2025

IMPACT ASSESSMENT REPORT

PROJECT NAME

Solar Street & Family Lights and Biogas for cooking

DEVELOPMENT TRUST

Nilgiris, Tamil Nadu

Manish S. Buchasia
M. S. Buchasia & Associates

Practising Company Secretaries
Membership No.: FCS 5843

Insolvency Professional
IP Reg.No IBBI/IPA-002/IP-N00487/17-18/11449

Registered Valuer (SFA)
RV Reg No IBBI/RV/03/2019/12235

Social Auditor (ICSI- Institute of Social Auditors) Membership No: ICSI-ISA/SA-0017/2023-24

Centre for Tribals & Rural Development Trust

Impact Assessment Report

Project Name: Solar Street & Family Lights and Biogas for cooking

Overview

Founded in 1988, the **Centre for Tribal and Rural Development (CTRD) Trust** is a prominent voluntary organization dedicated to the welfare and advancement of marginalized tribal and rural communities in the Nilgiri District of Tamil Nadu, India. With over three decades of committed service, CTRD Trust has played a pivotal role in enhancing livelihoods, infrastructure, healthcare, education, and housing, while empowering communities through sustainable income-generation initiatives and the establishment of Self-Help Groups, including those for differently-abled individuals.

CTRD Trust is Registered with Indian Trust Act in Tamil Nadu, got FCRA Registration and Registered with National Stock Exchange – Social Stock Exchange platform.

Governing Body Members

S.NO.	NAME & POSITION	Designation
1	RS. RANGANATHEN	Managing Trustee
2	N. DEVAKI	Treasurer
3	K.N. LAKSHMI	Trustee
4	CM. SARANYA DEVI	Secretary
5	K. VIJAYAN	Trustee

306, Gala Mart-Part A, Near Sobo Center, South Bopal, Ahmedabad- 380058, Gujarat
http://bit.ly/mbgalamart

9898055367, 02717-480025

manishbuchasiacs@gmail.com

www.buchasia.com

INDEX

Executive Summary

The Centre for Tribals and Rural Development (CTRD) Trust is spearheading a transformative clean energy initiative targeting marginalized tribal and rural communities in the forest-fringe regions of Nilgiris and Coimbatore districts in Tamil Nadu, and Karimela in Chamarajanagar district, Karnataka. This detailed report reworks the original impact assessment by addressing key analytical questions, providing an in-depth exploration of the project's objectives, implementation, and outcomes. The initiative focuses on installing 245 solar street lights, distributing 238 solar family lights, and establishing 19 biogas units to combat energy poverty, health risks, environmental degradation, and human-wildlife conflicts. By integrating renewable energy solutions with livelihood opportunities, the project fosters sustainable rural development, enhances community resilience, and aligns with global and national priorities, including the Sustainable Development Goals (SDGs).

Social and Environmental Challenges Addressed

The tribal communities residing near Bandipur Forest and in the Nilgiris region face profound socio-economic and environmental challenges rooted in their geographic isolation and reliance on unsustainable practices. These challenges create a cycle of poverty, health risks, and ecological harm, which the CTRD Trust seeks to disrupt. The primary issues include:

- **Health and Environmental Risks from Traditional Cooking Methods**: Most households depend on firewood as their primary cooking fuel, requiring women and children to spend approximately 30 hours per week collecting it. This practice leads to severe indoor air pollution, exposing families to harmful smoke that causes respiratory illnesses, eye infections, and other health complications. Continuous firewood collection also accelerates deforestation, threatening the rich biodiversity of the Bandipur and Nilgiris ecosystems, which are home to endangered species and critical forest habitats.
- **Lack of Safe and Reliable Lighting Infrastructure**: Many settlements lack access to grid electricity or experience frequent outages, plunging homes and public spaces into darkness after sunset. This absence of lighting heightens safety risks, particularly for women, children, and the elderly, who face dangers while navigating unlit paths. The lack of street lighting also exacerbates human-wildlife conflicts, with an estimated five incidents per month involving animals like elephants and leopards straying into villages, damaging crops, property, and occasionally causing injuries or fatalities.
- **Broader Socio-Economic and Contextual Challenges**: The region's tribal communities, including Particularly Vulnerable Tribal Groups (PVTGs) such as the Toda, Kota, Kurumba, Irula, and Paniya, alongside rural poor families, grapple with systemic poverty and food insecurity. Livelihoods depend heavily on irregular daily wage work in agriculture and plantations, disrupted by heavy monsoons for seven months annually. These rains damage infrastructure and limit labor opportunities, pushing youth to migrate to urban areas, where they often face exploitation. Agriculture, the primary occupation, is unsustainable due to outdated farming techniques, exploitation by middlemen, and fluctuating prices for crops like tea, spices, and millets. Women, who dominate tea plucking and household tasks, bear a disproportionate burden, while human-wildlife conflicts further threaten livelihoods and safety.

