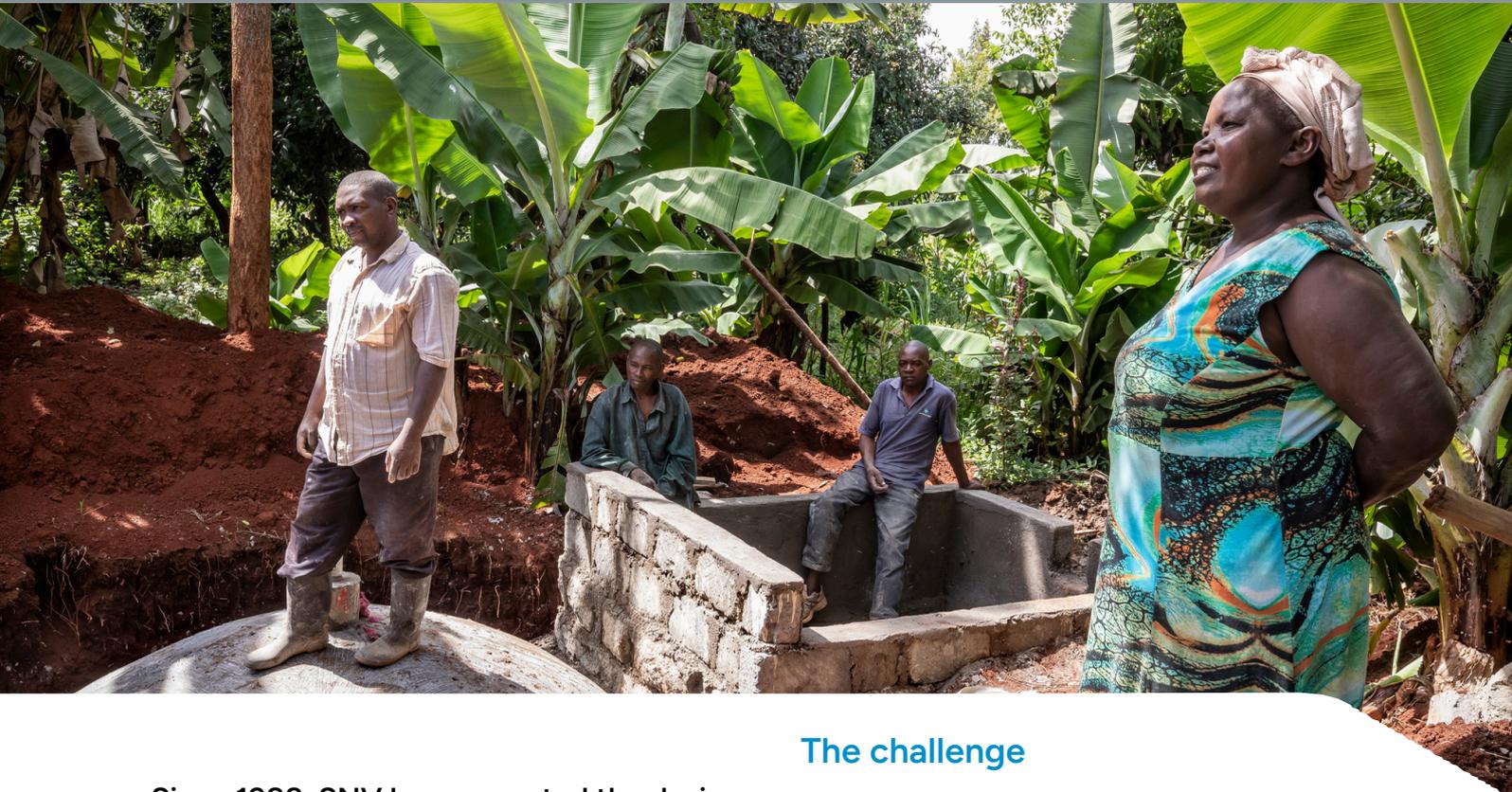




# Sustainable Energy Markets - Biodigesters

Advancing clean energy, soil fertility and climate-resilient livelihoods

Capability Statement | January 2026



Since 1988, SNV has supported the design and implementation of market-based biodigester programmes. A strong local presence, combined with over three decades of experience, has enabled us to gain an in-depth understanding of sector needs across diverse local contexts. To date, SNV-supported projects in 27 countries have cumulatively installed more than one million household biodigesters.

Among these countries, eight have developed carbon finance mechanisms to reduce dependence on development aid. SNV currently supports biodigester market development in six countries across Asia and Africa. A 2024 biodigester impact study found that biodigesters directly contribute to 11 and indirectly to two Sustainable Development Goals (SDGs), demonstrating their relevance across much of the SDG framework. As an integrated technology, biodigesters link clean energy access, improved soil fertility and soil health, and reduced greenhouse gas emissions, contributing to climate mitigation while strengthening climate-resilient livelihoods.

