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Efficiency for Access Design Challenge Technology Week: Webinar 2: Agriculture



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Max Garnick, Product Manager, SunCulture

- Nairobi-based AgTech Company
- Mechanical Engineer
- Studied at Northeastern University, Boston, Massachusetts



Matt Carr, CEO of Agsol

- Renewable Energy and Technical Specialist
- Living in Nairobi
- Leads business operations, drives sales and develops partnerships



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Max Garnick

Product Manager, SunCulture



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SunCulture

SunCulture develops and commercialize life-changing technology that solves the biggest daily challenges for the world's 570m smallholder farming households



SunCulture

Max Garnick
October 15th, 2019

<https://www.youtube.com/watch?v=jdaQU1irGU>



96% of Africa's smallholder farmers rely on rainfed agriculture

Waiting for the rain presents significant challenges, especially as weather patterns become more unreliable

Low-value crops

Rainwater is only sufficient to grow staple crops like maize and potatoes

Low yields

Africa's agricultural productivity is 50% lower than the world average

Limited growing seasons

Farmers cannot use their fields during the dry seasons



Farmers are trapped at the bottom of the productivity ladder

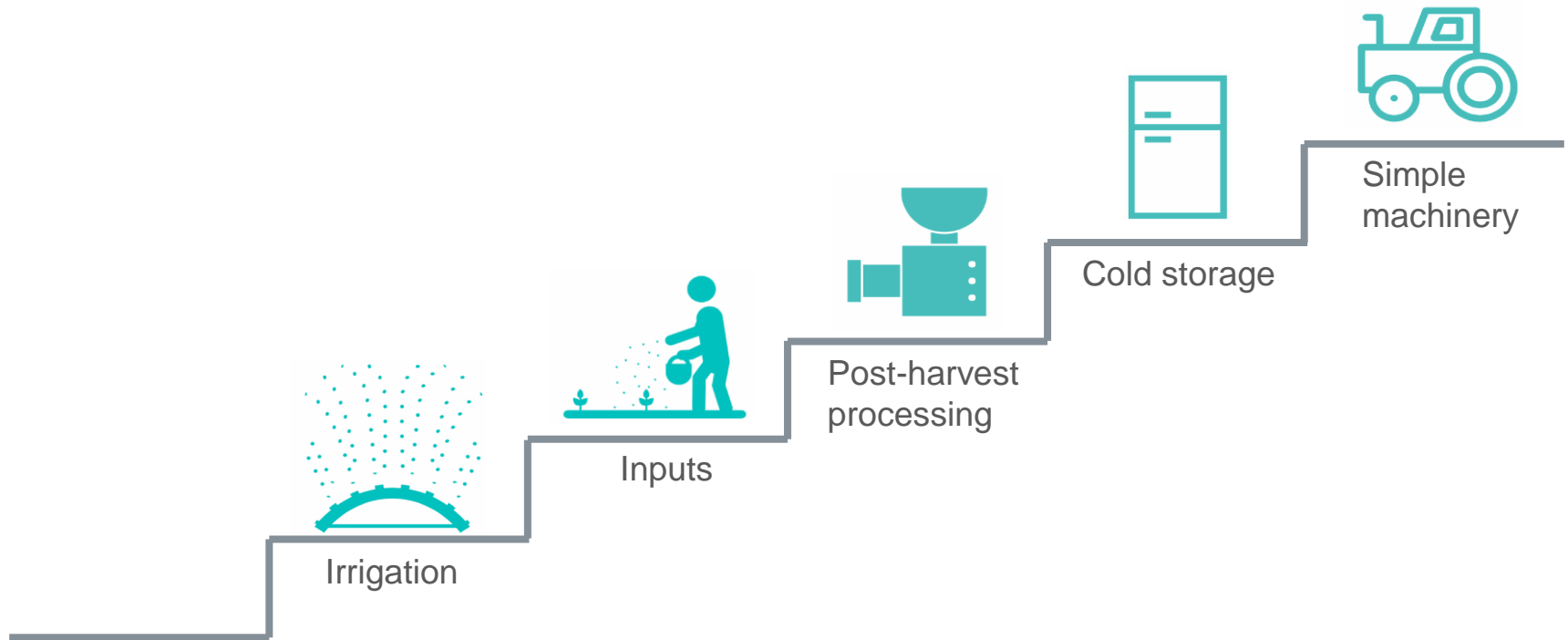
Smallholders make only \$600-\$1,000 a year, and are always just one bad harvest away from financial insecurity. As a result, they are unable to invest in their farms or in their families' futures