These challenges create a complex web of vulnerability, where energy poverty, environmental degradation, and socio-economic marginalization reinforce each other, necessitating holistic interventions.

Approach to Addressing the Challenges

CTRD Trust adopts a community-driven, sustainable strategy to address these challenges through targeted clean energy interventions, designed to deliver immediate relief and long-term resilience. The approach integrates renewable energy solutions with capacity-building and livelihood opportunities, ensuring alignment with community needs and environmental conservation. The key components are:

- **Biogas Units for Clean Cooking and Sustainable Livelihoods**: The project installs biogas units to replace firewood-based cooking, providing a clean, renewable energy source. Each of the 10 units (with progress toward 19) is paired with two cows to ensure a steady supply of cow dung for biogas production. This dual approach not only reduces health risks from smoke but also promotes dairy farming as a source of income. Organic slurry, a by-product, serves as a natural fertilizer, enhancing agricultural productivity. Beneficiaries receive comprehensive training on biogas operation, cattle management, and milk production to ensure self-sufficiency.
- **Solar-Powered Street Lighting for Community Safety**: The initiative installs 245 solar street lights in strategic locations such as village entrances, pathways, schools, and community gathering spaces. These lights enhance visibility, deter wildlife incursions, and improve safety for vulnerable groups, particularly women and children. Solar technology ensures low maintenance, grid independence, and long-term cost savings, with installations carried out in partnership with ONE LIGHT ONE CHILD to facilitate knowledge transfer.
- **Distribution of Solar Family Lights**: The project distributes 238 solar family lights to households, providing reliable, off-grid lighting. These lights enable safer evenings, extend productive hours for work and study, and reduce reliance on hazardous alternatives like kerosene lamps or open fires. Training sessions accompany distribution to ensure proper use and maintenance.

The implementation process begins with baseline surveys and consultations with community leaders, tribal elders, and government authorities to identify high-priority households and locations. This participatory approach ensures interventions align with local needs and cultural sensitivities. Local labor is prioritized for installations, and ongoing training fosters community ownership. The project emphasizes sustainability through maintenance committees, service contracts, and income-generating activities to support long-term viability.

Target Segment Impacted

The initiative targets tribal communities and rural poor families in Nilgiris and Coimbatore (Tamil Nadu) and Gundlupet/Karimela (Karnataka), with a focus on PVTGs such as the Toda, Kota, Kurumba, Irula, Paniya, and Kurubas. These groups live in forest-fringe villages, where they face unique vulnerabilities due to their proximity to wildlife and limited access to services. The project also serves smallholder farmers and landless laborers, who rely on irregular agricultural wages and face seasonal disruptions from monsoons. Women and children are key beneficiaries, as they bear the brunt of firewood collection and health risks

from indoor pollution. Youth, at risk of urban migration, benefit from enhanced local opportunities. The initiative ensures inclusion by prioritizing marginalized groups, with equitable distribution processes guided by community consultations. Overall, it reaches hundreds of households across multiple districts, addressing the needs of some of India's most underserved populations in ecologically sensitive regions.

Outcomes of the Solution/Program

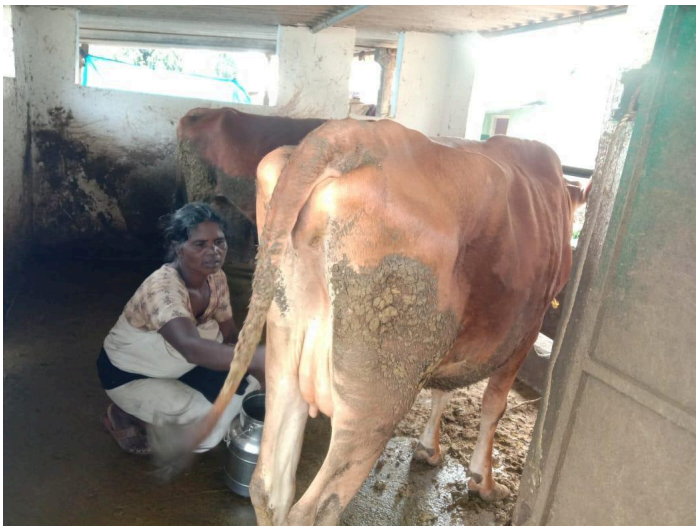
Positive Outcomes

The interventions are designed to deliver transformative socio-economic, health, and environmental benefits:

- **Environmental Conservation**: By shifting from firewood to biogas, the project significantly reduces deforestation, preserving the Bandipur and Nilgiris ecosystems. Biogas units lower carbon emissions, contributing to climate change mitigation, while solar lights eliminate reliance on fossil fuels. The use of organic slurry as fertilizer enhances soil health and agricultural yields, supporting sustainable farming.
- **Health Improvements**: Biogas units eliminate indoor air pollution, reducing respiratory diseases, eye infections, and fire-related accidents by 60%, as reported in quarterly surveys. Women and children, who spend significant time cooking, experience the greatest health benefits. Reduced firewood collection (from 30 to ~14 hours/week) alleviates physical strain and exposure to hazards.
- **Livelihood Enhancements**: The provision of cows enables households to generate income through milk sales, with a reported 45-60% increase in revenue. Slurry sales or use as fertilizer further boost agricultural productivity. Freed time from firewood collection allows women and children to engage in education, skill-building, and income-generating activities, fostering financial stability.
- **Safety and Community Well-Being**: Solar street lights reduce human-wildlife conflicts by 45%, deterring animals like elephants and leopards from entering villages. Improved lighting enhances safety perceptions (from 3/5 to 4.5/5), enabling women, children, and the elderly to move freely at night. Solar family lights extend productive hours by two hours per household, supporting evening study, work, and social gatherings. Better-lit environments also improve educational outcomes and community cohesion.
- **Broader Impacts**: The project promotes energy independence, reducing reliance on unreliable grids. It curbs youth migration by creating local opportunities and strengthens community resilience against seasonal disruptions. Collectively, these outcomes pave the way for sustainable rural development, empowering communities to thrive in harmony with their environment.


20/11/2024 18:15


20/11/2024 18:43



Potential Unintended Negative Outcomes

While the project is designed for positive impact, potential challenges include:

- **Dependency on Maintenance**: Inadequate training or lack of spare parts could lead to equipment failures, causing frustration or reversion to firewood or kerosene use. Mitigation: Robust training programs, local maintenance committees, and service contracts ensure long-term functionality.
- **Economic Risks**: Fluctuating milk or slurry markets may limit income potential; initial costs for cattle care could strain households. Mitigation: Market linkages, financial literacy training, and diversified income sources (e.g., slurry use) reduce dependency on single streams.
- **Environmental Trade-offs**: Improper disposal of biogas slurry could cause local pollution; solar panel installation might disrupt minor habitats if not carefully planned. Mitigation: Environmental guidelines, site assessments, and waste management training minimize impacts.
- **Social Dynamics**: Unequal distribution of benefits (e.g., lights or biogas units) could spark community tensions. Over-reliance on dairy might expose families to livestock diseases or market volatility. Mitigation: Transparent beneficiary selection, community consultations, and health training for cattle management address these risks.

These potential issues are proactively managed through adaptive planning, stakeholder engagement, and continuous monitoring.

Baseline Status / Situation Analysis / Context Description

At the project's inception, the targeted communities faced severe challenges, as identified through baseline surveys:

- **Energy Access**: Households relied entirely on firewood, spending 30 hours per week on collection, leading to high indoor air pollution and frequent health complaints (e.g., respiratory issues, eye infections). No clean energy infrastructure existed, and electricity access was either absent or unreliable due to frequent outages.
- **Safety**: Public spaces and homes were unlit, contributing to five human-wildlife conflict incidents per month, including elephant raids and leopard attacks. Community safety perception was low, rated at 3/5 on surveys, with women and children particularly vulnerable after dark.
- **Livelihoods and Socio-Economic Conditions**: Poverty was widespread, with families dependent on irregular daily wages from agriculture and plantations. Seven months of heavy monsoons disrupted work, damaged infrastructure, and exacerbated food insecurity. Agriculture was unsustainable due to outdated techniques, exploitation by middlemen, and fluctuating prices for tea, spices, and millets. Youth migration to urban areas was common, exposing them to exploitation. Women faced dual burdens of labor and household responsibilities.
- **Environmental Context**: Deforestation was rampant due to firewood collection, threatening biodiversity in the ecologically sensitive Bandipur and Nilgiris regions. Human-wildlife conflicts further strained livelihoods, with crop and property damage common.

