

5. Response

The Chandigarh Administration has undertaken several interventions toward the benefit of the farming community in the U.T. Agriculture in Chandigarh is being practiced under irrigated conditions and the Chandigarh Administration provides for the installation of deep-bore tubewells to supply adequate irrigation water to the farmers. For undertaking the farming practices, the Chandigarh Administration facilitates a timely supply of agricultural inputs such as seeds, fertilizers, pesticides and farm tools. For awareness generation on agricultural practices, the Administration arranges for study tours/camps of farmers. Due to a significant shift in an area under fodder cultivation to cater to the feed demand of milch cattle, there has been an increasing demand for quality high-yielding seeds of the fodder crop by the farmers. The Chandigarh administration facilitates the distribution of high-yielding varieties of fodder seeds to the farmers. Towards the promotion of animal husbandry and fisheries, the Department of Animal Husbandry & Fisheries, Chandigarh Administration, endeavour to promote scientific practices to enhance the lifetime productivity of livestock. The department established a Fish Seed Farm below the regulator on the end of Sukhna Lake to produce quality fish seed for keeping its stock in Sukhna Lake, Forest Dam and Village ponds and to maintain the ecology of Sukhna Lake. The department conducts the extension and training programs each year for the development of the livestock and fisheries sector.

6. Recommendations

In order to achieve sustainability within agriculture and allied sectors, the utilization of Key Performance Indicators (KPI's) such as economic, social and environmental is imperative.

- **Economic Indicator:** This includes ensuring producers have a sustainable form of income all year long; paying producers a sustainable price that covers cost of production, cost of living, and reflects the quality of the produce; maximizing yields through adoption of best sustainability practices; ensuring access to training and educational opportunities related to farm management techniques or processing methods.
- **Social Indicator:** This includes creation of smallholder inclusive and gender-equitable producers groups and supply chain; ensuring farmers access to adequate nutrition.
- **Environmental Indicator:** This includes having a clear and established plan to address the risks and threats associated with climate change; protecting and conserving local flora and fauna within the agro-ecosystems; practicing good agricultural techniques that help replenish and preserve natural resource base – soil and water; ecologically sustainable, cost-effective and efficient agricultural inputs to maximize productivity and mitigate against pests and diseases – as environmental sustainability indicators.

U.T. Specific Interventions

The establishment of an organic vegetable market wherein small landholding farmers from nearby areas can be encouraged to market their produce must be promoted.

There is a significant scope for ornamental landscaping in the region with respect to flowers and saplings. Thus, there is a large-scale capacity to encourage the production of nurseries in the state

There is a need to instill the concept of crop diversification within the agricultural lands of the region, since wheat-based monoculture cultivations is dominant in the area. Vegetable led intercropping and crop diversification activities can help rejuvenate the ecological landscape and aid in the development of market based agricultural practice.



With the increase in number of livestock over the last few years, there needs to be an enhanced focus on fodder seed availability and balanced feed management. Further given the scarcity of land, adoption of modern fodder cultivation practices such as hydroponics can be useful for the farming sector.

Additionally, since cultivable land is quite scarce within Chandigarh (UT), awareness campaigns focusing on home gardening techniques can help boost the growth of home-based nutritional gardens and augment the consumption of organic vegetables and fruits.





VI

ENERGY

VI

CHAPTER

ENERGY

1. Introduction

Energy is a pre-requisite for economic growth and access to energy is extremely important for fostering development. The energy sector makes a direct and significant contribution to the economy in terms of revenue generation, employment opportunities, and enhancing the quality of life. The growth of the modern industrial age was fuelled by abundant supplies of energy from fossil fuel sources. However, the consumption of fossil fuels for generation of energy is the major cause of air pollution and climate change. Reducing dependence on fossil fuels for energy generation and improving energy efficiency at the generation and consumption stages are desirable objectives for minimizing the impacts of economic development on climate and ensuring long-term sustainability. Today, the energy sector is in the process of transformation where there is steadily rising demand, but the need to save and conserve energy demands equal recognition. In this context, renewable energy, which offers clean and dependable alternatives, is seeing a rise in its deployment.

Chandigarh being a UT with limited rural areas and agricultural activities, the thrust on energy front is mainly to have uninterrupted power supply and to take care of an increasing power demand owing to growth in its population and commercial activities. However, in Chandigarh, due to shortage of vacant spaces, there is no option for the installation of wind mills or wind turbines. Also, due to the absence of yearly stream/river, hydro power generation is difficult to set up. With absence of any geothermal energy source or radioactive material site, solar energy is the only non-conventional source of energy for the UT. The subtropical humid climate of Chandigarh enables high intensity solar light availability during most time of the year.

Power or electricity being the most convenient and versatile forms of energy plays a key role towards accelerated economic development. Shortage of power is one of the major impediments to the economic development of any state. The growth of the industrial sector which is essential to clock high pace of growth would also come as a sequel to the improved electricity scenario. It is also the most crucial source for domestic energy requirements.

In Chandigarh, with the gradual increase in the population of the city, the demand for electricity has also increased at a faster rate. The total electricity demand increased from 1302 MUs in FY 2011-12 to 1562 MUs in FY 2019-20, almost 20% increase over the 9 years. As of March 2021, there were 2.34 lakh electricity consumers in the city, of which 2.01 lakh consumer were using domestic connections, while others have commercial, small power, medium and large supply, bulk supply, public lighting and agriculture connections. In this chapter, we analyse the energy sector of the UT Chandigarh.



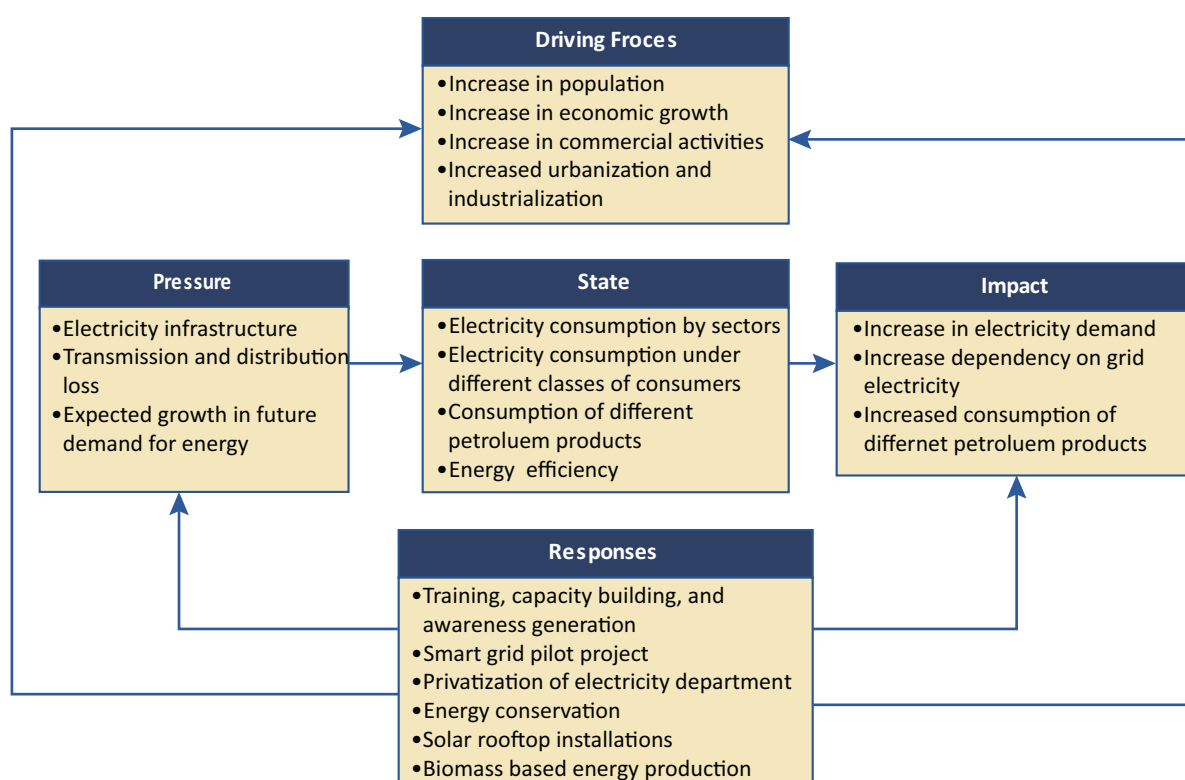


Figure 57: Diagram illustrating each component of DPSIR Framework

2. Drivers & Pressures

2.1 Electricity Infrastructure

The electricity infrastructure of the Electricity Wing Engineering Department, Chandigarh Administration as on dated 31.03.2021 is as under: -

(a) Power Transformers

Table 54: Power Transformers Electricity Infrastructure of Chandigarh for 2020-21

Voltage Class	Total No. of sub-station	Different voltage ratio in use	Different Capacities in use (KVA)	No. in each capacity size	Total No. of Power Transformers	Aggregate capacity (KVA)
220 KV	1	220/66	100000	3	3	300000
		66/33	16000	1	1	16000
			20000	5	5	100000
66 KV	14		12500	20	20	250000
66/11			20000	15	15	300000
			30000	2	2	60000



Voltage Class	Total No. of sub-station	Different voltage ratio in use	Different Capacities in use (KVA)	No. in each capacity size	Total No. of Power Transformers	Aggregate capacity (KVA)
			6000	6	6	36000
33 KV	4	33/11	12500	4	4	50000
			10000	1	1	10000
			20000	1	1	20000
Total				58	58	1142000

Source: Electricity Wing Engineering Department, Chandigarh Administration

(b) Distribution Transformers

Table 55: Distribution Transformers Electricity Infrastructure of Chandigarh for 2020-21

S. No.	Voltage class	Voltage Ratio	Total No. of Distribution Transformers	Different capacities in use (KVA)	No. in each capacity Size	Aggregate Capacity (KVA)
1	11	11/.440	0	50	0	0
2	11	11/.440	36	63	36	2268
3	11	11/.440	240	100	240	24000
4	11	11/.440	571	200	571	114200
5	11	11/.440	6	250	6	1500
6	11	11/.440	647	300	647	194100
7	11	11/.440	394	315	394	124110
8	11	11/.440	12	400	12	4800
9	11	11/.440	175	500	175	87500
10	11	11/.440	29	630	29	18270
11	11	11/.440	62	750	62	46500
12	11	11/.440	98	800	98	78400
13	11	11/.440	75	1000	75	75000
Total :						
			2345		2345	770648

Source: Electricity Wing Engineering Department, Chandigarh Administration



(c) Transmission and Distribution Lines**Table 56:** Transmission and Distribution Lines of Chandigarh for 2020-21

Sl. No	Nominal Voltage	Total Length of line in Ckt km at the end of the year				
		Single Ckt	Double Ckt	Multi Ckt*	Total	Grand Total
1	220kV	54.00	0.00	0.00	54.00	
2	66 kV (O.H)	32.9	87.77	0	120.67	132.96
3	66 KV (U.G)	12.288	0.00	0.00	12.29	
4	33 kV (O.H)	14	0.00	0.00	14.00	23.00
5	33 kV (U.G)	9	0.00	0.00	9.00	
6	11 kV (O.H)	552.784	0.00	0.00	552.78	913.54
7	11 kV (U.G)	360.754	0.00	0.00	360.75	
8	440/230 V, 3 phase, single phase if available (O.H)	1014.97	0.00	0.00	1014.97	1647.20
9	440/230 V, 3 phase, single phase if available (U.G)	632.232	0.00	0.00	632.232	

Source: Electricity Wing Engineering Department, Chandigarh Administration

2.2 Transmission and Distribution (T&D) Loss

The Electricity Wing of Engineering Department (EWEDC) is one of the best power utility in India which is serving to its consumers with better reliability of power supply on 24x7 basis. The Transmission & Distribution losses are within the 15% as mandated by Govt. of India. Further, the T&D losses are reduced from 20.20% to 11.91% in last 09 years.

