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Ignite Power in Rwanda

Electric Power on a Different Scale… for All?

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Abstract

In 2015, months after completing a successful and innovative pilot to deliver off-grid electricity for rural households in Rwanda, Yariv Cohen, CEO of Ignite Power, felt stuck in negotiations with the government.

Supported by the government, the startup had come up with a plan to install millions of solar home systems across the country, using the pay-as-you-go model, whereby the customers would pay for their kits in small instalments using mobile money. Removing upfront costs, using smaller solar systems, optimizing operations and leveraging government support, Ignite Power created a unique approach aiming to make solar kits, thus far expensive – an affordable alternative, even for the poorest households.

However, despite the success of the pilot, the government insists on Ignite Power using larger systems, which Yariv fears will increase the costs for customers. With the impasse dragging out for months and the company's resources shrinking at worrying levels, Yariv has to decide whether he should insist on his approach or accept the government's proposal. In addition, the company has another strategic decision to make: produce its own solar systems or procure these from existing suppliers. Behind these singular decisions, Yariv and his team know that they are indeed facing fundamental questions that will shape the company's future.

Keywords: electricity access; solar energy; public-private partnership; Africa; energy poverty; business at the base of the pyramid

*This Occasional Paper was prepared to be used as a case, as the basis for class discussion using the case method, rather than to illustrate either effective or ineffective handling of a business or administrative situation. This OP was written under the auspices of the Fuel Freedom Chair for Energy and Social Development to explore the specific challenges of and best practices in reducing energy poverty. The authors would like to thank Ignite Power for its collaboration.

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Introduction

More than a year after establishing Ignite Power in Rwanda, with the objective of improving electricity access in rural areas through off-grid solar home solutions, the CEO and cofounder Yariv Cohen felt stuck in negotiations with the government.

It all started in 2012 when the president of Rwanda, Paul Kagame, invited Clean Access Initiative, a UK-based NGO chaired by Cohen, to work with the Rwandan government to develop a roadmap towards increased energy access. Since then, Cohen and his team—in collaboration with the government—had made great progress in understanding Rwanda's power sector landscape, the population's needs and the challenges involved in electrifying rural communities. They were now convinced that off-grid solutions should play an important role in supplying energy to 91% of the rural population still living without electricity.[1] Tackling this problem was paramount to the country's economic and social development and in alignment with the president's Vision 2020 program[2] aimed to transform Rwanda into a middle-income country by the year 2020.

In 2014, Cohen and Angela Homsi co-founded Ignite Power Ltd, with the objective of implementing off-grid solar home solutions at large scale in Rwanda and thereby harnessing the potential of the opportunity they identified in the previous years of research under the Clean Access Initiative. Homsi was an experienced investor in leading firms such as Generation Investment Management and MicroVest, and Cohen was a seasoned executive with vast and global experience of developing clean energy projects. The two cofounders decided to join their efforts convinced that, through a public-private partnership model, Ignite Power could effectively tackle the low electricity access rate.

In September of that same year, the company and the Rwandan government signed a Memorandum of Understanding to implement a pilot project to install 1,000 small off-grid solar systems in rural households. The MoU also provided the framework for a future large-scale deployment whereby Ignite would install between 250,000 and 1 million off-grid solar home kits across the country. Ignite Power would use the pay-as-you-go model, where the customers would pay for their kits in small installments over a period of time using mobile phones and mobile money platforms- eliminating the upfront cost barrier.

The pilot was successfully completed three months later. However, months had passed since then, and Ignite had not been able to sign the final agreement with the Government to start the commercial deployment phase. The only sticking point paralyzing the negotiations was the size of the system. It was taking more time than anticipated to reach an agreement on what the power capacity of the stand-alone solar home systems should be.

Ignite Power's technical team strongly believed that small photovoltaic (PV) solar systems, with lithium batteries, were the perfect fit to fulfill basic household electricity needs and could be marketed at an affordable price (See **Exhibit 1**). This was extremely important with 56% of the population living below the poverty line.[3]

[1] Data for 2014. Source: World Bank.

[2] Vision 2020 was launched in 2000 and its ambitious goals included achieving electrification rates of 25% by 2010 and 35% by 2020, from a starting point of 2% in 2000. However, by 2013, the national rate was only 15%.

[3] Data for 2013. The poverty line is defined as $1.90 a day (2011 purchasing power parity).

In contrast, the government utility representatives insisted on larger systems that would provide customers with more electricity because, in their view, these would guarantee a better performance, albeit at a higher cost. As they explained, they expected that in the future the electricity grid would reach most of the households in the country. In the meantime, they did not want people in rural areas with a small off-grid solution (the size of a microwave) that they considered inferior to larger solar systems with more power capacity. Although more expensive, these larger solar systems with lead-acid batteries were already in use in Rwanda and had been proven to work. In addition, they argued that for a good and sustainable power system, it was necessary to attain to the same technical standards across the country. Government officers did not see the point of changing to a new, unfamiliar system just to save money.

