



CLEAN ENERGY SOLUTIONS IN DAIRY VALUE CHAINS

*Analysing and sharing challenges
and opportunities in India and Kenya*

Supported by:

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In low-income countries, most milk is produced by smallholder farmers, and in fact, it is one of the few commodities that can be produced even by the landless. Selling surplus milk to the market provides these farmers with much-needed income.

In Kenya, many farmers in rural areas lack access to cooling facilities to prevent their milk from spoiling before it reaches a collection centre or processing plant. Many farmers therefore sell their milk to neighbours or traders in the informal market. In India, cooling facilities are available at village milk collection centres, but since the electricity grid tends to be unreliable, these facilities frequently need to be powered by back-up diesel generators, which are polluting and expensive to run. Since most of the formal dairy market in India is in the hands of cooperatives, it is likely that savings made at the collection centre level would be passed down to farmers.

The successful application of clean energy cooling technology in the milk value chain therefore has the potential to improve the quality and increase the quantity of milk sold into the formal market, increasing the income of smallholder farmers. It can also provide opportunities for growth for businesses providing clean energy solutions.

The GIZ programme 'Sustainable Energy for Food - Powering Agriculture' aims to develop and implement clean energy solutions for agricultural value chains. Supported by Powering Agriculture, the Renewable Energy and Energy Efficiency Partnership (REEEP) investigated potential applications and challenges for clean energy solutions in milk value chains through literature research, field visits and stakeholder workshops.

The vast majority of the global population – more than 6 billion people – consume milk and milk products.

An important methodology used as part of this project was value chain mapping – visualizing the different actors and processes in the milk value chain in India and Kenya. This methodology was used not only to trace the flow of dairy through the value chains, but also the flows of money and information. This helped to identify points in the chain where problems might be alleviated by, for example, increasing access to finance or raising awareness of solutions. The resulting value chain graphics, presented in this brochure, were verified through stakeholder engagement in interactive workshops.



Cover photo: A farmer milking a cow in Uttar Pradesh, India.
Credit: Jonas Bartholomay for GIZ.

Above: Milk cooling solutions and milk transport in Kenya.
Credit: Quinn Reiffmesser for REEEP.

CHALLENGES FOUND IN THE FORMAL DAIRY SECTORS OF INDIA AND KENYA

- **Cooling at farm and collection centre level is energy-intensive**, which makes it expensive in areas where grid electricity is unavailable or unreliable and diesel generators have to be used. Diesel generators also cause high CO₂ emissions, noise disturbance and air pollution
- **Poor quality of milk** due to:
 - **Poor handling of the cows and milk:** poor animal husbandry, insufficient cleaning of equipment, adulteration of milk, and unreliable testing
 - **Poor infrastructure:** poor roads increase the time milk spends in transit and a lack of electric power, cooling and storage facilities lead to spoilage
- In India, milk entering the formal sector is chilled at village collection centres. In Kenya, though dairies and cooperatives carry out quality control of the milk they collect and reject milk that is spoilt, **many do not pay premiums for higher quality or chilled milk**, only for milk with high fat content. This reduces the farmers' incentive to invest in cooling equipment or otherwise improve the quality of the milk they provide

The value chain mapping and stakeholder engagement revealed the following challenges affecting the quality and quantity of milk produced through formal value chains in India and Kenya:

- **Low milk yield per cow**, due to lack of access to veterinary support, foot-and-mouth disease, the use of low-yield breeds, lack of appropriate fodder, and water stress
- **Seasonal fluctuation of production and consumption:**
 - In Kenya, production drops by up to 50% during the dry season
 - In India, during the festival season most milk is consumed by farmers and their families, and much less is sold to the market
- **High costs of production and procurement** – the dairy industry is largely in the hands of small-scale farmers and processors, which reduces economies of scale and increases the cost of production at the farm and at the dairy plants
- The formal market faces **fierce competition** from the informal market, where, particularly in Kenya, farmers can often get a better price for their milk. During droughts, when demand outstrips supply, Kenyan farmers will sell their milk almost exclusively to the informal market. The domestic dairy markets also face competition from imports of cheap milk powder

