Leveraging Renewable Energy in Agri-food Systems

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with Geothermal Heat,
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1. Why the Energy-Food Links Matter

10 SDGs for which Energy-Food Links are Most Relevant

Energy is Closely Linked to Food Security

- **Availability :** Energy is needed at all stages of food chains

- **Access:** Energy is linked to the price of agricultural inputs and therefore food prices and farmers' income, and can provide jobs

- **Utilization:** Adequate access to modern energy for cooking reduces health risks, **improves food quality/nutrition** and frees up time

- **Stability**: Volatility in energy prices can influence food price stability

And to huge Water↔Energy↔Food Nexus Challenge

Now

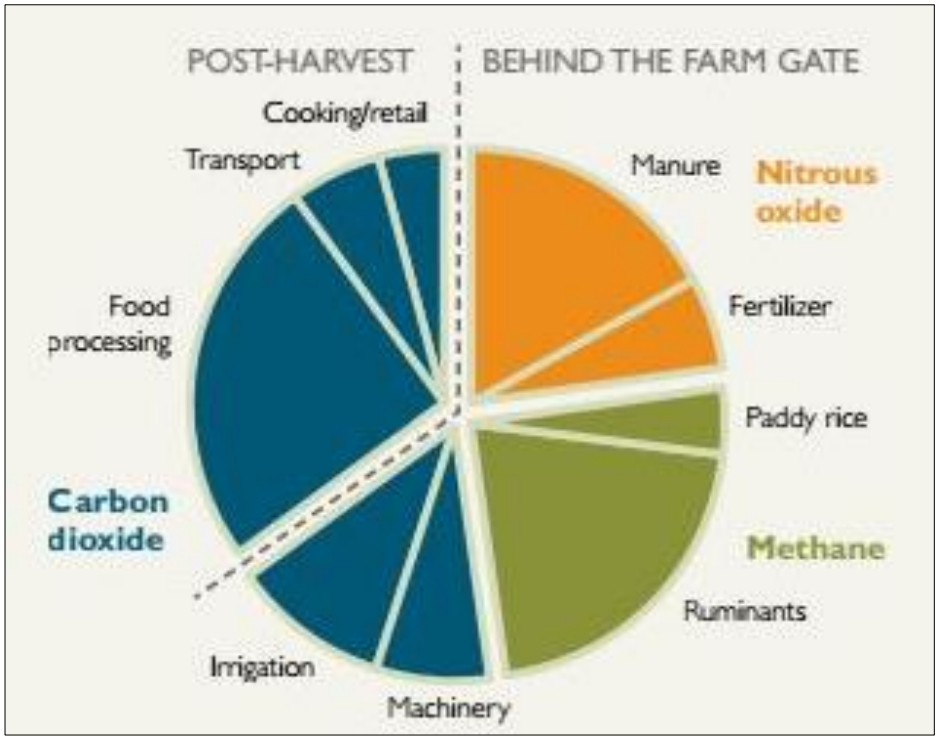
- 0.87 billion people are undernourished
- 1.3 billion people lack access to electricity
- 0.9 billion people lack access to safe drinking water and 2.6 billion to adequate sanitation

By 2030, if Business as Usual, simultaneous needs for:

- 50% more food
- 40% more water
- 40% more energy

Additionally –
Natural resource are stressed
Climate change does not help

Energy is part of the Climate Change Problem in Agrifood Systems



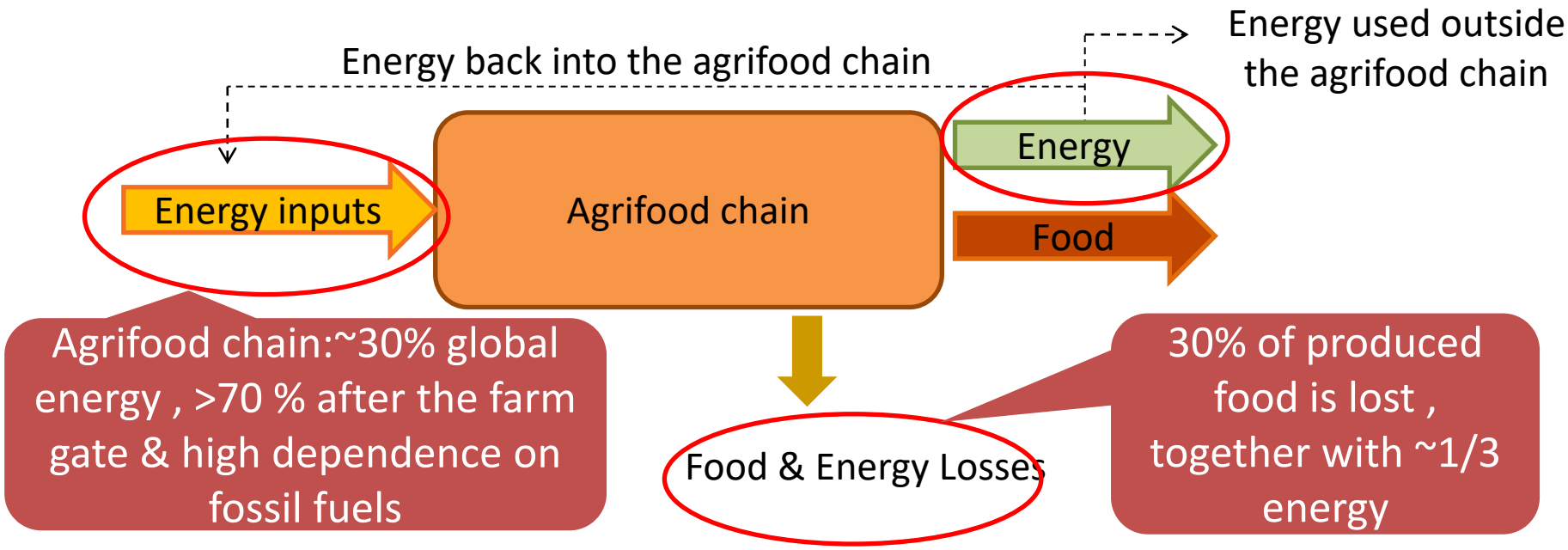
Source: FAO, Opportunities for agri-food chains to become energy-smart, 2015

- **Energy is responsible for ~30 % GHG emissions from agrifood systems** – mainly through direct CO_2 emissions in post-harvest stages + fertiliser manufacturing
- **Often overlooked** in agriculture because accounted for in the industry or energy sectors

Energy also Part of the Climate Change Solutions in Agrifood Systems - so part of Climate Action

- **Mitigation** through (i) reduction of fossil fuel use in agrifood chains, (ii) reduction of GHGs due to reduced food losses, (iii) sustainable bioenergy as clean energy; (iv) Use of biofuel by-products as animal feed to reduce need for land to grow animal feed, (iv) Resource use efficiency through integrated food energy systems
- **Adaptation** through (i) increased farmers' self sufficiency in sustainable energy and biofertilisers, (ii) income diversification through the sale of energy and/or energy jobs
- **Carbon sequestration** through (i) energy tree planting, (ii) increased soil carbon through bio-fertilizer and biochar from biogas

Energy in Agri-food Systems is Unsustainable



At the same time:

- **Lack of access to sustainable energy** for agri-food in a lot of developing countries
- **Forest degradation and deforestation from traditional use of woodfuel** for household heating and cooking

2. What to Do to Get Energy-Food Links Right

The proposed FAO solution: Need to decouple agrifood system development from the use of fossil fuels without compromising food security

Through **"Energy-Smart Food"** , with:

1. **Adequate access to modern energy** where needed in food chains, in four ways:

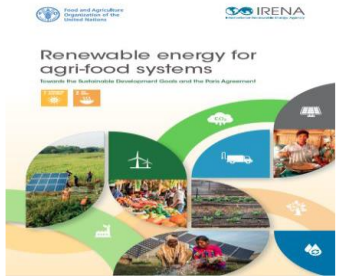
2. **Improved energy efficiency**

3. **Gradually more renewable energy**

4. **Sustainable Bioenergy**

5. **A Water-Energy-Food Nexus approach** in the above

Agenda from 2021 FAO-IRENA Report on Energy-Food Links



Improve data and information base

Improve access to financing for end-users and enterprises

Leverage mapping tools

Facilitate integrated food-energy systems

Mainstream cross-sector perspective in energy and food systems strategies

Strengthen innovation ecosystems for technologies and appliances

Focus on awareness raising and capacity building

Place inclusivity at heart of energy and food systems transformation

7 AFFORDABLE AND CLEAN ENERGY

2 ZERO HUNGER

Robust Science-based Feasibility Assessment Crucial to De-risk and Optimize Investments in RE for agrifood chains

