MINISTRY OF POWER
GOVERNMENT OF INDIA

STATE ENERGY EFFICIENCY ACTION PLAN (SEEAP)

HARYANA - ACTION PLAN

SEPTEMBER 2023

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

सत्यमेव जयते

Azadi Ka Amrit Mahotsav

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

Foreword

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

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

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

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

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

October, 2024

(Dr. Srikant Nagulapalli)

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

ACKNOWLEDGEMENT

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

The 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 input 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.

The ASSOCHAM team extends its sincere gratitude to Shri Apoorva Kumar Singh, IAS, Additional Chief Secretary to Govt. of Haryana, Energy Department, for their valuable guidance towards the execution of the assignment. We also acknowledge the support provided by Shri S. Narayanan, IFS, Director General, HAREDA, Haryana and Shri Pradeep Kumar Nautiyal (Technical Adviser), Shri Sukhchain Singh (Project Manager), and other respected officials of HAREDA for successfully completing the project. The team also extends its sincere thanks to all state government departments and stakeholders of the state of Haryana for their valuable input towards the completion of the earmarked project tasks.

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

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

ASSOCHAM - The Associated Chambers of Commerce and Industry of India

AgDSM - Agriculture Demand Side Management

AMRUT – Atal Mission for Rejuvenation and Urban Transformation

BEE - Bureau of Energy Efficiency

BLDC - Brushless Direct Current

CAGR - Compound Annual Growth Rate

CEA- Central Electricity Authority of India

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

HRIDAY – Heritage City Development & Augmentation Yojana

HAREDA – Haryana Renewable Energy Development Agency

MEEP – Municipal Energy Efficiency Programme

LED - Light Emitting Diode

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

RBI – Reserve Bank of India

SLNP – Street Light National Programme

SEEAP - State Energy Efficiency Action Plan

SEEI - State Energy Efficiency Index

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 state specific energy efficiency action plan to ensure that the allocation of resources is as per the requirement of State that will help in meeting state-specific goals on sustainable development.

The State Energy Efficiency Action Plan for a particular State developed by identifying focus sectors of the State and estimating the potential of energy conservation in sectors which are predominant in the region. The State Energy Efficiency Action Plan is developed for a short term-plan for a tenure of 5 years and a long-term plan targeting high-impact energy efficiency by the year 2030.
For the state of Haryana, SEEAP was developed under the guidelines of Bureau of Energy Efficiency, Ministry of Power, GOI and Haryana Renewable Development Agency (HAREDA) and inputs & suggestions from various government departments and sector experts were considered. The objective of the State Energy Efficiency Action Plan is to arrive at sector-specific approaches for energy efficiency for the state of Haryana.

In the fiscal year 2020, Haryana's total final energy consumption (TFEC) amounted to 21.61 Mtoe. The breakdown of TFEC reveals that the majority of energy was

consumed in the form of oil, accounting for 48.47%. The next most significant source of energy was imported coal, contributing 29.37%, followed by electricity consumption, which accounted for 19.99%. Non-power coal consumption for industrial purposes made up 0.97%, while gas consumption in state represented 0.84%.

Based on energy consumption and economic growth of state total final energy consumption of state is projected and it is estimated that TFEC of Haryana in FY2031 will be 59.17 Mtoe. On the basis of projected GSDP of the state and projected energy consumption, Industry, Buildings, Transport and Agriculture sectors were identified as focus sectors and sector specific strategies were analyzed. List of sector specific focused strategies to ensure that the allocation of resources is as per the requirement of the State is listed below:

Industry Sector:

- Deepening and Widening of PAT Scheme in Rice Mill & Textile
- Energy Efficiency Intervention in Foundry and Forging & Food Processing clusters

Transport Sector:

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

Buildings Sector:

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

Agriculture Sector:

- Transition of conventional diesel pumps to Solar powered pumps
- Replacement of old pumps (10 years old) or less efficient pumps (non-star rated) with 5 Star rated Pumps along with smart control panel

This action plan will result in a total energy consumption reduction of 1.9 Mtoe in the moderate scenario and 3.6 Mtoe in the ambitious scenario in FY 2031. This plan will also create awareness at the mass level and create a market potential of approximate rupees 6,610 Crore in the field of energy efficiency and reduce the CO2 emission 5.9 $MtCO_2$ in moderate scenario and 11.2 $MtCO_2$ in ambitious scenario by FY 2031.

Table 1 : Summary of Emissions & Energy Reduction Potential

Sector	**Emissions Reduction ($MtCO_2$) - FY2031**		**Energy Consumption Reduction (Mtoe) - FY2031**	
	Moderate	**Ambitious**	**Moderate**	**Ambitious**
Industry	0.003	0.007	0.001	0.002
Transport	4.143	8.987	1.32	2.87
Buildings	1.491	1.954	0.476	0.624
Agriculture	0.219	0.295	0.070	0.094
Total	**5.9**	**11.2**	**1.9**	**3.6**

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 Final Energy Consumption in FY 2020 was recorded at 533.44 Mtoe (as per Domestic Conversion Factors) with coal and crude oil being the largest contributors to the total energy consumption. India's per capita energy consumption and per capita emissions are well below the global average per capita emissions. However, India continuously taking steps to reduce the energy consumption and emissions and ensure sustainable growth of nation.

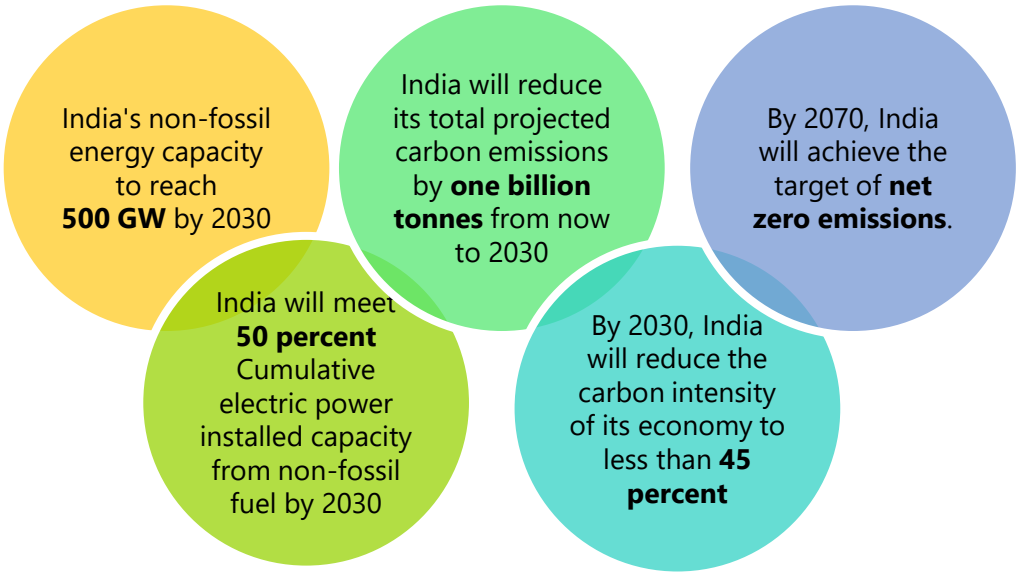
India has set ambitious economic goals for the future and achieving these goals is expected to result in significant increase in the country's energy demand and emissions. In view of this, India has also set ambitious goals for energy and climate performance. The country has also emphasized the importance 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 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

[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*

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 recent 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 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 actively participate in the schemes to facilitate the achievement of the overall goal of reducing the energy intensity of the country.

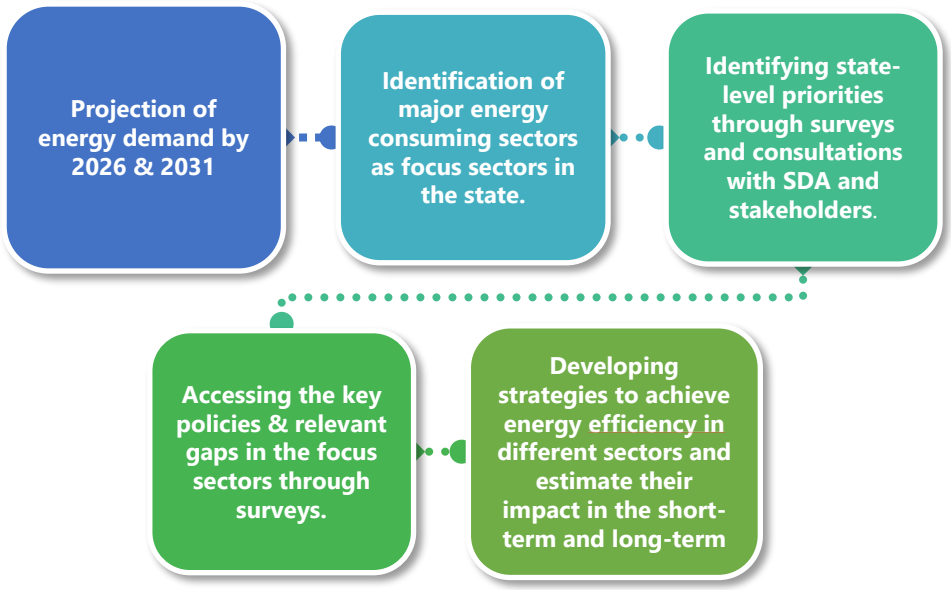
On 1st November 2021, during the 26th United Nations Climate Change Conference of the Parties (COP26) in Glasgow, Prime Minister Narendra Modi introduced the idea of 'Lifestyle for the Environment (LiFE)'. He urged individuals

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 more eco-friendly practices.

1.3. About SEEAP

The State Energy Efficiency Action Plan for Haryana is being developed by identification of focus sectors, to ensure that the allocation of resources is as per the requirement of Haryana and estimate the potential of energy conservation in sectors that are predominant in Haryana. The State Energy Efficiency Action Plan has been developed in two parts, a short term-plan for a tenure of 5 years and a long-term plan targeting high impact energy efficiency by the FY 2031 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 Haryana and will be implemented by them in the state after its adoption.

Expected Outcomes of State Energy Efficiency Action Plan (SEEAP)



1.4. State Profile

In the northern part of the country, Haryana is a rendezvous for diverse races, cultures, and faiths. The state capital is Chandigarh, and the most populous city is Faridabad, a part of the National Capital Region. The city of Gurgaon is among India's largest financial and technology hubs. Haryana is spread over an area of 44,212 km^2.

Figure 1: Geographical Location of Haryana on the Map of India

According to the 2011 Census of India, Haryana has a population of around 253.51 Lakhs, and the given projected population for the year 2020 is 290.77 Lakhs and a decennial percentage increase (2011 census) of 12.81%. In the same year, the state has a population density of 573 persons per km^2, fostering a per capita electricity consumption of 1805 kWh. As per Haryana Statistical Abstract, per capita electricity consumption has escalated from 1322 kWh in 2016-17 to 1805 kWh in 2019-20, indicating a growth of 36.53%. Given the growing needs of the State economy, the Government has taken steps to provide an uninterrupted power supply to the State. Haryana Power sector comprises four wholly State-owned Corporations viz HPGCL, HVPNL, UHBVNL, and DHBVNL, which after unbundling of the HSEB in 1998, are responsible for power

generation, transmission, distribution, and trading in the State. These utilities and the HERC work under the administrative control of the Department of Power.

1.5. State Energy Scenario

For any economy, power is the lifeline, as it is the crucial input for almost all the sectors agriculture, industry, services, etc. Agriculture has always been one of the most significant contributors to the Haryana economy; simultaneously, economic policies have attracted industrial activities and services, thereby raising the power demand. The priority in the energy sector in Haryana is mainly to maintain an uninterrupted power supply and take care of the increasing power demand. The energy source and consumption sector relationship are depicted in the figure mentioned below:

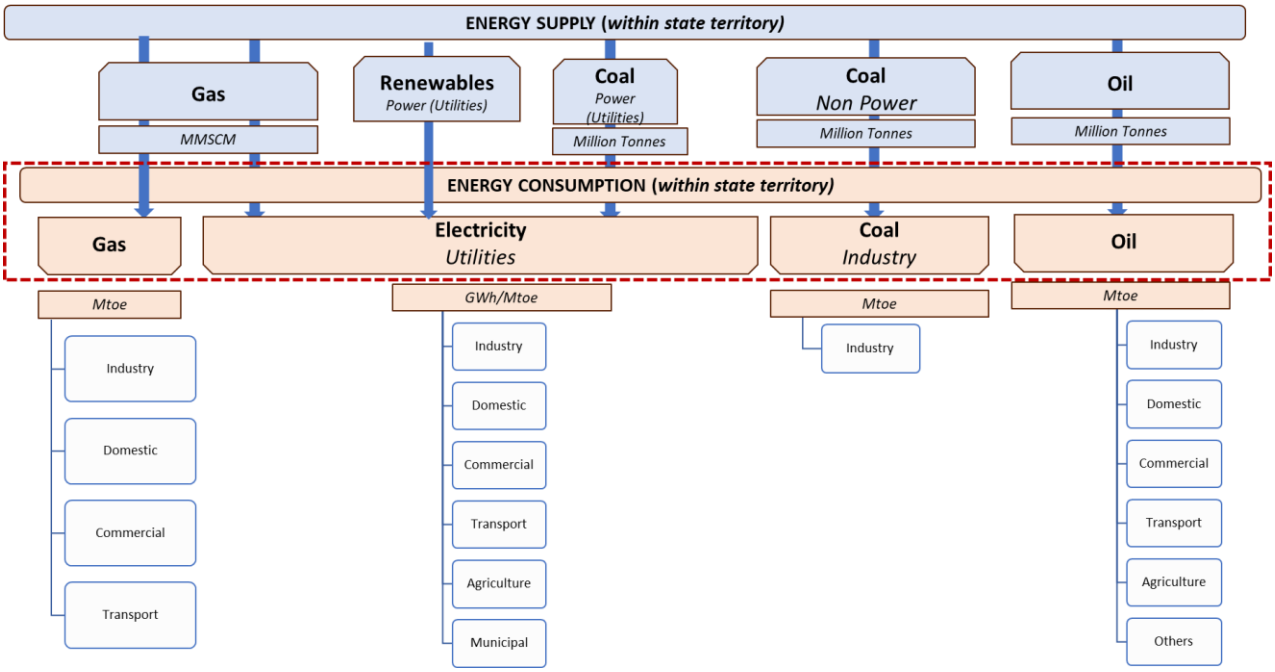


Figure 2: Energy Flow Diagram for Haryana

The state has seen a streamlined growth in power demand in the past years. The installed power plant capacity of the state inclusive of renewable and non-renewable sources has increased with a CAGR of 1.74% from FY 2015 to FY 2020.

The installed power plant capacity (including installed capacity within and outside the state of Haryana) is mentioned in the below figure.