Ignite Power's management team had solid experience with clean energy projects and the finance industry. They had devoted a significant amount of time to researching the most suitable plan and solar systems for Rwandans' needs, and they believed they had found a convenient yet affordable product. However, this was Ignite Power's first national-scale project and, seeing the government's reluctance to reduce the system's power capacity, Cohen wondered whether his company was taking the right approach.

Angela Homsi burst into Cohen's office and got straight to the point:

> "The systems proposed by the government would increase the final price by four. We know that several other companies are already selling expensive solar systems in the country with a lot of support from the government. We're stuck. What should we do now?"
>
> Cohen collected his thoughts and reminded Homsi of the conversation they had had a year ago, when they started Ignite Power: "We're not here to be just another solar company. If we really want to have an impact on the life of millions, we need to offer a product that millions can afford."

Homsi was not convinced yet. She knew that the negotiations with the government would not be straightforward. However, she brought up another urgent issue for discussion:

> "Regardless of the solar system to be used, we must also decide whether we will integrate the hardware design into our business and subcontract the manufacture, or whether we will buy the photovoltaic solar panels and accessories from external suppliers. We need to decide this now if we want to launch commercial operations this year".

Electricity Access in Rwanda: A Widespread Problem in an Unsustainable Power System

Low electrification rates are not an issue that is exclusive to Rwanda. It is a major problem in most low-income economies, especially in Sub-Saharan African countries,[4] where an average of 62% of the population lived off-grid in 2014, using toxic and expensive fuels such as kerosene and battery flashlights for lighting.

[4] Sub-Saharan Africa is the only region in the world where, due to a strong demographic growth, the number of inhabitants with no grid electricity increases every year—even with a positive electrification growth rate, population growth is outpacing electrification efforts.

In Rwanda, a country with 11 million inhabitants, the lack of electricity access is especially critical in rural areas, where 83% of the population lives. Only 9% of rural residents are connected to the grid, compared to 72% of people in urban areas.[5] This exacerbates further the socioeconomic gap between rural and urban areas.

A combination of factors have contributed to this situation in Rwanda. The electricity grid does not extend beyond the capital Kigali and a few other major urban centers, due to the lack of financial resources needed to invest on a mass scale in power generation, reinforcements and extensions. A new grid connection is estimated to cost around $600 to $1,000 per customer. Moreover, the cost of grid-based electricity generation is excessively high, given the lack of access to low-cost energy resources combined with the fact that noncompetitive forms of procurement are used to buy power capacity.[6] In addition, more than 20% of the energy produced is lost due to an outdated grid with metering and billing problems. The grid is unreliable, power outages are common, and the bill collection rate is low.

Even for those living in an electrified area, accessing the grid could be out of their financial reach. The connection charges alone could cost up to 90% of a household's monthly income, according to the World Bank. Even with highly subsidized end-user tariffs, "a subsistence level of electricity (30 kWh per month) is unaffordable for more than three-quarters of the unelectrified population."[7] (See Exhibit 2.)

The tariffs are too high for a significant part of the population but too low to cover the system costs. The total cost to produce and deliver each kilowatt-hour is $0.43 but just $0.23 ends up being collected. (See Exhibit 3.) This has obliged the government to commit up to 10% of its annual budget to cover the gap between system costs and revenues (estimated at 1% of GDP).

For those still living off-grid, the energy cost is even higher, taking up to 15% of a family's monthly income (usually from $60 to $100). The two main energy expenses are lighting and recharging mobile phones. Around 98% of off-grid households have at least one mobile phone but have no convenient means of charging it. To do so, they must get help from a neighbor or walk a few hours to the nearest market in an electrified village, paying an average of $0.32 per recharge.

To address this unsustainable situation, the Rwandan government is undertaking several reforms in the electricity sector and seeking innovative and cost-effective solutions, such as the off-grid solar home systems.

The Solar Market and the Pay-as-You-Go Solar Home Solutions Model

The prices of photovoltaic solar panels fell sharply, especially since 2010. The cheaper prices were driven by technology improvements coupled with growing demand from solar farm projects in developed countries, where the transition toward cleaner energy sources had been on the agenda for years.

[5] Data for 2014.

[6] World Bank Group, *Lighting Rwanda: Rwanda Economic Update*, Edition No. 14, June 2019, http://documents.worldbank.org/curated/en/593831561388957701/pdf/Rwanda-Economic-Update-Lighting-Rwanda.pdf.

[7] World Bank (2019, 23). The framework developed by Sustainable Energy for All (a United Nations and World Bank initiative) to define and measure access to energy considers 30 kilowatt-hours a month to be the subsistence level for grid electricity. The framework considers electricity to be affordable if a household does not have to spend more than 5% of its total monthly income to purchase it (International Energy Agency 2015).

Sub-Saharan African countries, meanwhile, embarked on a different path of development for the solar energy market: off-grid solutions. Solar lanterns, stand-alone solar home solutions and mini-grids were brought to rural communities and remotely located households. Their prices became competitive compared to the cost of extending the grid or relying on costly diesel generators but remained expensive for low-income households. Therefore, these solutions were initially funded by donor-based or subsidized programs or sold as luxury goods and they remained limited in reach.

