IMPACT ASSESSMENT OF SUPPLY, INSTALLATION AND COMMISSIONING OF 500 NOS. LED BASED SOLAR STREET LIGHTING SYSTEM (SLSs) IN VARIOUS VILLAGES OF BASTI REGION, U.P- PHASE-II

Sponsored by

POWER FINANCE CORPORATION LIMITED

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2025

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Acknowledgement

The study titled "**Impact Assessment of Supply, Installation & Commissioning of 500 nos. LED Based Solar Street Lighting System (SLS's) in Various Villages of Basti Region, U.P.- Phase-II**" has been successful due to assistance received and time devoted by many esteemed personalities.

First and foremost, we express our deepest gratitude to Power Finance Corporation (PFC) for engaging IIPA in an opportunity.

Our sincere thanks to Mr. Sandeep Jain, Director, Central Electronics Limited (CEL)and Mr. Raj Kumar, Site Manager (CEL) for their continuous support and cooperation extended to accomplish the completion of this project as well as for his painstaking efforts guiding us to fulfilll the objectives of the project. Their efforts, guidance, and attention to detail were crucial in achieving the project's goals.

We extended our thanks to the Administration Department, Finance & Accounts of Indian Institute of Public Administration for providing us with necessary facilities. Special thanks to Sh. S.N. Tripathi, Director of IIPA for his constant encouragement. We are pleased to thank our Research Associate for her hard work during the entire project.

Dr. Roma Mitra Debnath

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Executive Summary

The Power Finance Corporation had sanctioned financial assistance of Rs.1.13 Crore for supply, installation and commissioning of 500 nos. LED based Solar Street Lighting Systems (SLSs) in various villages of Basti region, Uttar Pradesh through Central Electronics Limited (CEL) under its CSR initiatives. A research has been undertaken to study the impact of the installation of LED based solar street lighting system in general and specifically on the llike of the stakeholders. Survey feedback was collected from diverse stakeholders, including residents, local government officials, business owners, hawkers, and community leaders, across five blocks: Bankati, Kaptanganj, Parashrampur, Raudhauli, and Vikramjot.

On the basis of detailed analyses of the questionnaire administered to the various stakeholders, the following findings have been drawn from the outcome of the study to address aimed to enhance public safety, energy efficiency, and community well-being. The project targeted improvements in safety, socio-economic activities, and mobility through sustainable, energy-efficient street lighting systems.

Improved Mobility and Accessibility

Solar lighting systems have enhanced night-time mobility, providing residents with safer roads and pathways. Residents reported increased confidence in traveling during late hours. The project also reduced dependency on male family members, particularly for homemakers, promoting independence and convenience.

Economic and Community Impact

The project positively influenced economic activities, with business owners/hawkers experiencing increased customer footfall and improved workspace visibility. Markets became more vibrant during evening hours, supporting livelihoods and fostering economic growth. Residents also reported greater participation in community events and social activities during night time.

Social and Environmental Benefits

The lighting project fostered a sense of community pride and improved quality of life for residents. Homemakers felt more independent in managing their evening activities, and students benefited from extended study hours. Environmentally, the project contributed to energy efficiency, reduced carbon emissions, and demonstrated a commitment to sustainable development.

Maintenance and Sustainability

The LED street lighting systems were highly efficient and required minimal maintenance, although some occasional issues were reported. This aspect underscored the need for a structured maintenance mechanism to ensure the project's long-term effectiveness.

Conclusion

Stakeholders response reflected high satisfaction with the project, particularly regarding safety and accessibility improvements. Women's safety and empowerment were highlighted as significant outcomes, while the economic and social benefits reinforced the project's value to the community. The solar street lighting project in the Basti region successfully enhanced safety, mobility, and economic activity, meeting its objectives and supporting sustainable development goals. By empowering women, improving livelihoods, and fostering community engagement, the initiative serves as a model for future CSR projects aimed at creating inclusive and sustainable communities.

