from BEE Star Rating and Shunya Rating of Buildings)

Electricity Consumption - Commercial Buildings			
Particulars	Electricity Consumption - Commercial (MTOE)	Electricity Consumption - Commercial (GWh)	Incremental Electrical Consumption (GWh)
FY 2015	0.04	468.13	
FY 2016	0.04	463.34	-4.79
FY 2017	0.04	498.68	35.34
FY 2018	0.04	494.02	-4.66
FY 2019	0.04	472.98	-21.04
FY 2020	0.04	474.48	1.50
FY 2021	0.04	475.76	1.28
FY 2022	0.04	477.04	1.28

Electricity Consumption - Commercial Buildings			
Particulars	Electricity Consumption - Commercial (MTOE)	Electricity Consumption - Commercial (GWh)	Incremental Electrical Consumption (GWh)
FY 2023	0.04	478.33	1.29
FY 2024	0.04	479.62	1.29
FY 2025	0.04	480.92	1.29
FY 2026	0.04	482.21	1.30
FY 2027	0.04	483.51	1.30
FY 2028	0.04	484.82	1.30
FY 2029	0.04	486.13	1.31
FY 2030	0.04	487.44	1.31
FY 2030	0.04	488.75	1.32

	2030	2026
Total Incremental Electrical Consumption (MUs)	5.17	11.71
Total Incremental Electrical Consumption (MUs) contributing to buildings having load >100kW	0.26	0.59
Total Incremental Electrical Consumption (MUs) contributing to BEE Star Rating for Buildings	0.03	0.06
Moderate Scenario Savings through Building Star Rating (3 Star) (MUs)	0.01	0.02
Moderate Scenario Savings through Building Star Rating (3 Star) (MTOE)	0.0000008	0.0000018
Ambitious Scenario Savings through Building Star Rating (5 Star) (MUs)	0.01	0.03
Ambitious Scenario Savings through Building Star Rating (5 Star) (MTOE)	0.0000011	0.0000025

Total Buildings Saving (%)

Particulars	Energy (Mtoe) 2026	
Strategy	**Moderate**	**Ambitious**
S&L	0.001401	0.001868
ECBC	0.000003	0.000005
ENS	0.000025	0.000032
ECSBC	0.0000288	0.0000365
BEE Star Rating and Shunya Rating	0.0000008	0.0000011
Domestic Buildings Savings	0.001	0.002

Commercial Buildings Savings	0.000	0.000
Buildings (Total)	**0.0014**	**0.0019**

Particulars	**Energy (Mtoe) 2030**	
Strategy	**Moderate**	**Ambitious**
S&L	0.003695	0.004850
ECBC	0.000013	0.000018
ENS	0.000060	0.000075
ECSBC	0.0000728	0.0000929
BEE Star Rating and Shunya Rating	0.0000018	0.0000025
Domestic Buildings Savings	0.004	0.005
Commercial Buildings Savings	0.000	0.000
Buildings (Total)	**0.0038**	**0.0049**

TRANSPORT SECTOR

5. Focus Sector 2: Transport

5.1. Current Scenario

The transport sector in Chandigarh is rising rapidly, being one of the richest UT, a greater number of vehicles are there.

The number of registered motor vehicles has shown a persistent rise over the years. As per the data from Vahan Dashboard, an increment of around 9.96% in FY 2021 is observed when compared with the base year FY 2019. Further, there has been a steady increase in private vehicles under the four wheelers and two-wheeler category which exhibits a potential of positive EV transition in Chandigarh. This transition will require some time and can be a part of the long-term strategy towards achieving the desired target of Panchamrit.

Adding to that, the sectoral transport share of the UT is led by 2-wheelers in the UT which holds around 52% of the total registered vehicles (FY 2019). Further, 4-wheelers contribute a substantial share of around 45% of total vehicles. The data for the number of vehicles has been sourced from the Vahan Dashboard. The number of registered vehicles in the UT has increased from 6,02,019 in FY 2017 to 7,64,697 in FY 2021, with an Average Annual Growth Rate (AAGR) of **5.80%.**

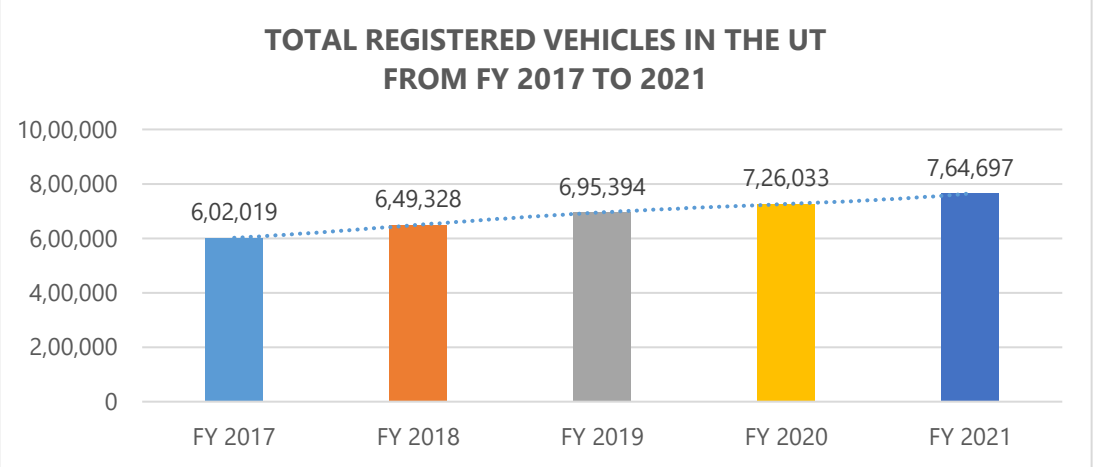


Figure 8: Total registered vehicles in the UT of Chandigarh[7]

[7] *https://vahan.parivahan.gov.in/vahan4dashboard/*

This AAGR is further treated as CAGR to project the number of registered vehicles by the years 2025 and 2030, with base year as 2019.

