Ministry of Health and Family Welfare
Government of India

Guidelines for Green and Climate Resilient Healthcare Facilities

February 2023

National Health Mission
राष्ट्रीय स्वास्थ्य मिशन

National Programme on Climate Change and Human Health

National Centre for Disease Control
Government of India

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Abbreviations

AC	Air Conditioner
ASP	Activated Sludge Process
BMW	Bio Medical Waste
CBMWTF	Common Bio Medical Waste Treatment Facility
CFC	Chlorofluorocarbon
CHC	Community Health Centre
CPCB	Central Pollution Control Board
CPWD	Central Public Works Department
CSSD	Central Sterile Service Department
CFL	Compact Fluorescent Light
CTF	Common Treatment Facility
DH	District Healthcare Facility
ETO	Ethylene Oxide
ETP	Effluent Treatment Plant
EPP	Environmentally Preferable Purchasing
GRIHA	Green Rating for Integrated Habitat Assessment
GWU	Green Waterless Urinal
HDU	High Dependency Unit
HCAI	Healthcare Associated Acquired Infection
HCF	Healthcare Facility
HFC	Hydrofluorocarbon
HMIS	Health Management Information System
HVAC	Heating Ventilation and Air Conditioning
HWC	Health wellness Centre
ICU	Intensive Care Unit
IPD	Inpatient Department
IPHS	Indian Public Health Standard
IEC	Information, Education and Communication
ICC	Infection Control Committee
ICT	Infection Control Team
LED	Light Emitting Diode
MIS	Management Information System
MBBR	Moving Bed Biofilm Reactor
OPD	Outpatient Department
OT	Operation Theatre
PPE	Personal Protective equipment
PHC	Primary health Centre
PVC	Poly Vinyl Chloride
STP	Sewage Treatment Plant
SC	Sub Centre
TSSU	Theatre Sterile Supply Unit
VOC	Volatile Organic Compound
VLT	Visual Light Transmittance

Acknowledgement

These comprehensive Green and Climate Resilient Healthcare guidelines have been prepared to support the strengthening of the healthcare system in India under National Programme on Climate Change and Human Health (NPCCHH). This updated version, focuses on environmentally friendly, sustainable, structural, and functional adaptations for health facilities. By guiding efforts on energy conservation and energy transition, it is envisioned to contribute towards India's greenhouse gas reduction goals and towards resilient health service delivery especially during extreme weather events.

We would like to extend our gratitude towards UNICEF, India Country office WASH team in preparing the guidelines. Their diligent efforts have brought together technical knowledge from health and diverse non-health disciplines. We would also like to thank all the members of Technical Expert Group (TEG) on Green and Climate Resilient Health Facilities who provided valuable inputs and suggestions.

We hope that these guidelines will be useful for health administrators and medical and public health professionals to get an overview of green measures i.e., environmentally friendly and sustainable, that can be adopted and prioritized to strengthen health facilities to withstand impacts of climate change, dynamic population and align with the 100-year vision for the country to avail best facilities both in the villages and the cities.

About National Programme on Climate Change and Human Health

National Programme on Climate Change and Human Health (NPCCHH) is a flagship programme of the Ministry of Health and Family Welfare (MoHFW), strengthening health system response to climate change in the country. The goal of the programme is to reduce morbidity, mortality, injuries, and health vulnerability to climate variability and extreme weather events. The actions being taken under the programme include increasing general awareness, building capacity of health care workforce, and strengthening the health systems structurally and functionally. This will strengthen our health system's adaptive capacity to increasing and compounding impacts of various climate-sensitive diseases and health impacts ranging from increased vector and water borne diseases, food insecurity, heatwaves, flooding, and other extreme weather events.

This guideline addresses one of the key components under the aegis of NPCCHH for which funds are being allocated through National Health Mission's Programme Implementation Planning (PIP) process. These green (Environmentally friendly and sustainable) measures to be implemented at health care facilities include;

a. Energy audit
b. Installation of LED lighting
c. Installation of solar panels
d. Water conservation measures, mainly rain water harvesting

Green and Climate Resilient Healthcare System Guidelines

"Climate-resilient and environmentally sustainable health care facilities anticipate, respond to, cope with, recover from and adapt to climate-related shocks and stresses, while minimizing the negative impacts on the environment and leveraging opportunities to restore and improve it, so as to bring ongoing and sustained health care to their target population and protect the health and well-being of future generations." (WHO)

As the climate continues to change, risks to health systems and facilities including hospitals, clinics, and community care centres are increasing, reducing the ability of health professionals to protect people from a range of climate hazards. Health care facilities are the first and last line of defence to climate change impacts as they can be responsible for large emissions of greenhouse gases (GHGs), and also because they provide the needed services and care to the people harmed by extreme weather and other long-term climate hazards.

Experts, including the United Nations, have long recognized and advocated for the impact of climate change on the status of population health and access to critical services. Recently, more than 200 global medical journals have acknowledged that climate change is the 'greatest threat' to global public health[1]. Therefore, this focus on developing a healthcare infrastructure that is environmentally friendly and promotes good health for the patient is timely and has the potential to be lifesaving.

About the Guidelines

This guideline covers the followings domains: energy efficiency, water conservation, and smart building. Though there is some documentary evidence present for all the above-mentioned components but a single document providing a comprehensive view for the above areas was not available. Keeping this view in mind and to facilitate the implementation of NPCCHH, these components are presented in the form of chapters and suggested user-friendly strategies to make the healthcare facility Green. Each chapter is divided into key guiding principles and under each guiding principle, certain standards and indicators have been proposed.

To better inform the green and climate resilient practices, a thorough literature review was conducted of national and international guidelines (Association of Healthcare Providers, BREEAM, Indian Green Building Council, Leadership in Energy and Environmental Design, GRIHA (Green Rating for Integrated Habitat Assessment etc.) and adapting the standards and benchmarks to the Indian context.

Using the Guidelines

The document can be utilized by all stakeholders when investing in green and resilient healthcare infrastructure across India. Under the NPCCHH, the document is to support all the functionaries at the state, district, and sub district levels including the State Nodal Officers, District Nodal Officers, Consultants, Medical Officers and all the other staffs associated with the healthcare delivery system in the District Hospitals, CHCs, PHCs, and Health and Wellness centres. Further, the larger public health community may also refer to the guidelines for knowledge building and sharing purposes. Additional resources for reference-

Kayakalp Guidelines- http://qi.nhsrcindia.org/kayakalp-guideline-2021
IPHS- https://nhsrcindia.org/IPHS2022/iphs-2022-guideline

[1] https://www.nejm.org/doi/full/10.1056/NEJMe2113200?query=featured_home

Green and Climate Resilient Healthcare Facility

Green or sustainable building is the practice of designing, constructing, operating, maintaining, and removing buildings in ways that conserve natural resources and reduce pollution. Green component in health care facilities provides an opportunity to enhance environmental performance while reducing the GHG emissions of the healthcare sector.

Energy Efficiency:

This chapter focuses on the energy conservation strategies that will be adopted by the healthcare facility to cut down their operational costs, reduce the emission of greenhouse gases, and protect public health from the impact of climate change.

Water Conservation:

This chapter focuses on water conservation strategies that will help the healthcare facilities to utilize water optimally and run efficiently at the time of water scarcity.

Smart Building:

This chapter focuses on strategies to make a healthcare facility a smart building that includes the proper department planning *(reduces the unnecessary movement of staff)*, strategies to make the building fire-resistant, and patient-friendly that helps to provide privacy, comfort, safety, and security to the patients.

Green Healthcare Facility:

This chapter focuses on landscaping, technology-based operations, and the use of green building material that reduces the overall impact of the built environment on human health, Green procurement for the minimization of waste, and promotes stress-free environment in the healthcare facility.

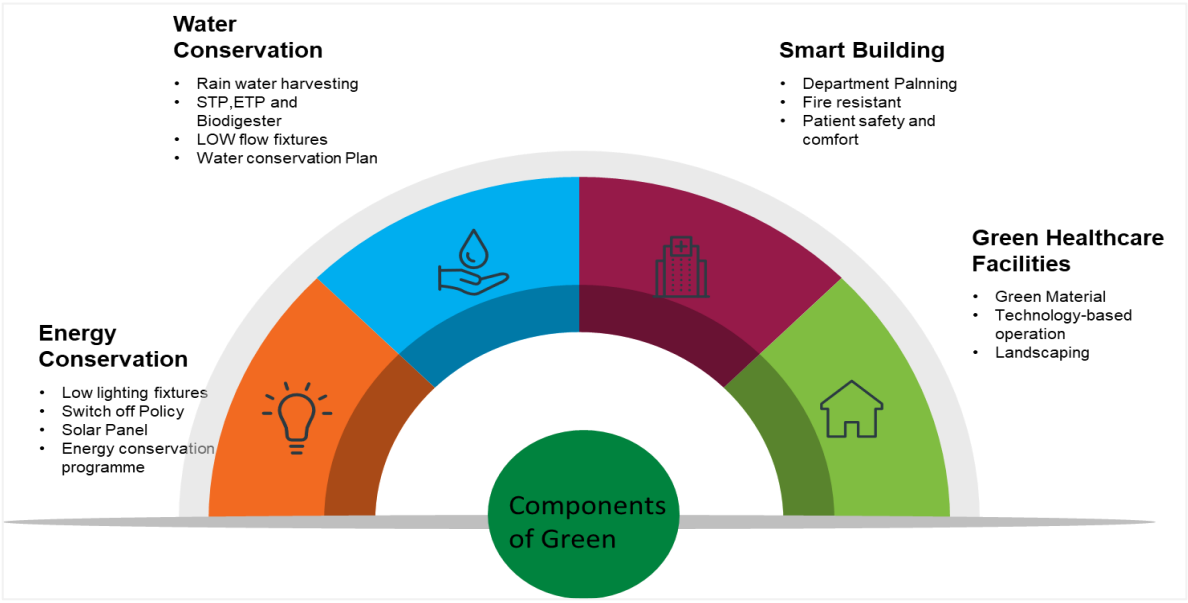

Figure1: Components of Green and Climate Resilient Healthcare Facility

CHAPTER

01

ENERGY EFFICIENCY

1.1 The global problem

Healthcare industry is amongst the largest employers in India and is also the largest in terms of revenue and growth. Indian healthcare facility is increasingly becoming a global destination for medical and patient care. There is a continuous growth of infrastructure to support the industry, resulting in increased energy use in the healthcare facilities. So, the demand growth of power in the healthcare facility sector would be over 8,500MW[2] per year. This would mean a capacity addition of over 40,000 MW. This statistic indicates that the healthcare facility is energy intensive. Further, in order to make this sector climate smart and reduce the carbon foot print, following aspects are to be considered for adoption in the health care facilities.

1.2 Need for energy efficiency

Present power system is insufficient to fulfil the existing demand. Thus, one of the ways for managing the current shortage and the future need for power is efficiency enhancement and conservation of energy. In the hilly or remote areas, there is an insufficient supply of energy due to the difficult geographic conditions, so, in such places, it becomes more important for us to conserve energy resources so that conservation plans can be easily implemented in hilly or remote areas.

Figure 2: Solar Panel, District Healthcare Facility, Bijapur, Chhattisgarh

[2] Healthcare Facility Energy Efficiency Best Practice Guide 2017

1.3 Importance of energy efficiency in healthcare sector

65% of energy consumption occurs by lighting, water heating, cooling and ventilation

In a healthcare facility, 65% of energy consumption occurs by lighting, water heating, cooling, and ventilation, therefore, it is essential for the construction of healthcare facilities to involve incorporation of green design and concepts into the process to reduce the impact on the environment, cut down operational cost and increase energy efficiency. Greater energy efficiency, lesser will be the emission of greenhouse gases, and it protects public health from the impact of climate change.

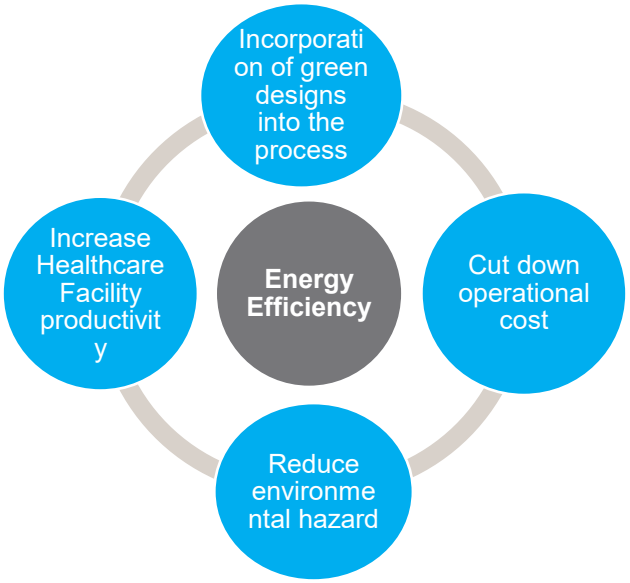

Figure 3: Benefits from Energy Efficiency

1.4 Energy contributors to the healthcare facility

Energy consumption in the healthcare facility is 3 KW per bed per day as per IPHS. The healthcare sector is the largest consumer of electricity within which heating consumes [3]43% of total energy, and lighting consumes 21% of the total energy.

While cooling, refrigeration, office equipment, and others consume more than 50% of the total energy in the healthcare facility, thereby, maximum energy savings at the facility level can be achieved by focusing on the major energy contributors.

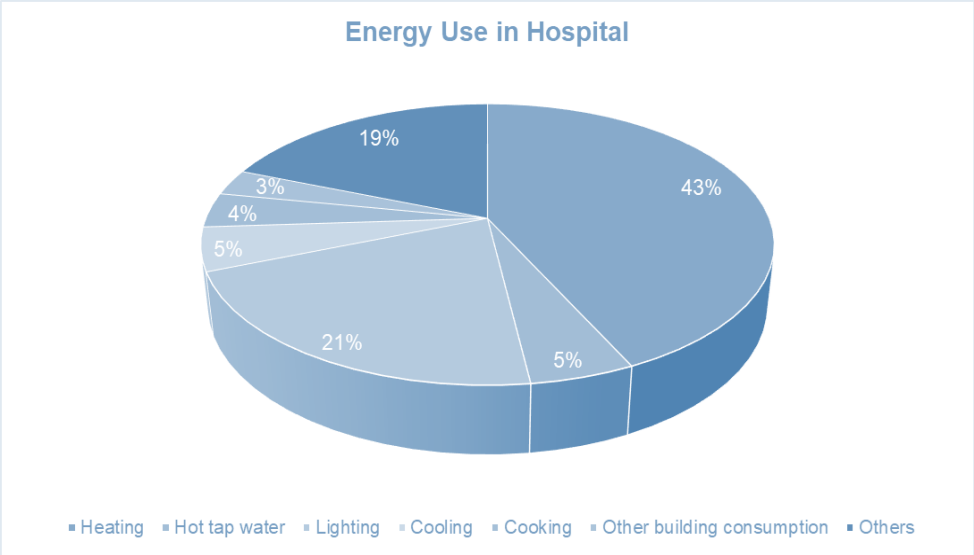

Figure 4: Major contributors of energy in the facility

[3] Source: ECN 2002
https://electrical-engineering-portal.com/energy-efficency-in-Healthcare Facilitys-part-1

Key guiding principle for energy conservation

GP1.1 The healthcare facility shall develop a strategy for the optimum usage and conservation of energy

S1.1.1 Healthcare facilities shall have a key process for energy savings

S1.1.2 Healthcare facilities shall have a policy of using and purchasing energy efficient equipment and devices

S1.1.3 Healthcare facilities shall develop a plan for the use of alternative sources of energy

GP1.2 The healthcare facility shall ensure energy audits of the building

S1.2.1 Healthcare facilities shall develop a plan for the energy audit to assess the level of energy consumption.

GP1.3 Healthcare facilities shall have an ongoing education program for efficient usage and conservation of energy for all the stakeholders (Staff, Patient, and Visitors)

S1.3.1 The healthcare facility shall have a plan to train the staff for energy savings techniques

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1.5 Guiding principle

GP1.1 The healthcare facility shall develop a strategy for the optimum usage and conservation of energy

S1.1.1 Healthcare facilities shall have key processes for energy savings

Public health facilities should have access to adequate, affordable, and reliable electricity supply.

A. Switch off policy

Organize awareness campaigns, and regular meetings in the healthcare facility to make the staff aware of the energy savings and place suitable stickers above light switches and posters in the staff areas.

Adequate use of natural lights/day light should be ensured.

B. Regular walk rounds

Identify a person who can be responsible for going around at set times during the day to check the lighting.

Ward in charge/unit in charge can check all the department during the rounds at the end of the day and switch off all the equipment when not in use and enable power-down modes. Defining and following "lights out" hours for different areas of the healthcare facility should be practiced. Natural lightning should be focussed upon and use of artificial lights should be limited

- Label light switches- Help staff to select only those lights they need, by labelling light switches suitably.
- Lights in unoccupied areas should be switched off.
- Switches to be made accessible to the patient for easy access

C. Maintenance

Regular maintenance of the equipment should be done; without regular maintenance, illumination levels can fall by 30 % in 2-3 years. Keep windows, skylights, and light fittings clean. Replace old, dim, or flickering lamps with the new LEDs. Encourage staff to report maintenance issues. This will help maintain desired light output and, in turn, provide a safer, more attractive environment for both staff and patients.

S1.1.2 Healthcare facilities shall have a policy of using and purchasing energy-efficient equipment and devices.

A. LEDs

Lighting is a critical factor in a healthcare facility environment. It is of great importance and must satisfy the needs of the patients, visitors, as well as those of the medical and nursing staff in terms of providing good patient care and quality treatment. Various areas of the health care facility require different types of lights in terms of intensity, quality, power requirements, and fitments.

Lighting is required to ensure proper illumination in the healthcare facility; however, lights used in the facility should be energy efficient. If a facility uses an incandescent bulb that consumes more energy, it and puts a financial burden on the facility.

Replace these bulbs with LEDs that consume 75% less energy than the incandescent lightings and have a longer life span. Also, LED bulbs consumes less than a third of energy consumed by fluorescents and seven times less than incandescent bulbs. Each LED light will save approximately INR 700-1400 over the course of a year.

Lighting calculation based on the categorization of the facility:

Sub Centre

Table 1: Lighting calculation for sub-centre

S. No.	Area	Space requirement	Illumination required	Wattage required	No. of LED requirement
1	Labour room	4050mm x 3000mm	500 lux	16 watts	6 (Dome light as per no. of table)
2	Clinic room	3300mm x 3300mm	300 lux	16 watts	4
3	Examination room	1950mm x 3000mm	500 lux	12 watts 8 watts	4 (12 W) 2 (8 W)
4	Pharmacy	3000x3000mm	300 lux	16 watts	4
5	Waiting area	3300mm x 2700mm	150 lux	16 watts	4
6	Toilet	1950mm x 1200mm	300 lux	10 watts	1
7 Residential Accommodation					
7.1	Room- 1	3300mm x 2700mm	*NA*	12 watts	4
7.2	Room-2	3300mm x 2700mm	*NA*	12 watts	4
7.3	Kitchen- 1	1800mm x 2015mm	*NA*	12 watts	4
7.4	W.C.	1200mm x 900mm	*NA*	10 watts	1
7.5	Bath Room	1500mm x 1200mm	*NA*	10 watts	1

Source: IPHS for Sub centre

Primary Health Centre

Table 2: Lighting calculation for PHC

S. No.	Area	Space requirement	Illumination required	Wattage Required	No. of LED requirement
High-Risk Areas					
1	Labour room	3800x4200mm	500 lux	16 watts	6 Dome light (as per no. of table)
Moderate Risk Areas					
2	Waiting area	3000 x 3500 mm	150 lux	16 watts	4
3	Ward	5500x3500mm	300 lux	16 watts	6
4	Clinic room	3300mm x 3300mm	300 lux	16 watts	4
5	Examination room	1950mm x 3000mm	500 lux	12 watts 8 watts	2 (12 W) 2 (8 W)
6	Laboratory	3800x2700mm	300 lux	16 watts	4
7	Dispensing cum store area	3000x3000mm	300 lux	16 watts	4
Low-Risk Areas					
8	Office room	3500x3000mm	150 lux	16 watts	4
9	Immunization/ counselling area	3000x4000mm	300 lux	16 watts	6

Source: IPHS for Primary Health Centre

Community Health Centre

Table 3: Lighting calculation for CHC

S. No.	Area	Space requirement	Illumination required	Wattage Required	No. of LED requirement
High-Risk Area					
1	Casualty	6400mm X 6400mm	300 lux	16 watts	6
3	Labour room	3800x4200mm	500 lux	16 watts	6
4	Operation theatre	247 m²	1,60,000 lux	24 watts	6 (Luminaire OT light as per the no. of table)
Moderate risk area					
5	Examination & Workup room	a. 3200mm X4000mm (Space for four general Doctor Room) Space for 2 AYUSH doctors Room 3200mm X 3200mm X2800mm	500 lux	16 watts	6
6	Cold Chain, Vaccines and Logistics area,	Public Utility / Common Toilets Waiting Area Cold Chain Room 3500mmx3000mm Vaccine and Logistics Room 3500mmx3000mm	300 lux	16 watts	4
7	Pharmacy cum store	6400mmX3200 mm	300 lux	16 watts	6
8	Pharmacy cum store for AYUSH	6400mmX3200 mm	300 lux	16 watts	6
9	Laboratory (sample collection, bleeding room, washing disinfections storage, sub waiting)	3800mmx2700mm	300 lux	16 watts	6
10	Inpatient Nursing units) Nursing station (Nurse desk, clean utility, treatment room,	Nursing station 6400mm X 6400mm 4 wards each with six beds (2	500 lux	16 watts	6

	pantry, store, a sluice room, trolley bay)	male wards & 2 female wards) size (6200mm X 6200mm)			
11	Private rooms with toilets	4 private room (2 each for male & females) with toilets 6200mm X 3200mm X 4000mm	300 lux	12 watts 10 watts	4 (12 watts) 1 (watts)
12	Isolation rooms with toilets	Isolation rooms with toilet (one each for male & female) 6200mm X 3200mm X 2000mm	500 lux	12 watts 10 watts	4 (12 watts) each room 1 (10 watts) in toilet
Low-Risk Area					
13	Consultation (consultation room Toilets, sub waiting)	3700mmX 3200mm X 8000mm Treatment room 3700mm X 3200mm	500 lux	16 watts	4
14	General store	1800mm x 2515 mm	150 lux	12 watts	4

Source: IPHS for Community Health Centre

District Healthcare Facility

Table 4: Lighting calculation for DH

S. No.	Area	Space requirement	Illumination required	Wattage Required	No. of LED requirement
High-Risk Area					
1	Casualty and outpatient department	7830mm x 9000mm	300 lux	16 watts	6
2	ICU/HDU	22 m²	300 lux for each bed	16 watts	8
3	Labour room	3800mmx4200mm	500 lux	16 watts	6 (Dome light as per the no. of table)
4	Radiology (x-ray room)	38-42 m²	500 lux	12 watts	6
5	CSSD	70.7 m²	200 lux- 500 lux	16 watts	10
6	**Operation Theatre** Operating room (Major) Minor OT				
		36-48 m²		24 watts	6
		6000mm x 7000mm		24 watts	6
		9260mm x 4000mm		16 watts	6
				10 watts	4

	Pre and Post-Operative room	6 m²	1,60,000 lux	12 watts	2
	Scrub area	10 m²		10 watts	6
	Dirty Utility	20-40 m²		16 watts	4
	Sterile storeroom	5370mm x 7100mm		16 watts	4
	Doctors Lounge	10-30 m ²		10 watts	4
	Change room				
Moderate Risk Area					
7	Wards	412 m² as per 30 beds in one Ward	300 lux	16 watts	6
8	Clinic room	3300mm x 3300mm	300 lux	16 watts	6
9	Examination Room	1950mm x 3000mm	500 lux	16 watts	6
10	Laboratory	3800mmx2700mm	300 lux	16 watts	6
11	Blood Bank	6100mm x 4000mm	300 lux	16 watts	6
12	Pharmacy	8190mm x 5050mm	300 lux	16 watts	6
Low-Risk Area					
13	Reception and waiting area	70 m²	150 lux	16 watts	4
14	Laundry	45m² (as per bed101)	150 lux	12 watts	4
15	Kitchen	50 m²	150 lux	16 watts	4
16	Post-Partum unit	6200mm x 6200mm	300 lux	16 watts	4
17	Physical Medicine and Rehabilitation	6400mm x 3200mm	150 lux	16 watts	4
18	Store room	3000x3000mm	150 lux	12 watts	4

Source: IPHS for DH

B. Occupancy sensors

- Install occupancy sensors that ensure that light only operates when there is someone to utilize it.
- The occupancy sensors can be used in office areas, toilets and washroom facilities, and storerooms.

