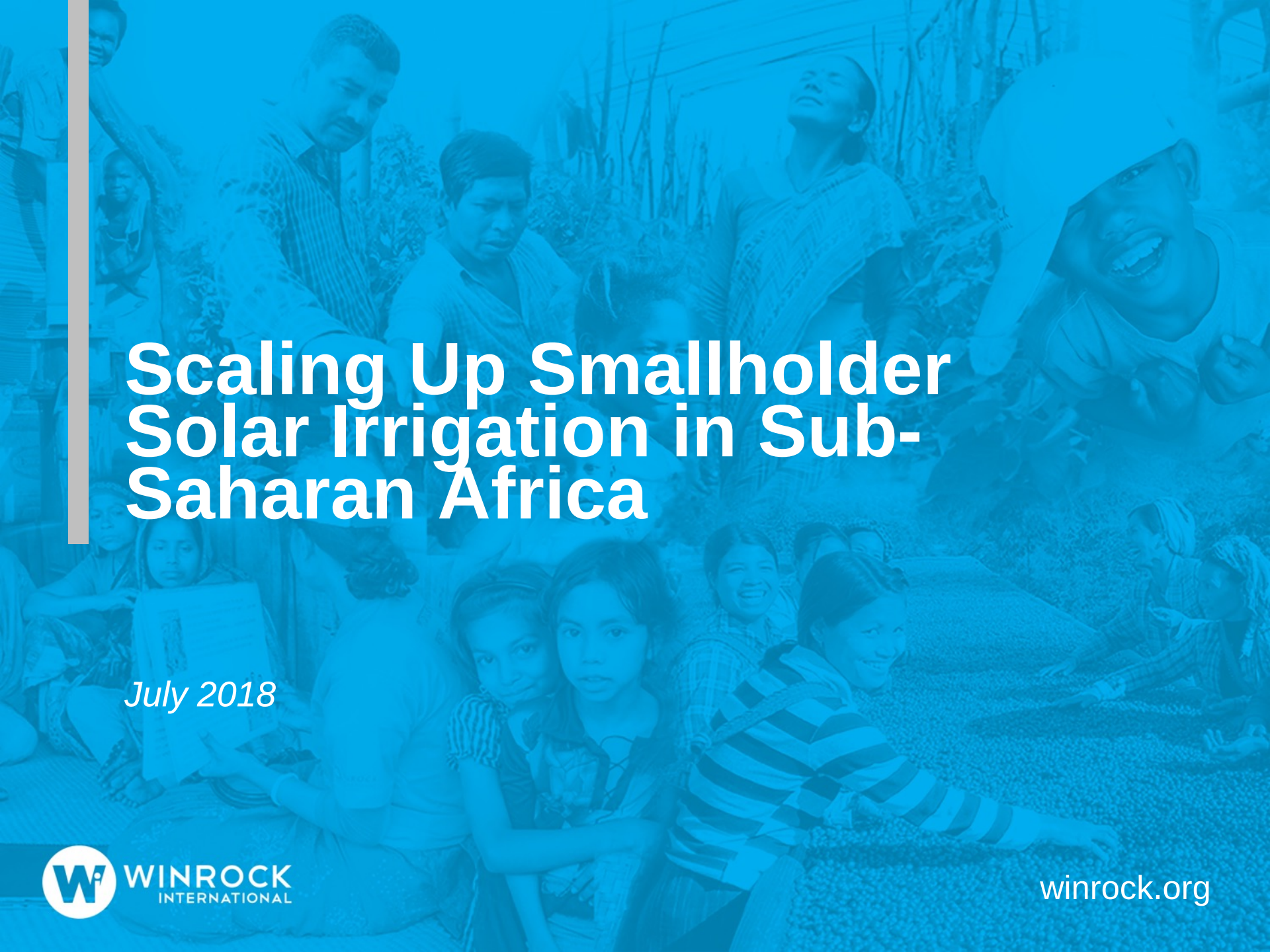
Overview of renewable energy links to agriculture in Africa