- Step 1 : **Food chain analysis**: status, constraints, markets, stakeholders and energy entry points

- Step 2**: Mapping best locations for RE investments,** from both the RE supply side and the RE demand side

- Step 3: **A comprehensive cost-benefit analysis of RE investments** in food chains

Step 1: Situation analysis and energy needs of the agri-food chain

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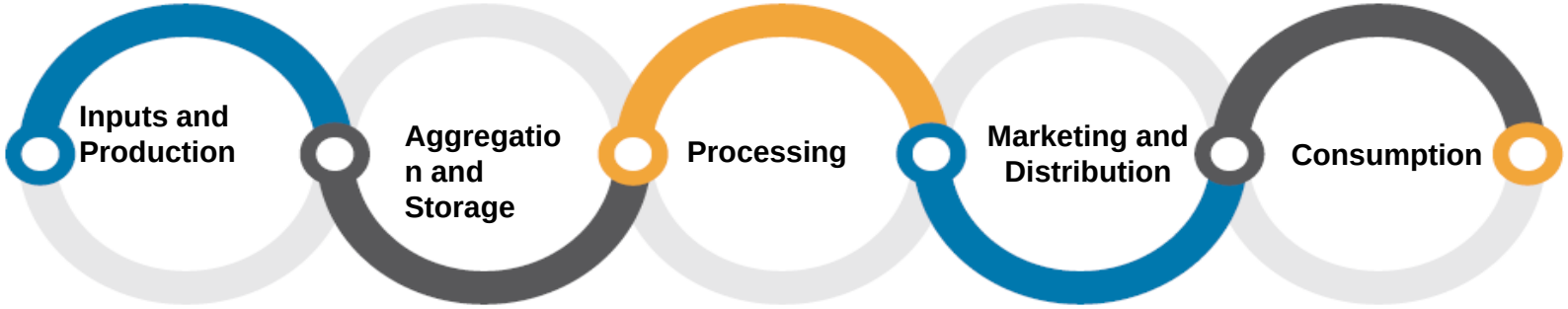
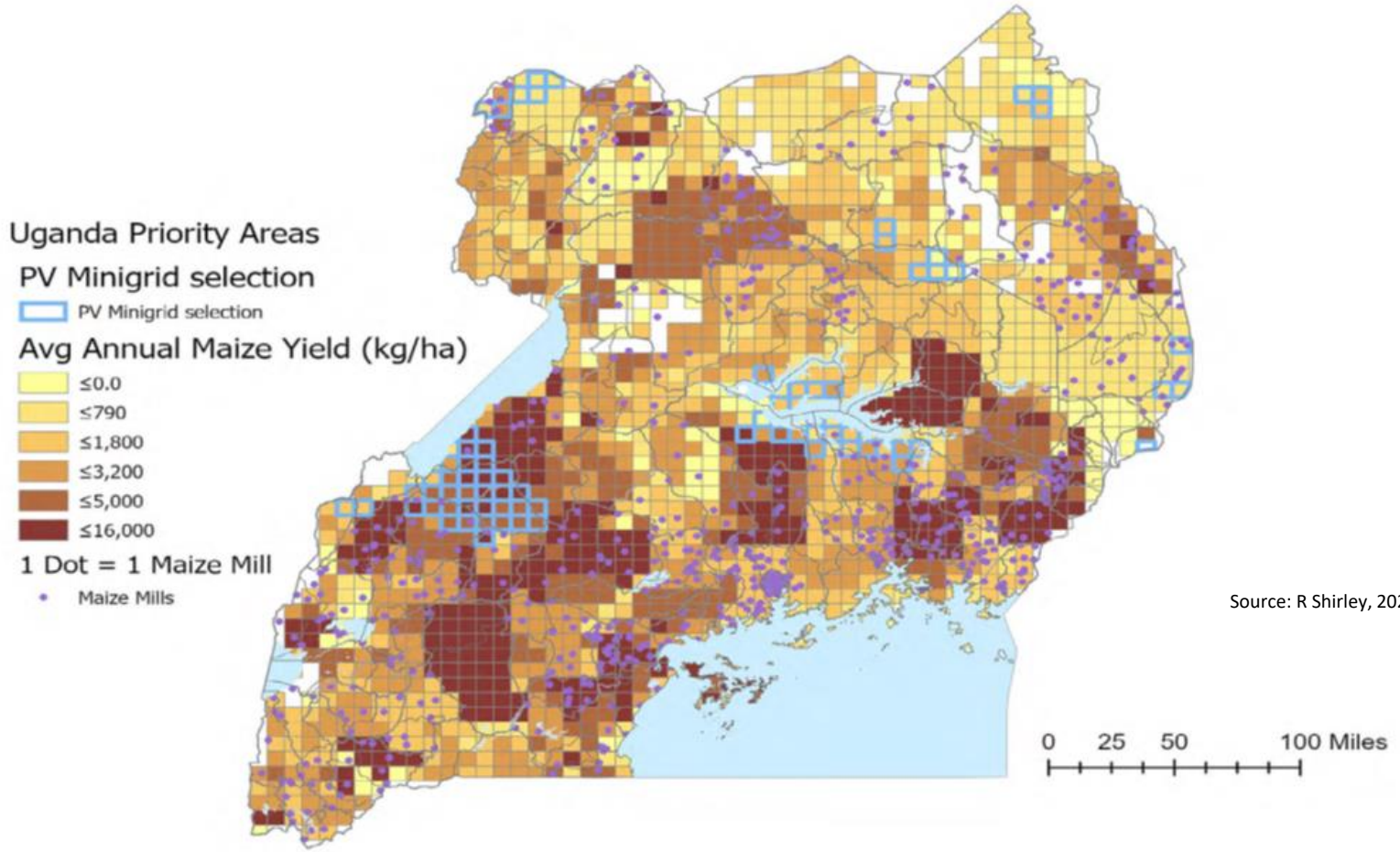


