



**Our World, Our Responsibility**

***Project Concept***

**SOLAR MINI-GRID  
(SMG)**

**Kowai Community, Kpaai District,  
Bong County, Liberia**

# Abbreviations



| Abbreviation        | Definition                                       |
|---------------------|--------------------------------------------------|
| \$                  | United States Dollar (USD)                       |
| CEC                 | Community Energy Committee                       |
| FTE                 | Full-Time Equivalent (jobs)                      |
| GDfH                | Global Development for Humanity                  |
| HHs                 | Households                                       |
| kWh                 | Kilowatt-hour (electricity produced or consumed) |
| LiFePO <sub>4</sub> | Lithium Iron Phosphate (battery technology)      |
| SDGs                | Sustainable Development Goals                    |
| SMG                 | Solar Mini-Grid                                  |
| W                   | Watt                                             |

# Agenda



|           |                                                 |           |
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# **Project Background and Timeline**

# Project Background

## Key Challenges in Kowai Town, Kpaai District, Bong County



**Energy Access Gap:** Kowai Town has no access to grid electricity. Households (HH) rely on kerosene, candles, and small diesel generators for lighting and energy needs.



**High Energy Costs:** Diesel and kerosene are expensive and inefficient. Energy costs consume a large share of household income, thereby limiting savings and investment.



**Limited Productive Use:** Lack of reliable electricity restricts agro-processing, refrigeration, phone charging, tailoring, and other income-generating activities.



**Social Service Constraints:** Schools, clinics, and community facilities lack reliable power, affecting education quality, healthcare delivery, and public safety.



**Environmental & Health Risks:** Kerosene and diesel use increase indoor air pollution, carbon emissions, and environmental degradation.



### SOLUTION



**SOLAR MINI-GRID (SMG)**



# Project Background

## Strategic Solution – SMG Overview



**Capacity/Size:** SMG with an installed generation capacity of 83.25 kWh/day, 40 × 550 W solar panels, battery storage, inverters, and a low-voltage distribution network supplying households.

**Core System Function:** The SMG generates, stores, and distributes clean electricity for household consumption and productive use, including lighting, refrigeration, phone charging, agro-processing, and small businesses.

**Beneficiaries:** Over 900 people, representing approximately 150 households and local public and community facilities.

**Optimal Location:** Strategically located in Kowai Town, Kpaai District, enabling efficient distribution to clustered households and community facilities.



# Project Timeline



| #                             | Project Timeline – Solar Mini Grid (SMG) Project   Liberia                                                                                                                       | Month 1 |   |   |   | Month 2 |   |   |   | Month 3 |   |   |   | Month 4 |   |   |   | Month 5 |   |   |   | Month 6 |   |   |   | Month 7 |   |   |   |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---|---|---|---------|---|---|---|---------|---|---|---|---------|---|---|---|---------|---|---|---|---------|---|---|---|---------|---|---|---|
|                               |                                                                                                                                                                                  | 1       | 2 | 3 | 4 | 1       | 2 | 3 | 4 | 1       | 2 | 3 | 4 | 1       | 2 | 3 | 4 | 1       | 2 | 3 | 4 | 1       | 2 | 3 | 4 | 1       | 2 | 3 | 4 |
| Key Implementation Milestones |                                                                                                                                                                                  |         |   |   |   |         |   |   |   |         |   |   |   |         |   |   |   |         |   |   |   |         |   |   |   |         |   |   |   |
| 1                             | Project Kick-Off, Community Entry, and Introductory Meetings with Town Leaders                                                                                                   | ■       |   |   |   |         |   |   |   |         |   |   |   |         |   |   |   |         |   |   |   |         |   |   |   |         |   |   |   |
| 2                             | Procurement & Logistics, including vendor selection, shipment of materials, and transport to Kowai                                                                               | ■       |   |   |   | ■       |   |   |   |         |   |   |   |         |   |   |   |         |   |   |   |         |   |   |   |         |   |   |   |
| 3                             | Construction & Installation of the Solar Mini-Grid, including wiring and household (HH) connections                                                                              |         |   |   |   |         |   |   |   | ■       |   |   |   | ■       |   |   |   | ■       |   |   |   |         |   |   |   |         |   |   |   |
| 4                             | Training & Activation, covering system operation, maintenance, troubleshooting, tariff administration, financial record-keeping, and revenue collection plans and documentation. |         |   |   |   |         |   |   |   |         |   |   |   |         |   |   |   | ■       |   |   |   | ■       |   |   |   |         |   |   |   |
| 5                             | System Commissioning and Testing                                                                                                                                                 |         |   |   |   |         |   |   |   |         |   |   |   |         |   |   |   |         |   |   |   | ■       |   |   |   | ■       |   |   |   |
| 6                             | Handover, Monitoring, and Long-Term Operations                                                                                                                                   |         |   |   |   |         |   |   |   |         |   |   |   |         |   |   |   |         |   |   |   |         |   |   |   | ✓       |   |   |   |

