

**Powering
Agriculture
for Food Security
and Resilience**

**Heifer's Commitment to
Accessible Renewable Energy**

APRIL 2025

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Solar panels in Cambodia power irrigation pumps and provide reliable water for various farming and households needs.

Heifer's Mission and Renewable Energy Vision

Heifer International works to end hunger and poverty while caring for the Earth. Since 1944, Heifer has been partnering with smallholder farmers to improve their livelihoods and increase healthy food production globally. Together, the principles and practices we promote serve to:

- ▶ build thriving and resilient communities.
- ▶ transform food systems to support sustainability and health.
- ▶ foster actions that care for the Earth and improve healthy ecosystems.

Renewable energy plays a crucial role in achieving food security and economic resilience by providing smallholder farmers with reliable, affordable and sustainable power for agricultural activities. Access to clean energy addresses the above pillars of Heifer's work, enabling farmers to irrigate their crops efficiently, preserve perishable produce through cold storage and mechanize labor-intensive tasks, all of which increase productivity and reduce post-harvest losses. It also reduces energy costs and reliance on fossil fuels, allowing farming to be more profitable and sustainable.

By reducing environmental harm and helping communities adapt to climate change, renewable energy equips farmers to withstand economic shocks, increase incomes, and contribute to stronger local and national food systems that ensure food security for millions.

Why Energy Matters for Smallholder Farmers

Agriculture is a vital economic activity in Heifer's operating regions, where smallholder farmers dominate food production but face low productivity due to factors, such as limited infrastructure, unreliable energy access and a lack of modern technology. In contrast, high-productivity countries like the United States have advanced through energy-intensive practices, such as mechanization and fertilization—made possible by affordable energy and strong infrastructure. This access to energy not only increased yields but also enabled better aggregation, processing and distribution.

Clean Cooking

While clean cooking doesn't directly increase productivity, it benefits smallholder farmers by reducing deforestation, improving health, and saving time — especially for women who are often the ones collecting fuel. Heifer integrates biodigesters into its livestock programs to support these outcomes and advance environmental sustainability.

This growth has come at a cost to the climate. Today, 80 percent of energy used in global food systems comes from fossil fuels, and agribusiness contributes to 30 percent of global greenhouse gas emissions. The Global South contributes the least to these emissions but suffers the most from their effects. To meet rising food demand sustainably, improve efficiency and boost farmer incomes, a shift to renewable energy is essential. In Africa, for example, agriculture is responsible for 58 percent of emissions. A just transition to renewable energy will be critical to building resilience, protecting the environment, and ensuring long-term sustainability.

Energy needs vary widely across Heifer's regions, from expanding supply to improving reliability and affordability. Globally, 789 million people lack energy access, and 1.46 billion experience unreliable power — many of them in rural farming communities. In Africa, 85 percent of farms operate without access to energy, leading to labor-intensive practices and low productivity. In Southeast Asia and the Americas, electricity is more available, but often remains unreliable or too costly for smallholder farmers.

To meet these diverse challenges, context-specific renewable energy solutions are essential. As global investments in renewable energy grow, Heifer is committed to ensuring a just and equitable transition in order for rural communities and smallholder farmers to reap the benefits.

Heifer's Approach to Renewable Energy Investments

Heifer's renewable energy investments aims to achieve two main goals:

- ▶ **Reduce emissions and health risks** by replacing polluting energy sources with clean, green alternatives.
- ▶ **Expand energy access for remote communities** with limited or no connection to electricity, enhancing wellbeing and agricultural productivity.

Heifer's approach to renewable energy investments is in line with its approach to all investments: Its initiatives are grounded in a farmer-centric, community-driven approach.

Country offices collaborate with local leaders and communities to assess energy needs and identify appropriate, context-specific solutions that can be implemented for long-term success.

During this process, key considerations include:

- ▶ Exploring potential investments that are inclusive.
- ▶ Estimating amounts of energy to meet both current and future demand.
- ▶ Managing any waste that may be generated.
- ▶ Identifying capital and credit needs, and improving farmer access to financial resources.
- ▶ Devising plans for infrastructure protection, management and maintenance.