Occupancy sensors can also be used to lower light levels in the corridors at the night time, which can be an effective cost-saving measure; however, it is imperative to maintain minimum light levels so as not to compromise health and safety standards. These measures not only save energy but also help to prevent the spread of disease because the staff no longer needs to touch switches.

Please note: Occupancy sensors may not be appropriate for wards and in-patient rooms. It can be installed in those areas where people may not frequently be moving, such as doctor and administration offices, and non-patient floors and hallways.

C. Refrigeration equipments

The facility should be environment friendly and energy efficient. Refrigerants used in the Heating, Ventilation and Air-conditioning (HVAC) equipment should be CFC (Chloro Fluoro Carbon) free, with a low Greenhouse Warming Potential (GWP) when available.

When choosing the technology, guidelines and standards issued by Ministry of New and Renewable Energy (Gazette of India April 16, 2018, No 1456)

Maintenance: Electrician/ mechanical in charge Heating Ventilation and Air Conditioning (HVAC) l of the healthcare facility should regularly monitor the door seals of cold rooms, fridges, and frozen stores and replace them if damaged. Keep condensers and evaporators coils clean and free of dust. Filters should be changed regularly to help keep the ice maker and water dispenser clean, inspect the gasket frequently for signs of wear and tear. Facility should ensure the AMC/CMC for the maintenance of the refrigerator.

Temperature control: Maintain the correct temperature of the cooling equipment and avoid over-cooling. Refrigerated equipment should be maintained at the correct temperature. It's better for the stored contents and for energy savings.

D. Energy-saving equipments

Use above three-star rating electrical equipments including computers, monitors, printers, scanners, external power adaptors, copiers, fax machines, digital duplicators, mailing machines, and water coolers, room air conditioner, refrigerator, and lighting equipment. ENERGY STAR-qualified office and imaging products consume 30 to 75% less energy than the standard equipment.

The healthcare facility should have the policy to purchase BEE labelled/ISI Marked office equipment and appliances.

Implementation Details

Implementing Partners: MoHFW; Bureau of Energy Efficiency (BEE) and Ministry of Power

State and District Nodal Officers are recommended to coordinate with BEE to conduct energy audits and energy conservation planning.

- District Nodal Officer-Climate Change (DNO-CC) should submit a proposal to conduct the replacement of existing lighting with LED in healthcare facilities (PHC and above) through District Nodal Agency of Bureau of Energy efficiency (BEE).
- If the District Nodal Agency of Bureau of Energy efficiency (BEE) is not available, DNO-CC has to submit the proposal through the State Nodal officer Climate Change. SNO-CC will further submit the proposal to the State Nodal Agency of Bureau of Energy efficiency (BEE).
- If the proposal has been approved, State/District Nodal Agency of Bureau of Energy efficiency (BEE) in the district themselves will conduct the activity.
- If the budget for this activity is not available through BEE, then the budget can be proposed under Green Healthcare Infrastructure in NPCCHH Programme under NHM.
- DNO-CC has to monitor the activity and should submit a report to SNO-CC and subsequently to NCDC.

S1.1.3 Healthcare facilities shall develop a plan for the use of alternative sources of energy.

A. Photovoltaic solar panels

Installing PV solar panels reduces electricity consumption and helps to decrease the peak demand of a facility, which contributes to lower operating costs for the organization has, and hence these saved costs can be utilized for better patient care. Installing solar panel will help to cut down electricity bill by 15-20% and will be more environment friendly. Use PV solar panels on the roof for onsite renewable energy generation.

Solar Panels

PV (Photovoltaic) solar panels converts sunlight into the electricity, and the electricity generated from solar panels can be used in the Healthcare Facility on critical loads. Healthcare Facilities both in urban and rural areas consume a lot of energy throughout the day as the electrical equipment used directly or indirectly to treat patients requires uninterrupted power. Many Healthcare Facilities have considerable unused rooftop space.

Combined with power shortages and rising cost of diesel, rooftop solar power makes a compelling case for implementation in Healthcare Facilities.

Location of the installation:

Solar panels should be installed in unused spaces like the roof of the facility.

Capacity of the solar panel:

The proposed capacity of the solar panel is calculated as per the 2-3 KW per bed per day as per the IPHS standard. The capacity will vary according to the bed capacity of health facility.

Table 5: Proposed Capacity of Solar Panel

S. No	Type of Facility	Proposed Capacity
1	District Hospital	300 KW
2	Community Health Centre	90 KW
3	Primary Health Centre	18 KW
4	Urban Primary Health Centre	18 KW
5	Sub Centre	3 KW

This calculation is as per the 100 beds:
Energy consumption per bed per day is 3 KW as per the IPHS for district healthcare facility (100 bedded) energy consumption is 300 KW

The proposed capacity of the solar panel shall supply electricity to all the critical departments like OT, LR, ICU, SNCU and others life support system/equipment, HMIS for the smooth operations of the departments and hospital in case of power failure.

Maintenance of Solar Panel:

- **Cleaning:** To remove a layer of dust, panels are simply washed with soft water. If the module has thick dirt or grime and bird droppings, which are harder to remove, cold water is used, and the panel surface is cleaned with a sponge. Sometimes, soft

detergents are also used along with water for easier cleaning. Metal brushes should be avoided to prevent wearing of the panel surface.

- **Defect Checking:** A visual inspection of the modules is done periodically to look for possible defects such as cracks, chips, de-lamination, fogged glazing, water leaks, and discolouration. If any obvious defects are found, their location is noted down in the system logbook so that they can be monitored for generation output. If the damage causes the modules to perform lower than the rated value, they should be replaced.
- **Structure Stability**: Solar module mounting frames are examined to make certain that the frames and modules are firmly secured, and mounting bolts are rust free. Junction boxes are inspected to ensure that the wires are not chewed by rodents or insects.
- **Inverter / charge controller:** This component is maintained by minimizing dust accumulation. A dry cloth is used to wipe away any accumulated dirt/dust. After which a visual inspection ensures that all the indicators such as LED lights are working and the wires leading to and from this device are not loose. If self-checks are done, note that the charge controller should indicate that the system is charging when the sun is shining.
- **Wiring and connection:** Wiring installations are regularly checked for any cracks, breaks or deterioration in the insulation. Panel boxes are scrutinized to prevent the box becoming a home for rodents and insects. Moreover, the connections are inspected for corrosion and/or burning.

Figure 5: Solar Panel, District Healthcare Facility, Bijapur, Chhattisgarh

Case Study: Solar Operated Water Cooler of CHC Bairamgarh, Chhattisgarh

. The facility has a water cooler near to Nutrition Rehabilitation Centre (NRC) to cater to the needs of patients and staff. It is a solar operating system which runs on a renewable source of energy that helps to reduce the dependability on the conventional source of electricity. Facility is maintaining it from the Jeevan Deep Samitis fund in case of any breakdown.

Once a month cleaning and testing of water (Ph, TDS testing) is being done to ensure the clean and safe drinking water. Block Program Manager posted at the facility is responsible to look after its cleaning and maintenance.

Figure 6: Solar operated water heater, CHC Bairamgarh

Implementing Partners: Ministry of Health and Family Welfare, Ministry of Environment and Climate Change, and Ministry of New and Renewable Energy

State and District Nodal Officers are recommended to consult with the nodal department responsible for solarization in the state for solarization of HCF.

If solar power is used as backup, ensure connectivity of services of prime importance – emergency, OPD, delivery, freezer for cold chain maintenance (vaccines), baby care centres (new-born care corners). Solar water heating is another way to use solar energy in HCF apart from solar photovoltaics for power generation.

Procedure

- District Nodal Officer-Climate Change (DNO-CC) should submit a proposal to conduct installation of solar panels in healthcare facilities (PHC and above) to District Nodal Agency of Bureau of Energy efficiency (BEE) /Renewable Energy Development Authority (REDA) in the District.
- If the District Nodal Agency of Bureau of Energy efficiency (BEE) and Renewable Energy Development Authority (REDA)is not available in the district, DNO-CC has to submit the proposal through the State Nodal officer Climate Change. SNO-CC further submit the proposal to the State Nodal Agency of Bureau of Energy efficiency (BEE) or Renewable Energy Development Authority (REDA)
- If the proposal is approved, State/District Nodal Agency of Bureau of Energy efficiency (BEE) or Renewable Energy Development Authority (REDA)in the District themselves will conduct the activity in Districts.
- 20-30% subsidy will be obtained from MNRE and the remaining money may be proposed under the budget Head of Greening under the National Programme on Climate Change and Human Health in the NHM PIP Process by the District.
- DNO-CC is to monitor the activity and should submit a report to SNO-CC and subsequently to NCDC.

GP1.2 The healthcare facility shall ensure energy audits of the building.

S1.2.1 Healthcare facilities shall develop a plan for the energy audit to assess the level of energy consumption.

Energy Audit is the key to a systematic approach for decision-making in energy management. It attempts to balance the total energy inputs with its use and serves to identify all the energy streams in a facility.

Energy Audit should also consider load management, poor maintenance aspects, and extreme temperature to avoid fire-related accidents. Audit should be conducted in the facility biannually.

A. Identification of person

Responsibility for the energy audit should be given to the Infection Prevention and Control Committee of the facility. If the healthcare facility lacks qualified staff, then the energy audit can be conducted by the state health department as well.

Infection Prevention and Control Committee constitutes qualified and trained personnel for the audit process. Committee members should possess proficient computer skills, a basic

understanding of the functioning of the healthcare facility, abilities to build energy systems, and skills to conduct an energy survey.

B. Energy audit process

An energy audit:

- Identifies all energy end-uses within the building
- Estimates how much energy is used in each department
- Determines the amount of energy used in relation to the desired values

When the energy audit is carried out, it always results in a certain amount of detailed information about different energy end-uses, and specify the energy efficiency opportunities, and the potential energy savings for the end-users.

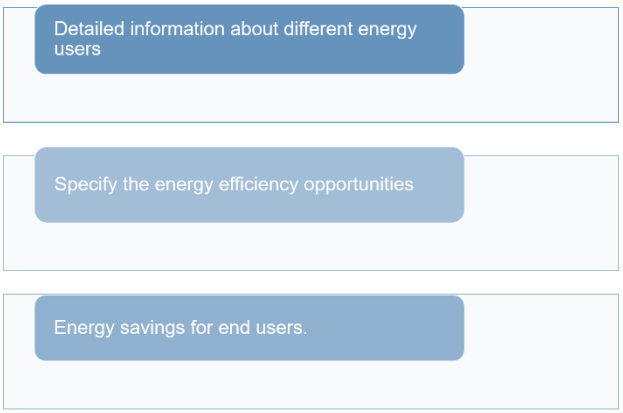

Figure 7: Energy Audit

Prior to the energy audit, the overall goal should be set at the beginning. In addition to this, the deadline for achieving the goals should also be set.

C. Prioritize possible measures

Based on the audit results, energy management programme would be restructured, for example, for all the energy conservation alternatives, the payback period would be too long, and that needs to be considered at the time to prioritize the measures.

Cost-effectiveness is one of the ways to prioritize the possible measures of energy conservation. For example, a simple payback period for any investment should not be too long.

D. Implementation of measures

In accordance with the energy management program implementation work at this stage of the process includes making agreements with manufacturers, depending on the complexity of the measures, consultants need to be hired to assist with the design work. Cost of the consultant is considered at the stage of prioritization.

E. Maintenance and follow up

Maintenance is essential to ensure efficiency and to prevent breakdowns. The monitoring of the measures gives the responsibility to the energy management staff for the overall control of energy usage. This control will be very useful if malfunctions occur in the energy system.

This overall process of energy management is repeated in a cycle, with emphasis on a different area each time. Using this, greater amount of energy savings could be achieved.

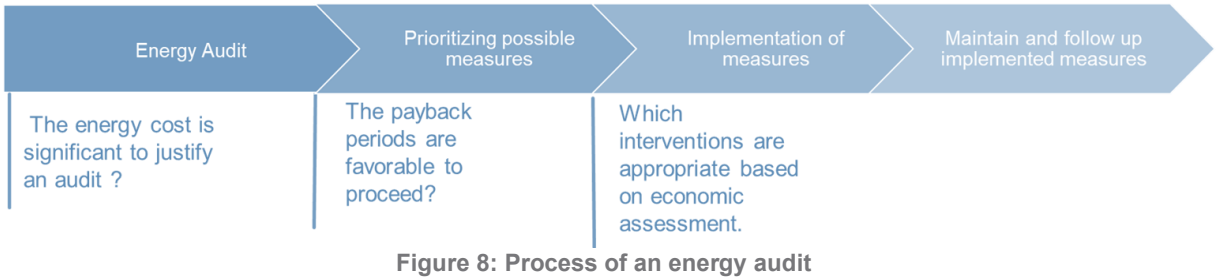

Figure 8: Process of an energy audit

F. Sub-metering

Install sub-meters in the facility premises as it is useful to understand how much energy is used across the healthcare facility. The information provided by the sub-meter will highlight the areas where cost savings can be made. Energy-intensive areas such as ICU, OT, and Radiology can be targeted, and energy savings can be made on these targeted areas.

GP1.3 Healthcare facilities shall have an ongoing education program for efficient usage and conservation of energy for all the stakeholders (Staff, Patient, and Visitors).

Figure 9: Submeter

S1.3.1 The healthcare facility shall have a plan to train the staff for energy savings techniques.

A. Training programme

- Awareness campaigns should be organized for the staff to sensitize on ways to minimize energy waste and trained to operate equipment in an effective way.
- Encourage staff to switch off devices when they are not being used, or to make use of built-in standby or power-down modes.
- Training should be given to the nursing supervisor for the regular monitoring of the energy-consuming equipment and utility services available at a facility (for example- Life care equipment, fans, tube lights.)

Procedure

- In accordance with the inputs from MOs, the District Nodal Officer-Climate Change (DNO-CC) should submit a proposal to conduct Energy auditing in healthcare facilities (PHC and above) through District Nodal Agency of Bureau of Energy efficiency (BEE) in the District.
- If the District Nodal Agency of Bureau of Energy efficiency (BEE) is not available in the district, DNO-CC has to submit the proposal through the State Nodal officer Climate Change. SNO-CC further submit the proposal to the State Nodal Agency of Bureau of Energy efficiency (BEE).
- If the proposal has approved, District Nodal Agency of Bureau of Energy efficiency (BEE) in the District themselves will conduct the activity in Districts.
- DNO-CC has to monitor the activity and should submit a report to SNO-CC and subsequently to NCDC.

1.6 Summary of key interventions for energy management

Table 6: Summarization of the key Interventions in different facilities for Energy Management

S. No	Key Interventions	DH	CHC	PHC	UPHC	HWC	SC
1	Place suitable stickers above light switches and put posters in the staff and patient areas to make them aware of the energy savings.	✓	✓	✓	✓	✓	✓
2	A nursing supervisor should monitor all the departments during the rounds at the end of the day.	✓	✓	✓	✓	✓	✓
3	Labelling of the light switches should be done.	✓	✓	✓	✓	✓	✓
4	Replace all the incandescent bulbs with the LED lights at the facility.	✓	✓	✓	✓	✓	✓
5	Occupancy sensors in office areas, toilets, storerooms, and washroom facilities which ensure that light only operates when there is someone to utilize it.	✓	✓	✓	✓	✓	✓
6	Use of meshwork on windows of rooms, wards, and waiting rooms for natural ventilation of air.	✓	✓	✓	✓	✓	✓
7	Energy audits should be done periodically to optimize power utilization.	✓	✓	✓	✓	NA	NA
8	Use 3 and above star rating equipment (ACs, Refrigerator) at the facility	✓	✓	✓	✓	✓	✓
9	Installation of solar panels for optimum utilization of renewable sources of energy.	✓	✓	✓	✓	✓	✓
10	Load-bearing capacity of the solar panel at the facility (calculation is per bed/day)	300 KW*	90 KW	18 KW	18 KW	18 KW	3 KW
11	Training should be given to the staff on energy conservation strategies.	✓	✓	✓	✓	✓	✓
12	Installation of sub-meter in the facility premises to understand the energy usage pattern across the healthcare facility.	✓	✓	✓	✓	NA	NA
13	Consider BEE labelled/ISI marked energy efficient equipment and appliances for procurement	✓	✓	✓	✓	✓	✓

*This calculation is as per the 100 beds. Energy consumption per bed per day is 3 KW as per IPHS so for the district Healthcare Facility (100 bedded) energy consumption is 300 KW

CHAPTER

02

WATER MANAGEMENT

2.1 The global problem

Our survival depends on water. In the last few decades, population growth and urbanization has been a recurring concern, which is leading towards higher water demand, which is a great concern. The demands of a rapidly urbanizing society come when the potential for augmenting supply is limited. Water levels are falling, and water quality is deteriorating. Our groundwater also gets contaminated with metals like fluoride, arsenic, uranium and other heavy metals. Our rivers and groundwater are both polluted by untreated effluents and sewage that are dumped into them. Climate change poses fresh challenges with its impacts on the hydrologic cycle, leading to more consumption and wasteful utilization of water in the country.

Figure 10: Scarcity of water

Water supply in most Indian cities refers to the layout of infrastructure, i.e., piped water supply lines, drainage lines, sewage lines, and sewage treatment plants (STPs), if the piped water supply is inadequate.

The current water situation has paved the way for overexploitation of the groundwater aquifer, encroachment, pollution of water bodies, excessive focus on extraction technologies and infrastructure network, leading to an increase in the demand-supply gap for water. The issues clearly show that conservation of water and measures to attain sustainability have not been addressed.

Figure 11: Water scarcity

2.2 Need for water conservation

With the present state of consumption and depletion of natural resources, striking a balance in the ecosystem is indisputably the need of the hour. Safe drinking water, which is a necessity for healthy living, has become a luxury in many Indian households, especially in semi-urban and rural areas. According to the recent estimates and projections by United Nations (UN), 783 billion people around the world do not have access to safe and healthy drinking water, and around 1.8 billion individuals drink contaminated water which puts them at risk of contracting water-borne diseases like cholera, jaundice, typhoid, etc.

To address this, the most widely known initiative, World Water Day, is celebrated every year on March 22 to bring to people's notice, the issues pertaining to availability of safe drinking water, the need for water conservation and the solutions that one can look at to tackle the water crisis in the country. The use and demand for water have grown manifold across various sectors due to rising disposable incomes and spending power among Indians. Despite

this shooting demand, there is a major mismatch in demand and supply of water in India. Most cities and towns in the country face the challenge of acute water scarcity.

