GOGLA

The Voice of the Off-Grid Solar Energy Industry

USAID FROM THE AMERICAN PEOPLE

POWERING AGRICULTURE: AN ENERGY GRAND CHALLENGE FOR DEVELOPMENT

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Community of Champions Webinar Series

Webinar 3: Socio-Economic Benefits of the Off-Grid Solar Sector

Logistics:

1. This is an audio broadcast. Attendee microphones will remain muted during the presentations. Only during the Q&A microphone access can be granted.
2. To ask questions during the webinar, please use the question box on the right-hand side of the webinar session. Please submit your question at any time during the webinar presentation.
3. The webinar recording will be emailed to all attendees and registrants.

Community of Champions

The Community of Champions was formed as an opportunity for high-level, ongoing exchange between **governments, the private sector** and **development partners to work collaboratively** towards creating a **supportive policy environment** to help achieve **universal energy access** in Africa.

- **Lisbon** May 2018
- **Kigali** November 2018
- **Addis Ababa** March 2019
  - (Eastern and Southern Africa only)
- **Dakar** October 2019
- **Nairobi** February 2020

GOGLA

ESMAP
Energy Sector Management Assistance Program
LIGHTING GLOBAL | WORLD BANK GROUP

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SUSTAINABLE ENERGY FOR ALL

POWER AFRICA
A U.S. GOVERNMENT-LED PARTNERSHIP

Agenda

- **Introductions and overview of the Community of Champions** - Francis Wainaina , GOGLA
- **Socio-Economic Benefits of Off-Grid Solar – Powering Opportunity Research**– Sjef Ketelaars, GOGLA
- **Q&A**
- **Powering Agriculture: An Energy Grand Challenge,** Mikael Matossian, Renewable Energy Specialist, Tetra Tech & Paolo Mele, Off-Grid Policy Consultant, Tetra Tech
- **Innovator Spotlight**– Ava Zhang, Chief of Staff, SunCulture
- **Q&A**
- **The True Cost of Solar Tariffs in East Africa** – Jonathan Phillips & Robert Fetter, Energy Access Project at Duke University
- **Q&A**
- End of the webinar

Socio-Economic Benefits of Off-Grid Solar – Powering Opportunity Research

Sjef Ketelaars, GOGLA, s.ketelaars@gogla.org

GOGLA

The Voice of the Off-Grid Solar Energy Industry

Powering Opportunity East Africa

Socioeconomic Impact Research

Solar Home Systems

- Funded by the DFID Sustainable Energy Access and Gender programme

- Undertaken by GOGLA and Altai Consulting
  - August 2017 – July 2018
  - November 2018 – March 2020

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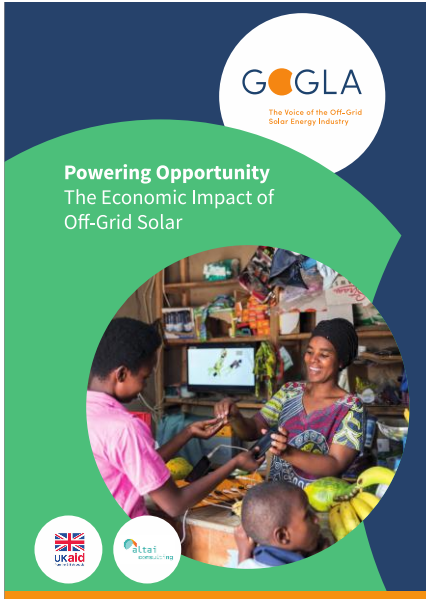
Powering Opportunity Series



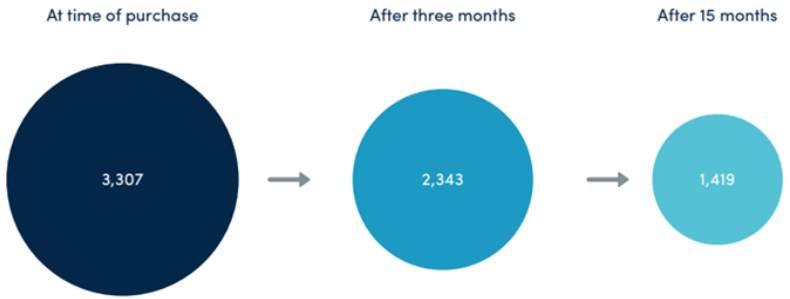
July 2018

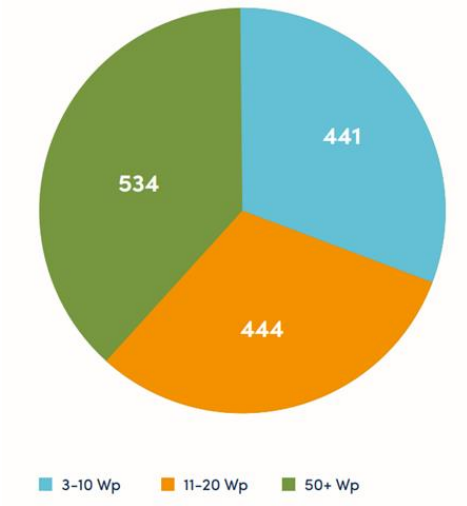
September 2019

December 2019

Methodology

- 1,419 households surveyed
- Baseline and follow-up interviews after 3 months and 15 months
- Rural, peri-urban and urban locations
- Impacts studied based on system size



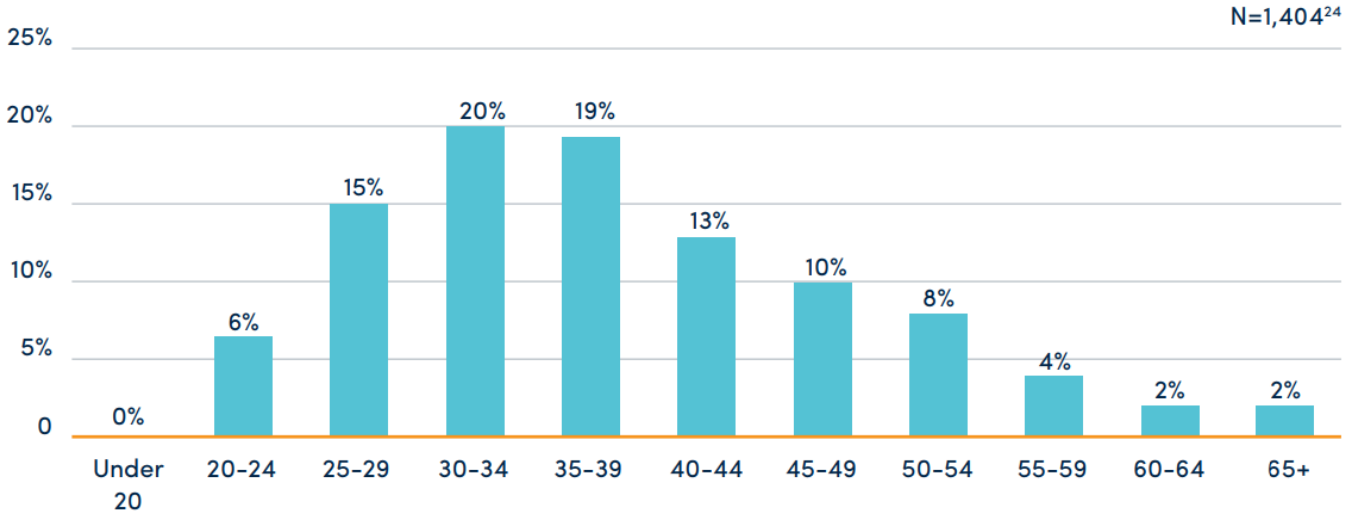


Sample size by system size

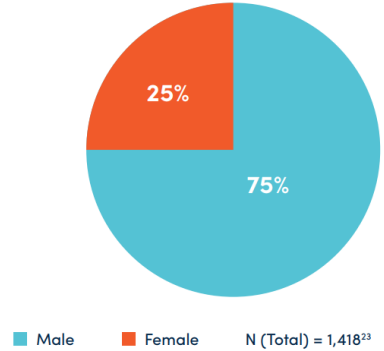
The Solar Home System Customer

The Solar Home System customer

- Purchaser: Male, 38-years old
- Household has 5.7 family members
- Beneficiaries: 51% children, 49% women or girls

