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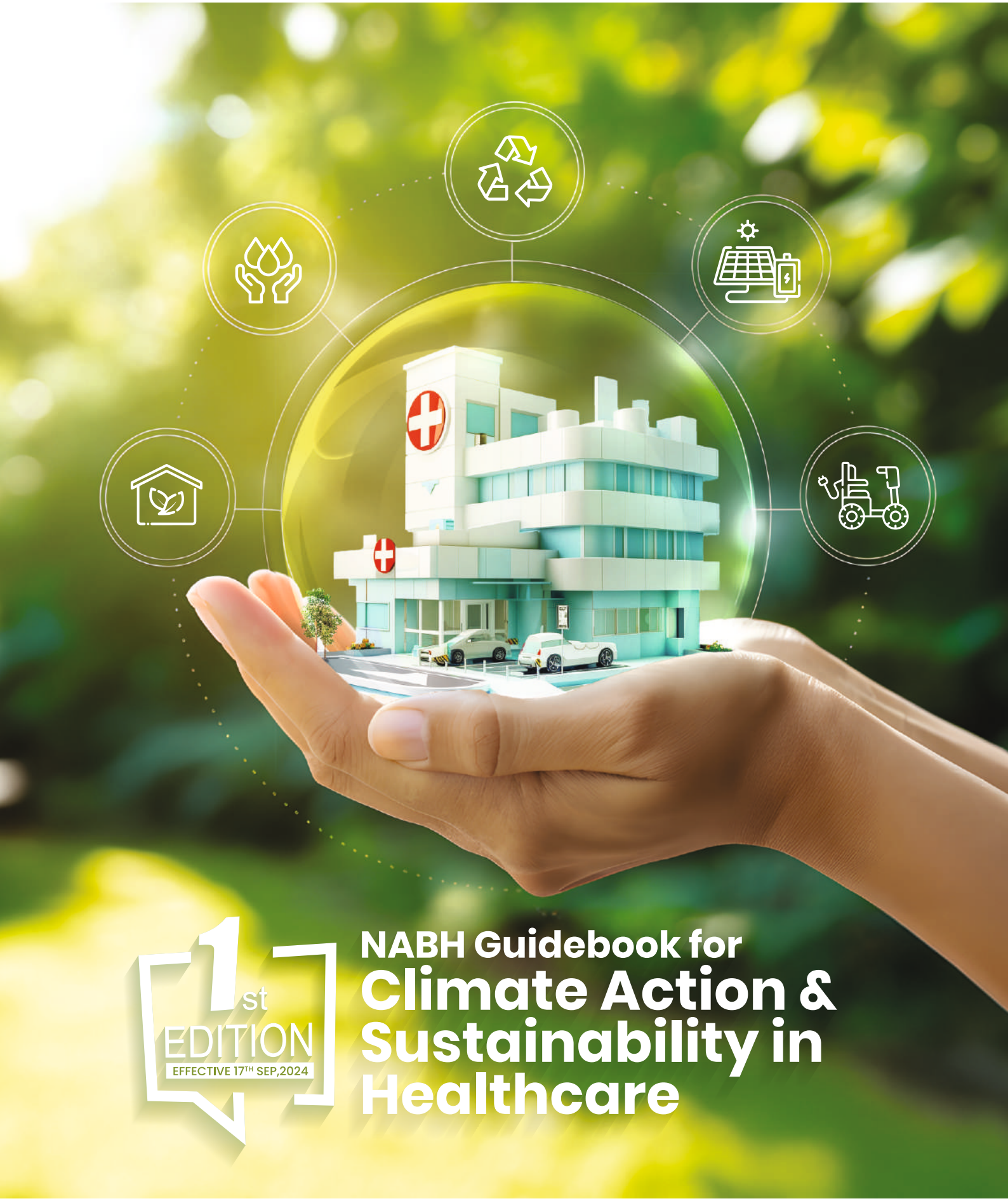
National Accreditation Board for Hospitals and Healthcare Providers



1st EDITION
EFFECTIVE 17TH SEP,2024

NABH Guidebook for Climate Action & Sustainability in Healthcare

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FORWARD

National Accreditation Board for Hospitals and Healthcare Providers (NABH) has been developing quality healthcare standards since past 18 years. NABH standards have always focused on creating an ecosystem for quality and safety of the services delivered in the healthcare organizations. NABH standards have been developed and modified considering the ever-evolving healthcare ecosystem. In a step towards addressing the biggest challenge of 21st century i.e. climate change and sustainability, NABH has developed an elaborate document to guide healthcare organizations to achieve climate change adaption, resilience and sustainability.

Over the years, NABH standards have sensitized the healthcare sector towards delivering quality healthcare services and has brought paradigm shifts. NABH standards have been able to sensitize healthcare organizations and at the same time helped them to effectively develop their disaster management plans.

It is my privilege and pride to release this "Guidebook for Climate Action and Sustainability in Healthcare", First Edition. This document aims to guide healthcare organizations for developing a system towards environmental sustainability and climate change resilience.

This document is developed considering available national and international guidelines issued by organizations of repute like WHO, MoHFW etc. This document includes detailing about concept of sustainability in healthcare, guidance for implementation, strategic framework which can be adopted for sustainability. To motivate healthcare organizations, industry best practices are also showcased in the document.

This document along with a self-assessment checklist will be available on NABH official website (www.nabh.co). The healthcare organizations can use this checklist for self- analysis. I sincerely hope that all healthcare organizations will certainly benefit from this document and self-assessment checklist.

With great enthusiasm and passion, I request all healthcare organizations in the country to embrace this opportunity and shoulder the responsibility of creating environmentally sustainable & climate change resilient healthcare ecosystem thereby becoming future prepared healthcare organizations.

Dr. Atul Mohan Kochhar
CEO, NABH

ACKNOWLEDGEMENTS

I would like to express my sincere appreciation and gratitude to all the experts who have contributed their invaluable time, knowledge and expertise in preparing this Guidebook for Climate Action and Sustainability in Healthcare 1st edition.

I express my heartfelt thanks and deepest gratitude to Shri Jaxay Shah, Chairman QCI, for his vision to take quality to the grassroot level and permeate the concept of quality in the DNA of every citizen of the country.

Mr. Rizwan Koita, Chairman NABH is our guiding torch and we thank him immensely for his continuous guidance, support and invaluable suggestions to make quality reach till last mile in the country. Without his active support, it would not have been possible to achieve this milestone.

My sincere thanks to Mr. Chakravarthy T. Kannan, Secretary General, Quality Council of India for his patient support and for carving the path by making available adequate resources for developing this guidebook.

I thank all our esteemed assessors, management of our partner hospitals who shared their experiences and exhaustive best practices to be included as a part of this guidebook.

I thank the officers at NABH Secretariat for working round the clock, to complete this work in time. It is entirely due to their dedicated efforts that we could present this guidebook in the current detail and format.

Dr. Atul Mohan Kochhar
CEO, NABH

ABBREVIATIONS

BEE	:	Bureau of Energy Efficiency
BLDC	:	Brushless Direct Current
CFL	:	Compact Fluorescent Lamp
CSR	:	Corporate Social Responsibility
ESG	:	Environmental, Social and Governance
ETP	:	Effluent Treatment Plant
GHG	:	Greenhouse Gas
GRIHA	:	Green Rating for Integrated Habitat Assessment
HVAC	:	Heating, Ventilation and Air Conditioning
IEC	:	Information Education and Communication
IPHS	:	Indian Public Health Standards
ISI	:	Indian Standards Institution
LED	:	Light-emitting diode
MoHFW	:	Ministry of Health and Family Welfare
MoU	:	Memorandum of Understanding
NABH	:	National Accreditation Board for Hospitals and Healthcare Providers
NBC	:	National Building Code
NCDC	:	National Centre for Disease Control
NDMA	:	National Disaster Management Authority
QCI	:	Quality Council of India
SDG	:	Sustainable Development Goals
STP	:	Sewage Treatment Plant
VFD	:	Variable Frequency Drive
WASH	:	Water, sanitation and hygiene
WHO	:	World Health Organization

PURPOSE OF THE DOCUMENT

Sustainability and climate change impacting the healthcare sector is among the buzzing areas of concern during the current period. Climate change is considered as one of the biggest global health threats of the 21st century. While all industries and sectors contribute to climate change, healthcare sector faces a double burden of, impact of climate change and also contributes to over 4-5% of global emissions. In addition to this, healthcare sector also has to face the burden of care due to climate-related health impacts.

Healthcare Organizations are the first and last line of defence to climate change impacts. Also, the healthcare organizations generate large amount of environmental waste & contaminants which can be infectious, toxic or radioactive and can be a threat for human health.

Healthcare organizations are vulnerable to climate change and other environmental factors. 2023 XDI Global Hospital Infrastructure Physical Climate Risk Report Published on December 3, 2023 concluded that without a rapid phase out of fossil fuels, up to 1 in 12 hospitals worldwide will be at a high risk of total or partial shutdown from extreme weather events and by the end of the century, this will impact as many as 16,245 hospitals.

National Accreditation Board for Hospitals and Healthcare Providers (NABH) is envisioned to sustainable healthcare practices, climate resilient healthcare infrastructure thereby aiming quality healthcare services for the society at large. Mitigation and preparedness with respect to changing climatic conditions is essential to ensure availability of quality healthcare services across country. This document has been developed by NABH with the intent to guide healthcare organizations towards becoming climate resilient and environmentally sustainable. This document also aims to enhance the capacity of the healthcare organizations to cope with the upcoming events/disasters related to climate change. Through this document following objectives are expected to be met:

i. Creating awareness regarding climate change, environment sustainability and its impact on the healthcare organizations.

ii. Guiding professionals working in healthcare settings to understand and prepare towards risks posed by climate change.

iii. Guiding healthcare organizations to self-assess the risks, plan and implement strategies for becoming climate resilient & environmentally sustainable organizations.

“BE FUTURE PREPARED"

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INTRODUCTION

Defining Sustainability

Previously, the term sustainability has been mostly related to environmental degradation. The meaning of sustainability is constantly evolving in this rapidly changing world. Nowadays, the term sustainability has been broadened to include other aspects, such as the well-being of patients, healthcare employees and the community. In 1987, the United Nations Brundtland Commission defined sustainability as **"meeting the needs of the present without compromising the ability of future generations to meet their own needs."**

The aim of healthcare services is to preserve, promote and improve the health of the communities they serve. However, during the course of providing healthcare services, there are risks of negatively impacting the environment and public at large. Thus, sustainability in healthcare is understanding that health of both the population and environment is intrinsically linked. Sustainability means **extending the responsibility of health services to patients and population not just of today but of the future**. The longer-term perspective highlights the impacts of our healthcare system on our **environment and communities** and in turn back **onto population health.**

Redefining Value for sustainable healthcare

A sustainable approach will expand the healthcare definition of value to measure health outcomes against environmental and social impacts alongside financial costs. **Traditional definition** of value is Outcomes as related to Costs incurred.

Redefined concept: Value is determined by how well the allocated resources are used to achieve outcomes not only for patients treated by a service but for all the people in need in the population. Achieving high value relies **not just on maximising the efficiency with which interventions are delivered**, but on **avoiding underuse** of high-value interventions in people with greater need and **overuse of low-value interventions** in people who will benefit less.

Defining Sustainable Development

Sustainable development is a broad term to describe policies, projects and investments that provide benefits today without sacrificing environmental, social and personal health in the future. These policies are often described as green because they focus on limiting the impact of development on the environment. However, the benefits of sustainable development are also felt across a wide cross section of human health and well-being, including reductions in pollution- and environment-related disease, improved health outcomes and decreased stress.

Sustainability is an important point of attention for the public at large, for governments, and for the healthcare system.

WHO defines Climate-resilient & environmentally sustainable health care organizations are the "Organizations that are capable to anticipate, respond to, cope with, recover from and adapt to climate-related shocks and stress, so as to bring ongoing and sustained health care to their target populations, despite an unstable climate, with access to minimum standards of WASH (and wastes) and energy services, an informed health workforce, and solid infrastructure, and which protects its environment for the benefit of its workers, patients and surrounding communities."

Sustainability and Regulations

Sustainability in healthcare has gained momentum over recent years largely due to government directives around environmental protection, resource conservation, and efficiency improvements. Governments worldwide have implemented several policy frameworks designed to encourage sustainable practices in healthcare institutions.

Government of India has always promoted environmental governance since 1972. The regulatory framework related to environmental, social and governance (ESG) cannot be found in any one piece of legislation but comes under various pieces of legislation, including: the Factories Act, 1948; Environment Protection Act, 1986; Air (Prevention and Control of Pollution) Act, 1981; Water (Prevention and Control of Pollution) Act, 1974; Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2016; Companies Act, 2013 (Companies Act); Securities and Exchange Board of India (Listing Obligations and Disclosure Requirements) Regulations, 2015 (Listing Regulations); Prevention of Money Laundering Act, 2002; Prevention of Corruption Act, 1988; and laws with respect to the payment of minimum wage, bonus, gratuity, welfare activities, health and safety, etc. Various aspects of ESG are covered under these pieces of legislations in a fragmented manner.

In order to combat the challenges of climate change, Indian government has taken a number of initiatives which include the National Action Plan on Climate Change, the National Adaptation Fund on Climate Change, the Climate Change Action Programme, and the State Action Plan on Climate Change. With the aim for climate resilient and green hospitals in the country, Guidelines for Green and Climate Resilient Healthcare Organization was released under the National Programme on Climate Change And Human Health in February 2023 with explicit details.

Some of the policies and regulations are listed below:

1. **Green Procurement Policies:** Government authorities have introduced guidelines and incentives to promote purchasing goods and services sustainably. These policies target energy efficient products, recyclable packaging materials and environmentally friendly cleaning agents.
2. **Renewable Energy Mandates:** Government is promoting healthcare organizations to transit towards renewable energy sources like solar panels or wind turbines, to lower reliance on fossil fuels and cut emissions. These mandates provide financial incentives for hospitals to invest in sustainable technologies.
3. **Waste Management Regulations:** Local and national governments impose stringent rules on waste disposal procedures for healthcare institutions. Recycling programs and requirements for hazardous waste disposal emphasize sustainable waste handling techniques to minimize environmental impact.
4. **Energy Efficiency Standards:** National Building Code standards for newly constructed healthcare organizations or during renovations. Compliance ensures better insulation, LED lighting, efficient heating/cooling systems, which ultimately results in lower energy usage and operating costs. IPHS 2022 explicitly mentions regarding the energy efficiency.
5. **Indoor Environment Quality Guidelines:** Air quality regulations dictate indoor air quality parameters requiring healthcare organizations to maintain optimal temperature, humidity levels and ventilation

rates to safeguard patients & staff health. Meeting these guidelines necessitates adoption of sustainable HVAC systems and building designs.

6. **Educational Programs:** Government frequently fund educational campaigns advocating for healthier lifestyles and sustainable habits among individuals, including employees of healthcare institutions. Such interventions raise awareness about environmental issues, promoting behavioural changes conducive to environmental stewardship.

These government directives underscore the significance of healthcare sustainability in promoting environmental preservation, enhancing operational efficiencies and ensuring patient safety simultaneously. Adherence to these policies drives continuous improvement in healthcare sustainability, benefitting society as a whole. Sustainability in healthcare ties directly with numerous Sustainable Development Goals (SDGs). Some key connections include:

1. SDG 3 - Good Health and Well-being: Sustainable healthcare practices promote prevention and treatment of illnesses, diseases, and injuries while focusing on holistic wellness and mental health. Accessible and affordable healthcare supports this goal while contributing positively to population health.

Fig 1: Sustainable Development Goals

2. SDG 4 - Quality Education: Training healthcare professionals in sustainable practices and integrating environmental awareness into curricula fosters informed decision-making, encouraging future generations to adopt sustainable healthcare models.

3. SDG 5 - Gender Equality: Addressing gender disparities in healthcare provision requires implementing sustainable healthcare practices targeting vulnerable populations. Targeting gender barriers to accessing quality healthcare ensures fairness & equality, promoting overall well-being.

4. SDG 6 - Clean Water and Sanitation: Ensuring adequate access to clean water and sanitation remains crucial to preventing disease transmission and maintaining patient safety in healthcare settings. Sustainable healthcare practices should consider water conservation measures and improve waste management systems to decrease pollution levels.

5. SDG 7 - Affordable and Clean Energy: Transitioning to renewable energy sources in healthcare organizations improves energy efficiency, reduces operational costs and carbon emissions. Investment in renewable energy allows hospitals to prioritize essential healthcare services instead of spending excessive amounts on utility bills.

6. SDG 8 - Decent Work and Economic Growth: Creating jobs through investments in sustainable healthcare initiatives stimulates economic growth, promotes decent work opportunities and raises living standards for people employed in the healthcare industry.

7. SDG 9 - Industry, Innovation and Infrastructure: Focusing on innovations in medical technology development and manufacturing processes driven by sustainability promotes a more resilient, circular economy model.

8. SDG 10 - Reduced Inequalities: Prioritizing disadvantaged groups in healthcare provision requires implementing sustainable healthcare practices targeting vulnerable populations. Improving healthcare equity ensures fairness and contributes to reducing disparities related to health outcomes among diverse populations.

9. SDG 11 - Sustainable Cities and Communities: Supporting urbanization by investing in sustainable healthcare organizations enables cities to adapt to growing populations and offers inhabitants healthier living conditions without compromising environmental sustainability.

