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Final Report:

Solar Square

A Community-based Distribution and Leasing System for Pico-powered Solar Lighting Systems

Author:
Joel Jeanloz, Antenna Technologies

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Prepared by:
Antenna Technologies
24 avenue de la Grenade, CH-1207 Genève
Tel: +41 79 217 16 05; jjeanloz@antenna.ch; www.antenna.ch

With the Support of:
REPIC Platform
c/o NET Nowak Energy & Technology AG
Waldweg 8, CH-1717 St. Ursen
Tel: +41(0)26 494 00 30, Fax: +41(0)26 494 00 34, info@repic.ch / www.repic.ch

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1. Summary

More than half of the population in Cameroon has no access to the electricity grid. They must thus rely on traditional and low-technology options to light homes and charge mobile phones. The project "Solar Square" of the organisation Solafrica[1] (today Antenna Technologies is the project owner) allows access to clean and cost-effective off-grid solar energy by using a community-based leasing and distribution system. This system makes solar energy available and reduces CO2 emissions significantly. Through various pilot test, the feasibility of the different Solar Square distribution and leasing systems were assessed.

During the project period (November 2014 – July 2018) different business and distribution models have been tested in Cameroon.

1. The first "Solar Square" model aimed at identifying, training and employing retailers in rural areas. This so-called "retail model" did not work very well at the beginning because of technical issues. With the support of REPIC, the ICT system (platform and mobile app) was improved. However, there were too many intermediaries who did not understand the model. As a consequence, the project partners decided to adapt the approach and to further develop the "Solar Square" project ".
2. The second model was based on a "door-to-door" distribution. Unfortunately, the complicated task of building a network of salesmen hindered the model's success.
3. The third model relies mainly on existing networks and can be considered a success. In Cameroon for example the OOLUX kits are distributed among cocoa cooperatives which are a respected and trusted network of people working in the cocoa sector. During the field test (2015-2018) the three models have been tested.

Altogether 1'100 OOLUX kits have been distributed using one of the three models. Additionally, Antenna Technologies cooperated with two local partners to distribute the solar power kits.

Relying on existing networks of trust to distribute larger quantities of solar power kits is a very promising model. At the moment, the local partner in Cameroon is signing ever more contracts with cocoa cooperatives. As a next step, the local partner in Cameroon will empty its stock. To upscale the model Antenna will help its local partner to raise investment in order to buy a larger stock of solar power kits.

Finally, Antenna already started to copy the model and deploy it in its countries of operation. Since the beginning of this year, 200 solar lamps have been distributed in Mali using the same model. Another roll out is planned in Burkina Faso.

2. Introduction

About 1.4 billion people in the world have no access to grid electricity, 600 million in Africa alone. Another 1 billion people are connected to unstable grids and experience regular power outages and can be classified as "under-electrified". The focus market is Sub-Saharan Africa as a whole, where the situation will become worse in the future because grid expansion is not able to keep pace with population growth. Thus, the off-grid population in Sub-Saharan Africa is expected to grow from 600 million people in 2011 to about 700 million in 2030.

With no alternatives at hand, most people will rely on traditional low-technology options to light their homes and charge mobile phones. Kerosene lamps in particular, but also candles, diesel generators or non-rechargeable batteries are commonly used with severe consequences for the health of the population. Studies have clearly shown that many by-products in kerosene have a negative impact on health. In addition, fuel-based lighting is the main cause of structural fires, burn injuries and this also negatively contributes to global climate change. Furthermore, the use of cheap and non-rechargeable batteries poses a danger to humans and causes irreversible environmental damage.

Cameroon relies heavily on biomass kerosene and diesel. Especially kerosene lamps are used for lighting by over 60 percent of the rural population and 10 percent of those who live in urban areas. Electricity, on the other hand, constitutes only a small part of the overall consumption. Large regions of the country do not have any access to electricity and those with access often face power outages. Only 48 percent of the

[1] At the beginning, Solar Square was a joint project between the organisation Solafrica and the Antenna foundation. To facilitate the implementation Antenna took over the responsibility of the project in June 2016.

total population is electrified while major access is concentrated in urban centres. People living in rural areas and especially the poor do not have access to electricity. Solar lighting products are not extensively used in Cameroon. Due to the underdeveloped solar market, people in rural as well as urban areas have only little access to the high-quality lighting products.

Cameroon is rarely in the focus of international attention, as there have not been any famines, wars (until the break out of the anglophone crisis) or any spectacular breakthrough regarding democracy. Nevertheless, the fact that Cameroon is a relative stable country in Central Africa should not obscure the huge economic problems the country faces. There is also the fact that Cameroon suffers under severe corruption which holds back growth and progress on development.

3. Results

During the “Solar Square” field test the overall approach of Solar Square was applied and tested in Cameroon. The Solar Square business and distribution model can be characterized as “retail system” using different intermediaries to distribute solar kits: The local partner buys the solar kits on credit from Antenna, and he identifies and trains retailers in off-grid villages. These retailers in turn lease out the kits to the end customers who pay by instalments until they own the kit (rent-to-own model).

The objectives of the pilot phase can be divided into three sub-groups: organisational/conceptual, technical and economic objectives:

1. **Organisational and conceptual objective**: The team of Solar Square in Switzerland and in Cameroon organises and implements the project Solar Square according to the concept/approach defined in the project outline. All involving stakeholders perform their respective duties in order to put the concept in practice.
2. **Technical objective**: The team of Solar Square is able to develop and implement the ICT solution.
3. **Economic objective**: Clear evidence of the economic market potential of the Solar Square distribution and leasing system will be found, in order to transform the project Solar Square in a social business after the pilot phase.

4. Project Review

4.1 Project Implementation History

The Solar Square field test can be characterized as a “trial and error” approach. It was very challenging to look ahead and plan properly as the market for solar kits in Cameroon is complex. Moreover, no available data could help to better shape a strategy. Hence, the project team developed its own approach to distribute solar power kits in a pioneer market such as the off-grid regions of Cameroon. The “Solar Square” retail model was tested, the learnings included, the model improved and tested again. Antenna mainly worked with its local partner “African Solar Generation” (ASG) a solar company with a social business approach. Besides this main partner, Antenna tested another business model with a local company (external project).

The main steps of the “Solar Square” project were the following:

Period	Main Activities
November 2014 - April 2015	Preparation of the field test
March 2015 – July 2015	Developing the ICT solution
August 2015 – September 2015	Recruiting and training of retailers
October 2015	Import of 200 OOLUX kits
	First intermediate report REPIC
November 2015 – April 2016	Retailers selling OOLUX kits, technical issues with the ICT solution detected
	Second intermediate report REPIC, pass the project management from Solafrica to Antenna foundation
July 2016 – November 2016	Developing improved ICT solution, deployment of ICT solution in Cameroon
December 2016	Import of 200 OOLUX kits
January 2017 – April 2017	Retailers selling OOLUX kits
May 2017	D-Lab Energy Assessment
	Third intermediate report REPIC
June 2017	Changing the “Solar Square” model from a “retail” to a “door-to-door” distribution system,
July 2017 – September 2017	Selling OOLUX solar kits in the South of Cameroon using the “door-to-door” model
October 2017	Import of 200 OOLUX kits (external partner)
November 2017 – January 2018	Testing a new distribution (“trust based” distribution) with an external project
February 2018	Changing the “Solar Square” model from a “doo-to-door” to a “network” distribution system
March 2018 – June 2018	Selling OOLUX solar kits in the Central Region of Cameroon using the “network” model
July 2018	Import of 500 OOLUX kits
August 2018 - XX	Upscaling of the “network” model, signing more contracts with additional cooperatives In the meanwhile, Antenna started to test the “network” model in Mali. A roll-out in Burkina Faso is planned for autumn 2018.

