Global Development For Humanity

GDfH

Our World, Our Responsibility

Project Concept

SOLAR MINI-GRID (SMG)

Sawula Community, Pujehun District, Sierra Leone

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)
$LiFePO_4$	Lithium Iron Phosphate (battery technology)
SDGs	Sustainable Development Goals
SMG	Solar Mini-Grid
W	Watt

Agenda

Project Background and Timeline

Project Background

Key Challenges in Sawula, Pujehun District, Sierra Leone

Energy Access Gap: Sawula Community has no access to the national electricity grid. Households (HHs) rely on kerosene lamps, candles, small torchlights, and limited diesel generators for lighting and basic energy needs.

High Energy Costs: Kerosene, diesel, and dry-cell batteries 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, workshops, 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 with negative health impacts.

SOLUTION

SOLAR MINI-GRID (SMG)

Project Background

Strategic Solution – SMG Overview

Capacity/Size: A Solar Mini-Grid (SMG) with an installed generation output of 80.64 kWh/day, 42 × 400 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 650 people, representing approximately 100 households and local public and community facilities.

Optimal Location: Strategically located in Sawula Community, Pujehun District, enabling efficient distribution to clustered households and community facilities.

Project Timeline

#	Project Timeline – Solar Mini Grid (SMG) Project | Sierra Leone	Month 1				Month 2				Month 3				Month 4				Month 5				Month 6				Month 7				Month 8			
		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	1	2	3	4
	Key Implementation Milestones (Start Date Unknown)																																
1	Conduct project introductory meetings with District & Town authorities, chiefs, landowners, and key stakeholders, and initial establishment of Community Energy Committee CEC																																
2	Secure project site, land agreements, community consent; conduct feasibility, load assessment & environmental screening																																
3	Detailed technical design, system sizing confirmation, and preparation of tender documents																																
4	Tendering, contractor & supplier selection; procurement of solar PV, batteries, inverters, poles, meters																																
5	Site preparation and civil works (mounting structures, battery room, control room, fencing)																																
6	Delivery & installation of solar PV system, batteries, inverters, control systems																																
7	Distribution network installation: poles, wiring, household connections, prepaid smart meters																																
8	Strengthen Community Energy Committee with official documentation; recruit & train local operators (operations, billing, customer service)																																
9	System testing, commissioning, safety checks, tariff rollout, and start of operations																																
10	Set up monitoring, performance tracking, financial reporting & impact evaluation mechanisms																																

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 lamps, candles, and diesel generator use.

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 **29,400 kWh per year** to 100 HHs, replacing diesel, kerosene, and candles with clean power.

Income Impact ($)

Households save **$120** per year, which represents a 44% increase in effective annual HH income **(+$120, 44%↑)**

Employment Impact (FTE*)

The SMG generates **4 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

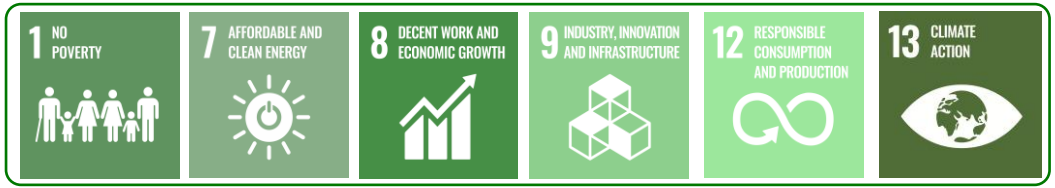
Reliable electricity supports small businesses such as phone charging, cold storage, tailoring, extended retail hours, and strengthening the local rural economy

Health, Safety & Climate

Reduced indoor air pollution, improved safety, and avoidance of **15-18 tons of CO_2** 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)



Impact on Production, Income, and Employment

Electricity Production (kWh)

The SMG delivers **29,400 kWh** per year to 100 HHs, providing clean power.

Households in Sawula Community 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, thereby 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, and improving sustainable economic activity.

Income Impact ($)

Estimated increase in households' annual income is $120 **(44% ↑)**.

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 44% increase in annual household income, raising average income from $273 to $393 per household through cost savings alone.

Employment Impact (FTE)

Creating **4 FTE jobs** in system operation, maintenance, billing, and site security.

The SMG will create a total of 4 direct FTE jobs.