Passing on the Gift

Since its founding, Heifer has embraced the model of Passing on the Gift, based on the principle of community-based sharing and sustainability. In livestock programs, this involves farmers passing on the offspring of their animals to others in the community.

For renewable energy investments, which don't reproduce naturally, this model is adapted through a revolving fund. In other words, farmers repay loans for energy infrastructure, and those funds are reinvested to support similar projects for other farmers. Participants are also encouraged to share their knowledge and experiences with neighbors and peers, helping to expand impact and foster a culture of collaboration and learning.

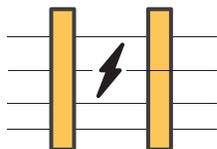
Examples of Heifer's Renewable Investments include:



150

Solar dryers

improve coffee quality and reduce post-harvest losses



51

Solar fencing

facilitates rotation grazing and protect livestock.



43

Solar water pumps (5 more planned)

improve access to water for drinking and household uses



600

Solar lighting

replace harmful, expensive fuels and support studying



4,609

Solar home systems

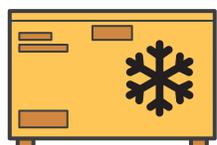
deliver off-grid electricity for rural households



4

Solar water heaters

replace fossil fuels for household heating water for bathing, washing dishes and doing laundry



14

Solar-powered cold rooms plus 57 refrigerators and freezers

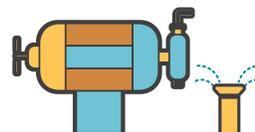
reduce post-harvest losses and preserve food quality



6,133

Biodigesters (105 more planned)

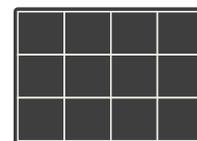
provide provide clean cooking fuel and organic fertilizer.



550

Large solar irrigation pumps (1,520 more planned)

support high-value crops and drought resilience



4

Large-scale dairy cooling system (4 more planned)

prevent milk spoilage and boost income

Real-World Impact: Renewable Energy in Action Across Heifer Communities



Solar dryers in Mexico help coffee and spice farmers produce quality products more consistently.

Solar Dryers improve coffee quality and livelihoods in Mexico

In Mexico, smallholder coffee farmers were losing up to 20 percent of their yield due to poor drying conditions that led to mold and fermentation, lowering quality and income. Additionally, the “grade” of coffee beans produced — a quality rating based on factors like size, shape, color and moisture content — was determining the price they receive.

To address the inefficiencies that limited the farmers’ incomes, Heifer introduced solar dryers, offering a controlled environment that improves bean quality, prevents spoilage, and helps farmers meet export standards. These interventions not only help farmers secure better prices but also guarantee a high-quality product for consumers—ensuring every cup of coffee meets the highest standards.

Solar-powered dairy cooling in Africa

East Africa’s dairy sector is a vital economic driver. Smallholder farmers rely on cooperatives to collect, store and sell milk to larger processors. However, Heifer’s partners face a constant challenge in maintaining milk quality, within strict temperature ranges to meet processors’ standards. This requires reliable, uninterrupted power which is not always available in rural areas. Frequent outages force cooperatives to rely on costly diesel generators, raising operational expenses and increasing the risk of milk spoilage and financial losses for both cooperatives and farmers.

To address these issues, Heifer International partnered with local stakeholders to pilot solar-powered solutions at three dairy cooperatives in Uganda. These large-scale solar installations provide consistent, cost-effective and sustainable power. Within the first months of operation, energy costs dropped by 46 percent, while milk spoilage was nearly eliminated. This solution increased the profitability of cooperatives and benefited farmers by increasing their earnings.

The success of these pilot projects presents a powerful opportunity for scale. With hundreds of cooperatives across the country facing similar challenges, expanding access to affordable, reliable and clean energy has high potentials to transform Uganda’s dairy sector — enhancing milk production, strengthening cooperative sustainability and, ultimately, improving the livelihoods of smallholder farmers.



Solar-powered cold storage in Tanzania increases profits and helps reduce post-harvest losses.



A biodigester in Bangladesh produces cooking gas while reducing methane emissions from cattle.