10. SDG 12 - Responsible Consumption and Production: Promoting sustainable healthcare supply chains reduces waste generation, saves resources and prevents negative impacts on local economies and ecosystems.

Importance of Sustainability in healthcare

The burgeoning population, increase in non-communicable diseases, unhealthy lifestyles, ageing populations will all result in higher demands on the healthcare systems leading to increased healthcare resource consumption in the coming decades. When this is linked to climate change and carbon blue prints, the need for sustainable transformation becomes clearer and becomes an issue of utmost priority.

Failure to transit to a model of sustainable healthcare, will lead to increase in adverse environmental impact on the healthcare sector.

Sustainability and Healthcare- The inter relationship

Healthcare systems are fundamental backbone to achieve societal health & welfare and thereby contributing to the economic growth & development. The Indian hospital sector was valued at INR 7940.87 Bn in Financial Year 21 in terms of revenue and is growing at compound annual growth rate of 18.24% (www.investindia.gov.in).

Figure 2 below shows impact of climate change on healthcare organizations and how healthcare organizations contribute to climate change.

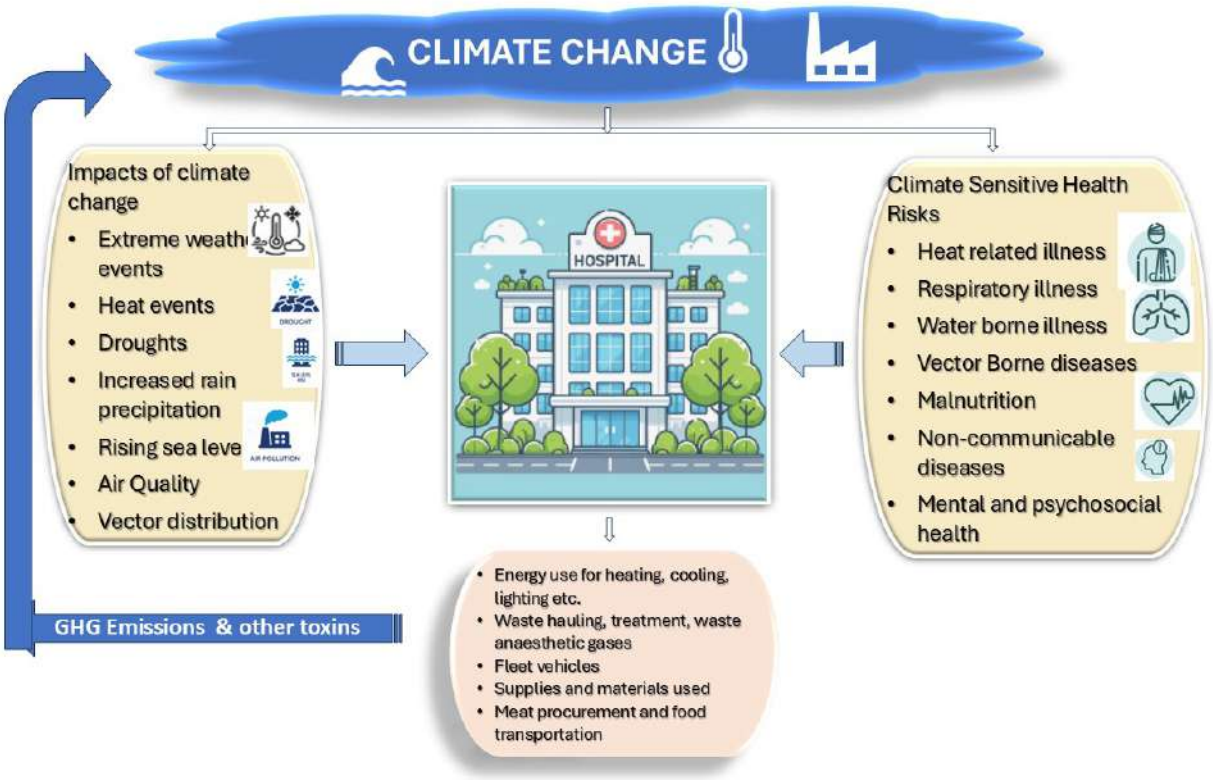


Fig. 2 Impact of climate change on healthcare organizations

As explained earlier in the document, healthcare organizations are vulnerable to climate change and other environmental factors. 2023 XDI Global Hospital Infrastructure Physical Climate Risk Report Published on December 3, 2023 concluded that without a rapid phase out of fossil fuels, up to 1 in 12 hospitals worldwide will be at high risk of total or partial shutdown from extreme weather events, by the end of the century this will impact as many as 16,245 hospitals. This number is almost twice the number of hospitals which are currently at high risk. A residential or commercial building would be considered uninsurable. All high-risk hospitals will require adaptation, where practical. Even with this enormous investment, relocation will be the only option for many. 71% (11,512) of high-risk hospitals by the year 2100 will be in low- and middle-income countries. In India, 2,700 of the country's total 53,473 hospitals are already at high risk of partial or complete shutdown due to extreme weather events. If fossil fuels are not phased out, this will increase to more than 5,100 hospitals by the end of the century.

To understand different impacts of climate change on healthcare organizations, details are depicted in the table 1 & 2.

Table 1 Details of health impacts of climate change

	Climate change effects	Health risks	Health related impacts (IPCC rating)	Consequences for health care facilities (impacted areas)
Direct effects	Increased number of warm days and nights; increased frequency and intensity of heat waves; increased fire risk in low rainfall conditions	Excess heat-related mortality; increased incidence of heat exhaustion and heat stroke; exacerbated circulatory, cardiovascular, respiratory and kidney diseases; increased premature mortality related to ozone and air pollution produced by fires, particularly during heat waves	Greater likelihood of injury, disease and death due to more intense heat waves and fires (very high)	Infrastructure damage; increase in energy and water usage; threats to patients from heat and air pollution; sudden increase in community cases of heat stroke, asthma and other respiratory diseases overwhelming the facility's capacity; mental health impacts on facility staff (health workforce, energy, infrastructure, technologies and products)
	Higher temperatures and humidity; changing and increasingly variable precipitation; higher sea surface and freshwater temperatures	Accelerated microbial growth, survival, persistence, transmission; shifting geographic and seasonal distribution of diseases (such as cholera, schistosomiasis); ecological changes, droughts and warmer temperatures leading to cyanobacterial blooms, pathogen multiplication; extreme events leading to disruption of water supply system and contamination; insufficient or intermittent water access for health care practices; insufficient quality and quantity of water leading to poor hygiene; flood damage to water and sanitation infrastructures; contamination of water sources through overflow	Increased risks of food- and water- borne diseases (very high)	Unexpected outbreaks of food- and water-borne diseases; heat stroke; lack of water or contaminated water in facilities; disrupted supply chain for essential supplies and medicines; issue of boil water advisories; disruption of food supplies; damage to medical equipment (water, sanitation and health care waste; infrastructure, technologies and products)

	Climate change effects	Health risks	Health related impacts (IPCC rating)	Consequences for health care facilities (impacted areas)
Effects mediated through natural systems	Higher temperatures and humidity; changing and increasingly variable precipitation	Accelerated parasite replication and increased biting rates; prolonged transmission seasons; re-emergence of formerly prevalent diseases; changing distribution and abundance of disease vectors; reduced effectiveness of vector control interventions	Increased risks of vector-borne diseases (medium)	Unexpected outbreaks of vector-borne diseases overwhelming response capacity; need for increased surveillance of climate sensitive diseases (health workforce, water, sanitation and health care waste)
	Higher temperatures and changes in precipitation	Lower food production in the tropics; lower access to food due to reduced supply and higher prices; combined effects of undernutrition and infectious diseases; chronic effects of stunting and wasting in children	Increased likelihood of undernutrition resulting from diminished food production in poor regions (high)	Increased number of patients (particularly children) with diseases related to, or made worse by, undernutrition (health workforce)
Effects mediated by human systems	Higher temperatures and humidity	Outdoor and unprotected health workers obliged to work either in physiologically unsafe conditions or to lose income and livelihood opportunities	Consequences on workers' health include risks from lost work capacity and reduced productivity (high)	Risk to health care workers and patients from higher temperatures; mental health impacts on facility staff; power outages (health workforce; infrastructure, technologies and products)

Sources: (1,10)

IPCC: Intergovernmental Panel on Climate Change

(Source: WHO guidance for climate-resilient and environmentally sustainable health care facilities. Geneva: World Health Organization; 2020. Licence: CC BY-NC-SA 3.0 IGO.)

Table 2: Examples of impacts on health care organizations from unsustainable environmental practices

Climate change effects	Health risks to patients, health workforce and the wider community	Health impacts to patients, health workforce and the wider community	Consequences for health care facilities (impacted areas)
Water	Excess water withdrawals leading to water shortages; water inefficiency (broken pipes and plumbing) leading to shortages; not using rainwater harvesting where available; incorrect water storage leading to increased vector breeding sites; potential concentration of pathogens, nutrients or chemicals in local water sources	Exposure to infectious disease agents; increased risks of water- and vector-borne diseases through reduced water access and untreated wastewater reuse for food production; increased likelihood of impacts from concentration of arsenic, iron, manganese, fluorides, phosphorus; increased risk of liver damage, neurotoxicity, risk of cancer, cardiovascular disease	Declining water supply reduces function of water- reliant sanitation systems and hygiene practices (flush toilets, sewerage, treatment, hand washing, medical procedures); unexpected outbreaks of food-, vector- and water-borne diseases; disrupted medical procedures and treatments; increased likelihood of hospital admissions and complex treatment for liver damage, neurotoxicity, cancer (health workforce; water, sanitation and health care waste)
Sanitation	Insufficient numbers and/or unsanitary toilets; damaged and unrepaired sewers resulting in overflow during storms and floods; insufficient cleaning, laundry and sterilization practicesto water and sanitation infrastructures; contamination of water sources through overflow	Increased risk of diseases from exposure to pathogens and hazardous substances through increased environmental contamination	Health workers may experience additional risks depending on their work context and level of occupational health and safety; unexpected outbreaks of infectious diseases (health workforce; water, sanitation and health care waste)
Health care waste; chemical and radiological hazards	Untreated or insufficiently treated health care waste in or near the facility; exposure to multiple hazardous chemicals (pesticides, lead, mercury, silver, cleaning products), and pharmaceuticals; accidents from improper handling and disposal of radioactive wastes; waste anaesthetic gases and refrigerants; untreated wastewater used for agricultural irrigation;	Exposure to hazardous wastes (biological, chemical, radiological); physical injuries (chemical burns), increased noncommunicable diseases (respiratory, dermal); increased risk of intoxication from absorption, inhalation or ingestion of chemicals; radioactive poisoning, injuries with tissue damage, and DNA damage;	Increased infectious disease cases from health care waste contamination; increased threat to the health workforce resulting in infectious diseases, physical injuries, intoxications and reproductive problems, leading to psychological stress; long-term impacts related to

Climate change effects	Health risks to patients, health workforce and the wider community	Health impacts to patients, health workforce and the wider community	Consequences for health care facilities (impacted areas)
Health care waste; chemical and radiological hazards	environmental pollution from waste dumping; production of dioxins and furans from open burning and low-temperature incinerationeffectiveness of vector control interventions	increased risk of absorption, inhalation, ingestion or injection of pathogens resulting in infectious diseases (tuberculosis, HIV/AIDS, hepatitis, SARS)	noncommunicable diseases (cancers, respiratory diseases); increased admissions for complex treatments; increased workforce absenteeism (health workforce; infrastructure, technologies and products)
Energy	Fossil fuel-based energy leading to air pollution and GHG emissions from transport, medical waste incineration, heating spaces and other equipment and operation processes powered by fossil fuels; insufficient or intermittent access to electricity leading to malfunction or failure of medical equipment and devices (refrigeration of vaccines and some medications, sterilization processes, diagnosis and therapy equipment)	Increased health impacts of air pollution to the health workforce, patients and visitors including respiratory and cardiovascular diseases; increased risk of infectious diseases and deaths due to lack of power for medical electrical equipment and devices	Increase in respiratory disease in patients, communities or staff, overwhelming the facility's capacity; long-term impact to staff (cardiovascular diseases, cancers); increased threat to the health workforce and patients from infectious diseases (health workforce; energy)
Procurement and the supply chain	Inadequate, unsafe and unsustainable procurement (mercury containing medical equipment and devices, lack of energy efficient technologies and renewable energy production, steam equipment, mechanical equipment, refrigerants, transportation, chemical and radioactive products, pharmaceuticals, food, building materials) leading to hazardous waste disposal, air pollution and GHG emissions; unsustainable supply chain productsand services leading to airpollution, soil and water, and possibly food contamination; unsafe storage of products	Increased health impacts of air pollution to staff, patients and visitors including respiratory and cardiovascular diseases; increased water- and food-borne diseases from contaminated products; increased risk to human health from biological, chemical, radiological hazards, causing chemical intoxication, infectious diseases, cancers, cardiovascular diseases and respiratory diseases	Increased likelihood of intoxication, infectious diseases, cancers, acute and chronic respiratory diseases, cardiovascular diseases overwhelming the health system and increasing medical expenses (health workforce; infrastructure, technologies and products)

Sources: (3,6,12,15–17)

DNA: deoxyribonucleic acid; HIV/AIDS: human immunodeficiency virus infection/acquired immune deficiency syndrome; SARS: severe acute respiratory syndrome.

(Source: WHO guidance for climate-resilient and environmentally sustainable health care facilities. Geneva: World Health Organization; 2020. Licence: CC BY-NC-SA 3.0 IGO.)

Healthcare organizations thus may lack functioning infrastructure, trained human resources and are predisposed to inadequate supply of energy, water and waste management due to climate change. An environmentally sustainable healthcare system improves, maintains or restores health, while minimizing negative impacts on the environment and leveraging opportunities to restore and improve it, for the benefit of the health & well-being of current and future generations.

NABH envisions that in order to ensure continuity of care and quality healthcare services across country, adoption of sustainable practices is need of the hour. To ensure the same, NABH standards from time-to-time have focused on implementation of sustainable and green practices as per current scenarios. NABH had introduced the concept of green hospitals in its 3rd edition of Standards for Hospitals and continued to add further requirements around sustainability in subsequent 4th & 5th editions. **Going forward, a dedicated standard on Environment sustainability and climate resilience is incorporated in NABH Accreditation Standards for Hospitals 6th Edition with the aim to bring pointed focus on this critical issue.**

By implementing sustainability practices in the healthcare organizations, significant contributions can be made towards achieving most of the SDG targets. As healthcare continues to evolve along with societal priorities, it will become even more critical to embrace sustainability in order to preserve the planet and promote equitable access to healthcare services.

CONCEPT OF SUSTAINABILITY IN HEALTHCARE

Healthcare structures serve to protect and improve health of community; however, they can have negative effects on human well-being and the environment. Thus, sustainability is considered as an important goal in a rapidly changing healthcare environment. As the threats of climate change become increasingly important, win-win strategies for mitigation, health improvement and cost savings offer a range of advantages for various stakeholders. For example, greener health care operations can generate patient and worker health benefits while also saving energy, mitigating climate risks and creating long-term cost savings. A sustainable structure is defined as a one that ensures preservation of resources, is practical from ecological, social & economical perspectives and meets the interests of different stakeholders. Sustainability in healthcare refers to the implementation of practices and policies aimed at preserving natural resources, minimizing waste generation, reducing environmental impact, promoting health equity, improving efficiency and ensuring patient safety while meeting population health needs.

For detailing on the climate resilient and environmental sustainability in relation to the environmental determinants of health in healthcare organizations, the following needs to be considered:

Water: Healthcare organizations require sufficient quantities of safe water to provide quality healthcare services. Essential activities like drinking, cooking, bathing, cleaning, hand hygiene, laundry & variety of other general and specialized operations require reliable supply of safe water. In present times, many healthcare organizations face difficulty in getting adequate supply of safe water including inadequate or non-existent municipal water supply and waste water treatment facilities. Alternate sources of water, efficient technologies to reduce water usage and reuse of waste water is need of the hour.

Air Quality: Ambient air pollution, which is principally driven by fossil fuel combustion, cause both morbidity and mortality which include damages to the heart, lungs & other vital organs. It is responsible for killing an estimated 4.2 million people annually. Health care organizations contribute to ambient air pollution through on-site fossil fuel energy combustion, medical waste incineration, purchase of energy generated from fossil fuel sources & procurement of goods that are produced and transported using fossil fuels. Facility vehicle fleets as well as patient & staff transport systems also contribute to air pollution emitted from transportation, which generates smog, resulting in poor air quality negatively impacting human health. Healthcare organizations can explore options to implement electric transportation planning & procurement strategies and use of cleaner fuels.

Healthcare waste: Over half of the world's population is estimated to be at risk from environmental, occupational or public health threats resulting from improperly treated health care waste. Improper health care waste management can occur due to several reasons such as lack of awareness about the health hazards related to health care waste, inadequate training in proper waste management, lack of infrastructure or energy. As per Annual Report for the year 2019 on Biomedical Waste (BMW) Management as per BMW Management Rules, 2016 published by Central Pollution Control Board (Ministry of Environment Forest & Climate Change), about 619 tons/day of biomedical waste was generated during the year 2018-2019 by 3,22,425 numbers of Healthcare Facilities. Out of 619 tons/day of biomedical waste, only 544 tons/day of biomedical waste is treated and disposed off. Also, Andaman & Nicobar Islands, Arunachal Pradesh, Goa, Lakshadweep, Mizoram, Nagaland and Sikkim do not have common facilities for treatment & disposal of biomedical waste.

