MINISTRY OF POWER
GOVERNMENT OF INDIA

STATE ENERGY EFFICIENCY ACTION PLAN (SEEAP)

UTTARAKHAND - ACTION PLAN

MARCH 2024

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सत्यमेव जयते

Azadi Ka Amrit Mahotsav

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

Foreword

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

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

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

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

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

October, 2024

(Dr. Srikant Nagulapalli)

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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.

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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
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

UREDA- Uttarakhand Renewable Energy Development Agency

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/UT developed by identifying focus sectors of the State/UT and estimating the potential of energy conservation in sectors which are predominant in the region. The State Energy Efficiency Action Plan is developed for a short term-plan and a long-term plan targeting high-impact energy efficiency by the year 2031.

For the State of Uttarakhand, SEEAP was developed under the guidelines of Bureau of Energy Efficiency, Ministry of Power, GOI and Uttarakhand Renewable Energy Development Agency (UREDA) 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 Uttarakhand.

In FY 2020, Uttarakhand has total final energy consumption (TFEC) 3.64 Mtoe in which oil consumption was 58.84%, followed by 28.42% electricity consumption, 7.77% consumption in terms of coal captive, 4.94% in terms of coal consumption in non-power or industry, and 0.03% in terms of gas consumption. Based on energy consumption and economic growth of state total final energy consumption of state is projected and it is estimated that TFEC of Uttarakhand in FY 2030 will be 8.77 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 (Paper & Pulp and Sugar)
- Energy Efficiency Intervention in Pharmaceuticals clusters

Buildings Sector:

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

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

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.

Municipalities Sector:

- Replacement of inefficient sewerage and water pumps with BEE 5-Star rated pumps under all municipal corporations of the state.

This action plan will result in a total energy consumption reduction of 0.34 Mtoe in the moderate scenario and 0.67 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 1,238 Crore in the field of energy efficiency and reduce the CO_2 emission by 1.06 $MtCO_2$ in moderate scenario and 2.10 $MtCO_2$ in ambitious scenario by FY 2031.

1. Introduction

1.1. Background

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

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

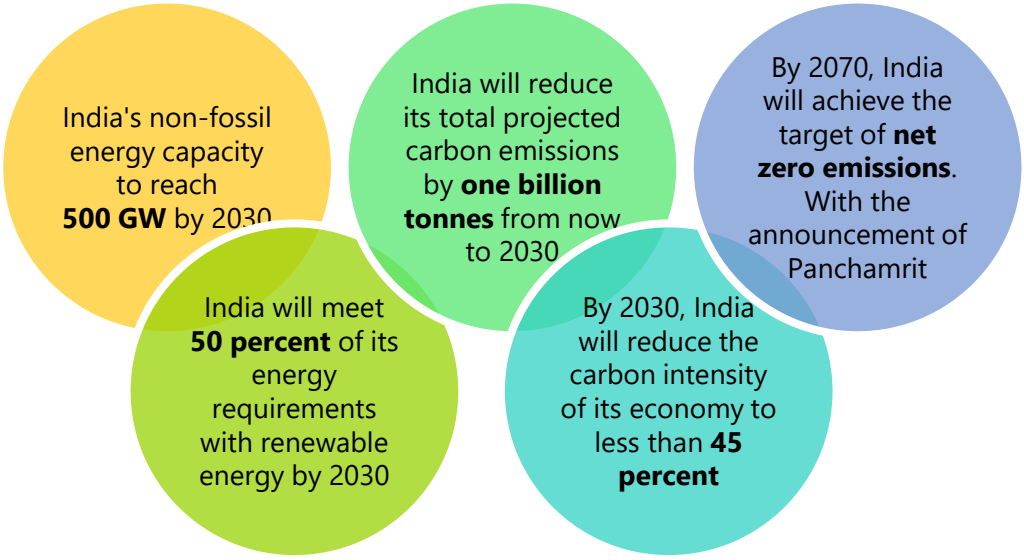
India has set ambitious economic goals for the future and achieving these goals is expected to result in significant increase in the country's energy demand and emissions. In view of this, India has also set ambitious goals for energy and climate performance. The country has also emphasized the importance of energy transition towards decarbonization of the economy and has recently emerged as one of the world leaders in Energy Transition. States and Union Territories of the country have a key role to play in the fulfilment of these goals. The key strategy adopted by the Government of India is the efficient use of energy resources and their conservation. This is essential since the efficient use of energy and its conservation is the least-cost option to meet the

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

increasing energy demand, reduce wasteful consumption and in leading the country's economic growth in sustainable manner.

1.2. India's Nationally Determined Contributions (NDCs)

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



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

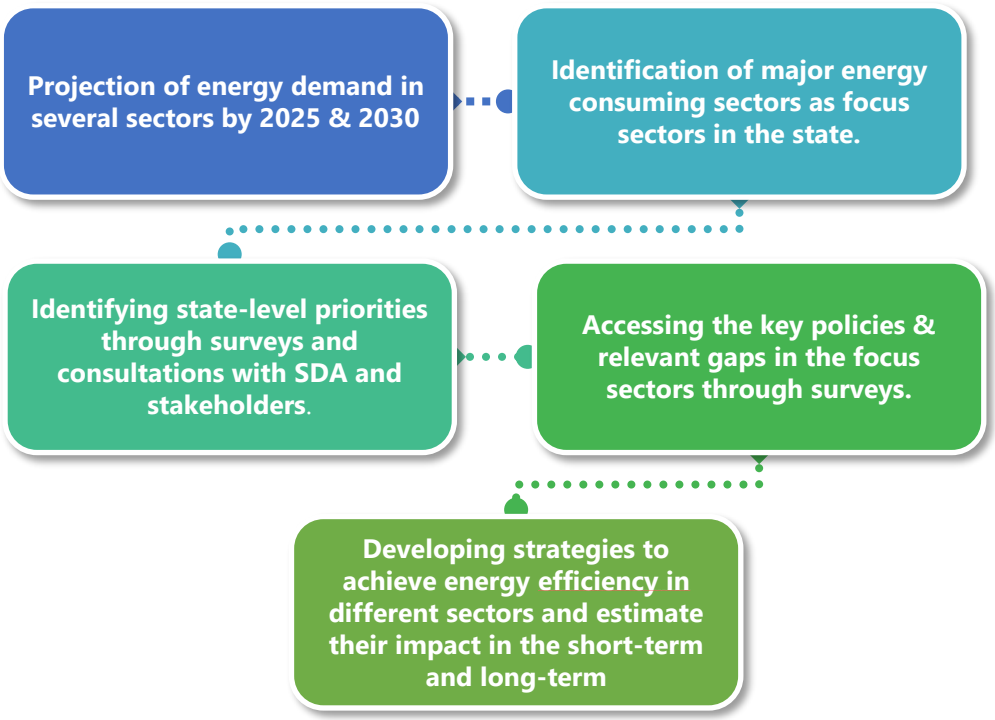
On 1st November 2021, during the 26th United Nations Climate Change Conference of the Parties (COP26) in Glasgow, Prime Minister Narendra Modi introduced the idea of 'Lifestyle for the Environment (LiFE)'. He urged individuals and institutions across the world to support LiFE as a global movement, aimed at promoting mindful and deliberate utilization instead of mindless and destructive consumption to safeguard the environment. This means making choices that are better for the environment, such as using renewable energy sources, reducing waste, and conserving resources. The

program aims to teach people about the impact their daily actions have on the environment and provide them with the tools and resources they need to adopt more eco-friendly practices.

1.3. About SEEAP

The State Energy Efficiency Action Plan for Uttarakhand is being developed by identification of focus sectors, to ensure that the allocation of resources is as per the requirement of Uttarakhand and estimate the potential of energy conservation in sectors that are predominant in Uttarakhand. The State Energy Efficiency Action Plan has been developed in two parts, a short term-plan and a long-term plan targeting high impact energy efficiency by 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 Uttarakhand 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

The State of Uttarakhand is located in the northern part of India, extending between latitudes 28°43′ N and 31°27′ N, and longitudes 77°34′ E and 81°02′ E. The state was

formed on 9th November 2000, becoming the 27th state in India. It is largely a hilly state, having international boundaries with China (Tibet) in the north and Nepal in the east. On its north-west lies Himachal Pradesh, while on the south is Uttar Pradesh. Dehradun is the interim capital of the state. The state has good connectivity with the National Capital Region of Delhi as well as the neighboring states of Himachal Pradesh and Uttar Pradesh.

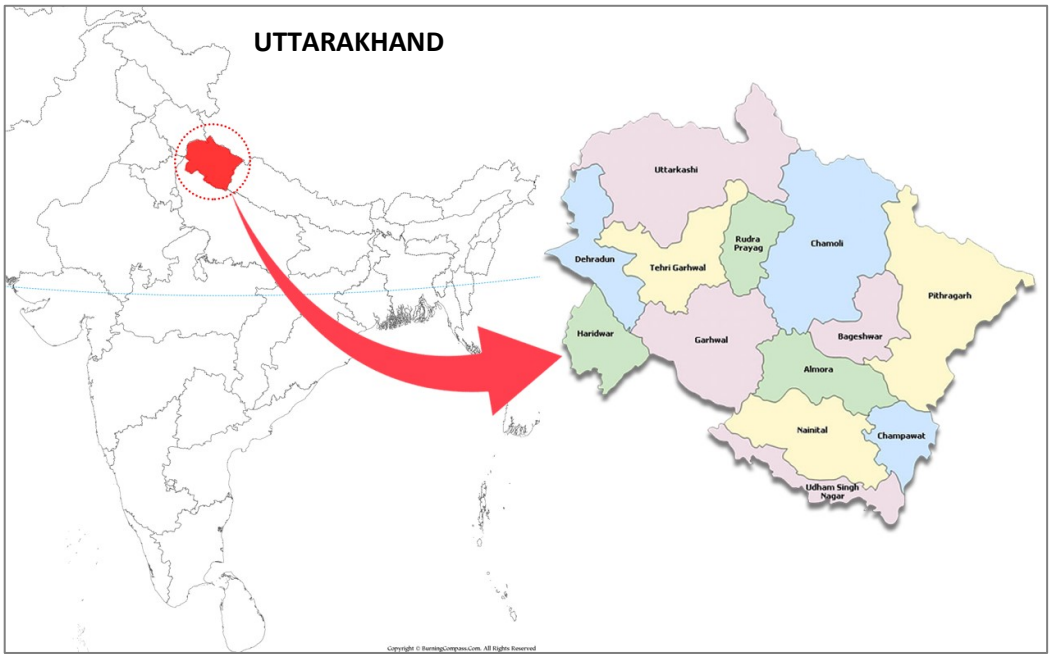


Figure 1: Geographic location of Uttarakhand and its districts

The climate of Uttarakhand is divided into two broad divisions of its topography. To a large extent, the state is covered with hilly terrains consisting of large mountain peaks, valleys, cliffs and glaciers. Most of the northern part of the state falls in the greater Himalaya ranges, characterized by peaks covered with ice and snow. The larger, hilly area of Uttarakhand falls under cold climate zone. The southern part of the state consists of foothill areas and plains, experiencing composite climatic conditions.

