Overview of renewable energy links to agriculture in Africa

Ag residues used for energy – can reduce deforestation
- To produce electricity:
  - Sugar cane bagasse
  - Palm Oil Mill Effluent (POME)
  - Liquid biofuels (bio-diesel, bio-ethanol)
  - Gasifiers (rice husks, solid biomass)
- To produce cooking fuel:
  - Clean cookstoves (e.g. rice husk briquettes)

Renewable energy used for ag production/processing
- Solar water pumps (can increase ag production on existing ag land and allow production of more residue for energy)
- Solar dryers (can replace charcoal drying for tea, tobacco)
Scaling Up Smallholder Solar Irrigation in Sub-Saharan Africa

July 2018
Smallholders increasingly need irrigation

THE CHALLENGE

95% of food grown in sub-Saharan Africa is rain-fed

climate change

less frequent, more intense rain; increased evaporation and evapo-transpiration

reduction in soil moisture

irrigation required to protect crops against increased risk of failure
Smallholders increasingly need irrigation

THE SOLUTION

large, untapped groundwater resources in sub-Saharan Africa

+ affordable solar pumps

= increased food security and climate change resilience; improved sanitation and hygiene
Solar water pumps: a robust technology

- Solar pumps have been used for irrigation since the 1980s
- Solar panels and a controller are paired with a water pump
- No battery needed
- Solar panels typically guaranteed for 20-25 years
Solar water pumps: a robust technology

- In Kenya, smallholder solar pump prices range from US $200 (up to 15 meters total dynamic head) to US $1,500 (up to 50 meters)

- Cost of solar panels has decreased 60% in last 5 years and expected to decline by another 50% in the next 5 years
Commercial viability of solar water pumps in sub-Saharan Africa

MARKET POTENTIAL WITH INDUSTRY FACILITATION

Using Kenya as an example:

5M smallholder farmers

→ demand for $650 solar pump from 1 million smallholders

+ US $645 avg gross profit margin increase per year from solar pump

= 100,000 solar pumps sold in 5 years

3,000 current annual sales of small solar pumps from all retailers

+ 70% annual increase in sales over next 5 years

= US $65 million invested in solar pumps

*Estimates derived from 2016 findings of the Kenya Agricultural Value Chain Enterprises project, which worked to integrate 500,000 smallholder farmers in 22 counties into value chains.
GHG mitigation potential of solar water pumps

GHG MITIGATION POTENTIAL WITH INDUSTRY FACILITATION

Using Kenya as an example:

- 5M smallholder farmers
- 0.3 tonnes CO$_2$e per year avoided by one 80 Watt solar pump
- 70% market growth each year, starting at 3,000 pumps sold per year

$= 68,000$ total tonnes of CO$_2$e emissions avoided in 5 years

*Estimates assume smallholders would use diesel pumps if solar pumps were not accessible.
Economic benefits to smallholders

SIGNIFICANT INCOME BENEFITS

Case Study: Lilian Akinyi, Homa Bay County

- September 2016: Invested US $786 in solar pump and 12-meter water pipe, stopped renting diesel pump
- Increased irrigated acreage from 1 to 1.25 acres
- Achieved rapid increase in gross profit: US $1,346 marginal increase in 2\textsuperscript{nd} harvest after pump purchase
- Using conservative estimates, gross profit is projected to increase by 350% after paying off solar pump loan

Marginal Increase in Gross Profit In Two Seasons After Solar Pump Purchase (Actual)
Economic benefits to smallholders

SIGNIFICANT INCOME BENEFITS

Case Study: Shadrack Nzioka, Machakos County

- August 2015: Invested US $4,655 in solar pump and drip kit; 27-meter borehole; water tank; land clearing
- Increased irrigated acreage from 0.25 to 0.875 acres; now growing two crops per year instead of one
- Has maintained positive gross profit margin while paying off loan
- Using conservative estimates, gross profit is projected to increase by 215% after paying off solar pump loan

Gross Profit Per 6-Month Season

<table>
<thead>
<tr>
<th></th>
<th>Before Solar Pump (Actual)</th>
<th>After Paying Off 2-year Loan (Projected)</th>
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<tbody>
<tr>
<td>$US</td>
<td>$2,224</td>
<td>$4,798</td>
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</table>

winrock.org
## Barriers to solar water pump sales

**MARKET BARRIERS**

<table>
<thead>
<tr>
<th>Demand Side</th>
<th>Supply Side</th>
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<tbody>
<tr>
<td>Low farmer awareness of solar pumps</td>
<td>Limited repair networks in rural areas</td>
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<tr>
<td>Farmers have few credit options for solar pump purchases</td>
<td>Lack of 3rd-party assessment of solar pump product quality</td>
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<tr>
<td>Lack of aggregated orders for solar pumps</td>
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**SOLUTIONS**

<table>
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<tr>
<th>Demonstrate solar pumps without distorting the market</th>
<th>Aggregate demand for solar pumps by working through value chain actors</th>
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<tbody>
<tr>
<td>Mobilize solar pump loan capital and loan products</td>
<td>CLASP is publishing performance test results for solar pumps</td>
</tr>
</tbody>
</table>
Resources – solar irrigation

Reports/Toolkits
- IRENA Solar Pumping for Irrigation
- Toolbox on Solar Powered Irrigation Systems
- Winrock Kenya Smallholder Solar Irrigation Project

Major Initiatives
- DFID Low Energy Inclusive Appliances
- OFID Solar Irrigation in Rwanda (Energy4Impact)
- Powering Agriculture Grand Challenge
Resources – energy for agriculture

Reports
Global Alliance for Clean Cookstoves
  • Briquettes
  • Ethanol
Small-Scale Biomass Gasification

Major Initiatives
Powering Agriculture Grand Challenge
Cogen for Africa project
Projects using jatropha for biofuels in Africa
THANK YOU

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