State Energy Efficiency Action Plan

Sikkim

June 2023

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Introduction & State Profile

India's first NDC in Paris Agreement on Climate Change - 2016 called for 33-35% reduction of emissions intensity of GDP by 2030 compared to 2005. However, this target has been increased to 45% in the recent COP26.

The objective of the **State Energy Efficiency Action Plan (SEEAP)** is to ensure that the allocation of resources is as per the requirement of the state and to estimate the potential of energy conservation in sectors that are predominant in the region. The current assignment envisions the following:

- Identification of stakeholders from various sectors,
- Identification of focus sectors in a state,
- Identification of gaps through surveys,
- Sector-specific energy projections and energy savings targets
- Benefits to the State and various stakeholders through the implementation of the Energy Efficiency Action Plan

Overview

With the energy efficiency agenda gaining traction and momentum in India, there is a need to continuously evaluate institutional capacity, policies, programs, and markets at the state level to identify best practices and promote cross learning. Developing State Specific Energy Efficiency Action Plan through identification of focus sector, undertaking gap analysis, adopting best practices followed in peer group with implementation plan strategy; that can act as platform for developing State's Energy Policy and Programs. This assignment aims to develop State Specific Energy Efficiency Action Plans for the state of Sikkim.

As a part of the assignment, there has identification of stakeholders from various sectors, identification of focus sector in the state of Sikkim, identification of gaps in the sector, providing best practices and identification of designated agency to carry out efficiency activity in the sector in consultation with state for preparation of a short-term plan till the year 2025 and a medium-term plan till the year 2030. The plan also highlights the benefits derived from these initiatives to the state.

State Profile

Located in the North-eastern part of India, Sikkim encompasses Lesser Himalaya, Central Himalaya, and the Tethys Himalaya. The area is like a stairway leading from the western border of the Tibetan plateau down to the plains of West Bengal. The habitable areas exist only up to the altitude of 2,100 m constituting only 20% of the total area of the state. Spanning Sikkim's western borders are the Khangchendzonga and the Singalila Range, a north- south spur of the Great Himalaya. The northern limits reaching out to the Tibetan Plateau is straddled by the Donkia Range while the eastern flank is bounded by the Chola Range. More than 64% of the population of Sikkim depends on agriculture for their livelihoods, directly or indirectly cultivating 1,09,963 hectares which is only 15% of the total land area of Sikkim. The hill slopes have been converted into farmlands using terrace-farming techniques and is used for cultivation. Cardamom is the main cash crop in the district, which makes a premier part of economy.

The Gross State Domestic Product (GSDP) of Sikkim expanded at a high CAGR of 12.66% between 2015-16 and 2020-21. In 2020-21, the secondary sector contributed 55.19% to the state's GSVA at current prices. It was followed by the tertiary sector at 34.16% and the primary sector at 10.64%. At a CAGR of 15.45%, the primary sector witnessed the fastest growth among the three sectors between 2011-12 and 2020-21.

Key Economic Areas in Sikkim

As per the state profile of Sikkim developed by Invest India, the following are the key sectors that have emerged as major contributors to the growth of Sikkim:

Food Processing and Argo 01

Sikkim is certified as the first fully organic state in India by Central Ministry of Agriculture and Farmer's Welfare. More than 64% of the population of Sikkim depends on agriculture for their livelihoods.

Pharmaceuticals 02

Investor-friendly policies with ease of doing business, attractive tax incentives and low cost of manufacturing and labour have made Sikkim a favourable destination for Pharma companies. Sikkim is home to more than 15 major pharma companies - Cipla, Sun Pharma, Zydus Cadila, Alkem Lab, etc.

Tourism 03

The Ministry of Tourism , GoI has awarded Gangtok as the Safest Tourist Destination in the Country. The State has also featured and ranked 17th in the New York Times magazine as "52 Best Places to Go, 2017"

Need of the Assignment & Scope

India is a diverse country with diverse energy consumption patterns in different states/UTs. Broadly, the energy consumption is divided in five major sectors i.e., Buildings, Transportation, Municipalities and DISCOMs, Agriculture and Industries. Although India remains progressive and one of the front runners to achieve its Energy Efficiency (EE) potential, through innovative programmes such as the PAT scheme, Standards & Labelling, UJALA scheme, Energy Conservation Building Code, Electric Vehicle mission and Smart metering etc. However, at a state level, there is still an immense potential to be realized from large-scale implementation of EE interventions in various afore-mentioned demand sectors.

Therefore, there is a dire need for a focused sector-based energy efficiency approach by states/UTs. In view of this, the Bureau of energy efficiency has taken on this endeavor to state specific Energy Efficiency Action Plan through identification of focus sector, undertaking gap analysis, adopting best practices followed in peer group with implementation plan strategy; that can act as platform for developing State's Energy Policy and programs.