Job Created	FTE
Operator	1
Maintenance & Technicians	1
Billing & Customer Service	1
Security	1
Total FTE Jobs Created	**4**

In addition to the direct FTE jobs, indirect employment is generated 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

Usage-based tariffs with prepaid smart meters ensure affordability, transparent billing, and full 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 tariff system with prepaid smart meters. Households pay per kWh consumed, ensuring affordability, transparent billing, and effective load management.
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 the mini-grid based on readiness and demand. Prepaid smart meters and inverter-based load control ensure equitable access, consumption management, and system protection.
Revenue & Tariff Management	Electricity payments are collected through prepaid smart meters. Revenues prioritize full coverage of operating costs and maintenance, with clear records for accountability and transparent reporting.
Community Contribution	The community provides land, active cooperation, local security support, timely payments, and compliance with electricity usage standards to keep the system stable over the long term.
Financial Sustainability	Electricity revenues cover SMG operational costs; surplus revenues are reinvested into maintenance, system expansion, community capacity strengthening, and other sustainable development activities.

Project Financials

Overview of Project Financials

INITIAL INVESTMENT COST

Solar Power Generation & Storage $24,630 + Distribution & Metering $21,650 + Installation & Contingency $13,155 = **Total Investment $63,085**

ANNUAL OPERATIONAL COST

Operations & Maintenance $600 + Personnel Cost $4,247 + Contingency & Others $2,060 = **Total Operating Costs $6,907**

ANNUAL REVENUE & SAVINGS

Revenue (annual, Years 1-4) *Usage-based electricity tariffs (100 households)* $10,558 − **Operating Cost** (annual) $6,907 = **Net Surplus** (Annual) * $3,652

SUSTAINABILITY

The project is financially sustainable with long-term expansion potential.

* : Average annual net surplus of $3,652 reflects the mean of Years 1–4 during demand ramp-up (from $1,109 in Year 1 to $5,768 in Year 4); net surplus stabilizes from Year 5 onward at approximately $6,402 per year under steady-state operation when annual electricity tariff revenue reaches approximately $13,309.

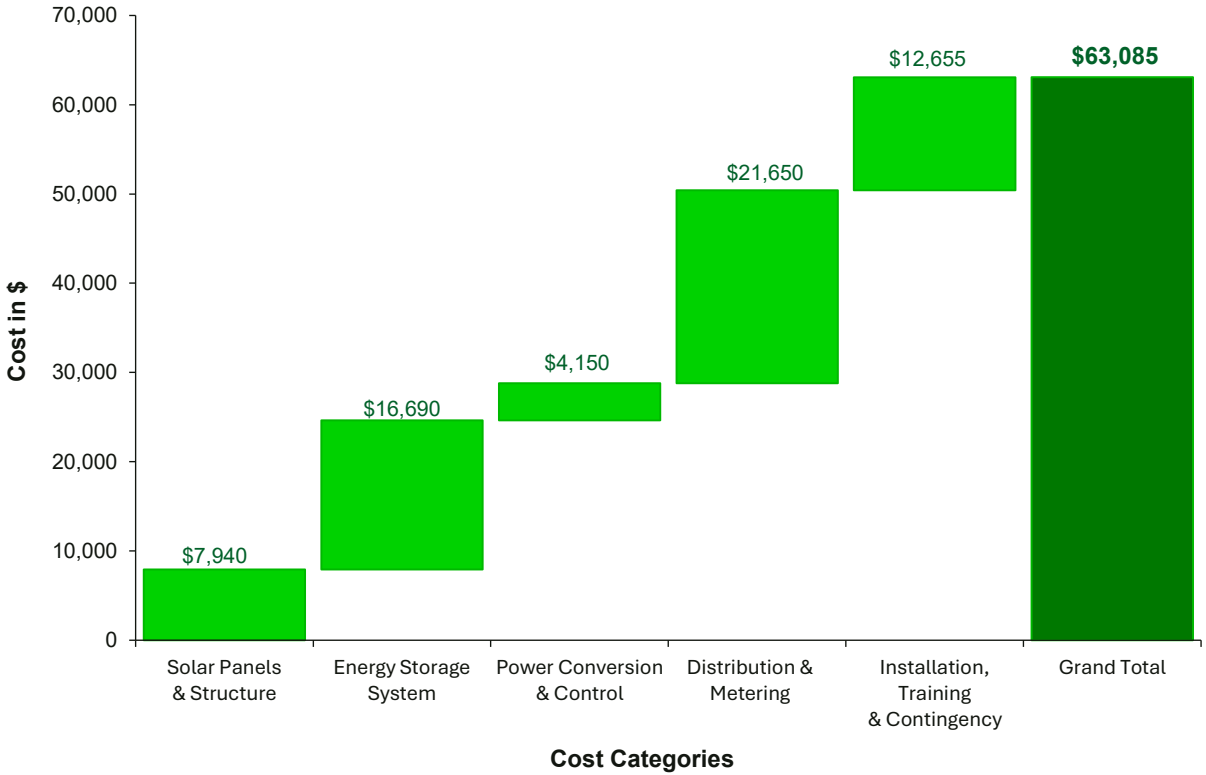
Project Financials

Total Initial Investment Costs

The chart illustrates the initial capital investment required to establish the Solar Mini-Grid (SMG) in Sawula Community, Pujehun District, Sierra Leone.