Chapter 1 Introduction

Background

The installation of five hundred (500) LED-based streetlights in the Basti region of Uttar Pradesh is a Corporate Social Responsibility (CSR) initiative aimed at promoting energy efficiency, public safety, and community well-being. This project provided eco-friendly LED lighting, reducing energy consumption and carbon emissions while lowering maintenance costs. In addition to enhancing night-time safety and supporting local businesses, it fosters social engagement and aligns with sustainable development goals.

Central Electronics Limited (CEL) installed the street lights in the blocks namely Harraiya, Kaptanganj, Ramnagar, Bankati, Rudholi, Kudaraha,Vikramjot, Parasrampur, Saltauwa, Saughat, Bahadurpur, Dubauliya, Gaur, Parshurampur, Basti Sadar in the Basti Region. CEL has installed five hundred (500) numbers of street lights in the Basti Region at Uttar Pradesh.

Objectives of the Study

The objectives of the Impact Evaluation are:

1. To assess there is better illumination in streets of villages in basti region with SLSs,
2. To assess that there is extended business duration due to extended nightlife and socio economic development of area, and
3. To assess the benefit of the interventions to various stakeholders of the activities.

Key Stakeholders for the Study

The relevant stakeholders were identified for the study purpose. They were, 1. The key officials of CEL, 2. The villagers who are residing in Basti Region , 3. Government authorities and Gram Panchayat/Block Development Officer (BDO)/Chief Development Officer (CDO). Total five hundred (500) numbers of solar street lights were installed in the selected villages of Basti region.

Conclusion

The objectives of the study have been provided in this chapter. To have a better understanding of the study, key stakeholders have been identified, and a brief is written about them.

Chapter 2 Research Process, Methodology & Project Approach

Introduction

This chapter provides a detailed overview of the research process, approach, and methods undertaken for the impact assessment study. It elaborates on the methodology adopted, including the use of the OECD-DAC framework, and highlights the secondary data sources reviewed during the study.

Desk Review

For the impact assessment the study has used the framework exhibited in Figure 2.1. The criteria adopted are that of The Organisation for Economic Cooperation Development (OECD) – Development Assistance Committee (DAC) Framework. As, per the need of the study we considered only three parameters that are: Relevance, Effectiveness, and Sustainability.

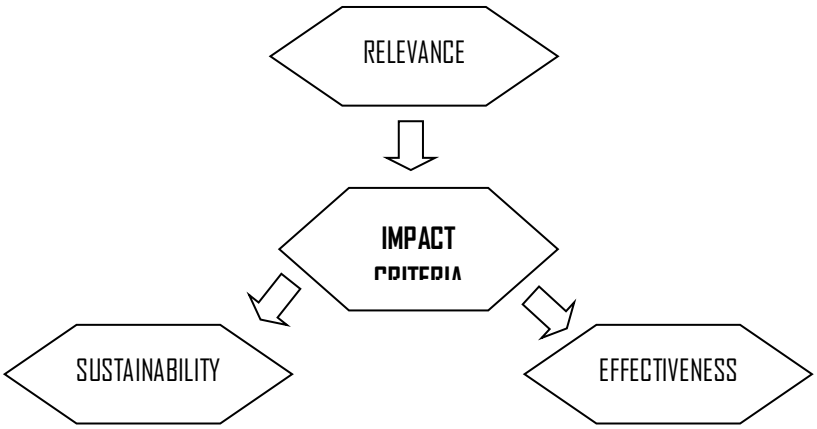


Figure 2.1: Three parameters of OECD- Development Assistance Committee (DAC)

Considering the above framework, the desk review of the project activities been considered to identify the various activities and to identify the targeted stakeholders.

