Impact Assessment Study of EGF's CSR Support to Dr. Shroff Charity Eye Hospital (SCEH)

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Abbreviations

AMF	Automatic Main Failure
BPL	Below Poverty Line
CAQM	Commission for Air Quality Management
CSR	Corporate Social Responsibility
DPCC	Delhi Pollution Control Committee
ENT	Ear, Nose, and Throat
EGF	Eicher Group Foundation
EWS	Economically Weaker Section
FY	Fiscal Year
MIS	Management Information System
NABH	National Accreditation Board for Hospitals and Healthcare Providers
NCR	National Capital Region
OPD	Outpatient Department
RAAB	Rapid Assessment of Avoidable Blindness
SCEH	Dr. Shroff's Charity Eye Hospital
SPOC	Single Point of Contact
UPS	Uninterrupted Power Supply System
VCEV	VE Commercial Vehicles Limited

Executive Summary

This report presents a comprehensive impact assessment carried out by Samhita Social Ventures Pvt Ltd of the financial support provided by the Eicher Group Foundation (EGF) to Dr. Shroff's Charity Eye Hospital (SCEH) during the fiscal year 2021-2022. The focus of this support was on upgrading the electrical infrastructure of SCEH, located in New Delhi's Darya Ganj area, aimed at ensuring uninterrupted eye care services for patients from all sections of society. The electrical infrastructure upgrade initiative, funded by a grant of INR 1.1 crore from EGF, involved installing a new generator set and transformer to enhance the hospital's capacity for serving patients.

Through a mixed-methods approach involving primary and secondary research, the study assessed various parameters such as

- Change in patient expenditure post the electrical upgrade
- Need-based programme design
- Frequency of power interruptions post the upgrade
- Change in quality of hospital service for the patients
- Change in workplace quality for hospital staff
- Change in operational costs for the hospital
- Maintenance and upkeep of electrical infrastructure
- Compliance with pollution regulations
- Change in capacity of hospital to manage patient loads
- Change in capacity of hospital to accommodate additional surgeries
- Change in capacity of hospital to operate OTs/ OPDs
- Change in capacity of hospital to introduce new equipment/ technology

under the Inclusiveness, Relevance, Efficiency and Effectiveness, Convergence, and Service Delivery (IRECS) framework before and after the intervention. This framework helps gain a qualitative understanding of the impact created, stakeholder perception, extent of collaboration with other actors and sustenance of the change. The primary research involved both qualitative and quantitative data collection methods. The qualitative data was collected through key informant and in-depth interviews with primary stakeholder such as patients and secondary stakeholders such as doctors, administrative, patient care, electronic medical department staff, nursing and other hospital staff. The quantitative data was collected through telephonic surveys from patients/ caretakers who had visited the hospital before and after the electrical upgrade.

The interactions with different stakeholders and data analysis of the quantitative survey revealed that the electrical infrastructure upgrade improved operational efficiency by reducing fuel consumption, maintained quality of services, and patient care. The upgrade addressed critical needs, including the replacement of a 37-year-old non-compliant generator and a frequently overheating transformer, frequent power interruptions, and increased patient load, enhancing the hospital's capacity to deliver quality healthcare services. Key improvements include reduced patient waiting times, improved workplace quality for staff, and structured equipment maintenance. The average patient waiting period for patients was reduced from 4 hours to 2 hours, facilitated by an electronic medical records system supported by the electrical upgrade. The interactions with medical and non-medical hospital staff also indicated that enhanced infrastructure led to increased staff morale and productivity due to fewer work interruptions during power cuts. Another notable finding was that subsidies for hospital services remained unchanged, with around 50% of services subsidised for individuals from poor socioeconomic backgrounds.

The challenges include complying with the new regulations by the Commission for Air Quality Management that necessitate the retrofitting of emission control devices onto existing diesel generators with a capacity of more than 800 kilowatts. Current studies have estab-lished a correlational relation-ship between many ocular diseases—including ocular trauma, trachoma, cataracts, and retinal pathology—and the surrounding environment. To this end, hospital should collaborate with relevant regulatory authorities like Delhi Pollution Control Committee (DPCC) and the Commission for Air Quality Management (CAQM) to ensure compliance with environmental standards. A social cost-benefit analysis of the project was carried out with data from primary and well as secondary research. Weighing the total monetary value of costs and total monetary value of benefits, the benefit to cost ratio was found to be 1.68. Based on the comprehensive impact assessment and social cost benefit analysis, it is also recommended to continue prioritising investments in sustainable healthcare infrastructure.

1. Introduction

Eicher Motors Limited (EML) is the listed parent company of Royal Enfield, a renowned brand in middleweight motorcycles. Established in 1901, Royal Enfield holds the distinction of being the world's oldest continuously produced motorcycle brand. Eicher Motors defines its commitment to the community in a holistic sense, encompassing social, economic, and environmental spheres within which it operates and contributes[1]. The company implements its Corporate Social Responsibility (CSR) initiatives either independently or through the Eicher Group Foundation (EGF), a Section 8 Company jointly established by Eicher Motors Limited and its unlisted subsidiary VE Commercial Vehicles Limited (VECV). This collaborative effort aims to facilitate and oversee CSR projects undertaken by both entities, ensuring a strategic and impactful approach to social responsibility.[2]

The present report offers a comprehensive impact assessment of EGF's financial support to Dr. Shroff's Charity Eye Hospital (SCEH) during FY 2021-2022, specifically for the electrical infrastructure upgrade programme. This initiative aimed to provide a new generator set and transformer to the hospital in New Delhi at Daryaganj to enable uninterrupted eye care services to patients belonging to all sections of society.

[1]Eicher :: Eicher Motors Limited :: About Us. (2016). https://eicher.in/about-us/heritage

[2] Annual Report on Corporate Social Responsibility (CSR) Activities for the financial year 2022-23. (2023). In STATUTORY REPORTS (pp. 178–179) [Report]. https://eicher.in/content/dam/eicher-motors/investor/corporate-governance/corporate-social-responsibility/CSR-Report-2022-23.pdf

2. About the Programme

2.1 About Implementation Partner - Dr Shroff Charity Eye Hospital (SCEH)

Founded in 1922, Dr. Shroff's Charity Eye Hospital (SCEH) has been a pioneer in providing comprehensive eye care services to the underprivileged sections of society, now comprising 8 hospitals and 53 vision centres. The mission of SCEH is to eradicate blindness and deafness in India through equitable healthcare services. SCEH's vision includes increasing access to eye care, achieving service excellence, developing eye care professionals, fostering innovation through research and technology, and reducing health inequalities through sustainable partnerships[3].

Since its establishment, SCEH has focused on comprehensive eye and Ear, Nose, and Throat (ENT) care, affordability and accessibility, community impact, research, education, and training. Over a hundred years, the hospital has grown into one of India's largest National Accreditation Board for Hospitals and Healthcare Providers (NABH)-accredited eye care institutes, making significant contributions to eye care nationally.

2.2 Relevance of Electrical Infrastructure in Eyecare

A reliable electrical supply is of great significance in hospitals for ensuring the delivery of quality healthcare services[4]. A stable power supply is paramount for the safe operation of critical medical equipment like ventilators and monitoring devices[5]. Proper load calculations and power backup supply play a pivotal role in guaranteeing that the hospital's electrical system can manage the required power demands safely and without interruptions. The technical suitability of electrical infrastructure in hospitals is not only about ensuring the frequency of uninterrupted supply of electricity but also about addressing issues like equipment safety during power overloads and managing ever-growing energy consumption.

Eyecare operations heavily rely on electricity, especially for critical functions like operating theatres, autoclaves, and air conditioning in treatment rooms, essential not only for staff comfort but also for infection control. Ophthalmology, being equipment-intensive, necessitates reliable electricity for various procedures like retinal imaging, refractive surgeries using lasers, corneal topography mapping, and advanced diagnostic equipment such as optical coherence tomography (OCT), fundus cameras, and automated refractors. These machines require stable electricity to function accurately and provide precise diagnostic results. In addition to diagnostics, surgical interventions like cataract surgery, corneal transplants, and retinal surgeries require

[3] Dr. Shroff's Charity Eye Hospital. (2024, April 26). About Us - Dr. Shroff's Charity Eye Hospital. https://sceh.net/about-us/

[4] The importance of reliable critical power in healthcare and hospital settings. (2023.). https://www.ipd.com.au/the-importance-of-reliable-critical-power-in-healthcare-and-hospital-settings

[5] Ibid.

sophisticated equipment such as phacoemulsification machines, operating microscopes, and laser systems. Any interruption in power supply during these delicate procedures can jeopardise the patient’s ability to see and may lead to avoidable blindness. This issue is particularly concerning in the context of India, where the proportion of blindness and visual impairment that is due to avoidable causes constitute 92.9% and 97.4% of the total cases respectively according to the Rapid Assessment of Avoidable Blindness (RAAB) survey conducted in 2015–19. [6] Therefore, addressing the infrastructure challenges related to electricity supply in hospitals in India is not just a matter of operational efficiency but also a fundamental component of providing quality healthcare services and improving patient outcomes, especially in addressing prevalent health issues like avoidable blindness in India.

