Case Study

Biodigester Results-Based Financing– Insights from the African Biodigester Component (ABC) in Kenya

ABC - Results-Based Financing for Biogas Adoption

Co-financed by:

Ministry of Foreign Affairs

MINISTRY OF FOREIGN AFFAIRS OF DENMARK
Danida

Coordinated by:

Netherlands Enterprise Agency

In partnership with:

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Executive Summary

How do you transform a nascent renewable energy market into a thriving commercial ecosystem? The African Biodigester Component (ABC) Kenya programme provides the answer: through strategically designed Results-Based Financing that aligns incentives, ensures quality, and builds sustainable markets.

Between February 2023 and June 2026, ABC Kenya deployed a groundbreaking RBF mechanism that catalyzed verified installation of 6508 small-scale and 62 medium-scale biodigesters across Kenya. By strategically disbursing €528,325 in results-based incentives to 17 biodigester companies, the programme achieved what traditional subsidies rarely accomplish: market transformation with exceptional quality outcomes.

This case study documents how Results-Based Financing stimulates biodigester adoption by solving three fundamental market challenges:

1. **The Quality Problem:** Traditional subsidies incentivize volume over quality. ABC Kenya achieved 97% functionality after one year dramatically exceeding the baseline of 82%

2. **The Dependency Problem:** Fixed subsidies create dependency. ABC Kenya's declining incentive structure (€100→€60) created urgency while signaling subsidy temporariness, compelling enterprises to develop sustainable business models.

3. **The Equity Problem:** Market forces concentrate in high-potential areas. ABC Kenya's geographic equity bonus (€40 for 20 arid counties) made commercially viable what markets alone could not reach.

6,508 small-scale bio digesters installed across Kenya
February 2023 – December 2025

62 medium-scale bio digesters deployed nationwide

€528,325 disbursed through performance based incentives

18 biodigester companies supported through Results-Based Financing

Program Profile

Implementing Organization	GIZ (lead), SNV, KPMG, ABPL, NIRAS, Private Equity Support
Funding Source	Dutch Ministry of Foreign Affairs (DGIS), DANIDA, European Union, coordinated by RVO
Timeline	February 2023 – September 2026
Geographic Scope	National programme with focus on 12 high-potential counties plus low sale arid counties
Total Budget	€6.290 million overall; €528,325 disbursed through RBF to enterprises

1.0 Project Overview

The ABC intervention in Kenya (2022 to 2026) aims at facilitating a shift of the biodigester market from its pioneering to the expansion phase with a focus on the installation of over 10,000 small-scale and 100 medium scale biodigesters, with an overall project budget €6.290 million. This will be achieved by means of a well-balanced mix of demand-side, supply side, financing and enabling environment interventions, geared at boosting demand and supporting small-scale and medium-scale biodigester companies in acquiring more clients.

The project runs from 2022 to 2026 and is implemented by a consortium between GIZ and SNV in partnership with ABPL.

The main objectives of the initiative are:

- Sustainable, stable and growing market for biodigesters
- Significantly contribute to national energy access and climate targets
- Market-based approach to triggering demand
- Promoting supply of high-quality technology and services
- Improving enabling environment through:

  - Promotion of quality standards
  - Building the capacities of relevant national and county-level government institutions
  - Integration of biodigesters into the national and county energy plans
  - Institutionalization of biodigester trainings
  - Target Beneficiaries & Implementation

Further value will be created by integrating biodigester by-product valorisation (use of bio-slurry/bio-slurry enriched compost as a fertiliser and use of biogas for energy generation) aiming at a full life-cycle approach and improvement of the business case for end-users and companies.

The Results-Based Financing (RBF) Facility under the African Biodigester Component (ABC) is structured around two complementary windows that collectively strengthen both the supply and demand sides of the biodigester market. These windows target distinct beneficiary groups Biodigester Enterprises (BEs) and Financial Institutions (FIs) and are designed to incentivize quality installations, expand access to finance, and accelerate market growth.

These results demonstrate that Results-Based Financing, when properly designed, doesn't just distribute subsidies it transforms markets, ensures quality, and builds sustainable enterprises capable of operating without continued support.