Uttarakhand is rich in natural resources especially water and forests, having several rivers and dense forests. The state has a total forest cover of 38,000 Sq. km., making up about 71% of the state's area.

The State of Uttarakhand is also rich in mineral deposits like limestone, marble, rock phosphate, dolomite, magnesite, copper, gypsum, etc. It has a vast tourism potential in adventure, leisure, and eco-tourism.

The state has a literacy rate of 79.63%, which is higher than the national average. Uttarakhand has recently emerged as a significant destination for investments in the

manufacturing industry, tourism, and infrastructure. Through a number of policy measures, fiscal and non-fiscal incentives, the Government of Uttarakhand has aimed at encouraging the inflow of investments in the various sectors of its economy.

Table 1: Basic Statistics of Uttarakhand

S. No.	Particulars	Unit	Number
1	Geographical Area	Sq. km.	53,483
	(i) Hill		46,035
	(ii) Plain		7,448
2	Forest Area		38,000
3	Administrative Units		
	(i) No. of Divisions	Number	2
	(ii) No. of Districts		13
	(iii) No. of Tehsils		110
4	Population (2011)		
	(i) Total Population	Lakh	100.86
	(ii) Rural Population		70.37
	(iii) Urban Population		30.50
	% of Rural to Total Population	%	69.77
	% of Urban to Total Population		30.23
5	Municipal Corporations	Number	8
6	Population Density	Person/sq.km	188.53
7	Household	Number	20,56,975
8	Avg. Households	Number	4.9
9	DISCOM	Uttarakhand Power Corporation Limited	

Source: Uttarakhand at a Glance 2019-20, Directorate of Economics and Statistics, Government

1.5. State Energy Scenario

Uttarakhand is endowed with abundant natural resources that have the potential to provide ample energy to the state. The state's energy mix is diverse, with both conventional and renewable sources of energy contributing to its overall energy supply. An overview of the state energy scenario of Uttarakhand is as follows:

Power Generation

The State of Uttarakhand has an immense potential of hydro-based power generation, owing to a large network of rivers and canals in the state. Around 80% of the electricity generated in the state is from hydro power plants (See **Figure 3**). Hydro power is utilized

through large hydro and small hydro power plants. The state's major generating company, Uttarakhand Jal Vidyut Vitran Nigam Limited (UJVNL) operates hydropower plants ranging in capacity from 1.5 MW to 304 MW as shown in Table given below.

Uttarakhand has a total installed capacity of 4,867 MW, as of March 2020, which is mainly composed of hydropower projects (3,756 MW). The state has a total hydropower potential of around 17,998 MW, out of which only around 5,246 MW has been harnessed so far[4]. The state's major hydropower projects are Tehri (1000 MW), Koteshwar (400 MW), and Vishnuprayag (400 MW).

Table 2: Source wise Installed Capacity (MW)

Uttarakhand - Source wise Installed Capacity (MW)*						
	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
Gas	0	0	450	450	450	450
Hydro	3,426.25	3,756.35	3,756.35	3,756.35	3,756.35	3,756.35
RES	287.32	323.47	515.81	547.36	594.07	660.72
Total	**3,713.57**	**4,079.82**	**4,722.16**	**4,753.71**	**4,800.42**	**4,867.07**

*The Installed Capacity is excluding the Captive Power Installed Capacity

Source: www.cea.nic.in/installed-capacity-report/?lang=en

Table 3: Ownership wise Installed Capacity (MW)

Uttarakhand - Ownership wise Installed Capacity (MW)						
	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
Central	1,444.1	1,774.2	1,774.2	1,774.2	1,774.2	1,774.2
Private	954.45	990.6	1,632.94	1,659.53	1,706.2	1,772.85
State	1,315.02	1,315	1,315.02	1,320.02	1,320.02	1,320.02
Total	**3,713.57**	**4,079.82**	**4,722.16**	**4,753.71**	**4,800.42**	**4,867.07**

*The Installed Capacity is excluding the Captive Power Installed Capacity

Source: www.cea.nic.in/installed-capacity-report/?lang=en

Table 4: Hydro Projects Under Operation in Uttarakhand State[5] in 2021-22

S.No.	Name of Project	Estimated Potential (MW)	Agency
CENTRAL SECTOR			
1	Dhauli Ganga	280	NHPC
2	Tanakpur	94.2	
3	Tehri Dam ST-I	1000	THDC
4	Koteshwar Dam	400	
5	Naitwar Mori	60	SJVNL
STATE SECTOR			
6	Chibro	240	UJVNL

[4] https://cea.nic.in/wp-content/uploads/2020/06/hydro_potential_region-03.pdf
[5] https://cea.nic.in/wp-content/uploads/hepr/2020/06/state_power-03.pdf

7	Chilla	144	
8	Dhakrani	33.75	
9	Dhalipur	51	
10	Khatima	41.4	
11	Khodri	120	
12	Kulhal	30	
13	Maneri Bhali-I	90	
14	Maneri Bhali-II	304	
15	Ram Ganga	198	
16	Vyasi [Lakhwar Vyasi - II]	120	
PRIVATE			
17	Shrinagar	330	AHPC
18	Vishnuprayag	400	JPPVL
19	Singoli Bhatwari [Mandankini]	99	ReNew Power
TOTAL		**4,036 MW**	

Table 5: Upcoming H.E. Projects in Uttarakhand[5]

S.No.	Project	Agency	District	I.C. (MW)
1	Lata Tapovan	NTPC	Chamoli	171
2	Tapovan Vishnugad [Tapovan Chunar]	NTPC	Chamoli	520
3	Vishnugad Pipalkoti	THDC	Chamoli	444
4	Phata Byung	LANCO	Rudraprayag	76
5	Lakhwar Multi-Purpose Project (MPP)	UJVNL	Dehradun	300
Sub-Total				**1,310**

*Subject to restart of work

Table 6: H. E. Projects yet to be allotted by the State for development.

S.No.	Project	River	Type	I.C.(MW)
1.	Kishau Dam	Tons	S	660
2.	Pisha Naitwar	Rupin	R	30
3.	Ram Ganga Dam	Ram Ganga	S	75
4.	Kuwa ford	Yamuna	R	42
5.	Nelang	Jadh Ganga	R	190
6.	Ganga Canal	Ganga	R	31
7.	Diulong Sumangaon	Bhagirathi	R	26
8.	Dhargaon Jhandarwali	Bhagirathi	R	29
9.	Jamolna Ghansyali	Bhagirathi	R	44
10.	Nayar Dam	Nayar	S	34
11.	Benakuli	Alaknanda	R	40
12.	Khel Kuran Neti	Dhauli Ganga	R	49
13.	Niti Ghansali	Dhauli Ganga	R	32
14.	Bampa Kurkuti	Dhauli Ganga	R	60
15.	Girthi Ganga	Girthi Ganga	R	34
16.	Deodi	Rishi Ganga	R	65
17.	Tikh Gurupha	Pindar	R	26
18.	Malkhet Dam	Pindar	S	37
19.	Banoli Nalgam	Pindar	R	55

S.No.	Project	River	Type	I.C.(MW)
20.	Lakhwar MPP (Lakhwar Vyasi - I)	Yamuna	S	115
21.	Uttyasu Dam	Alaknanda	S	1140
22.	Sobla Jhimirigaon	Dhauli Ganga	R	145
23.	Tawaghat Dharchula	Sarda	R	310
24.	Kalika Dantu	Sarda	R	140
25.	Garjia Dam	Gori Ganga	S	295
	Total	**25 nos. of projects**		**3,504**

Table 7: Gas Based Thermal Power Plants in Uttarakhand

Gas Based Thermal Plants			
S.No.		**Name of Plant**	**Installed Capacity (MW)**
1	**Gas Based Private Generators**	GIPL (Gamma Infra Pvt.Ltd)	225 (3x75)
2		SEPL (Shravanti Pvt.Ltd)	225(3x75)

Source: www.uksldc.in/installed-capacity

Table 8: Installed Capacity of Solar Power Plants in Uttarakhand

Category	Total Capacity (MW)
Installed Solar Power Plant – Grid Connected	254.55
Installed Solar Power Plant – Off Grid	3.66
Total	**258.21**

Source: Invest Uttarakhand (as of 2019)

Table 9: Small Hydro Power Plants Installed Capacity (MW) under UJVNL

S.No.	Small Hydro Power Plants	Installed Capacity (MW)
1	Kaliganga-II (2x 2.25 MW)	4.5
2	Kaliganga-I (2 x 2 MW)	4
3	Galogi (1 x 3 MW)	3
4	Mohammadpur (3 X 3.1 MW)	9.3
5	Pathri (3 X 6.8 MW)	20.4
6	Dunao (2 X 750 KW)	1.5
7	Urgam (2X1500 KW)	3
8	Suringad SHP	5
9	Madhyamaheshwar SHP	15
Total		**65.7**