To sum up, during the Solar Square project four different distribution models have been tested with three models being implemented directly by the Antenna foundation together with its local partner ASG:

I. Solar Square “retail model”: distributing solar kits among retailers who have been hired and trained
II. Solar Square “door-to-door model”: salesmen distributing solar kits by going from village to village
III. External project: artisanal mining company tested if they could distribute the OOLUX kits among villagers who live in mining districts (energy as a service model)
IV. Solar Square “network model”: local partner in Cameroon is solely making contracts with cooperatives, kits are leased out by the cooperatives among their members

The “Solar Square” project underwent several changes during the pilot phase (2014-2018). Firstly, because of technical difficulties with the ICT solution we had to invest more resources into the development of another version of the web portal and the application. Secondly, the off-grid market in Cameroon is underdeveloped and the outcome of the first tests unpredictable. Hence, we had to currently change and adapt the business and distribution model. Finally, the field test took more time than planned which is why the project team extended the project in 2016. Therefore, the budget had to be adapted as well.

The main objectives however did not change. With the “Solar Square” project we wanted to find a sustainable business as well as distribution model to efficiently distribute solar power kits in rural areas of Cameroon. The organisational, technical and economic objectives were sub goals and have just been modified with regard to the different models.

4.2 Achievement of Objectives and Results

To evaluate the objectives and results of the Solar Square field test it is important to first analyse the different business and distribution models which have been tested, and then in a second step, to evaluate the three different models on the basis of the organisational/conceptual, technical as well as economic objectives.

4.2.1 Solar Square “Retail” Model

Model description & party responsibilities

The “retail model” was the original business and distribution model which had been outlined in the project proposal: To reach the customers, Antenna uses different intermediaries. The solar power kits (e.g. OOLUX) are shipped to the main local partner in Cameroon, African Solar Generation (ASG), which is then responsible to implement the model. Hence, ASG delivers the products to the corner shops, but also take care of the financial processing, conduct the product training and do repair work.

The distribution system can be characterized as a level one channel. That means, the products are delivered to the corner shops which in turn leases them out to the people living in the village (the end customers). Neither Antenna nor ASG has a link to the end customer; the corner shop alone is responsible to supply the end customer with products and to collect the money from the leasing rates. However, the solar products remain the property of the local partner. The corner shops are the only form of distribution channel and it is thus important to make a solid due diligence to select trustworthy shop owners.

To make solar energy affordable, a leasing model will be put in place: due to the high upfront costs it is important to enable payments by instalments. On the one hand, this has the advantage that people with even a small (but regular) income can afford high quality solar devices. On the other hand, the leasing entails default risks and thus poses a challenge to the business. However, the reliability and commitment of the corner shop to meet its financial obligation is not sufficient enough. To offer high quality solar devices at an affordable price, it is extremely important that the corner shops as well as end customers pay back the leasing fees.

In order to guarantee that the end customer pays the leasing fee to the corner shop, solar kits with an integrated prepaid micro-finance system are used: As a first step, the customer makes a payment and obtains a solar kit from the corner shop. The owner of the shop activates the kit with a smartphone (through an USB interface) while the customer can use it until the pre-paid period expires and the system automatically deactivates. This procedure continues until the customer has paid the total amount of leasing rates back and thus, owns the kit. This allows the end customer to acquire a solar kit from the corner shop while paying progressively over several months (rent-to-own). The amount of the instalment payments can thus be covered by the savings made on weekly energy expense. In the end, the prepaid system is an incentive for the customers to pay back the leasing rates to the corner shop. As a result, the prepaid period expires whether or not the customer uses the solar kit. This approach is important to guarantee a regularly pay back of the leasing fees. Hence, when the customer decides to lease a kit, he has to make sure he is able to pay back the leasing rate.

In order to guarantee that the corner shop transfers the money (the collected leasing rates) to the local partner and finally to Antenna, an ICT solution is required. The technology includes an application (using a SMS gateway) and a cloud solution: The application running on the shop owner's smart phone requests a code from the Solar Square server (Solar Cloud) every month in order to activate his smartphone. When the corner shop owner requests the code, all the information from the last business month is sent to the

Solar Square server. The cloud stores every information about the shop owner (similar to a CRM) accumulated with a specific credit rating. If the corner shop does not meet its financial obligation, the smart phone

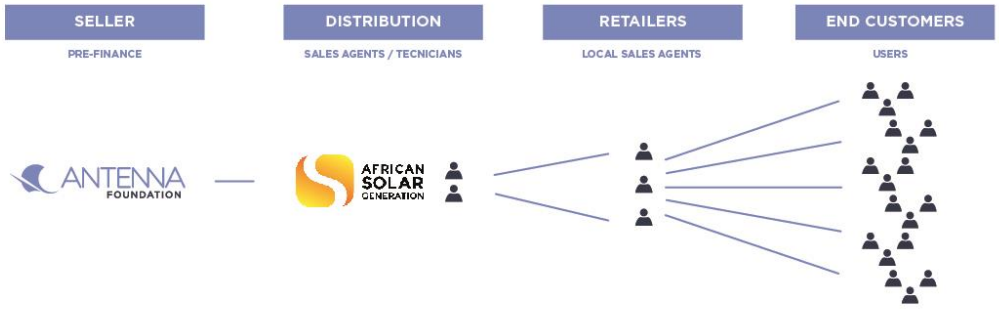

Figure 1: Presents the retail model and the relevant involved party structure

will not be activated again and thus, the corner shop owner is no longer able to continue the busines

Various responsibilities for the project implementation have been split amongst the local partner and the multiple retailers.

The local partner was responsible for the execution of the following tasks:

- To maintain the ICT system (SMS gateway and application)
- To monitor and manage the retailers
- To monitor and manage the customers (direct customers)
- To promote and market OOLUX in Cameroon
- To repair the products (handle the warranty) and send all related information to Antenna
- HR and organisation

The retailers were responsible for the execution of different tasks:

- To handle the OOLUX manager (application)
- To monitor and manage their customers
- To promote and market OOLUX in their villages
- To do a first troubleshooting (handle the warranty) and send all related information to ASG
- Legal security (fill out payment receipt and contract)

Organisational and conceptual evaluation

This paragraph evaluates to which degree the different stakeholders fulfilled their respective duties and responsibilities.

