State Energy Efficiency Action Plan

West Bengal

July 2023

WBSEDCL

GOVERNMENT OF INDIA
MINISTRY OF POWER

Energy is Life, Conserve it

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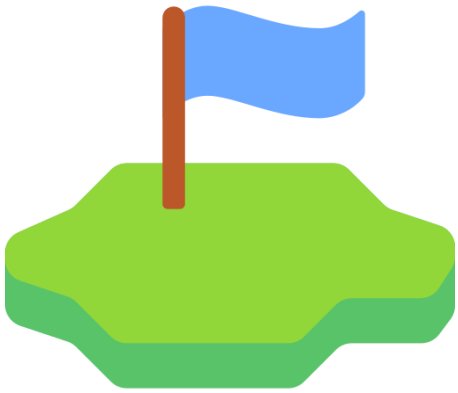
Introduction & State Profile

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 West Bengal.

As a part of the assignment, there has been identification of stakeholders from various sectors, identification of focus sector in the state of West Bengal, 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

Situated in the eastern part of India and shares international borders with Bangladesh, Bhutan and Nepal - It is the fourth most populated state (constitutes 7% of the country's total population) in India with a total population of approximately 9 million and a literacy rate of 77.1%. It has navigable waterways with 950 km of waterfront and constitutes 13% of the national coastline. It is richly gifted with natural maritime advantages.

It also has a vast road network of 3,15,404 km and a road density of 333.5 km per 1000 sq. meters. It has the second-largest metro rail network in the country and a leading rail density with approximately 4000 km of railway tracks.

Key Economic Areas in West Bengal

As per the state profile of West Bengal, the following are the key sectors that have emerged as major contributors to the growth of West Bengal:

Agriculture

West Bengal is a leading producer of vegetables, fruits, spices and flowers. It is also one of the major producers of poultry, meat and marine products. It has six agro-climatic zones that help in the production of myriad crops. The estimated production of food grains, eggs and meat are 198.65 lakh MT, 9.73 billion and 5.77 lakh MT respectively in 2019-20. Also, in 2020-21, there is an estimated production of 12.90 lakh MT of fish and 24875 million fish seeds.

Information technology

West Bengal has 17 Govt. IT parks and 4 additional IT parks are in different stages of construction. Bengal Silicon Valley Hub is a new IT park that was launched in 2018 and has 100+ acres of land which has been allotted to 20+ organizations.

Tourism

West Bengal has a rich history, cultural heritage and diverse socio-ethnic tradition with natural beauty. It has natural mountains in the north, a rich coastline along the Bay of Bengal, Gangetic plains and the World's largest mangrove forests in the south in Sunderbans. It is no surprise that West Bengal emerged as an all-season tourist destination.

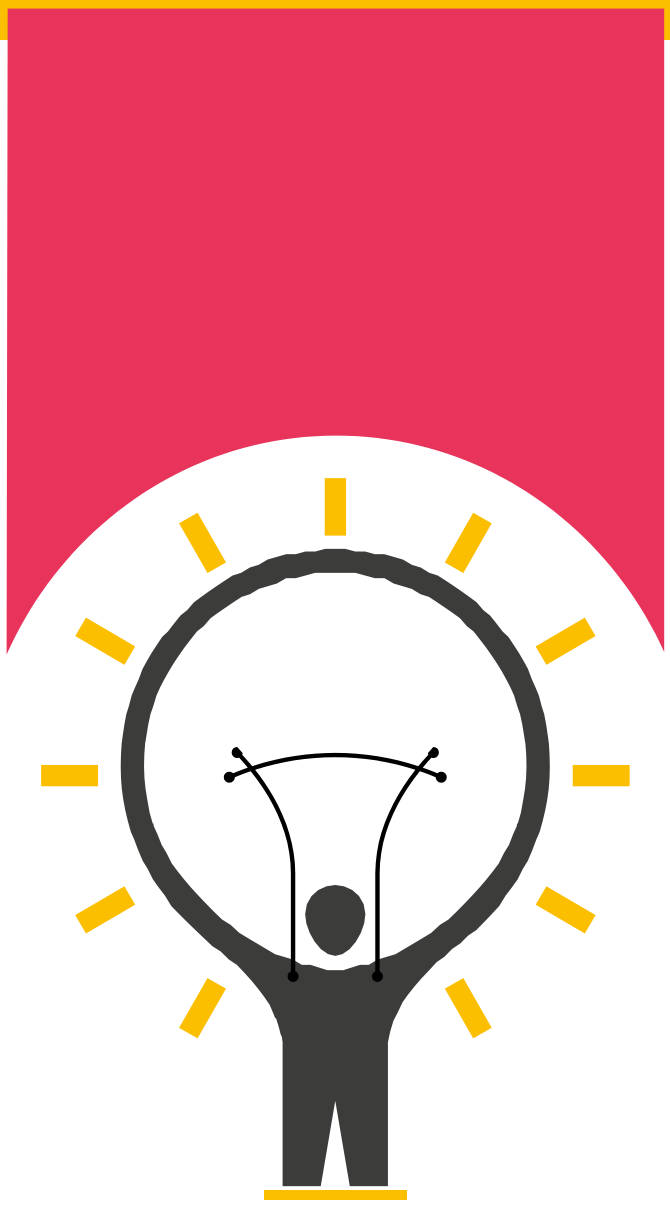
Textiles

West Bengal has a rich tradition of handloom products and 7 textiles parks (Govt. and Govt. supported private parks) over 320 acres of land. It helps to facilitate the creation of plug and play infrastructure for the textile sector.

