

KNOWLEDGE MANAGEMENT REPORT

COMMUNITY ENGAGEMENT AND EMPOWERMENT THROUGH ACCESS TO SOLAR ENERGY INITIATIVE

Takushara • Sauka • Burum in Burum District
Federal Capital Territory (FCT), Nigeria

IMPLEMENTING ORGANISATION
Empowerment Strategy for Women and Youth Development Initiative
(ESWAYDI)

Project Title	Community Engagement and Empowerment Through Access to Solar Energy
Implementing Body	Empowerment Strategy for Women and Youth Development Initiative (ESWAYDI)
Project Communities	Takushara, Burum, and Sauka
Report Date	June 2026

30 kW Total Solar Capacity (Burum + Sauka)	1.92 kWp Borehole Solar Array 6 x 320W Panels	8 Units Smart Toilet Cubicles (4F + 4M) Takushara
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Report Date: June 2026

SUMMARY

This Knowledge Management Report documents the design, implementation, outcomes, and lessons learned generated through the project titled the Community Engagement and Empowerment through Access to Solar Energy Initiative, carried out by the Empowerment Strategy for Women and Youth Development Initiative (ESWYDI). The initiative was executed in three rural communities — Takushara, Sauka, and Burum — all located within Burum District, Federal Capital Territory (FCT), Abuja – Nigeria. It represents a deliberate effort to address energy poverty, inadequate water access, and sanitation challenges facing underserved rural communities in the FCT.



The initiative comprised four interrelated infrastructure projects: construction of a Smart Public Toilet facility in Takushara; drilling and installation of a solar-powered borehole in Takushara; construction of a 10kW solar mini-grid in Sauka; and construction of a 20kW solar mini-grid in Burum. Each component was designed to address specific community needs while contributing to broader objectives of sustainable development, clean energy access, and improved quality of life.

PROJECT AT A GLANCE

3 Villages Beneficiary Communities	30 kW Total Solar Capacity (Burum + Sauka)	8 Units Smart Toilet Cubicles (4F + 4M)	1.92 kWp Borehole Solar Array 6 x 320W Panels
~500+ Households Energy Access	2 Mini Grid Installed	Takushara Clean Water	

SDG Alignment: 3,6,7, 8, 11,13

The initiative demonstrates a replicable model of multi-sectoral rural infrastructure delivery, through these four components, ESWYDI has delivered 30kW of total solar generation capacity, clean water access, and smart public toilet for improved public sanitation serving women, men, and persons with disabilities alike in Takushara. The interventions collectively advance Sustainable Development Goals and demonstrate a replicable community-centred model for integrated rural energy and WASH programming.

About the Implementing Organisation

ESWYDI — Mandate and Mission

Empowerment Strategy for Women and Youth Development Initiative (ESWYDI) is a community-focused non-governmental organisation dedicated to advancing the socio-economic wellbeing of women and young people through targeted capacity building, infrastructure development, and advocacy. ESWYDI operates at the intersection of gender equity, youth empowerment, and sustainable development, implementing programmes that address structural barriers to opportunity and dignity in underserved communities.

The solar energy access project falls squarely within ESWYDI's strategic pillar on sustainable livelihoods and community infrastructure, recognising that access to reliable electricity, clean water, and safe sanitation are foundational prerequisites for the empowerment of women, the productivity of youth, and the overall development of rural communities.

Organisational Approach

- Community-first design: All project components were shaped by community consultations, ensuring local ownership, cultural appropriateness, and genuine demand responsiveness.
- Gender-transformative programming: Infrastructure and capacity-building activities were designed to deliver measurable benefits for women and girls, including dedicated sanitation facilities and reduction of the water-fetching burden.
- Youth engagement: Local young people were prioritised for training as mini-grid operators, water pump technicians, and sanitation caretakers, creating durable employment pathways.
- Transparency and accountability: ESWYDI maintained open reporting to beneficiary communities, local government, and project donors throughout implementation.

BACKGROUND AND CONTEXT

2.1 Community Context and Needs Assessment

Takushara, Burum, and Sauka are rural communities characterised by limited or absent connection to the national electricity grid, reliance on unprotected water sources, and inadequate sanitation infrastructure. These conditions impose multiple, compounding disadvantages on residents — particularly women, girls, and youth — including health risks, economic constraints, safety concerns, and restricted learning opportunities.

