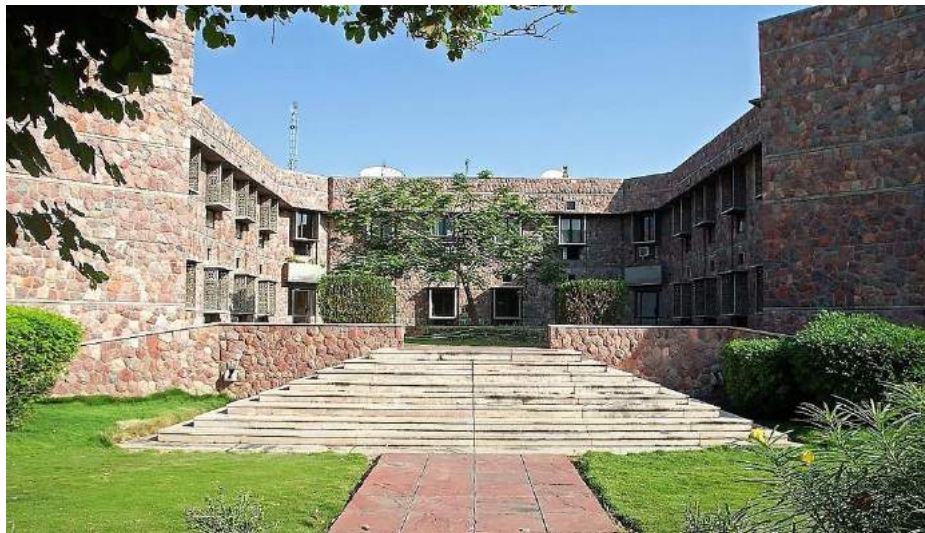


SUMMER TRAINING
at
Bhagwan Mahaveer Cancer Hospital & Research Centre,
Jaipur

EVALUATION REPORT ON THE GREEN BUILDING
HOSPITAL PLANNING OF BMCHRC.

By
Dr. Akshita Sharma
(1065)





Bhagwan Mahaveer
Cancer Hospital & Research Centre
(Managed By K. G. Kothari Memorial Trust)

BMH/HRD /2021/671

Date: July 3rd, 2021

To whomsoever it may concern

This is to certify that **Dr. Akshita Sharma**, MBA Hospital and Healthcare Administration student from **IIHMR University, Jaipur** has completed her internship program from **10th May 2021 to 2nd July 2021**.

During the tenure of her internship she has assisted the hospital operation team in NABH preparation as per 5th edition guidelines.

She has done her work satisfactorily during internship period.

We wish her all the best for her future endeavors.

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ACKNOWLEDGEMENT



This project would not have been possible without the support of Mr. Nirmal Chotia, Engineering Department Faculty Advisor. He was very supportive during this project and worked actively to provide me with all of the required data for my goals relating to Green Building and Environmental Conservation.

I'd like to express my gratitude for the opportunity to work with so many gifted individuals on this project: Dr. Subha Pathania (Medical Superintendent), Dr. Anjum S. Khan (HOD Anaesthesia and Palliative Department), Deepak Talukdar (HOD IT Department), Sonal Rai (Quality Assurance Head), Shankar Kumar Jha (HOD Engineering Department), Dr. Mr. Manendra Belle (HOD Bio-Medical Department) Mr. Manish Goswami (Head of Support Services), Radha Mohan Sharma (HOD MRD).

I would especially like to thank Dr. Sheenu Jain for being a great mentor. She has always been there when I needed her most and she has taught me more than I could ever give her credit for!

Lastly, I would like to thank my parents, whose support and guidance have kept me motivated throughout. Most importantly, I wish to thank my friends who have given me an unwavering source of inspiration: Rushi Joshi, Dr. Perna Soni, Dr. Munir Susham, Manshu Butta, Dr. Vaishnavi Rawal, and Ajay Rajput.

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ABBREVIATIONS

- **AML** - Acute Myeloid Leukaemia
- **BMCHRC** - Bhagwan Mahaveer Cancer Hospital & Research Centre
- **CSSD** - Central Sterile Supply Department
- **HVAC** - Heating, ventilation, and Air Conditioning
- **ICU**- Intensive Care Unit
- **IPD**- Inpatient Department
- **LED**- Light-Emitting Diode
- **LEED**- Leadership in Energy and Environmental Design
- **MRD**- Medical Records Department
- **NABH**- National Accreditation Board for Hospitals & Healthcare Providers
- **OPD**- Outpatient Department
- **OT**- Operation Theatre
- **RFID**- Radio-Frequency Identification
- **TBL**- Triple Bottom Line

PART 1

OBSERVATIONAL LEARNINGS at BMCHRC

INTRODUCTION

Jaipur, the capital of Rajasthan, is known for its art-driven, rugged culture and colourful heritage, clubbed with its beauty, has a lifestyle disease burden prominent amongst them is cancer. Bhagwan Mahaveer Cancer Hospital & Research Centre is the leader in cutting-edge cancer technologies. and affordable care so as to achieve benefit to the maximum population. To achieve this, the hospital has experienced faculty, state-of-the-art infrastructure, and qualified technical staff. The hospital has qualified specialists in the Surgical, Medical, Radiation, Ortho & Neuro-oncology departments. The diagnostic support includes nuclear medicine, radiology & laboratory.

Bhagwan Mahaveer Cancer Hospital and Research Center (BMCHRC) is a NABH-accredited, Not-for-profit, 300-bed super specialty cancer hospital managed by the K.G. Kothari Memorial Trust. The hospital has registered more than 1.75 lakh patients since its inception in October 1997.

The BMCHRC aims to lend a helping hand for the underprivileged. The hospital not only treats patients under BPL category for free up to the extent of 25% but also offers subsidized treatment at the cost of general patients. Besides this, the hospital also caters to all kinds of cancer care not only within Rajasthan but neighbouring states as well where top-notch cancer care facilities and treatments are unavailable.

VISION

“To make Bhagwan Mahaveer Cancer Hospital and Research Centre a comprehensive world class cancer treatment facility with cutting edge technology.”

MISSION

“To provide ‘Affordable Care with Human Touch’ to all sections of the society irrespective of economic considerations.”