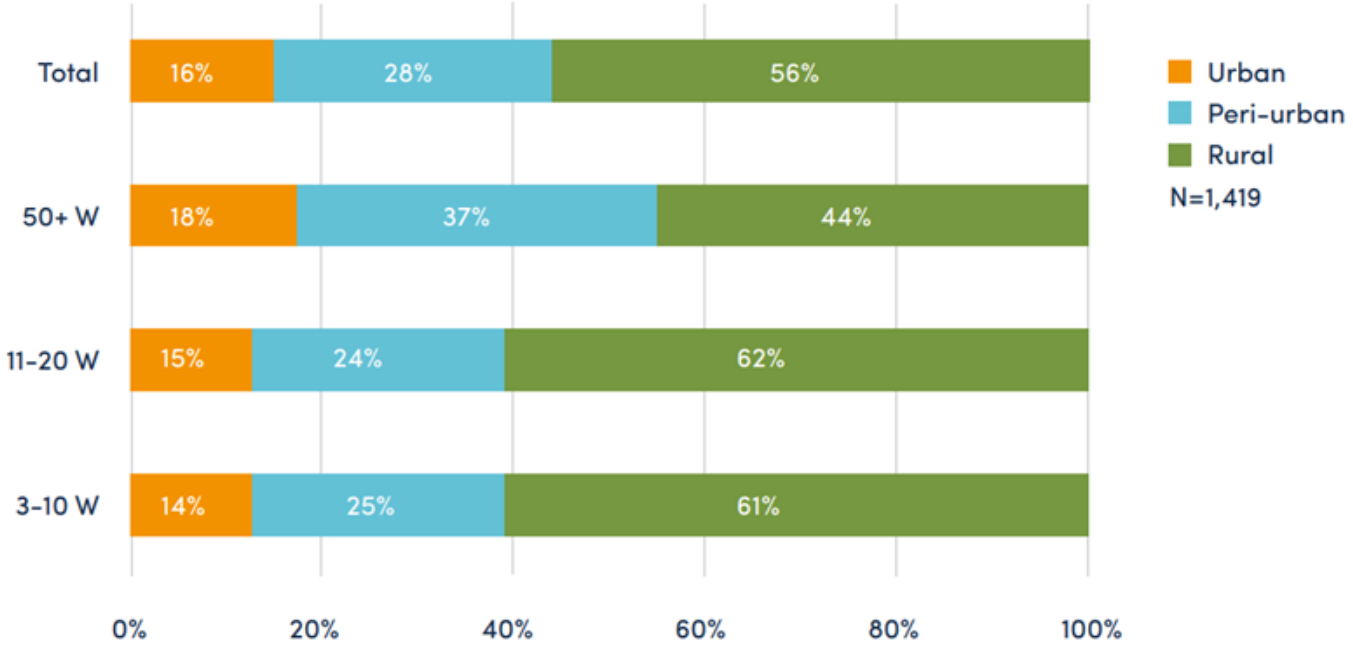


Average age of customer



The Solar Home System customer

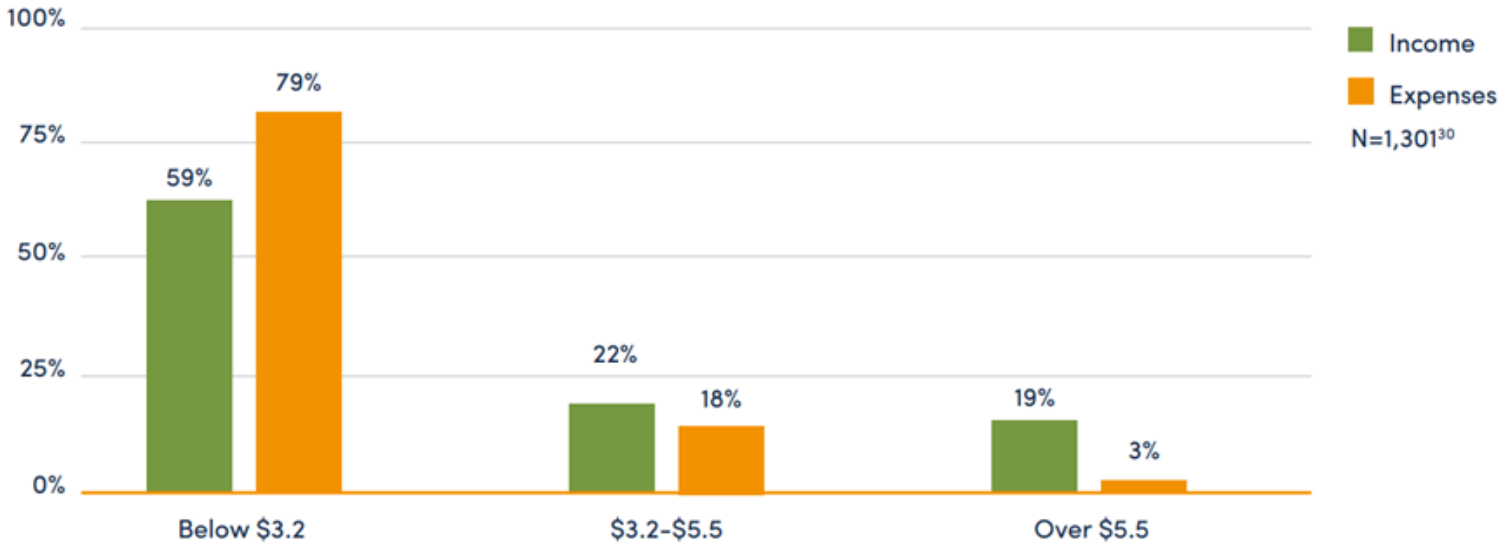
- Lives in a rural area



Distribution of households by type of location and system size

The Solar Home System customer

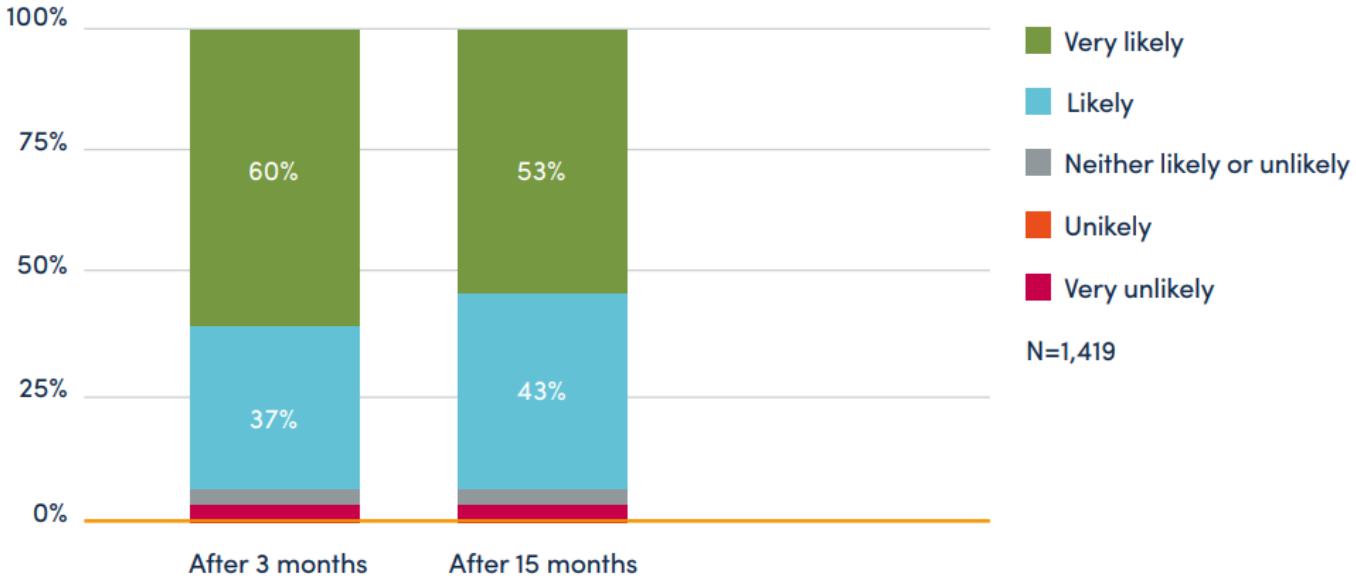
- 59% report an income below $3.20 per day