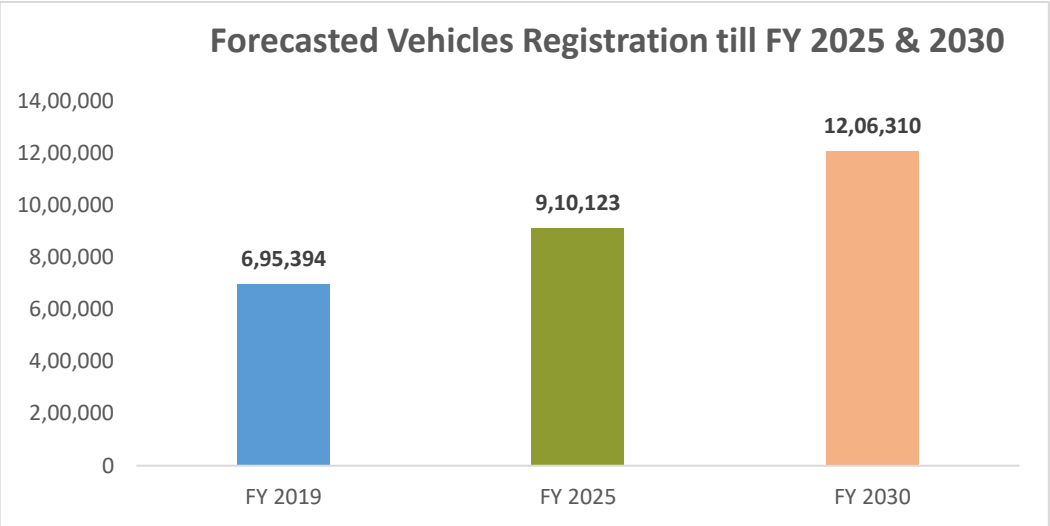


Figure 9: Projected number of registered vehicles

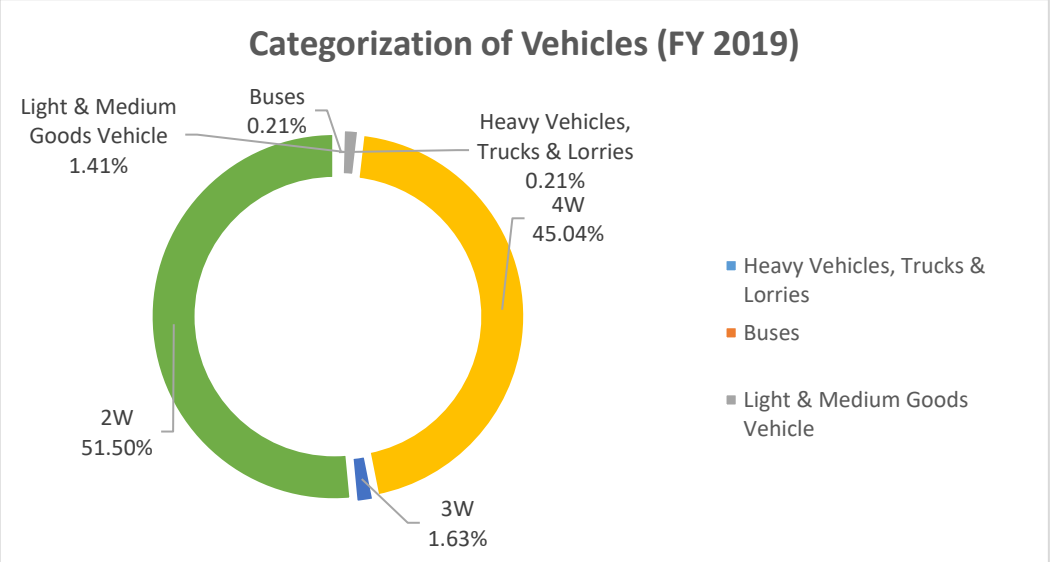


Figure 10: Share of vehicle types for registered vehicles (FY 2019)

It can be seen that 2-Wheleers (51.50%) make up the largest share in the vehicle category type. The next-highest is 4-Wheelers at 45% share. Hence, targeting two-wheelers and four-wheelers for transition to electric vehicles can bring about significant reduction in primary energy consumption in the transport sector of Chandigarh.

5.2. Energy Saving Targets in the Transport Sector

In the transport sector, the total energy saving potential is 0.086 MTOE in the moderate scenario and 0.156 MTOE in ambitious scenarios in FY 2030-31. The potential savings under moderate and ambitious scenarios is the overall estimated savings from individual strategies under the respective scenarios and can be considered as the energy saving targets for FY 2030-31 for the Transport Sector.

Table 9: Moderate and ambitious scenarios

Strategies	Energy Savings Targets (Mtoe)			
	FY 2025-26		FY 2030-31	
	Moderate	Ambitious	Moderate	Ambitious
Transition to electric vehicles	0.021	0.034	0.053	0.091
Ethanol blending	0.015	0.022	0.033	0.065
Total	**0.036**	**0.056**	**0.086**	**0.156**

5.3. Strategies for Energy Savings in the Transport Sector

In line with the Chandigarh EV Policy 2022, the long-term strategy for Electric Vehicle Transition has been proposed for the UT. The policy and the proposed strategy encompass a number of aspects of the transport sector ranging from incentives to consumers to undergo EV transition, converting UT's bus fleet to electric, electric transition in logistics transport, and development of charging station across the UT. Ethanol blending in petrol is proposed as another strategy to bring about emissions reduction in the transport sector. The strategy has been proposed in line with the national policy on ethanol blending.

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

Implementation Period: Long Term (Till FY 2030-31)

The transition to Electric Vehicles (EVs) across all segments of vehicles will be instrumental in decarbonization of the sector and in bringing significant savings in fossil-fuel based energy consumption. In this strategy, it is proposed to convert new vehicles registered in the UT till FY 2030-31 to electric vehicles along two different scenario trajectories, namely moderate scenario and ambitious scenario. The highest EV conversion rate is proposed for 2-wheelers because of it having the highest share in registered vehicles and taking into consideration the availability and affordability of 2-Wheeler electric vehicles. The EV conversion considerations for moderate and ambitious scenarios are given in the table below.

Table 10: EV transition considerations for moderate and ambitious scenarios

MODERATE SCENARIO	AMBITIOUS SCENARIO
• 50% of conventional 2-Wheelers convert to electric by 2030. • 35% of conventional 4-Wheelers convert to electric by 2030. • 60% buses in the UT to transition to electric buses by 2030.	• 80% of conventional 2-Wheelers convert to electric by 2030. • 60% of conventional 4-Wheelers convert to electric by 2030. • 80% buses in the UT to transition to electric buses by 2030.

Actionable Items:

1. **Establishment of regulatory mechanism to develop EV charging Infrastructure** - There are several regulatory mechanisms that can be put in place to develop EV charging infrastructure in Chandigarh. Some possible approaches are mentioned below:

- Incentives for private companies to install charging infrastructure: The government can provide incentives such as tax breaks or subsidies to private companies that install EV charging infrastructure in Chandigarh.
- Public-private partnerships: The government can enter partnerships with private companies to develop and operate EV charging infrastructure. This can include agreements on revenue sharing, investment, and maintenance.
- Zoning regulations: The government can zone certain areas of the city for EV charging infrastructure, such as near highways or in commercial areas, to ensure that the infrastructure is developed where it is most needed.

- Time-of-use pricing: The government can introduce time-of-use pricing for EV charging to encourage drivers to charge their vehicles during off-peak hours when electricity is cheaper.

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

Implementation Strategy:

Chandigarh Electric Vehicle Policy 2022 has been notified by Chandigarh Administration. However regulatory mechanism for effective implementation of policy is in process. Department of Science & Technology and Renewable Energy shall develop a regulatory mechanism to implement & monitoring of EV charging infrastructure in UT.

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

Implementation Strategy:

Chandigarh Renewal Energy and Science & Technology Promotion Society'(CREST) shall promote Renewable Energy based EV charging stations in UT. All public charging stations and charging points on petrol pumps and parking areas shall be powered through renewable energy source.

3. **Pilot projects on Battery Swapping stations -** As per the Chandigarh EV Policy 2022, establishment of a wide network of charging stations and swappable battery station is on high priority. The policy recognizes the importance of charging infrastructure for the growth of the EV industry and aims to create a robust charging infrastructure network across the UT.

The policy envisions the establishment of charging stations at various locations such as public places, commercial and residential buildings, parking lots, highways, and other strategic locations. The UT administration plans to provide incentives for the establishment of charging stations, including subsidies and other benefits, to encourage private players to invest in charging infrastructure. Other action items include awareness programs for energy conservation technologies in the transport sector, and the introduction of demonstration or pilot projects on alternative fuel vehicles. Pilot projects will build the readiness of the UT in adapting to vehicles run by alternative fuels such as Hydrogen Fuel Cell Vehicles (HCV).