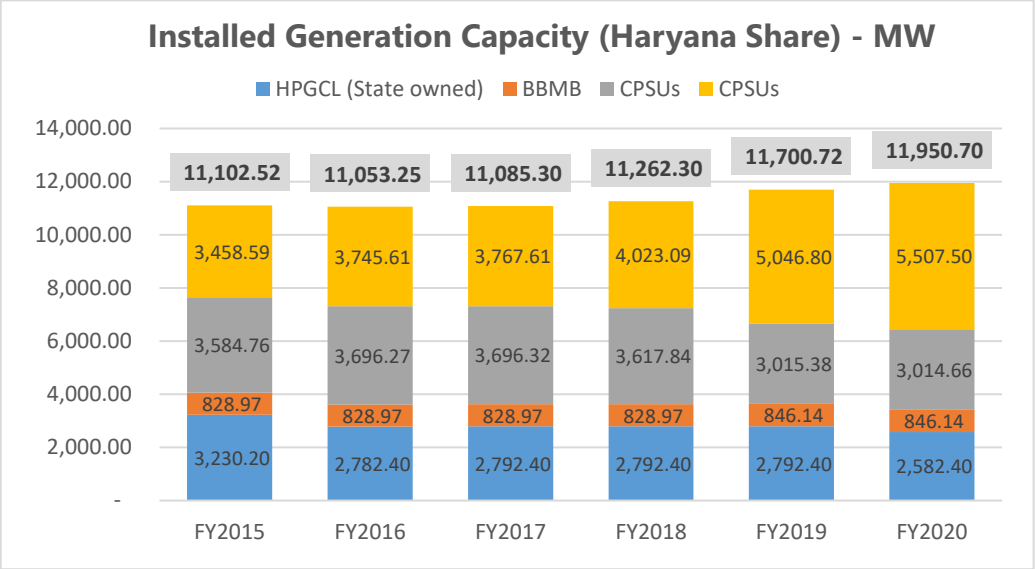


Figure 3: Installed Generation Capacity (Haryana Share) in MW[3]

In FY2020, the largest share of installed capacity of power plants was attributed to Independent Power Producers (IPPs), which accounted for a significant 46% of the total capacity, equivalent to a substantial 5,507.5 megawatts (MW). This dominance of IPPs in the power generation landscape reflects a growing trend in the energy sector, driven by various factors such as increased private sector participation, favorable government policies, and the need for a diversified and reliable power supply.

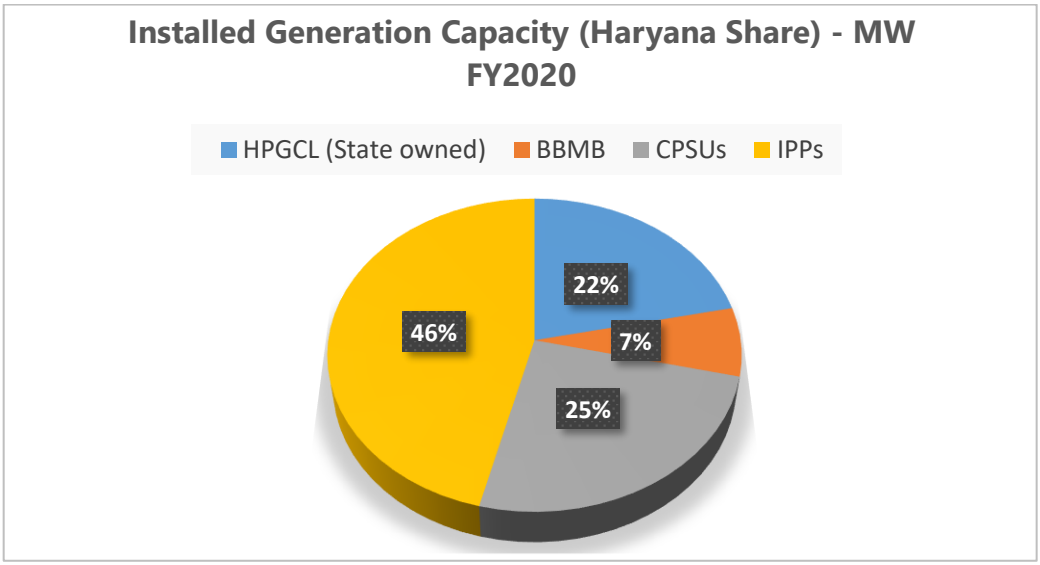


Figure 4: Share of Installed Capacity (MW) in FY2020

[3] *https://herc.gov.in/AnnualReport/1.aspx*

Under the governance of state-designated agency HAREDA (Department of New & Renewable Energy), several projects to boost the production of solar power have been initiated like installing a solar plant of capacity 45 kW in Haryana Raj Bhawan and smaller solar plants with of capacities 4.5 kW at district collectorates around the state and many more.

The State of Haryana has been experiencing a significant shift towards renewable energy sources. As of FY2020, renewable energy has become a substantial part of the installed capacity, with a diverse mix of solar, bio power, and small hydro contributing to this transformation. Solar power has emerged as the leading renewable energy source in Haryana, constituting 47% of the total installed capacity (252 MW), whereas Bio Power and Small Hydro constitute 39% (209 MW) and 14% (73.5 MW) respectively.[4]

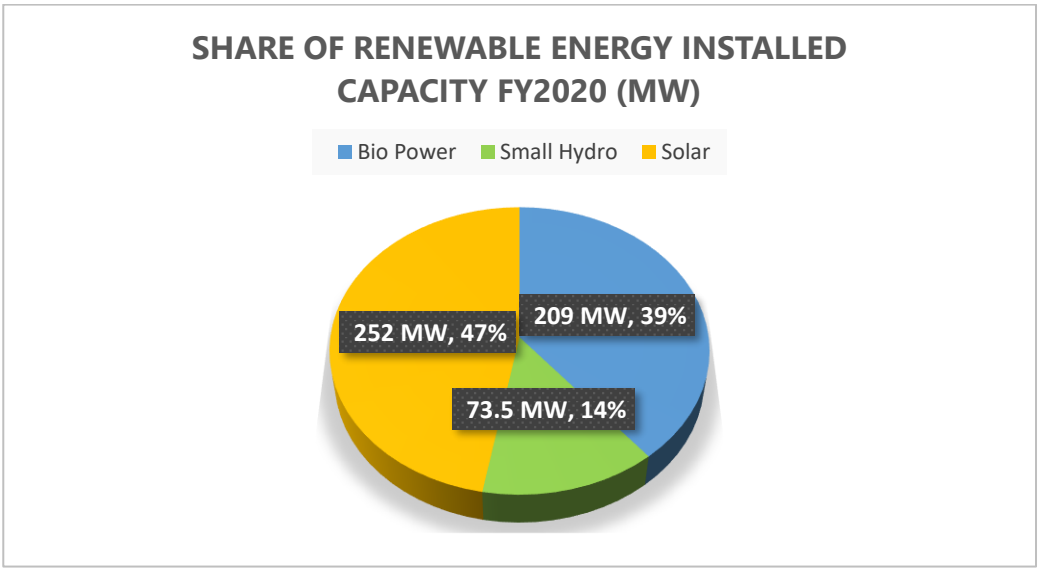


Figure 5: Share of Renewable Energy Installed Capacity (MW) in Haryana – FY2020[5]

1.6. Energy Consumption Scenario (TFEC)

The State of Haryana had 21.61 Mtoe total final energy consumption in FY 2020. TFEC is an energy consumption indicator which indicates the end use energy consumption in the respective energy guzzling sectors in the state and does not include the energy input in the power generation and transmission and

[4] *HAREDA; India Climate & Energy Dashboard (ICED)*
[5] *HAREDA; India Climate & Energy Dashboard (ICED)*

distribution (T&D) losses. TFEC is a sum of total end-use primary energy and electricity consumption in the sectors. Oil has the largest share of TFEC at 48.47%, followed by coal at 30.69 % and electricity at 19.98%. Gas consumption has the lowest share in the TFEC at 0.84%. The TFEC of the state has increased with a CAGR of 7.47% from FY 2015 to FY 2020.

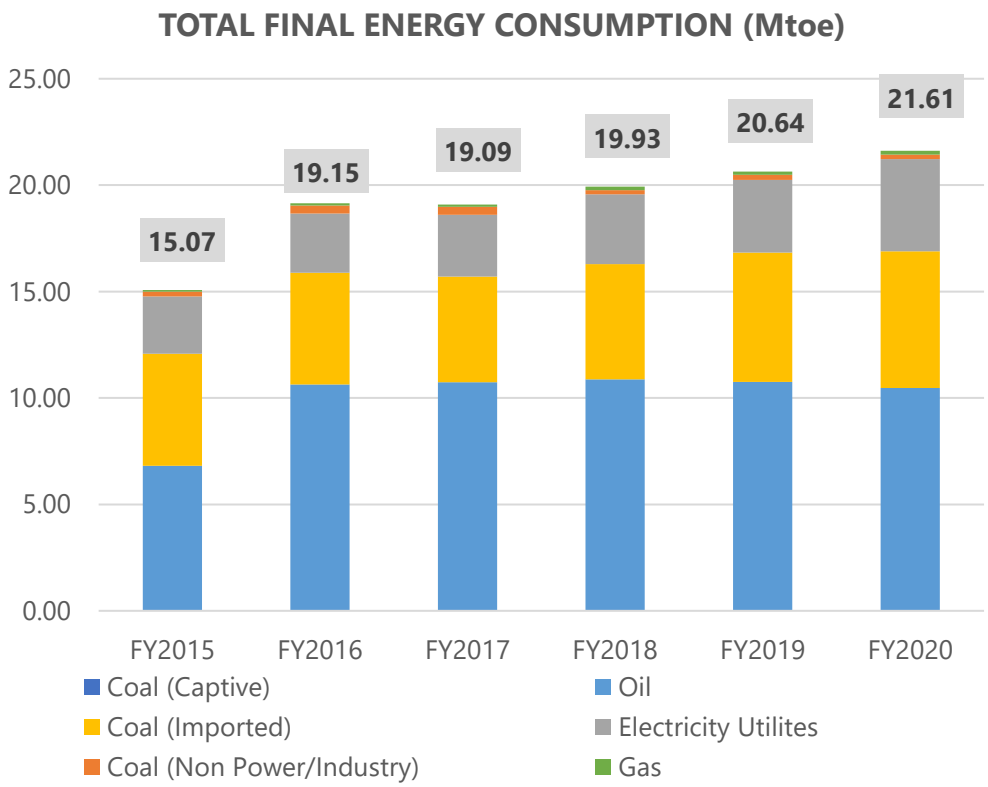


Figure 6: Source-Wise (TFEC) in Mtoe[6]

The coal consumption is classified into three different categories based on the purpose and the source of the coal:

1. Captive coal consumption refers to the use of coal by a company for its own consumption, rather than selling it to others. This can include coal used in industries for their own processes, such as in steel manufacturing, cement production, or chemical industries.
2. Coal consumption in non-power sectors refers to the use of coal in sectors other than power generation. This can include various industries, such as steel, cement, chemicals, and others.

[6] *Source: Coal - Coal Controller Directory, Oil & Gas - Ministry of Petroleum and Natural Gas (MoPNG), Electricity - Haryana Electricity Regulatory Commission*

3. Imported coal consumption refers to the use of coal that is brought into the country from other countries, rather than being produced domestically. The calculation of the imported coal consumption for Haryana involves taking the average percentage of the Gross State Value Added (GSVA) of the industry sector in the state and multiplying it by the total coal import of India, which is 248 million tonnes. This method provides an approximation of the quantity of imported coal that can be allocated to the Haryana in terms of consumption in Industrial sector. Imported coal forms about 4.66% of national imports and about 29.73% of Haryana state's total coal consumption.

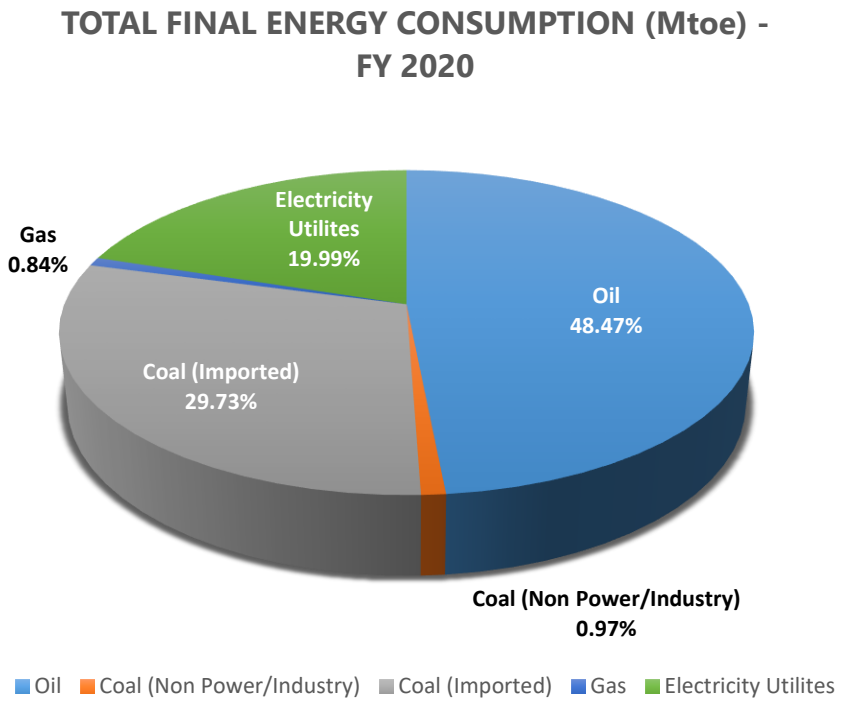
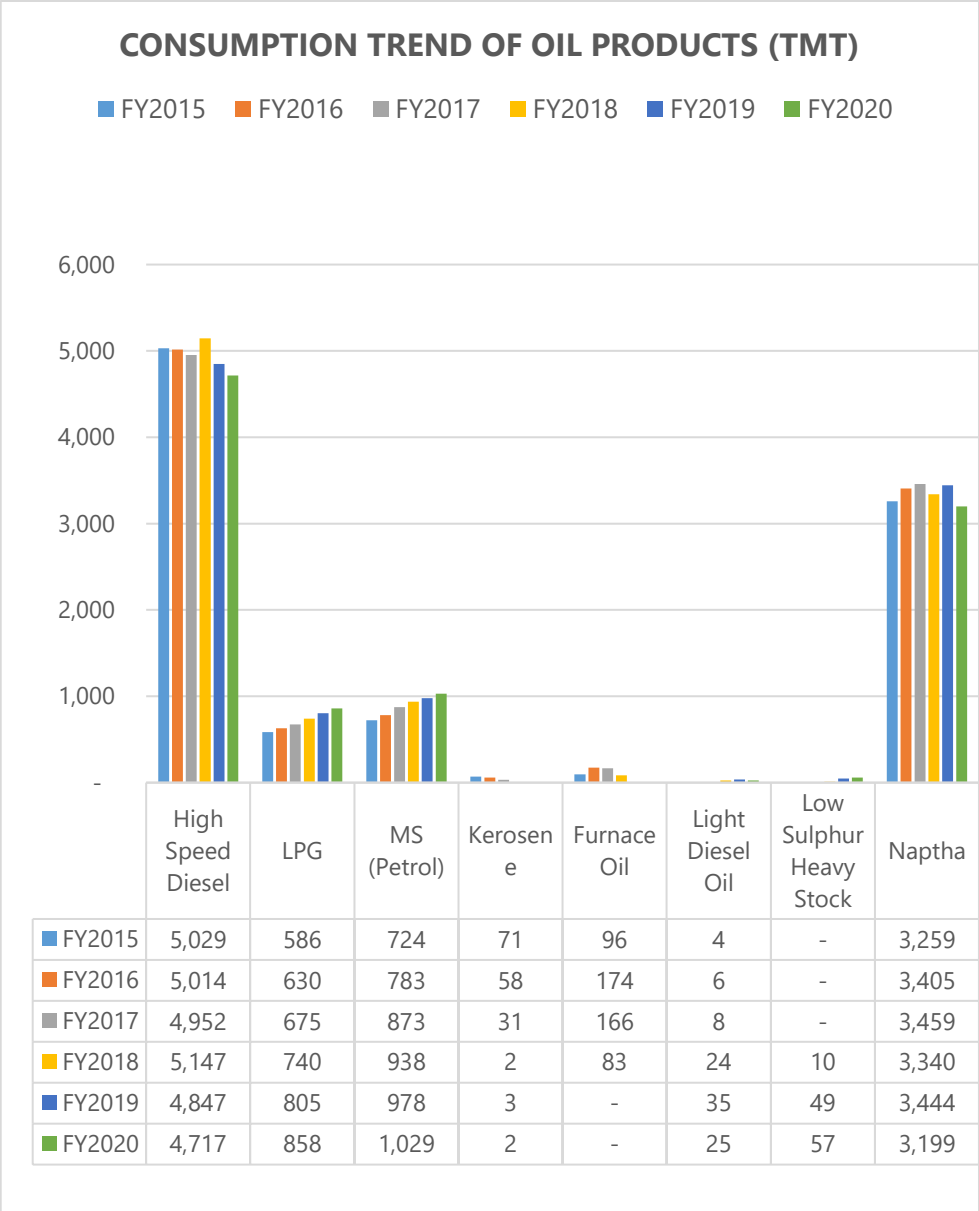


Figure 7: TFEC Break-Up for FY 2020

Oil consumption forms 48.47 percent of the total final energy consumption in the state. The majority of the oil consumption in the state is in the transport sector. The energy supplied from oil is in the form of different oil products, namely High-Speed Diesel Oil, Liquified Petroleum Gas (LPG), Petrol, Kerosene, Petcoke, Furnace Oil, Light Diesel Oil, Low Sulphur Heavy Stock and Naptha. Oil consumption has seen an increased trend from FY2015-2020 with the majority of the consumption being High-Speed Diesel, LPG and MS

(Petrol)[7]. Further, the use of clean cooking practice and aggressive outreach of LPG based cooking stoves leads to reduction in consumption of kerosene, petcoke and furnace oil from FY2015 to FY2020.