## The challenge

Worldwide, 2.1 billion people lack access to clean cooking. They rely on polluting open fires or basic stoves fuelled by biomass such as wood, charcoal, animal dung, crop waste, or kerosene. The World Health Organisation (WHO) estimates that nearly 3.2 million people die prematurely each year from illnesses attributable to household air pollution in the absence of clean cooking solutions.

Biomass resources are rapidly depleting in lower-middle-income countries, and further deforestation is causing ecological degradation and the emission of greenhouse gases (GHGs). Gathering biomass is typically carried out by women and children, limiting the time they can spend on leisure, productive activities, or education.

Soil fertility is crucial for sustainable food production. However, the Food and Agriculture Organisation (FAO) estimates that 33% of the world's soil is moderately to highly degraded, affecting approximately 2.6 billion people globally. Across Africa, major threats include soil erosion resulting from forest degradation, the depletion of soil organic matter and nutrients, and the loss of soil biodiversity.

## About biodigesters

### What is a biodigester?

Biodigesters convert organic matter, such as animal manure, human excreta, and food waste, into two valuable outputs. The first is biogas, a renewable and clean energy source primarily used for cooking and basic lighting in areas without reliable electricity access. The second is bio-slurry, a nutrient-rich organic fertiliser with nutrients more readily available to plants than untreated dung, which remains a common agricultural input in rural areas.

Smallholder farming households with at least two cows or seven pigs can generate sufficient biogas to meet basic household energy needs, including clean cooking and lighting. Bio-slurry, applied directly or as bio-slurry-enriched compost, plays a crucial role in enhancing soil health and improving crop and fodder productivity. Biodigesters are therefore a key component of regenerative and climate-resilient farming systems.

### How attractive is the business case for biodigester owners?

The initial investment for household-scale biodigesters typically ranges from US\$500 to US\$1,000, depending on system size and design. Annual operation and maintenance costs are generally low, averaging around 2% of the initial investment.

The quantified and monetised value of biogas use, in terms of improved family health and gender-related benefits, as well as savings in time and fuel, may appear modest. This is largely due to the low rural wage levels and the limited direct costs of traditional fuels, such as firewood, in some contexts.

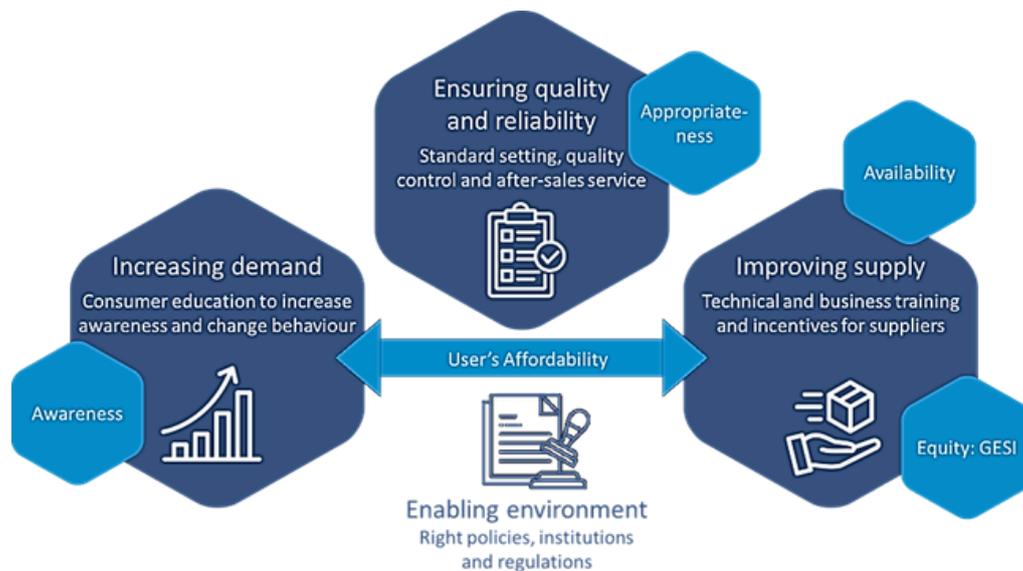
However, the monetised benefits from bio-slurry could be many times higher, with improved crop yields and reduced use of chemical fertilisers.