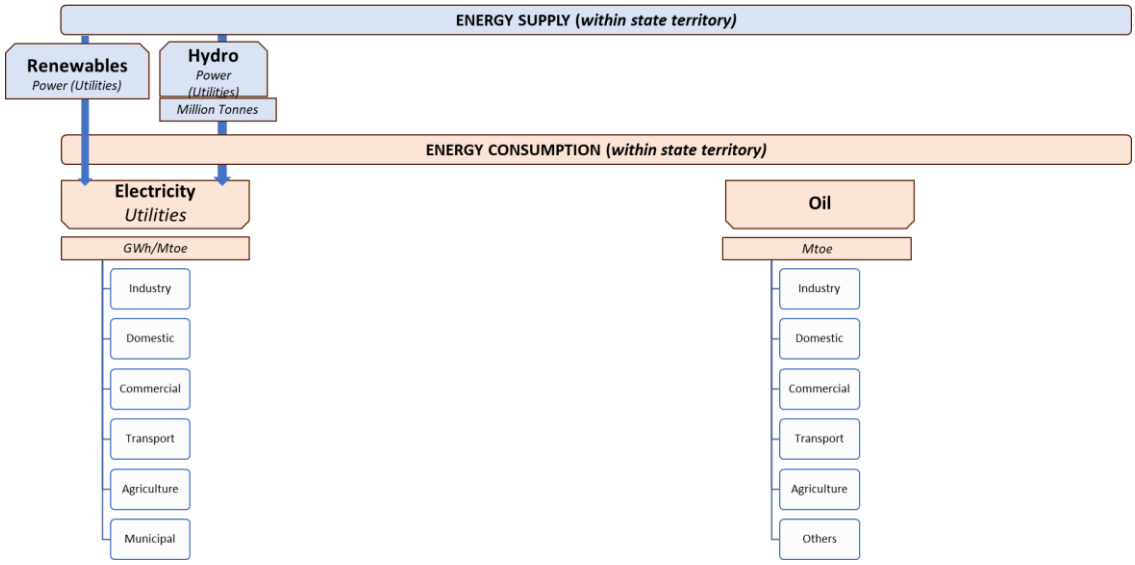
Broad scope of work

The overall scope of work for this assignment is as follows:-

- **Identification of stakeholders from various sectors**
- **Identification of focus sectors in the state**
- **Identification of gap via surveys**
- **Sector specific energy projections and energy savings targets**
- **Benefits to the State and various stakeholders through the implementation of the Energy Efficiency Action Plan**

More than 64% of the population of Sikkim depends on agriculture for their livelihoods, directly or indirectly cultivating 1,09,963 hectares which is only 15% of the total land area of Sikkim. The Gross State Domestic Product (GSDP) of Sikkim expanded at a high CAGR of 12.66% between 2015-16 and 2020-21.

From an energy supply standpoint – oil in the form of LPG, Petrol, Kerosene, HSD, LDO & FO and hydro-electric powerplant is the most prominent source of energy. Following flowchart illustrates energy supply and consumption scenario in Sikkim:-

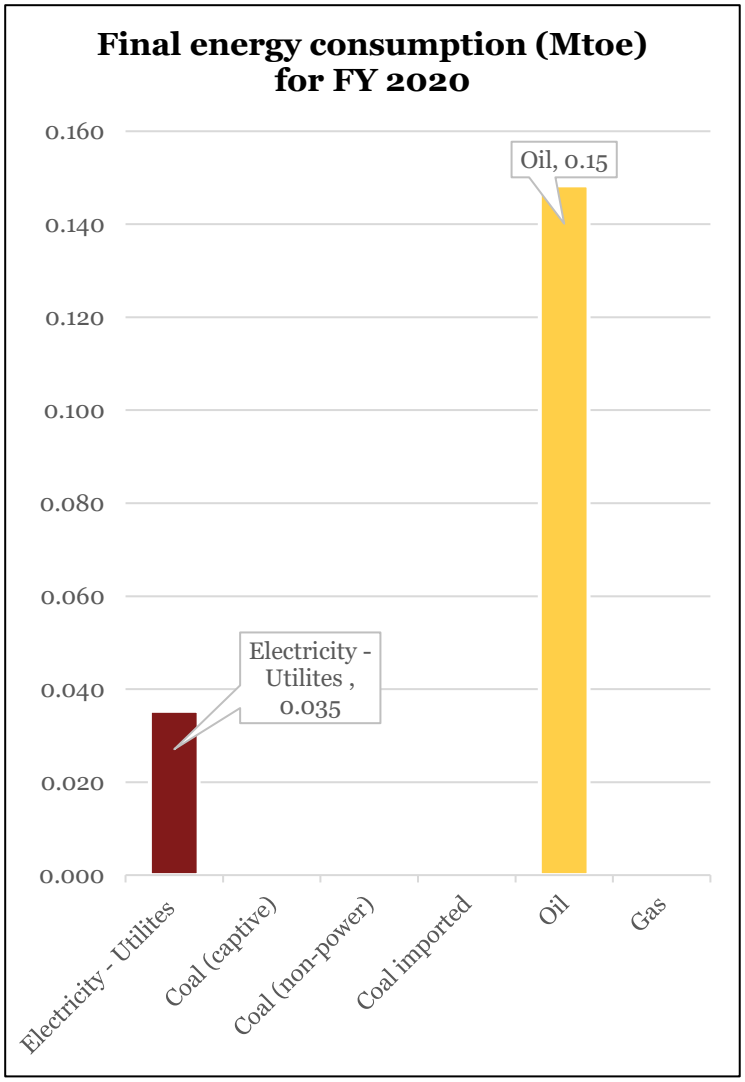


The Energy Consumption Scenario

From a consumption standpoint - the total energy consumption of Sikkim has been estimated to be approximately 0.18 Mtoe for the year 2019-20.