Results

Metric	Achievement
Small-scale biodigesters verified	6,508 units
Medium-scale biodigesters verified	62 units
People gaining clean cooking access	35,000 people
Functionality rate after 1 year	97% vs 82%
Active usage rate	99% actively use biogas, 98% utilize bio-slurry
Total RBF disbursed	€528,325
Participating biodigester companies	18 enterprises
Direct jobs supported	395 jobs (36% women)
Verification rate	98% (7131 verified vs 7265 submitted) 89% positively verified
Market ecosystem	1,647 loans by December 2025 for a value of EUR 556,099 (without interest)
Financial ecosystem	1000+ consumer loans (<3% default rate)
GHG emissions reduced	37,034 tCO_2eq/year

Supply-Side RBF (Biodigester Enterprises):

This window supports Biodigester Enterprises installing small- and medium-scale biodigesters forhousehold and productive use. Incentives are paid after independent verification of installations, promoting compliance with technical standards, quality service delivery, and market competitiveness. The RBF enables enterprises to scale operations, expand reach, and better respond to end-user needs.

Demand-Side RBF (Financial Institutions):

This window targets SACCOs, Micro Finance Institutions, and banks to address high upfront costs faced by end-users. Financial Institutions are incentivized to develop and scale biodigester loan products, with payments released after verified loan disbursement and system commissioning. This approach de-risks lending, expands access to affordable financing, and drives increased biodigester adoption.

2.0 Context & Challenge

1.1 Kenya's Energy Poverty Challenge

Approximately 70% of Kenyan households depend primarily on traditional biomass—firewood and charcoal—for cooking. This generates cascading consequences:

- **Environmental:** Accelerated deforestation, land degradation, climate impact
- **Health:** Severe indoor air pollution affecting women and children
- **Time burden:** 2-3 hours daily for firewood collection
- **Economic:** Lost productive opportunities, reduced income

1.2 The Biodigester Solution

Biodigester technology converts agricultural residues and livestock waste into methane-rich biogas for cooking, while generating nutrient-rich bio-slurry as fertilizer. Key benefits:

Clean cooking energy: Eliminates indoor air pollution and respiratory health risks
Climate mitigation: 5.5 tons CO_2-equivalent reduction per household annually
Agricultural productivity: Bio-slurry enhances soil fertility and crop yields by around 30%
Time savings: 2-3 hours daily freed for productive activities
Circular economy: Waste valorization converting residues into resource

1.3 Market Barriers

Despite favorable fundamentals, biodigester adoption remained trapped in low-equilibrium due to:

Supply-Side Constraints

- ✓ Distribution network gaps in rural/remote areas
- ✓ Inconsistent installation quality undermining consumer confidence
- ✓ Limited enterprise technical capacity
- ✓ Working capital constraints inhibiting expansion

Demand-Side Constraints

- ✓ Limited awareness of technology benefits
- ✓ High upfront costs (€400-800) unaffordable for rural farmers
- ✓ Lack of consumer financing from financial institutions
- ✓ Lack of trust
- ✓ Availability of other alternatives

A woman cooking using biogas as a source of clean energy

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3.0 This is How RBF works

Traditional subsidies often create dependency and distort markets. ABC Kenya's RBF mechanism was different designed from the ground up to build sustainable markets

The ABC Kenya Results-Based Reimbursement (RBR) facility represents a fundamental departure from traditional subsidy models. Rather than providing upfront capital subsidies directly to consumers, the RBF mechanism reimburses biodigester companies after they successfully install, commission, and maintain functional biodigester systems. Under the first national biodigester project, Africa Biogas Partnership Program (ABPP), a direct subsidy was allocated to farmers as an intervention on the cost barrier for adoption between 2009 and 2014, the subsidy was ranging from KES 25000 initially and gradually reducing to KES 15,000 towards the 5th year of the program.

The subsidy arrangements were aimed at building a critical mass of adopters to demonstrate the value proposition of biodigester technology to farmers. In the second phase of ABPP, an RBF program was launched targeting both financial institutions and Biodigester Enterprises. The FIs received a credit sanctioning incentive which was paid against every successful loan disbursed. The BEs received three sets of incentives two of the three were tied to aftersale service delivery and one was tied to quality work.

The schematic/process diagram

Results-Based Financing (RBF) isn't just about paying for results—it's about designing incentives that create markets. The African Biodigester Component (ABC) Kenya programme proves that when you get the incentive structure right, you can transform nascent markets into thriving commercial ecosystems.