Sources: World Bank

Irrigation is the first step up the productivity ladder

With 2X – 5X higher yields, farmers can raise their incomes and continue investing in productive-use technology



Irrigation is a \$65 billion opportunity in Africa

With new technologies, we can channel the continent's existing resources into unlocking agricultural productivity

Groundwater

There is enough water below our feet to expand irrigation by 20X across Africa, and 120X in 13 countries (covering 13.5m hectares of land)

Solar power

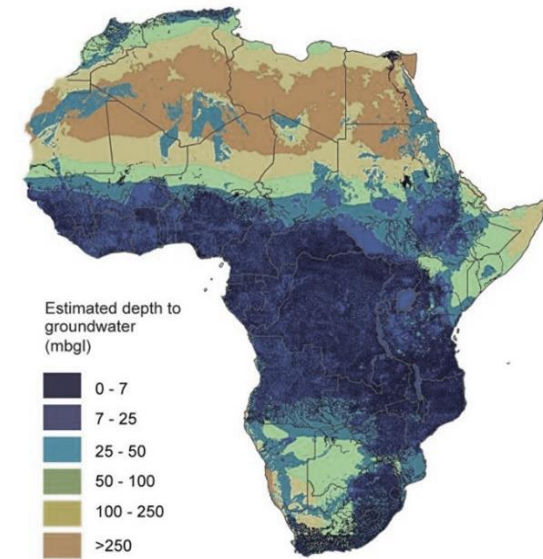
Abundant sunshine, paired with the falling costs of solar panels and lithium batteries, provides clean, affordable energy sources for irrigation systems

Mobile connectivity

High mobile penetration streamlines payments and customer communication, while introducing the potential for data-driven, precision agriculture

Arable land

Africa has 65% of world's unused arable land. Irrigation will enable more land to be cultivated and increase the productivity of land under use today



Sources: McKinsey, IFRI, CGIAR, World Bank

SunCulture is tackling the irrigation gap head-on

IoT-enabled solar energy systems and irrigation equipment, designed specifically for the needs of smallholder farmers

Our flagship product

The RainMaker 2 solar water pump, powered by the ClimateSmart Battery intelligent energy management system



Highest specifications on the market

RainMaker 2 pump can pull water from 70m below ground, while the ultra-powerful ClimateSmart energy system is capable of 500W output

The full package for smallholder farmers

Base system comes with sprinklers and 100m of piping for irrigation, as well as two 5V phone charging ports and a set of 4 lights for the house

Access to financing and value-add services

Pay-As-You-Grow credit enables customers to pay over 12-30 months, while supported by installation, repair and maintenance, aftersales support, and tailored agronomy advice

Ability to continue up the productivity ladder

“Plug and play” upgrades like drip irrigation, TVs with agricultural content, and pressure cookers (egg incubators, agri-machinery to come)

ClimateSmart Direct™

Solar Water Pump Controller



Description

ClimateSmart Direct™ is a revolutionary IoT-enabled MPPT converter and brushless DC (BLDC) motor controller optimized for battery-free operation of motor-based off-grid products (solar water pumps, agro-processing equipment, refrigerators, etc).

Features

- Drives 12V / 24V / 36V BLDC motors up to 540W
- Pay-as-you-go remote monitoring with aftersale identification and device locking provided to distributors through the easy to use Sentinel IoT Dashboard & API
- MPPT voltage can be tuned through cloud to work with 30, 36, 60, and 72 cell PV panels
- GSM/SigFox connectivity enable PAYG shut-off with IoT for device settings and remote monitoring
- Robust PV reverse polarity protection
- High efficiency (Max. ~99%)
- Drives BLDC motors even in cloudy weather or shaded PV conditions with as low as 30W of panel power
- 2G and SigFox IoT cloud connectivity
- WiFi & GPRS over-the-air (OTA) update support for firmware upgrades
- Sensor-based dry run protection detects when water source runs dry, disables pump and sends SMS notification to customer

Our customers increase their incomes by 5X - 10X

SunCulture offers a diverse value proposition for an underserved market



Customer case study: David Kirubi Mutuga

David is a 43-year-old farmer based near Eldoret, Kenya, who switched from a diesel pump to SunCulture seven months ago