# **Project Objectives and Economic Impact**

# Key Project Objectives



1

## Reliable Energy Access

Provide 24/7 clean and reliable electricity to off-grid rural households and community facilities, replacing kerosene, candles, and diesel generators.

2

## Productive Use of Electricity

Support income-generating activities such as agro-processing, refrigeration, phone charging, tailoring, retail, and small workshops through reliable electricity supply.

3

## Reduce Energy Costs

Lower household expenditure on inefficient fuels, increase disposable income, and strengthen household economic resilience.

4

## Long-Term Sustainability

A community-based, professionally managed mini-grid model with trained local operators, transparent revenue model, and reinvestment for expansion.

# Key Economic Uplifting Impacts



## Production Impact (kWh)

The SMG delivers **30,380 kWh per year** to 150 HHs, replacing diesel, kerosene, and candles with clean power.



## Income Impact (\$)

Households save **\$120** per year, which represents a 19% increase in effective annual HH income **(+\$120, 19%↑)**



## Employment Impact (FTE\*)

The SMG generates **4.5 FTE direct jobs** in operation, technicians, billing, security.



## Energy Infrastructure

A community-managed SMG provides long-term energy infrastructure, enabling productive use and future system expansion.



## Local Economic Activity

Reliable electricity supports small businesses such as phone charging, cold storage, tailoring, extended retail hours, and **strengthening the local rural economy**



## Health, Safety & Climate

Reduced indoor air pollution, improved safety, and avoidance of **15-30 tons of CO<sub>2</sub>** per year, while reducing pressure on firewood and diesel use.

\*FTE stands for Full-Time Equivalent, meaning a standard full-time job with 172 working hours per month.

**The SMG project contributes directly to the key Sustainable Development Goals (SDGs)**

**1** NO POVERTY



**7** AFFORDABLE AND CLEAN ENERGY



**8** DECENT WORK AND ECONOMIC GROWTH



**9** INDUSTRY, INNOVATION AND INFRASTRUCTURE



**12** RESPONSIBLE CONSUMPTION AND PRODUCTION



**13** CLIMATE ACTION



# Impact on Production, Income, and Employment



## Electricity Production (kWh)

The SMG delivers **30,371 kWh** per year to 150 HHs, provide clean power.

Households in Kowai primarily use kerosene lamps, candles, dry-cell batteries, and small diesel generators to meet basic lighting and energy needs.

These energy sources are costly, unreliable, and inefficient, limiting the use to a few hours, while increasing HH expenditure, health risks, and environmental damage.

The SMG introduces clean and reliable electricity, providing continuous power for lighting and productive uses, reducing fuel expenses, improving sustainable economic activity.



## Income Impact (\$)

Estimated increase in households' annual income is \$120 (**19% ↑**).