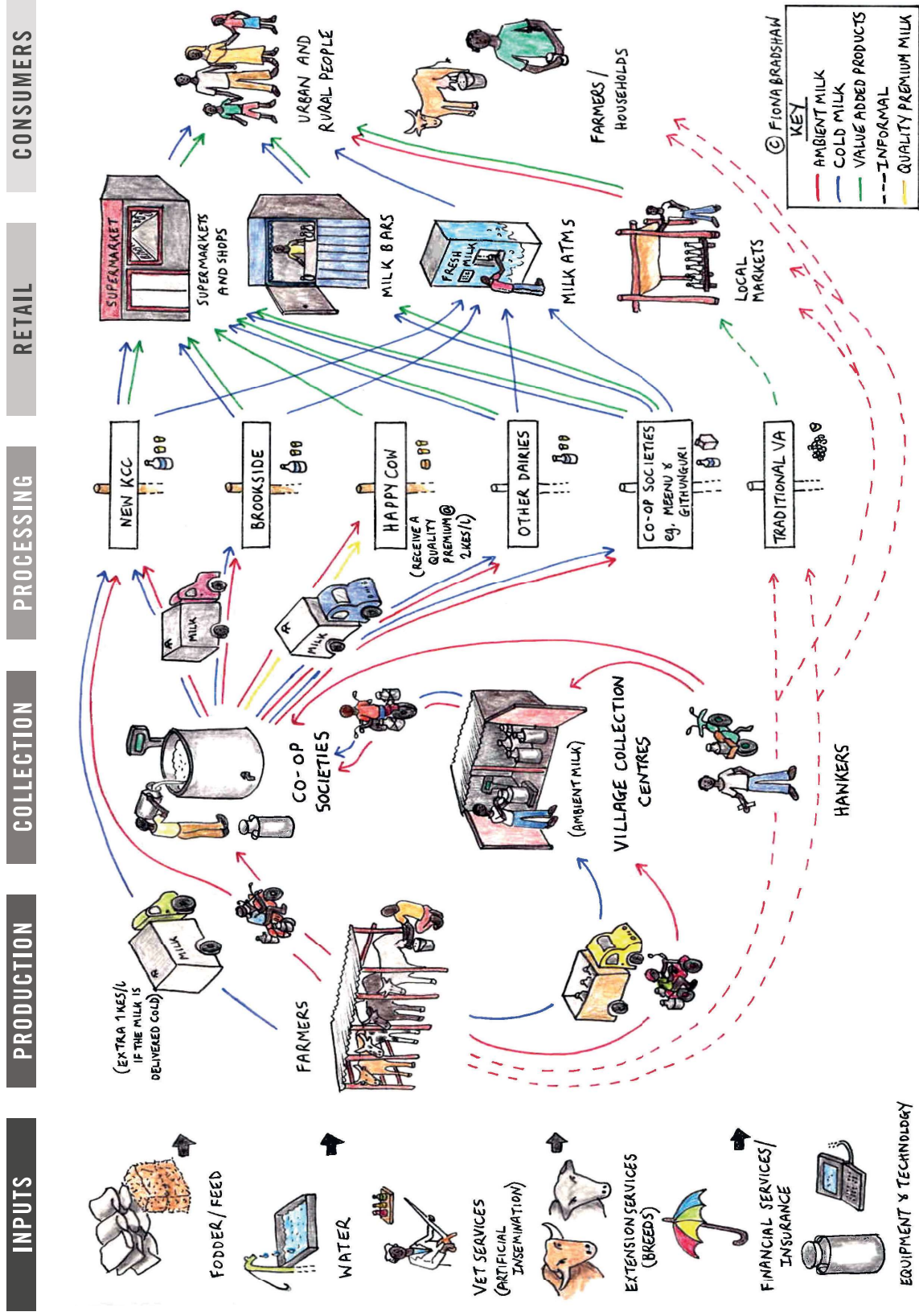
WHAT IS NEXT?

- Awareness-raising among farmers, co-ops and dairies about available technology and financing
- Support of small- and medium-sized enterprises supplying clean energy technology such as refrigerators running on solar energy or biogas, or clean energy solutions for milk collection centres
- Engagement with the policy and finance sectors to design supportive policies and financing models for this value chain

Clean energy interventions can provide solutions to some of the challenges described above. Through extensive engagement with stakeholders, the following high-potential interventions were identified:

Based on the outcomes of this project, targeted interventions are currently under development, with the long-term goal of creating sustainable growth of the clean energy share in the dairy value chain.