ASPECT	ABPP PHASE 1 (2009-2014)	ABPP PHASE 2	ABC KENYA (2023-2026)
Subsidy Recipient	Direct to farmers	Enterprises + FIs	**Enterprises + FIs (comprehensive)**
Payment Timing	Upfront or at installation	After installation + service	**55-60% at installation + 40-45% after 1 year**
Incentive Structure	Fixed amount declining over 5 years	Multiple incentives for quality + service	**Declining (€100→€60) + Quality PSR + Equity bonus**
Quality Assurance	Basic inspection	Quality tied to some incentives	**Independent KPMG verification + 3-stage process**
Geographic Equity	None	Limited	**€40 bonus for 20 arid counties**
Financial Ecosystem	Not addressed	FI incentives introduced	**Comprehensive: 8 SACCOs + 3 MFIs, 1,647 loans**
Functionality Rate	60-70%	70-80% (improved)	**97% after 1 year**
Market Sustainability	Market collapsed post-subsidy	Partial sustainability	**17 reporting companies**

The result: ABC Kenya achieved 97% functionality after one year versus 82% in the baseline direct consumer subsidy programmes while building a market ecosystem capable of continuing without donor support.

3.1 Declining Incentive Structure

This section documents how Results-Based Financing stimulates biodigester adoption through five strategically designed innovations that work in concert to transform market dynamics.

The Problem Traditional Subsidies Create

Fixed subsidies signal permanence, leading enterprises to build business models dependent on continued support. They fail to create urgency for market entry, resulting in slow development.

The ABC Kenya Solution

ABC Kenya implemented a declining incentive structure: €100 (Quota 1) → €80 (Quota 2) → €60 (Quota 3) a 40% reduction over 3-4 years as market penetration increases.

Quota	Units	Gas-in-Kitchen	Sustainability Payment
Quota 1	1 - 8,000	€55	€45
Quota 2	8,001 - 15,000	€35	€40
Quota 3	15,001 - 20,017	€25	€35

How This Stimulates Adoption

Creates Market Entry Urgency: Companies race to capture higher Quota 1-2 payments before filling, accelerating installations during critical early market development.

Signals Subsidy Temporariness: The 40% decline signals subsidies are temporary, compelling enterprises to develop subsidy-independent business models.

Incentivizes Operational Efficiency: Declining reimbursements drive innovation in installation techniques, supply chain optimization, and process improvements.

Enables Price Discovery: Forces enterprises to gradually reduce consumer prices, moving toward sustainable unsubsidized price points.

Prevents Market Distortion: Gradual predictable decline allows planning; market transitions smoothly rather than experiencing subsidy removal shock.

Critical Insight

Degression rate must be steep enough (30-50%) to create urgency but gradual enough (2-4 years) to allow sustainable model development. ABC Kenya's 40% over 3-4 years struck optimal balance.

Stakeholders posing for a picture during a knowledge exchange forum in June 2024

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3.2 Quality-Contingent Payments

The Problem Traditional Subsidies Create

Upfront-only payments incentivize volume over quality. No financial incentive for long-term functionality. Result: 60-70% typical global functionality rates.

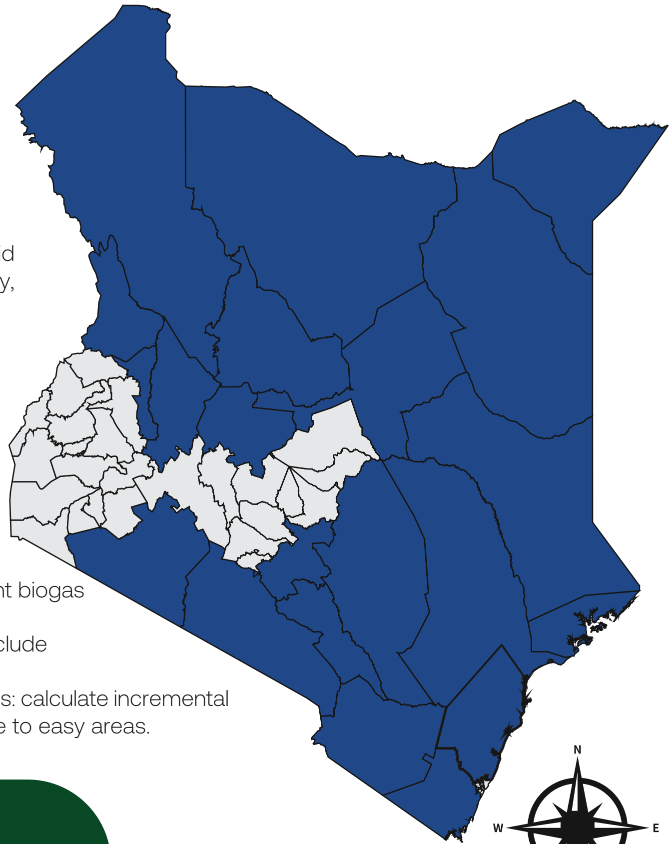
The ABC Kenya Solution: Plant Sustainability Reimbursement

Two-component payment structure: (1) Gas-in-Kitchen (55-60% PSR) paid upon installation verification, (2) Plant Sustainability Reimbursement (40-45%) paid only after 1-year functionality verification.