In addition, transporting health care waste in vehicles using fuels, inadequate incineration, inappropriate incinerator technology, or the incineration of unsuitable materials result in emission of green-house gases (GHG) and the release of pollutants into the air. Proper waste management, recycling of waste, composting etc. are the practices which need to be adopted.

Sanitation and waste water: Under the Environment Protection Act, treatment of waste water is mandatory. However, despite enactment of the above said act, proper facilities in rural parts of the country and in smaller healthcare organizations is still an area of concern. Affordable waste water treatment facilities should be looked upon. Also, the sewage treated in a bio-digestion system generates methane gas which can be utilized as a fuel within the facility. If such system is functional and well maintained, more resilient healthcare delivery is possible.

Chemicals: An estimated 1.6 million lives and 45 million disability-adjusted life-years were lost in 2016 due to exposure to selected chemicals. Chemicals are used for various purposes, such as in chemotherapy to treat cancer, as disinfectants for cleaning and sterilization. By replacing the chemicals with green disinfectants for cleaning purposes, addressing chemicals in use, potential exposure from them and also, related environmental & health risks can be minimised. This will not only protect patient & health worker but also the health of surrounding communities.

Radiation: It is estimated that there are more than 3600 million radiography examinations, 37 million nuclear medicine procedures and 7.5 million radiotherapy procedures conducted annually worldwide. Every year an estimated seven million health workers are exposed to radiation due to their professional activities. Beyond certain dose thresholds, radiation can impair tissues &/or organs and produce acute effects. Even if the radiation dose is low but is continuously delivered over a long period of time there is a risk of long-term effects, such as cancer. This demands radiation safety policies, strict implementation of AERB guidelines and training (sensitization) of staff.

Food: Healthcare organizations are major consumers of food. Healthy diet is crucial for speedy recovery. Healthcare organizations can promote health and sustainability through their food choices and food service menus. Healthcare organizations can include limiting the amount of meat in hospital meals. Promoting local producers to sell healthy food by the healthcare organizations, can be helpful. Utilizing leftover food for donation and composting food waste are steps which can be initiated towards sustainability.

It is increasingly important for healthcare organizations to adopt sustainable approaches due to following reasons:

1. Environmental Preservation: Healthcare contributes significantly to greenhouse gas emissions globally. Sustainable healthcare practices aim to reduce these emissions through energy-efficient buildings, transportation alternatives, green procurement, recycling programs and waste reduction initiatives. This can help mitigate climate change and protect our planet's fragile ecosystems.

2. Resource Conservation: Sustainability involves conserving finite resources such as water, food, medicine and medical supplies. Implementing sustainable practices ensure efficient use of available resources. This also reduces waste generated during healthcare delivery. These efforts contribute positively towards economic stability by avoiding unnecessary expenses on resource acquisition.

3. Health Equity: Healthcare sustainability focuses not only on providing services but also on addressing social determinants of health like education, income inequality, housing conditions and access to clean water. By adopting sustainable strategies, healthcare providers can minimize disparities related to health outcomes among different set of populations and ensure equitable distribution of healthcare resources.

4. Employee & Patient Safety: Sustainability initiatives promote safe working environments for healthcare professionals by reducing occupational hazards caused by pollution or inadequate infrastructure. They also prioritize medication safety and proper disposal methods to prevent adverse drug events and contamination risks. 'Healthcare without Harm' details on patient safety practices. All these factors contribute to enhancing patients' safety throughout their healthcare journey.

5. Economic Benefits: Investing in sustainable healthcare practices leads to long-term cost savings by cutting down operational costs associated with waste management, maintenance of inefficient equipment, electricity consumption, etc. Additionally, adopting eco-friendly measures generate revenue opportunities through reduced exposure to regulatory fines, enhanced brand reputation and customer loyalty.

6. Innovation & Job Creation: Sustainable healthcare encourages innovation across sectors ranging from medical technology development to pharmaceutical production processes. The focus shifts toward solutions that utilize fewer resources, generate minimal waste, enhance productivity and support a circular economy model. Innovations stemming from this shift lead to job creation within the healthcare sector itself and beyond.

Sustainability plays a critical role in shaping modern healthcare systems. Healthcare providers must recognize its significance and strive to incorporate sustainable practices into their operations effectively. Sustainable healthcare benefits both patients and providers alike by delivering high-quality care while protecting the environment and ensuring equal access to resources for communities.

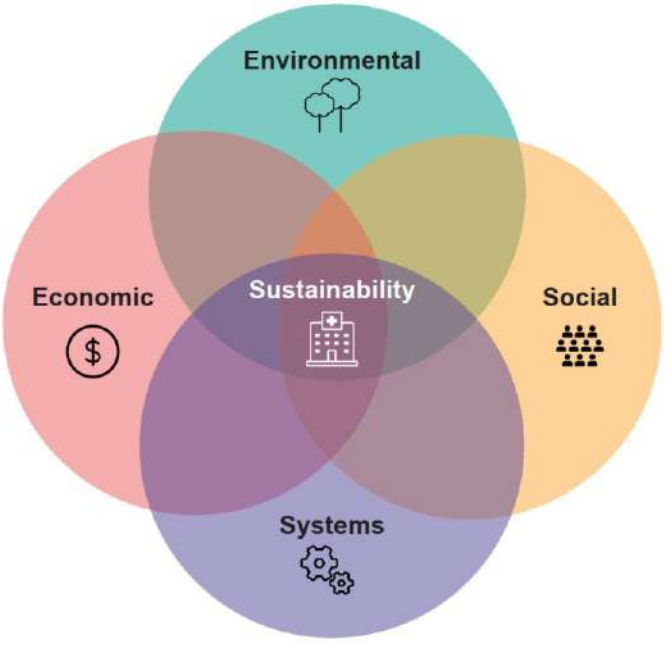


Fig. 3: Relation between sustainable and quality systems in healthcare

The figure 3 depicts the inter relationship between Environmental, Economic, Social and systems for achieving health care sustainability and quality.

Environmental sustainability is a moral responsibility and some examples of environmental sustainability are minimizing energy use through passive solar design and ventilation, Landscaping to improve biodiversity and contribution to passive cooling of the building, Harvesting Rainwater and sourcing renewable building material to reduce the manufacturing carbon footprint.

Social Sustainability refers to enhancing the quality of life, improving well - being of the population, enabling access, improving health and enhancing equity.

Economic Sustainability refers to reducing operational costs through renewable energy and minimizing waste. Capacity building of healthcare workers through improved services, model of care and ensuring proper utilization of equipment & facilities by monitoring their use coefficient.

Systems Sustainability refers to staff retention through incentives and promotion of staff well-being, use of technology like transiting to a digital platform through use of electronic health records.

The figure 3 reflects that Healthcare system sustainability and quality go hand in hand, as each element influences the other. Here's why they're interconnected:

1. Resources Optimization: Sustainable healthcare practices optimize resource allocation, resulting in higher efficiency and effectiveness of clinical services. Effective resource management ensures that healthcare providers deliver high-quality services while minimizing wasteful expenditure.

2. Patient Safety: Sustainable healthcare systems prioritize patient safety by creating secure and stable healthcare environment free of hazards. Safeguarding patient safety through sustainable healthcare practices enhances overall system reliability and credibility.

3. Service Delivery Continuity: Sustainable healthcare systems guarantee uninterrupted healthcare services by mitigating disruptions arising from power failures, disasters or pandemics. Continuous service delivery maintains patient trust and satisfaction while sustaining system integrity.

4. Staff Satisfaction and Retention: Sustainable healthcare systems promote employee satisfaction & retention by offering healthy & safe workplaces, competitive salaries, professional development opportunities and recognition of contributions. High levels of employee engagement translate into improved patient care and increased organizational success.

5. Community Trust and Support: Sustainable healthcare systems build strong community partnerships and garner support through transparency, communication & collaboration with local stakeholders. Strong stakeholder relationships increase community trust and participation in healthcare decisions, thereby driving positive system outcomes.

6. Future Resilience: Sustainable healthcare systems prepare for future uncertainties by investing in innovative technologies, adopting best practices, diversifying funding sources and continuously evaluating system strengths & weaknesses. Proactive approach to sustainability fosters resilience against emerging threats and enhances preparedness for unexpected events.

7. Regulatory Compliance and Accreditation: Sustainable healthcare systems facilitate compliance with applicable laws, regulations and accreditation standards. Compliance ensures accountability, transparency & acceptability to regulators, payers and patients. Successful accreditations reinforce high-quality healthcare delivery while attracting patients seeking trusted healthcare providers.

In conclusion, sustainable healthcare systems breed effective resource allocation, elevated patient safety, continuous service delivery, satisfied & motivated workforce, robust community involvement, future resilience and regulatory compliance. Ultimately, sustainable healthcare systems drive superior healthcare outcomes leading to greater patient satisfaction and improved quality of life.

GUIDANCE FOR IMPLEMENTATION

Guidance for Implementation

Achieving sustainability in healthcare requires strategic planning involving various stakeholders managing hospital operations. Below are some steps that hospitals can take to implement successful sustainability initiatives. These steps can be classified as per the figure 4. which details regarding the process of sustainability practices adoption and implementation in a healthcare setting.

Fig. 4 Sustainability Cycle

The details of each step of the process are as follows:

1. **Develop and train an interdepartmental/ multidisciplinary team:** Sustainability practices adoption in any organization requires unwavering support of the owners and top leadership. Thus, assembling and training an interdepartmental team who has a keen interest towards environmentally sustainable and climate resilience practices is the first step. Many of the interventions are cost-effective and can be immediately adopted by involvement of senior official or departmental head. Various online free courses are available regarding climate change & sustainability and all the staff should be encouraged to train themselves. In addition, combined trainings at regular intervals can be conducted by the identified trained staff. The team should be provided with the funds by the leadership to ensure it is a top-down approach to implement.

   Basic criteria to select team members could include the following:

   - Understanding of basic concept of sustainability
   - Keenness to devote at least 1-2 hours a week
   - Leadership qualities and potential to impact change

2. Conduct Sustainability Assessments/ Risk Assessments:

Climate hazard vulnerability assessment, carbon emission by the organization, energy audit etc. should be conducted based on national or international tools. Climate hazard vulnerability assessment or assessment of possible hazards that can impact the hospital should be based on past events and future predicted climatic changes in the specific geographical area. The team should establish a baseline data as per current situation in term of climate resilience and environment sustainability. Current carbon footprint and carbon emission should also be evaluated. Tools are available by various organizations like NCDC, Govt. of India, WHO, GRIHA, Geneva Sustainability Centre. A user-friendly self-assessment checklist has been developed by NABH for handholding of the healthcare organization and is enclosed with this guidance document for ready reference.

3. Define and develop short-term & long-term goals with budget

Subsequent to completion of self-assessment, the activities/ actionable points should be divided in short-term & long-term goals to strengthen the climate resilience and environment sustainability of the organization. Prioritize the interventions based on impact towards development of climate resilient and environmentally sustainable organization, financial implications and time frame for the intervention. Allocate budget for the short-term & long-term goals, set measurable targets for afore mentioned goals and assign responsibilities accordingly.

Examples of short-term & long-term goals include reducing greenhouse gas emissions, increasing recycling programs, switching to renewable energy sources, improving indoor air quality and promoting sustainability awareness behaviour among staff and patients.

Embrace sustainable technologies & practices that minimize environmental harm and maximize efficiency gains within the healthcare organizations. Examples include installing LED lights, upgrading HVAC systems, deploying sensors for remote monitoring of energy use, implementing electronic records and utilizing sustainable sourcing practices for food & consumables.

Table 3 Examples of short-term & long-term goals

Goal	Actionable	Responsibility	Timeline	Measure & sustenance
Reduce food wastage (Short term goal)	Create awareness among the staff / put up posters	Food & Beverages manager	30 days	Measure of actual amount of food wasted
Reduce water consumption in laundry (long term goal)	Buy & adopt technology/machines that utilize less amounts of water	CEO	270 days	Amount of water consumed in laundry

4. Engage Stakeholders, Educate Employees and Patients

Collaborate with all stakeholders – employees, patients, suppliers, investors and community members – throughout the process. Encourage ownership of sustainability goals by involving staff in determining solutions and rewarding their contributions. Engaging stakeholder fosters buy-in, motivation and commitment to realizing sustainability objectives.

The plan to achieve the identified and prioritized goals should be developed by engaging stakeholders. Plan should have goals listed in order of urgency to execute them along with the responsibility of the relevant stakeholders i.e. senior officials or departmental heads. The role and responsibility of each stakeholder should be clearly defined and understood.

Employees' education paves the key role to successful and continued implementation. Education can be in the form of training classes, educative posters or IEC material display in the organization. Staff may also be promoted for education through various free courses available online.

Train employees to incorporate sustainable habits into daily routines and instil a culture of environmental stewardship. For instance, implementing effective waste management practices across the organisation and inculcating the concept of 3Rs (Reduce, Reuse & Recycle) as an organisational culture lexicon.

Patient and visitors' education should also be focused upon as they are the most important stakeholders & users of the services being offered by the healthcare organizations. IEC materials across the organization on electronic displays & notice boards, educative videos across the organization, small awareness plays/acts by the staff in waiting areas can be some of the initiatives to increase awareness among patients, visitors and employees.

5. Measure Progress and Performance:

Establish Key Performance Indicators (KPIs) to monitor progress towards sustainability objectives regularly. Collect data, analyse trends, celebrate successes and learn from setbacks to continually refine & improve sustainability efforts moving forward. Report sustainability achievements internally & externally to demonstrate transparency, accountability and commitment to sustainable practices.

Sustainability is an ongoing journey; therefore, continually evaluate and adjust your sustainability strategy based on lessons learnt, feedback received, technological advancements and shifting societal expectations. Stay ahead of emerging trends, explore novel approaches and foster an atmosphere of creativity & innovation within the healthcare organizations.

By following these steps, healthcare organizations can achieve meaningful & lasting improvements in sustainability, demonstrating leadership in environmental protection and contributing positively to population health.

STRATEGIC FRAMEWORK FOR SUSTAINABILITY

Healthcare organizations play crucial role in responding and mitigating the impacts of climate change in the affected community. Thus, it becomes imperative for the healthcare organizations to have safe infrastructure which are environmentally sustainable & climate resilient. Environmentally sustainable health system should be put forth as being a health system that improves, maintains or restores health. Also the health system should minimize negative impacts on the environment and leverage opportunities to restore & improve it for the benefit of all.

Climate threats to health systems are particularly visible when it comes to health care organizations. Often, health care organizations are not built to cope with increasing climate-related risks, such as extreme climate events including storms, floods & droughts; extreme temperatures, fires, sea-level rise; and changed patterns of climate sensitive diseases. Though smaller healthcare facilities do not contribute much to emission of green-house gases yet, they are the ones which are most likely to get affected by climate change impacts. It is therefore important to address the four environmental fundamentals to deliver safe and quality care: A well-informed health workforce, minimum standards for energy, adequate access to WASH (and wastes) services and a strategically located solid health care infrastructure. Interventions to build resilience may include governance actions, commitment of stakeholders, risk assessments (hazards, vulnerabilities and exposures), training & capacity building in the health workforce, awareness & communication, service delivery and funding.

Healthcare organizations need to take effective measures to ensure sustainability and to withstand the impacts of increasing extreme weather events & other climate related hazards such as higher temperatures, increasing rain precipitation over longer periods of time, flash flooding, higher winds and storms. Climate change can also lead to new or exacerbate existing issues like increasing contamination of ground water during droughts, difficult accessibility to safe water supply, increasing air pollution etc. Most of these hazards have impact on the mental health of the community including that of healthcare workers putting larger pressure on the healthcare system.