DAIRY VALUE CHAIN KENYA



3.7m
tons annual milk production (2013)

Over **100 litres**
of milk per capita consumed per year

Up to **50%**
of milk consumed on-farm

More than **3.5 hours**
average journey from farm to co-operative society for cooling

20% of milk produced is sold into the formal value chain
80% ends up in the informal value chain

80%
of milk produced by small farmers with 2-3 cows

Up to **40%**
of the retail price for milk, is what farmers receive

post-harvest losses at farm level were estimated by stakeholders at 6%, but studies suggest they may be much higher in some cases - up to **40%**

Milk is usually collected once daily, in the morning

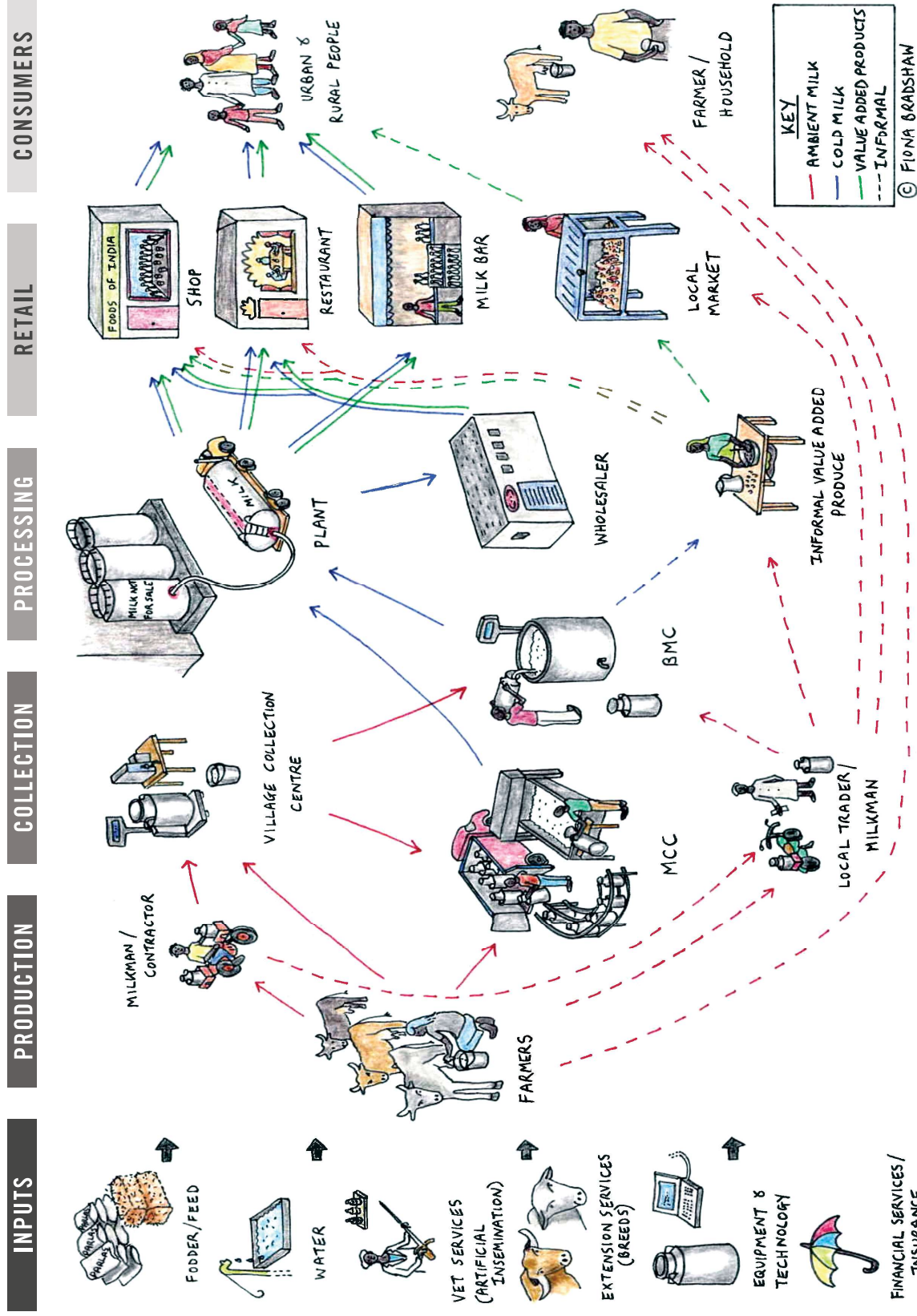
Often no grid access

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DAIRY VALUE CHAIN INDIA*

*Based on research in Uttar Pradesh and Rajasthan



155.5m tons annual milk production (2015)

Over 70 litres of milk per capita consumed per year

20-50% of milk consumed on-farm

Less than 3.5 hours from cow to Cooling Centre - procurement is very efficient but expensive

30% of milk produced is sold into the formal value chain