2.3 Importance of water conservation in the healthcare sector

Many healthcare care facilities work in developing countries where there are inadequate or non-existent municipal water or treatment facilities and where there is a chance of seasonal water scarcities. This lack of water and sanitation infrastructure is a major problem that directly impacts healthcare facilities and health care systems. Thereby, water conservation plays an important role here and this conserved water can be used at the time of shortages.

Figure 12: Symbol for water conservation

In addition to this, conserved water should be regularly tested so that it will be fit for use. For detailed procedure of water testing,

An important component of water conservation involves minimising water losses, prevention of water wastage and increasing efficiency in water use

2.4 Major contributors to water consumption in the healthcare facility

Water use is driven by the number of inpatients and outpatients, equipment used, facility size, number and types of services, facility age, and maintenance requirements. Other contributors include steam sterilizers, autoclaves, medical processes, heating ventilation and air conditioning (HVAC), sanitary, X-ray equipment, laundries, and food service, but the major contributors of water in the tertiary health care facility is sanitary fixtures and HVAC. Sanitary fixtures consume 42 % of water while HVAC consumes 23 % of water, so it is recommended that major water-consuming area needs to be focused on in order to reduce water consumption.

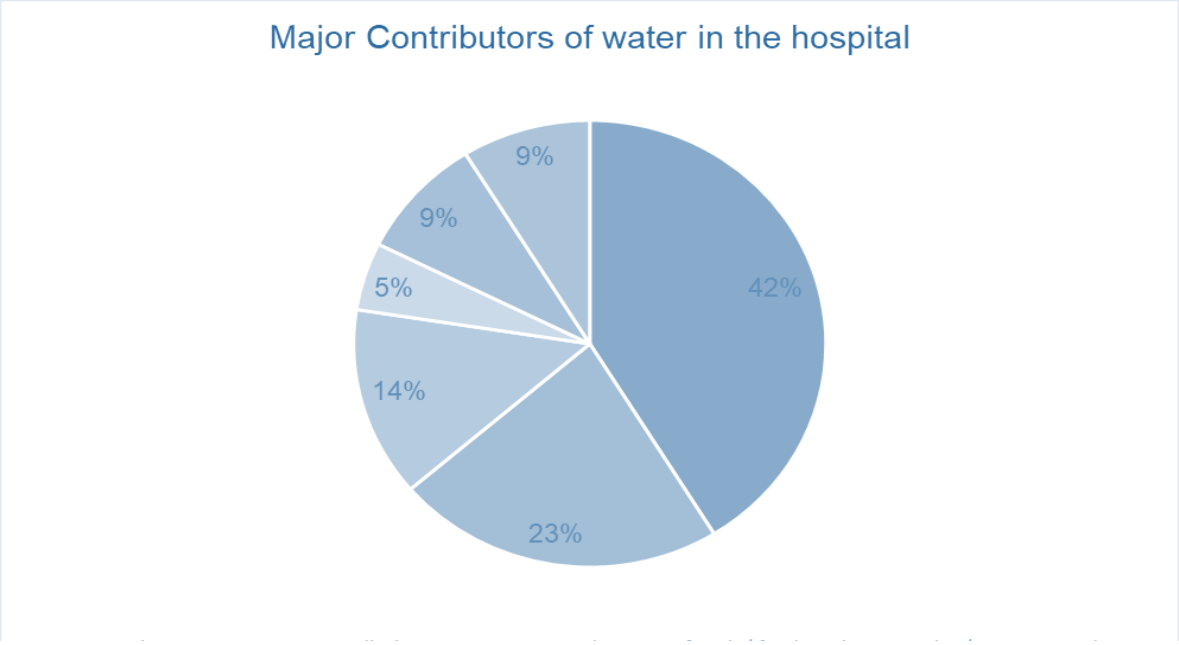

Figure 13: Major contributors of water in the facility

Source: 'Smith, M., Hargroves, K., Desha, C. and Stasinopoulos, P. (2009) Water Transformed - Australia: Sustainable Water Solutions for Climate Change Adaptation, The Natural Edge Project (TNEP), Australia.'
https://cms.qut.edu.au/__data/assets/pdf_file/0010/549865/TNEP-WaterTransformed-Lecture4.2.pdf

Key guiding principle for water conservation

GP2.1 The healthcare facility shall develop a strategy for the optimum usage and conservation of water.

S2.1.1 Healthcare facility shall develop a plan for the conservation of water

S2.1.2 Healthcare facility shall have a plan for the waste water treatment.

GP2.2 Healthcare facilities shall develop a programme/plan for the conservation of water.

S2.2.1 Healthcare facilities should have a water management programme for the conservation of water.

GP2.3 Healthcare facilities shall have an ongoing educational programme for the efficient usage and conservation of water for all the stakeholders (staff, patient and visitors).

S2.3.1 The healthcare facility shall have a plan to train the staff for water savings techniques.

2.5 Guiding principle

GP2.1 The healthcare facility shall develop a strategy for the optimum usage and conservation of water.

S2.1.1 Healthcare facility shall develop a plan for the conservation of water.

A. Low flow plumbing fixtures

Water-efficient fixtures are designed to use less water while maintaining the same level of performance as conventional water fixtures. Reducing water consumption by using water-efficient fixtures is a major step towards sustainable water management.

B. Retrofitting flush mechanisms

- Install dual or variable flush systems for water closets and commodes.
- Single flush toilets use 10-13 litres/flush while the larger flush of the double flush toilet uses 6 to 9 litres of water per flush and smaller flush uses 3 to 4.5 litres of water per flush, therefore double flush toilets conserve 4-11 litres/flush.

Figure 14: Dual flush System

Dual flush system

- The modern-day double flush toilets come with two different types of levers or buttons. One is larger, while the other is smaller and each button is connected to its own exit valve.
- The larger lever is to flush out around 6 to 9 litres of water, whereas the smaller lever is to flush out around 3 to 4.5 litres of water. Clearly, the larger one is to flush solid waste and the smaller one is to flush liquid waste.

C. Sensor operated urinals

- Urinals are often controlled through an automatic flush system, which is triggered at regular intervals.
- A typical system will flush volumes of approximately 10-13 litres/flush, resulting in unnecessary water and sewerage charges, so instead of using conventional urinals system, install sensor operated urinals which conserves 2.2-10 litres/flush, typically reducing 60% water consumption.

D. Waterless urinals

- Instead of installing water-reducing urinals, some medical facilities have installed no-flush urinal systems, which use no water at all.
- Waterless urinals look very much like conventional urinals in design, and these can be used in the same manner. However, waterless urinals do not require water for flushing and thus result in saving anything between 56,800 litres- 1,70,000 litres of water per urinal per year.

Best Practices: Establishment of Green Water Urinals in IIT Delhi

A Green Waterless Urinal (GWU) is low – cost onsite urine application model suitable for site where adequate space is available, and the number of users is limited. Urine collected is diverted to a plant bed of Canna Indica and Ficus planted around the urinal. For enabling uniform distribution of urine to the plant bed, a perforated pipe connected to the urinal is laid along the plant bed. As urine contains essential plant nutrients such as nitrogen, phosphate and potassium, these are utilized by the plants for their growth. The plantation also doubles as a hedge around the urinal offering privacy to the users.

The bed must be surrounded by the earthen bunds to prevent flow of urine to nearby areas during rainy seasons. At periodic intervals, watering and emptying of the phosphate deposits is carried out to maintain the system. Treatment for reducing salinity of the soil must be taken up at regular intervals.

This model of onsite utilization of the urine through GWUs can be adopted in public places, gardens and institutions where there is open space. The initial and maintenance cost of GWUs is also very low compared to the normal urinals. GWUs can be established at a cost of Rs 500 /- to Rs 10,000 /- based on the design adopted.

Figure 15: Green Urinals
Source: Dr V M Chariar, S Ramesh Sakthivel, Water less Urinals A Resource book :http://web.iitd.ac.in/~chariarv/WLUResource%20BookFinal.pdf

- On an average, a person urinates about four to five times a day. Urine, which is usually sterile and contains mostly water, does not require additional water for flushing to make it flow into drainage lines. Therefore, installing waterless urinals can make a large reduction in the quantity of freshwater used for flushing as also in the corresponding volume of sewage.

E. Maintenance

- Waterless urinals require less maintenance as compared to the water flush urinals. However, the fixtures require some periodic attention.
- Regular upkeep includes cleaning all surfaces, and drain care, whether the drain contains a cartridge type trap or one cast into the urinal.
- Cleaning involves using a nonabrasive cleanser, followed by wiping with a sponge or "Jonny mop," and drying. Abrasive cleaners and harsh chemicals should be avoided as they can damage the finish and remove its water-repellent characteristics.
- Abrasive cleaners and harsh chemicals should be avoided as they can damage the finish and remove its water-repellent characteristics.
- The care of the drain trap varies depending on the trap involved. For the models with removable cartridge trap, the trap must be replaced periodically. Replacement is required because the supply of sealant liquid becomes depleted, and the cartridge fills with sediment from urine.
- The cartridge itself is to be replaced once to six times a year, depending on the usage.

F. Low flow or high-pressure sensor-operated taps

- Install low flow or high-pressure plumbing fixtures in the faucets of the healthcare facility for reducing water consumption.
- Install sensor-operated taps with low flow fixtures or high pressure, which typically reduces water consumption. In addition to this, in areas where the risk of spread of infection is high, sensor-level- or foot-operated taps may be more appropriate.
- Standard fixtures use water 10-18 litres/minute depending on the pressure, while sensor-operated taps conserve 5.5-15.5 litres/minute water.
- Taps are prone to leakage. It is estimated that a dripping tap may consume around 15 L per day. Staff should be informed of the importance of reporting leakage, and a reporting system should be put in place.

G. Showers

- Baths typically use around 80 L per event and showers around 10-15 litres per minute. So, flow restrictors may be used to reduce the flow rate of water in showers, which typically reduces 4-20 litres/minuteReducing the water used for showers and baths may also potentially reduce energy bills due to a reduction in hot water used.

H. Water efficient mops

In the conventional method, wet mopping of floors occurs by cotton mops. Disinfectant is added to the water, and after the cleaning of every 2-3 rooms, the

Figure 15: Microfiber Mop

water is discarded. At the end of shifts, mops are changed, and used mops are sent to the laundry for washing and drying.

Use microfiber mops instead of cotton mops. It is more water-efficient. Mopping with micro fibrotic mops increases cleaning efficiency. This mop can also withstand 300-500 washings as against 55 for cotton mops.

Mop Specification:

- Constructed from nylon and polyester fibres
- The density of the fibres enables it to hold six times its weight in water
- For a hundred room Healthcare Facility, it only requires 19 litres of water as against 397 litres of water by using cotton mops

I. Eliminate leaks

Identifying leaks through water audits and repairing the same can be an efficient way to achieve water savings.

Regular monitoring of the faucets, faulty fittings, broken pipes, hoses, shower facilities, dishwashing facilities, and other water delivery devices should be done.

J. Rain water harvesting

Rainwater harvesting (RWH) is a process of collecting, conveying, and storing rainfall in an area for beneficial purposes. Considering the problems of severe water scarcity, pollution in existing surface water bodies, and floods during the rainy season in India; the adoption of rainwater harvesting practices is quite necessary and a need of the hour.

Note: *RWH can be the best safeguard against seasonal water shortages in states like Maharashtra and Tamil Nadu, where some of the rural HF's could not function during a drought period.*

I.1 Methods of rainwater harvesting

I.1.1 Surface runoff harvesting: During heavy rainfall, water flows away as surface runoff. This runoff can be collected in a tank and used for recharging aquifers. The storage of rainwater on the surface is an ancient technique and the structures used for the collection of water include underground tanks, ponds, check dams, weirs, etc. This collected water can be discharged into the ground, or it can also be used for drinking purposes and can be disinfected by chlorine treatment. Stored water can also be used for future purposes like gardening, toilet flushing, cleaning, etc.

I.1.2 Pits: Recharge pits are constructed for recharging the shallow aquifer. These are constructed 1 to 2 m wide and to 3 m deep, which are backfilled with boulders, gravels, and coarse sand.

I.1.3 Dug wells: Existing dug wells can be utilized as recharge structures, and water should pass through filter media before going into dug well.

I.1.4 Hand pumps: The existing hand pumps may be used for recharging the shallow/deep aquifers if the availability of water is limited. Water should pass through filter media before diverting it into hand pumps.

I.1.5 Recharge wells:

Recharge wells of 100 to 300 mm diameter are generally constructed for recharging the deeper aquifers, and water is passed through filter media to avoid choking of recharge wells.

I.1.6 Recharge shafts: For recharging the shallow aquifer which is located below the clayey

surface, recharge shifts of 0.5 to 3 m diameter and 10 to 15 m deep are constructed a backfilled with boulders, gravels, and coarse sand.

I.1.7 Lateral shafts with borewells: For recharging the upper as well as deeper aquifers lateral shafts of 1.5 to 2 m wide and 10 to 30 m long depending upon the availability of water with one or two bore wells are constructed.

Note: Diversion of runoff water into the existing water bodies can be made, and it may also be diverted into the nearest tank and depression which will create additional recharge

Things to remember

- The amount of rain water harvested in the facility differ area wise because the amount of rain water depends on the annual rainfall which is different in hilly areas, coastal areas and arid regions and semi- arid regions.

The total quantity of rain water that can be harvested annually is estimated as:

= catchment area * annual rainfall* runoff coefficient

For example:

From the data published by the Meteorological department of India, the annual average rainfall in Delhi has been adopted as 720 mm. The total quantity of rainwater that can be harvested annually is estimated as:

= catchment area x annual rainfall x runoff coefficient

= 1400 m^2 x 720 x 10^{-3} x 0.95

= 960 m^3/ year

- Volume of the tank can be calculated by using the following formula:

Volume of the tank= t x n x q

t = length of dry season

n = no. of people using the tank

q = Consumption in litres per capital per day

Borewell

Collection of water occurs in reservoir, tanks, dams, ponds etc. and can be used for gardening, toilet flushing, cleaning the healthcare facilities.

Water from surface run off water harvesting can be discharged into the trenches, borewell, pits, wells, and hand pumps.

Hand pump

Dug well

Figure 16: Recharge method of surface rain water harvesting

Source: http://agritech.tnau.ac.in/agriculture/agri_majorareas_watershed_rainwaterharvesting.html

I.1.8 Rooftop rainwater harvesting: As per this water harvesting method, the roof itself becomes the catchment area, and water can be collected from the roof of the building. This water can either be stored for utilization, or it can be discharged into an artificial recharge system. In this method, water can be collected without much expense. This method is highly effective, and it can also help in the recharge of the groundwater level.

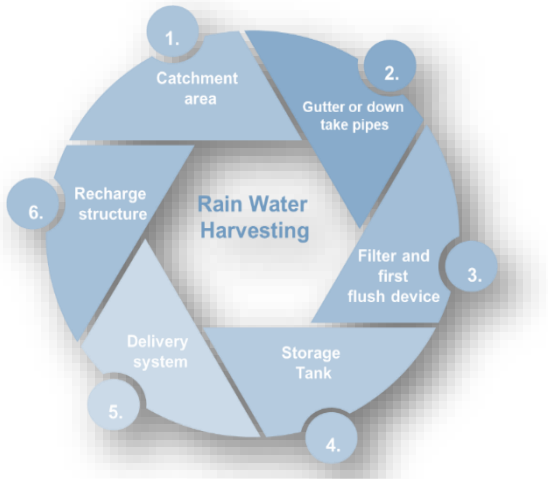

Figure 17: Components of rain water harvesting

I.2 Components of rainwater harvesting:

I.2.1 Catchments

- The area or surface which receives the rainfall is known as the catchment area for rainwater harvesting.
- The catchment area can be rooftop, courtyard, open ground, etc.

Down take pipes used for draining the water into the collection vessel, sometimes the collected water passes through the settling tank for the suspension of settleable particles before the collection in storage tank for further use.

I.2.2 Gutters (drains) and down take pipes

- Gutters and down take pipes are essential for taking up the water from the catchment area to the storage tank.
- The downpipe should be at least 100 mm diameter with 20 mesh (850 μ) nylon wire screen at the inlet to prevent dry leaves and debris from entering it.

I.2.3 Filters and first flush device

- These devices are used to remove dirt, leaves, and grit, which are often found in the first rain. It is essential to remove these from the water as it may contaminate the water in the storage tank.
- Sometimes rainfall occurs after a long time. In such conditions, it carries various dissolved pollutants. Materials such as gravel, sand or coconut, palm or betel nut fibre, etc. may be used as filter media.
- Filters and first flush devices divert the water from the first rain to avoid its mixing with the water in the storage tank.

I.2.4 Storage tanks

- These tanks might be either above the ground or underground or partly underground, and it should always be covered so that the water should remain clean.
- The storage tanks may be made up of reinforced cement concrete, masonry, etc. and the underground tank should be suitably lined with waterproofing material and have a hand pump installed for the withdrawal of water.
- Prior to the use of a storage tank, it should be thoroughly cleaned and disinfected using chlorine, bleaching powder, and potassium permanganate, etc.
- Measures to ensure the cleanliness of water can also be kept in the storage tanks for periodical disinfection to prevent the growth of pathogens.

I.2.5 Delivery system

- There should be an efficient piping system that can discharge the stored water for the end-use. In the absence of any treatment, rainwater should be avoided for consumption and cooking.
- Leaking and rusted pipes should be avoided completely; if found, must be replaced immediately
- To avoid any leakage, a timely check-up of the pipes is necessary.

I.2.6 Recharge structure

- Harvested rainwater can also be used for charging the groundwater aquifers through the construction of various kinds of structures like dug wells, borewells, recharge trenches, and recharge pits.
- There may be different depths in recharge structures, such as depth can be such that water reaches to lower soil strata.
- In other cases, the depth of the pipe down in the soil can be such that it reaches the level of groundwater and joins it.

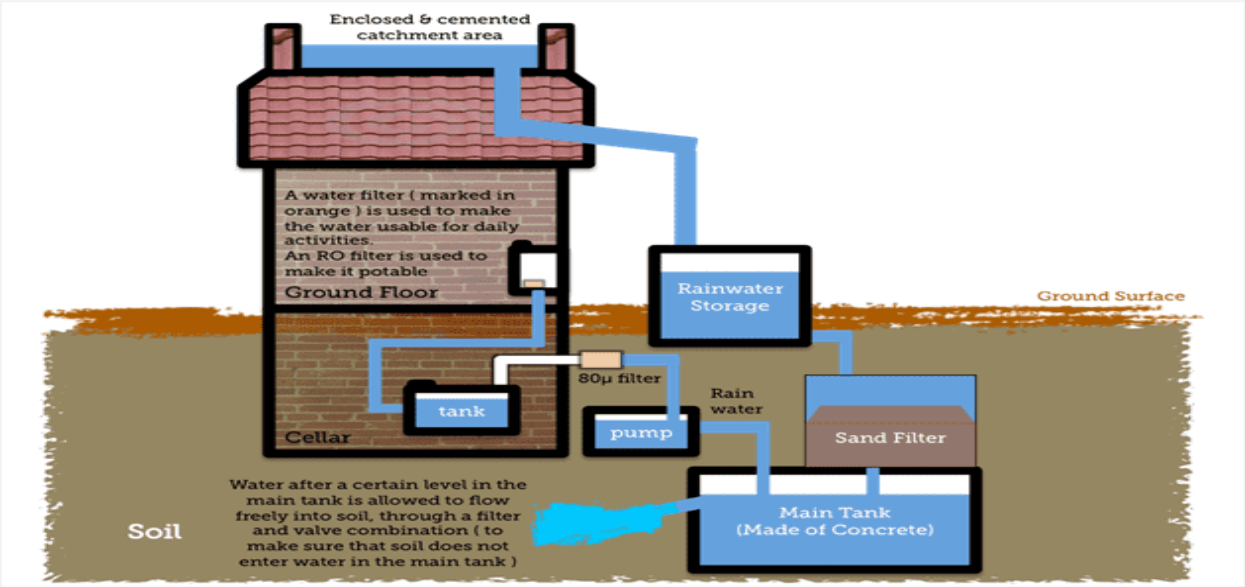

Figure 18: Rain Water Harvesting

I.3 Maintenance of rainwater harvesting

- To prevent leaves and debris from entering the system, mesh filters should be provided at the mouth of the drainpipe. Further, a first-flush device should be provided in the conduit before it connects to the storage container.
- If the stored water is to be used for drinking purposes, a sand filter should also be provided. Methods to protect rainwater quality include appropriate system design, sound operation and maintenance, and use of first flush devices and treatment.
- First flush devices can be effective in reducing the levels of contamination if properly maintained.
- To ensure the good water quality storage, provided sunlight and living organism are to be excluded from the tank and fresh flow inflows, do not stir up any sediment.

I.4 System maintenance

- The design should include a clean, impervious roof made from smooth, clean, non-toxic material. Overhanging branches above the catchment surface should be removed.
- Taps or draw-off pipes on tanks should be at least 5cm above the tank floor (more if debris accumulation rates are high). A tank floor sloping towards the sump can greatly aid tank cleaning, as will a well-fitting access manhole.
- Wire or nylon mesh should cover all inlets to prevent any insects and other creatures from entering the tank. The tank must be covered, and all light excluded to prevent the growth of algae and other organisms. The grill at the terrace outlet for rainwater arrests most of the debris carried by the water from the rooftop like leaves, plastic bags, and paper pieces.
- A coarse filter and/or foul flush device should be fitted to intercept water before it enters the tank for removing leaves and other debris.

I.5 Operation and maintenance

Proper operation and maintenance of rainwater harvesting systems helps to protect water quality in several ways. Regular inspection and cleaning of a catchment, gutters, filters, and tanks reduce the likelihood of contamination. Water from other sources should not be mixed with that in the tank.

