



LIGHTING THE WAY

How to Make Pay-As-You-Go Solar Work in the Amazon



I-DEV INTERNATIONAL
Unlocking Business Potential in Frontier Markets

Funded by:



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INTRODUCTION

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ABOUT THIS REPORT

This report seeks to disseminate the main lessons learned from the British Embassy's project '*Piloting Micro-Distribution of Household Renewable Energy Technologies in Iquitos*' in the Peruvian Amazon. I-DEV International designed and tested a business model to overcome the challenges of addressing demand at the last mile and support the adoption of renewable energy as a cheaper and cleaner source of lighting. These insights are based on our own experience and that of our strategic field partners, as well as interviews with end users and key value chain stakeholders.



Lessons learned from piloting a distribution network for household solar systems in the Peruvian Amazon

CONTEXT OF THE PROJECT

I-DEV, with the support of the Prosperity Fund via the British Embassy Lima, developed and piloted a distribution network of solar home systems targeting Base-of-the-Pyramid (BoP) households in remote communities in Iquitos and Belén in the Peruvian Amazon. In partnership with PowerMundo, a local Peruvian distributor of portable solar products, the goal was to introduce pay-as-you-go (PAYG) technology to local households, and ultimately define a scalable model that would allow PowerMundo to tackle barriers to energy access in the Amazon and other regions, as well as create new community income opportunities through an innovative last-mile distribution model.

I-DEV's role was to support PowerMundo in defining its market entry strategy and initial sales trials. To validate market demand and determine the best entry channels, we analyzed the energy consumption and needs of the local population through customer focus groups, a review of the existing energy supply, and an on-the-ground mapping of key stakeholders such as marketing and retail channels, NGOs, local government, and value chain intermediaries. Much of this field work was centered around deriving market insight and cost data through direct conversations with communities, local market players, and institutional actors. Our global experience with solar energy distribution models in Africa, Latin America and Asia also allowed us to leverage sector best practices when designing an appropriate business model and go-to-market strategy for the local context.

I-DEV International is a management strategy and investment advisory firm that specializes in helping to grow and scale businesses in emerging markets. Over the past decade, I-DEV has worked with 250+ small and medium businesses (SMEs) and helped raise over \$50M in financing for growth-stage companies across Sub-Saharan Africa, Latin America and Asia. Beyond clean energy, I-DEV has advised businesses and organizations working in m-commerce, agriculture, health, textiles and apparel, and the consumer retail industry on global connectivity, strategy, and investment.

PowerMundo is a social enterprise that distributes solar solutions and clean technologies to improve access to renewable energy for off-grid households in Peru and Latin America. By offering and financing world-class products and building a rural distribution network, the company improves lives while creating economic opportunities and a cleaner environment in remote areas.

The Prosperity Fund is a multi-year grant facility of the Government of the United Kingdom that promotes development, economic reform and the reduction of poverty in UK partner countries. Its focus is on improving business climate, competitiveness and operation of markets, energy and financial sector reform. This project was executed with support from the British Embassy Lima.

Executive Summary

In the Northeastern region of Loreto in Peru's Amazon, more than **25%** of households are not connected to the grid. The opportunity to provide solar energy to off-grid populations in Iquitos and Belén alone (the two largest districts of Loreto) represents an annual market value of **\$6.5 million**. However, high infrastructure and maintenance costs in such low-density areas make it difficult to attract investments.

To overcome these barriers in last-mile energy access, I-DEV helped to design and pilot a business model for pay-as-you-go solar technology – a first in Peru – aiming to considerably reduce distribution costs for a central company, PowerMundo.

Critical success factors for the pilot to enable rapid scale in the local context included:



Training community-based agents to ensure sales and fast-response customer service in remote areas



Offering customers the option to pay in monthly installments according to their income capacity, paired with default risk mitigation strategies (e.g. initial downpayment, lower interest rates for group loans, etc.)