Implementation Strategy:

Chandigarh Renewal Energy and Science & Technology Promotion Society'(CREST) shall develop pilot projects on battery swapping stations (BSS) and notify regulations for development of BSS in UT.

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

Implementation Strategy:

Chandigarh Renewal Energy and Science & Technology Promotion Society'(CREST) shall develop pilot projects on Hydrogen Fuel Cell Vehicles (HCVs) in UT

Strategy #2 Ethanol Blending Program

Implementation Period: Long Term (Till FY 2030-31)

The Ethanol Blending Program is proposed to ensure mixing of ethanol in motor spirit (petrol) in a fixed ratio to offset a part of the energy consumed by petrol and bring about reduction in emissions. In the proposed strategy and in line with the country's target of 20% blending of ethanol blending in petrol by 2030, a 10% blending target is suggested in the moderate scenario and a 20% blending target is suggested in the ambitious scenario.

Actionable Items:

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

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

Implementation Strategy:

Chandigarh Renewal Energy and Science & Technology Promotion Society'(CREST) shall develop a UT level policy on bioenergy which will encourage the production of biofuels in UT and use of biofuels with conventional fuels.

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

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

Actionable Items:

1. **Awareness campaigns:** The first step is to create awareness among consumers about the importance of fuel-efficient tyres and the benefits of using them. This can be done through advertising campaigns, social media, and other public outreach efforts. The government can provide education to consumers on how to maintain their tyres for optimal fuel efficiency. This can include tips on proper inflation, regular rotation, and alignment.

Implementation Strategy:

In Chandigarh, various awareness programs are conducting by SDA Chandigarh. However, there is a limited awareness on this initiative. For better outreach radio adds, social media adds, and awareness campaign can be run on of Standard and Labelling program of Tyres for Fuel Efficiency in Vehicles to increase the outreach of this program.

1. **Capacity Building of Tyre Manufacturer and Vehicle OEMs-** Capacity building workshops shall be organized in the UT to enhance the knowledge of Tyre Manufacturers and Vehicle OEMs about Star Rating of Tyre and its benefits and compliance methodology to encourage them to produce or use star rated tyres.

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

Implementation Strategy:

SDA Chandigarh shall conduct capacity building programs on tyre star ratings in UT for tyre dealers, manufacturers, consumers and vehicle OEMs so that they can be aware about the fuel efficiency with use of star rated tyres.

5.4. Monitoring Mechanism

The monitoring framework for achieving the target of the transport sector can be easily set up by defining annual reduction targets of the sector. Monitoring of points mentioned below through the dashboard will support in monitoring of energy efficiency initiatives in the UT.

- Development of dashboard to monitor the sale of electric vehicles sold in a year categorized under 2-wheelers, 3-wheelers, 4-wheelers, and buses.
- The dashboard can also include city-wise mapping of EV charging infrastructure across the UT.
- The dashboard may be scalable to include alternative fuel vehicles such as Hydrogen Fuel Cell Vehicles.

Mechanism for data collection and reporting from various clusters and various energy efficiency initiatives may be done through Setting up a Sector Specific Energy Efficiency Cell (SSEEC) and Cluster Level Energy Efficiency Cell (CLEEC)

Setting up a Sector Specific Energy Efficiency Cell (SSEEC)

- The working of this cell will be different from the operations of SDA, the SSEEC will be responsible to collect data from all the cluster energy efficiency cells in the UT and share the same with the SDA for tracking the achievement of the targeted goal.

Cluster Level Energy Efficiency Cell (CLEEC)

- The CLEEC will be responsible for gathering information and will report the same to the SSEEC at the end of each quarter.

Transport Savings

S.No.	Target/Transitions set for Action Plan	2026		2030	
		Moderate	Ambitious	Moderate	Ambitious
1	2-Wheelers Electric Vehicle share in new vehicle registrations	15%	30%	50%	80%
2	3-Wheelers/LMV Electric Vehicle share in new vehicle registrations	100%	100%	-----	-----
3	4-Wheelers Electric Vehicle share in new vehicle registrations	10%	15%	35%	60%
4	Electric Buses share in new vehicle registrations	40%	50%	60%	80%

Energy Savings (MTOE) - EV Transition		FY 2025-26		FY 2030-31	
		Moderate	Ambitious	Moderate	Ambitious
1	Replacement of new conventional two-wheeler vehicles into electric vehicles	0.0006	0.0012	0.0054	0.0086
2	Replacement of conventional three-wheeler & other vehicles into electric vehicles	0.003	0.003	-----	-----
3	Replacement of conventional four-wheeler vehicles into electric vehicles	0.0051	0.0077	0.047	0.081
4	Replacement of conventional buses into electric buses	0.00025	0.00031	0.00095	0.0012
Total Savings - EV Transition		**0.00895**	**0.01221**	**0.05335**	**0.0908**

Final Energy Savings for FY 2030-31		
	Energy Savings (MTOE)	
Strategy	**Moderate**	**Ambitious**
Energy Savings from EV Transition	0.053	0.091
Energy Savings from Ethanol Blending in Petrol	0.033	0.065
Total Savings	**0.086**	**0.156**

Savings from replacement of conventional two-wheeler vehicles into electric vehicles:

Particular	Unit	Value
Forecasted Registered Motor Vehicles by 2026	Nos	5,31,924
No. of Vehicles will be increased by 2026	Nos	58,618
Total no of vehicles registered & forecasted	Nos	
Average Mileage	km/Liter	60
Average Speed of Vehicle	km/Hour	25
Average daily run	Hours/ Day	1
Average Kilometer run per day	km/day	25
Petrol Calorific value	Kcal/ Kg	11085
	Kcal/ Liter	8169.65
Use of Electric vehicles		
Average electricity consumption of electric vehicles per Kilometer	KWh/ KM	**0.07**
Conventional vehicles average fuel consumption per Kilometer	Liter/KM	0.017
Conventional vehicles average energy consumption per Kilometer	kcal/KM	136.16
	KWh/KM	**0.158**
Average Energy Savings by replacing conventional vehicles with electric vehicles	KWh/ KM	0.088
Average Daily energy savings of vehicle	KWh/Day	2.21
Average yearly energy savings by a vehicle	KWh/Year	805.274

Energy Consumption - FY 2025-26		
Moderate - Replacement of conventional two-wheeler vehicles into electric vehicles	**%**	**15%**
	Nos	8,793
Total energy saving of the UT	KWh/Year	2,36,01,775
Energy Saved to Achieve the Target (Moderate)	**Mtoe/Year**	**0.0006**
Ambitious - Replacement of conventional two-wheeler vehicles into electric vehicles	**%**	**30%**
	Nos	17,585
Total energy saving of the UT	KWh/Year	1,41,61,065

Energy Saved to Achieve the Target (Ambitious)	Mtoe/Year	0.0012
Energy Consumption - FY 2030-31		
Forecasted Registered Motor Vehicles by 2030	Nos	7,26,122
No. of Vehicles will be increased by 2030	Nos	1,55,717
Moderate - Replacement of conventional two wheeler vehicles into electric vehicles	**%**	**50%**
	Nos	77,859
Total energy saving of the UT	KWh/Year	6,26,97,426
Energy Saved to Achieve the Target (Moderate)	**Mtoe/Year**	**0.0053**
Ambitious - Replacement of conventional two-wheeler vehicles into electric vehicles	**%**	**80%**
	Nos	1,24,573.6
Total energy saving of the UT	KWh/Year	10,03,15,881
Energy Saved to Achieve the Target (Ambitious)	**Mtoe/Year**	**0.0086**