Source: www.ujvnl.com/operational-plants#

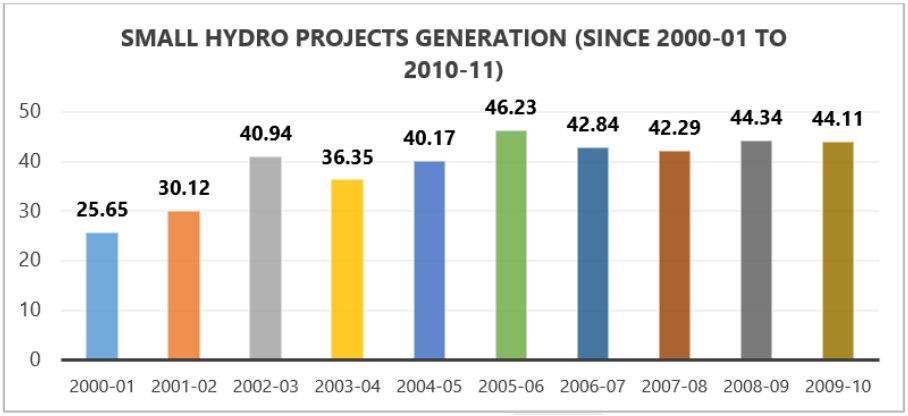


Figure 2: Generation from Small Hydro Power Project[6]

The integrated efforts by UJVNL have steadily increased the generation of Small Hydro Projects at a CAGR of 6.2 percent from FY2001 to FY2010.

A total 121.5 MW capacity addition has been targeted as shown in the table below. UJVNL is endeavoring to set up the Small Hydro Projects (SHPs) so as to bring about development in the remote areas of Uttarakhand there by facilitating overall development of the state.

Table 10: Upcoming Small Hydro Project in Uttarakhand

S.No.	Name of Project	District	I.C. (MW)	Expected Year of Completion
1	Tapovan	Chamoli	2	2027-28
2	Guptkashi	Rudraprayag	1.5	2026-27
3	Bhilangana II - A	Tehri	24	2028-29
4	Tankul	Pithoragarh	12	2028-29
5	Suwarigad	Uttarkashi	2	2027-28
6	Painagad	Pithoragarh	15	2029-30
7	Jimbagad	Pithoragarh	12	2029-30
8	Bhilangana II - B	Tehri	24	2028-29
	Sub-Total		**92.5**	

Renewable Energy

The state has potential in renewable energy i.e., solar-based power generation. The government of Uttarakhand has introduced multiple policy mechanisms to harness the state's abundantly available potential of solar energy.

[6] https://ujvnl.com/small-hydro-plants

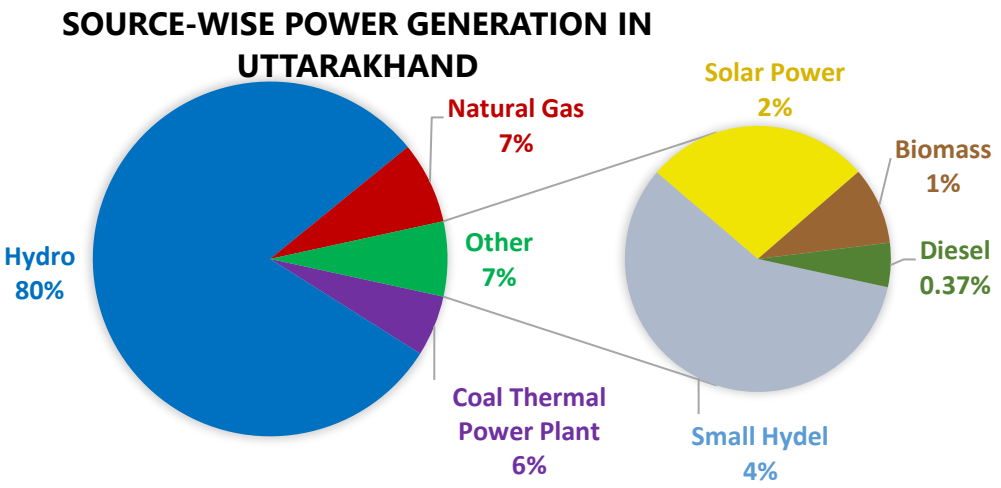


Figure 3: Source-wise power generation in Uttarakhand – FY 2019

Above charts represent that the majority of the energy is being generated by the Renewable energy sources in the State of Uttarakhand.

Solar Energy: Uttarakhand has significant potential for solar power generation due to its geographical location and climate. As of March 2019, the state had a total installed capacity of 258.21 MW of Solar Energy.[7] The largest solar power plant in the state is the 100 MW project in Bhagwanpur, which is being developed by the National Thermal Power Corporation (NTPC). The state government has recently launched its Solar Policy 2023, aiming to install a total of 2500MW of solar projects across the various categories. Through this policy the state offers exemption in the land use conversion fee, court fee, registration, land use approval, external development fee, investigation fee and infrastructure development fee. Also, the additional power generated through feed in tariffs by the consumer will be compensated. UREDA has been running solar programs such as Mukhayamantri Saur Swarojgar Yojana (MSSY) & had taken an initiative to provide state subsidy for National Solar Rooftop Scheme and also for solar water heaters.

Hydropower: Uttarakhand is known for its large hydroelectric projects. As of March 2019, the state had an installed capacity of 196.4 MW of micro, mini and small hydro power plants.[8] The state government is promoting small hydropower projects to promote clean energy and reduce dependence on traditional sources of energy. The state also has a policy to promote the development of micro-hydro projects with a

[7] https://mnre.gov.in/img/documents/uploads/file_f-1608040317211.pdf
[8]https://investuttarakhand.uk.gov.in/themes/backend/uploads/IP_UK_Renewable%20Energy%20SectorProfile-2019-05-21.pdf

capacity of up to 2MW. Nevertheless, access to electricity in the remote areas would generate livelihood and the impact can be spread to marginalized people and then to social activities. The proposed new SHPs for CDM for earning Emission Reduction credits which will generate additional revenue for SHPs and make them financially viable.

As various renewable energy projects are coming up in Uttarakahnd region, to ensure the effectiveness of the project and energy efficiency in the project it is crucial to consider various aspects. Here is a structured approach to meet those requirements:

1. Technical Efficiency:

- Evaluate the design and installation of solar panels. Ensure they are positioned optimally to capture maximum sunlight throughout the day.
- Assess the efficiency of the solar panels themselves. High-quality panels with efficient conversion rates are essential for maximizing energy production.
- Check for any shading issues or obstructions that might reduce the efficiency of the panels.

2. Operational Efficiency:

- Review the maintenance schedule. Regular cleaning and inspection of panels are vital to ensure optimal performance.
- Check if there are any technical issues with the inverters or other components that could affect energy production.
- Analyze the monitoring system in place to track energy production and identify any areas for improvement.

3. Financial Efficiency:

- Evaluate the return on investment (ROI) of the project. Calculate the cost per unit of energy produced and compare it to other energy sources.
- Assess any government incentives or subsidies that might impact the financial efficiency of the project.
- Consider the overall economic benefits of the project for the local community, such as job creation and revenue generation.

4. Environmental Impact:

- Measure the carbon footprint of the project compared to traditional energy sources. Solar power should significantly reduce greenhouse gas emissions.

- Consider any potential environmental concerns, such as habitat disruption or land use issues, and ensure they are properly addressed.

5. Community Engagement:

- Evaluate how the project has engaged with the local community. Public support and involvement can contribute to the success and longevity of the project.
- Assess any educational initiatives or outreach programs related to renewable energy and energy efficiency.

6. Long-Term Sustainability:

- Consider the scalability of the project. Is there potential for expansion or replication in other areas of Uttarakhand?
- Evaluate the resilience of the project to factors such as weather events or changes in energy policy.

7. Regulatory Compliance:

- Ensure that the project adheres to all relevant regulations and permits related to energy production and environmental impact.
- Review any certifications or standards that the project has achieved, such as ISO or other certifications.

1.6. Energy Consumption Scenario (TFEC)

Primary Energy Demand

Table 11: Primary Energy Consumption (Mtoe)[9]

Primary Energy Consumption (MTOE)						
Source/Year	**FY2015**	**FY2016**	**FY2017**	**FY2018**	**FY2019**	**FY2020**
Oil	2.95	3.24	2.86	2.52	2.47	2.14
Coal (Non-Power/Industry)	0.08	0.04	0.06	0.06	1.72	0.18
Coal (Captive)	0.13	0.22	0.16	0.09	0.00	0.28
Gas	0.000	0.000	0.000	0.000	0.0001	0.001
Total	**3.17**	**3.50**	**3.067**	**2.66**	**4.19**	**2.60**

[9] www.coalcontroller.gov.in; NITI Ayog; www.mopng.gov.in

Oil Consumption: As of March 2020, the State of Uttarakhand consumed around 20,58,000 tonnes of petroleum products (equivalent to 2.14 Mtoe), which includes LPG, Kerosene, Petrol, Diesel, Furnace Oil, Low Sulphur Heavy Stoke and Pet Coke annually.

LPG is a clean-burning fuel commonly used for cooking and heating, while Kerosene is mainly used as a fuel for lighting and heating appliances. Petrol and diesel are the primary fuels used in transportation, while Furnace Oil is used for heating and power generation. LSHS is a residual fuel oil used in industrial boilers and power plants, while Pet Coke is a solid fuel used in cement and power plants. This consumption of petroleum products indicates the high level of energy usage in Uttarakhand, which is essential for the state's economic and social development. However, it also highlights the state's dependence on fossil fuels, which has significant environmental and economic implications.