VALUES

- Clinical Excellence
- Ethical Practice
- Patient Centric Approach
- Teamwork
- Integrity

MILESTONES

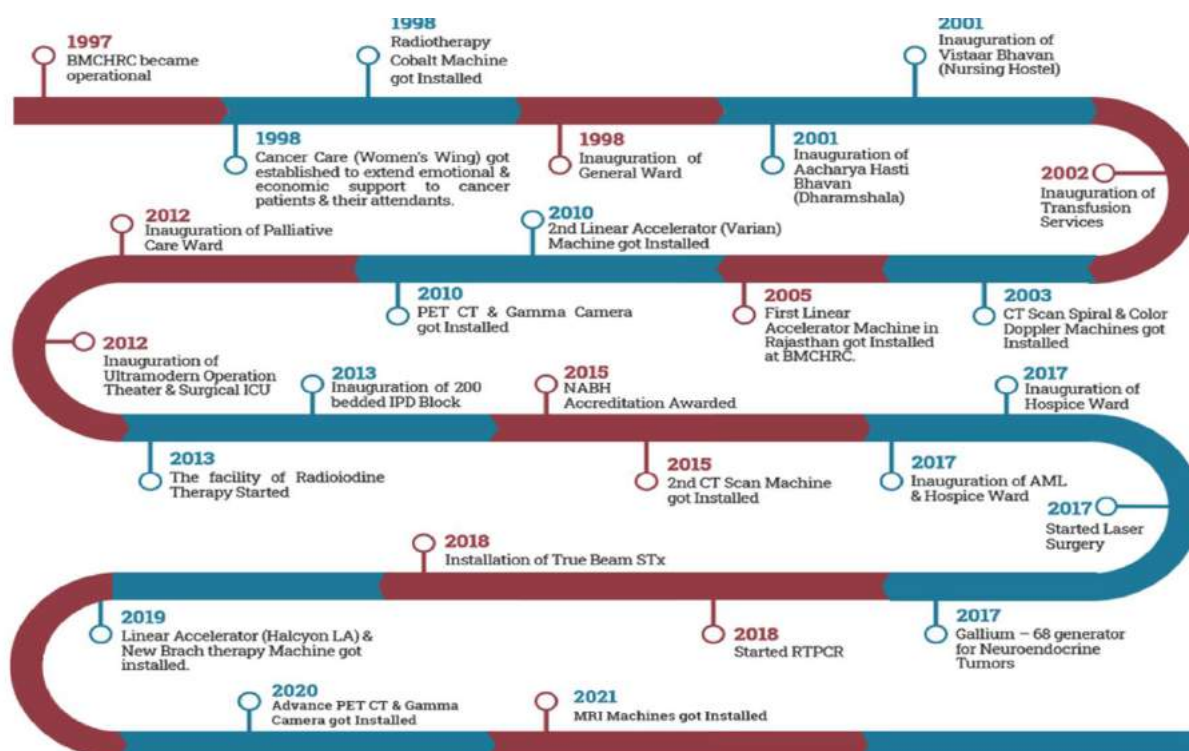


Fig 1: Milestones achieved by BMCHRC

ORGANOGRAM

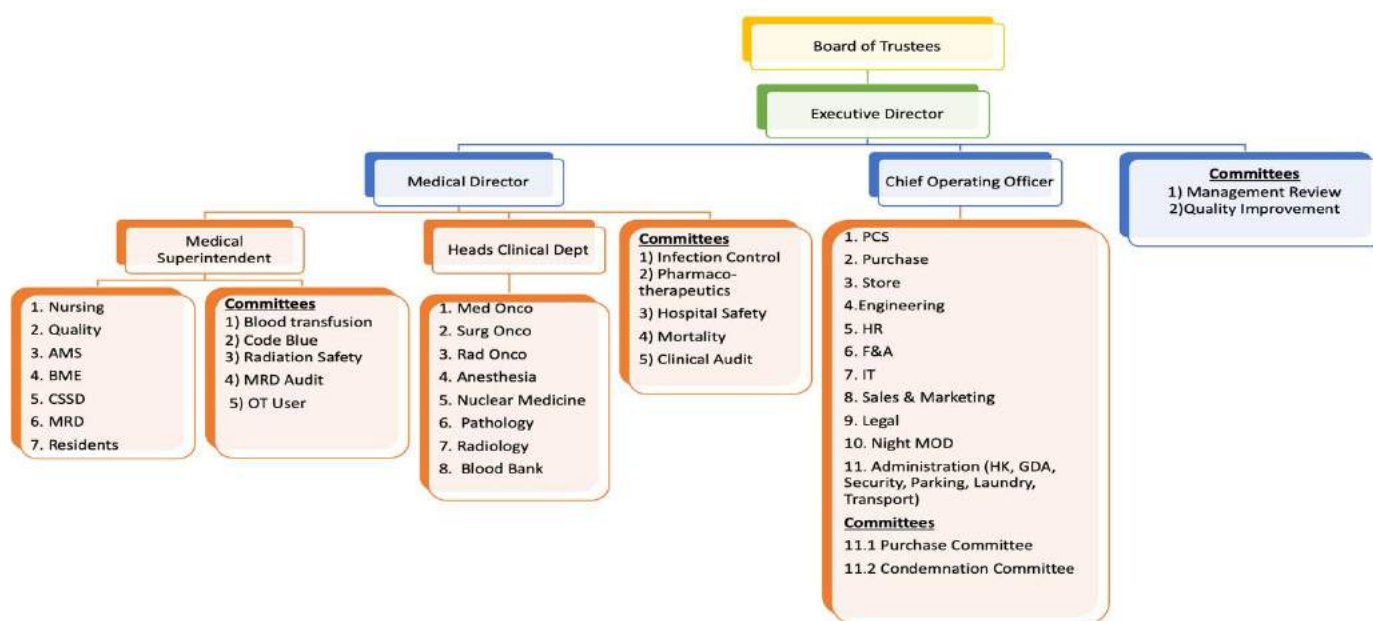


Fig 2: Organogram of BMCHRC

MODE OF DATA COLLECTION

The primary purpose of this project was to gain a better understanding of how people assign meanings to their hospital surroundings. Participants were all employees, patients, and visitors who were chosen for their involvement in the place and environment under investigation. With staff being a particularly important group involved, they received specific conditions given that they are more likely to exercise power than laymen. This study had participants describe their direct experience inside the hospital over an unspecified period; data were collected through questionnaires, interviews, and participant observation where actual conversations with patient visitors were documented present onsite.

Through a series of observations, interviews, and documentation, it was attempted to extrapolate patterns that could explain the behavior and attitudes seen or heard about to reach a deeper understanding – one that goes beyond theories and incomplete pieces of information.

I started with my study onset ascertaining the environment and identifying patterns by documenting the chain of procedures a participant undergoes, walking through various areas, examining graphics and signage, and interviewing crew members for general information that illustrates my study theme. With days passing, I started conducting individual interviews with a few medical professionals whom I selected based on convenient time availability vs. ability to contribute an interview that supports my research study.

People in general care about the environment they live and work in, but sometimes it's hard for them to understand why. People always act when they have visibility into the effects of certain things. The basic idea was to try and get a better understanding on how the participants derived their meaning from their hospital surroundings and secondly, get feedback from them on how their meaning affected their behavior of being in a hospital.

GENERAL FINDINGS ON LEARNINGS

1) Bone Marrow Transplant Unit and AML Ward:

For a month I worked with the Head of the Bone Marrow Transplant Unit, where we collaborated on a protocol to sample AML patients for inclusion in our research project. I was observing AML patients admitted to the hospital as they passed through the admission center and observed that triage was generally handled by a telephone call before their arrival because of the pandemic.

