INDUS OORJA RENEWABLE ENERGY SUNDARBANS

Impact Assessment Report

FOREWORD

The Sundarbans, a region of immense natural beauty and ecological significance, is also home to many communities that live in remote, hard-to-reach areas where access to electricity is limited or non-existent. These communities often face significant environmental challenges, including the impacts of climate change and the need to balance their needs with the needs of the natural world around them, including the protection of endangered species such as tigers.

Over 30 million people in rural areas are deprived of accessing energy for their basic needs, with residents relying on forest resources such as wood, twigs, dry leaves, and kerosene for cooking and lighting. This reliance on biomass and kerosene harms biodiversity, climate change, and respiratory health, particularly for women who spend most of their time cooking or collecting forest resources for their livelihoods.

In such areas, the provision of decentralised renewable energy sources can play a vital role in providing communities with access to the reliable, affordable, and sustainable energy they need to power their daily lives. By investing in renewable energy sources such as solar and wind power, various stakeholders such as non-governmental organisations, corporates and local government bodies can help to reduce the dependence on fossil fuels and mitigate the impacts of climate change, while also providing much-needed support to communities who are struggling to access basic amenities such as lighting, refrigeration, and communication.

As responsible corporate citizens, we recognise the importance of supporting sustainable development and the achievement of the United Nations' Sustainable Development Goals (SDGs). Our efforts are aligned with the SDGs, particularly SDG 7 (which calls for access to affordable, reliable, sustainable, and modern energy for all), SDG 13 (climate action) and SDG 15 (life on land). By investing in renewable energy in the Sundarbans, we can help to promote clean energy, create jobs and opportunities, and support the growth and development of communities in some of the most challenging and environmentally sensitive areas of the world.

The people of Sundarbans deserve access to reliable and sustainable energy sources, and we are proud to play a part in making that a reality. We believe that by working together with local communities, NGOs, government agencies, and other stakeholders, we can create a brighter, more sustainable future for all.

EXECUTIVE SUMMARY

The Sundarbans region in West Bengal and Bangladesh suffered immense devastation from cyclone Amphan, which breached embankments, uprooted trees, and destroyed homes, leaving millions of people vulnerable. The region’s fragile ecosystems, coupled with its low-lying geography, pose significant challenges to traditional infrastructure such as utility grids, which are often rendered useless in extreme weather events. As a result, the Sundarbans experience persistent power outages, leaving people in darkness and exacerbating the risks they face.

A case in point is Kumirmari Island, one of the last inhabited masses in the Sundarbans delta, which is home to around 24,000 people, with nearly 94% belonging to scheduled castes and tribes. The island frequently witnesses extreme weather events and conventional utility grids have proven to be unreliable there. Moreover, man-animal conflict is a routine affair there.

To address this critical issue, IndusInd Bank, in partnership with WWF India, has implemented a decentralised solar energy solution in the Sundarbans region. Launched in December 2020, the solution includes a solar AC microgrid in Kumirmari Island, which provides electricity to 200 households and village institutions, while also reducing the risk of human-wildlife conflicts. Additionally, 100 smart solar streetlights have been installed, further enhancing safety and security in the region.

The programme aims to provide sustainable and reliable energy to the region, while also addressing the environmental challenges and risks posed by climate change and man-animal conflicts. This report provides an overview of the programme’s objectives, challenges, and achievements, along with the impact it has had on the forest-dwelling community. The report also highlights the importance of sustainable, decentralised energy solutions, and their role in achieving the SDGs.

Key Findings

- ✓ For 55% of households, fishing and crab collection are the primary occupations, while 38% are involved in small farming, 4% in animal husbandry, and 3% in private jobs
- ✓ 93% of the population has a monthly family income of less than Rs. 7,000.
- ✓ Before the installation of the solar plant, the primary sources of illumination for the population were solar home systems (SHS) and kerosene oil.
- ✓ The risk of tiger attacks was significantly higher in the project hamlet before the installation of the solar plant.

Key Impact

- ✓ The solar grid connection has become the primary source of illumination for all respondents.
- ✓ The adoption of solar grid connections has significantly reduced kerosene use, leading to an estimated savings of Rs. 300-400 per household, which has been redirected towards expenses such as food consumption, academics, and medicine.
- ✓ 57% of households reported an increase of 2-3 hours in their children's average study time and observed an improvement in academic performance.
- ✓ 74% of beneficiaries reported a decrease in women's workload.
- ✓ 43% of households reported an improvement in overall social connections, including self-help group meetings, farmers' meetings, visits of relatives, and occasions.
- ✓ The installation of 50 solar streetlights has improved the overall safety and security of the villagers, resulting in an 84% reduction in human-animal conflicts.