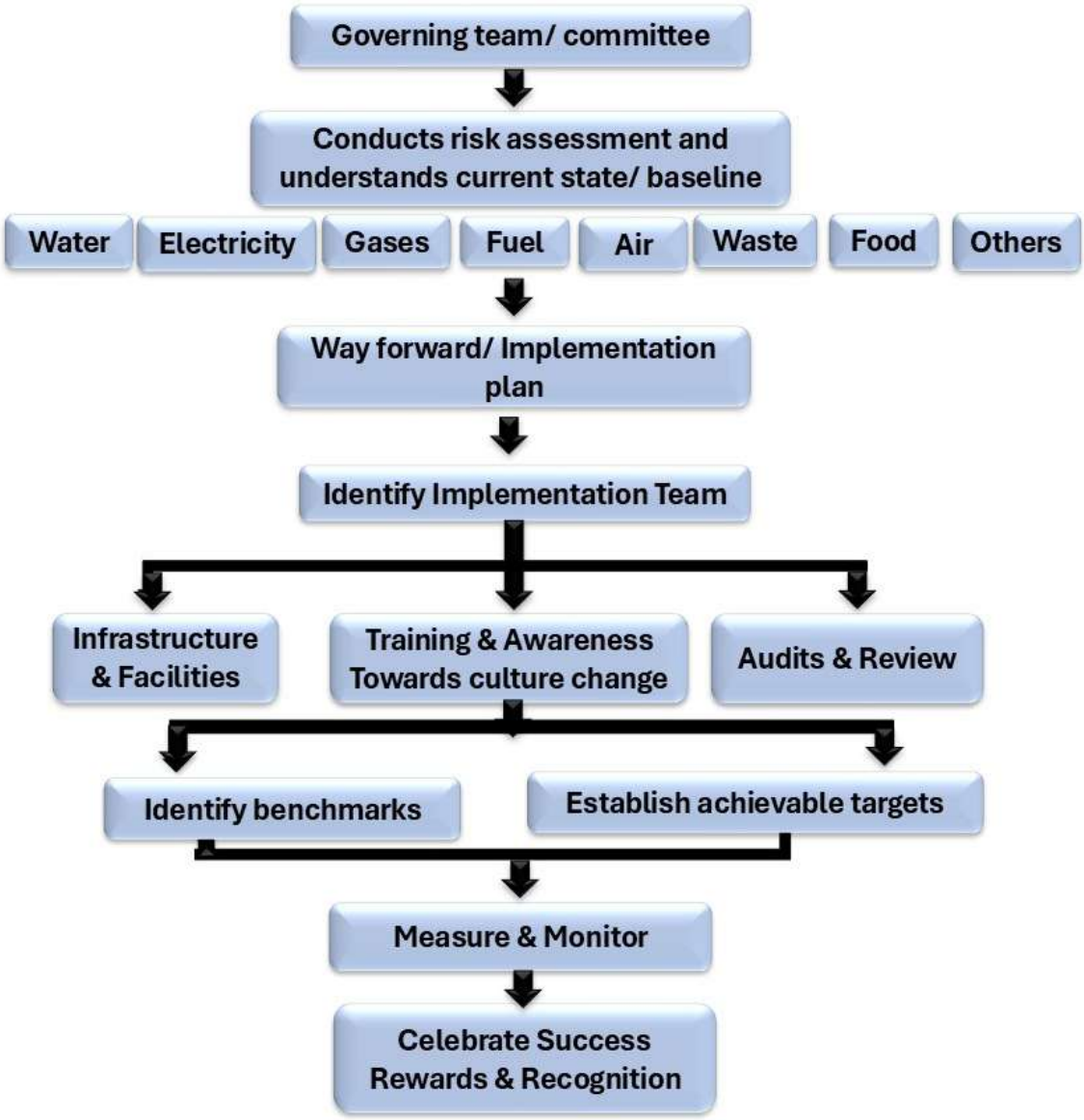


Fig. 5 NABH sustainability approach matrix for healthcare organizations

The Core Principles

The strategy for a sustainable development plan should focus on the core principles **of sustainable prevention, pathways and practice.** Figure 5 depicts the sustainability approach matrix i.e. a flowchart for approach towards sustainability practices' implementation in a healthcare organization.

The Core Elements of Strategy.

The core elements of the strategy for developing sustainability in healthcare are detailed as following. Figure 6 shows the components for sustainable healthcare, these are not all inclusive but broadly lay out the guidelines for strategy development for sustainable healthcare.

Fig. 6 Components for Sustainable Healthcare

A. Governance:

Governance is fundamental aspect of any organization, which establishes intent, practices and process of an organization. Commitment at governance level is key to sustainability in any healthcare organization. At Governance level following steps can be initiated:

1. Development of short term and long-term goals: Immediate 1-2 years of short-term goals should be defined and synced with the operational plan of the organization. Further goals to achieve net zero carbon emission should be defined as long-term and be included in strategic plan of the organizations.
2. Dedicated staff: A staff trained in environment sustainability and climate resilience should be designated as **Sustainability Officer**. The staff can be entrusted with the responsibility for evaluating & suggesting changes, ensuring sustainable practices implementation in the organization and training of staff etc.
3. Allocation of budget: Annual Budget should be allocated for sustainability activities and is linked with operational & strategic plan.
4. Risk Assessment: Detailed risk assessment as per the probable environment related and climate related risk is conducted using standardised tools and is reviewed at least annually by top management.

5. Regular reports and performance parameters: Regular updates in the form of reports may be presented to the top management quarterly. Key performance parameters to be defined and reviewed on monthly basis by governing committee.

B. Infrastructure and Facilities (including resource management)

Healthcare organizations must consider the climate related impacts and develop infrastructure with the use of sustainable materials & models. The structural & non-structural components and measures should be taken into consideration. Structural components include load bearing systems of the building like columns, beams, floor, slabs, walls etc. While developing the structural components identified climate risks should be considered like floods, earthquake, cyclone, sea-level rise and construction should be done to resist them. Non-structural components include those which are essential for providing services like electricity, water supply, fire protection, waste management, emergency access & exit routes, food supply, medical & non-medical supplies etc. Hospitals are one of the largest consumers of electricity with approximate daily consumption of 3 Kw per bed. Huge percentage of energy consumption i.e., almost 65% is used for lighting, heating, cooling and ventilation. It is noteworthy that higher energy efficiency helps in reduction of emission of greenhouse gases.

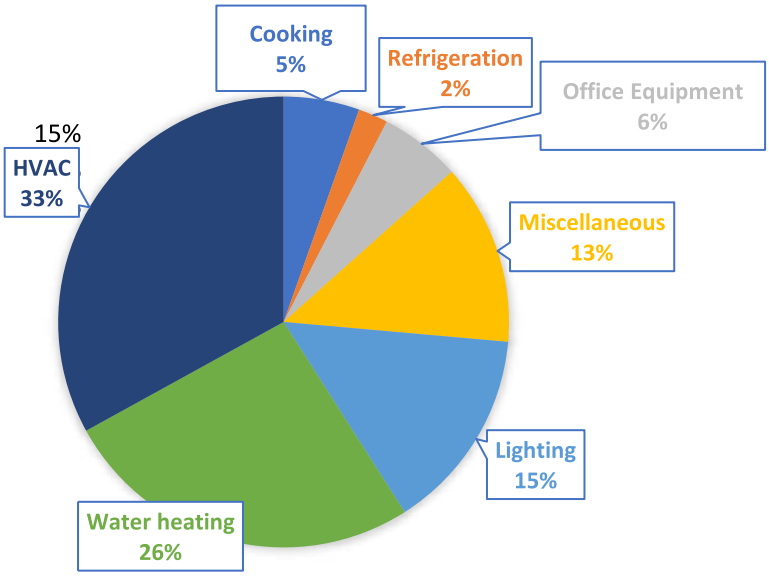


Fig. 7: Typical energy use in hospitals

(Source: Energy Management in Healthcare Facilities by Bureau of Energy Efficiency available at https://cdkn.org/sites/default/files/files/ICF-Guidebook_Energy-Management-in-Health-care-Facilities.pdf)

Following points should be considered for infrastructure and facilities:

Green building:

i. Current building regulations in the country like NBC 2016, IPHS guidelines 2022 should be adapted, thus retrofitting the facilities to ensure climate resilience and environmental sustainability.

ii. Development of new infrastructure should include consideration to identified climate risks and resistance to them.

iii. Sustainable and environment friendly construction materials, paints etc. should be used.

iv. Glass windows, doors, walls should be placed considering resistance to the wind speeds of 200-250 kph.

v. Double glazing glass that provides thermal optical properties to the building and also reduces noise should be considered for use.

vi. Proper drainage in the entire facility and adequate waste storage areas should be available.

vii. Coating on roof or reflective roofing to ensure heat resistance should be done.

viii. Reliable and sustainable primary & back up communication systems should be available.

ix. Patient safety and comfort should be considered while planning infrastructure like proper ramps, side rails, grab bars etc.

x. Exit passages should be clearly marked using self-illuminating material.

xi. Blue prints and Fire escape routes should be readily available for the entire building.

xii. Disable friendly washrooms should be available and easily accessible.

xiii. 10-30% Green areas and herbal gardens should be available.

Energy Efficiency (Electricity):

xiv. Energy audit of the entire building should be conducted at regular interval (at least once a year) to identify energy consumption patterns in the organization.

xv. Monitoring should be done through rounds or devices (like sub meters) regarding energy utilization in different areas/ departments of the organization on continuous basis.

xvi. All incandescent bulbs should be replaced with the LED lights across the facility.

xvii. Natural ventilation and maximum use of natural light should be considered using newer technology in market.

xviii. Motion sensor or occupancy sensor lighting should be used in office areas, toilets, storerooms etc.

xix. 3 star and above star rating equipment, BEE labelled/ ISI marked energy efficient equipment and appliances should be considered while procuring.

xx. Installation of solar panels for utilization of renewal sources of energy, load bearing capacity of the solar-panel at the facility should be analysed.

xxi. Labelling of switches across the facility for awareness, energy saving posters should be placed across the organization.

xxii. Periodic maintenance & check of all equipment should be carried out across the facility for wear-tears and repairs/replacements.

xxiii. Alternate sources of electricity should be available to ensure at least 3 days uninterrupted supply of electricity.

xxiv. Back up sources should be periodically checked to ensure functionality and placed at a location which can withstand extreme weather conditions like storms, cyclones, heavy rains etc.

xxv. Other renewable sources of energy should be explored and utilized like wind energy, biogas plants or hydroelectricity.

xxvi. Back up source of electricity should be connected with all critical service areas and equipment like ICU, OT etc.

xxvii. Voltage stabilizers should be made available to protect equipment from voltage frequency fluctuations.

xxviii. Reliability on fossil fuels to be reduced and use of biofuels should be promoted, where feasible.

Water management:

xxix. Current water storage tanks, valves, pipes & connections should be checked for safety conditions like mosquito breeding, etc. and proper functioning.

xxx. Storage tanks should be placed to ensure prevention of damage like breakage, mixing with unsafe water etc. due to extreme climatic conditions.

xxxi. Water quality supply should be monitored and tested regularly including emergency conditions.

xxxii. Based on current or historical disasters/events a water safety supply plan should be developed and implemented. In drought prone areas water management plan including identification of alternate source of safe water should be developed and tested.

xxxiii. Back up storage tanks based on water consumption of the organization should be available within the facility to ensure supply for at least 3 days in situations of emergency.

xxxiv. Kitchen should have adequate supply of clean water.

xxxv. Non-return valves on water supply pipes should be installed to prevent back flows.

xxxvi. Various mechanism should be adopted to conserve and reduce water usage like use of sensor taps, low flow faucet/tap, dual flush mechanisms in toilets.

xxxvii. Rain water harvesting with safe storage should be installed in the facility where rainfall is sufficient and regular.

xxxviii. Alert system for reporting of leaking taps by the staff and repaired within defined turn around time.

xxxix. Water efficient cleaning practices should be adopted like deep cleaning instead of fumigation, microfiber mops instead of cotton mops. To clean 100 rooms in a healthcare facility, microfiber mops need only 19 litres of water whereas 397 litres of water is needed by cotton mops.

xl. Waste water treatment plants should be installed within the facility and treated water should be used for activities like gardening, toilet flushing etc., where feasible.

xli. Water consumption audit should be done, action plan should be developed and implemented for reduction of water usage, where feasible.

Food supply:

xlii. Locally available food should be promoted in menu.

xliii. Access to essential backup food sources during emergency situation via multiple vendors should be developed.

xliv. Vegetarian food instead of meat and poultry products should be promoted in order to reduce carbon emission.

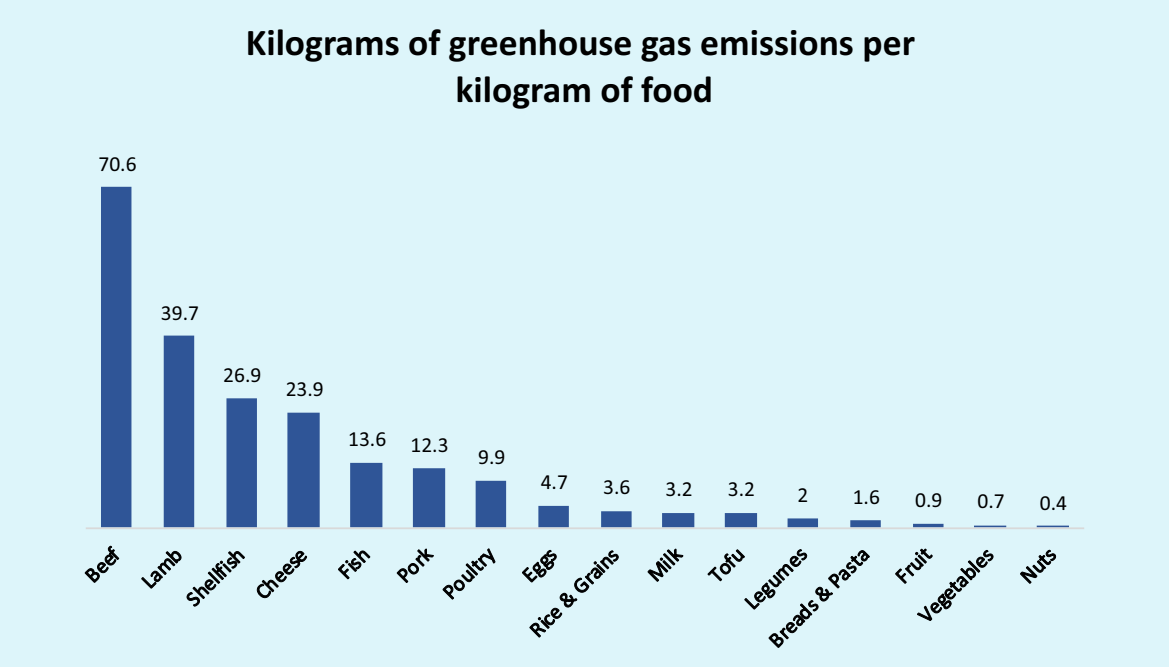


Fig. 8 Kilograms of greenhouse gas emissions per kilogram of food

(Source: https://www.un.org/en/climatechange/science/climate-issues/food)

xlv. Mechanism should be developed to ensure uninterrupted food supply for patients and staff for at least 3 days.

xlvi. IEC posters should be placed for reduction of food waste.

xlvii. Food waste audit should be conducted periodically (at least once in 6 months).

C. Waste Management Practices (including e-waste)

Hospitals, in addition, to healthcare waste also generate general/solid waste and e-waste. Waste generated can be the potential source of infection for the community and the healthcare workers, if not managed properly. Healthcare waste management practices are governed by Biomedical Waste Management Rules 2016. Exhaustive guidelines have been developed by Ministry of Environment, Forest and Climate Change, Government of India with reference to Biomedical Waste Management Rules 2016 (Amendments thereafter), Solid Waste Management rules 2016 and E-waste Management rules 2022 (Amendments thereafter). Waste management in the organization should focus on 3Rs Reduce Reuse Recycle. Following points to be considered for waste management:

i. Strict Implementation of Biomedical Waste Management Rules 2016 (Amendments thereafter), Solid Waste Management rules 2016 and E-waste Management rules 2022 (Amendments thereafter).

ii. Policy for waste management for different categories of wastes generated and their disposal should be available & implemented.

iii. Identify staff responsible for waste management practices including reduction of waste.

iv. Reduce, Reuse & Recycle should be the basic principle for waste management. Reduce the waste as far as possible e.g. prefer products with least packaging etc. Reuse the waste products like reuse of waste water from water treatment plants, reuse of biogas generated from water treatment plants etc. Recycle the waste like composting of waste food products, sell discarded general plastic waste to vendors etc.

v. Availability of appropriate size of waste bins with proper colour coding in each patient care and non-patient care areas should be ensured. Educative posters or stickers should be placed for proper segregation of waste.

vi. Covered waste transportation trolley should be available to ensure infection prevention.

vii. Availability of vendor details for collection of different categories of wastes should be ensured. MoU with Central/state pollution control board authorized vendor should be promoted.

viii. Central biomedical waste area should have capacity to store waste in case of emergency or disaster conditions. Central biomedical waste area drainage should be connected with waste water treatment plant.

ix. Promote use of hand dryers in place of tissue papers/paper towels.

x. Proper reuse policy with details on items that can be reused and number of times sterilization of items can be done.

xi. Promote use of non-disposable items over single use items, if feasible.

xii. Prevention of back flow from sewer lines should be ensured.

xiii. Conduct waste audit which can include points like proper segregation, collection, transportation, quantity of waste generated department/area wise, amount of waste reused, amount of waste recycled, cost of waste collection and disposal. Action plan should be developed and implemented on the basis of findings of waste audits.

D. Human Resource Management

Human resource is the most essential resource of any organization and are the key enablers for the success towards climate resilient & environmentally sustainable healthcare organizations. Human resource will include all the people working within the organization. As the concept is new, creating awareness through training and capacity building is essential. Also, at the same time factors like labour & human rights, team empowerment, fair employment practices should be implemented in the organization. Following points should be considered:

i. Assessment of potential workplace hazards with respect to current situations and emergencies

should be done on regular basis with active involvement of staff working in concerned area.

ii. System for management of occupational safety and health of all the workers should be established.

iii. Identify minimum needs of the workforce in situation of emergency and develop action plans accordingly.

iv. Regularly conduct training programs and awareness programs for all staff on different aspects of climate change & environment sustainability like energy conservation, water conservation, food waste reduction etc.

v. System to provide workforce in case of emergencies with necessary credentials should be established.

vi. Psychosocial support teams should be available for staff during and post-disaster situations.

vii. Workforce should be trained to initiate early warning systems and handle situations of disasters/ emergency events.

viii. Contingency plan for transportation of staff should be available during situation of disaster or emergency events. The plan is tested at regular intervals.

E. Social-Ethics and Fair Operating Practices:

Active participation of all humans in terms of diversity and equal opportunity should be promoted in all activities within the organization. Discretion on the basis of creed, religion, race, colour, gender should be discouraged. Organizations should be committed to continuously improving all its processes and operations, as the basis for efficiency, effectiveness and competitiveness. Community activities should be promoted. CSR activities should be done at least yearly.