I.6 Treatment

- **Chlorination:** Chlorination is most appropriately used to treat rainwater if contamination is suspected due to the rainwater being colored or smelling bad. It should only be done if the rainwater is the sole source of supply, and the tank should first be thoroughly inspected to try to ascertain the cause of any contamination. Chlorination is done with stabilized bleaching powder (calcium hypochlorite - $CaOCl_2$), which is a mixture of chlorine and lime. Chlorination can kill all types of bacteria and make water safe for drinking purposes. About 1 gm (approximately 1/4 teaspoon) of bleaching powder is enough to treat 200 litres of water.
- **Chlorine tablets:** Chlorine tablets are easily available in the market. One tablet of 0.5 g is enough to disinfect 20 litres (a bucketful) of water.
- **Boiling:** Boiling is a very effective method of purification and very simple to carry out. Boiling water for 10 to 20 minutes is enough to remove all biological contaminants.

Things to remember

- Just before the arrival of the monsoon, the rooftop/catchment area must be cleaned properly.
- The roof outlet on the terrace should be covered with a mesh to prevent entry of leaves or other solids waste into the system.
- The filter materials must be either replace or washed properly before the monsoon.
- The diversion valve must be opened for the first 5 to 10 minute of rain to dispose of the polluted first flush.
- All the polluted water should be taken away from the recharge structures.
- The depth of bores (of recharge structure) shall be finalized depending on the actual site condition.

State and District Nodal Officers are recommended to consult with the nodal committee/ department/ for watershed management programme, Ministry for Rural Development or Department of Drinking Water & Sanitation for HCF in rural area and Jal Board/Urban Development or equivalent in urban areas.

Procedure

- District Nodal Officer-Climate Change has to identify healthcare facilities (PHC and above) in the districts to install Rainwater Harvesting System in healthcare facilities (PHC and above) and get an estimate from the Department of Public works (PWD) and submit the proposal to the Department of Water and Sanitation under Ministry of Jalshakthi in the District.
- If the budget for this activity is not available through the Ministry of Jalshakthi, then the budget can be proposed under Green Healthcare Infrastructure in NPCCHH Programme under NHM.
- After getting the funds, the work has to be submitted to the Department of Public works (PWD) to complete the activity.
- DNO-CC has to monitor the activity and should submit a report to SNO-CC and subsequently to NCDC.

GP2.2 Healthcare facilities shall develop a programme/plan for the conservation of water.

S2.2.1 Healthcare facilities should have a water management programme for the conservation of water.

Water management plans must be part of an integrated approach that examines how changes in water use will impact all other areas of operation.

Water conservation includes two distinct areas: technical and human. The technical side includes collecting data from water audits and installing water-efficient fixtures and procedures. The human side involves changing behaviours and expectations about water usage.

To introduce and implement the water management programme, the following steps need to be taken:

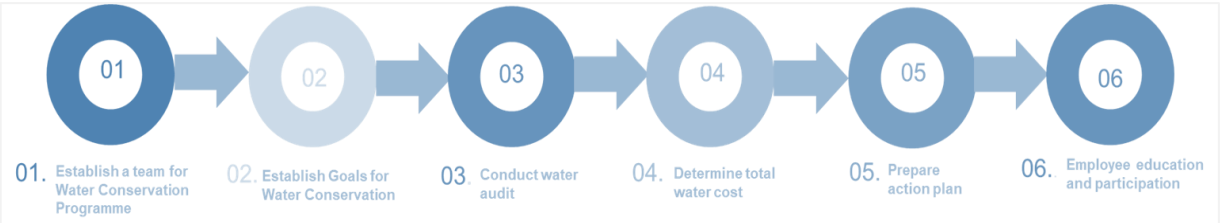

Figure 19: Steps of implementation of water management programme

A. Establish a team for the water conservation programme

A member of the Infection Prevention and Control Committee should be responsible for the Water Conservation Programme implementation in the healthcare facility or they can appoint a person for the implementation of all the green aspects.

- Member of the committee is responsible for transforming a commitment to water conservation into a workable plan designed to systematically achieve the healthcare

facility's water reduction goals.

- Member of the committee, as empowered by top management, should have the resources available to create and implement specific water conservation plans and measures.

B. Establish goals for water conservation

- Goals should be stated in terms of gallons saved and the percentage of water saved.
- Goals should also be including the time frame for achievement, the area of the facility where the water savings will be realized, and how the water savings will be achieved.

Water conservation falls into three general areas:

Reducing losses	Reducing use	Reusing water
•Fixing leaky faucets •Fixing leaked pipes	•Installing ultra low flush toilets •Installing sensor operated faucets •Install water less urinals	•Treated water is reused in gardening , toilet flushing etc. •Treated water can also be used for cleaning.

Figure 20: Areas of Saving Water

C. Water audit

- The first step in the quantification of the water use is a water audit- a detailed examination of where and how much water enters the system, and where and how much water leaves the system.
- A major objective of a water system audit is estimating and reducing unaccounted water use. Unaccounted water includes losses through leaks and unauthorized water consumption.
- Water audit can also identify the areas where the chances of water wastage are high, like kitchen, laundry, gardening, etc.

C.1 Process of water audit:

To conduct a water audit in the facility, the committee must follow the following steps:

Step 1: Gather and prepare information about the floor plans, location maps, inventory of plumbing fixtures, etc.

Step 2: Conduct the facility survey in which the identification of leaks occurs, and the manager enlists all the water using equipment and calibrates all the existed water meter, etc.

Step 3: Prepare an audit report which includes blueprint and water facility diagram, utility bills, and water flow charts,

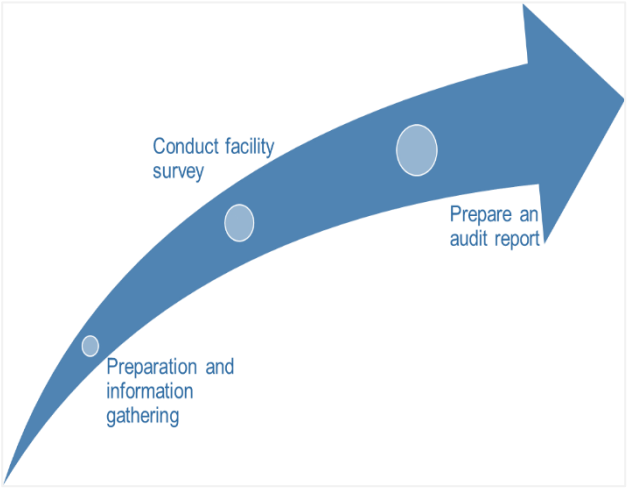

Figure 21: Steps of Water Audit

which show the movement of water from times it enters the facility until it becomes discharged.

C.1.1 Preparation and information gathering:

Before starting the actual water audit, information from the records and the staff is to be collected by the water conservation manager.

Information includes the following:

- Building and location information, including physical size, floor plans, etc.
- Location maps, identifying each water supply meter that measures incoming (source) water plus each water meter that records on-site use.
- Inventory of plumbing fixtures and all water-using equipment with their flow rates.
- Utility records for the past two years.
- Anticipated water and sewer billing rates for the next two years.

C.1.2 Conduct facility survey:

- Water Conservation Manager walks through the facility with the supervisor to understand how water is used in various areas.
- Identify and list all the water using equipment, including faucets, toilets, showerheads, kitchen equipment, reverse osmosis filers, etc.
- Check the water using equipment against the inventory information.
- Records hours of operation for each piece of water using process equipment.
- Calibrate all existing water meters to ensure accuracy.
- Measure the amount of water used by each water consuming fixtures or piece of equipment and compare it with the recommended flow rates.
- Ask for water conservation suggestions from employees who are familiar with each water-use process.

C.1.3 Prepare an audit report

- Audit reports include an updated set of facility diagrams, blueprints, and water flow charts.
- Current list of all water-using equipment with manufacturers 'recommended input/output flow rates and the actual flow rates recorded during water audit.
- Water flow chart that shows the movement of water from the time it enters the facility until it is discharged.
- Water use figures (total facility and broken out by operating areas and processes).
- Any additional water-use observations revealed by the walk-through audit and analysis.
- Evaluation of the total cost of water used by the entire facility.

D. Determine total water cost

- Based on the findings of the audit report, the total cost of water can be determined.
- The cost of water can also vary. Some utilities charge different rates based upon the amount of water used. And water rates may vary seasonally

- In addition to the utility cost, the total cost of water also includes the cost of heating, cooling, energy cost of pumping pre-treating, including filtering, purifying, and softening, chemical treatment, including treating boiler feed, cooling tower water predisposal treatment, disposal of hazardous aqueous substances and sewer discharge which can be based on the amount of water.
- Adding up the total annual cost of water and water processing. This total will be the current baseline cost of water.

E. Prepare an action plan

- During the formulation of an action plan, those area needs to be focused on where the water consumption and water wastage is high.
- Review all equipment and water using devices for possible water efficiency improvements.
- Water using equipment like faucets, showerheads, single flush toilets need to be replaced with low flow plumbing fixtures, and in some cases retrofitting existing equipment will be the better solution.
- Regular monitoring of sanitary fixtures should be done to identify the leaks, and it needs to be repaired early.
- Install sensor-operated faucets and new low flow taps in place of dripping taps.
- Regular monitoring of the checkpoints from where the water enters and water leaves in the facility should be done.
- Regular monitoring in the areas where water consumption is high like kitchen, laundry, and gardening so that optimum usages of water can occur.
-

S2.1.2 Healthcare facilities shall have a plan for wastewater treatment.

A. Sewage Treatment Plant

Sewage treatment is the process of removing contaminants from healthcare facility wastewater, containing mainly healthcare facility sewage. Physical, chemical, and biological processes are used to remove contaminants and produce treated wastewater (or treated effluent) that is safe enough for release into the environment. A by-product of sewage treatment is a semi-solid waste or slurry, called sewage sludge. The sludge has to undergo further treatment before being suitable for disposal or application to land. The treated water can be reused again for gardening and flushing.

Figure 22: Sewage Treatment Plant

There are two ways for setting up of sewage treatment plant for healthcare facility. It may be connected to the centralized treatment plant, in that scenario, the facility should ensure with the agency representative that periodic check-ups and regular maintenance of the pipeline etc.is conducted. On the other hand, if the healthcare facility is not connected with the centralized sewage treatment plant and have a sufficient space to install STP, then detailed design and flow is illustrated below for setting up of such system.

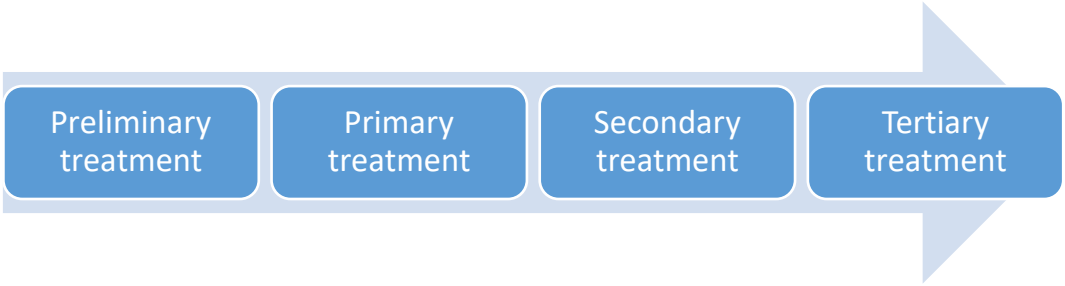

Figure 23: Process of Sewage Treatment Plant

A.1 Capacity of the sewage treatment plant:

Table 7: Capacity of STP across different facilities

Facility	No. of bed	Capacity of STP + ETP	Type of STP + ETP
District Healthcare Facility	100-500	25 KLD (as per 100 beds)	ASP/MBBR (Activated Sludge Process/ Moving Bed Biofilm Reactor)
CHC	30	5 KLD	ASP/MBBR
PHC	6	NA	NA
HWC	6	NA	NA
SC	1	NA	NA

Note: Frequency of STP may vary as per the requirement.

***Note**: This calculation is as per the norm of NBC code (1000 litter = 1 KLD), as 450 litres per bed per day water consumption is recommended so, for 100 bedded District Healthcare Facility, consumption of water is 45,000 litres per bed per day that requires STP of 45 KLD, but STP with capacity of 45 KLD is expensive in nature, so 25 KLD is suggested and that can be run twice in a day to fulfil the requirements.*

A.2 Maintenance of Sewage Treatment Plant:

A.2.1 Bar screen

- Check and clean the bar screen at frequent intervals.
- Do not allow solids to overflow/ escape from the screen.
- Ensure no large gaps are formed due to corrosion of the screen.
- Replace the corroded/ unserviceable bar screen immediately.

A.2.2 Grit

- Check and clean trap at frequent intervals.
- Remove both settled solids (at the bottom) and the floating grease.

- Do not allow solids to get washed out of the trap.
- Do not allow oil and grease to escape the trap.
- Redesign the trap if solids and grease escape on a regular basis, despite good cleaning practices.

A.2.3 Equalization tank

- Keep air mixing on at all times
- Ensure that the airflow/ mixing is uniform over the entire floor of the tank.
- Adjust the placement of diffusers and the air-flow rate as needed.
- Keep the equalization tank nearly empty before the expected peak load hours (otherwise it will overflow).
- Check and clean clogged diffusers at regular intervals. Manually evacuate settled muck/ sediments at least once in a year.

A.2.4 Aeration tank

- Operation considerations include maintaining the correct design level of MLSSMLSS (biomass concentration) in the aeration tank. Problems arise both in the case of excess or shortage of biomass, causing an imbalance, leading to failure of the process.
- Dead zones on the sewage surface indicate that membranes are blocked from the airside or the liquid side, so it needs to be replaced or cleaned.
- Cleaning of membranes is generally carried out by lifting out the defective units and scouring out the adhering materials by high-pressure hosing.
- In the case of encrustation of membrane cleaning or scrubbing with a mild acid solution would be done.

A.2.5 Secondary clarifier

The sacrificial rubber squeegees sweeping the floor of the clarifier need to be checked and replaced, possibly once in two years.

A.2.6 Tertiary clarifier

In addition, if an intermediate sludge sump is provided, it is advisable to force-flush the sludge line of the clarifier at frequent intervals, so that the pipe always remains clear, and the incidence of choking is minimized.

A.2.7 Excess sludge handling

- Fresh sludge (not more than a day old), kept fully aerated and mixed (agitated), dewaters easily in the filter press. Hence, sludge must not be stored in the handling tank for longer duration.
- After every dewatering operation, the filter cloths must be thoroughly cleaned, so that clogging in the pores of the woven polypropylene filter fabric is avoided. Periodic cleaning of filter cloth with the Hypo solution will also prolong the life of the cloth.

A.3 Typical Design of Sewage Treatment Plant

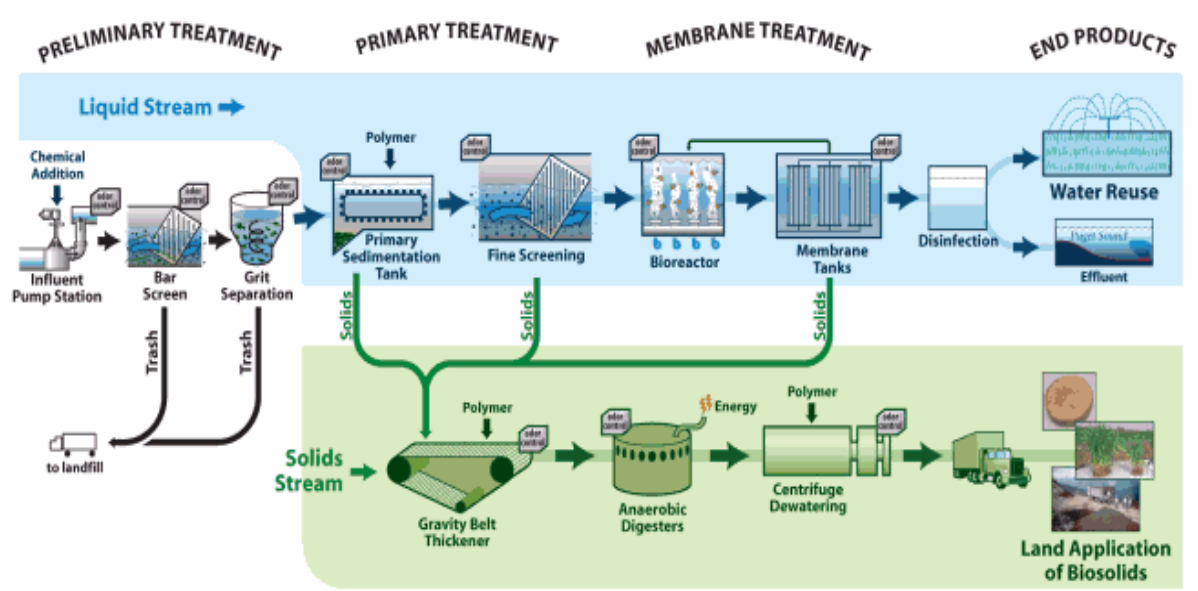

Figure 24: Typical Design of Sewage Treatment Plant

Innovative design: A biodigester for the treatment of waste water

Figure 25: Biodigester

- Bio Digesters are cylindrical/ rectangular structure with the provision of inlet for human waste and outlet for bio gas and odourless, harmless fertile water produced by bacteria digesting the human manure.
- Bio digester contains a bacterial consortium which can function from -40 to +60 Deg centigrade temperature/s
- The bacterial consortium degrades the night soil and produces colourless, odourless and inflammable bio gas containing 50 – 70% methane.
- Bio-Digesters do not require sewage-line connection or additional septic tanks for disposal of black water or waste from toilets.
- Bio digester disposes human waste in 100% eco-friendly manner and generates colour less, odourless water and inflammable methane- gas for cooking, water heating & room heating etc. as a by-product.
- The water can be used as a self-sustaining irrigation source.
- By adding a reed bed, the water can be recycled and used further.
- Based on the usage of the bio toilet, the methane produced can be used to generate electricity and for cooking purposes
- Multigrade Pressurized Sand and Carbon Filter removes solid, suspended particles and turbidity from water. Sand filters produce high-quality water without the use of chemical aids. Passing water through a rapid gravity sand filter strains out the particles trapped within it reducing numbers of bacteria and removing most of the solids
- Carbon filter removes colour, chemicals, and odour from water. Carbon filters are very effective at removing a number of harmful chemicals. These include chlorine, benzene, radon, volatile organic chemicals such as pesticides and herbicides and hundreds of other man-made chemicals that may come into contact with tap water as it proceeds through the system. In addition, filters remove bad tastes and odour from the water. This technology is 100% maintenance free and is a continuous biological process.

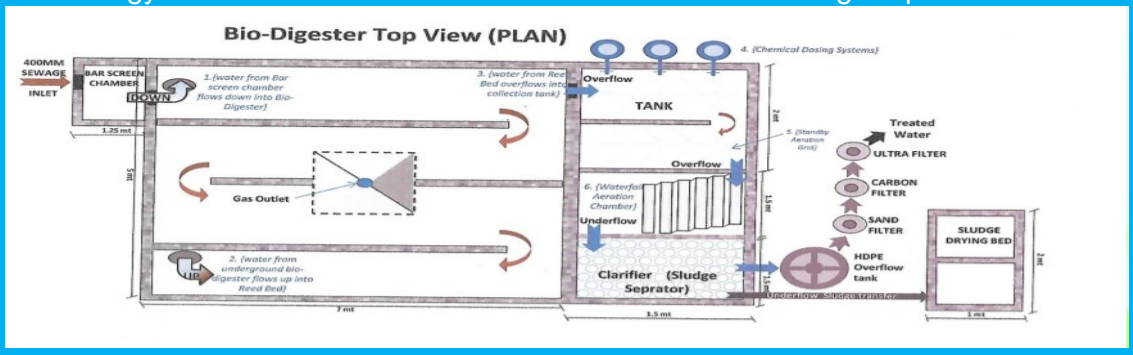

Figure 26: Top view of Biodigester

B. Effluent Treatment Plant

B.1 About ETP

Effluent Treatment Plant should be provided in every HCF to treat the chemical wastewater generated from the healthcare facility in order to comply with the effluent standards prescribed under the BMW Rules, 2016. Sources of wastewater generated from the healthcare facilities are wards, laboratories, used disinfectants, floor washing, washing of patient's area, hand washing, laundry, discharge of accidental spillage, firefighting, bathroom/toilet, etc. Liquid waste generated due to the use of chemicals or discarded disinfectants, infected secretions, aspirated body fluids, liquid from laboratories and floor washings, cleaning, house-keeping, and disinfecting activities should be collected separately and pre-treated prior to mixing with rest of the wastewater from HCF.

The combined wastewater should be treated in the ETP having three levels of treatment; primary, secondary and tertiary-

- Primary Treatment: equalization, neutralization, precipitation, and clarification.
- Secondary Treatment: High-rate aerobic biological treatment, secondary settling tank.
- Tertiary Treatment: Pressure Filtration, Disinfection, and disposal to drain/sewer.

Options for reuse of treated wastewater: Wastewater generated from the HCF is treated in the ETP and shall be disposed into drain / sewer or could be reused in flushing and horticulture.

