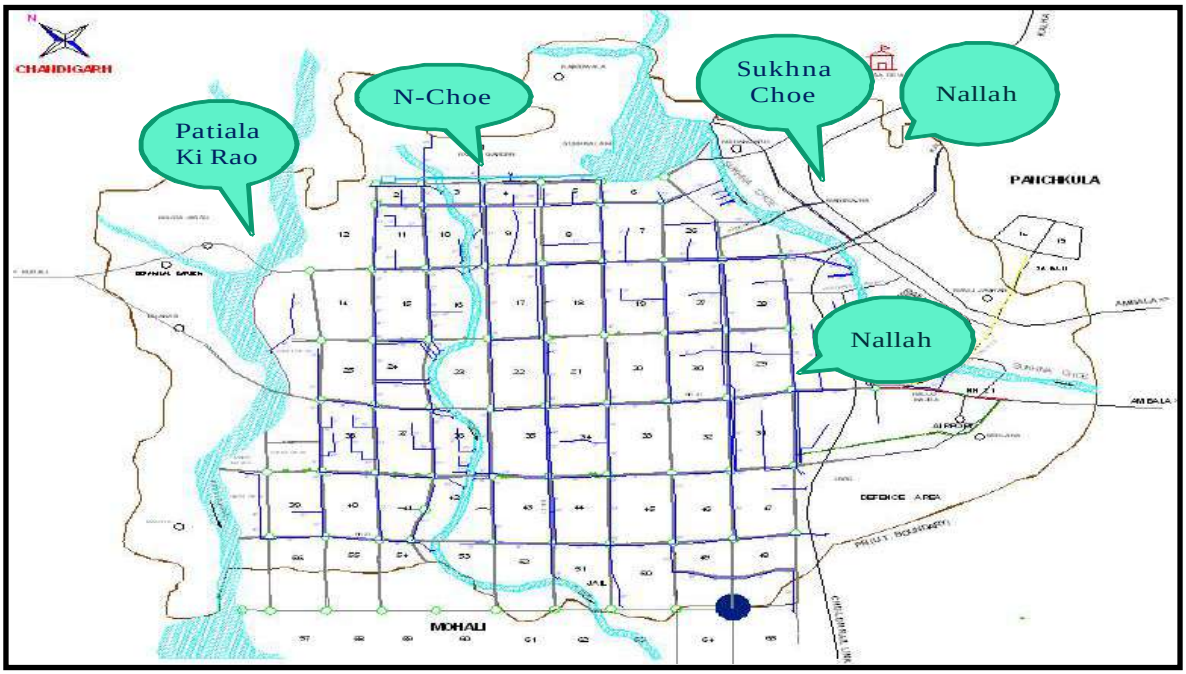
In order to meet the situation of flooding, it had been planned to augment the main trunk lines running from North to South. One trunk main running between sector 17 & 18, 21 & 22, 34 & 35, 43 & 44 and discharging in the N-Choe in sector 51 has been laid at a cost of about Rs. 2 crores. To augment the drainage system additional lines have been provided in sector 7, 8, 15, 24, 28, V3 road dividing sector 34 & 44, 38, 41.



Additional lines have also been provided on road leading to railway station. About 500 vertical road gullies have been provided to increase the intake of water in the storm water lines. The storm water drains have also been provided in Rehabilitation colony Maloya, Janta & Kumhar Colony sector 25.

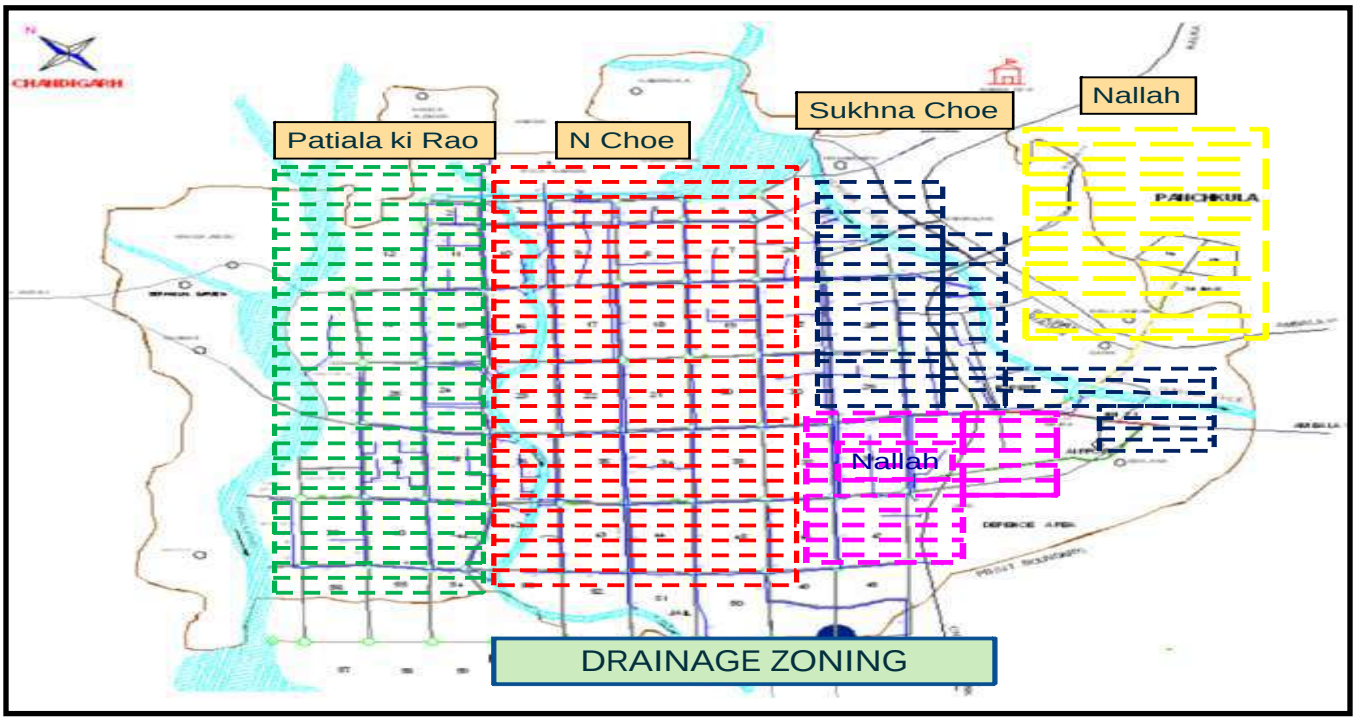
Improvements to Storm Water Drainage

- The Municipal Corporation has undertaken a study to prepare a storm water drainage master plan to alleviate the problems of flooding by providing adequate measures. The study recommended deepening and widening of the nallahs for the sections affected by encroachments, critical sections for further improvement and a broad cost to carry out the Improvements.

The improvements proposed include:

- Clogging
- Deepening
- Widening
- Provision of retaining walls at critical sections
- Modification to cross drainage works and in addition suggested some soft measures such as prevention of dumping of waste into the nallah to prevent clogging.

India churns out 18.5 lakh tonnes of e-waste annually.



Flood Prone Areas in Chandigarh

The key reasons for this situation are assessed as follows:

- Drainage system, which was designed for the rainfall of 12 mm/hour.
- Excessive concentration of flood due to heavy down pour.
- Disappearance of flood absorbing 'N' choe because of urbanisation.
- Dumping of debris and garbage into the open Nallahs/N-choe.
- Illegal encroachment of natural water courses.
- Indiscriminate laying of service lines all along and across natural courses.
- Filling of 'N' choe in Chandigarh which decreases the drainage capacity.
- Diversion of natural water courses to accommodate habitations.
- Increased run-off due to increase in impervious areas.

THE KEY ISSUES

One of the, key issue is the silting of the N-choe and the Sukhna choe over the passage of time. The silting of the bed level of the choe has ultimately affected the efficiency of Drainage System during torrential rains. All storm water drains are held up for longer periods. Thus causing flooding of roads and low lying areas. For this very reason, a part of pipe networks especially the branch sewers have been silted and need either replacement or Augmentation. The storm water drainage system of northern sectors of Chandigarh City has been designed at 15mm rainfall intensity per hour whereas southern sectors have been designed at 20mm rainfall intensity per hour. Previously system was in order since the storm water use to spread in the open areas of southern side of the city but now due to development of southern part of the city, the runoff has increased and there is dire need to augment the whole S.W.D. system of the city at 25mm rainfall intensity/hr in order to check flooding of roads, low lying and other critical areas.

Globally, there are around 2,200 waste-to-energy plants, of which the European Union has 445, China has 150 and USA has 86 and India has just 8.