Metals and minerals

West Bengal accounts for one-fifth of the total mineral production of India. It is the third-largest producer of minerals in India. Out of the extracted minerals, coal accounts for 99% of them. West Bengal has India's largest coal mine and accounts for 11% of the total coal reserves of India.

Need of the Assignment & Scope

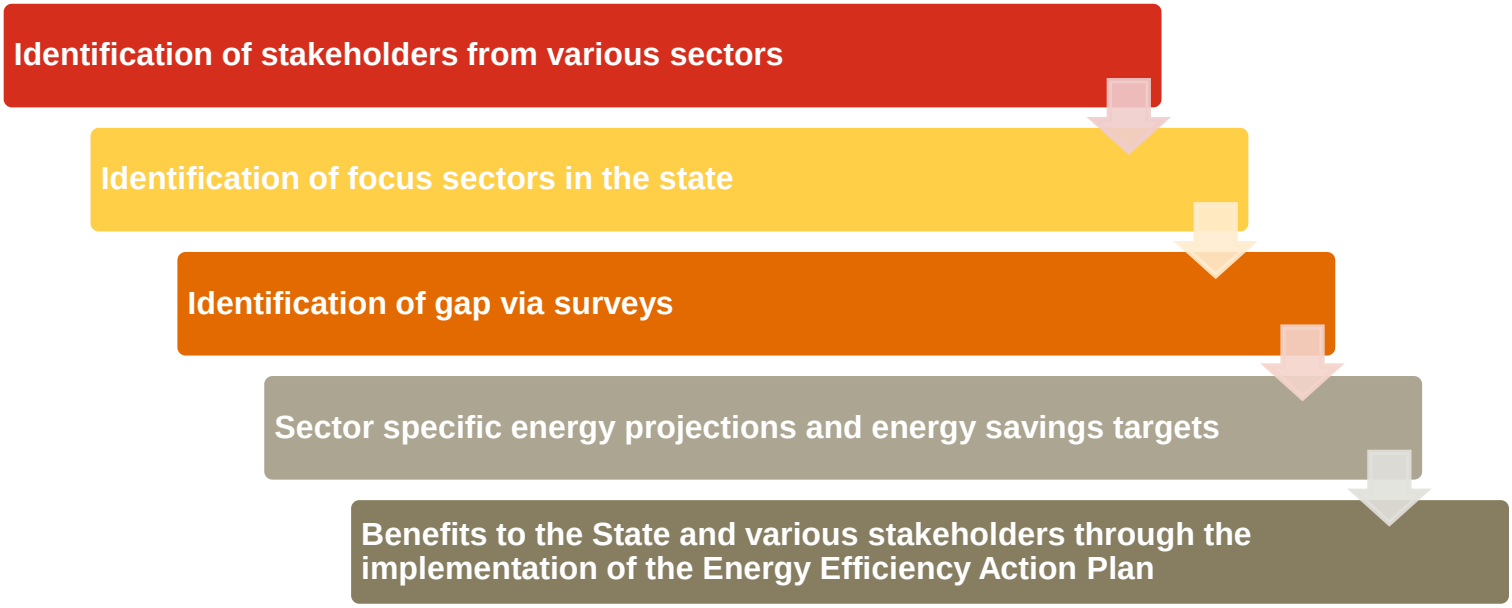


India is a diverse country with diverse energy consumption patterns in different states/UTs. Broadly, the energy consumption is divided in five major sectors i.e., Buildings, Transportation, Municipalities and DISCOMs, Agriculture and Industries. Although India remains progressive and one of the front 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.