In 2012, a new and disruptive business model arose. Companies started to offer solar-power kits that included a photovoltaic panel, a battery, two or three lights, a mobile-phone charger and sometimes other appliances. A customer would make a down payment for the kit, followed by regular payments (weekly or monthly). Payments would be made by mobile money,[8] to harness the population's extensive and fast-growing adoption of this payment method. This model is usually referred to as pay-as-you-go, given the flexibility of the payments and their prepaid nature.

East Africa has seen the emergence of the first companies operating with this model, in countries such as Kenya and Tanzania, where the use of mobile money—a key enabler for the model—is widespread.

The possibility of paying in installments, rather than in a one-off lump sum, made the product attractive for thousands of low-income households that had been living until then with no electricity. More start-ups entered the market over time in different African countries, with variations in their operational and financial models. For example, most companies use a lease-to-own scheme, whereby, after a period of regular payments (usually from 12 to 24 months), the client owns the asset. Other companies just offer the option of renting. The methods used to enforce payment also vary. Some providers install a chip in the solar-panel system, allowing the company to disable the supply of energy remotely in case of a payment default. Others prefer to confiscate the equipment.

The model is positioned between the energy and financial sectors, with a strong technological character. It requires very cost-efficient logistics and skilled management teams. To deal with all these areas, the first pay-as-you-go companies usually adopted a vertically integrated approach. They deal with the hardware and software design, sales, distribution, customer service and financing in-house.

The Ignite Power Approach

When Ignite Power was set up in Rwanda in 2014, two pay-as-you-go companies were already operating there, and several others were entering the market. These providers were employing old-generation technology, such as lead-acid batteries similar to the ones used by diesel trucks, which require recurring maintenance and replacement every two years and are heavier to transport, increasing the overall cost of the system to $500- $1,200.

The most affordable system available costs around $20 per month, over long-term payment periods of up to 10 years. Customers end up paying between $500 and $900. Fewer than 10,000 consumers use such systems, which remained out of reach for most low-income rural

[8] Mobile money is an electronic payment system that enables users to send and receive payments through an electronic account that can be accessed via a mobile phone. Each customer's account is linked to their mobile-phone number by means of an application built into the SIM card. Since customers do not need a bank account, mobile money can extend the reach of its financial services to people who have traditionally been unbanked, such as low-income or remote households.

households. These types of systems were the ones the Government was pushing for Ignite Power to use. They had more power, supported more domestic appliances, and a longer battery life after the sunset compared to the Ignite's systems, which on the other hand used lithium-polymer batteries, that had a longer life span reducing the total cost of the systems to $100 - $150.

Another difference among Ignite Power and other companies operating in Rwanda was their views on government participation, the nature of the business and its scalability. While other companies saw pay-as-you-go solar home systems as an attractive market per se, Cohen realized that the model could be the key to unlocking demand on an unprecedented scale, a tool to implement a mass electrification plan. He told government officials:

> "If we aim to reach hundreds of thousands of households, we can achieve enough economies of scale to offer the solar kits at a much lower cost. We will optimize our operations, from production to sales, to commercialize a solar PV system that all households in this country can afford, using the pay-as-you-go model. But to accomplish this, the support of the Rwandan government is indispensable."

Most pay-as-you-go companies were happy to operate as purely private players, completely separate from the plans of the government or utilities[9] and taking advantage of the lack of regulation in this nascent industry. Other solar developers preferred to enter projects as executors, while the government or other institutions paid all costs or subsidized most of the final cost for the user.

Cohen had a different opinion, as he said in his first meeting with the government:

> "Electricity is a social good and a basic right, having a huge impact on people's lives. Therefore, it needs to be planned by the government as a public service. If we integrate pay-as-you-go solar home systems into the country's central energy planning — with the government's energy experts participating in the decision-making process regarding the off-grid communities to be targeted and prioritized, prices to be applied and services to be provided, with private initiative providing the capital needed — our impact can be significantly greater."

Ignite Power worked with officials from the Ministry of Infrastructure for two years, planning a national-scale rural electrification project with the main objective of connecting the households of 6,000 villages to safe, sustainable and affordable electricity.

Within this plan, Ignite Power's role would be to carry out the national project, being ultimately responsible for all field operations: bringing in the technology (hardware and software), setting up sales channels, installing the solar systems, collecting the payments and providing customer support, as well as raising the capital needed to support all the activities.

To this end, Ignite Power was to engage with many partners, both within the industry and across industries, to create a synchronized ecosystem involving technology suppliers, telecom companies (enabling mobile-money payments), Rwandan banks, foreign investors and Rwandan distribution companies. (See Exhibit 4 for more details.)

[9] Although the situation varies from country to country, off-grid solar home systems are usually not integrated into governments' energy plans.

