INTERNATIONAL WORKSHOP

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

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WORKSHOP REPORT

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Workshop Background

The FAO Investing in Sustainable Energy Technologies in the Agrifood Sector (INVESTA) project is a follow up of the FAO-USAID study Opportunities for Agri-Food Chains to Become Energy-Smart, it is funded by the *Deutsche Gesellschaft für Internazionale Zusammenarbeit* (GIZ) and contributes to the international initiative *Powering Agriculture: an Energy Grand Challenge for Development*.

The INVESTA project developed a cost-benefit analysis (CBA) methodology tailored to energy technologies in food value chains (VCs) covering their financial, economic, social and environmental costs and benefits. The approach has been applied to specific technologies in the milk, vegetable and rice VCs. A report illustrating the methodology and the results of the analysis at intervention level (e.g. at the farm or food processor level) has just been co-published by FAO and GIZ. The objective is to assess costs and benefits associated with the introduction of renewable energy and energy efficiency technologies, including the hidden socio-economic and environmental costs and benefits, beyond financial benefits. Indeed, financial returns can be significantly different (higher or lower) if co-benefits are incorporated. This could justify public support to the investment to cover the positive externalities.

The approach has been piloted in four countries (Kenya, Philippines, Tanzania and Tunisia). In each pilot country, the project organized scope missions to collect information and data, and a national stakeholder workshop with the main actors of the selected VCs. The findings of the four national stakeholder meetings include the lessons learned from the national stakeholder discussions and an overview of barriers, suitable business models and financing mechanisms to foster the adoption of energy technologies in the agrifood sector. The overall results were discussed at the international workshop. Experiences from investors and financers on financing energy technologies in agrifood were presented and solutions to upscale investments in the three VCs were discussed.

The international workshop represented an opportunity to discuss barriers and means to foster investments in technologies including milk cooling systems, biogas from manure for electricity, solar-powered water pumps, solar cold storage of vegetables, rice husk gasification and solar-powered rice processing. It gathered stakeholders from the public, private and financial sector, as well as experts on rural development, and resulted in general recommendations for policy-makers and investors on how to improve the enabling environment for investments. It was also an opportunity to propose and discuss concrete means of collaboration among participants.

Rationale

Energy-smart and climate-smart agrifood systems can be viable solutions for development and bring significant structural change in rural areas relying on clean energy solutions. However, addressing these challenges calls for better evidence to target actions and promote solutions. This concerns in particular the amount and types of energy required at particular stages of the agrifood chain and their viability.

At each stage of the food supply chain, current practices can be adapted to become less energy intensive and therefore smarter. Such efficiency gains can often come from modifying existing farming and processing practices at little or no cost. Options include the use of more fuel efficient engines, the use of compost and precision fertilizers, irrigation monitoring, the adoption of no-till farming practices and the use of less-input-dependent crop varieties and animal breeds. After food has been harvested, improved transportation and infrastructure, better insulation of food storage facilities, reductions in packaging and food waste, and more efficient cooking devices offer the possibility of reducing additional energy use in the food sector.

The challenge is to decouple fossil fuel energy inputs (both for production and processing as well as for indirect inputs) from the increasing demands for food supply in the short term while ensuring food security and access to modern energy. According to latest FAO estimates, 49% more agricultural production will be needed to meet the demand by 2050 and, in spite of the current efficiency gains, energy consumption in agriculture is set to increase over the next decades.

The INVESTA project supports new and sustainable approaches to accelerate the development of clean energy solutions in agri-business. The main challenge addressed by the project is how to enable the development of clean energy interventions in agrifood chains in developing and emerging countries.

Objectives of the workshop

- Validate the INVESTA project findings and recommendations
- Share lessons and initiate discussions between financers, investors, practitioners and regulators
- Identify ways to improve the enabling environment for investments
- Develop concrete ideas for cooperation

Coverage of Sessions

Session 1. The INVESTA Cost-Benefit Analysis methodology and main findings

This session presented the results of the INVESTA project which includes lessons learned from the stakeholder discussions in Kenya, Tanzania, Tunisia and the Philippines. It also provided an overview of

barriers, suitable business models and financing mechanisms to foster the adoption of energy technologies in the agrifood sector.

INVESTA is a FAO project which stems from a previous study which highlighted opportunities for energy interventions in the milk, vegetable and rice VC. More than 200 national stakeholders were interviewed in the countries to collect data and information. The value chain perspective and the CBA methodology were explained, as well as main policy and regulatory areas, business models and risk mitigation options.

Gender equality is still far to be reached in the agriculture sectors, in many VCs and in the energy sector. The FAO gender approach has been introduced into the INVESTA methodology, into VC mapping, cost-benefit analysis, barriers, lessons learned and policy response. A limitation of the INVESTA gender analysis is that a national level can lead to important generalizations and simplifications. Barriers and policy recommendations to promote gender equality and women's empowerment were introduced.

