From Providers to Communities to Policy: Embedding SDGs in Women-Led Clean Energy Transitions in Kenya (2022–26)

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Background

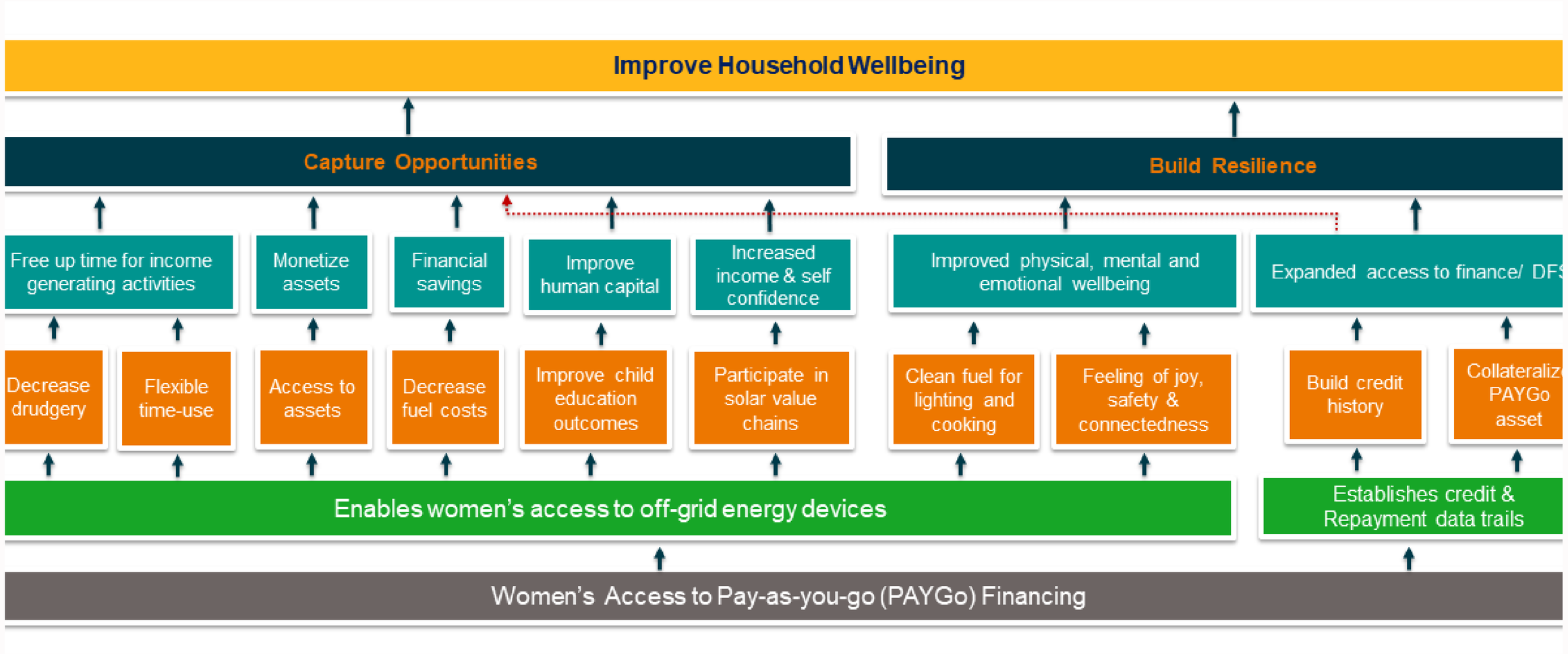
01 37% of rural Kenyan households still lack reliable electricity