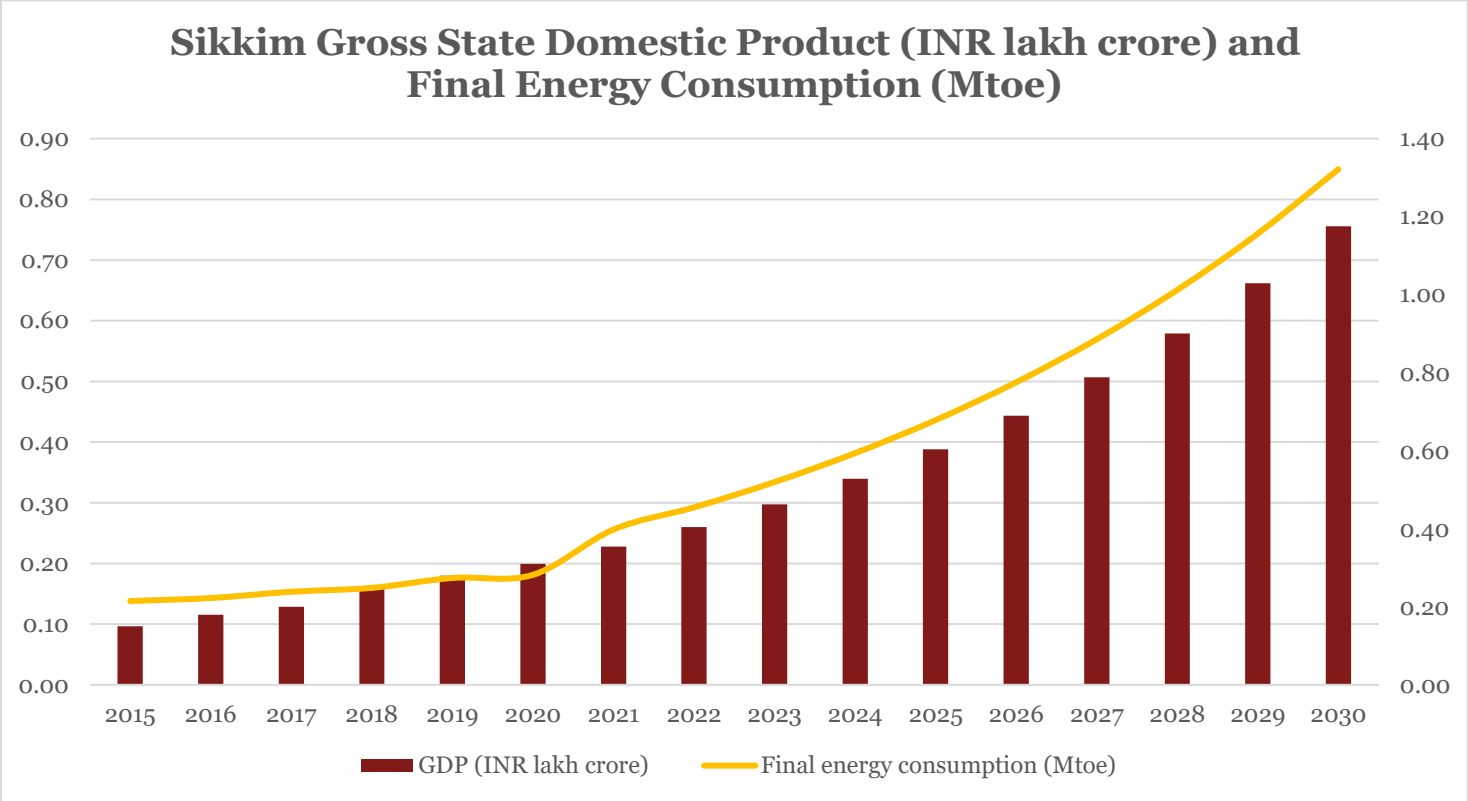
The total energy consumption for the State of Sikkim has been estimated to be approximately 0.18 Mtoe for the year 2019-20. This energy consumption scenario is split majorly between two energy source types which are, Electricity (Utilities) and Oil. The energy consumption related to rest of the sources is non-existent. The following graph depicts the Final Energy Consumption with respect to different sources in Sikkim for the FY 2020.