ESWYDI's assessment of these communities identified three critical gaps driving the initiative:

- ⌘ Energy poverty: The majority of households in Sauka and Burum communities lacked reliable electricity connections, relying on kerosene lamps, candles, and expensive petrol generators for lighting and power — sources that are expensive, hazardous, and environmentally damaging. School-age children are unable to study after dark; healthcare workers cannot safely deliver services; and businesses cannot operate beyond daylight hours.
- ⌘ Water insecurity: Residents of Takushara depended on unprotected surface water sources and water vendors, exposing the community to water-borne diseases and high household expenditure on water procurement.
- ⌘ Sanitation deficits: The absence of publicly accessible toilets, particularly gender-segregated facilities in Takushara compels community members to practise open defecation, posing significant public health risks — especially for women, girls, and persons with disabilities.

2.2 Policy and Regulatory Alignment

The initiative was designed in alignment with multiple policy frameworks at national and sub-national levels:

- ⌘ Nigeria's Electricity Act 2023: Provides the regulatory framework for off-grid and mini-grid electricity generation and distribution.
- ⌘ Rural Electrification Agency (REA) Guidelines: Mini-grid development adheres to REA's technical and social safeguard standards.
- ⌘ FCT Development Plan: Aligns with the territory's objectives for inclusive urban-rural development.
- ⌘ Nigeria's Nationally Determined Contribution (NDC): Contributes to Nigeria's commitment to increase renewable energy's share in the electricity mix.
- ⌘ SDG Framework: Directly supports SDG 3 (Good Health), SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 11 (Sustainable Communities), and SDG 13 (Climate Action).

2.3 Stakeholder Mapping

Stakeholder Category	Key Actors	Role in Initiative
Government	FCT Administration, Area Council	Policy oversight, land allocation, regulatory compliance
Implementing Partner	ESWAYDI	Technical design, procurement, installation, supervision
Community Leadership	Village heads, Ward Councillors, Community Development Associations	Community mobilisation, land provision, beneficiary engagement
Beneficiaries	Households, Women's Groups, Youth Associations	Project ownership, operations committee, revenue collection
Technical Partners	Solar energy contractors, borehole drilling firms	Specialised installation and commissioning services
Monitoring & Evaluation	Project Management Unit, Independent Evaluators	Progress tracking, quality assurance, impact assessment

PROJECT COMPONENTS — DESIGN AND IMPLEMENTATION

Component I: Smart Public Toilet Facility — Takushara

Overview

ESWAYDI designed, constructed, and commissioned a Smart Public Toilet facility at a central, publicly accessible location within the Takushara community. The facility comprises eight cubicles: four dedicated to female users and four to male users, with clearly marked, separately accessed entrances to ensure privacy, safety, and dignity. The designation "Smart" reflects the integration of solar-powered LED lighting — enabling safe night-time use — water-efficient fixtures connected to the adjacent borehole, and accessible design features consistent with inclusive infrastructure standards.

Technical Specifications

Parameter	Specification
Facility Type	Smart Public Toilet Facility (Solar-Assisted)
Number of Cubicles	8 Total: 4 Female + 4 Male
Structure	Reinforced block construction, durable roofing, tiled floors
Lighting	Solar-powered LED fixtures per cubicle and in common areas
Water Supply	Plumbed from the solar-powered borehole

Access Features	Gender-segregated, ventilated, accessible design
Accessibility	One cubicle per block adapted for persons with disabilities
Energy Source	Solar-powered lighting and ventilation
Sanitation System	Septic tank with soak-away / sealed waste system
Additional Features	Handwashing stations, gender-coded signage at all entrances
Location	Takushara Community Centre — accessible to all residents

Design Rationale and Community Engagement

The Smart Public Toilet was designed to address a critical gap in community sanitation identified during the needs assessment. The facility was positioned at a central location accessible to community members of all demographics, including women, children, elderly persons, and persons with disabilities. The gender-segregated design (4 female and 4 male cubicles) directly responds to safety and privacy concerns raised by women and girls during community consultation sessions.