Table 57: Yearly Transmission and Distribution Losses in Chandigarh

S.No.	Financial Year	T&D Loss
1.	2011-12	20.20%
2.	2012-13	18.42%
3.	2013-14	15.10%
4.	2014-15	15.17%
5.	2015-16	15.24%
6.	2016-17	13.65%
7.	2017-18	9.51%
8.	2018-19	13.50%
9.	2019-20	11.91%

Source: Electricity Wing Engineering Department (EWEDC), Chandigarh Administration



2.3 Expected growth in future demand for energy

The UT of Chandigarh does not have any generation capacity of its own and most of the energy requirement is being met from the allocation of Central Generating Stations (CGS) which puts immense pressure. With the gradual increase in the population of the city, the demand for electricity has also been increased at a faster rate. The per capita consumption of electricity has increased from 1284 in 2015-16 to 1481 in 2019-20, almost 15% increase in the last 5 years and accordingly last few years have also seen a consistent increase in electricity consumption in Chandigarh.

The following table presents the trend in electricity consumption.

Table 58: Annual per capita consumption of electricity in Chandigarh

Year	2018-19	2019-2020	2020-21
Annual per capita consumption of electricity (KWH)	1456	1513	1375

Source: Electricity Wing Engineering Department, Chandigarh Administration; (Chandigarh Master Plan 2031)

Given this trend, there is expected a rise in future demand for electricity too in the UT.

2.4 Details of Power Allocation from various GENCO's

Chandigarh UT does not have any generation capacity of its own excluding the roof top solar PVs and most of the power / energy requirement is met from the allocation of central generating stations and through necessary tie-ups. The maximum demand of Chandigarh is 426 MW in FY 2021-22. With the increase in population and per capita consumption of electricity it is imperative for the union territory to reduce its dependency on grid electricity and build its own captive generation or switch to renewable power that helps to generate its own power. The EWEDC does not have its own generation and procures power allocation from central generating stations such as NTPC, NHPC, THDC, SJVNL, BBMB, MUNPL, NPCIL, & Wind Power. The remaining is met through bilateral transactions and power exchange etc. The power allocation from various Central Generating Stations (CGS) Plants is as under: -

Table 59: Power Allocation from various Central Generating Stations (CGS) Plants in Chandigarh for 2020- 21

Sr. No.	Source Type	Allocation in MW	% age of unallocated 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



Sr. No.	Source Type	Allocation in MW	% age of unallocated power
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: Electricity Wing Engineering Department, Chandigarh Administration

400/220 kV Grid substation at Nalagarh (PGCIL), 220kV GSS Mohali (PSTCL), 66kV Dhulkote (BBMB) are the main feeding source to Chandigarh UT.

The details of the transmission network grid substations are presented as below:

Table 60: Transmission Network Grid Substations in Chandigarh

S.No.	Grid Sub-Station (GSS)	Voltage Ratio	No. of Transformers MVA Capacity	%age Share	Remarks
1	Kishangarh Manimajra	220/66kV	3X100	51%	The Grid S/Stn. is owned by the EWEDC.
2	PSTCL Mohali	220/66kV	1*100 2*160	46%	There is 2/3rd share of EWEDC.
3	BBMB (Dhulkote)	220/66kV	2x75/100 MVA	3%	There is share of EWEDC & BBMB

Source: Electricity Wing Engineering Department, Chandigarh Administration

3. State and Impact

3.1 Electricity consumption by sectors

Bulk of the electricity consumption in the state of the supplied electricity is by the domestic sector. The domestic sector consumption has seen an upward trend. One of the reasons for this is due to growth of urban centres, improved economic conditions of people and thereby changes in lifestyle patterns, leading to increase in demand for electricity. Electricity consumption by the agriculture sector is on the decline because of rapid expansion and growth in the city. The major portion of the electricity consumption has been occupied by the domestic, commercial and other sectors such as Industries, Public Lighting, Educational and Medical Institutions, Government Buildings and offices etc.

The commercial data of EWEDC is as under: -



COMMERCIAL DATA

(a) Energy Sale (MUs)

Table 61: Energy Sale (MUs) of Chandigarh from FY 16 to FY 19

Consumer Category	FY 16	FY 17	FY 18	FY 19
Domestic	659	722	732	705
Commercial	463	499	494	473
Large Industrial Supply	132	126	120	125
Medium Industrial Supply	111	115	119	116
Small Industrial Supply	19	20	20	19
Agriculture	1	1	1	1
Public Lighting	23	22	18	15
Bulk Supply	77	81	81	77
Temporary Supply	7	5	4	4
Total	1492	1591	1589	1536

Source: Electricity Wing Engineering Department (EWEDC), Chandigarh Administration

(b) Connected Load (kW)

Table 62: Connected Load (kW) of Chandigarh from FY 16 to FY 19

Consumer Category	FY 16	FY 17	FY 18	FY 19
Domestic	818, 172	850, 347	909, 069	896, 688
Commercial	400, 437	424, 746	446, 005	454, 578
Large Industrial Supply	71, 904	70, 044	69, 431	69, 231
Medium Industrial Supply	70, 162	71, 457	72, 362	76, 548
Small Industrial Supply	-19, 364	19, 565	19, 717	22, 321
Agriculture	737	748	843	834
Public Lighting	6, 243	6, 660	6, 756	4, 911
Bulk Supply	41, 916	42, 454	42, 253	42, 053
Temporary Supply	3, 250	2, 480	2, 191	32, 529
Total	1, 432, 185	1, 488, 501	1, 568, 627	1, 599, 693

Source: Electricity Wing Engineering Department (EWEDC), Chandigarh Administration



(c) No. of Consumers**Table 63:** No. of Consumers in Chandigarh between FY2018-19 to FY2020-21

Consumer Category	Unit	2018-19	2019-20	2020-21
Domestic	M.Kwh	704.67	759.21	738.37
Commercial	M.Kwh	472.98	484.49	374.44
Industrial	M.Kwh	260.42	248.57	235.30
Public Lighting	M.Kwh	15.09	14.78	15.49
Agriculture	M.Kwh	1.36	1.41	1.28
Bulk Supply	M.Kwh	77.31	82.88	81.22
Total	M.Kwh	1535.76	1595.54	1449.97

Source: Electricity Wing Engineering Department (EWEDC), Chandigarh Administration

3.2 Growth of consumption of electricity under different classes of consumers

The following table presents the data for growth of consumption of electricity under different classes of consumers over time.

Table 64: Growth of consumption and percentage of electricity under different classes of consumers between 2018 to 2021.

Consumption & Percentage of Electric-Power by Uses						
Category of	2018-19		2019-20		2020-21	
	Consumption in Percentage M. Kwh to total		Consumpti in Percentage M. Kwh to total		Consumpti in Percentage M. Kwh to total	
Domestic	704.67	45.88	759.21	47.58	738.37	50.92
Commercial	472.98	30.80	484.49	30.37	374.44	25.82
Industrial	260.42	16.19	248.57	15.58	235.30	16.23
Public Lighting	15.09	0.98	14.78	0.93	15.49	1.07
Bulk Supply	77.31	5.03	82.88	5.19	81.22	5.60
Agricultural	1.36	0.09	1.41	0.09	1.28	0.09
Others	3.93	0.26	4.20	0.26	3.87	0.27
Total	1535.76	100.00	1595.54	100.00	1449.97	100.00

Source: Electricity Wing Engineering Department (EWEDC), Chandigarh Administration



3.3 Consumption of different petroleum products

In the mechanised and the fast-moving world of today the consumption of petroleum products is considered an important yardstick of a region/country's prosperity. Though many new sources of unconventional energy have been discovered, petroleum remains the primary energy source in India, and its consumption is increasing at a very steep rate.

Table 65 presents the consumption of different petroleum products.

Consumption of petroleum products

Table 65: Consumption of petroleum products in Chandigarh

Consumption of Petroleum Products					
Products	Units	2017-18	2018-19	2019-20	2020-21
Products including ULP	kilo-litres	146925	173056	178911	128909
High Speed Diesel	kilo-litres	156999	232825	239200	153150
Kerosene	kilo-litres	213	271	71	141
Light Diesel Oil	kilo-litres	931	558	459	414
Furnance Oil	metric-ton	-	-	2021	1286
Low Sulphur Heavy Stock	metric-ton	9070	5064	-	28
L.P.G. Connections	Nos.(cum.)	2, 72, 930	2, 99, 000	2, 78, 565	2, 81, 659

Source: (Statistical Abstract of Chandigarh, 2021)

Liquefied Petroleum Gas as a cooking fuel

LPG is the main source of energy for activities like cooking food, commercial eateries etc in Chandigarh. The main suppliers of LPG in Chandigarh are done by Indian Oil Corporation (IOC), Hindustan Petroleum Corporation (HPC) and Bharat Petroleum Corporation (BPC). Chandigarh administration also promoted the use of LPG in the territorial villages, instead of traditional fuel sources to control the air pollution caused by their combustion, greenhouse gas emission and to preserve the natural resources like nearby forests and water bodies. There has been an increase in LPG connections over the years due to an increase in population, trend of nuclear families and progressive development of commercial sectors. Maximum consumption of LPG is by the domestic sector, followed by industrial and commercial consumption

The main suppliers of LPG in Chandigarh are done by Indian Oil Corporation (IOC), Hindustan Petroleum Corporation (HPC) and Bharat Petroleum Corporation (BPC). To control the air pollution caused by traditional fuel sources, Chandigarh administration has promoted the use of LPG in the territorial villages. This helps to reduce the greenhouse gas emissions and to preserve the natural resources like nearby forests and water bodies.



Table 66: Number of LPG connections provided by different companies in Chandigarh

Company	No. of connections released
Indian Oil Corporation	
2013-14	17735
2014-15	8075
2015-16	12104
2016-17	10614
2017-18	7418
2018-19	7062
2019-20	4117
Hindustan Petroleum Corporation	
2013-14	1764
2014-15	1817
2015-16	2055
2016-17	1908
2017-18	1819
2018-19	2024
2019-20	1119
Bharat Petroleum Corporation	
2013-14	4011
2014-15	2401
2015-16	2664
2016-17	1329
2017-18	815
2018-19	846
2019-20	489

Source: Manager-SLC, UTC, HPCL, Chandigarh, 2020

With the increase in population, trend of nuclear families and progressive development of commercial sectors, the number of LPG connections are also increasing day by day.

Work is already in progress to expand the reach of piped natural gas to households for cooking and other domestic uses and CNG to auto-rickshaws, cars, taxis, buses and other commercial vehicles and natural gas (NG) to industries and commercial establishments. Network of pipelines is being laid across the UT in a phased manner for cooking and other domestic uses.



3.4 Wind

The National Institute of Wind Energy in 2019 (MNRE, 2019) has assessed the wind power potential in all states and Union Territories of the country, and found the potential to be negligible in Chandigarh based on the applied methodology and land suitability analysis. However, the Electricity Wing of Engineering Department, Chandigarh has entered into power sale agreement of 40 MW with Solar Energy Corporation of India (SECI) for purchasing of power from various wind power projects in order to fulfil its non-solar renewable purchase obligations targets by purchasing renewable energy certificates. The move to purchase wind power would help reduce the burden on the union territory's electricity department and became 100% reliant on renewable energy.

3.5 Solar

A. Solar energy potential and installed capacity

Given that solar energy is the only feasible non-conventional energy option for Chandigarh, the states has adopted many measures to move ahead in a structured manner in the field of generating solar energy using solar water heaters, solar lights, blinkers, solar cookers and solar electricity generation by solar panels. The Chandigarh Administration is keen to proliferate and scale up the solar rooftop development in the city and has been an active participant of the "Development of Solar Cities" programme notified by the Ministry of New and Renewable Energy (MNRE) through The Chandigarh Renewable Energy and Science & Technology Promotion Society (CREST), it's nodal agency for promotion and development of projects based on non-conventional energy. The Joint Electricity Regulatory Commission had set 50 MW as Solar PV target for Chandigarh Administration to be achieved by 2022 in tune with Revised Power Tariff policy of 2016 which was later revised to 69 MW to be achieved by 2021-2022. Presently, Chandigarh Administration has set an ambitious target of 75MWp to be achieved by 15th August, 2023.

Chandigarh has adopted policies in the building bye laws that mandate solar power installations which has made rooftop solar power plants must in new properties measuring 500 sq yds and above and in group housing societies. Recently, the UT Administration has warned all building owners of action if they failed to install solar power plants as per the Building Bylaws.

Chandigarh is almost fully built up and land is very precious. As a result, Rooftop Solar was the best alternative available to utilize vacant roof space as resource. All are Grid tied solar PV Plants mostly under Net metering arrangement so that solar energy generated is first consumed locally at respective building loads and excess if any, is exported to the grid.