Overall, cost-benefit analyses of biodigesters in various countries indicate an average payback period of approximately three years. In recent years, many biodigester projects have secured carbon finance, which can yield annual revenues of US\$50 to US\$100, depending on factors such as baseline fuel and manure management practices prior to the project and the carbon price. With carbon revenue, some biodigester projects enable owners to pay less than 40% of the original price.

With or without carbon finance, biodigesters offer an attractive rate of return for smallholder farmers. However, challenges remain in terms of awareness, access to finance, and the availability of biodigesters and associated services.

**Bio-slurry, either directly or in the form of bio-compost, used as organic fertiliser for the production of crops and fodder, also plays a vital role in improving soil health.**





## Our approach

SNV has been developing sustainable biogas markets using a framework approach built around five pillars: demand, supply, financing, inclusion, and the enabling environment. Intervention areas vary depending on the country's context and the market's maturity.

Across all programmes, SNV focuses on strengthening capacities within and across these five pillars. This includes institutional strengthening and governance, catalysing partnerships among local and, at times, international actors—including those involved in carbon finance—and aiming for systems change rather than focusing solely on immediate sales of biogas and their functionality.

### Stimulating demand

- Promotional activities inform potential biogas households and other stakeholders about the benefits and costs of the technology, whether constructed in situ using traditional building materials or prefabricated.
- Improving the business case for biogas owners by maximising the value of biogas and bio-slurry, considering both consumptive and productive uses, and showcasing successful, attractive business cases.

### Strengthening supply

- Assessment of market entry barriers and opportunities for local and international constructors and fabricators, distributors, and retailers.
- Provision of technical capacity and business development services, including training, coaching, mentoring, and advice, based on needs assessments.
- Support to private sector companies for quality improvement, including through product development and standardisation, internal quality control, and warranty systems.

- Matchmaking with selected agri-food value chain actors and cooperatives for market access.

### Improving access to finance

- Facilitate access to finance for households to manage the high up-front investment costs and for suppliers to ease working capital constraints, including through credit sales.
- Depending on the context, access to finance may also involve grant investment in the form of demand-side subsidies or results-based financing for suppliers.
- Matchmaking with private and public financiers for business investment (debt, equity) and with financial institutions for consumer financing.
- Large-scale biogas projects have relied on carbon finance, with the revenue used to sustain demand-side subsidies and provide incentives to suppliers, including repair and maintenance.





### Promoting gender equality and social inclusion

- Promoting gender equality and social inclusion in the supply side of the market is essential, though in the demand side, biogas primarily benefits women and children by reducing the time spent on fuel preparation, cooking, and cleaning, and by minimising indoor air pollution.
- Projects may include sensitisation, capacity development, and financial or non-financial incentives for improved gender equality and social inclusion.

### Improving the enabling environment

- Support national and subnational government agencies with evidence-based advocacy to develop conducive frameworks, including policies, strategies, regulations, institutional arrangements, targets, and programmes.
- Engage with government institutions and business associations on skills development and certification, product quality specifications or standards, and testing and certification.
- Promote and build the capacity of non-state actors, including the private sector, to strengthen the enabling environment, working in partnership with government agencies.
- Facilitate structured interaction and knowledge exchange among relevant stakeholders within the country and beyond.

## Future direction

### Biodigesters and climate change

Household biodigesters mitigate climate change by reducing GHG emissions by three to eight tonnes of CO<sub>2</sub>-eq per unit each year. The technology's benefits also support household adaptation to the effects of climate change by enhancing resilience and improving livelihoods, particularly through clean cooking and sustainable agricultural production. Improved human health and soil health are clear benefits of biodigesters, which contribute to climate resilience. Biodigester projects with a carbon finance component generate carbon revenues as a sustainable source of finance.

### Emerging niche markets for medium-sized digesters

In several countries, niche markets for medium- to large-sized biodigesters are emerging. These systems, installed by businesses, institutions, and large farms, process larger quantities of organic matter, including agricultural processing residues, animal manure, human excreta, slaughter waste, and municipal solid organic waste. Biogas is used for thermal energy or electricity generation, while bio-slurry is used on farms or sold. SNV has been piloting medium-scale digesters in more than 15 countries, including Vietnam, Nepal, Indonesia, Ethiopia, Kenya, Zambia, Nicaragua, and Honduras.

### Scaling to 10 million biodigester installations

By 2030, SNV aims to enable benefits for 50 million people through the cumulative installation of 10 million biodigesters across all countries where it has supported biodigester market development. The ambition is driven by two approaches for scaling and acceleration:

- Capitalising on carbon finance opportunities
- Designing multisectoral biodigester programmes

In addition to these scaling approaches, SNV also works on an innovation track through:

- Strategic partnerships with donors, other development partners, and prefabricated biodigester companies.
- Digitalisation for biogas metering and remote sensing, including diagnostic purposes and carbon monitoring.
- Playing a market facilitator role, particularly in medium- to large-sized biodigester market segments.
- Innovations in business models and financing.