Methodology

To meet the objectives and collection of data related to above factors, both primary and secondary data sources has been used in the study. The study is a mixed nature, viz. a combination of qualitative and quantitative. Research methods used for the study purpose are

1. Desk Review, and 2. Survey of the stakeholders with the help of a structured villagers with the help of a structured questionnaire. (Presented in Annexure I)

An explorative research was conducted to understand the nature, design, and aspects of implemented projects for which impact assessment has to be done. This was completed primarily through desk review.

Desk Review

Desk Review of the existing documents has been done during the study. The list incudes;

1. Questionnaire (Annexure I)
2. Photograph of the Stake Holders and Lights (Annexure II)

In-Depth Interview with Stakeholders

Structured questionnaire has been used for survey method have been used to understand the impact of the project. A questionnaire has been prepared and exhibited in Annexure I. The questions are primarily quantitative in nature, framed on a likert scale of high (1) to low (5).

Research Approach

1. The primary focus of the impact assessment is the beneficiaries of the project.
2. The project is assessed in terms of the evaluation criteria of relevance, effectiveness, impact, and sustainability.
3. The qualitative data analysis its inference is aimed at expressing the relevance of the project
4. The framework for assessing the impact follows a modified version of the OECD-DAC framework for the evaluation of developmental and humanitarian projects.The impact study adopted a four-phase structured methodology for evaluation as exhibited in Figure 2.2

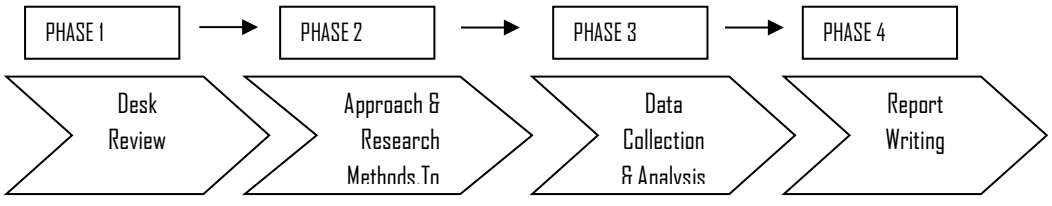


Figure 2.2: Research Methodology

This impact assessment follows a structured methodology divided into four key phases. First, a desk review is conducted to analyze existing reports, policies, and relevant data to understand the present situation. In the next phase, an approach and research methods framework is designed, including questionnaires, and interview schedules, which will be used for data collection. During the data collection and analysis phase, primary data has been gathered from staff, visitors, patients, and stakeholders and analyzed using appropriate tools. Finally, in the report writing stage, findings have compiled into a comprehensive report with actionable insights and recommendations to document the impact.

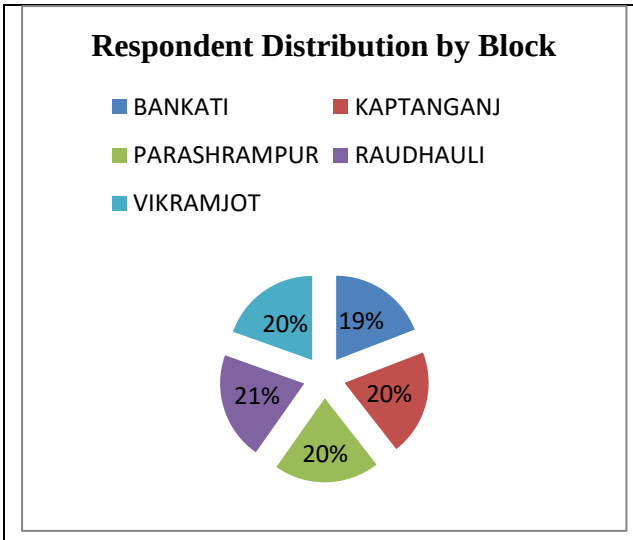
Conclusion

This chapter provides a detailed overview of the research process , research approach and methods undertaken to elaborate the methodology adopted for the study. The sources of the secondary data been reviewed during the study has been listed.