The 'smart' designation refers to the solar-powered electrical infrastructure integrated into the facility — enabling reliable lighting for night-time safety, powered ventilation for hygiene maintenance, and potential integration of future IoT monitoring for maintenance alerts. A community operations committee was established and trained to manage day-to-day operations, maintain cleanliness standards, and administer

a nominal user fee system to sustain operations and maintenance costs.

Construction Process and Quality Assurance

- ☒ Site survey and soil testing conducted prior to foundation design
- ☒ Construction supervision by certified civil engineers throughout the building phase
- ☒ Materials procurement aligned with approved bill of quantities and technical specifications
- ☒ Siting of septic tank and soakaway system in compliance with public health guidelines
- ☒ Defects liability period established with the
- ☒ contractor for post-handover remediation

Component II: Solar-Powered Borehole — Takushara

Overview

A solar-powered mechanised borehole was drilled and commissioned in Takushara to deliver a reliable, safe, and sustainable water supply. The system uses a DC/AC 2.5HP submersible pump driven entirely by solar photovoltaic energy, eliminating the need for grid power or diesel fuel. This approach ensures continuity of water supply regardless of grid availability while maintaining very low operating costs for the community.

Location	Takushara Village, FCT, Nigeria
Borehole Depth	Based on hydrogeological survey (estimated 80–120m)
Pump Type	Solar submersible pump
Solar Array	6 units of 320W solar panels (Total: 1,920W)
Storage	Elevated storage tank for gravity distribution
Distribution	Reticulated pipe network to community water points
Yield Target	Sufficient to meet community daily water demand
Management	Takushara Sustainable Development Cooperative Society

Solar System Technical Specifications

The borehole pumping system is powered entirely by a dedicated photovoltaic (PV) array consisting of 6 units of 320-watt solar panels, yielding a combined array capacity of 1,920 watts peak (1.92 kWp). This configuration was selected following a detailed solar resource assessment and water demand analysis. The system includes:

- ☒ Solar PV array (6 x 320W monocrystalline panels) mounted on a galvanised steel structure
- ☒ Solar-compatible variable-frequency drive (VFD) submersible pump controller

- ☒ Submersible pump calibrated to the aquifer depth and required head pressure
- ☒ Elevated storage tank providing gravity-fed distribution to community standpipes
- ☒ PVC reticulation network with multiple distribution points across the village
- ☒ Overflow and drainage management infrastructure

Water Quality and Sustainability Measures

Prior to this, borehole water quality tests were conducted in accordance with World Health Organisation (WHO) and Nigerian Industrial Standard (NIS 554) guidelines for potable water. Results were shared with community leadership and relevant FCT authorities. A borehole maintenance schedule, spare parts inventory, and operational manual were handed over to the community Water Users Association, which received capacity-building training in basic operations and minor maintenance tasks.

Component III: 10kW Solar Mini-Grid — Sauka Village

Location	Sauka Village, FCT, Nigeria
System Capacity	10 kilowatts (10kW) peak
System Type	AC-coupled solar mini-grid with battery storage
Solar PV Array	High-efficiency monocrystalline panels
Battery Storage	Deep-cycle battery bank (lithium/lead-acid)
Charge Controller	MPPT solar charge controller
Inverter	Hybrid solar inverter with grid-forming capability
Distribution Network	Low-voltage distribution lines to connected households
Tariff Model	Community-managed pay-as-you-go (PAYG) metering
Estimated Connections	Approximately 10–50 households and small businesses

Implementation Approach

The 10kW solar mini-grid in Sauka was designed as a standalone off-grid power system serving the community's residential, social, and light commercial electricity needs. The mini-grid architecture employs an AC-coupled configuration to optimise energy dispatch efficiency and enable future capacity expansion without significant system redesign.

Community engagement was embedded throughout the implementation process. A pre-installation community meeting identified priority end-users (households with children in school, health workers,

small businesses) to guide connection sequencing. A Mini-Grid Operator Committee was constituted, trained, and registered as a community enterprise, taking ownership of revenue collection, consumer management, and basic system monitoring.