How This Stimulates Quality Adoption

- **Makes Quality Financially Profitable:** PSR represents 40-45% of revenue. Enterprises earn/lose €4,000-4,500 per 100 units based on quality. Quality becomes profit center, not cost center.
- **Aligns Time Horizons:** 12-month delay forces enterprises to think beyond installation day, requiring robust construction, training, and ongoing support.
- **Drives Quality System Investment:** To achieve 90-100% functionality for full PSR, enterprises invested in superior materials, comprehensive training, preventive maintenance, customer support, and warranty programs.
- **Creates Competitive Advantage:** Companies achieving 95-100% functionality earned full PSR while 60-70% performers forfeited substantial revenue. Quality became market differentiator.
- **Eliminates Moral Hazard:** Makes enterprises bear quality risk. Biodigester failure = 40-45% revenue loss.
- **Builds Customer Confidence:** 97% functionality (vs. 60-70% typical) created positive reputation cascade, word-of-mouth referrals, organic demand growth.

3.3 Geographic Equity Mechanism



The Problem Market Forces Create

Market forces naturally concentrate in high-potential areas. ASALs remain underserved. Creates geographic inequality where energy poverty concentrates in marginalized communities.

The ABC Kenya Solution

Additional €40 per-unit bonus for installations in 20 designated arid/semi-arid counties. Calculated based on actual incremental costs (transport, low density, water scarcity, limited financial services, after-sales distances).

How This Stimulates Equitable Adoption

- **Makes ASALs Financially Attractive:** €140 total (vs. €100 high-potential) = 40% premium. Transforms arid counties from least to most attractive markets.
- **Offsets Real Incremental Costs:** €40 covers actual extras: transport (€10-15), service travel (€8-12), density inefficiency (€10-15), payment flexibility (€5-8).
- **Expands to Marginalized Communities:** Enabled enterprises to reach West Pokot, Kajiado and Isiolo pastoral communities with significant biogas potential but high poverty.
- **Prevents Geographic Inequality:** Ensures market-based programmes include marginalized populations aligning economic efficiency with social equity
- **Demonstrates Replicable Model:** Principle applicable to other technologies: calculate incremental costs and provide bonuses rendering challenging areas similarly profitable to easy areas.

Critical Insight

PSR must be significant minimum 30-40% of total to drive behavioral change. ABC Kenya's 40-45%: proved transformative. Lower percentages fail to overcome short-term profit maximization.

Bonuses must be cost-based, not arbitrary. Under-sizing (€10-15) fails to incentivize; over-sizing (€80-100) creates windfall profits. Right bonus makes challenging areas similarly profitable—no more, no less.

Target Counties:

Baringo, Elgeyo Marakwet, Garissa, Isiolo, Kajiado, kilifi, Kitui, Kwale, Lamu, Laikipia, Machakos, Makueni, Mandera, Marsabit, Narok, Samburu, Taita Taveta, Tana River, Turkana, Wajir, West Pokot

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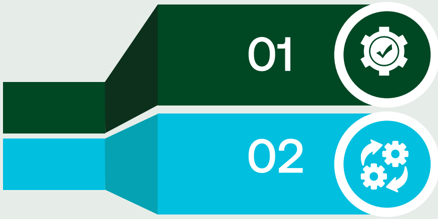
3.4 Independent Verification System

The Problem Traditional Subsidies Create

When implementing agencies both disburse and verify, conflicts of interest arise. Pressure to show high numbers creates incentives to overlook quality or accept inflated claims. Fraud proliferates, credibility collapses.

