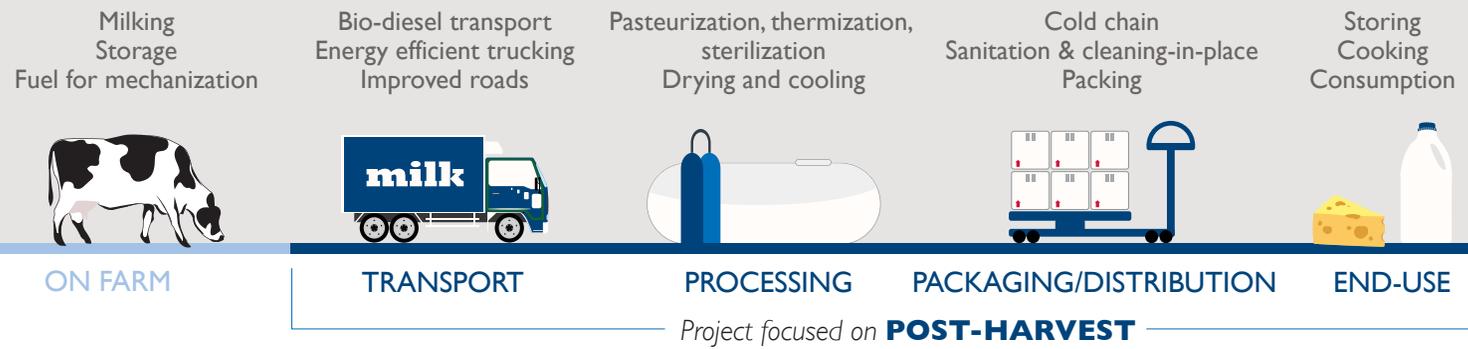


CLEAN AND RENEWABLE ENERGY FOR PRODUCTIVE USE: SPOTLIGHT ON DAIRY

Key Findings from the Energy for Agriculture and Food Security Project

Addressing Energy Constraints in Off-farm Dairy Segments is Critical to Inclusive Growth in Africa

WHERE IS ENERGY USED?



BUSINESS IMPLICATIONS (field work findings)

Reliability

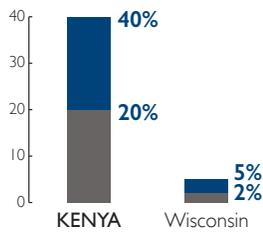
28% rural **SENEGAL** access to electricity

3-5x /week **KENYA** power outages in dairies

+ Many solar products have oversized inverters and batteries, affecting product efficiencies and lifespan.

Expense

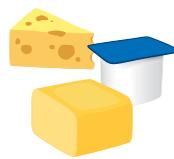
Electricity consumes 20-40% of operating costs in Kenyan small-scale dairies



Outages increase operating costs by: (1) requiring dairies to invest in backup power systems; (2) increasing wear and tear on equipment through frequent stops and starts; and (3) spills and jams on packing lines, with wasted product and labor clean up costs.

Value addition & market access

Yogurt, cheese, & butter require energy to chill and/or heat products



+ Tight delivery times restrict rural market access, divert fresh into fermented milk

Employment



Power outages reduced hiring

24% SMEs, 15% large enterprises in **SENEGAL**

High energy operating costs are a major factor limiting business growth, hiring, or diversification

dairies in **KENYA**

Energy cost savings would go to increased wages

3 of 5 dairies in **KENYA**

Long-term competitiveness



Kenya's dairy sector is formalizing for food safety—energy is required all along this shift. Without it, small operations will struggle to remain competitive.

Hidden Impacts

Energy's hidden impact is on **business growth**, **food safety**, and **value addition**. This affects farm-gate prices and demand for producers, employment, and retail prices and product availability for consumers.

The Time is Ripe for Energy-Fueled Agricultural Transformation

MARKET-BASED OPPORTUNITIES TO INCREASE UPTAKE OF CLEAN ENERGY



Small-scale solar chillers extend delivery windows from farm to collection center & refrigerate transport by bicycle, bus or donkey



Solar minigrids increase rural electricity access off-grid and minimize costs and power disruption for those on-grid



Energy efficiency audits for SMEs identify tailored options (e.g. blended solar and on-grid energy models)



Private and impact capital investments can fill renewable energy financing gap left by commercial banks—key due to high upfront RE costs



Infrastructure: Well-maintained, networked roads reduce travel time and fuel use. Access to electricity and potable water reduces spoilage



Waste heat recovery is a relatively simple, inexpensive process that uses pumps, pipes, and heat exchangers to recover waste heat from the chilling process, using it to reduce energy in pasteurization and sterilization. WHR can reduce total energy use by up to 19%.