Diversifying portfolio with faster-moving products (e.g. lanterns, headlamps, radios) to satisfy demand from non-off-grid customers for more affordable, supplementary lighting solutions



Leveraging local community leaders and early adopters as product ambassadors

The next step post-pilot for PowerMundo is to expand its distributor network, enable direct mobile payments from customers, and add new portable products such as battery chargers and cameras to its catalogue.

THE MARKET

25% of Households Off-Grid

\$6.5M Annual Spending on Energy

THE PILOT

9 Months of Research & Testing

13 Communities Impacted

825 Beneficiaries with Additional Daily Hrs of Light & Increase in Household Income



SECTION 1.

Overview of Pay-As-You-Go Solar

Pay-as-you-go technology has radically changed the clean energy landscape in developing countries by breaking the cost and logistical barriers for low-income, off-grid households to access energy.

What is Pay-As-You-Go (PAYG) Solar?

Solar Home Systems (SHSs) are individual photovoltaic systems that can meet the basic energy needs of remote, off-grid households and small businesses. SHSs allow users to light rooms and charge mobile phones, radio batteries and low-power compatible appliances such as TVs, fans or small refrigerators. For un-electrified households in developing countries who primarily rely on firewood, gasoline and disposable batteries for fuel and lighting at a high cost, SHSs can have a life-changing impact by producing more hours of energy at a lower cost and reducing indoor air pollution.

Since 2011, there has been a significant rise in the number of enterprises using the pay-as-you-go (PAYG) model to provide more affordable SHSs to rural and unbanked households. PAYG's main feature is that the SHS is equipped with an internal SIM card or code-activated battery that communicates with the provider every time a customer makes a payment. A critical PAYG success factor in any given market is therefore the sufficient uptake of mobile technology, which is why this model has had great success in East African countries, where mobile coverage and penetration rates have soared in the last decade. M-KOPA, the poster child for PAYG solar, sells SHSs via a 1,500-agent network in Kenya, Tanzania, and Uganda, charging a small daily fee of \$0.45 using mobile payments.¹ In Latin America, while few success cases of this model exist, Kingo in Guatemala delivers pre-paid energy using a cloud-based platform, and allows customers to add solar "credit" to buy an hour, day, week or month of energy – like adding minutes to a mobile

1. TechCrunch, 2016



At least 3 million PAYG solar home systems will be sold globally by 2020

Source: CGAP, Access to Energy via Digital Finance: Overview of Models and Prospects for Innovation, 2014

phone. With the rapid uptake of mobile phones and mobile money solutions in Latin America, the replication of the PAYG solar model beyond African markets to meet the energy needs of the estimated 30 million people who still lack access to electricity in the region,¹ was something that I-DEV was interested in testing out. We set out to find out if this model would work in the Peruvian Amazon, where hundreds of thousands of households still lack access to electricity.

PAYG Business Models

The payment scheme (i.e. how a company charges for the product or service) and the distribution channel (how the product or service is delivered to the final customer) are the two key components of a PAYG business model.

The Payment Model

With most SHSs typically ranging between \$150 and \$1,000 in price, the choice of a viable payment model not only depends on the value proposition and service model of the company, but also the expected volume of clients, working capital needs and the amount of credit risk that the company is willing to take.

Upfront Payments: While upfront cash is preferred for the business, it is often not possible for low-income customers.

Installment Payments: Breaking down the price into smaller, more manageable amounts allows customers to overcome the high upfront cost of the system.

Lease-to-Own Model: SHS ownership is transferred to the customer once they have paid it off in full over 1-2 years.

Subscription Fee: Company maintains ownership and Charges small daily, weekly or monthly fees for an energy service. This model may attract more clients but involves more volatile customer payments.

The Distribution Model

While partnering with third party distributors can significantly facilitate market entry, a more vertically integrated distribution model ensures control over product pricing, after-sales service, and influencing customer behavioral change, which is fundamental to successfully marketing new technologies to the BoP.