Reported income and expense levels

The Solar Home System customer

- Likelihood to recommend system remained stable



Likelihood to recommend over time

Economic Impact

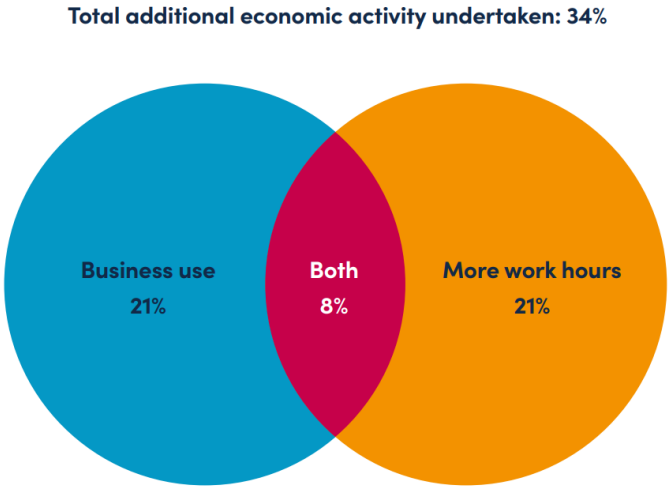
Key findings

After 15 months, 34% of households undertake more economic activities thanks to off-grid solar

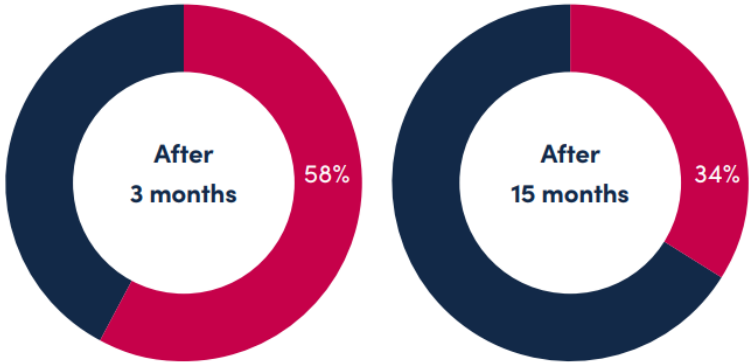
28% of solar home system owners increased their income per month – by $46 on average

SHS help household to work more or start new activities. Overall, this additional work translates in 21 FTE jobs per 100 SHS sold

Economic activity

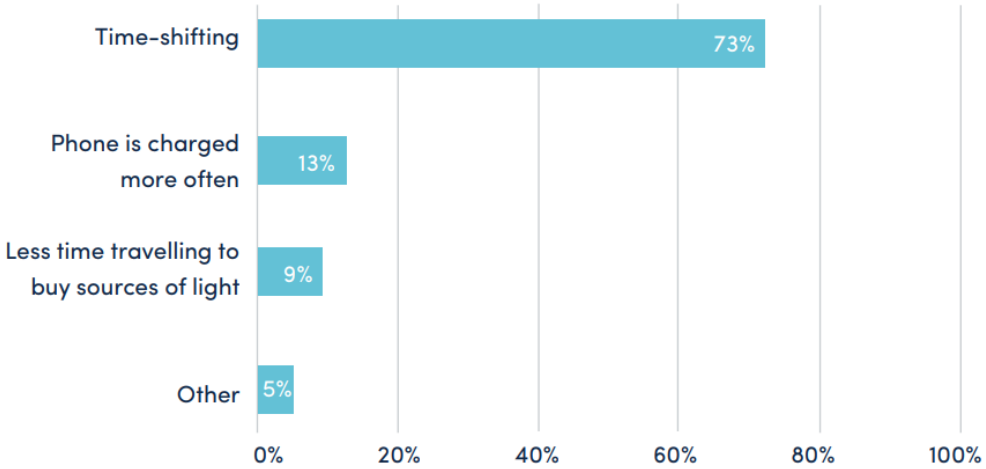


Type of additional economic activity undertaken reported by households

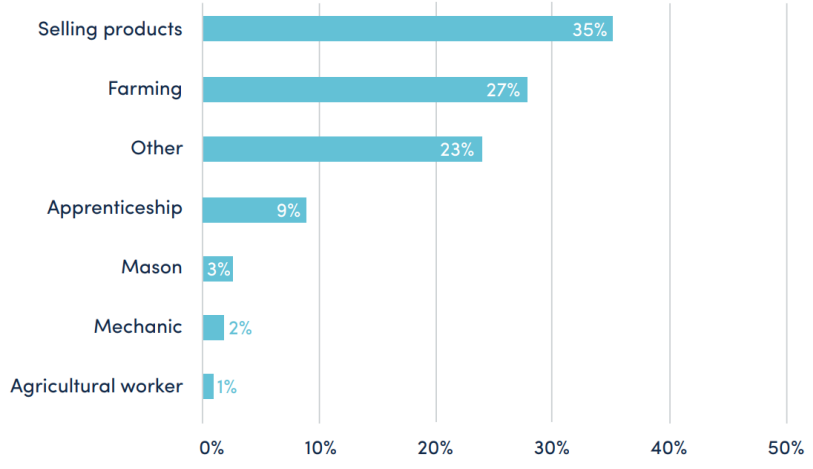


Share of households reporting additional economic activity since the purchase of the product after 3 months and after 15 months

More work hours



How the SHS is generating opportunities



Main types of activities conducted through more work hours

Open for business

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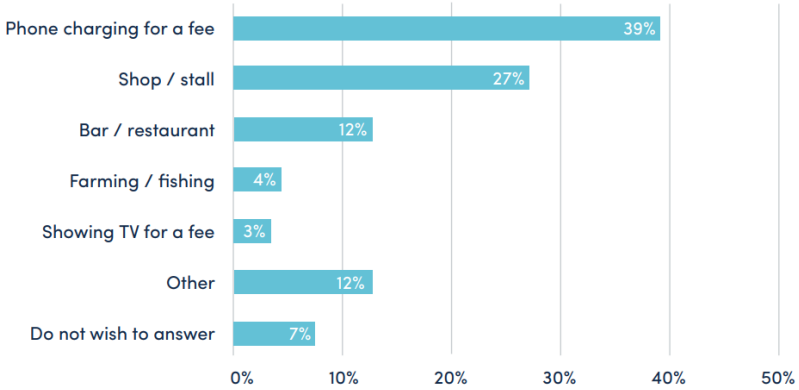
21% of households use their SHS in a business or income generating activity

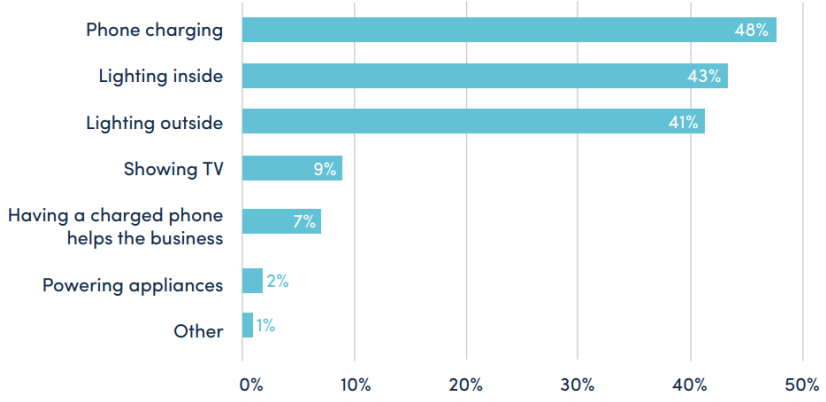
52% are new business, while 48% existed prior to the purchase of the SHS