RESEARCH METHODOLOGY AND DESIGN

The impact study on the Indus Oorja Renewable Energy programme at Kumirmari island in Sundarbans, conducted by a third-party consulting firm SoulAce, aimed to assess the extent of its impact on the lives of the villagers and was conducted using a descriptive research design.

A purposive sampling technique was employed, and 100 households out of the 200 covered under the project were selected for the study through random sampling. The study used both quantitative and qualitative methods for data collection, including discussions with focus groups, in-depth interviews and case studies to gain deeper insights.

In addition to interacting with the beneficiaries, the qualitative data collection involved engagement with stakeholders such as panchayat pradhan, gram panchayat members, principal of Dakhshin Kumirmari Mirdhagiri Primary School, anganwadi centre workers, forest officials and members of the project implementing team.

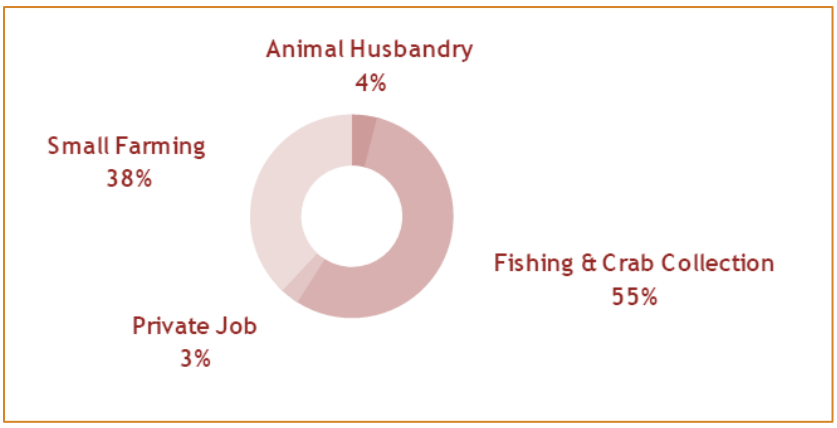
After the data collection, the results were analysed following the OECD DAC Network on Development Evaluation criteria, which looked at the performance and impact of the programme based on six evaluation criteria: relevance, coherence, efficiency, effectiveness, impact, and sustainability for each of the indicators.

OECD Criteria	Justification	Ratings
Relevance	The initiative is capable of addressing the gap in power supply in the remote forest fringe island. The programme is well executed by the expert organisation and managed by the villagers through the Village Energy Committee.	*****
Coherence	The initiative is implemented in close coordination with the local panchayat. The project is meeting the SDGs, specifically Goal 7 (affordable and clean energy), and Goal 13 (climate action).	*****

Effectiveness	The programme is aimed at addressing the basic power supply to rural households. The project further ensures stable power supply to the household level and the installation of streetlights, mostly at the bank of the river, which helps to reduce the risk of human-animal conflicts.	*****
Efficiency	The programme is carried out to facilitate the beneficiaries, despite various difficulties and logistic challenges during implementation due to lockdown and cyclone Amphan. The project meets all the requirements envisioned during the planning and implementation process.	*****
Impact	Improved study hours of the children, decreased overall fuel costs, decreased workload of the women, increased safety and security of the villagers, and enhanced home-based income opportunities are some of the reported changes. Additionally, the programme has improved the quality of life in terms of social interaction.	*****
Sustainability	The programme is sustainable in the sense that it is primarily funded by the service charge collected from each household.	*****

BACKGROUND: UNDERSTANDING THE CHALLENGES

To establish a baseline, this study analysed the socioeconomic background, size of the family, source of electricity and illumination, cost borne for power supply and the extent of various challenges that the people of Kumirmari island faced before they received the support of Indus Oorja Renewable energy programme.



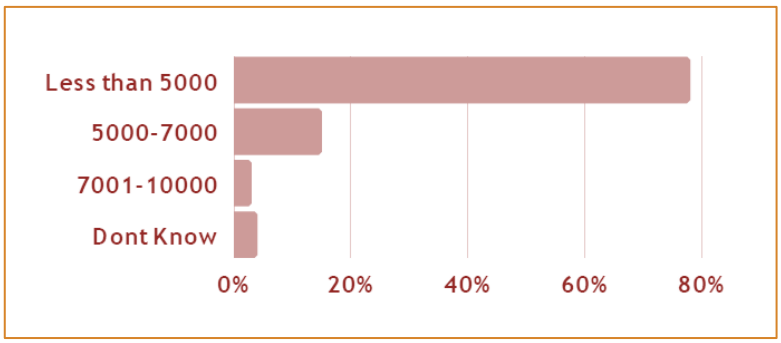
According to the study, the majority of the households had between 2-4 family members (68%), with 20% of households having between 5-6 family members. Additionally, 8% of households had more than six people, and 4% of respondents were individuals staying alone in their households, mostly elderly widowed women. The population of the hamlet was reported to be 300, and households were mostly divided into three locations, Adibasipara, Mridhapara, and Bagnapara.