Hazardous Waste Generation and Management in Chandigarh

There is no TSDF facility available in the Union Territory, Chandigarh and the Hazardous Waste generated in Chandigarh is being disposed off through TSDF of Punjab, named RAMKY Enviro Engineers Ltd. (Unit: Punjab Waste Management Project) situated at Opp: Vardhman Chemtech Ltd., Village : Nimbua, Derabassi. CPCC has authorised M/s Ramky Enviro Engineer Ltd. for collection and transportation of landfillable hazardous waste from various units located in Chandigarh to their TSDF located at Village Nimbua, Tehsil Derabassi, District Mohali, Punjab. CPCC has formal agreement with Punjab Pollution Control Board for utilizing TSDF facility.

Further, there is very minimal amount of incinerable waste generated in Chandigarh for which Chandigarh Pollution Control Committee has authorised M/s Bharat Oil and Waste Management ltd. for collection and transportation of incinerable hazardous waste from various units located in Chandigarh to their facility at Sahibabad, Industrial Area, Ghaziabad, U.P.

The recyclable/ reprocessed hazardous waste generated in Union Territory, Chandigarh is being disposed through recycling/reprocessing facilities siuated in neighboring states like Punjab & Haryana for which CPCC has given authorisation to collect and transport waste to their respective state for further processing. List of hazardous waste authorised service providers as given below:

S.No	Name of the Unit	Contact Person	Address	Contact No. Vehicle No.	Category	Valid upto
1	M/s Ramky Enviro Engineers Limited	Sunil Sawant, Project Head	Opposite Vardhman Chemtech Ltd., Village-Nimbua, PO.-RampursainiaS, Tehsil-Derabassi, District-Mohali, Pb.	01762-650116, 9914260516 PB-65F-1780	ETP Sludge, Chemical Sludge etc.	31.01.2020
2	Bharat Oil Company (I) Regd.	Mr. Mohinder Singh, Manager (Admin.)	E-18, Sahibabad Industrial Area, Site-IV, Ghaziabad, Uttar Pradesh.	0120-3220356 011-29816466 UP-14AB-9152	Used Oil and Incinerable Waste	31.01.2020
3	M/s B.N. Concast (P) Limited	Ms. Neha Garg, Director	HSIDC Complex, Plot No. 18, Industrial Area, Alipur, Barwala, Panchkula, Haryana	9815088322 HR-68- 8151	Used Oil	31.01.2024
4	M/s Golden Petro	Mr. Raman Garg, Partner	Plot No. C-45, Industrial Focal Point, Chanalon, District- SAS Nagar, Punjab.	9814216198 9876489193 PB-65L-6724	Used Oil	30.11.2020
5	M/s Mahadev Petrochemicals	Mr. Vikas Goyal	Plot No. D-116(P), Industrial Focal Point, Mandi Gobindgarh, Distt. Fatehgarh Sahib (Punjab).	7696209810 9876009600 PB11-BU-1292	Used Oil	13.06.2021

Smartphones are the major E-waste contributors as India is the second largest market for mobiles with 1.03 billion subscribers.

6	M/s J.B.R Technologies (P) Ltd. -II	Mr. Rajinder Singh	Opposite Nexo Industries, Kohara Machhiwara Road, Kohara, Ludhiana East, Punjab.	9872531910 PB 11 BF-8898 PB 13Q - 1488	Acid residue	31.12.2019
7	M/s Bhagwati Agro Industries	Mr. Nitin	Tosham Road, VPO. Balawas, Hisar, (Haryana).	9216450503 HR68-9947	Acid residue	06.09.2020
8	Malana Silver Nitrate Recycling Unit	Mr. Jatinderpal Singh	Village Rampuran Gunjan, Tehsil Moonak, District Sangraur, Punjab	9357216106 PB 13BD- 3846	Spent fixer hypo solution & X-ray films	30.11.2023
9	V.K. Plastic Enterprises	Mr. Rohit Gupta	Plot No. 96/6, Arya Nagar, Industrial Area, Ghaziabad, U.P.	9891222627 DL1LX-7944, DL1LR-7950	Empty Plastic. Containers/Barrels/Jar, Hypo -fixer Solution X-Ray films	31.10.2023

Source: Member Secretary, CPCC, Chandigarh

Year	Type of Hazardous Waste	Quantity (MT/yr)	Method of Disposal
2014-15	Used Oil	163.17	Sale for re-processing
	Acid Residue	2309.77	Disposed Through Authorised Recycler/Reprocessor
	Hazardous Waste Incinerable	5.29	Disposed 126 Kg of Ash to BOWML, Kanpur in PP Bags
	Inorganic Natured Waste	126.877	Landfill
	Zinc Ash	1411.784	Sold to Zinc Sulphate Manufacturers
	Total	**4016.89**	
2015-16	Used Oil	199.06	Re-processing
	Acid Residue/Spent Acid	1788.58	Sale for re-processing
	Hazardous Waste Incinerable	23.615	Disposed 118 Kg of Ash to BOWML
	Inorganic Natured Waste	99.482	Landfill
	Zinc Ash	1466.77	Sold to Zinc Sulphate Manufacturers
	Total	**3577.52**	
2016-17	Used Oil	444.888	Re-processing
	Acid Residue/Spent Acid	529.06	Sale for re-processing
	Hazardous Waste Incinerable	11.25	Disposed 118 Kg of Ash to BOWML
	Landfillable	69.294	Landfill
	Zinc Ash	1792.4	Sold to Zinc Sulphate Manufacturers
	Total	**2846.89**	

2017-18	Used Oil	272.41	To registered recyclers
	Acid Residue	753.5	To registered recyclers
	Hazardous Waste Incinerable	24.73	To registered recyclers
	Inorganic Natured Waste	129.033	Landfill
	Zinc Ash	935.945	Sold to Zinc Sulphate Manufacturers
	Total	**2115.62**	

Source: Member Secretary,CPCC Chandigarh.

Bio-Medical Waste

Bio-medical waste is defined as any waste, which is generated during the diagnosis, effective treatment and immunizations of human beings or animals or research activities or used in the production or testing of biological health camps, inclusive of all categories mentioned in schedule I of BMW Rules, 2016. As per the recent BMWM amendment rules, 2018, it becomes the duty of every occupier to phase out use of chlorinated plastic bags (excluding blood bags) and gloves by 27th March, 2019. It will also be mandatory for the health care facilities to make available the annual report on its web-site within a period of two years from the publication of BMW Rules, 2016. The safe and sustainable management of Bio-Medical Waste (BMW) is a legal and social responsibility of all people supporting and financing health-care activities. Effective BMW management is mandatory for cleaner environment and a healthy sustainable mankind. An effective framework involving right from handling of waste, segregation, mutilation, disinfection, storage, transportation and proper disposal are crucial steps for safe and scientific management of biomedical waste in any establishment. The key to minimisation and effective management of biomedical waste is segregation (separation) and identification of the waste. The most appropriate way of identifying the categories of biomedical waste is by sorting the waste into color coded plastic bags or containers. This waste is required to be managed as per the BMW Rules, 2016, as amended by the Ministry.

The total bio-medical waste generation in Chandigarh is around 2503 kg. per day including 2207 kg from bedded facilities and 296 kg/day from non bedded small health care facilities. Presently, there are 788 Health Care Facilities (HCFs) operational in Chandigarh. These HCFs include 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).

95% of all data in the world is still stored on paper. Most of it is never looked at again.

Year	Total Quantity of BMW Generated Per Day
2014	**2169**
2015	2134
2016	1994
2017	2503

Source: Member Secretary, CPCC

Year	Total Number of Beds
2014	3120
2015	3259
2016	4090
2017	4413

Source: Member Secretary,CPCC

Status of Incinerated Bio-Medical Waste in Chandigarh

There were two fully operational incinerators in Chandigarh. One of them is located at Post Graduate Institute of Medical Education & Research (PGIMER), Sector 12 that has a treatment capacity of 200 kgs/hour and the other is at Government Multi Specialty Hospital (GMSH), Sector 16, Chandigarh with a treatment capacity 100 kgs/hour of bio-medical waste. PGIMER Chandigarh treats the incinerable bio-medical waste of Panjab University, Chandigarh in addition to the waste generated from their own hospital.They also treat the incinerable biomedical waste from the private health care facilities which is transported by BMWTF. The existing incinerators at PGIMER and GMCH were commissioned in the year 1988 & 1995 respectively and now they are too old to be functioning efficiently. A number of break downs in these incinerators were also reported in the past few years. Moreover, these incinerators do not meet with the latest norms of Central Pollution Control Board (CPCB) i.e. installation of online continuous emission monitoring system and design parameters. To resolve this issue, CPCC has granted consent to establish the installation of incinerator with capacity of 200 kgs/hr. to M/s Alliance Envirocare Company Pvt. Ltd. - A biomedical waste treatment and disposal facility operational in Chandigarh. The proposed incinerator will fulfill the latest guidelines and norms of CPCB. Presently, this BWTF treats the non incinerable waste of all the private health care facilities in Chandigarh and transport their incinerable waste to PGIMER for incineration. The BWTF has deployed a number of vehicles for collecting the biomedical waste from all the private health care facilities of Chandigarh along with government dispensaries. All these vehicles are Global Positioning System (GPS) enabled and are approved by CPCC.