Patients were asked about their symptoms (fever, cough, rhinitis, and diarrhea) within the last 15 days and how they had been exposed to anyone else displaying similar symptoms. When the patients were finally admitted to the hospital, there was a delay in treatment for some patients awaiting cytogenetic and molecular testing.

This strategy was not always appropriate - many of them were elderly or had moderate to severe illnesses, so it quickly became clear that this strategy would not be right for all of them.

While experiencing troubling symptoms which necessitate hospitalization, treatment may conveniently be delayed if it's not urgent or life-threatening; however, treatment mustn't be altogether delayed due to the delicate health of patients during this time.

2) NABH Quality Audit:

I was involved in the NABH internal audit for a couple of weeks at the hospital. I realized that internal audits are cool because they're done independently from the organization which is being audited so it allows for a more accurate reflection of operational policies and risk management practices.

The four primary areas which were being evaluated during this audit were patient billing, inventory management & purchase, quality assurance & compliance management, and finally the finance department. I undertook the audit management of clinical prescriptions, civil and electrical corrections, and MRD files across multiple consent applications including surgical, oncology, blood transfusion.

I reviewed how long patients must wait before going in for radiology and found that sometimes, they must line up outside of the diagnostics department. Some patients even had to go back to the OT after getting discharged from it. There were even issues about returning to the emergency within 72 hours with similar presenting complaints.

When performing prescription audits, it was seen that doctors were close to committing prescription mistakes because of their handwriting not being as legible as they could have liked.

In some instances, it was difficult to find out what failed during the surgeries and checklists were not updated accordingly. In many cases, consent forms which should have been filled in by doctors were missing completely or had their information either incomplete or incorrect. Some files did not even contain a timestamp or if they did, the document was invalid because there was no signature or names of some of the people who would have otherwise filled them in beforehand!

3) Operation Theatre:

We know that overuse of antibiotics can often lead to resistance, so it's important that we monitor the appropriate use of antimicrobial drugs and find ways to improve patient's compliance with their prescription medication. The time an antibiotic was given in what quantity and after how many hours before or after the surgery were important aspects of its administration that needed to be checked regularly. The frequency with which it was needed was also something that had to be noted accordingly. Hence, performing an audit on antibiotics helped make sure to prove their effectiveness during a regular NABH compliance check at the hospital. I created an audit checklist for the antibiotic and surgical checklist so administration-related aspects such as these could be confirmed more efficiently.

4) Surgical ICU

There were challenges related to doctor handover in the surgical admitting department during the morning, evening, and night. The challenges included communication, weak coordination without a checklist, and poor management (including time-management failures). To handle these problems, I developed a new doctor handover communication form to make it easier for doctors to communicate with each other during shift changes and after they have finished operations.

5) Patient Care and Safety

The patient's wait time in the OPD was one of the biggest problems in the hospital. Patients tend to get frustrated and aggravated with their wait times, that they waste a lot of time sitting around waiting for their consultation, which is probably why they've come to the hospital in the first place. It was important to consider that patients spend a large chunk of their time just sitting around waiting, sometimes longer than it takes for them to see a doctor or specialist; this is unacceptable not only because it wastes an enormous amount of time but also because it goes against what someone who is sick or injured wants most.

Once the patients came out of the consultant's cubicle, I gave them a questionnaire to fill in. The patients were generally satisfied with the availability of facilities and with their treatment but there were certain areas they had problems with. They claimed that

the guards ignored them or were rude when spoken too and some also complained about being ignored by staff in the pharmacy department.

An average patient will spend a good amount of time at the hospital. One might visit a doctor, see to a procedure, or test, or visit someone at the hospital, depending on the circumstances. What really matters is that, when you are around patients and visitors, you're bound to find yourself in stressful conditions no matter how hard you try to keep your cool; having some form of Wayfinding is critical when it comes down to potentially saving lives throughout this process. Visitors visiting anyone in dire need could get confused as we may forget our way around a location where we're not familiar with leaving us vulnerable to getting lost while walking aimlessly about an area that can be perceived easily as daunting or overwhelming!

6) Palliative Department

Hospitals are supposed to be a place where one feels comfort and calm but with all that commotion near the palliative department – it is not. When patients arrive at a hospital for serious treatment, they need all the help they can get, so there is no need for more stress put upon them by illogical planning decisions. The noise of the nearby canteen and people entering from a huge gate nearby often disturb patients recuperating in the palliative department.

SUGGESTIONS FOR IMPROVEMENT

- There should be a computer and printer for patients on each floor of the hospital. This way, people who are waiting for their documents to be printed can get these accomplished in an adjacent room instead of having to go through the entire billing procedure in order to accomplish this one small job.
- The file dispersal procedure should be changed. It takes too long for files to reach from the OPD or Initial Assessment departments to patients waiting in the consultant department or their respective rooms in general. Either more manpower needs to be allocated or the procedure should be digital, so even files of new patients can reliably get to where they need to go without delay.
- Admissions could benefit from a BOOK-MY-SHOW or URBAN COMPANY type software/mobile application in order for patients to book slots for themselves on their own and also know about what time slots are available. They could make the informed decision independently. A short message such as " Thanks! Make your payment online on our website and call us for any further clarification. You can even book an appointment in case you would like to discuss it briefly over the phone before scheduling your surgery " This can be sent automatically once the online payment is made if the user had requested that.
- Incorrect signage in hospitals can be sorted out by the colour coordination of the different departments. The idea is that each department has a specific colour – or for example, if your company uses a particular colour brand image (like blue or yellow) - and so by applying these colours to hospital signage, patients are able to find their way around wards and corridors more easily throughout standard hospital practices because they know which colours represent which departments.
- A separate counter should be designated for emergency situations in order to give them the quick attention they deserve and to make sure that there is a minimal amount of time wasted.
- This is something that I feel is important because it's not always about how you respond to a customer, but also how quickly you allow customers to respond to you. In radiology, this could conceivably mean being able to get appointments for patients as soon as they need them but also referring doctors with reports and films as fast as possible after an examination has taken place. In general (especially when dealing with radiology), a long waiting time is not acceptable, and if an opportunity arises for better service to be provided in a timely fashion.