The occupation pattern of the communities was mainly divided into two broad categories, agriculture and jungle-based livelihood (mainly crab collection, fishing, and honey collection). Small farming was the main occupation for 38% of the population. However, the crop pattern was a mono-crop, predominantly rice cultivation. The income from cultivation could support their consumption and needs to some extent.

The income from cultivation could support their consumption and needs to an extent, but agricultural yields had been decreasing over the past few years, especially after the effect of cyclone Yaas, which destroyed the fertility of the soil.

A large section of the village was mainly dependent on fishing and crab collection from the creek of the rivers deep into the dense forest. More than half of the population (55%) from the villages was involved in this activity, and they often encountered tiger attacks. Even death by tiger attacks became a major concern over three to four years. The fishing and crab collection occupations were seasonal, primarily for 8-9 months in a year.

Additionally, backyard poultry, such as raising chicks and goats, is practised by a small percentage of the population (4%). Only 3% of the population is involved in small private jobs or small businesses, and most of the families are under the below-poverty-level category.



The majority of the population (78%) had a monthly income of lower than Rs. 5,000 per family, and small farmers were primarily part of this category. Additionally, 15% of the population's monthly income was around Rs. 5,000-7,000, including the population dependent on crab collectors and harvesting. However, the income depends on the collections, and the greater the size of the crab collection, the greater the risk to their lives. The same group belongs mostly in the category Rs. 7,000-10,000, which is 3%. Crab collectors need to pay a good amount of around Rs. 30,000 to permit holders who reside in cities to get entry into the jungle, and there are very few who have valid permits in the village.

Before the installation of the solar microgrid, the significant sources of illumination were the majorly personal solar system of the households (90%), and the kerosene oil (98%). However, most reported that their solar systems were not very efficient to cater to their needs. Besides, 42% of the respondents reported having chargeable batteries LED torches, and 46% of the respondents reported having torches with regular batteries. A minuscule portion (5.4%) reported using solar lamps even before the solar microgrids were installed.

The respondents reported using kerosene lanterns, solar lamps, and torches for an average of 2, 7, and 4 hours daily, respectively. During cyclone Amphan, the village experienced a 20-day government connection power cut, causing immense hardship. However, during cyclone Yaas, the solar connection was restored within four to five days, providing much-needed relief to the affected families.

Regarding the usage of appliances before the programme, 65.4% of the respondents used fans earlier, and 83.1% of the respondents used lights before the programme, with an average of three lights earlier. Additionally, 46.2% of the respondents purchased televisions before the programme, and 92.3% of the respondents had purchased mobile phones post-installation of the programme. None of the households had refrigerators, and only 8.5% of the respondents earlier had water pumps.

Difficulties faced earlier	%. of HHs
Children were not able to study properly	15.5
Increased fuel cost	22.3
Less productivity at household level	8.7
Less safety from wild animal	13.6
low vision	25.2
Others	14.6

The respondents faced numerous challenges due to an improper illumination source. Around 22.3% of respondents reported paying higher costs for fuel, including the cost of candles, kerosene, and the purchase price of solar systems. Additionally, 25.2% of those interviewed suffered from low vision due to constant work under the low light of lanterns and candles. Some respondents (15.5%) mentioned that their children could not study without sharing a lantern with other siblings.

Moreover, 13.6% of respondents claimed that there was no safety after dark, and women could not venture outside their homes. The villagers were also worried about tiger attacks since the village is surrounded by rivers. Furthermore, 8.7% of respondents reported a reduction in productivity due to the inability to do housework or other income-generating work at night, causing an increase in women's workload.

The government grid has a power plant in Dhamakhali, which is far from the island, and the line crosses challenging obstacles since the islands are surrounded by rivers. Although the government connection built some sub-stations in the village and connected some households, only a few families received the full connection with a meter. Panchayat pradhan Debashish Mondal and panchayat chairman Ankan Mondal also stated that more than 40% of families who

received government connection did not yet receive the meter. Moreover, there is no street lighting scheme under the government project, as reported by the panchayat.

Respondents reported frequent house fires caused by lanterns, candles, and oil lamps.

ABOUT THE PROGRAMME

The Indus Oorja Renewable Energy at Sundarbans project was launched on December 9, 2020, to support poor families and those from lower-income groups in Kumirmari Island in Sundarbans, West Bengal. The project location comprises Adibasipara, Mridhapara, and Bagnapara, covering 200 households. The project partner for this initiative is World Wildlife Fund (WWF) India, while Punam Energy Pvt. Ltd. serves as the technical partner.

The project coverage area includes 200 households, with a total of 172 households covered so far (as of the last visit). The project has also provided electricity to a primary school, ICDs centre, local club, and temple in the area.