E-Waste (Electronic Waste)

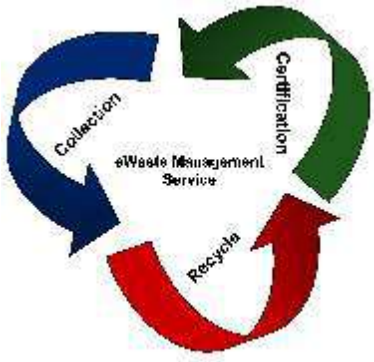
The impact of e-waste on human health and environment are very much inter-related. It is a proven fact that when electronic goods are past their shelf life and broken down manually for extracting precious metals or even burnt or discarded, they tend to contaminate land and water to an extent unimaginable to humankind.

Majority of electronic waste processing happens in the unorganized sector, which fills a glaring lacuna in the processing cycle, and collects waste from household and establishments.

As the city beautiful, Chandigarh has been rapidly growing in the educational and IT sector. Therefore, in this era, e-waste generation in the city has also realised to pose the possible threats to the environment into the coming years. First e-waste project in Chandigarh was launched by the Young Indians body of confederation on Indian Industry Chandigarh and Noida based Attero Recycling, in association the presence of Chandigarh administration on 6th June 2011.As per annual record of CPCC, in 2017, 29 MT of e-waste is generated and disposed off. It was found that most of the e-waste generated was from the use of Electrical and Electronic Equipment (EEE) such as Mobile phones, Laptops, Cameras, Washing machines, Air conditioners, Heaters, Geysers, LEDs and LCDs. Moreover, taking the annual GDP growth rate of India into account e-waste generation from households was estimated to reach 9565.1 tons/annum by 2020. Among the various disposal channels "selling as scrap" was the most favoured one among the respondents to discard the used EEE. Therefore, it can be concluded from the survey that informal sectors or scrap dealers are very active in e-waste collection as they are aware about the profitability from its dismantling and recycling.

In Chandigarh, all the big I.T. companies are disposing their E-Waste through registered Recyclers and M/s Ramky Enviro Engineers Pvt. Ltd., Nimbua, Derabassi. As Chandigarh is very small city and cost of land is very high. Hence, there is no dismantler and recycler facility for e-waste generation in Chandigarh and e-waste generated in Chandigarh is being disposed through recyclers in neighboring states. There are following three E-waste collection centres of Karo Sambhav in Chandigarh which are authorized by Central Pollution Control Board:-

1. Savex Technologies Pvt. Ltd., SCO No. 364, 2nd Floor, Sector 44-D, Chandigarh
2. Mobile Connect, SCO 2473-2474, 2nd Floor, Sector 22-C, Chandigarh.
3. Supertron Electronics Pvt. Ltd., Plot No. 38-D, Indl. Area, Phase - II, Chandigarh.

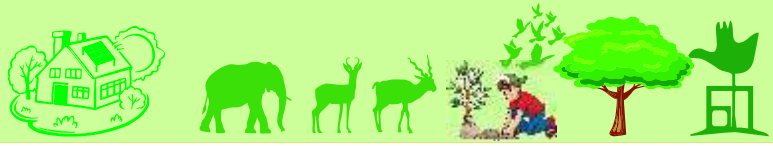


More than 70% of collected urban waste is dumped straight into the landfills. As a result most of them are brimming and are way past their limit.

List of E-Waste Collection Units Placed in Chandigarh at Different Locations

Year	e-Bin Locations	Date of Install
2013	e-Sampark PGI Sector-12, Chandigarh	6/6/2012
2013	e-Sampark Sector-15 Chandigarh Near Existing Electricity Bill Collection Centre	6/6/2012
2013	e-Sampark Sector-17 Chandigarh Central Treasury Office	6/6/2012
2013	e-Sampark Sector-18 Chandigarh Near Existing Electricity Bill Collection Centre	6/6/2012
2013	e-Sampark Sector-23 Chandigarh	6/6/2012
2013	e-Sampark Sector-40 Chandigarh	6/6/2012
2013	e-Sampark Sector-43 Chandigarh Near Existing Electricity Bill Collection Centre	6/6/2012
2013	e-Sampark Sector-47 Chandigarh Near Existing Electricity Bill Collection Centre	6/6/2012
2013	e-Sampark Sector-10 Chandigarh Near Existing Electricity Bill Collection Centre	6/6/2012
2013	e-Sampark Industrial Area Phase-1Chandigarh Near Existing Electricity Bill Collection Centre	6/6/2012
2013	Punjab & Haryana High Court, Sector-1, Chandigarh	7/8/2012
2013	Shop No. 16 & 17, Mehak Medicos. Sector-48-A, Market Chandigarh	7/8/2012
2013	e-Sampark Sector-21, Chandigarh	20/12/2012
2013	Chandigarh Pollution Control Committee (CPCC), Ground Floor, Paryavaran Bhawan, Sector-19-B, Chandigarh	20/9/2012
2013	Department of Forest , U.T., Chandigarh. 2nd Floor, Paryavaran Bhawan, Sector-19-B, Chandigarh	20/9/2012
2013	Department of Environment, U.T., Chandigarh. 3rd Floor, Paryavaran Bhawan, Sector-19-B, Chandigarh	20/9/2012
2013	e-Sampark Mani Majra Near Existing Electricity Bill Collection Centre	6/6/2012
2015	Centre for Social Work, Panjab University, Sector-14, Chandigarh (Ground Floor)	2/7/2015
2017	Dev Samaj College of Education, Sector 36-B, Chandigarh	27/3/2017

Source: Member Scretary, CPCC Chandigarh (UT)



Activities & Initiatives Taken in Chandigarh following Swachh Bharat Mission (Urban)

There is remarkable improvement in cleanliness after the launch of SBM (U). Following activities have been conducted:

Awareness among citizens:-

1. Campaigns were organized in various parts of the city to sensitize and create awareness amongst residents about sanitation.
2. Signature Campaigns were organized in different parts of city to pledge support of people towards cleanliness.
3. Clean hands drive and quiz competitions were organized in schools.
4. Plays/Nukkad Nataks were held in different parts of the city.
5. Talk shows were held on Radio and Doordarshan.

Special Thematic Drives -

1. Special Sanitation Campaigns are being organized from time to time to cleanse the city from Malba, leaves and mixed garbage. Various NGOs were involved in these drives. During this, staff of Engineering Wing of MC and U.T. also conducted drives to lift the horticulture waste, malba and clean the roads A special campaign was done in which 5000 volunteers of Nirankari Mission participated to clean the otherwise neglected areas of the city.
2. As per the directions of the MoUD, regular thematic drives are being carried out in the city w.e.f. 1st April, 2016 on different themes. The pictures/video of the drives are being uploaded on the Portal of Swachh Bharat Mission, Facebook, Twitter and Whatsapp. The drives are covered by the local media also.

Initiatives Taken -

In order to promote onsite composting, 26 bulk waste generators in Chandigarh are practicing onsite processing of wet waste at their respective premises. Additionally, there are 11 institutes wherein pit composting have already been implemented. Moreover, 105 parks/ Gardens have on-site composting facility. Besides, many households are also practicing onsite composting.

For the effective treatment of wet waste, MCC has installed Bio-Methanation plant with a capacity of 5TPD for the effective treatment of wet waste .

The MC has developed the required infrastructure to collect & transport wet and dry waste in a segregated manner. The wet waste will finally be sent to the compost unit of JP plant.

The Municipal Corporation has hired an agency named, (M/s Speedways Advertising) for promoting of Information, Education and Communication (IEC) activities. They will also be preparing IEC material for schools including the general public to convey the messages for effective waste management.

The MC has installed bins for the collection of E-waste in different commercial areas of the City. The same has also been put up on the website of the MC, Chandigarh.

1 Ton of recycled plastic saves equivalent to 5774 Kwh of electricity.

The upgradation of STPs having tertiary treatment is proposed to be executed by Chandigarh smart city limited in next two years in a phased manner.

The bad odour will be removed at STPs itself , if proposed to have BOD design less than equal to 10 mg/ltr. E-waste disposal can be enhance by the app- SPRECO, which is a true end-of-life recycler of electronic waste.