Final energy consumption (Mtoe) for FY 2020



Projection and forecasting of GDP and Energy Consumption

It has long been axiomatic that economic growth and energy demand are linked. As an economy grows – its energy demand increases; if energy is constrained, GDP growth pulls back in turn. Sikkim's GDP varies from INR 0.15 Lakh Cr in 2015 to 0.31 Lakh Cr in 2020 at a CAGR OF 15.6%. This figure also projects the increase in GDP from 2020 to 2030. This has been projected till 2030 using 80% weightage to historic trend of 15.6% and 20% weightage to the forecast of 14.3% as per the latest Sikkim Economic Survey. Following graph forecasts Sikkim's GSDP and its energy consumption from 2015 to 2030:-



Installed Capacity in Sikkim

The Sikkim Power Department is responsible for the production of electricity, its transmission to various load centres, and its final consumption by all types of consumers. To meet the state's constantly expanding demand and generate income, the Department as a whole is in charge of developing electricity projects. Sikkim may look forward to generating and utilizing its enormous hydropower potential, which has been estimated to reach 8000 MW Peak with a firm base of 3000 MW, with the opening of this sector for private developers. The state now has 95.70 MW of installed capacity overall. There is currently 5352.7 MW of total hydropower potential in the state, and it is spread out over different stages of implementation.

Identifying Focus Sectors

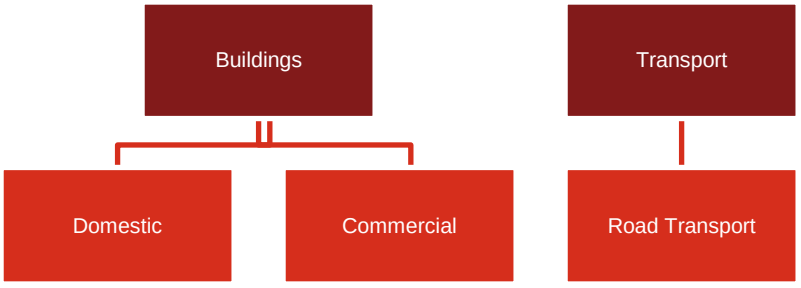
Transport & Building Sector Contribute to 84% Energy consumption in Sikkim in FY 2020

For identifying the major energy guzzling sectors in the state, energy consumption data of a number of sectors was researched and analyzed. This data was gathered via primary consultations with the various stakeholders and through secondary domain research.