This helps households generate an additional $34 per month

Open for business



Types of business using a SHS



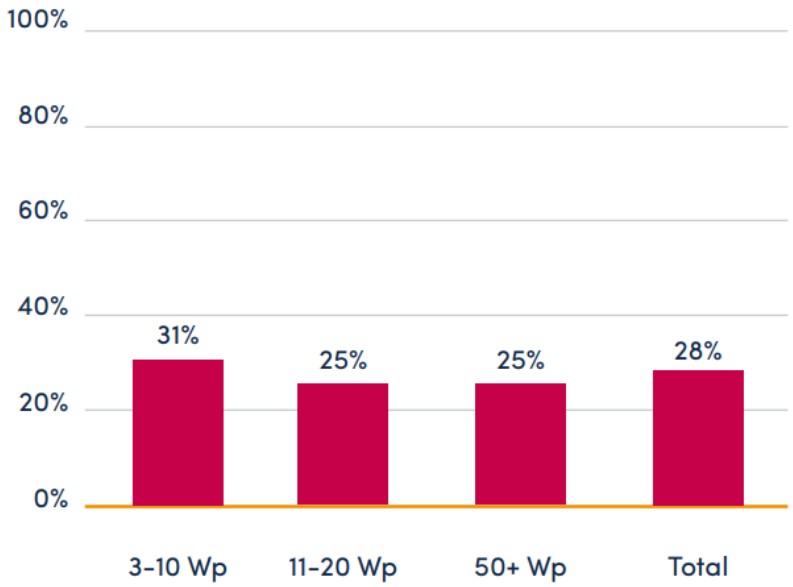
How the SHS is used in businesses

Open for business

		Share of business		Average income generated	
		After 3 months	After 15 months	After 3 months	After 15 months
	Phone charging for a fee	34%	39%	$13	$16
	Shop or stall	20%	27%	$36	$50
	Bar or restaurant	11%	12%	$46	$52

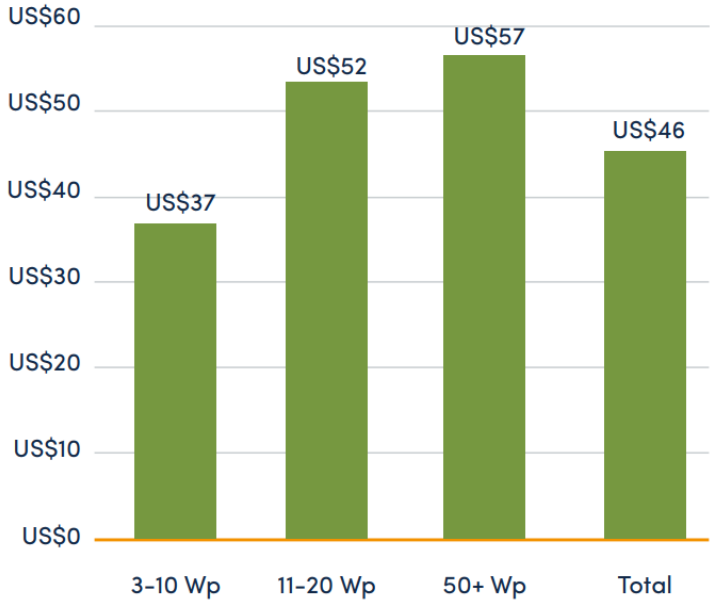
Key business types and monthly income generation

Income generation



Share of households generating income thanks to the SHS after 15 months

Income generation

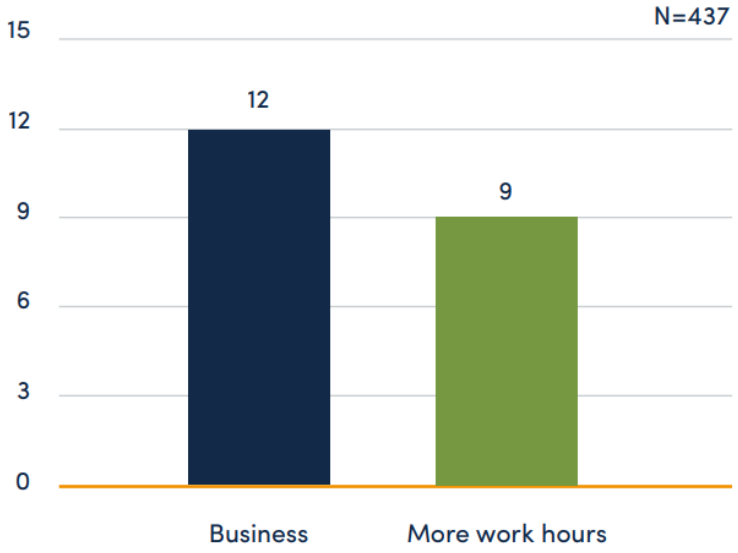


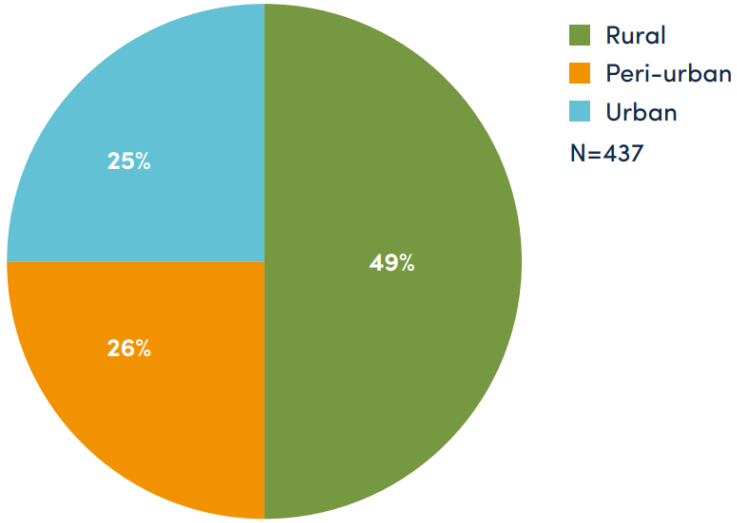
Average income generated after 15 months by system size (per month)

Evolution of the average additional income (per month)

Off to work

- 21 FTEs per 100 systems sold
- 49% of these FTEs are in rural areas, 52% are undertaken by women