Savings from replacement of conventional three-wheeler vehicles into electric vehicles:

Particular	Unit	Value
Forecasted Registered Motor Vehicles by 2026	Nos	16,398
No. of Vehicles will be increased by 2026	Nos	1,597
Average Mileage	km/Liter	30
Average Speed of Vehicle	km/Hour	30
Average daily run	Hours/ Day	8
Average Kilometer run per day	km/day	240
Petrol Calorific value	Kcal/ Kg	11085
	Kcal/ Liter	8169.65
Use of Electric vehicles		
Average electricity consumption of electric vehicles per Kilometre	KWh/ KM	**0.06**
Conventional vehicles average fuel consumption per Kilometre	Liter/KM	0.033
Conventional vehicles average energy consumption per Kilometre	kcal/KM	272.32
	KWh/KM	**0.316**
Average Energy Savings by replacing conventional vehicles with electric vehicles	KWh/ KM	0.256
Average Daily energy savings of vehicle	KWh/Day	61.56
Average yearly energy savings by a vehicle	KWh/Year	22469.254

Energy Consumption - FY 2025-26		
Moderate - Replacement of conventional 3-wheeler vehicles into electric vehicles	**%**	**100%**
	Nos	1,597
Total energy saving of the UT	KWh/Year	3,58,83,398
Energy Saved to Achieve the Target (Moderate)	**Mtoe/Year**	**0.003**
	%	**100%**

Ambitious - Replacement of conventional 3-wheeler vehicles into electric vehicles	Nos	1,597
Total energy saving of the UT	KWh/Year	3,58,83,398
Energy Saved to Achieve the Target (Ambitious)	**Mtoe/Year**	**0.003**

Savings from replacement of conventional four-wheeler vehicles into electric vehicles:

Particular	Unit	Value
Forecasted Registered Motor Vehicles by 2026	Nos	4,62,974
No. of Vehicles will be increased by 2026	Nos	47,249
Average Mileage	km/Liter	12
Average Speed of Vehicle	km/Hour	50
Average daily run	Hours/ Day	1
Average Kilometre run per day	km/day	50
Petrol Calorific value	Kcal/ Kg	11085
	Kcal/ Liter	8169.65
Use of Electric vehicles		
Average electricity consumption of electric vehicles per Kilometre	KWh/ KM	**0.096**
Conventional vehicles average fuel consumption per Kilometre	Liter/KM	0.083
Conventional vehicles average energy consumption per Kilometre	kcal/KM	680.80
	KWh/KM	**0.791**
Average Energy Savings by replacing conventional vehicles with electric vehicles	KWh/ KM	0.695
Average Daily energy savings of vehicle	KWh/Day	34.76
Average yearly energy savings by a vehicle	KWh/Year	12688.237
Energy Consumption - FY 2025-26		
Moderate - Replacement of conventional 4-wheeler vehicles into electric vehicles	**%**	**10%**
	Nos	4,725
Total energy saving of the UT	KWh/Year	5,99,50,651
Energy Saved to Achieve the Target (Moderate)	**Mtoe/Year**	**0.0051**
Ambitious - Replacement of conventional 4-wheeler vehicles into electric vehicles	**%**	**15%**
	Nos	7,087
Total energy saving of the UT	KWh/Year	8,99,25,976
Energy Saved to Achieve the Target (Ambitious)	**Mtoe/Year**	**0.0077**
Energy Consumption - FY 2030-31		
Forecasted Registered Motor Vehicles by 2030	Nos	6,15,873
No. of Vehicles will be increased by 2030	Nos	1,23,699
Moderate - Replacement of conventional 3-wheeler vehicles into electric vehicles	**%**	**35%**
	Nos	43,295
Total energy saving of the UT	KWh/Year	54,93,32,780
Energy Saved to Achieve the Target (Moderate)	**Mtoe/Year**	**0.047**
	%	**60%**

Ambitious - Replacement of conventional 3-wheeler vehicles into electric vehicles	Nos	74,219
Total energy saving of the UT	KWh/Year	94,17,08,262
Energy Saved to Achieve the Target (Ambitious)	**Mtoe/Year**	**0.081**

Savings from replacement of conventional buses into electric vehicles:

Particular	Unit	Value
Forecasted Registered Motor Vehicles by 2026	Nos	1,879
No. of Vehicles will be increased by 2026	Nos	150
Average Mileage	km/Liter	7
Average Speed of Vehicle	km/Hour	30
Average daily run	Hours/ Day	10
Average Kilometer run per day	km/day	300
Diesel Calorific value	Kcal/ Kg	10800
	Kcal/ Liter	9310.34
Use of Electric vehicles		
Average electricity consumption of electric vehicles per Kilometre	KWh/ KM	**1.1**
Conventional vehicles average fuel consumption per Kilometre	Liter/KM	0.143
Conventional vehicles average energy consumption per Kilometre	kcal/KM	1330.05
	KWh/KM	**1.546**
Average Energy Savings by replacing conventional vehicles with electric vehicles	KWh/ KM	0.446
Average Daily energy savings of vehicle	KWh/Day	133.74
Average yearly energy savings by a vehicle	KWh/Year	48816.630
Energy Consumption - FY 2026		
Moderate - Replacement of conventional 3-wheeler vehicles into electric vehicles	**%**	**40%**
	Nos	60
Total energy saving of the UT	KWh/Year	29,28,997.8
Energy Saved to Achieve the Target (Moderate)	**Mtoe/Year**	**0.00025**
Ambitious - Replacement of conventional 3-wheeler vehicles into electric vehicles	**%**	**50%**
	Nos	75
Total energy saving of the UT	KWh/Year	36,61,247
Energy Saved to Achieve the Target (Ambitious)	**Mtoe/Year**	**0.00031**
Energy Consumption - FY 2030-31		
Forecasted Registered Motor Vehicles by 2030	Nos	2,337
No. of Vehicles will be increased by 2030	Nos	379
Moderate - Replacement of conventional 3-wheeler vehicles into electric vehicles	**%**	**60%**
	Nos	227
Total energy saving of the UT	KWh/Year	1,10,81,375
Energy Saved to Achieve the Target (Moderate)	**Mtoe/Year**	**0.00095**
	%	**80%**

Ambitious - Replacement of conventional 3-wheeler vehicles into electric vehicles	Nos	303
Total energy saving of the UT	KWh/Year	1,48,13,280
Energy Saved to Achieve the Target (Ambitious)	**Mtoe/Year**	**0.0012**

Savings from Ethanol Blending

Year	Petrol Energy Consumption (in Mtoe)
2015	0.09
2016	0.11
2017	0.10
2018	0.11
2019	0.13
2020	0.14
2021	0.15
2022	0.16
2023	0.17
2024	0.19
2025	0.20
2026	0.22
2027	0.24
2028	0.26
2029	0.28
2030	0.30
2030	0.33

CAGR (2015-2020)	***8.3%***

Scenario	% - Savings 2030	Savings (Mtoe)2026	Savings (Mtoe) 2030
Moderate	10%	**0.015**	**0.033**
Ambitious	20%	**0.022**	**0.065**

INDUSTRY SECTOR

6. Focus Sector-3: Industry

6.1. Current Scenario

The Industrial Area in Chandigarh has been developed over 1,200 acres in two phases, Phase – I has an area of 776.14 acres and Phase – II has an area of 486 acres. While Phase – I and Phase – II are fully developed, Phase – III with an area of 153 acres is yet to be developed.

