POWER FOR ALL FACT SHEET

Mini-grids productive use of energy (PUE) in agriculture

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This fact sheet provides a view on the latest trends in mini-grid productive uses of energy (PUE)[1] in agriculture. It provides highlights on the opportunities, tested and proven business models, and challenges of PUE in the agriculture value chain. These insights are based on recent studies by the National Renewable Energy Laboratory (NREL)[2], the International Institute for Environment and Development (IIED)[3], the Energy and Environment Partnership (EEP)[4], and Energy 4 Impact (E4I).

Using mini-grids in agricultural values chains provides an opportunity for rural communities to boost local economies. Some agricultural activities that have effectively benefitted from mini-grids include milling, oil pressing, egg incubation and ice making for fish.

» Electric, motor-driven mills are a prefered to diesel-driven mills because they are easier to operate, require less maintenance, and reduce labour by removing time and cost required to travel for fuel purchases. Moreover, if electricity costs are less than $0.32/kWh, electric motor-driven mills are less expensive to operate. (M1, p.28)

» A 250 kW hydro mini-grid in Sierra Leone powers a palm oil pressing plant along with a community of 300 households. The palm oil pressing plant improved the financial case for the power plant as an anchor client, buying one-third of the electricity generated. The power plant created 7 permanent jobs locally and supplied affordable power with an uptime of 85%.[5]

» For rural communities, egg incubation offers an attractive business opportunity due to the low upfront cost and potential high returns. A pilot in Tanzania shows that for an initial investment of US$122 investment in a 100W incubator, entrepreneurs can expect 34% profit margins if the mini-grid tariffs are set at $0.90 per kWh. (M1, p.31)

» In Ukara island, Tanzania, mini-grid systems have been used to make ice and reduce inefficiencies in the fishery value chain, resulting in less fish catch losses that could be as high as 20% in the area, and lower fuel costs for ice boats. (M2, p.28)

$0.32/kWh

TARIFF AT WHICH ELECTRIC MILLS BREAK EVEN WITH DIESEL MILLS

10–20%

FISH CATCH LOSSES CAN BE PREVENTED BY PROVIDING FISHERMEN WITH ENOUGH ICE.

34%

PROFIT MARGIN OF EGG INCUBATION WITH MINI-GRIDS AT A TARIFF OF US$0.9/KWH

More research is needed to quantify the social impacts in the adoption of mini-grid systems for agricultural activities. However, based on past evidence of rural electrification, there are expected impacts in gender equality, job creation, and environmental impact.

» A study in India found that around 90% of the women who gained access to mini-grid electricity highly appreciated the increased ease of daily chores. Women's involvement in personal development activities also increased by 0.5 hours per day from benchmark.[6]

» Automating the milling process would free up a significant amount of time for women and girls, which could be put towards other productive or educational activities.[7]

» Access to electricity can create jobs by helping new businesses form and existing businesses expand. Also, jobs created by PUE can have a multiplier effect as workers spend part of their income on the local economy. (M1, p.41)

From its portfolio companies EEP Africa identified three key business models that are currently being used to promote mini-grid PUE in agriculture: Energy Supply Model, Business Acceleration Model and Supplier-Offtaker Model.

» EEP Africa has identified 3 business models from their portfolio that mini-grids developers integrate PUE activities with: 1) the Energy Supply Model, in which the mini-grid developer produces and supply electricity, 2) the Business Acceleration Model, in which the mini-grid developer also provide appliance and loans, and 3) the Supplier-Offtaker Model, in which mini-grid developer operates agricultural activities as the main electricity offtaker. (M3, p.13,24,31)

» An effective model is characterized by 1) a direct increase in project IRR, 2) indirect financial benefits brought to mini-grid customers, and 3) social benefits such as better health for the community at large. (M4[8], p.129)

» A Supplier-Offtaker Model in Cape Verde failed to achieve financial viability due to the low cost of electricity, high cost of back-up diesel generation and little revenue from the agricultural applications. This case, however, excelled in technical implementation and affordable, high quality supply of electricity and PUE service. (M4, p.51,52)

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By the Numbers:

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Despite the promise of increased local economic activities, mini-grid system developers and communities are confronted with several barriers to replicate or scale success, including high upfront costs, lack of skills and knowledge, technical challenges and market constraints.

» Low cash flows outside of the harvest periods negatively affects the ability of users to pay for electricity and appliances. This risk can be mitigated by mini-grid operators requiring users to pre-pay for a certain service or level of consumption, and/or providing alternate finance models for appliances.[9] (M1, p.42; M3, p.44)

» Local entrepreneurs in rural areas often lack the skills to run a business,[10] while mini-grid developers lack adequate knowledge of local rural agriculture value chains. To mitigate this, accessible market information is crucial. (M1, p.43; M2, p.20,34,35)

» Mini-grid systems must be designed to serve the required loads while maintaining power quality, reliability, and availability. Inadequate assessment of the power demands leads to underuse of the mini-grid thus driving up costs. This risk can be mitigated through systems modularity and better understanding of PUE loads. (M1, p.19, 43)

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» Mini-grids have seen successful integration of agricultural applications in various value chains, bringing various benefits for farmers while improving their financial performance. Challenges remain, however, to replicate success.

» Various business models have been tested. However, to ensure long term economic viability, mini-grid developers should build a strong understanding of agricultural practices and adapt project design to the local context.

» Rural customers are price sensitive due to variable incomes associated with seasonal harvests. Therefore, mini-grid tariffs should reflect consumers' ability to pay and financing should be provided for appliances when available.

Sources:

1. GIZ defines PUE as "agricultural, commercial and industrial activities involving energy services as a direct input to the production of goods or provision of services" (GIZ and EUEI-PDF 2013).
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3. Contejean, A., and Verin, L. "Making Mini-Grids Work Productive Uses of Electricity in Tanzania" IIED. 2017. **(Herein M2)**
4. "Powering Productivity: Lessons in Green Growth from the EEP Africa Portfolio," EEP Africa. 2019. **(Herein M3)**
5. Janse, S. "Affordable and reliable mini-grids in Sierra Leone." TU Delft. 2019.
6. The Rockefeller Foundation. "Understanding the Impact of Rural Electrification in Uttar Pradesh and Bihar, India." May 2017.
7. "Solar Milling: Exploring Market Requirements To Close the Commercial Viability Gap" Efficiency for Access Coalition. January 2020.
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10. "Productive Use of Energy — PRODUSE. Measuring Impacts of Electrification on Small and Micro-Enterprises in Sub-Saharan Africa." GIZ and EUEI-PDF. 2013.