Partnerships with Local Distributors (B2B): e.g. wholesalers, hardware retail chains and local shops allow a company to leverage existing commercial channels and enter a market with little investment costs. However, this model also limits brand-building and value-add in the market.

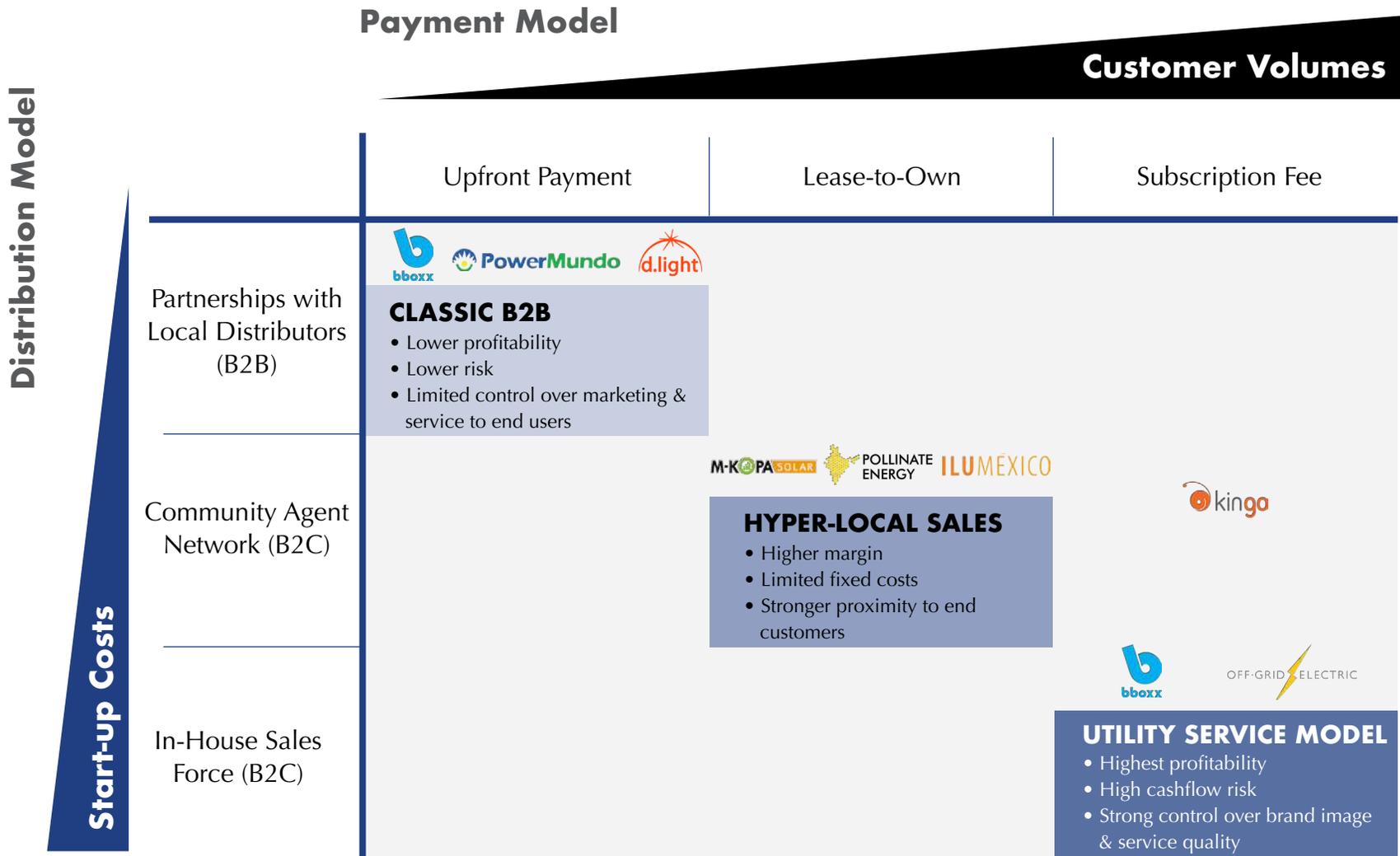
Community Agent Network (B2C): This model allows the company to reach the last mile while outsourcing sales, service and payment collection to third party distributors who earn a per-unit commission.