Local partner ASG

With the technical improvements implemented in 2016, the ICT system performed well with very few failures, and ASG was doing a good job in maintaining the SMS gateway. The SMS gateway phone had access to the internet through mobile data and normally there was enough airtime on the phone. However, the back office was often just putting small amounts of airtime on the phone with the result that after a certain period of time the gateway was not able to send sufficient confirmation messages. This could lead to technically issues. By putting more credit on the phone the problem was solved quickly. To make sure that the SMS gateway phone always had enough power the phone was connected to a powerbox and the powerbox itself to the grid. The OOLUX manager was also working well since the elimination of several bugs.

On the contrary, the monitoring and management of the retailers remained a problem. At ASG, a project manager was responsible for contacting the retailers on a weekly basis. However, it was often not possible to call the retailers as the mobile phone coverage in rural areas is very poor. When there were technical issues (with the OOLUX kit or the OOLUX manager app) it often took a week until the back office got to

know about it and could take fixing measures. This did not strengthen the relationship between ASG and the retailers and could lead to personal misconduct. Fraud was another problem discovered on the field. The local project manager was doing a poor job in collecting money from the retailers. ASG's back office discovered that he was not always transferring the money he received from the retailers to the back office. This led to several problems:

1. ASG was not able to tell the exact amount of money the retailers transferred. As the retailers owed ASG money, it was important to put some pressure on them to meet their financial obligations, but the retailers insisted that they transferred more money than what had been stated in the web portal.
2. The local project manager's unprofessional behaviour led to further personal misconduct. The retailers felt motivated not to pay back the money to ASG. One even stated that he did not see the point of giving money to the local project manager as he would anyway keep it for himself.
3. The local project manager misbehaviour corrupted the field test

Similarly, the monitoring and management of the customers remained a problem as well. On the one hand, the local partner failed in pushing the retailers to get back the money (or the OOLUX kits) from their customers. The retailers needed to be reminded to get in touch with defaulting customers. And if the customers refused to make their payments, the retailers should have taken the kits back immediately. However, due to the poor mobile phone coverage it was not easy to be in constant touch with the retailers. On the other hand, the local partner leased out some kits directly (through their technicians and the back office) to customers living in urban areas. Most of them stopped their payments at a certain point.

The local partner took several marketing measures (sometimes rather expensive and complex) to promote the OOLUX kits:

- In rural areas, it was mainly through the retailers (with or without a representative of ASG):
    - By visiting customers the retailer identified and showing them the product
    - By holding village meetings to present the product
    - With a promotion stand at the marketplace (accompanied by a DJ playing music)
    - By hanging up posters
    - By handing out flyers
    - Additionally, some radio spots have been played promoting OOLUX
- In urban areas it was mainly through the ASG employees
    - By presenting the product in different events (religious meetings, meetings of local elites etc.)
    - Recently, ASG started to use different e-marketing channels (e.g. facebook, youtube)

The repair and warranty processes were conducted by the local partner. Thus, when a kit was broken the retailer replaced the components and sent them back to the local partner. Once the broken parts were in the office the local partner did the trouble shooting. Except of some lamps it was mostly the powerbox that didn't work anymore (10% of all powerboxes had issues). About 40% of the powerboxes could be repaired in Cameroon. The other powerboxes needed to be sent back to Switzerland as the spare parts could not be found locally. ASG knew how to repair the OOLUX kits as one of their technicians had been trained by the OOLUX team at Antenna.

The weakest part of the local partner was the HR management and the organisation of the field activities. ASG still struggled to find reliable, motivated and skilled people in Cameroon. Since the beginning of Solar Square several employees had been fired due to fraud. The project manager was removed as he did not carry out the Solar Square activities in a responsible manner.

Retailers

The retailers could handle the OOLUX manager (application) without major problems. After the technical improvements which have been executed in the months July – November 2016 the app did not have bugs anymore. Hence, the retailers did not face problems anymore in handling the app. Additionally, the app has

been optimised and simplified (see technical modifications above). The only problem that still existed was the connection of the powerbox with the phone (through USB cable). If the USB cable was not properly attached the app did not properly detect the app and the retailer could get lost.

The main obligation of the retailers was to monitor and manage their customers. All retailers failed in managing their customers due to the following main reasons:

- The retailers did not put enough pressure on their customers to pay back their kits on time or to give back the kits to the retailers in case they were bankrupt. We identified two main reasons for this behaviour: On the one hand, the retailers often had a personal relationship to their customers. This bond was stronger than the loyalty among ASG with the result that they often did not want to risk their relationship. On the other hand, the retailers were very negligent. They did not proactively reach out to their customers to remind them of their obligation to pay.
- The retailers did not always see it as their responsibility to get back the kit in case the customer refused to pay (although it was stated in the contract).
- The customers did not want to give back the kit to the retailers, only to officials of ASG, as they were afraid of being cheated.

The retailers also had a mandate to promote and market the OOLUX kits. However, according to the sales figures some retailers were more successful than others. One retailer for example drove with this motorbike to several neighbourhood villages to promote OOLUX. But as this endeavour was very expensive (espe-cially the collecting of the money) he stopped at a certain point. Others market the kit during presentations (either with the support of ASG or not) in the village. And still others made little efforts to promote the kit. Summed up, there were different strategies and ways to market OOLUX. Every retailer got 10% commission on every sale (or leasing). Although it was an appealing business most of the retailer did not push sales hard enough. This has to do with the fact that selling OOLUX was not their core business but rather a side business.

The first troubleshooting was also an important task of the retailers. In case an OOLUX kit did not work anymore the retailers either must find out how to fix it or to replace the broken components (often the powerbox). However, in any case they had to send the information to ASG. At the beginning of the Solar Square field test the retailers were not able to replace components themselves but they did it anyways as the customers pushed them to do so (especially when ASG technicians were not available). Thus, during the field test a new process has been implemented as well as the application adapted. From a general point of view the retailers executed this task well. However, in several cases the customers did not reach out to the retailers to get them to replace the broken ones. This can be explained by the bad experiences most of the customers already had with “customer care” in Cameroon. They tended not to report warranty issues as they expected no support.

In order to double check the accounting as well as to give the customers and the retailers’ legal security, two processes were introduced:

- First, the retailer filled out a contract (on paper) with the customer whereby each party (including ASG) got a copy. In this contract, every payment during the leasing period was registered.
- Second, every payment made by the customer to the retailer was confirmed by handing out a receipt (with three copies for the retailer, customer and ASG). Similarly, every payment from the retailer to an ASG employee – they often collected money when they were on the field – was confirmed by handing out a receipt (one for the retailer and one for ASG). The retailers normally did a good job. However, some ASG employees convinced the retailers not to hand out a receipt for the payments made to ASG to misappropriate funds. This was also the reason why ASG fired the responsible project manager.