The continued reliance on fossil fuels can contribute to air pollution, climate change, and other environmental issues, while also making the state vulnerable to fluctuations in global oil prices. Therefore, there is a need to explore alternative energy sources and promote energy conservation measures to reduce the state's dependence on petroleum products.

Coal Consumption: The coal consumption can be classified into two categories: coal (non-power/industry) and coal (captive). Coal (non-power/industry) refers to the coal consumed by non-power industries, such as pulp paper, sugar, steel, and other industries, for their production processes. The state consumed 0.32 million tonnes of coal (non-power/industry) in FY2020, which is equivalent to 0.18 Mtoe. Coal (captive) refers to the coal consumed by industries for their captive use, such as for power generation or production processes. The state consumed 0.65 million tonnes of coal (captive) in FY2020, which is equivalent to 0.28 Mtoe.

Gas Consumption: The consumption of natural gas in the state was minimal, with a total supplied gas (CNG) of 1,060 tonnes equivalent to 0.001 Mtoe as of March 2022. Natural gas is a clean-burning fuel that can be used in various applications such as power generation, heating, and transportation. However, the consumption of natural gas in Uttarakhand seems to be very low, and the state mainly relies on other sources of energy like petrol, diesel, LPG, and hydropower. This indicates that the use of CNG vehicles in

the state of Uttarakhand is not very popular, and the majority of vehicles run on petrol or diesel.

Overall, the state was heavily reliant on hydropower for electricity generation, with a growing focus on solar power.

Secondary Energy Demand

Electricity Consumption: As of March 2020, the total electricity consumption in Uttarakhand was 12,021 GWh per year, with a peak demand of 2,233 MW. The peak demand usually occurs during the summer months when the use of air conditioning and other cooling appliances is more prevalent. The state had an installed capacity of around 5,383 MW as of March 2022, which included hydropower, and renewable energy sources (Small Hydro Project, Urban & Industrial Waste Power, Solar Energy). In addition, Uttarakhand has also made progress in the use of renewable energy sources, such as Small Hydro Project, Urban & Industrial Waste Power, and Solar Energy, to generate electricity.

1.7. Overview of Institutional framework and stakeholder mapping

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

The power institutional framework of Uttarakhand is represented below:

	Uttarakhand Electricity Regulatory Commission (UERC)	▪ Regulates the transmission and sale of electricity in the state
	Uttarakhand Jal Vidyut Nigam Limited (UJVNL)	▪ Generation of Hydroelectricity in the State. ▪ Operates large and small hydro powerplants from 1.5 MW to 304 MW
	Power Transmission Corporation of Uttarakhand Limited (PTCUL)	▪ Handles the power Transmission front in the state
	Uttarakhand Power Corporation Limited (UPCL)	▪ Handles the Power Distribution in the state
	Uttarakhand Renewable Energy Development Agency (UREDA)	▪ Handles the development of Renewable Energy in the state

2. Identification of Focus Sectors

The economic sectors of the State of Uttarakhand can be broadly classified into sectors namely Industry, Building, Transport, Agriculture, Municipalities and DISCOMs, and Cross Sectors.

Identification of focus sectors or focus areas is important because it is a general characteristic of a state that a major portion of energy is being consumed by a 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.

2.1. Methodology of Focus Sector Identification

The methodology used to determine the focus sectors in the State of Uttarakhand includes multiple factors. The first factor is the energy consumption profile of the state. This information provides a clear understanding of where energy is being used and which sectors are consuming the most. The analysis reveals that the industry sector is the largest energy consumer in the state.

The second factor is the input from stakeholders. Stakeholders include individuals, organizations, and communities that have a vested interest in energy consumption and production in the state. Their input is valuable as they have a direct impact on the sector they represent.

The third factor is priority areas of the state. Priority areas are determined based on the state's development goals, energy policies, and future aspirations. These priority areas help in identifying sectors that require immediate attention and support.

After considering these factors, the focus sectors are identified, which are the Industry, Buildings, Transport, Agriculture & MuDSM sectors. The industry sector is the primary focus as it is the largest energy consumer in the state. The buildings sector is important as it accounts for a significant amount of energy consumption in the domestic and commercial sectors with 37.5% of the total electricity consumption. The Transport sector

is also a critical focus as it is one of the largest energy consumers and relies heavily on fossil fuels (oil).

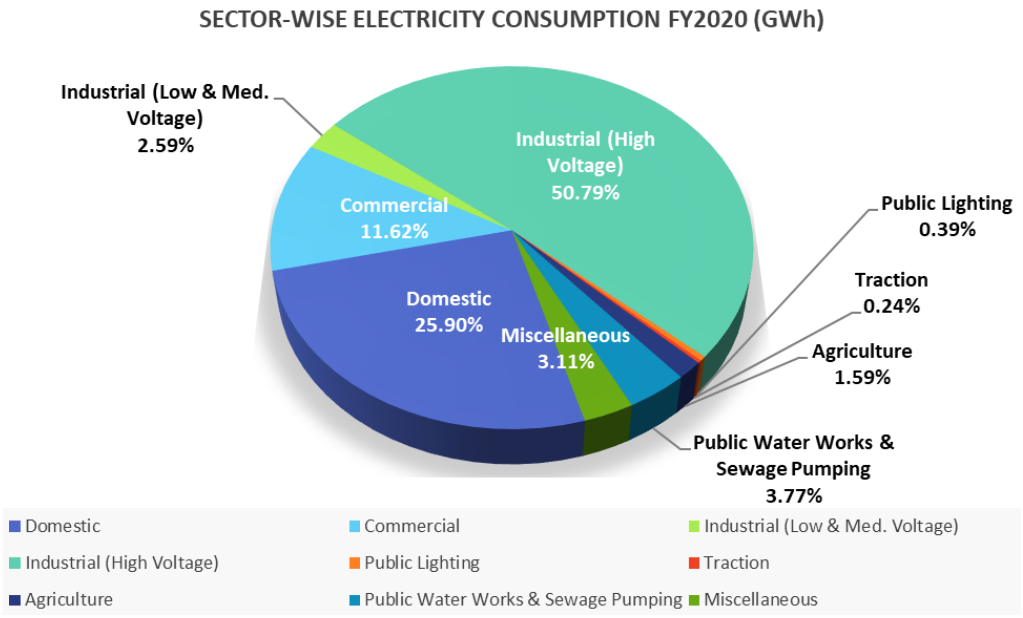


Figure 4: Electricity Consumption FY2020 (GWh)

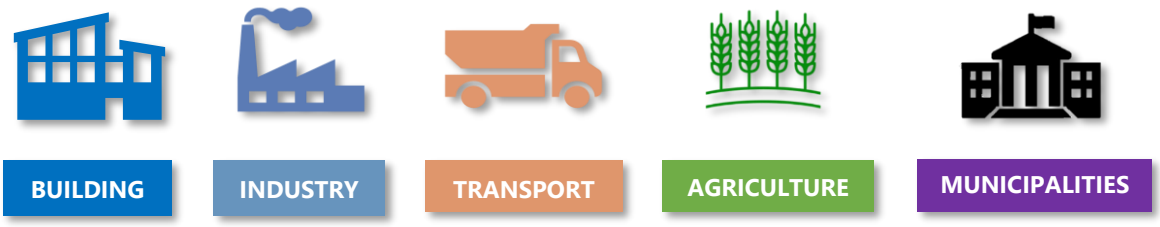
Source: Central Electricity Authority (CEA) Dashboard

Stakeholder Consultation

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

2.2. Identified Focus Sectors

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



3. Projections and Forecasting

Economic and energy projections for the State of Uttarakhand to the target year FY 2031 are performed in order to predict the future growth patterns of the respective sectors and to assess the impact of possible energy efficiency interventions in these sectors. The Gross State Domestic Product (GSDP) projections and the energy consumption projections form the basis of defining the actions for energy conservation in the state, which is important in developing the consumption 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 Uttarakhand was recorded at INR 1.87 Lakh Crore in FY 2020 and is projected to reach INR 3.78 Lakh Crore in FY 2031, at constant prices of 2011-12. The GSDP for the period FY 2023-FY 2031 is forecasted by taking weightage of the GSDP growth rate recorded in the years FY 2015-FY 2020 and the projection of GSDP growth rate by vision document of Uttarakhand. The historic and forecasted GSDP for the State of Uttarakhand is shown in the figure below.

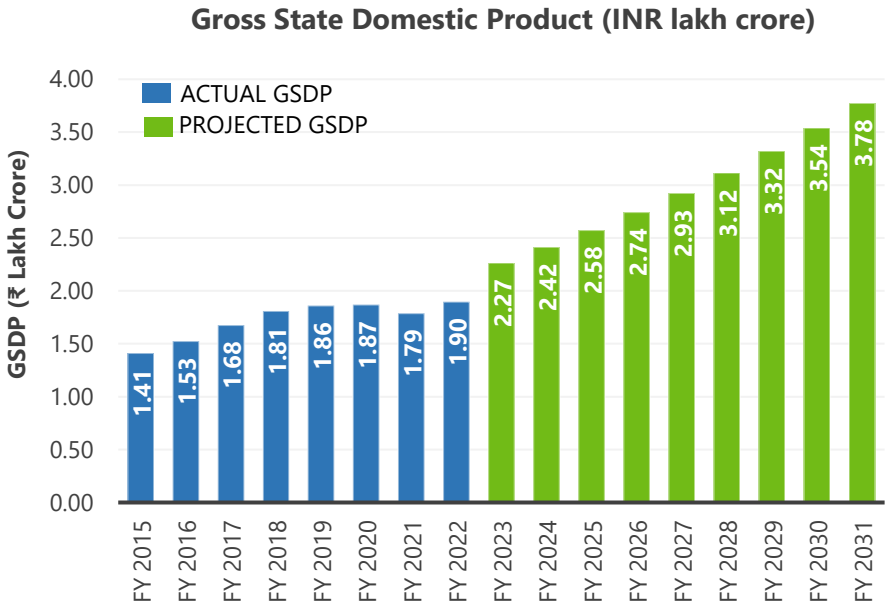


Figure 5: GSDP Projection of Uttarakhand

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

The Total Final Energy Consumption of the state in the Business-As-Usual (BAU) scenario is projected to reach 8.77 MTOE in FY 2030 from 3.64 MTOE in FY 2020, with a projected CAGR of 9.20%.