The INVESTA analysis can be a base for financing instruments as official development assistance (ODA) and blended funding.

Session 2. Financing energy technologies in agrifood: experiences from investors and financers

Financing institutions (FIs) and investors presented and discussed the enabling conditions for the development of energy interventions in developing and emerging countries. The session focused on experiences, the main policy and regulatory barriers encountered, and available tools and support mechanisms targeting energy technologies for the agrifood sector.

There are several examples of instruments used to deploy development finance: grant-based models, revolving funds, results-based financing (RBF) schemes, blending, etc. It was discussed what is most suitable and how to move away from a purely grants-based approach.

Technology, business models, information, collaboration and co-ordination are key factors to achieve increasing access to reliable and affordable energy.

Regarding the role of guarantees to leverage investments into the sector, it is key to design elements and addressing end-user/ small and medium enterprise (SME)/project financing needs across different scales (commercial, farmer/cooperative, domestic). 'Financial viability' can depend on type of project, model, ownership structures and investors. It is important to include additional project assessment parameters such as market development.

Increasing access to reliable, affordable energy is the overarching goal of the World Bank energy practices. It is important to have a good understanding of demand: what comes first? Productive end-use or excess capacity (i.e. should new generation capacity be planned on the basis of productive end-use demand or should productive activities be started where there is an excess of generation capacity?) Who supports productive end-use development?

Also, it is important to develop pilot projects and to incorporate adaptive learning loops into policy making, business and financing model design. For instance, solar-powered irrigation systems (SPIS) should be seen as stand-alone solutions but can be bundled with other products (seeds, fertilizers, drip irrigation), which make investments more productive. Customer education, product awareness and access to capital are key factors for success.

There is a need for a **variety and alternatives of products**, as well as for opening credit lines. **De-risking** can make innovation interesting for financial institutions, but it is unclear how it can be applied to small projects/programmes. International development FIs often work with smallholder farmers through local partner FIs.

Governance in developing countries is facing key structural challenges which needs to be addressed before any market is created.

Session 3. The milk value chain: solutions to upscale investments

The panel shared experiences on the successful business models, financing and institutional arrangements to promote and up-scale the adoption of clean energy technologies in the milk VC, with a focus on experiences in Kenya, Tanzania and Tunisia. The presentations were followed by an open discussion between practitioners, policy-makers and financers.

A key recommendation in the **milk sector**, for Tanzania and Kenya in particular, is to "strengthen controls and fines against illegal milk commercialization (e.g., at local markets)". During the discussion it was mentioned that 'minimum food quality standards' might negatively impact income of remote farmers which struggle to reach cooling facilities.

The need for a **premium pricing** for chilled milk has been often highlighted as farmers don't have incentive to introduce milk cooling. With partial penetration of decentralised cooling, there is an issue with reduction of quality during aggregation stage.

The role of **sector champions** within the dairy sector is vital: processing companies should have incentives to promote renewable energy throughout VC to maintain competitiveness.

A **successful approach** to attract investment in clean energy in the VC is made by a combination of subsidy, extension services, self-regulation and quality assurance mechanism for sustainability purposes. Other key factors are education and training, skills development and quality and standards for equipment.

Government intervention is needed when net economic benefits are different from financial benefits, but there should be an emphasis on **reliability and affordability of technology**. It is key to develop systems and technologies that are locally adapted. For instance, a VC approach should consider several steps of the VC to obtain robust business models in Kenya (e.g. improved feeding + milk cooling + pasteurization).

Investments in R&D and innovation frameworks are needed in the sector and they require **high risk capital**. Policy-makers should help the private sector with pure risk capital (government research). Financing model innovation for SMEs is crucial to ensure growth and scalability of innovative solutions.

It is important to tailor the feasibility analysis to the remoteness of the area taking into account high distribution and maintenance cost in areas where the benefits of milk chilling is highest. **Service model** is key for the sustainability of biogas digestors, as well as other decentralised solutions.

Since, without cooling facilities, farmers often sell/give the evening milk to neighbours, there is an important **trade-off** between local food security and bringing all milk produced into the market. This is also linked to social cohesion.

Session 4. The rice value chain: solutions to upscale investments

Barriers to the adoption of clean energy technologies in the rice VC (e.g. lack of financial support and awareness about the technology) and support interventions, such as capacity building and energy literacy,

technical assistance, insurance products, were discussed between practitioners, policy-makers and financers.

Post-harvest losses, energy consumption, GHG emission, technology costs and other factors change according to different practices. For instance, there is a need to look at rainfed and irrigated farming systems separately when assessing cost and benefits of renewable energy technologies in the rice VC. Poor access to manufacturer support and spare parts is a barrier to clean energy technology adoption.