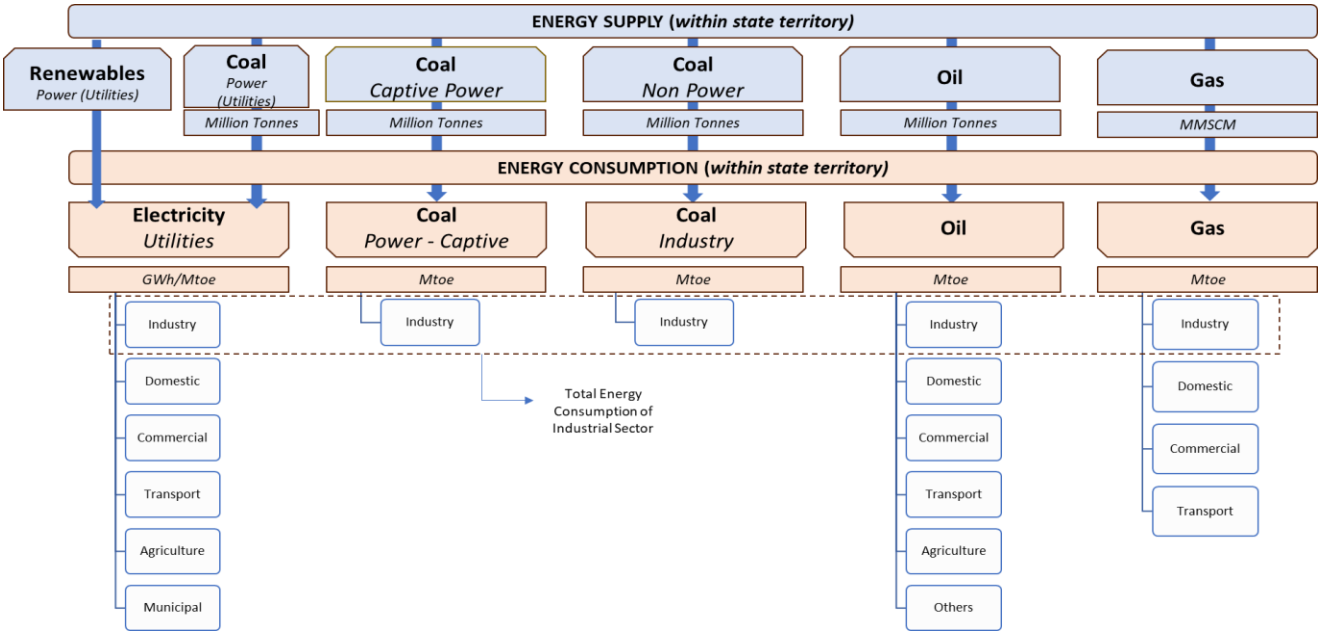
Broad scope of work

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



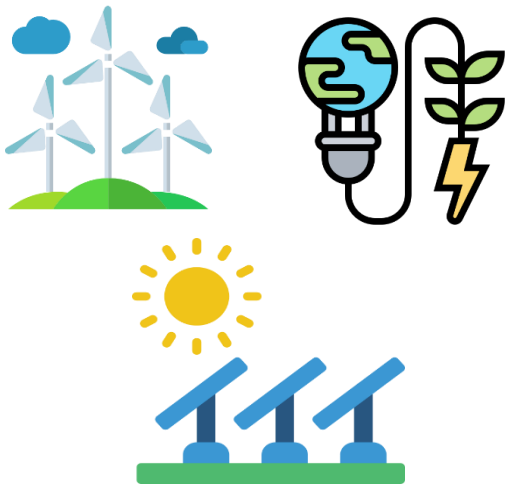
West Bengal is one of the 29 States in India, lying in the eastern part of the country with a population of approximately 10 Cr. It has only 2.7% of the total landmass of the country. The State is divided into 23 administrative districts and has international borders with Bangladesh, Nepal and Bhutan and has common boundaries with the States of Odisha, Jharkhand, West Bengal, Sikkim and Assam. West Bengal is highly dependant on agriculture as majority of the state population are cultivators and agricultural labours.

From an energy standpoint - oil in the form of LPG, Petrol, Kerosene, HSD, LDO & FO is the most prominent source of energy followed by coal (coal for thermal power plant and non-power activities). Following figure illustrates the energy supply and consumption flow in the state: -



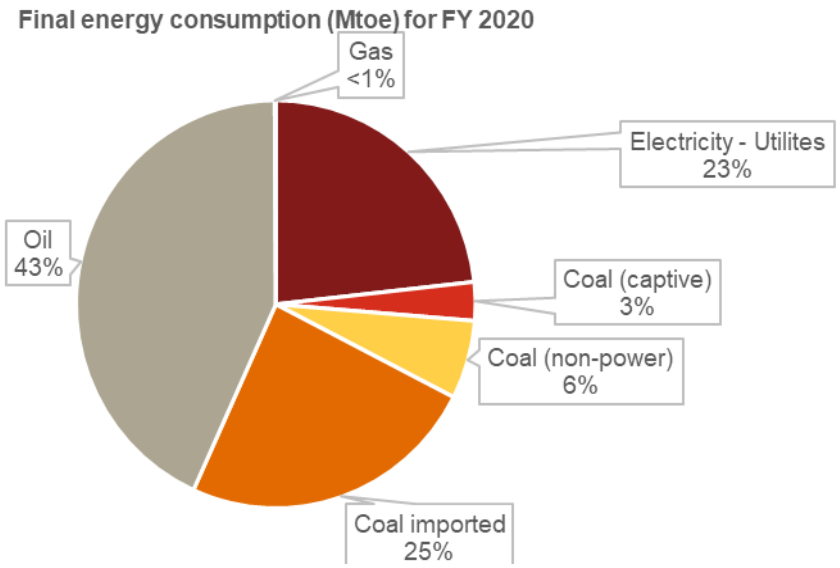
The Energy Consumption Scenario

From a consumption standpoint - the total energy consumption of West Bengal for the year 2019-20 has been estimated to be approximately 18.68 Mtoe for the year 2019-20.