Higher income



Expanded land used on his farm from 1 acre to 3 acres



Producing 5X more cabbages, 1.5X more potatoes



Can grow in the dry season, when prices are 10X higher



Diversifying with spices, which are high-value cash crops



Planning to buy more cows and start making yogurt to sell

Better quality of life



Can do other farm work while the system pumps, without the manual adjustments of diesel



Free from respiratory problems brought on by diesel generator and kerosene lights



Additional income is being used to send a child to boarding school

Scaling up access to irrigation has far-reaching effects

Unlocking the productivity of smallholder farmers is critical for inclusive, sustainable development in Africa

Improving food security



Despite having most of the world's arable land, Africa is projected to spend up to \$110B per year on importing food by 2025. Increasing agricultural productivity will empower Africa to **feed itself**

Sources: African Development Bank, Malabo Montpellier Panel, UN, World Bank, AGRA

Lifting millions out of poverty



There is \$150B in unmet annual demand for agricultural finance in Africa. De-risking farming through irrigation enables farmers to tap into the financing and markets that will keep them climbing up the productivity **ladder**

Fueling economic growth



Agriculture employs more than half of the population in Africa, and comprises 15% of the continent's GDP. Irrigation expansion in sub-Saharan Africa could generate up to US\$22B per year

Irrigation is only the first step in our journey

Through continual innovation, we will accompany our customers as they progress up the productivity ladder



Technology

Smart, relevant technologies tailored for farmers



Information

Access to data and advice to boost productivity



Credit

Affordable financing and risk models that unlock lending



Services

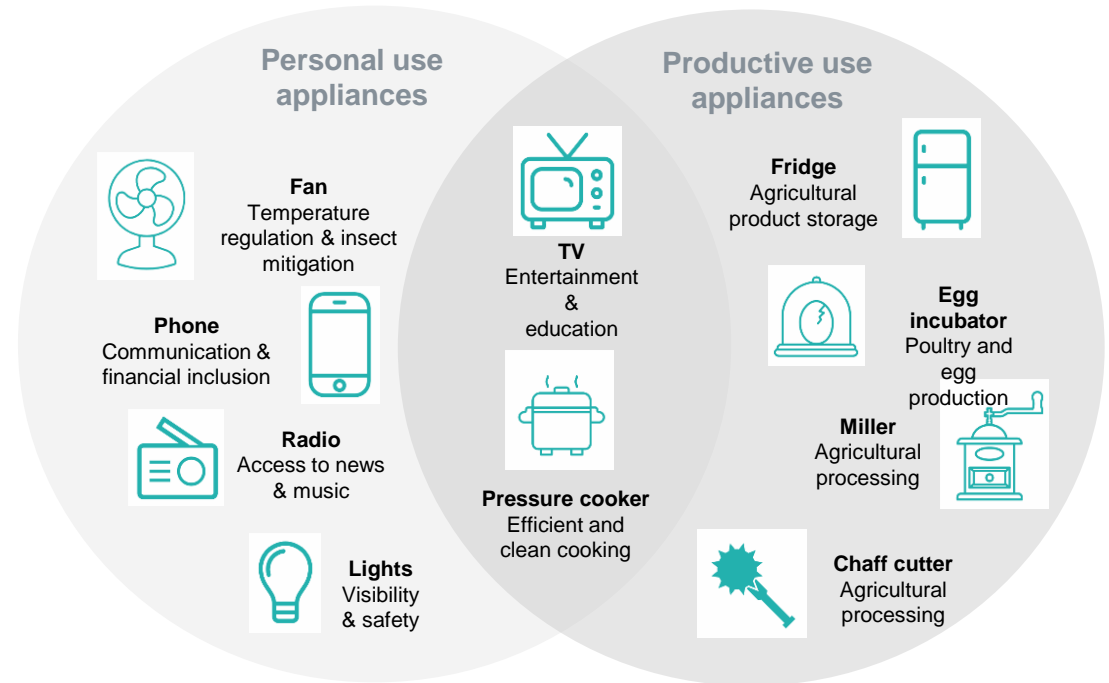
Dedicated customer care and value-add services

SunCulture is the access point for farmers' technology needs

With 500W output capacity, the ClimateSmart Battery™ system can power additional personal use and productive use appliances

A natural upgrade ladder

We are developing a suite of upgrades that farmers can layer onto their base systems to continually increase income and quality of life



