Maziwa Zaidi (More Milk) in Tanzania

Off-grid solar milk cooling systems offer technical and market opportunities for remote dairy producers

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Key messages

- Farmers in areas without access to reliable grid electricity lack access to milk cooling facilities and their milk is often spoiled.
- Further, as milk in remote areas is only collected and transported to dairy markets in the morning, evening milk cannot be stored and it goes to waste.
- Renewable energy technologies, such as solar PV provide small-scale solutions and decentralized energy supply in areas where the power grid does not exist or is at a great distance.
- A technically and economically viable off-grid solar milk cooling system would offer smallholder dairy farmers in remote areas of Tanzania the opportunity to grow their businesses, increasing their disposable income and improving their standards of living.

Objectives and approach

- To evaluate the techno-economic viability of an off-grid solar-powered milk cooling system and assess the risk factors that have an impact on its economic success, the system was modeled and simulated using HOMER software in order to determine its Net Present Value (NPV), simple payback period and Internal Rate of Return (IRR). The sensitivity of the project's financial viability to changes in uncertain parameters such as milk prices and PV system costs was assessed. The risk-adjusted NPV and the probability of the system being profitable was calculated using a Monte Carlo simulation approach.

Key results

- A 1.83 kW PV system powering a 100-liter milk cooling tank was the most profitable option with a 77% return on initial investment over a period of 10 years, a 16% internal rate of return and a payback period of 5 years.
- The economic performance of the system is most sensitive to variations in the milk prices. The system becomes unprofitable when the net revenue per liter ($ 0.03) reduces by about 48% (Figure 1).
- The key risk factors (milk prices, battery life, PV system cost) reduce the potential profitability of the system to a 4% return on the initial investment (Figure 2), with a 55 % probability of being profitable.

Opportunities to invest and scale

- Facilitate the setting up of solar milk cooling systems in dairy market hubs in off-grid communities in Tanzania, in order to reduce milk wastage.
- Facilitate the organization of milk producers into focal points for milk cooling, service and information delivery, and build their capacity to produce milk as a business.
- Adapt the system to different community sizes and cooling capacity and hence increased economic performance (Table 1).