As mandated by the Ministry of Renewable Energy in 2017, the Chandigarh Electricity Department prepared a Master Plan for making their UT 100% renewable energy powered.

The peak demand of Chandigarh is 400 J in FY 2020-21, out of which more than 73% is met with renewable energy and the remaining 27% of the electricity demand is met through Non-RE Power. However, the steps are being taken to make Chandigarh the first green city of the country with 100% Renewable Energy powered by 2030.

Chandigarh Administration is maximising its efforts to increase solar energy share and identifying every new opportunity to minimise dependence on Non-RE. The Joint Electricity Regulatory Commission had set 50 MW as Solar PV target for Chandigarh Administration to be achieved by 2022 in tune with Revised Power Tariff policy of 2016 which was later revised to 69 MW to be achieved by 2021-2022. Presently, Chandigarh Administration has set an ambitious target of 75MWp to be achieved by 15th August, 2023.



B. Model Solar City

Chandigarh as Model Solar City was formally launched in 2013 with the inauguration of two Roof top Grid Interactive Solar Photovoltaic Power Plants at Paryawaran Bhawan, Sector 19-B, Chandigarh (50 kWp) and at Model Jail, Burrayil (100 kWp).

The target is to promote solar energy in both the residential as well as non-residential sector. Through this model, an enabling environment for the sectors to produce green power using grid connected solar PV systems, install solar water heaters (SWH) and use energy efficient appliances for lighting and cooking is being focussed upon. Initiatives to use the solar power for electricity generation in the government buildings and public facilities are being promoted.

The programme has also potential to generate socio-economic co-benefits which can be used to leverage the sustainable development goals (SDGs) as well as the country's nationally determined contribution (NDC) targets as part of the Paris Agreement.

To illustrate, the model enables access to affordable and clean energy, which meets both India's emission reduction NDC target and SDG 7. The model can be qualified as a good practice in terms of its innovative approach, technical feasibility, its alignment with the DGs and all this guided by engagement with the key stakeholders.



Figure 58: Solar Panel placed at GMCH, Chandigarh

Source: CREST



C. Cumulative installation of SPV systems

Solar photovoltaic systems include lanterns, home lights, street lights, pumps, as well as stand-alone power plants. Under off-grid and decentralised solar PV Applications Programme, Ministry of New and Renewable Energy has been providing central financial assistance for deployment of solar street lights, solar lamps, solar power packs to meet out the electricity and lighting needs of the local communities/institutions. (Ministry of New & Renewable Energy, 2020). Cumulative numbers and capacity of the off-grid solar applications in Chandigarh and nationally as on 31.12.2020 is presented in Table 67.

Table 67: Cumulative numbers and capacity of the off-grid solar applications in Chandigarh

Agency	Solar Street Light (Nos)	Solar Home Light (Nos)	Solar Lamps (Nos)	Solar Pump (Nos)	Solar Power Plant (KW)
Chandigarh	935	275	1675	12	730
India	813132	1723479	8402449	334886	216862.67

Source: Ministry of New & Renewable Energy, 2020

The number of SPV installed and their capacity year on year is presented below in Table 68:

Table 68: Number of SPV installed in Chandigarh with their capacity from 2015-16 to 2019-20.

Year	Number of SPV Installed	Capacity of SPV (kwp)
2015-16	68	2173 kwp
2016-17	24	2978 kwp
2017-18	98	11281 kwp
2018-19	1171	7332 kwp
2019-20	923	5458 kwp

Source: (CREST, Chandigarh) (Department of Environment, 2018)

D. Floating solar panels

The Municipal Corporation of Chandigarh will get its first floating solar power plant at the Sector 39 waterworks. The floating solar power panels are expected to generate electricity worth ₹1.38 crore annually. The 2 MWp floating SPV floating power plant at the Sector 39 waterworks will generate 28 lakh units per annum and will be set up under the CAPEX mode where all expenditure will be borne by Chandigarh Renewable Energy and Science and Technology Promotion Society (CREST). In addition, a floating solar power plant will produce 500 KWp of power at Dhanas Lake which will be used by the UT forests and wildlife department for their activities (Saur Energy, 2021).

E. State Level Energy Park

The state Level Energy Park was set up in the Botanical Garden at Sarangpur, U.T. Chandigarh. The State Level Energy Park has different demonstration units based and run by Solar Energy, objects on theme Conservation of Energy, Solar run Video Games, Cars, Train, SPV Street Lights, Wind Energy generation, Storage of Energy etc. The park was set up with the financial assistance of Ministry of New & Renewable



Energy, Govt. of India that supported the procurement cost of different solar devices to be installed and commissioned in the Energy Park and other financial support came from the U.T. funds.

F. Energy Efficiency

Implementing energy efficiency measures can help manage the demand for energy. Demand side measures (DSMs), such as energy efficiency, can help reduce peak electricity demand but also reduce blackouts and increase system reliability. DSMs can be applied across sectors, such as agriculture, industry, and the domestic sector. The following table outlines the possible DSM measures which can be used in Chandigarh and their potential energy savings.

Table 69: Energy savings from state-specific DSM measures in Chandigarh.

Sector	DSM measure	Energy saving potential of total consumption as %	Investment of savings crore) / MU (in Rs
Domestic	Replacement of ICLs with LED bulbs	23%	0.8
Commercial	Retrofitting of energy efficient equipment's	15%	1.5
Street lighting	Replacement of existing street light with LEDs	51%	2.0

Source: (Ministry of Power, 2016)

The Unnat Jyoti by Affordable LED for All (UJALA) Scheme is already been launched in UT Chandigarh by BEE Govt. Of India under which LED Bulbs, LED Tube lights & 5 Star Rated Energy Efficient Fans are provided to domestic consumers for replacement of conventional and inefficient variant. The Status of selling of energy efficient items up to May 2022 is as under: -

Table 70: Status of selling of energy efficient items up to May 2022

S. No.	Name of Item	Units	Quantity
1.	LED Bulbs	Nos.	604071
2.	LED Tube Lights	Nos.	58750
3.	5-Star Rated Energy Efficient Fans.	Nos.	17149

Source: Electricity Wing of Engineering Department, Chandigarh Administration

The energy saving, cost saving, and carbon reduction per year due to selling of energy saving items is as under: -

Table 71: Energy Saving, Cost Saving, and Carbon Reduction Per Year Due to Sale of Energy Saving Items (2020-21)

S. No.	Name of Item	Energy Saving (MW Hour)	Cost Saving (In Crore)	Carbon Reduction (tCO ₂)
1.	LED Bulbs	71983	29.00	58306
2.	LED Tube Lights	2511.58	0.85	2060



S. No.	Name of Item	Energy Saving (MW Hour)	Cost Saving (In Crore)	Carbon Reduction (tCO ₂)
3.	5-Star Rated Energy Efficient Fans.	1437.22	0.49	1179
	TOTAL	75931.80	30.34	61545

Source: Electricity Wing Engineering Department, Chandigarh Administration

The energy saving potential is highest in the street lighting sector because replacement of street lights with LEDs can be carried out by the government authority in- charge of street lighting. Implementing energy efficiency in other sectors requires awareness generation, and behavioural change among users.



Figure 59: Roads and Street Lighting having LEDs in Chandigarh

Source: Crest

The Chandigarh municipal corporation was awarded the first prize among municipal sectors in 2020 by the Bureau of Energy Efficiency at the National Energy Conservation Awards - 2020, which are given for exceptional achievement in energy efficiency in different categories like industry, buildings and municipal sector. The municipality had reduced its energy foot-print and cut down electricity consumption costs. Further, it has replaced 48, 524 street light points with energy efficient LED lights, saving the city 13.02 million units of energy annually and reducing its power bills from INR 14 crore per year to Rs. 8 crore. The use of LED street lights also generated benefits in the form of reduction of carbon footprints (over 10000 metric tonne of carbon foot prints are reduced annually).

The table below provides the details of LED street lights and LED Flood Lights under electrical division



Table 72: Details of LED street lights and LED flood lights

S. No	Wattage of LED Lights	Quantity
1.	200 WFL	2443
2.	120 W SL & FL	3302
3.	80 WSL	19140
4.	35 WSL	3642
5.	18 WSL	13576
6.	18 WSL	13576
Total		42103
Reduction in load after installation (in kW)		3241.90
% Reduction in Load		54
Energy Saving in kwh (@11 hrs and 365 days)		13016212
Energy Saving in Mega Unit(MU) (@11 hrs and 365 days)		13.02
Reduction in CO2 Emission in tonne CO2 (1kwh=0.81 kg CO2)		10543.13

Source: (Municipal Corporation Chandigarh, 2022)

4. Institutional Structure for Energy in Chandigarh

Electricity Wing of Engineering Department (EWEDC)

The EWEDC is a part of Engineering Department Chandigarh Administration which carries out the business of transmission, distribution and retail supply of electricity in Chandigarh UT. The EWEDC does not have its own generation and procures power allocation from central generating stations such as NTPC, NHPC, THDC, SJVNL, BBMB, APCPL, MUNPL, NPCIL & Wind Power. The remaining is met through bilateral transactions and power exchange etc.

Department of Science & Technology & Renewable Energy (S&T&RE)

The department provides support to research institutions which includes conducting short term research studies in the field of Alternative Sources of Energy Conservation and any other related areas. The Model Solar City Programme is also run by the department through the separate body CREST that has been constituted as the executing agency. The department also engages in conducting awareness generation activities

Chandigarh Renewable Energy and Science & Technology Promotion Society(CREST)

CREST is the Nodal Agency for executing Solar & other RE Projects. The Department of Science & Technology and Renewable Energy, UT Chandigarh has established a "Solar City Cell" in CREST and has developed capacity building through interactions/Seminars/Field visits of other Solar Plants in the country.



4.1 Training, Capacity Building and Awareness Generation

A Post-Graduate Professional Development Program in Energy Management and Climate Action is offered in the UT. This is an industry- oriented online continuing Education Program under the Collaboration of Confederation of Indian Industry, CII- Centre of Excellence for Competitiveness and School of Energy & Environment, Thapar Institute of Engineering and Technology (TIET)- Deemed to be University). The Program is run jointly by Energy Management Cell, CII and School of Energy & Environment, TIET. During the program, the participants get learning and Mentorship from Eminent Experts in Energy and Climate Action Domain and are given exposure to industrial best practices and case studies.

Promotional Activities by CREST in the F.Y. 2021-22

- Celebration of Akshay Urja diwas-2021-Solar School Declaration at CIHM, Sector-42, Chandigarh in collaboration with Yuvasatta
- Creating awareness and to popularize the installation of Solar PV Plants through different modes of media such as print media, broadcast media, and the internet
- Disseminating information on energy conservation, promotion of solar energy through distribution of leaflets/brochures
- Organizing quiz competitions, essay writing competition, poster making competition and Akshay Urja lecture under Renewable Energy Scheme in the colleges of Chandigarh, UT

In the past, the Bureau of Energy Efficiency launched programmes for capacity building of DISCOMs with an objective to build capacities of DISCOMs for carrying out load management programme, Development of DSM action plan and implementation of DSM activities in their respective areas.

The State Designated Agency, Chandigarh provides financial assistance to schools to establish energy clubs and organise energy conservation activities like painting, slogan writing, quiz competitions etc.

5. Responses

24x7 Power for All: Chandigarh is committed to provide quality life to its people and electricity supply serves as an important means to achieve this. The programme of “24X7 Power for All” is an important step in this direction and this programme is being implemented by the Chandigarh Administration with the objective to ensure supply of quality, reliable, and affordable power to all categories of consumers on a 24X7X365 basis. The initiative of 24X7 power supply to all mainly encompasses the following:

- Reliable and quality 24X7 power supply to the existing consumers.
- All upcoming households to be provided access to electricity in a time bound manner.
- To ensure adequate capacity addition planning & tie ups for power from various sources at an affordable price to meet the projected increase in power demand for the future.
- Strengthen the T&D network to cater to the expected growth in demand of existing as well as forthcoming consumers.
- Put in place a strategy to ensure reduction of T&D losses as per the agreed loss reduction trajectory and methodology and steps required to be taken at every level of distribution in this regard.
- Introduce modern technologies to monitor reliable supply, such as sub-station automation, providing adequate communication infrastructure, GIS, Reliability, Centralized Network Analysis and



Planning tools, SAP-driven ERP systems, DMS (Distribution Management Systems), OMS (Outage Management System), etc.

vii. To undertake essential measures for meeting the performance standards as laid down by JERC.