Households lose income and time due to energy-related costs, i.e., phone charging, fuel for generators, transport to markets, and inefficient use of diesel and petrol for basic services.

Access to reliable electricity reduces these expenses, generating savings of about \$10 per HH per month, equivalent to \$120 annual disposable income.

This represents an estimated 19% increase in annual household income, raising average income from \$636 to \$756 per household through cost savings alone.



## Employment Impact (FTE)

Creating **4.5 FTE jobs** in system operation, maintenance, billing, and site security.

The SMG will create a total of 4.5 direct FTE jobs.

| Job Created                   | FTE        |
|-------------------------------|------------|
| Operator                      | 1          |
| Maintenance & Technicians     | 1.5        |
| Billing & Customer Service    | 1          |
| Security                      | 1          |
| <b>Total FTE Jobs Created</b> | <b>4.5</b> |

In addition to the direct FTE jobs, through electricity-supported activities such as phone charging, retail services, agro-processing, and refrigeration.

# **Operational and Implementation Framework**

# Key Operational Aspects



## Operation & Distribution

Delivers 24/7 solar-powered electricity generation, storage, and low-voltage distribution to households through an integrated mini-grid system.



## Quality & Load Management

A reliable power supply through preventive maintenance, system monitoring, smart load control, and electrical protection systems.



## Tariff Management

Flat-rate, tiered tariffs with smart meters ensure affordability, predictable payments, transparent billing, and cost recovery.



## Governance & Oversight

Community Energy Committee supports compliance and grievance handling, while GDfH provides technical, operational, and financial oversight.



## Capacity Building

Local operators, technicians, billing agents, and security staff are trained to manage daily operations, maintenance, and customer support.



## Resilience & Security

System security, surge protection, fencing, and contingency reserves protect against theft, weather damage, and equipment failure

# Project Implementation Framework



## Community Engagement



Formation and training of a Community Energy Committee (CEC), comprising household representatives and local leaders, working with GDfH to ensure ownership, transparency, and grievance handling.

## Operations & Service Model



The SMG operates under a flat-rate, tiered tariff system designed for affordability. Households subscribe to service levels (amperage-based), ensuring fair access while preventing system overloading.

## Capacity Building



Local operators, technicians and billing agents are trained in system operation, routine maintenance, billing, customer service, and basic troubleshooting, ensuring reliable day-to-day operation.

## Connection & Service Delivery



Households are connected to mini grid based on readiness and demand. Smart meters and current-limiting devices ensure equitable access, load control, and system protection

## Revenue & Tariff Management



Monthly flat-rate payments are collected transparently. Revenues prioritize operations cost coverage and preventive maintenance with clear records maintained for accountability and transparent reporting.

## Community Contribution



The community provides land, active cooperation, security and contributing in on time payment, applying the electricity usage standards to keep the system stable for long time.