*We're building a world where people
take control of their environment in
rewarding, sustainable ways...*



*...by developing and commercializing life-
changing technology that solves the
biggest daily challenges for the world's
570m smallholder farming households*

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Matt Carr

CEO of Agsol





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A G S O L

Solar Powered
Agro-Processing Machines

Matt Carr
matt@agsol.com



1 billion people have no access to electricity

Most are smallholder farmers and depend on agriculture for their livelihood

MILLING STAPLE FOODS CREATES HARDSHIP FOR OFF-GRID FARMERS



Manual processing: <200W
Laborious, inefficient, a few kg/hr

TECHNOLOGY
& MARKET
GAP



Diesel mills: >7,500W
Costly, larger towns only, >150 kg/hr

Women farmers across Africa spend up to 15%, or 30 billion hours annually, of their time processing foods.

Off-grid households spend \$50/yr on milling, so a community of 50 families has \$2500 to invest in a better solution.



THE PROBLEM WITH DIESEL MILLS

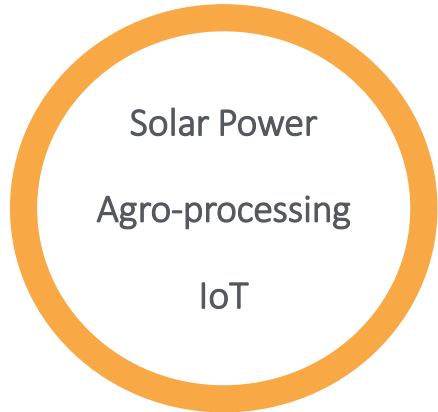
Diesel powered mills are the incumbent agro-processing technology in off-grid areas across the developing world

But even the smallest diesel mills are over capacity and unviable in small communities

That means people living in small communities are forced to process manually or transport produce to larger and often remote villages

That burden is usually tasked to women and girls who waste up to 1 hour every day manually processing or transporting produce to/from diesel mills

THE AGSOL SOLUTION: PRODUCTIVITY LED ENERGY ACCESS



- ✓ Income generation
- ✓ Labour efficiency
- ✓ Energy access



Productive anchor loads are and always have been the most effective driver for rural electrification

OUR CUSTOMERS & COMPETITORS

TARGET CUSTOMERS

Village entrepreneurs who want to sell milling and energy services for a fee to end users.

Farmer cooperatives that jointly own, operate and profit collectively.



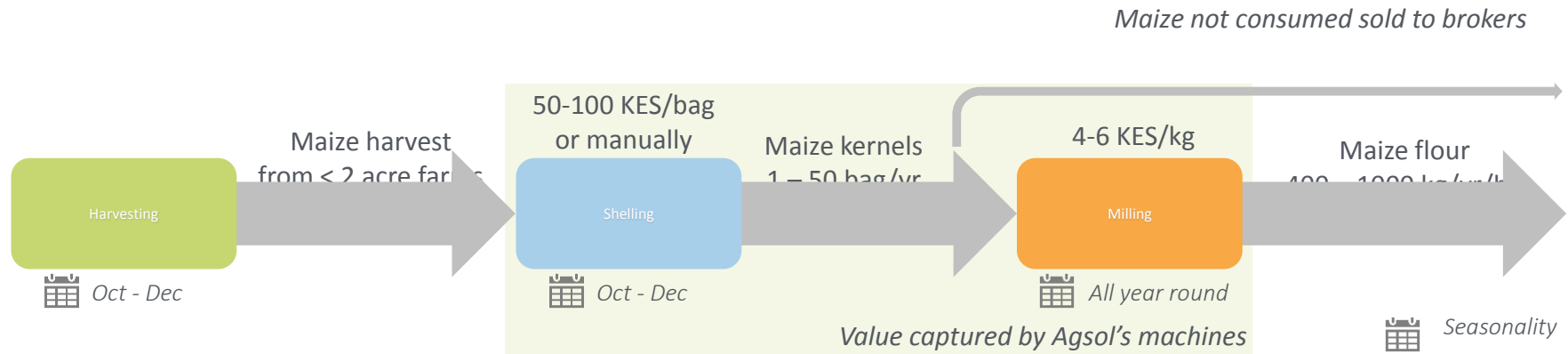
COMPETITORS

Diesel mills, which are inefficient, polluting and unviable in small villages.

www.solarmilling.com is the only other company making solar mills - twice the cost, inefficient, no other power services, poor market fit, NGO model.