The growth in the Industrial Sector is limited in Chandigarh because of the limited space provided for industrial development. A limited area of 1,450 acres has been provided in the city for development as an industrial area as industries provide crucial resource base in the city. 40% of the total Industries in the city, are ancillary units, which produce components for the major tractor industries around Chandigarh. Other Industrial units produce industrial fasteners, machine tools, pharmaceuticals, sanitary fittings, steel, wooden furniture, food products, etc. The total estimated output of the industries is around 650 crores.[8]

As per the consultation with the stakeholders, it has been noted that the UT of Chandigarh has space or land constraint for the vast development of the industries in the future. Also, due to high prices of commercial land doesn't promote significant industrial investment.

The Chandigarh Administration is focusing on promotion of Information Technology (IT) industries, which require less space and are also non-polluting.

The focus industries in the UT of Chandigarh:[9]

- Automotive & Electronics Manufacturing.
- IT/ITES/Biotech and Nano technologies.
- Light Engineering Goods.
- Handlooms/Handicrafts and Furniture manufacturing.

[8] *Source: https://chandigarh.gov.in/industries*
[9] *Industrial Policy, UT of Chandigarh - 2015*

6.2. Energy Efficiency Targets in the Industry Sector:

The industrial sector has potential to achieve energy savings of 0.0013 Mtoe in moderate scenario and 0.0021 MTOE in ambitious scenario by FY 2030. The energy saving targets for the short term (till FY 2026) and long term (till FY 2030) for the industry sector under the two scenarios are shown in table below:

Table 11: Moderate and ambitious scenarios energy savings for Industry sector

Action Plan	Energy Savings (Mtoe)			
	2026		2030	
	Moderate	Ambitious	Moderate	Ambitious
Energy efficiency in MSME Clusters	0.0004	0.0008	0.0013	0.0021

6.3. Energy Efficiency Strategies in the Industry Sector:

This section presents the proposed strategies in the prominent sectors and focus areas identified in the industry sector along with their impact in terms of energy efficiency.

Strategy #1: Energy Efficiency Interventions in MSME clusters

Implementation Timeline: Short Term (Till FY 2025-26) for lower coverage; Long Term (Till FY 2030-31) for higher coverage.

The strategy is proposed for the Small and Medium Enterprises (SME) sector industries which consist of MSMEs in identified prominent sectors. The strategy would involve the implementation of energy efficient technologies and new & innovative decarbonization technologies in the market in order to enable SMEs to meet their energy saving targets.

It was assumed that 50% of industries will be able to adopt the strategy in a moderate scenario and 70% industries will be covered in the ambitious scenario. The strategy is expected to result in energy savings of 0.0013 MTOE and 0.0021 MTOE in the moderate and ambitious scenarios respectively.

Actionable items:

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

1. **Workshops on technology interventions for energy conservations in MSMEs –** It is proposed to organize cluster wise workshops for MSMEs on technology interventions that can be implemented in respective industries.

   It is important to disseminate technical information about new technologies among owners and maintenance team of MSMEs so that they can implement the latest technologies in their units.

   Carrying out energy and resource-mapping studies in MSME clusters – For the industries not covered under PAT, there is a challenge in reporting accurate energy consumption data for individual clusters or sub-sectors. Understanding of energy consumption patterns in the clusters is necessary to ensure optimized allocation of resources and assess the feasibility of technology implementation in a particular cluster. Energy and resource-mapping studies are comprehensive studies on MSME clusters and sub-sectors that can give insights into the current status of technology implementation in the cluster, set benchmark energy consumption, design threshold limits for a PAT-like scheme, and analyze the future potential of technology implementation in terms of energy and cost savings. Energy and resource-mapping studies are proposed to be carried out in the prominent MSME clusters and industry sub-sectors of the UT annually to set benchmarks and track progress in the implementation of this strategy.

Implementation Strategy:

SDA Chandigarh shall conduct workshops on technology interventions for energy conservations in MSMEs and empanelment of ESCOs to ensure the availability of adequate technical pool in UT.

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

Implementation Strategy:

SDA Chandigarh shall carry out demonstration projects on technology interventions for energy conservations in MSMEs with the support of empaneled ESCOs.

3. **Periodic standardized energy audits for MSMEs on load basis and reimbursement of energy audit cost with a maximum cap** – The Administration of Chandigarh shall develop a standard format of energy audit and issue notification for conducting mandatory periodic (in every 3 Years) energy audits by every unit above a certain limit of connected load. The government can also provide reimbursement of energy audit cost with a maximum cap of INR 75,000. Monetary support to small industries and MSMEs can be provided to maintain the standard of conducted energy audit.

Implementation Strategy:

Department of Engineering of UT Administration shall issue the policy for periodic standardized energy audits for MSMEs on load basis and reimbursement of energy audit cost with a maximum cap.

4. **Sector-specific policy development for financial assistance on implementation of ECMs suggested in energy audit-** A policy shall be developed at UT level to provide the financial assistance for implementation of ECMs recommended in the energy audits. Policy development shall consider the sector specific requirements, energy saving potential of sector and its importance in UT level GSDP.

Implementation Strategy:

Department of Engineering of UT Administration shall issue policy on financial assistance for implementation of ECMs recommended in the energy audits.

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

Implementation Strategy:

Directives shall be issued from the Department of Industries and Department of Engineering of Chandigarh Administration to MSMEs for implementation of ISO 50001, Energy Management System in organizations on load basis.

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

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

7. **Renewable Energy Transition in Industries & MSMEs**

   India is making significant strides towards transitioning its industries to renewable energy sources. As per Panchamrit target, India's non-fossil energy capacity will reach 500 GW by 2030. In Chandigarh, industries have already begun adopting renewable energy technologies such as solar and biomass which not only help to reduce carbon emissions but also offer cost savings in

the long run. Promotion of installation of renewable energy plants in the complete industrial sector will make a significant contribution in achieving the national targets.

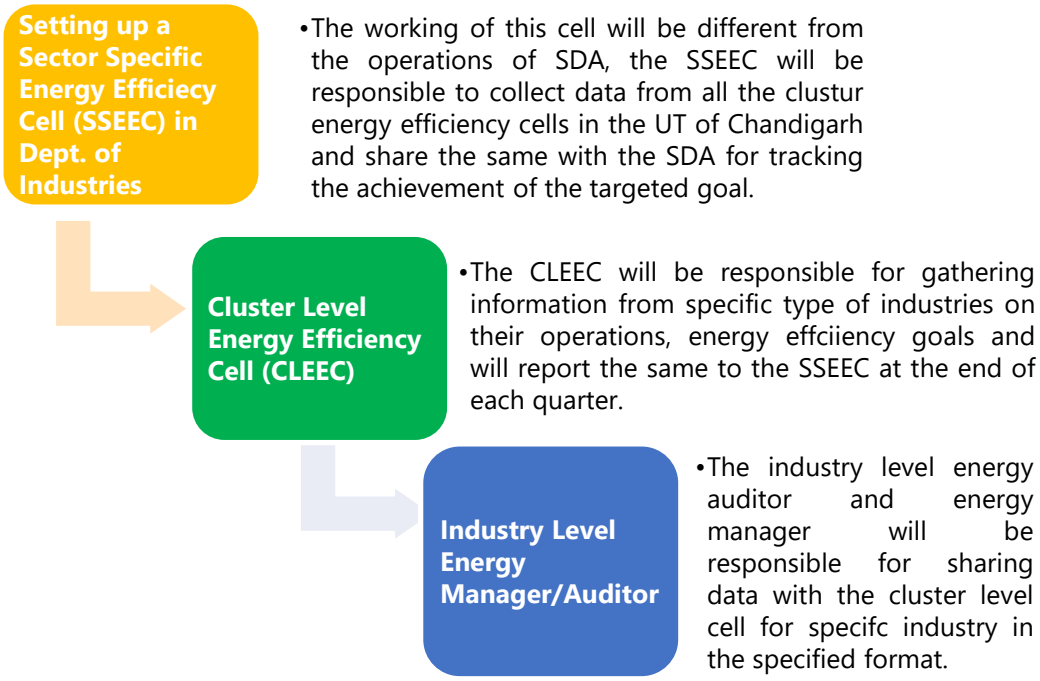
Implementation Strategy:

Chandigarh Renewal Energy and Science & Technology Promotion Society'(CREST) shall promote more aggressively Renewable Energy sources in Industries and MSMEs.