	High Speed Diesel	LPG	MS (Petrol)	Kerosene	Furnace Oil	Light Diesel Oil	Low Sulphur Heavy Stock	Naptha
FY2015	5,029	586	724	71	96	4	-	3,259
FY2016	5,014	630	783	58	174	6	-	3,405
FY2017	4,952	675	873	31	166	8	-	3,459
FY2018	5,147	740	938	2	83	24	10	3,340
FY2019	4,847	805	978	3	-	35	49	3,444
FY2020	4,717	858	1,029	2	-	25	57	3,199

Figure 8: Consumption Trend of Oil Products in the state

Increase in CNG fueling stations leads to increase in CNG vehicles in states which results increased rate of gas consumption in the state, with AAGR of 1.84% from FY 2015 to FY 2020.

[7] *https://mopng.gov.in/en/petroleum-statistics/indian-png-statistics (FY2020-21)*

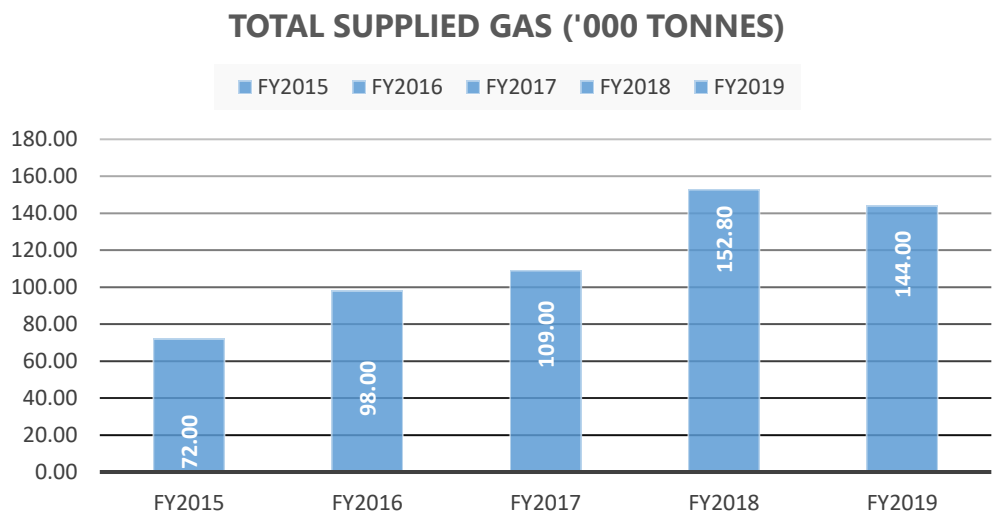


Figure 9: Gas Consumption Trend in Haryana

Electricity demand continues to increase in the state as new industry and building projects are in development and accessibility of electricity to the population is enhanced. The electricity consumption has shown an increase of nearly 48% in FY 2020 from its FY 2015 level, going from 31.36 TWh in FY 2015 to 50.23 TWh in FY 2020[8], with a CAGR of approximately 9.88 percent.

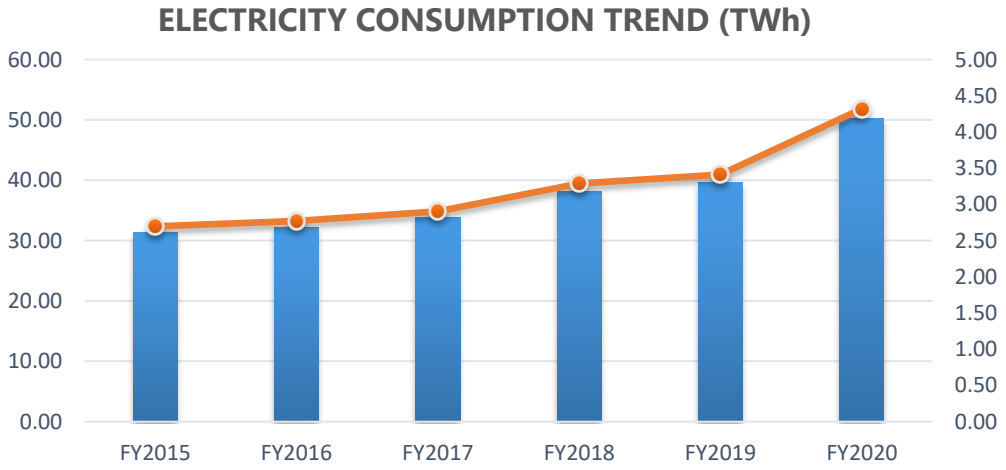


Figure 10: Electricity Consumption Trend (TWh)

[8]*Annual Reports of Haryana Electricity Regulation Commission (HERC)*

1.7.Overview of Institutional framework and stakeholder mapping

Haryana is the second state in the country to bring the power sector under regulatory purview.

Generation and transmission: Electricity generation is generating electric power from sources of primary energy. For utilities in the electric power industry, it is the stage before its delivery to end-users or storage. Transmission is the bulk movement of electrical energy from a generating site to an electrical substation. Haryana State Electricity Board was disintegrated into two corporate entities, viz. Haryana Power Generation Corporation Limited (HPGCL) for the Generation of Power and Haryana Vidyut Prasaran Nigam Limited (HVPNL) for the Transmission.

Distribution: Power distribution is the final stage in delivering electric power; it carries electricity from the transmission system to individual consumers. Uttar Haryana Bijli Vitran Nigam Limited (UHBVNL) and Dakshin Haryana Bijli Vitran Nigam Limited (DHBVNL) are two power distribution companies in Haryana.

Policy: The Department of New and Renewable Energy or Haryana Renewable Energy Development Agency is responsible for formulating policies and programmers necessary for popularizing the applications of various non-conventional and renewable sources of energy in the State. It is implementing various schemes concerning the utilization of solar energy, biogas, micro hydel, biomass Energy, etc.

Regulatory Body: The Haryana Electricity Regulatory Commission is designated to function as an autonomous authority responsible for regulating the power sector in the state. The current electricity institutional framework is as follows:

Table 2: Institutional Framework for Electricity in Haryana

Process	Utilities/ Governing Institution
Generation	Haryana Power Generation Corporation Ltd. (HPGCL)
Transmission	Haryana Vidyut Prasaran Nigam Ltd. (HVPNL)
Distribution and Trading	Uttar Haryana Bijli Vitran Nigam Ltd. (UHBVNL)
	Dakshin Haryana Bijli Vitran Nigam Ltd. (DHBVNL)
Policy	Department of New & Renewable Energy/HAREDA
Regulatory Body	Haryana Electricity Regulatory Commission

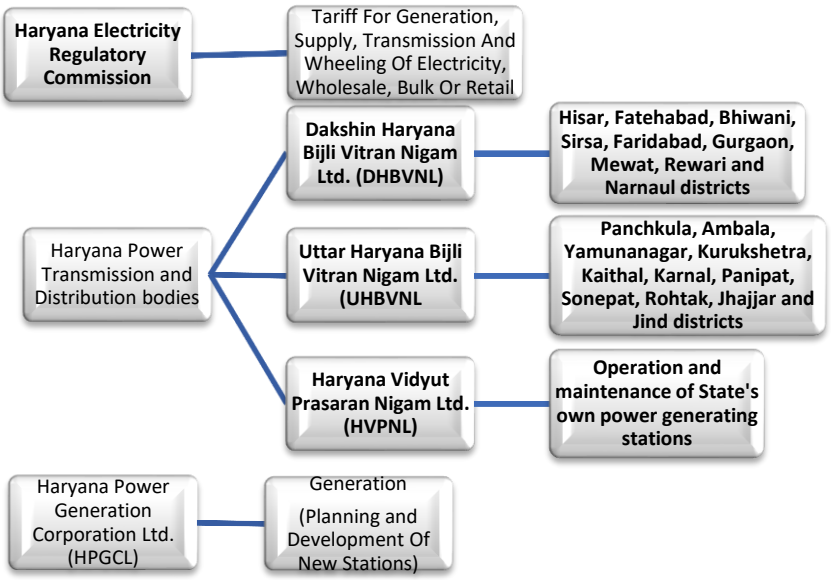


Figure 11: Institutional Framework of Haryana

Haryana Power sector comprises four wholly State-owned Corporations viz HPGCL, HVPNL, UHBVNL, and DHBVNL, which after unbundling of the HSEB in 1998, are responsible for power generation, transmission, distribution, and trading in the State.

2. Identification of Focus Sectors

The economic areas of a state can be broadly classified into sectors namely Industry, Buildings, Agriculture, Municipalities, Power and DISCOMs and Cross Sectors. The sectors can be further divided into sub-categories, as shown in the figure below:

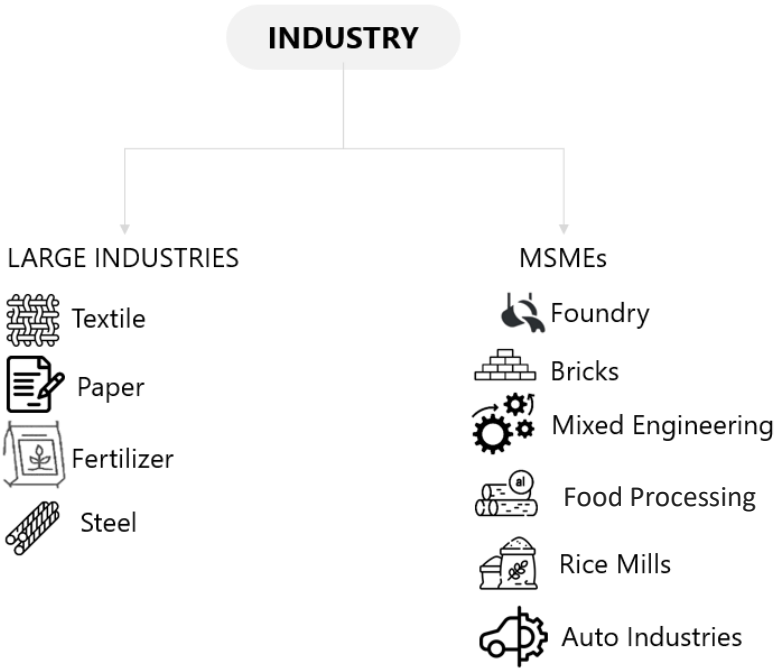


Figure 12: Sub-Sector categories of Industries sector

Identification of focus sectors or focus areas is important because it is a general characteristic of a state that a major portion of energy is being consumed by few energy-guzzling sectors. Focusing efforts towards these sectors is necessary to ensure that the allocation of resources is as per the state's priorities and towards sectors that have the highest potential for energy savings and emissions reductions.

The focus sectors of the state have been identified based on the share of energy consumption and emissions in the respective sectors, gap analysis of the respective sectors, inputs from stakeholder consultation, and priority areas of a state.

2.1. Methodology of Focus Sector Identification

In order to arrive at the focus sectors, the various factors were analyzed namely the energy consumption, emissions, Gross State Value Addition (GSVA). Adding to that, gap analysis in respective sectors, potential for energy efficiency and emissions reduction, state has planned efforts in prioritized sectors, and SDA and stakeholder inputs have been considered to arrive at the focus sectors.

Gross State Value Addition (GSVA)

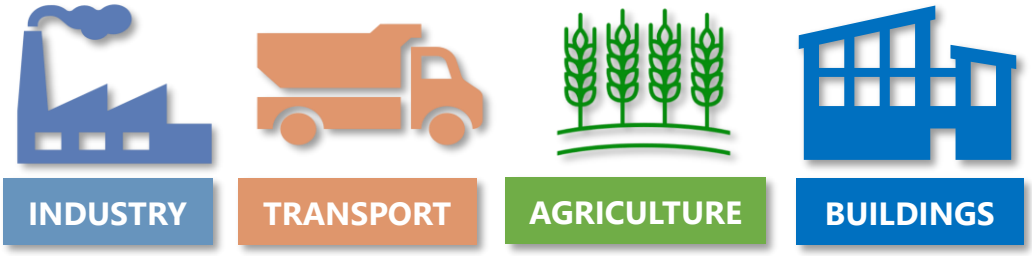
The Gross State Value Added (GSVA) of different economic categories was sourced from National Accounts Data, prepared by MoSPI. The GSVA sectors are not the same as the end use sectors used for the purpose of this report. However, these sectors have been used to deduce end use sectors for calculating imported coal and the same has been detailed in relevant sections. The GSVA sectors may also oftentimes not be representative of sectoral growth in terms of energy as the link between economic activity and energy use in several sectors is dependent on several factors, analyzing which is beyond the scope of this plan.

2.2. Identified Focus Sectors

The total final energy consumption for the state of Haryana is about 21.61 Mtoe for the FY 2020. In which Industry sector has the highest contribution of about 11.64 Mtoe, followed by the Transport sector accounting for 4.71 Mtoe. Building and Agriculture also holds a great amount of share in the energy consumption comprising 2.54 Mtoe and 2.10 Mtoe. The remaining 0.61 Mtoe is being shared by the other sectors like Municipalities and Cross-Sectors.

Based on the TFEC, electricity consumption in the state and its sectoral distribution, and priority of the state, focus sectors have been identified for the state. The focus sectors represent share of energy consumption through available data in Primary and Secondary Energy sources. It also reflects the views and recommendations of the stakeholders, existing and proposed policy infrastructure and vision of the state Government for different 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

Haryana. For the fiscal year 2020, the focus sector including Industry, Transport, Buildings, and Agriculture are estimated to have the highest share of the total energy consumption in the state.