Smart Grid Pilot Project

The Empowered Committee of National Smart Grid Mission (NSGM) approved Smart Grid Pilot Project on 29.03.2016 for an amount of Rs. 28.58 Crore against the DPR cost of 49.67 Cr. with 30% grant from NSGM under Electricity OP Sub Divn. No. 5, UT Chd. comprising of Sector 29, 31, Industrial Area Phase-I & II Ram Darbar, Sector 47 and Sector 48. M/s RECPDCL has been appointed as Project Management Agency (PMA) for execution of the work. As per tendering process conducted by PMA the project cost was later revised to 36.41 Crore.

The Status of Smart Grid Pilot Project is as under: -

(A) SCADA Project: -

Table 73: Status of SCADA Project

Particulars	SCADA Compatible Feeder Panels (Nos)	SCADA Compatible Transformer Panels (Nos)	Total
Non-motorized feeders	29	3	32
Motorized feeders	32	12	44
Total Quantity	61	15	76

Source: Electricity Wing Engineering Department, Chandigarh Administration

The SCADA centre has already been established at Sector 18 for controlling & monitoring the various Grid Sub Stations covered under the pilot project.

(B) AMI Projects (Smart Meter installation): -

Table 74: Smart Meter Installation in Chandigarh

Sr. No.	Area	Meter Type	Actual Smart Meter Installed
1	Area under S/div No.5	Single Phase	17265
2		Three Phase Whole Current	5805
3		Three Phase LTCT	1142
	TOTAL		24212

Source: Electricity Wing Engineering Department, Chandigarh Administration

Energy Audit: Under the Smart Grid Pilot Project, the smart energy meters have already been installed at the distribution transformers. However, 61 feeder meters installation is in progress under O&M phase.

100% Renewable Power City: As per the direction of Ministry of Renewable Energy, the EWEDC has prepared a Master Plan to achieve 100% Renewable Power City by 2030. The status of percentage share of RE power for FY 2021-22 is as under: -



Table 75: Status of percentage share of RE power in Chandigarh for FY 2021-22

Type		Energy in MU	%age Share	Total RE/NON RE in %age
Renewable Energy Sources	Hydro	1313.537	66.03	73.30
	Solar	45.220	2.27	
	Wind	99.302	4.99	
Non Renewable Energy Sources	Gas	9.746	0.49	0.49
	Thermal	330.313	16.61	16.61
	Nuclear	191.086	9.61	9.61
TOTAL		1989.204	100.00	100.00

Source: Electricity Wing Engineering Department, Chandigarh Administration

Privatization of Electricity Department: As part of the country's plan to privatize electricity distribution companies (DISCOMS) in the Union territories, Chandigarh too moved ahead with this plan. Kolkata based Eminent Electricity Distribution had submitted the highest bid for the privatization of the electricity department. However, the UT administration will retain the state transmission utility (STU) and the state load dispatch centre (SLDC). The former will be responsible for smooth transmission of power and the SLDC will be the main body to ensure integrated operation of the power system.

Energy conservation: The UT has been engaging in many efforts for energy conservation which includes promotion of energy conservation programmes through advertisements, pamphlets, posters, hoardings, etc., many of which have also been translated into local dialects. Many demonstration projects on space heating, LED bulbs, LED Tube Lights, 5-Star Rated Fans and street lighting have also been initiated. Further, the UT has organized road shows and school level essay competitions on energy conservation (Economic Survey 2010- 11).

Support for facilitating solar rooftop installations: Chandigarh Administration has been taking multiple initiatives to encourage, incentivize and support the development of solar rooftops. CREST has empanelled large number of Solar Plant Installers/aggregators along with rates from whom any residents can install solar plant and can avail subsidy, as decided by MNRE, GOI.

Further, a new online website/ software platform was launched to provide ease of Business & transparency to people in Chandigarh. The UWP for Solar Net Metering – Chandigarh is a unified single window clearance portal for processing solar rooftop photovoltaic applications. It is devised for accelerating deployment of Grid Connected Solar Rooftop Photovoltaic (GRPV) installations in the Chandigarh. The UWP for Solar Net Metering – Chandigarh serves as an integrated platform for multiple solar rooftop stakeholders namely the EWEDC, all Consumers and Developers. The platform enables the people to obtain a subsidy from CREST as well as all regulatory clearances from the EWEDC electrical clearance from Electrical Inspector, within a fixed time through a single-window for efficient installation of Solar Power Plants.

UT Chandigarh also notified the amended Building Bye- laws to make Solar PV Installation mandatory on all buildings in U.T., Chandigarh above 500 Sq yard plot size, to promote the Chandigarh as a Model Solar City.



Efforts to publicize the need and initiatives for expanding the spread of solar power, media and awareness generation campaigns have been used. Various activities are carried out throughout the year by different modes such as Print Media, Science Slides, Public Debates, Slogan Competition, Hand Bills, Audio & Visual Multimedia CDs, Poster Making, Quiz, Mobile Van, Drama / Skit, Healthcare Talk, Animation Posters etc., Lectures, Melas, Debates, Film Shows, Folk Performances & Science Exhibitions etc.

Biomass based energy production:

CREST had installed a biogas plant with a capacity to 200 cubic meters per day utilizing the waste from Model Jail (Burai) Chandigarh, residential quarters and cow dung from Gaushala, Sector 45, Chandigarh.

The biogas thus produced is being directly used in the kitchen resulting in savings of around 10 LPG cylinders daily. Further, the slurry produced after production of biogas is being used as organic fertilizer. The project is economically beneficial to both Chandigarh Administration and Jail Authorities due to its short payback period of only 1 year and 4 months.

6. Recommendations

Encouraging energy conservation

The UT needs to continue enhancing the importance of energy conservation and reducing energy wastage both in residential as well as in commercial buildings. Simple measures, such as use of energy efficient bulbs like Compact Fluorescent Lamps (CFL), Light Emitting Diode (LED) and propagation of Energy Star and other energy efficient appliances such as the 5-Star Rated Fans can also play an important role. Campaigns to raise awareness for conserving energy must be conducted. Furthermore, adoption of green building concepts in the building designs of the city such as retrofitting existing government buildings to address the optimization of building energy demand.

Auditing electricity supply chain and upgrade T&D infrastructure

To meet the increasing demand and to avoid the breakdown of transformers due to overloading and higher transmission and distribution losses the existing T&D infrastructure should be upgraded. With the ongoing efforts of the Electricity Wing of Engineering Department, Chandigarh the T&D losses have been reduced from 20.20% to 11.91% in 9 years. Further, strengthening it would help in reduction of technical loss for Chandigarh. For reducing commercial losses regular audits of electricity supply, consumption, leakage, and theft of power in the city should be conducted to identify the problem areas and devise strategy to address the same. Illegal power connections should be identified and disconnected.

Expanding use of solar power: The subtropical humid climate of Chandigarh ensures the solar light availability during most time of the year which can be harnessed to generate its own power generation to the extent possible. Most rooftop solar power generation has already been tapped in Chandigarh, such as initiating the setting up of solar power plant on canals and Choes. All large commercial establishments and governmental offices have a mandatory solar power generation set up in accordance with the Building Bye-laws. Given that Chandigarh has a large number of independent houses and bungalows, there is tremendous scope to expand the use of solar power by these houses.. The use of solar power can also be expanded in private sector and small house. Subsidy could be provided for the installation of solar panels.

Focus on implementation of policies: UT must take an active authority to exercise powers under the Energy Conservation Act and start formulating supporting policies and implementation rules to shift the focus from “policies in place” to “policies successfully implemented” (AEEE, 2019).



Data and information management systems: There is need to strengthen the mechanism for data capture, management and public availability of data. For this there should be a deeper engagement with the key stakeholders including the private sector to build and maintain a robust data system for demand side energy consumption. This initiative will also contribute significantly towards a national Energy Data Management System.

Enhancing the credibility of the EE schemes: UT must include and strengthen enforcement and compliance checks for ensuring the integrity of EE programs. For this, independent monitoring and verification of savings should be made integral to all EE policies and programmes. Creation of accredited certifiers who can be engaged by the house owners/builders/developers for obtaining energy conservation compliance certificates.

Innovate and Incubate: Emphasis should be given to stakeholders including academia and research organizations to ideate, innovate and incubate in the renewable energy sector. Given that there are many technical institutions in Chandigarh, these could provide the platform for innovative solutions. A renewable energy park with the support of the Chandigarh Administration could be set up to promote the use of renewable energy.

Strengthen the institutional framework: Given that the future demand trends develop from the existing status, there is need to create an institutional framework that is focussed on energy planning to achieve energy security. An integrated and updated database on the consumption of fossil fuels in different sectors will guide the identification of potential of substitution with renewable energy and streamline energy planning. It is also essential to collect and document comprehensive energy statistics that lead to a development of an efficient monitoring of energy generation from various sources, along with losses and damages done to the environment by the various processes that use energy.





VII

ENVIRONMENT AND HEALTH

VII

CHAPTER

ENVIRONMENT AND HEALTH

1. Introduction

The chapter on Environment and Health looks at human health and diseases, determined by factors in the environment including natural and anthropogenic factors (the built environment). The chapter will not just focus on any particular environmental factor with respect to the DPSIR framework but instead will cover the full topic of the environmental factors and human health of Chandigarh (UT).

The chapter provides a description of the healthcare infrastructure and delivery system in Chandigarh (UT) at all levels of healthcare-primary, secondary, and tertiary levels and the associated population that depends on it.

Health indicators are explored over time to determine the health status of the citizens. These indicators include health data and statistics of Chandigarh on general health information and disease-specific data including communicable and non-communicable diseases; maternal & child health; injuries and occupational health associated with waste handling. Health indicators were also selected for environment-associated illnesses such as climate-sensitive diseases including, vector-borne diseases (malaria, dengue, chikungunya etc.), water-borne (cholera, diarrhoea etc.) and extreme weather-related deaths and disability, extreme heat-related illnesses, air pollution linked diseases (cardiovascular disease (CVD), asthma, COPD etc.) and food insecurity related impacts such as malnutrition, anemia etc.

The environment-related health impact policies and health care schemes were also reviewed to understand the access to essential and specialized health care including National Environment Policy, National Health Policy, and those with respect to the SDGs in Chandigarh (UT).

Environmental factors affecting human health

The environment we live in contains a variety of harmful pollutants and toxins present in the different environmental compartments including air, water, soil, etc. which adversely affect the human health. These harmful effects can result from the natural environment through forest fires or from anthropogenic activities such as crop burning or vehicular pollution causing ill effects that are either acute illnesses and/or chronic health issues. Acute illnesses come rapidly mostly due to infection (chemical or virus) or injury and require urgent care. Symptoms from acute illnesses can be treated. Chronic illnesses are slower to develop and can progress over time and it may not be fully treated but can be controlled to some extent. Acute illnesses can be a respiratory infection, COVID-19, heart attack, physical injury etc. Chronic illnesses include thyroid, diabetes, obesity, chronic obstructive pulmonary disease (COPD) etc. The route of exposure to the environmental toxins may be via inhalation, ingestion, dermal, or through an injection.



National Environmental Policy

In India, policies like the *National Environmental Policy (NEP), 2006* by the Ministry of Environment, Forest, and Climate Change (MoEFCC) focuses on the need for environmental conservation and its associated positive health outcomes, especially for the urban poor, and therefore a productive workforce as seen by higher employment retention. According to NEP, in India environmental factors are responsible for about 20% of the disease burden, and various environment-health factors are linked with aspects related to poverty including malnutrition, lack of access to clean energy and water (MoEF, 2006). The policy not only acts as a guide to state and local governments but also makes individuals responsible for their environment.

National Health Policy (NHP), 2017

The *National Health Policy (NHP), 2017* identifies the need for the highest quality of healthcare systems throughout the country provided in an affordable, decentralized manner to all age groups across socio-economic boundaries. The goals outlined in the NHP are characterized under three components of (a) health status and programme impact (b) health systems performance and (c) health system strengthening. These goals are aligned with the sustainable development goals (SDGs).