2.3 About the Programme – Electrical Infrastructure Upgrade at SCEH

The Dr. Shroff Charity Eye Hospital (SCEH) in New Delhi, Darya Ganj, with the support of EGF initiated a project to upgrade its electrical infrastructure during the fiscal year 2021-22. The project focused on procuring and installing a 1000 kilowatt generator set and a 500 kilo-volt-ampere transformer. This initiative, funded by a grant of INR 1.1 crore received on 30 March 2022, was vital for addressing the hospital's needs and ensuring patient care.

The implementation of the project resulted in the installation of the new equipment by September 2022, including the generator becoming fully functional by 11th March 2023. This upgrade increased the hospital's capacity, allowing for the functioning of 10 operation theatres and approximately 30 outpatient chambers, enabling the hospital to have a target to serve an additional 45,00,000 patients in outpatient services and provide sight-restoring surgeries to an extra 4,50,000 patients over the subsequent decade. This significant impact on service delivery aligns with SCEH's mission to contribute to the elimination of avoidable blindness in India, making the electrical infrastructure upgrade a crucial step towards fulfilling their healthcare objectives.

3. Research Methodology

In FY 2024-25, Samhita Social Ventures undertook a project evaluation of the electrical infrastructure upgradation programme supported by EGF and implemented by SCEH in FY 2021-22, with the intention of assessing the intervention’s outcomes.

3.1 Research Objectives and Framework

3.1.1 Objectives of the Study

i. Assess the impact and changes resulting from EGF-supported interventions at SCEH;

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[6] Gupta, N., Senjam, S. S., Gupta, V., Gupta, V., Shamanna, B., Wadhwani, M., Shukla, P., Manna, S., Yadav, S., & Bharadwaj, A. (2022). Blindness and visual impairment and their causes in India: Results of a nationally representative survey. PloS One, 17(7), e0271736. https://doi.org/10.1371/journal.pone.0271736

ii. Identify key elements triggering project-induced changes;
iii. Determine evidence of improved patient services.

3.1.2 Analysis - IRECS Framework

IRECS is a tool that focuses on evaluating the performance of social development projects in terms of inclusiveness, relevance, effectiveness and efficiency, convergence, and sustainability. It helps gain a qualitative understanding of the impact created, stakeholder perception, extent of collaboration with other actors and sustenance of the change.

Parameter	Description	Indicators
Inclusiveness	• Extent to which communities equitably access benefits of assets created and services delivered • Role of different stakeholders in project design and implementation	• Change in patient expenditure post the electrical upgrade
Relevance	• Whether the project is geared to respond to the needs of communities	• Need-based programme design • Frequency of power interruptions post the upgrade
Efficiency and Effectiveness	• The extent to which project implementation meets the expectations of communities, • Extent of intended and unintended positive (benefits), socioeconomic, and cultural changes accrued for beneficiaries • How efficiently resources are utilised	• Change in quality of hospital service for the patients • Change in workplace quality for hospital staff • Change in operational costs for the hospital • Maintenance and upkeep
Convergence	• Degree of convergence with government/other partners and linkages with concurrent government programmes in the field • Degree of stakeholder buy-in achieved	• Compliance with pollution regulations

Parameter	Description	Indicators
Service Delivery	• State of operations of programme outputs in terms of delivering intended services to beneficiaries	• Change in capacity of hospital to manage patient loads • Change in capacity of hospital to operate OTs/ OPDs • Change in capacity of hospital for new equipment/ technology • Change in capacity of hospital to accommodate additional surgeries

3.1.3 Modes of Data Collection

Samhita adopted a mixed-methods study involving primary and secondary research. This involved the following:

1. Secondary Research

This stage included the review and analysis of documents about the programme including project inception reports, programme design, progress reports, and MIS, to map the various stakeholders involved and create a research framework.

2. Primary Research

Quantitative data collection was undertaken by administering structured, digitised surveys to the primary stakeholders of the programme i.e. the patients at the hospital for the electrical & infrastructure upgradation programme through telephone. The tools collected data on various parameters, including patient demographics, their perception of the program's impact on access, affordability, and quality of eyecare, as well as the actual impact of the program. Additional indicators relevant to the program were also assessed, such as changes in patient waiting times, changes in waiting times for surgeries, and the adequacy of hospital lighting before and after the electrical upgrade.

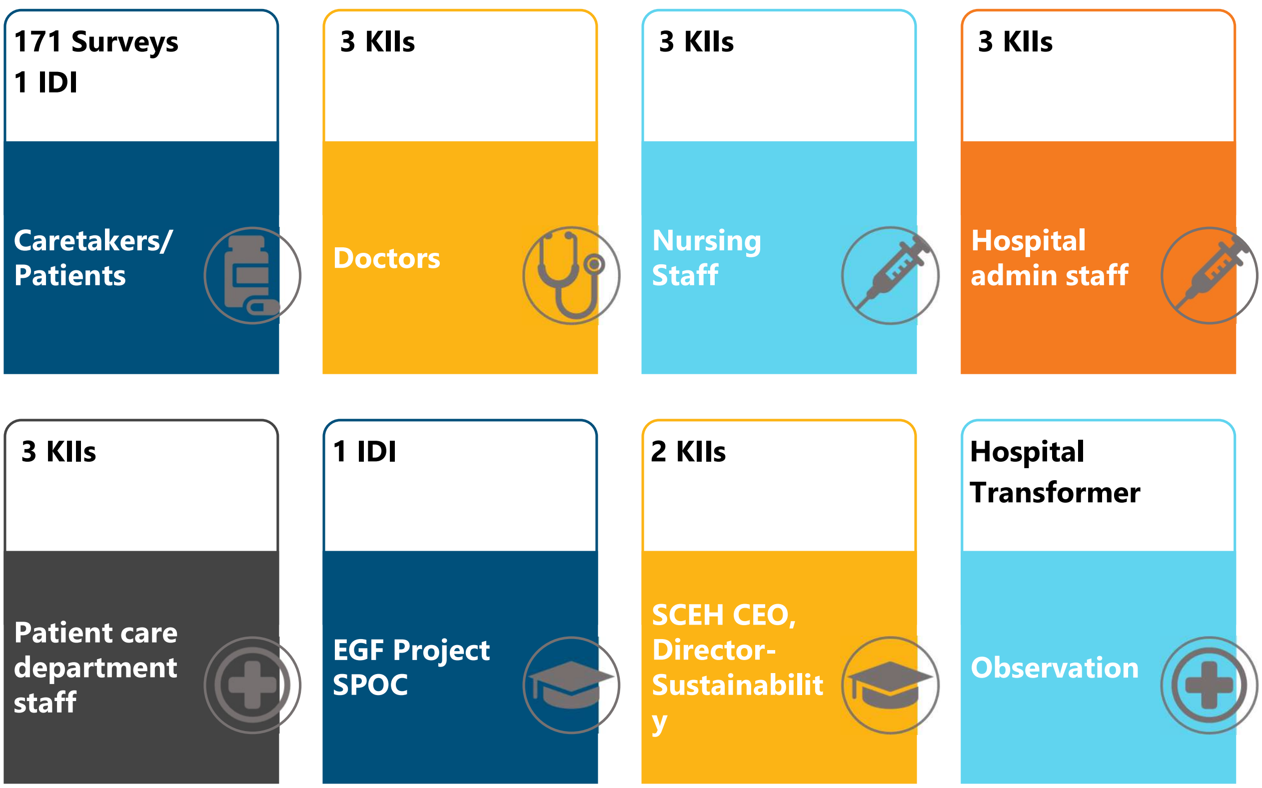
Qualitative data collection was undertaken with secondary stakeholders such as SCEH medical – doctors, nursing dept staff and non-medical staff – administrative staff, patient care department staff, and EGF programme SPOCs to triangulate findings and obtain a more holistic understanding of programme implementation and impact.

The details of the methods used for this study are as follows -

- **In-depth interviews / Key Informant Interviews:** Face-to-face interviews based on interaction guides were conducted with primary stakeholders such as patients, key stakeholders like SCEH medical and non-medical staff, EGF programme coordinators, and patients to gain a comprehensive understanding of the impact of the programme.
- **Observations:** Observation of the electrical infrastructure upgrade at Dr Shroff Charity Eye Hospital was carried out with the help of an observation checklist[7] to gain an understanding of the efficiency of the use of resources including its maintenance and upkeep.

3.1.4 Sampling

For the qualitative data collection, purposive sampling was followed to interact with programme stakeholders as per the sample sizes stated in the figure below.



A random sampling technique was used to select the respondents for patient surveys from a database of patients who had visited the hospital in FY 22-23 when the transformer and generator became functional and FY 23-24, the year following that. A sample with a 95% confidence level

[7] Observation checklist is added to the Annexure

and a 7.5% margin of error from a sample universe of all patients was taken into consideration for the assessment having a total of 171 surveys. The patients or caretakers for the electrical and infrastructure upgrade programme were surveyed by telephone. However, in cases where patients were under the age of ten the patient's caretaker was the respondent. The respondents were administered through a structured survey by a team of enumerators in their vernacular language.

4. Profile of Primary Stakeholders

4.1 Gender Profile

Out of the 171 respondents, 43.86% identified as female, 55.56% as male and 0.58% (1 individual) as transgender. The gender profile of the respondents is depicted in the graph given below.