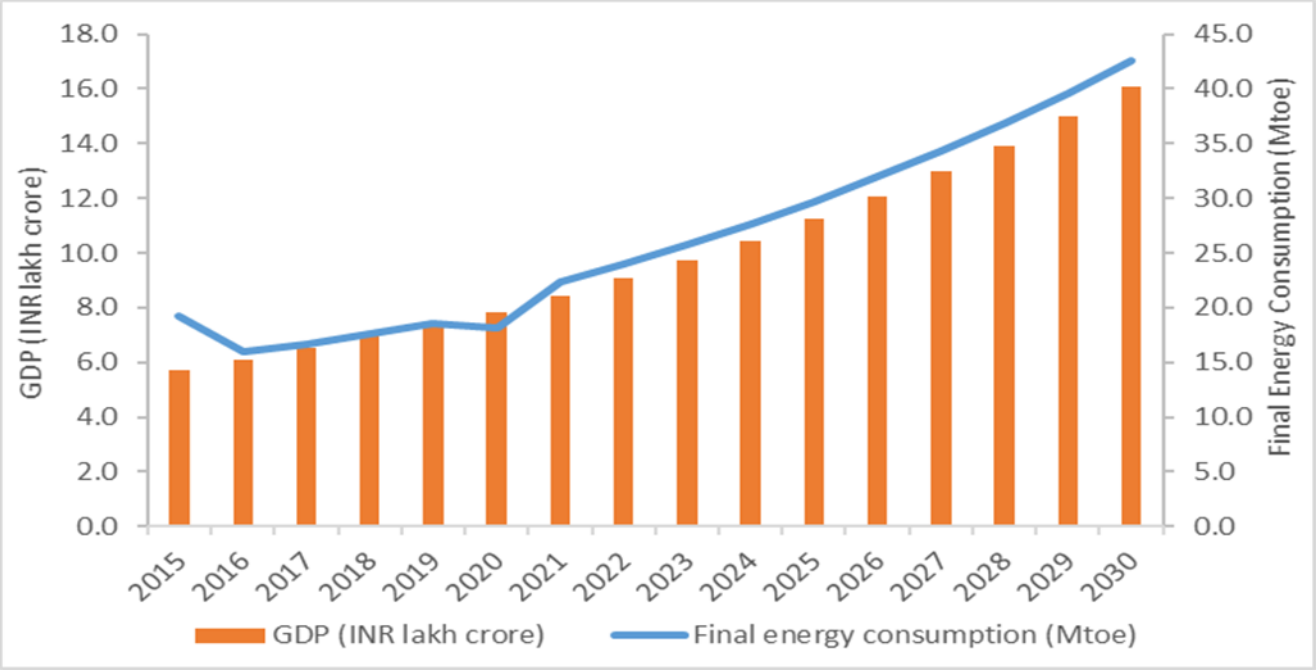
The total energy consumption of West Bengal for the year 2019-20 has been estimated to be approximately 18.68 Mtoe for the year 2019-20. It is pertinent to mention here that oil consumption is the major contributor to this estimate at 8.06 Mtoe followed by coal (domestic and imported) at 6.26 Mtoe and electricity at 4.34 Mtoe. Following figure illustrates the same: -

Final energy consumption (Mtoe) for FY 2020



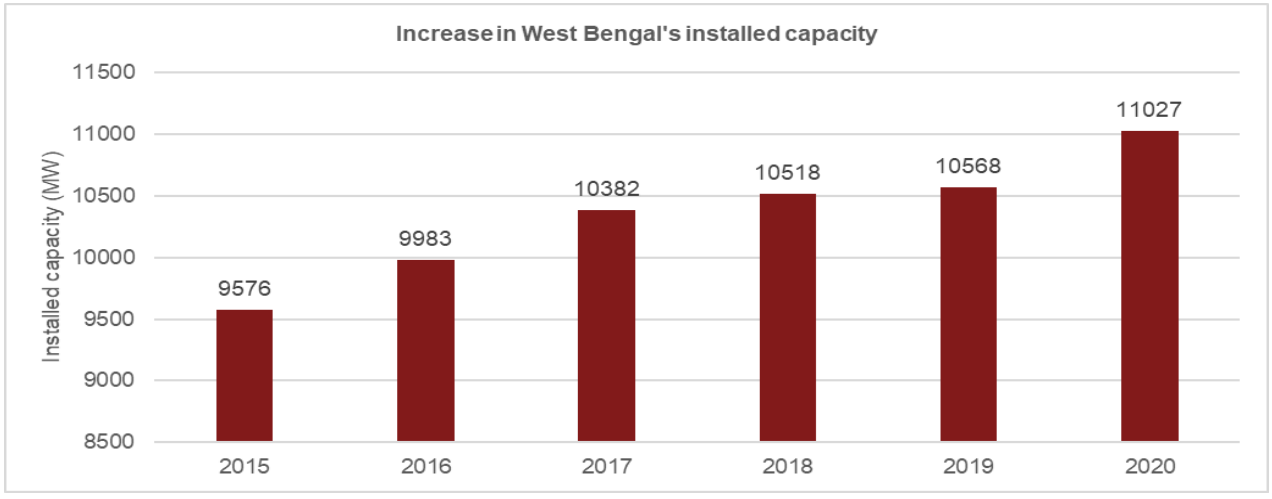
Projection and forecasting of GDP and Energy Consumption

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. Following figure captures West Bengal's GDP over the years (between 2014/15 to 2019/20). West Bengal's GDP varies from INR 5.74 Lakh Cr in 2015 to 7.84 Lakh Cr in 2020 at a CAGR of 6.4%. 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 6.4% and 20% weightage to the forecast of 7.4% as per the latest West Bengal Economic Survey.



Installed Capacity in West Bengal

West Bengal's total installed capacity at the end of 2019-20 FY was 11027 MW. It is pertinent to mention here that the power availability in the state has increased from 9576 MW in 2014-15 to 11027 MW in 2019-20 with the growth being by 15%.