- Palliative department should be shifted away from the canteen area, where it can operate in a peaceful environment away from the hustle and bustle of a working canteen.
- With electronic prescribing such as e-Prescribing, healthcare providers can fill out prescriptions electronically and securely transmit the necessary information to likely pharmacies using software and a transmission network. Once one of these possible pharmacies receives this prescription information, they will have the ability to confirm these requests and begin printing off medications as early as possible. This will also make the discharge process easier and would also save a lot of prescription errors. Studies have shown that computers have reduced medication error rates by as much as 80%.
- Hospital food doesn't have to be wasted – give people a broader range of options and more appetizing plates. One way to improve hospital meals for everyone is by making things more nutritious and appealing by monitoring and adjusting portion sizes while also improving quality as well as providing menu items that better appeal to patients' meals). Also, perform a regular audit for the food waste generated per bed.
- Use of food wastage in the bio-methanation plant along with generating manure can also generate electricity with could be beneficial for the organization.
- Token system for the footwear being misplaced outside of the operating theatre. This was a concern brought forth by the head of OT.
- Use of a 'Tap and Pay Card' for the OPD billing. Tap-and-pay cards reduce billing inaccuracies and time spent on invoicing.
- Implementing RFID at the pharmacy for verifying and tracking numerous medication kits, trays, and boxes will improve long lines at the pharmacy, as well as reduce the risk for error.

CONCLUSION

I visited every department and understood each individual decision-maker, as well as what current products/services they were using and which ones they wanted to like. I then researched the problems that they were having with their current product or service and came up with a solution that could fix it. This likely meant changing some of their usual ways of operating or taking some responsibilities upon myself (depending on how much of a problem it was). Ultimately though, this gave me the opportunity to learn about the existing team members, what drove them and how I could help improve their day-to-day lives.

PART 2
PROJECT REPORT



GREEN BMCHRC
MAKING SUSTAINABLE DEVELOPMENT A REALITY.

INTRODUCTION

Healthcare sector, by consuming resources, constructing, and operating large or small, complex, or not establishments, including technologies that are some of the most energy-intensive and producing various types of waste—including medical waste—has itself become a public health concern. Our daily survival heavily depends on our environments. Despite modern medication and sophisticated technologies, curing sick patients can be a complicated process burdened with serious implications both for the environment and humans. The hospital sector influences that very same environment and is being influenced by it as well. The hospital industry can help save lives but what many don't realize is that this same industry could be also responsible for killing the planet if left untreated. Hospitals are among the largest, most complex, and energy-intensive organizations in the world. In fact, they consume enormous quantities of resources such as electrical equipment and medical instruments, food, and water as well as construction materials - all resources that must be available at a moment's notice. However, hospitals have multiple means available for reducing their environmental impact while simultaneously saving on costs too.

We all know that the field of health and medicine can have an enormous impact on fighting climate change. In fact, as members from WHO's Health Security and Environmental Cluster wrote in their article published in the American Journal of Preventive Medicine "The health sector is one of the most trusted and respected sections of society, and it is also one of the largest employers and consumers of energy. This presents both: a duty and a window of opportunity to achieve climate-neutrality, efficiency and cost reduction all at the same time" (1)

To be environmentally friendly, the hospital sector can deploy some basic measures like improvement of hospital design, the introduction of sustainable waste-reduction and management strategies, sustainable use of natural resources such as water and energy, and utilization and purchase of such products and chemicals, which have a minimal impact on the environment (2)

Bhagwan Mahaveer Cancer Hospital & Research has tried to reduce its environmental footprint by pursuing green initiatives. This hospital often tries to increase the number of energy efficiency and water conservation measures they put into place to find ways to save money while remaining environmentally conscious.

According to Indian Green Building Council, a green hospital building can be defined as one which enhances patient well-being, aids the curative process, while utilizing natural resources in an efficient, environment-friendly manner (3). The concept of developing sustainable green buildings received a further fillip with the introduction of the Triple Bottom Line (TBL) approach, which was introduced and popularized by the green business guru – John B Elkington in the mid-1990s (4). According to the TBL approach, the primary goal of designing a green building should be to reduce the use of resources (5) such as land, water, energy, and supplies so that the people who live, work, learn and heal in green buildings are healthier, happier and more productive.

The Confederation of Indian Industry (CII) established The Climate Neutral and Sustainable Buildings Council in 2001 to promote the development of climate neutral and sustainable buildings throughout India, so that by 2025 it will be a global leader in this effort. The council is licensed by the US Green Building Council to award LEED certificates for projects investing within India.

Constructing Green Hospital can be a challenge, but BMCHRC did a great job at overcoming their common challenges and obstacles like-

- 1) **System Redundancy-** As organizations grow, so should their back-up options. Infrastructure and tech services must be properly paired with significant redundancy to avoid any halt caused by failure.
- 2) **Regulatory compliance-** Building codes and government health and safety regulations vary among countries, so it was equally challenging for the hospital to adopt sustainable practices.
- 3) **Operational Hours-** Hospital functions uninterruptedly throughout the year.
- 4) **Infection Control-** Hospitals and other healthcare facilities take very prudent measures to avoid and control the spread of infections associated with doctors, nurses, patients and their treatment.
- 5) **Ventilation Rates-** Hospital generally requires more frequent air changes in comparison to other commercial office spaces since it tends to have a lot more equipment and necessities that contribute to excess moisture.
- 6) **Accreditation Demands-** Compliance with insurance and accreditation standards could have prevented the hospital from making environmentally sound choices.
- 7) **Energy and Water Use-** Hospital has achieved a more environmentally friendly mode of operation through innovations in technology and facility design.
- 8) **High-Volume Waste Stream-** A high-volume waste stream is any kind of waste that is found in large quantities and tends to be less harmful than some other types of waste generated.
- 9) **Chemical Use-** There are many types of chemicals. In laboratories and hospitals, they use toxic chemicals to clean and disinfect equipment, sterilize, and treat diseases, and for laboratory research. They have a committee for Code Orange (Hazmat Spill).
- 10) **Life Cycle-** Hospital's renovations required key skill sets, such as architectural planning, design management, construction, and engineering.

RESEARCH QUESTION

Evaluation Report on the Green Building Hospital Planning of Bhagwan Mahaveer Cancer Hospital and Research Centre.

RATIONALE

Green hospitals are becoming an increasingly common sight. They aim to be economically and environmentally friendly. They focus on providing a healthy environment for the patients, staff, and other visitors. The term "sustainability" goes beyond being environmentally friendly. Such facilities require a certain level of quality, having been constructed in such a way that would last longer than many others without breaking the bank in terms of finances during these current difficult economic times.

I was very impressed by Bhagwan Mahaveer Cancer Hospital & Research Centre after learning about all of the green initiatives that this hospital has taken to make it a more eco-friendly environment. When assessing the sustainability of hospital building with the hospital staff, I observed that they have done their part to help assess employee productivity which might be improved along with strategies for waste reduction as well as pollution and resource usage. I observed first-hand how the hospital's employees are actively working together to reduce resource usage and environmental waste.

Sustainable hospitals promote a healthy environment through sophisticated planning. Buildings that are designed to be flexible allowing for efficient demand-driven operations that support the flow of work and processes. Staff will have an improved working environment by enjoying healthier conditioned areas, while patients will enjoy more comfortable environments and space when recovering from illness or while on convalescence. By contributing natural elements such as plants or water features, hospitals are able to better connect with nature in more ways than one!