Biodigesters for fuel and fertilizer in Asia, Africa and Latin America

Most low-income households worldwide rely on traditional cookstoves that burn wood, charcoal and other solid fuels indoors. These fuels are inefficient, costly and hazardous to health, exposing families — especially women and children — to toxic fumes and carbon monoxide. For rural families collecting fuel can take dozens of hours each week, and households spend significant portions of their income on cooking energy. Beyond the human cost, traditional cooking methods contribute to environmental degradation, releasing a gigaton of carbon dioxide and other pollutants like black carbon due to inefficient combustion and deforestation.

To address this challenge, Heifer International has invested in biodigesters in countries, such as Bangladesh, Kenya, Mexico, Nepal, Senegal and Uganda, supporting farming households who own cattle and rely on inefficient, unhealthy cooking fuels. These systems convert cow dung and water into methane-rich biogas, piped directly to kitchen stoves, as a clean, renewable cooking fuel. A valuable byproduct of this process is nutrient-rich slurry, which serves as an organic fertilizer, improving soil health, increasing crop yields and reducing reliance on chemical inputs.

For livestock farmers, biodigesters offer a practical, sustainable solution that align with Heifer's mission. By transitioning to clean cooking, families reduce their environmental footprint, protect their health and, women in particular, free up valuable time. With fewer hours spent gathering fuel, women have the opportunity to invest in farm work, start entrepreneurial ventures and contribute to their household's income, fostering greater economic resilience and long-term prosperity.

Cold storage reduces food loss in Africa and Asia

Each year, across Asia and sub-Saharan Africa, 30 to 40 percent of smallholder farmers' horticultural produce is lost post-harvest. Smallholder farmers have described to Heifer that unreliable supply chains and the lack of cold storage force them to sell their produce immediately or risk spoilage. This urgency leaves them vulnerable brokers who dictate low prices, preventing sales at optimal market rates.

In recognition of this challenge, companies like ColdHubs (Nigeria), Koolboks (Kenya) and SOGE (Cambodia) offer solar-powered cold storage, allowing farmers to rent space and safely store produce until market conditions are favorable.

After hearing directly from farmers about the importance of cold storage in reducing food waste and boosting incomes, Heifer International introduced solar-powered cold storage solutions in several program areas. In Nigeria alone, 10 solar-powered cold storage units have been installed in key food markets, enabling farmers to extend the shelf life of their produce, reduce losses and secure better prices. These interventions are a critical step toward building resilient agricultural supply chains, reducing food waste and strengthening farmer livelihoods.



Solar-powered cold storage in Nigeria increases profits and helps reduce post-harvest losses.



Solar fencing in Honduras enables cattle to graze more flexibly, improving pasture management and livestock productivity.

Solar-powered fencing in the Americas

For smallholder farmers, fencing is often a major expense and a key barrier to adopting regenerative rotational grazing practices. Solar-powered fencing is an innovative and highly effective application of renewable energy, offering significant advantages over traditional fencing solutions. Electric fencing requires fewer materials, is easier to maintain and provides greater flexibility, particularly in regions with unreliable or unavailable grid electricity. Systems powered by solar energy are more adaptable and support regenerative agriculture practices that emphasize rotational grazing. Effective grazing management enhances plant growth, increases soil carbon sequestration and improves overall pasture productivity, contributing to both environmental sustainability and agricultural resilience.

Heifer has incorporated solar-powered electric fencing in cattle programs in Honduras and the United States, helping farmers improve livestock management, support ecological health, and build more resilient food systems.

Lessons Learned in Implementing Renewable Energy Programs

Heifer draws from decades of hands-on experience to continuously improve its renewable energy investment programs. The following key lessons guide the design and implementation of all Heifer renewable energy programs:

1. Energy budgeting must take into account both current and future needs

When communities first consider renewable energy solutions—like solar for irrigation or cold storage—they often focus only on immediate needs. But once electricity becomes available, new uses quickly emerge, and systems can become undersized. To avoid this, Heifer prioritizes energy budgeting that considers both current and future demands, ensuring solar systems are designed with room to grow and support long-term development.