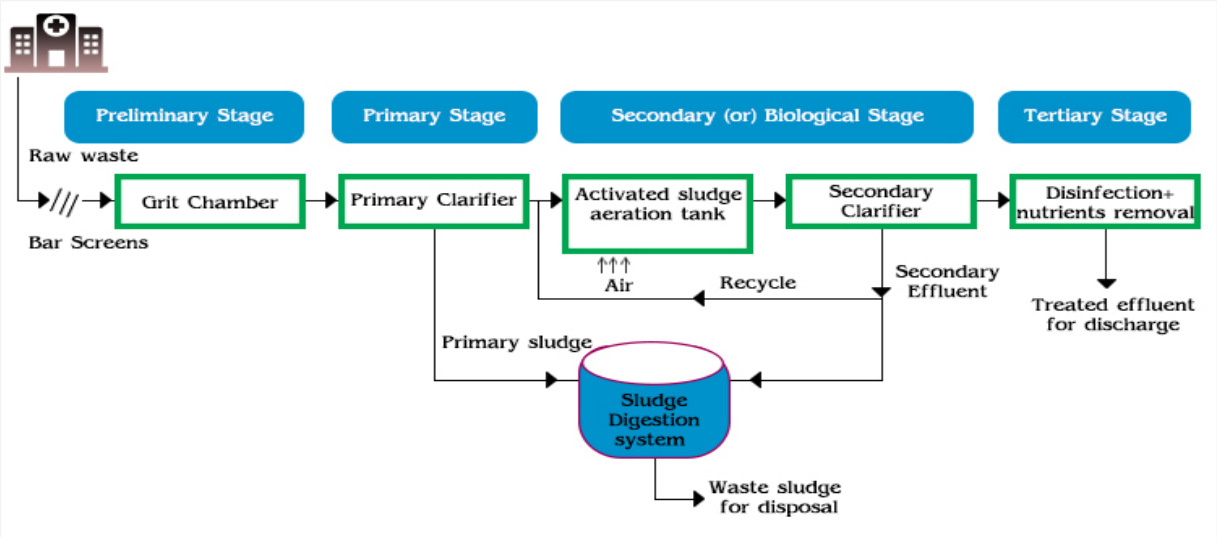

Figure 27: Effluent Treatment Plant

Note: Effluent treatment plant is required in smaller facilities also.
Facilities that have 10, or more than 10 number of beds, effluent treatment plant is required there for the treatment of waste water.

B.2 Maintenance of Effluent Treatment Plant

B.2.1 Routine maintenance

- In the case of ETP, monitoring of inlet and outlet parameters of the waste and treated effluent respectively plays a vital role.
- Lubrication and leak detection of rotatory equipment is part of routine maintenance.
- As wastewater can be of corrosive nature, it is mandatory to take corrosion/rust prevention aids in this plant, e.g., piping used, or equipment used should be rubber lined

from internally and externally protected by anticorrosive paint.

B.2.2 Mechanical maintenance

- Rotary equipment should be checked for physical health, vibration, alignment, and leakage periodically.
- All electrical drives, including motor control centre & control panel, should be fortnightly checked with regards to current ampere, load, temperature rise, etc.
- Monitoring and periodic checking of accuracy of this instrument, recalibration, cleaning of electrodes/sensors.

B.2.3 Breakdown maintenance

- The need for doing breakdown maintenance can arise due to the failure of any critical equipment high fluctuation in inlet quality of effluent, the collapse of the secondary treatment system, etc.
- During this, the respective equipment to be immediately repaired by replacing the faulty part (spares), analysing the source due to which fluctuation of inlet parameter has occurred and rectifying the same.

B.2.4 Annual shutdown maintenance

- Shutdown maintenance is to be planned annually along with other plants of the industry for overhauling of the equipment. During the annual shut down, the maintenance period should be planned in such a way that all the equipment can be opened overhauled.
- In the case of tertiary treatment plant involving ion exchanger reins, and/or membrane process, necessary chemical cleaning of resin or membrane should be carried out as recommended by the manufacturer.

GP2.3 Healthcare facilities shall have an ongoing educational programme for the efficient usage and conservation of water for all the stakeholders (staff, patient and visitors).

S2.3.1 Healthcare facility shall have a plan to train the staff on water savings techniques

- Establish an employee water education program, and it should communicate the information regarding the importance and need for the Water Conservation Programme and the importance of everyone's contribution to the success of the water conservation goals of the entire organization.
- Training should be given to the staff on the new procedures and water conservation equipment.
- Use a wide variety of methods to communicate the ongoing water conservation message like IEC material, new and/or revised operating guides and manuals, emails, water conservation progress reports, etc.
- Get employees involved. Establish incentive programs to encourage and reward participation.
- Create a "Water Conservation Ideas Box" where employees can submit suggestions on how the organization can save water.
- Reward employees who spot leaks and other instances of water waste.

2.6 Summary of key intervention for water management

Table 8: Summarization of the key interventions in different facilities for water management

S. No	Key Intervention	DH	CHC	PHC	UPHC	HWC	SC
1	Availability of low flow plumbing fixtures like taps with a flow restrictor, dual flush toilets, showers, etc. in the handwashing area, washroom, and in-service area.	✓	✓	✓	✓	✓	✓
2	Sensor operated urinals should be available in the washrooms.	✓	✓	✓	✓	✓	✓
3	Availability of waterless urinals in water-deficient areas (like hilly area).	✓	✓	✓	✓	✓	✓
4	Regular monitoring (monthly) of the plumbing fixtures to identify the leakages to reduce water wastage.	✓	✓	✓	✓	✓	✓
5	Availability of rainwater harvesting system to conserve water.	✓	✓	✓	✓	✓	✓
6	Availability of Sewage Treatment Plant to recycle wastewater.	✓	✓	NA	NA	NA	NA
7	Availability of effluent treatment plant to treat the sewage.	✓	✓	NA	NA	NA	NA
8	Combined capacity of the Sewage treatment plant and effluent treatment plant to recycle water.	25KLD	5 KLD	NA	NA	NA	NA
9	Training should be given to the staff on water conservation strategies.	✓	✓	✓	✓	✓	✓
10	Water audit should be conducted in the facility to understand the usage pattern.	✓	✓	✓	✓	NA	NA

CHAPTER

03

SMART BUILDING

3.1 Background

It has rightly said that healthcare facilities age unpredictably with changing medical technology, architecture designing, and evolving healthcare delivery system rendering some obsolete while reprieving others. It must be acknowledged that what is built for today will not be permanent. Prediction is very difficult, particularly when it concerns the future. It is a herculean task to visualize healthcare facilities for tomorrow, so it is essential that at the time of healthcare facility planning and its designing, focus should be given to make Smart building, which will ensure technological driven infrastructure and ensure safety and comfort of the patients and staff.

The healthcare facility for tomorrow should be planned and designed with patient-focused philosophies. The patient-centred architecture will facilitate their participation as partners in their care. The architecture should be welcoming to the patient, and the healthcare facility's design would value human beings over technology. Smart healthcare facilities will provide privacy, comfort, safety, security, and enable patients to be in touch with nature. The architecture would be a humanizing one, which is a friendlier and a responsive place providing customized care based on patient's needs and values.

3.2 Components of smart buildings

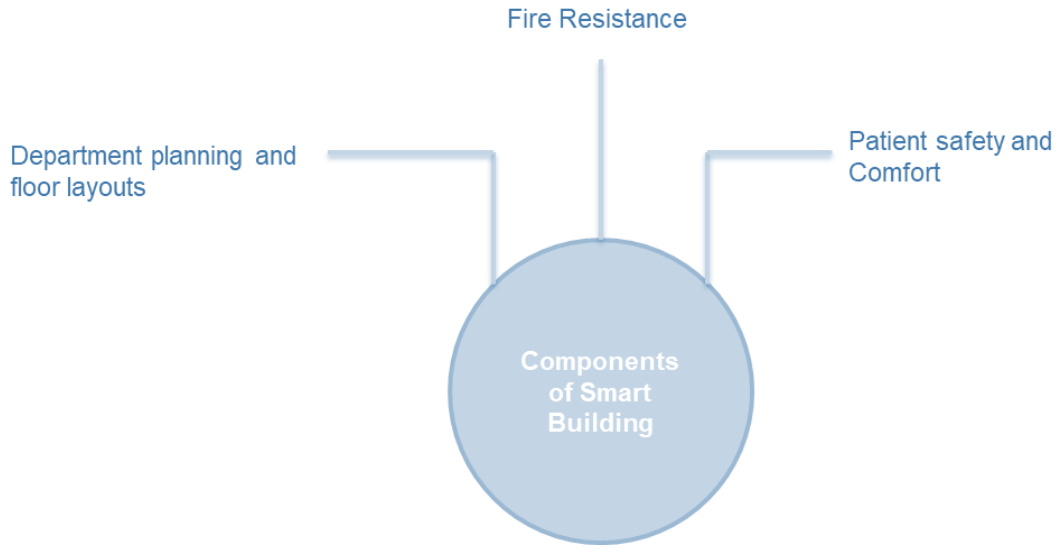

Figure 28: Components of smart building

Key guiding principal for smart building

GP3.1 Healthcare facility shall develop strategies to consider it to be a smart building.

S3.1.1 Healthcare facility shall consider the patient safety and comfort during the time of construction.

S3.1.2 Healthcare facilities shall have a proper planning of the department to minimize the unnecessary travel of the staff.

3.3 Guiding principle

GP3.1 Healthcare facility shall develop strategies to consider it to be a smart building.

S3.1.1 Healthcare facility shall consider patient safety and comfort during the time of construction.

A. Patient safety and comfort

- All the toilets should be disability friendly in the facility.
- Handrails should be present in the toilets and floors for patient safety.
- The slope of a ramp shall not exceed 1 in 12.
- Handrails shall be provided on all ramps and staircases on both sides.
- Western toilets should be present in the labour room.
- IEC material should be displayed in the toilets of the labour room to make the patient aware about the use of a toilet.

B. Fire resistance in the healthcare facility

B.1. Fire barrier

- Fire barrier is horizontally and vertically aligned, such as curtain, walls, or a floor, and this may be discontinuities created by opening with a specified fire-resistance rating, and these are designed and constructed to limit the spread of a fire that also restricts the movement of smoke.
- Install fire door, frame, and other accessories that together provide specific fire resistance to the opening in terms of its stability, integrity, and insulation properties.
- Fire exits should be present on each floor.
- Fire-resistant paints should be used in the facility, which helps to reduce the spread of flames in the event of a fire.
- Fire doors in exits shall be provided with an intumescent seal.
- Fire doors in exits shall not be allowed to be on an open-hold position and kept closed and to close by door closure spring mechanism.

B.2. Firefighting shaft

- An enclosed shaft having a protected area of 120 min fire-resistance that protects lobby, staircase, and fireman's lift or area from exit passageways to exit discharge.
- The respective floors shall be approachable from fire-fighting shaft enabling the firefighters to access the floor and assist in evacuation through fireman's lift.
- The firefighting shaft shall be equipped with 120 min fire doors. The firefighting shaft shall be equipped with firemen talk back, wet riser, and landing valve in its lobby, to fight fire by firefighters.
- Where such lobbies and staircases in the firefighting shaft are naturally ventilated/cross-ventilated, the shaft may not be enclosed, and a fire door need not be provided.
- For all enclosed firefighting shafts, the shafts lobby should have a floor plan duly displayed for the information of firefighters.

B.3. Fire resistant wall

Fire-resistance rated wall, having an opening(s) with specified fire-resistant rating, which restricts the spread of fire from one part of a building to another part of the same building.

B.4. Fire suppression system

- ***Gas-based systems:*** System that uses gaseous agents as fire suppression media, such as, all agents alternate to Halon gases.
- ***Water-based system:*** Systems that use mainly water as firefighting media such as hydrant system, sprinkler system, water spray system, foam system, and water mist system.

B.5. Escape lighting and exit signages

Adequate lighting should be maintained in the exit access, exits, and exit discharge so that all the occupants shall be able to leave the facility safely.

B.5.1 Lighting:

- All the exits, exit access, and exit discharge should be illuminated continuously. The floor should be illuminated at all points, including angles, corridors, passageways, stairwells, landings of a stairwell, and exit.
- A power backup should be present for the emergency lightings.
- Fire alarm call points and firefighting equipment provided along the escape routes can be readily located.
- The horizontal illuminance at the floor level on the centreline of an escape route shall not be less than 10 lumen/m2. In addition, for escape routes up to 2 m wide, 50 percent of the route width shall be lit to a minimum of 5 lumen/m2.
- The emergency lighting shall be provided to be put on within five seconds of the failure of the normal lighting supply. Also, emergency lighting shall be able to maintain the required illumination level for a period of not less than 90 min in the event of failure of the normal lighting even for smaller premises.
- The luminaires shall be mounted as low as possible, but at least 2 m above the floor level.
- Signs are required at all exits, emergency exits, and escape routes.
- Install double-throw switches to ensure that the lighting installed in the staircase, and the corridor does not get connected to two sources of supply simultaneously.

B.5.2 Exit signages:

- Exit signages should be in the bilingual language so, the occupants shall be able to identify the way to exits easily.
- Exit signs shall be provided such that no point in exit access is more than 30 m from a visible exit directional sign.

Figure 29: Signage

- Exits shall be clearly visible, and the route to reach the exits shall be clearly marked and signs posted to guide the occupants of the floor concerned.
- Signs shall be illuminated and wired to an independent electrical circuit on an alternative source of supply.

- All landings of the floor shall have the floor indicating boards prominently indicating the number of the floor.

S3.1.2 Healthcare facilities shall have proper planning of the departments to minimize the unnecessary travel of the staff.

A. Department planning

A.1 Routes, Roads, and Parking:

- Roads to reach the healthcare facility shall be illuminated in the nights.
- There shall be dedicated parking spaces separately for ambulances, healthcare facilities staff, and visitors.

A.2 Administrative block:

- Block should have independent access and connectivity to the main building, wherever feasible.
- It should be attached to the main healthcare facility building along with the provision of MS office.

A.3 Circulation areas:

Circulation areas comprise corridors, lifts, ramps, staircases, and other common spaces, etc. The flooring should be anti-skid and non-slippery.

A.4 Corridors:

Corridors shall be at least 3 m wide to accommodate the daily traffic. Size of the corridors, ramps, and stairs shall be conducive for manoeuvrability of wheeled equipment. Corridors shall be wide enough to accommodate two passing trolleys, one of which may have a drip attached to it.

A.5 Roof height:

The roof height should not be less than (Ministry of New and Renewable Energy, 2010) approximately 3.6 m measured at any point from floor to roof.

Note: For operation theatre, the minimum roof height should be 4.2 meters.

A.6 Entrance area:

There should be four access points to the entrance area.

- **Emergency** for patients in ambulances and other vehicles for an emergency department.
- **Service** corridor/ entry gate for delivering supplies and collecting waste.
- **Exit** gate for the removal of dead bodies
- **Main**: for all others (patients/relatives and staff)

B. Department layouts

B.1 OPD:

The facility shall be planned to keep in mind the maximum peak hour patient load and shall have the scope for future expansion. OPD shall have an approach from the main road with signage visible from a distance.

Reception and Enquiry: Services available at the healthcare facility displayed at the inquiry.

Waiting spaces:

- Waiting area with adequate seating arrangement shall be provided
- Waiting area at the scale of 1 sq. ft/per average daily patient with a minimum of 400 sq. ft of area is to be provided.

Layout of OPD: **Functional flow of the patient is**

Enquiry→ Registration→ Waiting→ Sub-waiting→ Clinic→ Dressing room/Injection Room→ Billing→ Diagnostics (lab/X-ray) → Pharmacy→ Exit

Patient amenities:

- Potable drinking water available for patients and staff.
- Functional and clean toilets with running water and flush for patients and staff.
- Fans/coolers.
- Seating arrangement of the patients as per the patient load.

B.2 Imaging:

- The department shall be located at a place which is accessible to both OPD and wards and to the operation theatre department.
- The size of the room shall depend on the type and size of equipment installed. The room shall have a sub-waiting area with a toilet facility and a change room facility.

B.3 Clinical laboratory:

- The department shall be situated such that it has easy access to IPD as well as OPD patients.
- There shall be separate and demarcated areas for sample collection, sample processing, haematology, biochemistry, clinical pathology, and reporting. The table top shall be acid and alkali proof.

B.4 Blood bank:

Blood bank shall be near the pathology department and at an accessible distance to the operation theatre department, intensive care units, emergency, and accident department.

B.5 Wards:

- Location of the ward should be such to ensure quietness and to control a number of visitors.
- Ward unit will include nursing station, doctors' duty room, pantry, isolation room, treatment room, nursing store, dirty utility along with wards and toilets
- The distances to be travelled by a nurse from bed areas to the treatment room, pantry, etc. should be kept to the minimum.
- There shall be at least 2.5 m distance between the centers of the two beds to prevent cross-infection and allow bedside nursing care.
- Dedicated toilets with running water facility and flush shall be provided for each ward.

B.6 Pharmacy:

- The pharmacy should be located in an area conveniently accessible from all clinics.
- For every 200 OPD patients daily, there should be one dispensing counter.
- Pharmacy should have a component of a medical store facility for indoor patients and separate pharmacy with accessibility for OPD patients.

B.7 ICU and high dependency wards:

- This unit should be located close to the operation theatre department and other essential departments, such as X-ray and pathology, so that the staff and ancillaries could be shared.
- Easy and convenient access from the emergency and accident department is also essential.
- There should be good natural light and pleasant environment.

B.8 Accident and emergency services:

- There should preferably be a distinct entry independent of OPD main entry so that very minimum time is lost in giving immediate treatment to causalities arriving in the healthcare facility.
- Emergency shall have dedicated triage, resuscitation, and observation area.
- Separate provisions for an examination of rape/ sexual assault victims should be made available in the emergency.
- Separate emergency beds may be provided. Duty rooms for doctors/nurses/ paramedical staff and medico-legal cases. Enough separate waiting areas and public amenities for patients and relatives and located in such a way that does not disturb the functioning of emergency services.

B.9 Operation theatre:

- Operation theatre should be available on the upper floors. Zoning should be done to keep the theatres free from microorganisms.
- There may be four well-defined zones of varying degrees of cleanliness/asepsis, namely, Protective Zone, Clean Zone, Aseptic or Sterile Zone, and Disposal or Dirty Zone.

  An Operation Theatre should also have a Preparation Room, Pre-operative Room, and Post-Operative Resting Room.
- There should also be a scrub-up room where operating team washes and scrub-up their hands and arms, put on their sterile gown, gloves, and other covers before entering the operation theatre.

B.10 CSSD

As the operation theatre department is the major consumer of this service, it is recommended to locate the department at a position of easy access to the operation theatre department.

B.11 Delivery suit unit:

The delivery suite unit is located near to the operation theatre and located preferably on the ground floor.

C. Floor layouts

- Layouts of the floor should be displayed on each floor.
- All the zones and area should be clearly marked on floor layouts
- Fire exits should be clearly marked on floor layout.

Figure 30: Floor layout of district Healthcare Facility Bijapur, Chhattisgarh

3.4 Summary of Key Interventions for Smart Building

Table 9: Summarization of the key intervention in different facilities for Smart Building

S. No.	Key Interventions	DH	CHC	PHC	UPHC	HWC	SC
1	Ensure the availability of a disable friendly toilet in the facility	✓	✓	✓	✓	✓	✓
2	Ensure the availability of separate male and female toilets in the facility.	✓	✓	✓	✓	✓	✓
3	Availability of updated floor layouts with clearly marked fire exit routes in it.	✓	✓	✓	✓	✓	✓
4	All the exit, exit routes should be properly illuminated.	✓	✓	✓	✓	✓	✓
5	All the firefighting equipment, like fire extinguishers, sprinklers, fire detection systems, should be installed in the facility.	✓	✓	✓	✓	✓	✓

CHAPTER

04

GREEN HEALTHCARE FACILITIES

4.1 Green building

A 'green' building is a building that, in its design, construction or operation, reduces or eliminates negative impacts and can create positive impacts on our climate and natural environment. Green buildings preserve precious natural resources and improve our quality of life. The Green Building practice expands and complements the classical building design concerns of economy, utility, durability, and comfort.

Although new technologies like HMIS are constantly being developed to complement current practices in creating greener structures, the common objective is that green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment by:

- Efficiently using energy, water, and other resources
- Protecting occupant health and improving employee productivity
- Reducing waste, pollution, and environmental degradation

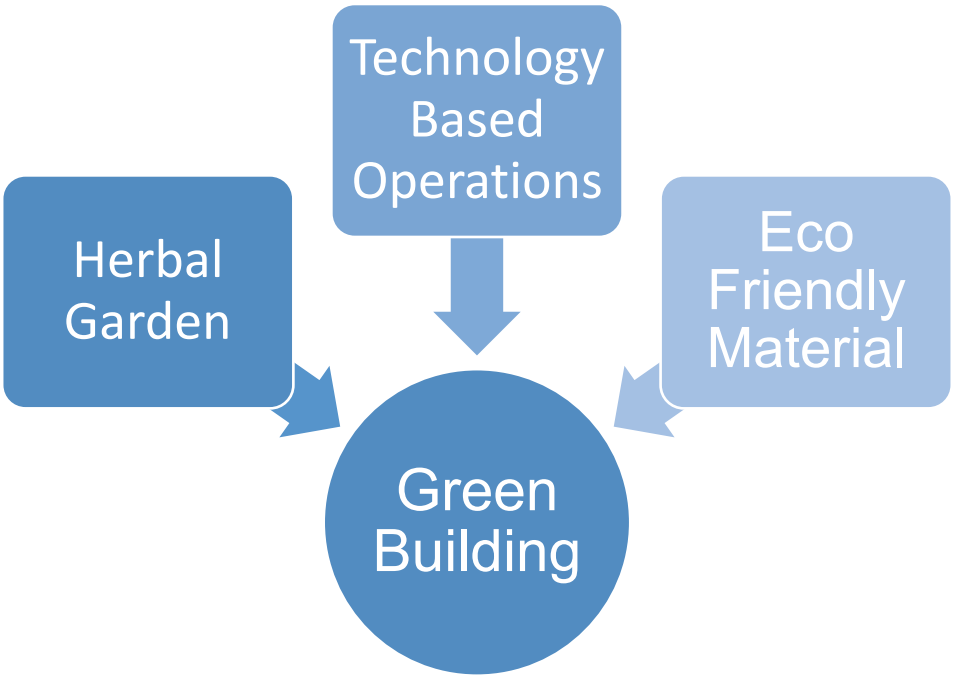

Figure 31: Components of Green Building

4.2 Benefits of green building

Green Building includes an herbal garden with medicinal plants, Green material, Technology-based operations, that provides the following benefits:

- Green building helps to reduce the operational cost of the facility by incorporating green material into the building during construction.
- Technology-based operations in the healthcare facility use less paper and thus reduces waste making it more environment-friendly.
- Green building has an herbal garden with medicinal plants that provides comfort and stress-free environment to the patients.