In-House Sales Force (B2C): Vertical integration of all sales and marketing functions imply significantly higher fixed costs but can make sense in high volume markets or if customer service is an important part of the business model.

1. Multilateral Investment Fund and GSMA, 2013

Pros & Cons of Different PAYG Models

By combining different variations of the payment scheme and the distribution model, three common business models exist and can be identified, each one with specific advantages.



SECTION 2.

The Market Opportunity

With 25% of the population off-grid in Loreto, PAYG solar presents a scalable solution to bridge the energy access gap in the Peruvian Amazon.

Peru's Energy & Mobile Landscape

Current State of Electricity Access in Peru

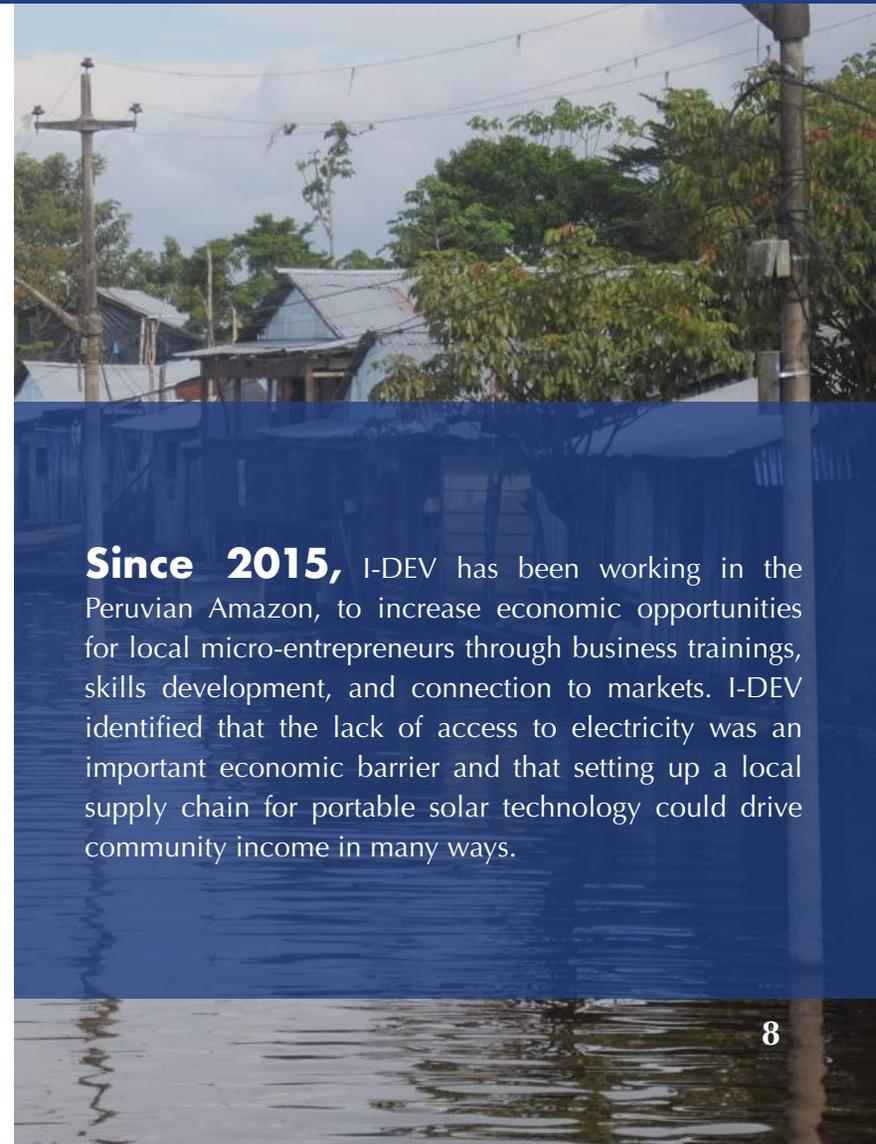
In Peru, the national electrification rate is above 90%, but in certain rural regions in the Andes and the Amazon, up to 80% of the population does not have access to electricity.¹