My love for an issue that has arisen and found solace in research on hospital sustainability makes me determine the features of a sustainable hospital in the future. This study would help me to make a better plan and write better architecture as well as engineering plans for such structures. I wish that through exploring the issues of this nature, the user who reads this could gain some kind of application-based exposure.

Therefore it is my aim to focus on the gaps in knowledge from planning and establishing the hospital right through to maintaining and thriving, as a sustainable hospital in this world of uncertainty. I will carefully analyse all factors that can help the hospital be sustainable and then delve into how we can develop solutions for these points by exploring some relevant data for particular aspects like Acoustical and Visual comfort, Environmental management, Reuse of recoverable materials/ resources, Waste avoidance, etc.

OBJECTIVES

- A primary goal of designing sustainable hospital's building is to limit the environmental impact of the hospital structure, while improving the economic and social consequences of the people occupying the building.
- To utilize key resources like energy, water, materials, and land much more efficiently than traditional structures.
- To create healthier, more comfortable, and productive indoor environments.
- To make BMCHRC a sustainable building seeking to reduce the environmental footprint and enhance its economic and social value for its owners, occupants, and the surrounding community.
- To try reducing the cost of implementing energy-efficient devices

METHODOLOGY

AREA OF THE STUDY

There was a **GO GREEN** sign in the hospital corridor that triggered the idea of evaluating sustainability on campus. Going green is a process of conserving the environment and saving it from damage. Here, at this hospital, we're trying to use local resources such as energy and water to protect the planet while also dramatically improving the quality of care for our patients.

RESEARCH DESIGN

The hospital was already taking steps to become a more sustainable facility. Therefore, the research I decided to conduct was evaluative in nature and quantitative in design. Therefore, I wanted to find things that would be present within the hospital that could be even better and improve the quality of lives of employees, visitors as well as patients by improving their surroundings and overall health through environmentally safe practices.

SAMPLE SIZE

In my work for BMCHRC I helped the organization to earn a LEED-Certified Building tag by evaluating five areas that would work to make a hospital building green.

- 1) Sustainable Sites in the hospital
- 2) Water Efficiency
- 3) Energy Use.
- 4) Materials and Resources.
- 5) Indoor Environmental Quality.

For this I visited 8 Departments majorly and observed the rest.

- Laundry
- Pharmacy
- MRD
- Engineering Department (Civil and Electrical)
- Bio-Medical Engineering
- Food Court
- Wards
- Central Store
- Bio-Medical Waste

SAMPLING TECHNIQUES

The sampling technique I used was a **selective sampling technique** because I had to find out departments which are already doing green initiatives so that I could study the effectiveness of the study. I researched how 9 different departments within my hospital were being proactive about undertaking an initiative to make their practices more sustainable. It was important for me to find out this information to figure out what I could do next in my research and report. In the process of researching this topic, I learned how other departments were coming up with ideas about the work they wanted to get done based on their current operations, assets, and financial status.

MODE OF DATA COLLECTION

- 1) In-Depth Interviews- Unstructured and Semi-structured
- 2) Website articles
- 3) Hospital records.
- 4) Research Journals
- 5) Observation

I started with my study onset ascertaining the environment and identifying patterns by documenting the chain of procedures a participant undergoes, walking through various areas, examining graphics and signage, and interviewing crew members for general information that illustrates my study theme. With days passing, I started conducting individual interviews with a few medical professionals whom I selected based on convenient time availability vs. ability to contribute an interview that supports my research study.

METHOD OF ANALYSIS

The thematic analysis was one possible way to do this research. It's a bit of an exploratory method that focuses on discovering, analyzing, summarizing, and explaining the results rather than coming to some specific conclusions.

DATA COMPILATION

ANALYSIS

1) Bio- Methanation Plant

Food waste has been linked to nutrient intake, menu performance, food acceptance, cost, and environmental impact. Potential factors could include the production of large quantities food and subsequent serving at set meal times that may or may not be in sync with the patient's appetite or the hours of medical care. The hospital produced waste is then distributed as a compost after getting processed in Bio-Methanation Plant.

Bio-methanation is the process of combining organic waste materials into biogas. This provides a simple solution to disposing of food that would otherwise end up as trash, and it reduces the need for disposal in a landfill. Bio-methanation is also used to generate energy from manure that could otherwise be wasted before being used as fertilizer for plants at the hospital's garden.

- 1) Total **Food Waste** generated in the hospital in the month of **May: 353 kgs**
Total **Compost** received after getting processed in the month of **May: 253 kgs.**
- 2) Total **Food Waste** generated in the hospital in the month of **June: 425 kgs**
Total **Compost** received after getting processed in the month of **June: 345kgs**



Fig 3: Bio Methanation Plant at BMCHRC



Fig 4: Pantry near the wards at BMCHRC

2) Sewage Treatment Plant

To maintain cleanliness and sanitation of the hospital, wastewater from different departments such as operation theatre, emergency ward, laundry, etc. is treated. This sewage water contains a variety of hazardous substances harmful to human health and the environment. Hence, it must be treated in a hospital sewage treatment plant. The treated water from this plant can be used for gardening purposes only since bacteria are still present in the treated water and organisms such as algae, fungi, flourish on it.



Fig 5: Sewage Treatment Plant at BMCHRC



Fig 6: Water being used for gardening purposes.

3) Solar Plant

BMCHRC has two Solar Panels, which show a certainty about sunlight-based boards and their maintainability. One is on the IPD Terrace (50KW) and the other one is in the Patient Parking Lot (120KW). Introducing a sun-based energy framework is an extraordinary method to lessen power charges and work on their general efficiencies. The greater part of these focuses is additionally qualified for appropriations or tax cuts, but such data on BMCHRC couldn't be extracted.

Total Power Generated by Solar Panels in the Parking Lot-

May: On an average **616.45 KWH** (Out of which, solar was off for three days)

June: On an average **612.37 KWH**

Total Power Generated by Solar Panels on the IPD terrace-

May: On an average **197.59 KWH.**

June: On an average **262.7 KWH**

According to The EnergySage Solar Marketplace in 2020, solar shoppers can achieve payback on their solar investment in about 8 years, before continuing to enjoy free electricity for the life of their solar panel systems, which can last between 25 and 35 years.

Total Electricity Consumption (kWh):

May : on an average 366520 (814.04 from the solar panels)

June : on an average 395920 (875.07 from the solar panels)



Fig 7: Patient Parking Space – 120kw



Fig 8: Terrace- 50kw

4) Chiller Plant

HVAC systems (or heating, ventilation, and air conditioning) play a vital role in regulating the indoor environment for most buildings. A chiller plant acts as the central cooling system for the building and supplies much of its cool air to HVAC systems by circulating refrigerant fluid. They are a form of green energy technology that's helping us find new ways to raise global awareness about global warming issues.