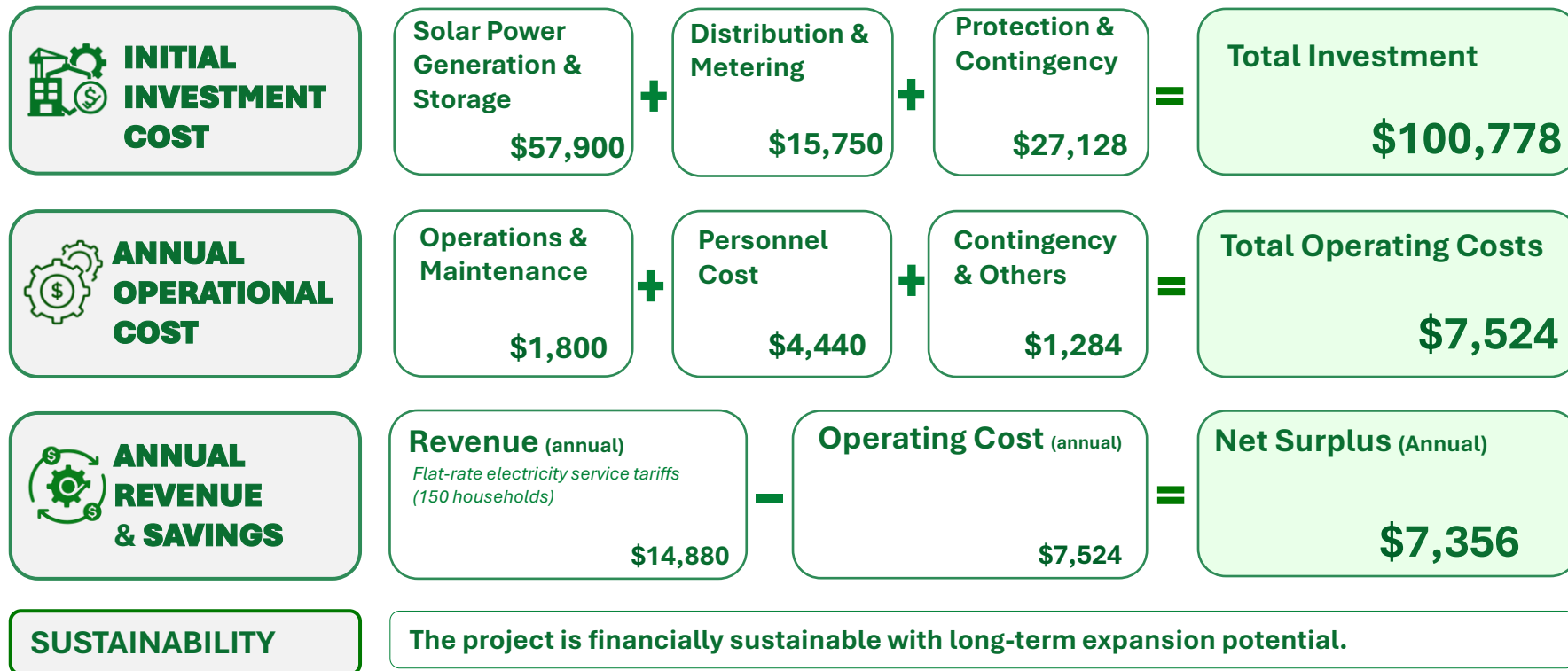
## Financial Sustainability



Flat fee revenue covers SMG operational costs; surplus will be reinvested into maintenance, expansion, cooperative strengthening, and other sustainable development activities.