A committe by the name of Justice Pritmpal Committee has been formed to monitor the water quality of river Ghaggar. Concrete action plan is being prepared to ensure that no untreated waste water goes into these choes.

The upgrdation of 5 nos. existing STPs alongwith construction of new STP of 2 MLD capacity at Kishangarh is being done under Chandigarh Smart City Ltd.

E-Waste Bins have been placed at prominent places in the city including Sampark Centres and awareness in this regard has been initiated amongst general public (and school students) by giving them press notes in leading newspapers and attaching a hand bill with electricity/water bills.

In, 2018, a total of 129 challans have been issued against the ban on polythene/plastic carry bags. The Challan under SWM-Bye Laws is of Rs.500/- & challans for use of plastic/polythene is of Rs.5000/-. The Municipal corporation is under process to issue revise Solid Waste Management Bye-Laws in which the rate of challans is going to be increased from Rs.500/- to 5000/-.

The Municipal Corporation is regularly checking the activity of the whole sellers dealing with disposal of polythene/ carry bags.

The MCC is regularly cleaning the area after any public event. However necessary provision has been made in the revised Solid waste Bye-Laws to be notified shortly.

The Rehries of Door to Door collectors are also being modified by Municipal Corporation Chandigarh and set of 6 bins of 40 ltr. Capacity are being provided to transport the segregated waste from household to the SSK/Waste collection point. The Door to Door Collectors have also been identified and I. Cards have been issued to them by the Municipal Corporation, Chandigarh. They are being provided with gloves, masks, jackets and caps etc.

In order to process the organic waste coming out of the city, MCC has installed Bio-Methanation Plant with the capacity of 5.00 ton in the city at the cost of Rs.91.37 lacs.

The attendance of the MSW staff is being monitored by installation of ICT based attendance system in the office as well as in the field.

VTS system has been installed on 102 MSW vehicles for providing an ICT based vehicle tracking and monitoring solution through BSNL. After the implementation of GPS System on MSW Transport vehicles, the Municipal Corporation has been able to have a complete track of lifting of the solid waste in the city.

The southern area i.e. from Sector 31 to 63 including all villages and colonies have been outsourced for mechanical sweeping, manual sweeping, washing, cutting of grass, pruning of trees etc and collection of MSW.

Chandigarh Municipal Corporation initiated the segregation of waste at source by celebrating World Environment Day on 5th June, 2017 at Tagore Theatre, Sector 18, Chandigarh. Sh. V. P. Singh Badnore, Governor-cum-Administrator U.T. Chandigarh was the chief Guest. The Function was attended by the Member Parliament Mrs. Kirron Kher, Mayor, Councillors, officers, students of various institutions, Residents Welfare Associations, Market Welfare Associations and residents of the city. Sh. Badnore administered Blue Green Pledge to the residents to ensure segregation of waste at source.

It was intimated that as per Solid Waste Management Rules, 2016, all households, commercial establishments and other institutions are required to segregate the waste at source and store the waste in two different bins i.e. Green bin for wet and biodegradable waste and blue bin for dry and non-biodegradable waste. Initially the Municipal Corporation is providing set of two bins green and blue to the residents of Chandigarh free of cost. The commercial establishments of Chandigarh are required to put up two bins system for source segregation from their own resources.

IEC activities to educate the public regarding segregation are being conducted. Pamphlets were distributed to the public. Hoardings have been installed at prominent locations.

The collection of segregated waste through door to door collectors is being made mandatory and Municipal Corporation, Chandigarh is in the process to fix the said rates. However, initiatives are taken to Segregate at source, in the city, as per Standard Operating procedures sent by MoUD.

Some Specific Final Achievements

The Municipal Corporation got the Swachh Survekshan Award being the India's Cleanest State Capital / Union Territory from the Ministry of Urban Development, New Delhi.

- Chandigarh secured 3rd rank as the cleanest city of India, as per the Swachh Sarvekshan ranking 2018.
- Chandigarh has been awarded the “Green and Clean City”, title on 08.04.2017, in “Smart and Sustainable Summits” at Nagpur.
- Chandigarh City has been declared “Open Defecation Free Million plus city” on 27th September 2016. Hon'ble Prime Minister has presented the certificate during INDO-SAN 2016 on 30th September 2016 which was valid for 6 months. Chandigarh city has been recertified as 100% Open Defecation Free after Third Party Inspection by Quality Council of India.
- In 2016 the Municipal Corporation has also been awarded “Skoch Order of Merit” for Solid Waste Management, Street Vendors Survey and Maintenance of Parks through Public Participation.
- Chandigarh has also been selected as Smart City in the Smart City Mission in which a total of 33 cities have qualified in India.
- Chandigarh has been awarded with Best City Award for Cleanliness and Sanitation by a survey conducted by ABP News in year 2014 and 2015.
- The Municipal Corporation has also been awarded “Skoch Order of Merit for “Solid Waste Management in Chandigarh” in 2014 and for “Online Tracking of Garbage bins in 2015.
- The India Today group has awarded Chandigarh as the Best City for Cleanliness in India at “Best City Awards” in 2014.

Recycling one plastic bottle saves 60 Wh of energy

Energy

Energy is the mainstay of India's total economic growth and development. It serves as a tradable commodity in boosting the national income and thus promoting a nation's international diplomacy. It also serves as an input into the production of goods and services in the country's transport sector, agriculture, industry, health, education and security. Nowadays, some of the common energy carriers are coal, petroleum, natural gas, nuclear fuels, biomass etc. Of all these, the most widely used energy sources are the fossil fuels which accounts for more than 80% of global primary energy consumption. Despite their efficient extraction and use, it is estimated that these natural reserves will eventually be depleted at a point where further exploration would be highly uneconomical. Thus, it becomes imperative to switch to energy efficient alternatives and conservation systems.

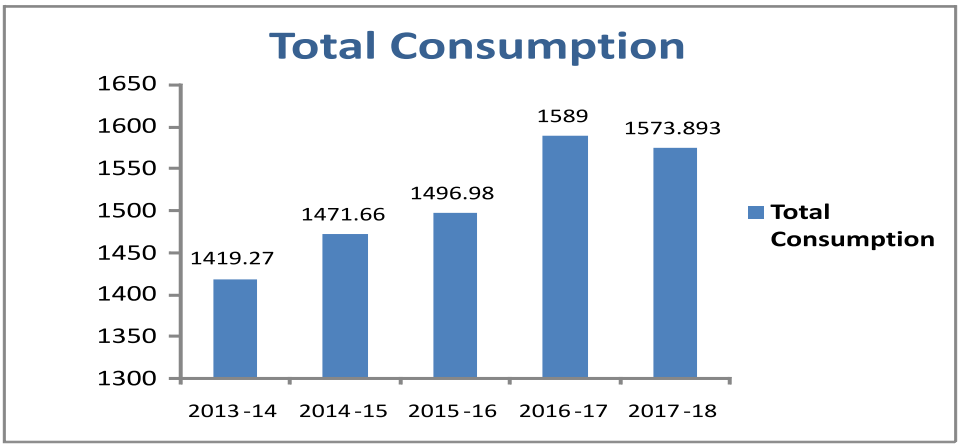
Chandigarh for that matter has been maintaining its statistics of renewable energy resources. With commendable initiatives and approach taken by experts in the field, Chandigarh has developed as a Model Solar City through Chandigarh Renewal Energy, Science and Technology Promotion Society (CREST). A Master Plan for Model Solar City was prepared by, "The Energy and Resource Institute" (TERI) and approved by MNRE, GOI in Jan 2012. The Solar City plan is aimed to reduce the dependence on conventional electricity consumption. MNRE, GOI has set 69 MW as Solar PV target for Chandigarh Administration to be achieved by 2022. Projects have been identified to achieve the target, Chandigarh has already installed and commissioned 26.069 MWp Grid tied Rooftop Solar Plants as on 31st Dec, 2018 including private sectors.

Electricity Consumption in Chandigarh

Union Territory of Chandigarh came into existence with effect from 01/11/1966 after re-organization of erstwhile state of Punjab. The Local Distribution of electricity in Chandigarh was taken over by the Chandigarh Administration from the PSEB on 2nd May, 1967 and is responsible for Transmission and Distribution of power supply up to consumers door-step for making quality and continuous power supply available to each and every resident. The Electricity Operation Circle is headed by Superintending Engineer along with four Executive Engineers with the employee's strength of 1246 approx.

The city has a transmission network which comprises of one No.220 KV Sub Station at Kishangarh Manimajra, 13 Nos. 66 KV Sub Stations and 5 Nos. 33 KV Sub Stations.