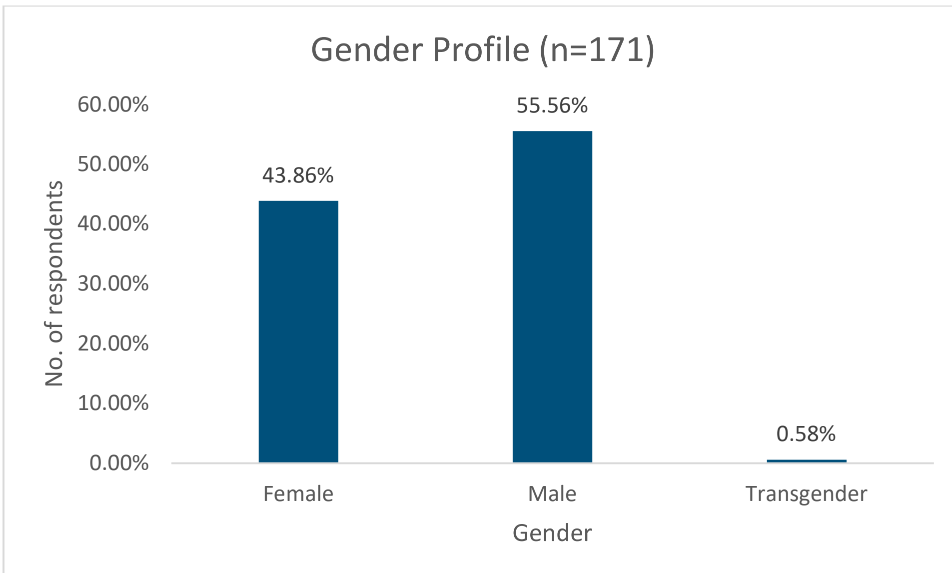


Figure 1 Gender Profile

4.2 Age Profile

Out of 171 respondents, the majority (35.67%) belonged to the age group above 60 years old, while 29.24% were below 18 years old. 16.96% of the respondents were between the ages of 46 and 60, 9.94% were between 31 and 45, and 8.19% were between 18 and 30. Through interaction with the patient care, administrative, and nursing department staff, it was confirmed that patients come from all age groups – including those above 60 years old and below 5 years old. This data is in line with the National Blindness and Visual Impairment Survey 2015-2019 findings that suggest that the prevalence of blindness and visual impairment among the age group above 60 is greater than that of other age groups with a rate of 1.99 and 1.96 respectively[8].

[8] National Programme for Control of Blindness & Visual Impairment (NPCBVI). (2019). Report on the National Programme for Control of Blindness & Visual Impairment. Ministry of Health and Family Welfare, Government of India. https://npcbvi.mohfw.gov.in/writeReadData/mainlinkFile/File341.pdf

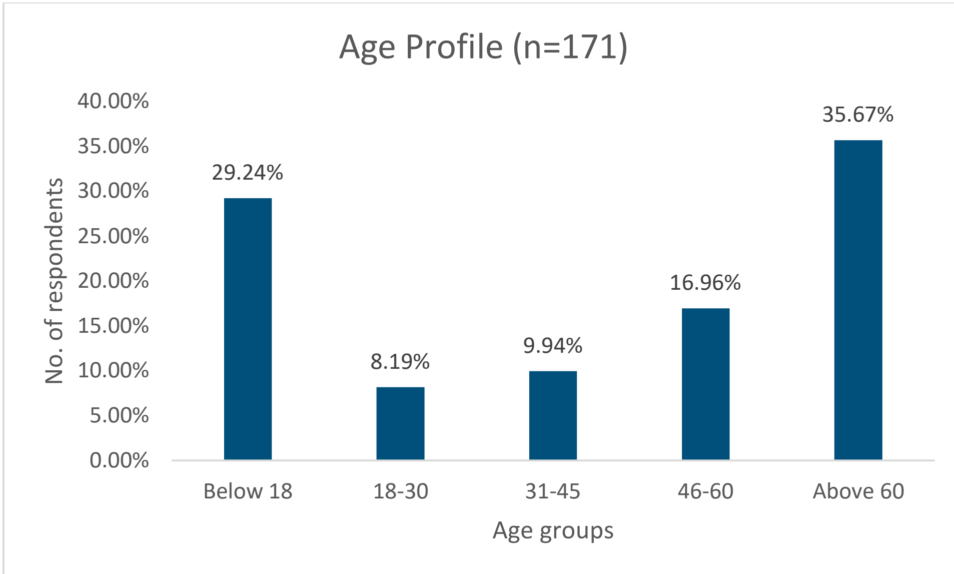


Figure 2 Age Profile

4.3 Income Profile

Out of the 171 respondents, 75.44% reported an average annual income between INR 10,000 and INR 50,000. Additionally, 18.71% had a yearly income of less than INR 100,000, 3.51% reported an average annual income between INR 50,000 and INR 100,000, and 2.34% did not disclose their income. These findings were corroborated by interactions with administrative staff, who indicated that individuals from lower middle-class and lower-class income groups predominantly utilise the services, as the institution mandates that 50% of total medical care be provided free of charge.

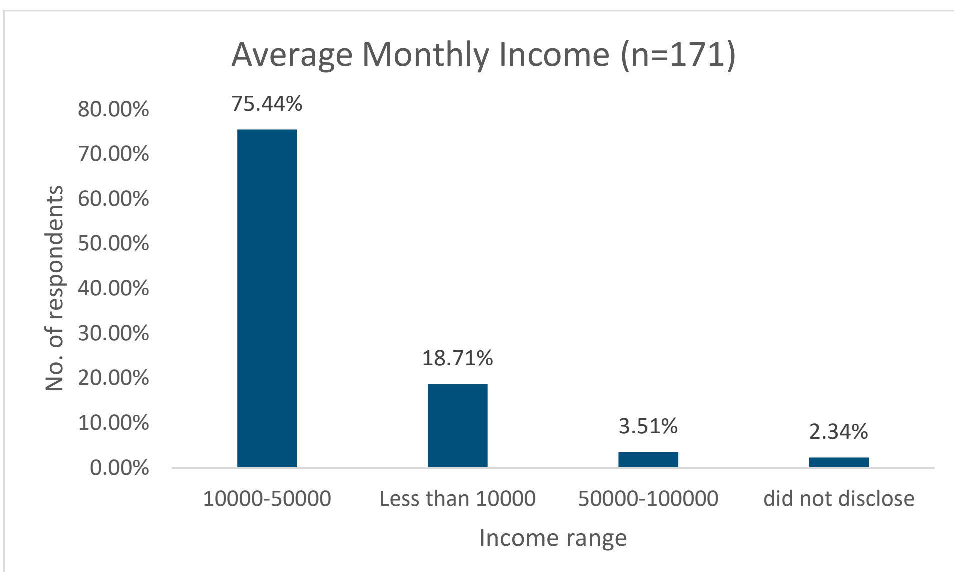


Figure 3 Income Profile

4.4 Medical History

Out of the 171 respondents, most of them visited the hospital for multiple issues, almost half of the respondents (49.8%) had myopia, a sizeable 13.1% of people were operated on for cataracts, 10.8% of respondents had irritation in the eye, 9.6% of respondents had trouble reading text, rest of the respondents visited for other reasons such as glaucoma, ENT, dryness/watering of eyes. This data is in line with the National Blindness and Visual Impairment Survey 2015-2019 findings that suggest that refractive errors such as myopia, and hyperopia are the leading cause of visual impairment accounting for 29.6 per cent of all cases of blindness in India and cataracts are the second leading cause of visual impairment, accounting for 25.2 per cent of the cases[9].

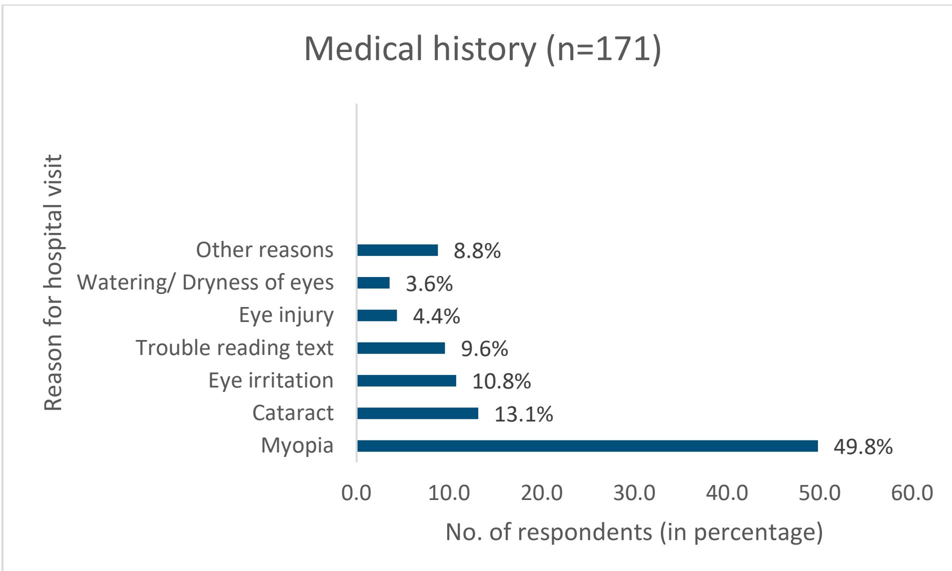


Figure 4 Medical History Profile

[9] National Programme for Control of Blindness & Visual Impairment (NPCBVI). (2019). Report on the National Programme for Control of Blindness & Visual Impairment. Ministry of Health and Family Welfare, Government of India. https://npcbvi.mohfw.gov.in/writeReadData/mainlinkFile/File341.pdf