Chapter 3 Empirical Analyses

Survey feedback was collected from diverse stakeholders, including residents, local government officials, business owners/hawkers, and community leaders, across five blocks: Bankati, Kaptanganj, Parashrampur, Raudhauli, and Vikramjot. Through weighted averages, the findings highlight the project's contributions to safety, accessibility, and quality of life, while also identifying areas requiring improvement.

Survey Report on the Impact of 500 LED-Based Solar Street Lighting Systems in the Basti Region



Blocks	Total no. of Residents
BANKATI	50
KAPTANGANJ	52
PARASHRAMPUR	52
RAUDHAULI	52
VIKRAMJOT	50
Grand Total	256

Figure 3.1: Distribution of Survey Respondents Across Five Blocks of the Basti Region

As exhibited in Figure 3.1, the survey was conducted across five blocks of the Basti region—Bankati, Kaptanganj, Parashrampur, Raudhauli, and Vikramjot—to evaluate the impact of the installation of 500 LED-based solar street lighting systems. The survey collected responses from a total of 256 residents, with participation distributed as follows: 50 respondents from Bankati, 52 each from Kaptanganj and Parashrampur, 52 from Raudhauli, and 50 from Vikramjot. This comprehensive data collection effort aimed to assess the effectiveness and benefits of the lighting systems in improving safety, accessibility, and community satisfaction across these areas. The results provide valuable insights into the project's impact on the daily lives of the residents in the Basti region.

Demographic Classification of Block Residents in the Basti Region

As presented in Figure 3.2, the chart shows the demographic breakdown of residents across five blocks in the Basti region by age and gender. Most respondents are in the 21–40 and 41–60 age groups, reflecting strong participation from the working-age population. Both males and females are well-represented, ensuring inclusivity. While the elderly (61+ years) and younger groups (10–20 years) have lower representation, their perspectives added valuable diversity to the survey. This balanced distribution ensures the survey results capture the views of various community segments effectively.

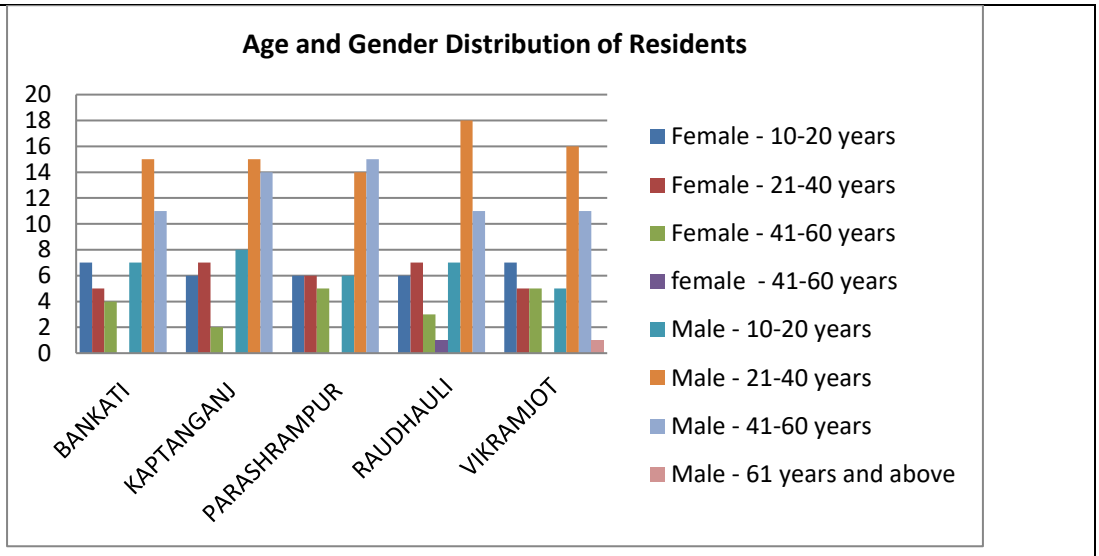


Figure 3.2: Classification of Residents by Age and Gender Across Five Blocks

Distribution of Responses by Occupation

As shown in Figure 3.3, the total number of respondents from the Basti region is 256, with a diverse group represented. There are 52 business owners/hawkers, 8 community leaders such as panchayat members, and 50 homemakers. Additionally, 62 school students, 80 working professionals, and 4 local government officials participated in the survey. This variety of respondents reflects a broad spectrum of the community's demographic in the Basti region.