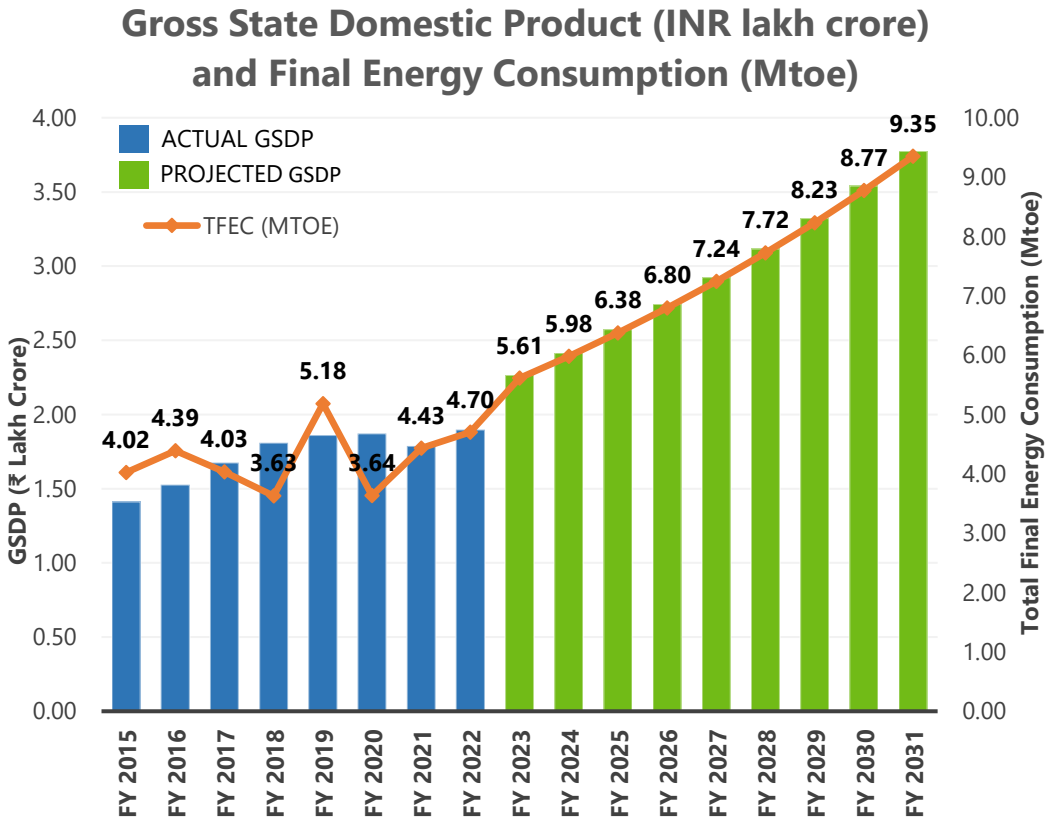


Figure 6: Gross State Domestic Product (INR lakh crore) and Final Energy Consumption (Mtoe)[10]

[10] Ministry of Statistics and Programme Implementation (mospi.gov.in)


INDUSTRY
SECTOR

4. Focus Sector-1: Industry

4.1. Current Scenario

Uttarakhand is a state in northern India that is rich in natural resources and has a favorable location for industrial development.

The state has a diverse range of industries, including agriculture, tourism, and manufacturing. Some of the major large and medium industries in the state include Tata Motors, Bajaj Auto, Mahindra & Mahindra, Hero MotoCorp, and Nestle. These industries are primarily involved in automobile manufacturing, food processing, and other manufacturing activities.

As per the MSME annual report of 2020–2021, there are approximately 4.17 lakh MSME units (registered & unregistered) operating in the State out of which over 58,040 are registered MSMEs (Micro, Small, and Medium Enterprises), employing over 4 lakh people.[11]

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: Deepening and Widening of PAT Scheme

Implementation Timeline: Long Term (Till FY 2031)

In the proposed strategy, it is recommended that the state enhances 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. Paper and Pulp sector was introduced to the PAT in the PAT Cycle – I in the year of 2012, also the sugar sector was introduced in the year of 2023.

[11] https://journals.sagepub.com/doi/pdf/10.1177/09708464211073536

Moderate and Ambitious SEC assigned to pulp & paper non-PAT units, and to Sugar plants units above 3000 TCD. 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. The sugar sector is expected to grow at a CAGR of 4.9% while the Paper & Pulp sector is expected to grow at a CAGR of 6.7%.

Table 12: Moderate and ambitious scenarios for deepening and widening of PAT scheme for Sugar and Paper & Pulp industry.

Sector	Baseline SEC	Moderate SEC	Ambitious SEC	Production in 2030 ('000 tonnes)	Energy saving in moderate scenario (Mtoe)	Energy saving in ambitious scenario (Mtoe)
Sugar	28 (kWh/tonne of cane)	22 (kWh/tonne of cane)	18.7 (kWh/tonne of cane)	9965	0.003	0.004
Pulp & Paper	0.83 (toe/tonne)	0.75 (toe/tonne)	0.66 (toe/tonne)	562	0.047	0.093

Implementing Agency: Bureau of Energy Efficiency, UREDA, Directorate of Industries

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)**

   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 2027) for lower coverage; Long Term (Till FY 2031) for higher coverage.

The strategy is proposed for the Small and Medium Enterprises (SME) sector industries which consist of MSMEs in identified prominent sectors such as pharmaceutical clusters for moderate scenario and in addition to moderate scenario Food products in ambitious scenario. 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 4% energy savings in moderate scenario and 14% energy savings will be covered in the ambitious scenario, through the intervention of technology such as Conversion of HSD-fired Boiler to Biomass-fired Boiler, Installation of VFD for Screw Chiller Compressor, Electronically Commutated Motors for AHUs and Condensate Recovery System. The strategy is expected to result in energy savings of 0.00071 MTOE and 0.00287 MTOE in the moderate and ambitious scenarios respectively.

Table 13: Moderate and ambitious scenarios

Particulars	Moderate Scenario by FY 2031	Ambitious Scenario by FY 2031
Energy Saving Potential (MTOE)	0.00071	0.00287

Implementing agency(s) – Bureau of Energy Efficiency (BEE); UREDA, SIIDCUL

Actionable items:

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

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

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

2. **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 in 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.
3. **Demonstration projects on latest Energy Efficiency Technologies in SME clusters –** Demonstration projects are proposed to be carried out every year on a periodic basis in all prominent SME clusters to promote these technologies and make stakeholders aware about the monetary and energy performance impact of these technologies.
4. **Periodic standardized energy audits for MSMEs on load basis and reimbursement of energy audit cost with a maximum cap** – Government of Uttarakhand shall develop a standard format of energy audit and issue notification for conducting mandatory periodic (in every 3 Years) energy audits by every unit above a certain limit of connected load. The government can also provide reimbursement of energy audit cost with a maximum cap of INR 75,000. Monetary support to small industries and MSMEs can be provided to maintain the standard of conducted energy audit.
5. **Sector-specific policy development for financial assistance on implementation of ECMs suggested in energy audit-** A policy shall be developed at state level to provide the financial assistance for implementation of ECMs recommended in the energy audits. Policy development shall consider the sector specific requirements, energy saving potential of sector and its importance in state level GSDP.

6. **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 500001 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.
7. **Phase wise plan to implement DSM scheme for replacement of existing inefficient (non-star rated) pumps through SDA/DISCOMS-**

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

4.3. Energy Saving Targets & Monitoring Mechanism

The proposed strategies can together achieve maximum potential energy savings of 0.1004 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 industry sector under the two scenarios are shown in **Table 14** below.

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

Action Plan	Energy Savings by 2031 under moderate scenario (Mtoe)	Energy Savings by 2031 under ambitious scenario (Mtoe)
Deepening and Widening of PAT scheme	0.0495	0.0975
Energy efficiency in pharmaceutical cluster	0.00071	0.00287
Total	**0.0502**	**0.1004**

Monitoring Mechanism:

To effectively carry out the action plan, it is essential to establish a robust monitoring and verification system. While the State Designated Agency – UREDA holds the primary responsibility for overseeing progress, it is imperative for other stakeholders, including organizations engaged in industry sector development and planning, to actively engage in diligent monitoring and reporting. The suggested monitoring framework, outlining the steps to track the scheme's progress, is presented in the table below:

Type of Monitoring	Frequency	Nodal Agencies	Responsible Agencies
Reporting, Monitoring and Review of the scheme advance and implementation status	Quarterly	UREDA	• UREDA • Directorate of Industries • SIIDCUL
Review of the scheme advancement and course correction, if required.	Half-yearly	UREDA	• UREDA • Directorate of Industries • SIIDCUL
Review of the scheme advancement and policy interventions required	Yearly	UREDA	• Directorate of Industries • SIIDCUL • UREDA • Bureau of Energy Efficiency
Progress reporting of scheme advancement	Monthly	UREDA	• UREDA

BUILDINGS SECTOR

5. Focus Sector 2: Buildings

5.1. Current Scenario

Out of the total population of Uttarakhand, only 30.23 percent of the people live in the urban region. Despite this fact, the power consumption in the buildings sector is gradually increasing. The energy consumption in the urban areas is significantly high due to the growing demand of energy in the building sector.