5. Key Findings

Parameters	2021-22 (Pre-Intervention)	2022-24 (Post-Intervention)
Inclusiveness indicators		
Economic accessibility maintained	• 50% of hospital services subsidised for individuals from poor socio-economic backgrounds as per SCEH counsellor assessment	• This remains the same even after the upgrade; the cost of operations and upgrade is not transferred to the patients
Relevance indicators		
Need-based programme design	• 37-years-old diesel generator was being used which was non-compliant with Delhi Pollution Control Committee norms	• EGF-sponsored generator set compliant with Delhi Pollution Control Committee norms installed
Frequency of power interruptions	• Power outages lasting 30-60 minutes were common and power backup was prioritised for operation theatres and medical areas such as OPD over non-medical areas	• Transformer doubled power capacity and generator set was able to provide backup power in patient and non-patient areas with minimal transitory loss of power
Efficiency and Effectiveness indicators		
Change in quality of hospital services	• Average patient waiting period was 4 hours	• Average patient waiting period reduced to 2 hours facilitated by electronic medical records system indirectly supported by electrical upgrade

Change in workplace quality for hospital staff	• Interruptions in work during power cuts and patient distress during power cuts affected the morale of the hospital staff	• Increased morale and workplace productivity due to presence of back up supply even during power outages
Maintenance and upkeep	NA	• Daily maintenance and periodic maintenance carried out periodically and no generator/ transformer breakdowns so far
Savings on operational costs	• Hospital relied on a 37-year-old diesel generator set that contributed to high fuel consumption regardless of energy demand, leading to significant inefficiencies in energy usage and increased operational costs	• New diesel generator set, capable of adjusting fuel consumption according to load requirements, resulted in improved energy efficiency, with fuel consumption of 1350 litres over 20 hours compared to the expected 1634 litres for a standard generator • New transformer enhanced voltage stability, reducing power outages and equipment damage, ensuring a more reliable power supply and operational cost savings
Convergence indicators		

Compliance with pollution regulations	• Old generator set not compliant with Delhi Pollution Control Committee norms that necessitated	• New generator set compliant with Delhi Pollution Control Committee norms
Service delivery indicators		
Change in capacity for new equipment/ technology	• Limited capacity to add new equipment/ technology	• Addition of new equipment and an additional 155-ton air conditioning capacity supported by the upgrade post-COVID
Change in capacity to support additional OTs/ OPDs	• Capacity to support 6 operation theatres	• Capacity to support an 10 operation theatres
Change in capacity to support additional surgeries	• Capacity to support an average 50 surgeries daily (16405 surgeries in 2019-2020)	• Capacity to support 1.6 times more surgeries without interruptions compared to 2019-2020 (26095 surgeries in 2023-2024)
Change in capacity to manage increasing patient load	• Capacity to support the patient flow of an average of 600 patients daily (185590 patients in 2019-2020)	• Capacity to support increased patient flow capacity by 1.4 times compared to 2019-2020 (258221 patients in 2023-2024)

Table 1 Key findings

6. Detailed Findings

6.1 Inclusiveness Indicators

6.1.1 Economic accessibility maintained

Through interactions with the patient care department staff and administrative staff, it was found that there are sliding consultation rates for different categories of outpatients – express outpatients consultations (OPD) is charged at INR 1200, private OPD at INR 750, and general OPD at INR 100. Patients who cannot afford the charges of surgeries are assessed by a counselling team with the help of an assessment form.

"We see all patients as equal whether paying or not. There are different categories in OPD – Express OPD charged at INR 1200, private OPD charged at INR 750, general OPD charged at INR 100. This information is given to patients firsthand during hospital visit so that they could make an informed choice."

- Patient care dept staff 2, KII

"Doctors and counsellors take the final call on who should get free or subsidised surgeries. An assessment form with all the details to gauge the socio-economic background of the patient is collected for this purpose."

- Patient care dept staff 1, KII

The assessment form for patients includes various criteria, including identification details such as Aadhaar, financial information like salary or wages alongside family size and validation documents for proof of the furnished details in forms such as a Below Poverty Line (BPL) card, Economically Weaker Section (EWS) certificate, certificate from Pradhan/ Ward commissioner/ MLA. This comprehensive approach aims to gauge the socioeconomic background of individuals seeking care. This is important because, in India, 64.7% of healthcare is financed through out-of-pocket payments by households[10].

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[10] National Health Accounts Cell. National Health Accounts Estimates for India Financial Year 2015-16. New Delhi: Ministry of Health and Family Welfare, Government of India; 2018. p. 13.

The hospital's mission is anchored in providing eye care to those in need, transcending economic barriers. This hasn't changed even after the electrical upgrade and no cost of the upgrade was transferred to the patients as confirmed by the quantitative survey with the patients who visited the hospital before and after the upgrade. This is depicted in Figure 5. 47.37% of the respondents still found the hospital services highly affordable in 2023-2024 compared to 49.12% of respondents who found the hospital services highly affordable in 2022-2023. This was also validated by the data from the SCEH electronic medical record department, depicted in Figure 6.

> ***"My eye tests are free and my doctor keeps affirming me not to worry about the cost of my surgeries. I have been visiting the hospital for a long time and this has been the case ever since."***
>
> ***- Patient 1, KII***

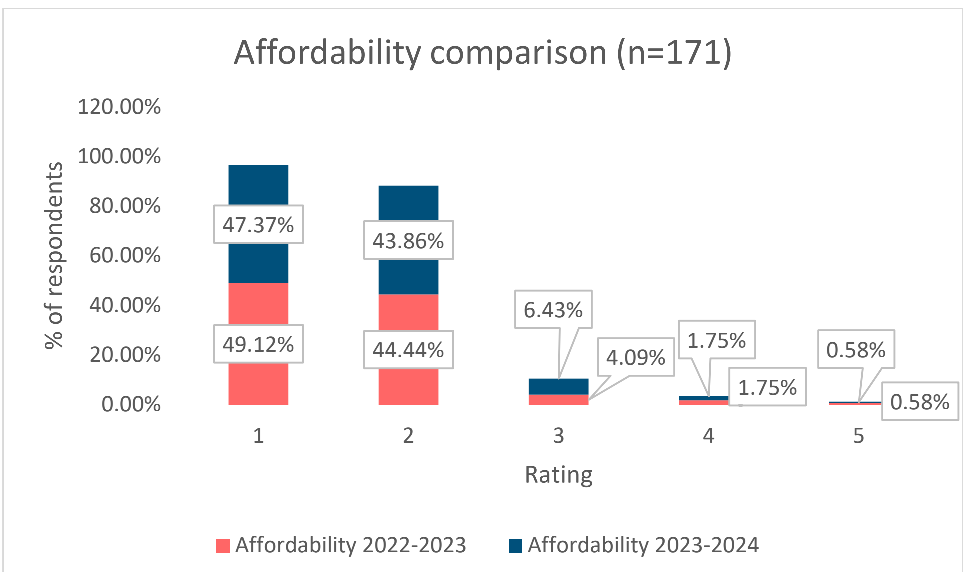

Figure 5 Comparison of affordability pre and post-intervention

Rating	Description
1	Most affordable
2	Affordable
3	Moderately affordable

4	Less affordable
5	Least affordable

Table 2 Rating description for affordability of service

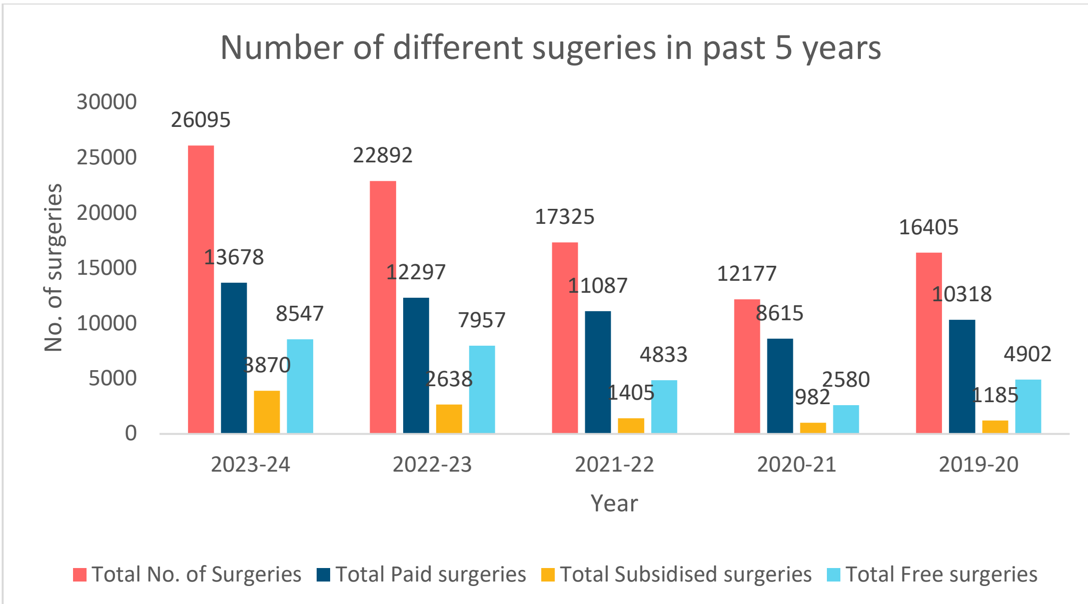

Figure 6 Number of different surgeries in past 5 years

In the fiscal year 2023-2024, a total of 26,095 surgeries were conducted. Of these, 52.4% were paid, 14.8% were subsidised, and 32.7% were free. In comparison, during the fiscal year 2022-2023, 22,892 surgeries were performed, with 53.7% being paid, 11.5% subsidised, and 34.7% free. The proportion of free and subsidised surgeries remained relatively stable, constituting 47.5% of the total surgeries in FY 2023-2024 and 46.2% in FY 2022-2023. This data validates that neither the operating costs nor the expenses associated with electrical upgrades have been transferred to patients in the form of increased surgery costs.

