



COSTS AND BENEFITS OF CLEAN ENERGY TECHNOLOGIES IN TANZANIA'S MILK VALUE CHAIN

Cooling technologies can significantly improve milk quality and add value along the milk value chain. Since grid electricity does not reach many rural areas, off-grid renewable energy (RE) solutions to cool milk can be a viable option.

Biogas domestic milk chillers (10 l capacity) and solar milk coolers (600 l capacity) are attractive from a financial point of view and have socio-economic and environmental net co-benefits.

Policies, financing mechanisms and capacity building activities to facilitate the adoption of renewable energy cooling solutions for milk include: the development of a clear national strategy for the milk sector, strict milk quality standards and a price premium for quality refrigerated milk, the establishment of controls and fines against illegal milk commercialization, eradication of counterfeit RE products, financial incentives, extension services, technical assistance, information programmes and training.



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ENERGY TECHNOLOGIES IN THE TANZANIAN MILK VALUE CHAIN

Approximately 37 percent of the 1.68 million households in Tanzania own cattle and approximately 60 percent of rural households derive 22 percent of their income from livestock. The milk sector is based on traditional farming systems consisting of extensive grazing on mostly communal land by nomadic pastoralists and the more sedentary sometimes transhumant, agro-pastoralists. Improved dairy cattle farms are more intensively managed in mixed farming systems. However, only about 20 percent of small-scale dairy farmers have access to extension services, which could help improve productivity of the cows.

Raw milk is usually transported to milk collection facilities without any form of cooling, with high probability of being rejected at milk collection centres (MCCs). Most rural households do not refrigerate milk on farm, as just 11 percent of them have access to electricity. This particularly compromises the quality of evening milk. Out of 183 official MCCs, only 30 percent have cooling facilities.

Cooling technologies can improve milk quality and add value. But farmers have few incentives to improve

milk quality and hygiene as there is no price premium. Moreover, the relevance of the informal milk sector (where the quality of the milk is not checked) has a significant negative influence on the development of a market for cooling technologies. Tanzania's poor rural infrastructure results in high transaction costs to reach remote dairy farmers, in particular during the rainy season, when milk production is more abundant. Many regions have neither established milk collection centres nor processing factories. RE technologies require high initial investment costs and are often not affordable for small scale dairy farmers who face difficulties in accessing credit and have to confront milk price fluctuations.

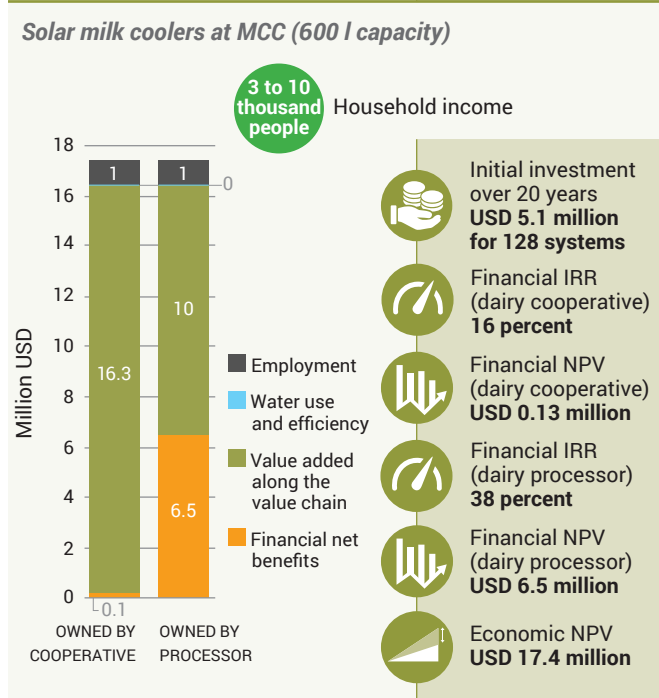
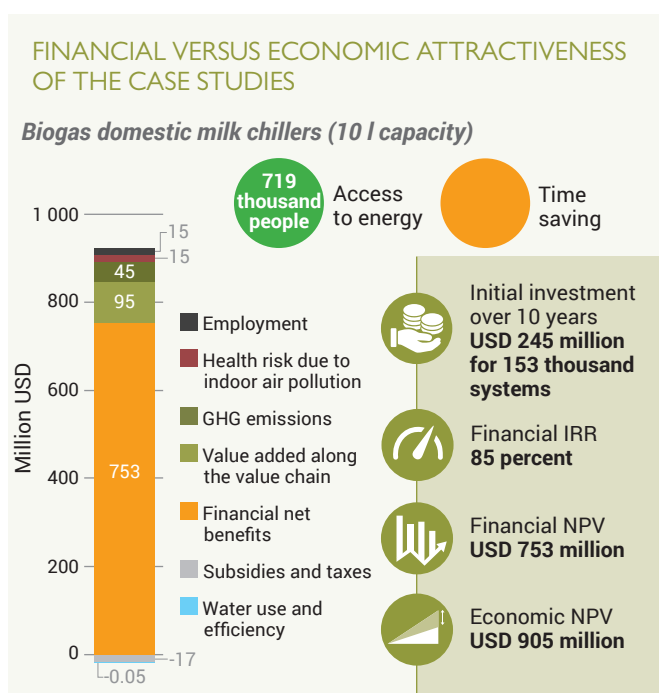
Women are generally involved in feeding and milking the cows and in selling the milk. However, men traditionally control the income generated, although women are becoming more empowered at home and through dairy cooperatives, where they make up a higher proportion of members.