2

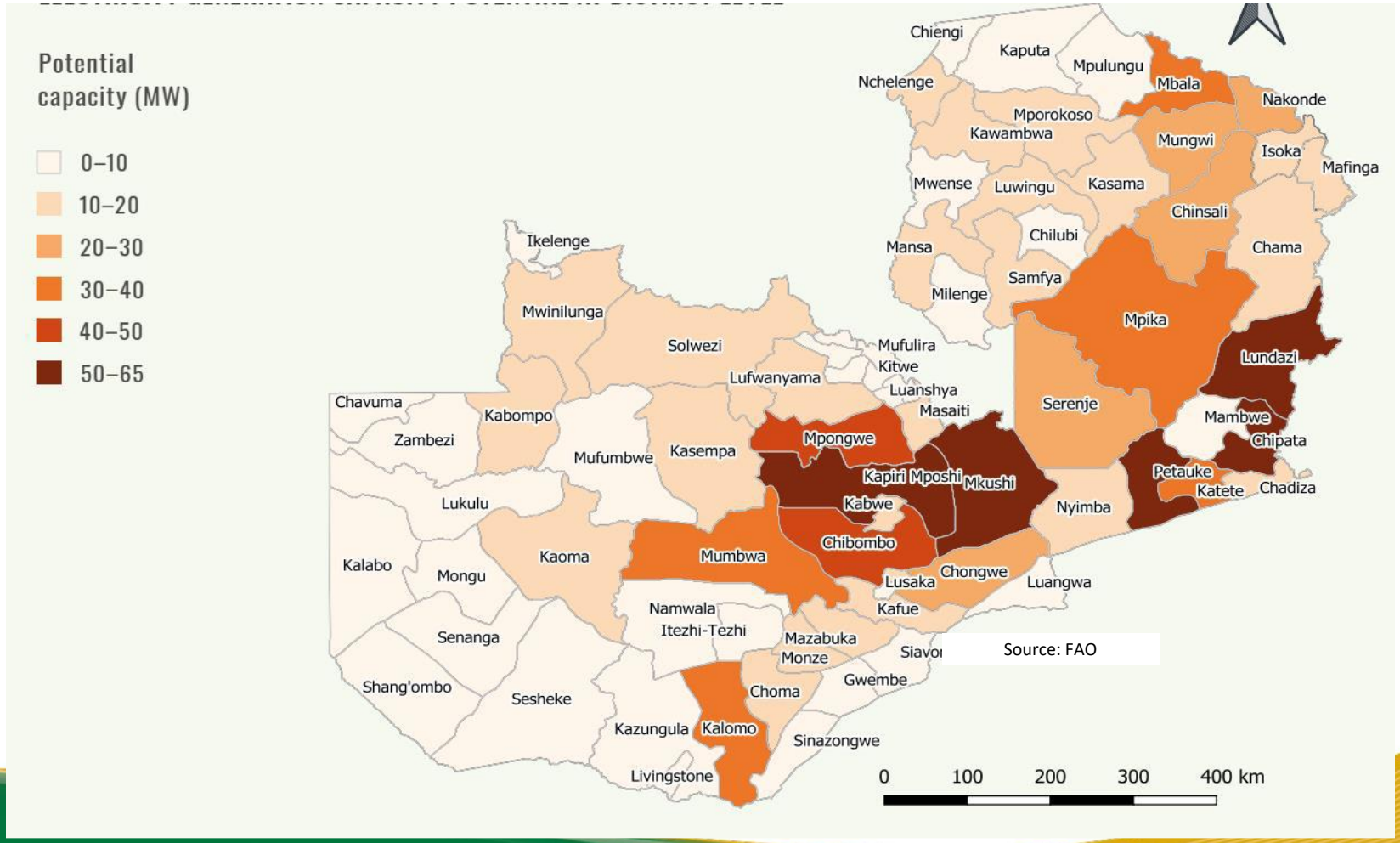
Inputs and Production	Aggregation and Storage	Processing	Marketing and Distribution	Consumption
• Energy for fertilisers & pesticides • Diesel or electricity for irrigation and ag-machinery	Electricity for temperature, for moisture regulation, to run sorting or packaging equipment	•Heating for drying •Electricity for grinding/milling or for sorting or packaging equipment	• Cooling of produce • Electricity for packaging or branding, sorting, packaging equipment	• Heat for cooking • Refrigeration • Electricity household appliances