6.2 Relevance Indicators

6.2.1 Need-based programme design

The interactions with hospital administrative staff revealed that the need for upgraded electrical infrastructure was two-fold – one, in terms of managing the increasing patient load in the face of frequent power cuts, and two, in terms of compliance requirements.

Figure 7 New generator set with 1000 KW capacity

Figure 8 New transformer of 500 KVA capacity

The hospital previously relied on a 37-year-old generator with a capacity of 380 kW, which struggled to handle the load during power cuts. From various interactions with the patient care supervisor, and nursing staff, it was inferred that during frequent power cuts especially during summer seasons lasting from 0.5 to 1 hour, they first had to reduce the load coming onto the generator before switching it on as the capacity of the generators was less. The priority for backup supply was given to operation theatres (OTs), followed by OPDs, then wards and finally the non-medical areas. The waiting time for patients was as high as 3 hours during this period, confirmed by both quantitative surveys and in-depth interviews with patients/caretakers.

> ***"Older generator was about 37 years old and of 380kw capacity. It could not take the whole hospital load during power cuts, so the administrative block lights, most of the ACs had to be switched off before starting the generator."***
>
> **- *Administrative Staff 1, SCEH***

The older 500 kW transformer also frequently overheated and tripped, especially when the load increased to 800-1600 kW. This caused frequent power interruptions. Over the past four years, hospital functionality increased by 30-40% due to increased surgeries and patient visits. Ophthalmology requires reliable electricity for retinal imaging procedures, transformers were operating at over 80% capacity, posing safety risks and requiring makeshift cooling methods, thus making the upgrade imperative.

> ***"Previously, we operated transformers at over 80%, often requiring makeshift cooling methods. During power cuts, we prioritised electricity supply for critical areas. Upgrading was imperative to meet these growing demands and comply with safety regulations."***
>
> **- *CEO, SCEH***

The old generator also did not comply with Delhi Pollution Control Committee (DPCC) regulations which necessitated the replacement of diesel generators older than 15 years in the National Capital Region (NCR). With support from EGF, when SCEH was able to replace it with the new generator and comply with the regulations.

6.2.2 Decreased power interruptions after the upgrade

After interactions with hospital staff, it was identified that during the summer months from March-June, there were frequent power interruptions and most of the non-medical equipment such as ACs, and fans in waiting areas had to be switched off before switching on the generator for power backup. These interruptions would affect the electronic medical registrations and lead to increased waiting time for patients. Interactions with nurses and patient care department staff revealed that patients used to be distressed due to these reasons.

> ***Now power cuts are not felt much. Earlier, the generator had to be switched on, which took time."***
>
> **- *Patient 1, KII***

After the electrical upgrade, wherein a new transformer with 500KVA capacity and a generator with 1000 KW capacity were installed which minimised the power interruptions. Once the main power is cut off, it takes less than 2 minutes for the generator backup power supply to power the medical and non-medical areas whereas earlier patients, and staff sometimes had to wait 15-20 minutes before the power was back on which translated into an average waiting time of more than three hours for patients. This was also physically verified by the researchers from Samhita during observations.

An Automatic Main Failure Panel (AMF) was also installed as part of the upgrade. AMF panels are designed to restore power during power failures and are installed in between the generators and the main power supply. When the main supply failure occurs, the panel disconnects the main from the load, activates the generator and shifts the load to the generator output. On the restoration of the main supply, the generator automatically stops, gets disconnected and the load is again transferred to the mains - maintain power factoring and distribution to different departments minimising power interruptions.

6.3 Efficiency and Effectiveness Indicators

6.3.1 Improved quality of service for the patients

Through interactions and surveys with patients as well as staff from the patient care department, it was found that the waiting time of patients saw an improvement. This was also validated through the quantitative surveys where it was found that the average waiting time of patients decreased by around 6 minutes from 90.94 minutes in 2022-23 to 84.57 minutes in 2023-24.

> ***"Earlier the waiting time was very high around 3 hours, now I am able to complete all procedures by 2 hours and leave the hospital."***
>
> ***- Patient 1, KII***

Different factors facilitated this improvement including the electronic medical record system's triage flow that divided the patient cohort into two age groups and pre-screening on individuals above 50 years old, among others. Various interviews with electronic medical record department staff and patient care supervisors indicated that these factors functioned without interruptions due to the electrical upgrade, thereby indirectly enhancing the quality of service for patients. This was corroborated by a quantitative survey, in which 90.6% of respondents rated the quality of service at the hospital post-upgrade as either "highest quality" (rating of 1) or "good quality" (rating of 2). When compared to pre-intervention data from FY 2022-2023, 91.7% of respondents had given similar ratings, indicating a rating of 1 or 2 for the quality of service at the hospital.

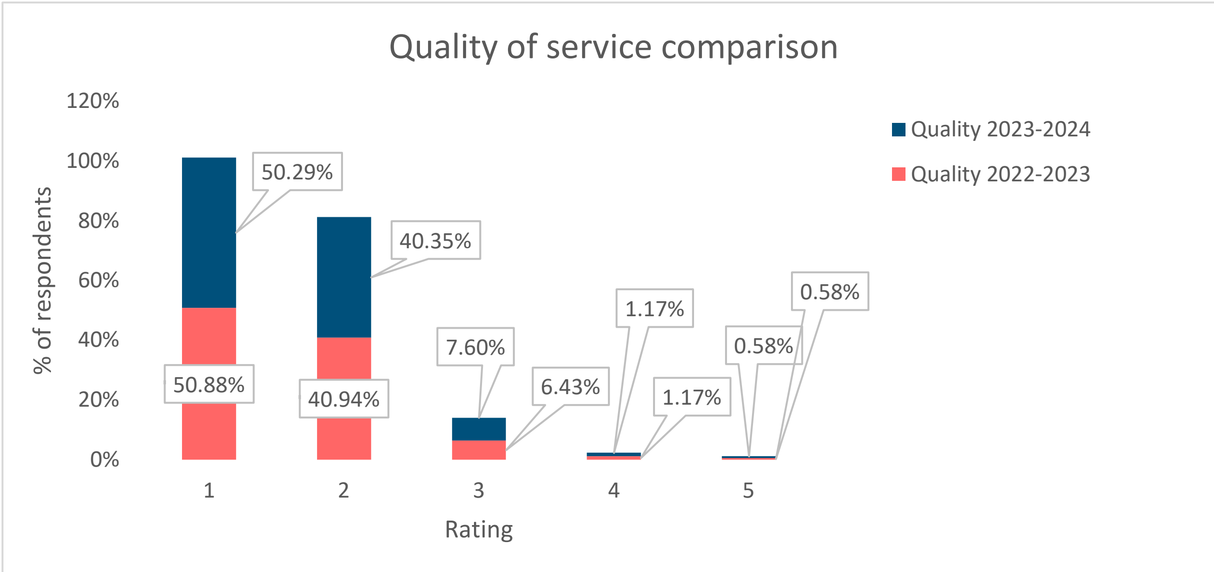

Figure 9 Quality of service comparison

6.3.2 Improved workplace quality for hospital staff

Prior to the recent electrical infrastructure upgrade, the hospital staff faced significant challenges due to frequent power outages. These challenges were two-fold. Firstly, patients often experienced distress when air conditioning in waiting areas or wards was turned off, or when registration services had to be halted due to electricity issues. Nursing and patient care staff were at the forefront, bearing the brunt of patient dissatisfaction. Interviews with nursing staff revealed that these issues significantly affected their morale.

> ***"Patients used to get aggressive during power cuts. Nursing staff were at the forefront bearing the brunt of it. Now, we are relieved that we don't need to go through that. Employee satisfaction is also important."***
>
> \- ***Nursing staff 1, KII***

Secondly, non-medical staff were frequently forced to leave their workstations and sit outside or in gardens due to the lack of power backup during outages. Interviews with administrative staff highlighted that the hospital's backup system was consistently overloaded. This situation necessitated instructions to non-biomedical staff to avoid using air conditioning and, in some cases, to switch off the power supply to entire non-medical departments. This measure was crucial to conserve and divert power to critical areas such as Operating Theatres (OTs). Consequently, the productivity of non-medical staff was significantly impacted, as they had to wait for the power to be restored before they could resume their work.