6.4. Monitoring Mechanism

The monitoring framework for achieving the target of the industry sector can be easily set up by defining annual reduction targets of the sectoral reduction goal.

The reduction target verification can be later done for monitoring the following for each quarter:



Calculation:

Savings in MSME

Total Consumption of Chandigarh	1604.00	GWh in FY 2020
Industrial Consumption	259.6876	GWh in FY 2020
Consumption in Motors	51.93752	GWh
No. of MSMES in Chandigarh	3060	Units
Consumption in each Unit	0.016973	GWh
Consumption in each Unit	0.000001	GWh

Moderate Scenario	
Clusters	No of MSMEs
Total Units	3060
50% Units	1530
Consumption in 50% Units	0.0022
Savings through pump replacement	0.0013

Ambitious Scenario	
Clusters	No of MSMEs
Total Units	3060
80% Units	2448
Consumption in 80% Units	0.0036
Savings through pump replacement	0.0021

TOTAL INDUSTRY SAVINGS (MSME CLUSTERS)	
Moderate (Mtoe)	**Ambitious (Mtoe)**
0.0013	**0.0021**

7. Other Focus Areas

Strategy#1: Replacement of inefficient sewerage and water pumps with BEE 5-star rated pumps under all municipal corporations and Chandigarh Administration:

1. **Assessment of existing pumps:** The first step is to conduct a thorough assessment of the existing sewerage and water pumps in all municipal corporations and Chandigarh Administration. This assessment will identify pumps that are inefficient or consume excessive energy.
2. **Replacement planning:** Once the assessment and pump selection process is complete, a comprehensive replacement plan will be developed. The plan outlines the specific pumps to be replaced in each municipal corporation, the timeline for replacement, and the associated costs.
3. **Implementation of Replacement Scheme:** Municipal Corporation may implement the scheme through their existing operation & maintenance team or through Energy Service Companies (ESCOs) empaneled in the UT of Chandigarh or through any DSM scheme.
4. **Testing and monitoring:** After installation, the new pumps undergo thorough testing to ensure proper functionality and performance.
5. **Training and capacity building:** Municipal staff and operators responsible for maintaining and operating the pumps receive training on the new equipment.
6. **Performance evaluation and optimization:** Regular evaluations are conducted to assess the performance of the new pumps. Energy consumption data, cost savings, and efficiency improvements are analyzed to measure the success of the strategy.

Implementation Strategy:

Municipal Corporation Chandigarh in collaboration with Department of Engineering of Chandigarh Administration shall conduct a study to identify the

energy inefficient pumps & motors and develop a phase-wise plan and run drives for replacement of inefficient pumps with BEE 5 Star rated pumps.

Strategy#2: Development of energy efficiency curriculum for school & college students

1. **Curriculum design:** Experts in the field of energy efficiency and education collaborate to design an engaging and comprehensive curriculum. The curriculum may be tailored to suit different age groups and academic levels, ensuring it aligns with educational standards and learning objectives.
2. **Interactive learning materials:** The curriculum may incorporate a variety of interactive learning materials, such as textbooks, worksheets, presentations, videos, and online resources. These materials are designed to make the subject matter reader-friendly, visually appealing, and accessible to students.
3. **Real-world examples:** The curriculum utilizes real-world examples to illustrate the importance and impact of energy efficiency. Students learn about successful energy conservation initiatives, energy-efficient technologies, and the positive outcomes achieved by implementing energy-saving practices**.**
4. **Interactive discussions and debates**: The curriculum encourage interactive discussions and debates among students to promote critical thinking and engagement. Students can analyze energy-related issues, explore different viewpoints, and develop innovative solutions to address energy challenges.
5. **Field trips and guest lectures:** To enhance the learning experience, the curriculum may include field trips to energy-efficient buildings, renewable energy installations, or sustainability-focused organizations. Additionally, guest lectures by experts from the energy sector can provide valuable insights and inspire students to pursue careers in energy conservation and sustainability.
6. **Awareness campaigns:** The curriculum can be complemented by energy efficiency awareness campaigns within schools and local communities. Students can actively participate in spreading awareness, organizing events, and implementing energy-saving practices both at school and at home.

Implementation Strategy:

Education department in collaboration with Department of Engineering of Chandigarh Administration shall conduct a study and develop an effective curriculum on energy efficiency and provide basic education to all school and college level to develop the concept of Life for Environment (LiFE) from beginning.

Strategy#3: All new transformers in Residential-Commercial Buildings and Industrial Buildings shall be BEE 3 Star Rated.

1. **Requirement for BEE 3 Star Rated transformers:** The strategy establishes a requirement that all new transformers to be installed in residential-commercial buildings and industrial buildings must have a minimum BEE 3 Star rating. The BEE rating indicates the energy efficiency level of the transformer, with higher star ratings representing greater energy efficiency.
2. **Compliance and enforcement:** The strategy involves regulatory measures to ensure compliance with the requirement. Building codes, regulations, or guidelines may be updated to include the mandate for BEE 3 Star Rated transformers. Government agencies and authorities responsible for building approvals and inspections will enforce compliance during the construction or renovation process.
3. **Awareness and education:** To support the implementation of the strategy, awareness campaigns and educational initiatives may be conducted. Building owners, architects, electrical contractors, and relevant stakeholders need to be informed about the benefits of energy-efficient transformers and the importance of complying with the rating requirement. Workshops, seminars, and informational materials can be utilized to disseminate knowledge and promote understanding.

Implementation Strategy:

Directives shall be issued from the Department of Engineering of Chandigarh Administration to all DISCOMs, Local Authorities to ensure the installation of new transformers in Residential-Commercial Buildings and Industrial Buildings shall be BEE 3 Star Rated.