Step 2a - Mapping existing DEMAND for energy from the food side Ex - Uganda : Location of deficit in maize mills due to lack of energy – so highest potential for solar mini-grids



Source: R Shirley, 2020

Step 2b - Mapping adequate RE SUPPLY potential - Ex: Locations with best bioenergy potential from crop residues in Zambia – can also be done for other RE sources

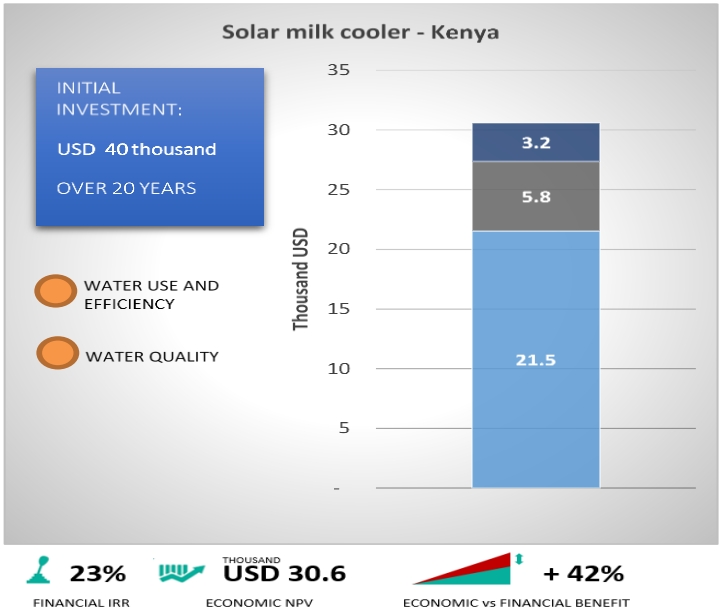


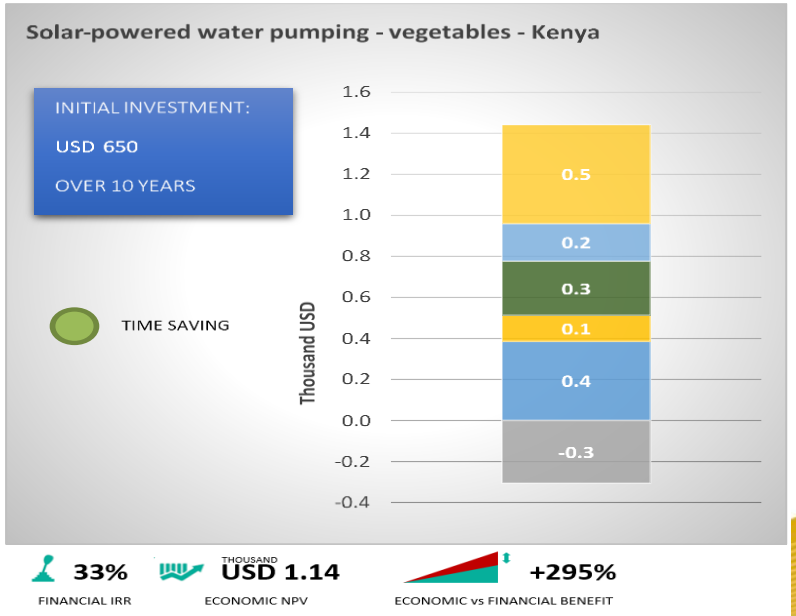
Comprehensive Cost-Benefit Analysis of RE Investments in Agrifood Systems (INVESTA)

- **Included environmental, financial, economic, social and gender aspects of solar and biogas** in the **milk, vegetables** and **rice value chains** at operation and country levels
- **Tunisia, Kenya, Tanzania** and **The Philippines** as country case studies
- The work resulted in recommendations on **how policy-makers and investors can foster investments in clean energy technologies**

Step 3: Comprehensive Cost-Benefit Analysis on RE in food chains- with two examples from Kenya

- Financial NPV
- Taxes
- Soil quality
- Indoor air pollution
- Water quality
- Land use change
- Access to energy
- Time savings
- Value added down the food chain
- Subsidies
- Fertilizers' use and efficiency
- Water use and efficiency
- Food loss reduction
- GHG emission reduction
- Household income
- Employment





Strengthening demand for renewable energy

