Food and Agriculture Organization of the United Nations

INVESTING IN SUSTAINABLE ENERGY TECHNOLOGIES IN THE AGRIFOOD SECTOR (INVESTA)

COSTS AND BENEFITS OF CLEAN ENERGY TECHNOLOGIES IN THE PHILIPPINES' RICE VALUE CHAIN

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Small-scale rice farmers, especially in small islands, often face difficulties in reaching milling services and usually do not have access to grid electricity. Local renewable energy systems can provide electricity and heat for productive activities, hence improving production and reducing food losses in remote rural areas.

In off-grid areas the gasification of rice husks and solar-powered domestic rice milling interventions, assessed here as case studies, can be financially viable as well as provide social and environmental co-benefits.

Adoption of clean energy technologies in the rice value chain can be facilitated through targets and strategies for rural electrification, the introduction of financing and insurance products, technical assistance to manufacturers and consumers, capacity building and improving energy literacy.

ENERGY TECHNOLOGIES IN THE PHILIPPINES' RICE VALUE CHAIN

Rice represents the most important staple crop in the Philippines. There are about 2.4 million rice farmers with an average farm size of about 1.2 ha. In recent years, domestic rice production has been increasing, due to both increased land area cultivated and improved yields per hectare.

Some remote rural communities still do not have access to grid electricity and rely on diesel-generators to power the mills. Renewable energy (RE) systems can therefore provide solutions for those remote areas by improving access to energy for farmers and rice processors. A key factor to determine the viability of RE investments lies in the local price of fossil fuels.

The initial capital investment needed for RE technologies can be a key challenge for small-scale rice producers and processors. Tailored financing for smallholders and access to credit schemes are lacking. Access to credit is a particular problem for farmers who do not own their land, as they cannot use land as collateral. Often, collective actions, for instance through farmers' associations, are needed for a new technology to be deployed, but farmer groups and cooperatives often face credit market constraints.

Other barriers to the adoption of RE applications include poor awareness about the technical potential; lack of supplier networks, maintenance companies and support services in rural areas and especially on small islands; and variability of price that can affect the attractiveness of investments in this sector.

In traditional rice farming systems, women provide most of the labour for production and post-production tasks as well as marketing. Men are more involved at the input stage. Nevertheless, gender inequality continues to pervade rural areas and the agricultural sector, which limits equitable economic growth and development.

CASE STUDIES

Gasification of rice husks and solar-powered domestic rice milling technologies were analysed as case studies. Their technical potential was estimated to be around 75 and 3 600 installations, respectively.

Gasification of rice husks for electricity generation is hardly competitive with grid electricity today, but it is a competitive option when it replaces a diesel generator used for rice milling. The gasifier and gas engine to drive a generator can be installed at or close to a mill site, or can serve a cluster of small local mills. The financial profitability of a system depends on the husk processing

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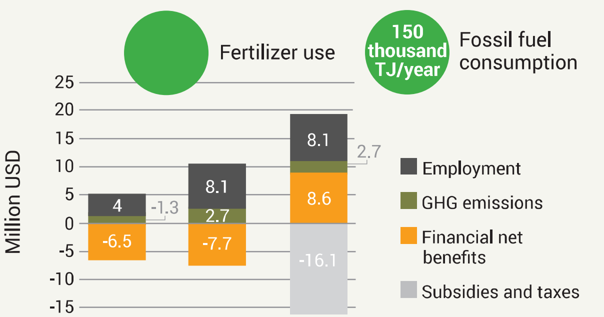
schedule at the plant (one or two daily shifts) and on the feed-in-tariff for electricity generated in the off-grid islands (i.e. the Subsidised Approved Generation Rate - SAGR). Without this subsidy, the investment would not be financially profitable at current diesel prices. However, GHG emissions reduction and employment creation make the investment attractive from an overall economic perspective that includes non-monetized benefits.

Solar-powered domestic rice milling can be adopted in off-grid areas and in small islands where production quantities are not high or where rice has to be transported over long distances before being processed, usually in a diesel-powered mill. This energy intervention is financially viable, and becomes even more appealing when social and environmental co-benefits are factored in.

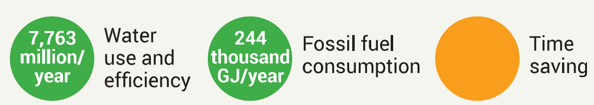
FINANCIAL VERSUS ECONOMIC ATTRACTIVENESS OF THE CASE STUDIES

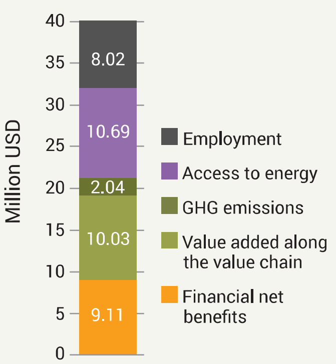
Rice husk gasification replacing diesel-powered generation for rice mills (100 kW$_{el}$ gasifier)



Initial investment over 10 years **USD 4.2 million for 75 systems**	**1 Shift (8h/day)**	**2 Shifts (16h/day)**	**2 Shifts with SAGR**
Financial IRR **percent**	**0**	**24**	**25**
Financial NPV **Million USD**	**-6.5**	**-7.7**	**8.6**
Economic NPV **Million USD**	**-1.1**	**3.0**	**3.2**

Solar-powered domestic rice milling (huller and polisher with capacities of 120 kg/day)





Initial investment over 20 years **USD 17.6 million for 3.6 thousand systems**

Financial IRR **16 percent**

Financial NPV **USD 9.1 million**

Economic NPV **USD 39.9 million**

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.*

The development of a market for gasifier systems also depends on local regulations concerning environmental limits on the rice husk disposal, such as a ban on burning the husks in the open. Where biochar is produced as a co-product, the market price varies and there could be duties on biochar exports. Higher market prices for rice husks and lower diesel prices could make the technology financially less viable.

Solar-powered domestic rice milling technologies can be financially attractive and have several socio-economic and environmental benefits, including; subsidy and tax reduction, added value along the supply chain, GHG emissions avoided, access to energy, employment creation, water use and efficiency and reduced fossil fuel consumption. However, adoption of this technology remains low due to lack of awareness, low efficiency, poor coverage of supply and maintenance networks, and difficult access to credit for potential adopters.

POSSIBLE SUPPORT INTERVENTIONS

Public, private and financial actors can facilitate the adoption of renewable energy technologies in the rice value chain. Possible support interventions include:

- reforming policies to include **targets and strategies for rural electrification**;
- **removing any subsidies for diesel fuel**;
- **coordinating planning** with relevant ministries on minimum standards for agricultural and food waste disposal;
- introducing more stringent **environmental standards** to protect the environment from their disposal;
- considering the inequity of **grid electricity** being offered at prices below cost during electrification planning;
- simplifying **procedures for grid connection** for small RE producers;
- introducing **specific loan packages** to allow farmers to overcome the relatively high up-front costs of RE systems (e.g. through micro-financing for farmers and millers without land ownership or guarantees);
- introducing and mainstreaming **insurance products** to hedge against market price for the feedstocks;
- providing **technical assistance** to local RE technology manufacturers and to develop minimum performance quality standards for RE systems;
- providing **technical and financial assistance** to improve awareness by technology adopters of the potential benefits, particularly in rural areas through promotional campaigns, radio advertising, demonstrations, and extension support; and
- using **capacity building and energy literacy** to bring productive technologies to remote areas.

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