Simultaneously, the Rwandan government's role would be to support Ignite Power's operations by:

- Providing thorough information about the target market.
- Raising the population's awareness of the new plan and Ignite Power's role as the leading supplier of solar energy in the Rwandan market.
- Supporting credit for the poorest people. If a customer failed to pay and Ignite Power was unable to collect the solar equipment, the government would help cover the amount still due on the contract.

Through this approach, Ignite Power would be able to offer high-quality technology, including long-lasting lithium batteries and certified appliances, with the most affordable price plan in Africa: only $6 per month to be paid over a reduced period of 24 months. This represented an undiscounted total cash flow of $144 per system. The basic system that Ignite Power was proposing would include not only a solar panel and battery but also four lights, a USB phone charger to suits all kinds of mobile phones in use and a rechargeable radio. Thanks to the battery, the appliances could continue to be used for six hours after sunset.

Cohen was sure that the innovative public-private partnership model would make rapid scalability and growth possible. Within a few years of the launch, he expected to reach at least 100,000 households—which would save up to $100 million compared to a grid expansion.[10]

Writing the Future

The Ignite Power team was proud to have built a plan that had the potential to expand the solar off-grid market in a unprecedent way, not just in Rwanda but in the Sub-Saharan Africa region. The team members were eager to move to the implementation phase but, to do so, Cohen and the rest of the team still had two important decision to make.

First, they had to decide whether they would agree with the government on the use of a bigger solar system, similar to the ones already being used in Rwanda—with more appliances and a battery that would allow the system to be used for more hours each day—or insist on a smaller and cheaper system.

Cohen summed up the situation: "We ran a pilot with 1,000 families and we have substantial indications that the product that we are endorsing is excellent for the current needs of the population we are targeting." (See client profile in Exhibit 5.) He continued:

> "The technology of the lithium-polymer batteries we use is clearly superior than the lead-acid ones used by competitors. And our system is four times cheaper! The poorest households will finally have an affordable choice. But how can we convince the government to take a chance on these systems? Winning the government over could take several more months or even years. If we drag out this situation, we could run out of capital. But what really worries me is that every day that we are delayed, there are another 500 families that could be connected and are not."

[10] Provided by Ignite Power based on conversations with Government and utilities, whom estimated the investment required to extend the grid to connect rural households to be around $1,000 per household.

> "On the other hand, if we go for the pricier option, we could have this deal closed by tomorrow and we could start our commercial operations in a few months. Then maybe later we could renegotiate the inclusion of smaller, more affordable systems?"

Cohen was trying to convince himself that a later renegotiation could be an option, but he knew that they were really deciding on a core issue with lasting consequences.

The second key aspect to resolve was whether Ignite Power should produce its own solar systems or procure them from existing suppliers. Manufacturing their own kits would mean designing the system, outsourcing or procuring the different components (such as the small solar panels, the batteries, the smart-lockup systems and the basic appliances included such as lights and mobile chargers) and then assembling them. Cohen said:

> "Nowadays, there are only three producers of the type of solar kits we sell – and there's growing demand for their products. If we decide to integrate production into the business, we can produce the systems to cover our demand and sell to other companies, positioning our company as a technology provider too. We can create a product specifically designed to meet the needs of the population we are targeting, and it will be cheaper than buying from external providers. All of this would be a huge competitive advantage right now. What do you think, Angela?"

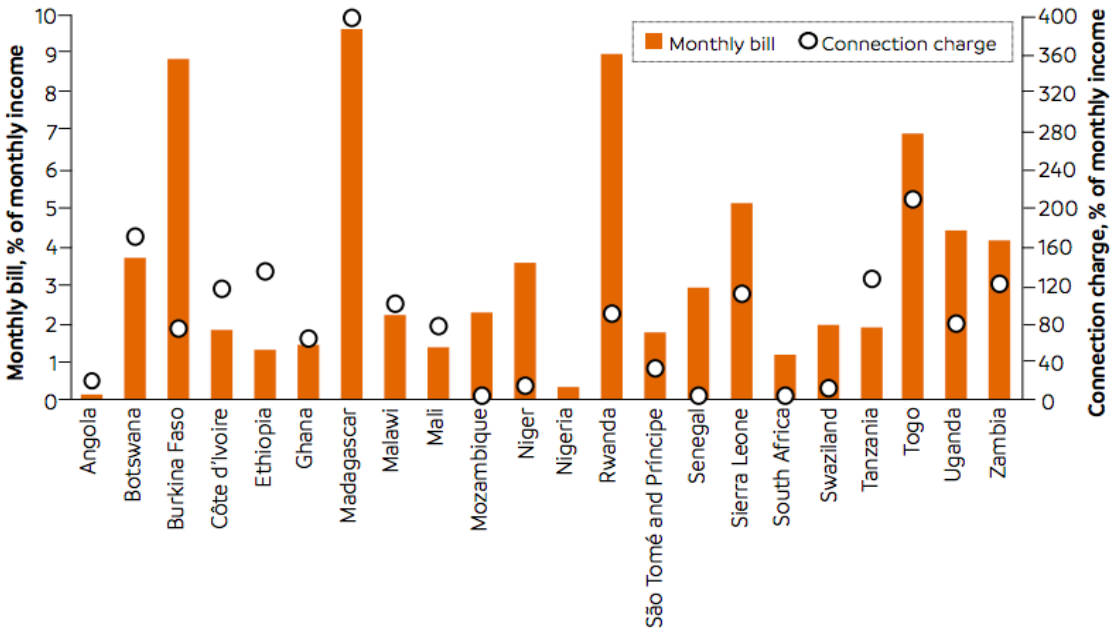
Homsi replied:

> "With more and more companies entering the pay-as-you-go solar market, I believe the number of manufacturers of solar systems is likely to increase quickly too. With more competition in the production of the kits, the technology will improve, and the prices will go down. As a buyer, we'll benefit from that, always being able to offer the best technology available on the market at the lowest cost to our customers, instead of getting stuck with our own production."
>
> "And we'll have more time and resources to focus exclusively on our customers and on improving our operations on last-mile distribution," Cohen concluded. "What kind of company do we want to be?"

Exhibit 1
Pictures of the Solar Home Solution Proposed by Ignite Power

Source: Information provided by the company.

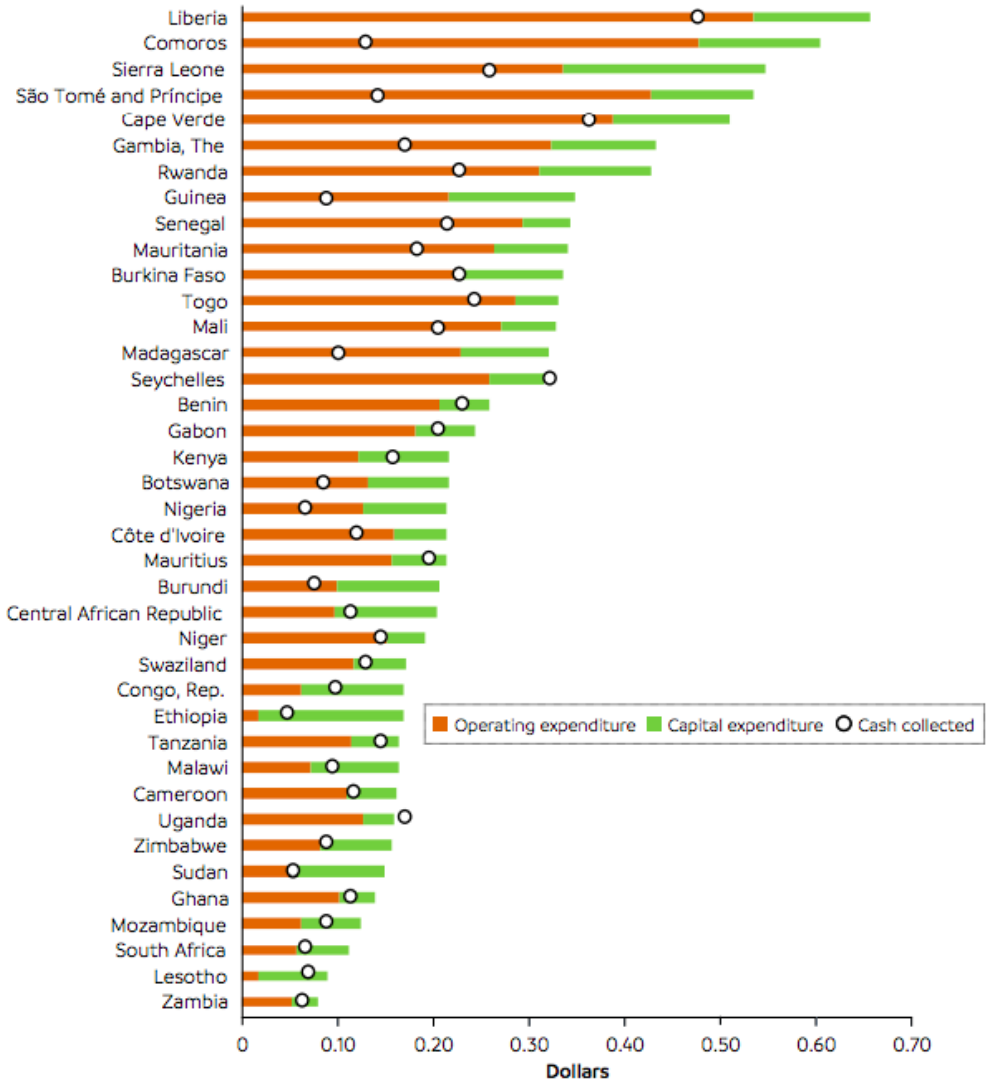
Exhibit 2
Monthly Bill for 30 kWh and Connection Charge as Percentage of Monthly Household Income



Source: Masami Kojima and Chris Trimble, *Making Power Affordable for Africa and Viable for Its Utilities* (Washington, DC: World Bank, 2016), 20.