> ***"We are human beings - when we get a good working environment, our productivity will also increase."***
>
> **- *Patient care department staff 1, KII***

Research indicates that staff morale improves significantly when they have reliable infrastructure to support their work, leading to reduced stress and enhanced productivity[11]. Although the direct correlation between infrastructure upgrades and staff morale may not be easily quantifiable in this case, interactions with the non-medical staff showed that these upgrades have had a substantial indirect impact.

The recent upgrades have addressed the overload issues of the backup system. With the new generator capable of handling the power demands of OTs, wards, and non-patient areas such as non-medical staff offices simultaneously, staff no longer need to pause their work during power cuts. This improvement has led to enhanced staff morale and productivity, as the fear of work interruptions due to power failures has been mitigated.

6.3.3 Structured maintenance and upkeep

An interaction with the head of the administrative department revealed that the hospital maintains a comprehensive master plan for the upkeep of various equipment, including generators, transformers, and other biomedical devices. This master plan is developed in consultation with manufacturers to determine the necessary frequency of preventive maintenance.

[11] [11] Mj, E., Eu, A., & Nm, P. (2017). Impact of workplace environment on health workers. Occupational Medicine & Health Affairs, 05(02). https://doi.org/10.4172/2329-6879.1000301

> ***"Non-medical areas were more affected, with employees often having to sit in gardens, which disrupted their work.***
>
> ***- Administrative department staff 3, KII***

Each month, a list of equipment scheduled for preventive maintenance is generated. In addition to daily maintenance performed by the administrative staff on transformers and generators, periodic maintenance is conducted at intervals recommended by the manufacturers. This process is independently managed and funded by the hospital's annual budget. To minimise disruptions to hospital services, preventive maintenance is typically scheduled on Sundays.

Since the implementation of this maintenance strategy, there have been no breakdowns of either the transformers or the generators. This reliability is crucial, as effective maintenance is a key component in ensuring an uninterrupted power supply, thereby supporting the continuous delivery of hospital services.

6.3.4 Improved savings on operational costs

Prior to the recent electrical infrastructure upgrade, the hospital relied on a 37-year-old diesel generator set that consumed a much larger amount of power than conventional equipment. This outdated equipment contributed to inefficiencies in energy usage and increased operational costs.

Interviews with administrative department staff and the director of sustainability revealed that the recent infrastructural upgrades have significantly enhanced both energy efficiency and reliability. The installation of a new diesel generator set, capable of adjusting fuel consumption according to load requirements has resulted in improved energy efficiency. The total running hours for the generator set from the date 13/3/23 to till date was 20 hrs. and its fuel consumption was 1350 litre. The average efficiency of a normal diesel generator set of 1000KW capacity is 81.7 per litre[12] i.e. a normal diesel generator should have consumed 1634 litre of diesel.

[12] Sales. (2024, March 5). Diesel Generator Fuel Consumption Chart (in Gallons & Litres) - Swift Equipment Solutions. *Swift Equipment Solutions*. https://swiftequipment.com/diesel-generator-fuel-consumption-chart-in-gallons-litres/

Additionally, the installation of a new transformer has enhanced voltage stability, thereby reducing the risk of power outages and equipment damage. This improvement not only ensures a more reliable power supply but also contributes to operational cost savings by minimising disruptions and maintenance expenses.

The upgrades have enabled better management of energy resources, optimising usage to effectively meet the hospital's needs. According to the Director, of Sustainability, it is anticipated that, over time, these enhancements will lead to more substantial energy savings and cost efficiencies.

> ***"Overtime, these electrical infrastructure improvements may lead to more significant energy savings and cost efficiencies "***
>
> **- *Director, Sustainability***
>
> -

6.4 Convergence Indicators

6.4.1 Improved compliance with pollution regulations

The Delhi Pollution Control Committee (DPCC) and the Commission for Air Quality Management (CAQM) in the National Capital Region (NCR) have consistently identified the extensive use of diesel generators as a significant contributor to the deteriorating air quality in the region. In response, the CAQM has issued several orders and advisories since February 2022 to control emissions from diesel generator sets. Among these directives was the mandate to replace diesel generators older than 15 years[13]. With the support from EGF, the existing generator, which was 37 years old and non-compliant with DPCC norms, was replaced with a new unit. A compliance monitoring report from the DPCC confirmed that the new generator met the necessary standards before commencing operations.

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[13] Pati, I. (2022, March 9). Diesel generator sets older than 15 years likely to be scrapped in Delhi-NCR. *The Times of India*. https://timesofindia.indiatimes.com/city/gurgaon/diesel-generator-sets-older-than-15-years-likely-to-be-scrapped-in-delhi-ncr/articleshow/90089069.cms

> ***"Our current infrastructure meets immediate needs, but with increasing patient loads, growth-driven investments are inevitable. While we've considered solar energy, practical constraints like space and initial investment hinder large-scale adoption."***
>
> **- *Director, Sustainability***

The most recent regulation from the CAQM requires all diesel generators in the Delhi NCR region with a capacity greater than 800 kW to be retrofitted with emission control devices[14]. However, SCEH has not yet implemented this requirement. Interviews with the hospital's administrative head and staff revealed several challenges: One, The Daryaganj area, where the hospital is located, lacks the necessary infrastructure to support generators that run on gas. This makes the option of switching to gas-powered generators infeasible. Two, the hospital's administrative team expressed a lack of clarity on the procedures and technical requirements for retrofitting existing diesel generators with emission control devices. This uncertainty is a significant barrier to compliance with the latest CAQM regulation.

6.5 Service Delivery Indicators

6.5.1 Improved capacity to manage patient load

SCEH, a leading eye care hospital, experienced a surge in patient footfall due to its quality of healthcare services and affordability. This necessitated an increase in the electricity backup capacity as the existing 37-year-old generator with a capacity of 380 kW and the older 500 kW transformer could no longer meet the rising load of the hospital. The primary objective of this intervention was to ensure an uninterrupted power supply to support the hospital's operations effectively.

The interactions with the electronic medical department staff, doctors, and CEO revealed that the capacity of the hospital to cater to patients has increased since the intervention of the electrical infrastructure upgrade. This was also verified using the data from the electronic department depicted in Figure 10 showing the increase in the number of patients catered to by the hospital in the past 5 years.

[14] Commission for Air Quality Management in NCR and Adjoining Areas. (2023). Press Release on Operation of DG sets in NCR under GRAP Regulations. In *Commission for Air Quality Management in NCR and Adjoining Areas* [Press-release]. https://caqm.nic.in/WriteReadData/LINKS/CAQM%20PR%2008%2006%202023%20014ba02f-c8d4-413f-b51b-d02f75a8d3052889aac5-08b7-43f8-a7bb-b1c1c5c4b79b.pdf

The electrical infrastructure was able to support an increase of 6.7% in the number of patients from the FY 2022-2023 and an overall capacity increase of 1.4 times compared to 2019-2020. This is evidenced by the number of patients served, with 258,221 patients in 2023-2024, compared to 185,590 patients in 2019-2020.

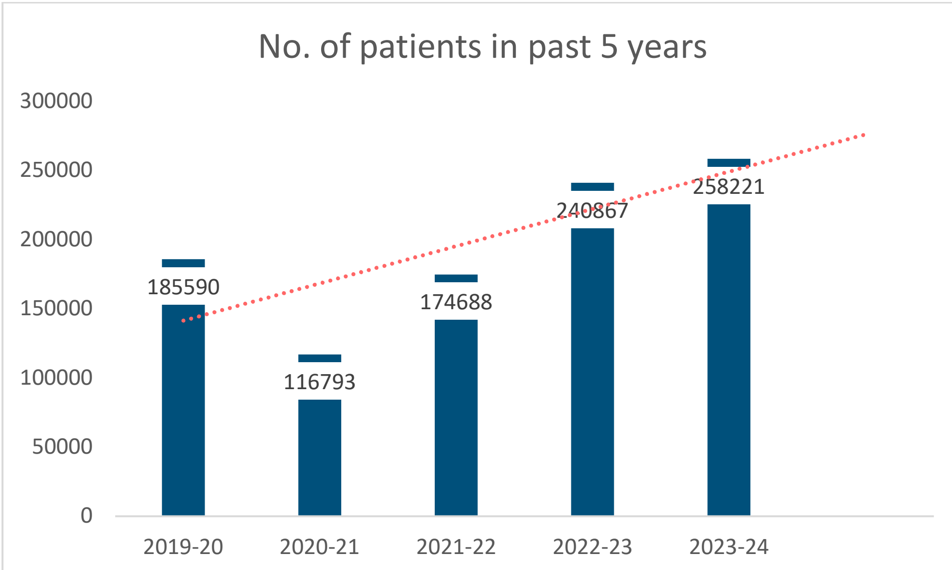


Figure 10 No of patients in past 5 years

6.5.2 Improved capacity for operation theatres (OTs) and OPD chambers

SCEH, before the intervention, experienced negligible power failures in the Operating Theaters (OTs) due to prioritisation during power cuts and the presence of an Uninterrupted Power Supply (UPS) system. However, the challenge arose due to an increasing number of patients requiring surgeries and a shortage of wards and OTs, resulting in a week of waiting for surgical procedures. Before the intervention, there were 6 OTs in the hospital which was insufficient to serve the increasing patient load. The increase in patient load from 185,590 patients in 2019-2020 to 258,221 patients in 2023-2024 not only necessitated additional OTs but also called for additional OPDs. Based on interaction with different stakeholders at the hospital and physical observation, it was found that four new OTs have been added to the hospital post the upgrade and OPDs have also been extended from 3 to 7.