F. Sustainable Procurement in Healthcare:

Sustainable Procurement practices integrate requirements, specifications & criteria that are compatible and in favour of the protection of the environment, of social progress and in support of economic development, namely by seeking resource efficiency, improving the quality of products & services and ultimately optimizing costs. Adopt & procure items which have low environmental impacts and enhances climate resilience & environmental sustainability. Following points should be considered:

i. Develop a sustainable procurement policy which includes purchasing items which are environmentally friendly, low or no packaging product. Preferably items should be procured from vendors who promote green practices.

ii. Additionally, use of e-vehicles for transportation etc. should be promoted.

iii. Mechanism for supply of medical and non-medical requirements in case of emergencies should be developed. Contingency agreement systems should be developed for supplies in case of emergency events.

iv. Plastic packaging should be highly discouraged. Also, minimal packing of items should be promoted in collaboration with vendors.

v. Combining of supplies for multiple departments should be considered in order to ensure less transportation.

vi. Use of e-bills & challan systems, first in first out (FIFO) mechanisms should be followed.

vii. Environmentally safe chemicals should be procured and used as cleaning agents.

viii. Environmentally safe medical supplies like anaesthetic gas sevoflurane in place of desflurane should be considered for use.

ix. Audits should be conducted to understand where sustainable procurement can be implemented and impact of implementation in various areas.

G. Readiness for disasters

Disaster Management planning is the most essential step towards reducing the impact of any disaster. First step towards development of disaster management plan includes assessment of risks. Risks can be assessed through various tools like Hazard Vulnerability Assessment, HIRA etc. A disaster management plan should be developed by a multi-disciplinary team which includes departmental heads, finance head, administrative head etc. National disaster management guidelines by NDMA, Govt. of India explicitly cover the requirements of disaster management plan. Guidelines by State Disaster Management Authority should also be considered. A disaster management plan should essentially include the following:

i. Early warning: Warning mechanism i.e. collaboration with district disaster management authorities should be done. Mechanism for initiating early warning and in-house training of staff should be there in terms of communication system.

ii. Coordination: Command system or team which includes administrative heads, finance head, nursing head, medical head, security head etc. should form a team and act in coordination to manage situation of disaster in terms of finances, supplies, human resource, security of the organization etc.

iii. Planning, training and mock drills: Proper planning & implementation for each category of risk should be carried out including back up response teams, availability of surge medications & essential supplies, role & responsibility of each member, setting up information centre etc. Training of all staff on disaster management plan should be conducted at regular interval at least once a year & also during induction training. Mock drills should be conducted (at least twice a year) to test the plan, identify deficiencies and take action towards them.

H. Monitoring and Performance Measurement criteria:

The practices initiated should be monitored regularly and quarterly reports should be presented to the top management or in management review meetings. Performance measurement criteria should be defined and monitored on regular basis. Performance Measurement Criteria can include units of electricity conserved, litres of water saved, quantity of food donated, quantity of food waste reduced, financial profits from sustainable practices like solar plant installation, number of staff trained, number of mock drills conducted and number of deficiencies observed etc.

EXAMPLES OF BEST PRACTICES

Best practices for sustainability in healthcare involve implementing practical and actionable measures focused on reducing waste, conserving resources, enhancing operational efficiency and adopting sustainable technologies. Some notable examples include:

1. Adopt Green Building Design Strategies: Build green buildings designed around principles of energy efficiency, water conservation, material sustainability and indoor environmental quality. Consider passive design techniques, smart building automation systems, daylighting strategies, rainwater harvesting, solar panels and geothermal heating/cooling systems while constructing new facilities or renovating older ones.

2. Optimize Supply Chain Management: Implement lean supply chain practices to minimize waste generation and reduce transportation emissions. Use inventory management tools to forecast demand accurately and streamline purchasing procedures. Also, partner with suppliers who share similar sustainability goals to collaborate in achieving collective sustainability milestones.

3. Incorporate Renewable Energy Solutions: Invest in renewable energy options such as wind turbines, solar panels, bio boilers & geothermal heat pumps to reduce reliance on fossil fuels and decrease greenhouse gas emissions. If feasible, obtain renewable energy certifications or participate in community solar projects to offset remaining emissions.

4. Foster Sustainable Behaviours Among Employees and Patients: Develop and implement campaigns educating employees & patients about sustainable practices relating to energy conservation, waste reduction, recycling and responsible consumption. Offer incentives such as reward programs or discounts to encourage adoption of sustainable habits.

5. Monitor Energy Usage: Install smart meters to track real-time energy consumption patterns, enabling better control over energy usage and identification of inefficiencies. Analyse energy consumption data regularly to benchmark performance, identify trends and implement corrective actions.

6. Maintain Sustainable Facilities Operations: Continuously review and update facility maintenance protocols to ensure optimal energy efficiency, conservation of resources and hazard prevention. Schedule routine inspections, retrofits & upgrades to eliminate waste generation and reduce operational costs.

7. Establish Sustainability Metrics and Benchmarks: Establish metrics to measure and assess sustainability performance comprehensively. Track indicators such as carbon footprint reduction, amount of waste recycled, quantity of water conserved, employee engagement rates and customer satisfaction surveys. Compare performance to industry benchmarks and strive for continuous improvement.

8. Participate in Local Initiatives: Join regional sustainability networks, engage in collaborative initiatives led by government agencies, NGOs, academic institutions and industry associations. Share knowledge, best practices and expertise to accelerate sustainability progress in healthcare sector collectively.

By adopting these best practices, healthcare institutions can develop sustainable strategies to address environmental concerns, enhance operational efficiency, reduce waste generation and cultivate an engaging culture centred around sustainable behaviour.

Few of the best practices adopted by the NABH accredited healthcare organizations are being showcased for guidance and encouragement for all.

i. **Energy efficiency and renewable energy being practiced by Apollo Hospitals Group**.

Apollo Hospitals Group invested in energy management systems to monitor usage, identify inefficiencies and implement targeted energy-saving measures. These measures aim to reduce carbon footprint, lower operational costs and contribute to a more sustainable healthcare sector.

Below is a list of ongoing measures and monitoring processes undertaken in all southern region hospitals of the group which have contributed to 20%-30% reduction in their carbon footprint:

- Use of solar panels for hot water facilities and efficient heat pumps.
- Installation of Automation System, timers for air handling units (AHUs), streetlights, exhausts, heat pumps etc.
- Installation of energy monitoring & optimization platform, the Building Management System (BMS).
- Replacement of existing fans with Brushless Direct Current (BLDC) fans.
- More than 270 energy conservation measures were implemented across the sites.
- 73% power consumption through renewable energy sources.

Apollo Hospitals has launched Project Virya in September 2021 with the aim to save 235 million kWh of energy and reduce 290,000 tons of CO2 emissions in a 10-year time frame. Major interventions undertaken under this project are:

- Deep instrumentation with intelligent energy monitoring, analysis and intelligent control technology

- Installation of ultra energy efficient chillers
- Installation of low approach cooling towers
- Installation of energy efficient and variable speed pumps
- New heat pumps for hot water generation installed to switch from diesel & gas-based heating to electric heating
- Installation of automated condenser tube cleaning systems
- Revamped laundry systems with new efficient electrical heating systems
- LED Lights, BLDC Fans, modulating valves & VFDs for AHUs implemented
- Bespoke energy conservation measures implemented opportunistically

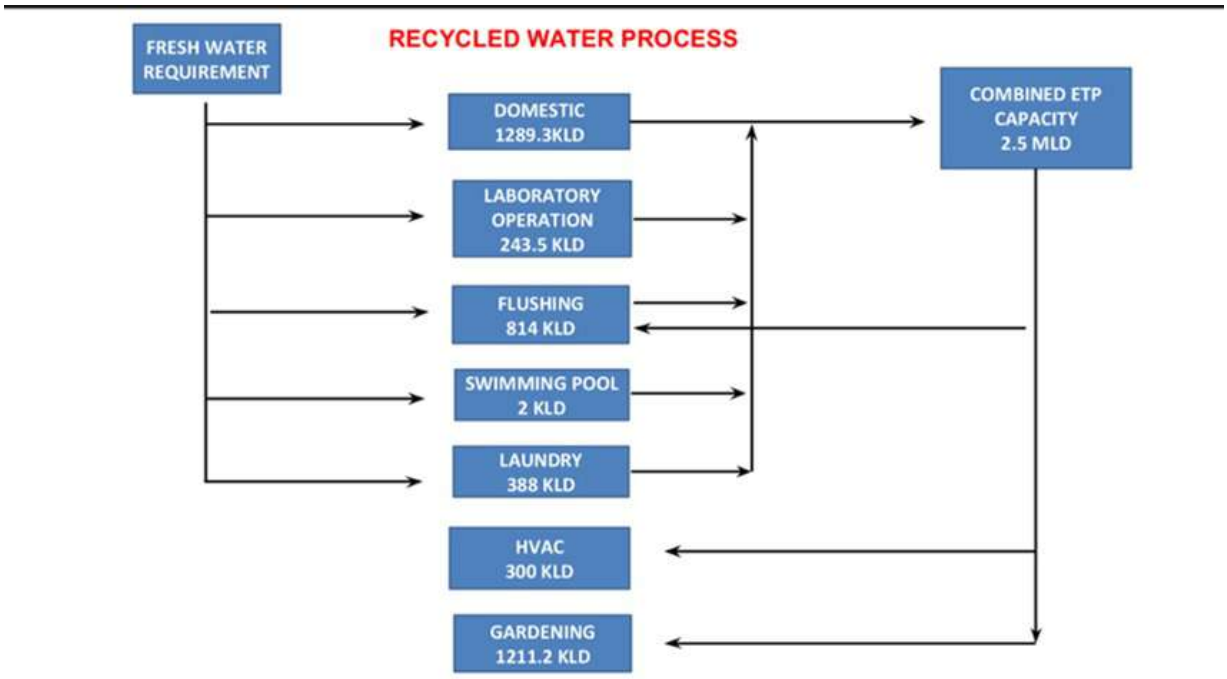
ii. In order to reduce carbon emission, **Sri Ramachandra Medical Centre, Chennai, Tamil Nadu** has started various initiatives like conducting energy audit, development of water conservation system within the facility in the form of ponds, rainwater harvesting etc., use of electrical vehicles, replacement of chiller plants, use of energy efficient laundry machines. The hospital installed LED lights which led to saving of 99.8 kwh per day in the year 2021 and further addition of 57.6 kwh per day in the year 2022 & 2023. This initiative led to overall saving of approximately 57000 kwh of electricity. Further use of energy efficient machinery in laundry led to saving of INR 101765.4/annum as detailed below:

Power Saving In Laundry

	OLD –DOUBLE ROLLER CALENDAR MACHINE	NEW- DOUBLE ROLLER CALENDAR MACHINE
DRIVE MOTOR MOTOR CAPACITY	15 HP	2 HP
ROLLER LIFTING MOTOR CAPACITY	1 HP + 1HP	Nil
GUIDE ROLLER MOTOR	3 HP	Nil
EXHAUST BLOWER MOTOR	3 HP	3 HP
2 CHEST HEATER COIL CAPACITY	54 Kw + 54Kw	72 Kw
PER DAY TOTAL UNIT'S CONSUMPTION	129.5 units	75.5 Units
2 CHEST PRE HEALTING TIME	2 h rs	20 mins (variable speed)

	OLD –DOUBLE ROLLER CALENDAR MACHINE	NEW- DOUBLE ROLLER CALENDAR MACHINE
MACHINE RUNNING HOURS PER DAY CONSTANT SPEED	11 hrs	8 hrs
MONTHLY CONDEMNED SHEETS DUE TO DAMAGE BY FRICATION	250 to 300 numbers	Nil
COST OF EQUIPMENT	N.A	1991250.0
ELECTRICAL BILL AMOUNT PER ANNUM	2849232.0	1661232.0 (total saving per annum: 1188000)
INSTALLATION DATE	1987	20.07.2023
	WASHER EXTRACTOR- 110 Kgs	WASHER EXTRACTOR- 100Kgs
DRIVE MOTOR CAPACITY	25 HP	10 HP
LOADING CAPACITY	90Kgs	80Kgs
HEATING COIL CAPACITY	27 KW	27 KW
HEATING TIME	45 Minutes	20Minutes
TOTAL POWER CONSUMPTION IN UNITS	101 UNITS PER DAY	64 Units per day
ELECTRICAL BILL AMOUNT PER ANNUM	277799.00	176050.0
TOTAL SAVINGS PER ANNUM	101765.4	

Use of recycled water from the STP and ETP plants, that helped the hospital to manage the facility as displayed below:



The hospital is committed to greener initiatives and is continuing its journey towards net zero carbon emission.

iii. Following green initiatives have been undertaken by **U.N. Mehta Institute of Cardiology and Research Centre (UNMICRC), Ahmedabad, Gujarat**:

a. Energy Efficiency: Implemented 33 points as per GRIHA (version 3.1) to reduce energy consumption and maximize solar energy use.

b. Water Management: An on-site Membrane Bioreactor (MBR) type Sewage Treatment Plant (STP) with a capacity of 740 kLd treats and recycles wastewater for various purposes like Flushing, irrigation, HVAC plant, etc. An Effluent Treatment Plant (ETP) with a 60 kLd capacity treats and recycles infected water.

c. Harmonic Filters: Harmonic filters are used to mitigate harmonic currents and reduce harmonic voltage distortion.

d. 236 occupancy sensors installed for reducing power consumption of HVAC system

e. Renewable Energy: 80 kWp rooftop solar plant and a 45,000 LPD solar hot water system have been installed.

f. HVAC Efficiency: Highly energy-efficient HVAC equipment with variable frequency drives for fan speed control is installed.

g. Fire Suppression: An aerosol-based gas suppression system enhances fire suppression measures.

h. Rainwater Harvesting: Three rainwater harvesting pits recharge surplus rainwater.

i. E-Vehicle Charging: The parking area is equipped with 24 e-vehicle charging points.

j. Lighting Controls: Automatic time-based controls are provided for outdoor lighting to reduce energy consumption.

k. Natural Light: Glass partitions allow natural light in waiting areas, cardiology wards, CTRR, special rooms and the administrative wing.

l. ODP Minimization: Nitrile rubber is used for piping and ducting insulation to minimize ozone-depleting substances.

The hospital witnessed following impact due to green initiatives undertaken:

a. Energy Consumption: Annual energy consumption for internal lighting is 7,90,659 kWp/annum. The 80 kWp solar system generates 1,23,403 kWh/annum, offsetting 15.61% of internal lighting consumption.

b. Hot Water System: The solar hot water system achieves a 75.2% reduction in energy consumption.

c. Water Reuse: 36,724.56 kL/annum (48.79%) of wastewater is reused, reducing dependence on potable water.

d. Air Quality: Low VOC paints have improved performance, reduced flammability, and enhanced air quality.

iv. Several measures have been undertaken by **PSG Hospitals, Coimbatore, Tamil Nadu** to integrate sustainability into their operations and care practices.

a. Energy Efficiency Measures innovations and technologies implemented to enhance energy efficiency and reduce carbon emission.

LED Lighting: Replaced traditional lighting with LED bulbs, which consume significantly less energy and last longer. Solar Power: PSG Hospital has installed "Grid-Tie Captive Solar PV System" on roof-tops with 9 no. of 100 KW generating 1300000 units of 'Green Power' per annum.

Renewable Energy Systems: PSG Hospital also gets 5 MW from its wind energy grid.

b. Waste Reduction and Recycling: Entire sullage and sewage water in PSG Hospital is treated and captively used for gardening & lawns. The combined capacity of sewage plants is more than 3 MLD.

c. Rainwater Harvesting: The hospital has rainwater harvesting pits, to prevent water from going to waste during periods of rainfall. Rain water is harvested across the campus and approximately 600MLD/ annum of water is received.

d. Solar Hot water systems are being extensively used for cooking & bathing purposes replacing electric heaters & LPG. This has resulted in a power savings of 25 lakh KWHR and

25 tons of LPG per annum.

e. Sustainable Transportation: The hospital has electric vehicles and uses them for public transportation to reduce carbon emissions from commuting.

f. Sustainable Building Materials: The hospital uses sustainable building materials and practices in construction & renovation projects.

Photographs of various initiatives undertaken by PSG Hospitals:

No Plastic Zone

Solar Grid on Rooftop of Campus Buildings

Eco - Friendly

EV Used for Patient Transport in Campus

Solar Water Heaters of Rooftop

Rain Water Harvest

v. In an effort to reduce operational costs and promote environmental sustainability, **The Gujarat Cancer & Research Institute (GCRI)**, **Ahmedabad, Gujarat** invested in renewable energy solutions. The hospital installed a 75-kW rooftop solar photovoltaic (PV) system.

Technology Implementation

Solar Photovoltaic (PV) System: The installed system consists of high-efficiency monocrystalline solar panels, inverters and a comprehensive monitoring system. The key components and their functions are as follows:

Solar Panels: High-efficiency monocrystalline panels were chosen for their superior performance and longevity. These panels convert sunlight directly into electricity.

Inverters: These devices convert the direct current (DC) produced by the solar panels into alternating current (AC), which is used to power our hospitals.

Energy Efficiency and Financial Benefits

Annual Energy Production

The 75kW rooftop solar plant generates approximately 82,000 kWh of electricity per year. This substantial energy production directly offsets the hospital's energy consumption from non-renewable sources.