The state government of Uttarakhand has adopted the ECBC and notified it through the Uttarakhand Energy Conservation Building Code (UECBC) in 2018. The UECBC is applicable to all new commercial buildings, including buildings for office, hotels, and healthcare facilities, with a plot area more than 500 sq.m. with minimum built up area of 500 sq.m. or the buildings having a connected load of 50kW or above or a contract demand of 60 kVA. The code mandates certain energy-efficient building design and construction practices, including requirements for building envelopes, lighting, air conditioning, and ventilation systems, and renewable energy utilization.

To facilitate the implementation of the UECBC, the state government of Uttarakhand has established a State Designated Agency (SDA) for energy efficiency. The SDA is responsible for providing technical assistance to building owners and developers to ensure compliance with the UECBC provisions.

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

In Recent, The Energy Conservation (Amendment) Act, 2022. A unified code for the 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 building sector is a major energy guzzling sector in Uttarakhand. As per the graph below it can be witnessed that the energy consumption in building sector is continuously increasing since FY 2015.

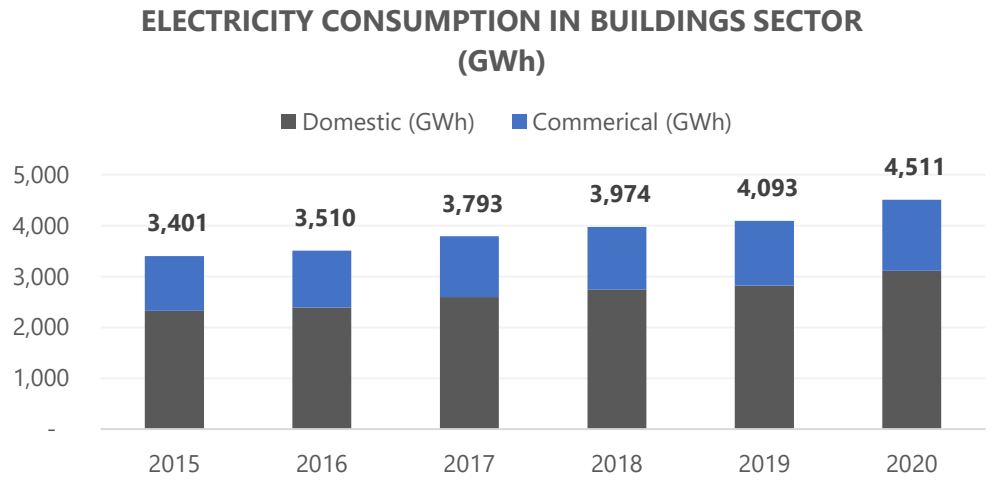


Figure 7: Electricity Consumption in the Buildings Sector (GWh)

The commercial sector supports urbanization in Uttarakhand, but still caters to only 31% of the total electricity consumption in the building sector. The domestic sector on the other hand, retains 69% of the electricity consumption, this indicates that the state requires a policy to encourage energy efficiency in the domestic sector, it may be noted that even if a fraction of the domestic sector is addressed by following energy efficiency plans, then a huge some of electricity consumption can be eradicated.

The sharing pattern of electricity consumption of the commercial and domestic sector for FY 2020 is represented in the following figure:

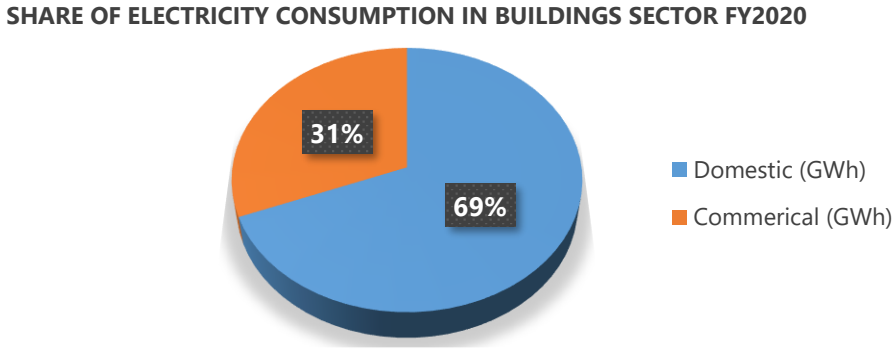


Figure 8: Share of Electricity Consumption in Buildings sector FY 2020

5.2. 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 program for inefficient appliances**
3. **Promotion of BEE Star Rating and Shunya Rating of Buildings**

Although programs like Standards & Labelling and ECBC are prevalent in the 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 (previously known as ECBC & ENS)

Uttarakhand is in the process of adopting Eco-Niwas Samhita (ENS) for residential buildings, while ECBC has been adopted and notified through UECBC 2018. However, in the recent EC Act Amendment 2022, unified code "Energy Conservation and Sustainable Building Code" (ECSBC) is introduced which will cover both commercial and residential buildings. Till the implementation of ECSBC in 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 of commercial buildings in the state is projected to be 921 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 46 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 **12 GWh** and **16 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 5,933 GWh. The overall incremental electrical consumption is estimated to be 2,432 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 FY2031. The strategy is expected to result in electricity savings of 11.67 GWh in the moderate scenario and that of 14.58 GWh in the ambitious scenario.

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

Table 15: Moderate and ambitious scenarios for effective implementation of ECSBC

Particulars	Moderate Scenario by FY 2031	Ambitious Scenario by FY 2031
Energy Saving Potential (MTOE) in ECBC	0.0010	0.0014
Energy Saving Potential (MTOE) in ENS	0.0010	0.0013
Total	**0.0020**	**0.0027**

Implementing Agency: Bureau of Energy Efficiency, UREDA, UHADA.

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, check points, monitoring mechanism and penalties must be properly defined in ECSBC rules & regulations.

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

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

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[28] of Bureau of Energy Efficiency (BEE) has seen a successful implementation across the country, leading to significant savings in energy through mandatory and voluntary use of energy efficient electrical appliances by consumers in a wide range of applications. The S&L programme encompasses

appliances and equipment that have applications in multiple sectors, however the buildings sector is the most widely covered sector in terms of types and number of appliances.

At present, the S&L Programme covers 38 appliances, with 16 appliances subject to mandatory regulation and the remaining 22 appliances subject to voluntary regulation. The list of mandatory and voluntary appliances is given in below table:

Table 16: List of mandatory and voluntary appliances under S&L Programme

Mandatory Appliances	Voluntary Appliances
1. Room Air Conditioners 2. Frost-free refrigerators 3. Tubular Florescent Lamps 4. Distribution Transformer 5. Room Air Conditioner (Cassette, Floor Standing) 6. Direct Cool Refrigerator 7. Color TV 8. Electric Geysers 9. Variable Capacity Inverter Air Conditioners 10. LED Lamps 11. Ceiling Fans 12. Light commercial AC 13. Deep Freezers 14. Washing Machine 15. Chillers 16. UHD Color TV	1. General Purpose Induction Motors 2. Agriculture Pump Sets 3. LPG Stove 4. Office Equipment's (Printers & Copier) 5. Ballast 6. Computers (Laptop/Notebooks) 7. Diesel Engine driven mono set pumps 8. Solid State Inverter 9. Microwave Oven 10. Solar Water Heater 11. Diesel Generator Set 12. Grid Connected solar Inverter 13. Commercial Beverage Coolers 14. Air Compressor 15. High Energy Li-Battery 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 the below table.

Table 17: Appliances taken into consideration for the strategy.

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

According to the study conducted by CLASP (Collaborative Labeling and Appliance Standards Program)[12] 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 0.02 MTOE in the moderate scenario and 0.03 MTOE in the ambitious scenario till FY 2031.

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

Table 18: Moderate and ambitious scenarios for deepening of S&L Programme

Particulars	Moderate Scenario by 2031	Ambitious Scenario by 2031
Energy Saving Potential (MTOE)	0.0235	0.0309

Implementing Agency- UREDA**,** 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.
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 stars 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 DISCOM's 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; UREDA; UHUDA

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 of promoting energy efficiency in buildings. In order to increase awareness about these rating programs, promotional 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.

5.3. Energy Saving Targets & Monitoring Mechanism

The proposed strategies can together achieve maximum potential energy savings of 0.034 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 19**.

Table 19: 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	0.0020	0.0027
Replacement program for inefficient appliances	0.0235	0.0309
BEE Star Rating and Shunya Rating of Buildings	0.0001	0.0002
Total	**0.0256**	**0.0337**

Monitoring Mechanism:

To effectively carry out the action plan, it is essential to establish a robust monitoring and verification system. While the UREDA (State Designated Agency) holds the primary responsibility for overseeing progress, it is imperative for other stakeholders, including organizations engaged in building sector development and planning, to actively engage in diligent monitoring and reporting. The suggested monitoring framework, outlining the steps to track the scheme's progress, is presented in the table below:

Type of Monitoring	Frequency	Nodal Agencies	Responsible Agencies
Reporting, Monitoring and Review of the scheme advance and implementation status	Quarterly	UREDA	• UHUDA
Review of the scheme advancement and course correction, if required.	Half-yearly	Urban Administration Development Department	• UREDA • UHUDA
Review of the scheme advancement and policy interventions required	Yearly	Urban Administration Development Department	• UREDA
Progress reporting of scheme advancement	Monthly	State Designated Agency (through the ECSBC Cell)	• Bureau of Energy Efficiency

In conclusion, Monitoring mechanisms are essential for successful implementation of energy efficiency action plans, providing a way to track progress, identify areas for improvement, and evaluate energy efficiency measures. Moreover, monitoring mechanisms can also help to identify patterns and trends in energy consumption, allowing policymakers to develop effective energy efficiency strategies. Effective monitoring mechanisms are essential for achieving energy efficiency goals in the building sector, leading to cost savings, improved comfort, and environmental benefits.

TRANSPORT SECTOR

6. Focus Sector 3: Transport

6.1. Current Scenario

Being a tourist spot Uttarakhand receives heavy in-flow traffic of vehicles throughout the year. Most of the oil consumption in the state goes into the transportation sector. The Uttarakhand government, to promote sustainable transportation is taking several steps. One of these steps includes promotion of Electric vehicles. The data for electricity consumption in the transportation sector in Uttarakhand is available on the public domain. This is expected to increase in the future owing to an expected increase in the penetration of electric vehicles in the state as well as charging infrastructure.