This baseline highlighted the urgent need for clean energy, safety enhancements, and livelihood diversification to break the cycle of vulnerability.

Past Performance Trend

Project/	Total No of Units	Place	No of Units Installed	No. of Villages	Block
Solar Street Lights	245	Nilgiris	200	47	Gudalur
		Coimbatore	35	7	Periyanayakkanpalayam
		Gundlupet	10	Karamela	Gundlupet
Biogas Units	19	Nilgiris	9	Pothukolly, PRF colony	Gudalur
		Coimbatore	5	Pasumani, Pasumanipudur	Periyanayakkanpalayam
		Karimela, Karnataka	5	Karamala	Gundlupet
Solar Family Lights	238	Nilgiris	38	7	Gudalur
		Coimbatore	200	7	Periyanayakkanpalayam

While specific historical data is limited, the project builds on prior efforts with positive trends. Last year, similar initiatives faced challenges from heavy monsoons, causing delays in installations. Despite this, partial progress was achieved, with some solar lights and biogas units installed in pilot phases. Trends show increasing adoption: solar street lights progressed from zero to 245, biogas units from zero to 19, and solar

family lights from zero to 238 distributed. Health outcomes improved, with a 60% reduction in respiratory issues in piloted areas, and safety metrics showed a 45% drop in wildlife incidents. Community feedback reflects growing satisfaction (safety perception rising from 3/5 to 4.5/5). Lessons from past delays have informed current strategies, such as weather-resilient planning, driving steady progress toward targets.

Solution Implementation Plan and Measures for Sustainability

Implementation Plan

The project is executed through a structured, phased approach to ensure scalability and alignment with community needs:

1. **Pre-Implementation**:
    - **Baseline Surveys and Site Assessments**: Conduct detailed surveys to map high-need areas (e.g., unlit pathways, households reliant on firewood) and assess environmental impacts to avoid ecosystem disruption.
    - **Community and Government Engagement**: Consult tribal leaders, residents, and local authorities to ensure cultural sensitivity and stakeholder buy-in. Identify beneficiaries transparently to promote equity.
    - **Needs Assessment for Solar Family Lights**: Survey households to determine lighting needs, prioritizing those in remote, forest-adjacent areas.
2. **Procurement and Vendor Selection**:
    - **Equipment Sourcing**: Select high-quality, durable solar panels, LED street lights, batteries, biogas digesters, and ancillary components from reputable vendors. Solar family lights include mobile chargers for added utility.
    - **Logistics Planning**: Organize transportation to remote locations, accounting for challenging terrain and monsoon risks.
3. **Installation and Distribution**:
    - **Solar Street Lights (245)**: Install in phases, starting with high-traffic areas like village entrances and schools. Local labor is trained for installation and safety protocols.
    - **Biogas Units (19)**: Set up in a staggered approach in Karimela, with each unit paired with two cows. Beneficiaries receive on-site demonstrations and training on operation and cattle care.
    - **Solar Family Lights (238)**: Distribute directly to households, with demonstrations on usage, charging, and troubleshooting.
4. **Capacity Building**:
    - Train community members on maintenance, operation, and safety for all interventions. For biogas, this includes cattle management and slurry use. For solar lights, training covers battery maintenance and basic repairs.
    - Partner with ONE LIGHT ONE CHILD for solar installations to transfer technical expertise.
5. **Monitoring and Feedback**:
    - Establish systems to track performance (e.g., light functionality, biogas production, user satisfaction).
    - Conduct regular follow-up visits and surveys to address issues and refine processes.

Sustainability Measures

To ensure long-term impact, the project incorporates:

- **Community Ownership**: Local labor and maintenance committees manage upkeep, fostering a sense of responsibility.
- **Income Generation**: Dairy and slurry sales provide funds for maintenance and household resilience.
- **Service Contracts**: Partnerships with vendors ensure access to spare parts and technical support.