3. Projections and Forecasting

Economic and energy projections for the state up 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 sectoral energy consumption projections form the basis of the expected emissions and emissions intensity of the state in the target year FY 2031, which is important in developing the emissions reduction targets for the state and in aligning the state with the national goals.

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

The Gross State Domestic Product (GSDP) of the State of Haryana was recorded at INR 5.37 Lakh Crore in FY 2020 and is projected to reach INR 13.20 Lakh Crore in FY 2031, at constant prices of 2011-12. The GSDP for the period FY 2023-FY 2031 is being forecasted in the document Government of Haryana Vision 2030[9].

The Total Final Energy Consumption (TFEC) has been projected for all sectors up to FY 2031 taking into account the historic energy consumption trend from FY 2015 to FY 2020 along with the historic and projected GSDP growth for Haryana.

Using the above-mentioned factors, the Business-as-Usual (BAU) growth rate factors are calculated for all the sectors in order to project the future energy demand by FY2031. The Total Final Energy Consumption of the state in the Business-as-Usual (BAU) scenario is projected to reach 59.17 Mtoe in FY 2031 from 21.61 Mtoe in FY 2020, with a projected CAGR of 9.22%.

[9] *https://cdnbbsr.s3waas.gov.in/s32b0f658cbffd284984fb11d90254081f/uploads/2020/08/2020080664.pdf*

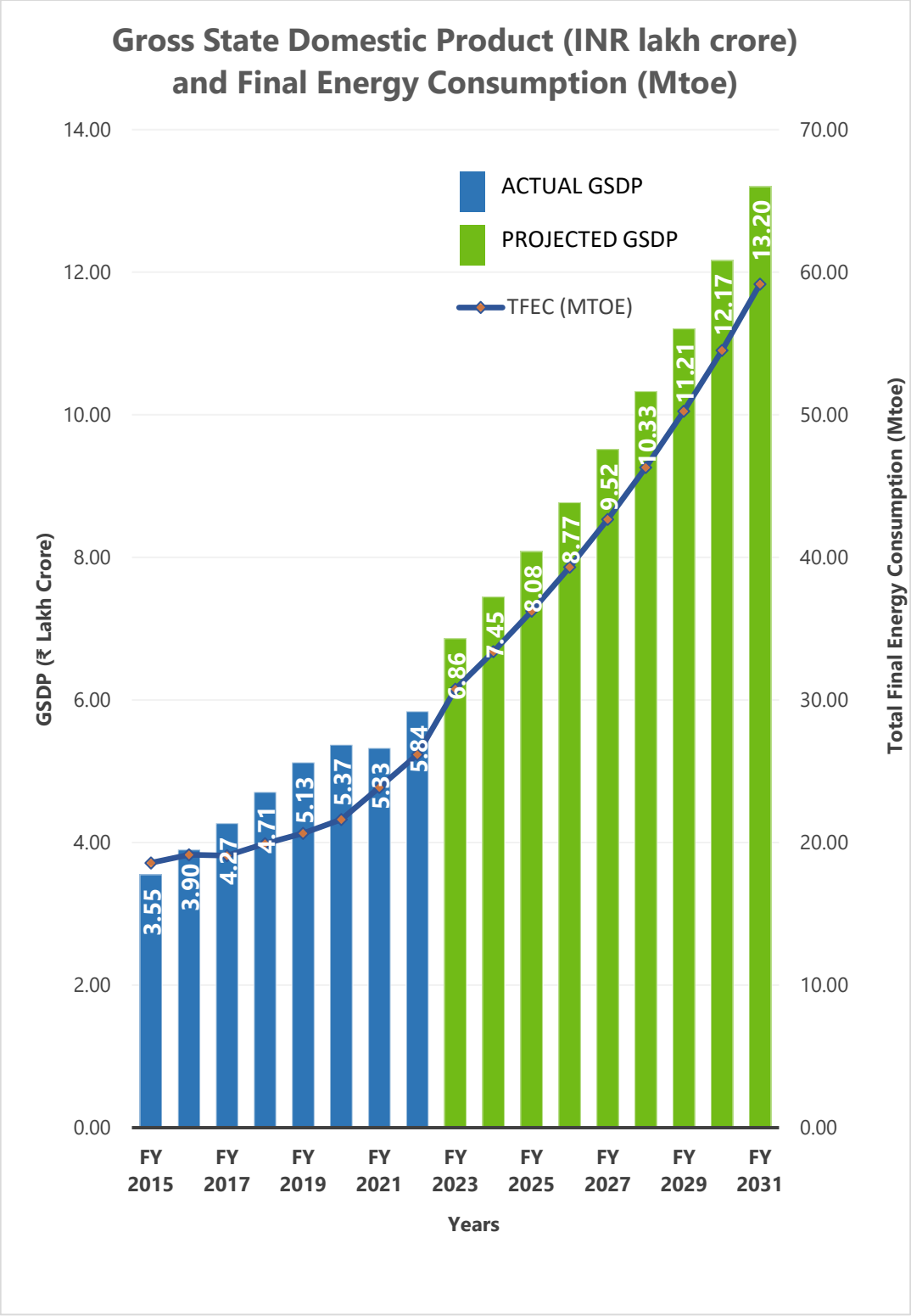


Figure 13: GSDP and TFEC Trend

INDUSTRY SECTOR

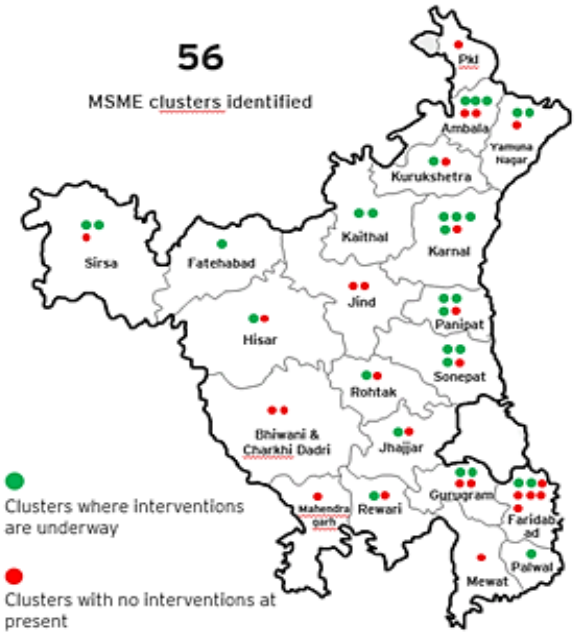
4. Focus Sector 1: Industries

4.1. Current Scenario

Haryana has emerged as a preferred investment destination for national and international investors. The state is a vibrant and fast-growing, attracting investors for profitable investments. It is enjoying the advantages of various aspects such as proximity to the NCR region, good law and order condition, quality infrastructure, skilled manpower, conductive policy environment etc. The following are the major industries in Haryana:

- Agro-based, food processing and allied industry.
- Automobile and automotive components
- Footwear and accessories
- Handloom and textile
- Steel
- Foundry

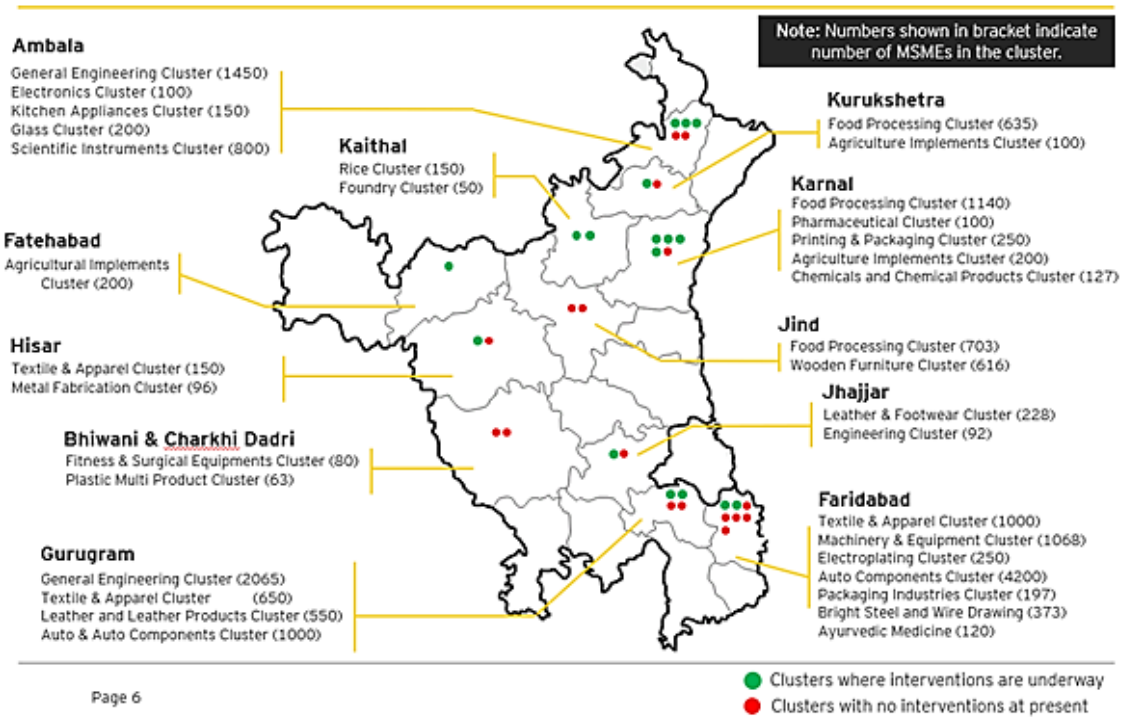
The manufacturing MSME spectrum in the state comprises both state of the art mediumenterprises (majorly located in Panipat, Faridabad and Gurugram) as well as a large number of traditional micro and small enterprises (majorly located in Panchkula, Ambala, Karnal, Rohtak, etc).

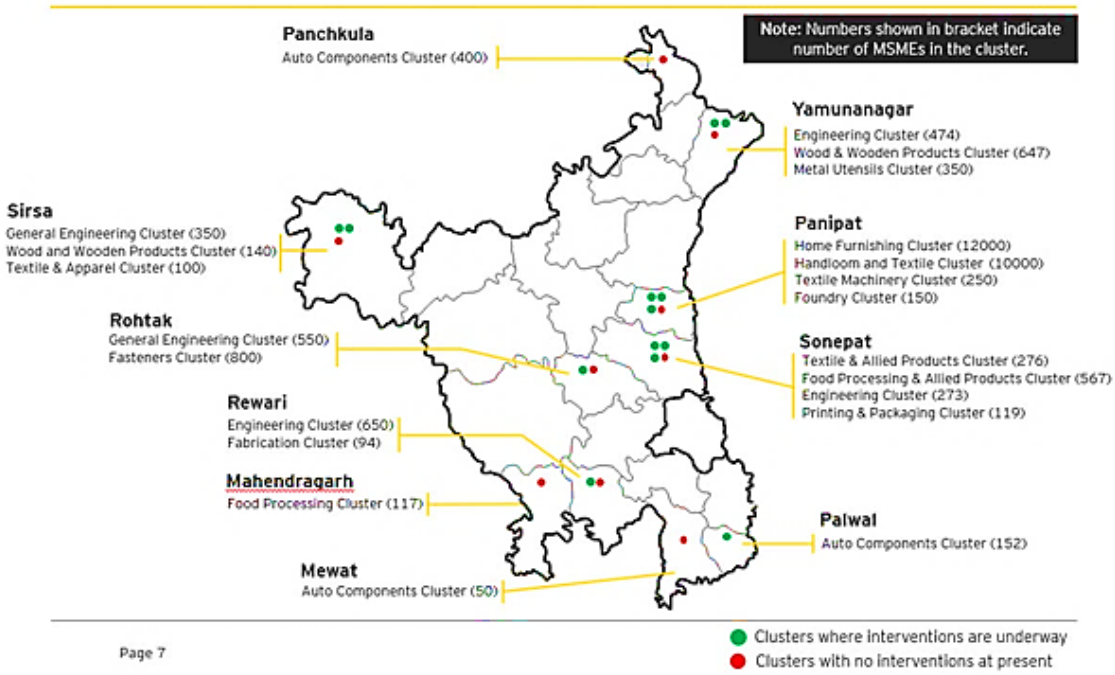


S. No.	District	Identified Clusters
1.	Ambala	5
2.	Bhiwani & Charkhi Dadri	2
3.	Faridabad	7
4.	Fatehabad	1
5.	Gurugram	4
6.	Hisar	2
7.	Jhajjar	2
8.	Jind	2
9.	Kalthal	2
10.	Karnal	5
11.	Kurukshetra	2
12.	Mahendragarh	1
13.	Nuh	1
14.	Palwal	1
15.	Panchkula	1
16.	Panipat	4
17.	Rewari	2
18.	Rohtak	2
19.	Sirsa	3
20.	Sonepat	4
21.	Yamunanagar	3
	Total	**56**

Source: www. msme.haryana.gov.in/clusters

As per the Directorate of Micro, Small & Medium Enterprises, there are a total of 56 MSME clusters in 21 districts of State of Haryana.





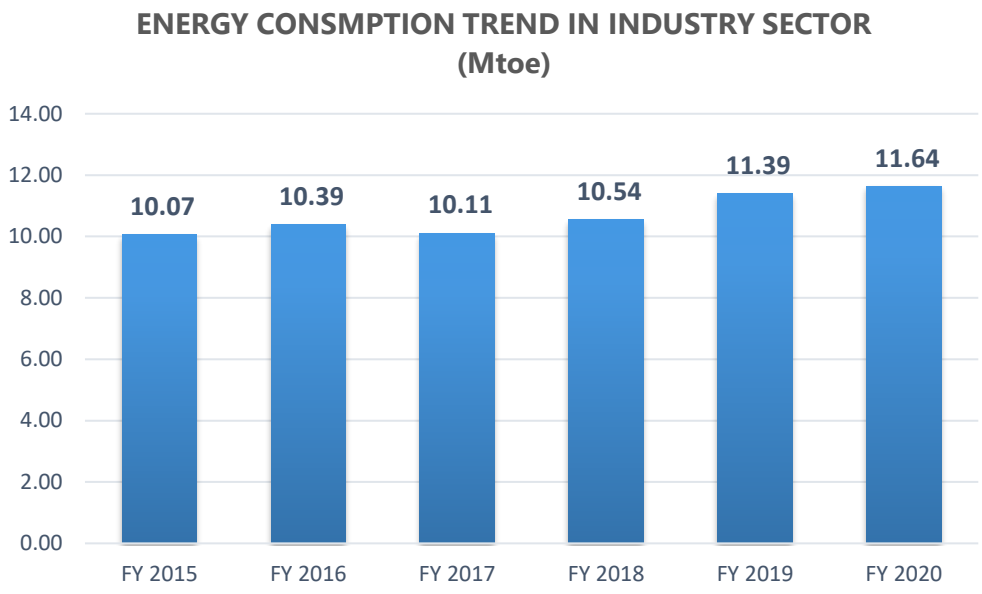


Figure 14: Energy Consumption Trend in Industry Sector

The figure above depicts the energy consumption trend in the industry sector. The imported coal has been allocated to the industry sector; however, it may be consumed in the thermal power plants. The coal captive, coal non-power and industry has also been allocated to the industry sector. The electricity consumption of the industry sector has also been added to the total energy consumption of the industry sector.