Cost Savings

- **Electricity Rate:** Rs 9 per kWh
- **Annual Energy Production:** 82,000 kWh
- **Annual Cost Savings:** 82,000 kWh x Rs 9/kWh = Rs 7,38,000

By generating its own electricity, the hospital saves approximately Rs 7,38,000 annually.

Carbon Emission Reduction

The carbon offset can be calculated as follows:

- **Emission Factor:** Approximately 0.92 kg CO_2 per kWh (for coal-based power)
- **Annual CO_2 Reduction:** 82,000 kWh x 0.92 kg CO_2/kWh = 75,440 kg CO_2 (75.44 metric tons of CO_2)

The installation of the 75 kW rooftop solar plant at the 1000-bedded hospital has proven to be a financially and environmentally beneficial initiative.

ii. In order to deliver healthcare in a greener and close-to-nature environment, tree gardens are maintained in and around **Dr. Hedgewar Rugnalya, Aurangabad, Maharashtra.**

However, the hospital was facing following issues related to management of garden waste:

1. The storage of garden waste- the need to collect and store the garden waste at a specified place for a month led to decomposition, bad odour and insect breeding.

2. The logistics of transportation and disposition- there was need to hire tractors to collect and transport this waste out of the city that incurred a monthly expense of Rs. 9000/-. Additionally, a fine had to be paid upon failure to ensure the waste disposal outside of the municipal corporation area.

With a view to have optimum utilization of natural resources, following steps were taken:

1. Vermicompost beds were prepared by the staff of civil department using waste / scrapped material from stores. (Saving up to rupees 50,000/-)
2. Places were identified for the storage of garden waste, for placing the vermicompost- beds and storing the manure.
3. HK staff was identified for collecting & storing the garden waste, transferring it to the vermi compost-beds, collecting & storing the manure.

This monthly cycle was done for 6 months and the collected data was analysed.

Manure produced from Vermicompost project in last six months was 1000 kg. 300 kg of manure was used for the in-house tree-garden. 650 kg of manure was sold; thereby earning Rs. 8970/-.

Logistics	Initial Expenses	Expenses after project implementation
Tractor to shift the waste	Rs. 9000/month	Rs. 00
Manure cost for the Garden	Rs. 1500/month	Rs. 00 (In house manure)
Cost for preparing 5 vermi compost beds	Rs. 50,000	Rs. 00 (In house from scrap material)

The innovative idea of building in-house compost beds from scrapped material took the project expenses down drastically.

The produced manure was not only used for tree-garden but also sold to interested groups creating income for the hospital. Hospital saved Rs. 1, 81, 970 in the last six months.

This project is an example of implementing new ideas that recognize the natural resources around us, put them to optimum utilization thereby tendering the daily requirements and producing surplus to share.

vi. The initiatives taken by **KMCT Medical College Hospital, Kozhikode, Kerala** are as under:

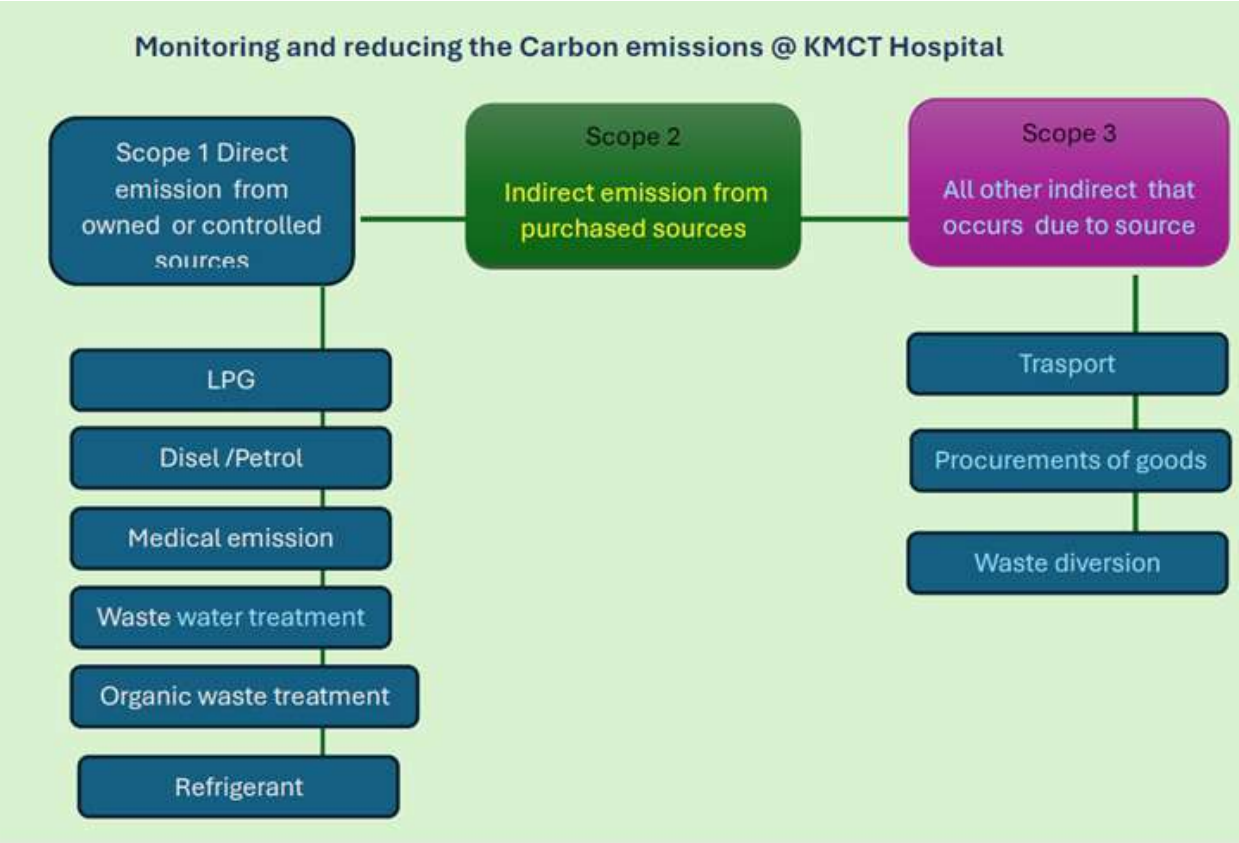
Monitoring and reducing the Carbon emissions at the Hospital was done as per following strategy:

Scope 1 covers direct greenhouse gas emissions from sources owned or controlled by the hospital. This is mainly the fuel used to power generators and the fuel used in Hospital -owned vehicles and refrigerant leakage.

Scope 2 covers indirect emissions from electricity consumed by the Hospital.

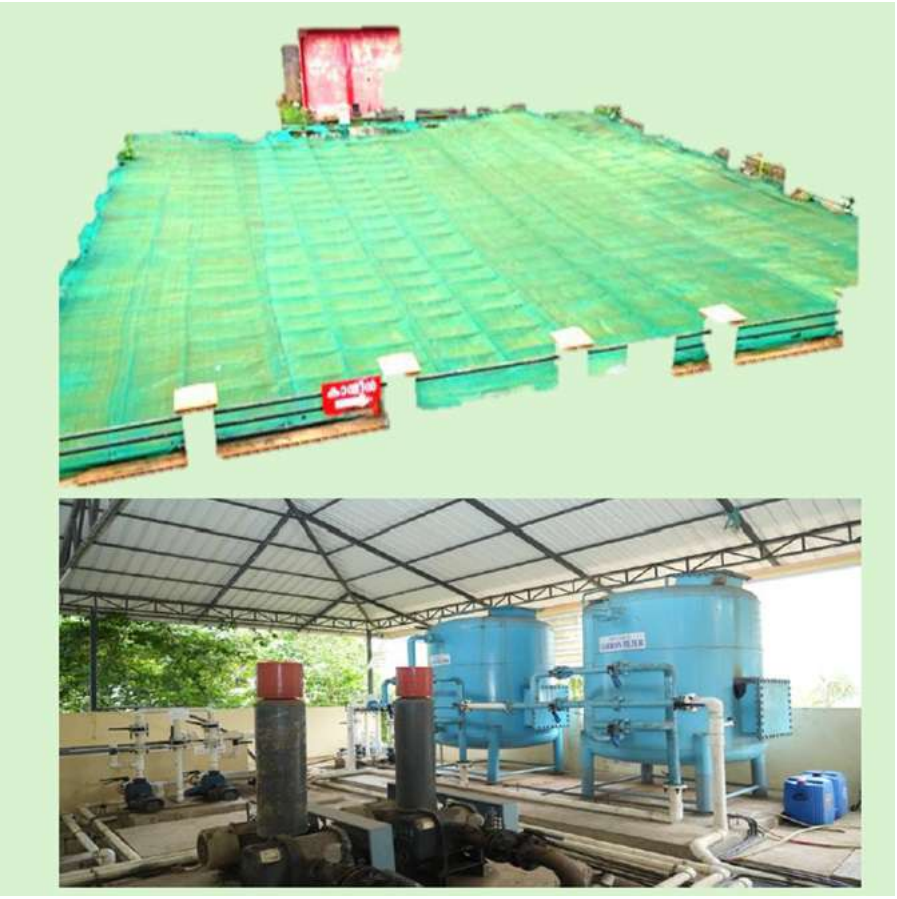
Scope 3 covers the other indirect emissions that occur upstream and downstream, associated with carbon emissions generated from commuting, business travel, waste, water, and construction.

This is depicted in picture below:



The hospital has been dedicated to minimizing water consumption and advocating for water efficiency. To achieve this, the hospital has incorporated water-saving solutions such as low-flow taps, waterless, sensor-based urinals and dual-flushing toilets across our campus sites. Moreover, certain hostel blocks utilize recycled water for toilet flushing, reducing our reliance on freshwater.

The first step of conservation is protecting and recharging the available water. Rooftop rainwater is harvested, sent to percolation pits and water is recharged through the artificial lake on the campus. The excess water from stormwater drains is used for groundwater recharge through bore wells and pervious surface absorption. The open green spaces and native landscapes ensure water percolation.



The hospital has the capacity to access a substantial water supply of over 20 lakh kilolitres from rainfall. It is crucial to analyse the campus water demand in order to grasp our water consumption, visualize the current situation and establish objectives for the future. The provided narrative furnishes background information and assumptions for the reported figures:

1. The total area of land available for capturing rainwater is 30 acres.
2. Annual rainfall in Kozhikode amounts to 4100 mm.
3. The potential of rainwater recharge on the site is calculated using the formula: Annual Rain (in mm) X Area (in SQM) x Coefficient Factor.

4. The hospital can capture 70% of the total rainfall, while the remaining 30% needs to naturally flow into nearby water bodies to maintain surface water balance.
5. Additionally, the site is equipped with elements and recharge wells to aid in capturing rainwater.

Based on this, the campus has the potential to capture approximately 20 lakh kL of rainwater per year. However, the current recharge of water through the artificial lake, natural drain, softscape and recharge wells is 15 lakh kL. This initiative has led to reduced dependency on water supply and conservation of natural resource.

Local education programme on climate

At the hospital great emphasis is given on prioritizing environmentally sustainable practices. The hospital is dedicated to imparting knowledge about the local ecosystem to staff, patients, their families, local schools and community leaders. Through these efforts, the hospital aims to foster a deeper understanding of environmental responsibility and promote active involvement in preserving our natural surroundings.

viii. The measures taken by **Yenepoya Medical College Hospital (YMCH), Mangalore, Karnataka** are as follows:

1. Solar PV Panels: The solar panels are covering an area of 702 sq mts with capacity of 114.075 kWp. In the year 2023, units of electricity generated through the panels were 139020. With MESCOM charges at 10 Rs per unit, the installation of solar panels is saving approximately Rs. 1,390,200. Additionally, by installing LED lights throughout the campus have achieved energy savings of around 44%.
2. Tree Audit: The Centre conducted an audit of trees in the campus during November to December 2023 and found a total of 1676 trees on the entire campus. The carbon sequestration capacity of the trees was calculated and approximately 6503 Kg of CO2 may be sequestered.
3. Sustainable transport: The hospital has electric vehicles for transportation needs within the campus.
4. Going Plastic Free: The hospital discourages use of plastic covers and displays are available across the hospital. Patients and their attendants are encouraged to use cloth bags and steel containers for carrying food.
5. IT related initiatives:

   a. Most PC's go in sleep mode after a defined period of inactivity hence reducing energy usage

   b. Implementation of PACS (Picture archiving and communication systems)

ix. By installing roof top solar power plant, **NIMHANS, Bangalore, Karnataka** have evidenced following impact on electrical units generated and savings:

S. No.	Month and year	Solar Power Consumption units (kwh)	Tariff (3.330 Rupees/kwh)	BESCOM (7.20 Rupees/kwh)	Savings Amount By Using Solar Power in rupees
1	Jan-24	140264	467079.12	1009900.8	542821.68
2	Feb-24	131349	437392.17	9457712.8	508320.68
3	Mar-24	176363	587288.79	4269813.6	682524.81
4	Apr-24	142918	475916.94	1029009.6	553092.66
5	May-24	127217	423632.61	915962.4	492329.79
6	June-24	120238	400392.54	865713.6	465321.06
7	Jul-24	94957	316206.81	683690.4	367483.59
8	Aug-24	104892	349290.36	755222.4	405932.04

x. Adoption of renewable energy sources in form of solar energy plant by **Alluri Sitarama Raju Academy of Medical Sciences (ASRAM), West Godavari, Andhra Pradesh** helped saving operational cost savings.

Key Components of the Solar Power System are:

Multi-crystalline Modules: 1540 multi-crystalline modules, each with a capacity of 325 Wp, are used to ensure high efficiency and reliability.

Grid-tied Inverters: Eight 66 kVA MPPT-based inverters optimize energy conversion, ensuring maximum efficiency.

Indigenous Non-tracking Structures: Non-tracking structures ensure a stable installation with minimal maintenance, designed for long-term durability.

Tilt Angle: A 16° tilt angle is used to maximize solar exposure and energy capture.

Innovations in Solar Energy Utilization:

RFID Tags for Module Identification: Each solar module is equipped with RFID tags, aiding in the easy identification & management of the modules for maintenance and inventory purposes.

Copper-Bonded Earthing Rods: To enhance safety, copper-bonded earthing rods are used, providing effective grounding and protection against electrical surges.

Custom-Designed Distribution Boxes: AC and DC distribution boxes are custom-designed with in-built safety features, ensuring efficient and secure energy distribution.

Lightning Protection System: A robust lightning protection system is in place, including multiple lightning arresters with separate earthing pits, ensuring the safety of the solar installation during storms.

xi. Following initiatives by **Kokilaben Dhirubhai Ambani Hospital (KDAH), Mumbai, Maharashtra** contributes to a healthier environment and a more sustainable future:

1. Implementation of BMS (Building Management Software): BMS enables to monitor and optimize energy usage down to the device level, helping to meet carbon reduction goals. It uses Artificial Intelligence (AI) and Machine Learning (ML) to identify energy conservation opportunities, thereby enhancing efficiency and sustainability across the building.

2. LED Lighting and Energy Efficiency

   Initiative: Replacing traditional lighting with energy-efficient LED lights, transitioning from CFL to LED, and implementing a thyristor-based capacitor bank.

   Impact: Significant reduction in energy consumption and operational costs. A detail the transition and energy savings.

Open access saving statement - November 2014 to October 2015							Rs. Lacs	296.51
Sr.No.	Month	Unit consumed (KWH)	Unit rate	Total Bill Amount	Gepl bill amt	Tata / R infra bill amt.	Rinfra / Tata + GEPL	Saving due to Open Acceess
1	Nov-14	1,332,360	10.62	14,151,761	1,372,998	12,778,763	14,151,761	1,543,440
12	Dec-14	1,287,048.00	11.62	14,960,790.46	3,604,570	11,356,220	14,960,790	200,635
3	Jan-15	1,242,600	8.05	10,003,150				4,634,678
4	Feb-15	1,196,172	11.07	13,242,136	3,265,686	9,976,450	13,242,136	848,770
5	Mar-15	1,350,528	11.08	14,961,215	3,564,555	11,396,660	14,961,215	948,005
6	Apr-15	1,364,848	9.60	13,295,749	3,511,449	9,784,300	13,295,749	1,632,912
7	May-15	1,436,655	9.50	13,635,421	3,913,071	9,722,350	13,635,421	1,840,940
8	Jun-15	1,394,606	8.18	11,405,712	3,967,112	7,438,600	11,405,712	3,628,140
9	Jul-15	1,472,858	8.27	12,183,876	4,140,836	8,043,040	12,183,876	3,693,533
10	Aug-15	1,426,640	8.29	11,822,264	4,084,414	7,737,850	11,822,264	3,556,915
11	Sep-15	1,385,409	8.23	11,395,579	3,964,069	7,431,510	11,395,579	3,539,130
12	Oct-15	1,425,860	8.27	11,786,906	4,075,186	7,711,720	11,786,906	3,583,865

November 2015 to October 2016	Rs. Lacs	525.42

November 2016 to October 2017	Rs. Lacs	166.87

November 2017 to October 2018	Rs. Lacs	137.83
November 2018 to August 2019	Rs. Lacs	5.06
Total Saving from Nov 2014 to July 2018	Rs. Lacs	1,131.69

Motion Sensors: Installed 650 motion sensors for lighting control to reduce energy waste.
Impact: Significant reduction in energy consumption and operational costs.