Key guiding principal for green healthcare facilities

GP4.1 Healthcare facility shall develop strategies to consider it to be a green building.

S4.1.1 Healthcare facilities shall have innovations in operation to contribute to green practices.

S4.1.2 Healthcare facilities shall have a plan to use the technologies for easy operation in service delivery.

S4.1.3 Healthcare facilities shall have strategies for improving the healing process of the patient.

4.3 Guiding principle

GP4.1 Healthcare facility shall develop strategies to consider it to be a green building.

S4.1.1 Healthcare facilities shall have innovations in operation to contribute to green practices.

A. Use of natural ventilation

- Use windows and doors to provide good levels of natural ventilation in the non-critical area of a building, it allows mechanical ventilation to be switched off for some time and turn down to save energy. In addition to this, it gives the patient a sense of bearing and helps them to establish orientation to time.
- Meshwork should be present on the windows and doors of a room, wards, and non-critical areas of a building.
- Eco-friendly design plans and renovation of facilities that ensure the optimization of natural light and air should be incorporated in the design of the building.

B. Glazing

- Use insulated black panels in some of the glazed space's area like the waiting rooms.
- For fully sprinkled buildings, fire separation of 9 m or more, tempered glass in a non-combustible assembly, with the ability to hold the glass in place, shall be provided.
- It shall be ensured that sprinklers are located within 600 mm of the glass facade providing full coverage to the glass.
- Openable panels shall be provided on each floor and shall be spaced not more than 10 m apart measured along the external wall from centre-to-centre of the access openings. Such openings shall be operable at a height between 1.2 m and 1.5 m from the floor and should be in the form of openable panels (fire access panels) of size not less than 1m × 1m opening outwards.
- Fire openable panel shall be open in case of fire, do not obstruct and of at least 25mm letter height shall be marked on the internal side. These panels should be present on each floor based on the occupant concentration.
- These panels should not be limited to cubicle areas; only, it should also be in common areas/corridors to facilitate the access by the building component and fire personnel for

smoke exhaust in times of distress.

- Unless otherwise specified, all the exits and exit passageways to exit discharge shall have a clear ceiling height of at least 2.4 m. However, the height of the exit door shall be at least 2.0 m.
- Use the high-performance glass on windows that have a coating that improves the insulation properties and allows daylight to enter but block or reduces heat, so it can be effective at reducing overheat from direct sunlight and lowers mechanical cooling requirement. It should be done, especially in the wards for the better healing of the patient.

Note: High performance glass is one which can contribute to optimizing energy efficiency and at the same time enhance light penetration. High performance glazing has low U-value, low shading coefficient and high VLT (visual light transmittance).

C. Environment Friendly Purchasing/Green Procurement

- Environmentally Friendly Purchasing (EFP) refers to the purchase of the least damaging products and services, in terms of environmental impact. Hence, it provides a healthier environment for patients and staff.
- Proper management of the stores prevents the waste of outdated chemicals and limits the waste of packaging and residue left in the container. These small amounts of chemical or pharmaceutical waste can be disposed of easily and relatively cheaply, whereas disposing of larger amounts requires costly and specialized treatment, which underlines the importance of waste minimization.

Green Procurement

- Procure those products which could be easily recycled, or order goods supplied without excessive packaging. For example, the purchasing manager at healthcare facility could investigate the possibility of purchasing plastics that may be easily recycled. The most easily recyclable plastics are polyethylene, polypropylene and polyethylene terephthalate (PET), whereas poly vinyl chloride (PVC) is the most difficult one to recyclable and packaging of mixed materials, such as paper or card covered in plastic or aluminium foil, is rarely recyclable.
- Use latex or nitrile gloves instead of PVC gloves.
- Latex or silicone tubing can replace PVC tubing, polyethylene IV bags can replace. Ethylene vinyl acetate bags can replace PVC bags for saline and blood.

Figure 32: Gloves

S4.1.2 Healthcare facilities shall have a plan to use the technologies for easy operation in service delivery.

A. HMIS

- Computer with an internet connection is to be provided for MIS purposes. Provision of

the flow of information from PHC/CHC to district healthcare facility and from there to district and state health organization should be established.

- Information with regards to an emergency, outdoor, and indoor patients be recorded and maintained for enough duration of time as per state health policy.
- Maintain electronic medical records in the facility instead of maintaining it in the paper.
- Backup system should be provided to the computers with HMIS records in case of power failure for the smooth operations of the hospital.

S4.1.3 Healthcare facilities shall have strategies for improving the healing process of the patient.

B. Stress-relieving space for patient and staff

Healthcare facilities and employees often turn to nature to help them de-stress while in the middle of a shift. There should be soothing background noise while employees relax.

Facilities should create small outdoor gardens where staff can step out and get away from the chaos of the healthcare facility for a few minutes. There should be a separate meditation area in the facility for the mental relaxation of the patient, and it will also help to heal the patient faster.

Case Study: Stress relieving space of PHC Kutru, Chhattisgarh

As per the Ayushman Bharat guidelines, PHC Kutru has a place to carry out the yoga activities. It is an effort to bring indigenous health system and yoga will be mainstreamed into the health care delivery system, by actively engaging practitioners of these system. Facility is conducting fortnightly schedule of yoga classes for community yoga training by taking the help of local yoga teacher.

Figure 33: Yoga place in PHC Kutru, Chhattisgarh

B. Landscaping

A growing number of healthcare professionals acknowledge that outdoor landscapes can assist the psychological and physical recovery of patients, facilitate relaxation, and recovery from the mental fatigue of caregivers and healthcare facility staff, and establish good relations with nearby communities by offering local recreation opportunities. In addition to this, hospital open area should be cleaned regularly to give an aesthetic look. Please refer to Kayakalp guidelines for further details on cleaning.

B.1 Green and herbal gardens

- Establishment of an herbal garden with medicinal plants and aromatic plants with medicinal value considering the importance of species/varieties of concerned areas
- Use of proper cultivation practices.
- Walking trails, signages, etc. to be established in the garden.
- Proper documentation, data collection, harvest, and post-harvest management operations to be a part of the herbal garden.
- Material harvested could be used for value addition or further propagation.
- Herbal Gardens should be on the premises of the facility, and treated water can be used for gardening, and these gardens also enhance the beautification of the surroundings.

Figure 34: Herbal Garden, PHC Kutru, Chhattisgarh

As per the GRIHA guideline, the area of the herbal garden is recommended as 30% of the total available area of the facility. However, considering many facilities like UPHC located in the urban areas may not have recommended sufficient space for setting up of herbal garden. Therefore, it is advisable to provide at least 10-30% area in the health care facilities for setting up of herbal garden.

B.2 Kitchen garden

Ideal location of the kitchen garden would be on the rooftop or at the backyard of the facility. Vegetables, fruits, and herbs with medicinal plants grow in the garden, and these can either be used in the healthcare facility canteen or can be sold to local villagers. It also gives a pleasing and aesthetic environment to the facility. Organic vegetables and fruits grow in the kitchen garden, and it is healthy for the patient's health. Sewage treated water can be used for gardening purpose and it will also help in achieving water conservation in the HCF.

Note: Facilities which do not have sufficient space for the development of kitchen garden or herbal garden, should focus on making the corridors and surroundings green by placing portable plants/flowerpots for better aesthetics.

Case Study: Herbal Garden and Kitchen Garden of PHC Unava, Gandhinagar

The facility has a very well planned and maintained herbal garden and kitchen garden which is spread in the front and back side of the building. The herbal and terrace garden are made at the cost of Rs. 12 lakhs in just a span of three months. Total 112 different species are grown including commonly used vegetables, fruits, and herbs with medicinal value. The seeds used in herbal garden are from Tamil Nadu which is organic and use for medicinal plants. The garden is covered with the Nigiri wooden post treated with tar to prevent the plants from termites. The vegetable and fruits grown in the kitchen garden are sold to local villager and the income received is used for the maintenance of the garden and the salary of the staff appointed for gardening.

Figure 35: Herbal garden of PHC Unava, Gandhinagar, Gujarat

C. Transportation

Electricity-run vehicles should be used for the provision of ambulance services as well as for other official purposes. Use of cycles and public transportation is recommended for the healthcare facility staff to reduce the carbon emissions.

4.4 Summary of key interventions for green building

Table 10: Summarization of the key Interventions in different facilities for Green Building

S. No	Key Intervention	DH	CHC	PHC	UPHC	HWC	SC
1	Use of high-performance glass on windows, doors, and roofs to prevent the heat inside and allows sunlight to enter the room.	✓	✓	NA	NA	NA	NA
2	Use double glazing glass on windows; it provides thermal and optical properties to the building and reduce the noise level inside the Healthcare Facility and provide better comfort to the patient.	✓	✓	NA	NA	NA	NA
3	Insulation of building from inside and outside.	✓	✓	✓	✓	✓	✓
4	Use insulated black panels in the high glazed space area like waiting rooms.	✓	✓	NA	NA	NA	NA
5	Introduce electronic patient records in the facility to reduce the use of paper.	✓	✓	✓	✓	NA	NA
6	Availability of 10-30% area of herbal garden in the facility.	✓	✓	✓	✓	✓	✓

CHAPTER

05

WASTE MANAGEMENT

5.1 The global problem

The World Health Organization has published the Core Principles describing safe and sustainable healthcare waste management as a public health imperative and calling on all associated with it to support and finance it adequately. The world's governments, through the World Health Assembly, have called for greater action on medical waste. A United Nations Human Rights Commission Special Rapporteur has called for "the development of a comprehensive international legal framework aimed at protecting human health and the environment from the adverse effects of improper management and disposal of hazardous medical waste.

Figure 36: Waste

In India, inadequate waste management was reported that cause pollution, growth, and multiplication of vectors like insects, rodents and worms and may lead to transmission of disease like typhoid, cholera, hepatitis and AIDS through syringes and needles.

As per a joint report by Associated Chambers of Commerce and Industry of India (ASSOCHAM) and velocity [4]in 2018 said, the total quantity of medical waste generated in India is 550 (tonnes per day)TPD, and these figures are likely to increase close to 775.5 TPD by 2022.

Unfortunately, health care waste management is still poorly funded and implemented. The combined toxic and infectious properties of medical waste represent an underestimated environmental and public health threat. A recent literature review concluded that over half the world's population is at risk from the health impacts of healthcare waste.

Key guiding principal for the management of waste

GP5.1 Healthcare facilities shall develop a strategy for management of waste.

S5.1.1 Healthcare facilities shall have a plan for the management of waste.

S5.1.2 Healthcare facilities shall have a waste reduction programme.

S5.1.3 Healthcare facilities shall have an audit to ensure the minimization of waste.

S5.1.4 Healthcare facilities shall have a strategy for the food waste reduction.

S5.1.5 Healthcare facilities shall have a provision for the recycling of food waste.

GP5.2 Healthcare facilities shall have an educational and training programme for all the stakeholders (staff, patients and visitors).

S5.2.1 Healthcare facilities shall have a training program for the stakeholders to aware them about the waste management technique.

[4] Velocity is an organization which collaborates with ASSOCHAM and published a joint report that highlights the India's medical waste growing estimates.

5.2 Guiding principle

GP5.1 Healthcare facilities shall develop strategies for management of waste.

S5.1.1 Healthcare facilities shall have a plan for the management of waste.

A. Need for waste management

Healthcare waste drastically affects the environment and human health, as it is responsible for the spread of infections, and it's a major cause of the disease/ ill health.

The effluent from healthcare facilities contains more drug-resistant pathogens, a greater variety of chemicals, and more hazardous materials than domestic sewage.

Burning of medical waste generates several hazardous gases and compounds, including hydrochloric acid, dioxins and furans, and the toxic metals lead, cadmium, and mercury. The disposal of solid waste produces greenhouse gas emissions, including methane, a greenhouse gas twenty-one times more potent than carbon dioxide, so it affects the environment badly, and there is an acute need for the treatment of such waste. Healthcare facility waste water is often excluded from the list of medical wastes but is worth considering.

B. Types of Waste

- **General Waste:** This is the waste that is comparable to the waste generated in the home. It poses no risk to human health.
- **Bio-Medical Waste:** "Bio-medical waste" means any waste, which is generated during the diagnosis, treatment, or immunization of human beings or animals or in research activities or in production or testing of biological or in health camps.

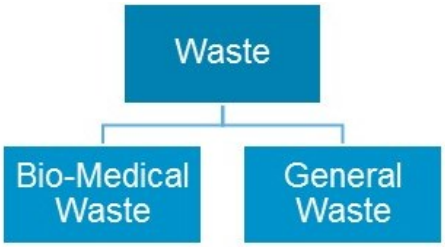

Figure 37: Type of waste

About 80% of the waste generated by the healthcare facility is general waste, 15% is hazardous and infectious, and the remaining 5% is hazardous but non-infectious. When this 20% of the waste is mixed with the general waste, all the waste turns hazardous and infectious.

A facility must follow Bio-medical Waste Management Amendment Rules, 2018, along with Bio-medical Waste (Management) Rules, 2016 for segregation, collection, transportation, and disposal of the waste separately.

The components under waste management include waste segregation, collection and storage, transportation including on-site and off-site transport, and water treatment and disposal. Detailed processes on the same may be accessed from-

Bio-medical Waste Management Amendment Rules, 2018-
https://pcb.ap.gov.in/APPCBDOCS/Tenders_Noti//WasteManagement//Bio%20medical%20waste%20management%20(amendment)%20Rules%202018.pdf

Bio-medical Waste (Management) Rules, 2016-
https://hspcb.gov.in/content/laws/bmw/BMW_Rules.pdf

S5.1.2 Healthcare facilities shall have a waste reduction programme

A. Waste reduction programme

Infection control resource person would be responsible for the waste reduction programme, and should have good communication skills, organizational ability, and sound knowledge of healthcare operations. The point person is to effectively engage in all aspects of the waste reduction programme to achieve greatest impact.

Waste treatment and disposal

The bulk of healthcare waste falls into the category of non-risk waste, which can be recycled or reused. With correct segregation, a low amount of waste can be categorized as risk waste, which requires special attention. The healthcare facility should adopt the following strategies for better waste management:

B. Waste management hierarchy

The waste management hierarchy is largely based on the concept of the "3Rs," namely reduce, reuse, and recycle, and broadly relates to the sustainable use of resources. Best practice waste management will aim to avoid or recover as much of the waste as possible in or around a healthcare facility, rather than disposing it by burning or burial method.

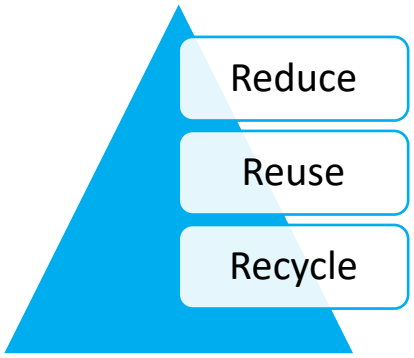

Figure 38: Waste management hierarchy

The most preferable approach, if locally achievable, is to avoid producing waste as far as possible and thus minimize the quantity entering the waste stream. Where practicable, recovering waste items for secondary use is the next most preferable method. Waste that cannot be recovered must then be dealt with by the least preferable options, such as treatment or land disposal, to reduce its health and environmental impacts.

B.1 Reduce waste

The preferred management solution is quite simply not to produce waste by avoiding wasteful ways of working. To achieve lasting waste reduction (or minimization), the focus should be on working with medical staff to change clinical practices to ones that uses less materials. Although waste minimization is most commonly applied at the point of its generation, health-care managers can also take measures to reduce the production of waste through adapting their purchasing and stock control strategies.

Practices that encourage waste reduction:

- Use a product that produces less hazardous waste products and select those suppliers that are less wasteful where small quantities can be used.
- Use of physical cleaning methods rather than chemical cleaning methods (sterilization instead of chemical disinfection.)
- Centralized purchasing of hazardous chemicals.
- Monitoring of chemical use within the facility from delivery to disposal as hazardous waste.
- More frequently order inventories in small quantities rather than a large amount in one time, to reduce the quantities used.

- Checking of the expiry date of all products at the time of delivery, and refusal to accept short-dated items from a supplier.
- Use the oldest batch of a product first.
- Use electrical thermometers in place of a mercury thermometer.
- Use of air dryer in the healthcare facility, wherever possible, otherwise paper towel should be used everywhere.
- Training should be given to the employees of waste minimization practices.
- Health care facility should focus on green purchase so, that maximum waste gets decomposed and generate lesser residue at the end.

Table 11: Various disposable and reusable items used in a healthcare facility

Disposable Items	Reusable Products
Disposable Gowns	Washable Cloth Gowns
Paper plates, cups, plastic spoons and forks	Washable dishware, glass, and cutlery
Disposable bedpans	Sterilizable metal pans
Disposable wipes	Washable cloth
Single-use batteries for the equipment	Rechargeable batteries
Single-use cardboard packaging	Reusable plastic containers

B.2 Reuse

- The use of non-disposable items for medical procedures should be encouraged where their reuse after cleaning can be done to minimize the infection transmission to acceptably low probabilities.
- Single-use items should never be reused because they cannot be properly sterilized and possess a chance to spread infection. For example- reusing disposable syringes and hypodermic needles pose a great risk of spreading disease.
- Reuse may involve a combination of the following steps: cleaning, decontamination, reconditioning, disinfection, and sterilization.
- Certain types of non-disposable medical devices such as an endoscope, bronchoscope, laryngoscope can be reused, but proper monitoring should be done at the time of sterilization of non-disposable devices on a regular basis.
- Training should also be given to the person who is responsible for performing the reprocessing of devices.
- Urinary catheters, face mask for oxygen that is considered for limited reuse by the individual and only requires washing with mild detergents.
- Increase the use of non-disposable items over single-use disposable.
- The use of reusable products helps in the minimization of waste, and it is cost-effective as well.

B.3 Recycle

Recycling involves the processing of used materials to convert it into the raw materials that can be used for different purposes. It helps to prevent the waste that is generated from useful

materials, reduces the use of fresh materials, and reduces air and water pollution that occurs from incineration and landfilling, and it lowers the greenhouse gas emission as well.

The products that can be recycled include:

- Glasses
- Plastics
- Aluminium cans
- Papers
- Food scraps
- Cardboards

Recycling is the lengthy process that initiates from segregation, collection, and transportation of the waste to the processing facility, which can be off-site and on-site. Disposal of recyclable and biodegradable waste convert it into the manure, which can be used for gardening and plantation.

S5.1.3 Healthcare facility shall have a waste audit to ensure the minimization of waste.

A. Waste audit

Waste audit is to be conducted to reduce the waste in the facility and identify the areas from where the maximum waste is generated. This approach is intended to identify the major waste contributors and to provide a starting point for waste diversion initiatives.

Waste audits would be conducted quarterly by the Infection Prevention and Control Committee in the healthcare facility.

B. Process of waste audit

B.1 Assemble basic information

These are the following information that needs to be assessed before conducting the audit:

- Number of employees, building area or floor area, or other indicators relevant to the type of entity.
- Site location and size
- Type of entity
- Purchasing policies
- Composition and quantity of all the waste directly generated within the establishment through all normal activities.
- Review existing waste reduction and disposable activities.
- Identification of the responsible person for the waste management and reduction.
- Timing and frequency of existing waste collection.
- Amount of waste and recyclables are collected.
- Method for waste collection in the facility for internal and external waste handling.
- Gross cost of waste collection and disposal.

B.2 Identify resource requirements

Resource requirement may include the following:

- Adequate time for assigned people to carry out audit tasks to ensure the quality of audit data.
- Storage containers to isolate, move, and sort waste and recyclables.
- Bags tags or labels to identify wastes from various generation points.
- Space for sorting and storing wastes during the audit. should be done extremely carefully. Infected waste bags should not be opened without proper precautions

B.3 Identify waste

- The objective of this step is to estimate the types of waste and places where they are generated. During the review, person should note existing collection and storage practices and any other special considerations that should be considered for the waste reduction work plan.
- The best way to identify the different types of waste that healthcare facility generates is to complete a walk-through while noting the types of waste and recyclables that are generated in each operation or area. Be sure to investigate waste/recycling containers and to ask other questions, e.g., staff, management.

B.4 Estimate waste quantity

It is necessary to estimate how much waste a healthcare facility generates during a specific period. It can be estimated by-

- By weighing representatives' containers or bags of waste and recycling.
- By obtaining data collected by the waste and recycling contractors.
- By auditing waste samples
- By weighting materials before they are placed into the main waste or recycling containers for collection.
- By determining the estimated volume of waste and recyclables and converting it to weight.
- Identified recycled content.
- Estimate waste for a baseline year.
- Complete waste audit report.