With escalating population, there was been an ever-increasing per capita consumption of electricity, making it difficult for the city to meet the demand. This scenario, in turn leads to discontinuous supply of power and recurrent power cuts to residential, non-residential and industrial areas. As Chandigarh draws its power supply from the central grid and has no power generation of its own, it puts immense pressure with a threat of low productivity on the grid. With the gradual increase in the population of the city the demand for electricity has also been increased at a faster rate. The total electricity demand in 2013-14 was 1419.27 MKWH as compared to 1573.89 MKWH in 2017-18. There has been nearly an increase of 10% consumption over the past 6 years.



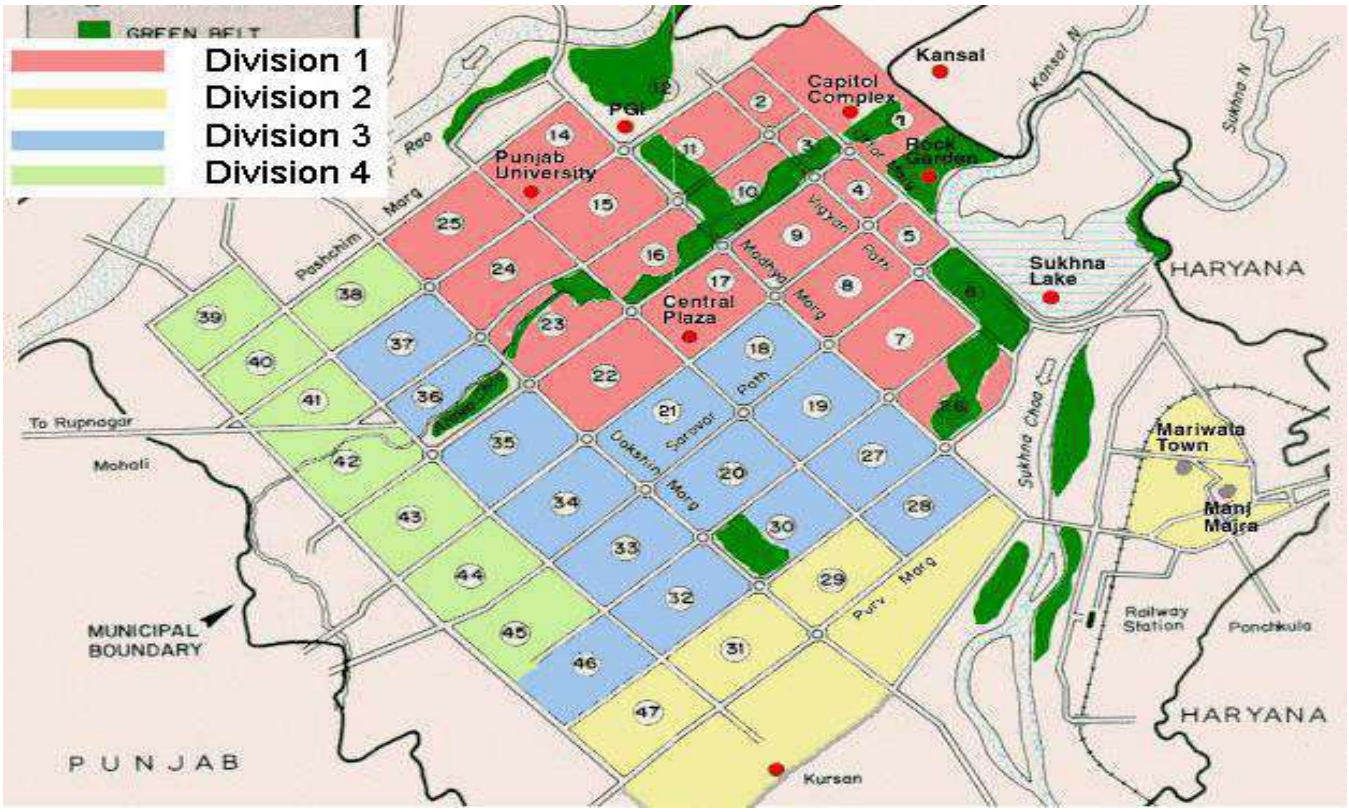
Source: Supdt. Er. Electy, 'OP' Circle U.T Chandigarh.

Ministry of New & Renewable Energy (MNRE), Govt. of India. New Delhi has selected Chandigarh to be developed as Model Solar City in July 2009.This Master Plan for Solar City is a dynamic document meant to change with time, experience, and need. The development of master plan has benefitted from the collaborative participation of CREST, Public Works Department, Municipal Corporation UT, Chandigarh Administration, Municipal Water Supply Department, Forest Department, power utilities, electricity department of Chandigarh Administration; and other agencies with energy-related responsibilities. Development of a solar city requires an integrated urban planning approach, which simultaneously involves reducing reliance on fossil fuels by the application of energy conservation & efficiency measures and by replacing the conventional energy generation with the renewable energy.

Just 1 wind turbine can generate enough electricity to power 1,400 homes.

The key steps of the Model Solar City concept comprised:

- Base line determination
- Energy planning Energy use projections
- Energy efficiency measures and audit
- Utilization of available renewable energy sources .



Electricity Division wise map of Chandigarh

With the rapid urbanization in the city, there has been a gradual increase in the demand of electricity. In 2014-15, the electricity demand was 1471.66 Million Kilowatt Hour (M.kWh) and in 2017-18, it came up to be 1573.89. There has been an increase in demand of approximately 6.9% over the past five years.

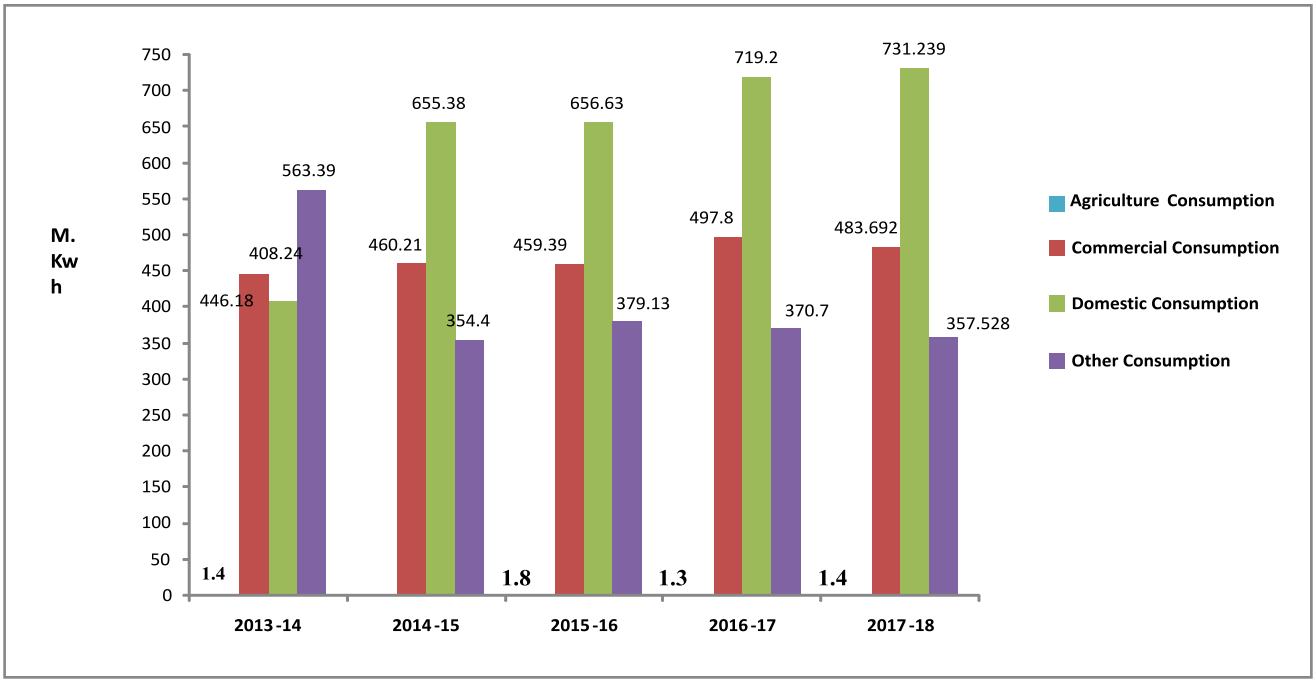
Year	Total Consumptions (M.KWH)
2014-15	1471.66
2015-16	1496.98
2016-17	1589.00
2017-18	1573.89

Source: Supdt. Er. Electy, 'OP' Circle U.T Chandigarh.

Kurnool, in Andhra Pradesh, is currently the site of the world's largest single-location solar park, which has a potential capacity of 1,000 mega watts.