8. Market Potential in Focus Sectors

The energy saved as a result of the proposed strategies in all sectors will lead to avoided generation of equivalent amount. In order to implement the suggested strategies, there will be a need for investments in energy efficiency projects, development of new policies, and modification of existing policies. In order to estimate the market potential generated from the suggested strategies in the focus sectors, the equivalent cost of the saved energy in terms of metric tonnes of oil equivalent has been calculated. The Ministry of Power, Government of India, in consultation with the Bureau of Energy Efficiency (BEE) has notified the price of per metric tonne of oil equivalent as INR 18,402 only for the year 2018-19. The same amount has been applied to energy savings under ambitious scenario for the estimation of maximum market potential. Total energy saving potential by implementing various strategies in Chandigarh is shown in the graph below:

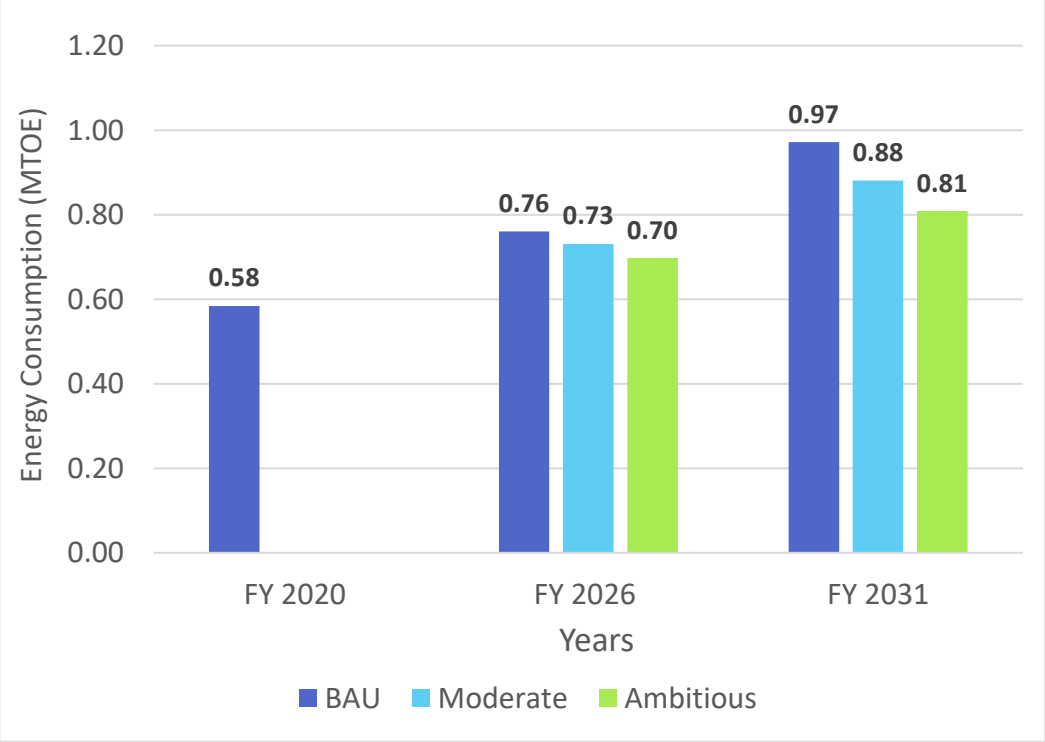


Figure 11 Energy Consumption Scenario

It is estimated that with the implementation of various proposed strategies of Buildings, Transport and Industry Sectors, energy saving of 0.091 MTOE in moderate scenario and 0.163 MTOE in ambitious scenario can be achieved. In the moderate scenario 10.33% energy saving can be achieved and in ambitious scenario 20.15% can be achieved.

Table 12 Moderate and ambitious Energy Saving Summary

Sectors	Energy Saving Potential (Mtoe)		Emission Reduction Potential ($MtCO_2$)		Market Potential (INR Crore)
	Moderate	Ambitious	Moderate	Ambitious	
Buildings	0.0038	0.00495	0.0118	0.0155	9.10 Cr
Industry	0.0013	0.00214	0.0042	0.0067	3.93 Cr
Transport	0.086	0.156	0.2688	0.4879	286.85 Cr
Total	**0.0910**	**0.1630**	**0.2848**	**0.5101**	**299.89 Cr**

9. Way Forward: Carbon Neutral Chandigarh

India's emissions grew at a CAGR of 4.90% from 1.586 $GtCO_2e$ in 2005 to 2.953 $GtCO_2e$ in 2018. The emission by 2030 is estimated to be 5.50 $GtCO_2e$. The per capita emissions increased at a CAGR of 3.41% from 1.45 tCO_2e per capita in 2005, to 2.24 tCO_2e per capita in 2018. [10] However, in 2015, the Indian government submitted its first biennial update report (BUR1) to the UNFCCC. According to this report, the emission intensity of India's GDP had decreased by 12 per-cent between 2005-2010. The emission intensity further decreased 21% between 2005-2014 and 24% between 2005-2016 and 28% between 2005-2021. Emission intensity of GDP was 35.14 kg CO2e / 1000 Rs (at constant 2004–05 prices) in 2005. It declined to 25.3 kg CO2e / 1000 Rs in 2021.

India's GHG Emission ($GtCO_2e$)	2005	2018	2030 (projected)
	1.586	2.95	5.50
Source: GHGPI Trend-Analysis 2005 to 2018 India			

Analyzing the emission intensity rate, India revised its targets for 2030 and set an ambitious target to become carbon neutral by 2070. It means, India would put out no more greenhouse gases than it can absorb back. It cannot be done unless you completely discard the Indian electricity sector, which means no more burning of coal or gas and reduce the consumption of coal to a greater extent. To become net-zero, the very first step is to reduce the demand through various energy conservation and energy efficiency measures and the second is to fulfill the reaming demand with the help of renewable energy sources and other clean energy sources. Here are some key strategies and initiatives that India is pursuing to mitigate climate change and reduce emissions:

[10]https://www.ghgplatform-india.org/wp-content/uploads/2022/09/GHGPI_Trend-Analysis_2005-to 2018_India_Sep22.pdf

Renewable Energy: India has been actively promoting the use of renewable energy sources, such as solar and wind power. The country has set ambitious targets for increasing its renewable energy capacity, including the goal of reaching 175 GW of renewable energy capacity by 2022 and 500 GW by 2030.

Energy Efficiency: India has been implementing energy efficiency measures in various sectors, including industry, transportation, and agriculture. The Perform, Achieve, and Trade (PAT) scheme is an example of an initiative aimed at improving energy efficiency in energy-intensive industries.

Electric Mobility: India has been encouraging the adoption of electric vehicles (EVs) to reduce emissions from the transportation sector. Incentives and policies to promote EV manufacturing and charging infrastructure have been introduced.

Afforestation and Reforestation: Efforts have been made to increase forest and tree cover to enhance carbon sequestration and biodiversity conservation.

Sustainable Agriculture: Promoting sustainable agricultural practices that reduce emissions and enhance resilience to climate change has been a priority.

Adaptation Measures: India has also focused on adaptation measures to cope with the impacts of climate change, particularly in sectors like water resources, agriculture, and disaster management.

India has started developing the state/UT specific energy transition plan, climate action plan, energy efficiency action plan and Net Zero plans. However, to achieve net zero many other areas need to address along with the energy. As per the UNNATEE report, while emphasizing on the energy savings in each of the demand sectors, brings out the emission reduction that is possible through the adoption of efficient energy-saving practices, adoption of novel technologies and better enforcement of existing policy and programs. The emission savings projections under the moderate and ambitious scenarios are 0.438 and 0.623 $GtCO_2e$ respectively by 2030. This gives a percentage reduction of 8% and 11% in

moderate and ambitious scenario respectively out of the total emissions of 5.50 $GtCO_2e$ by 2030.

