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Environmental Information, Awareness, Capacity Building and Livelihood Programme (EIACP)

Programme Centre-Hub

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paryavaran patra

CURRENT ENERGY PRODUCTION AND CONSUMPTION STATUS OF CHANDIGARH

Introduction

Energy is the primary fuel for all the physical, chemical, and biological processes occurring in nature. All life forms depend on energy as an essential source of life. As human civilization advanced, many new ways to use energy were developed, including the use of fire for heating, cooking, lighting, and defence, among other things. Energy is essential to our everyday lives in today's world. It has a role in every aspect of our lives, from basic domestic activities like heating, cooking, and washing, to large-scale businesses, transportation, and communication. The energy we use is derived from a variety of sources, but it is primarily classified into two types based on its origin: conventional sources and non-conventional sources. The conventional sources of energy are fossil fuels which includes coal, petroleum, and other types of such sources that are formed over millions of years by geological processes from dead organisms. These sources are limited in amount; in addition to that, they release greenhouse gases when burned, whereas non-conventional sources, such as sunlight, water, wind, etc., are clean and plentiful in nature. The amount of energy generated from these diverse sources differs enormously among nations around the world. The population and the country's level of development are some of the important factors that impact this demand. China is the world's largest energy consumer, followed by the United States.[1]

According to the information provided by the National Investment Promotion and Facilitation Agency, India is the 3rd largest energy consuming country in the world. According to the Ministry of Power, the share of energy derived from fossil fuels in India was 57.9% until September 30, 2022, among fossil fuels coal was accounting for the majority, or 50%. The non-fossil fuel resources contributed 42.1% as a source of energy in India, among non fossil fuels the majority, i.e., 40.4%, came from renewable energy sources, including hydro energy. Globally, India ranks third in the Renewable 2022 Global Status Report. Overall, India's total energy production rose by 7.96% during the fiscal years 2021–2022. These trends in energy production and consumption, however, vary at the state or union territory level.

Referring to the Union Territory of Chandigarh, the topographical conditions in this region, such as the absence of a perennial river, restrict the construction of hydropower-producing plants like those found in the neighbouring states, such as Himachal Pradesh, Uttarakhand, and Punjab. As a result, centralized generating grid supply the majority of the energy required for consumption by citizens. Out of the total power acquired from the generating stations, 67% is attained from PSEB (Mohali), 10% from BBMB (Dhulkote), and 23% from PGCIL (Nalagarh).[2]

Apart from energy sourcing from these stations, work is being done to establish solar photovoltaic power generation units for energy generation, which has emerged as the most viable choice for Chandigarh to have its own energy production unit.

Since the unused land is limited in the region, rooftop-based SPV plants have emerged as the best options for energy production. The Ministry of New and Renewable Energy has chosen Chandigarh to be created as a Model Solar City. The Department of Science, Technology, and Renewable Energy has designated Chandigarh Renewable Energy and Science & Technology Promotion Society (CREST) as the executing agency for the rooftop-based SPV plant under this plan. By October 31, 2022, Chandigarh has installed 52.042 MWp of grid-connected rooftop solar power plants at 4279 locations. Details of the current state of energy production and consumption in Chandigarh are given further.

Energy derived from Conventional and Non conventional sources w.r.t. Chandigarh

FUEL DERIVED ENERGY

Conventional energy sources, as mentioned before, are also referred to as "non-renewable sources" and are the most commonly used energy sources. During the production of energy, these sources discharge contaminants into the air, resulting in air pollution. The energy for domestic use, transportation, and commercial activities, etc., is majorly derived from these sources in the Union territory. *Figure 1* illustrates that, for the period of 5 years between 2017–18 and 2021–22, Diesel HSD was primarily used for energy generation from conventional sources (exception in 2019–2020), with motor spirit following as the second-highest source and LPG as the third-highest source for the same time period. The energy contribution from natural gas was at its lowest in each of the five financial years.

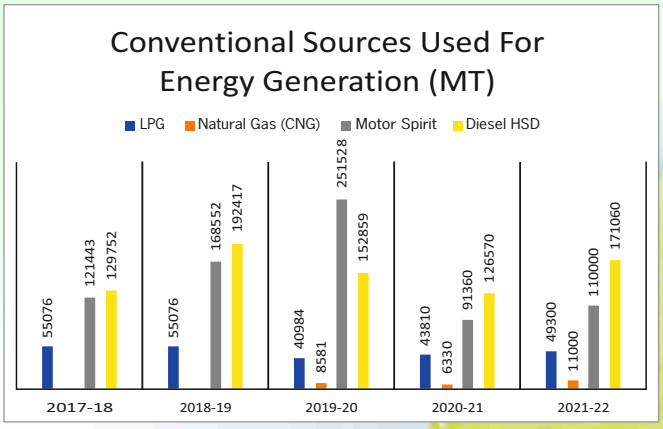


Figure 1: Conventional resources used for energy generation
Source: Additional Director, Department of Science & Technology, Sec-19, Chandigarh.