Sector-Wise Electricity Consumption

As per census 2011 report, Chandigarh lies amongst the highly populous cities of India with a remarkable per capita income. Due to high living standards, the domestic consumption of electricity was observed to be the highest as compared to the other sectors. Agricultural sector of Chandigarh is shrinking day by day due to rapid growth and expansion of the city. With, merely 600 Hectare crop area, the agriculture sector of the city has the lowest electricity consumption, of just 14.6 lac units per annum. The major portion of the supplied electricity has been occupied by the domestic, commercial and other sectors such as Industries, Public Lighting, Educational & Medical Institutions, Govt. Buildings & offices etc. Sector wise annual consumption of electricity is given by the graph below-

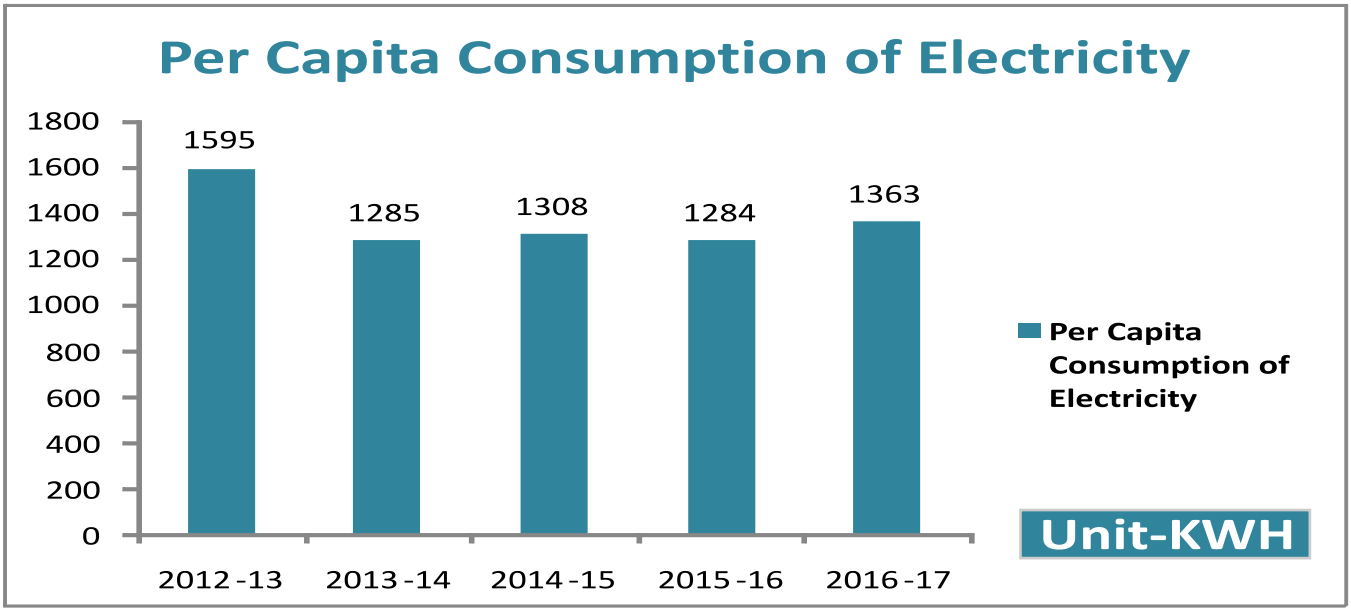


Source: Supdt. Er. Electy, 'OP' Circle U.T Chandigarh.

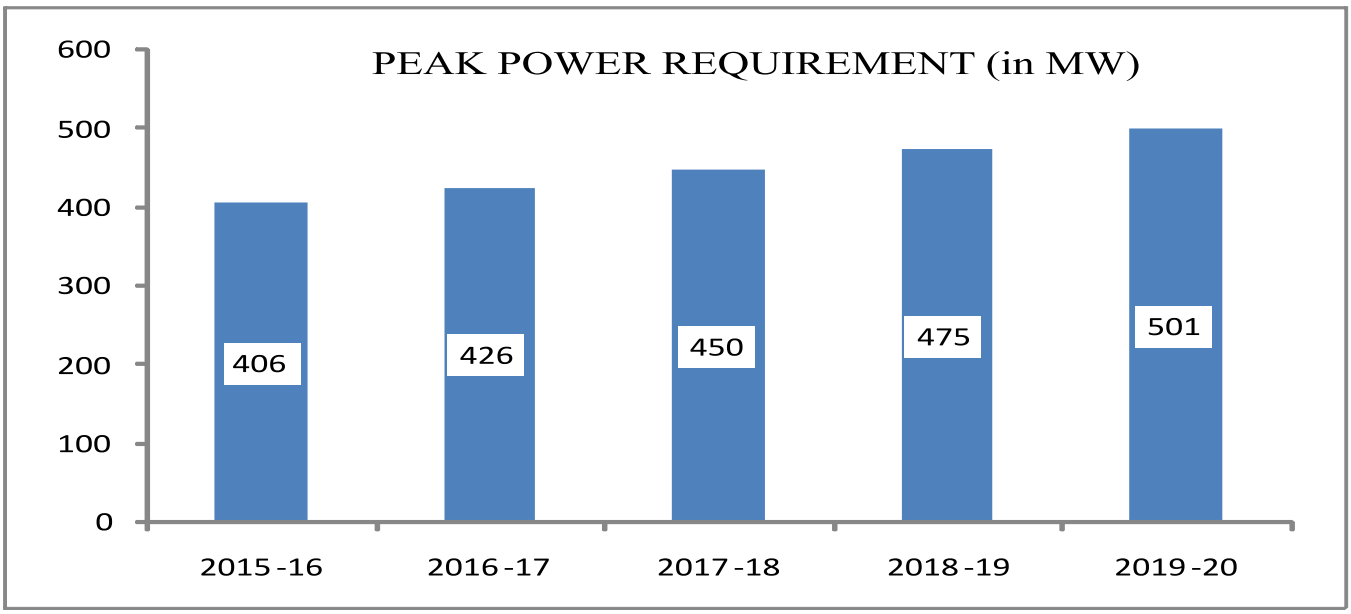
Per Capita Electricity Consumption in Chandigarh

Per-Capita Energy Consumption is one of the most used policy indicators, both at national and international levels. The UT of Chandigarh does not have any generation capacity of its own and most of the power/energy requirement is being met from the allocation of central generating stations. The energy and peak demand is well managed in the UT of Chandigarh as there is no shortage observed in peaking or energy requirement from last many years. The annual energy demand of the UT has been estimated to grow from level of 1734 MU in FY 2014-15 to 2328 MU by FY 2018-19 with prevailing rate of demand growth. The UT has already planned additional capacity availability of 157.27 MW by financial year 2018-19 through allocations from central generating stations, purchases from Independent Power Producers and through renewable energy sources in a phased manner.

India, is the world's 4th largest carbon emitter (after China, the U.S. and the EU) at present, and is one of the countries to have signed on the Paris Climate Agreement (2016).



Source: Supdt. Er. Electy, 'OP' Circle U.T Chandigarh.
Http://chandigarh.gov.in/engg_web/pages/about_us.html



Source: Chandigarh Electricity Department

POWER SUPPLY SOURCES

Generating Companies	Installed Capacity (in MW)	Total Allocation inc. unallocated quota (in MW)
NTPC (13)	11942	75
NPCIL (3)	1320	28
NHPC (11)	3885	37
THDC (2)	1400	12
BBMB (3)	2356	127
SJVNL (2)	1843	14
TOTAL (34)	22746	293

Renewable Energy creates 5 times more jobs than fossil fuels.

Power Shortage/Surplus (-/+)

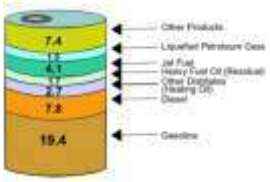
Sr. No.	Months	Availability of Power (in MW)
1	APRIL-SEPTEMBER	220-260 MW
2	OCTOBER-NOVEMBER	150-210 MW
3	DECEMBER-MARCH	130-190 MW
THE AVAILABILITY OF POWER HAS BEEN DETERMINED KEEPING IN VIEW THE OUTAGES (FORCED/PLANNED) AND THE INFLOW OF WATER TO VARIOUS HYDRO GENERATING PLANTS.		