4.2. Energy Efficiency Strategies in the Industry Sector

This section presents the proposed strategies in the prominent sectors and focus areas identified in the industry sector along with their impact in terms of energy efficiency and emissions reduction. Strategies are proposed with their relevant action items.

Strategy #1: Deeping and Widening of Perform, Achieve and Trade Scheme

Implementation Timeline: Long Term (Till FY 2031)

The analysis performed to determine the coverage of Perform, Achieve, and Trade (PAT) in Haryana revealed that as of FY 2019, the industries covered under the PAT scheme have a share of 37.05% in the total energy consumption in the industry sector.

In the proposed strategy, it is recommended that the state enhance coverage of energy consumption in PAT industries (DCs) by deepening and widening the PAT scheme in the state. Deepening and Widening of PAT scheme would imply notifying more industries as designated consumers under the current PAT sectors by lowering the threshold limit for eligibility (toe/annum), as well as the inclusion of new sectors under the PAT scheme. There are 24 Designated Consumers (DCs) have been notified in the state. Introduction of new sectors such as Dairy, Food Processing, rice mills etc. in the PAT scheme can be targeted for Haryana where these sectors are prominent. There are 451 Rice Milling units in Haryana.[10] District Karnal owns maximum Rice Mills including 8 large/medium units & 19 exporting units and 63 units in Taraori with others in Assand, Biana, Gharanda, Gheer, Indri, Jundla, Kunjpura, Nilokheri, Nissing & Nigdu. In the strategy of deepening and widening, deepening can be done through reducing the threshold of textile industries so that more units can be covered under the PAT scheme.

Moderate and Ambitious SEC assigned to Textile non-PAT units, and to Rice Mills. It is assumed that the existing units of both sectors will achieve the moderate SEC target in 50% units and achieve the ambitious SEC target in 70% units.

Table 3: Energy Savings in Moderate and Ambitious Scenario

Sector	Baseline SEC (toe/tonne)	Moderate SEC (toe/tonne)	Ambitious SEC (toe/tonne)	Production in 2031 ('000 tonnes)	Energy saving in moderate scenario (Mtoe)	Energy saving in ambitious scenario (Mtoe)
Rice Mills	0.06	0.054	0.048	8018	**0.0001**	**0.0002**
Textile	1.49	1.35	1.20	4689	**0.0007**	**0.0014**

Actionable items:

1. **Partial Risk guarantee program to encourage implementation of latest energy efficient technologies in the sectors (Over and above existing schemes with state contribution)**

[10] *Department of Industries and Commerce, Haryana*

A Partial Risk Guarantee (PRG) program can be an effective tool for encouraging the implementation of the latest energy-efficient technologies in various sectors. The program involves providing a guarantee to a lender or investor, which covers a portion of the risk associated with financing the adoption of energy-efficient technologies.

Under the program, the lender or investor can provide financing at a lower cost, as the risk is partially covered by the guarantee. This helps to reduce the cost of financing for the borrower, making it more affordable to implement energy-efficient technologies.

BEE, under its existing PRGFEE scheme has already released guidelines for partial risk guarantee that may be adopted by the state for effective implementation.

2. **Capacity Building of Energy Managers and Energy Auditors in PAT DCs and new probable sectors for compliance with scheme and new technologies.**

   Though its mandatory to go through a refresher training for all energy auditors and managers, it is important to attain knowledge of changing schemes and policies that could positively impact large consumers and help them implement schemes in their respective organizations.

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

   Though separate guidelines are issued for PAT industries, non-PAT, non-MSME industries could also benefit from energy audits. This shall not only ensure their improved energy performance, but also, ensure that if brought under PAT scheme at a later stage, they would be accustomed and more willing to participate in it. The audits will also improve competitiveness of these industries. A monitoring mechanism may be developed to see the impact of energy audits and advise industries in a constructive way from time to time.

4. **Development of mechanisms for B2B interaction with global technology suppliers.**

Global technologies are often beyond the reach of domestic industries due to several reasons. A platform to improve competitiveness and efficiency in energy may be provided under a structure to ensure advancement of manufacturing process and improvement in energy efficiency at the same time.

Strategy #2: Energy Efficiency Interventions in MSME Clusters

Implementation Timeline: Short Term (Till FY 2026) for lower coverage; Long Term (Till FY 2031) for higher coverage.

The strategy is proposed for the Small and Medium Enterprises (SME) sector, which consists of MSMEs in identified prominent sectors such as Foundry, Food Processing, Automobile, mixed engineering, etc. A PAT-like scheme is proposed under this strategy for the unorganized and small industries sectors, which would not meet the threshold energy consumption under the conventional PAT scheme. The strategy would involve the implementation of energy efficient technologies and new & innovative decarbonization technologies in the market 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 0.0003 Mtoe and 0.0005 Mtoe by FY2031 in the moderate and ambitious scenarios respectively.

Table 4: Energy Savings in Moderate and Ambitious Scenario in MSME Clusters

Particulars	Moderate Scenario (Mtoe)	Ambitious Scenario (Mtoe)
Energy Saving Potential (Mtoe)	0.0003	0.0005

Implementing agency(s): Bureau of Energy Efficiency, HAREDA, Directorate of Micro, Small & Medium Enterprises

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. **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 state annually to set benchmarks and track progress in the implementation of this strategy.
2. **Implementation of Demonstration Projects on energy efficient 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.
3. **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.
4. **Periodic standardized energy audits for MSMEs on load basis and reimbursement of energy audit cost with a maximum cap** – Government of Haryana may 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 of Haryana is providing reimbursement of energy audit cost with a maximum cap of 50,000 Rs. with undertaking to implement ECMs recommended in energy audits. This can be increased up to 75% reimbursement or INR 1 Lakhs. Monetary support to small industries and MSMEs can be provided to maintain the standard of conducted energy audit. Further, subsidy on cost of capital equipment required for undertaking measures to conserve energy, 50% in "D category blocks, 40% in C' category blocks, 30% in 'B' category blocks and 20% in 'A' category blocks, subject to maximum of INR 20 lakhs once in every 5 years.

The below table summarizes the subsidy in each category:

Category	Subsidy	Maximum Amount	Frequency
Energy audit	75% reimbursement or INR 2 lakhs	INR 2 lakhs	One every 3 Years
Cost of capital equipment	20% in 'A' category blocks	INR 20 lakhs	Once in every 5 years
	30% in 'B' category blocks		
	40% in 'C' category blocks		
	50% in 'D' category blocks		

Note: No subsidy is available for units for energy audit in case audit recommendations are not implemented.

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 State Government shall issue directives to all units in state which are above a limit of connected load, to implement ISO 50001 and adopt Energy Management System in organizations. Implementation of ISO 50001 can help organizations identify and address energy efficiency opportunities, reduce energy consumption and costs, and improve their environmental performance.

6. **Technical assistance for transition from inefficient (installed before 2010) boiler to Energy Efficient boilers, use of steam traps, heat recovery systems and use of EE motors with different drive and other ECMs-**
   State government departments through energy efficiency cell or ESCOs can provide technical support to MSMEs for transition from inefficient or old technology-based boiler with latest technology-based energy efficient boilers in Food Processing units. Steam Traps and heat recovery systems can also be used in Food and Pharma industries. In Light Engineering clusters, support in replacement of motors & drives along with Installation of energy saver for welding machines can be provided. These technology changes can reduce the energy consumption of MSME sectors.
7. **Technical assistance for upgrading the Furnaces for energy savings, use of recuperator for waste heat recovery from hot flue gases of furnace and insulation of furnace -** State government departments through energy efficiency cell or ESCOs can provide technical support to MSMEs for transition from inefficient or old technology-based furnace with latest technology-based energy efficient furnace in Food Processing units. The waste heat available with high temperature flue gases can be recovered using metallic recuperator which can preheat the combustion air. There is also a huge potential of energy savings in using ceramic insulations in the box type of furnaces.
8. **Phase wise plan to implement DSM scheme for replacement of existing inefficient (non-star rated) pumps and motors through DISCOMS-**
   State government department may develop a demand side management (DSM) plan to replace all existing pumps, which are lower than 3 star-rated or purchased/installed before 2015 with BEE 5-Star rated appliances. Phase wise plan can be executed through DISCOMs or listed ESCOs in the state.
9. **Awareness and Capacity Building Workshops for Clean Energy Technologies in MSMEs**
   Organize workshops and training sessions focused on clean energy technologies for MSMEs. Collaborate with industry experts, technology providers, and research institutions to deliver comprehensive capacity

building programs. Provide practical guidance on implementing energy-efficient practices, including energy auditing, equipment optimization, and process improvements etc.

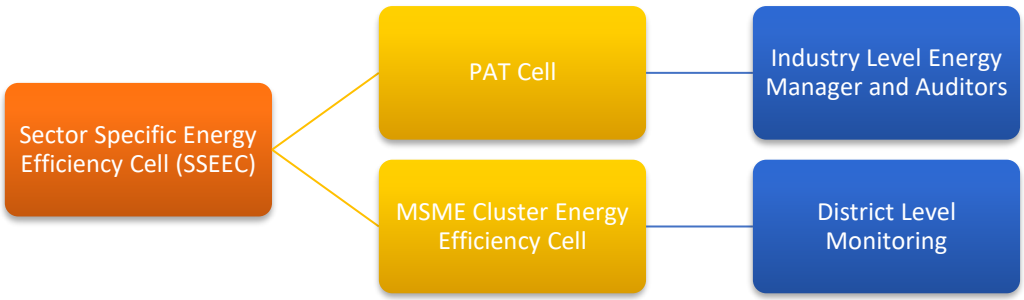
4.3. Energy Saving Targets and Monitoring Mechanism

The proposed strategies can together achieve maximum potential energy savings of 0.0022 Mtoe by FY 2031.

Table 5: Energy Savings in Industry Sector

Action Plan	Energy Savings in 2031 under moderate scenario (Mtoe)	Energy Savings in 2031 under ambitious scenario (Mtoe)
Deepening and Widening of PAT Scheme	0.0008	0.0016
Energy Efficiency Intervention in MSME clusters	0.0003	0.0005
Total	**0.0011**	**0.0022**

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.



1. Sector-Specific Energy Efficiency Cell (SSEEC): The operation of this cell will be different from the state SDA. It will be responsible for the progress of energy efficiency measures across the state in the designated sectors. It will also be responsible for collecting all the data from the Cluster Level Energy Efficiency Cell of the state. It will

share the same with the state SDA for target achievement. The cell will share the data with SDA on a quarterly wise.

2. PAT Cell: The operations of PAT cell will remain same to the existing working scenario. The cell will be responsible for developing the dashboard for monitoring the energy savings achieved and SECs for the different sectors in the state. It will coordinate with the concerned stakeholders and the industry level energy managers/auditors for the better implementation of this measure and for collecting the required information. The cell will share the data with the SSEEC every month.
3. MSME Cluster Energy Efficiency Cell: A cell under the SSEEC will be created for monitoring the energy savings, energy consumption and SECs of the dominant clusters in the state. The cell will be responsible for developing the portal for monitoring the above-mentioned and other parameters required for promoting and implementation of the energy efficiency measures in the MSMEs. It will coordinate with concerned stakeholders and district level associations for the implementation of the EE measure. The cell will gather the information and will share it with SSEEC on a monthly basis.
4. District Level Monitoring: This cell will work with the block level authority/agency for the monitoring of the energy efficiency measures, along with the energy consumption data should be provided monthly to above-mentioned cells in the state.

Transport Sector

5. Focus Sector 2: Transport

5.1. Current Scenario

Due to emerging of Haryana as one of the most vital business centers in India, the government of Haryana has invested a lot in recent years to provide proper transportation facilities to the people. The common modes of transportation in the State of Haryana are roadways, railways and airport through which the state is very well connected to the other stats in India. The number of registered motor vehicles has shown a persistent increase over the year. As per the data available from the Department of Transport an average increment of 8.4% is observed in 2019 when compared with the base year 2015. Further, there has been a steady increase in private vehicles under the four wheelers and two-wheeler category, which exhibits a potential of positive electrical vehicle transition in Haryana. It may also be noted that, in commercial vehicle category, the vehicle used for good carriages owns 48% of the total share; however, considering the market availability of EVs for this category in the whole country, this transition will require some time and can be a part of the long-term strategy towards achieving the desired target of Panchamrit.

In addition, to achieve the desired target of Panchamrit, the state of Haryana has to define a policy, which targets an annual transition rate of 7% from their conventional fuel-based vehicle with EVs. The commercial vehicles will be required to be converted to EV by 2030 to achieve the desired target of Panchamrit. The Haryana government has set the Target to convert 100% of bus fleet owned by State Transport Undertakings in the state into electric buses (Battery Electric Vehicles or Fuel Cell Electric Vehicles) by 2029, with the first phase of 100% conversion of bus fleet in Gurugram and Faridabad by 2024.

The breakdown of vehicle types reveals that two-wheelers constitute the largest share, accounting for 86.01% of all vehicles. Heavy Vehicles comes in at a close second, making up 3.94% of the vehicle category. The Haryana EV Policy aims to

target all types of vehicles and promote the transition of a significant percentage of vehicles into electric vehicles.

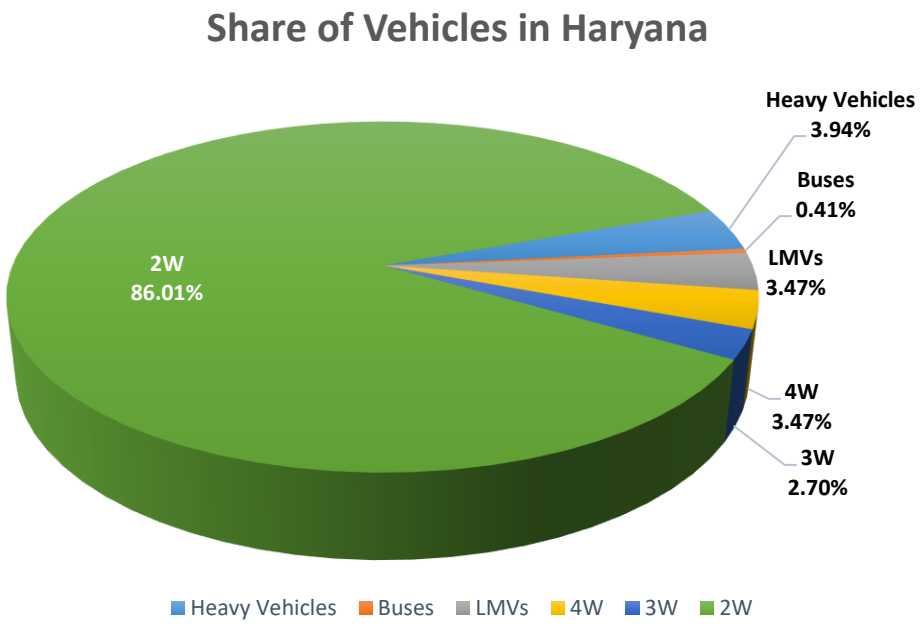


Figure 15: Percentage Share of Vehicles in Haryana for FY 2020

5.2. Strategies in the Transport Sector

The Haryana EV Policy 2019 has proposed a long-term strategy for the transition to electric vehicles in the state. The strategy covers various aspects of the transport sector, including providing incentives to consumers for transitioning to EVs, converting the state's different types of vehicles into electric vehicles, transitioning to electric logistics transport, and developing a network of charging stations across the state. Ethanol blending in petrol is proposed as another strategy to bring about emissions reduction in the transport sector. The strategy has been proposed in line with the national policy on ethanol blending.