Existing Led Light With Motion Sensor								
	Present				Proposed with sensor			
Existing Light to be replaced by LED Light		1 x 18 watts Down light				1 x 18 watts Down light		
Qty installed		1000				1000		
Cost of motion sensor						1250		
total investment		0				1250000		
Power Consumption in KWH per tube light per day considering 24 hours operation [watt / 1000 x 11 = KWH]		0.432				0.198		
Power Consumption in KWH per light per year		157.68				72.27		
Power Consumption in KWH for total no of fittings per year		157680				72270		
Power Consumption in Rs. per year unit rate considered Rs. 11/-- per unit		1734480				794970		
Saving Rs.						939510		
Pay back period calculation								
total investment for sensor	1250000							
Total saving in year	939510							
Difference	310490							
Pay back period	15 months							

3. Refrigerants

   Initiative: Transition planning to environmentally friendly refrigerants such as R404A and R134A.

   Impact: Reduced greenhouse gas emissions, aligning with environmental regulations and sustainability goals.

4. Heat-Resistant Paints

   Initiative: Application of heat-resistant paints in cooking areas to reduce ambient temperature, with plans to implement across the hospital using Japanese nano-technology.

   Impact: Improved energy efficiency in temperature management.

5. Water Conservation

   Initiative: Installed of water-saving devices and replacement of flush valves with fixed quantity flushing cisterns in public toilets.

   Impact: Significant water conservation.

6. Energy-Efficient Equipment in Operating Theatres

Air Ventilators: The use of ventilators with turbine technology, such as the new air ventilators that only require an oxygen supply, eliminates the need for air compressors. This not only enhances patient safety but also reduces energy consumption and operational costs.

LED Lighting: Replacing OT halogen lights with LED lights significantly reduces energy consumption. LEDs are more energy-efficient and have a longer lifespan, contributing to lower carbon emissions and reduced waste.

xii. Service to local and regional community by **Acharya Vinoba Bhave Rural Hospital, Sawangi (Meghe), Wardha, Maharashtra** with the vision of transforming life through wellbeing has undertaken various initiatives in regards to environmental awareness and sustainability in immediate and distant communities.

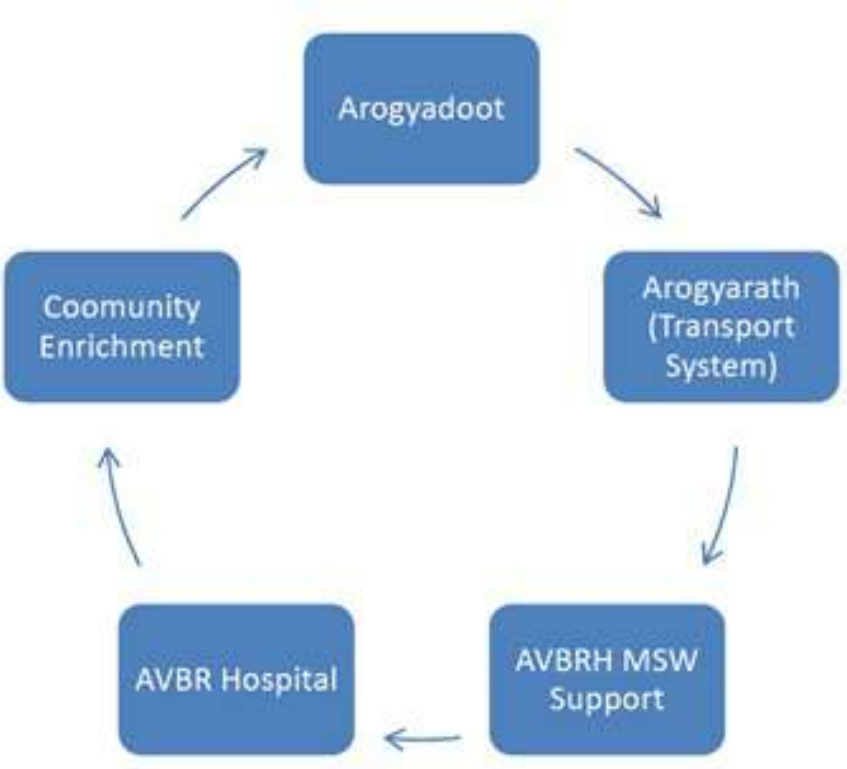
The initiatives conducted in immediate & distant communities and adopted villages include:

Plastic free village campaigns

As an initiative in Unnat Bharat Abhiyan all the single use plastics causing pollution were collected from community members and an environment friendly and sustainable cotton bags were provided in 5 villages adopted.

Family Adoption Programme under which among the adopted families in adjoining villages various programs on Cleanliness, Hygiene and Infection prevention and control like hand washing etc. are conducted

The sustainable developments of community through all such activities are being done since last 10 years, motivating them to motivate others to adopt such initiatives through various community leaders created at village levels known as “Arogya Doot” to promote preventive and curative health through a well-establish network.



This chain of network linking has brought the community of around 10 lakhs populations under the domain preventive and promotive modes of heath care.

xiii. As an initiative towards carbon footprint mitigation by **Shri Mata Vaishno Devi Narayana Superspeciality Hospital, Reasi, Jammu and Kashmir** has implemented various renewable energy sources, such as hydropower energy & solar water system, to supplement energy needs. The hospital has also assessed and optimized transportation practices, including patient transport and supply chain logistics, to reduce emissions associated with these activities.

Hospital is also actively doing tree plantation every year.

Organizations including Bhaktivedanta Hospital & Research Institute (Mumbai), Parul Sevashram Hospital (Vadodara), Shri Ram Murti Smarak Institute of Medical Sciences & Hospital (Bareilly), Symbiosis University Hospital and Research Centre (Pune), Sevenhills Hospital (Mumbai), SGT Medical College Hospital and Research Institute (Gurgaon), Cancer Hospital and Research Institute (Gwalior) and Baby Memorial Hospital (Kozhikode) are implementing great initiatives towards climate resilience and environmentally sustainable through installation of solar plants, energy efficient mechanisms, installation of waste water treatment plants & use of waste water, focusing on reduce, reuse & recycle, use of e-Vehicles, paperless initiatives by adoption of EMR, tree plantation drives, training and awareness programs.

NABH appreciates the efforts of all accredited/ certified/ empanelled healthcare organizations towards building a quality healthcare ecosystem in the country. Also, NABH encourages all the healthcare organizations towards becoming climate resilient & environmentally sustainable and be future prepared.

Note: The best practices detailed above are only for illustration purposes. Any proprietary tool and/ or system if showcased in above best practices are not endorsed by NABH, QCI.

SELF-ASSESSMENT CHECKLIST

To hand-hold the healthcare organizations, NABH has developed a self -assessment checklist which can be used to assess the current situation of the organization and further develop an action plan towards environment sustainable and climate resilient healthcare facility. The checklist is developed using National and International guidelines. Each element can be assessed and compliance can be recorded as follows:

i. Non-compliant '0' – Non-compliance to the requirement

ii. Partial complaint '5'- Partial compliance to the requirement (if any of the sample is found to be non-complying out of total samples selected)

iii. Fully compliant '10' – Compliance to the requirement

vi. NA - Not Applicable

CHECKLIST FOR SUSTAINABILITY IN HEALTHCARE ORGANIZATIONS

	Elements	Scores (0/5/10) Non-compliant - 0 Partial Compliant – 5 Fully Compliant - 10	Remarks/ Action plan
A.	**Governance**		
1.	Environment Sustainability and climate resilient plan is included in organization's current strategic and operation plan.		
2.	National/International regulation and guidelines are considered while preparing the Environment Sustainability & climate resilient plan.		
3.	Indicators to measure, track and report outcomes/progress are defined and monitored		
4.	A person is appointed or designated to lead environment sustainability and climate resilient implementation in the organization.		
5.	Top leadership allocates annual budget for environment sustainability and climate resilient implementation and oversees the progress at least quarterly.		
6.	Assessment of hazards that can impact healthcare facility as per location, climatic conditions etc. is conducted and inclusion of the same in risk registers.		
7.	Hazard vulnerability analysis is prepared and regularly updated (including the impacts of extreme weather risks on infrastructure, human resource etc.)		
8.	Disaster Management Plan is developed to manage identified climatic hazards		
9.	Hospital incident command group/multidisciplinary team is identified and trained to handle climate related emergencies.		

	Elements	Scores (0/5/10) Non-compliant - 0 Partial Compliant – 5 Fully Compliant - 10	Remarks/ Action plan
B.	**Infrastructure and utilities**		
I.	**Infrastructure**		
1.	Healthcare facility is built or is retrofitted to cope up with extreme weather events ensuring resilient, safety and continuous operations.		
2.	Glass walls, doors and windows are resistant to basic wind speeds of 200–250 kph		
3.	Regular inspection of building is conducted both internally & externally for signs of deterioration and necessary actions are taken.		
4.	Continuous roof insulation/ Reflective roof covering is carried out		
5.	Meshwork is used on windows of rooms, wards and waiting rooms for natural ventilation of air.		
6.	Diesel-powered generator converted to use biofuels		
7.	High-performance glass is used on windows, doors and roofs to prevent the heat inside & allows sunlight to enter the room.		
8.	Double glazing glass is used on windows which provides thermal & optical properties to the building and reduce the noise level inside the Healthcare Facility		
9.	Electronic patient records are introduced in the facility to reduce the use of paper.		
10.	Availability of 10-30% area for herbal garden/ garden in the facility.		
11.	Power-operated doors can be opened manually to permit exit in the event of power failure		
12.	Roof drainage system has adequate capacity and is properly maintained		
13.	Improved safety roofing designed to withstand wind velocity of 175–250 kph in high intensity tropical storm prone areas		
14.	Paints and coating used is of low emitting material		
15.	Natural floodwater infiltration in place to reduce risk of facility flooding		

	Elements	Scores (0/5/10) Non-compliant - 0 Partial Compliant – 5 Fully Compliant - 10	Remarks/ Action plan
16.	Information and telecommunications systems safely secured with backup arrangement (via cloud, satellite) to satisfy the facility's demand, at all times		
17.	Patient medical records are safely stored particularly in flood prone areas		
18.	Facility equipped with air pollution filters to improve indoor air quality		
19.	New healthcare organizations designed and constructed based on low carbon approaches		
20.	Medical gases and chemicals stored securely in well-ventilated areas		
21.	Equipment & supplies (furnishings, medical and laboratory equipment and supplies) safely secured in sufficient quantity and quality with backup arrangement to satisfy the facility's demand for at least three days, at all times.		
22.	Monitoring of sewer overflows to fix pumps in advance of flood seasons		
23.	Waste storage & transport is properly managed in case of extreme weather events		
24.	Dishwasher and laundry machines have water-saving functions		
25.	Floor-care/Floor-cleaning products free of zinc, heavy metals, phthalates, glycol ethers and ammonia		
II.	**Energy Efficiency**		
1.	All Incandescent bulbs are replaced with the LED lights at the facility.		
2.	Energy audits done periodically (at least once a year) to optimize power utilization or Sub-meter installed in the facility premises to understand the energy usage pattern across the healthcare facility.		
3.	Suitable stickers are placed above light switches & awareness posters in the staff and patient areas to make them aware of the energy savings.		
4.	Equipment (ACs, Refrigerator) used have a star rating of 3 & above		
5.	BEE labelled/ISI marked energy efficient equipment and appliances are considered for procurement		

	Elements	Scores (0/5/10) Non-compliant - 0 Partial Compliant – 5 Fully Compliant - 10	Remarks/ Action plan
6.	Solar panels installed for optimum utilization of renewable sources of energy		
7.	Calculation of Load-bearing capacity of the solar panel at the facility (calculation is per bed/day)		
8.	Air changes are reduced overnight and weekends in unused operating rooms		
9.	Setting of max air changes per hour (ACH) across the facility is done		
10.	Use of lighting controls with timers and motion sensors lights across the facility		
11.	Switch equipment off (not standby mode) when equipment are not in use is promoted.		
12.	Reduce heating and cooling requirements in areas that are not being used (cafeterias, educational area, office space)		
13.	Test, adjust and balance (TAB) chilled water pumps, valves, and refrigerant lines to ensure that supply air temperatures meet cooling loads and no unnecessary flow restrictions are present		
14.	Ensure correct refrigerant charge in cooling systems and heat pumps, and repair any refrigerant leaks		
15.	Freezers and refrigerators defrosted regularly		
16.	Established a comprehensive maintenance protocol for HVAC equipment, including cleaning cooling and heating coils, chiller tubes, burners, and radiators		
17.	Maintenance plan is developed and implemented to work proactively		
18.	Voltage stabilizer is available to protect equipment from electric damage caused by voltage fluctuations and surges		
19.	Air, water and lubricant filters are cleaned/replaced at regular intervals		
20.	Standard furnace is replaced with a high efficiency condensing furnace		
21.	Devices and equipment installed for monitoring indoor temperatures, cooling existing buildings and spaces, blocking direct sun, increasing air flow in case of extreme heat		

	Elements	Scores (0/5/10) Non-compliant - 0 Partial Compliant – 5 Fully Compliant - 10	Remarks/ Action plan
22.	Health care facility uses proven smart materials and applications, sensors, low power electronics and similar health care appropriate technology (such as telemedicine, remote sensing systems)		
23.	Electrical systems safely secured with backup arrangement to satisfy the facility's demand for at least three days, at all times		
III.	**Water Management**		
1.	Implemented water conservation strategies: install efficient faucets and toilets, routinely check plumbing and pipes to prevent leaks, eliminate seal and cooling water on medical air compression and vacuum pumps, and retrofit refrigeration systems.		
2.	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 areas		
3.	Water supply system has sufficient reserves, with backup arrangement, to satisfy the facility's demand for at least three days, at all times		
4.	Switched from film-based radiological imaging equipment to digital imaging.		
5.	Drought-resistant plants are planted to minimize water use.		
6.	Consider harvesting rainwater and/or recycling water for process water uses.		
7.	Eliminated bottled water facility-wide if high quality potable water is available or alternate plastic free sources are considered.		
8.	Water quality is regularly analysed.		
9.	On-site wastewater treatment technologies or municipal service is available.		
10.	Harvested rainwater or grey water is safely used to flush toilets, clean outdoor pavement areas, water plants when possible		
11.	Plastic water storage tanks supported and anchored to resist strong winds		
12.	Increased patient & visitor awareness about water conservation including signs and notices in patient rooms and visitor restrooms		
13.	Eating utensils are washed immediately after use (reducing water and energy)		

	Elements	Scores (0/5/10) Non-compliant - 0 Partial Compliant – 5 Fully Compliant - 10	Remarks/ Action plan
C.	**Waste Management**		
1.	Separate bins for potentially infectious waste, sharps, chemicals, pharmaceuticals, non-hazardous wastes i.e. biomedical waste management rules 2016 & amendment 2018, solid waste management rules 2016, e-waste management rules are followed.		
2.	Reduce, reuse and recycle mechanism is followed		
3.	Recycling programme for all types of non-hazardous waste is established		
4.	Segregated collection of different types of waste according to hazards is carried out		
5.	Plastic bottled water are eliminated where drinking tap water is available		
6.	Phasing out of incineration of medical waste (if applicable): a variety of non-burn technologies are available to safely disinfect, neutralize or contain waste (such as autoclaving)		
7.	Cleaning products that contain hazardous chemicals such as those found in some soaps, disinfectants and pesticides are clearly labelled following the Globally Harmonized Classification System		
8.	Proper packaging, labelling and identification of chemical waste in separate chemical-resistant containers (i.e. not mixing hazardous chemical wastes of different types) is carried out		
9.	Low-level radioactive waste that are collected in containers is clearly labelled with the radioactive symbol and the words “radioactive waste”		
10.	Monitoring systems in place for early detection and control of health care associated infections		
11.	Hand hygiene facilities (water and soap and alcohol-based hand rub) are available at points of care and before health care facility entry during outbreaks, epidemics and pandemics		
12.	Health care facility safely disposes of hazardous wastewater and liquid waste into the sanitation system through pre-treatment (such as oils and fats, corrosive waste and other wastes, depending on the level of concentration) is followed		
13.	STP & ETP plants are available and functional		

	Elements	Scores (0/5/10) Non-compliant - 0 Partial Compliant – 5 Fully Compliant - 10	Remarks/ Action plan
14.	Waterless urinals are made available in water-deficient areas (like hilly area, drought prone areas etc).		
15.	Implementation of waste minimization programme in the facility for the reduction of waste at the point of its generation		
16.	Biodigester is made available to treat the sewage in the facility.		
17.	Waste is transported in the closed container trolley to prevent cross-contamination.		
18.	Bulk garden and horticultural waste is kept un-mixed and composted at the source.		
19.	Regular monitoring (monthly) of the plumbing fixtures is carried out to identify the leakages to reduce water wastage.		
20.	Waste audits are conducted in the facility to identify the areas where the maximum waste is generated. Also corrective & preventive actions are taken as required.		
D.	**Food Management**		
1.	Implementation of food waste reduction programme in the facility is carried out.		
2.	Participation in local food donation programs is carried out.		
3.	Composting of inedible and organic waste is done		
4.	Trayless dining is implemented across the facility.		
5.	Purchasing of sustainable and local/seasonal food is promoted		
6.	More plant-based foods is added to meals		
7.	Switch (or limit) disposable products to reusable products (kitchen items/dishware, linens, surgical supplies)		
8.	Food waste audit should be conducted in the facility to reduce the wastage of food.		
9.	Training is given to the staff and patient on food waste reduction.		
10.	Proper inventory management is practiced at regular intervals		