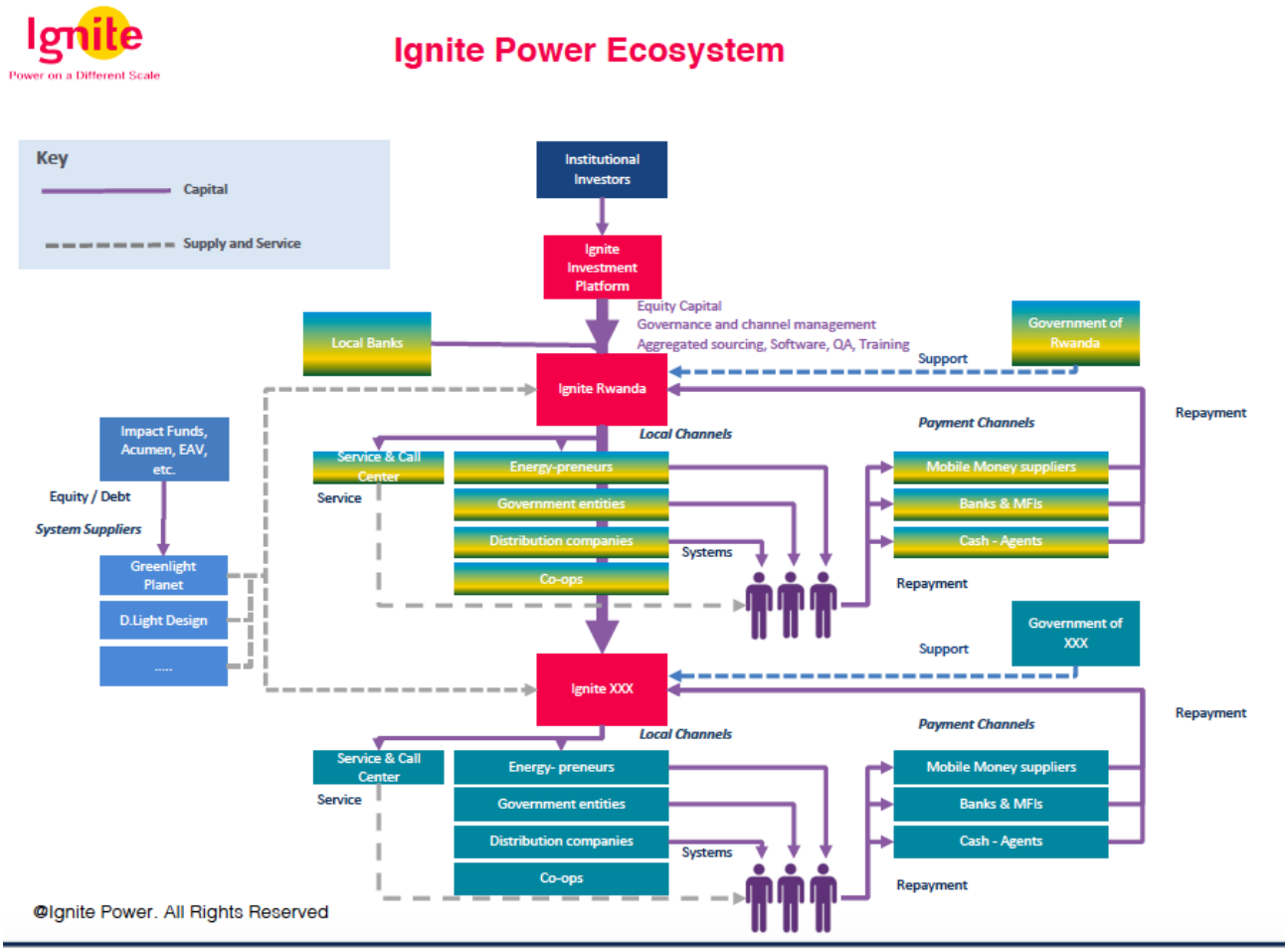
Exhibit 3

Comparison of Electric Supply Costs With Cash Collected in 2014 US Dollars per kWh Billed



Source: Masami Kojima and Chris Trimble, *Making Power Affordable for Africa and Viable for Its Utilities* (Washington, DC: World Bank, 2016), 8.