The **total** initial investment amounts to **$63,085**, covering core infrastructure, installation, and connecting 100 households to the solar mini-grid. Major cost components include **Solar Panels and Mounting Structures ($7,940)**, **Energy Storage System** with $LiFePO_4$ batteries **($16,690)**, **Power Conversion and Control equipment ($4,150)**, **Distribution and Metering Infrastructure ($21,650)**, and **Installation, Transport, and Contingency ($12,655)**.

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.



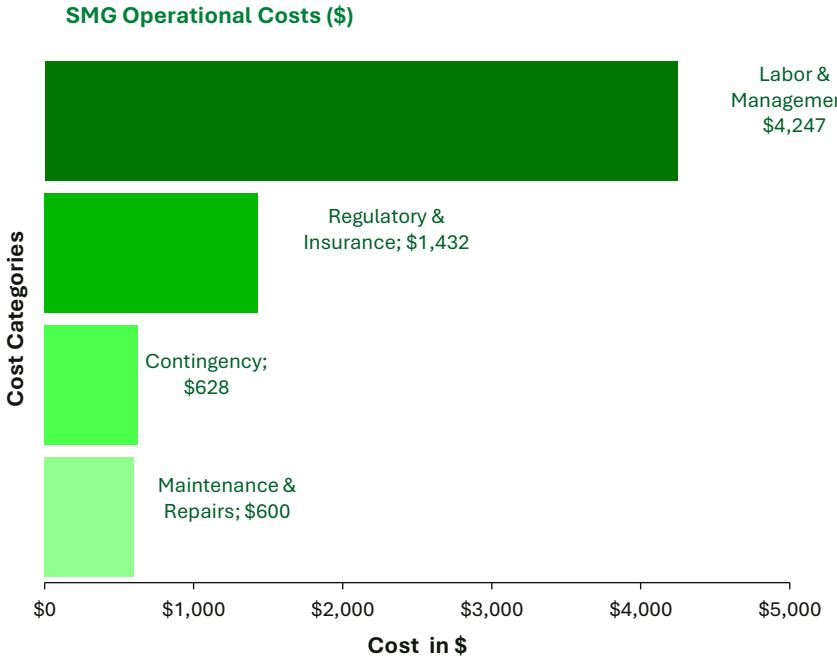
Project Financials

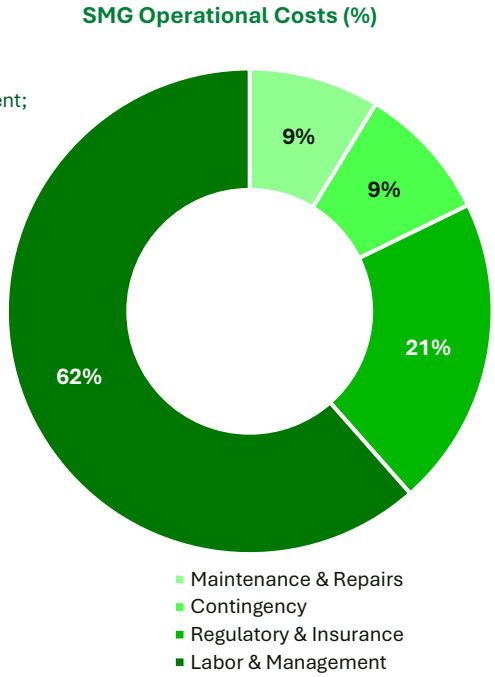
Annual Operating Costs

The charts illustrate the annual operating costs of the SMG in Sawula Community, totaling **$6,907** for yearly operations.

Labor & Management represents the largest cost item at **$4,247 (62%)** covering local system operators, technicians, billing agents, and security staff required for daily operation. **Maintenance & Repairs** account for **$600 (8.7%)**, including maintenance, cleaning, checks. **Regulatory & Insurance** costs total **$1,432 (20.7%)**, covering monitoring systems, communication, permit renewals, insurance, and applicable local taxes to ensure regulatory compliance. A **Contingency** of **$628 (9.1%)** is included to address unforeseen operational costs and risks.