Sustainable Development Goals (SDGs) and human health

The SDGs have on a global level created overall parameters to achieve security in various areas including improved human health. Critical SDGs associated with respect to human health include No poverty (SDG 1), Zero Hunger (SDG 2), Good health and well-being (SDG 3), Clean water and sanitation (SDG 6). Fulfillment of all other SDGs contributes towards SDG 3 that is to ensure good health and well-being. SDG 3 itself has 13 targets and indicators to be monitored and are presented in Table 76 given below:

Table 76: Targets and indicators to achieve SDG 3(Good health and well-being)

Target 3.1	Reduce Maternal Mortality
Target 3.2	End all preventable deaths under five years of age
Target 3.3	Fight communicable diseases
Target 3.4	Reduce mortality from non-communicable diseases and promote mental health
Target 3.5	Prevent and treat substance abuse
Target 3.6	Reduce road injuries and deaths
Target 3.7	Universal access to sexual and reproductive care, family planning and education
Target 3.8	Achieve universal health coverage
Target 3.9	Reduce illnesses and deaths from hazardous chemicals and pollution
Target 3.a	Implement the WHO framework convention on tobacco control
Target 3.b	Support research, development and universal access to affordable vaccines and medicines
Target 3.c	Increase health financing and support health workforce in developing countries
Target 3.d	Improve early warning systems for global health risks



2. Health Index and Burden of diseases in Chandigarh

Health index is a key indicator related to health and healthcare system of an area. Traditionally, the health index is expressed as an index of life expectancy at birth using a minimum value of 20 years and a maximum value of 85 years.

In India, NITI Aayog along with the Ministry of Health and Family Welfare (MoHFW) and the World Bank in 2017 initiated an Annual Health Index for tracking the overall performance of current year and incremental performance to determine progress on health outcomes and health systems and develop a healthy competition and encourage cross-learning among all States and Union Territories (UTs).

The framework criteria of NITI Aayog's Health Index is a weighted composite score incorporating about 24 indicators which cover key aspects of health performance. The health performance criteria are modified to include selected indicators grouped under the following domains of: (a) Health Outcomes; (b) Governance and Information; and (c) Key Inputs and Processes. The Health Index covers some targets and indicators under the aforementioned SDG 3 including Neonatal Mortality Rate (NMR), Under-five Mortality Rate (UMR), Maternal Mortality Ratio (MMR), institutional deliveries (proxy to skilled birth attendance) and total case notification of Tuberculosis (proxy to Tuberculosis incidence per 100, 000 population).

In the fourth edition of the health index released, Chandigarh as compared to the other six UTs ranked 2nd in its overall performance after Dadra and Nagar Haveli and Daman and Diu (DH&DD) followed by Lakshadweep, Puducherry, Delhi, Jammu & Kashmir, and Andaman & Nicobar. In the health outcomes domain Chandigarh ranked the highest with health outcome index score of 78.49. The health index data for Chandigarh is summarized in the table 77 below. The National Health Mission Department in the Chandigarh Administration (NHMCHD) has determined the overall birth rate and death rate at 13.3 and 4.3 respectively that is 2018, birth rate for Chandigarh, UT was 13.3 births per 1000 inhabitants and death rate of 4.3 deaths per 1000 inhabitants and the infant mortality rate (IMR) was 13 deaths per 1000 live births (National Health Mission, 2022).



Table 77: Health Index and data indicators on health outcomes and health systems in Chandigarh (UT) (MoH&FW, 2020)

Indicator	2018- 19 (BY)	2019- 20 (RY)	Increment	
Overall Index Inference Year (2019-2020)				
Score: 62.53; Rank 2				
Score: -10.85; Rank 7				
Incremental Index Base Year (2018-19) to Reference Year (2019-20)				
HEALTH OUTCOMES DOMAIN				
1.1.1	NMR (per 1000 live births)	-	-	-
1.1.2	U5MR (per 1000 live births) @	-	-	-
1.1.3	Sex ratio at birth	920	950	-
1.2.2	Full immunization coverage (%)	93.83	77.58	-16.24
1.2.3.b	Proportion of pregnant women received 4 or more ANCs (HMIS)	-	100	9.17
1.2.5	Total case notification of TB (%)	100	100	0
1.2.6	TB treatment success rate (%)	88.2	87.77	-0.43
1.2.7	PLHIV on ART (%)	-	-	-
GOVERNANCE AND INFORMATION DOMAIN				
2.2.2	Average occupancy: CMOs (in months)	11.95	9.01	-2.94
KEY INPUTS AND PROCESSES				
3.1.1	Shortfall: ANMs at SCs (%)	0	N/A	N/A
3.1.6.a.	Level of registration of births (%)	100	100	0
3.1.6.b	Level of death registration (%)	100	100	0
3.1.7	IDSP reporting of P form (%)	95	91	-4
3.1.7	IDSP reporting of L form (%)	95	89	-6
3.1.8.a	Proportion of DH-SDHs with accreditation certificates (State report)	0	0	0
3.1.8.a	Proportion of CHCs with accreditation certificates (State report)	N/A	N/A	
3.1.8.a	Proportion of PHCs with accreditation certificates (State report)	0	0	
3.1.8.a	Proportion of UPHCs with accreditation certificates (State report)	N/A	N/A	
3.1.8.b	Proportion of DHs certified under LaQshya - Labour Room (MoHFW)	100	100	

@Negative indicator where higher number means lower performance [Source: NITI Aayog's State Health Index Round IV 2019-20] *Source: Registrar Birth and Death, U.T Chandigarh. (NITI Aayog 2020)



3. Environment-related health impacts in Chandigarh (UT)

With the population growth and development of infrastructure and services, the environmental effects on human health and burden of different diseases will also vary with time. Earlier, the burden of water-borne diseases was significantly affecting human health. However, more recently the burden of non-communicable diseases such as diabetes and hypertension has become more prevalent. This section determines the different illnesses associated with climate change, air, water and food-borne, and vector-borne diseases (VBDs) along with communicable and non-communicable diseases and injuries associated with occupational health in Chandigarh (UT).

Climate change effects are closely linked with various diseases and health-related issues. Chandigarh issues timely warnings to health institutions for identifying illnesses related to heat and cold waves with special focus on vulnerable groups including migratory population and daily wage workers. In order to manage heat and cold waves, the Chandigarh administration has made provisions for clean drinking water, sheds, preventative advisory warnings, sensitization and capacity building for doctors and healthcare staff.

There is enough evidence on health-related problems arising from environmental factors such as air and water pollution, floods and droughts, improper sanitation, VBDs, improper waste management, etc. (MoHFW, 2018). A study conducted by Joseph and Xavier in the year 2018 determined that in Chandigarh, prevalence of *Entamoeba histolytica* parasite is influenced by rainfall characteristics (Micheau, Joseph, & Rodó, 2018). The increase in humidity over the region especially during the summer season contributes to more rainfall and is associated with an increase of parasites *Entamoeba Histolytica* and *Giardia Lamblia*, leading to food-borne diseases.

a. Air - borne diseases

Air borne diseases are communicable diseases spread through pathogens in the environment. The droplets of pathogens spread through an infected individual, from coughing or sneezing, find its way in the air and on surfaces and infect individuals who come in contact with the contaminated air and/or surface. Influenza is a type of air-borne disease which is seasonal in nature largely dictated by temperature and humidity that directly impacts the respiratory system and is not particularly prevalent in Chandigarh UT. However, as seen in the table 78 below between 2011-2015 cases related to Avian Influenza led to five and seven deaths in 2013 and 2015 respectively. Seasonal Influenza has been prevalent in the U.T from 2017-2020, with the highest number of cases being 63 in 2017 leading to six deaths followed by 54 cases and three deaths in 2019 and 28 cases and two deaths in 2020.

Table 78: Number of total reported cases of common air-borne diseases in Chandigarh (U.T.)

Year	Number of Infections (Avian Influenza)	No of Deaths (Avian Influenza)	Number of Infections (Seasonal Influenza)	No of Deaths (Seasonal Influenza)
2011	0	0	-	-
2012	1	0	-	-
2013	37	5	-	-



Year	Number of Infections (Avian Influenza)	No of Deaths (Avian Influenza)	Number of Infections (Seasonal Influenza)	No of Deaths (Seasonal Influenza)
2014	1	0	-	-
2015	22	7	-	-
2016	0	0	0	0
2017	0	0	63	6
2018	0	0	4	2
2019	0	0	54	3
2020	0	0	28	2

Source: Assistant Director Malaria-cum-SSO, IDSP, NVBDCP, U.T.Chandigarh

b. COVID-19 and health

Table 79: Year Wise Covid-19 Data for UT Chandigarh

Year	Samples	Positive Cases	Deaths
2020	181186	19748	373
2021*	6086697	46147	706
Total	867883	65895	1079

***Up to 27.10.2021**

The Corona virus (Covid-19) outbreak originating from Wuhan, China is a pandemic that has affected us globally. It is an air borne disease that causes respiratory infections ranging from common cold, to middle-east and sever acute respiratory syndrome (MERRS and SARS).

Vulnerable populations including older people, those with co-morbidities such as high blood pressure, heart and lung problems, diabetes, and cancer are at high risk of being adversely affected by Covid-19.

Source: Assistant Director Malaria-cum-SSO, IDSP, NVBDCP, U.T. Chandigarh

Air pollution can be through ambient (outdoor) air pollution or household (indoor) air pollution. Chandigarh's ambient air quality is better than that of most other cities in India. The overall SO_x and NO_x levels and the suspended particulate matter (SPM) levels are within permissible limits however the levels show site-specific and seasonal variations showing the effects of different anthropogenic activities on air quality. Studies have shown decreased air quality in December during crop burning season, higher NO_x levels linked to higher vehicular density, and variations in levels at the industrial and commercial sites (Khaiwal R.2020). Therefore, the main causes of air pollution in the UT that lead to deteriorating air quality in the environment include crop/ agricultural waste burning, pollen, and vehicular congestion. The main diseases linked to air pollution in Chandigarh UT include asthma, chronic obstructive pulmonary disease (COPD), pneumonia, and acute respiratory infections (ARI). The limited data on diseases associated with air pollution is given in the table below:



Table 80: Number of total reported cases of common air pollution linked diseases in Chandigarh (U.T.)

Air pollution linked Diseases	2018	2019	2020
Acute Respiratory Infections (ARI)* (As per P-Form of IDSP)	-	186913	107149
Pneumonia (As per P-Form)	-	4900	2996
COPD	3297	-	-
Asthma	31036	-	-

*Data TBD for all years (numbers based on limited information) Source: Assistant Director Malaria-cum-SSO, IDSP, NVBDCP, U.T.Chandigarh

Measures taken by the Chandigarh administration to mitigate air pollution related diseases and increase preparedness include:

- Training of healthcare workforce doctors, NGOs, and associated staff on air pollution adaptation
- ARI surveillance data on designated forms
- Awareness generation on health impacts for air pollution

c. Food and Water-borne diseases and health

The various food and water-borne diseases are associated with contaminated food and poor water quality. The population may be exposed to through infectious food and/ or through the fecal-oral route due to lack of proper water treatment. In Chandigarh (UT), the water supply is supplied through central piped water supply system, however, improved water is still lacking in slum and informal settlements. The common food and water borne diseases include cholera, typhoid, hepatitis-A, hepatitis-E, and acute diarrheal diseases. The total number of reported cases of common water-borne diseases is given in the table 81 below. As can be seen, there is a significant reduction in typhoid, hepatitis A, and hepatitis E cases in 2020 as compared to 2019 and deaths related to water-borne diseases since 2016 have been negligible.



Table 81: Number of total reported cases of common water-borne diseases in Chandigarh (U.T.)

Diseases	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021* (As per IHIP- IDSP Portal)
People infected with											
cholera	16	24	1	12	67	-	-	-	-	-	-
(As per IDSP L form)											
Number of deaths (cholera)	0	0	0	0	0	-	-	-	-	-	-
People infected with											
typhoid	-	-	-	-	-	341	389	371	415	168	68
(As per IDSP L form)											
Number of deaths (typhoid)	-	-	-	-	-	0	0	0	0	0	0
People infected with hepatitis A	31	80	48	79	148	154	197	141	180	81	77
Number of deaths (hepatitis A)	0	0	0	0	0	0	0	0	0	0	0
People infected with hepatitis E	28	23	37	32	30	149	457	325	101	51	11



Number of deaths (hepatitis E)	0	0	0	0	0	0	0	0	0	0	0
People infected with acute diarrheal disease (IDSP as per P form)	-	-	-	-	-	-	-	-	48254	23799	1819

Source: Assistant Director Malaria-cum-SSO, IDSP, NVBDCP, U.T.Chandigarh

In 2021, however, the Peermuchalla village and Baltana area in Zirakpur that has proximity to Chandigarh UT had localized cholera outbreaks due to the pipe leakage and construction of illegal submersible pumps. The contaminated water from the failed infrastructure was subsequently treated.