2. Security, operations and maintenance planning are as important as the investment itself

Delivery of an infrastructure is a single step in investing in energy. Experience from past projects show that solid operations and maintenance plans are essential to preserving infrastructure, avoiding an item from breaking or being unused. A budget must be allocated for protection and maintenance of the equipment, irrespective of the communities' well-intentioned promises to undertake this task on a volunteer basis. Firm commitments following a set schedule are also important. Furthermore, many projects struggle due to lack of spare parts, technical expertise or long-term maintenance plans. Partnering with local technicians and ensuring a sustainable supply chain for parts can increase system longevity and effectiveness. Security is another planning component: Investments are often targets of theft and vandalism. To reduce this risk, community buy-in, with tangible benefits to all members, coupled with allocated budget for security, are essential.

3. Monitoring and impact measurement strengthens future projects

Effective monitoring and evaluation (M&E) are essential for ensuring long-term success and scalability of smallholder renewable energy projects. By systematically tracking key performance indicators, such as energy use, cost savings, productivity gains and environmental benefits, organizations can refine their approaches and make data-driven decisions. For instance, measuring how solar-powered irrigation improves crop yields or how biogas adoption reduces household fuel costs helps demonstrate tangible benefits to both farmers and potential investors.

Additionally, impact measurement strengthens accountability and transparency, making projects more attractive to donors, development partners and governments. Regular assessments help identify operational challenges, such as maintenance issues or low adoption rates, enabling timely interventions to improve project performance. Establishing clear metrics, conducting periodic evaluations and leveraging digital tools for data collection ensure that renewable energy investments deliver sustained economic, social and environmental benefits to smallholder farmers and rural communities.

Strategic Plan to Scale Renewable Energy Access Across Heifer's Programs

Heifer is committed to scaling renewable energy solutions across its programs, building on decades of successful interventions. By integrating renewable energy as a key enabler in achieving thriving and resilient smallholder communities, we aim to address critical energy needs for farming, aggregation, processing and distribution. We pledge to make access to renewable energy an integral part of program design, conducting comprehensive energy needs assessments in each country to tailor solutions to local contexts.

We commit to eliminating diesel and wood-fired generators in our programs except in cases where renewable options are entirely unfeasible. Instead, we will promote innovative, subsidized yet sustainable renewable solutions that engage farmers and communities as active stakeholders, fostering scalable and lasting impact. To enhance our effectiveness, we will strengthen data collection efforts, leveraging insights from Heifer's extensive farmer network to inform energy sector decisions, attract investment and guide policy development. This includes supporting off-grid appliance innovation, ensuring technology meets the specific needs of farmers and collaborating with partners for quality-assured solutions.

Heifer will also prioritize cross-sector collaboration to bridge the gap between agriculture and energy, forming alliances with public and private stakeholders, such as the Global Alliance for People and Planet and solar mini-grid developers. Together, we will design partnerships that provide renewable energy for productive agricultural uses, while exploring opportunities like carbon financing to generate additional income for farmers. Finally, Heifer commits to examining its organizational energy and carbon footprint, implementing changes to reduce emissions and lead by example. By embedding renewable energy at the core of our programs and operations, we aim to drive sustainable, transformative impact for the farmers and communities we serve.

Partnering for Impact

Heifer International actively fosters public-private partnerships to scale renewable energy solutions that benefit smallholder farmers and their cooperatives. By working with governments, private sector innovators and financial institutions, Heifer has successfully integrated solar-powered irrigation, biodigesters and cold storage into agricultural value chains, reducing costs and improving productivity. Moving forward, Heifer seeks to expand these collaborations to bring clean energy to more rural communities, ensuring reliable power for farming operations while enhancing sustainability. Strengthening partnerships with policymakers can also help create supportive regulatory environments that facilitate broader adoption of renewable energy in agriculture.

To further expand energy access, Heifer is actively seeking investment opportunities in renewable energy projects that directly benefit smallholder farmers. By mobilizing impact-driven investors and development agencies, Heifer aims to support scalable, cost-effective energy solutions that increase farmer resilience and productivity. Moreover, Heifer is eager to deepen research collaborations to refine and optimize renewable energy applications, ensuring they are tailored to the specific needs of smallholder farmers. By leveraging technical expertise and on-the-ground insights, Heifer can develop and implement solutions that maximize both economic and environmental benefits for rural communities.