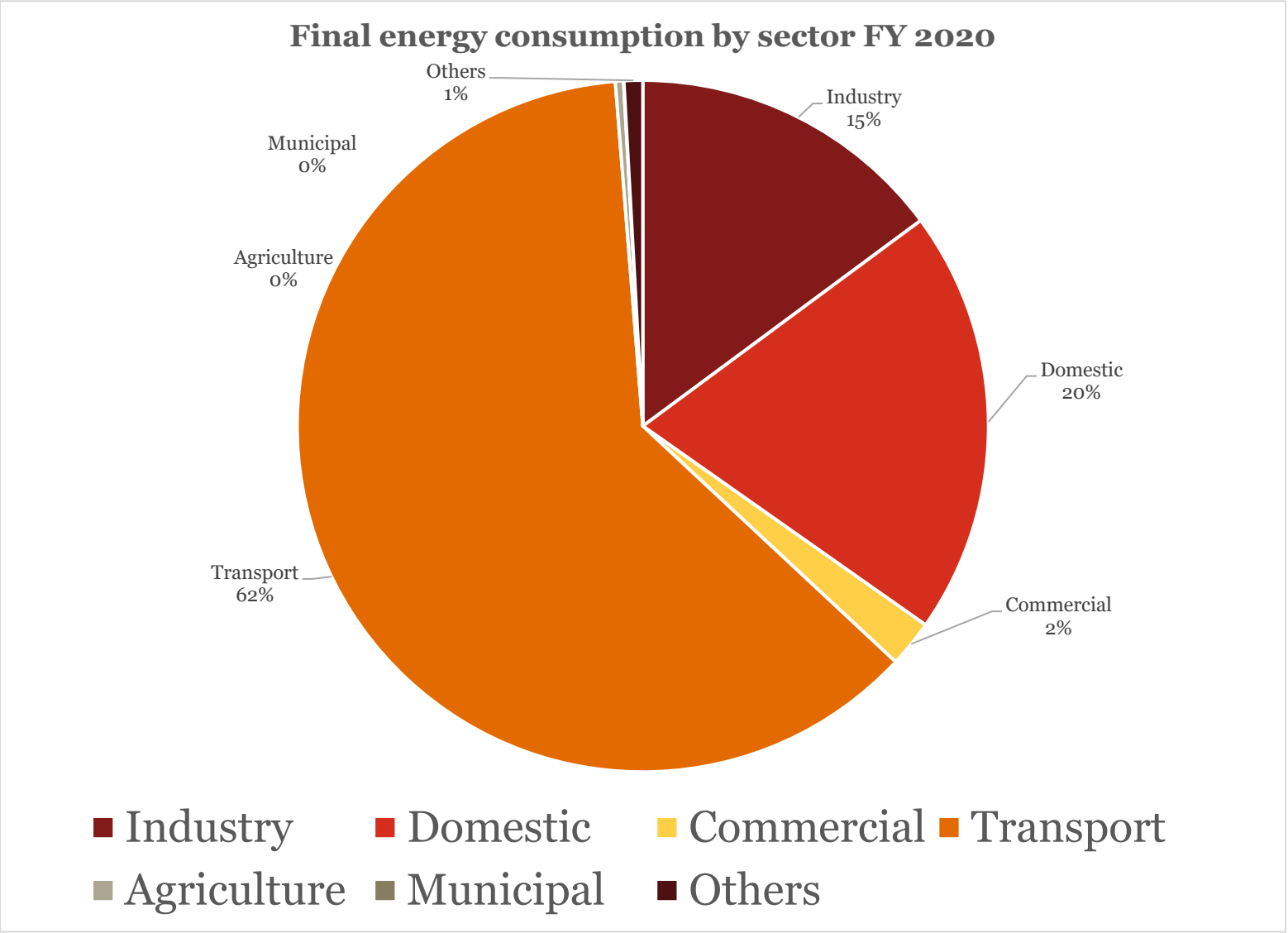
Identified Focus Sectors

In the year 2019 - the transport sector of Sikkim consumed 62% of the total final energy consumption at 0.112 Mtoe followed by the domestic sector at 20% (0.036 Mtoe), Industrial sector at 15% (0.027 Mtoe) and the remaining by the commercial, agriculture, municipal and others.

Upon analyzing the energy consumption data gathered via primary exercise and secondary research the following focus sectors have been identified:



Energy Consumption Sector wise Split



Focus Sector: Buildings

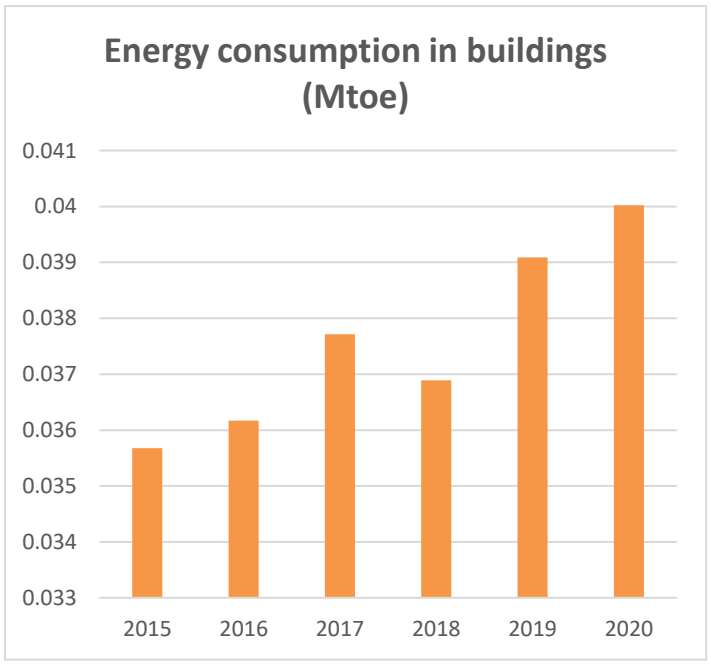
The Building Sector contributes to 22% of the total energy consumption in the State of Sikkim in FY 2020.

The buildings sector in encompasses different types of buildings present in Sikkim i.e., domestic (households) and commercial (health facilities, commercial complexes, public buildings etc.). This sector can be considered as a low hanging fruit from the perspective of EE implementation as such programmes in this sector are relatively less complex as compared to industries.

Key highlights for the building sector in Sikkim

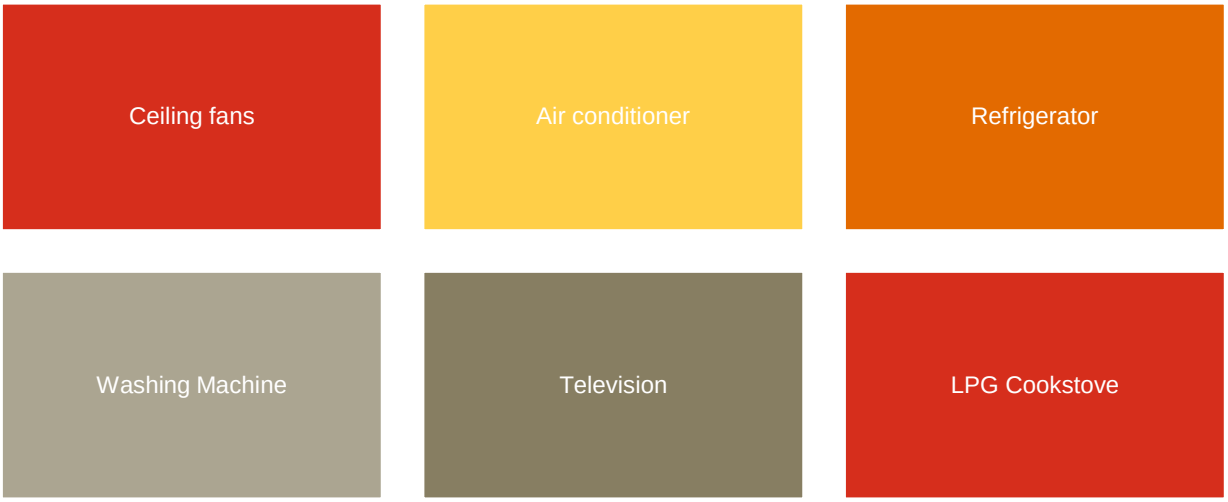
The total energy consumption in Sikkim related to Building Sector in FY 2020 is 0.04 Mtoe. It constitutes to around 22% of the total energy consumption in the State.