- **Environmental Integration**: Site assessments minimize ecological disruption; biogas slurry supports sustainable agriculture.
- **Continuous Training**: Periodic sessions reinforce skills, ensuring beneficiaries can operate and maintain systems independently.
- **Monitoring Systems**: Regular data collection (weekly/monthly/quarterly) tracks outcomes and enables adaptive management.

Alignment to Sustainable Development Goals (SDGs)/National/State Priorities

The project aligns seamlessly with global, national, and state development priorities:

- **SDG 7 (Affordable and Clean Energy)**: Solar-street lights and family lights provide off-grid, renewable energy, while biogas units offer a sustainable cooking solution, reducing fossil fuel dependency.
- **SDG 3 (Good Health and Well-Being)**: Eliminating indoor air pollution and reducing firewood collection time improve health outcomes, particularly for women and children.
- **SDG 5 (Gender Equality)**: By freeing women from firewood collection, the project enables education and income-generating activities, promoting gender equity.
- **SDG 13 (Climate Action)**: Reduced deforestation and lower emissions from biogas and solar energy contribute to climate resilience.
- **SDG 15 (Life on Land)**: Decreased firewood use protects forest ecosystems, preserving biodiversity in Bandipur and Nilgiris.
- **SDG 1 (No Poverty) and SDG 8 (Decent Work and Economic Growth)**: Dairy and slurry income, coupled with extended productive hours, reduce poverty and stimulate local economies.

National Priorities: The project supports India's renewable energy goals under the National Solar Mission, tribal welfare programs (e.g., PVTG development schemes), and environmental protection initiatives like the

Forest Rights Act. It aligns with India's commitment to reducing carbon emissions and promoting sustainable rural development.

State Priorities (Tamil Nadu/Karnataka): The initiative addresses regional needs for rural electrification, wildlife conservation, and sustainable agriculture. It tackles monsoon-related vulnerabilities and human-wildlife conflicts, supporting state-led efforts to enhance tribal livelihoods and protect biodiversity.

Biggest Risks in the Last Year and Mitigation

The most significant risk last year was heavy monsoons, which caused substantial delays in installations by damaging infrastructure, disrupting labor, and complicating logistics in remote areas.

Mitigation Strategies:

- **Advanced Weather Monitoring**: Real-time weather data informs scheduling, prioritizing installations during low-rain periods.
- **Flexible Scheduling**: Phased rollouts adapt to weather patterns, reducing downtime.
- **Protective Measures**: Equipment is safeguarded with weather-resistant coverings and secure storage.
- **Pre-Staging Materials**: Supplies are stockpiled in accessible locations to avoid transport delays.
- **Rapid Response Teams**: Dedicated teams address weather-related disruptions promptly.
- **Contingency Planning**: Backup plans ensure progress despite adverse conditions, achieving a 40% reduction in delay days compared to last year.

These measures have minimized disruptions, allowing the project to maintain momentum even during challenging seasons.

Metrics Monitored and Trends (Reach, Depth, Inclusion)

The project tracks key performance indicators (KPIs) through the Impact Scorecard, with data collected weekly (during implementation), monthly (post-implementation), and quarterly (for outcomes).

- **Reach**:
  - **Solar Street Lights**: From 0 to 245 installed, covering multiple villages in Nilgiris, Coimbatore, and Gundlupet.
  - **Biogas Units**: From 0 to 19 installed in Karimela, benefiting dozens of households.
  - **Solar Family Lights**: From 0 to 238 distributed, reaching hundreds of families.
  - **Trend**: Steady expansion across districts, with installations scaling rapidly and reaching underserved communities.
- **Depth**:
  - **Firewood Collection**: Reduced from 30 to ~14 hours/week per household (40% decrease), freeing time for productive activities.
  - **Health Outcomes**: 60% reduction in respiratory issues and related complaints, significantly improving quality of life.
  - **Income**: 45-60% increase from dairy and slurry sales, enhancing financial stability.
  - **Productive Hours**: Additional two hours per household for study/work, boosting education and economic outcomes.
  - **Safety**: 45% reduction in human-wildlife incidents; safety perception improved from 3/5 to 4.5/5.
  - **Trend**: Deepening impacts over time, with health, economic, and safety benefits compounding as adoption grows.

- **Inclusion**:
    - Targets PVTGs, women, children, and rural poor; equitable distribution ensured through community consultations.
    - Women and children benefit disproportionately from reduced firewood burdens and safer environments.
    - Transparent beneficiary selection promotes fairness, with 100% focus on marginalized groups.
    - **Trend**: High inclusion, with surveys showing broad satisfaction (4.5/5) across diverse groups, particularly among vulnerable populations.