OUR FIRST MARKET: THE MAIZE AGRO-PROCESSING VALUE CHAIN FOR SMALLHOLDER FARMERS

Small scale farmers shell 100% of their maize after harvest, store what their family needs to survive for the year ahead, and process what they eat every week – i.e. milling services are required year round

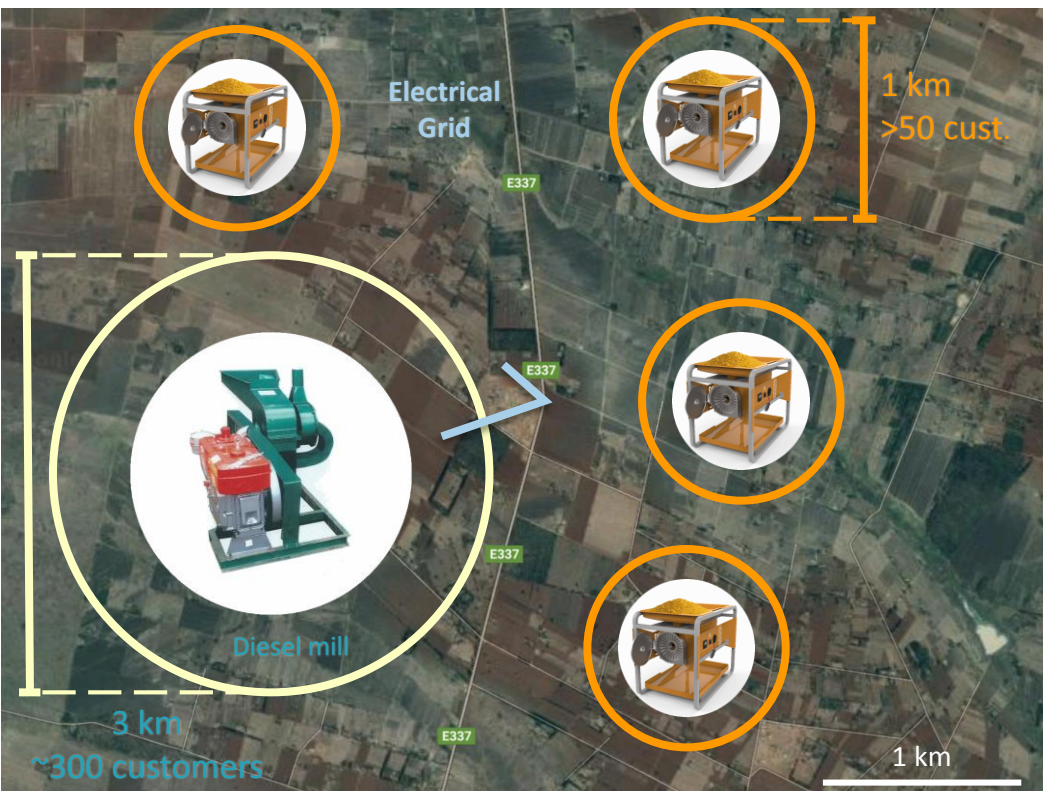


In Kenya, maize shelling and milling for small scale maize farmers annually generates a turnover of ~ 115 million USD for the owners of agro-processing machines

- More than 3.5 million smallholder maize farmers grow less than 2 acres
- Up to 25 million USD can be generated by shelling activities
- Up to 90 million USD can be generated by milling activities

Sources: USAID, Direct interviews with small scale farmers in Laikipia, Uasin Gishu, Nandi Hill, and Trans-Nzoia counties