Fig 9: Chiller Plant at BMCHRC

Chiller Plant uses the water coming from the 3 Borewells. The average consumption in-

MAY:

Borewell 1- 54,000 L

Borewell 2- 30,000 L

Borewell 3- 37,000 L

JUNE:

Borewell 1- 45,000 L

Borewell 2- 80,000 L

Borewell 3- 36,000 L

Out of this **35,000 L** of water is used by the chiller tank in the **centralized cooling** system present in the corridors and rooms. Hospital is still left with 3.5 to 4.5 lakhs liter as reserve.

5) Hot Water Solar

As one of the most common ways we take advantage of solar energy, the heating of water is the perfect example. The system is set up on a roof and connected to pipes, and once it's fully operational, it absorbs heat from the sun and heats the water that flows between its tubes. This method works best with installed insulation or specially designed vacuum tubes.

Because it's so practical, there are various models available today including panels used for hot water systems such as solar water heaters and solar pool heaters as well as more industrialized applications like commercial solar panels that are used to generate electricity during peak demand periods like summertime when consumer demand soars. **The one at the hospital saved up to 1500 units of electricity last year, which is equivalent to 100 liters of water heated per day using solar power.**



Fig 10: Hot Water Solar Panel at BMCHRC

6) Biophilia

The hospital knows that redesigning the hospital experience from a biophilic point of view can benefit patients. Exposure to natural elements; whether directly from nature or interpretations of it, can help to reduce stress and anxiety for both the patient and for his/her loved ones.

Biophilia also helps make hospitals more environmentally friendly by cutting back on their carbon footprint. Hospital has a responsibility to both their patients and local communities to care for them in a manner that will provide positive healing health outcomes while being more sustainable all at the same time!



Fig 11: Patient waiting area near the Nuclear Medicine at BMCHRC



Fig 12: Children Activity Area at BMCHRC



Fig 13: Inside Nuclear Medicine Department (PET SCAN) at BMCHRC



Fig 14: Inside Nuclear Medicine Department at BMCHRC

7) Natural Lighting and Air Ventilation

Light can be considered a form of medicine. The way it works is that it influences hormone receptors & neurotransmitters in the brain as well as the body's mood.

Benefits of Natural Light in the Hospital –

- Patients admitted to brighter rooms spent up to 41% less time in hospital than dimly lit or windowless rooms.
- Patients who have great views from their hospital bed tend to feel less stressed after surgery as compared to those whose windows offer a dull view.
- Patients who experience reduced pain also require less medication for symptomatic relief.
- Natural light increases the productivity and mood, and helps them feel more energetic.



Fig 15: Main Entrance



Fig 16: Near the OPD Billing at BMCHRC



Fig 17: Outside Department of Clinical Research at BMCHRC



Fig 18: Patient Waiting Area Outside Nuclear Medicine at BMCHRC



Fig 19: Surgical Ward at BMCHRC

8) LED Lightings

With an estimated 80-90% energy efficiency compared to traditional lights, LEDs are a more efficient lighting option and significantly lower energy usage. Since the lifespan of these lights is four to five times longer than traditional options, you can enjoy long-term savings on replacing burned-out bulbs, not only helping your pocketbook but also helping the environment.

All the lights were changed to LED last year. This was done to prevent short-circuiting, fires, and to eliminate the problem of burnt-out light bulbs. The hospital has 700 LED lightings which consume about 15KW of power.



Fig 20: Outside Children Activity Area at BMCHRC

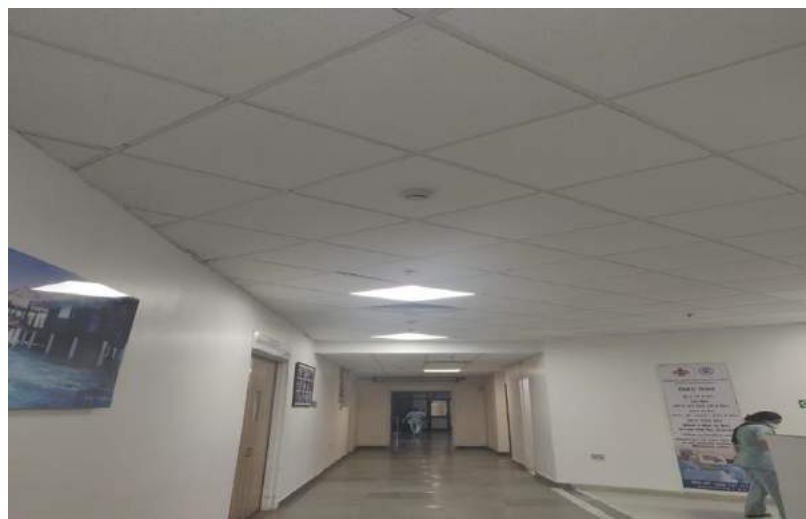


Fig 21: Surgical OPD at BMCHRC

9) Material and Resources

By using materials and elements that reflect the local ecology or geology, we can make ourselves feel at home. Making use of construction materials that are both more energy-efficient and rely on natural materials will continue to help contribute to the reduction of greenhouse gas emissions. Materials that are less energy-intensive, such as bamboo which grows very quickly, will make it possible to reduce the greenhouse gas emissions associated with traditional construction materials. Letting nature play an important role in your buildings makes everything seem more natural.



Fig 22&23: Near Cancer Care (Arogya Dham)

10) Biomedical Waste

Our hospital has 10 wards, 5 major and 1 minor operation theatres (OT), an outpatient department (OPD), and emergency services as well as a laboratory. We also have a waste treatment area that is approximately 500 meters away. In total (May and June), the hospital handled 8463.58 kilograms of BMW which are transported via separate color-coded trolleys, which is in adherence with BMW's policy for 2016.

Waste generated during May and June 2021

- **Yellow Biomedical Waste: 2300.98 kgs**
- **Red Biomedical Waste: 3771.39 kgs**
- **White Biomedical Waste: 127.01 kgs**
- **Blue Biomedical Waste: 2264.20 kg**



Fig 24: Biomedical Waste Room at BMCHRC

11) Water Treatment Plant

Water treatment ensures that harmful organic and inorganic pollutants are removed from water. If we consider the use of drinking water for the hospital, then it must be safe to drink and not cause potential harm. This is very important since hospital recycling waste water which makes it possible to drink again! Hospital uses water for gardening as well, as it must also be pumped back into the environment.



Fig 25: Water Treatment Plant at BMCHRC

**Chiller Plant uses the water coming from the 3 Borewells. The average consumption in-
MAY:**

Borewell 1- 54,000 L

Borewell 2- 30,000 L

Borewell 3- 37,000 L

JUNE:

Borewell 1- 45,000 L

Borewell 2- 80,000

Borewell 3- 36,000 L

Out of this **25,000 L** of water is used by the water treatment plant for filtering out water for drinking purposes and **70,000 L** of water is used by the water treatment plant for gardening.