Customer

Finally, the customer had the obligation to refund ASG for the leased OOLUX solar power kit. Around 30% of the customers did not pay back their kits and the retailers were not making any effort to make the customers bring back the kits. This percentage could have been reduced if the retailers would have proactively talked to the customers and convinced them to meet their obligations. Regarding the warranty process most of the customers contacted the retailers when they faced technical problems with their kits.

Technical evaluation

The technical problems faced in the first part of the field test (August 2015 – April 2016) have been solved. Antenna's partner taktwerk did a good job in improving the web portal, fixing the bugs of the OOLUX manager (application) and the SMS gateway. Thus, from a technical point of view the Solar Square field test was a success.

Economic evaluation

The biggest challenge in distributing high quality solar power kits in Cameroon was to find a sustainable business model. Within the Solar Square project an own distribution system for the portable solar power kit OOLUX has been established as described above. After the development and improvement of the ICT solution the project had a solid foundation. Hence, the business model could be tested, in particular the extension of the retailer network: To scale up, new retailers with the following profile have been recruited:

- **High population density**: They should live in areas with a very high population density, which decreases the cost of reaching new customers.
- **Salesmen:** They should be able to dedicate a relevant amount of time to selling OOLUX kits, ideally in combination with their already existing sales business.
- **Stable Income:** They should operate in regions with a stable income during the whole year, implying that their customers have a more stable income.
- **Strong communication skills:** They should be able to market solar power kits, requiring strong communication skills to point out the advantages of high quality solar energy products such as the warranty, the battery size, the efficiency of the lamps etc.

In addition to the three retailers from the first phase of the project (August 2015 – April 2016) another five retailers respectively salespeople have been trained during the project duration. Compared to the expected results mentioned in the project application (10 retailers) this was below the expectations. This can be explained by the following reasons:

- It was difficult to find retailers who fit the criteria mentioned above and that are reliable at the same time. We quickly learned that it was worth spending more time on the careful screening of the retailers before working with them. Quality before quantity should be the credo.
- We realised that it was not easy for the retailers to promote a high quality solar power kit. A lot of efforts needed to be taken to train the retailers on marketing and promotion.
- Retailers sell very well at the beginning but get stuck once their villages or home towns are saturated.

In Cameroun's social and cultural context, the following elements of the retail model caused problems:

- **Mistrust:** There was a mistrust between people living in the village and the retailer. It was hard for them to understand that a retailer who has been in the village ever since can suddenly offer high quality products. Additionally, they did not want to give him money as they always had the impression that the retailer did not sell the product at a fair price (especially when the product was expensive).
- **Communication:** Although the retailers had been trained he could not communicate the advantages (quality, guarantee etc.) of an OOLUX kit. Moreover, he was not the right "ambassador" for OOLUX, which is an expensive product from Switzerland.
- **Selling Skills:** To sell an expensive product in a market with a lot of cheap products, one needs very good selling skills. A local shop owner may be an entrepreneur but it does not automatically make him a good salesperson, especially when there is no brand awareness for OOLUX (people living in the village only get the information from the retailer and not through a neutral channel).
- **Close support**: Retailers have been left alone. Because we expected them to explore their markets, and due to communication problems, it was not easy to stay in touch permanently with them. Retailers were overstrained and they needed much more support by someone who knows more about the product, market and need for clean energy. This freedom or independence often made them vulnerable to fraud.

Besides these qualitative evaluations, it is important to have a look at one particular key figure, the default rate. The intended default of payment was fixed at 5%. However, the default payment was around 15%. This was three times as high as expected. Because of the small margins of solar power kit, this ratio is too high to have a reliable business model. According to our calculations we cannot have higher default rates than 10%.

Consequently, Antenna realised that the "retail model" was too complex for the different intermediaries to manage. The model depended too much on a careful execution of complex tasks which was beyond their professional skills. One solution could have been to find people with the required knowledge, but this would have put enormous pressure on costs. Considering the small margins of solar power kits, labour costs are critical. Also, the social context of traditional villages in rural areas of Cameroon is complex. To interact with every single customers requires a lot of resources which leads to higher CRM costs and thus, makes the business model less profitable and sustainable. Antenna thus decided to change the business and distribution model.

4.2.2 Solar Square "Door-to-Door" Model"

Model description & party responsibilities

In June 2017 the project team decided to change the business and distribution model, from a "retail" to "door-to-door" model. While during the first part of the project the retailers and sales agents of the local partner were selling the OOLUX solar power kits, sales agent should become the main distribution channel.

In this model, ASG trains the salespersons for the promotion and selling of the OOLUX solar power kits. Through an integrated prepaid-system the OOLUX kits can be controlled by the salespersons by using a smartphone and ultimately be leased to the rural villagers. For this purpose, the salespersons are touring through well-defined regions. ASG is not only defining the exact route but also the schedule. This is important so that customers always know exactly when the salesperson will be coming so that they can prepare their payments, avoiding that the customer runs out of credit. If the customer refuses to pay, the OOLUX can automatically be deactivated and the salesperson can take the kit back.

To control the implementation of the model as well as to sell efficiently the following measures were taken:

- **Organisation**: It is crucial that ASG plans and schedules the village tours. People should know when a salesperson is coming. It also gives a certain consistency.
- **Control**: It is very important that this salesperson can build up a relationship of trust with their customers. It is important that one has reliable people, considering the fact that people living in rural areas have enormous trust issues and fraud is a common. As control mechanism, tours can for example be GPS tracked.
- **Free Trial**: Every customer has the possibility of using the OOLUX kit the first 2 weeks for free. If he is satisfied he will start to pay and lease the product. This is not only a marketing measure but also a way to build up trust.

Figure 2: Presents the door-to-door model and the relevant involved party structure

Organisational and conceptual evaluation

A technician of the local partner was touring the Southern region of Cameron during several weeks. In order to track the routes as well as to systematically plan the tours, a GPS tracker had been used. Based on the record the local partner's back office, we were able to monitor and control the routes. This was important to make sure that the sales agent would go back to the villages at the right time to unlock the kits.

A crucial challenge was thus the organisation of the routes to make sure the sales agent is able to unlock the solar kit before the leasing period expires. To run the first tests, our technicians worked as salespersons at the very beginning. Although they have been well trained, unexpected incidences (e.g. strong rain) made it complicated to stick to the plan and routes we defined in advance. Hence, with newly hired the organisation would be even more complicated. To sum up, this model can be put in place but it is challenging to organise in detail beforehand due to the unpleasant surprises that can be found in rural areas. A strong back office and employees with good organisational skills are important.

Technical evaluation

The ICT solution used for this model worked well, as the use of the application and the web portal was made much easier. This was enabled by the fact that the sales agent was going back to the local partner's office regularly in order to synchronise the app himself. Additionally, the sales agent was more trained and much more experienced in using such technologies compared to a retailer living in an off-grid area.

However, during the pilot phase of the "door-to-door" model we faced technical issues with the solar kit. In Cameroon, the rainy season begins in August and September, and it is often very cloudy especially in the South (long cloudy periods in 2017). Originally, the solar panel of the OOLUX kit was of 5W, which is was not sufficient to charge the kit when there were clouds several days in a row. This was unfortunate when the free trial period coincided with the low solar panel performance during the rainy season, leading to a higher solar kit give back rate. As a consequence, 10W solar panels became the norm for Cameroon.