Role	Total No. of Respondent
Business owner/hawker	52
Community leaders such as panchayat members	8
Home maker	50
Local government officials	4
School student	62
Working professional	80

Grand Total	256	

Figure 3.3 Respondent Demographics from the Basti Region

Impact Analysis of LED-Based Solar Street Lighting Systems on Residents

As presented in Figure 3.4, the following analysis highlights the impact of the 500 LED-based solar street lighting systems installed in the Basti region, as captured through a detailed community survey. The survey assessed residents' perceptions across various aspects, including safety, comfort, accessibility, and overall satisfaction. The weighted averages of responses provide insights into the effectiveness of the lighting systems in addressing key community needs, particularly in enhancing nighttime security and improving public infrastructure usability. This analysis, accompanied by the corresponding chart, presents a comprehensive understanding of the project's outcomes.

The questions were asked on a likert scale from 1 (highly satisfied) to 5 (highly dissatisfied). The weighted average less than 3 (neutral) shows that the respondents are collectively agreeing with the intervention. The same methodology has been applied for other similar questions.

S.NO.	QUESTIONS	WEIGHTED AVERAGE
1	Do the street lights help you or your family members feel more comfortable commuting or working during late-night hours?	1.90
2	Has the lighting reduced incidents of harassment in your area?	2.24
3	Do you feel more comfortable participating in evening events?	2.07
4	Has the lighting improved your confidence in travelling alone at night?	2.16
5	Do the lights make you feel more comfortable using public transport at night?	2.10
6	How well-lit are roads and pathways in your area?	2.45
7	Do you feel the roads are more accessible at night due to the lights?	2.14
8	Are public spaces like playgrounds, markets, temples, etc. seeming safer in the evening now?	2.14
9	Do you feel that the lights have made your neighbourhood safer?	2.19
10	Do you feel the lighting has improved your sense of security?	2.15
11	Overall, how satisfied are you with the brightness of the lights?	2.32
12	Overall, how would you rate the solar lighting system on women's safety?	2.12
13	Overall, how satisfied are you with the installation of solar street lights?	2.18

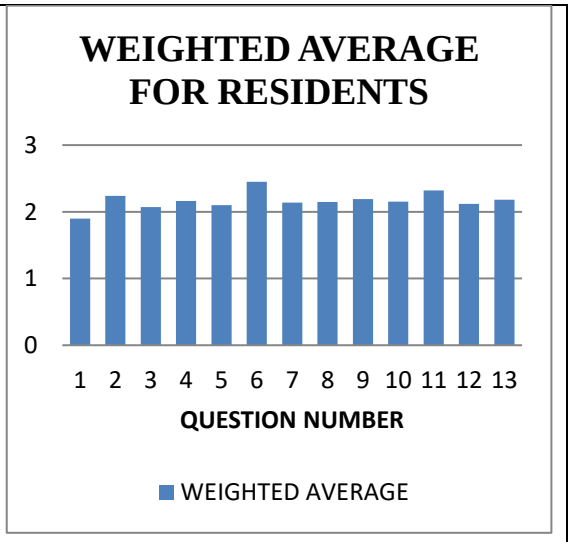


Figure 3.4: Weighted Average Responses by Residents

The Figure 3.4 exhibits the questions that were administered on likert scale and the corresponding weighted score is also being depicted. The bar chart is the graphical

represenstaiton of the weighted score, indicating all the scores are much below 3, representing positive response from the stakeholders.