From an energy perspective – the buildings sector is one of the major consumers at 0.04 Mtoe. Following figure illustrates the sector's energy consumption over the years:-



Strategies in Building Sector

1. Action plan 1 – Replacement Programme for inefficient appliances: Replacement of inefficient appliances with their efficient counterparts can be considered as a low hanging fruit from and energy efficiency implementation standpoint. This strategy can be implemented in both domestic as well as commercial buildings. As part of the strategy, following appliances have been identified that can be in the contention for replacement:-



Following table encapsulates the energy efficiency potential in the year 2030 as per this strategy appliance replacement Programme:-

Appliance	Inefficient stock in FY2020	Energy saving in moderate scenario (Mtoe)	Energy saving in ambitious scenario (Mtoe)
Fan	150750	**.000526**	**.000877**
Air conditioner	23450	**.000182**	**.000304**
Refrigerator	75375	**.00056**	**.000933**
Washing Machine	61975	**.0000576**	**.0000959**
Television	87100	**.0000243**	**.0000404**
LPG cookstove	155775	**.000391**	**.000782**

(Note: In moderate scenario, it is assumed that 30% of appliances will be replaced with efficient appliances and 10% switch to electric cookstove. In ambitious scenario, it is assumed 50% appliance replacement with efficient appliance and there will be a 20% switch to electric cook stove)

2. Action Plan 2 - it is recommended that the new and upcoming commercial and domestic buildings (having a connected load of minimum 40 kW) may be mandated as per the energy conservation buildings code (ECBC) in the state. Following table illustrates the energy efficiency that can be achieved via this strategy:-

   Following table encapsulates the energy efficiency potential in 2030 as per this strategy of mandating the compliance of ECBC for new buildings:-

2030 energy consumption in new commercial building more than 40 kW (Mtoe)	Energy saving in moderate scenario (Mtoe)	Energy saving in ambitious scenario (Mtoe)
0.00001092	**0.00000014**	**0.00000019**

(Note: In moderate scenario, it is assumed ECBC will be implemented in new commercial buildings more than 40 kW connected load and lead to 25% savings. In ambitious scenario, ECBC is assumed to be implemented in new commercial buildings more than 40 kW and lead to 35% savings)

3. Action plan 3 - Under this strategy, it is recommended that periodic energy audits may be carried out at public/commercial buildings on load basis. Directives may be issued to government departments to carry out detailed energy audits at their respective building facilities. Following table illustrates the energy efficiency that can be achieved via this strategy: -

2030 energy consumption in commercial and public buildings sector (Mtoe)	Energy saving in moderate scenario (Mtoe)	Energy saving in ambitious scenario (Mtoe)
0.004	**0.000056**	**0.000112**

(Note: In moderate scenario, it is assumed 5% buildings will have energy audit and in ambitious scenario, it is assumed 10% of buildings will get energy audit. In ambitious scenario, it is assumed that energy audit recommendations implementation will lead to 30% savings.)

Focus Sector: Transport

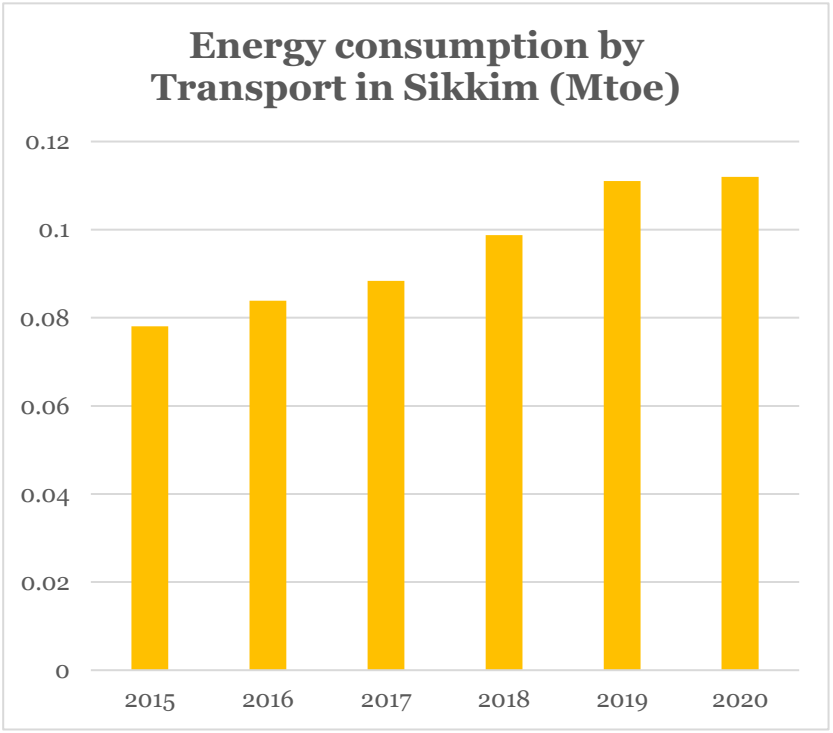
The transport sector is a major consumer of energy in Sikkim and contributes to approximately 62% of the total energy consumption in the state. Therefore, there needs to be a strong emphasis on electric vehicles to decarbonize this sector. Unlike other state where the transport sector is looked after by road transportation corporations, in Sikkim, this is directly taken care of by the government department i.e., Transport Department.

