Harvesting the sun twice: Enhancing livelihoods in East African agricultural communities through innovations in solar energy

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Principal Investigator: Prof Sue Hartley. Funder: UK GCRF-ESRC
Contents

1. Agrivoltaics concept
2. Factors driving agrivoltaic performance
3. Why East Africa, and potential benefits of agrivoltaics
4. “Harvesting the sun twice” project in East Africa
5. Roadmap to support agrivoltaics in Africa

Talk duration: 20 slides, 20 minutes.
Agrivoltaics: combining agriculture with photovoltaics

A triple win for the food, energy and water nexus

Conventional solar park
Westmill Solar Park, Oxfordshire, UK

Agrivoltaics research site
Montpellier, France
Factors driving agrivoltaic performance and livelihood benefits
Location of existing agrivoltaic research sites
Why East Africa?

2/3
71%
Off-grid/mini-grid

75%

8-45%

72% ↑ 448m
<table>
<thead>
<tr>
<th>Energy</th>
<th>Food</th>
<th>Water</th>
<th>Land</th>
<th>Socio-economic</th>
</tr>
</thead>
</table>
| • Electrification for off-grid communities.  
• Power farming activities, education, healthcare, clean cooking etc.  
• Low-emission electricity.  
• Improve crop yields.  
• Switch to nutritious and high economic value crops.  
• **Expand growing ranges into marginalised land and extend seasons.**  
• Mitigate climate change.  
• Electricity for post-harvest processing.  
• Mitigate drought impacts on crops through reduced evapotranspiration/improved water use efficiencies.  
• **Harvest rainwater for irrigation.**  
• Dual use of land.  
• Avoid land use conflicts.  
• Avoid land degradation and deforestation.  
• **Soil conservation.**  
• Diverse income streams.  
• Business and employment opportunities.  
• **Shade for farm labourers.**  
• Reduce household particulates.  
• Gender inclusion. |
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£1.4m to determine livelihood benefits derived from agrivoltaic systems for agricultural communities in East Africa
Project structure

1a. Evaluate renewable energy land-use governance.
   - Literature review
   - Policy analysis

1b. Socio-technico-economic impacts.
   - User journey map
   - Financial cost-benefit analysis

1c. AV operational impacts.
   - Income generation values
   - Environmental data
   - AV performance data

2a. Participatory Modelling of AV Suitability.
   - Participatory models
   - Spatial probability maps of AV success

2b. A decision-support tool to inform AV development.
   - Predicted livelihoods benefits
   - Spatial maps

3. Uptake strategy evaluation, policy mapping and dissemination.
   - Region-specific dissemination strategies
   - Horizon scan for policy scenarios
   - Development handbook
   - Policy briefs

AV = Agrivoltaics
Our agrivoltaic systems in Kenya and Tanzania

<table>
<thead>
<tr>
<th></th>
<th>Kenya</th>
<th>Tanzania</th>
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</thead>
<tbody>
<tr>
<td><strong>Stakeholders</strong></td>
<td>Agri-business</td>
<td>Agri-business</td>
</tr>
<tr>
<td><strong>Capacity</strong></td>
<td>65 kWp</td>
<td>36 kWp + battery storage</td>
</tr>
<tr>
<td><strong>Agro-Ecological zone</strong></td>
<td>Semi-arid</td>
<td>Semi-arid</td>
</tr>
</tbody>
</table>
65 kWp Agrivoltaic system
Latia Farm, Kenya
36 kWp Agrivoltaic system
Sustainable Agriculture Tanzania
Spatial potential for agrivoltaics in East Africa

a) Global Horizontal Irradiation

b) People without Energy Access

c) Mean Annual Precipitation

d) Agricultural Croplands

e) Agrivoltaics: Avoiding land-use conflict

f) Agrivoltaics: Enhancing marginal cropland

Analysis by Christine Lamanna (ICRAF Nairobi)
Initial stakeholder perspectives

Communication
• Have agrivoltaic “champions”
• Engage with wider community beyond the direct site

Opportunities
• Diversify into new agricultural processes e.g. irrigation or post-harvest processing
• Lighting for evening activities
• Commercial and economic opportunities for developers

Challenges
• Security
• Prevents mechanised activities
• New approach for developers and engineers

Led by Steve Cinderby (SEI York) and Cassilde Muhoza (SEI Africa)
Roadmap for agrivoltaic development

Context review

Partnership creation

Stakeholder engagement

Pilot systems & empirical research

Industry engagement

Results dissemination

Policy engagement

Business model development & DST

Kaizen - 改善, かいぜん
Summary

• Agrivoltaics offer energy, food, water, land use and socio-economic benefits.
• **Huge potential in East Africa:** suitable environment; food and energy needs; livelihood benefits.
• Several questions need addressing and **locally relevant evidence needed.**
• “**Harvesting the sun twice**” project: assessing potential livelihood benefits.
• Initial spatial assessment of suitability and stakeholder perspectives.
• **Co-design and community engagement is key!**
Thank you
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Latia Farm, Kenya