The project site was selected based on the financial conditions of the villagers and to reduce their dependence on the forest, thereby reducing the risk of human-wildlife interactions. The majority of the villagers depend on forest-based resources for their livelihood, such as bee collection and crab collection. The first phase of the solar grid, with a capacity of 32 kWp and comprising 80 modules with 395 Wp wattage each, has been a source of strength for the community during times of despair.

The solar grid generates a total of 60-65 units per day, with an average consumption of 30-35 units each day, which is expected to increase to 45-50 units per day during the summer months. The project has a buffer of 30-35 units per day for emergency purposes, which can be useful to meet future increases in electricity demand and also for the productive use of energy.

Sustainability is an essential aspect of any project, and the Indus Oorja Renewable Energy at Sundarbans project is no exception. The implementing agency has handed over the project to the Panchayat and is now managed by the local Village Energy Committee. WWF India is responsible for paying the annual maintenance cost for the next three years.

While the project is generating revenue, it will take a couple more years to generate corpus funds. To monitor the project, WWF India visits the site, interacts with stakeholders and villagers, and keeps track of the documents, such as unit consumption, revenue collected, and the total number of household connections. They explore opportunities to add economic loads and promote the productive use of renewable energy in these projects. The project will continue to be monitored for the next couple of years to ensure its long-term sustainability.

IMPLEMENTATION OF THE PROJECT

It is impressive to see the implementation and intervention of the solar microgrid project. The project aimed to provide electricity to 200 homes on the island, and it has already connected 172 households.

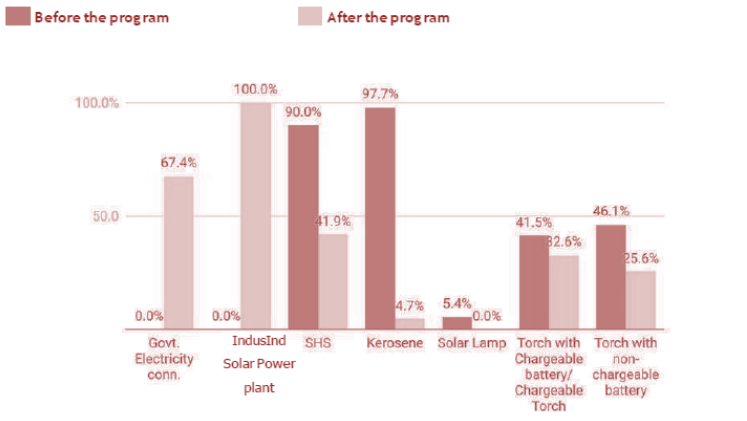
The panchayat played a crucial role in this project. They provided a no-objection certificate, negotiated land usage rights, and even helped in deciding the location of streetlights. The forest officer was also aware of the project from the beginning and participated in different awareness programmes. This shows that the project had community participation and support.

The villagers contributed towards the microgrid connection by paying an initial payment of Rs 500 to Rs. 1,000 to get the solar connection. The Village Energy Committee collected the initial payment and kept it in their bank account. The committee members finalised the unit cost and the initial amount voluntarily, with no influence from outside. The committee members also decided to keep the project inclusive and not strike out households from the list if they couldn't pay the full amount at once.

Most respondents paid less than Rs. 200 every month for the solar connection, and the unit cost was Rs. 12. The flat rate of up to 9 units was fixed so that each family could get a basic electricity supply. The unit cost was Rs. 15 per unit if the unit went beyond 9 units.

The solar power package provided under the programme was cost-efficient, and the villagers felt that it was a significant financial benefit. Before this project, villagers had to arrange for wiring out of their own cost, which ranged between Rs. 2,000 and Rs 3,000 per household.

The microgrid power plant has not only provided household connections but also extended its support to different community institutions. The intervention of providing free solar connectivity to primary schools, ICDS centres, local clubs, and temples can have a positive impact on the community's overall development.



The above table indicates the illumination status of the hamlet before and after the IndusInd Solar Plant installation in the hamlet itself.

Implementation of this intervention involved identifying the institutions in need of solar connectivity and interacting with their respective authorities. The primary school and ICDS centre were identified as the institutions in need of solar connectivity, and the village school principal and worker were contacted for the implementation process. The microgrid power plant provided the institutions with solar connections for free.

The implementation process also involved monitoring the usage of solar connections. During the research, it was found that the primary school and ICDS centre had barely used the connection due to the Covid-19-induced lockdown. On the other hand, the local club and Durga temple have been using the connections intermittently daily and on several occasions.

The intervention of providing free solar connectivity to community institutions can lead to the development of the community as a whole. The institutions can have access to electricity, which can improve the quality of education in schools, ensure the proper functioning of health centres, and provide the necessary lighting for religious and social events in the community.