02 Millions rely on firewood, kerosene with health and environmental consequences

03 Energy poverty constrains education, safety, health, food security and economic mobility

04 Women disproportionately share energy poverty burden

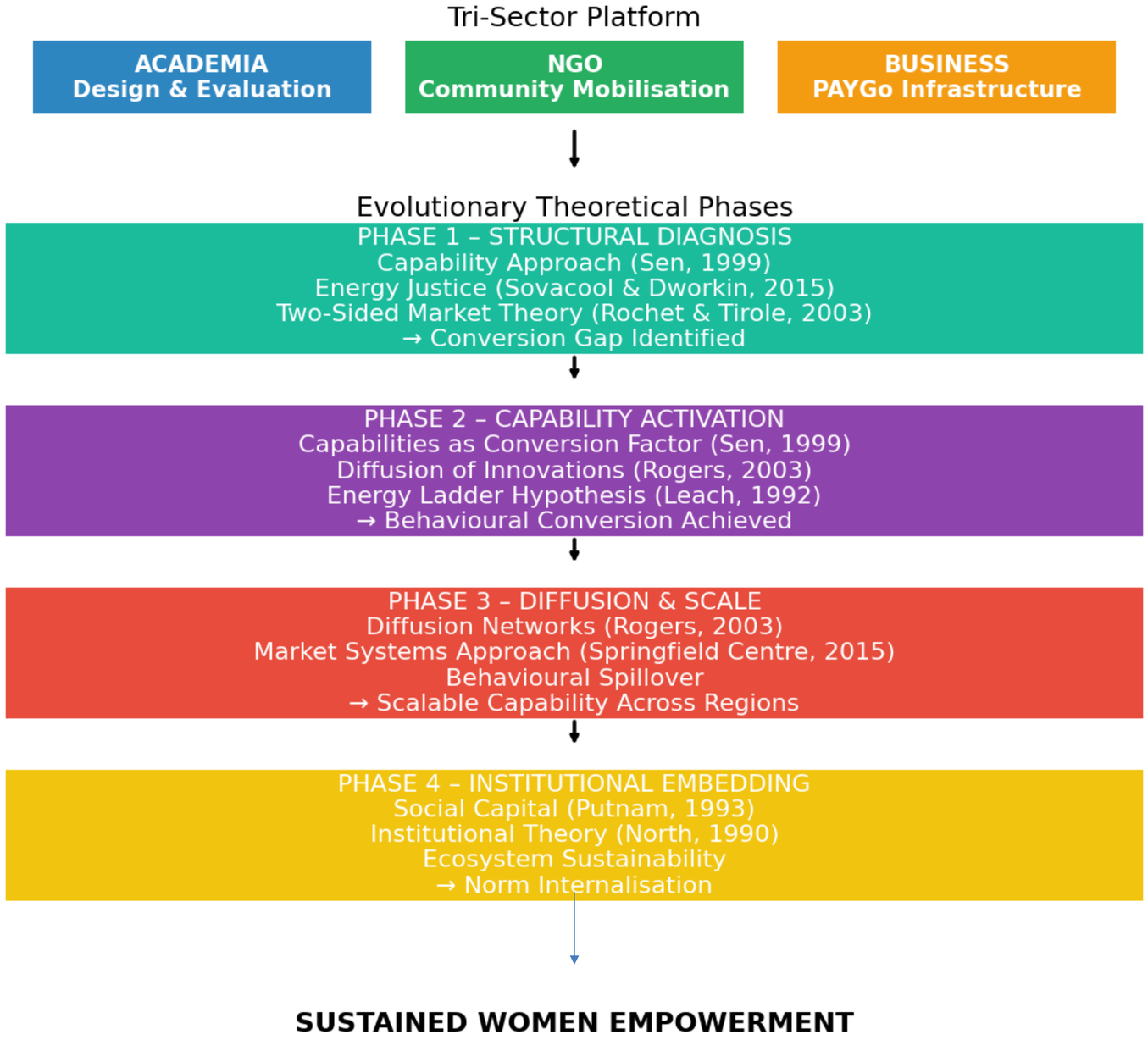
PAYGo solar has rapidly expanded access through mobile-money-based asset finance



Source: CGAP

Yet emerging evidence suggests that energy access does not automatically translate into gendered economic empowerment. **The Core Problem:** How do we move from energy access to gendered economic capability and agency within market systems?

Research Architecture: Theory and concept



Research Architecture –Application:

Diagnose – Activate – Scale - Embed

Phase 1 – Diagnostic & Market Realignment (2022-2023)

- Demand-side SDG implication survey (N=201)
- Supply-side SDG-aware sales training (46 agents)

→ Where does conversion break?

Phase 2 – Behavioural Capability Activation (Pilot) (2023-2024)

- 30 women
- Pre–post training

→ Can SDG-aware capability shift outcomes?

Phase 3 – Scale-Up of SDG-Aware Capability (2024–2025)

- Expanded training: 30 → 200+ women
- Geographic expansion: 2 → 13 counties
- SDG-aware clean energy adoption diffusion
- Follow-up survey & behavioural tracking

→ Can SDG-aware capability scale across regions?