The ABC Kenya Solution: KPMG Independence

KPMG Netherlands contracted directly by RVO (not GIZ/SNV), ensuring structural independence. -
Two-phase protocol:



01 Installation verification

02 Functionality verification 12 months later Pressure Safety Relief (PSR) trigger.
Digital systems: TaroWorks, SOFY, API integration

How This Stimulates Credible Adoption

- **Prevents Fraud:** 89% positive verification rate (6445 / 7265) demonstrates robust checking. GPS, photos, customer interviews prevent inflated/fraudulent claims.
- **Maintains Credibility:** KPMG's independence contracted by RVO, not implementers ensures verification can't be compromised.
- **Deters Low-Quality:** Knowing independent professionals verify within 8 weeks, enterprises invest in quality from start. 11% fail rate catches issues early
- **Enables Learning:** Verification data disaggregated by failure cause enables targeted technical assistance to enterprises.
- **Balances Speed/Credibility:** 2025 transition to risk-based sampling for high-performers (>95% pass rates) accelerated disbursements while maintaining quality.
- **Provides Replication Evidence:** Independently verified 97% functionality certified by KPMG Netherlands carries weight in policy discussions globally.

Critical Insight

- **Cutting Verification to save money undermines entire programme.**
- **Independence is non-negotiable: separate contracting, funding, reporting lines.**

A farmer collecting cow dung

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3.5 Financial Ecosystem Development

The Problem Market Forces Don't Solve

Even with reduced costs, €400-800 remains unaffordable for rural farmers. Financial institutions lack biodigester products, risk tools, confidence. Consumer financing doesn't emerge organically—requires explicit intervention.

The ABC Kenya Solution: Dual-Window RBF

Window 1 (€1.6m):

Supply-side RBF to biodigester enterprises.

Window 2 (€380K):

Demand-side RBF to financial institutions (SACCOs/MFIs), incentivizing biodigester-specific lending products with technical assistance.

How This Stimulates Affordable Adoption

- ✓ **Addresses Affordability Directly:** Consumer financing spreads €400-600 over 12-24 months (€20-40/month), transforming unaffordable capital purchase into manageable monthly payment.
- ✓ **De-Risks Financial Institutions:** RBF incentive offsets initial costs while institutions learn biodigester lending, build portfolios, develop expertise.
- ✓ **Builds Institutional Capacity:** Technical assistance (risk tools, training, templates) provides knowledge infrastructure for sustainable lending.
- ✓ **Creates Sustainable Products:** <3% default rate demonstrated viability. SACCOs now offer loans as standard products without RBF support.
- ✓ **Enables Enterprise Evolution:** When consumer financing available, enterprises partner with SACCOs, receive full payment, focus on quality vs. financing management.
- ✓ **Expands Market Dramatically:** Research suggests financing increases market 3-5x. 1,000+ loans in year 1 (20% of installations) demonstrates expansion potential.

Critical Insight

Financial ecosystem requires proactive intervention. Allocate 15-25% of budget from start (ABC Kenya 32% of supply-side). Consumer financing is an endogenous constraint requiring explicit attention.

Participants of the ABC Programme milestone celebration stand in front of a prefabricated biodigester on a farm in Nanyuki. This was the 6,000 small-scale verified biodigester of the programme.

4.0 Implementation Journey

4.1 Enterprise Recruitment & Onboarding

The programme leveraged existing relationships through BIO-NET, Clean Cooking Association of Kenya (CCAK), Africa Bioenergy Programme Limited (ABPL). Conducted stakeholder consultations, competitive application process with eligibility criteria: formal registration, technical capacity, quality commitment.

Initial onboarding challenges:

- Complex verification process causing payment delays
- Data entry errors (ID mismatches, duplicates)
- Need for companies to pre-finance before RBF disbursement
- Training requirements for Taroworks data systems

A fixed dome biodigester under construction

4.2 Capacity Building & Training

- ✓ **Technical training:** 240 masons trained on small-scale construction and 44 Financial Institutions
- ✓ **Sales/marketing:** 100+ biodigester sales agents trained
- ✓ **Business development:** Energy Enterprise Coach (EEC) provided BDS support
- ✓ **Data management:** Training on Taroworks and verification requirements
- ✓ **Quality standards:** Continuous sensitization on construction and customer service

A farmer collecting manure to put on her farm.

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5.0 Critical Success Factors & Lessons Learned

5.1 What Made ABC Kenya Successful

Integrated approach: Five innovations working in concert, not isolation

Independent verification: KPMG structural independence maintained credibility

Financial ecosystem: Proactive intervention in consumer financing

Flexibility: Adapted processes based on learning (risk-based sampling)

Quality focus: 40-45% PSR made quality profitable, not costly

Subsidy exit signal: Declining incentives prevented dependency

Capacity building: Substantial investment in enterprise training/support

Strong partnerships: Clear roles among GIZ, SNV, KPMG, ABPL, NIRAS, PES

5.2 Key Lessons for Replication

01 Quality requires significant incentives: Minimum 30-40% contingent on functionality. Lower percentages fail.

02 Declining incentives must signal exit: 30-50% reduction over 2-4 years. Faster risks collapse; slower prolongs dependency.