IMPACT OF THE PROGRAMME

The solar microgrid project in Kumirmari island of Sundarbans has brought a significant, multi-faceted impact on the lives of the people and the community dwelling in one of the remotest regions of the world.

Reduced carbon footprint

The post-intervention stage of the solar microgrid project has brought significant changes in the source of illumination of the households in the village.

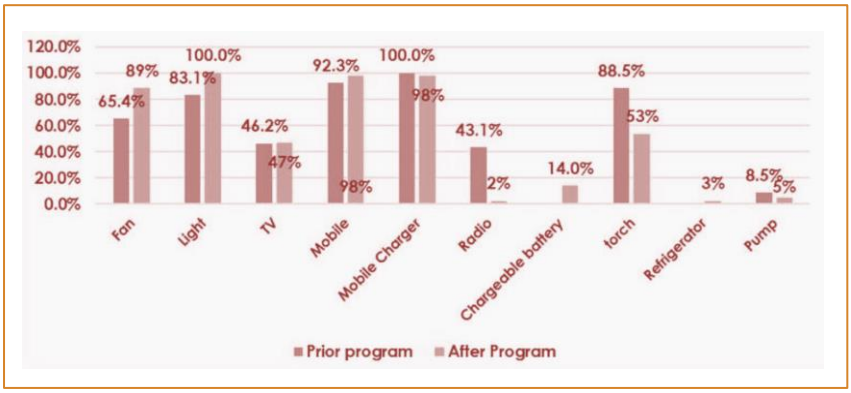
According to the survey conducted, 100% of the respondents reported that they have the solar power connection as their primary source of illumination post-launch of the solar microgrid. This has helped to reduce the overall carbon footprint and improve the health conditions of the villagers.

The government electricity connection is also available to 68% of the households, but only a few have proper meters from the government department, and most of them get the link from the overhead wire through hooking drawn illegally. However, the usage is less due to the solar connection, which will help to reduce the use of fossil fuels. The usage of kerosene oil as a source of illumination has been reduced to only 5% of households, which use it mainly during emergencies. However, most household store kerosene oil for the sake of keeping their ration cards active and use it for cooking fuel during the monsoon period. Reduction of the use of kerosene oil has also led to improved health and safety of the people.

Additionally, 42% of the respondents still operate personal solar systems, but they mostly keep them for emergency uses. The usage of regular battery-led torches has also reduced, and only 26% of the respondents still use them.

Before the solar plant was installed, the average monthly household cost for kerosene was Rs. 95. After the intervention of the programme, the kerosene cost has become almost zero for at least eight to nine months. The cost of a chargeable battery is usually one-time, around Rs. 300-400 depending upon the size and brand, and the recurring cost is nil. The average cost of a non-chargeable battery torch is around Rs. 28.8, and the usage of regular battery torches has been reduced.

Increased use of appliances



The installation of the solar microgrid has led the community to increase electronic appliance usage. Most of the households have installed fans, and 89% of the respondents shared that they started using fans post-installation of the programme. They used an average of four lights post-installation of the programme, and 47% purchased a television post-installation. 92.3% of the respondents already had mobiles earlier, and they reported having two sets of mobile during the post-programme. There is an increase of 7% in the case of purchasing new mobile sets and 1% in the field of television. In this regard, the respondents shared that they could not operate the television due to the poor voltage of their solar home system. 3% of the respondents purchased a refrigerator.

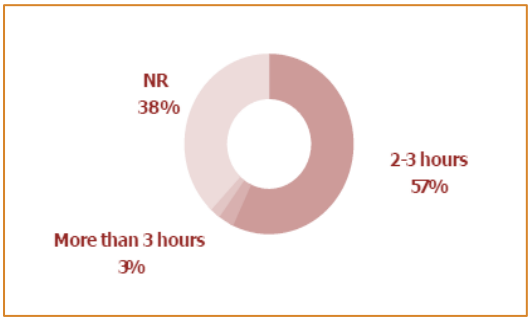
The respondents use solar power connections for an average of four hours daily, and their solar system for an average of three hours daily. They use chargeable batteries for an average of two hours daily, and a regular battery torch for two hours daily. The average kerosene use is reduced to one hour, mainly during emergencies.

The solar microgrid project has helped reduce the carbon footprint and improved the health conditions of the villagers. The villagers have turned to an environment-friendly power connection, which has brought significant changes to their source of illumination. The increased usage of electronic appliances shows that households are benefiting from the project, and the reduced cost of kerosene and other sources of illumination has helped to improve their financial situation.

Improved standard of living

The project has significantly improved the basic standard of living of the villagers. The project has enabled 100% of the respondents to have lights in their households, and 89% have access to a fan. This has enabled the villagers to afford basic needs like fans and lights, which they couldn't before due to the poor functioning of their solar home systems.