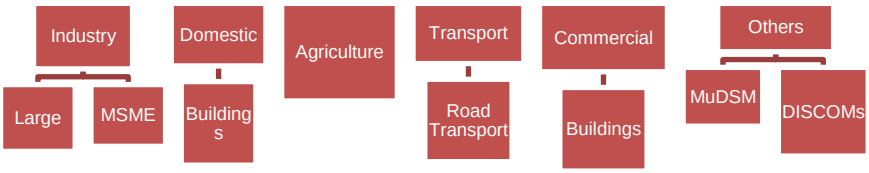
Identifying Focus Sectors

Industry, Transport & Building Sector Contribute to ~93% Energy consumption in West Bengal in FY 2020

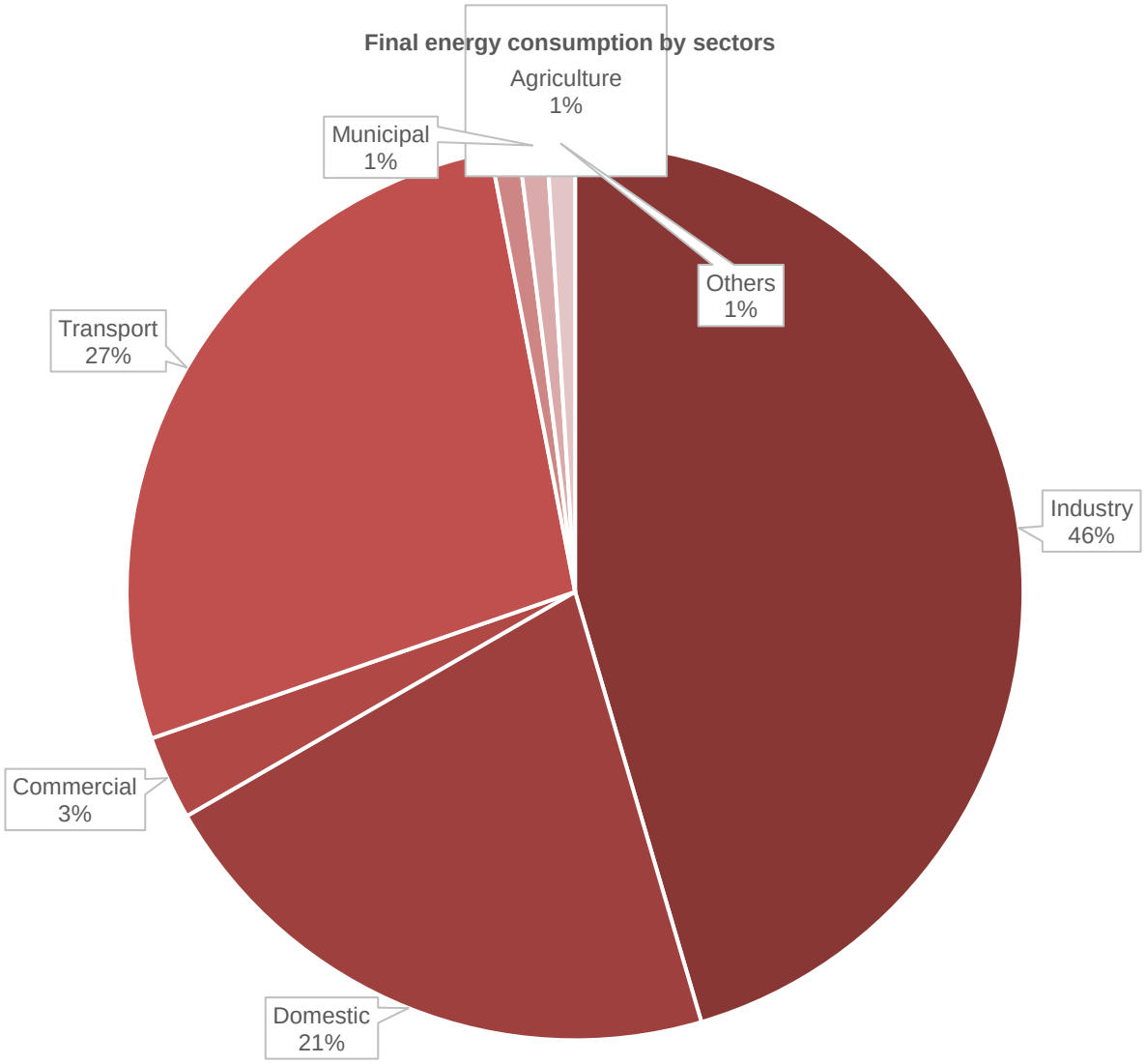
For identifying the major energy guzzling sectors in the state, energy consumption data of a number of sectors was researched and analyzed. This data was gathered via primary consultations with the various stakeholders and through secondary domain research.

Identified Focus Sectors

In the year 2019-20 the industrial sector of West Bengal consumed 45% (8.36 Mtoe) of the total final energy consumption followed by the transport sector at 27% (5.07 Mtoe), domestic building sector at 21% (3.97 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