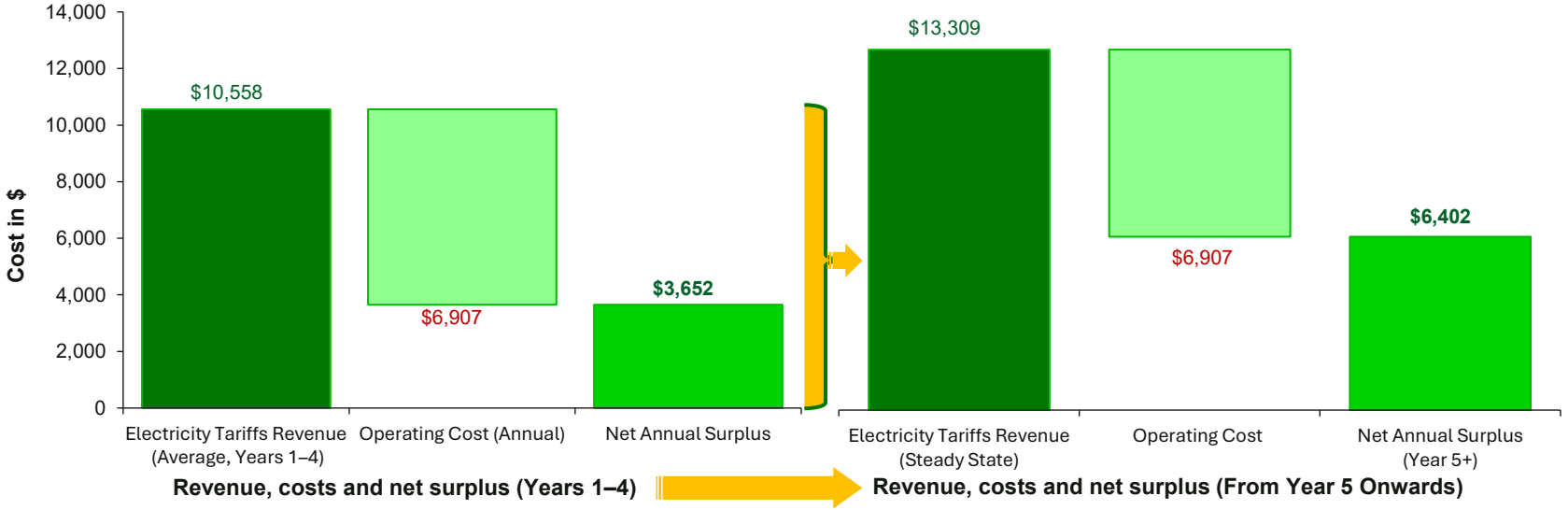
Together, these expenditures ensure reliable electricity service delivery, cost control, and long-term financial sustainability of the community-managed SMG system.





Project Financials

Annual Revenues and Savings



The charts present the annual financial performance and sustainability of the (SMG) in two phases in Sawula, Pujehun District, Sierra Leone.

During the initial ramp-up period (**Years 1–4**), the SMG generates **annual electricity tariff revenue** of **$10,558** under a usage-based prepaid tariff system. Total **annual operating costs** amount to **$6,907**, covering, maintenance, regulatory and insurance costs, and contingency reserves. This results in an average **net annual surplus** of **$3,652**.

From **Year 5** onwards (steady-state operation), annual revenue increases to **$13,309** as electricity consumption stabilizes. With **operating costs** remaining stable at **$6,907**, the **net annual surplus** increases to approximately **$6,402**.

These surpluses are reinvested into system maintenance, component replacement reserves, service quality improvement, and future expansion, ensuring long-term financial sustainability of the community-managed SMG system.

Key Impact

Overview Project Impact

Reliable Energy Access

The SMG provides clean, reliable electricity to 100 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 HH ($120/year), equivalent to 44% of current average annual HH income.

Jobs and Skills Development

The SMG creates 4 direct FTE jobs in operations, maintenance, billing and customer service, throgh 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, theryby strengthening the rural economy and encouraging gradual appliance uptake.

Financially Sustainable and Scalable Development Model

With an annual expected surplus fund of $3,652 during the first four years and $6,402 from Year 5 onward, the SMG ensures operational sustainability, maintenance reserve capacity, and creates reinvestment potential for similar community energy initiatives.

Thank You!

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