Increased study hours for children



One of the critical impacts of the solar grid was on the children. Due to the Solar grid, the children's study hours have increased from 2-3 hours. Previously there used to be a lot of power cuts and blackouts during the cyclone. But now, due to the IndusInd power grid, there is more power supply and fewer blackout days. This has impacted the education of the children. They have more time for their studies.

Increased safety, reduced man-animal conflicts

The respondents said with access to more lights, villagers can put extra light on their verandas to watch for approaching tigers or other wild animals, increasing safety and security. Villagers can better see and avoid approaching animals, reducing the likelihood of man-animal conflicts. It has helped to increase safety and security immensely. Women can go out in the evening and also spend a decent time after sunset because of the illuminated streets. The main roads are no longer in total darkness and women reported feeling safer.

Change in workload for women

As the households can keep the light on at their homes for as long as needed, the majority of women have reported a significant decrease in their workload, and they were able to allocate time for household tasks and cooking in the evening, which reduced their workload during the day. As a result, they now have a few hours of relief from constant work pressure during the day and can cook in the evening without difficulty. 72.5% of the respondents reported a decrease in the overall workload of women compared to before.

Employment opportunities

The solar microgrid project has also had an impact on employment generation in the villages. The availability of solar electricity has enabled some women to start their small businesses and allowed local shops to stay open later. Villagers are now able to work for longer hours, allowing for increased productivity and economic opportunities. The increase in access to the Internet, printing, and photocopying facilities is also a positive development that can open up new opportunities for education and commerce in the area. The project has also generated employment opportunities for technicians and electricians in the village for the upkeep of the microgrid.

This has led to increased social participation and community gathering, as villagers are now able to participate in community events that were previously difficult due to frequent power cuts.

Reduced ecological impact

The project has significantly reduced the environmental impact by reducing the use of fossil fuels. The findings also refer to respondents accessing the government connection through hooking for fewer hours. If the solar power plant did not exist, they would have accessed more hours of government grid connection. That refers to more numbers of fossil fuel usage. Presently they use the conventional grid but less in hours means a lesser generation of fossil fuels.

Cost savings

In terms of cost savings, the solar microgrid project has had a significant impact. Respondents reported that they saved approximately Rs 300 to Rs 400 per month on kerosene oil for cooking and lighting for eight to nine months. They also reported that they saved Rs 80 to Rs 90 on battery-led torch usage. The savings varied based on their usage, but on average, respondents reported saving Rs 400 to Rs 500 per month.

The respondents primarily spent their savings on food, with 79% reporting that they used the savings to purchase vegetables, chicken, meat, rice, pulses, spices, and cooking oil. After food, savings were mostly spent on medication (34%) and educational purposes (16%), such as tuition fees. Additionally, 7% of respondents spent the amount on animal husbandry, 5% on paying the solar power bill, 3% on recharging cable connection or mobile data, and 2% could not make any savings.

Increased social participation

The project has increased social participation and community gathering in the village. According to 43.2% of respondents, there has been an enhancement in social connections within households. The respondents noted that this improvement is evident in the culture of the village as a whole. Additionally, members of the local club and panchayat reported an increase in cultural gatherings due to the installation of solar-powered street lights and access to electricity at night.

Overall, the power programme has had a positive impact on the villagers' standard of living, with increased access to basic necessities and improved safety and security. It has also led to significant savings and increased spending on essential needs like food, medicine, and education.

KEY OBSERVATIONS AND CONCERNS

After interacting with beneficiaries, the Village Energy Committee, and other stakeholders, several key observations and concerns have been identified regarding the project:

Documentation process

- ✓ The village committee's documentation process needs to be organised, with bills and vouchers properly maintained and the Management Information System (MIS) clearly written for better understanding.
- ✓ VEC members require hand-holding orientation for record-keeping and documentation, and constant support to enhance the record-keeping part in simple formats with relevant information.
- ✓ Periodical training is required to figure out best practices for different categories like record-keeping, utilisation of funds, profitability from buffer units, maintenance, and collection of bill dues, and conflict resolution.

Ensuring clarity in the bill

- ✓ The blue card issued by the village energy committee needs to be upgraded to a bigger size so that monthly meter readings can be well documented on the bill
- ✓ The monthly total unit consumption and cost should be clearly written on the bill, and discrepancies should be avoided.
- ✓ The bill collection process should be strengthened, especially for due amounts from local institutions.

Ensuring planning for AMC

- ✓ Strengthening the planning for organising the Annual Maintenance Contract (AMC) amount for the future is required, with proper guidance provided to calculate the AMC payment.
- ✓ The solar grid unit does not support heavy usage by households like motor pumps, and illegal hooking or heavy usage can cause sudden power failures.

Scope of more street lights

- ✓ 100% of respondents want more street lights inside the village for safety and security.