While the government has made significant strides towards rural electrification with a household solar panel installation program since 2006, more than 3 million households remain off the grid.² The high cost of electricity supply in rural areas like the Amazon where population density is very low, and the limited capacity of households to pay for services make it difficult to attract investments in rural electrification.

The PAYG solar model has the potential to provide electricity to millions of small businesses and households that are not expecting to be connected to the grid in the medium-long term.

1. INEI, Perú: Síntesis Estadística 2015

2. Multilateral Investment Fund and GSMA, 2013



Since 2015, I-DEV has been working in the Peruvian Amazon, to increase economic opportunities for local micro-entrepreneurs through business trainings, skills development, and connection to markets. I-DEV identified that the lack of access to electricity was an important economic barrier and that setting up a local supply chain for portable solar technology could drive community income in many ways.

Energy Gaps & Demand in Iquitos and Belén

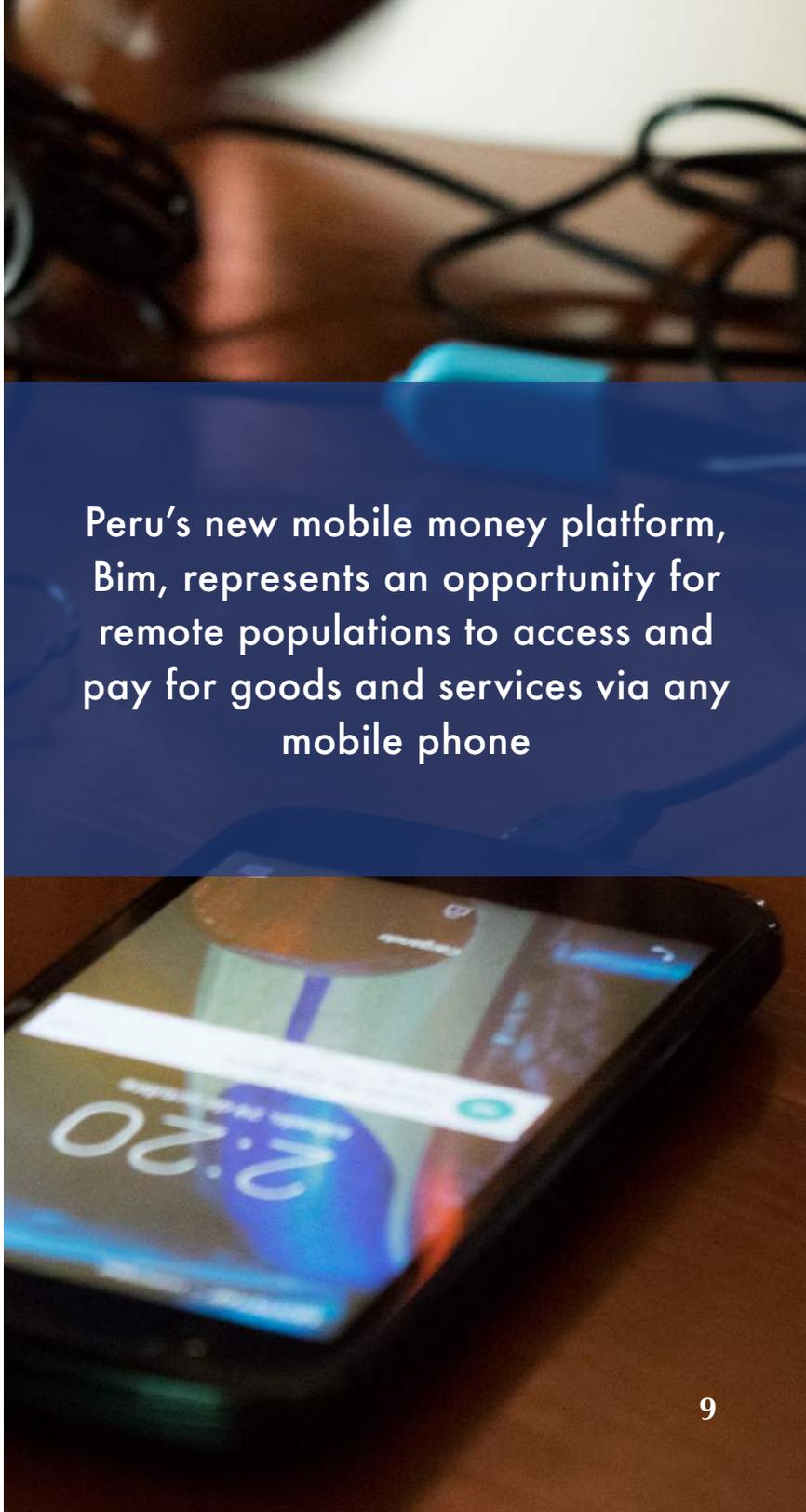
The Northeastern region of Loreto in Peru's Amazon covers almost a third of the country's territory yet is home to only 3% of its population. With only 77% of households on the grid – well below the national average – it is also the region with the second lowest electrification rate in Peru (behind Amazonas).¹ Within the districts of Iquitos and Belén where almost a quarter of the region's population live, an estimated 25% of households are not connected to the grid according to local authorities, and many more have an unreliable or intermittent connection due to load-shedding and frequent power outages. Furthermore, only a few thousand households have received SHSs from the government's rural electrification program¹ and there have been no clear indications whether other communities will follow.