Figure 1. Sensitivity characteristic model of the project net present value

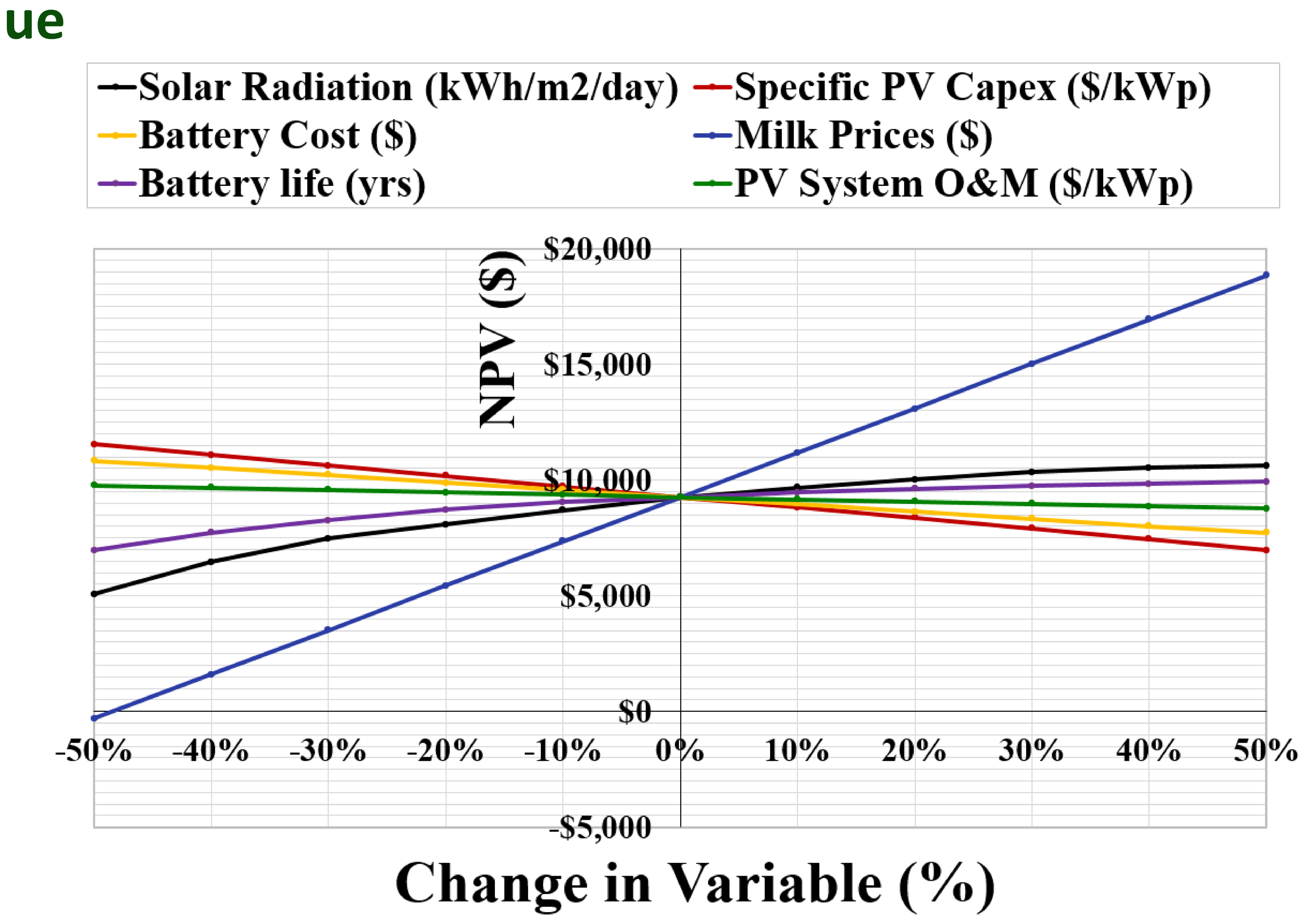

Figure 2. Risk adjusted economic performance of a solar milk cooling system

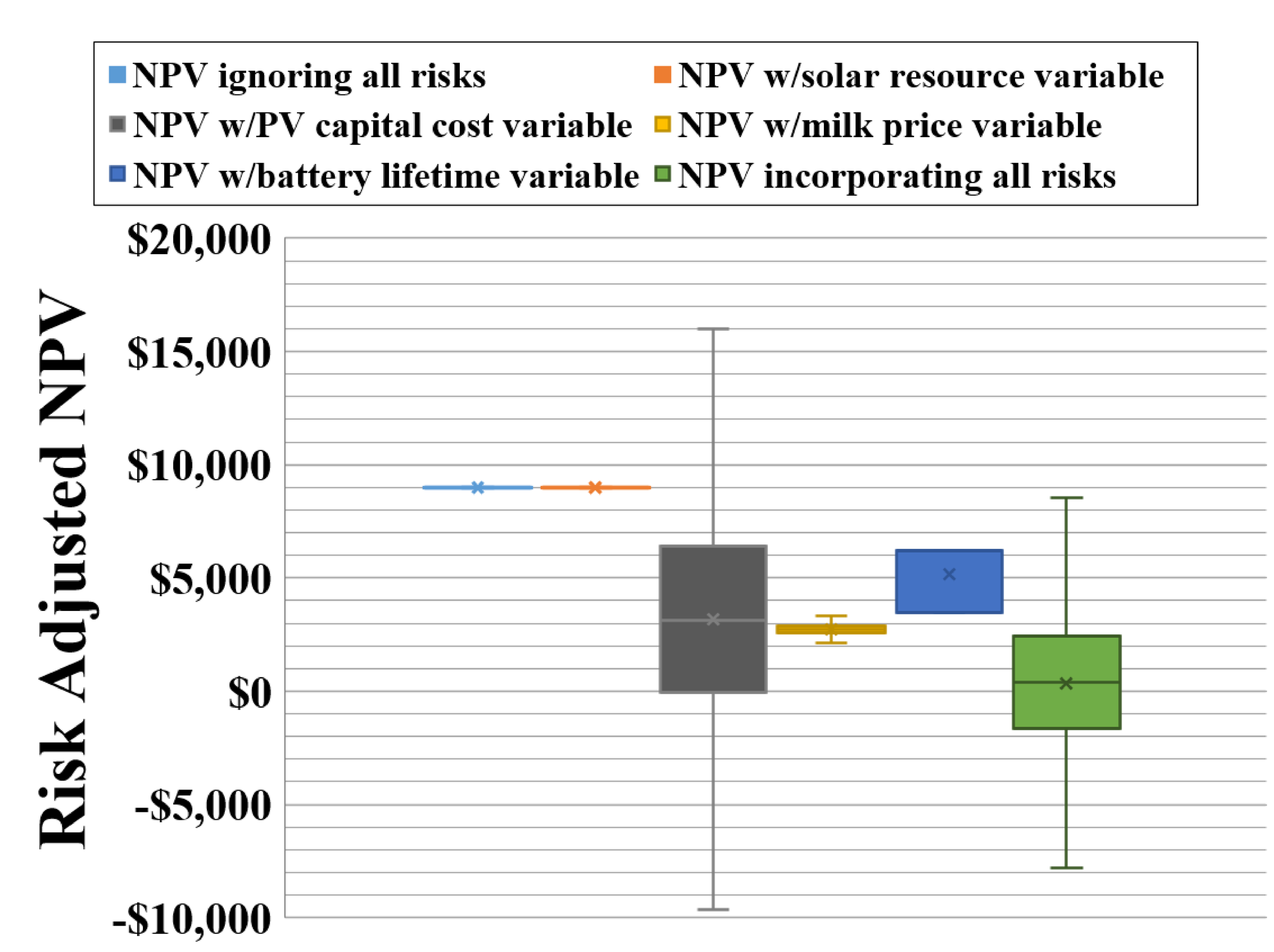

Table 1: Economic performance with increased cooling capacity

Milk Cooling Capacity (L)	Internal Rate of Return (%)	Payback Period (yrs.)
100	16%	5.1
200	24%	3.8
300	18%	4.7
550	25%	3.7
1000	24%	3.8

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