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

Implementation Period: Long Term (Till FY 2031)

The transition to Electric Vehicles (EVs) across all segments of vehicles will be instrumental in decarbonization of the sector and in bringing significant savings in fossil-fuel based energy consumption. In this strategy, it is proposed to convert

new vehicles registered in the state till FY 2031 to electric vehicles along two different scenario trajectories, namely moderate scenario and ambitious scenario. The highest EV conversion rate is proposed for 2-wheelers because of it having the highest share in registered vehicles and taking into consideration the availability and affordability of 2-Wheeler electric vehicles. The EV conversion considerations for moderate and ambitious scenarios are given in table below-

Table 6: EV transition considerations for moderate and ambitious scenarios

Moderate Scenario	Ambitious Scenario
• 30% of conventional 2-Wheelers convert to electric by 2031. • 30% of conventional 4-Wheelers convert to electric by 2031. • 50% buses in the state to transition to electric buses by 2031. • 30% of 3-Wheelers to convert to electric by 2031. • 50% of heavy vehicles (trucks and lorries) to convert to electric by 2031	• 80% of conventional 2-Wheelers convert to electric by 2031. • 80% of conventional 4-Wheelers convert to electric by 2031. • 100% buses in the state to transition to electric buses by 2031. • 80% of 3-Wheelers to convert to electric by 2031. • 100% of heavy vehicles (trucks and lorries) to convert to electric by 2031

The EV transition strategy can result in potential energy savings of 1.08 Mtoe and 2.39 Mtoe by FY2031 in the moderate scenario and ambitious scenario respectively.

Table 7: Energy Savings and Emission Reduction Potential

Particulars	Moderate Scenario	Ambitious Scenario
Energy Saving Potential (Mtoe)	1.085	2.394

Actionable Items:

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

   Several regulatory mechanisms can be put in place to develop EV charging infrastructure in the state of Haryana. 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 the state.
- Public-private partnerships: The government can enter into partnerships with private companies to develop and operate EV charging infrastructure. This can include agreements on revenue sharing, investment, and maintenance.
- Zoning regulations: The government can zone certain areas of the city for EV charging infrastructure, such as near highways or in commercial areas, to ensure that the infrastructure is developed where it is most needed.
- Time-of-use pricing: The government can introduce time-of-use pricing for EV charging to encourage drivers to charge their vehicles during off-peak hours when electricity is cheaper.

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

2. Pilot projects on Battery Swapping stations -

The Haryana EV Policy 2019 has proposed the establishment of battery swapping stations across the state. The state government aims to set up battery-swapping infrastructure at key locations such as public charging stations, commercial hubs, and along highways. The policy also proposes incentives for private players to set up battery-swapping infrastructure in the state. Establishing battery-swapping infrastructure is expected to increase the adoption of electric vehicles in the state by addressing range anxiety and reducing charging times.

The policy also includes the provisions for the development of charging infrastructure across the state. The policy aims to establish a network of charging stations in the state to support the growing number of electric

vehicles. The policy also includes provisions for setting up charging stations at public places like malls, parking lots, and petrol pumps to ensure easy accessibility for EV owners. The state government is also incentivizing private entities to set up EV charging infrastructure by providing financial assistance and other incentives. Additionally, the policy encourages the development of renewable energy-based charging infrastructure to promote sustainable energy usage in the state. Establishment of a wide network of swappable battery station is a key of success for EV infrastructure in the state. Pilot projects on battery swapping stations can provide valuable information and insights into the feasibility and effectiveness of this technology.

Battery swapping pilots can be tried in key Government offices and through private, especially IT buildings, with large car ownership. As UP has many highways, battery swapping stations could be setup along a major highway to demonstrate how this technology can enable long-distance electric vehicle travel. This pilot project can provide valuable data on how battery swapping affects driving patterns and charging behaviour. These pilot projects can provide valuable information on the practicality, cost, and user acceptance of battery swapping stations, which can inform the development and implementation of future policy initiatives.

3. 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.

Strategy #2 Ethanol Blending Program

Implementation Period: Long Term (Till FY 2031)

The Ethanol Blending Program is proposed to ensure mixing of ethanol in motor spirit (petrol) in a fixed ratio to offset a part of the energy consumed by petrol and bring about reduction in emissions. In the proposed strategy and in line with

the country's target of 20% blending of ethanol blending in petrol by 2031, a 10% blending target is suggested in the moderate scenario and a 20% blending target is suggested in the ambitious scenario.

The ethanol blending can lead to potential fossil fuel energy savings of 0.239 Mtoe and 0.477 Mtoe by FY2031 in the moderate and ambitious scenarios respectively.

Table 8: Moderate and ambitious scenarios for infrastructure development and incentives to consumers for EV transition

Particulars	Moderate Scenario	Ambitious Scenario
Energy Saving Potential (Mtoe)	0.239	0.477

Implementing Agency: State Transport Department, Oil Marketing Companies

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.

   Biofuels are produced from organic waste materials which plays an essential part in the reduction of greenhouse gases. Biofuel, being a renewable source energy, can replace conventional sources of energy across various cross-sectors. It emits less greenhouse gases and will help in improving energy efficiency. By introducing strategies such as fuel switch to biofuels and blending the biofuel products in the conventional sources will lead in energy efficiency and reduction in the carbon emissions.

Financial assistance to biofuels can be provided considering the above-mentioned points in the terms of tax credits, subsidies or grants that can help and boost the production of the biofuels. This will encourage the development of biofuels and will lead to the use of cleaner and more sustainable energy sources.

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.
2. **Capacity Building of Tyre Manufacturer and Vehicle OEMs-** Capacity building workshops shall be organized in the state 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.

5.3. Energy Saving Targets & Monitoring Mechanism

Based on the two strategies proposed for the transport sector, the total energy saving estimated is 1.324 Mtoe in the moderate scenario and 2.871 Mtoe in ambitious scenarios by FY2031. The potential savings under moderate and ambitious scenarios is the overall estimated savings from individual strategies under the respective scenarios and can be considered as the energy saving targets for FY 2031 for the Transport Sector.

Table 9: Energy Saving Targets in Transport Sector

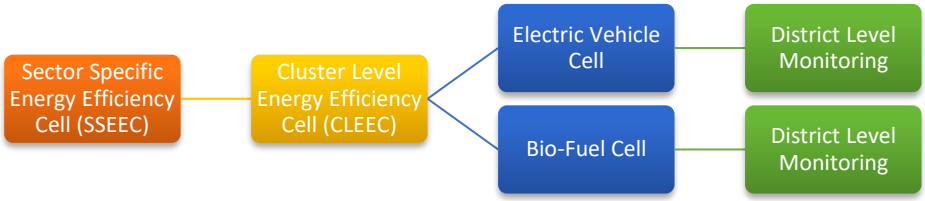
Strategies	Energy Savings in 2031 under moderate scenario (Mtoe)	Energy Savings in 2031 under ambitious scenario (Mtoe)
Transition to electric vehicles	1.085	2.394
Ethanol blending	0.239	0.477
Total	**1.324**	**2.871**

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 state.

- Development of dashboard to monitor the sale of electric vehicles sold in a year categorized under 2-wheelers, 3-wheelers, 4-wheelers, buses, and heavy vehicles.
- The dashboard can also include city-wise mapping of EV charging infrastructure across the state.
- 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).



1. Sector-Specific Energy Efficiency Cell (SSEEC): The operation of this cell will be different from the state SDA. It will be responsible for the progress of energy efficiency measures across the state in the designated sectors. It will also be responsible for collecting all the data from the Cluster Level Energy Efficiency Cell of the state. It will share the same with the state SDA for target achievement. The cell will share the data with SDA on a quarterly wise.
2. Cluster Level Energy Efficiency Cell (CLEEC): The cell will be responsible for managing and working of the different sub-cells categorized under them for the implementation of EE measures. CLEEC will help the sub-cells for the development of the specific dashboards for monitoring purposes. The cell will gather all the data regarding charging infrastructure development, number of the EVs category-wise, research work, incentives schemes and energy consumption etc. It will share all the gathered data with SSEEC monthly.
3. Electric Vehicle Cell: The cell will be responsible for developing a portal for displaying the number of transitions of conventional vehicles into the EV. The dashboard will also include the city wise EV charging mapping. The cell will also calculate the savings achieved from the EV transitions, it will also be responsible for developing new methods for more sustainable

charging stations. The cell will work with concerned stakeholders and at district level for better implementation. The cell will gather and share the data with CLEEC on a monthly basis.

4. Bio-Fuel Cell: The cell will be responsible for developing the method for the fuel-switch measure and promoting the biofuel blending program across the state. The cell will also work for promoting the hydrogen fuel cell. The cell will coordinate with concerned stakeholders and the industries for determining the gaps, also working out on increasing the production of the biofuels. The cell will collect the information and will share with the CLEEC on a monthly basis.
5. District Level Monitoring: This cell will work with the block level authority/agency for the monitoring of the energy efficiency measures and provide monthly data to the other cells in the state.

BUILDINGS SECTOR

6. Focus Sector 3: Buildings

6.1. Current Scenario

As per the population projection report by Ministry of Health and Family Welfare, Haryana is estimated to have a population of 2.5 Crore by FY2030 out of which 41.37% (1.2 Crore) of the population will reside in the urban areas.

The following graph represents the energy consumption trend in the building sector. The total energy consumption of the building sector majorly includes electricity and gas consumption. We can observe that consumption has seen a growth of 0.98 Mtoe from FY 2015 to FY 2020 with a CAGR of 10.16%.

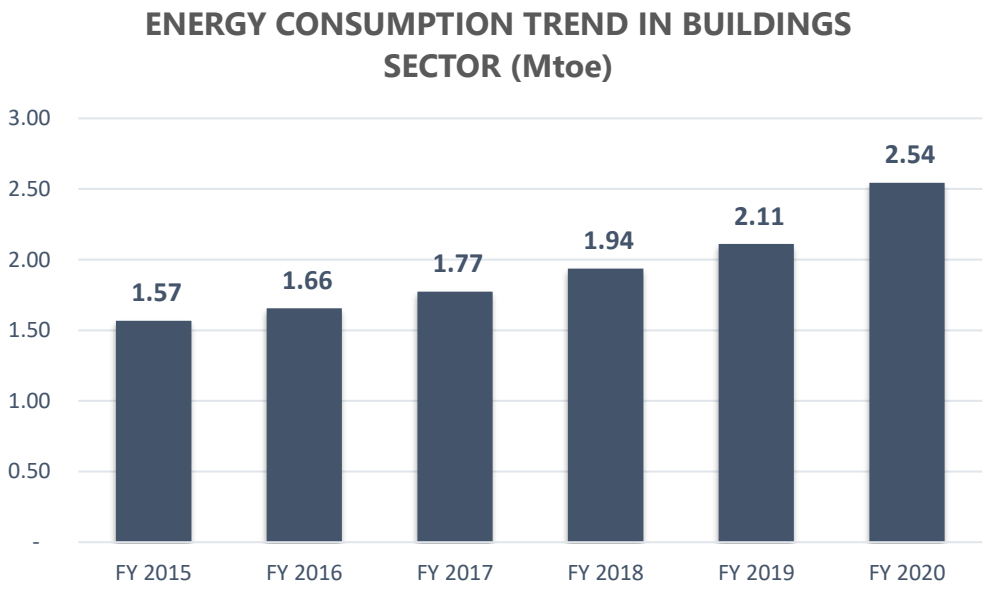


Figure 16: Energy Consumption Trend

In Haryana, HAREDA has prepared and notified the Energy Conservation Building Code for the state. Furthermore, Bureau of Energy Efficiency, GoI has 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 **"Haryana Building Code – 2017"**.

In Recent, the Energy Conservation (Amendment) Act, 2022. A unified code for the buildings 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 one of the energy-guzzling sector in the state of Haryana. As per the graph below it can be witnessed that the energy consumption in the buildings sector is continuously increasing since FY 2015. The increase in urbanization is very rapid and the demand in the domestic sector is major in terms of buildings and electricity requirement.

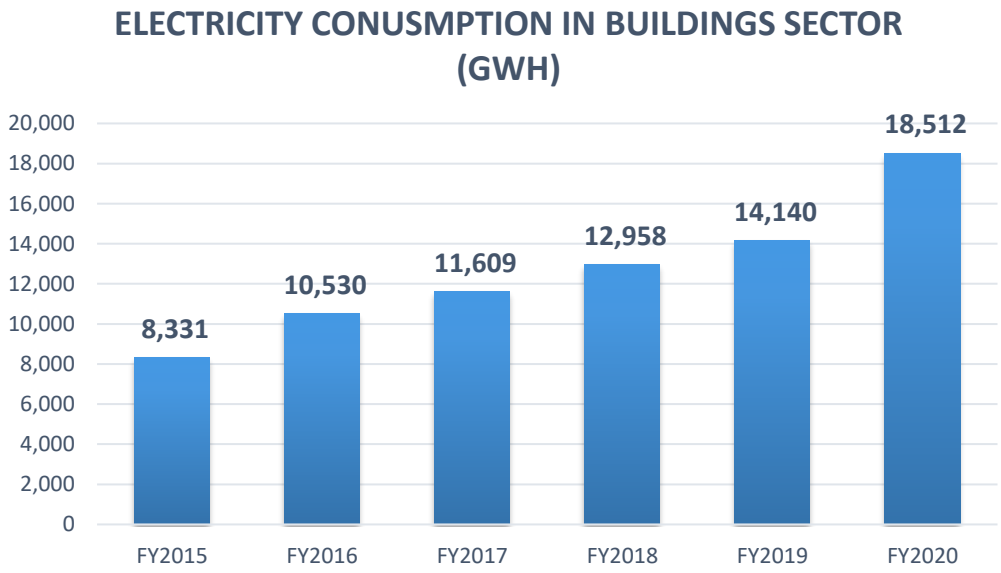


Figure 17: Electricity Consumption in Buildings Sector

The commercial sector plays a vital role in the urbanization of Haryana, but it contributes only 35.09% to the total electricity consumption of the building sector. Meanwhile, the domestic sector accounts for 64.91% of the total electricity consumption, highlighting the need for a policy to promote energy efficiency in households. Implementing energy efficiency plans in even a small fraction of the domestic sector could significantly reduce electricity consumption.

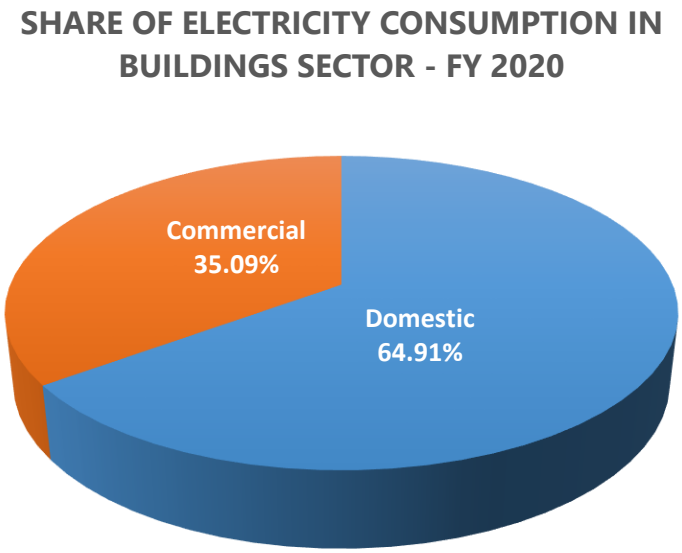


Figure 18: Share of Electricity Consumption in Buildings Sector

6.2. Energy Efficiency Strategies in the Buildings Sector

This section presents the proposed strategies in the domestic buildings and commercial buildings sector along with their impact in terms of energy saving potential. The following strategies are proposed in the building sector, as part of the State Energy Efficiency Action Plan:

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

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

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

The state of Haryana has already amended the Energy Conservation Building Code (ECBC) for commercial buildings and the state is in process of adopting ECO-Niwas Samhita (ENS) for residential buildings. However, in a recent EC Act

Amendment 2022, unified code "Energy Conservation and Sustainable Building Code" (ECSBC) is introduced which will cover both commercial and residential buildings. Till the implementation of ECSBC in state, 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 state is proposed for upcoming commercial and domestic buildings in the state 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 2031. After forecasting the energy demand in the commercial building sector from FY 2023 to FY 2031, the annual increment in the electricity consumption in the commercial buildings sector was projected.