Among petroleum and its by-products High Speed Diesel was used most in quantity as a fuel for energy generation followed by Motor spirit in Chandigarh. In the year 2021-22 the total petroleum and its by products used were 374760 MT which were mostly used in transportation and commercial sectors. Out of the total amount of LPG consumed, cooking fuel for domestic households accounted for the majority of its use, followed by commercial and industrial/non-domestic sectors.

FOR ELECTRICITY PRODUCTION

Non-conventional energy sources are less commonly used as an energy source, but they are clean, renewable, and have an unlimited supply in nature. As mentioned before, Chandigarh does not have its own power-producing units. The necessary electricity is provided by centralised production facilities, details of which are provided in Table 1. Chandigarh's renewable energy generation is entirely powered by solar energy. The total installed capacity of the solar photovoltaic power generation station in Chandigarh is 48.244 MW (2021–2022), which has increased by 33.54 MW over a period of 5 years (from 2016–17 to 2021–22) from 14.9 MW.

Over the years, the solar energy production in Chandigarh has seen an increase of 15.32 MU (2018-2021) *(Figure 2)* due to great efforts put in to promote the installation of solar panels at various public and private locations by the CREST *(Figure 3)*. Figure 2 represents this increase in the solar energy production for Chandigarh, which has increased from 29.89 MU for the year 2018 to 45.21 MU for the year 2021.

Table 1: Power Allocation from various Central Generating Stations (CGS) Plants in Chandigarh

Sr. No.	Source Type	Allocation in MW	% age allocated Power
1	HYDRO NTPC	6.32	1.82
2	HYDRO NHPC	39.99	11.54
3	THDC	47.44	13.69
4	SJVNL	7.95	2.29
5	HYDRO BBMB	139.40	40.24
6	THERMAL NTPC	39.24	11.33
7	MUNPL	3.04	0.88
8	GAS NTPC	15.02	4.34
9	NUCLEAR NPCIL	8.01	2.31
10	WIND POWER	40.00	11.55
	TOTAL	**346.41**	**100.00**

Source: Superintending Engineer, Electricity, 'OP' Circle, U.T., Chandigarh

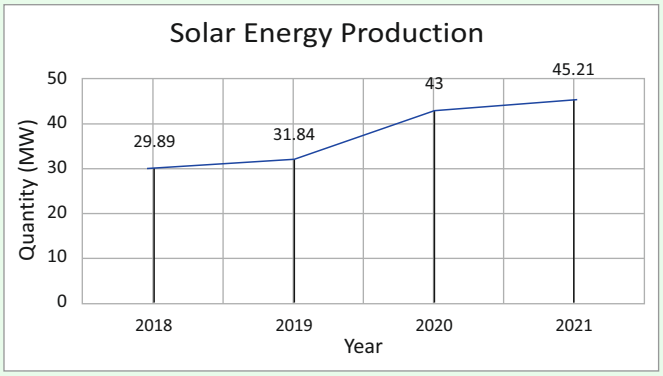


Figure 2: Solar Energy Generation for Chandigarh (2018-2021) Source: Chandigarh Renewable Energy and Science & Technology Promotion Society (CREST)

Figure 3: Installed solar power panels at various public sites in Chandigarh

ELECTRICITY

Figure 4 illustrates how, over the course of 18 years (from 2004–2005 to 2021–2022), overall energy consumption increased by 750 M.kWh, from 918 M.kWh to 1668 M.kWh. The energy use per capita has seen a similar pattern *(Figure 5)*. The per capita usage increased overall by 197 kWh during the course of five years, from 1284 kWh in the financial year 2015–2016 to 1481 kWh in the year 2019–2020. The main contributors to this increase in energy consumption may be rising incomes, which raise people's standards of living, as well as technological developments that have boosted demand for energy.