Impact Analysis of LED-Based Solar Street Lighting Systems on Business Owner/Hawkers

As presented in Figure 3.5, the following analysis summarizes the responses received from business owners/hawkers in the Basti region regarding the impact of the 500 LED based solar street lighting system project. Each question was evaluated using a weighted average based on their feedback.The methodology has been explained in the earlier section.

S.NO.	QUESTIONS	WEIGHTED AVERAGE
1	How has the lighting impacted your business operations during evening hours?	1.75
2	Has there been an increase in customer footfall after the installation of lights?	2.00
3	Has the lighting made your workspace more visible to customers during night?	2.28
4	Has lighting increased the evening vibrancy of the market?	2.11
5	Overall how satisfied are you with the solar street lighting project's impact on your business?	2.05

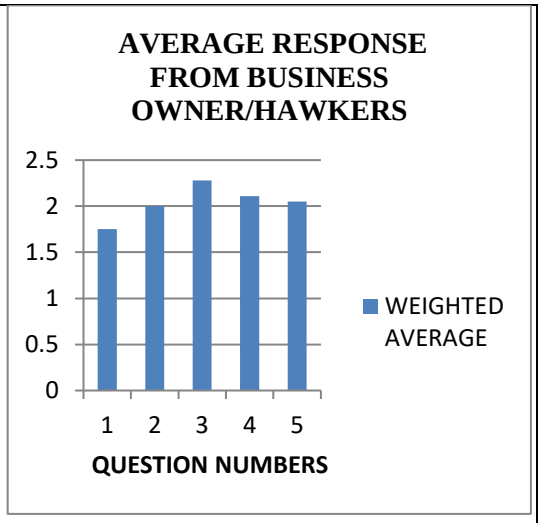


Figure 3.5: Impact of Solar Street Lighting on Business Owner/Hawkers in the Basti Region

Impact Analysis of LED-Based Solar Street Lighting Systems on Local Government Officials

S.NO.	QUESTIONS	WEIGHTED AVERAGE
1	How has the street lighting project improved public safety in your jurisdiction?	1.5
2	Do you believe the lights have contributed to reducing theft and crime in the area?	1.75
3	Has the ighting made it easier for officials to monitor public spaces at night?	2.00
4	Do you think the lighting has enhanced the overall image of the community?	1.75
5	How has the lighting affected the economic activities in the area?	2.00
6	Do you believe the lighting project has fulfilled its objectives?	1.75
7	Do you feel the project has created a positive impact on locals?	1.50
8	Overall, how satisfied are you with the installation of solar street lights?	1.75

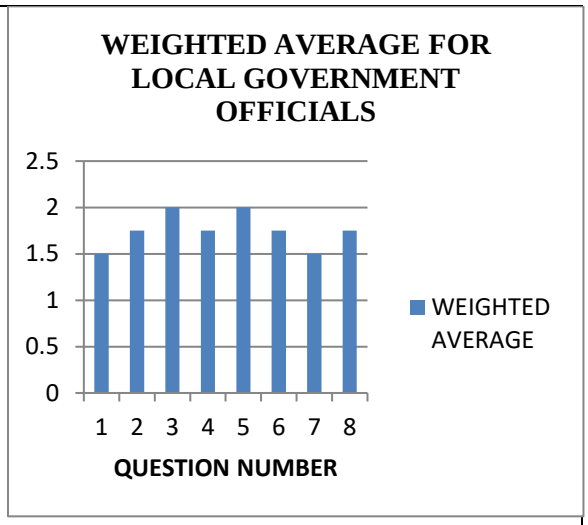


Figure 3.6: Impact of Solar Street Lighting on Local Government Officials in the Basti Region

As depicted in Figure 3.6, the following data presents the feedback collected from local government officials, including the Block Development Officer (BDO), District President (ziladhyalksha), and Zila Pradhikari, regarding the solar street lighting project in the Basti region. These stakeholders were surveyed to assess the impact of the lighting on various aspects such as public safety, crime reduction, monitoring of public spaces, economic activities, and community welfare. The responses provided valuable insights into how the project has affected the local area, with a focus on its objectives and outcomes. The feedback reveals a generally positive perception.