- Within Food chains : **Combine seasonal demand** (crops chains) with **more constant demand** (meat and milk)

- Beyond food : Combine **renewable energy for food** with renewable energy for other sectors – for instance **health** (pumping good quality water and powering local clinics)

Example of key role Water-Energy-Food Nexus Approach BEFS Review of Rwanda's Biogas Programme

- In 2021, FAO did a review of Rwanda's biogas program.
- The program aimed at using cattle manure to produce biogas to provide energy for cooking in rural households which relied on firewood.
- BEFS assessment identified water availability was a impeding factor.

Not having access to water in close vicinity of the biogas digester was a significant barrier where households do not have access to water but would need to fetch the water to run the biogas system.

Applying the WEF Nexus approach to foster circular agrifood systems - e.g. Zaatary refugee camp in Jordan

- Biogas using sewage water from refugee camp
- Solar energy used to heat biogas unit
- Bio-fertiliser by-product from biogas used as compost in local agriculture
- Clean water used for irrigation in fruit tree nurseries
- Many refugees employed in local biogas plant and local solid waste treatment unit

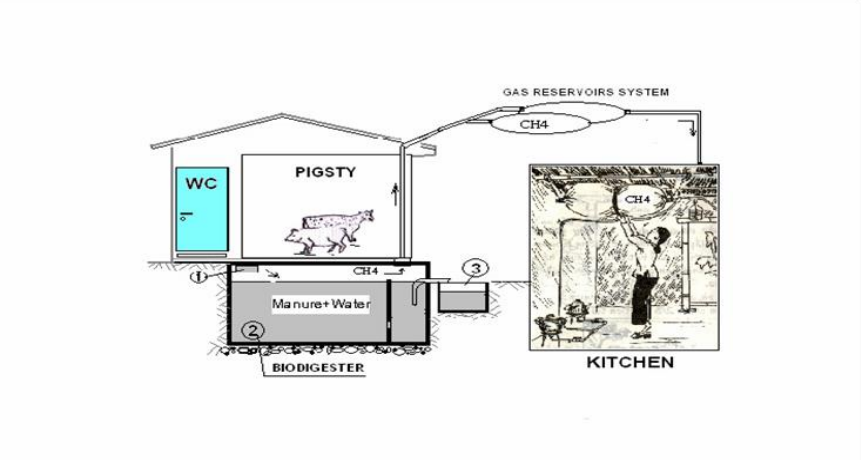
Rapid Assessment of the Sustainability & Replicability of Integrated Food-Energy Systems (IFES)