12) Recycling and Reuse

Paper products are made of organic materials that can be recycled. The Central Store at the hospital collects old paper products and then they donate them to be recycled. As a result of this recycling in total over 9600 kgs have been diverted from the landfill in just one year alone up to March 2021. In return, the hospital received envelopes, files, printed stationery, and paper rims.

From this year forward wherever possible the hospital has digitized its processes and started using Google Forms and other means of digital technology thereby saving paper.



Fig 26: MRD Department at BMCHRC

13) Arogya Dham

The Arogya Dham building was refurbished by the hospital itself using leftover resources, paint and other supplies which made it extremely cost-effective to maintain. The hospital already had the manpower on hand and this arrangement allowed for a great saving of both time and money. Like a pretty painting, nature is an image that elicits a sense of euphoria in people, which can improve general well-being as well as your mood on any given day.



Fig 27&28: Way to Arogya Dham at BMCHRC

RECOMMENDATIONS AND SUGGESTIONS

1) Food Court

- Move the bio-methanation plant near the canteen. Bio-manure and biogas generated here can be supplied to cater to the waste disposal needs of both the canteen and onsite gardens. The biogas generated can be used to cook food, whereas the bio-manure can be used in gardening. This will help reduce the wastage of resources in our internal ecosystem.
- Replace round tap with a sensor tap, this will not only save the environment but will also prevent illnesses that one can get while sharing the same tap for handwashing.
- If your patients/attendants/employees aren't finishing their meals, you can reduce portion sizes.
- Regularly checking that your refrigerator and freezer are running at optimum efficiency is essential to reduce food waste and reduce the chance of unwanted odors in your kitchen, but more important than that, by doing so regularly you lower your energy bill and carbon footprint.
- The administration should take out the food waste generated per bed for better analysis.

2) Laundry

Hospital's laundry use about 15 litres of water to clean one kilogram of clothing - resulting in the production of 400m³ of wastewater daily. This wastewater can be reused for washing outdoor areas, vehicles and irrigating gardens. So not only it is reducing our dependence on traditional water sources but it also saves us a whole lot of energy and upkeep costs.

3) CSSD

- Utilize the low-energy hibernation mode when the sterilizer is not in use.
- Draft to plan and keep track of when instruments are available. One way is to divide and categorize the surgeries is according to urgency:
 - P1: Instruments must be available within 3 hours
 - P2: Instruments must be available within 5 hours
 - P3: Instruments must be available in the afternoon
 - P4: Instruments must be available the following day

This categorization and optimization help you to optimize your operation planning process and determine how to set-up and run your washer-disinfectors and sterilizers.

4) Pharmacy

A shift towards e-prescriptions could save thousands of tons of paper each year. In addition to reducing paper, the move may also improve the sustainability of pharmacy practice and may reduce prescription errors caused by illegible handwriting notes – leading to better health outcomes for patients.

5) Palliative Department

It's important to find a new place for your Palliative Care Unit where there aren't so many patients/attendants/employees in the vicinity because of the busy corridor (Canteen). In Palliative Care, noise can impact patients' ability to rest or work, take medicine, and develop skills required for recovery. It has also been linked with worsened appetite, anxiety, depression, fatigue, and physical exhaustion - all of which could lead to longer patient stays in the hospital! And that doesn't make you very popular with the budget board!

If the entire department cannot be shifted, the use of acoustic baffle panels can help isolate and limit the sound being produced.



Fig 29: Outside Palliative Department at BMCHRC



Fig 30: Inside the Palliative Department at BMCHRC

6) Patient Care and Safety

Green buildings are unique in that they focus on minimizing risks and staying away from error-prone situations at all cost. That being said, navigation can also be very risky and potentially dangerous if the wrong kind of signage or wayfinding is involved with your Green Building's designs for example. Consequently, for best results when it comes to signage or wayfinding inside of a Green Building, consider implementing and using a strategy that prominently incorporates colour coordination schemes.

Interactive displays are always cost effective because printing costs get saved being it is digitally projected over LED screen/TVs.

7) Wards and Treatment Room

Biophilic designs help with managing stress and coordinating with nature takes advantage of your brain's inherent desire to synchronize with natural rhythms.

I recommended dimming lights and using light sensors as a way to keep energy consumption down.

8) Air Ventilation

Find experts in your particular region that are working on wind direction and quality control. You can identify them by giving attention to which way the wind blows and reading maps of potential contamination. Look for areas where more wind could be present as opposed to areas where the air is contaminated.

Avoid using sliding windows, which are prone to collect dust, dirt, and rain water which will result to cause infection in patient areas.

9) Lightings

According to a research, 47% of the spaces do not have natural lights and 24% of the spaces do not provide a sense of light and space. If natural light is not available, it's important for lighting designs to incorporate dimming and motion sensor functions into the layout in order to save energy as well as doing what they can to create a more comfortable mood.

10) Water

Quarter turn taps or touchless/sensor taps are much better for conserving water and preventing infections than handwashing. Educate your staff about the importance of conservation as well as saving water with every use. Pressmatic taps also help in saving water using auto-closing valve mechanism after 8-10 seconds.

11) It's time for a celebration!

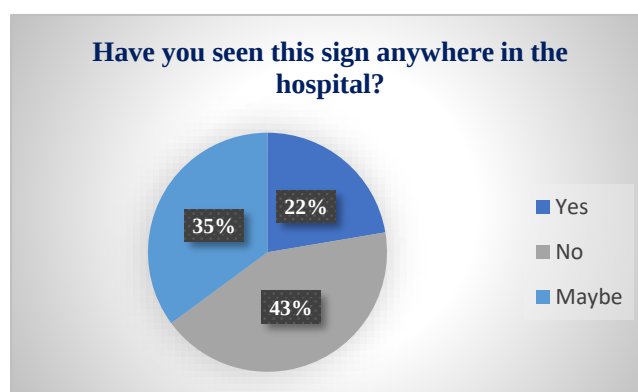


Chart1 : Chart depicting the survey done about the poster in Fig 31



Fig 31: Poster near the handwashing areas at BMCHRC

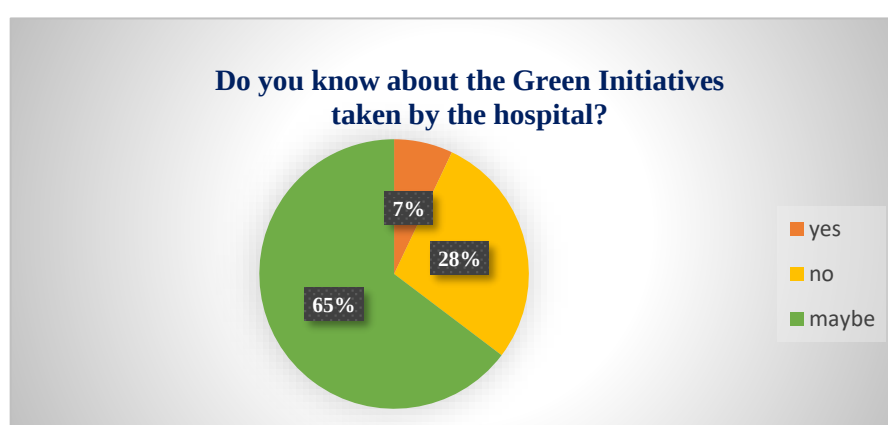


Chart2: Chart depicting the survey done regarding hospital's green initiatives

The hospital should celebrate Green Day, World Health Day, and World Environment Day. They can do this by planting trees to establish a greener environment as well as to raise awareness about the eco-friendly initiatives that the hospital has taken up in previous years.