Impact Analysis of LED-Based Solar Street Lighting Systems on Community Leaders

As presented in Figure 3.7, the survey conducted with community leaders, including the Pradhan, Chairman, and Ward Members, aimed to assess the impact of the recently installed LED-based solar street lighting systems in the Basti region, U.P. The feedback gathered from these stakeholders highlights various aspects of the project, such as safety, ease of commuting, road accidents, visibility of public spaces, and overall quality of life.

S.NO.	QIUESTIONS	WEIGHTED AVERAGE
1	Do you feel the lighting has made it safer for community members to travel at night?	1.75
2	Do you think the lighting has made easier/safer to commute at night?	2.00
3	Are the lights helpingreduce road accidents in your area?	2.00
4	Do the lights help enhance the visibility of markets, shops and public spaces at night?	1.75
5	Do you feel the lights have improved the overall quality of life in your community?	1.75
6	Has the project inspired a sense of pride in your community?	1.87
7	How well do you think the project was planned and executed in your area?	1.87
8	Overall, how satisfied are you with the lighting project's impact on your community?	2.12

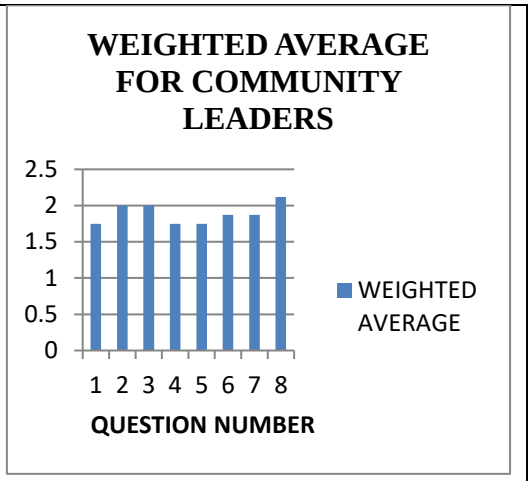


Figure 3.7 Impact of Solar Street Lighting on Community Leaders in the Basti Region

Case Study 1

"The solar street lighting initiative has brought a significant improvement in public safety within our jurisdiction. There is a noticeable reduction in incidents of theft and crime, and it has become much easier for officials like us to monitor public spaces after dark. The enhanced visibility has also improved the overall image of the community, making it appear more developed and well-maintained.

Economically, the project has boosted local activities by extending operational hours for vendors and making markets and roads safer for evening use. I believe the project has mostly fulfilled its objectives and has positively impacted the lives of residents. I strongly agree that it has contributed meaningfully to local development, and I am satisfied with the overall implementation and outcomes."

-Sh. Bhawani Prasad, Block Development Officer (Bankati)

Case Study 2

"The installation of solar street lights has made commuting and working during late-night hours somewhat more comfortable for me and my family. Incidents of harassment in the area have reduced significantly, and I now feel very comfortable participating in evening events and more confident when travelling alone at night.

Public spaces are more accessible and feel safer than before, and the roads and pathways are sufficiently lit. The lighting has slightly improved my overall sense of security and has had a slightly positive impact on women's safety in the locality. Overall, I am satisfied with the initiative and very satisfied with the brightness of the lights."

-Sh. Vinod, Working Professional

Conclusion

The solar street lighting project in the Basti region has positively impacted community safety, economic growth, and public infrastructure usability. Survey results demonstrate enhanced nighttime security, better visibility, and increased market vibrancy, particularly benefiting women, businesses, and local commuters. While the initiative has largely fulfilled its objectives, feedback indicates moderate satisfaction among stakeholders.