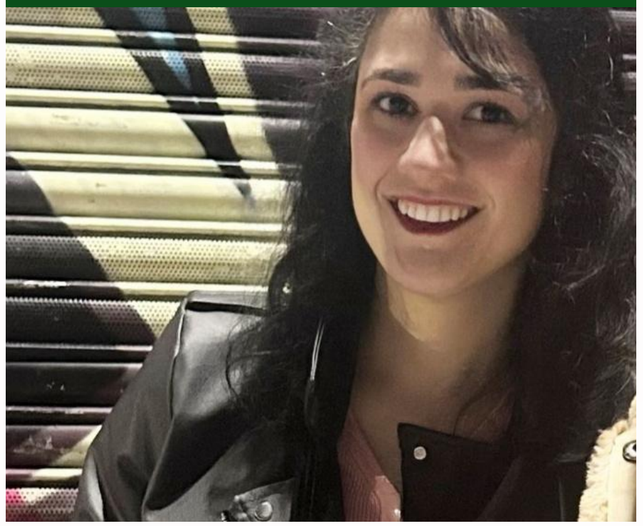
Phase 4 – Community-Led Embedding (2025–2026)

- SDG leadership selection (17 leaders)
- 17 community micro-projects
- Peer-to-peer diffusion mechanisms
- Collective productive-use initiatives

→ Can SDG-aware behaviour become self-sustaining within communities?

Project Research team (Academia)

DR ISABELLA KIPLAGAT:
Economist at Ministry of Planning, Kenya



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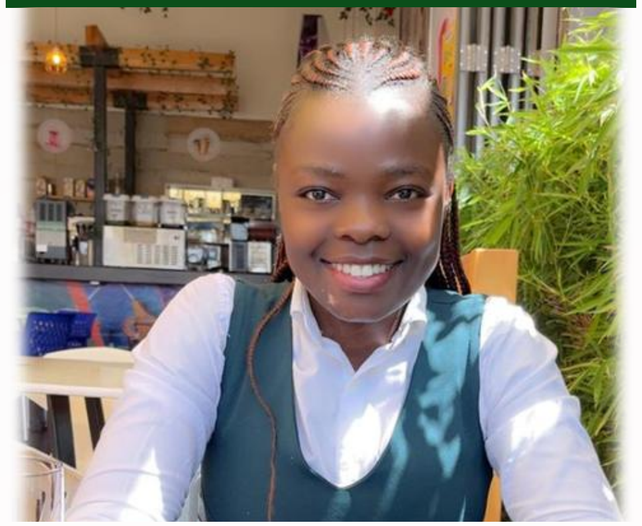

An NGO focused on empowering rural women (800 members), TWK works to provide education, resources, and support, enabling women to become self-reliant and economically independent.
TWK team: CEO- Scovia Amulen; Board president-Lillian Mussigali; Treasurer Lucy Mworiah

Solar Panda(Business)

Solar Panda operates within a PAYGo asset-financing model that links modular solar home systems (lighting, charging, tv, cookstoves) with mobile-money instalments.
A small upfront deposit followed by flexible payments allows households to gradually convert energy access into asset ownership.

Founded in 2017, the company operates in Kenya, Zambia, and Senegal, delivering clean, safe, and reliable energy to over 1.4 million people who previously relied on kerosene or candles.

PHASE 1 –
Diagnostic & Market Realignment

Component 1:
Demand-side SDG implication survey (N=201)

Component	*Phase 1 - Component 1: Survey Design*
Problem	PAYGo expands energy access, yet access may not automatically translate into sustained gendered economic empowerment. Repayment stress limits long term benefits of adoption, limited **awareness of productive-use opportunities further constrains income generation and empowerment.**
Theoretical Foundation	*Capability Approach (Sen, 1999): Energy as a conversion input.* *Energy Justice: Asset access ≠ agency.*
Objective	*Assess whether PAYGo adoption generates SDG-aligned economic and gender-responsive outcomes among users*

PHASE 1 –
Diagnostic & Market Realignment

Component 1:
Demand-side SDG implication survey (N=201)