As of 2023, 48,250 registered electric vehicles in the state of Uttarakhand which is 1.33% of the total registered vehicles in the state. The total number of public charging stations is approximately 48.

Adding to that, the sectoral transport share of the state is led by 2W (2 Wheelers) which holds 71% of the total registered vehicles. Further, the two-wheeler sector also shows potential of transition when compared with the market availability. The data for the number of vehicles has been sourced from the Vahan Dashboard. The number of registered vehicles in the state has increased from 26,95,594 in FY 2018 to 33,22,590 in FY 2021, with an average Annual Growth Rate (AAGR) of 7.66%. In the study, tractors, ambulances, tankers and private trailers have been excluded which is negligible in the numbers as compared to the total registered vehicles.

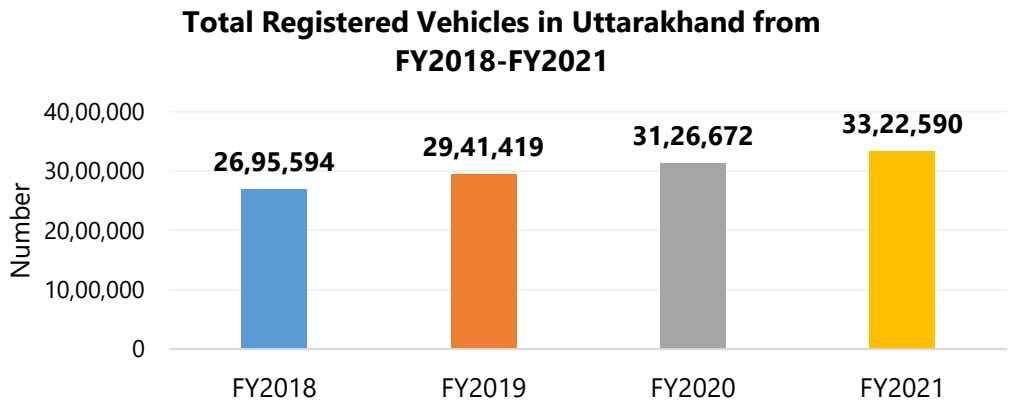


Figure 9: Total registered vehicles in the State of Uttarakhand

This AAGR is further treated as CAGR to project the number of registered vehicles by the years 2025 and 2030, with base year as 2021.

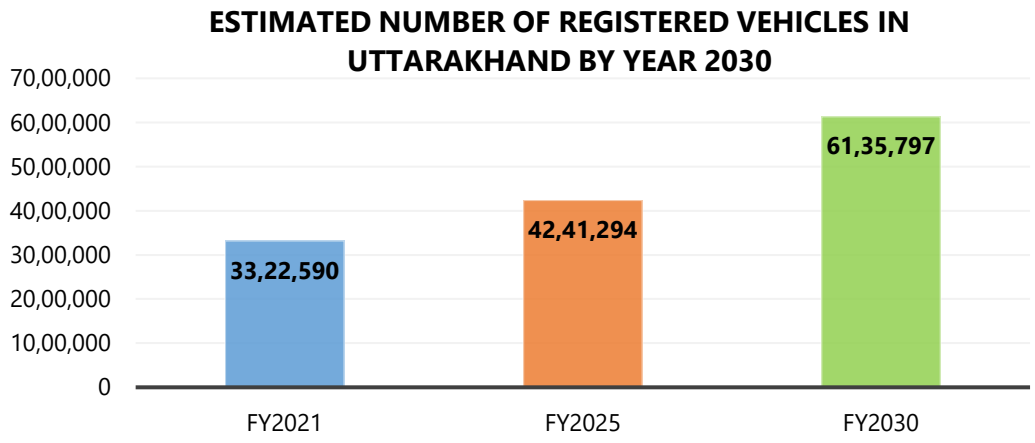


Figure 10: Estimated number of registered vehicles in Uttarakhand by year 2030

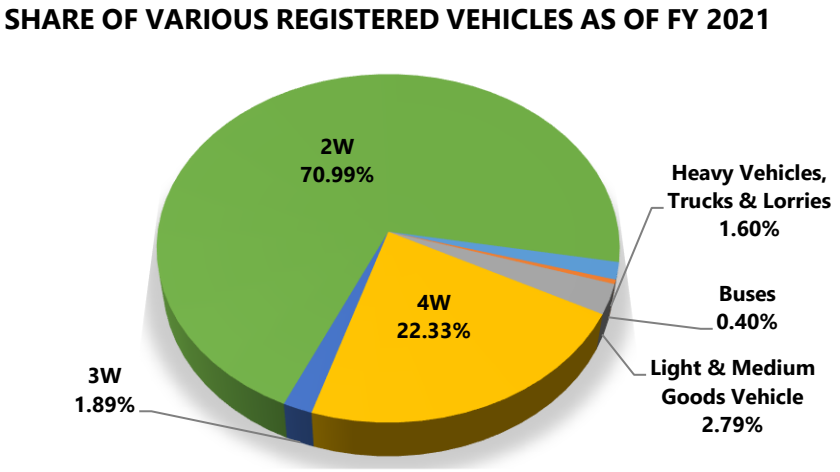


Figure 11: Share of vehicle types for no. of registered vehicles

It can be seen that 2W (small four wheelers/cars) (71%) make up the largest share in the vehicle category type. The next-highest is truck cargos at 13% share. Hence, targeting the 2-Wheelers for transition to electric vehicles can bring about significant reduction in primary energy consumption in the transport sector of Uttarakhand.

6.2. Strategies in the Transport Sector:

In line with the Uttarakhand EV Policy 2018, the long-term strategy for Electric Vehicle Transition has been proposed for the state. The policy and the proposed strategy encompass a number of aspects of the transport sector ranging from incentives to

consumers to undergo EV transition, converting state's bus fleet to electric, electric transition in logistics transport, and development of charging station 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 20**.

Table 20: EV transition considerations for moderate and ambitious scenarios

Moderate Scenario	Ambitious Scenario
• 25% of conventional 2-Wheelers convert to electric by 2031. • 25% of conventional 4-Wheelers convert to electric by 2031. • 25% buses in the state to transition to electric buses by 2031. • 50% of 3-Wheelers to convert to electric by 2031. • 25% of heavy vehicles (trucks and lorries) to convert to electric by 2031	• 50% of conventional 2-Wheelers convert to electric by 2031. • 50% of conventional 4-Wheelers convert to electric by 2031. • 50% buses in the state to transition to electric buses by 2031. • 75% of 3-Wheelers to convert to electric by 2031. • 50% of heavy vehicles (trucks and lorries) to convert to electric by 2031

The EV transition strategy can result in potential energy savings of 0.18 MTOE and 0.36 MTOE in the moderate scenario and ambitious scenario respectively.

Table 21: Energy Savings Potential

Particulars	Moderate Scenario by FY 2031	Ambitious Scenario by FY 2031
Energy Saving Potential (MTOE)	0.18	0.36

Implementing Agency: Transport Department, DISCOMs, PSUs and private sector

Actionable Items:

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

There are several regulatory mechanisms that can be put in place to develop EV charging infrastructure in Uttarakhand. 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 Uttarakhand.
- 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, the Uttarakhand 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

As per the Uttarakhand EV Policy 2018, establishment of a wide network of charging stations and swappable battery station is on high priority. The policy recognizes the importance of charging infrastructure for the growth of the EV industry and aims to create a robust charging infrastructure network across the state.

The policy envisions the establishment of charging stations at various locations such as public places, commercial and residential buildings, parking lots, highways, and other

strategic locations. The state government plans to provide incentives for the establishment of charging stations, including subsidies and other benefits, to encourage private players to invest in charging infrastructure.

Other action items include awareness programs for energy conservation technologies in the transport sector, and the introduction of demonstration or pilot projects on alternative fuel vehicles. Pilot projects will build the readiness of the state in adapting to vehicles run by alternative fuels such as Hydrogen Fuel Cell Vehicles (HCV).

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 0.09 MTOE and 0.17 MTOE in the moderate and ambitious scenarios respectively.

Table 22: Moderate and ambitious scenarios for Ethanol blending

Particulars	Moderate Scenario by FY 2031	Ambitious Scenario by FY 2031
Energy Saving Potential (MTOE)	0.09	0.17

Implementing Agency: State Transport Department & Individual Government Departments

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.

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.

6.3. Energy Saving Targets & Monitoring Mechanism

On the basis of the proposed strategies for the transport sector, the total energy saving estimated is 0.26 Mtoe in the moderate scenario and 0.54 Mtoe in ambitious scenarios. 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 23: Moderate and ambitious scenarios energy savings for transport sector

Strategies	Energy Savings in 2031 under moderate scenario (Mtoe)	Energy Savings in 2031 under ambitious scenario (Mtoe)
Transition to electric vehicles	0.18	0.36
Ethanol blending	0.09	0.17
Total	**0.26**	**0.54**

Monitoring Mechanism:

To effectively carry out the action plan, it is essential to establish a robust monitoring and verification system. While the Transport Department, Uttarakhand holds the primary responsibility for overseeing progress, it is imperative for other stakeholders, including organizations engaged in building sector development and planning, to actively engage in diligent monitoring and reporting. The suggested monitoring framework, outlining the steps to track the scheme's progress, is presented in the table below:

Type of Monitoring	Frequency	Nodal Agencies	Responsible Agencies
Reporting, Monitoring and Review of the scheme advance and implementation status	Quarterly	UREDA	• Transport Department, Uttarakhand
Review of the scheme advancement and course correction, if required.	Half-yearly	UREDA	• UREDA • Transport Department, Uttarakhand
Review of the scheme advancement and policy interventions required	Yearly	UREDA	• Transport Department, Uttarakhand • UREDA • Bureau of Energy Efficiency
Progress reporting of scheme advancement	Monthly	UREDA	• Transport Department, Uttarakhand • UREDA

In conclusion, Monitoring mechanisms are essential for successful implementation of energy efficiency action plans, providing a way to track progress, identify areas for improvement, and evaluate energy efficiency measures. Moreover, monitoring mechanisms can also help to identify patterns and trends in energy consumption, allowing policymakers to develop effective energy efficiency strategies. Effective monitoring mechanisms are essential for achieving energy efficiency goals in the transport sector, leading to cost savings, improved comfort, and environmental benefits.