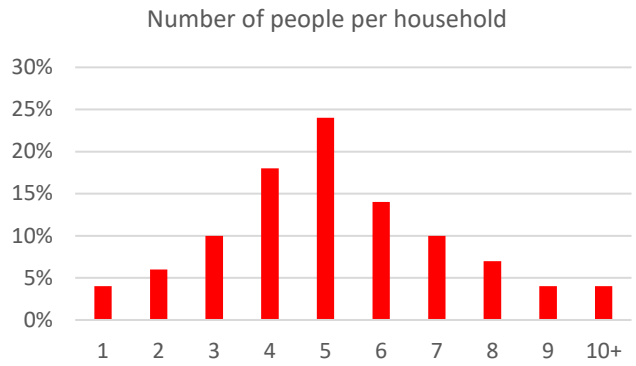
Exhibit 4
Ignite Power Ecosystem Chart

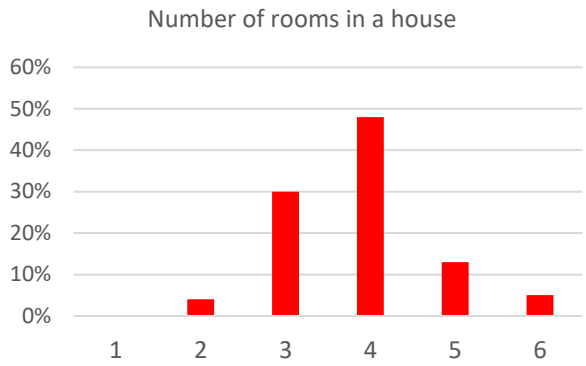


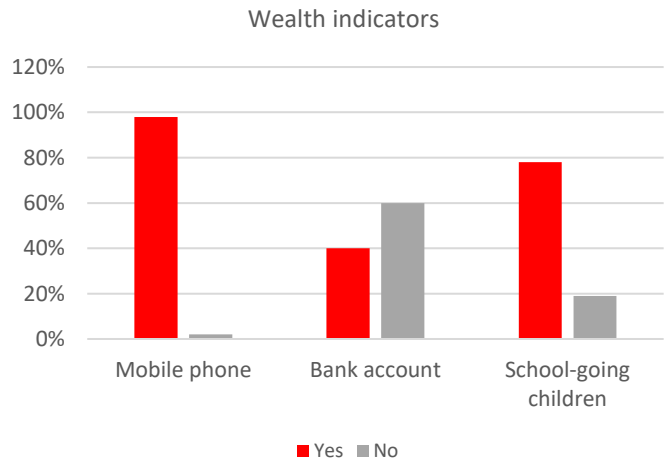
Source: Document provided by the company.