Component	Phase 1-Component 1: Survey Design
Activity	Telephone survey of 201 PAYGo customers across 17 counties in Kenya (randomly selected)
Method / Evidence	Descriptive statistics, non-parametric analysis, 2SLS (endogeneity correction), Recursive Probit (binary interdependence)
Key Empirical Signals	Strong welfare gains (health, safety, time). 3.2% defaulted at least once 59.7% struggled with down payments 65.2% created zero new income streams Mean repayment completion = 59.7% Significant negative tenure effect for women (2SLS, p=0.025)
Outcome (Phase 1 Insight)	However, empowerment plateaus over time due to repayment burden and household constraints. Access ≠ Automatic SDG-aligned economic transformation.-motivating a targeted sales agents capability intervention-behavioral translation of energy access

PHASE 1 –

Component 2: SDG-Aware Sales Realignment (Supply-Side Intervention)

Component	***Phase 1 -Component 2– Sales Agent Training***
Problem	*PAYGo providers lacked a gender-responsive and SDG-aware sales strategy. Women were not treated as a distinct customer segment. Sales force disproportionately male. Incentives focused on volume, not SDG-aligned outcomes*
Theoretical Foundation	*Two-Sided Market Theory: Outcomes shaped by supply-side incentives.* *Gender-Responsive Market Design.* *Behavioral Economics: Framing effects influence purchase decisions.*
Objective	*Align sales incentives with SDG-aware clean energy messaging and gender-responsive outreach.*

PHASE 1 –

Component 2: SDG-Aware Sales Realignment (Supply-Side Intervention)

Component	Phase 1 -Component 2: Sales Agent Training
Activity	17-week project: 10-week pre-training performance data collection 1-day SDG-aware Sales Training Workshop 7-week post-training monitoring (46 agents)
Method / Evidence	Interrupted Time Series (GLM) Zero-Inflated Poisson XGBoost predictive modelling
Key Empirical Signals	+42% increase in average weekly sales revenue post-training +50% increase in active male agents +22% increase in active female agents Revenue share of male agents increased by 9%
Outcome (Phase 1 Insight)	SDG-aware sales training increased agent activation and sales performance. However, sales growth alone does not guarantee gender-balanced outcomes. Incentive alignment matters for SDG embedding in demand side as well

PHASE 2 –

Behavioural Capability Intervention
SDG-Aware Women Training (Pilot Study)

Problem	*Phase 1 showed that access alone does not guarantee SDG-aligned empowerment. Financial stress and limited productive use constrained transformation.*
Theoretical Foundation	*Capability Approach (Sen, 1999): Training as a conversion factor.* *Diffusion of Innovations (Rogers, 2003): Knowledge reduces uncertainty.* *Energy Ladder Hypothesis: PAYGo lowers adoption barriers but requires capability activation.-(Leach, 1992)*
Objective	*Test whether structured SDG-aware clean energy adoption training enhances adoption, productive use, and financial empowerment among women.*


solarpanda
Providing smart, low-cost solar power to communities in Africa.
TV | LIGHTS | CHARGING
RADIO | TORCH

PHASE 2 –

Behavioural Capability Intervention
SDG-Aware Women Training (Pilot Study)

Activity	*Baseline survey (N=30) → PAYGo SDG awareness & training session → 6-month follow-up survey (Matched N=23) (Nakuru and Nyakash Counties)*
Method / Evidence	*Pre–Post design Ordered Logit & Ordered Probit models Satisfaction improvement as ordinal outcome*
Key Empirical Signals	*100% adoption post-training 100% satisfaction 52% reported reduced energy spending 36% extended business hours 56% increased savings Education positively associated with satisfaction (p≈0.10) Financial capability significant (model consistent)*
Outcome (Phase 2 Insight)	• Training increased adoption and productive energy use • Income effects were strongest where financial capability was present • Awareness alone was insufficient without behavioural activation *. Individual activation worked, the next step is diffusion and scale-motivating Phase 3*

PHASE 3 –

Scale-Up of SDG-Aware Training

Problem	*Pilot (N=30; 2 counties) showed behavioural shifts, but external validity and scale impact were unknown. Can SDG-aware capability activation hold beyond a controlled setting?*
Aim (Theory)	*Test scalability of SDG-aware behavioural activation. • Capability Approach → expansion of agency • Energy Ladder → transition pathway • Behavioural Activation → intention → action shift*
Objective	*Examine whether scaling training increases SDG-aware clean energy adoption across counties and income groups.*
Activities	*• Baseline survey (N=198; 8 counties) • Training expanded: 30 → 200+ women • Geographic expansion: 2 → 13 counties. SDG leaders appointed –Micro-projects pipeline created*
Outcome	*Community-level diffusion channels activated-Institutional diffusion architecture established to enable sustained women empowerment*