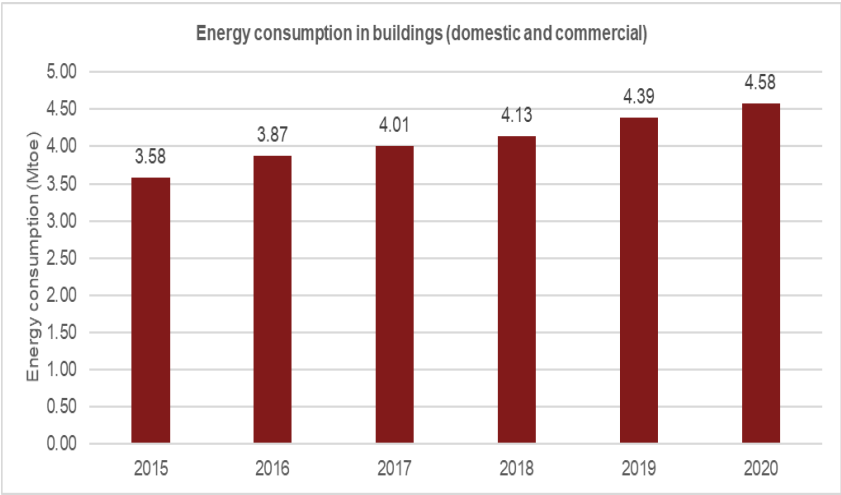
Buildings sector comprise all residential, commercial and institutional buildings across the state of West Bengal, both in rural and urban areas. Energy consumption in buildings is due to usage of lighting, household appliances and commercial heating, ventilation and air conditioning (HVAC) systems and primary source of energy is in the form of electricity. Diesel and kerosene are the 2 other sources of energy in this sector.

The Building Sector contributes to ~30% of the total energy consumption in the State of West Bengal in FY 2020.

Key highlights for the building sector in West Bengal

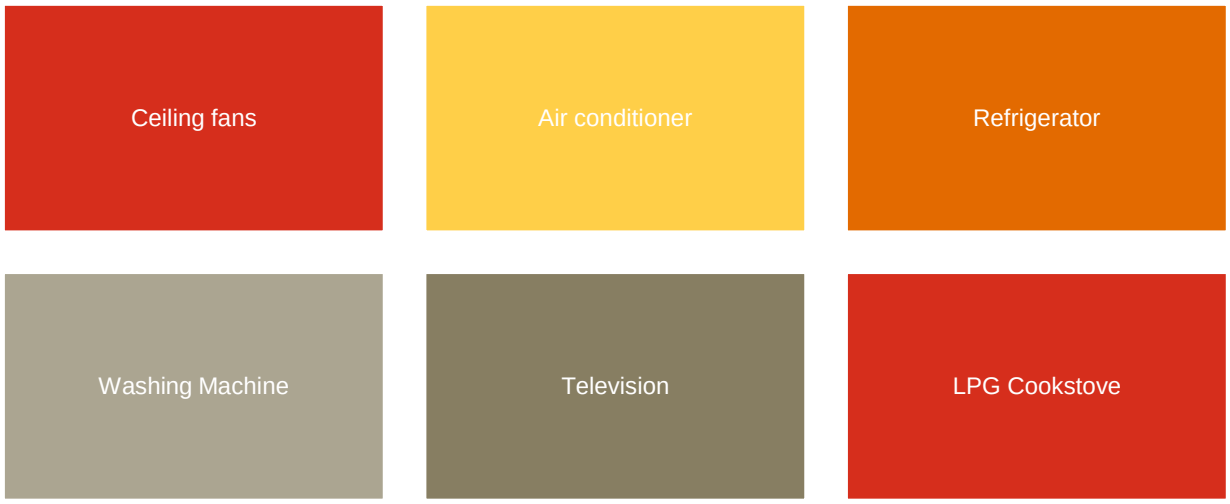
The domestic building sector consumes more than 30% of the total electricity consumption in 2019-20 while the commercial buildings sector consumed around 14% of the total electricity.

In terms of the final energy consumption – the buildings sector (including domestic and commercial) is one of the major consumers at 4.58 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	21941100	0.08	0.13
Air conditioner	3413060	0.027	0.044
Refrigerator	10970550	0.082	0.136
Washing Machine	9020230	0.008	0.014
Television	12677080	0.004	0.006
LPG cookstove	22672470	0.057	0.114

(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 100 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:-

2030 energy consumption in new commercial building more than 100 kW (Mtoe)	Energy saving in moderate scenario (Mtoe)	Energy saving in ambitious scenario (Mtoe)
0.002474	**0.0006**	**0.0009**

(Note: In moderate scenario, it is assumed ECBC will be implemented in new commercial buildings more than 100 kW connected load and lead to 25% savings. In ambitious scenario, ECBC is assumed to be implemented in new commercial buildings more than 100 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)
0.991	**0.015**	**0.030**

(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

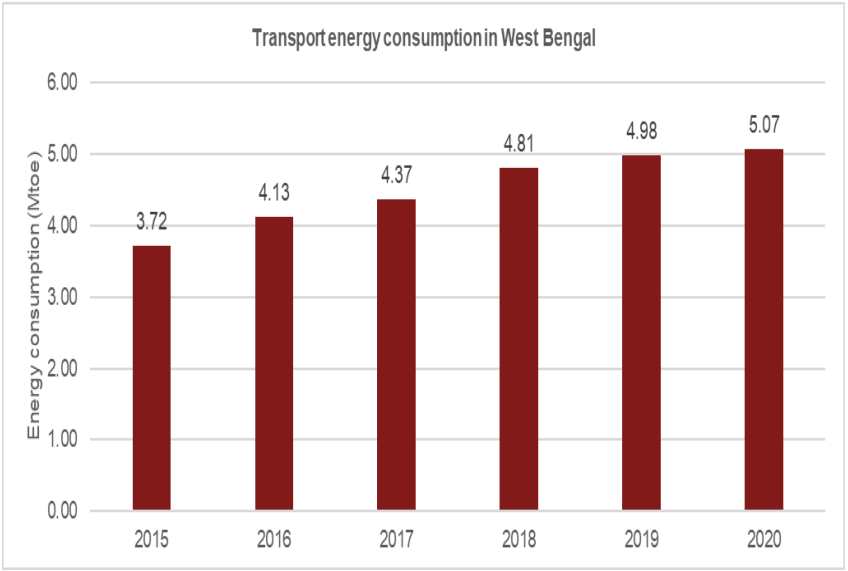
The transport sector is a major consumer of energy in West Bengal and contributes to approximately 27% of the total energy consumption in the state. Therefore, there needs to be a strong emphasis on electric vehicles to decarbonize this sector.