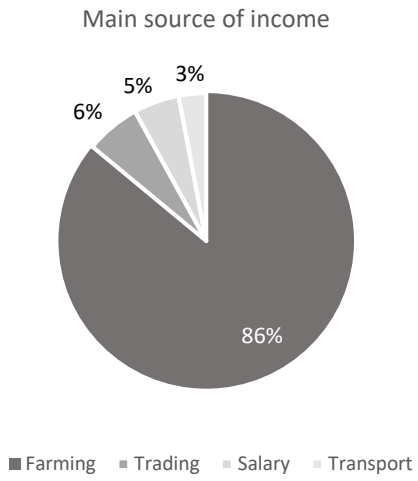
Exhibit 5

Customer's Perception of Solar Home Systems

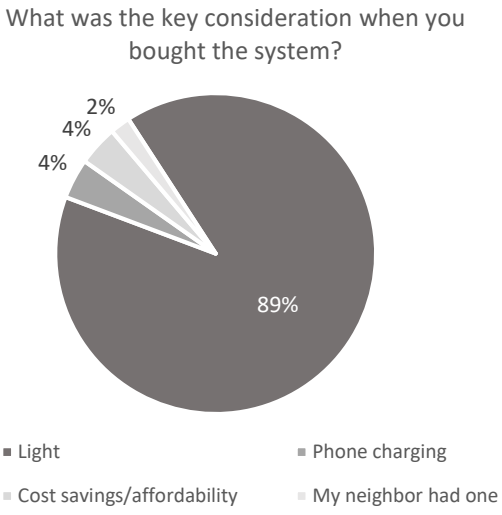








Customer's Perception of Solar Home Systems



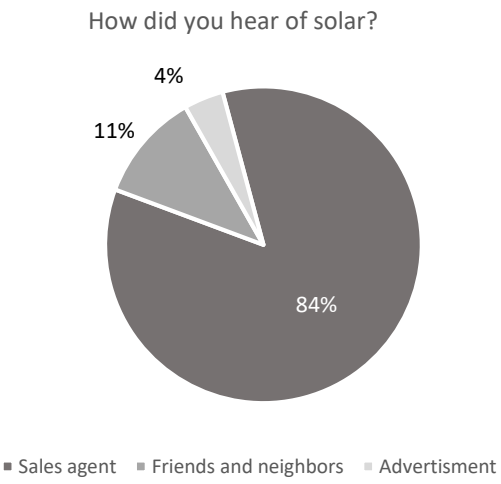
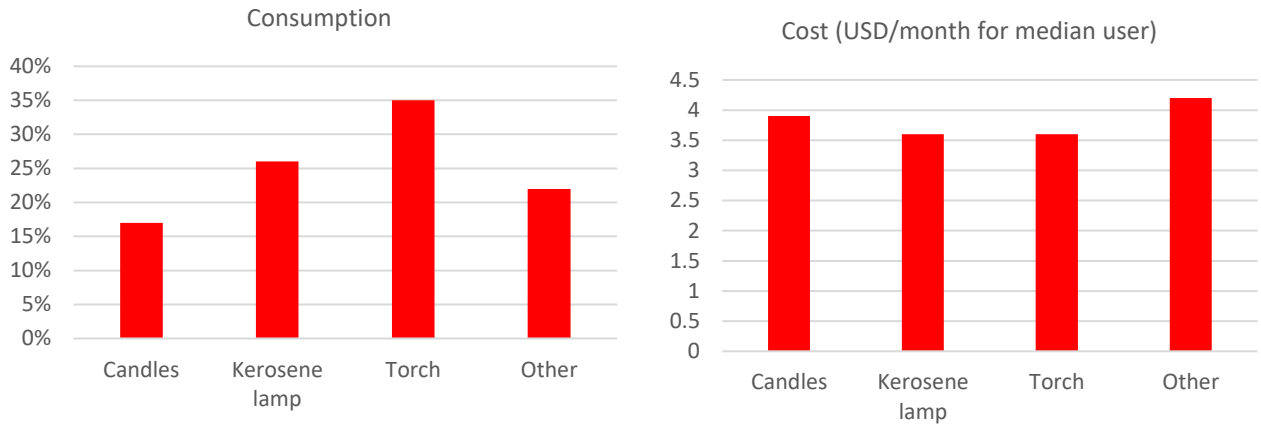
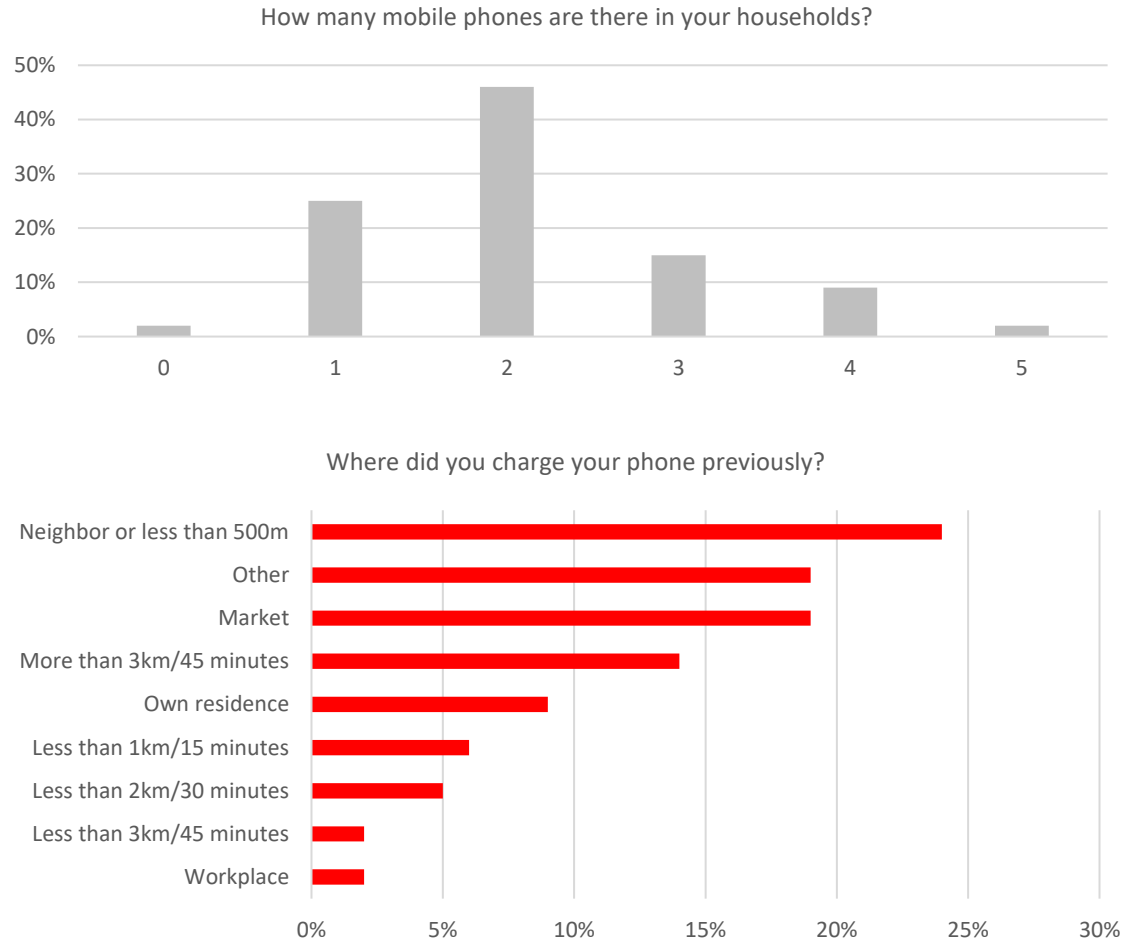


Exhibit 5 (Continued)

Previously Used Technology



Mobile Phone Use



Source: Prepared by the authors with data from Ignite Power.