The Mobile Ecosystem

In 2015, 87% of Peruvian households had at least one mobile phone, and mobile broadband coverage reached 95% of the population – one of the highest in Latin America.² However, digital inclusion in rural areas remains low, and the ecosystem for mobile money is still maturing. In early 2016, the Peruvian government partnered with local banks and telecom companies to launch the first fully interoperable mobile money platform, Bim, which allows users to perform transactions and pay for goods and services via any mobile phone, a game-changer for many remote populations. The platform has attracted more than 300,000 users in its first year and is expected to scale up in 2017 and offer a range of new services, including merchant payments, which could enable more scalable opportunities for PAYG.

1. ADINELSA

2. INEI, Perú: *Síntesis Estadística 2015*

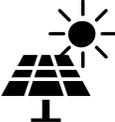
A close-up photograph of a person's face, focusing on their eyes and nose. They are wearing black-rimmed glasses and looking down at a smartphone held in their hand. The phone's screen is lit up, showing a colorful interface with a large blue circle and the number '2:20'. The background is blurred, showing a wooden surface.

Peru's new mobile money platform, Bim, represents an opportunity for remote populations to access and pay for goods and services via any mobile phone

Customer Profiles

Three Customer Segments

Target households in Iquitos and Belén were classified into three groups: the ones with access to electricity, the ones who had received a panel from the government’s solar access program, and the ones who were completely off the grid. While only about a third of households were off-grid, they represented an annual market opportunity of almost \$6.5 million due to high monthly expenditure on lighting, phone charging and generator fuel. A PAYG SHS offer was therefore most relevant for this segment given the considerable potential savings for users, without excluding the possibility to target other segments with smaller, supplementary products in a later stage.