Economic evaluation

The "door-to-door" model faces similar problems as the "retail" model, most notably:

- Distribution costs are very high, due to the sales agent's field expenses every week, such as transportation, accommodation and food.
- A well organised back office to manage and control the agents as well as to coordinate the routes is crucial. As mentioned in the previous chapter, it is challenging to find skilled and reliable employees who work for a regular salary. The organisation of sales agent is a complicated task and thus, a strong team is required.
- Customers do not have a lot of trust in people coming from the outside selling solar kits. Marketing the kit is more challenging especially when you want to sell a high quality product.

About 30 OOLUX solar power kits have been sold using the "door-to-door" distribution model. Due to the problems mentioned, Antenna decided to change the approach.

4.2.3 Solar Square "Network" Model

Model description & party responsibilities

In February 2018 the project team decided to change the business and distribution model, from a "door-to-door" to a "network" model. While during the second part of the project the sales agents of the local partner were directly selling the OOLUX solar power kits, in the new model, we started to cooperate with existing networks and groups who are socially embedded in rural areas (e.g. cocoa cooperatives).

In this network model, ASG presents the OOLUX solar power kits and the business idea to the leaders of cooperatives or other networks. If they are interested, ASG asks the cooperative director to make a list of interested members of his cooperative, this is normally limited to two weeks. During this time, a contract is signed with the responsible of the branch obligating him to collect weekly fees and send them to ASG (using mobile money). Two weeks later the members receive their kit which they must pay back within 75 weeks. From then on, the cooperative is fully responsible for collecting the money and the after sales service. In return, the cooperative director receives 20% of the collected fees. If the members do not pay their fees, the cooperative is fully responsible and thus, must pay itself the outstanding amount. For control reasons,

the kits need to be unlocked every 3 times (for 1 month, 2 month and 3 months = 6 months). In order to find trustful networks a due diligence process is established. For example, only cooperatives that have been doing business for a certain time and who are registered can participate.

Figure 3:Presents the network model and the relevant involved party structure

Organisational and conceptual evaluation

The model has been put in place exactly as described above and the results are very positive. For 75 weeks each customer pays CFA 1000 (= CHF 1.60) per week. This amount can be paid easily by the customers, in our case cocoa farmers, who normally have higher weekly expenses for energy. At the same time, the underlying administration which is necessary to collect the money has been outsourced to the cooperatives. This allows it to reduce costs and make the solar kit affordable. Moreover, there is no sophisticated PAYG technology needed and because the cooperatives transfer the collected money via mobile money to the local partner, transfer costs are low. With this model it is furthermore possible to reach many customers in a very short period of time. So far, the involved parties understood and executed well their duties.

Technical evaluation

Part of the ICT solution is used as well. The app for example is fundamental to unlock the solar kits according to the patter mentioned in the last paragraph. What is new, however, is the relation with the customer. ASG has a contract with the cooperative and not with the end customer anymore. Hence, the web portal is no longer used the way it had been used before.

Economic evaluation

In the network model, we stopped working directly with retailers as well as with the end customers. Instead, we cooperate with trustful networks who are well organised. As such networks (e.g. cooperatives) are often business oriented, their members have regular incomes and are able to pay pack the kits.

The transition from the “retail” and “door-to-door” towards the “network” model has several advantages:

- **Economies of scale:** With a small sales team we can easily reach a lot of people. We only have to get in touch with the people in charge who carry out a large part of the work. It is thus essential that the local partner finds trustful networks and negotiates the contracts. The collecting of the money as well as a big part of the distribution will be carried out by the cooperative.
- **Marketing and communication:** Often it is sufficient to convince the responsible of the cooperative, who are often more aware of the solar power advantages.
- **Mobile money:** Most people in rural Cameroon do not use mobile money, except for the head of the cooperatives, who often already have a mobile money account for their business. And if not, it is much easier to introduce mobile money to one a single person than to every single customer.
- **Up- and Cross-Selling**: It is very important to build up trustful relationships with cooperatives. If they meet their obligations we can also start to sell other products (e.g. solar pumps, SHS etc.) to

them. We want to encourage the cooperatives to respect the payments and thus, win our confidence (to benefit in the long-run).

- **Decentralised responsibilities**: The cooperatives will earn 20% from all kits sold. In return they are fully responsible to collect the money as well as to send it using mobile money. If they aren't successful they have to pay the missing amount out of their own pocket.

Until today, contracts have been signed with 7 cooperatives. 180 solar kits have already been delivered while another 230 kits are ordered. Soon the local partner is running out of stock.

4.2.4 The role of mobile money in Cameroon

The landscape of the mobile money market is changing significantly. According to the GSMA, alone in 2017 about 136 Million new mobile money accounts have been registered. This is an increase of 25% compared to the year 2016. In 2017 Western and Middle Africa (e.g. Cameroon) were the fastest growing areas of Sub-Saharan Africa, led by tremendous growth in registered accounts in countries like Ghana, Côte d'Ivoire and Cameroon.

These findings coincide with the experiences in Cameroon where only in the last two years mobile money became widespread. However, this should not hide the fact that especially in Western and Middle Africa the urban penetration grows. The latest GSMA report states that people living in off-grid areas remain the hardest to reach group. This is mainly because of the difficulties and high costs to establish a network of agents who disburse money or accept deposits[2]. This is also true for rural areas in Cameroon where villages often have a very low density and most people hardly have access to mobile money agents. Hence, the people who have access are often the ones who can travel and charge their mobile money accounts in urban or semi-urban areas. But not only the network of agents is key to the development of the mobile money market, the regulations as well as the services offered by the providers are important. In Cameroon, the regulations are quite complex especially as the country is part of the Economic and Monetary Community of Central Africa (BEAC) which has unfavourable laws regarding electronic money. Moreover, the services offered by mobile money providers in Cameroon are poor. It is for example very difficult for online shops and online services to integrate existing mobile money platforms in their payment systems. Hence, this not an environment that fosters the use of mobile money, neither in urban nor in rural areas[3]. Although the market is growing in Cameroon, a wide coverage in rural areas will not be reached soon. This is in line with the findings of the energy assessment we conducted in Cameroon (see "Energy Assessment Cameroon 2017").