CASE STUDIES

Biogas domestic milk chillers (10 l capacity) and solar milk coolers (600 l capacity) have been selected as case studies of clean cooling technologies for the milk sector.

Biogas domestic milk chillers are suitable solutions for off-grid households with few zero-grazing cows. The technology can cool two milk cans of up to 5 litres each and power a biogas cookstove for one household. Benefits arise from additional milk revenue, slurry and digestate that can be applied on farm and the biogas cookstove (which allow savings on traditional fuelwood and charcoal and reduces indoor air pollution). At country level, the technical potential for this technology was estimated to be 153 000 systems.

Solar milk coolers can be installed at existing MCCs without cooling facilities (128 units nationally), and owned and managed by dairy cooperative societies or processors. The financial attractiveness of a solar milk cooler depends on who makes the investment, as processors are able to keep a large part of the value added along the chain.



Note: NPV: net present value; IRR: internal rate of return. Non-monetized impacts are depicted as circles (green: positive, orange: variable, red: negative impact) and quantified where possible.

These energy interventions are attractive from a financial perspective; they also have important socio-economic and environmental co-benefits. Both significantly contribute to adding value along the milk value chain by reducing milk rejections and improving milk quality.

Important synergies exist between these technologies: if they were to be adopted together additional benefits should be considered from the establishment of a complete milk cold chain. A system of incentives could be put in place to facilitate the adoption of clean milk cooling technologies at MCCs and to pay a premium to farmers for quality refrigerated milk.

POSSIBLE SUPPORT INTERVENTIONS

Public, private and financial actors can facilitate the adoption of milk cooling technologies through the following measures:

- develop a **clear national strategy** to guide the development and implementation of **milk value chain**;
- set **milk quality standards** and payment of a **price premium** to farmers for quality refrigerated milk;
- gradually strengthen **controls and fines against illegal milk commercialization** (e.g. at local markets), minimizing the additional burden for remote farmers;
- development of **infrastructure** for milk transport in remote areas;
- complement the effort for **eradication of counterfeit RE technologies and components**;
- introduce **financial incentives** to make RE technologies more affordable (e.g. low interest subsidized loans, loan guarantees or technical assistance funds), both for systems at farm and MCC level;
- facilitate business opportunities in the dairy sector, in particular for **young and women farmers**;
- use public extension services, associations and local NGOs to facilitate **technical assistance** and to **educate dairy farmers** on the benefits and effective usage of milk cooling technologies;
- initiate **information programmes** to promote milk cooling technologies and introduce programmes for educating and training technicians;
- facilitate **contractual agreements** on milk quantity and price between farmers or technology adopters and processors.



For more information on the INVESTA project and a description of the case studies please visit: www.fao.org/energy/agrifood-chains/investa