ACCESS TO HAMMER MILLS CREATES HARDSHIP AND INEFFICIENCIES

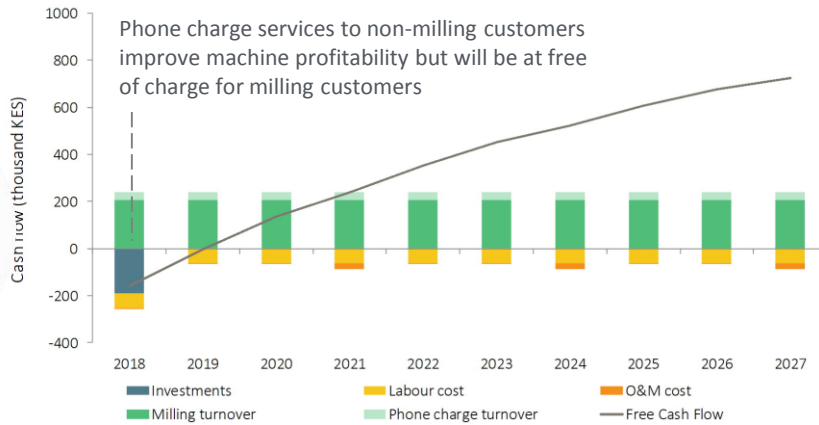


Potential for Agsol's hammer mills around an existing diesel mill in Trans-Nzoia county

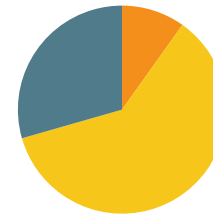
- Off-grid communities in rural Kenya are located 1 to >10 km away from the power grid.
- Diesel hammer mills are the only option in these communities, where farmers need to travel from 1 to 5 km or more to get to these mills.
- Most of the trips are performed by women or girls, wasting up to 1 hour per day, and keeping them from school or more productive activities.
- Within 1 km diameter, an off-grid community can have more than 100 households.

COMPARED TO DIESEL MILLS, AGSOL PROVIDES A MILLING SERVICE AT LOWER PRODUCTION COST AND LOWER PAYBACK PERIODS IN SMALL VILLAGES

Agsol



Production cost : 2,5 KES/kg

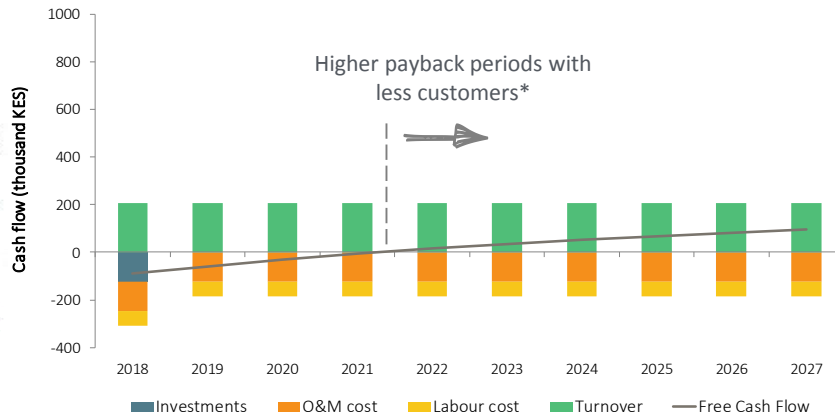


Σ costs of sales Σ Overhead Σ Investment

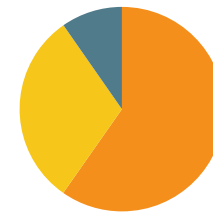
Main assumptions:

- Solar system: 500W + 2hrs batteries
- Max capacity: 75kg/hr
- Retail price: 191 500 KES
- Number of customers: 80
- Daily volume of maize milled: 133kg
- Service charge: 5 KES/kg
- Daily number of phone charges: 10
- Phone charge fee: 10KES/charge
- Annual maintenance: 2.5% of CAPEX

Diesel mill



Production cost : 4,9 KES/kg



Σ costs of sales Σ Overhead Σ Investment

Main assumptions:

- Max capacity: 180kg/hr
- Retail price: 150 000 KES
- Number of customers: 80
- Daily volume of maize milled: 133kg
- Service charge: 5 KES/kg
- Diesel cost: 100KES/L
- Diesel consumption: 0.03L/kg
- Annual maintenance: 5% of CAPEX

*Field survey show that many diesel mills operate at capacities <80 kg/day, which translates into even lower revenues and higher production costs

BUSINESS IMPACT – 2023 PROJECTIONS



GROWING

Economic

No. of Agsol mills sold per annum	30,000
Agsol revenue from sales	14 million USD
New productive energy use per year	16 MWh
Customer income generated from selling milling services	41 million USD



VILLAGE

Social

Women's time saved per annum	170 million hours
Households with improved milling/energy access	1.3 million
New jobs created in rural areas	37,000
Proportion of Agsol employees who are women / in leadership	50% / 40%



LIFE

Environmental

Diesel avoided from traditional mills per annum	14 million litres
CO2 offset per annum	39,000 tonnes



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