GOALS


Coffee Lounge

PHASE 4 –

Community-Driven SDG Embedding

Problem	After structured activation and diffusion, the key question becomes sustainability: Can SDG-aligned behaviours institutionalise through community ownership rather than external facilitation?
Aim (Theory)	*Embed SDG-aware clean energy within community systems. • Diffusion of Innovations (Rogers) • Social Capital Theory • Market Systems Approach*
Objective	*Test whether SDG leadership + Microprojects-product exposure accelerates sustained adoption.*
Activities	*• SDG leaders selected and trained • 22 community groups monitored • Solar product demonstration visits • Community-led clean energy advocacy* • Sustaining 17 micro-project initiatives • Normalising clean energy advocacy within community structures • End-line surveys

PHASE4 Component:	SDG Leaders	Community Micro-Projects	Baseline–Endline Impact Evaluation
Activity	• 22 SDG leader activation• Clean energy training (June)• Solar showcase (July)• Promotion campaign (Aug)• 500 KES incentive alignment	• Call for solar micro-project proposals• 17 projects funded (KES 10,000 each)• Solar asset procurement• June–Aug implementation	• Pre-training survey (Dec 2024, n=198) • Post-training survey (Feb 2026, n=122) • Training + mobilisation + micro-projects
Method	• Leadership-based mobilisation• Group-level diffusion model• Incentive alignment mechanism• WhatsApp monitoring• Excel tracking	• Community-led selection• Seed funding model• Product-based intervention• Post-implementation reporting• Comparative asset analysis	• Matched pre–post design • Wilcoxon tests (ordinal shifts) • Binomial tests (binary outcomes) • Chi-square tests (income predictors)
Output	• 22 chama/women groups (10-15 people per group) trained• Leaders appointed across groups• Product-specific demand formed• Regional mobilisation strengthened	• 17 operational micro-projects• Weekly savings (KES 120–280)• Income gains (KES 200–600/week for productive assets)• Reporting documentation completed	**Adoption & Transition** • 97% energy source change • 98% product adoption • 92% kerosene reduction **Economic Effects** • 87–88% income increase • Clean energy use = strongest income predictor (χ^2=65.7, p<0.001) **Well-being** • Stress reduction • Expense reduction • Lighting, clean cooking, clean water access improvement
Outcome	• Collaborative diffusion (NGO + provider) strengthened adoption • Leadership translated awareness into market-linked demand • Incentive alignment shaped purchasing decisions	"Triple win": financial savings, improved study conditions, reduced smoke exposure • Productive-use assets (pumps, cookstoves) generate stronger income gains than lighting-only systems • Flat grant model underfunded highest-impact assets • Clear demand for income-linked clean energy solutions	**Economic Empowerment** Productive use → economic growth **Capability Expansion** Training → Understanding → community empowerment **Structural Finding** Productive use not access alone→ Sustained Women Empowerment

CONCLUDING REMARKS

1 Design Contribution

Tri-Sector + Sequential Model
NGO – Academia – Business alignment
Diagnose → Realign → Activate → Scale
Leadership-based mobilisation embedded within market structures.

2 Empirical Evidence

Access ≠ Empowerment
- SDG awareness produces statistically significant behavioural shifts
- Productive clean energy use is the primary income transmission channel
- Incentive alignment shapes adoption patterns
- Community leadership accelerates diffusion
- Impact not driven by demographics → broad accessibility

3 Theoretical & Policy Position

Sustained women empowerment does not emerge from access alone.
It emerges when clean energy is:
- Productively integrated into livelihoods
- Diffused through trusted community leadership
- Supported by aligned market incentives
- Embedded within system-level structures

→ Empowerment is a systems outcome, not a product outcome

Current Stage

Final survey data
March (1-3)

UNFCCC-reference project 01

02 COP30 Invitation to talk about project

Scale-up- Global Methan Hub 03

THANK YOU

SUSTAINABLESTEPS4KENYA