> ***"First, we used to think how load will be managed, now we can extend our hospital infrastructure without any worries, general OPDs were extended, and new equipment were introduced. "***
>
> \- ***Administrative Staff 3, SCEH***

Interviews with doctors and administrative staff revealed a significant improvement in their ability to introduce and operate new medical equipment without concerns about electrical load capacity. Previously, the limited electrical infrastructure necessitated careful deliberation and often restricted the addition of new equipment due to potential overload risks. The enhanced electrical system now provides the necessary support for modern medical technologies, fostering an environment of innovation and efficiency. The table below is data obtained from the administrative department which shows the new equipment brought to the hospital after the upgradation of the electrical infrastructure. An additional 155-ton AC capacity could be installed in the hospital post the electrical upgrade. Also, the electrical infrastructure supports the second-largest eye bank in India, after AIIMS, and the stem cell research lab funded by Eicher Group where the support of non-fluctuating electricity is essential.

> ***"Previously, we had to carefully consider how the electrical load would be managed before introducing new equipment. Now, we can extend our capabilities without any worries, allowing us to enhance the infrastructure of our general outpatient departments and acquire new equipment seamlessly***
>
> - ***Director, Sustainability***

Sr. No.	Dept.	Equipment Name	Qty.
1	OT	Microscope	04 No.
		Phaco Machine	04 No.
		Oxygen Plant	01 No.
		Recording system	04 No.
		OCT Microscope	01No.
		A-SCAN	01 No.
		UBM Machine	01 No.
2	Stem cell Lab	Deep Freezer	03 No.
		Microscope	01 No.
		Fridge	04 No.
		Hot Case	01 No.
3	Gen OPD All	Slit lamp	05No.
		Ophthalmic Chair	08No.

		I-Chart	11 No.
		Vision Drum	07 No.
		Yag Laser	01 No.
		Photo Slit lamp	02 No.
		A-scan Machine	02 No.
		IOL Master	01 No.
		Keretometer	01 No.
		Computer	20 No.
4	Gen Children OPD	Slit lamp	07 No.
		Ophthalmic Chair	07 No.
		I-Chart	13 No.
		NCT	02No.
		Computer	18 No.
5	PVT Children OPD 1st Floor	Applanation Tonometer	01 No.
		Indirect Ophthalmoscope	01 No.
		I CHART	04 No.
		Ophthalmic Unit	04 No.
		Slit Lamp	02 No.
		Computer	06 No.
6	Low Vision Computer Center	Computer	08 No.

Table 3 Equipment added post-upgrade

Sr. No.	Dept.	Qty.	A/C Capacity
1	OT	4 No.	28 Ton
2	IT + Bio-medical	02 No.	2 Ton
3	Project Prakash	07 No.	8.5 Ton
4	SP Core	07 No.	14 Ton
5	Stem cell Lab	11 No.	16.5 Ton
6	Gen OPD All	11 No.	19 Ton
7	Gen Counselling	07 No.	11.5 Ton
8	Gen Children OPD	08 No.	12 Ton
9	PVT Children OPD 1st Floor	10 No.	14 Ton
10	Khemka ward	03 No.	4.5 Ton
11	Public HealthCare Dept.	09 No.	14 Ton

12	Optical Shop	03 No.	5.5 Ton
13	Pharmacy	01 No.	2 Ton
14	Low Vision Computer Center	02 No.	3.5 Ton
	Total Ton		**155 Ton**

Table 4 AC capacity post electrical upgrade

6.5.3 Improved capacity for additional surgeries

Previously, SCEH faced challenges in expanding the number of surgeries due to limitations in electricity backup for OTs and an increase in the number of patients leading to a shortage of medical equipment for surgeries like high-precision operating microscopes, crucial for magnifying the small and delicate structures of the eye, require consistent illumination and magnification during surgery. Phacoemulsification machines, used in cataract surgery, depend on electrical power for ultrasound function, and excimer lasers for LASIK procedures, need precise and stable electrical power to maintain the accuracy and safety of the laser pulses.

In the past few years, SCEH has seen a significant increase in the number of surgeries performed, reflecting the growing demand for surgical interventions. Data shows that in FY 22-23, 22,892 surgeries were conducted, while in FY 23-24, this number rose to 26,095. Addressing these challenges, SCEH increased its number of OTs from six to ten, enabling better and more timely operations for patients.

> ***"Earlier we were performing 50 surgeries in a day, now we sometimes perform 100 surgeries in a day which has almost doubled due to overall increase in the capacity of hospital "***
>
> \- ***CEO, SCEH***

The interactions with the electronic medical department staff, doctors, and CEO revealed that the capacity of the hospital to cater to additional surgeries has increased since the electrical infrastructure upgrade. The electrical infrastructure was able to support an increase of 12.27% in the number of surgeries from the FY 2022-2023 and an overall capacity increase of 1.6 times more surgeries without interruptions compared to 2019-2020.

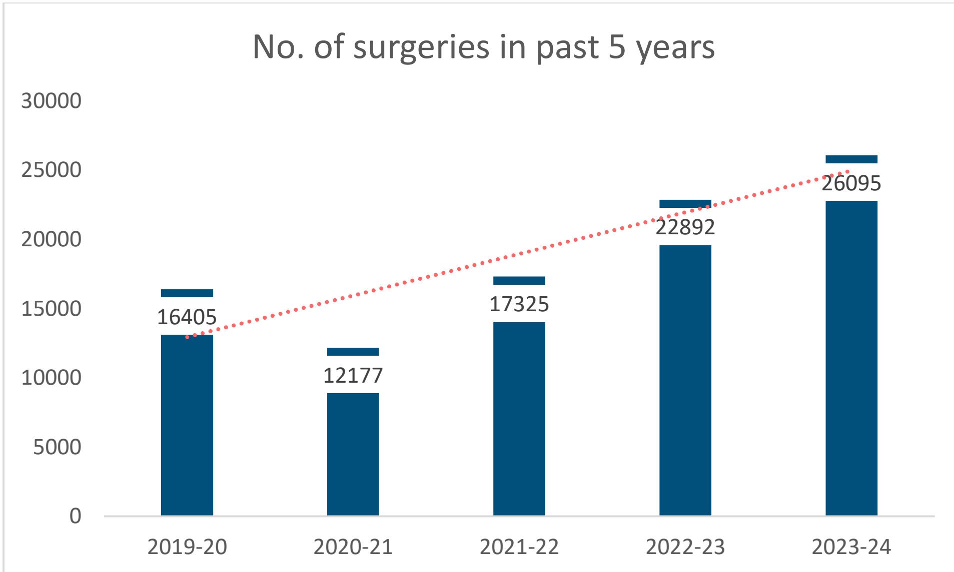
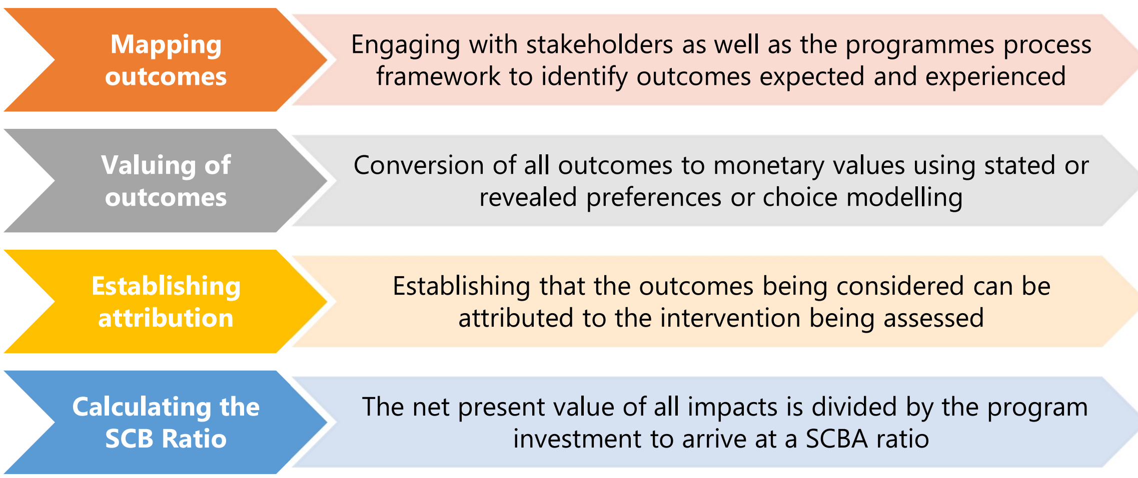


Figure 11 No of surgeries in past 5 years

7. Social Cost Benefit Analysis

A Social Cost-Benefit Analysis (SCBA) is one of the major tools used to analyse the relative efficacy and effectiveness of development interventions. The idea behind using this methodology is that the criterion for an intervention to be undertaken is that its' benefits outweigh its costs. Social cost-benefit analysis is an extension of economic cost-benefit analysis, adjusted to take into account the full spectrum of costs and benefits, including social and environmental effects, borne by society as a whole as a result of an intervention. The non-monetary outcomes, however, have to be monetised or quantified in order for there to be a like-for-like comparison.