Prominent causes of food and water borne diseases in Chandigarh UT include:

- Mixing of sewage contents in old pipes with drinking water lines. Also, overcrowding due to migratory population can further contribute to overloading sewage system and creation of illegal connection causing mixing of sewage contents.
- Unhygienic, illegal factories for food preparations in informal slum areas, unhygienic working conditions, lack of personal hygiene of food handlers, and lack of improved sanitation are key causes of food borne diseases.

Clean water and improved sanitation are closely related to better health outcomes. A combination of strategies employed by the Chandigarh administration has curtailed water and food borne diseases including:

- Provision of 24/7 quality water supply, removal of blockages in drainage system. Improved infrastructure separating water and sewage pipes.
- Training of healthcare staff, food handlers, and integrating water borne illness in health programs and policies.
- Data maintenance and joint surveillance with citizens and coordination body.
- Building partnerships with citizens, businesses, government through proper communication channels - phone, in-person, IEC awareness raising activities.
- Prohibiting open defecation.

d. Vector borne diseases (VBDs)

Vector borne diseases are also closely linked to climate change effects. With increasing global warming, the rise in temperature combined with higher precipitation and humidity increases the duration of warm



season provides ideal conditions for vector breeding. The following may be the causes of different VBDs in the UT:

1. Increased construction activities (Malaria & Dengue);
2. Multiple breeding points/leakages (Malaria & Dengue);

The data below provides VBDs most prevalent in Chandigarh UT from 2011-2021. As per the total number of reported cases, dengue is the most prevalent VBD in Chandigarh (Table 82).

Table 82: Number of total reported cases of common vector borne diseases in Chandigarh (U.T.)

Diseases	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Malaria	446	204	152	109	152	157	114	44	22	7	6
Dengue	73	351	107	13	966	1246*	1951*	301	286	265	1596
Chickungunya	0	0	0	0	1	272	54	4	0	0	7

Source: Assistant Director Malaria-cum-SSO, IDSP, NVBDCP, U.T.Chandigarh

Further, a vulnerability assessment conducted by Chandigarh Administration showcases that children and elderly are more vulnerable groups compared to adult population for VBDs. In the year 2019, out of the total 22 malaria cases 4 cases were of <5years and out of the total 286 dengue cases, 9 cases were of <5years, 8 for <60 years of age. While in 2020, out of the total 7 malaria cases 1 case was of <5years and out of the total 265 dengue cases, 8 cases were of <5years, seven for <60 years of age and 1 case of a pregnant woman (Chandigarh Administration, 2021).

Over the last five years, there is a significant decrease in number of cases of vector borne diseases in Chandigarh UT due to consistent efforts in the field and strategies adopted for controlling VBDs. These include the following:

- House to house field survey and micro-planning of spray and fogging operations;
- Mapping of permanent breeding points;
- Disease surveillance: filling dengue cards, case detection and field action etc.;
- Hands on training of MPWs (Regular & Contractual) and health care providers;
- Stepping up Intersectoral coordination and strengthening of IEC activities: involvement of public health wing, education department, RWAs, village Panchyats, NGOs etc.;
- WhatsApp linkages and 24 x 7 Dengue Helpline;
- Screening of plasma donors for malaria in all blood banks.
- Quality control for malaria diagnosis.
- Screening of Pregnant Women for malaria;
- Public procurement of requisite insecticides/ larvicides and replacement of chemicals used for spray to prevent resistance from similar chemicals.

In conclusion, the data presented from IDSP on VBDs and food and water borne diseases is given below from 2011-21



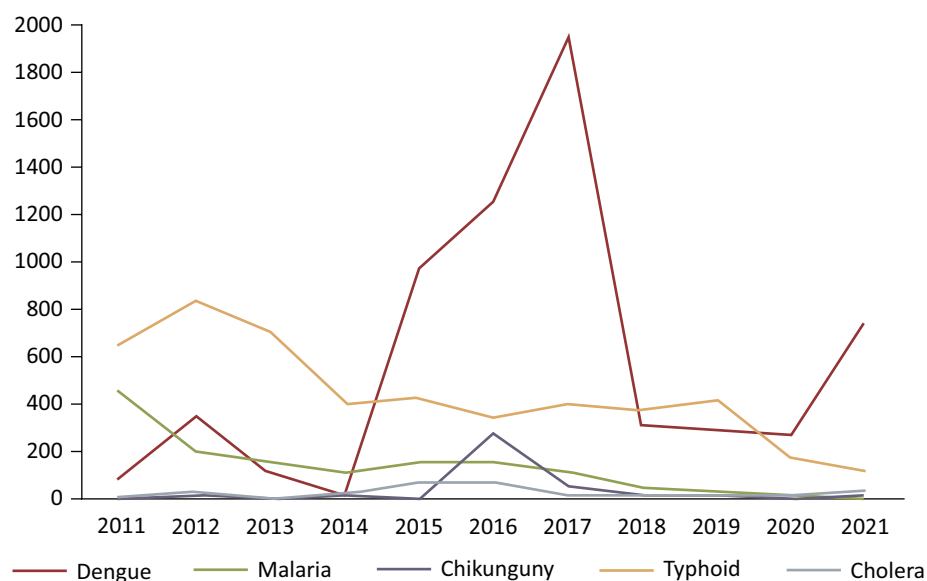


Figure 60: Trends of vector borne diseases in Chandigarh (2011-2020)

Source: Assistant Director Malaria-cum-SSO, IDSP, NVBDCP, U.T.Chandigarh

e. Non- communicable diseases (NCD)

India is a fast-developing nation with an increasing socio-economic development, urbanization, the changing demographic structure and associated lifestyles which have now made NCDs a growing burden. Malnourishment is seen as a key risk factor for NCDs (Global Panel on Agriculture and Food Systems for Nutrition, 2016) and improving nutritional status can help overcome their increasing burden.

The nutritional status for adults residing in Chandigarh is given in the table below. The 2019-21 shows a marginal drop in underweight population compared to 2015-16 among both men and women between the age of 15 and 49 years. However, obesity has risen to 44% in women (up by 2.5%) and 34.4% in men (up by 2.4%).

Table 83: Nutritional status of adults (age 15-49 years)

	2015-16 (%)		2019-21 (%)	
	Women	Men	Women	Men
Body Mass Index (BMI) is below (BMI<18.5 normal kg/m ²)	13.3	21.7	13	15.1
Overweight or obese (BMI≥25.0 kg/m ²)	41.5	32	44	34.4
High risk waist-to-hip ratio (≥0.85)	NA		60.7	66.9

Source: National Family Health Survey (NFHS-5), 2019-21



Diabetes, cardio-vascular and cancer data is given in the table below. The NFHS-4 data for 2015-16 shows that women are more vulnerable to diabetes than men with 2.3% cases in women as opposed to only 1.6% in men however, the reverse is true for cardio-vascular conditions with 1.8% cases in men and only 0.6% in women.

Table 84: Diabetes and cardio-vascular and data for 2015-16

Indicators	2015-16 (%)	
	Women	Men
Diabetes (%)	2.3	1.6
Cardio-vascular disease (%)	0.6	1.8

Source: NFHS-4

Blood sugar levels of adult men and women residing in Chandigarh are given below. The NFHS-5 data for 2019-21 shows that women have a higher percentage of blood sugar level or higher percentage of women are taking medicine for blood sugar, i.e., 19% as compared to men which is at 16.6%. However, for hypertension, 25% cases in women as opposed to 30.6% in men higher than the national average of 21.3% and 24% respectively.

Table 85: Blood sugar level among adults (age 15 years and above)

Indicators	2019-21 (%) Women	Men
Blood sugar level - high or very high (>140 mg/dl) or taking medicine to control blood sugar level	19	16.6
Elevated blood pressure (Systolic \geq 140 mm of Hg and/or Diastolic \geq 90 mm of Hg) or taking medicine to control blood pressure	25	30.6

Source: NFHS-5

The estimated number of incidences of cancer cases in Chandigarh is presented in below, which shows an upward trend of cancer cases in Chandigarh.

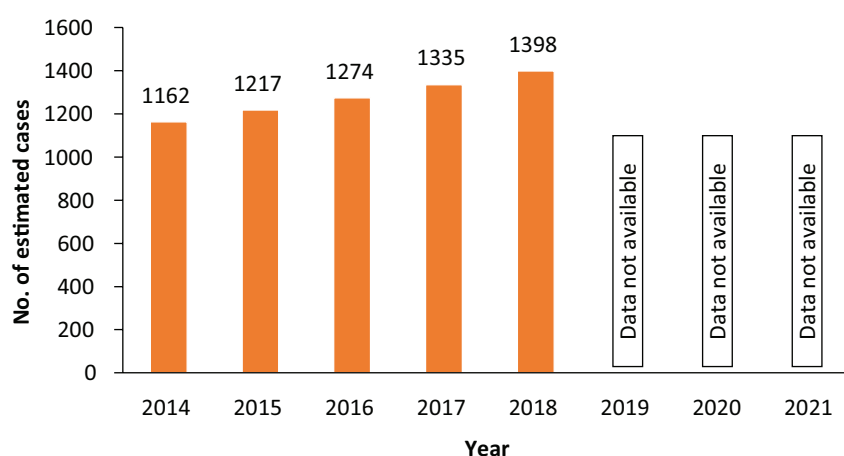


Figure 61: Estimated incidences of cancer cases

Source: National Cancer Registry Program, 2014-18, MoHFW



4. Occupational hazards

To address health issues arising from one's workplace, the U.T. of Chandigarh adheres to the Punjab Occupational Safety and Health Law passed in 2016, which makes provision for the occupational safety and health of all persons at work for protection of other persons against risks to safety or health arising from workplace activities. This includes prevention of occupational hazards, promotion of safe and healthy working environments to address the physiological and psychological needs of workers. Further, Chandigarh health department under the National Health Mission has developed an Infection Control manual describing measures and medications for preventing and controlling infection. Other important measures are described in the manual such as the importance of personal protective equipment (PPEs).

a. Waste management and health of waste pickers

Waste management as an occupation has been linked to adverse health effects due to the unregulated nature of the work. People working in the informal setting, collecting, dismantling, recycling and disposing the waste materials without proper health and safety measures leads to exposure to various toxins and high risk of injury. A study by Ravindra et al 2016 determined that in Chandigarh UT, 22.2% of waste collectors, 43.2% of street sweepers and 25.5% of rag pickers do not use any type of personnel protective equipment (PPEs) and commonly suffer from various health related issues such as respiratory disorders, injuries and allergies (Khairwal, Kaur, & Mor, 2016).

b. Industrial pollution and health of workers

Industries in Chandigarh are primarily small-scale industries because of which the emissions of SO₂ are well within limits of 50µg/m³ (Department of Environment, Chandigarh Administration, 2018). The Labor Bureau part of the Ministry of Labor and Employment, GOI collects the annual data from factories for formulation of data driven policies, improving the working conditions of labor, and ensuring adequate health and safety measures for the workers and efficacy of their implementation. The table 86 below gives the output of health, safety, and welfare measures from the factories inspected from 2015 to 2018.