SME SNAPSHOT

10,000L/day **DAIRY**
invested in a 100kWh solar array for \$100,000



& reduced monthly costs by 75%

\$4,000/mo



\$1,000/mo

BEFORE

AFTER

Empowering Women Through Energy in Dairy? A Complex Reality

ENERGY SOLUTIONS CAN:



Reduce women's time poverty



Create jobs for women as businesses expand
Beyond the farm gate, women mostly work in cleaning, packaging, retail; jobs less at risk of automation as businesses grow

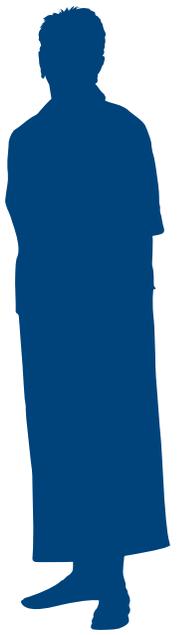


Address women's mobility constraints
i.e. solar-powered chilling on motorized transport enables collection at farm gate



Trigger male takeover of functions and income
as milk becomes more commercial and value-added

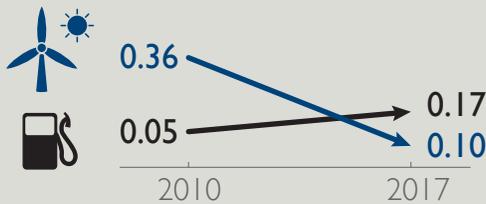
Understand this risk and how it will influence technology adoption and growth



Clean and Renewable Energy Can Reduce Greenhouse Gases and Contribute to Low Emission Development

RENEWABLES INCREASINGLY BEAT FOSSIL FUELS ON COST

Change in average cost of utility-scale renewables (\$/kWh)



CONTINUE TO INVEST IN IMPROVED GHG DATA FOR TRANSPORT, PROCESSING, AND RETAIL



Energy consumption data post-harvest is often lacking; better quantifying energy savings and GHG emissions and reductions can inform future policy and illustrate policy impacts

CONTEXT MATTERS

% fossil fuel in power generation mix



Off-set high fossil fuels by targeting on-grid, larger dairies. In off-grid areas, dairy is currently highly informal and therefore does not use significant energy



Dairies use more energy. GoK's NEMA plans to reduce GHGs in dairy, but must improve livestock emission estimation methods to monitor mitigation and trends

Policy and Partnership Opportunities



1. Embrace a systems approach to analysis and design

Exciting ideas can fail to have systemic impact; many energy opportunities struggle with widescale adoption and market penetration. Systems approaches help us understand the broader ecosystem, social and economic dynamics that will influence impact, and design smarter policies and programs



4. Reduce or eliminate tariffs on solar products (as in Kenya) and provide subsidies (guarantees, subsidized debt interest, tax incentives) to spur investment, adoption and reduce user costs



2. Leverage partnerships with solar and energy innovators and programs to synergize investments, support scale-up and commercialization, and apply lessons learned. E.g. Powering Ag, USAID's Photovoltaics for Sustainable Milk for Africa through Refrigeration Technology (PV-SMART) project; Strathmore Univ's Energy Research Centre in Kenya



5. Support user education campaigns on energy efficient best practices



3. Net metering incentivizes distributed storage and increases total supply of RE



6. Strengthen the solar energy ecosystem e.g:

- Installation and maintenance: strengthen vocational and enterprise skills, alternative delivery models (e.g. layered service onto rural agent networks)
- Support alternative financing and directed investment for companies and end customers to minimize upfront costs. (e.g. alternative collateral, bundled investments, business accelerators)
- Expand access and availability of appropriately sized inverters, batteries, and chargers
- Build industry platforms for collaboration, advocacy and co-creation



Interested in more?

Visit www.agrilinks.org/post/clean-energy-productive-use-post-harvest-value-chains-integrated-literature-review-field-work for more E4Ag resources, including briefs on solar thermal and solar PV for small scale dairies; single to three phase electrical conversion; and energy-sensitive value chain development design, plus a series of gender-focused blogs.

The Energy Opportunities for Agricultural Systems and Food Security Project (E4AS) expands and focuses information on how clean energy and energy efficiency can strengthen post-harvest value chains and reduce loss in sub-Saharan Africa, while also contributing to LED goals and incorporating gender considerations. E4AS is funded by USAID's Africa Bureau and implemented by Green Powered Technology in partnership with ACIDI/VOCA.