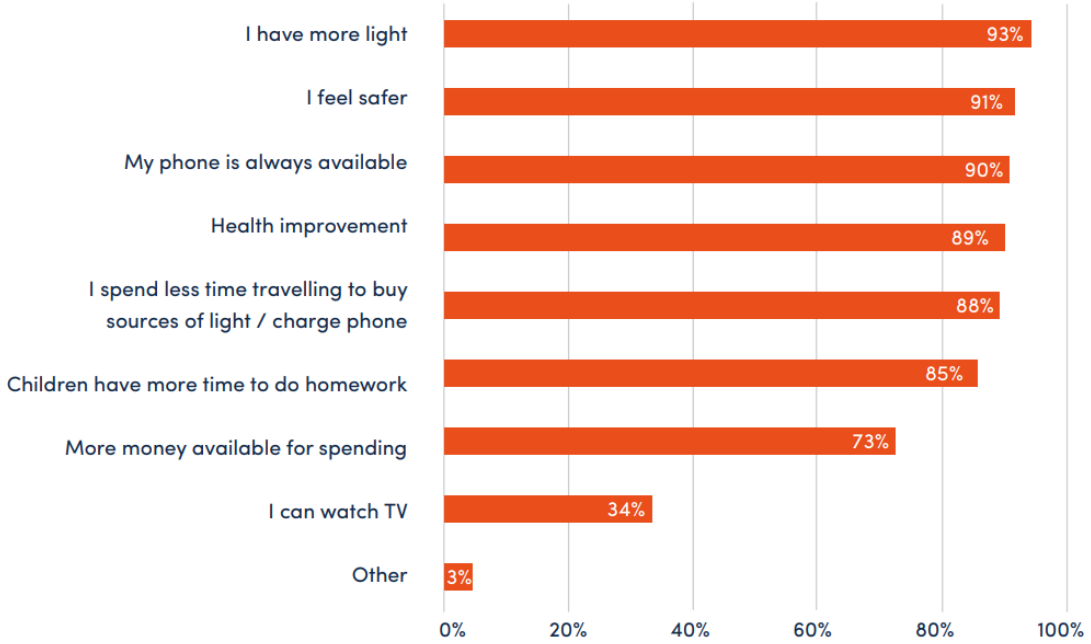




Quality of Life

Changes in Quality of Life

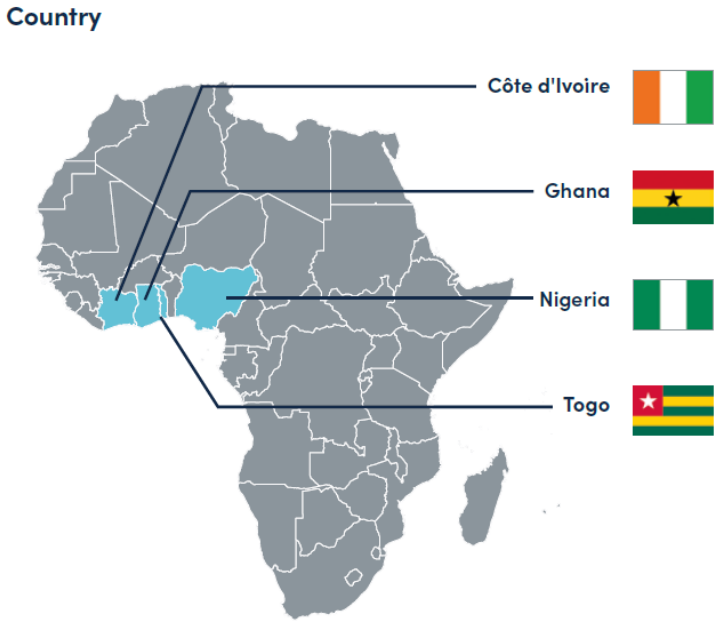
- After 15 months, 94% of households report the SHS has improved their quality of life
- Access to light (93%), improved safety (91%) and a charged phone (90%) are most frequently mentioned



West Africa: Sneak Peak

West Africa: Sneak Peak

- 1,678 households surveyed
- Baseline and follow-up interviews after 3 months
- Rural, peri-urban and urban locations
- Report to be released beginning of December



West Africa: Sneak Peak

After 3 months

1. Improved energy access
   - For 51% of households, SHS replace torches or kerosene lamps as a primary source of light
   - For 26% of households SHS provides a back-up for unreliable electricity access
2. More economic opportunity (but less compared to East Africa)
   - 19% of households undertake more economic activity
   - Equal to creating 8 new full-time equivalent positions for every 100 SHS sold.
3. Improvement in quality of life
   - 97% of households report an improvement in their quality of life

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Download the East Africa report at https://www.gogla.org/powering-opportunity-proving-off-grid-solar-is-a-power-tool-for-change

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Q&A – Please send your questions in the box on the sidebar

Powering Agriculture: An Energy Grand Challenge

Mikael Matossian & Paolo Mele, Tetra Tech

POWERING AGRICULTURE:

AN ENERGY GRAND CHALLENGE FOR DEVELOPMENT

Powering Agriculture: An Energy Grand Challenge

GOGLA Community of Champions Webinar

November 20th, 2019

USAID FROM THE AMERICAN PEOPLE

SWEDEN

german cooperation DEUTSCHE ZUSAMMENARBEIT

DUKE ENERGY

OPIC

Powering Agriculture: An Energy Grand Challenge

- Powering Agriculture was launched in 2012 to help develop and scale clean energy solutions for the agriculture sector that:
  1. **Enhance agricultural yields and productivity**
  2. **Decrease post-harvest loss**
  3. **Improve farmer and agribusiness income** generating opportunities and revenues
  4. **Increase energy efficiency and associated savings** within the operations of farms and agribusinesses

- 5 Founding Partners

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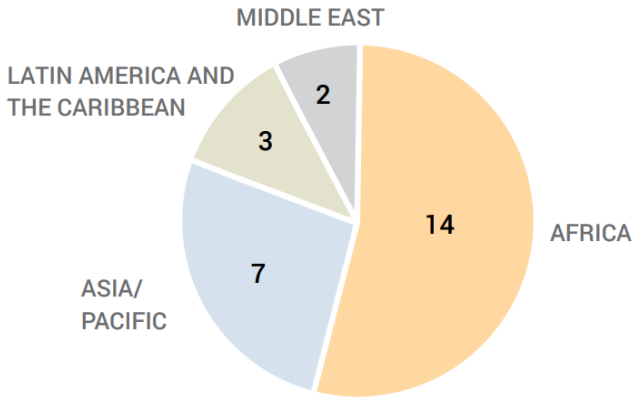
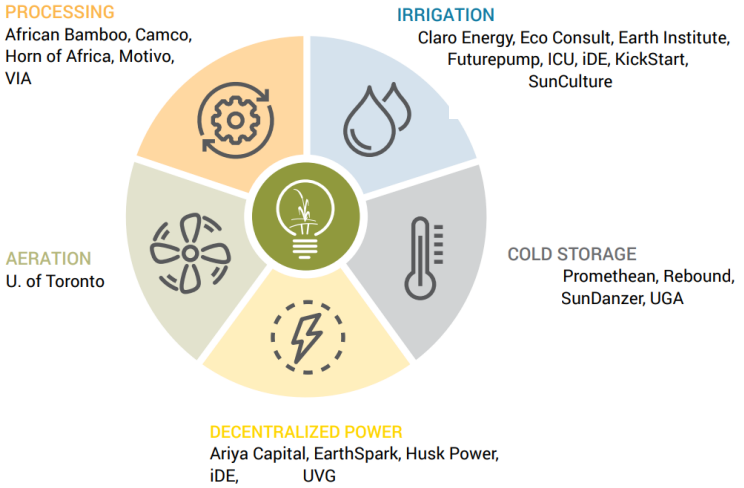
Technology and Business Model Innovation

- 2 global calls for innovators in 2013 and 2015 resulting in 24 grants



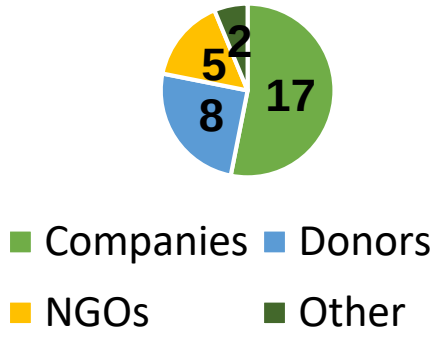


Policy Round Table

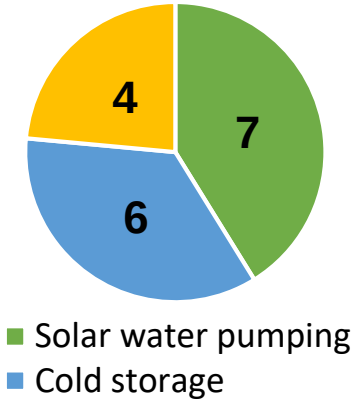
- National policies and regulations have impacted innovators' business plans and operations
- Currently, few forums dedicated specifically to convening stakeholders in the energy-agriculture space
- Policy round table and guide to capture lessons learned and common challenges, and promote greater policy dialogue
- Three technology areas
  - Water pumping
  - Cold storage
  - Agricultural processing