The total incremental electricity consumption in the commercial sector of the state is projected to be 12,130.23 GWh between FY 2023 to FY 2031. This increment in electricity consumption accounts for all the categories of commercial buildings of varying loads. The Energy Conservation Building Code (ECBC) sets minimum energy standards for commercial buildings having a connected load of 100 kW or more. It has been taken into consideration that around 5% of the buildings in the state have connected load of 100 kW or more. Considering this percentage, the Total Incremental Electrical Consumption contributing to buildings having load >100kW is estimated to be almost 606.51 GWh.

Based on the energy savings percentage from ECBC and ECBC+, the moderate and ambitious savings in the commercial building sector are found to be **151.63 GWh** and **212.28 GWh** respectively.

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

In the residential sector, by FY 2031, the electricity consumption is projected to be around 1,07,163.52 GWh. The overall incremental electrical consumption is estimated to be 89,276.63 GWh based on the anticipated household electricity demand by FY2031. 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 2031. The strategy is expected to result in electricity savings of 428.53 GWh in the moderate scenario and that of 535.66 GWh in the ambitious scenario by FY2031.

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

Table 10: Moderate and ambitious scenarios for effective implementation of ECSBC

Particulars	Moderate Scenario	Ambitious Scenario
Energy Saving Potential (Mtoe) in ECBC	0.0130	0.0183
Energy Saving Potential (Mtoe) in ENS	0.0368	0.0461
Total	**0.0499**	**0.0643**

Implementing Agency: Bureau of Energy Efficiency, HAREDA, Haryana Urban Development Authority

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 state. To ensure the same role & responsibility of all concerned departments, checkpoints, monitoring mechanism and penalties must be properly defined in ECSBC rules & regulations.

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

2. **Development and maintenance of ECSBC compliance portal, directory of energy efficient materials/technologies** – For effective and aggressive

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

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.
4. **Pilot projects for Super ECBC buildings as case studies (initial 20 Buildings)** – It is proposed that the state government also undertake the development of Super-ECBC buildings in the state and publish its case studies for the understanding of stakeholders. Initially upcoming government building can be taken as a pilot project and the best energy efficient technologies can be implemented to achieve the Super ECBC level. Case Study can be published in social media to encourage developers and other stakeholders to make Super ECBC compliant buildings.
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 the state of Haryana to train building professionals about the benefit of auditing and implementation of Energy Conservation Measures (ECMs) in residential houses. SDA may encourage RWAs by providing some incentive based on energy savings on implementation of

ECMs in their societies. These action items will help in the promotion of ENS in the state and create technical capacity of the professionals.

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 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. It is also suggested to incorporate the embodies energy while selecting the/suggesting the energy efficient materials/appliances.

7. **Incorporating Embodied Energy Concept in ECSBC Implementation**

   Create a comprehensive guideline within the ECSBC framework that outlines the assessment and consideration of embodied energy in building projects. These guidelines should cover the following aspects:

   a. Material Selection: Encourage builders and designers to prioritize the use of low-embodied-energy materials, including recycled materials that have significantly lower embodied energy compared to virgin counterparts. Provide a list of recommended low-embodied-energy materials and promote their use in construction projects.

   b. Life Cycle Assessment (LCA): Integrate LCA methodologies as a requirement for building projects. Ensure that LCA includes the assessment of embodied energy, considering factors such as manufacturing efficiency, transportation distance, durability of materials, and construction methods.

8. **Inclusion of curriculum on energy efficiency in buildings, in universities and Schools**

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

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

Implementation Timeline: Long Term (Till FY 2031)

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. Currently, the S&L Programme encompasses a total of 38 appliances, of which 16 are subject to mandatory regulation while the other 22 are regulated on a voluntary basis. The following table provides a detailed list of appliances that fall under mandatory and voluntary regulation:

Table 11: 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. Agriculture Pump Sets
3. Tubular Florescent Lamps	3. LPG Stove
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 mono set pumps
8. Electric Geysers	8. Solid State Inverter
9. Variable Capacity Inverter Air Conditioners	9. Microwave Oven
10. LED Lamps	10. Solar Water Heater
11. Ceiling Fans	11. Diesel Generator Set
12. Light commercial AC	12. Grid Connected solar Inverter
13. Deep Freezers	13. Commercial Beverage Coolers
	14. Air Compressor
	15. High Energy Li-Battery

14. Washing Machine 15. Chillers 16. UHD Color TV	16. Side by Side/Multi Door Refrigerator 17. Pedestal Fan 18. Induction Hob 19. Tires 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 state as per the report "Population Projections for India and States 2011 – 2036" and Household Size as per census, the number of households were estimated out for urban and rural regions. Different categories of appliances have different penetrations among the urban and rural households, based on the usage pattern. Some appliances viz. Fans, refrigerators, washing machines, LEDs, air-conditioners and microwaves have higher penetration as compared to other appliances. 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 table below.

Table 12: Appliances taken into consideration for the strategy

Window AC	Color TV - LCD/Plasma/LED
Split AC	Washing Machines
Refrigerator-DC	TFL (Tubular Fluorescent Light)
Refrigerator-Frost Free	Electric Geysers

Ceiling Fans	Cook-Stoves
Color TV CRT	Computer/Laptop/Notebooks

According to the study conducted by CLASP (Collaborative Labeling and Appliance Standards Program)[31] 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 0.42 Mtoe in the moderate scenario and 0.56 Mtoe in the ambitious scenario by FY 2031.

Table 13: Moderate and ambitious scenarios for deepening of S&L Programme

Particulars	Energy Savings in 2031 under Moderate scenario (Mtoe)	Energy Savings in 2031 under Ambitious scenario (Mtoe)
Energy Saving Potential (Mtoe)	0.42	0.56

Implementing Agency- HAREDA, Haryana Urban Development Authority, DISCOMs, ESCOs

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 state-specific implementation models and identification of relevant agencies-** A detailed phase-wise plan needs to layout based on consumer's priority and reachability. It is important to develop a transparent model that can reach out to every household in the state. Financial implications will play a major role in replacement schemes so ESCOs and PPA models can be analyzed in detail. UJALA scheme is a successful case study in this area, can be referred for the development of state specific plan. Identification of implementing departments and agencies and listing of ESCOs in the state is required. Considering the significant number of appliances that will be replaced, it is essential to develop a comprehensive policy that addresses the reuse and waste management of mandatory and voluntary appliances rated below 3 stars.
2. **Issuance of directive to government offices and buildings in the state to replace all existing inefficient appliances (lower than 3 Star Rated) with BEE 5-star rated appliances-** State Government shall issue directives to all government offices and buildings owned by state government to replace all appliances which are lower than 3 star-rated or purchased/installed before 2015 with BEE 5-Star rated appliances.
3. **Phase-wise plan for replacement of existing inefficient appliances (lower than 3 Star Rated) with BEE 5-star rated appliances in all buildings, through DSM schemes** Development of phase-wise Demand Side Management (DSM) plan based on the consumer's priority and market scenario shall be developed in consultation with DISCOMs. Implementation can be done with the support of DISCOMs and various ESCOs listed with the state government.
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. State Government 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.

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

Implementation period: Long Term (Till FY 2031)

The Star Rating and Shunya Rating of buildings is currently at a voluntary stage which is used as a benchmarking system for buildings 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 state. Certification of Star Rating or Shunya Rating can be provided based on this assessment.

Implementing Agency: Bureau of Energy Efficiency; HAREDA, Haryana Urban Development Authority, and PWD (Buildings & Roads) Haryana Department.

Actionable Items:

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

   State Government shall issue directives to all government departments and buildings owned by state government to conduct energy audit and implement energy conservations measures and target to achieve BEE Star Rating or Shunya Rating for their buildings.

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

   A notification from State Government shall be issued for conducting mandatory energy audits of commercial buildings based on their connected load and incentives can be given on the achievement of star rated energy efficient buildings to encourage more building owners to reduce their EPI and save more energy.

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. 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 this rating program, promotion campaigns shall be carried out to reach masses by advertising in print media, social media, conduct nukkad nataks, plays and run radio jingles etc.

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 the lead in the implementation of this practice across the state.

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.

7. **Appointment of resource for energy simulation:** To accurately assess the energy consumption patterns and energy requirements of the upcoming buildings during the planning stage, it is crucial to have a qualified resource person in the departments such as Architectural and PWD (B&R) Haryana. This expert will play a pivotal role in achieving sustainable measures by analyzing and adjusting the building design as necessary. Their expertise will aid in estimating energy usage and ensuring that the design aligns with sustainable practices.

6.3. Energy Saving Targets & Monitoring Mechanism

The proposed strategies can together achieve maximum potential energy savings of 0.624 Mtoe by FY 2031. The energy saving and emissions reduction targets for the short term (till FY 2026) and long term (till FY 2031) for the buildings sector under the two scenarios are shown in table below.

Table 14: Moderate and ambitious scenarios energy savings for buildings sector

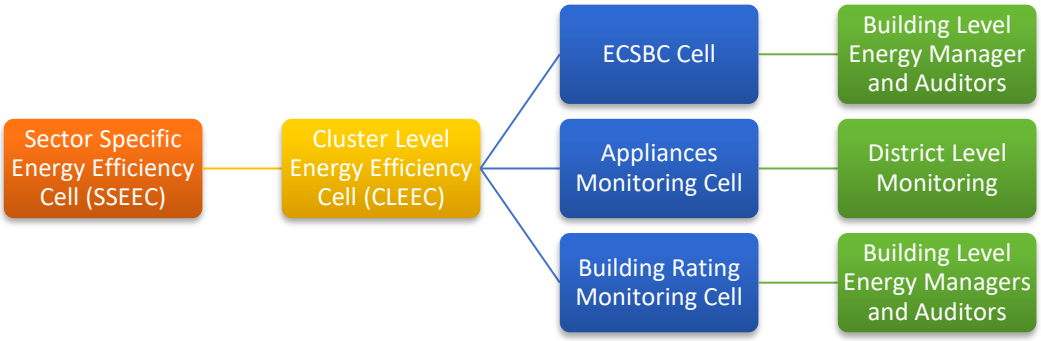
Action Plan	Energy Savings in 2031 under moderate scenario (Mtoe)	Energy Savings in 2031 under ambitious scenario (Mtoe)
Effective implementation of ECSBC	0.0499	0.0643
Replacement program for inefficient appliances	0.42	0.56
BEE Star Rating and Shunya Rating of Buildings	0.0018	0.0026
Total	**0.476**	**0.624**

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 state.

- Development of strategy-specific dashboards to monitor the impact and track progress of ECBC buildings, ENS buildings, Net Zero buildings in the state and the energy savings achieved from these strategies.
- Regular reporting and updating of dashboard can be done with the support of HAREDA 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.



1. Sector-Specific Energy Efficiency Cell (SSEEC): The operation of this cell will be different from the state SDA. It will be responsible for the progress of energy efficiency measures across the state in the designated sectors. It will also be responsible for collecting all the data from the Cluster Level Energy Efficiency Cell of the state. It will share the same with the state SDA for target achievement. The cell will share the data with SDA on a quarterly wise.
2. Cluster Level Energy Efficiency Cell (CLEEC): The cell will be responsible for managing and working of the different sub-cells categorised under them for the implementation of EE measures.

CLEEC will help the sub-cells for the development of the specific dashboards for monitoring purposes. The cell will gather all the data regarding energy consumption and the progress set. It will share all the gathered data with SSEEC monthly.

3. ECSBC Cell: The ECSBC cell will be accounted for the development of the dashboard for the complied buildings, depicting the energy savings achieved and the energy consumption of the buildings. The cell will coordinate with concerned stakeholders and building level energy managers and auditors for collecting all the information and calculating the energy savings achieved. The cell will also monitor the ECSBC implementation in the state. The cell will share the data with the CLEEC every month.
4. Appliances Monitoring Cell: A cell under the CLEEC will be created for monitoring the sales of the BEE-rated appliances. The cell will deal with the responsible stakeholders for the collection of the required data. It will calculate the monthly savings achieved from the replacement of the old and inefficient appliances with BEE-Star rated appliances. The cell will share the data with the CLEEC at the end of every month.
5. Building Rating Monitoring Cell: A designated cell for the BEE star rating and Shaunya Rating will be placed and it will create a portal for the energy savings achieved by the buildings under different star labelling. The cell will coordinate with Building Level Energy Manager/Auditor for the collection of data and sharing it with the CLEEC every month.
6. District Level Monitoring: This cell will work with the block level authority/agency for the monitoring of the energy efficiency measures and provide monthly data to the other cells in the state.

AGRICULTURE SECTOR

7. Focus Sector 4: Agriculture

7.1. Current Scenario

Haryana is one of the finest Indian states in terms of Agriculture performance. The state is a major producer of food grains in the country, accounting for about 12% of national wheat production and about 3% of the national rice production.[11]

Nearly two-thirds of the state population still depend on this sector for their livelihood. In terms of area, agriculture has already reached a saturation level and almost all the available cultivable land in the State is under plough. Thus, there is hardly any scope to bring more areas under cultivation. The state witnessed all the 11 Argo Climatic Zones of the country. The state also contributes about 40% to India's total organic farming.

The Haryana state has a total geographical area of 44,212 km^2, out of which 38,090 km^2 is under cultivation (about 86.2 %) compared with the national average of 40%.

The agriculture production can only be increased through enhanced cropping intensity, change in cropping pattern, improvement in seeds of high yielding varieties, better cultivation practices and post-harvest technology etc. The surface water is carried to the fields by canals, distributaries,and channels. Ground water has been extracted by electric tube wells and diesel pump sets.

Consequently, the number of electric tube wells has increased over the period of time. The power sector exerts a critical influence on the performance of the agriculture sector as it affects farmer's access to use of electricity for a variety of irrigation operations, particularly pumping ground water for irrigation.