Table 86: Output of health, safety, and welfare measures from the factories inspected from 2015 to 2018

Year	Industrial Accidents in Factories			Cause	Avg. Mandays Lost due to Non-Fatal Accident	Factories inspected	Safety Measures	Health	Welfare
	Fatal	Non-fatal	Total						
2015			0			3	<p>The factories, equipped with power-aided machines, generally violated the provisions relating to safety measures</p> <p>Sometimes even workers did not take proper care in replacing the guard on the machine after work and sometimes negligence resulted in accidents. However, management has been cautioned to take suitable measures to avoid industrial accidents.</p>	<p>All the provisions of the Factories Act covering health and sanitation, i.e., cleanliness, ventilation, disposal of waste & effluents, dust & fumes, artificial humidification etc. were implemented satisfactorily. In small factories also the standard of cleanliness was satisfactory as management staff is educated and well trained.</p>	<p>These facilities were specially checked by the Additional Chief Inspector of Factories as per provisions of the Factories Act. The management provided first aid boxes as per section 46 of the Factories Act, some factories provided canteens for their workers.</p>
2016	1		1	Explosion	0	19			
2017	1	7	8	Machinery Moved by Mechanical Power - Belts, Ropes, Pulleys and Gearing; falling etc	44.43	13			
2018		3	3	Machinery Moved by Mechanical Power - Belts, Ropes, Pulleys and Gearing	59.33	12			



Year	Industrial Accidents in Factories		Cause	Avg. Mandays Lost due to Non-Fatal Accident	Factories inspected	Safety Measures	Health	Welfare
	Fatal	Non-fatal						
						<p>The safety measures regarding protection from dangerous fumes and dust (section 35 and 36) as per Factories Act, 1948. In cases, units involved in operation such as emission of dangerous fume and dust, exhaust fans were provided. Workers were issues safety goggles and protection equipment.</p>		<p>The implementation of the provisions regarding shelter & rest room was found to be quite satisfactory as 44 factories were providing these. No factory had provided the crèche facility. The provisions regarding weekly holidays, compensatory holidays, hours of work and rest intervals etc. were satisfactorily implemented.</p>

Source: Ministry of Labour and Employment, 2018



5. Transport, Environment and Health

Transport related infrastructure development has benefited the public by allowing them easy access to various parts of the U.T. of Chandigarh. Traditionally, the U.T. is a well-planned city but with increasing population demands and urbanization, transportation can be considered as one of the main noise pollution-related stressors. Further, given that the number of motor vehicles within the city is increasing so is the traffic on the roads in terms of volume and intensity. It is determined that the U.T. of Chandigarh has the highest density of vehicles in India, with over two vehicles per capita household, approximately 878 vehicles per 1,000 population (MoRTH, 2021). Increasing vehicular traffic has contributed to adverse environmental health effects including worsening air pollution and road accidents in the U.T. The figure 62 below shows the trend of road related accidents from 2011-2020. Although the number of road accidents in 2011 was high at 881 accidents, this number has now decreased to 159 in 2020 (Figure 62).

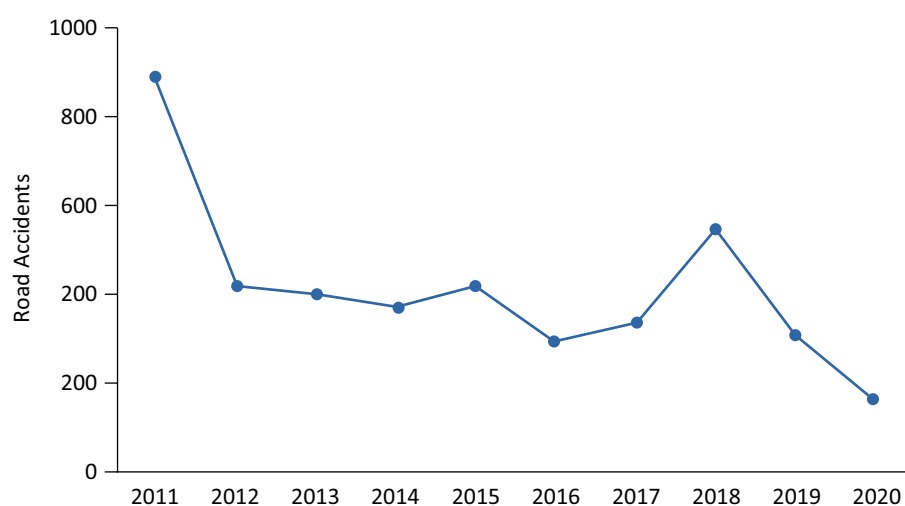


Figure 62: Road accidents in U.T. of Chandigarh from 2011-2020

Source: SSP Traffic, Police HQ, Sector 9, Chandigarh)

6. Overview of the Health Management System in Chandigarh

According to the report of the technical group on Population Projections for India and States 2011-2036, the projected population of Chandigarh for the year 2021 is nearly 12 lakhs (MoHFW, National Commission on Population, 2020). The current health infrastructure caters to this population. There are five government hospitals including PGI Hospital, General Multi-Specialty Hospital (GMSH), Sector 16, General Medical College & Hospital, Sector 32. Also, one hospital each in the field of Homeopathy and Ayurveda along with various other hospitals in the private sector.

Presently, there are about 788-809 Health Care Facilities (HCFs) including 583 small clinics/dispensaries, 13 veterinary institutions, 3 animal houses, 118 pathological laboratories, 4 blood banks, 4 research institutes and 14 Ayush clinics/hospitals. The total bed strength is 4413 in Chandigarh (as per 2018 Annual Report).

The list of health institutions includes two tertiary-level medical colleges and hospitals: the Post Graduate Institute of Medical Education and Research (PGIMER) and Govt. Medical College and Hospital (GMCH),



Chandigarh. There is one district government multispecialty hospital and one sub-divisional hospital. There are two urban community health centers (UCHC) and 29 health and wellness centers. Five Ayush centers are listed on IDSP, three non-bedded PHC/DCs and two ESI hospitals (National Health Mission, 2020).

The various steps that have been taken up to upgrade the healthcare infrastructure in Chandigarh include the following (Chandigarh Administration, 2022):

- The general hospital been upgraded to General Multi- Specialty Hospital (GMSH). This hospital along with the General Medical College & Hospital will meet the primary and secondary healthcare needs of all citizens, especially the underprivileged.
- The Postgraduate Institute of Medical Education and Research (PGIMER) to be upgraded for treatment of complicated medical cases in the region.
- Study on the integration of the Health Care systems by PGIMER sent to GOI, identifying the need for additional Medical Education Centre, with implementation under the PPP business model.
- Medical drives to ensure 1.5 lakh children are given the benefit of the healthcare system.
- Updating the mid-day meal scheme starting with the non-recognized schools comprising of 50000 students and gradually extending to the 104 government schools. With subsidy support from the government and additional funding from other institutes and corporations.
- Tele-medicine project undertaken to integrate IT services in the medical system.

6.1 Integrated Disease Surveillance Project (IDSP)

Chandigarh has implemented the pilot project of IDSP under the Phase II in 2006 to detect early warning signals of impending outbreaks. The main objectives include:

- Establishing a decentralized state-based system of surveillance for communicable and non-communicable diseases, for timely and effective public health actions are initiated in response to health challenges in the country at UT and national level.
- Improving efficiency of the existing surveillance activities of disease control programs.
- Establishing public health laboratories.
- Providing a secure online data management system.

The IDSP portal conducts weekly surveillance, provides early warning signals on outbreaks, conducts IEC and BCC activities for prevention and control of communicable and NCDs, and provides guidelines on prevention and control of various different virus outbreaks in Chandigarh (UT).

6.2 Chandigarh (UT) contribution towards managing environment & health

- Mechanical Street Sweeping machines were procured along with water sprinklers. This enabled footpaths, market areas and road berms to be cleaned with tertiary treated water at regular fixed intervals. This helped towards reducing of the particulate matter suspended in the atmosphere, with proper utilization of tertiary treated water and reduction in the emission load in our environment.
- Coming up of C&D waste processing plant in Industrial area of Chandigarh UT with the processing facility of 160 MT of C&D waste per day. The produced material can be utilized for cement concrete roads like washed sand and crushed aggregate of size 10 mm, 20mm and 40 mm. The plant alongside manufactures road material PCC kerbs, PCC Channels, PCC tools, Paver blocks etc at a very lower cost.



- Dissemination of Air Quality Index (AQI) to the citizens. The big display boards present in prime locations of sector 17, PGIMER sector 12, Railway Station of Village Daria, ISBT sector 43 and Sukhna lake sector 6. The real time ambient air quality data is showcased at Paryavaran Bhawan, sector 19, Chandigarh. This resulted in creating awareness among general public and enhanced their participation on air pollution control activities.
- Chandigarh Pollution Control Committee (CPCC) installed about 3 CAAQMS in Sector 25, Sector 22 and Sector 53 that monitors about 13 parameters on real time basis along with the prevailing meteorological conditions.
- Chandigarh Pollution Control Committee (CPCC) installed 1 Air Purification Tower at Transport Chowk, Sector 26, Chandigarh. It is one of the busiest Chowk with presence of air pollutants that contribute to the high AQI of the city.
- CPCC came up with one Public Grievance Redressal Portal for the citizens of Chandigarh that help them to resolve their issues pertaining to environmental pollution.
- In Chandigarh, PNG has been laid down with 130 Kms of high pressure and 300 kms of low pressure network. The Low Pressure MDPE Network is laid in 18 Sectors that have potential of 31000 dwelling units. 6 CNG Fuel Stations are operational and PNG line is also laid in some parts of the Industrial area.
- Ban on the biomass and garbage burning in city. No industry is allowed to run without installation of air pollution control devices. (National Center for Disease Control, 2021)

7. Recommendations and way forward

Chandigarh administration is taking various steps to improve its healthcare facilities and associated services. Further recommendations for an overall better healthcare system include:

- Chandigarh should model healthcare delivery through aggressive preventative medical care. The importance of the Integrated Disease Surveillance Program (IDSP) has increased as it allows us to understand the epidemiology of diseases through robust data collection and surveillance and predict future disease outbreaks to take action in a timely manner.
- Cost-benefit analysis of environment-related health impacts and studies on sectoral analysis of the implications of adverse impacts of environmental health will help in evidence-based policy planning to mitigate these impacts.
- Strengthening of existing facilities such as early warning systems and forecasts related to seasonal disease outbreaks, i.e., alerts on poor air quality, heavy rainfall and vector breeding to reduce the burden of prevalent VBDs, WBDs, air pollution-linked illnesses needed.
- In order to reduce the burden of increasing non-communicable illnesses due to poor air quality, environment and changing lifestyles such as diabetes, high blood pressure, obesity and other heart diseases etc. through promotion of physical activity and recreational activities in existing parks like yoga camps, monthly marathons etc.
- Communicable diseases such as VBDs, FBDs and WBDs should be targeted through behaviour change strategies to be implemented such as promotion of hand washing campaigns, eliminating mosquito breeding habitats, and wearing protective clothing.
- Regular awareness generation and development of knowledge networks among public on improved water and sanitation, ill effects of improper waste and wastewater disposal, air pollution-linked



diseases and other climate-related health illnesses. Awareness generation activities should be accompanied by behavior change campaigns.

- Development of Integrated Disease Surveillance Systems for collection of regular data and data analysis through health impact assessment, risk assessments, and correlation studies to develop evidence-driven policies.
- Capacity building and sensitization of target groups including healthcare staff, policymakers, NGOs and associated staff to increase preparedness for timely and effective public health actions.
- Moving forward, policymakers must look at its demographic population and its health status to come up with robust policies. Data collection as part of this study from ENVIS and in-person interviews and its analysis suggest that the main environmental stressors in the U.T. Chandigarh include:
- **Air pollution** in the U.T. is attributed to anthropogenic activities including crop burning in nearby villages and increase in vehicular traffic. Policies should be made to curb air pollution related to increasing vehicular density. It is expected that the U.T. Transport Department is developing a carpooling policy to reduce the number of private cars on the road and tackle vehicular emissions. To prevent crop burning in neighbouring villages, the U.T. of Chandigarh with the help of NABARD has launched campaigns against paddy straw burning (crop residue management) in 160 villages (NABARD, 2019). In Chandigarh, the air quality has site- and seasonal- specific variations therefore, the air monitoring should be done in key areas including hotspot analysis to determine the effect of such carpooling policies and anti-crop burning campaigns on air quality.
- To prevent fatalities from respiratory diseases linked to worsening air quality, the U.T. could set up health care infrastructure prepared to provide care to increasing cases during crop burning season. Further, the people of the U.T. should be advised against locating in areas with higher vehicular emissions or site with worsening air quality. In cases where this is not possible, the U.T of Chandigarh engages in tree plantation drives to mitigate the effects from worsening air quality.
- **Non-communicable diseases:** The U.T. has shown a rise in non-communicable diseases in different age-groups and gender. Overweight children <5 years has increased to 1.9% in 2019-2021 and levels of stunted and underweight although reduced are still significant at 25.3% and 20.6% respectively. Mother-child healthcare policies should extend to all vulnerable groups to overcome stunting and weight related issues by increasing provision of nutritional food and education for the same.
- Although a decrease from 2015-16 levels, still a high percentage of population is anaemic which includes 54.6% children, 60.1% non-pregnant women, all women who are anaemic are between 57.7% - 60.3%, while only 8.1% men are anaemic. Guidelines should be developed and followed to improve women's dietary education to increase iron intakes; oral supplementation such as through incorporation of National Iron+ initiative to be made accessible to deficient populations. Also, making use of existing parks and recreational activities to target obesity in children and adults, diabetes, high blood pressure and other lifestyle related cardio-vascular diseases in Chandigarh U.T.
- Elevated blood sugar and blood pressure levels among adults - High blood sugar levels with 19% for women and 16.6% for men. There is elevated blood pressure in 25% women and 30.6% men. Policies should target at-risk population to prevent these diseases and lead a healthier life. These may include government programmes to enable purchase of fresh vegetables and fruits, mandating product description on food items, screen-tests for high-risk groups for early detection. The Environmental health policies will be most effective when combined with communication strategies encouraging people to lead a healthier life such as through regular exercises.