A SCBA largely follows the stages illustrated by the following figure:



An SCB ratio of more than 1 means a programme was beneficial. The following section showcases the programme's SCB analysis.

7.1 Framework

The upgradation of electrical infrastructure at SCEH involved significant investment. A comprehensive analysis of the costs incurred and the benefits realised from this infrastructure was used as a framework to calculate the SCB ratio. The cost indicators include the cost of the updated electrical infrastructure (purchase, procurement, and installation), operating costs, the cost of human power required to handle the infrastructure, and the annual cost of maintenance of the infrastructure. The indicators to measure benefits include a reduction in health expenditure for patients, an increase in social profit, and an increase in staff efficiency post-intervention. The data collection process including secondary research from data provided by the electronic medical records department, and administrative department of SCEH and primary research involving the survey and interviews with various stakeholders such as doctors, nursing staff, and administrative staff assessed each of these indicators to learn about the outcomes. The values of these indicators in monetary terms are summarised in the next section.

Costs	**Benefits**
Cost of the machines (purchase, procurement, installation)	Reduced health expenditure for patients
Operating costs	
Cost of staff recruited to handle the machine, if any	Increased social profit
Annual cost of maintenance and repairs	Increased staff efficiency

7.2 Analysis

Costs data were collected through data from the electronic medical department and administrative department records at SCEH. The total capital expenditure for the electrical infrastructure was INR 11,148,962 including the purchase, procurement, and installation costs of a 1000 KW generator, 500 KVA transformer, and the additional cables, accessories, and installation. The operating costs were primarily driven by diesel consumption and amounted to INR 118,287 in total from the date of operation, September 2023 to March 2024. The presumptive cost for one year comes to INR 202777.71 assuming the diesel costs remain stable. Staff costs associated with handling the new machinery were INR 300,000 annually. This was calculated using the costs of the human power involved in the operation and maintenance of the electrical infrastructure. The maintenance of the generator, transformer, and associated services was INR 810,000 annually. Also, no breakdowns were reported, so no additional repair costs were incurred. It is assumed that from September 2023 to September 2024, there will be no breakdowns, as the current capacity of the transformer and generator set is sufficient to support the patient load.

Benefits data were collected through patient interactions, data from the electronic medical department and administrative department records at SCEH. The reduction in health expenditure was calculated using the cost saved by the patient on medicines/ eye drops due to reduced waiting time for surgeries, which amounted to INR 1696175 considering the annual number of patients who visited the hospital post-intervention. This is a direct benefit to patients, leading to overall lower health expenditures. The reliable electrical infrastructure enabled an increase in the number of eye surgeries. With an average cost of INR 60,00 per PHACO-free surgery, and an additional 3,203 surgeries performed post-intervention, the increased social profit amounted to INR 192,180,00. The average cost of PHACO-free surgery is considered here while the average cost of a SICS-free surgery may be lesser (INR 5000).

Staff efficiency, measured by the number of patients received per day relative to the total staff cost, improved to 0.49, considering 261 working days in the post-intervention year this amounted to INR127.42. This indicates a more efficient use of human resources enabled by reliable power supply. The assumption here is that average staff costs have not varied greatly between the pre-intervention and post-intervention years. Weighing the total monetary value of costs and total monetary value of benefits, the benefit ratio comes to 1.68. Though substantial, the investment in the electrical infrastructure at SCEH has resulted in significant social and operational benefits. The improved infrastructure has reduced patient costs, making healthcare more affordable for the community. This reduction in costs is evident from the decrease in average health expenditure due to a more efficient and reliable power supply, which ensures uninterrupted medical services.

The improved infrastructure has reduced patient costs and also enhanced the hospital's capacity to perform more surgeries, directly contributing to increased social profit. Moreover, the enhanced reliability and efficiency have optimised staff utilisation, further justifying the expenditure. There are however three limitations to this analysis. First, future expenses, such as retrofitting the current generator with an emission control device to comply with the new CAQM norms in 2023, have not been estimated and added to the cost. This omission could alter the cost-benefit dynamics, potentially reducing the overall benefit-cost ratio. Second, some benefits are difficult to quantify accurately. For instance, the psychological well-being of patients and staff or the community’s trust in the hospital are significant yet intangible benefits but are challenging to monetise. As a result, the current estimated benefit might be lower than the actual benefit, i.e., the actual benefit-cost ratio could be even higher than the calculated ratio.

Third, the limitation is that some of the benefits accrued may be also because of different factors such as the introduction of triage flow that divided the patients into groups based on age and reduced the waiting time for patients in the hospital which has not been accounted for in the analysis. Also, the intervention being an electrical infrastructure, the benefit-cost ratio may reduce over time, due to various reasons such as increasing patient load, increased operating costs, and increased environmental costs. Thus, a more sustainable health infrastructure is essential for future considerations.

8. Conclusion

The electrical infrastructure upgradation project at SCEH funded by Eicher Group Foundation brought about an improvement in operational efficiency, quality of hospital services, and patient care post-upgrade. The upgrade addressed critical issues such as outdated equipment, frequent power interruptions, and increased patient load, thereby enhancing the hospital's ability to deliver quality healthcare services. Important improvements include a reduction in patient waiting time, improved workplace quality for hospital staff, and structured maintenance and upkeep of equipment. Through structured maintenance and upkeep, the hospital has been able to sustain these improvements, ensuring continuous functionality of the upgraded electrical systems.

The upgrade led to enhanced compliance with pollution regulations, as the new generator set met DPCC norms, contributing to improved air quality in the region. This programme is also in alignment with the following Sustainable Development Goals (SDGs):

3 GOOD HEALTH AND WELL-BEING	**By enhancing the hospital's capacity for sight-restoring surgeries and comprehensive eye care, the project aids in reducing preventable blindness and promoting good health among affected individuals. Through these efforts, the project directly contributes to advancing SDG 3 and promoting well-being for all.**
10 REDUCED INEQUALITIES	**By maintaining subsidised hospital services for individuals from poor socioeconomic backgrounds and providing free or low-cost care, the project helps mitigate disparities in healthcare access. This initiative aligns with the goal of reducing inequalities within and among countries by addressing barriers to accessing essential healthcare services.**

The challenges for the project include catering to the new compliance requirement which necessitates the use of generators retrofitted with emission control devices that reduce pollution.

9. Recommendations

9.1 Continue to prioritise investments in sustainable healthcare infrastructure

The healthcare sector relies heavily on various resources, from medical supplies to energy, all of which come with their own environmental implications. The World Health Organisation, American Medical Association, and the U.S. Depart-ment of Health and Human Services have all declared climate change a public health emergency. Current studies have estab-lished a correlational relation-ship between many ocular diseases—including ocular trauma, trachoma, cataracts, and retinal pathology—and the surrounding environment[15]. These and other diseases are affected by exposure to heat, ultraviolet radiation, ozone, and numerous environmental pollutants. Keratitis, ocular surface disorders, glaucoma, macular degeneration, uveitis, and allergic conjunctivitis are conditions seen increasing, especially in highly polluted areas where studies have been done. More research is needed, but without efforts to address climate change, the severity of its impact on the eyes is only expected to increase

To achieve sustainability in healthcare, innovative tools and techniques are to be continuously developed and implemented. Based on the comprehensive impact assessment of the electrical infrastructure upgrade project at Dr Shroff Charity Eye Hospital, it is recommended to continue prioritising investments in sustainable healthcare infrastructure. To further enhance the project's impact, ongoing collaboration with relevant regulatory authorities like DPCC and CAQM should be maintained to ensure compliance of the electrical infrastructure including transformer and generator with environmental standards. Though it is currently not feasible to transition to a gas-powered diesel generator, other upcoming technologies have to be continuously looked at and explored.

[15] Making ophthalmology more sustainable. (2023, November 13). American Academy of Ophthalmology. https://www.aao.org/eyenet/article/making-ophthalmology-more-sustainable

10. Annexure

Observational Checklist

Visual inspection	
• Check for any visible damages, no exposed wires, wear and tear on the genset and transformer	• Okay • Partially okay • Not okay
• Ensure that there are no signs of corrosion, rust, or leakage	• Okay • Partially okay • Not okay
Functional assessment	
• Test the genset to ensure it starts and operates smoothly	• Okay • Partially okay • Not okay
• Test the transformer to ensure it is functioning within the specified parameters	• Okay • Partially okay • Not okay
Safety measures	
• Check the presence and functionality of safety devices such as circuit breakers, fuses	• Okay • Partially okay • Not okay
• Ensure proper labelling of electrical panels and equipment	• Okay • Partially okay • Not okay
Maintenance records	
• Review maintenance logs and records to ensure regular servicing and upkeep of the electrical infrastructure	• Okay • Partially okay • Not okay

• Check if any preventive maintenance has been carried out since installation	• Okay • Partially okay • Not okay
Operational efficiency	
• Verify that there are no fluctuations or interruptions in the electrical supply to the hospital.	• Okay • Partially okay • Not okay
• Check the backup capabilities of the Genset during power outages (subject to feasibility)	• Okay • Partially okay • Not okay
Feedback from staff	
• Gather feedback from the hospital staff regarding the reliability and performance of the electrical infrastructure	• Okay • Partially okay • Not okay