## Project experience

### **African Biogas Component (ABC) | Multi-country | RVO/DGIS, Danida | €13.45 million | 2022–2025**

A continuation of the Africa Biogas Partnership Programme (ABPP), this multi-country initiative aims to install 50,000 household and 250 medium-sized biogas digesters by 2026. SNV is the lead implementer in Burkina Faso, Mali, Niger, Benin, and Uganda, and provides technical assistance in Kenya.

### **The Biogas Dissemination Scale-Up Programme (NBPE+) | Ethiopia | European Union, Government of Ethiopia | €22.85 million | 2017–2024**

NBPE+ was a public–private partnership hosted by the Ministry of Water, Irrigation and Energy (MoWIE). SNV served as the overall programme manager and provided technical assistance. The project aimed to improve the living standards of smallholder farmers in nine regions of Ethiopia by sustainably developing the biogas digester sector, reducing the overexploitation of biomass resources, and reducing GHG emissions. By the end of the project in January 2024, 25,516 households and 24 medium-scale digesters had been installed.

### **Towards a Market-Driven Biogas Sector in Vietnam | EnDev, Government of Vietnam | €7.5 million | 2013–2020**

Building on earlier work to develop the biogas digester sector in Vietnam, SNV supported the Ministry of Agriculture and Rural Development in implementing an innovative results-based financing (RBF) facility to further commercialise the sector. Participating companies refined their market approaches and increased their sales. By the end of the project, more than 55,000 digesters had been installed under this facility. Companies offering pre-manufactured, composite systems benefitted most, reaching over 80% market share in the last two years.

### **Energy for Agriculture in Zambia | Zambia | Sida | €6.5 million | 2015–2019**

The Energy for Agriculture project began in a context with a limited existing biogas digester sector. Through steady collaboration and local engagement, key foundations were established, including the development of appropriate digester designs and standards, training masons, supporting enterprise formation, and partnering with local stakeholders. By the project's conclusion, around 45 companies, working closely with more than 70 farmer cooperatives, had installed 4,877 biogas digesters, strengthening livelihoods and improving access to sustainable energy.



### **Biogas Market Development Programme | Nicaragua | IADB, NDF | €6.2 million | 2012–2018**

This programme aimed to stimulate a market-based biogas digester sector in Nicaragua, utilising manure primarily produced from cattle kept in extensive husbandry systems. Alongside small-scale units, the project piloted several larger-scale digesters made from bricks and prefabricated components. Gas from the larger units was used to power appliances such as water heaters, milking systems, milk chillers, and water pumps. The programme supported the installation of more than 1,400 digesters.



## Climate and livelihood initiatives

In recent years, SNV has integrated biodigesters into a broader package of solutions for people and the planet. Some examples are:

- **Increasing Climate Resilience in Energy, Agriculture Systems and Entrepreneurship (INCREASE) Project** (2020–2024) in Zambia, funded by Sida.
- **Regenerative Agricultural Practices for Improved Livelihoods and Markets (REALMS) Project** (2021–2024) in Kenya and Rwanda, funded by IKEA Foundation.
- **Power for Food Partnership** (2025–2030), in Ethiopia, Kenya, Rwanda, and Uganda, funded by IKEA Foundation, is integrating productive use of renewable energy and regenerative agriculture, inclusive of biodigesters.
- **Ethiopia's NBPE+ project**, co-financed by EUD and the government of Ethiopia, has been successful in integrating biodigesters into a new phase of the dairy project funded by EKN.
- The **ABC Sahel project**, funded by DGIS/RVO, integrates biodigesters into other SNV climate resilience projects. For example:
  - Pro-ARIDES funded by DGIS
  - Soil health (Soil Values programme funded by DGIS)
  - Youth empowerment (EJASA funded by EKN and EUD) in Mali, Niger, Burkina Faso, and Benin

These projects have demonstrated the effectiveness of biodigesters in enhancing the climate resilience of smallholder farmers, particularly through the use of bio-slurry to improve soil fertility and soil health. Biodigesters have also contributed to broader clean cooking and youth employment initiatives in several countries.

SNV is a global development partner deeply rooted in the African and Asian countries where we operate. With 60 years of experience and a team of approximately 1,600 people, we strengthen capacities and catalyse partnerships that transform agri-food, energy and water systems. Working on the core themes of gender equality and social inclusion, climate adaptation and mitigation, and strong institutions and effective governance, we tailor our approaches to different contexts to achieve large-scale impact and create sustainable and more equitable lives for all.

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