Overall, the project requires more training and support for the VEC members, improvement in the documentation and bill collection processes, planning for AMC, and addressing the issue of heavy usage by households that may lead to power failures. Additionally, more streetlights could be installed inside the village for safety and security.

MITIGATION STRATEGIES

To mitigate the concerns related to the capacity of the solar grid and the per-unit cost, the following strategies can be considered:

Documentation

- ✓ Provide training on documentation and record-keeping to strengthen capabilities.
- ✓ Engage a part-time accounting professional to maintain accounts and records.

Clarity in the bill

- ✓ Upgrade the electricity bill size from the next printing.
- ✓ Orient consumers on how to check meter readings and bill statements
- ✓ Strengthen VEC's internal monitoring system by randomly checking individual electricity bills and the master sheet (MIS).
- ✓ Appoint an additional account person on an ad-hoc basis if needed.

Bill collection process

- ✓ Explore alternative solutions like instalment payments.

Planning for AMC

- ✓ Keep an investment plan for the AMC amount separately in the bank
- ✓ Negotiate with the bank for a flexible investment.

More street lights

- ✓ Strengthen financial contributions of the panchayat, villagers, and VEC to install more street lights.

Capacity of solar grid

- ✓ Provide clarification to users that heavy-duty motor and other heavy engine applications are prohibited for this project.
- ✓ Revise the per-unit cost to make solar power more affordable for villagers and reduce the gap between unit costs compared to government connection costs.

Overall, a multi-pronged approach is needed to address the concerns related to the solar power project. By implementing these strategies, the Village Energy Committee can strengthen its operations and ensure the project's long-term sustainability.

SWOT ANALYSIS

The analysis below identifies the Strengths, Weaknesses, Opportunities, and Threats of the programme:

Strengths	✓ The project is unique and sustainable. ✓ The project is managed at ground level by the village committee. ✓ Coordination of the implementation body with the village committee and villagers is quite robust. ✓ The village energy committee functions moderately well in such a short timeframe. ✓ Demand for solar connectivity is rising among villagers. Regular payment of electricity bill for project progress. The overall set-up was completed. ✓ Panchayat’s cooperation is one of the biggest strengths of the project.

Weaknesses	✓ Local institutions may become permanent defaulters if debt collection is not properly focused Village energy committee needs to be more active in regularly collecting bills, and dues, regularly managing the programme, document checking, and prompt response to the repairing. ✓ Local repair support needs to be responsive. No such investment plan for the collection amount.
Opportunities	✓ The electricity demand of the villagers will increase over the period. ✓ A good investment plan can lead to a good corpus fund for the microgrid plant. ✓ VEC may sell surplus units and remaining connections for commercial purposes.
Threats	✓ Natural calamity is a major concern in these coastal areas.

CONCLUSION

The solar power project has been successful in providing electricity to the villagers and addressing the issue of lack of electricity in the area. The project has provided a reliable and sustainable source of electricity to the village, which has significantly improved their quality of life. It has also shown the potential of renewable energy sources to provide electricity to remote and underdeveloped areas.

However, some concerns need to be addressed to ensure the continued success of the project. The lack of clarity in the billing process and documentation is a major issue that needs to be addressed to ensure transparency and accountability in the project. Proper orientation and training of the villagers and VEC members, as well as the engagement of a part-time accounting professional, can help to address these concerns.

The financing of the project, including the AMC amount and the installation of more streetlights, needs to be better planned and managed to ensure the continued sustainability of the project. The VEC committee can explore alternative solutions such as instalment payments and strengthening the financial contribution of the panchayat, villagers, and VEC.

The project's capacity needs to be better understood and communicated to the villagers to avoid the misuse of the solar power system. Revising the per-unit cost to be more competitive with government connection costs can also help to promote the use of solar power.

Having said that, the project has also highlighted the importance of community participation and engagement in renewable energy projects. The involvement of the Village Energy Committee, panchayat, and residents has been critical in the success of the project. It has also demonstrated the need for proper planning and management to ensure the sustainability and effectiveness of such projects.

Overall, the solar power project in the village has been a positive development in improving the access to electricity in remote areas. It has also provided valuable insights into the challenges and opportunities of implementing renewable energy projects in rural communities. The success of the project can serve as a model for other villages and communities looking to adopt renewable energy solutions.

CASE STUDIES

Kakoli Gayen

Kakoli Gayen faced financial difficulties as her partially disabled husband was unable to contribute much to the family. To improve their situation, she considered starting her own business raising female crabs for some time in a chamber to lay eggs. However, to do so, she needed a constant power supply to heat the chamber and verify which crabs were laying. She approached the village's solar committee and implementation agency to extend the solar connection to the crab chamber, which was filled with sweet water.