HOW THE SHORTAGES BEING MANAGED ?	
BANKING ARRANGEMENT WITH J & K	30 MW
SHORT TERM POWER PURCHASE	40-80 MW
POWER EXCHANGE PLATFORM	NEED BASED

Energy Consumption Petroleum Products

Products	2012-13	2013-14	2014-15	2015-16	2016-17	Units
Petrol Incl. ULP	116921	82147	85161	142061	137065	Kilo-Litres
High Speed Diesel	91267	70651	82636	138776	123609	Kilo-Litres
Kerosene	3941	3037	2035	921	95	Kilo-Litres
Light Diesel Oil	573	479	447	502	571	Kilo-Litres
Furnace Oil	19827	29359	39975	63303	0	Metric Ton
Low Sulphur heavy Stock	643	0	0	0	11910	Metric Ton
L.P.G Connections	323685	343538	408289	425112	269584	No.s (Cum.)

Source:Statistical Abstract Chandigarh-2003,2006,2007,2008,2009,2010,2011,2012,2013,2014,2015



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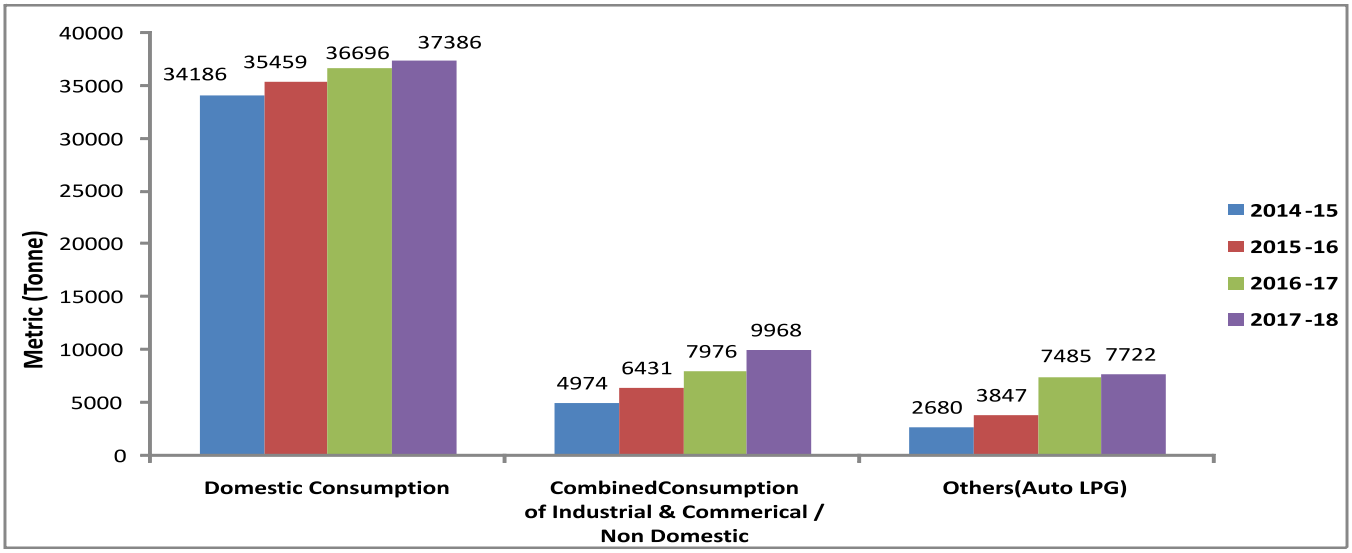
Solar power isn't just a daytime deal – power from the sun's rays can be stored in salt and used at night too. A power plant in Spain soaks up sun by day and pumps out 7 hours of power to the surrounding area by night.

Consumption of LPG

LPG is a type of conventional source and is the mainstay of Chandigarh's electricity requirement. It is the main source to fulfil energy requirement related to 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 has 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. 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. Maximum consumption of LPG has been seen in the domestic sector, followed by industrial and commercial consumption.



Number of LPG connections

Indian Oil Corporation

Year	No of Connections Released(IOC)	Customer Population(Lacs)(IOC)	DBC Population(Lacs)(IOC)
2013-14	17735	2.07	1.14
2014-15	8075	1.8	1.64
2015-16	12104	2.73	1.86
2016-17	10614	2.81	1.99
2017-18	7418	2.88	2.06

Source: Manager-SLC,UTC,HPCL,Chandigarh

Hindustan Petroleum Corporation

Year	No of Connections Released(HPC)	Customer Population (Lacs) (HPC)	DBC Population (Lacs) (HPC)
2013-14	1764	0.82	0.58
2014-15	1817	0.84	0.59
2015-16	2055	0.84	0.60
2016-17	1908	0.86	0.61
2017-18	1819	0.88	0.62

Source: Manager-SLC,UTC,HPCL,Chandigarh

Bharat Petroleum Corporation

Year	No of Connections Released(BPC)	Customer Population(Lacs)(BPC)	DBC Population(Lacs)(BPC)
2013-14	4011	0.54	0.35
2014-15	2401	0.55	0.35
2015-16	2664	0.58	0.42
2016-17	1329	0.59	0.40
2017-18	815	0.6	0.41

Source: Manager-SLC,UTC,HPCL,Chandigarh

Plan for Augmentation of Generation Capacity

The UT of Chandigarh is receiving power from 400/220 KV Nalagarh S/S of Power Grid Corporation of India Limited (PGCIL), from Mohali S/S of Punjab State Transmission Corporation Limited (PSTCL) and from Dhulkote S/S of Bhakra Beas Management Board. As per generation plan, UT of Chandigarh has already tied up for supply of additional capacity of around 118.27MW by FY 2018-19 (allocation from Central Sector and IPP Projects) through conventional energy sources. In addition, 39MW, through non-conventional energy sources is also tied up.

As such the total available capacity by FY 2018-19 is expected to be 496.94MW (452.62MW conventional and 44.32MW Renewable) (Source - 24x7 Power for all, Joint Initiative of GOI & UT, Chandigarh Constant efforts to achieve the aforesaid efforts are already under action. Year-wise targets are presented the following table-

S.No.	Particulars	Year wise Existing & Likely Capacity to be added (MW)-Cumulative				
		As on March 2015	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
A.		State Sector				
a.	Thermal	0	0	0	0	0
b.	Hydro	0	0	0	0	0
c.	RES (MNRE)	0	0	0	0	0
B.		Private/IIPs				
a.	Thermal	0	0	0	0	0
b.	Hydro	0	0	0	0	0
c.	RES (MNRE)	5.32	6.32	18.32	30.32	44.32
C.		Central Generating Station (CGS)				
a.	Thermal	67.64	67.64	67.64	129.16	129.16
b.	Hydro	240.26	280.26	280.26	297.01	297.01
c.	RES (MNRE)	0	0	0	0	0
D.	Nuclear	26.45	26.45	26.45	26.45	26.45
	Total:	339.67	380.67	392.67	482.64	496.94

SolarTargets Achieved by Chandigarh

The climate of Chandigarh is subtropical humid, thus high intensity solar light is available during most of the period throughout the year. Therefore, taking account of the benefits of a cleaner energy, Chandigarh has adopted a well structured plan to move forward in the field of generating solar energy using solar water heaters, solar lights, blinkers, solar cookers and electricity generation by solar panels etc. Chandigarh is leading towards a complete solar city concept and the administration has installed solar panels over the roofs of houses, commercial buildings schools, colleges, universities, hospitals and government offices etc. Solar lights has been installed at various places including parks, street lights at road sides and blinkers on the roads interconnecting different sectors of the city.

If taken advantage of to its fullest extent, sunlight beamed on the earth for 1 hourcould meet world's energy demands for an entire year!

Year	Solar Water Heating	Solar Cookers	Solar Street Lights	Blinkers	Battery Operated Vehicles	Solar Green House
2014-15	245,330	105	894	14	560	32
2015-16	245,330	105	894	14	560	37
2016-17	245,330	105	894	14	562	37
2017-18	245,330	105	894	14	567	37
Units	LPD	No.	No.	No.	No.	No.

Solar Renewable Power Obligation (RPO): Future Targets

Year	Energy Consumption (MU)	Energy Consumption excluding hydel power	Revised solar RPO	RPO (Solar Requirement) MU	SPV Capacity (MW)
2016-17	1841	644.35	2.75	17.72	13.63
2017-18	1948	681.8	4.75	32.39	24.91
2018-19	2062	721.7	6.76	48.71	37.47
2019-20	2182	763.7	7.25	55.36	42.58
2020-21	2309	808.15	8.75	70.71	54.39
2021-22	2444	855.4	10.5	89.81	69.08

MNRE has identified 60 cities in the country to be developed as solar city by 2012 as part of the National Mission of Solar Energy with Chandigarh being one of them in the northern region.

Chandigarh is among one of the 4 Model Solar Cities chosen by MNRE, GoI.