Policy Round Table: Interviews

Interviewees by Sector



Companies by Technology



- Companies operating in East and West Africa, Southeast Asia, and Latin America
- Key topics: government policy, subsidies, customs, tariffs, regulations, product quality standards, industry associations

Policy Round Table: Event

- 30+ private companies, Government of Kenya representatives, donors, and other stakeholders convened for action-oriented round table
- Small group discussions on government policy, customs and tariffs, and product quality standards for clean energy-agriculture appliances

Policy Round Table: Focus Areas

- **Promoting ease of business**
  - Greater clarity in customs and tariff applications
  - Easy access to foreign currency and lending mechanisms
- **Stimulating market growth**
  - Awareness programs for clean energy-ag technology among consumers
  - Concessionary loans or grants for working capital (e.g. RBF)
- **Recognizing and rewarding quality**
  - Data-driven labeling and voluntary product quality standards
- **Partnering with private sector**
  - Inter-agency government working groups
  - Engagement of national and regional trade associations

Innovator Spotlight: SunCulture

Ava Zhang, SunCulture

Innovator Spotlight: SunCulture

SunCulture

- SunCulture unlocks the productivity of smallholder farmers through **solar-powered water pumps and irrigation systems**, bundled with PAYG financing and value-add services

SunCulture

2x - 5x

Increase in yields

1.5x - 2x

Increase in milk production

5x - 10x

Increase in income

17 hours

Saved from fetching water weekly

- As a productive-use asset, **SunCulture systems enable farmers to grow their incomes** by increasing yields, growing higher value crops, expanding land under cultivation, raising more livestock, and increasing milk production

SunCulture

- **Public sector policy in support of productive-use technologies** could play a significant role in advancing:
  - **Ease of business** (e.g., making tariffs more transparent and consistent, implementing exemptions for agri-tech)
  - **Market awareness** (e.g., running public awareness and education efforts to highlight importance of irrigation)
  - **Affordability** (e.g., implementing smart subsidy programs to increase uptake and accessibility)

Q&A – Please send your questions in the box on the sidebar

The True Cost of Solar Tariffs in East Africa

Jonathan Phillips & Robert Fetter, Nicholas Institute for Environmental Policy Solutions, Duke University

THE COST OF SOLAR TARIFFS IN EAST AFRICA

ENERGY ACCESS PROJECT

DUKE UNIVERSITY

NOVEMBER 2019

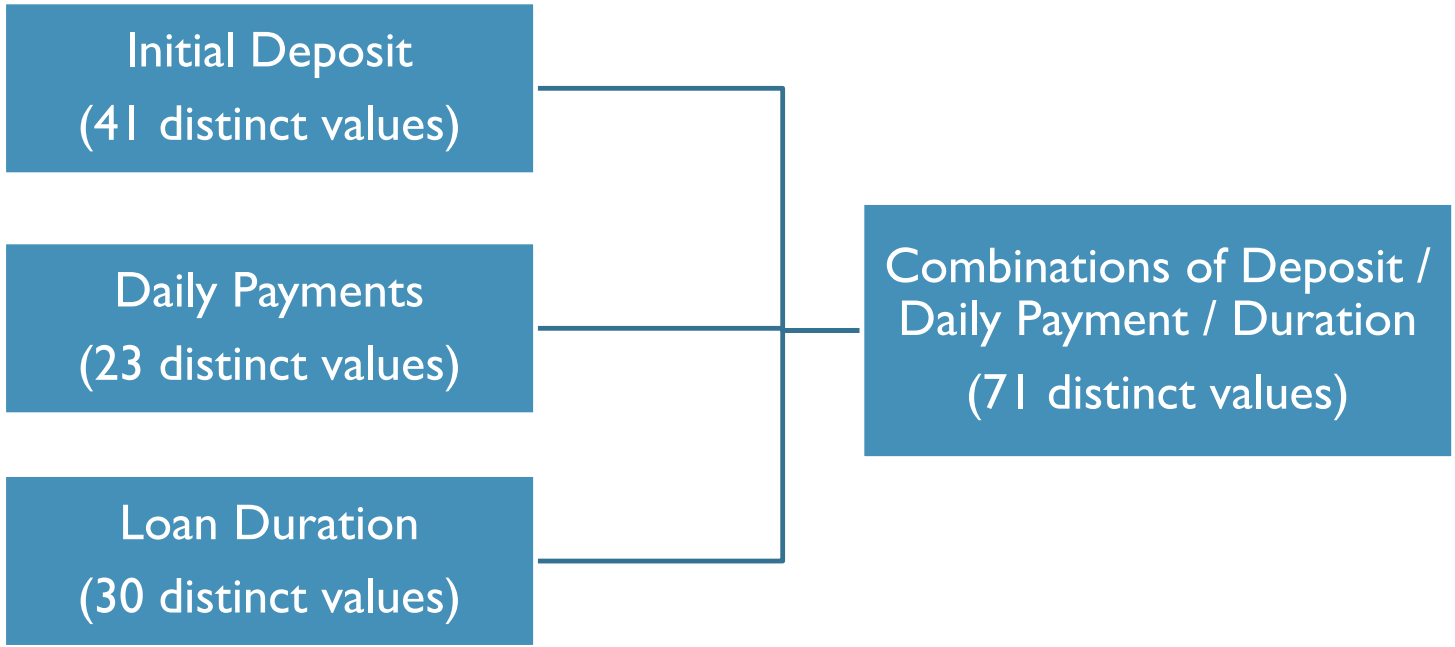
SCOPE OF STUDY

- East African Community: Burundi, Kenya, Rwanda, South Sudan, Tanzania, Uganda
- Confidential sales data from several large private firms
- Sales of over 700,000 units from 2012-2018
- Consolidated to two product types: with and without TV
  - Basic kit: 2, 3, or 4 lamps, battery, panel, USB charger for mobile phone, radio, torch/lantern
  - Kit with TV: All of the above, plus a television
  - Some kits also include bundled TV subscriptions like StarTimes – these are excluded

DATA REFINEMENT

Account for seasonal and geographic variation in income	• Uganda National Panel Survey 2013-2014 • Kenya Integrated Household Budget Survey 2015-2016
Level of geographic merge	• Uganda: 4 administrative regions, 121 districts • Kenya: 7 regions, 47 counties
Account for month-specific events	• Holiday sales and marketing campaigns • Major household expenditures, e.g. seasonal school fees
Convert to common currency (USD)	
Collapse to firm-country-month-region-type-cost	• Use a range of discount rates to incorporate sensitivity analysis

PAY AS YOU GO

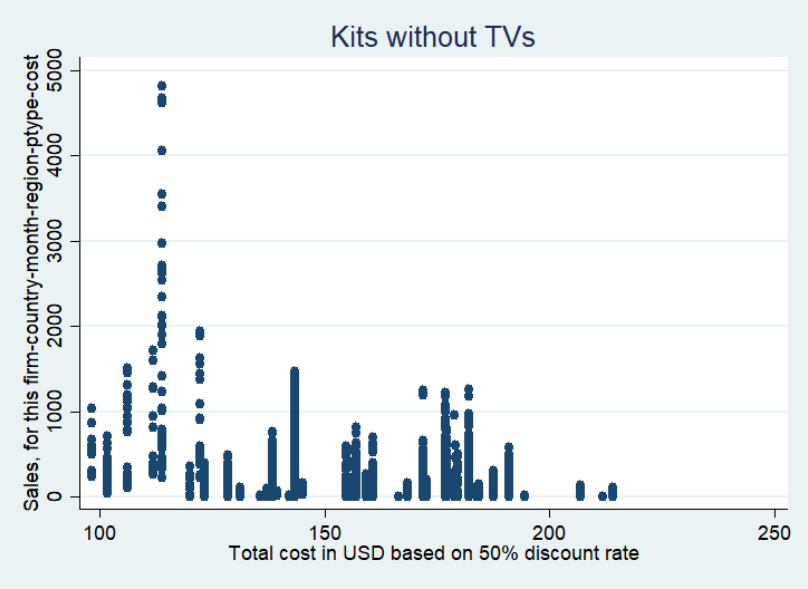

Initial Deposit
(41 distinct values)
Daily Payments
(23 distinct values)
Loan Duration
(30 distinct values)
Combinations of Deposit / Daily Payment / Duration
(71 distinct values)