Type 1: Land use Optimization

through mixed cropping systems

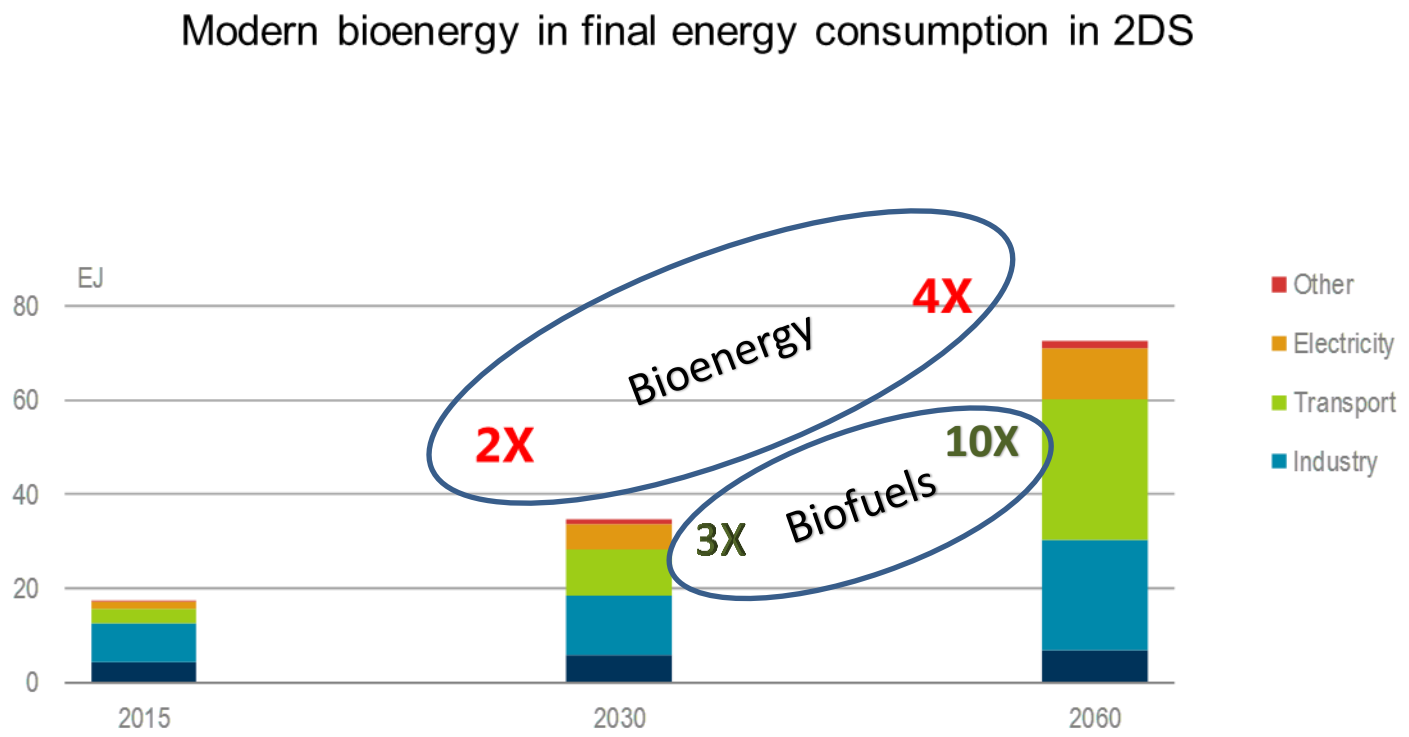
Type 2: Biomass use optimization

through cascading use of biomass



Methodology to assess **IFES sustainability** & **replicability** used for 3 IFES **in Mozambique** and 3 IFES in **Ghana** in 2015 - 2017