With the extension of the solar connection, Kakoli's crab business began to thrive. They now sell the crabs in the neighbouring market at a wholesale price, earning her about 8,000/- to 10,000/- per month. Her husband also helps her in the business. Thanks to the solar connection, her family was able to survive the financial downturn and continue to sustain their livelihood.

Nimai Gayen

Nimai Gayen is a resident of Bagnaparar who runs a small book and computer shop in the hamlet. He opted for both a solar connection and a government connection to run his shop, but he primarily uses the solar connection to power the computer due to zero voltage fluctuation and fewer power cuts. According to Nimai, power cuts are almost non-existent, except during heavy thunderstorms or cyclones. Even during the monsoon season, power cuts are infrequent. He can also run the shop and work on the computer at night.

Nimai mostly uses the solar connection for his shop, which is the only one in the neighbouring islands with computer facilities, making the service essential for the villagers. He earns a sustainable income of about Rs. 4,000-5,000 per month to support his family.

Tumpa Raptom

Tumpa Raptom is a housewife from Bagnapara, living with her husband and two children. Her husband engages in daily wage labour work, and their average income is below Rs. 5,000 per month. They grow vegetables in the backyard mainly for their consumption and hardly get surplus products to sell. Tumpa, who has good stitching skills, wanted to stitch Kantha to contribute to her family's income. But she couldn't do it properly because she did not have any free time during the day, and she was unable to sew at night under the light of the lantern. Fine stitching needs proper lighting.

However, she was among the first candidates for the solar connection batch, and once they got the solar connection at home, she was able to stitch more Kanthas without any hassle. She earns around Rs. 1,500-2,000 per month by selling them at Rs. 300 each. Sometimes she earns more than that. She is happy that, besides becoming independent, she can also contribute to the family's income.

Santosh Barman

Santosh Barman, a local singer who performs at various religious gatherings, was struggling to make ends meet. Although singing was his profession, he was not earning enough to support his family. To supplement his income, he started poultry farming and began selling eggs and whole chickens at local markets and Dhamakhali at wholesale prices.

However, poultry farming requires good lighting to ensure that the chicks grow properly, and Santosh was using a government connection for this purpose. Unfortunately, frequent power cuts during the monsoon period caused many of the chicks to die, resulting in significant financial losses for Santosh.

To address this problem, Santosh switched to a solar connection. With the solar connection, he was able to reduce the number of chick deaths due to adequate voltage and minimal power cuts. As a result, he was able to gradually restart his business and pay off most of his debts.

Dipankar Baishnab

Dipankar Baishnab used to work as a mason in neighbouring villages, but due to a lack of regular work, he faced difficulties in supporting his family. To improve his financial condition, he decided to open a grocery store in his house. However, he faced difficulties running his store at night due to the absence of an electrical connection, which affected his business.

Fortunately, Dipankar was among the first to obtain a solar connection when it was introduced in the village. He shared that his shop gets more customers in the evening as he can keep it open until 8pm. Additionally, a solar street light located right next to his shop provides a sense of safety to villagers, who now feel comfortable visiting his shop regularly.

Krishnapada Mondal

Krishnapada Mondal lives with his wife and two children and works as a labourer on a daily wage basis. However, due to irregular work, he struggles to support his family with an income of around Rs 2,500 per month. As he has a skill in mat weaving, he decided to take it up as an alternative source of income. Since he does his other work during the day, he weaves mats at night.

After obtaining a solar connection, he started weaving mats professionally. He chose a solar connection because there are minimal power failures, and the voltage and brightness are fairly satisfactory. He shared that he could continue mat weaving because of the solar connection. He sells each mat at Rs 400 and earns Rs 2,000-3,000 as an additional income. His standard of living has improved considerably since he began weaving mats. His children and wife are also supporting him in mat weaving.

Anjali Munda

Anjali Munda resides in Mridhapara with her mother, mother-in-law, brother, sister-in-law, and two sons. Her husband passed away ten years ago due to a tiger attack, leaving her as the sole earning member of the family. However, she finds it hard to manage her family by raising livestock, and the average income of the family is only around Rs 2,000-2,500, which is extremely low for seven family members. They do receive some remuneration through the BPL card, but it's not enough. Anjali has great hope for her sons, who are studying in 12th and 9th standard, respectively, and she believes that they will excel in their studies and take care of the family. However, they face a lot of challenges in their studies, as they have to study in the evening under a single lantern, and they only have two bedrooms for the family of seven members, which means they barely get an individual lantern for study.

Anjali desperately wanted to get a solar connection, but could not afford the full initial amount. She requested the solar committee for help, and they provided her with a solar connection for Rs. 200 Her elder son is going to appear for the higher secondary board exam this year, and the solar connection has become very useful for him to prepare thoroughly for the examination in bright light. Her son shared that studying in such bright light gives him greater motivation to perform well. Both the mother and son expressed their happiness and gratitude, as they hope to achieve good grades in the board exam.