[2] GSMA State Industry Report (2017), S.9

[3] https://www.probewrite.com/en/articles/22/cameroon-no-hope-for-mobile-money

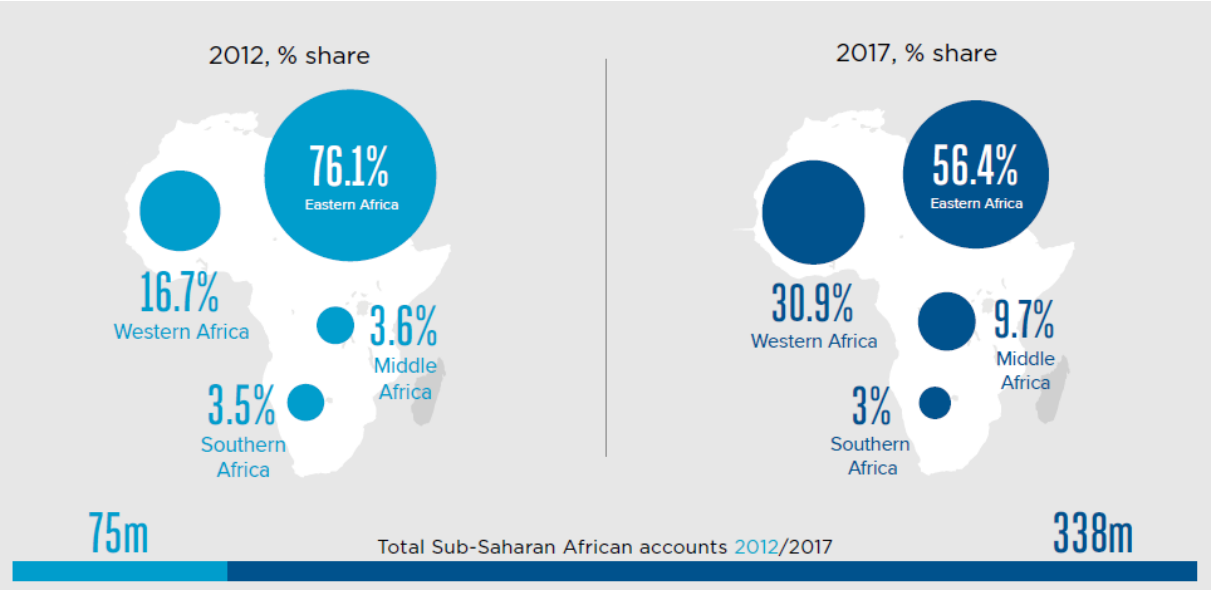

Figure 4: The use of mobile money in Africa

The integration of mobile money within the "retail" as well as "door-to door" distribution model is complicated. As mentioned in the last paragraph, many people living in rural areas of Cameroon still do not use mobile money on a regular basis. Hence, relying on mobile money as mode of payment either results in the exclusion of customers or is an additional burden for the sales team as they have to train the new users. Our colleagues from UpOwa, a start-up in Cameroon selling small solar home systems, is doing exactly this. They use the "door-to-door" model to distribute their solar kits and only accept mobile money for the payments. They therefore not only have to train the customers in using the solar kit but also have to help them handle mobile money. An additional training makes the distribution of solar kits more complicated and expensive. Furthermore, the operator takes a fee for the service (e.g. when you transfer or withdraw money). Given the small margins of solar power kits these additional costs make the business model less profitable.

To use mobile money within the "network" model is less challenging. Cooperatives are very progressive, business-oriented and more experienced in using modern technologies. During our pilot test we did not introduce mobile money as those responsible already have an account. Today, we receive every week the payment to our Orange money account. We pay, however, the fees to withdraw the money and put it on our bank account.

To sum up, the use of mobile money services is an advantage when the customers already have an account. In Cameroon, this is not the case in rural areas, except for some private individuals like for example the head of local cooperative branches.

4.2.5 Comparison of the different model

The different models examined in the last paragraphs have different advantages and disadvantages. Hence, it is even more important to test them and find the one that fits best for the rural off-grid market in Cameroon. During the Solar Square field test, we examined three business and distribution models, each with their advantages and their disadvantages:

	Advantages	**Disadvantages**
Retail model	• permanent advertising • decentralised stock • "closer" to the customer" • After sales service easier • cost calculation easier	• training of retailers complicated • well established processes important • decentralised responsibilities

		• complicated communication • upscaling of the model complicated
Door-to-door model	• more sales • less training needed • up- and cross-selling possible • centralised responsibilities • good processes can be established • communication easier	• advertising complicated • logistics complicated • unpredictable costs • model is expensive • upscaling of the model expensive
Network model	• more sales • less training needed • up- and cross-selling possible • decentralised responsibilities • good processes can be established • communication easier • model is profitable • legal security • upscaling of the model easier	• complicated to find trustful "networks" • cluster risk ("too big to fail")

4.3 Multiplication / Replication Preparation

The main purpose of the Solar Square field test was to identify the best business and distribution model. After testing the "retail" and "door-to-door" approach, with the "network" model we found a suitable approach. However, to have proof of concept we aim at selling more solar kits in the coming months. We have already sent 500 OOLUX kits to Cameroon to sign contracts with at least four more cooperatives. More than 230 solar kits have already been pre-ordered. Our field staff is currently touring through several regions taking contact with more cooperatives. It is planned that until the end of the year we will have sold all 500 kits.

Thanks to the success in Cameroon, Antenna started to test the model in Mali as well. In January 2018, a local solar company has been established in Bamako. In collaboration with a manufacturer of solar lamps in Ouagadougou (Burkina Faso), Antenna started to distribute solar lamps as well as OOLUX kits in Mali. Although it was planned to sell the products just only cash, the "network" model tested in Cameroon inspired the local team to introduce a similar model. Today, about 250 solar lamps/kits have been sold to 6 different associations using the "network" model.

4.4 Impact / Sustainability

To develop energy access programs or businesses it is important to know the local energy landscape and the societal context. Thus, Antenna worked together with D-Lab of the MIT (Massachusetts Institute of Technology). D-Lab developed an "Energy Assessment Toolkit" which helped Antenna and its partner in Cameroon to gather information needed to make decisions about what technologies and business models are best suited to meet the specific needs of the communities (through market-based initiatives). In May 2017, a research team including two members of the Antenna energy department, a MIT expert as well as five Cameroonian researchers conducted more than 100 field surveys to assess the potential of the solar power kits in Cameroon. The findings will help Antenna to better evaluate the Solar Square business model and the potential of solar energy in rural areas.

The main purpose of the energy assessment was not to measure the impact of Antenna's energy program in Cameroon but rather to analyse the needs. Furthermore, we wanted to better understand our customer and find out what kind of products and services we had to offer. The study revealed that most people still rely on kerosene lamps or very cheap solar products and, due to the high cost of last-mile distribution, it is very difficult to disseminate high quality solar lamps. As such, it will be necessary to develop new distribution

and business models. Support from NGOs also remains important, as small companies cannot handle all costs alone. In addition, more productive usage solutions are required as there is a huge desire to use solar energy to improve businesses. In agriculture in particular, food conservation can have a telling impact on increasing incomes in rural areas.[4]

The main result of the Solar Square field test was the testing of the business and distribution models which led to the implementation of the "network" approach. During this process 600 OOLUX solar kits have been distributed in Cameroon, with 500 more kits being distributed until the end of this year. With a total of 1'100 kits being distributed in the Centre and South regions of Cameroon, the impact is noticeable when visiting the relevant villages. At nightfall, these villages are no longer in the dark.