# **Project Financials**

# Overview of Project Financials



# Project Financials

## Total Initial Investment Costs

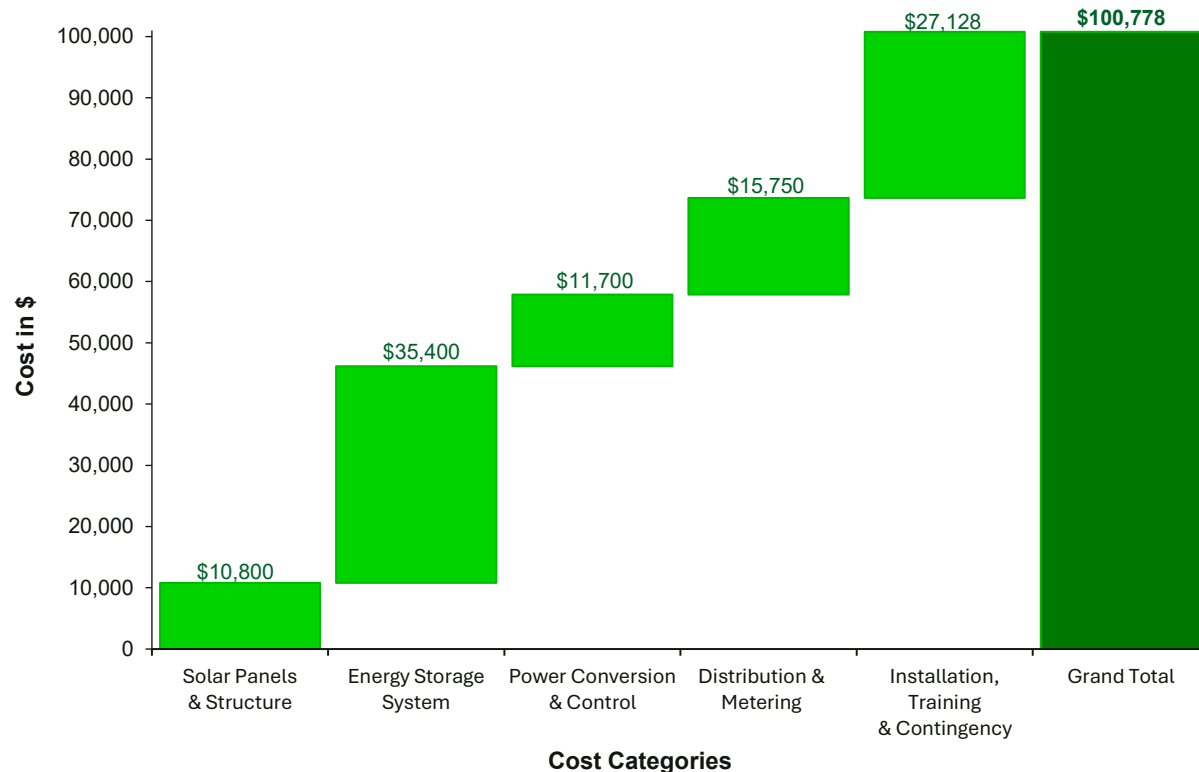


The chart illustrates the initial capital investment required to establish the Solar Mini-Grid (SMG) in Kowai, Kpaai District, Bong County, Liberia.

The **total** initial investment amounts to **\$100,778**, covering core infrastructure, installation, and connecting 150 HHs to the solar mini-grid.

Major cost components include **Solar Panels and Mounting Structures (\$10,800)**, **Energy Storage System with LiFePO<sub>4</sub> batteries (\$35,400)**, **Power Conversion and Control equipment (\$11,700)**, **Distribution and Metering Infrastructure (\$15,750)**, and **Installation, Training, Transport, and Contingency (\$27,128)**.

All cost estimates are based on official supplier quotations and local contractor bids, with reduced pricing offered to GDFH due to its non-profit and community-oriented operational focus.