[11] *http://web.worldbank.org/archive/website00811/WEB/PDF/H1.PDF*

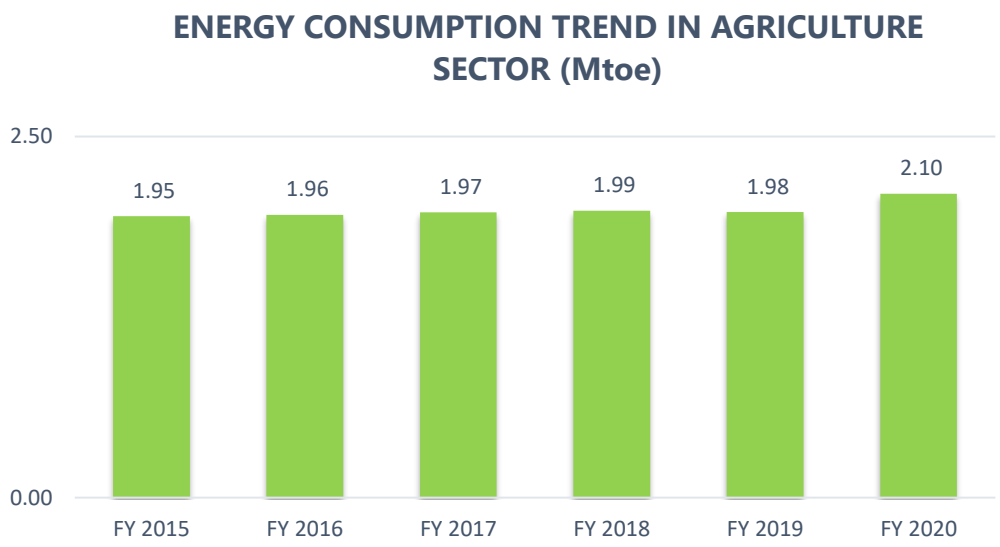


Figure 19: Energy Consumption Scenario in Agriculture

The figure shows the total energy consumption trend in the agriculture sector, which comprises of mainly electricity and oil. Consumption has grown from 1.95 Mtoe to 2.10 Mtoe from FY 2015 to FY 2020.

The main sources of energy consumption in this sector are agricultural machinery/ equipment and pump sets in the state.

Table 15: Agriculture Statistics[12]

Particulars		Units	Values
TOTAL REPORTED AREA (2019-20)		Sq. km	**44.21**
Forest Area		Sq. km	**0.40**
Culturable Waste Land		Sq. km	**0.29**
A	Fallow Land	Sq. km	1.10
	Current Fallow	Sq. km	1.05
	Fallow Land Other than Current Fallow	Sq. km	0.05
B	Net Area Sown	Sq. km	35.76
A+B	**Land Available for Cultivation**	Sq. km	**36.86**

[12] *https://cdnbbsr.s3waas.gov.in/s32b0f658cbffd284984fb11d90254081f/uploads/2023/02/2023022411.pdf*

7.2. Energy Efficiency Strategies in the Agriculture Sector

This section presents the proposed strategies in the agriculture sector along with their impact in terms of energy saving potential. The following strategies are proposed as part of the State Energy Efficiency Action Plan:

1. Transition of conventional diesel pumps to Solar powered pumps
2. Replacement of inefficient (non-star rated) pumps with BEE 5 Star Rated Pumps along with smart control panel

Strategy #1 Transition of conventional diesel pumps to Solar powered pumps

Implementation period: Till FY2024

The proposed strategy in the agriculture sector is to transition from conventional diesel pumps to solar-powered pumps by FY2024. This strategy is in line with the country's target to replace diesel with renewable energy sources in the agricultural sector to achieve the goal of zero diesel use by FY2024. This transition is necessary to reduce the sector's dependence on fossil fuels and move towards a more sustainable and environmentally friendly energy source.

The first scenario is the moderate scenario, which aims to transition 75% of diesel-powered pumps to solar pumps by 2024. This scenario aims to achieve a significant reduction in the energy consumption of pumps used in irrigation, leading to significant energy savings.

The second scenario is the ambitious scenario, which aims to transition 100% of diesel-powered pumps to solar pumps by 2024. This scenario is the ideal goal and aims to achieve maximum energy savings in the agriculture sector by completely eliminating the use of diesel-powered pumps. This scenario will not only lead to energy savings but will also contribute to reducing carbon emissions, improving air quality and environmental sustainability.

It is also essential to note that the transition to solar-powered pumps will reduce the operational and maintenance costs as solar pumps do not require regular fuel refilling and have fewer moving parts, resulting in less wear and tear.

Moreover, the installation of solar pumps will also provide an additional source of income for farmers, as they can sell excess electricity generated by the solar panels back to the grid.

In addition to the benefits mentioned above, the transition to solar-powered pumps will also lead to increased reliability and stability of power supply, as solar energy is available throughout the day and is not subject to disruptions in fuel supply.

Overall, the transition from conventional diesel pumps to solar-powered pumps will lead to a total savings of 0.06 Mtoe in moderate scenario and 0.08 Mtoe in ambitious scenario by FY2031.

Table 16: Energy Savings Potential in Transition of conventional diesel pumps to Solar powered pumps

Particulars	Moderate Scenario	Ambitious Scenario
Energy Saving Potential (Mtoe)	0.06	0.08

Actionable items:

1. **Greater outreach to relevant stakeholders:** It is crucial to engage and inform all relevant stakeholders, including farmers, Panchayat officials, and other key players in the agriculture sector, about the benefits of the PM KUSUM Yojana. This can be done through awareness campaigns, workshops, and meetings at the local level. This will help ensure that everyone is aware of the program and its benefits and can work together to implement it effectively.

2. **Capacity building of Panchayat/Block level officials:** It is important to provide training and capacity building programs to Panchayat and Block level officials to ensure effective implementation of the program. This can include training on the technical aspects as well as on the administrative aspects of the program. This will enable officials to provide the necessary support and

guidance to farmers and other stakeholders in their respective areas and ensure the successful implementation of the program.

Strategy #2 Replacement of inefficient (non-star rated) pumps with BEE 5 Star Rated Pumps along with smart control panel

Implementation period: Long-term (Till FY2031)

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

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

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

Overall, this strategy will lead to a total saving of 0.01 Mtoe in moderate scenario and 0.02 Mtoe in ambitious scenario by FY2031.

Table 17: Energy Savings Potential in Replacement of inefficient (non-star rated) pumps with BEE 5 Star Rated Pumps along with smart control panel

Particulars	Moderate Scenario	Ambitious Scenario
Energy Saving Potential (Mtoe)	0.01	0.02

Actionable items:

Development of a phase-wise plan to implement Demand Side Management (DSM) scheme for replacing existing inefficient pumps through Energy Service Companies (ESCOs).

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

7.3. Energy Saving Targets & Monitoring Mechanism

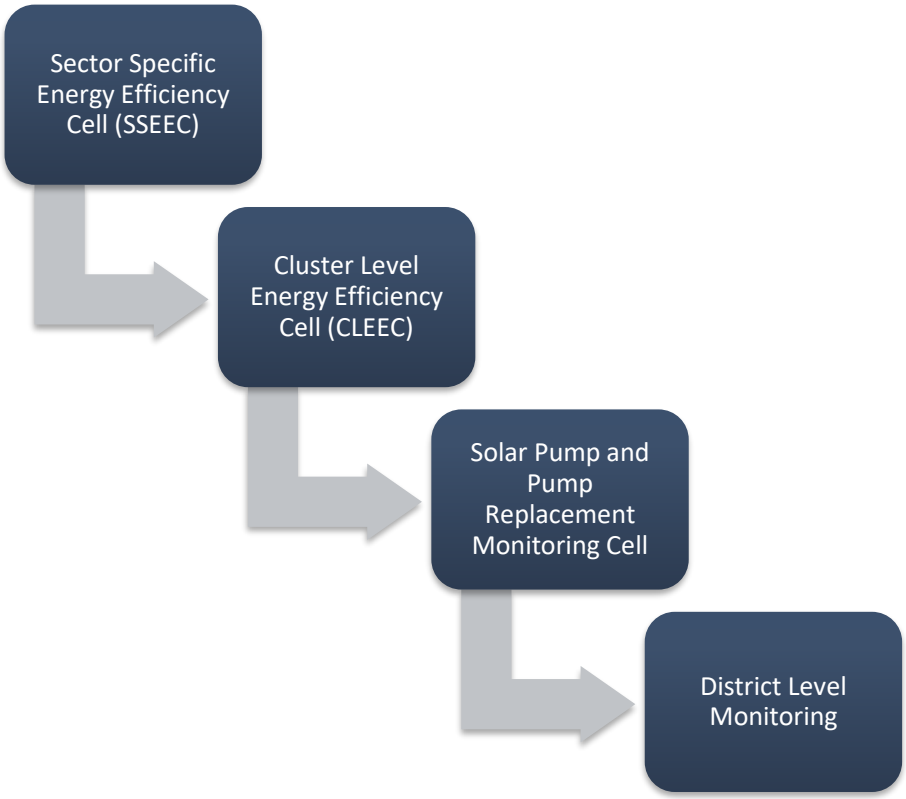
On the basis of the two strategies proposed for the agriculture sector, the total energy saving estimated is 0.07 Mtoe in the moderate scenario and 0.09 Mtoe in ambitious scenarios by FY2031. The potential savings under moderate and ambitious scenarios are the overall estimated savings from individual strategies under the respective scenarios and can be considered as the energy saving targets for FY 2031 for the Agriculture Sector.

Table 18: Energy Savings from Agriculture Sector

Strategies	Energy Savings in 2031 under moderate scenario (Mtoe)	Energy Savings in 2031 under ambitious scenario (Mtoe)
Transition of conventional diesel pumps to Solar powered pumps	0.06	0.08
Replacement of inefficient (non-star rated) pumps with BEE 5 Star Rated Pumps along with smart control panel	0.01	0.02
Total	**0.07**	**0.09**

Monitoring Mechanism:

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



1. Sector-Specific Energy Efficiency Cell (SSEEC): The operation of this cell will be different from the state SDA. It will be responsible for the progress of energy efficiency measures across the state in the designated sectors. It will also be responsible for collecting all the data from the Cluster Level Energy Efficiency Cell of the state. It will share the same with the state SDA for target achievement. The cell will share the data with SDA on a quarterly wise.
2. Cluster Level Energy Efficiency Cell (CLEEC): The cell will be responsible for managing and working of the different sub-cells categorized under them for the implementation of EE measures. CLEEC will help the sub-cells with the development of the specific dashboards for monitoring purposes. The cell will gather all the data regarding the solar pumps' installation, transition into BEE star rating

pumps and energy consumption etc. It will share all the gathered data with SSEEC monthly.

3. Solar Pump and Pump Replacement Monitoring Cell: The cell will be responsible for developing a portal for displaying the number of transitions of conventional pumps into the solar and the number of old and inefficient pumps replaced into BEE star rated pumps. The dashboard will include the number of pumps transitioned along with the energy savings and reduced carbons emissions. The cell will coordinate with concerned stakeholders and at district level. It will be responsible for gathering all the information and sharing with CLEEC every month.
4. District Level Monitoring: This cell will work with the block level authority/agency for the monitoring of the energy efficiency measures and provide monthly data to the other cells in the state.

8. Other Focus Areas

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

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. 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 state 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 in collaboration with HAREDA 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 encourages 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 HAREDA 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.

9. Investment 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 investment potential generated from the suggested strategies in the focus sectors, the equivalent cost of the saved energy in terms of metric tonnes of oil equivalent has been calculated. The Ministry of Power, Government of India, in consultation with the Bureau of Energy Efficiency (BEE) has notified the price of per metric tonne of oil equivalent as INR 18,402 only for the year FY19. The same amount has been applied to energy savings under ambitious scenarios for the estimation of maximum investment potential. Total energy saving potential by implementing various strategies in the state of Haryana is shown in the graph below:

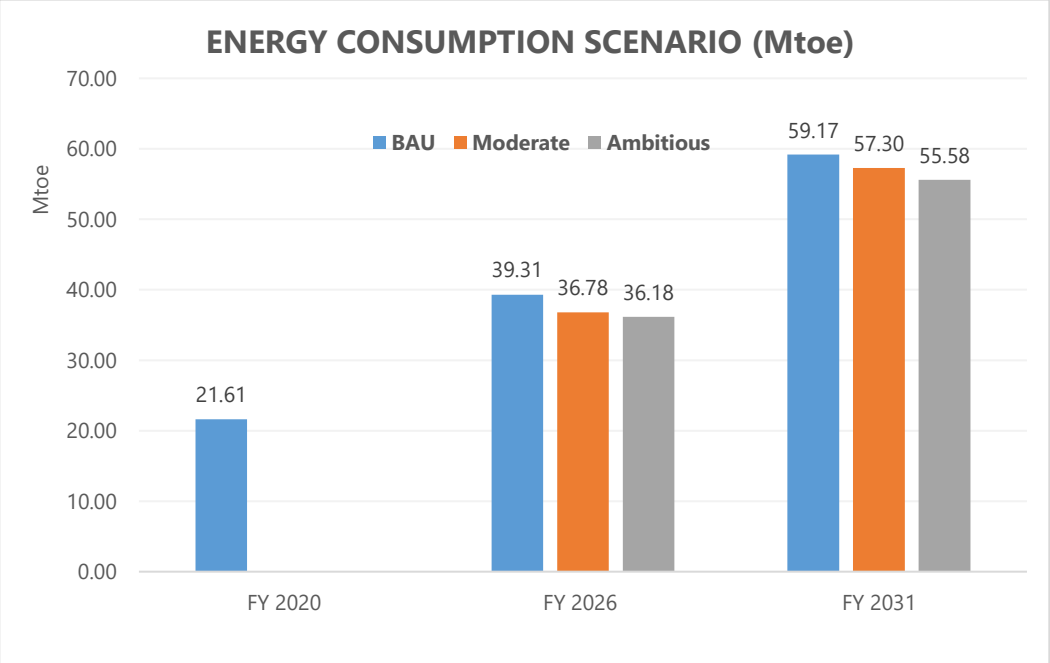


Figure 20: Energy Consumption Scenario (Mtoe)

It is estimated that with the implementation of various proposed strategies of Industries, Transport, Building and Agriculture sector, the energy saving of 1.9 Mtoe in moderate scenario and 3.6 Mtoe in ambitious scenario can be achieved. In the moderate scenario 3.16% energy saving can be achieved and in ambitious scenario 6.07% can be achieved.

Table 19: Energy Savings Summary and Investment Potential

Sector	Emissions Reduction ($MtCO_2$) - FY2031		Energy Saving (Mtoe) - FY2031		Market Potential (INR Crores)
	Moderate	Ambitious	Moderate	Ambitious	
	$MtCO_2$ reduction	$MtCO_2$ reduction	Mtoe Reduction	Mtoe Reduction	
Industry	0.003	0.007	0.001	0.002	4
Transport	4.143	8.987	1.324	2.871	5,284
Buildings	1.491	1.954	0.476	0.624	1,149
Agriculture	0.219	0.295	0.070	0.094	174
Total	**5.9**	**11.2**	**1.9**	**3.6**	**~ 6,610**

10. Way Forward

The state energy efficiency action plan, through research and interaction with various stakeholders, identifies the need, opportunity, and the potential of energy efficiency in the State of Haryana. While addressing the key focus sectors – Industry, Transport, Buildings and Agriculture, the action plan envisages analyzing consumption pattern, growth rates in alignment with GDP growth rate of the state and potential strategies for achieving savings.

The action plan lays out a plan for the state to implement the strategies, while at the same time being able to monitor implementation. It is imperative that implementation is carried out in the state through various stakeholders.

A market-based mechanism is anticipated to be developed through the implementation of the action plan which drives energy efficiency through better availability of energy efficiency products, financial instruments for improving the product reach and a wider adoption of energy efficiency schemes and policies curated by both state and central governments.

A collaborative approach, on the part of the government, industry and academia is the ideal way forward to implement the vision and targets of this action plan and continue to put the country on a high pedestal of energy efficiency achievements at the global platform.

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