5. Outlook / Further Actions

5.1 Multiplication / Replication

The next step planned is the commercial proof of concept. Although we already sold 200 kits in Cameroon using the "network" model, we aim to sell another 500 OOLUX solar kits (with an order of 200 kits already placed). Until the end of this year, we will empty our stock and initiate another importation of solar kits. The same is true for Mali where we plan to distribute another 250 solar lamps until the end of 2018.

To multiply the project in Cameroon we started to contact more cocoa cooperatives. At the moment, we have 12 cooperatives who show strong interest to sign contracts with our local partner in Cameroon. These cooperatives have a potential to lease out 600 solar kits alone. To find more cooperatives we acquired a list from all cooperatives registered in the South region (where the local partner is based). We will contact each of them to organise a big assembly where we present the model. Interested cooperatives will first be evaluated and if they are trustful we will sign contracts with them. In order to establish the "network" model more systematically, especially to implement the due diligence process, Antenna will send a civilian service member to Cameroon who will help the local partner with the implementation. From October 2018 to February 2019, we will establish with the local partner a business selling solar power kits using the "network" approach". This business should be financially reliable and will be even further multiplied in 2019.

Antenna already started to replicate the model in Mali. As mentioned above, 250 solar lamps of the Burkina Faso based manufacturer "La Gazel" have been distributed from January – July 2018 using mainly the "network" model (cash sales are accepted as well). If Antenna is able to sell at least 50 solar lamps per month, the model will be applied to Burkina Faso as well where we already got in touch with several women networks. To fight gender inequalities Antenna aims to distribute among women networks whose members often suffer the most from energy poverty.

There are three constraints regarding the replication as well as multiplication of the "network" model:

- First, it is very important to identify trustful networks as well as to find responsible persons who can manage the money collection. Although Antenna has very good partners in several countries, the due diligence process is key. Thus, we should rely on partners who already have a track record working with Antenna or who could recommend associations, cooperatives or other networks. Only if they are strongly embedded in rural areas the model can be put in place successfully.
- Second, seasonality poses a major problem for a linear payment as proposed in the "network" model. Cocoa cooperatives in Cameroon for example struggle to pay shortly before harvest season. The same is true in Mali. When working with artisanal miners you cannot expect payments during the rainy season as the mines are closed. Although the "network" model tries to reduce payment intervals from monthly to weekly payments (with very low amounts), there are seasons where customers cannot pay. This is especially true for farmers who did not diversify their crops (e.g. cocoa farmers). Hence, a certain flexibility of the payment periods is required.
- Finally, the pre-finance of the solar kits is challenging as well. In Cameroon the payment durations lasts 75 weeks. Antenna must raise sufficient investments to pre-finance bigger amounts of solar kits over a long period (18 months not taking into account the shipment).

[4] For more information see «Energy Assessment Cameroon 2017"

5.2 Impact / Sustainability

One sustainable effect that can be measured is the CO2 saving potential of solar kits. According to our own calculations (see document “OOLUX Greenhouse Gas Emissions Reduction) an OOLUX solar power kit replaces 1.5 kerosene lamps as well as the charging of mobile phones with diesel generators. Hence, Antenna estimates the CO2 saving potential at roughly 1 ton per kit per year. Other calculations are more pessimistic. Solar Aid states that a kerosene lamp emits roughly 370 kg of CO2 (and black carbon) per year. Hence, replacing 1.5 kerosene lamps results in a CO2 saving potential of 555 kg per year per OOLUX kit. During the Solar Square project, the following amount of CO2 has been saved taking into account the kits which will be sold until the end of 2018:

	Pessimistic scenario (CO2 savings in tonnes)	**Optimistic scenario (CO2 savings in tonnes)**
1 OOLUX kit	0.555 t	1 t
1’100 OOLUX kits	610.5 t	1100 t

Other sustainable effects such as social, health or socio-economic impacts can be observed, however not measured. When talking to the different stakeholders of the Solar Square project during the energy assessment, the following observations were made:

- Although kerosene lamps are both expensive and harmful to people’s health, they remain the preferred lighting source. This is related to wide availability of petroleum – including in many villages – allowing people to purchase it whenever they have money. People spend up to 10,000 CFA a month (18 USD) for lighting. However, solar lamps and torches are increasing in usage.
- Often, small solar lanterns do not completely replace kerosene lamps, but are instead used as a secondary lighting source.
- In summary, most people are aware of solar energy and would like to use it, but high upfront costs have prevented a high penetration. Thus, it is very important to pre-finance solar kits which can replace kerosene lamps entirely (kits are more powerful than lamps). This will certainly improve the health of families living in rural areas.

Expenses for lighting the house and charging mobile phones account for a big share of the household budgets, in particular the latter is very expensive. Mobile phones are quite common in rural areas of Cameroon. In the regions of the Solar Square project, each household has an average of three phones while one out of three phones has access to the internet. Although there is growing network coverage, charging remains an issue. Nearly 40% of people have to travel several kilometres to charge their phones. Not including the cost of transportation, the price for charging a phone can reach 200 CFA per charge (0.35 USD) and, as such, charging mobile phones is not only time-consuming but also expensive. An OOLUX solar power kit solves the charging problem and helps rural households to save a relevant amount of money. With 1’100 solar kits being distributed until the end of this year, the Solar Square project will have helped a significant number of families to improve their lives, from an economic and health point of view.

6. Lessons Learned and Conclusions

6.1 Main findings of the Solar Square project

1. Finding: Need for solar kits remains high

The need for solar kits (pico as well as SHS) remains high in Cameroon. Although there are new products available as well as solar companies in the market, the rural population, which counts for almost 50%, has no access to the electricity grid at all and just little access to off-grid solar devices (pico solar kits or SHS). According to GOGLA, the size of the potential market has remained largely unchanged despite the strong advances in energy access. This is due to the fact that there are still not enough players in the sector, especially not in Central Africa, who can meet the needs of so many people, and also due to the fact that high population growth keeps the market size large in absolute numbers. Moreover, customers that the

market has already served require replacement devices every 2-4 years and remain part of the potential market[5]. Hence, the distribution of solar kits has become more essential than ever.

2. Finding: Distribution is the bottleneck

Distribution of solar devices is still the bottleneck of fighting energy poverty. To serve the off-grid population we have to find ways to reduce the cost of the last-mile distribution. With the Solar Square field test we tried to find efficient ways to distribute solar power kits. As outlined in paragraph 4.2.2 costs related with the distribution remain high but can be strongly reduced with the "network" approach.

3. Finding: Business model innovation

According to GOGLA, most of the off-grid companies have focused on relatively easier commercial options due to the difficulty of large scale distribution to remote market. This is especially true in Eastern Africa where the biggest player in the market operate. But in order to expand to the last-mile areas, innovations and investment in the business model and distribution will be required. We have observed the same in Cameroon where TOTAL gas stations are the biggest distributer of solar lamps. They however struggle to reach rural areas. Moreover, TOTAL shops do not pre-finance bigger devices which makes it complicated for people in rural areas to climb up the "energy ladder". GOGLA highly recommends seeking innovative distribution partnerships to penetrate the harder-to-reach customers[6].