# Project Financials

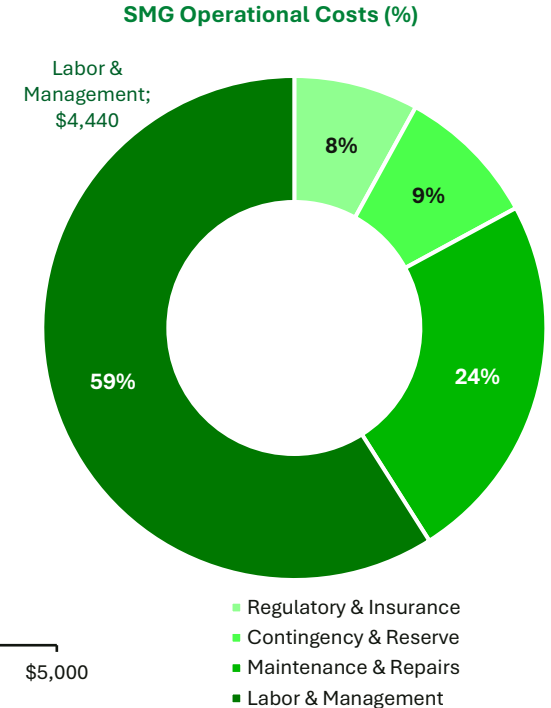
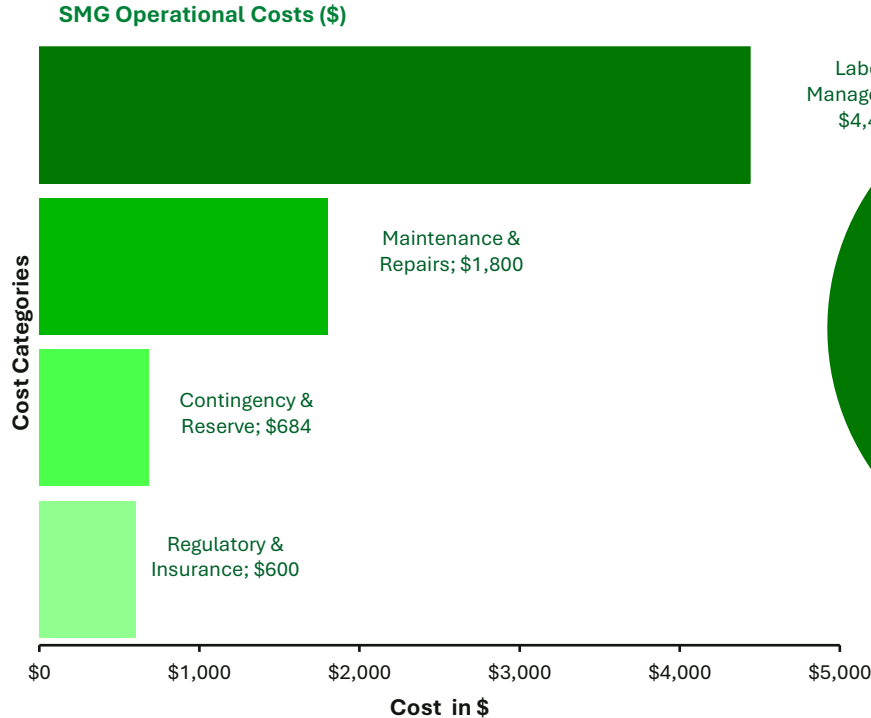
## Annual Operating Costs



The charts illustrate the annual operating costs of the SMG in Kowai Town, **totaling \$7,524** for stable yearly operations.

**Labor & Management** represents the largest cost component at **\$4,440 (59%)**, covering local system operators, technicians, billing agents, and security staff required for daily operation. **Maintenance & Repairs** account for **\$1,800 (24%)**, including preventive maintenance, cleaning, checks, and to ensure system reliability. **Regulatory & Insurance costs** total **\$600 (8%)**, covering permit renewals and liability insurance to ensure regulatory compliance. A **Contingency** of **\$684 (9%)** is included to address unforeseen operational costs and risks.

Together, these expenditures ensure reliable electricity service delivery, cost control, and long-term financial sustainability of the community-managed SMG system.