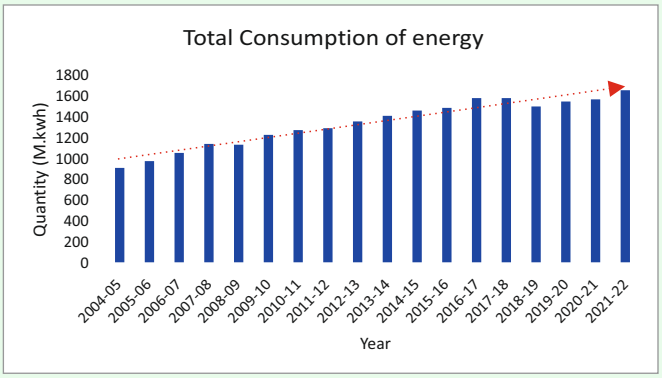


Figure 4: Total Energy Consumption for Chandigarh
Source: Superintending Engineer, Electricity, 'OP' Circle, U.T., Chandigarh

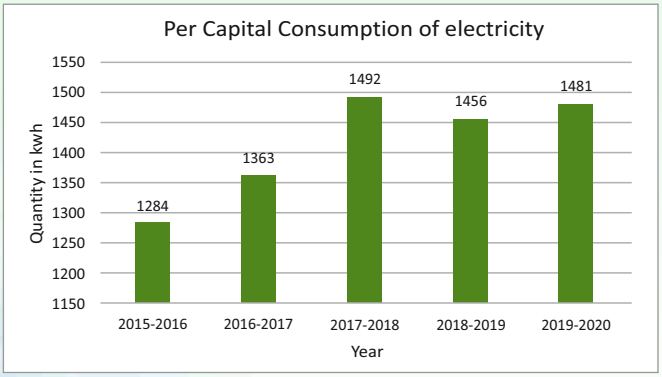


Figure 5: Per Capita Consumption of Energy for Chandigarh
Source: Statistical abstract Chandigarh, (2019-2020, 2018-2019, 2017-2018)

Figure 6 illustrates the sector-wise energy consumption in Chandigarh. It is revealed from the figure that the domestic sector consumes the most energy, followed by the commercial and industrial sectors (the exception being the financial year 2019–2020). The agriculture sector consumed a negligible amount of energy when compared to these different sectors.

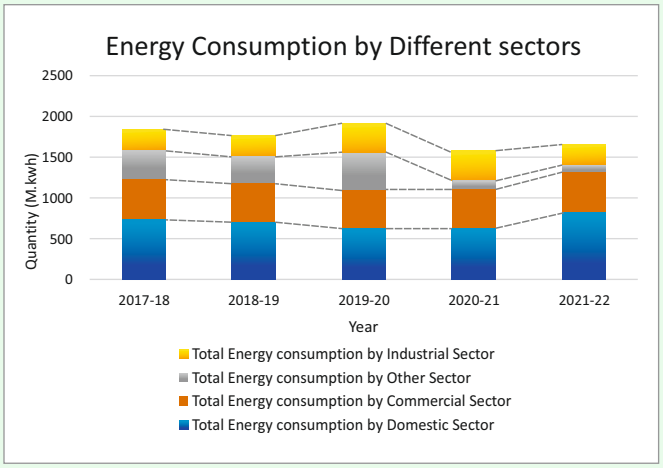


Figure 6: Energy Consumption by different sectors in Chandigarh
Source: Superintending Engineer, Electricity, 'OP' Circle, U.T., Chandigarh

ENERGY REQUIREMENT AND AVAILABILITY (ELECTRICITY)

As shown in *Figure 7* the demand for the power supply was highest for the July month of 2021, while it was lowest for the November month of the same year. The rise in demand for energy in the month of July can be linked to the high temperatures and humid conditions prevailing in the area due to the monsoon season. November has pleasant weather with optimal temperature conditions, causing the least energy demand. The power supply position *(Figure 7)* for Chandigarh shows that the department is able to completely meet the energy demand according to the requirements of the consumers throughout the year, thereby providing a non-disrupting supply of energy.

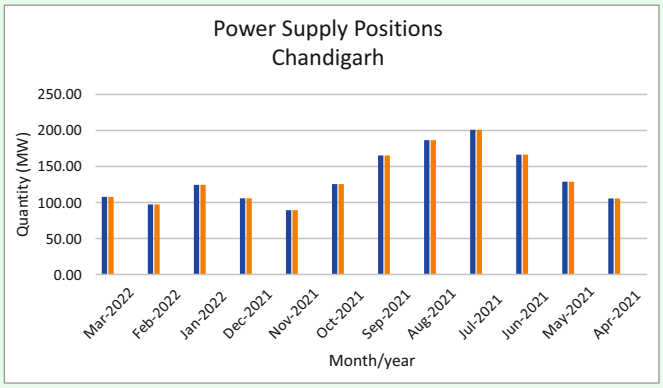
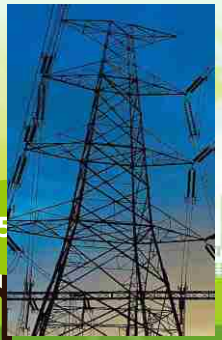