Heifer's Renewable Energy Investments and Projects

ASIA	PROGRAM	RENEWABLE ENERGY INVESTMENT(S)
Bangladesh	<i>Climate-smart Vegetable and Flower Value Chain Project</i>	Solar irrigation pumps
	<i>BD Beef and Goat Meat Brand</i>	Biodigesters
Cambodia	<i>Poultry Project of National Pride in Cambodia</i>	Solar-powered cold rooms for chicken producers
	<i>Promoting Solar Technologies for Agriculture and Rural Development (PSTARD)</i>	Solar-powered cold room for produce storage
	<i>Cambodia Vegetable Value Chain Development Project (CVCD)</i>	Solar irrigation pumps and five solar water pumping stations
India	<i>Hatching Hope</i>	Solar-powered cold rooms for chicken producers and produce storage
Nepal	<i>Project with Heifer Korea</i>	Biodigesters
	<i>Project with Heifer Netherlands</i>	Solar water pumps
	<i>Milky Way Dairy Sector Reform Project</i>	Solar water heaters
AMERICAS		
Guatemala	<i>GTPWI</i>	Solar-powered internet hotspots, 600 solar home systems,
	<i>Strategic Program for Climate Action</i>	Biofuel, solar irrigation pumps, in planning
Honduras	<i>Sustainable Livestock Program</i>	Solar fencing installations, 10 biodigesters
Mexico	<i>Accelerating Income through Diversification</i>	Solar water pumps
	<i>Hijuelos</i>	Solar installation at agave distillery
	<i>Beyond Coffee (funded by Walmart Foundation)</i>	Solar dryers
USA	<i>Heifer Ranch</i>	Solar electric fencing system, solar-powered brooding chambers for chickens, solar electric car charging stations
	<i>Heifer Supported Farmers</i>	Solar powered electric fencing



Farmers in Nepal use solar dryers for peppers and other spices.

AFRICA	PROGRAM	RENEWABLE ENERGY INVESTMENT(S)
Ethiopia	<i>Sustainable Smallholder Irrigation Pilot Program</i>	Solar pumps
Kenya	<i>Kenya Market-Led Dairy Supply Chain Project</i>	Biodigesters, solar irrigation pumps
	<i>India-Kenya Dairy Innovation Bridge Program</i>	Solar-powered dairy coolers
	<i>Food for the Hungry</i>	Home biodigesters
	<i>Kenya Livestock Marketing and Resilience Project</i>	Small solar installations for poultry brooding and large solar water pumps for common use feedlots
Malawi	<i>Enhanced Community-Based Financial Organizations</i>	Solar home systems, solar irrigation pumps
	<i>Scaling up Climate Adapted Agriculture in Malawi and Mozambique (funded by Norway)</i>	Solar irrigation pump
Nigeria	<i>Naija Unlock</i>	Solar cold rooms, solar freezers, solar irrigation pumps
Rwanda	<i>Rwanda Dairy Development Program</i>	Solar home systems with light
	<i>Dairy Development Program (Phase II)</i>	Solar milk cooling tanks, solar-powered vaccine refrigerators, solar lights and solar water heaters
Senegal	<i>Blue Flames Project</i>	Biodigesters
	<i>Strengthening Resilience to Food and Nutritional Insecurity Shocks Project</i>	Biodigesters
	<i>Mliteju Wasu</i>	Biodigesters planned, tricycles with solar powered fridges for milk transport
Tanzania	<i>Igunga Eco Village</i>	Solar home lights, biodigesters, fuel-efficient cookstoves
	<i>Mbozi Farmers Livelihood Improvement Project</i>	Energy-saving stoves
	<i>COVID Adaptation Project</i>	Solar-powered freezers
	<i>Transform Agriculture in Tanzania</i>	Solar cold storage and water pumps in planning
Uganda	<i>Domestic Biogas Project</i>	Biodigesters
	<i>Accelerate Dairy Production and Productivity Project</i>	Biodigesters
	<i>Solar for Sustainable Income in Dairy Project</i>	Solar-powered coolers
	<i>Aqua for All</i>	Solar boreholes
	<i>Green Dairy Program</i>	Biodigesters
	<i>Ayute Challenge</i>	Solar irrigation and greenhouse youth innovations



A solar-powered industrial borehole built by Heifer in Nigeria provides farming and household water for the whole community.



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