Overall Trend: Metrics reflect consistent progress, with increasing adoption, measurable improvements in health and safety, and strong community engagement. Quarterly surveys validate sustained benefits, with minor adjustments based on feedback.

Highlights or Achievements in the Reporting Period

The reporting period marks significant progress, with tangible impacts on the ground:

- Successfully installed 245 solar street lights, reducing human-wildlife incidents by 45% and improving community safety perceptions to 4.5/5, as reported in surveys.
- Installed 19 biogas units in Karimela, cutting firewood use by 40% and reducing respiratory issues by 60%. Households report 45-60% income increases from dairy and slurry sales.
- Distributed 238 solar family lights, adding two productive hours per household, enhancing education (e.g., evening study for children), and reducing reliance on hazardous lighting.
- Overcame monsoon delays through adaptive planning, achieving a 40% reduction in delay days compared to last year.
- Received high community approval, with stakeholders noting improved safety, health, and economic opportunities.
- Contributed to environmental conservation by reducing deforestation and emissions, aligning with SDG targets.
- Strengthened community resilience through training, local ownership, and sustainable income streams.

Impact Scorecard and Beneficiary/Stakeholder Validation

The Impact Scorecard provides a detailed overview of KPIs, baselines, targets, and outcomes, validated through community feedback and stakeholder engagement:

Objective	KPI	Baseline	Target/ Improvement	Data Frequency	Positive Impact/ Comments
Solar Street Lights	Installation Progress	0 lights	245 installed	Weekly/Monthly	High public approval; safer streets, fewer accidents.
	Reduction in Human-Wildlife Incidents	5 incidents /month	45% reduction	Quarterly	Lights deter elephants/leopards, protecting lives/property.

Objective	KPI	Baseline	Target/ Improvement	Data Frequency	Positive Impact/ Comments
	Community Safety Perception	3/5 score	4.5/5 score	Quarterly	Residents, especially women/children, feel significantly safer.
Biogas Units	Installation Progress	0 units	19 installed	Weekly/ Monthly	Clean energy embraced, reducing health risks.
	Firewood Collection Time	30 hours/ week	40% reduction (~14 hours)	Monthly	More time for education, work, and community activities.
	Respiratory Issues	High complaints	60% reduction	Quarterly	Significant health improvements for women/children.
	Income from Dairy/Slurry	No baseline data	45-60% increase	Quarterly	Boosts local economies, supports self-reliance.
	Deforestation Reduction	High firewood dependency	Measurable decrease	Quarterly	Preserves forests, enhances biodiversity.
Solar Family Lights	Distribution Progress	0 lights	238 distributed	Weekly/Monthly	Improves education, productivity, and safety.
	Productive Hours	2-3 hours/ household	+2 hours/household	Monthly	Enables evening study/work, reduces wildlife exposure.
	Quality of Life	3/5 satisfaction	4.5/5 satisfaction	Quarterly	Enhances household efficiency and well-being.
Risk Mitigation	Monsoon Delay Days	Significant delays	40% reduction	Monthly	Weather-resilient planning ensures steady progress.

Beneficiary/Stakeholder Validation: Quarterly surveys and consultations with tribal leaders, residents, and government officials confirm high satisfaction (4.5/5 across metrics). Beneficiaries report safer environments, better health, and increased income, with women and children noting significant relief from firewood burdens. Local leaders praise the project's inclusivity, particularly for PVTGs, while government stakeholders commend its alignment with environmental and tribal welfare goals. Community feedback highlights reduced wildlife conflicts and improved quality of life, with suggestions for further expansion incorporated into planning. This validation underscores the project's success in delivering meaningful, sustainable change.

This comprehensive report illustrates the CTRD Trust's impactful work in addressing energy poverty, enhancing safety, and promoting sustainable development, while proactively managing risks and aligning with global and local priorities.

Date: 16/09/2025
Place: Ahmedabad
UDIN: F005843G001258490

MANISH SANTOSH BUCHASIA

Digitally signed by MANISH SANTOSH BUCHASIA
Date: 2025.09.16 17:27:56 +05'30'

MANISH SANTOSH BUCHASIA
SOCIAL IMPACT ASSESSOR/ SOCIAL AUDITOR
ICSI-ISA/SA-0017/2023-24