Economic and Livelihood Impact

- ⌘ Small businesses (barbers, tailors, phone charging kiosks) now able to operate extended hours
- ⌘ Students benefit from reliable evening lighting, improving study hours and academic performance
- ⌘ Community health volunteers able to refrigerate vaccines and essential medicines
- ⌘ Women's cooperative activities (grain processing, craft production) extended beyond daylight hours
- ⌘ Reduction in household expenditure on kerosene and generator fuel

Component IV: 20kW Solar Mini-Grid — Burum Village

Location	Burum Village, FCT, Nigeria
System Capacity	20 kilowatts (20kW) peak
System Type	AC-coupled solar mini-grid with battery storage
Solar PV Array	High-efficiency monocrystalline panels
Battery Storage	Expanded deep-cycle battery bank
Charge Controller	Industrial-grade MPPT solar charge controller
Inverter	Industrial hybrid solar inverter, grid-forming
Distribution Network	Extended low-voltage distribution network
Tariff Model	Smart metering with PAYG and post-paid options
Estimated Connections	Approximately 20–100 households, institutions, and businesses

Scaling Up: Rationale for 20kW Capacity

Burum was identified as having a larger population base and higher projected electricity demand compared to Sauka. The 20kW system was designed to accommodate not only current residential connections but also to provide sufficient capacity headroom for institutional anchors — including the village primary school, a health post, and a cluster of small agro-processing enterprises — all of

which were earmarked as priority consumers given their community-wide socioeconomic importance.

The expanded battery storage bank ensures a minimum of 12–16 hours of backup power during periods of low solar irradiance, providing reliability particularly for refrigeration, health services, and security lighting. The smart metering infrastructure allows for remote monitoring, automated disconnection for non-payment, and data collection for ongoing demand analysis and system optimisation.

Governance and Revenue Management

- ☒ A Mini-Grid Management Committee (MMC) established with representation from households, businesses, and community institutions
- ☒ Financial management protocols established including revenue collection, operations fund, maintenance reserve, and reinvestment account
- ☒ Tariff structure designed to be cost-reflective yet affordable, with cross-subsidy provisions for the most vulnerable households
- ☒ Quarterly financial reporting system established for community transparency
- ☒ Linkages established with Rural Electrification Agency for potential future subsidy support and national integration

OUTCOMES, RESULTS, AND IMPACT

4.1 Summary of Achieved Outputs

#	Project Component	Key Output	Status
I	Smart Public Toilet — Takushara	8 cubicles (4F + 4M) operational; solar-powered lighting; handwashing stations	Completed & Operational
II	Solar Borehole — Takushara	6 x 320W PV array (1.92 kWp); submersible pump; elevated tank; community standpipes	Completed & Operational
III	10kW Mini-Grid — Sauka	10kW solar mini-grid; battery storage; LV distribution; ~80-120 connections; PAYG metering	On-going
IV	20kW Mini-Grid — Burum	20kW solar mini-grid; smart metering; extended LV network; ~200-300 connections	Completed & Operational

4.2 Community Impact Assessment

Health and Sanitation Improvements

The Smart Public Toilet facility in Takushara immediately addressed open defecation, which had been prevalent particularly in areas near the community market and school. Post-commissioning community surveys indicated a significant reduction in open defecation and an increase in community perception of personal safety and dignity in sanitation practices. Women and girls reported feeling significantly safer using the toilet facility at night due to solar-powered lighting.

Water Security Transformation

The solar-powered borehole fundamentally transformed the water security situation in Takushara. Previously, women and girls spent an average of 1–3 hours daily collecting water from distant or unsafe sources. The installation of community standpipes fed by the borehole reduced collection time to under 15 minutes, freeing significant time for economic activities, education, and rest. Water quality testing confirmed the borehole water met potable water standards, reducing risks of cholera, typhoid, and diarrhoeal disease.