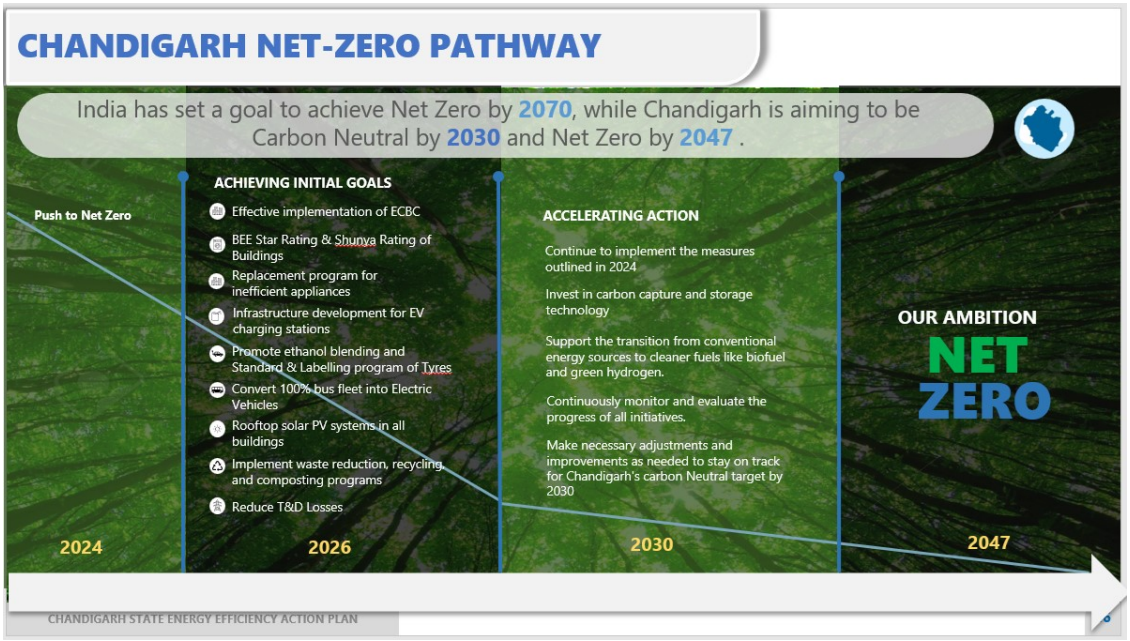
(UNNATTEE 2019) India's potential reduction due to Energy Efficiency by FY2030 in $GtCO_2e$	Moderate	Ambitious
	0.44	0.62
Share of Reduction (%)	8%	11%

9.1. Carbon Neutral Chandigarh

Chandigarh has a very small fraction of share in national energy and emission scenarios. Chandigarh has witnessed an increase in the emissions with a CAGR of 3.44% from 0.71 $MtCO_2e$ in the year 2005 to 1.10 $MtCO_2e$ in 2018. The per capita emissions of Chandigarh remained very low throughout the reference period. They increased at a compound rate of 2.60% from 0.67 t CO_2e/capita in 2005 to 0.94 t CO_2e/capita in 2018.

Chandigarh's GHG Emission ($MtCO_2e$)	2005	2018	2030 (projected)
	0.71	1.10	1.64
Source: GHGPI Trend-Analysis 2005 to 2018 - Chandigarh			

The UT of Chandigarh demonstrates a great potential in emission reduction of approximately 0.2848 $MtCO_2e$ and 0.5101 $MtCO_2e$ in moderate and ambitious scenario by the year 2030. These reduction targets represent a decrease of 17.36% and 31.10% in moderate and ambitious scenario, respectively, compared to the total emissions of 1.64 $MtCO_2e$ expected by 2030.



Chandigarh administration has also set a target to become Carbon Neutral by 2030. Recently UNDP has released the **Chandigarh Vision Document 2030 & Beyond**, giving footsteps for the UT of Chandigarh for becoming a Carbon Neutral City. The action plan to become Carbon Neutral outlined the importance of energy transition and efficiency in all sectors, fuel witching in transport sector, promotion of renewable energy, waste management and green spaces development etc.

Additional provisions will be incorporated into the State Energy Efficiency Action Plan (SEEAP) to advance Chandigarh's journey towards achieving Carbon Neutrality by 2030 and Net Zero status by 2047.

Energy Efficiency: This state energy efficiency action plan is in line with the targets of UT to become Carbon Neutral. It covers major energy guzzling sectors like buildings, transport and industries. In the building section it is recommended to implement below mentioned measures to reduce the energy demand in each sector:

Buildings Sector:

- Effective Implementation of Energy Conservation & Sustainable Building Code (ECSBC) to promote energy efficient buildings in the UT in both commercial and residential sectors.
- Replacement program for inefficient appliances to promote energy efficiency in building systems and household appliances to reduce the energy demand.
- BEE Star Rating and Shunya Rating of Buildings to promote the Green and Net-Zero buildings in the UT.

Transport Sector:

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

Industry Sector:

- Energy Efficiency Intervention in MSME clusters to make then energy efficient.

Other Focus Area:

- Replacement of inefficient sewerage and water pumps with BEE 5-star rated pumps under all municipal corporations of the UT.
- Development of energy efficiency curriculum for school & college students
- All new transformers in Residential-Commercial Buildings and Industrial Buildings shall be BEE 3 Star Rated.

Renewable Energy: Installation of rooftop Solar PV systems in all building will support in meeting the energy demand through renewable energy system which will lead to reduce the demand to a greater extent. Further, solar PV parks can be developed to meet the remaining demand of UT. In recent years, the government of Chandigarh has been promoting the use of renewable sources of energy, such as solar energy, to reduce the dependence on non-renewable sources. Total Peak demand of Chandigarh is approximately 400 MW in summer season. The city has installed 53.45 megawatts of solar energy capacity till February 2022 and is targeting to increase the capacity by multiple folds in upcoming years to meet the demand.

Public Transportation: Chandigarh is continuously working on promoting the use of public transportation, cycling, and walking to reduce emissions from private vehicles. In addition, transition of convention fuel vehicle into electric vehicle will reduce the oil consumption in the UT and take it further for the clean transport system in the UT. Chandigarh is targeting to convert 100% bus fleet into Electric Vehicles with promotion of Renewable Energy based EV charging stations.

Waste Management: Implementing waste reduction, recycling, and composting programs to minimize landfill emissions and will promote the circular economy in the UT.

Reforestation and Green Spaces: Increasing green cover and creating urban green spaces to enhance carbon sequestration and improve air quality.

Climate Resilience: Developing plans to adapt to the impacts of climate change and enhance resilience in areas such as water management and disaster preparedness.

Engaging the Community: Engaging the local community, businesses, and stakeholders to raise awareness and gain support for emissions reduction initiatives.

Environment, Tower & Heritage Preservation: Under this vision the city urges on becoming "Resilient to climate change", for achieving the aim they need to shift their focus on adopting all circularity principles that propose a restorative and regenerative economic system, using renewable resources, optimizing resources, optimizing resources use and recovery and supporting sustainable livelihoods and lifestyle.

10. Bibliography

1. Bureau of Energy Efficiency (BEE). (2019). *Unlocking National Energy Efficiency Potential (UNNATEE)*
2. Bureau of Energy Efficiency (BEE). (2019). *Roadmap of Sustainable and Holistic Approach to National Energy Efficiency (ROSHANEE)*
3. Reserve Bank of India (RBI). (2021). *Handbook of Statistics on Indian Economy 2020-21*
4. Statistical Abstract of Chandigarh 2020
5. Ministry of Power, Govt. of India & Govt. of UT of Chandigarh. (2016). *24x7 Power for All (Chandigarh)*
6. Census of India 2011
7. NITI Aayog: India Energy Dashboards
8. Annual Report, Govt. of India, *Ministry of Micro, Small and Medium Enterprises, 2014-15*
9. *Central Electricity Authority (https://cea.nic.in/wp-content/uploads/installed/2022/02/installed_capacity.pdf)*