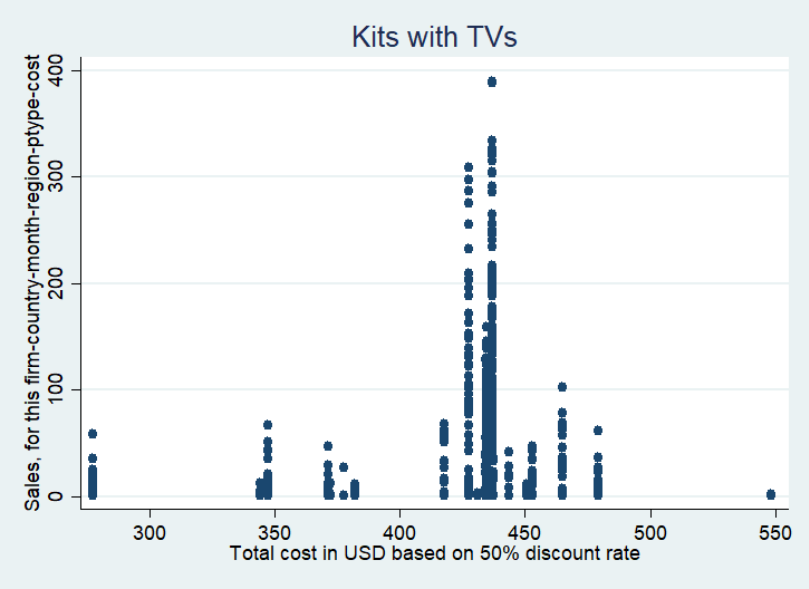
DISCOUNT RATES

We use a range of discount rates from **25% to 100%** to conduct a sensitivity analysis. This reflects how people prioritize near-term benefits and costs, and discount future events.

Study	Discount Rate
Carvalho (2010), rural Mexico	43% - 1150%
Holden, Shiferaw, and Wik (1998), rural Indonesia	93%
Holden, Shiferaw, and Wik (1998), rural Zambia	104%
Holden, Shiferaw, and Wik (1998), rural Ethiopia	53%
Penden and Walker (1990), rural and urban areas in India	30 - 60%
Lawrance (1991), rural and urban areas in USA	12-19%

SALES FIGURES





PRICE ELASTICITY: KITS WITHOUT TV'S

Discount Factor	Discount Rate	Price Elasticity of Demand
0.80	25%	-0.9
0.70	43%	-0.9
0.67	50%	-0.9
0.50	100%	-0.9

- Price elasticity is remarkably consistent across a range of customer discount rates
- Demand is close to unit elastic: e.g., 10% increase in price would lead to 9% decrease in quantity demanded
  - Elasticity is less than one, reflecting that kits are more of a need than a luxury…
  - … But not as small as one might expect, perhaps reflecting the availability of generic products

PRICE ELASTICITY: KITS WITH TV'S

- For 50% discount rate: 10% increase in price would lead to 16% decrease in quantity demanded
- For most customers, demand is more elastic: more like a luxury good
- Customers who weight the present more heavily (i.e., with higher discount rates) respond more to price
  - Kits with TVs nearly always have higher deposits…
  - … and customers with higher discount rates respond more strongly to initial deposit amount

Discount Factor	Discount Rate	Price Elasticity of Demand
0.80	25%	-0.03
0.70	43%	-1.2
0.67	50%	-1.6
0.50	100%	-4.1

ESTIMATED EFFECTS: KENYA MARKET

Tariff	Change in demand (%)	Change in demand (#)	Change in govt revenue
20%	-18% (kits w/o TV) -32% (kits w/ TV)	-36,500 (kits w/o TV) -6,400 (kits w/ TV)	+$5.0M
15%	-13.5% (kits w/o TV) -24% (kits w/ TV)	-28,600 (kits w/o TV) -5,000 (kits w/ TV)	+$3.9M
10%	-9% (kits w/o TV) -16% (kits w/ TV)	-20,000 (kits w/o TV) -3,500 (kits w/ TV)	+$2.7M

Assumptions:
1. Average total customer cost of $200/kit for kits without TVs, and $600/kit for kits with TVs.
2. Average annual sales of approximately 104,000 SHS kits without TVs and 14,000 kits with TVs (based on GOGLA 2018 and additional company data).
3. Full pass-through (eventually) of any change in tariff or tax.
4. Point elasticity of demand from our analysis holds over the period and domain of the market.

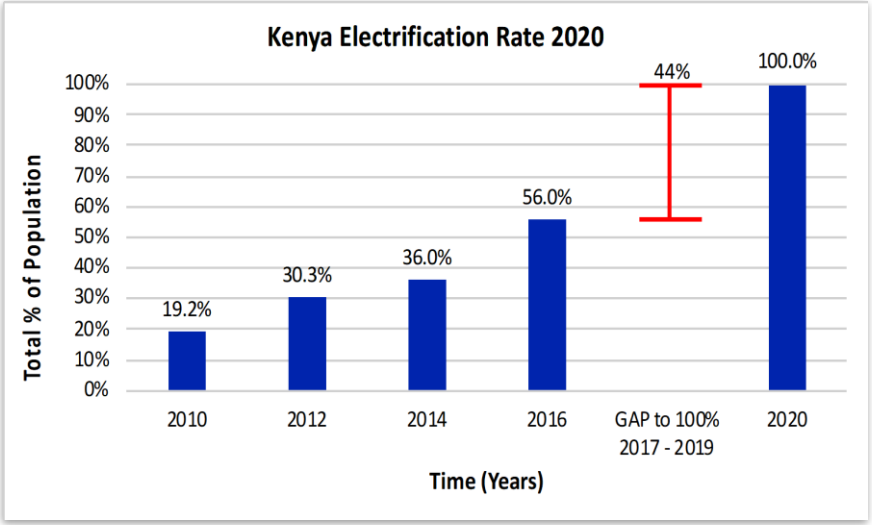
ESTIMATED EFFECTS: UGANDA MARKET

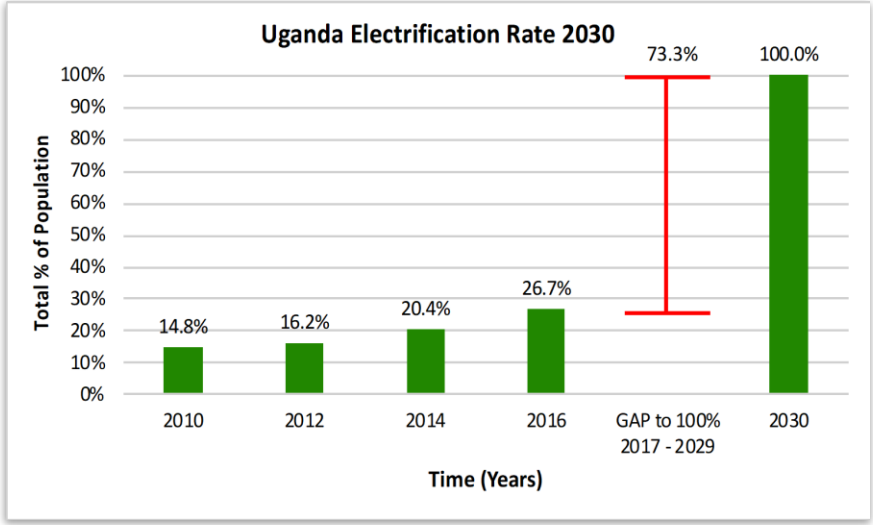
Tariff	Change in demand (%)	Change in demand (#)	Change in govt revenue
20%	-18% (kits w/o TV) -32% (kits w/ TV)	-13,000 (kits w/o TV) -2,200 (kits w/ TV)	+$1.8M
15%	-13.5% (kits w/o TV) -24% (kits w/ TV)	-10,200 (kits w/o TV) -1,700 (kits w/ TV)	+$1.4M
10%	-9% (kits w/o TV) -16% (kits w/ TV)	-7,100 (kits w/o TV) -1,200 (kits w/ TV)	+$1.0M

Assumptions:
1. Average total customer cost of $200/kit for kits without TVs, and $600/kit for kits with TVs.
2. Average annual sales of approximately 31,000 SHS kits without TVs and 3,000 kits with TVs (based on GOGLA 2018 and additional company data).
3. Full pass-through (eventually) of any change in tariff or tax.
4. Point elasticity of demand from our analysis holds over the period and domain of the market.