Figure 7: Energy Requirement and Availability for Chandigarh
Source: Central Electricity Authority
(https://cea.nic.in/dashboard/?lang=en)



Chandigarh's energy needs will rise over time due to the city's growing population and the increased living standards of its residents. The majority of the energy demand is met by external sources, as seen from the figures. Given that solar energy is a possible source of energy for Chandigarh, rooftop solar panels which are being installed in the city's buildings may help to meet the demand of the domestic sector, which consumes the maximum energy. This green energy will further help in reducing emissions during energy generation and help in combatting environment problems such as climate change. Promoting Chandigarh as a Model solar city will encourage other cities to adopt such green initiatives of energy production which in turn will help in achieving India's goal of increasing renewables capacity to 500 GW by 2030, meeting 50% of energy requirements from renewables and to reduce cumulative emissions by one billion tonnes by 2030.

Apart from the previously mentioned efforts, energy conservation programmes should also be prioritised to manage the increased demand for energy. Energy conservation refers to actions taken to reduce energy consumption, which can be done by using energy more efficiently and by reducing energy wastage. The general public's awareness for energy conservation can be raised through public awareness campaigns that use print and digital media to advertise. Adopting appliances and technologies that use less energy will help to reduce energy consumption even more. Such initiatives for efficient use of energy are required in order to reduce the expenditure on energy production and preserve conventional resources for longer periods of time, resulting in decreased emissions.

ACHIEVEMENT OF SPV POWER PLANT PROJECT

Under National Solar Mission, to achieve the target of 75MWp by 2023 in Model Solar City Programme, so far a total aggregate capacity of 54.999 MWp Grid tied Rooftop Solar Power Plants at 4346 No. sites have been installed and commissioned in U.T., Chandigarh including Private Sectors, as on 31st December,, 2022.Among the overall capacity of 54.999 MWp, aggregate capacity of 29.940 MWp Rooftop SPV Plants on 851 No. of different Govt. Sites in U.T. Chandigarh besides this rest 25.059 MWp at 3495 No. private different sites have been installed. The Solar Power Plants installed by CREST are being monitored through remote monitoring systems and are working well. As on 31st December, 2022, Chandigarh has already generated cumulative 219.37 MU of solar energy from the Solar Power Plant installed on the rooftop of Govt. buildings, which is equivalent to a reduction of 149495 ton of CO^2.

OTHER ACHIEVEMENTS

- The largest floating solar plant project in North India, with a capacity of 2000 kWp, has been installed at Raw Water Reservoirs.
- All government schools and colleges are self-sufficient, with solar power meeting all of their energy needs.
- All of the bus terminal's energy requirements are met through solar.
- All the water works of the municipal corporation are covered with SPV power plants to meet their energy demand.
- Green Police Stations: Police Stations that are solar-powered.
- Paryavaran Bhawan Building, Sector 19-B, Model Jail, Sector 51, all the buildings of the Forest Department in Chandigarh are self-reliant in terms of energy, i.e., "NET ZERO." All the energy requirements of these buildings are met through solar energy (Both Net Metering & Virtual Net Metering).

FUTURE PLANS OF CHANDIGARH ADMINISTRATION

- Chandigarh Administration has set a target to make all government schools, government hospitals, government department buildings, and police establishments "NET ZERO" by 15th Aug, 2023.
- To achieve the "NET ZERO" target of the above buildings, the Chandigarh Administration has planned to install 8 MWp canal-top SPV power plants under a virtual net metering arrangement.

RECOMMENDATIONS TO MEET ENERGY CHALLENGES

1. More capacity building programmes should be organized for various stakeholders, including architects, builders, solar panel dealers, town planners, and other government officials, in order to support the Model Solar City programme.
2. Escalating the use of rooftop solar panels on various public and private structures in the U.T., since the domestic sector uses the most energy there, by installing solar panels in every residential building, will significantly reduce the demand for energy from outside sources.
3. Increasing the number of solar-powered streetlights and other public lighting systems.
4. Organization of regular awareness campaigns for efficient energy consumption for different age groups to inculcate the habit of wise use of energy among the citizens.

Source

https://yearbook.enerdata.net/total-energy/world-consumption-statistics.html

https://powermin.gov.in/sites/default/files/uploads/joint_initiative_of_govt_of_india_and_Chndigarh.pdf

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CURRENT ENERGY PRODUCTION AND CONSUMPTION STATUS OF CHANDIGARH

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