Chandigarh Renewable Energy and Science and Technology Promotion Society (CREST) under the aegis of Department of Science & Technology and Renewable Energy, Chandigarh Administration, has been appointed as the executing agency for MNRE (GoI) schemes & Renewable Energy projects in Chandigarh.

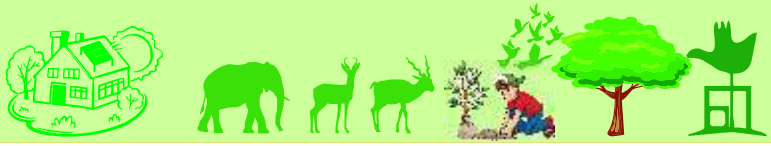
Master Plan for 10 years for Model Solar City was prepared by " The Energy and Resource Institute (TERI)", New Delhi.

Approved Master plan of 'Chandigarh Solar' City envisaged mid term target of 5 MWp Rooftop Solar (by 2017) and long term target of 10 MWp rooftop solar plants installation by 2022 to be achieved.

However, in view of enhanced target of 100 GW to be achieved by 2022 as recently announced by MNRE (GoI), Government of India, has set 50 MW as SPV target for Chandigarh Administration to be achieved by 2022.

Unique Achievement towards Rooftop SPV Systems

7.395 MWp SPV Power Plants have been installed at 8 nos. of Water Work Stations of MC, off-set with the conventional power consumption. Thus using 100% Green Power for pumping the water. SPV Power plants have been installed at all the 14 nos. of Govt. College which is off-setting the 100% in-house need. 80% schools have been covered with SPV power plants which meets the 100% requirement of power of the all the Govt. Schools. 500kWp SPV Power Plants have been installed at ISBT Sector-17 (300kWp) & ISBT, Sector-43 (200kWp) meeting their 100% in-house need. 10kWp Floating SPV Power plant has been installed at Dhanas Lake, Chandigarh for Aeration of the lake to improve the biological health condition of the lake.



This concept will prove to be extremely beneficial for Chandigarh, which is located in the sunny belt of the country and receives a good amount of solar radiation over the year. The Chandigarh Administration has got a DPR (Master plan for implementation of solar city program) prepared from TERI. The underlying philosophy of the concept of the Solar City is to ensure that the energy demand in will be met in affordable, technologically advanced, and environmentally friendly manner. It means that after cost effective efficiency and demand response, the city relies on renewable sources of power and distributed generation, to the extent possible.

Amendment of Building Bye-laws of Chandigarh:

Chandigarh has a well defined boundary of 114 sq. Km and almost all the area is covered under different land use patterns. Due to shortage of vacant spaces Chandigarh do not have any option for the installation of wind mills or wind turbines. Also, due to the absence of yearly river/stream; the hydro power generation can't be done in the city. Chandigarh also do not have any geothermal energy source or radioactive material site, therefore the only way out left for the city to get non-conventional energy is Solar light. Therefore, it becomes imperative for Chandigarh to adopt a well structured plan to move forward in the field of generating solar energy, using solar water heaters, solar lights, blinkers, solar cookers and electricity generation by solar panels etc.

Amendment dated: 18th May 2016 has been made to the existing building bye-laws of Chandigarh. It has been made mandatory to install SPV Power Plants on different categories of buildings as under:

Accordingly, 1498 number of more applications have been received from residential and Social/ Institutional Sector for 8.50MWp till 30th April 2019.

Sr. No.	Category	Capacity of SPV Power Plant
1	Residential Sector	All residential buildings above 500 sq. yard- min 1kWp
2	All private institutional sector having connected load of 30kW and above	Min 5 kWp or 5% of the connected load whichever is higher
3	All industrial or commercial establishments including private hospitals having connected load of 50kW or above	Min 10 kWp or 5% of the connected load whichever is higher
4	All new buildings to be Constructed by Housing complex, developed by Group housing societies and housing boards for plot size 0.5 acre and above	Min 10 kWp
5	All Government Buildings and offices etc having load 30kW and above	Min 2 kWp

Renewable energy is also called clean energy because it does not produce pollution.

Journey So far :

- Chandigarh is working with an approach to achieve solar targets at the latest and transform itself in a Smart Solar City. Master Plan of Chandigarh was approved by MNRE in Jan 2012, as per master plan long term target for installation of rooftop SPV Power plants was 10MWp till 2018.
- Chandigarh for that matter is well ahead in terms of achievement and has already installed & commissioned 26.069 MWp Grid tied Rooftop Solar plants as on 31st Dec, 2018 including Private Sectors.

Target 2020

In view of enhanced target of 100 GW for India to be achieved by 2022, Govt of India has set 69 MW as Solar PV target for Chandigarh Administration to be achieved by 2022, as a part of Model Solar City Programme under the aegis of National Solar Mission.

Sr. No.	Description	No. of Sites	Capacity Installed (MWp)
1	Govt buildings	261	17.981 MWp
2	Private buildings	961	8.088 MWp
	Total	**1222**	**26.069 MWp**

These 261 solar plants on Govt. Buildings/ Sites are as follows:

Sr. No.	Type of institution	No. of Systems	Capacity (kWp)
1	Govt. Colleges	14	2990
2	Govt. Hospitals	5	740
3	Govt Schools	81	3005
4	Other Govt. Buildings	82	11038
5	Govt. Residential Houses	78	198
6	Floating SPV Power Plant at Dhanas Lake, Chandigarh.	1	10
	Total	261	17981 kWp

We currently are not able to use more renewable energy sources because typically renewable energy is more expensive to produce than non-renewable sources.

Mission and Vision of Chandigarh Administration to Rooftop SPV

Chandigarh Administration is planning to install about 15 MW rooftop Solar plants over Raw Water Tank of sec-39 water works under RESCO mode and 2MWp on STP-3 BRD. In addition, 25.00 MWp SPV Power Plant on Patiala-ki-Rao,(a seasonal rivulet) in Chandigarh is also in pipeline.

On the initiative of UT administration, Joint Electricity Regulatory Commission for Goa & UT has notified a new Solar Tariff & Net metering Regulation for FY. 2016-17 & FY. 2017-18 wherein solar Tariff has been kept very attractive and is likely to motivate private residents to go for solar rooftop plants.

CREST has empanelled large no. of Solar Plant Installers/aggregators along with rates from whom any residents can install Solar plant and can avail 30% subsidy, as decided by MNRE, GOI.

A new online website/ software platform: www.solarchandigarh@gmail.com has been launched thereby providing ease of Business & transparency to all people of Chandigarh wherein they shall be able to obtain subsidy from CREST as well as all regulatory clearances from Electricity deptt. & electrical clearance from Electrical Inspector, within a fixed time through a single online platform for efficient installation of Solar Power Plants.

UT Chandigarh has recently 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.

Publicity through Newspaper, FM, advertisements in Movie Hall, Cable Operators, organization of camps in residential sectors etc.

CREST has made a HD quality Video film on massive deployment of Rooftop solar through Drone Videography and its video film has been widely appreciated. It has been loaded on You Tube at web address: **https://www.youtube.com/watch?v=19Bt69fsv-c&t=8s**

Awards/Recognition:

2015:

CREST has received following awards from the MNRE, Govt. of India on the First Foundation Day of Association of Renewable Energy Agencies of State (AREAS) on 27th August, 2015 at Bengaluru for its excellent performance in the field of Renewable Energy.

1. Second Prize for highest grid connected solar rooftop power capacity addition in the country.
2. Second Prize for second highest cumulative grid connected renewable power capacity amongst the UTs in the country.
3. Second Prize for installation of renewable power applications in its office building at Chandigarh.

2016:

CREST has received following National Excellence Awards from the MNRE, Govt. of India on 7th June, 2016 at Vigyan Bhawan, New Delhi for its excellent performance in the field of Solar Energy.

Unlike fossil fuels, renewable sources of energy like hydropower, wind and solar do not directly emit greenhouse gases

1. National Excellence Award 2016 for Rooftop Solar Projects as number one Solar City of the Country.
2. National Excellence Award 2016 to CREST as top performing State Nodal agencies for Renewable Energy among UTs & special category states.

2017:

As on 31st Dec, 2018, Chandigarh has already generated 56.16 MU of solar energy (in about last 5 years) which is equivalent to reduction of 38750 metric ton of CO_2. Thus, CREST is marching fast towards harnessing the solar energy and making the UT Chandigarh 100% Renewable Energy dependent in near future.

तामस्य रीतिं परशोरिव प्रत्यनीकमरव्यं भुजे अस्य वर्पसः।
सचा यदि पितुमन्तमिव क्षयं रत्नं दधाति भरहूतये विशे।।

The beautiful form of heat of the sun, like the sharp fire which pierces like an axe, is to give the human glory if we harness that solar energy.

Rigveda 5.48.41.