Chapter 4 Desk Research

This chapter presents the analysis of the Desk Research conducted as the initial step. The documents that were shared by the organization, have been read and content analysis has been carried out. The significant observations have been presented in the next section.

Enhanced Night time Accessibility Through Solar Street Lighting

Data from Central Electronics Limited (as exhibited in Annexure VII) indicates that public areas have become more accessible at night, thanks to the LED-based Solar Street Lighting Systems. This improvement has enhanced safety, mobility, and community engagement after dark.

Resident Satisfaction with Solar Street Lighting

As depicted in Annexure VII, residents are highly satisfied with the street lighting system in their area. The LED-based Solar Street Lighting has improved safety, visibility, and security, encouraging outdoor activities and enhancing the overall quality of life.

Improved Night time Safety Perception with Solar Street Lighting

As shown in Annexure VII, the safety perception in the area has greatly improved due to the Solar Street Lighting System. On a scale of 1 to 5, the safety level was rated a high 5 by respondents, indicating a strong sense of security for the public at night.

High Efficiency and Low Maintenance of Solar Street Lighting

According to Annexure VII, residents rated 4 out of 5 for the ease of maintenance and high performance of the Solar Street Lighting System. The lights require minimal maintenance, making them efficient and reliable, and ensuring consistent operation without much hassle.

Occasional Maintenance and Lighting Issues in the Area

Occasionally, there were reports of maintenance and lighting issues in the area, though these incidents were infrequent and did not significantly affect the overall performance of the Solar Street Lighting System (as presented in Annexure VII).

User Satisfaction with Nighttime Lighting System

According to the data exhibited in Annexure VII, users were satisfied with the lights and the lighting system in their area at night, appreciating the enhanced visibility and safety provided by the Solar Street Lighting.

Conclusion

In conclusion, the LED-based Solar Street Lighting System in the Basti region has successfully improved safety, accessibility, and community engagement at night. Residents are highly satisfied with its performance, ease of maintenance, and positive impact on quality of life.

Chapter 5 Conclusion

In addition to the desk rsearch, the survey was conducted across five blocks of the Basti region—Bankati, Kaptanganj, Parashrampur, Raudhauli, and Vikramjot—to evaluate the impact of the installation of 500 LED-based solar street lighting systems.

Different stakeholders were involved with the survey to validate the responses from differenet sources, implying the method of triangulation was considered for the present study.

The analysis shows the average responses from the stakeholders, and a unanimous convergenance can be observed in their responses. Most of the respondents are in the 21–40 and 41–60 age groups, representing form the working group, across gender ensuring inclusivity.Although the elderly (61+ years) and younger groups (10–20 years) have lower representation, their perspectives have added valuable diversity to the survey.

Across the society, irrespective of their roles, overall there has been an opinion on positive impact on women safety. Women's safety in India is a major concern, with high crime rates and a widespread fear of violence. Although the government has taken steps to address this, including laws, schemes, and other initiatives, however, a small initiative like installing street lights can have a major impact on the lives of women. It has given them a sense of security and safety , which also impacts their economic activities, as they are able to join the work force or continuing their studies in the evening.

Business owners/hawkers have experienced a higher footfall in number of the customers because of lighted pathways. This has contributed a better economic activities and thus a better livelihood.

The homemakers, even though, they are not involved with any economic acitvites, they have been impacted socially. It gives a sense of independence for enhanced social life, contributing happiness in their family.Whether going to the temple or the nearest market, they do not have to depend on any male members to accompany them. A clear visibility has significantly created an impact on their life.

The local government officials have found it easier to monitor the area with sufficient lighting on the street, making it safer for its citizens. Reduced crime rate makes it a sustainable place. Which also beings a good reputation in the neighbourhood as a safe zone, creating a sense of pride amongst the people.

School students along with the working professionals found it safe to travel during the odd hours. Students can go for their extra curricular activities or for tutions in the evening without creating worry for their parents or family members.