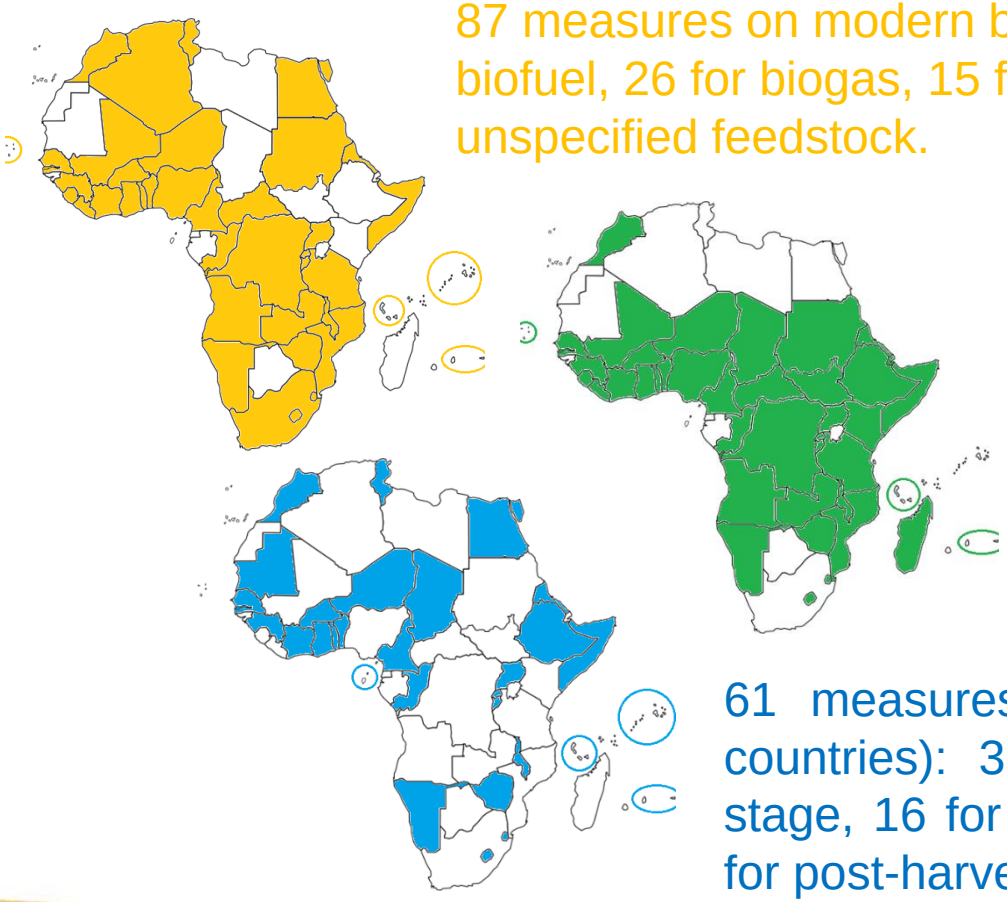
Bioenergy Badly Needed in Climate Action confirmed by the International Energy Agency – IEA 2017



Compared to 2015, bioenergy in final energy consumption **needs to double by 2030**, and **biofuels in transport treble**.

Advanced biofuels will need a massive scale up (IEA 2017 Bioenergy Roadmap)

Confirmed by the (I) NDCs in Africa: More than 80% mention Bioenergy + a lot on Energy-Food Links



87 measures on modern bioenergy (41 countries): 28 for liquid biofuel, 26 for biogas, 15 for solid biofuel & 18 for unspecified feedstock.

95 measures on traditional bioenergy (41 countries): 24 countries combining sustainable wood to energy systems with efficient cookstoves 15 supporting efficient cookstoves only & 2 supporting more sustainable wood to energy systems only.

61 measures on energy use in agriculture (30 countries): 33 for energy use at the production stage, 16 for food value added in processing & 12 for post-harvest handling. 6 countries combine the 3 categories.

FAO's Key Messages on Bioenergy

- **The sustainability of bioenergy is context specific.** Therefore its **assessment must be based on reality** not models and global studies
- **Tools and knowledge are now available** to help governments and operators reduce risks and enhance opportunities of bioenergy development
- *Per se* **bioenergy is neither good nor bad.** What matters is the way it is managed
- **Bioenergy** should be seen as another **opportunity for responsible investment in sustainable agriculture, rural development and bioeconomy**.

Summing Up

- Energy-Food links matter to many SDGs
- We know how to get them right
- So let's join forces to enhance their sustainable implementation
- FAO has the competence and is ready to play a leading role in moving this agenda forward share in

Thank you for your attention

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