- 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

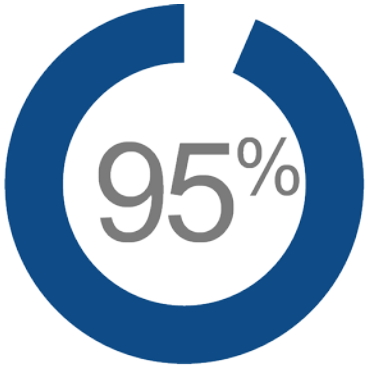
July 2018

WINROCK INTERNATIONAL

winrock.org

Smallholders increasingly need irrigation

THE CHALLENGE

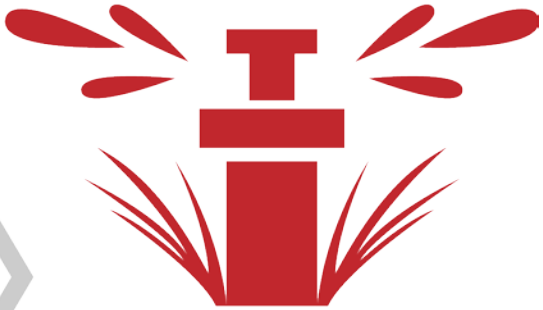


of food grown in sub-Saharan Africa is rain-fed

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

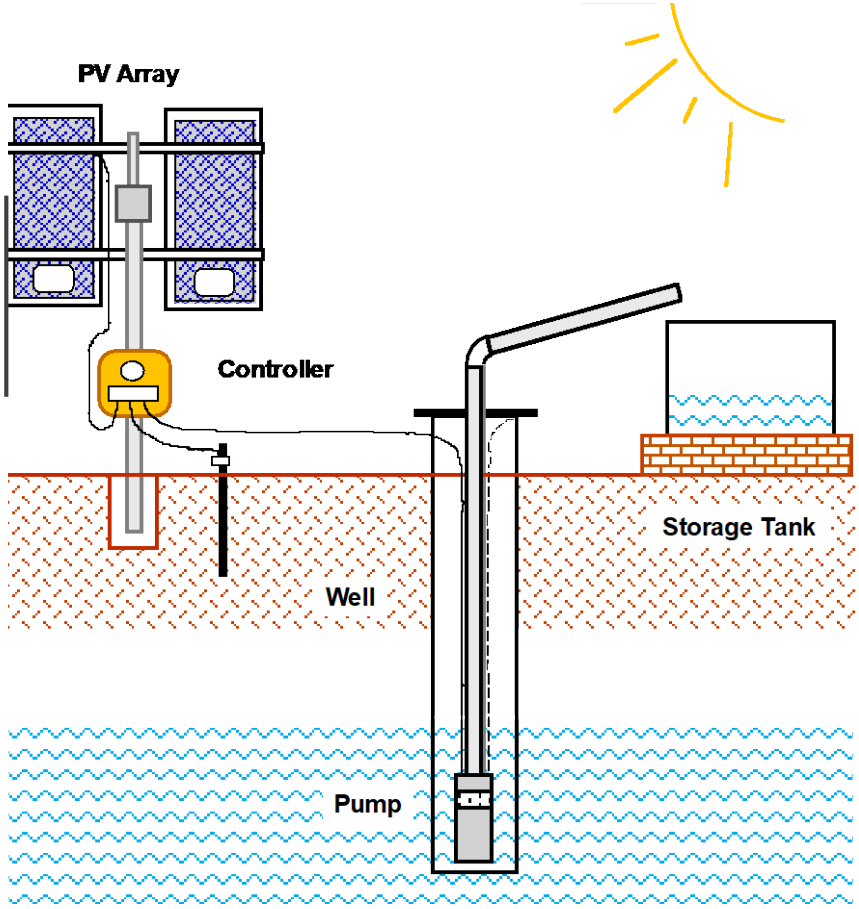
+

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:*

→ 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:*

→ **0.3 tonnes CO_2e 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_2e emissions avoided in 5 years**

