Efficiency for Access Design Challenge
Technology Week:
Webinar 2: Agriculture
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 is Nairobi
- Leads business operations, drives sales and develops partnerships
Max Garnick
Product Manager, SunCulture
SunCulture develops and commercialize life-changing technology that solves the biggest daily challenges for the world’s 570m smallholder farming households.

Max Garnick
October 15th, 2019
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

Higher yields
Yields increase by 2X - 5X, while eliminating risk of losing harvest due to insufficient rain

More cash crops
An abundant supply of water sustains cash crops, like kale, tomatoes, and spices

Time savings
Not having to fetch water manually gives farming households back 17 hours a week

Higher income

More livestock and milk
More water and feed for raising livestock, along with 1.5X - 2X increase in milk production

More land under use
Customers can grow during the dry season, and put more of their land under cultivation

Access to clean energy
Switching from kerosene to electricity improves respiratory health and children’s ability to study at night

Better quality of life
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.
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.
Any questions?
Matt Carr
CEO of Agsol
Solar Powered Agro-Processing Machines

Matt Carr
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1 billion people have no access to electricity

Most are smallholder farmers and depend on agriculture for their livelihood
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.

**TECHNOLOGY & MARKET GAP**

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

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

Solar Power
Agro-processing
IoT

✓ Income generation
✓ Labour efficiency
✓ Energy access

Consumer appliances
Lighting
Education
Comm’s & technology
Health
...and much more

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

Maize not consumed sold to brokers

Harvesting
Maize harvest from < 2 acre farms
Oct - Dec

Shelling
50-100 KES/bag or manually
Oct - Dec

Milling
Maize kernels 1 - 50 bag/yr
4-6 KES/kg
Maize flour 400 - 1000 kg/yr
All year round

Value captured by Agsol’s machines

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

• 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.

Potential for Agsol’s hammer mills around an existing diesel mill in Trans-Nzoia county
**COMPARED TO DIESEL MILLS, AGSOL PROVIDES A MILLING SERVICE AT LOWER PRODUCTION COST AND LOWER PAYBACK PERIODS IN SMALL VILLAGES**

**Production cost:** 2.5 KES/kg

**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

**Production cost:** 4.9 KES/kg

**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

**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

**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%

**Environmental**
- Diesel avoided from traditional mills per annum: 14 million litres
- CO2 offset per annum: 39,000 tonnes
Any questions?