The Transport Sector contributes to 27% of the total energy consumption in the State of West Bengal in FY 2020.

Key highlights for the Transport sector in West Bengal

The transport sector is one of the major consumers of energy in West Bengal and contributes to approximately 27% of the total energy consumption in the state from a sector perspective.

Following graph illustrates the final energy consumption in West Bengal (in Mtoe) in the transport sector in West Bengal 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)
0.115	**0.215**

(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 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)
	1.5582

Focus Sector: Industry

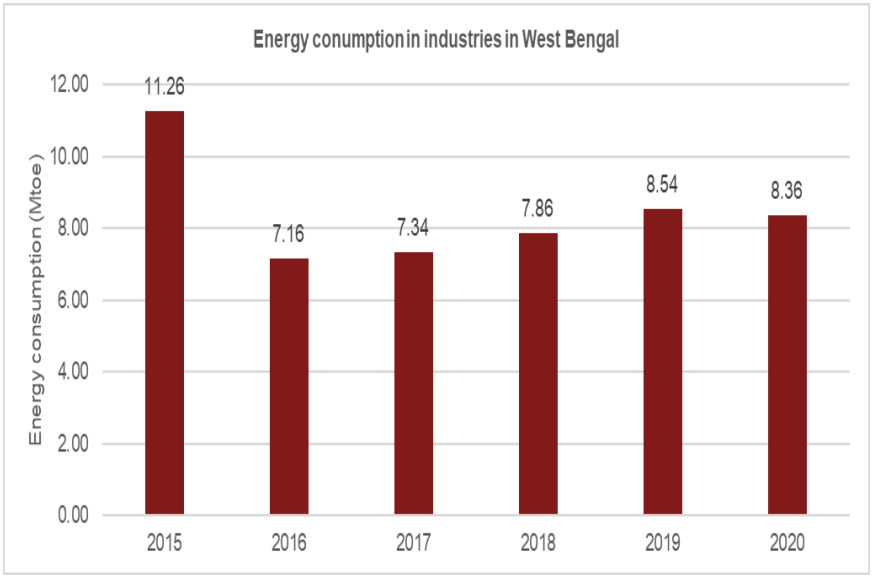
The industrial sector refers to various sizes of manufacturing industries including designated consumers from sectors like iron & steel and cement which are significant consumers of energy and have high potential for energy efficiency measures along with MSME industries belonging to sectors like brick manufacturing, sponge iron, coke oven to name a few.

The Industry Sector contributes to 46% of the total energy consumption in the State of West Bengal in FY 2020.

Key highlights for the Industry sector in West Bengal

The industries sector of West Bengal contributes 25% to the state GDP. The major industries of West Bengal in terms of GVA is basic iron and steel, basic chemicals, food processing, textiles and metal casting, refined petroleum products. Major industrial areas of West Bengal are Haldia, Kolkata, Asansol-Durgapur region and Kharagpur. As of July 2018, West Bengal had 21 SEZs; of which, 7 are operational, 5 are notified, 7 are formally approved and 2 have in-principle approval (IBEF, 2018). In West Bengal, there are close to 52.7 lakh MSME establishments, the highest in the country.

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



Strategies in Industry Sector

1. **Action plan 1 – Deepening of PAT scheme:** It is pertinent to comprehend that some of the existing manufacturing units of the already notified sectors (cement and iron & steel) does not fall under the purview of the PAT scheme. In this regard, it is recommended that the threshold for the PAT criteria may be lowered so that some of the existing cement and sponge iron units like ACC Damodar, Nuvoco Vistas Corp., Ramsarup loha udyog, and New Metaliks ltd.. may be added to the PAT scheme.

   Following table encapsulates both the aforementioned scenarios and demonstrates the energy efficiency potential in the year 2030 as per this strategy of deepening the PAT scheme:-

Baseline SEC (toe/tonne)	Moderate SEC (toe/tonne)	Ambitious SEC (toe/tonne)	Production in 2030 (tonnes)	Energy saving in moderate scenario (toe)	Energy saving in ambitious scenario (toe)
Cement	0.0708	0.0676	3601068	1440	10082
Iron and steel	0.55	0.4	1187952	59397	207891

   (Note: The baseline, moderate and ambitious specific energy consumption has been assumed based on various studies on the secondary domain along with the consultant's previous experience in the industrial sector. For moderate scenario - It is assumed that all the existing units will achieve the moderate SEC target in 50% units. For the ambitious scenario - it is assumed that all existing units will achieve ambitious SEC target in 70% unit)

2. **Action plan 2 - Energy efficiency in the Non-PAT sector:** Manufacturing MSME industries form the backbone of the Indian economy – so it is only justified that this sector may be looked at more carefully from the lens of energy efficiency. From secondary research – it was discovered that there are a number of MSME industry clusters that are energy intensive. It is recommended that clay fired brick, brick and coke oven sectors may be incentivized or prompted to adopt energy efficient technologies. In view of this, following scenarios are proposed:-