The Transport Sector contributes to 62% of the total energy consumption in the State of Sikkim in FY 2020.

Key highlights for the Transport sector in Sikkim

The total energy consumption in Sikkim related to Transport Sector in FY 2020 is 0.11 Mtoe. It constitutes to around 62% of the total energy consumption in the State.

Following graph illustrates the final energy consumption in Sikkim (in Mtoe) in the industrial sector in Sikkim from 2015 to 2020:



Strategies in Transport Sector

1. Action Plan 1: **Transition of existing fleet to electric vehicles:** Under this strategy, it is recommended to transition the existing ICE (Internal combustion Engine) fleet (two wheelers, three wheelers, four wheelers, bus and heavy vehicles) to electric vehicles. Following table encapsulates both the aforementioned scenarios and demonstrates the energy efficiency potential in the year 2030 as per this strategy of transition from ICE to electric vehicles :-

Energy saving in moderate scenario (Mtoe)	Energy saving in ambitious scenario (Mtoe)
0.00008	**0.000332**

(Note: As per NITI Aayog projections, 80% EV penetration in two-wheelers, 80% EV penetration in three-wheelers, 30% EV penetration in four-wheelers, 40% EV penetration in buses and 20% EV penetration in HDV in moderate scenario. 100% EV penetration in two-wheelers, 100% EV penetration in three-wheelers, 60% EV penetration in four-wheelers, 80% EV penetration in buses and 40% EV penetration in HDV in ambitious scenario)

2. Action plan 2: **Ethanol blending Programme:** Under this strategy - it is recommended that, as per the national target, ethanol blending in conventional fuels may be executed. The target already set in this segment is 20%. Following table encapsulates both the aforementioned scenarios and demonstrates the energy efficiency potential in 2030 as per this strategy: -

2025 energy consumption in transport (Mtoe)	Energy saving as per policy (Mtoe)
0.166	**0.0331**

About Sikkim SDA and its Activities

Name and brief description of the State Designated Agency (SDA) under Energy Conservation Act, 2001: To facilitate implementation of various energy conservation activities, the State Government of Sikkim has notified Power Department of Sikkim as State Designated Agency.

Ongoing Activities

(i) Demonstration Project: Energy Efficiency Activities in 100 Govt. schools-

- Sikkim SDA has completed implementation of demonstration project on replacement of conventional luminaries and fans with LED luminaries and energy efficient fans in 50 Govt. schools. SDA Sikkim has identified new 100 nos. of Govt. schools across the state for the 2nd 3rd phase for the replacement conventional luminaries and fans with LED luminaries and energy efficient fans.

- SDA has completed implementation demonstration project on replacement of conventional luminaries and fans with LED luminaries and energy efficient fans in three college i.e. NBBG College,Tadong, Gangtok District, Kamrang College & CCCT Polytechnic Chisopani, Namchi District.

- SDA has completed implementation demonstration project on Thermal based Heating system(Space Heating) in Power Secretariat, Gangtok District.

(ii) Model Energy Efficient Village Campaign:

- Sikkim SDA has successfully implemented this programme of BEE in 230householdsofMangnam, Karzee & Pokhery villages under West Sikkim by providing 2 LED tube-lights and 4 LED bulbs to each household.

- Sikkim SDA has successfully implemented this programme of BEE in 200 households of Sakyong, Pentok villages under North Sikkim by providing 2 LED tube-lights and 4 LED bulbs to each household.

- Sikkim SDA has successfully implemented of this programme of BEE in 760 households of Okheray, Ribdi villages under West Sikkim & 2400 household of Kamrang, Wok & Denchung (Poklok) by providing 5 LED bulbs to each household.

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- Sikkim SDA has successfully implemented of this programme of BEE in 1385 households of BudangJambudara, Mangasari, Tharpu, Bojek villages under West Sikkim & 1531 household of Yangthang GPU, Darap Nambu by providing 5 LED bulbs to each household.

- SDA Sikkim has completed implementation of this programme of BEE in 1560 house holds of Lachung, Lachen,Chaten & Thangu villages under Mangan District & 1531 household of Sitam Tikpur Lungyam in Gayzing District & villages under Soreng District

(iii) Energy Conservation Building Code (ECBC):

- ECBC Sikkim Codes and Rules had been notified in the state on 15th October 2020, publication underway with the Printing &Stationery Department though Home Department, Govt of Sikkim.

- Guidelines for Mandatory & Regular energy audit of the existing energy intensive building has been prepared and finalized by the power department, same shall be notified after the publication of the ECBC

- The State Designated Agency, Sikkim is Constructing Super ECBC Building in LLHP Gangtok District

(iv) Implementation of Energy Efficient activities in Govt Hospitals (NMEEE): SDA Sikkim has already given works orders for Implementation of Energy Efficient activities in Govt, Hospital i.e., Namchi Govt Hospital & Gaylshing Govt Hospitals and the work is under progress.