IMPACT ON ENERGY ACCESS TARGETS

- The tariff will adversely affect the universal access goals set by Kenya (2020) and Uganda (2030)





Source: World Bank / Sustainable Energy for All (SE4ALL) database.

EFFECTS ON DEVELOPMENT, PRODUCTIVE USE & QUALITY OF LIFE

- Energy services for households and microenterprise
  - Lighting, cooling (fans), mobile phone charging; connectivity through radio and television
  - Recent GOGLA survey found 58% of recent buyers increased economic activity within 3 months
- Development impacts and quality of life
  - Avoided air pollution, fire risk, poisoning risk (e.g. from kerosene)
  - Increased study time and potential impact on future earnings
  - Increased satisfaction and improved gender equity
- Employment in SHS company distribution, sales, and support services
- Environmental impacts
  - Avoided emissions of black carbon and CO_2 from alternative lighting sources, e.g. kerosene

BENEFITS OF HOUSEHOLD ENERGY ACCESS

Change in expenditure or impact	Average benefit per household (USD)
Reduced kerosene consumption	$21.02
Increased study time (effects on discounted future earnings)	$1.97
Reduced expenditures on cell phone charging	$2.52
Reduced climate-forcing emissions	$13.70
Total (per household)	$39.20
Total (for households affected by 20% tariff)	$2,278,000

Original Kit Prices
w/out TV = $200

→

Impact of Tariff on Kit Price
w/out TV = $20

→

New Price of Kit with Tariff
w/out TV = $220

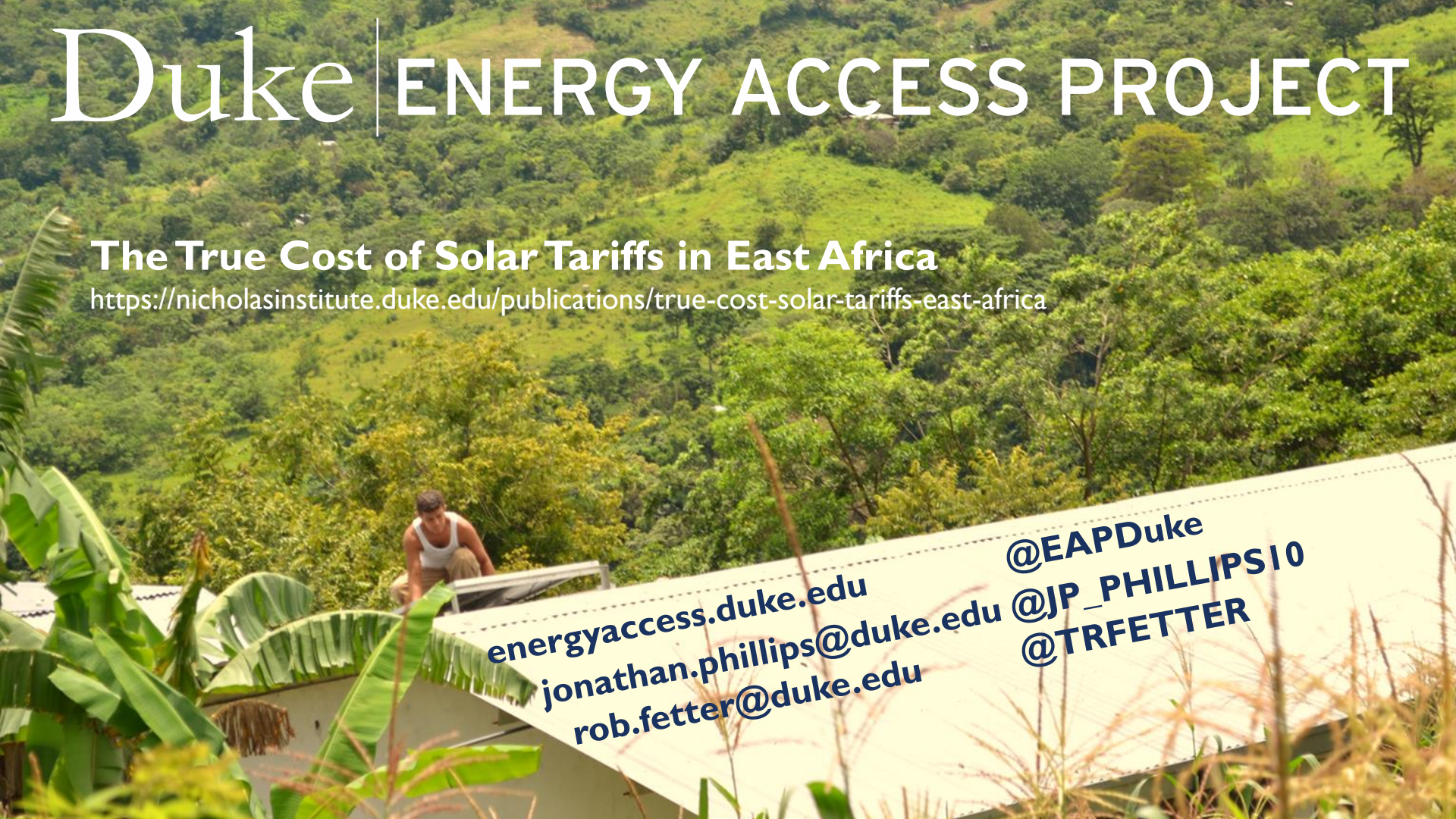
KEY TAKEAWAYS

- Households are sensitive to price changes
  - 20% import tariff on SHS would lead to 18% reduction in sales of "basic kit" w/o TV
  - 20% import tariff would lead to 32% reduction in sales of kits w/ TVs
- Numerous effects on quality of life and economic development
  - Tariffs hinder universal access goals: in Uganda & Kenya, 300k fewer people gain access per year
  - Foregone benefits amount to at least $39 per affected household; $2.3m total per year
  - Additional benefits: reduced fire and poisoning risk, employment in SHS sales and service, etc.
  - Burden of tariff would be regressive, hitting unconnected households the hardest
- Building domestic manufacturing is appealing – but very challenging

Duke | ENERGY ACCESS PROJECT

The True Cost of Solar Tariffs in East Africa

https://nicholasinstitute.duke.edu/publications/true-cost-solar-tariffs-east-africa



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Q&A – Please send your questions in the box on the sidebar or raise your hand

Global Off-Grid Solar Forum & Expo 2020

Global Off-Grid Solar
FORUM & EXPO
THE BIENNIAL MEETING OF THE OFF-GRID SOLAR ENERGY INDUSTRY

GOGLA

LIGHTING GLOBAL
Catalyzing markets for modern off-grid energy

AN INNOVATION OF WORLD BANK GROUP
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The Global Off-Grid Solar Forum and Expo is the premier meeting of the off-grid solar sector providing a unique platform for knowledge exchange, networking and showcasing off-grid solar products and services.

With the conference continuing to grow with every new edition, we are now set to welcome more than 800 attendees and 65+ exhibitors in Nairobi, Kenya on 18 - 20 February 2020.

What's next:

1. We will email you the webinar recording and related materials

2. Please take a moment to respond to the survey questions after exiting the webinar

3. We hope to see you in Nairobi in February for the Global Forum!

Powering Agriculture

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