B.5 Creating a Waste Reduction Plan

- Review current 3Rs activities
- Identify areas of greatest waste reduction impact via the 3Rs.
- Assess waste reduction priorities
- Identify opportunities to reduce, reuse, and recycle waste.

B.6 Implementation

Implement the action plan and monitoring it by assessing the baseline measurement of waste quantity.

GP5.2 Healthcare facilities shall have an educational and training programme for all the stakeholders (staff, patients, and visitors).

S5.2.1 Healthcare facilities shall have a training program for the stakeholders to aware of the waste management technique.

- Engage trained staff about food waste and losses, so that they can concretely help to reduce waste on daily basis.
- Use of IEC materials that are to be displayed near the food counter to prevent food wastage.
- Reward should be given to the staff/patient who produces less plated waste.

5.3 Summary of key intervention for waste management

Table 12: Summarization of the key interventions in different facilities for waste management

S. No	Key Intervention	DH	CHC	PHC	UPHC	HWC	SC
1	Set up a Waste Management Committee for planning, monitoring, budgeting and training of waste management programme	✓	✓	✓	✓	✓	✓
2	Waste audits should be conducted in the facility to identify the areas where the maximum waste is generated.	✓	✓	✓	✓	✓	✓
3	Implementation of waste minimization programme in the facility for the reduction of waste at the point of its generation.	✓	✓	✓	✓	✓	✓
4	Segregation of waste at source as per the BMW guidelines 2018 and initiate recycling.	✓	✓	✓	✓	✓	✓
5	Waste management training programme should be conducted in the facility to educate the end-user.	✓	✓	✓	✓	✓	✓
6	Connectivity with the biomedical waste agency is required for the transportation of waste.	✓	✓	✓	✓	NA	NA
7	Availability of deep burial pits for waste disposal (if in case CTF connectivity is not there)	✓	✓	✓	✓	✓	✓
8	Availability of biodigester to treat the sewage in the facility.	✓	✓	NA	NA	NA	NA
9	Use PPE at the time of handling the waste.	✓	✓	✓	✓	✓	✓
10	Waste should be transported in the closed container trolley to prevent cross-contamination.	✓	✓	✓	✓	✓	✓
11	Monitor the treatment process from the facility to recycling plants, treatment centers, and landfill sites.	✓	✓	✓	✓	✓	✓
12	Waste should be disposed of as per the BMW guideline 2018	✓	✓	✓	✓	✓	✓
13	Segregation of biodegradable solid waste and recyclable waste as per the BMW guideline.	✓	✓	✓	✓	✓	✓
14	Hand over Bio-degradable solid waste to Municipal authority if not composted by the facility.	✓	✓	✓	✓	✓	✓

15	Bulk garden and horticultural waste shall be kept un-mixed and composted at the source.	✓	✓	✓	✓	✓	✓
16	Implementation of food waste reduction programme in the facility	✓	✓	✓	✓	NA	NA
17	Food waste audit should be conducted in the facility to reduce the wastage of food.	✓	✓	✓	✓	NA	NA
18	Training should be given to the staff and patient on food waste reduction.	✓	✓	✓	✓	NA	NA
19	IEC material should be displayed near the food counter to educate the patient and staff for reducing the food wastage.	✓	✓	✓	✓	✓	NA

CHAPTER

06

COSTED PLAN FOR DIFFERENT FACILITIES

6.1 Costed plan

There are different types of funds being allocated to each level of the healthcare facilities from state and centre government, so in order to utilize those funds appropriately, there should be a measure in the facility called a costed plan.

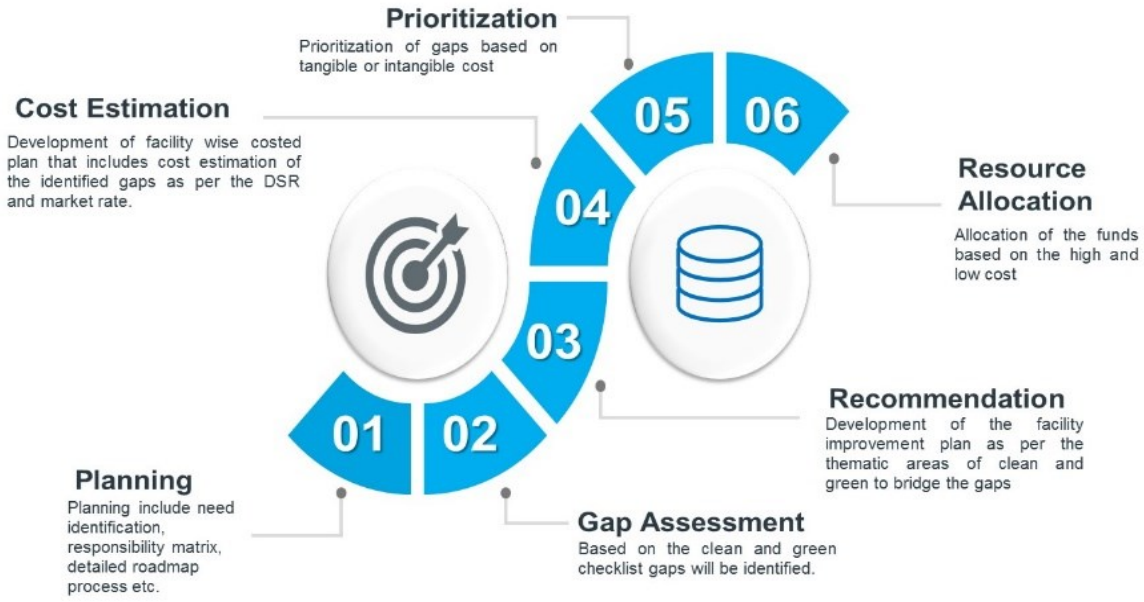

Figure 39: Process of Developing Costed Plan

In the costed plans, gaps will be addressed as per the thematic areas of clean and green. Recommendation and cost estimation will be given as per the identified gaps and based on these, funds will be allocated to the facilities.

6.2 Need of costed plan

The cost estimates require a detailed description of activities so that the type and magnitude of resources required to support each activity can be determined. The costed plan can be used by the government facilities to:

- Determine priority goals and objectives to be achieved
- Define targets for programmatic inputs required to be achieved to meet the priority goals
- Specify key interventions and activities needed to meet the priority goals
- Determine the costs associated with the intervention and activities
- Advocate for resources needed for the plan

Note: In this guideline, the process to make an ideal costed plan in different budget heads are added which can be used to make the facility green. It will be different for the different healthcare facilities.

6.3 Process of developing costed plan

The costed plan and budgets for all activities that will be undertaken to make the facility Clean and green includes: Planning, Gaps identification, Recommendation, Costing, Prioritizing based on the tangible or intangible cost, and resource allocation for the fund.

A. Planning

Figure 41: Indicators of Green and Climate Resilient HCF

A.1 Identification of need

Identification of need can save a significant amount of time and money for a healthcare facility. It is one of the most critical stages of planning because this stage helps to guide all subsequent analysis and decision making. Infection Prevention and Control Committee in the healthcare facility should conduct an audit bi-annually, and based on the observations, needs will be identified to make the facility clean and green and later on costed plan will be prepared.

A.2 Detailed process roadmap to make a costed plan

Development of a detailed description of the costed plan refers to the process roadmap, which includes the scope for intervention, activities, process, approach, tool (assessment checklist), and available resources. Assessment of the facilities will be conducted to identify the gaps by using the clean and green checklist.

A.2.1 Development of checklist

To ensure holistic development and strengthening of health care facilities, it is a necessity to first identify the gaps at the facility level. For the same facility, an assessment checklist has developed. While making it all, the national and international guidelines were considered and adepts the standards/measurable elements in the Indian context. Assessment Checklist (attached as Annexure) has covered the following areas:

Figure 40: Reference Guidelines for Checklist

Assessment of the facilities will be conducted by the Infection Prevention and Control Committee biannually.

Assessment is based on the scoring on a scale of 0, 5, 10 as per the following details:

- Full Compliance to the requirement :10
- Partial compliance to the requirement: 5
- No Compliance to the requirement: 0

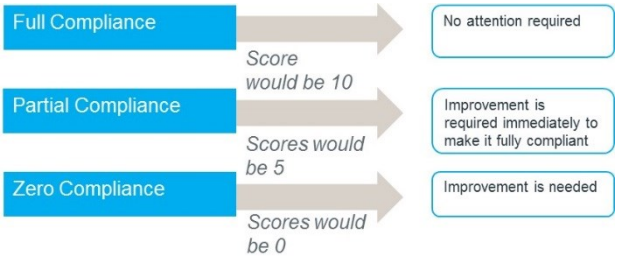

Figure 42: Scoring pattern to assess gap

Note: *Full compliance means the facility is following all the standards and norms and partial compliance means the facility has achieved less than substantial compliance but has made progress toward satisfying the requirement for most of the component of the target being assessed.*

A.2.2 Evaluation criteria:

Indicator of the checklist will be measured on the scale of 0, 5, 10. If the score of indicators is 5, that means improvement should be made immediately to make it fully compliant, but in case of zero compliance, an action plan will be prepared and within the given timeline and budget, the plan will be implemented in the facility.

SL#	Question	Response Code	Response	Assessment Method	Skips	Method of verification	Remarks
PART C: Clean Hospital Standards							
1. Health care facility should ensure cleanliness of surrounding areas							
C.1.1	Is the area around the facility neat and clean?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	OB		Check for any litter/garbage in the surrounding area	
C.1.2	Are all drains, and sewer covered?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	OB		Check for open manhole and overflowing drains.	

Figure 43: Snapshot of the checklist

B. Gap assessment

Assessment will be conducted biannually to identify the gaps in the facility by the Infection Prevention and Control Committee. On the basis of the indicators given in the checklist, an assessor will identify and verify the gap by observation, record review, and staff interview. Clean and Green checklist has a column of a method of verification in which the assessor can mark their observation. In addition to this assessor can also mark additional information related to the gap in the column of remarks, then he will give the scoring to a particular gap on a scale of 10, 5, 0 later on recommendations will be given for a particular gap.

C. Development of facility-based improvement plan

Improving Quality of care is an essential part of health system strengthening. Quality of health services in India is delivered across the various levels of the health system- primary, secondary, and tertiary. Each recommendation to address the identified gaps will be given by the Infection Prevention and Control Committee Responsible person and timeline will be clearly marked in the facility improvement plan to bridge the gaps and for the regular monitoring.

These plans will be developed in close consultation with healthcare providers, district, and sub-district officials at respective facilities with an objective to enable facility-level ownership

to improve the quality and efficiency of day to day operations. Recommendations given in the plan should be cost-effective and easy to implement. An example of the facility improvement plan can be seen below:

Table 13: An example of the facility improvement plan

Thematic area	Gap	Recommendation	Comments	Responsible person	Cost estimation	Budget line	Timeline
Environmental cleaning	Carbolic acid for surface cleaning of procedure areas was not available in supply.	Facility should ensure the regular supply of the cleaning materials on a timely basis	Saponin is available	Pharmacist	549Rs/-	JDS/United fund	1 Month

D. Cost estimation

Facility wise costed plan, which includes cost estimation, will be formed as per the recommendations given across the facilities. These cost estimates will be prepared individually for DH, CHC, PHC, and SC. During the development of costed plan, facilities need to consider their bed capacity, service statistics like OPD, IPD load and manpower availability etc. to ascertain the fund requirement to make the facility Green. These cost estimates will work as a guidance note for national and state government.

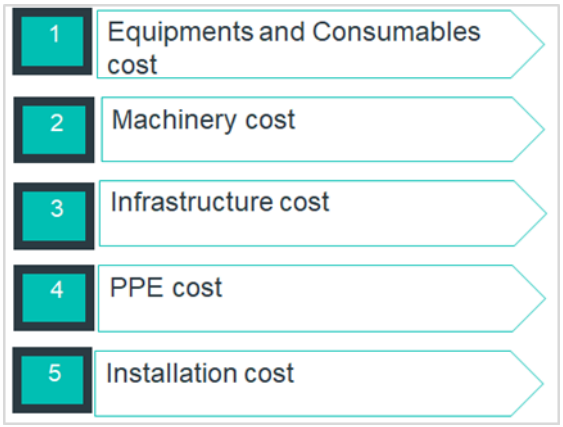

Figure 44: Budget heads in costed plan

Costed plans are added in the guideline for a reference, and it is segregated into the different budget heads that include: Equipment and consumables cost, Machinery cost, Infrastructure cost, PPE cost, and Installation cost. All the gaps and their recommendations will be segregated in the given budget heads and later on, the cost estimation will be given as per the DSR and Market rates. This plan will be prepared by the Infection Prevention and Control Committee and finalized after discussion with the facility in charge in a meeting.

Note: Costed plans are added in the guideline for a reference as per the current market rates, but rates can be changed over the period of time, so please consider the current market rates of that time while constructing the costed plan for the different facilities.

E. Prioritization

Cost estimation will be given in the costed plan as per the recommendations given the facility improvement plan but, Facility In charge needed to prioritize the cost of the recommendation based on the tangible and intangible cost. Those interventions which can be easily implemented and require low cost are to be implemented first, and the high-cost interventions will be implemented in the last.

F. Resource allocation

In the healthcare facility funds will be allocated based on the cost required to implement the intervention, Facility in-charge must examine regularly and identify areas where different funds can be utilized for a better program implementation while making on-going corrective actions at the same time

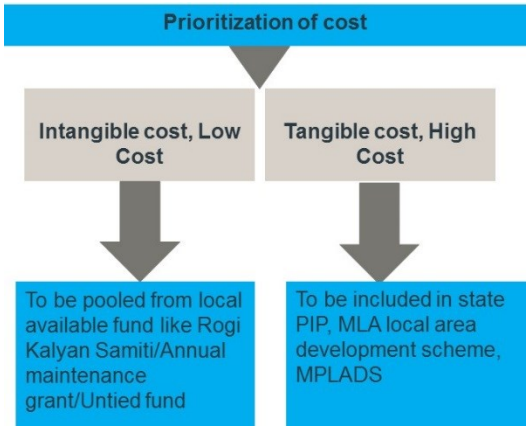

Figure 45: Prioritization of cost

Facility In-charge approach to the state level officials with the detailed action plan including the gap, recommendation and cost estimation and requesting them to support and allocate the fund which can be pooled from different sources as given below:

F.1 Use of state PIP funds:

For addressing large gaps (for example, construction of walls, toilets fulfilling water storage requirements, maintenance of major cracks, seepage, chipped plaster and floor in the department, etc.) costed plans will be developed for all the facilities in consultation with facility in-charge/ authorities. These plans will be shared with the district program managers/ chief medical officer in -charge of the district for any further amendments. These costed plans will be submitted as a part of the state PIP.

F.2 Use of locally available funds:

Health Sector reform under the National Health Mission (NHM) aims at increasing the functional, administrative, and financial autonomy of health care facilities.

Locally available funds and community funds are other potential sources of funding, to utilize these funds, facility in charge should approach the government and request to allocate funds for addressing the small gaps in which low-cost intervention is required.

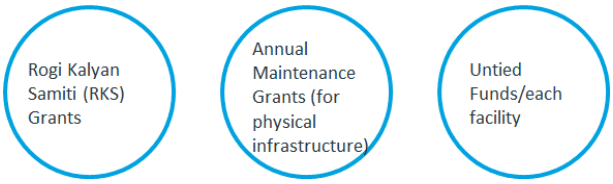

Figure 46: Different Funds in Healthcare Facility

Accordingly, funds are allocated to health facilities at different levels in the form of untied fund, annual maintenance grant & Rogi Kalyan Samiti grant to undertake any innovative or responsive facility-specific and need-based activity to enhance the quality of services.

The funds allocated to the public health sector are made available through the annual budget. The government allocates funds to the health facilities through the plan (i.e., new investments) and non-plan (i.e., continuing expenses) allocation. These funds can be used for ongoing maintenance and physical infrastructure improvement. United funds may be spent to meet the shortage of funds required to complete an activity planned under the annual maintenance grant/RKS fund and vice versa. Following are the funds which are given by NHM to each facility per annum, depending on the type of facility:

Table 14: Funds given under NHM to each facility per annum[5]

Type of Facility	Total of RKS Grants / Annual Maintenance Grant/ Untied fund/ each facility/ annum (Rs.)
District Healthcare Facility	10 Lakh
SDH	5 Lakh
CHC/UPHC/Area Healthcare Facility (AH)	5 Lakh
PHC	1,75000
Sub- Centre	20,000

F.3 Use of fund allocated to MLA and MP:

Facility in charge should approach the MP and MLA with the detailed action plan and request them to give support and allocate funds to the particular facility, which is required to address the gaps. There are two types of a scheme under which funds can be utilized:

F.3.1 The Members of Parliament Local Area Development (MPLADS):

Under this scheme, each MP has the choice to suggest to the District Collector for works to the tune of Rs.5 Crores per annum to be taken up in his/her constituency and can allocate this fund to the healthcare facility for the improvement.

F.3.2 MLA Local Area Development Scheme:

MLAs, too, are entitled to recommend funds, but the amount varies from state to state depending on the state budget and allocated funds for the MLALAD scheme. Generally, the amount will be around 2 to 4 crores per year. For MLA's every year, each state has its own MLA Local Area Development Scheme Fund. For big states, it usually - Rs. 2 - 4 crores per year whereas for small states b Rs. 30 lakhs to 1 crore.

F.4 Corporate social responsibility fund:

Facility In-charge can approach the private companies at the local level and request them to allocate funds under CSR to bridge the gaps. CSR is the funding and grant process under which government facilities can get financial and other support from the corporate sector. Under the Companies Act 2013, it is a mandatory provision to provide a contribution of 2 percent of the average net profits of companies. CSR provision is applicable for a company having a net worth of rupees 500 crores or more, or a turnover of rupees 1000 crores or more a net profit of rupees 5 crores or more during any financial year.

The fund provided under CSR is for social development issues, health, promotion of education, water, environment, social empowerment.

Summarization of all the schemes

The below table summarizes all the schemes as given below:

[5] Source: National Health Mission PIP Guidelines 2019-2020

Table 15: Summarization of all the Schemes

S. No	Scheme	Amount	Fund Allocated used For
1	State PIP Funds	As per the planning and justification provided to Govt. of India	Construction of walls, toilets fulfilling water storage requirements, maintenance of major cracks, seepage, chipped plaster and floor in the department, etc.)
2	Local available fund like Rogi Kalyan Samiti Grant, Annual Maintenance Grant, Untied fund	DH- 10 lakh SDH- 5 lakh CHC/UPHC/AH- 5 lakh PHC- 1,75000 Sub Centre- 20,000	On going maintenance and physical infrastructure improvement
3	Member of parliament Local Area Development (MPLADS)	Rs 5 crore per annum	Improvement in the facility
4	MLA Local Area Development Scheme	Big States- 2-4 Crore Rs per year Small States- 30 lakh to 1 crore per year	Improvement in the facility
5	CSR Fund	2-3 percent of net worth of private companies	social development issues, health, promotion of education, water, environment, social empowerment.

G. Tentative Costing for Different Categories of Health Care Facilities

Team of Hospital Experts were visited to different healthcare facilities like 1 MC, 2 DH,2 CHC, 2 PHC, 3 UPHC and 2 SC in three different states named, Chhattisgarh, Gujarat and Madhya Pradesh for conducting the Clean and Green assessment and identified gaps and best practices. Based on the identified gaps, facility wise tentative costed plans are developed to provide the understanding of the tentative budget required for making the facility clean and green which is depicted below:

Table 16: Tentative Costing of Different Healthcare Facilities to make it Clean and Green[6]

S. No	Categories of the Healthcare facility	Total Cost (Rs) to make health care facility Clean	Total Cost (Rs) to make health care facility Green	Total Cost to make health care facility Clean + Green
1	Medical College	1,014,452	23,929,201	24,943,653
2	DH	16,97,559	1,87,42,124	1,02,19,841
3	CHC	32,32,289	42,10,445	74,42,734
4	PHC	3,92,420	8,46,195	6,19,307
5	UPHC	185382	1,827,346	2,012,728
6	SC	1,37,315	3,23,257	2,30,286

** The costing mention above for all the categories of healthcare facilities are tentative and this will vary according to the gaps in the health care facilities so, kindly do not use the same costing as a reference to make the health care facility clean and green. In addition to this, the below mentioned table depicted the budget heads and this can be used as a standard format for developing the costing of all the different healthcare facilities.*

[6] The budget depicted in the table is comprising of one time and recurring expenses which were estimated based on the clean and green assessment and to get the estimate for recurring expenses facility needs to conduct clean and green assessment on periodic basis.

6.4 Standard costed plan template for preparing budget estimates to make the facility green and climate-resilient

The below mentioned template showcasing the budget line items for clean and green. Healthcare facilities can develop their costing based on the current site condition by using the standard template.