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

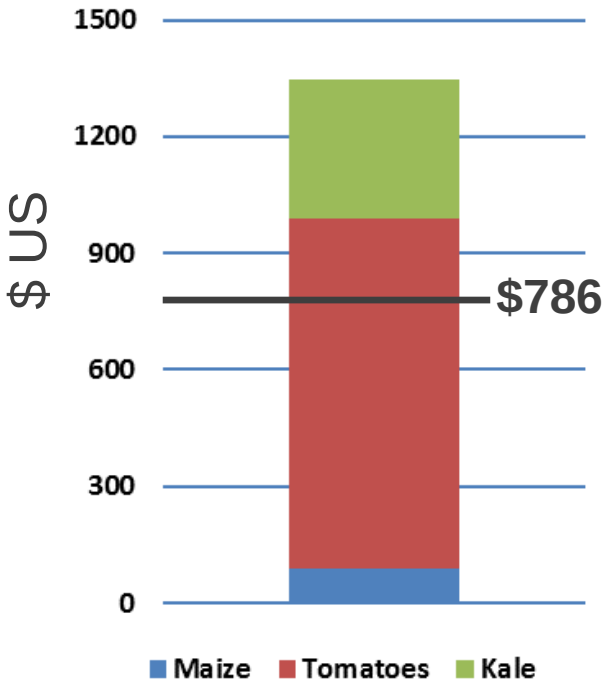
Economic benefits to smallholders

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 2nd 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)

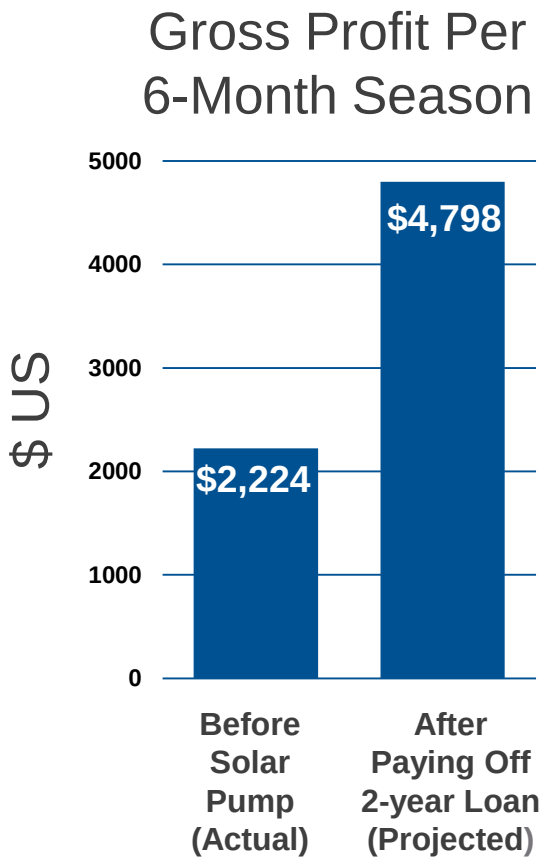


Economic benefits to smallholders

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



Barriers to solar water pump sales

MARKET BARRIERS		SOLUTIONS
DEMAND SIDE	Low farmer awareness of solar pumps	Demonstrate solar pumps without distorting the market
	Farmers have few credit options for solar pump purchases	Mobilize solar pump loan capital and loan products
	Lack of aggregated orders for solar pumps	Aggregate demand for solar pumps by working through value chain actors
SUPPLY SIDE	Limited repair networks in rural areas	
	Lack of 3rd-party assessment of solar pump product quality	CLASP is publishing performance test results for solar pumps

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

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