Baseline SEC (toe/tonne)	Moderate SEC (toe/tonne)	Ambitious SEC (toe/tonne)	Production in 2030 (tonnes)	Energy saving in moderate scenario (toe)	Energy saving in ambitious scenario (toe)
Refractories	0.1378	0.0636	120600	5143	14400
Brick	0.031	0.028	49604009	99430	278403
Foundry	0.093	0.088	750000	2119	5935

   (Note: The baseline, moderate and ambitious specific energy consumption has been assumed based on various studies on the secondary domain along with the consultant's previous experience in the industrial sector. For moderate scenario - 50% penetration of zig-zag in brick sector, coke dry quenching in coke oven units. For the ambitious scenario - 70% penetration of zig-zag in brick sector and coke dry quenching in coke oven units)

Focus Sector: Agriculture

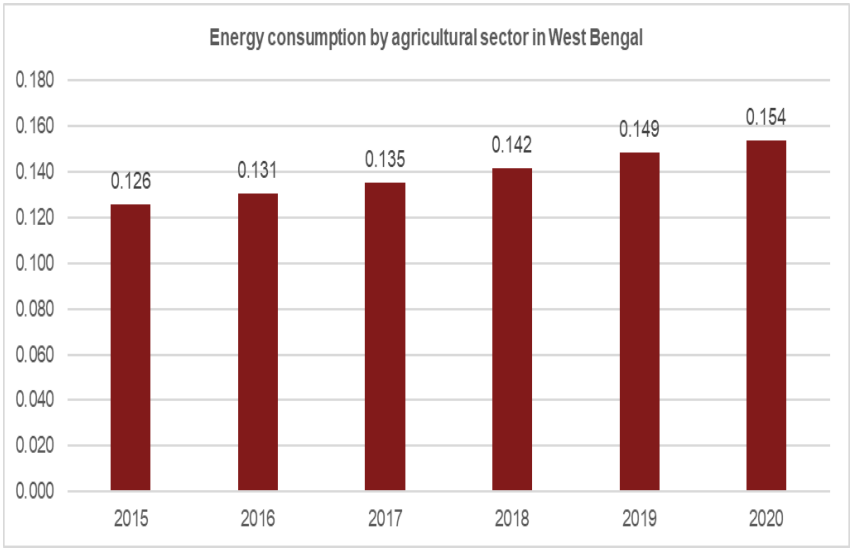
The Agriculture Sector contributes to 1% of the total energy consumption in the State of West Bengal in FY 2020.

The agriculture sector is a major area of economic activity in West Bengal and accounts for 18.33% of the state GSDP and 59% (5.2 million hectares) of state geographical area is under agriculture. The cropping intensity i.e. raising of a number of crops from the same field during one agriculture year, for West Bengal is 184%, while the national average is 142%. The state is the largest producer of paddy, jute, pineapple, brinjal, cabbage and the 2nd largest producer of potato, tea and fish. (Dept. of Agriculture, Govt. of West Bengal, 2019)

The sector is a focus area for the state considering the fact that it employs 57% of the state's workforce under various core and allied activities and 96% of Bengal's farmers are classified as small or marginal farmers. In order to improve the economic condition of workforce in agriculture sector, the state's has increased its expenditure in agriculture and allied activities by more than 6 times from INR 3029 Cr in 2010-11 to INR 20323 Cr in 2017-18

Key highlights for the Agriculture sector in West Bengal

Most of the energy consumption in agriculture sector of West Bengal is in irrigation pumps and tractors. Following graph illustrates the final energy consumption in West Bengal (in Mtoe) in the agriculture sector in West Bengal from 2015 to 2020:



Strategies in Agriculture Sector

1. **Action plan 1 – Transition of existing diesel pumps to solar based pumps:** Under this strategy, it is recommended that the existing stock of diesel-based pumps may be replaced by solar based pumps by 2025.

   Following table encapsulates both the aforementioned scenarios and demonstrates the energy efficiency potential in the year 2030 as per this strategy of transition from diesel pumps to solar based pumps :-

Diesel pumps estimated inventory by 2025	Energy saving in moderate scenario (Mtoe)	Energy saving in ambitious scenario (Mtoe)
330,000	0.068	0.093

   (Note: For moderate scenario - By 2025, moderate scenario assumes 75% replacement of diesel pumps with solar pumps. For the ambitious scenario By 2025, ambitious scenario assumes 100% replacement with solar pumps)

2. **Action plan 2 - Replacement of inefficient electric pumps with efficient electric pumps:** Under this strategy, it is recommended that the existing stock of inefficient electric pumps may be replaced by solar based pumps by 2025.

   Following table encapsulates both the aforementioned scenarios and demonstrates the energy efficiency potential in 2030 as per this strategy: -

Inefficient pumps estimated inventory by 2030	Inefficient pumps replaced by Star-Rated pumps in ambitious scenario by 2030	Energy saving in moderate scenario (Mtoe)	Energy saving in ambitious scenario (Mtoe)
442182	**132655**	309528	0.0100

   (Note: For moderate scenario - assumes 30% replacement with efficient Star-Rated pumps. For the ambitious scenario - assumes 50% replacement with efficient Star-Rated pumps)