- Communicable diseases have seen an overall decrease however cases of seasonal influenza and dengue outbreaks are occurring leading to some fatal cases. It is therefore advised for the U.T. to regularly monitor cases and adopt a prevention, surveillance, and control policy to track and prevent outbreaks such as the 2017 outbreak of Dengue which led to over 1200 cases in the U.T. Policies enabling access to vaccines to be adopted to prevent seasonal influenza, to be targeted towards high-risk population to prevent fatalities.





VIII

SOLID WASTE AND ITS MANAGEMENT

SOLID WASTE AND ITS MANAGEMENT

1. Introduction

Municipal Corporation of Chandigarh (MCC) is the authorized urban local body in the Union Territory for providing basic amenities such as potable water supply, efficient waste management, proper sewage system, clean and pollution-free environment, and other civic utilities to its citizens. As far as management of solid waste is concerned, rapid urbanization and an increase in population along with a flourishing economy and extravagant societal attitude have resulted in increased rates of solid waste generation in the city. Additionally, ineffective handling and mismanagement of this solid waste are starting to exert an extraneous amount of pressure on the environment and human health. Appropriate solid waste management in an environmentally sound, economically sustainable, and organized manner has become a priority for Chandigarh, where there are limited land resources and environment is susceptible for pollution.

Depending upon its source, solid waste is categorized into six different categories (solid waste streams), namely:

1. Municipal Solid Waste (MSW)
2. Plastic Waste
3. Electronic Waste (E-Waste)
4. Construction and Demolition Waste (C&D Waste)
5. Hazardous Waste
6. Biomedical Waste (BMW)

As per the DPSIR framework (illustrated in Figure 63) for presenting the state of the environment, the following sections of this chapter intend to analyse information about the causes (Pressures), current situation (Status), release and notice consequences (Impacts) and finally discuss mitigation and adaptation strategies implemented by the administration (Responses) related to the Solid Waste and its Management in Chandigarh.



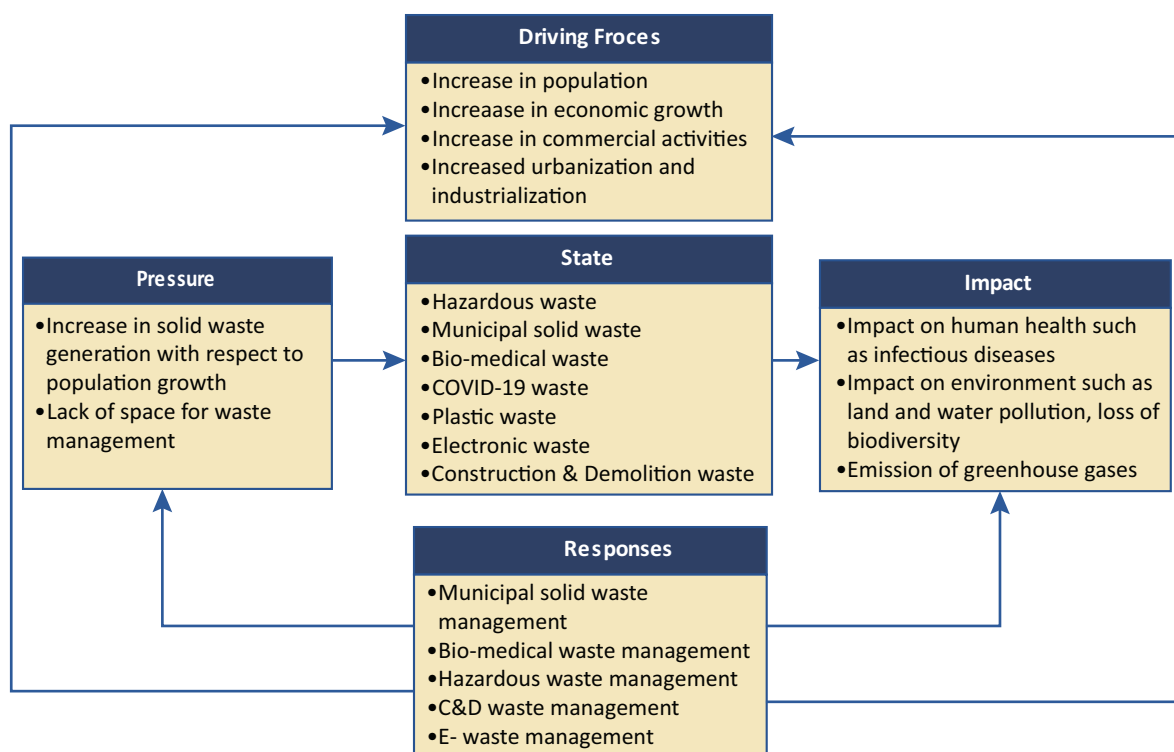


Figure 63: DPSIR Framework for Waste Management

2. Driver and Pressure

As reported by District Environment Plan (DEP) for Chandigarh UT, Chandigarh generates 513 TPD of municipal solid waste (MSW) comprising of wet, dry and horticultural wastes (District Environment Plan for U.T. Chandigarh, 2021). Without basic understanding of the factors that impact the waste generation patterns, waste composition, and also its management methods, it is practically impossible to isolate the causes and determine responsible practices to abate and mitigate the negative impacts of waste. This section provides the most serious pressures on solid waste streams and its management currently existing in Chandigarh.

2.1 Increase in solid waste generation with respect to population growth

Since its inception, Chandigarh has witnessed unprecedented rise in its population, reaching 10.5 million in 2011 as per the 2011 Census. Already exceeding the design population as envisioned by the city's planners, the inhabitants are estimated to further increase to 14.67 lakhs in 2021 and 20.93 lakhs in 2031 with approximate decadal growth rates of 39.17% for the period 2011-2021 and 42.59% in 2021-2031 (Chandigarh Master Plan 2031). Furthermore, in 2011, out of all the States and Union Territories, Chandigarh was found to be the second most densely populous, accommodating 9, 252 people per square kilometer. Approaching its maximum holding capacity, such high population density hinders the administration's capability to provide basic and essential services including efficient solid waste management.

Being a planned city, Chandigarh is predominantly urban with 97.25% of its population residing in urban households and a meagre fraction of 2.75% in rural areas (Chandigarh Master Plan 2031). Following a



similar trend as observed throughout the rest of India, the urban settlements of Chandigarh are correlated with generating more waste per capita as compared to its rural villages. As per the Human Development Indices (5.0) Report by UNDP, with a HDI of 0.776 in 2019, Chandigarh was placed second all over India (Institute for Management Research, n.d.). Quantitatively indicating the standard of living, HDI takes diverse parameters like education, public health and per capita income into consideration. Such a high HDI, like that of Chandigarh, imply a very decent standard of living which, in-turn, is usually directly proportional to the amounts of solid waste generated. In less than a decade's time, for Chandigarh the daily per capita waste generation increased by 16.22%, soaring from 0.37 kg in 2011 to 0.43 kg as reported in 2020 (Chandigarh Master Plan 2031). Thus, with increasing population, improved standard of subsistence and the orthodox linear (Take-Make-Dispose) mentality, the quantities of waste generated are anticipated to amplify even more, as seen below in Figure 64.

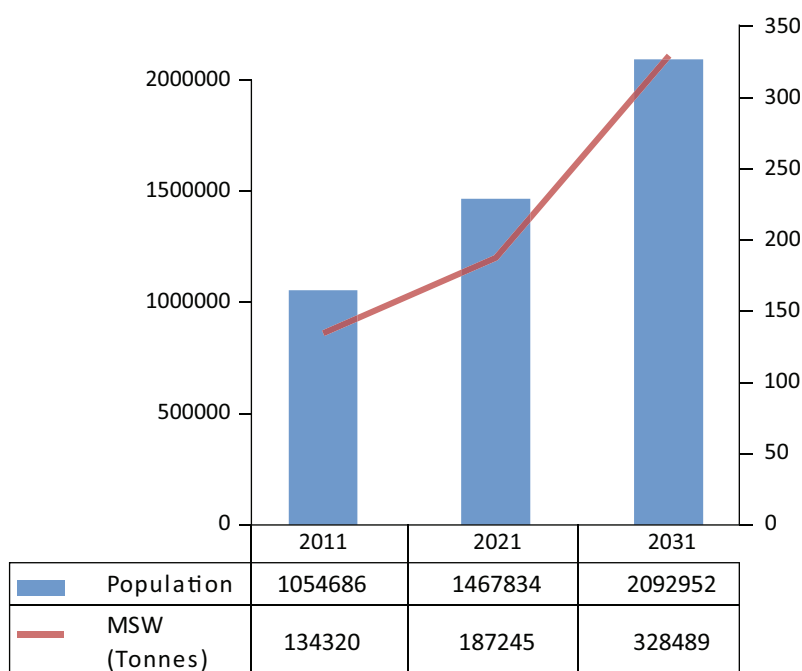


Figure 64: Population Growth and Associated MSW Generation

Source: (Chandigarh Master Plan 2031)

2.2 Lack of Space for Waste Management

Constituting a miniscule 0.0035% of India's total area, the Union Territory of Chandigarh is spread across 114 square kilometres. Taking into account its importance, the area of this UT is very less, especially when compared to other metropolitan cities of similar significance. The land-use in Chandigarh is quite unique. More than a third (37.88%) of the entire available landscape is utilised to habitat the huge number of residents (Chandigarh Master Plan 2031). Crucial sectors like Commercial, Industrial (including the IT Park- Rajiv Gandhi Technology Park) and Defence, each occupy about approximately 5% of the area (4.76%, 4.71% and 4.52%, respectively). Taking up a total of 27.49% of the ground for civil objectives like Public / Semi-Public purposes, Transport, Recreation and Public Utilities, negligible margin is left for waste handling facilities and treatment plants. Despite being a planned development, not enough provisions were made for locating infrastructure for waste handling, treatment or disposal thereby resulting in



increasing challenge of handling solid waste. This has left both, the biota as well as the environment, more vulnerable to the direct and indirect externalities of solid waste and its unscientific management. For detailed land-use scenario of Chandigarh, please refer Table 87 below:

Table 87: Existing Land-use of Chandigarh

Sr No.	Purpose	Area Utilised (Acres)	Percentage of Total
1.	Residential	10672.16	37.88
2.	Commercial	1339.73	4.76
3.	Transport	2046.10	7.26
4.	Industrial / IT Park	1326.50	4.71
5.	Public / Semi-Public	2968.79	10.54
6.	Recreational	2428.47	8.62
7.	Agriculture	-	-
8.	Public Utilities	302.33	1.07
9.	Railway Land	316.29	1.12
10.	Defense	1573.00	5.58
11.	Forest	2113.97	7.50
12.	Reserved	-	-
13.	Vacant Land	3082.67	10.94
Total		28170	100

Source: (Chandigarh Master Plan 2031)

3. State

Having understood the factors that act as pressure on solid waste generation and its management, the section below provided status of solid waste management in Chandigarh for the last five years.

3.1 Hazardous waste

As per the DEP for UT Chandigarh, the entire region, comprising 1363 registered industrial units, generated a total of 1279.098 MT of Hazardous Waste in the year 2021 (District Environment Plan for U.T. Chandigarh, 2021). A detailed breakdown of the HW stream into land fillable, incinerable and recyclable fractions for the past two years is tabulated below. Summarising the hazardous waste produced annually, Table 88, reveals a steady decline in the same which is due to Chandigarh's stringent regulations and its rigorous enforcement of hazardous waste regulation.