Energy Access and Economic Empowerment

The combined 30kW of solar mini-grid capacity installed across Sauka and Burum Village represents a transformative shift in energy access. Key observed impacts include:

- ⌘ Elimination of kerosene lamp use in connected households, reducing indoor air pollution and fire risks
- ⌘ Household energy expenditure redirected from fuel costs to productive uses
- ⌘ New and expanded small businesses (phone charging, welding, food processing, barbering) enabled by reliable electricity
- ⌘ Extended school study hours for children, with anticipated improvement in educational outcomes
- ⌘ Community health posts able to maintain cold chain for vaccines and medications
- ⌘ Evening community activities, meetings, and social events now feasible and safer

4.3 SDG Contribution Matrix

SDG Goal	Goal Title	Initiative Contribution
SDG 3	Good Health & Well-Being	Reduced waterborne disease risk; improved sanitation; reduced indoor air pollution from kerosene
SDG 6	Clean Water & Sanitation	Potable water access for Takushara; improved sanitation through Smart Toilet facility
SDG 7	Affordable & Clean Energy	30kW of clean solar energy access for ~500+ households across two communities
SDG 8	Decent Work & Economic Growth	New livelihoods and SME growth enabled by reliable electricity access
SDG 10	Reduced Inequalities	Targeted marginalised rural communities with equitable infrastructure investment
SDG 11	Sustainable Communities	Improved community resilience and infrastructure in underserved FCT communities
SDG 13	Climate Action	Displacement of fossil fuel use; reduction in carbon emissions from kerosene and generators

SECTION 5: LESSONS LEARNED AND KNOWLEDGE CAPTURE

5.1 What Worked Well

Community Ownership Model

The participatory approach to community engagement — involving community leaders, women's groups, and youth associations from the project design phase through commissioning — proved to be a critical success factor. Communities that were actively consulted and involved in decision-making demonstrated greater ownership, protected project assets, and proactively contributed to site preparation and community sensitisation.

Integrated Infrastructure Approach

Delivering water, sanitation, and energy infrastructure simultaneously within Takushara (borehole + smart toilet) created synergistic benefits that exceeded what any single intervention could achieve. The co-location and integration of complementary interventions maximised impact per investment and reinforced community trust in the implementation process.

Solar Technology Appropriateness

The choice of solar photovoltaic technology as the energy backbone for all four project components proved appropriate for the context. Solar systems require no fuel supply chains, are low-maintenance relative to diesel alternatives, have falling costs, and align with Nigeria's renewable energy policy objectives. The long-term operating cost advantages of solar were well understood and appreciated by community stakeholders.

5.2 Challenges and Mitigation Strategies

Challenge Encountered	Mitigation Approach	Lesson Learned
Supply chain delays for solar panels and inverters	Early procurement planning; engagement of multiple pre-qualified vendors	Build 6-8 week procurement buffer into project schedules
Community land ownership disputes at borehole site	Mediation by community head and area council; documented land use agreement	Formalise land agreements before design finalisation
Resistance from some households to mini-grid tariff system	Financial literacy workshops; demonstration of cost savings vs. generator/kerosene	Budget for community financial education in all energy projects
Limited local technical capacity for system maintenance	Training of community technicians; establishment of maintenance partnerships	Pair installations with formal technical training and certification
Vandalism of distribution poles during construction phase	Community security watch system; rapid response protocol	Community security buy-in is a pre-condition for infrastructure protection

5.3 Innovation and Good Practices for Replication

- ☞ Integrated WASH + Energy delivery model is replicable across rural FCT and other Nigerian states
- ☞ Solar-powered public toilet design provides a blueprint for sustainable public sanitation in off-grid communities
- ☞ Mini-grid governance model (community enterprise + PAYG metering) ensures financial sustainability without external subsidy dependency
- ☞ 6-panel 320W borehole array sizing provides a tested, cost-effective template for similar communities
- ☞ Participatory community commissioning process (public demonstration, operations training, certificate of handover) builds lasting ownership
- ☞ Establishment of maintenance reserve funds within community tariff models ensures long-term operational sustainability.

SECTION 6: SUSTAINABILITY PLAN AND MONITORING FRAMEWORK

6.1 Operations and Maintenance Framework

Long-term sustainability of the four infrastructure components is anchored in community-led operations and maintenance (O&M) frameworks tailored to each facility type. The following institutional arrangements have been established:

Facility	Management Body	Revenue Mechanism	M&E Reporting
Smart Toilet — Takushara	Community project committee	Per-use fee	Monthly cleanliness audit; quarterly maintenance report
Borehole — Takushara		Volume-based water tariff at standpoints	Monthly water quality test; quarterly pump maintenance check
10kW Mini-Grid — Sauka	Community project committee	PAYG	Monthly energy accounts; quarterly technical inspection
20kW Mini-Grid — Burum	Community project committee	PAYG	Monthly financial report; quarterly technical audit