12) Lean Management Tool- 5S

Hospital should implement the principles of Japanese manufacturing industry, 5S which is a highly effective lean manufacturing methodology to ensure workplace cleanliness, efficiency, and safety. By taking care of environmental issues such as workplace cleanliness and safety, the 5S method facilitates risk management, waste reduction, cost savings and employee engagement.

STEP NAME	JAPANESE TERM	EXPLANATION
1) Sort	Seiri (tidiness)	Remove unnecessary items
2) Set-in-Order	Seiton (orderliness)	Organize and store for efficient use
3) Shine	Seiso (cleanliness)	Clean and inspect regularly
4) Standardize	Seiketsu (standardization)	Incorporate these measures into SOPs
5) Sustain	Shitsuke (discipline)	Track progress and keep implementing new ideas

INTERPRETATION

IGBC Green Factory Building Rating System has a rating system which has been specifically designed for factory buildings in India. It would be applicable to all sectors of industry and for all climatic zones around the country. To implement the IGBC rating system, the project team should first develop a checklist that will help to evaluate all the necessary criteria. It can earn the certification if it meets all the mandatory requirements and scores the minimum required number of points on its checklist.

IGBC Green Factory Buildings rating system addresses green features under the following categories:

- Site Selection and Planning
- Water Conservation
- Energy Conservation
- Materials Conservation
- Indoor Environmental Quality
- Innovation and Design Process

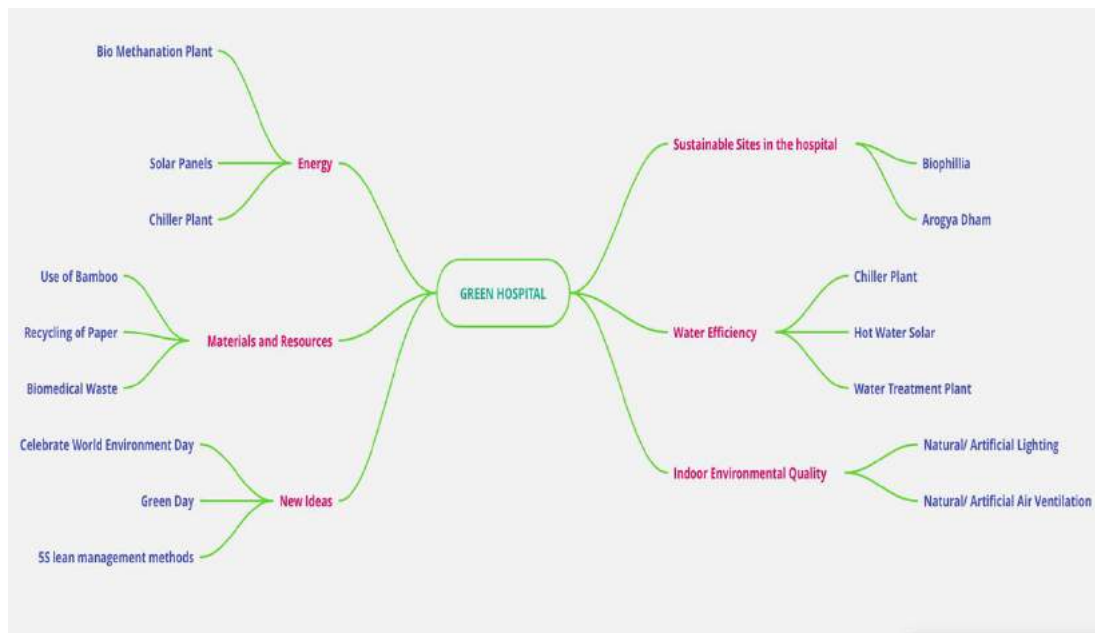


Fig 32: Mind-Map of the Green Initiatives taken at BMCHRC (IGBC Green Building Framework)

CONSIDERING ALL THE FACTORS, BMCHRC HAS DONE A TREMENDOUS JOB AND SHOULD DEFINITELY CONSULT GREEN BUILDING CONSULTANTS IN ORDER TO EARN THIS CERTIFICATION. Their proficient portfolio of services and expertise are highlighted by their ability to make clients' dreams a reality. As such, we think they'd be exceptionally qualified to help the BMCHRC take on this project successfully!

CONCLUSION

The hospital has initiated various steps towards becoming a greener, more environmentally conscious structure and eventually practice. They have carried out this mission while maintaining an increasing number of patients per year even though the energy consumption has remained steady over the past few years, showcasing their commitment to protecting the environment as well as their patients who come from it. By introducing these new measures and having them be implemented properly in that period, it's safe to say that this emphasizes the commitment to use natural resources responsibly and help contribute to the environment.

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ANNEXURE

S. No	Name of the Department	Date(s) of Visit	% Of Time Spent	Interacted with (Name and Designation)
1	Bone Marrow Transplant Unit	10 th May	37.5%	Brig. Dr. Anil Dhar (Head of BMT Services)
2	Quality Assurance Department	31 st May	12.5%	Dr. Sonal Rai (HOD)
3	Operation Theatre	12 th June	12.5%	Dr. Renu Joshi (HOD)
4	Patient Care and Safety	19 th June	10.41%	Ambika Verma (HOD)
5	Medical Administration	26 th June	10.41%	Dr. Subha Pathania (MS)
6	CSSD	7 th June	2.08%	Mohammad Khalid (HOD)
7	Central Store	8 th June	2.08%	Anil Kumawat (HOD)
8	Blood Bank	9 th June	2.08%	Dr. K.C Lokwani (HOD)
9	Engineering Department	10 th June	2.08%	Shankar Kumar Jha (HOD)
10	MRD	11 th June	2.08%	Radha Mohan Sharma (HOD)
11	Support Services	26 th June	2.08%	Manish Goswami (HOD)
12	IT	27 th June	2.08%	Deepak Talukdar (HOD)
13	Marketing	28 th June	2.08%	Siddharth Verma (Senior Manager)
14	Clinical Research	29 th June	2.08%	Dr. Ashok Sinha (HOD)
15	Pharmacy	30 th June	2.08%	Praful Golechha (HOD)
16	Bio-Medical Engineering	1 st July	2.08%	Manendra Belle (HOD)

Note: 11-16 were covered under the Medical Administration