Table 17: Standard costed plan template for estimating the cost to make the Healthcare Facility Clean and Green

S. No.	Items	Unit of Measure	Unit Cost (in INR)	Quantity	Total Cost (in INR)
1	**Procurement**				
1.1	**Procurement of Cleaning Equipment and Consumables**				
1.1.1	Broom				
1.1.2	Microfiber cloths				
1.1.3	Fibre optic mops				
1.1.4	Reusable (dry+wet) Mop				
1.1.5	Three Bucket Cleaning System				
1.1.6	Trolleys for dirty linen				
1.1.7	Trolleys for clean linen				
1.1.8	Glutaraldehyde 500 ml				
1.1.9	Alcohol 5lt				
1.1.10	Hydrogen peroxide .5lt				
1.1.11	NaCl 1lt				
1.1.12	Quaternary Ammonium compound				
1.1.13	Alcohol rub Avagaurd 3m				
1.1.14	Liquid Soap 900ml Dettol				
1.2	**Procurement of Machine**				
1.2.1	Gravity Displacement 175 lt autoclave				
1.2.2	Pre vacuum type 20 lt autoclave				
1.2.3	120 lt autoclave				
1.2.4	Flash Autoclave table top Tauttner				
1.2.5	Table Top ETO sterilizer				
1.2.6	Floor Standing ETO sterilizer				
1.2.7	Washing Machine				
1.2.8	Hydro-extractors				
1.2.9	Calendaring Machine				
1.2.10	Flatwork iron				
1.2.11	Automatic scrubber dryer polishers				
1.2.12	Commercial vacuum cleaner				
1.2.13	Autoclave				
1.3	**Procurement of Waste Management Equipment**				
1.3.1	Dustbins for Bio-Medical Waste				
1.3.2	Dustbins for General Waste				

1.3.3	Different colored polybags for dustbins				
1.3.4	Trolley for waste transport				
1.4	**Procurement of Personal Protective Equipment**				
1.4.1	Surgical gloves				
1.4.2	Examination gloves				
1.4.3	Utility gloves				
1.4.4	Mask without Face Shield				
1.4.5	Mask with Face Shield				
1.4.6	Shoe Cover				
1.4.7	Gumboot				
1.4.8	Reusable gown				
1.4.9	Disposable gown				
1.4.10	Rubber Apron				
1.4.11	Normal headcap				
1.4.12	Stretchable headcap				
1.4.13	Eye wear				
1.5	**Maintenance**				
1.5.1	Cleaning Equipment Maintenance				
1.5.2	Maintenance of Machine				
2	**Infrastructure**				
2.1	**New Construction**				
2.1.1	Construction of Male Staff Toilet with urinal and Handwashing Facility				
2.1.2	Construction of Female Staff Toilet with Hand Washing Facility				
2.1.3	Construction of Disable friendly Patient Toilet with Hand Washing Facility				
2.1.4	Scrubbing station with elbow operated tap, alcohol rub dispenser, and soap dispenser				
2.1.5	Overhead tanks				
2.1.6	Sharp pit				
2.1.7	Development of STP				
2.1.8	Development of ETP				
2.1.9	Setting up of Biodigester				
2.1.10	Development of compost				
2.1.11	Deep Burial Pit				
2.1.12	Rain water harvesting				
2.2	**Installation**				
2.2.1	Automatic Alarm - Overhead Tanks				

2.2.2	Water Coolers with RO filters				
2.2.3	Installation of LEDs lights				
2.2.4	Installation of CFL lights				
2.2.5	Installation of 3 rated star ACs				
2.2.6	Installation of 3 rated star Refrigerator				
2.2.7	Installation of solar operated water heater				
2.2.8	Installation of solar panel(s)				
2.2.9	Low flow Taps				
2.2.10	Low flow showers				
2.2.11	Sensor operated taps				
2.2.12	Waterless urinals				
2.2.13	Cost of installing sensor-based urinals				
2.2.14	Fire extinguisher (ABC)				
2.2.15	Hose Reel				
2.2.16	Cost of setting up of standalone smoke detector in the critical areas				
2.2.17	High-performance glass + Installation of Insulated black Panel				
2.2.18	Installation of HMIS software				
2.3	**Renovation/Repair**				
2.3.1	Renovation of Infrastructure				
2.3.2	Repair of Infrastructure and installations				
3	**Training**				
3.1	**Training on Clean and Green components**				
3.1.1	Biannual Training on WASH, Cleanliness, Waste Management, Energy Conservation, Water Conservation, Smart Building and Green Building				
3.1.2	Training of Housekeeping Staff on Cleaning protocols				
4	**Reviews, Research and Survey**				
4.1	**Review meeting**				
4.1.1	Monthly review meeting on the status of HCF with respect to Clean and Green concept				
4.2	**Research and Survey**				
4.2.1	Quarterly assessment of facility by using the clean and green checklist				
5	**IEC/BCC**				
5.1	**IEC to sensitize the staff, patients and visitors on clean and green concept**				

5.1.1	Posters on the clean and green concept including waste management, hand hygiene, use of toilets, water conservation, energy conservation, fire safety etc				
6	**Printing**				
6.1	**Printing of Monitoring Checklist**				
6.1.1	Department Checklist				
6.1.2	Toilet Checklist				
6.1.3	Hand Washing Station Checklist				

Assessment checklist for checking the compliance of green measures

PART A: IDENTIFICATION

State _____CODE ☐☐

District Name _____CODE ☐☐

Block Name _____CODE ☐☐

Name of Facility _____CODE ☐☐☐☐☐☐

Assessment of DH ☐ SDH ☐ CHC-FRU ☐ CHC ☐ PHC ☐ SC ☐

Is the Facility Awarded by Kayakalp Initiative? Yes ☐ No ☐

Name of the Interviewer _____

Name of Facility In-charge _____

Signature & Seal _____ EMAIL ID of the Facility_____

Contact Number of The Facility_____

	DD	MM	**YY**	HH	MM	AM/PM
Assessement Start Date & Time	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐
Assessement End Date & Time	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐

S.No	Questions	Response Code	Response	Assessment Method	Skips	Method of Verification	Remarks
PART B: Green Healthcare Facility Standards							
Section B1: GARABAGE							
B1.1 Health care facility shall have a reduce, reuse and recycle policy							
B1.1.1	Does the facility have reduced, reuse, recycle policy?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	RR/SI			
B1.1.2	Does the facility have a system to treat sewage water before its final disposal?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	OB		Check if Health care facility has Sewage treatment plant	
Section B2: Energy							
B2.1 Facility shall have a plan for optimum usage and conservation of water resources							
B2.1.1	What is the Source of water in the facility? **(Multiple Answer)**	Piped……A Hand Pump…… B Tube well……C Bore Well…… D Water Harvesting…E Tanker……F None…… G Other (Specify)……98	☐	SI/OB			
B2.1.2	Does the facility have a water conservation strategy?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	SI/OB		Water conservation strategies such as a. Use of Sensor taps/ auto stop water taps to reduce water wastage b. Water recycling and reuse. c. Water harvesting	
B2.1.3	Does the facility use low flow water taps in toilets and hand washing area?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	OB			
B2.1.4	Does the facility have rain water harvesting system?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	OB/			
B2.1.15	Is the facility staff trained for efficient water usage?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	SI/RR			
B2.1.16	Is the facility staff trained about	Full Compliance…10 Partial compliance….5	☐	SI/RR			

S.No	Questions	Response Code	Response	Assessment Method	Skips	Method of Verification	Remarks
	conservation of water?	No Compliance….0					
B2.2 Health care facility shall have a plan for optimum usage and conservation of energy resources							
B2.2.1	Does the facility have 24x7 electricity supply?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	SI/RR			
B2.2.2	Does the facility have alternate source of energy?	Invertor……. A Generator……. B Solar Panel……C Other (Specify)…….98	☐	SI/OB			
B2.2.3	Is the facility having arrangements for usage of renewable energy?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	SI/RR/OB		Check documents for plan Physical verification will include installed solar panels, solar geysers etc.	
B2.2.4	Is the facility equipped with energy efficient LED Bulbs?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	OB			
B2.2.5	Does the facility have a policy to purchase energy efficient equipment?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	SI/RR			
B2.2.6	Does the facility ensure optimum use of natural light?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	SI/OB			
B2.2.7	Does the facility use CFC/HCFCs free refrigerators?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	SI/OB		Check if facility has phase out ozone depleting substances as refrigerant	
B2.2.8	Does the facility use energy efficient appliances? **(Multiple answer)**	Refrigerators……A Air Conditioners……B Other Equipment's……....C	☐	SI/OB		Check for availability of minimum **4-star** rating energy efficient appliances	
B2.3 Health care facility shall have education program for staff and patients for conservation of energy							
B2.3.1	Does the facility promote education programme for conservation of energy?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	SI			
B2.3.2	Is the facility staff trained	Full Compliance…10 Partial compliance….5	☐	SI/RR			

S.No	Questions	Response Code	Response	Assessment Method	Skips	Method of Verification	Remarks
	about energy conservation?	No Compliance….0					
B2.3.3	Do the facility display IEC posters to switch off the lights if they are not in use?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	OB			
Section B3: ENVIORMENT							
B3.1 Smart Building							
B3.1.1	Does the facility have provision of green coverage?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	OB		At least 30% of the facility	
B3.1.2	Does the facility have layout plans?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	RR			
B3.1.3	Does the toilets have sensors to control flushing of water?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	OB			
B3.1.4	Does the facility have periodic calibration plan for office equipment (Environment friendly)?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	RR/SI			
B3.1.4	Are the facility windows fitted with frosted glass for appropriate AC usage?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	OB		Check if windows have greenhouse prevention film	
B3.1.5	Does the facility have herbal garden?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	OB		At least 20% herbal garden	
B3.1.6	Does the facility have a provision of separate space for stress relieving?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	OB		Check - separate space for yoga or games is available	
B3.1.7	Does the facility use paints and coating of low emitting material?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	OB		Check paints and coatings are of low or no VOC content	
Section B4: NUTRITION							
D4.1 Health care facility shall have a programme to reduce, recycle food waste and food donation shall be encouraged							
B4.1.1	Does the facility have a food waste reduction system?	Full Compliance…10 Partial compliance….5 No Compliance….0	☐	SI/OB			

S.No	Questions	Response Code	Response	Assessment Method	Skips	Method of Verification	Remarks
B4.1.2	Does the facility have a system to donate un-utilized food?	Full Compliance…10 Partial compliance.…5 No compliance….0	☐	SI/RR/OB		Check if there is any "MOU" with NGO	
B4.1.3	Does the facility have a provision to recycle food waste?	Full Compliance…10 Partial compliance.…5 No Compliance….0	☐	OB			
B4.1.4	Does the facility use environmentally friendly cleaning products to clean food preparation/food service area?	Full Compliance…10 Partial compliance.…5 No Compliance….0	☐	OB		Check bottles of chemicals for cleaning of cafeterias, kitchen equipment, surface and dishware	
B4.1.5	Does the facility have kitchen garden in the premises?	Full Compliance…10 Partial compliance.…5 No Compliance….0	☐	SI/OB			

S.No	Questions	Response Code	Response	Assessment Method	Skips	Method of Verification	Remarks
PART C: Green Healthcare Facility Standards							
Section C1: GARABAGE							
F1.1 Health care facility shall have a reduce, reuse and recycle policy							
C1.1.1	Does the facility have reduced, reuse, recycle policy?	Yes…….1 No……..2	☐	RR/SI			
C1.1.2	Are all paper based items available in the facility are environment friendly?	Yes…….1 No……..2	☐	OB		Check paper-based items like napkins, paper towels, wiper, tray liners fulfil environmentally preferred material criteria	
C1.1.3	Does the facility have phased out mercury equipment?	Yes…….1 No……..2	☐	OB/SI			
C1.1.4	Does the facility have phased out lead material in Healthcare Facility?	Yes…….1 No……..2	☐	OB/SI			
C1.1.5	Does the facility segregate Biodegradable and recyclable waste?	Yes…….1 No……..2	☐	OB		Check if separate waste bins for biodegradable and recyclable waste is available	
C1.1.6	Does the facility have verified contractor for waste collection?	Yes…….1 No……..2	☐	OB		Check records for who collects general waste and biomedical waste?	
C1.1.7	Is the contractor licensed and permitted by the state?	Yes…….1 No……..2	☐	OB/RR		Check with records for permission and its validity period	
C1.1.8	Does the facility have a system to treat sewage water before its final disposal?	Yes…….1 No……..2	☐	OB		Check if Health care facility has Sewage treatment plant	
C1.1.9	Does the facility have training program for staff to train them on biomedical waste management?	Yes…….1 No……..2	☐	SI/OB			
C1.1.10	Is there any process to train new employee for	Yes…….1 No……..2	☐	SI/RR			

S.No	Questions	Response Code	Response	Assessment Method	Skips	Method of Verification	Remarks
	efficient waste management?						
Section C2: Energy							
C2.1 Facility shall have a plan for optimum usage and conservation of water resources							
C2.1.1	What is the Source of water in the facility? **(Multiple Answer)**	Piped.....A Hand Pump..... B Tube well.....C Bore Well..... D Water Harvesting...E Tanker.....F None..... G Other (Specify).....98	☐	SI/OB			
C2.1.2	Does the facility have a plan for water usage?	Yes.....1 No.....2	☐	SI/RR		Calculation of water consumption, requirement, storage etc.	
C2.1.3	Does the facility have a water conservation strategy?	Yes.....1 No.....2	☐	SI/OB		Water conservation strategies such as d. Use of Sensor taps/ auto stop water taps to reduce water wastage e. Water recycling and reuse. f. Water harvesting	
C2.1.4	Does the facility use low flow water taps in toilets and hand washing area?	Yes.....1 No.....2	☐	OB			
C2.1.5	Does any water recycling being done in the facility?	Yes.....1 No.....2	☐	OB	If response is 1 skip to F3.1.7		
C2.1.6	Does the facility have a plan for recycling of water?	Yes.....1 No.....2	☐	SI/RR/OB			
C2.1.7	Does the facility have rain water harvesting system?	Yes.....1 No.....2	☐	OB/			
C2.1.8	Does the facility have rain water storage tank?	Yes.....1 No.....2	☐	OB		Underground or overhead	
C2.1.9	Does the facility have designated person for water conservation activities?	Yes.....1 No.....2	☐	SI			

S.No	Questions	Response Code	Response	Assessment Method	Skips	Method of Verification	Remarks
C2.1.10	Does the facility have alternate source of water?	Yes…….1 No……2	☐	SI			
C2.1.11	Does the facility have plan for proper usage of potable water?	Yes…….1 No……2	☐	RR		Calculation of water consumption, requirement, storage drinking water points.	
C2.1.12	Is the potable water tested at regular intervals for following? **(Multiple Answer)**	Colour……..…A Turbidity…… B Ph…….C Taste…… D Door……E	☐	SI/RR		Check maintenance plan for RO, water coolers etc.	
C2.1.13	Does the facility have regular and uninterrupted supply of chlorine tablet?	Yes…….1 No……2	☐	SI/RR		Check availability through stock and purchase registers	
C2.1.14	Does the facility ensure disinfection of water?	Yes…….1 No……2	☐	OB		Check use of chlorine 0.2 ppm	
C2.1.15	Does the facility have obtained permission from pollution control board for waste water treatment and disposal?	Yes…….1 No……2	☐	RR			
C2.1.16	Is the facility staff trained for efficient water usage?	Yes…….1 No……2	☐	SI/RR			
C2.1.17	Is the facility staff trained about conservation of water?	Yes…….1 No……2	☐	SI/RR			
C2.1.18	Does the facility have provision to educate patients to ensure efficient water usage?	Yes…….1 No……2	☐	SI/RR			
C2.1.19	Does the facility have provision to educate patients about conservation of water?	Yes…….1 No……2	☐	SI/RR			
C2.1.20	Did the facility face interruption of water supply in the past 1 year? If so indicate how many times and for how long?	Yes…….1 No……2	☐	SI			
C2.2 Health care facility shall have a plan for optimum usage and conservation of energy resources							
C2.2.1	Does the facility have 24x7 electricity supply?	Yes…….1 No……2	☐	SI/RR			

S.No	Questions	Response Code	Response	Assessment Method	Skips	Method of Verification	Remarks
C2.2.2	Does the facility have alternate source of energy?	Invertor……. A Generator……. B Solar Panel……C Other (Specify)…….98	☐	SI/OB			
C2.2.3	Is the facility having arrangements for usage of renewable energy?	Yes…….1 No……2	☐	SI/RR/OB		Check documents for plan Physical verification will include installed solar panels, solar geysers etc.	
C2.2.4	Is the facility equipped with energy efficient LED Bulbs?	Yes…….1 No……2	☐	OB			
C2.2.5	Does the facility have a policy to purchase energy efficient equipment?	Yes…….1 No……2	☐	SI/RR			
C2.2.6	Does the purchase department follow procurement policy?	Yes…….1 No……2	☐	SI/RR			
C2.2.7	Does the facility have biogas plant?	Yes…….1 No……2	☐	SI/OB			
C2.2.8	Does the facility ensure optimum use of natural light?	Yes…….1 No……2	☐	SI/OB			
C2.2.9	Does the facility use CFC/HCFCs free refrigerators?	Yes…….1 No……2	☐	SI/OB		Check if facility has phase out ozone depleting substances as refrigerant	
C2.2.10	Does the facility use energy efficient appliances? **(Multiple answer)**	Refrigerators……A Air Conditioners……B Other Equipment's…….....C	☐	SI/OB		Check for availability of minimum **4-star** rating energy efficient appliances	
C2.2.11	Does the facility use eco-friendly plastic?	Yes…….1 No……2	☐	OB/SI			
C2.2.12	Has there ever been an energy audit in the health facility in past 2 years?	Yes…….1 No……2	☐	SI/RR		Check documents for energy audit which will include inspection, survey and analysis of energy flows for energy conservation in a building	

S.No	Questions	Response Code	Response	Assessment Method	Skips	Method of Verification	Remarks
C2.3 Health care facility shall have education program for staff and patients for conservation of energy							
C2.3.1	Does the facility promote education programme for conservation of energy?	Yes.....1 No.....2	☐	SI			
C2.3.2	Is the facility staff trained about energy conservation?	Yes.....1 No.....2	☐	SI/RR			
C2.3.3	Do the facility display IEC posters to switch off the lights if they are not in use?	Yes.....1 No.....2	☐	OB			
Section C3: ENVIRONMENT							
C3.1 Smart Building							
C3.1.1	Is the facility wall colour conducive to natural light?	Yes.....1 No.....2	☐	OB			
C3.1.2	Does the facility have provision of green coverage?	Yes.....1 No.....2	☐	OB		At least 30% of the facility	
C3.1.3	Does the facility have floor plans?	Yes.....1 No.....2	☐	RR			
C3.1.4	Does the facility have layout plans?	Yes.....1 No.....2	☐	RR			
C3.1.5	Are the layout plans up to date?	Yes.....1 No.....2	☐	RR			
C3.1.6	Are the facility layout plans approved by local body/municipal corporation/panchayat?	Yes.....1 No.....2	☐	OB			
C3.1.7	Does the facility have clearly marked fire exit routes?	Yes.....1 No.....2	☐	OB			
C3.1.8	Does the facility have fire alarms in critical areas?	Yes.....1 No.....2	☐	OB			
C3.1.9	Are sprinklers installed in critical areas?	Yes.....1 No.....2	☐	OB			
C3.1.10	Are powder sprinklers available in MRD (Medical Record Department)?	Yes.....1 No.....2	☐	OB			
C3.1.11	Does the facility have fire NOC (No Objection Certificate)?	Yes.....1 No.....2	☐	RR			
C3.1.12	Is the fire NOC (No Objection Certificate) up to date?	Yes.....1 No.....2	☐	RR			
C3.1.13	Does the facility have alarm system to notify the filling up of water tanks?	Yes.....1 No.....2	☐	OB		Check if alarms are functional on filling of tank	

S.No	Questions	Response Code	Response	Assessment Method	Skips	Method of Verification	Remarks
C3.1.14	Does the toilets have sensors to control flushing of water?	Yes.....1 No.....2	☐	OB			
C3.1.15	Does the facility have periodic calibration plan for office equipment (Environment friendly)?	Yes.....1 No.....2	☐	RR/SI			
C3.1.16	Is the capacity of air conditioning system in proportionate to room size?	Yes.....1 No.....2	☐	OB			
C3.1.17	Does facility have air purifiers? (In case in a high pollution environment).	Yes.....1 No.....2	☐	OB			
C3.1.18	Are occupied spaces in the facility properly ventilated?	Yes.....1 No.....2	☐	OB			
C3.1.19	Are the facility windows fitted with frosted glass for appropriate AC usage?	Yes.....1 No.....2	☐	OB		Check if windows have greenhouse prevention film	
C3.1.20	Does the facility have herbal garden?	Yes.....1 No.....2	☐	OB		At least 20% herbal garden	
C3.1.21	Does the facility have a provision of separate space for stress relieving?	Yes.....1 No.....2	☐	OB		Check - separate space for yoga or games is available	
C3.1.22	Does the facility use paints and coating of low emitting material?	Yes.....1 No.....2	☐	OB		Check paints and coatings are of low or no VOC content	
Section C4: NUTRITION							
C4.1.1 Health care facility shall have a programme to reduce, recycle food waste and food donation shall be encouraged							
C4.1.1	Does the facility have a food waste reduction system?	Yes.....1 No.....2	☐	SI/OB			
C4.1.2	Does the facility have IEC posters to reduce food waste?	Yes.....1 No.....2	☐	OB		Check posters like “TAKE WHAT YOU EAT, EAT WHAT YOU TAKE “are available in canteen, pantry etc.	
C4.1.3	Does the facility have a system to donate un-utilized food?	Yes.....1 No.....2	☐	SI/RR/OB		Check if there is any “MOU” with NGO	

S.No	Questions	Response Code	Response	Assessment Method	Skips	Method of Verification	Remarks
C4.1.4	Does the facility have a provision to recycle food waste?	Yes…….1 No……2	☐	OB			
C4.1.5	Does the facility use environmentally friendly cleaning products to clean food preparation/food service area?	Yes…….1 No……2	☐	OB		Check bottles of chemicals for cleaning of cafeterias, kitchen equipment, surface and dishware	
C4.1.6	Does the facility have kitchen garden in the premises?	Yes…….1 No……2	☐	SI/OB			
C4.1.7	Does the facility have any provision of community participation for food supply to the Healthcare Facility?	Yes…….1 No……2	☐	SI/OB			

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