Furthermore, grants play an important role. Although the share of grant funding has declined, it remains important for long-term growth of the industry, in particular for reaching the last-mile, innovation and new market entry. In light of this evidence, REPIC's contribution, helping Antenna identify new models, was very important[7].

4. Finding: Small margins make it complicated to run a sustainable business

Margins for solar power kits (pico) are very small. In the "network" model, which is by far the most profitable distribution approach we tested, we have a gross margin of around 17%. From the CHF 130 selling price, only about CHF 22 are left to cover administration and interest rate costs (and profit for the local partner). In our calculations we included a default rate of 10% (with the "network" model we do not have any defaults so far). Compared to the retail as well as other sectors this margin is very low. To be profitable when selling solar kits one has three options:

- **Increase volume**: One way to generate high turnovers is by increasing the sales volume. But as last-mile distribution is very complex and raising the capital to pre-finance the kits is challenging, this strategy is not very likely.
- **Diversification**: Another way is to extend one's product portfolio to bigger solar systems (e.g solar home systems). Hence, it is important to create a close relationship with your customers, so they can "climb up the energy ladder".
- **Cost-efficiency**: Finally, with low margins it is important to minimize administration costs as well as the number of employees (labour costs). The advantage of the "network" model is the decentralised responsibility. Those responsible of a network collect the money and are the first point of contact for the customer in case of warranty claims.

Consequently, the inherent small margins make it difficult to run a sustainable business distributing solar kits to people living in remote, off-grid areas. It is therefore even more important to apply one or more of the strategies mentioned above.

5. Finding: Vertical disintegration

In 2010, when Antenna came up with the idea to actively fight energy poverty in developing countries, the landscape of the off-grid lighting sector looked very different from today. Just a few organisations and companies were developing solar lighting kits for off-grid regions. Moreover, due to the lack of the suppliers in various parts of the value chain, these companies had a high degree of vertical integration. This means, they developed their own hardware (e.g. solar lamps and kits) as well as software (pay-as-you-go systems)

[5] GOGLA (Global Off-Grid Lighting Association), Off-Grid Solar Market Trends Report, 2018, p. 22
[6] GOGLA, Off-Grid Solar Market Trends Report, 2018, p. 37
[7] GOGLA, Off-Grid Solar Market Trends Report, 2018, p. 139

to allow the introduction of a pre-finance model. As the market was not mature at all, most of the companies even distributed the products to the end customers themselves.

Antenna was no exemption. With the OOLUX and its PAYG model, Antenna started in 2013 with the distribution of its own solar kits in various countries. In this sense, the Solar Square field test was an attempt to improve the PAYG system as well as to find the right distribution model. In the last years, the off-grid lighting industry maturated significantly. Despite the many challenges the sector faces, like for example the lack of adequate distribution and business models, a vertical disintegration can be observed. Today, players in the market exist which no longer produce hardware but concentrated their efforts on the development of PAYG technologies. At the same time, manufacturer of solar kits integrate these PAYG technologies into their products. Yet other players focus on distribution only. The emergence of suitable partners therefore allows a vertical disintegration which helps the actors in the off-grid sector to save costs.

6.2 Recommendations for Antenna's future strategy

The energy department has set itself the goal to become more specialised as well. With the experiences made during the Solar Square field tests and the positive development of the "network" model, Antenna is convinced to more efficiently fight energy poverty by focusing on distribution and business model identification. We are confident that our strategic focus has enabled us to better serve the population living in off-grid regions. Hence, the road map could be defined as follows:

1. **Short run**: We empty the stock of OOLUX solar power kits. The PAYG system, the ICT solution including the web portal as well as mobile app, is still operating.
2. **Middle run**: Identification of hardware and software suppliers. Antenna is already in discussion with manufacturer of solar kits.
3. **Long-run**: Improving existing business and distribution models. If necessary, identify new models which are adapted to the local context. Help local partners to scale up to serve more and more people living in off-grid areas.

As the ICT solution will not be used anymore in the middle- and long-run the property of the software, namely the web portal and the mobile application, is no longer a pressing issue. Today, both the company taktwerk as well as Antenna have the right of the source code. According to the contract with taktwerk, they have further rights if Antenna decides to use the software commercially. However, as it is not planned to produce any OOLUX in the future and, subsequently, to make use of the ICT solution, the legal situation remains unchanged. To sum up, both parties have the right to use the existing codes and to make use of the developed software.

Finally, we are convinced that the future strategy of Antenna's energy department is wisely chosen, even though we have to make painful cutbacks such as giving up a product in which we invested a lot of resources and passion. This corresponds to the experiences made by other actors in the industry. A member of GOGLA, which is going the opposite way of Antenna, made an observation which perfectly sums up the energy department's past: "*We started as a vertically integrated company, which is important to learn the nitty gritty of a market. During our most recent expansion, we decided to partner with local companies rather than carry the heavy cost of distribution and last mile support all by ourselves. Our operations are much leaner and all our financial KPIs are stronger as a result*[8]*."*

6.3 Recommendation for other projects

The Solar Square field test was very important for Antenna to learn about the conditions and challenges of reaching the off-grid population. Today, we are proud to have found a business and distribution model that not only works in Cameroon but seems to have an impact in other countries such as Mali and Burkina Faso. Thanks to the Solar Square field test, 1'100 solar power kits have been distributed with almost 6'000 people benefiting from clean light. And the future looks promising as more and more cooperatives register to sign contracts with the local partner in Cameroon. Today, we need to open another chapter by scaling up the

[8] GOGLA, Off-Grid Solar Market Trends Report, 2018, p. 88

model we tested successfully. However, this success would not have been possible without the many mistakes we made in the past. There are many lessons we learned during the last years:

1. **Not all at once:** With the Solar Square field test we did many things at the same time. Identifying the right distribution and business model while developing an ICT solution adapted to the OOLUX solar power kits. Working in a complex environment like Cameroon while developing a complicated software was very difficult. Hence, if we had to do it again, we would just focus on one thing. For other projects we highly recommend to first identify the core competences of the own company/organisation, and rather rely on experts for other aspects of the project. The key is finding good partners along the value chain.
2. **Minimum viable product (MVP):** The MVP is a product that has enough features to satisfy early customers and provides feedback for future developments. Instead of developing a “perfect” product (e.g. OOLUX) and business model (e.g. Solar Square) it is better to test an idea first under real conditions. The energy department of the Antenna foundation decided to reshape its development cycle by going through the different stages much faster.
3. **Fail successfully:** The learnings during the Solar Square field test were very important for Antenna’s energy department. We are convinced that today’s approach, the network model explained above, is a promising way of distributing solar kits and of fighting energy poverty in developing countries. These results are based on a simple trial and error method. By constantly learning from the mistakes and improving single elements of the model, we evolved. Thanks to the support of our partners, including REPIC, we achieved our goals even though we could not implement the model as describe at the very beginning.

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