70% ends up in the informal value chain

70-80% of milk produced by small farmers with 2-3 cows

Up to **80%** of the retail price for milk, is what farmers receive

1% losses total, 45 to 50% of that at farm level

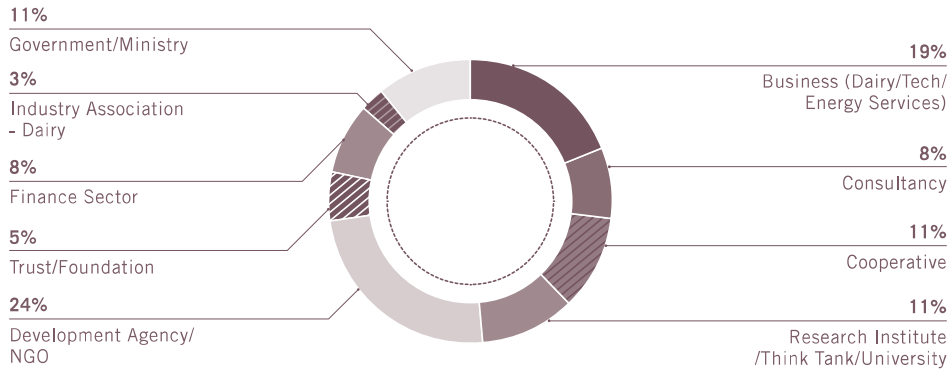
Milk is collected twice daily

Grid access widespread but unreliable - using a diesel generator as back-up is expensive

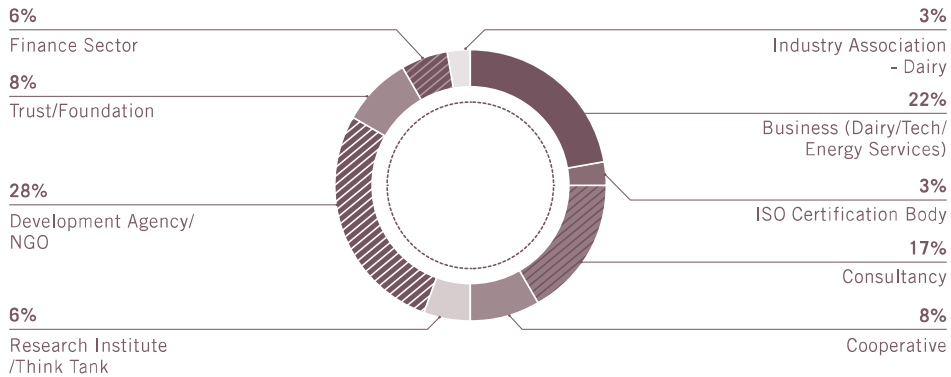
STAKEHOLDER ENGAGEMENT

During field missions in India and Kenya, REEEP interviewed more than 100 stakeholders in total, including farmers, clean energy technology providers, cooperatives, NGOs, dairy companies, research institutions as well as government agencies, ministries and regulators. A representative subset of those stakeholders attended the stakeholder workshops held in Delhi and Nairobi:

Stakeholders at Nairobi workshop



Stakeholders at Delhi workshop



FIND OUT MORE

If you would like to learn more about this project or REEEP's methodology, or if you would like to get involved in a follow-up project, contact Katrin Harvey at katrin.harvey@reeep.org or Katharina Meder at katharina.meder@giz.de