6.2 Key Performance Indicators (KPIs)

Indicator	Baseline	Target (Year 1)	Monitoring Frequency
% households with electricity access (Sauka + Burum)	~0%	>20%	Quarterly
Average hours of electricity supply per day	0 (no facility)	>12 hours	Monthly
% households using safe water source (Takushara)	~5%	>85%	Quarterly
Toilet facility utilisation rate (Takushara)	0 (no facility)	>50 uses/day	Monthly
Mini-grid system uptime (%)	N/A	>95%	Monthly
Revenue collection rate (mini-grids)	N/A	>85%	Monthly
Number of new businesses enabled by electricity	0	>20	Bi-annual
Reduction in household energy expenditure (%)	Baseline	>30% reduction	Annual

SECTION 7: RECOMMENDATIONS FOR FUTURE PROGRAMMING

7.1 Immediate Recommendations (0–12 Months)

1. Conduct post-commissioning baseline survey: Establish rigorous community-level data on household energy access, water use, and sanitation practices across all three communities to enable impact measurement.
2. Strengthen community management capacity: Provide follow-up technical training for all community management committees, focusing on financial management, basic troubleshooting, and system performance monitoring.
3. Formalise maintenance service agreements: Negotiate and execute annual maintenance contracts with qualified solar technicians for the mini-grids and borehole systems, with clear response time standards.
4. Register community management entities: Facilitate formal registration of community water and energy management bodies with relevant FCT authorities to improve accountability and access to regulatory support.
5. Document replication toolkit: Package the project's technical designs, community engagement processes, and governance templates into a replication toolkit for use in future community energy and WASH projects.

7.2 Medium-Term Recommendations (12–36 Months)

6. Expand mini-grid connections: As community demand grows, undertake demand assessments and extend distribution networks to reach un-connected households in both Sauka and Burum communities.
7. Introduce productive use of energy (PUE) programmes: Facilitate access to finance and technology for agro-processing, refrigeration, and other productive energy applications to maximise economic returns from mini-grid access.
8. Replicate model in neighbouring communities: Identify 3–5 additional FCT communities with similar energy and WASH deficits and develop proposals for the replication of this integrated infrastructure approach.

SECTION 8: CONCLUSION

ESWAYDI's project (Community Engagement and Empowerment through Access to Solar Energy Initiative) has demonstrated that targeted, community-centred solar infrastructure investment can catalyse transformative change in rural and peri-urban communities within the Federal Capital Territory. The simultaneous delivery of clean water, improved sanitation, and clean electricity to Takushara, Sauka, and Burum communities addresses multiple dimensions of human development deprivation in an integrated and mutually reinforcing manner.

The project's four components — Smart Public Toilet, solar-powered borehole, 10kW mini-grid, and 20kW mini-grid — collectively provide direct benefits to an estimated 500 or more households, with broader positive spill-overs for health facilities, small businesses, and the overall community economy. The initiative contributes meaningfully to Nigeria's Nationally Determined Contributions under the Paris Agreement, displacing significant quantities of fossil fuel consumption and associated greenhouse gas emissions.

Critically, the initiative demonstrates that community ownership and governance are not simply desirable features of rural infrastructure projects — they are essential pre-conditions for long-term sustainability. The governance models, financial systems, and community management structures established through this initiative provide a blueprint for durable, community-led infrastructure management that can outlast the project lifecycle.

This Knowledge Management Report serves as an institutional memory document, ensuring that the critical insights, technical knowledge, community engagement approaches, and lessons learned from this initiative are captured, disseminated, and available to inform future programming across the FCT and beyond. It is hoped that this initiative will serve as a model for expanded investment in community solar energy access as a pathway to sustainable development, dignity, and empowerment for Nigeria's rural populations.

"Clean energy is not just about electricity — it is about dignity, opportunity, and the future."

Community Engagement and Empowerment through Access to Solar Energy Initiative, FCT, 2026

END OF KNOWLEDGE MANAGEMENT REPORT

Community Engagement & Empowerment through Access to Solar Energy Initiative

Takushara • Sauka • Burum Village, FCT, Nigeria • June 2026