03 Verification is non-negotiable: Cutting Verification to save money undermines entire programme.

04 Consumer financing needs explicit intervention: Allocate 15-25% of budget from start. Doesn't emerge organically.

05 Geographic equity requires cost-based bonuses: Calculate real incremental costs. Make challenging areas similarly profitable to easy areas.

06 Enterprise pre-financing creates barriers: Consider mechanisms to reduce working capital requirements.

07 Digital systems critical: API integrations, GPS verification, photographic evidence essential for scale and integrity.

08 Multi-year commitment required: 3-5 years minimum for market transition. Short programmes fail to achieve sustainability.

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6.0 Stakeholder Recommendations

6.1 For Practitioners & Programme Managers

- **Design incentives strategically:** All five innovations in concert, not isolation
- **Budget adequately:** 8-10% for verification, 15-25% for financial ecosystem
- **Ensure independence:** Contract verification agent separately from implementers
- **Build capacity intensively:** Substantial enterprise training/ support investment
- **Allow flexibility:** Adapt based on learning; don't rigidly stick to initial design
- **Commit long-term:** 4-5 years minimum for market transition to sustainability

Farmers feeding their biodigester

6.2 For Policymakers & Government

- **Create enabling environment:** Remove regulatory barriers, streamline approvals
- **Establish quality standards:** Certification, testing protocols, installer training requirements
- **Integrate into national plans:** Include biodigesters in energy/ climate strategies
- **Support consumer financing:** Encourage MFI/SACCO biodigester products
- **Plan for subsidy exit:** Develop post-RBF frameworks ensuring market sustainability
- **Invest in awareness:** National campaigns on biogas benefits

Modern Milking Technology Showcasing Efficient Dairy Processing

6.3 For Donors & Development Partners

- **Commit multi-year funding:** 4-5 years minimum, flexible for learning
- **Accept realistic targets:** Quality over volume; 5,000 at 97% beats 15,000 at 60%
- **Support verification costs:** 8-10% is investment in credibility, not overhead
- **Enable financial ecosystem:** Allocate 15-25% for consumer financing from start
- **Encourage adaptation:** Build in learning loops, allow mid-course corrections
- **Coordinate with other donors:** Avoid conflicting incentive structures

Members at the International Livestock Research Institute (ILRI) actively participate in a knowledge sharing workshop.

6.4 For Private Sector & Enterprises

- **Invest in quality systems:** 40-45% PSR makes quality profitable long-term
- **Develop sustainable business models:** Plan for post-subsidy viability from start
- **Build customer relationships:** After-sales service = repeat business + referrals
- **Embrace verification:** See independent checking as credibility builder, not burden
- **Partner with MFIs/SACCOs:** Consumer financing expands market 3-5x
- **Participate in capacity building:** Training improves workforce quality and outcomes

A woman carefully inspects her healthy crops on the farm after applying bioslurry fertilizer to improve soil fertility.

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Conclusion

The ABC Kenya programme demonstrates that Results-Based Financing, when strategically designed through five inter connected innovations, transforms markets. Through declining incentives, quality contingent payments, geographic equity, independent verification, and financial ecosystem development, ABC Kenya achieved what traditional subsidies rarely accomplish: rapid market growth (6,570 biodigesters), exceptional quality (97% functionality), sustainable enterprise development (90 active businesses), and inclusive reaching (11 out of 20 arid counties 35,000 people).

The Path Forward:

The ABC Kenya model offers a replicable framework applicable to solar home systems, improved cookstoves, micro-hydro, and other renewable technologies. The five innovations are universal principles that can transform nascent markets into thriving commercial ecosystems.For replication to succeed, stakeholders must commit to all five innovations in concert. The power lies in their integration.The 35,000 people now cooking with clean biogas in Kenya represent proof of concept: Results-Based Financing can transform markets, improve lives, and accelerate progress toward universal energy access when we commit to doing it right.

How RBF Stimulated This Adoption:

- **Declining incentives created urgency while signaling subsidy exit**
- **Quality-contingent payments made quality profitable, not costly**
- **Geographic equity bonuses expanded reach to marginalized communities**
- **Independent verification built credibility and prevented fraud**
- **Financial ecosystem RBF addressed affordability barriers**

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