(v) Implementation of GEF-UNIDO-BEE-SME Project:

Figure 1: Clusters covered under the project

The project activities started in the cluster around 2018 and, the entrepreneurs barely acknowledged energy efficiency and fuel savings. This is because the majority of them are first and second-generation family-owned businesses with a non-technical background. However, the current situation is completely different in the cluster due to the various initiatives taken through the project. The project started with an inception workshop and exclusively to hand hold the units for promotion of energy efficiency activities in the cluster. After that, regular walkthrough energy audits and detailed energy audits (DEAs) in selected units in the cluster, identification of energy efficiency (EE) measures including Best Operating Practices (BOP) for adoption by the MSMEs in the cluster were done. Hands-on training on BOP was provided to shop-floor personnel; BOP documents and Common Monitorable Parameters (CMP) posters were developed, and three workshops were conducted for knowledge sharing among other units in the cluster. **The project also established an energy management cell (EMC) equipped with a set of energy auditing instruments and provided comprehensive training to unit personnel on the usage of the instruments for conducting energy audits and to analyze the saving potential. Currently, about 27 units participating in the upscaling of the project.**

During the phase project is providing handholding support to the units in terms of developing technology compendiums, conducting awareness workshops & energy audits and implementation support.

(vi) State Energy Conservation Fund (SECF): Under the Contribution to State Energy Conservation Fund (SECF) scheme, Government of Sikkim has notified their SECF and finalized the rules and regulations to operationalize the same. BEE has provided an amount of Rs 4.0 Crores in the SECF in two instalments of Rs. 2.0 Crore each. The state has contributed Rs. 25.00 Lakhs as matching contribution by state. Following are the projects carried out by SDA from the SECF fund:

S.No	Activity Undertaken	Funds utilized till date (Rs. In Lakhs)	Modalities of recoupment
1	Replacement of conventional lights with LED bulbs, tubes, street lights at District Hospital, Singtam, East Sikkim.	8	Project undertaken with the interest earned from SECF Fund.
2	Energy Efficient Electrical Appliance Loan under SECF	10	The programme was implemented to the C& D employees under Government of Sikkim of West Sikkim
3	Electric Two-wheeler Interest Free loan	15	The proposal has been approved by the Steering Committee

(vii) AgDSM:

- SDA Sikkim organised Energy Conservation programme on Energy Efficiency in Agriculture sector and have conducted 4 nos of Awareness programme in all the KrishiVigyan Kendra in all the districts headquarters i.e. KVK Ranipool, East District; KVK Namthang, South District; KVK Gayzing, West District; & KVK Mangan, North District.

- SDA Sikkim has successfully implemented Energy Conservation programme on Energy Efficiency in Agriculture sector and have conducted 8 nos of Awareness programme with the Agriculture Department & farmers in all the districts i.e. Pakyong & Rongli, East District; Sadam & Kamrang, South District; Soreng & Dentam, West District; & Chungthang & Dzongu, North District.

- SDA Sikkim has successfully implemented the Demonstration Project on IOT and Sensor Base Agricultural Practice implemented at KVK Namthang & KVK Gayzing

- SDA Sikkim has implemented programme the Demonstration Project on in Aquaculture (Fisheries) under the AgDSM Programs under Demand Side Management

(viii) Awareness:

- Many workshops / awareness programmes on Energy Conservation have been periodically organized by the Sikkim SDA for different stakeholders.

- The State Designed Agency, Sikkim has organized awareness programmes on Energy Conservation, Standard & Labelling, UJALA etc. at Senior Secondary and Secondary schools and village panchyat, covering remote villages in South & West District.

- The proposal for organizing awareness program on E-Mobility has been forwarded to Steering committee.

- The State Designed Agency, Sikkim has organized awareness programmes on Energy Conservation, Standard & Labelling, UJALA etc. at Senior Secondary and Secondary schools and village panchyat, covering remote villages in South & West District.

- The state Designated Agency, Sikkim has organized Energy efficient professional training program to technical professionals from DISCOM Govt. Department & pharma industries.

- The State Designated Agency, Sikkim has organized Municipal demand side Management program to ULBs, public water bodies, Urban Development Department & Municipal Councils officials

- The State Designated Agency, Sikkim has organized awareness program in Government Department, Colleges for the purchase of Electric Vehicle rather than convention vehicle.

(ix) Capacity Building of DISCOMs:

- DSM regulation is formulated in the state of Sikkim.

- Under this program, BEE has carried out the load research and developed the DSM action plan for Power department of Sikkim. 30 officials of the DISCOM have been trained as Master Trainers and capacity building of 71 circle level officials has been completed.

(x) Retailer Training Programme: Under this program, SDA Sikkim has successfully carried out the training programmes to 231 nos of retailer & vender of all the 6 district under the State i.e. Gangtok, Singtam, Rangpoo, Jorethang, Mangan & Namchi.