It is important to address **data gaps** at national, regional and provincial level for a **conductive public-private investment framework**.

Standards for by-products can be part of market development efforts and ease business, as well as reducing administrative barriers on purchase power agreements.

The establishment of a **market for high-value co-products** is a priority to increase the attractiveness of the investment in the sector. On the other hand, accounting for hidden cost (e.g. negative environmental impacts of digestors) is key.

Policies measures such as **transparent grid extension plans** can overcome a major barrier for financial viability of project.

Feedstock quality and availability can be an issue. The availability depends on technology and yields, which are flexible and can change over time due to climate change, therefore its market price can change. Price mitigation solutions for rice husk as a feedstock include long supply agreements as regulatory requirement. Also it is important to look at ownership of feedstock (e.g. in the case of rice husk in the Philippines, the feedstock is owned by the miller and not by the farmers).

Equipment import tariffs and enforcement of environmental regulation affect the viability of rice husk gasification.

The need to strengthen '**network of practitioners'** to facilitate exchange on lessons and best practices and vocational training was advocated.

Day 2 - Opening and keynote address

Ralph Sims (Massey University and GEF Scientific and Technical Advisory Panel) explained how the **future of food supply** can match with the target of reducing GHG emissions signed under the Paris Agreement. The world cannot continue along the current exponential pattern if the target is to reduce GHG emissions. Even the current NDCs presented after the Paris agreement cannot be enough meet the 'below 2 degrees' objective.

Our conventional food systems are environmentally unsustainable. We can improve resource efficiency based on **circular economy**. However, this is a slow process.

19% of global warming result from GHG emissions from livestock and human demand for animal proteins should be reduced. Animal proteins can be replaced with vegetable crops, insects and synthetic proteins produced in laboratories. There is already a trend and significant investments in this direction.

Session 5. The vegetable value chain: solutions to upscale investments

In East Africa, lack of quality standards in the vegetable sector implies that the premium needed to justify investment in cooling facilities is not generated. This, coupled with lack of awareness of technologies and lack of access to finance, is a **major barrier** to the adoption of off-grid clean energy solutions.

Agriculture data availability and reliability is a key challenge for all stakeholders. Sharing of data and statistics on agriculture is needed (e.g. through Open Data platforms).

Positive examples to address the barriers to adoption of irrigation are: reduction of market entry cost, fiscal incentives, demand-pull approach, irrigation water supply service approach, special zoning approach, involvement of local (county/province) governments.

A coherent framework is needed to ensure that every initiative can be coordinated from a central point to monitor and maximize value. Small-scale farmers need comprehensive solutions. For instance, in Kenya there is a tendency to create farmer groups, in which production can be controlled and managed to produce both high-value and staple crops. Financial innovation has to be coupled with farmer innovation with high value products to be able to de-risk and afford clean energy solutions. Technologies are often measured in the wrong way: the focus should be on their values/services.

Climate change will reduce cropping areas in many areas and it must be considered by policy makers, there is no alternative. Business can chose not to invest in risky areas, but governments must deal with it. Government-driven processes can be expensive and long-drawn. Local ownership and local finance can ensure sustainability. MFI experience validate that financing products should be spread over a sufficient amount of harvest/cropping cycles to allow flexibility in case of bad seasons.

Session 6. Outcomes of the workshop and overall recommendations

This session was organized around relevant issues emerged from workshop sessions and discussed the following questions:

1. What have we learned regarding the prospects for energy interventions in agrifood in developing countries?
2. What capacity is needed and who should take the lead in building it locally?
3. How can the international organizations and financing institutions present here catalyze investments in energy-smart agrifood systems?
4. What are the next steps?

Overall, a key recommendation is to go beyond the financial impact and consider environmental and socio-economic factors when evaluating the impact of an investment in agrifood VCs.

The main barriers to investments in clean energy identified by the INVESTA project were shared by all stakeholders. To overcome them, the promotion of coherent regulatory framework and measures to foster investment are needed: policy, regulation and financial mechanisms should complement each other.

It is important to identify underlying drivers for technological, product/services, business and financing model innovation, and foster those through coherent policy/regulation/programme design. Institutional capacity and willingness to engage and deploy solutions are key for scale-up the adoption of technology. The business case should be tailored for different stakeholders and to local context. Emphasis was given to locally customised technology and capacity building (developing skills in rural areas) and to fostering local ownership and investments.

Financing challenges include improve access to finance and financing options for projects, SMEs and end-users. Local, national and international FIs should work hand-in-hand with governments and technology providers to identify these solutions. It is important to consider different scales of intervention for various VC applications, as interventions can be at large scale, community scale or domestic scale.

Gender should be mainstreamed into project conception, design and implementation, as well as policy making, considering broadly at the local socio-economic development objectives (e.g., youth employment).