AGRICULTURE
SECTOR

7. Focus Sector 4: Agriculture

7.1. Current Scenario

Like most parts of India, agriculture plays a significant role in the economy of Uttarakhand. In 2019-20, agriculture sector contributed to about 9% of the economy in the State of Uttarakhand.[13] Owing to its vivid topography and diverse agro-climatic endowments, subsistence farming is practiced in most parts of Uttarakhand. The hilly areas of Uttarakhand practice mixed cropping, while in the plain areas single crops are grown. Crops like basmati rice, wheat, coarse cereals, pulses, soybeans and oil seeds are widely grown in Uttarakhand. About 45 percent of the main workers and 69 percent of marginal workers are engaged in agricultural and cultivation.[14]

TOTAL REPORTED AREA (2019-20)		**60,01,576 Hectare**
Forest Area		**38,11,662 Hectare**
Culturable Waste Land		**3,29,564 Hectare**
A	Fallow Land	1,82,950 Hectare
	Current Fallow	92,566 Hectare
	Fallow Land Other than Current Fallow	90,384 Hectare
B	Net Area Sown	6,37,978 Hectare
A+B	**Land Available for Cultivation**	11,50,492 Hectare
Source: https://des.uk.gov.in/files/Uttarakhnad_At_a_Glance_2020-21.pdf		

Most of the area of the State is under forests and wastelands thus leaving only a small amount of land i.e. 8.20 Lakh Hectare (Fallow Land & Net Area Sown), about 14% for cultivation out of the total reported area of 60.01 Lakh Hectare. Out of the total, about 89% are under small and sub marginal. As large number and area is under small and marginal holdings, scale of economies cannot be availed of, and so the input cost per unit of output is higher.

Against all these odds, the farmers of Uttarakhand are constantly endeavoring to fully utilize the agricultural potential of the State to increase food production and to supplement the income by producing quality cash crops. The main sources of electricity consumption in this sector are agricultural machinery/ equipment and pump sets in the State.

[13] https://prsindia.org/budgets/states/uttarakhand-budget-analysis-2021-22
[14] https://des.uk.gov.in/files/Uttarakhnad_At_a_Glance_2020-21.pdf

7.2. Energy Efficiency Strategies in the Agriculture Sector:

As of 2023, the total number of solar pumps installed by Minor Irrigation Department under the state sector are 136 and under the PM-KUSUM scheme are 5367 and the department is aiming to increase the efforts to fulfil the targets defined by the central and state government. 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 FY2027

The proposed strategy in the agriculture sector is to transition from conventional diesel pumps to solar-powered pumps by FY2027. 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 FY2027. 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 50% of diesel-powered pumps to solar pumps by 2027. 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 75% of diesel-powered pumps to solar pumps by 2027. 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 0.15 ktoe in moderate scenario and 0.22 ktoe in ambitious scenario.

Table 24: Energy Savings Potential in Transition of conventional diesel pumps to Solar powered pumps

Particulars	Moderate Scenario by FY 2031	Ambitious Scenario by FY 2031
Energy Saving Potential (kToe)	0.15	0.22

Implementing Agency: Minor Irrigation Department, UREDA

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 75% 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 0.41 ktoe in moderate scenario and 0.86 ktoe in ambitious scenario.

Table 25: 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 by FY 2031	Ambitious Scenario by FY 2031
Energy Saving Potential (ktoe)	0.41	0.86

Implementation Agency: UREDA, Minor Irrigation Department

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 0.56 ktoe in the moderate scenario and 1.08 ktoe in ambitious scenarios. 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 Agriculture Sector.

Table 26: Moderate and ambitious scenarios energy savings for agriculture sector

Strategies	Energy Savings in 2031 under moderate scenario (ktoe)	Energy Savings in 2031 under ambitious scenario (ktoe)
Transition of conventional diesel pumps to Solar powered pumps	0.15	0.22
Replacement of inefficient (non-star rated) pumps with BEE 5 Star Rated Pumps along with smart control panel	0.41	0.86
Total (kTOE)	**0.56**	**1.08**

Monitoring Mechanism:

To effectively carry out the action plan, it is essential to establish a robust monitoring and verification system. While the Directorate of Agricultural Department holds the primary responsibility for overseeing progress, it is imperative for other stakeholders, including organizations engaged in building sector development and planning, to actively engage in diligent monitoring and reporting. The suggested monitoring framework, outlining the steps to track the scheme's progress, is presented in the table below:

Type of Monitoring	Frequency	Nodal Agencies	Responsible Agencies
Reporting, Monitoring and Review of the scheme advance and implementation status	Quarterly	UREDA	• Minor Irrigation Department, Uttarakhand
Review of the scheme advancement and course correction, if required.	Half-yearly	UREDA	• UREDA • Minor Irrigation Department, Uttarakhand
Review of the scheme advancement and policy interventions required	Yearly	UREDA	• Minor Irrigation Department, Uttarakhand • UREDA • Bureau of Energy Efficiency
Progress reporting of scheme advancement	Monthly	UREDA	• Minor Irrigation Department, Uttarakhand

In conclusion, Monitoring mechanisms are essential for successful implementation of energy efficiency action plans, providing a way to track progress, identify areas for improvement, and evaluate energy efficiency measures. Moreover, monitoring mechanisms can also help to identify patterns and trends in energy consumption, allowing policymakers to develop effective energy efficiency strategies. Effective monitoring mechanisms are essential for achieving energy efficiency goals in the agriculture sector, leading to cost savings, improved comfort, and environmental benefits.

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 of Uttarakhand or through any DSM scheme.
4. **Testing and monitoring:** After installation, the new pumps undergo thorough testing to ensure proper functionality and performance.
5. **Training and capacity building:** Municipal staff and operators responsible for maintaining and operating the pumps receive training on the new equipment.
6. **Performance evaluation and optimization:** Regular evaluations are conducted to assess the performance of the new pumps. Energy consumption data, cost savings, and efficiency improvements are analyzed to measure the success of the strategy.

Implementation Strategy:

Municipal Corporation of the Uttarakhand in collaboration with Jal Nigam and Jal Sanasthan 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.

9. Market Potential in Focus Sectors

The energy saved as a result of the proposed strategies in all sectors will lead to avoided generation of equivalent amount. In order to implement the suggested strategies, there will be a need for investments in energy efficiency projects, development of new policies, and modification of existing policies. In order to estimate the 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 2018-19. The same amount has been applied to energy savings under ambitious scenario for the estimation of maximum investment potential. Total energy saving potential by implementing various strategies in Uttarakhand is shown in the graph below:

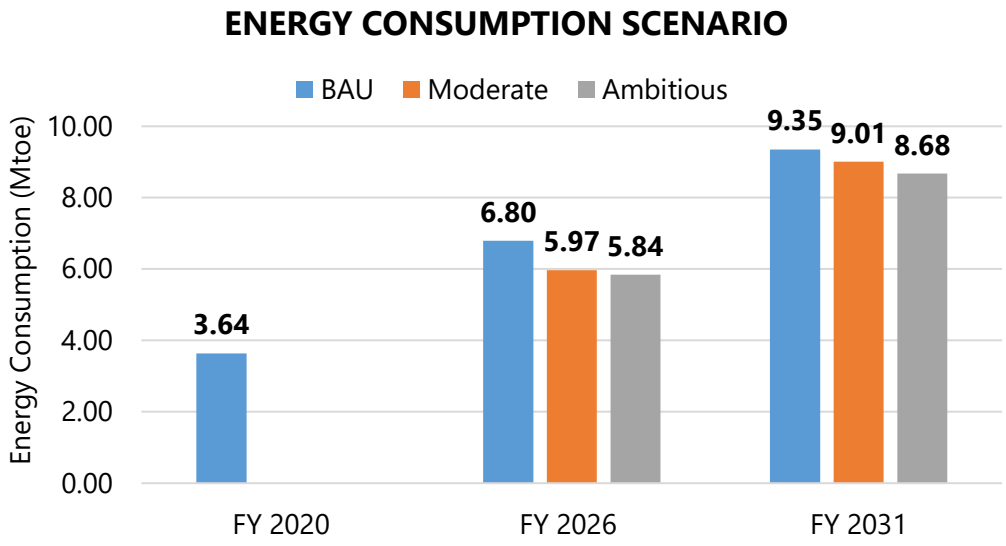


Figure 12: Energy Consumption Scenario

It is estimated that with the implementation of various proposed strategies of Industry, Buildings, Transport, and Agriculture, energy saving of 0.34 Mtoe in moderate scenario and 0.67 Mtoe in ambitious scenario can be achieved.

Table 27 Moderate and ambitious Energy Saving Summary

Sectors	Energy Saving Potential (Mtoe)		Emission Reduction Potential ($MtCO_2$)		Market Potential (INR Crore)
	Moderate	Ambitious	Moderate	Ambitious	
Industry	0.0502	0.1004	0.16	0.31	184.72
Buildings	0.0256	0.0337	0.08	0.11	62.02
Transport	0.2636	0.5373	0.82	1.68	988.78
Agriculture	0.00056	0.00108	0.00	0.00	1.98
Total	**0.3399**	**0.6725**	**1.06**	**2.10**	**~ 1,237.51**

10. The 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 Uttarakhand. While addressing the key focus sectors – Industry, Buildings, Transport 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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