	Elements	Scores (0/5/10) Non-compliant - 0 Partial Compliant – 5 Fully Compliant - 10	Remarks/ Action plan
E.	**Transportation**		
1.	Reduction of transportation emissions is set as a goal in strategic/operation plan		
2.	Telehealth services are made available where appropriate		
3.	Awareness about public transport or active transport use is done in prominent areas (bicycling, staff public transportation discounts, carpooling)		
4.	Use of bicycle and public transport among staff is being promoted through incentivization, discounts, recognition etc.		
5.	Electric vehicle charging infrastructure is installed with access for staff and community within the organization.		
6.	Utilization of virtual meetings where possible are done to reduce business travel-related emissions (flights, cars)		
7.	Group department purchase orders are taken up to cut down on delivery emissions		
8.	Fleet vehicles are converted to zero-emissions or low-GHG model vehicles		
F.	**Anaesthesia Gases**		
1.	Anaesthetic agents with lower GHG emissions (eg sevoflurane is used in place of desflurane) are used		
2.	Total intravenous anaesthesia (TIVA) is used as an alternative to volatile/inhaled anaesthetics		
3.	Regular monitoring of airborne concentrations of waste gas is carried out & records are maintained.		
4.	Minimization of fresh gas flow rates, switch to low flow or closed anaesthesia systems is implemented		
5.	Efficient ventilation and scavenging systems are utilized		
6.	Anaesthesia equipment is well-maintained without leaks		
7.	Construction of central nitrous oxide piping is avoided or decommissioned		
8.	Portable cylinders are used in those locations where nitrous oxide use is considered essential		

	Elements	Scores (0/5/10) Non-compliant - 0 Partial Compliant – 5 Fully Compliant - 10	Remarks/ Action plan
9.	Appropriate and safe procedures for the disposal of IV anaesthetics is implemented		
10.	Metered-dose inhaler is used (e.g., soft mist or dry powder)		
G.	**Human resource, training and awareness**		
1.	Human resource plan along with contingency plan is available to ensure operational sufficiency of the facility in case of climate related disaster or emergency		
2.	Occupational hazards are identified and documented		
3.	Occupational safety and health of human resource is ensured as per identified hazards		
4.	MoU with external agencies is available to provide human resource in case of emergency/disaster event		
5.	Contingency plan is available for transportation of human resource in case of emergency/disaster event.		
6.	Post-disaster employee recovery assistance programme is developed and implemented		
7.	Multidisciplinary psychosocial support teams are developed and available in situation of disaster or emergency for employees, patients and visitors		
8.	Security measures for safe and efficient hospital evacuation are defined.		
9.	Requisite training of designated staff to lead the environment sustainability & climate resilience is implemented		
10.	Regular Programme for prevention and education regarding disease burden of climate related hazards for employee is developed and implemented.		
11.	Employees are trained to identify health threats made worse by climate related events like respiratory disease, cardiovascular disease, nutritional deficiencies etc.		
12.	Regular training of employees through simulation exercise for early warning signs, contingency plan, disaster preparedness, response & recovery management from climate related disasters & outbreaks, epidemics & pandemics is carried out.		
13.	Regular training of employees to implement environmentally sustainable interventions including infection prevention and control is carried out.		

	Elements	Scores (0/5/10) Non-compliant - 0 Partial Compliant – 5 Fully Compliant - 10	Remarks/ Action plan
14.	Employees are trained and sensitized to report requirement of prompt repairs like water drips, leaks, flickering lights, cracks etc.		
15.	Sensitization and Training to the staff on energy conservation strategies.		
16.	IEC material should be displayed near the food counter to educate the patient and staff for reducing the food wastage.		

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GLOSSARY

1. **Biophilic Design**: Architecture integrating elements of nature into built environments to foster healthier and happier occupants, boost productivity, create calming environments, etc., inspired by the concept of biophilia.
2. **Building Energy Performance Standard (BEPS):** A rating system measuring energy efficiency performance of commercial buildings. It evaluates how well a building performs relative to industry benchmarks, guidelines and best practices.
3. **Care Coordination:** Harmonizing efforts undertaken by diverse actors involved in patients' healthcare journeys, including physicians, nurses, pharmacists, therapists, social workers, case managers, insurance representatives, family members, etc., ensuring timely interventions aligned with patient needs, avoiding redundancies, reducing discrepancies, preventing fragmentation, improving collaboration, enhancing patient navigation, simplifying administrative burdens, optimizing care pathways, cutting unnecessary expenses.
4. **Carbon Footprint:** The total amount of greenhouse gases emitted directly and indirectly by an individual, organization, event, or activity over its entire life cycle - from raw material extraction and processing through manufacturing, distribution, consumption, disposal, and decomposition. Minimizing carbon footprints is crucial for addressing climate change and preserving our planet's ecological balance.
5. **Circular Economy:** An economic model focused on designing out waste and pollution, keeping products and materials in use for longer periods, recycling and recovering valuable materials, and regenerating natural systems. Applies principles toward sustainable healthcare production, service delivery, and facility management.
6. **Climate Change Adaptation Plans:** Emergency strategies put forth by hospitals to tackle extreme weather events triggered by global warming, protecting critical healthcare infrastructures against damage and disruption, preparing emergency response teams, enhancing disaster preparedness training for staff, securing backup generators, establishing evacuation plans, etc.
7. **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 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
8. **Collaborative Care:** Partnership among different healthcare providers working together to coordinate patient care activities, sharing responsibilities, leveraging complementary skills and expertise, breaking down silos, enhancing coordination, promoting communication, facilitating shared decision making, improving care outcomes, and reducing costs.
9. **Daylighting:** Optimal utilization of natural sunlight for illumination purposes reduces dependence on artificial lighting, saving energy costs, enhancing occupants' well-being, contributing to a healthier environment indoors.

10. **Deep Energy Retrofits:** Comprehensive renovations targeting substantial reductions in energy use intensity involving major upgrades in mechanical systems, envelope improvements, electrical retrofits, lighting retrofits, etc., often accompanied by funding incentives provided by utility companies, government agencies, etc.
11. **Disaster risk management**: Process for designing, implementing and evaluating strategies, policies and measures to improve the understanding of disaster risk, foster disaster risk reduction and transfer, and promote continuous improvement in disaster preparedness, response and recovery practices, with the explicit purpose of increasing human security, well-being, quality of life and sustainable development.
12. **Early warning system** Set of technical, financial and institutional capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare to act promptly and appropriately to reduce the possibility of harm or loss.
13. **Equity:** Providing equal opportunity for all individuals regardless of race, gender, socioeconomic status, age, ethnicity, disability status, sexual orientation, religion, national origin, language barriers, geographic location, citizenship status, or immigration status, ensuring equitable access to quality healthcare services
14. **Energy Efficiency**: Practices aimed at reducing energy consumption through better insulation, LED lighting systems, motion sensors, high-efficiency HVAC equipment, renewable energy sources like solar panels, and improving operational efficiencies across hospital operations.
15. **Energy Recovery Ventilation (ERV):** Mechanical ventilation systems employing technologies allowing exhausted outdoor air to extract heat or coolness before being replaced with fresh indoor air, increasing energy efficiency and reducing peak cooling load demands.
16. **Extreme weather event** Event that is rare at a particular place and time of year. Definitions of "rare" vary, but an extreme weather event would normally be as rare as or rarer than the 10th or 90th percentile of a probability density function estimated from observations. By definition, the characteristics of "extreme weather" may vary from place to place in an absolute sense. When a pattern of extreme weather persists for some time, such as a season, it may be classed as an extreme climate event, especially if it yields an average or total that is itself extreme (e.g. drought or heavy rainfall over a season).
17. **Green Building Certification Programs:** Third party certification schemes awarding recognition to buildings that meet specific sustainability criteria. Examples include Leadership in Energy & Environmental Design (LEED), BREEAM (Building Research Establishment Environmental Assessment Method), Green Star, Living Building Challenge, etc.
18. **Green Building Materials**: Construction materials selected based on factors such as recycled content, biodegradability, minimal toxicity levels, and reduced embodied carbon footprint, ensuring buildings' lifecycle contributes positively to environmental health rather than harming it.
19. **Green Hospitals:** Health facilities that implement environmentally friendly practices such as energy efficiency, waste reduction, water conservation, sustainable food sourcing, transportation

optimization, and green building material.

20. **Green Infrastructure:** Urban landscape designs incorporating vegetation, stormwater management systems, permeable pavements, and wetlands that help mitigate urban heat islands, improve air quality, absorb excess stormwater runoff, filter pollutants from entering streams and rivers, enhance wildlife habitats, and promote overall environmental sustainability.
21. **Healthy Environment Index (HEI):** A tool developed by WHO to assess countries' progress towards achieving optimal environmental conditions required to sustainably support human health and wellbeing. HEI covers several domains such as air quality, water security, nutrition, sanitation, housing, and environmental management.
22. **High Performance Glass:** Windows featuring advanced glass coatings and composites designed to minimize heat gain/loss, UV radiation penetration, noise transmission, enhancing insulation properties, increasing energy savings, reducing carbon emissions.
23. **Hospital Acquired Infections (HAIs):** Illnesses acquired by patients during hospital stays resulting from infections transmitted either from contaminated surfaces, improper hand hygiene measures, or from other patients suffering from infectious diseases. HAIs pose significant threats to public health and can be mitigated through proper infection control protocols, improved patient safety procedures, and enhanced cleaning routines.
24. **Holistic Care:** Integrative approach emphasizing on physical, psychological, social, spiritual aspects of wellness, recognizing interconnectedness among these dimensions and understanding role of lifestyle behaviors, genetic predisposition, cultural beliefs, stressors, etc. in determining individual health status and responses to medical interventions.
25. **Indoor Environmental Quality (IEQ):** Ensuring that indoor environments maintain acceptable conditions for human health, comfort and productivity, taking into consideration factors such as temperature, humidity, ventilation rates, light intensity, noise levels, chemical concentrations, etc.
26. **Interdisciplinary Teamwork:** Practice relying on collective input from professionals with diverse competencies, backgrounds, perspectives, roles and responsibilities who collaborate cohesively and synergistically to deliver optimum healthcare outcomes, foster learning culture, encourage problem solving, stimulate innovation, improve patient satisfaction, strengthen professional identity, build trust, and ensure effective communication.
27. **Low Impact Developments (LID):** Land planning strategies intended to minimize environmental impacts during urban growth by treating stormwater runoffs on site rather than discharging them into public drainage systems, preserving ecosystems, reducing traffic congestion, etc.
28. **Modular Construction**: Using standardized components manufactured offsite then assembled on site; enables faster construction timelines, greater precision, reduced waste, decreased environmental disturbances, increased worker safety, etc.
29. **Net Zero Energy Building:** A structure producing exactly as much energy consumed annually as it produces through solar panels, wind turbines or other clean sources; considered highly sustainable due to zero reliance on traditional fossil fuels.

30. **Organizational Effectiveness:** Ability of healthcare entities to fulfill their missions efficiently and successfully, delivering high-quality patient care while managing resources wisely, fostering innovation, engaging employees, attracting investors, satisfying stakeholders, adhering to regulations, etc.
31. **Patient Safety:** Keeping patients safe from harm or injury during every stage of medical care, avoiding errors related to medication administration, surgical procedures, diagnostic tests, and prevention of infections.
32. **Passive House Concept:** A high-performance architectural design strategy focusing on maximizing thermal comfort and minimizing heating requirements by carefully controlling heat transfer between inside and outside spaces; implemented mainly in residential constructions but also applied to some commercial buildings.
33. **Public Transportation Systems:** Planning infrastructure and supporting policies for alternative modes of transportation such as buses, trains, bicycles, walking, and carpooling to reduce dependency on personal vehicles, thus decreasing CO2 emissions generated by fossil fuel combustion.
34. **Quality Improvement:** Continuous process of identifying gaps in patient care delivery and implementing changes aimed at enhancing patient experience, safety, satisfaction, efficiency, equity, effectiveness, and value.
35. **Rainwater Harvesting System:** Collecting and storing rainwater collected from roofs or other surfaces for various applications, like gardening, toilet flushing, washing clothes, etc.; reducing dependence on municipal water supplies and saving money.
36. **Radiant Heat Flooring:** Heating systems beneath floor surfaces radiating warmth upwards to warm rooms evenly, eliminating convective currents and reducing energy consumption compared to forced air heating systems.
37. **Renewable Energy Sources:** Alternative energy solutions derived from natural resources, such as wind turbines, hydroelectric power plants, geothermal heating systems, and biom boilers that generate electricity or heat without polluting the atmosphere.
38. **Risk Management:** Process of assessing, analyzing, prioritizing, responding to, and mitigating risks arising during healthcare provision, focusing specifically on hazards threatening patient safety, property protection, financial stability, legal liabilities, reputation, etc.
39. **Solar Roof Tops:** Installing photovoltaic cells on rooftop areas of buildings capturing sunlight to generate electricity, fulfilling renewable energy needs and reducing carbon footprint
40. **Smart Building Technologies:** Digital systems monitoring and controlling energy consumption patterns, automating tasks such as lighting, heating, cooling, ventilation, etc., remotely sensing occupancy levels, optimizing energy usage, detecting maintenance issues proactively, etc.
41. **Sustainable Architecture:** Incorporating environmentally conscious design principles, passive design features, efficient building materials, renewable energy systems, circular economy concepts, adaptive reuse, net zero objectives, etc., aiming to minimize detrimental environmental impacts throughout a building's life cycle.

42. **Sustainable Food Sourcing:** Obtaining food products from local suppliers whenever possible to reduce carbon emissions associated with transporting goods over long distances, selecting organic produce to minimize exposure to harmful chemicals used in conventional farming methods, and prioritizing plant-based diets due to their lower environmental impact.
43. **Sustainable Healthcare:** Refers to the practice of providing patient care while minimizing negative environmental impacts and promoting long-term benefits for communities, society as a whole, and future generations.
44. **Sustainable Medical Device Management:** Managing medical devices effectively and efficiently throughout their lifetime—from acquisition until disposal—to maximize resource utilization, extend device useful life, prevent wastage, and minimize environmental impacts.
45. **Sustainable Procurement Policies:** Guidelines followed by procurement departments when purchasing goods and services ensuring they align with the organization's sustainability goals. This includes considering life cycle assessment data, product durability, recyclability, fair labour standards, and environmental certifications along with pricing considerations.
46. **Sustainable pathways** refer to improved access, getting right people to the right services at the right time by making healthcare systems more efficient through use of appropriate technology. These also include lean service delivery measures, streamlining care to reduce low value activity, preventing duplication and unnecessary tests.
47. **Sustainable practice** refers to preferential use of effective treatment and medical technologies with lower environmental impact, minimising waste of medications, consumables and energy**.** The idea in sustainable practice is to ensure that the carbon footprints as a result of the healthcare delivery process are kept to a minimum without compromising the quality of care.
48. **Sustainable prevention** refers to strategy for education, engaging communities to imbibe healthy lifestyles, good & balanced nutrition, awareness on the importance of staying healthy & early diagnosis of diseases through screening instruments. These measures will reduce the demand on the constrained healthcare resources thereby having long term sustainability benefits through lowered healthcare consumption.
49. **Sustainability Reporting:** Transparent disclosure regarding environmental performance indicators to stakeholders, demonstrating commitment to sustainable business practices and encouraging accountability among organizations. Encourages continuous improvement initiatives within hospitals aiming for more sustainable outcomes.
50. **Sustainable Site Development:** Approach aiming to integrate land development with preservation efforts to protect soil, water, flora and fauna around construction sites. Techniques involve creating buffer zones, conserving native species, utilizing rain gardens, installing permeable pavers, etc.
51. **Telemedicine:** Utilizing telecommunications technology to provide remote access to healthcare services, enabling patients to consult doctors virtually, reducing unnecessary travel for both providers and patients which cuts down greenhouse gas emissions related to transport.
52. **Waste Reduction:** Strategies employed to decrease solid waste generation by implementing recycling programs, composting organic waste, using reusable medical supplies instead of disposables where

feasible, reducing paper usage, and adopting electronic records wherever applicable.

53. **Water Conservation:** Methods designed to preserve and conserve water throughout hospital premises, including low flow fixtures, rainwater harvesting, greywater treatment systems, efficient irrigation techniques, and reducing water use during laundry processes.

Take Home Message

To truly embrace sustainability into the healthcare culture **we need to work towards** it. We need to **create awareness amongst the healthcare professionals** and include it in the **education and training** of healthcare professionals during their undergraduate courses and trainings.

Focus should be on the core principles of sustainable prevention, pathways and practices. Engage patients & the community by not only capturing their experiences and outcomes but also **involving them in sustainable efforts** that have long-term bearing on **our future generations**.

We need to look at Sustainable Quality initiatives not as an exercise to get a certificate but as a tool for further improvement. **Design sustainable systems and effectively work** towards sustaining them. This will need Commitment and Passion with an intent to improve. It is everybody's business and not somebody else gone do it.

Sustainability in Healthcare should be the goal of every healthcare professional. The dream of every health care professional **should be to remain relevant and effective in a dynamic environment**. We have **to work hard to give reality to our dreams.** All healthcare professionals should **implement patient safety and quality improvement strategies as a means of sustaining healthcare.**

Individuals cannot do it but as a Team WE CAN and WE MUST Do it for our future generations.

NABH through this document attempts at creating awareness and serving as a resource material to spread knowledge regarding steps to implement and develop a sustainable healthcare Quality Improvement framework in the country.

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