Data collection frameworks are a key factor. More effort should be put in place to have reliable data, as these are needed for better planning as well as for monitoring and evaluation (M&E). **M&E frameworks** should be adapted to capture the cross-sector impacts as well as trade-offs.

The following table summarizes the **overall recommendations** discussed during the workshop.

Beyond Financial impacts	Regulatory Framework	Fostering investments	Gender issues	Data gaps
Assess not only the financial aspects of Energy-Smart Food (ESF) but also the co-benefits and hidden costs associated with it.	Reform electricity tariffs so that they cover real electricity costs	Mainstream insurance and financing products tailored to agrifood energy interventions	Mainstream gender considerations throughout the ESF innovation process	Support the collection, processing, storage and appropriate sharing of data and statistics on agriculture and the food industry in partnership with international organizations
Establish proper baselines and well defined and quantitative indicators in planning, and an effective results and impact monitoring	Foster local ownership, maintenance, repair, availability of spare parts, as well as saving schemes for maintenance	Remove fossil fuel subsidies and develop government-backed financial mechanisms or preferential loans for early ESF adopters	Promote equal rights for men and women	Ensure that the data collected for national statistics are consistent with international standards.
Address potential food-energy-water nexus issues and look for opportunities to de-couple	Favour new small-scale productive energy solutions in rural areas rather than the national utility grid, as they are more likely to contribute to SDGs	Prioritize win-win public-private partnerships		Facilitate the collection of sex-disaggregated data in agricultural sub-sectors
Prioritize interventions and policies that increase resilience to natural disasters and social conflicts	Establish codes and standards for equipment and by-products to foster the development of a new market for these products which in turn can improve the financial viability of the investment in energy technology.	Provide technical and financial assistance, possibly backed by international support for micro-finance and local savings organizations.		
	Introduce environmental standards including	Foster ESF knowledge and education schemes		

	on waste disposal which favour the use of waste for bioenergy			
	Set minimum food quality standards to justify investments in ESF			
	Ease bureaucracy to obtain permits for commercial RE producing systems and grid connection.			
	Develop national renewable energy and food quality targets specific for the agriculture or food industry sectors			

Next steps and concluding remarks

Overall, the INVESTA methodology was considered a good starting point with some small missing points and some recommendations that were challenged. For instance, it was argued that from the power sector perspective, small-scale solutions are not necessarily better than national utility grid. Also, the reform of electricity tariffs can create customers' complaints. These points will be considered in the final versions of the project outcomes (report and policy briefs).

One of the main innovations of the INVESTA methodology is the set of indicators that tailor the methodology to energy interventions in the agrifood chain. The analysis should be replicated to a **larger number of case studies** to strengthen the findings of the INVESTA project. The methodology could also be transformed in a rapid assessment tool that could be used for investment screening by financial institutions.

Suggestions for improvement of the methodology are to include youth on top of gender-disaggregated indicators, to include the analysis of co-products, and to consider land tenure. It was highlighted that the VC approach adopted in the methodology needs clear boundaries to become a tool and be quickly replicable. The **main difficulties** to quickly replicate the analysis to other technologies and VCs are in data availability, which could lead to significant uncertainties of the CBA results.

An agreed conclusion was the need to improve **national data collection** to allow for better planning and coordination. The mainstream of **gender** was agreed to be a core point. As information is power, it is the responsibility of all to collect information in a proper way, so that gender and other social issues are not overlooked.

The main users of economic CBA results are governments, but also farmers should be made aware of environmental and social externalities. The **communication** of the main findings of the project can be

different for financing institutions, farmers, for policy makers, etc. since final users of the methodology and of the recommendations can be different actors with different objectives. Governments often struggle to achieve Sustainable Development Goals (SDGs) and Nationally Determined Contributions (NDCs), and the INVESTA approach to investments can help achieving both objectives.

Likewise, the barrier categories (target, policy, financing, capacity development/guidance) were agreed upon and they need actions from different actors (government, developing agency, financial and private sector). Some stakeholders are already using the INVESTA methodology in some islands in the Philippines.

A wide range of experiences and barriers was presented and the project recommendations can help overcome them. Maria Weitz (GIZ Project Coordinator) underlined that FAO and country partners involved in the INVESTA project did a great job and she hoped that "we continue to contribute to agriculture productivity in sustainable way".

Alexander Jones (CBC Director) underlined that there is need for more emphasis on gender and youth to retain them in rural areas. De-risking and blending finance should not be the 'flavour of the month' but a real thing, linked to farming systems' innovation (linked to land tenure system). SDGs and NDCs are interlinked and both follow a bottom up approach, which FAO is supporting countries into achieving.

Suggested next steps include more analysis of additional VCs and countries, and enhanced communication of results to reach more actors. Evidence-based is needed, and pilots in the clean energy for agrifood sector should also be increased.