# Project Financials

## Annual Revenues and Savings

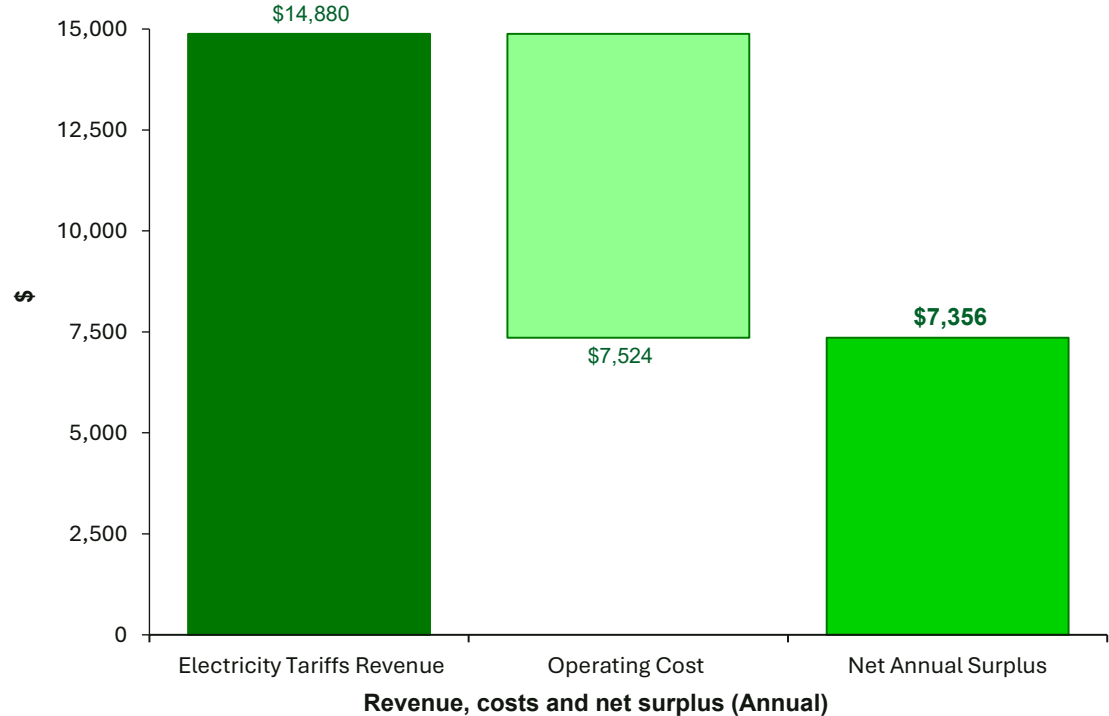


The chart presents the annual financial performance and sustainability of the Solar Mini-Grid (SMG) in Kowai Town.

Under the flat-rate, tiered tariff system, the SMG generates **annual electricity service revenue** of **\$14,880**, collected from 150 connected households based on affordable subscription levels.

Total **annual operating costs** amount to **\$7,524**, covering labor and management, preventive maintenance, regulatory and insurance fees, and contingency reserves required for reliable system operation.

After covering all operating costs, the SMG generates a net annual operating **surplus** of **\$7,356**. This surplus is reinvested into system maintenance, component replacement reserves, service quality improvement, and future expansion, ensuring long-term financial sustainability of the community-managed energy system.



**Key Impact**

# Overview Project Impact



## Reliable Energy Access

The SMG provides clean, reliable electricity to 150 households (and key community facilities), replacing kerosene lamps, candles, dry-cell batteries, and limited generator use.



## Savings and Income-Equivalent Gains

Reliable electricity reduces “energy-related” costs (phone charging trips/fees, generator fuel and maintenance, frequent market trips for fresh goods). Average savings are estimated at \$10/month per household (\$120/year).



## Jobs and Skills Development

The SMG creates 4.5 direct FTE jobs in operations, maintenance, billing and customer service, through local training and day-to-day system management, while also enabling indirect employment through electricity-supported activities.



## Economic Activity and Productive Use

Stimulates electricity-based livelihoods and services such as phone charging, lighting, refrigeration, tailoring, small workshops, and strengthening the rural economy and encouraging gradual appliance uptake.



## Financially Sustainable and Scalable Development Model

With an annual expected surplus fund of \$7,356, the SMG demonstrates operational sustainability, maintenance and replacement reserve capacity, and creates reinvestment potential for similar community energy initiatives.

# Thank You!



**We Sincerely Appreciate Your Attention and  
Interest in Our Operations**



**Our World, Our Responsibility**

# Join the Mission of Global Development For Humanity

*Together, we can create a progressive world we can be proud of*



## Support

Contribute to our projects  
to expand our impact



## Partner

Collaborate with us to  
promote a progressive world



## Advocate

Spread the message to  
increase awareness

## Get in Touch

- |                                                                                                                                 |                                                                                                                                    |                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
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