POWER FOR ALL FACT SHEET

Harnessing the Power of Solar for Agro-processing

POWER FOR ALL

In rural communities, agro-processing activities[1] often rely on diesel or grid-powered machinery. A shift towards using solar-powered machinery in off-grid and weak-grid areas could improve food security, create new employment opportunities, and enhance resilience to shocks. This fact sheet provides an overview of the current state of solar-powered agro-processing machinery from studies by the International Finance Corporation (IFC)[2], the Efficiency for Access Coalition[3], and the International Renewable Energy Agency (IRENA)[4].

US$417 MN

SERVICEABLE MARKET FOR SOLAR AGRO-PROCESSING BY 2030

US$2500

COST OF A SOLAR MILL

3.2 T/year

CO2 REDUCTION BY REPLACING A DIESEL MILL WITH SOLAR IN ETHIOPIA.

32.7kg/hr

THROUGHPUT OF SOLAR POWERED MILLS

Solar-powered agro-processing machinery has the potential to improve rural livelihoods, by improving food security, creating employment opportunities, enhancing resilience to shocks, and reducing environmental pollution.

» The 26% gap in food insecurity faced by Africa's population can be minimized by reduction of post-harvest losses and increased productivity using solar-powered machinery. (AP1, p.14)
» For the smallholder farmers who do not have access to large processors and/or grid electricity, solar-powered machinery offers an opportunity to diversify value adding employment due to greater agricultural productivity and output. (AP1, p.15)
» Consumers in East Africa reported an absence of smoke discharge and lower noise levels (77dB) by displacing diesel mills with solar. Furthermore, in Ethiopia, displacing a diesel mill with solar can reduce CO2 emissions by 3.2 tonnes per year. (AP2, p.25;p.16; AP3, p.63)
» Farmers are vulnerable to fuel prices variation and fluctuation. This can be mitigated with the use of solar-powered machinery. (AP1, p.15)

The total serviceable market in sub-Saharan Africa (SSA) for solar-powered agro-processing machinery is large and growing with an expected market value of US$ 417 million by 2030. However, challenges towards capturing this market potential include: identifying appropriate crop value chains, competition from incumbents technologies, and local area logistics.

» In 2018, about 937,000 smallholder farmers can be served by agro-processing machinery; however, if grid access and ability to pay is considered, the total serviceable market is only about 54,000. (AP1, p.23,24)
» Total serviceable market is expected to grow by an estimated 14% year-on-year, from 54,000 to 257,000 units between 2018–30. This corresponds with a market value of US$ 417 million by 2030. (AP1, p.23,24)
» The market for solar agro-processing machinery is greatly determined by the composition of crops in the local agricultural sector; for example, in Kenya, smallholder agro-processing is highest for maize milling while in Côte d'Ivoire cassava grating and rice hulling is common. (AP1, p.18, 34)
» The commercial viability of solar machinery varies depending on the competition from incumbent (diesel and grid-powered) products; in Côte D'Ivoire, solar mills have 70% lower capacity and cost 6x more than diesel ones, which presents a challenge for higher uptake of solar mills. (AP1, p.27)
» Local area logistics such as proximity of agro-processing services to customers is a vital consideration towards setting up of solar-powered machines. This is because 96% of milling customers in off-grid communities are women and children, who wish to avoid carrying heavy loads (up to 10kg) of grain and flour over long distances. (AP2, p.25)

For mill operators and communities to experience the full benefits of solar milling, further research is needed to develop more technically viable solar-powered machinery that can compete with diesel-powered ones.

» A one-phase motor 1.5–2.2 kW solar mill has throughput approximately 32.7kg/hr compared with 120–150kg/hr for a 7.5–17.5 kW diesel mill. For solar mills, this throughput is too low to meet customer peak demands and customers must then wait double the time for grains to be milled. (AP2, p.7,13,17)

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By the Numbers:

US$417 MN

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THROUGHPUT OF SOLAR POWERED MILLS

» As maintenance and repair infrastructure remains inadequate in off-grid communities, solar mill designs must be robust to allow for easy repair, troubleshooting, and interoperability of replacement spare parts. (AP2, p.8)
» Most available standalone solar systems can only provide power for AC one-phase motor mills; more energy efficient AC three-phase motor mills would require the addition of high cost controllers and inverters for compatibility to the energy systems. (AP2, p.16)
» Solar mill developers have the option of designing battery coupled or direct-drive solar mills. Battery coupled mills retail for US$2500 and due to energy stored in the battery bank, users can mill at any time of the day; direct-drive mills, on the other hand, are the half the cost of battery coupled mills, but milling can only be done during peak sunshine hours (AP2, p.7)

Solar mills have high capital costs and are difficult to maintain. Greater deployment of financing to appliance developers and potential mill operators can aid towards an increased use of solar mills in off-grid communities.

» Prohibitively high capital expenditure associated with solar mill ownership contributes to the low uptake among potential off-grid mill operators, who have limited access to consumer financing; battery-coupled solar mills have a lower throughput than diesel mills and cost approximately US$2,500 with a nine-year payback period, compared with US$1,000 for diesel mills and US$2,000 for electric mills. (AP2, p.21; AP1, p.23)
» Building a strong distribution and service network, especially in remote off-grid regions, is an expensive undertaking for early-stage solar machine developers. (AP1, p.42)
Potential mill operators are, however, willing to purchase solar machinery through various consumer financing options such as: pay-as-you-go (PAYGO) financing, microfinance institutions (MFIs), and mobile lending/digital loans. (AP1, p.24; AP2, p.22)
» Governments, investors and donors can make financing available to solar machine manufacturers and suppliers to support aspects of the value chain such as product research and development, and last-mile distribution and servicing. (AP1, p.43; AP2, p.27)
» Solar agro-processing machinery providers expressed a need for clear guidelines on value-added tax (VAT) and import duties associated with importation of high cost solar components such as motors and controllers. (AP1, p.42; AP2, p.21)

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» Despite solar-powered agro-processing machinery offering a potential viable alternative to diesel-powered machinery, its technical and commercial maturity remains hindered due to high capital costs, low processing capacity, and limited time of use.
» Greater deployment capital financing by governments and investors is needed to subsidize research and development and capital expenditure associated with owning a solar agro-processing machinery.

Sources:
1. IRENA defines agro-processing activities as, "Processing, which, when applicable, involves transforming the raw product into one that is adjusted to the needs of the consumer. Examples include drying, milling, grinding, pressing, shredding and de-husking."IRENA, Decentralised Solutions in the Agri-Food Chain, 2016, http://www.irena.org/publications/REagrifood/.
2. Lighting Africa, "The Market Opportunity for Productive Use Leveraging Solar Energy (PULSE) in Sub-Saharan Africa." Lighting Africa. July (2019). **(Herein AP1)**
3. Efficiency for Access Coalition, "Solar Milling: Exploring Market Requirements To Close the Commercial Viability Gap January 2020 Efficiency for Access Coalition," no. January (2020): 1–33. **(Herein AP2)**
4. IRENA, Decentralised Solutions in the Agri-Food Chain, 2016, http://www.irena.org/publications/REagrifood/. **(Herein TZ3)**