	Unmet Energy Needs	Replaceable Energy Spending ¹		Estimated Market Size	
		Monthly Average	Types Included	No. Households	Annual Market Value ²
1  Household with Access to Electricity	<ul style="list-style-type: none"> • Back-up energy during rainy season power outages 	Avg. \$3	<ul style="list-style-type: none"> • Flashlights • Batteries 	46,000	\$1.66 Million
2  Recipient of Government SHS	<ul style="list-style-type: none"> • Approx. 30-50% need to renew obsolete batteries • Additional capacity (more light bulbs, phone charging, radio, small appliances) 	Avg. \$12	<ul style="list-style-type: none"> • Flashlights • Batteries • Generator fuel 	14,000	\$2.02 Million
3  Off-Grid Household	<ul style="list-style-type: none"> • Home & portable lighting • Phone charging • Small appliances (TV, radio, etc.) 	Avg. \$25 (higher for households with generators)	<ul style="list-style-type: none"> • Batteries • Candles • Lighter fuel • Charging phone at kiosks • Generator 	21,370	\$6.41 Million

Notes:

1. Replaceable Energy Spending refers to the monthly amount that households spend on energy (not including electricity bills for segments 1 and 2) that they would not spend if they purchased a solar energy solution

2. The annual market value is calculated by multiplying the number of households in each segment by the average replaceable energy spending on a 12 month basis

Off-Grid Segment Breakdown

Within the Off-Grid segment, different household profiles with varying energy uses and spending levels existed:



Off-Grid Household



Group 1
Subsistence income

Very low-income households, conservative with resources. They use candles and burners as their main source of lighting and have one cell phone per household, sparsely charged.

Group 2
Low income

Households who rely on burners and battery-powered appliances, such as lanterns, flashlights and radios. They have 1 to 2 cell phones per family which they charge daily.

Group 3
Above average income

Households who own an electric generator. This allows them to charge phones, power a TV, and have lighting. One gallon of fuel per day yields approx. 3 hours of electricity, resulting in a high cost for little value compared to an SHS.

Energy Types

Candles

Units/month	Spending
30 candles	\$4.55

Batteries

4 AAA	\$1.52
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Lighter Fuel

2 gallons	\$4.85
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Phone Charging

15 charges	\$4.55
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Generator Fuel

-	\$0
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Units/month	Spending
15 candles	\$2.27
10 AAA	\$3.79
3.5 gallons	\$8.48
45 charges	\$13.64
-	\$0

Units/month	Spending
-	\$0
6 AAA	\$2.27
-	\$0
-	\$0
30 gallons	\$109.09

TOTAL SPENDING

Monthly	\$15.47
Annual	\$185.64
5 Years	\$928.20

Monthly	\$28.18
Annual	\$338.16
5 Years	\$1,690.80

Monthly	\$111.36
Annual	\$1,336.32
5 Years	\$6,681.60

SECTION 3.

The Pilot

Over 9 months, I-DEV worked with the Peruvian solar energy distributor PowerMundo to trial the Bboxx Home, an SHS that uses PAYG technology, in Iquitos and Belén through a community distribution network.

Setting Up the Pilot

Bboxx Home: An All-Inclusive Household Energy Solution

With support from the UK Prosperity Fund, we partnered with Bboxx, a UK-based company that manufactures a plug-and-play solar home kit, the Bboxx Home.

Our market research indicated that the Bboxx Home not only met market demand for high-quality, in-home energy solutions but also outperformed competing products in the market with its higher watt-peak capacity. The Bboxx's main differentiator lied in its ability to power a compatible TV on top of lighting, radio and phone-charging capabilities, a feature which the majority of customers valued. Users could enjoy 6-7 hours of TV usage per day, with 2 light bulbs and full phone charging as well, without using all of the battery, making it a very energy-efficient option. There were no other SHSs on offer in B2C channels in the local market, and alternative products such as solar lamps and flashlights were mostly low-quality and did not provide the possibility to plug in other appliances or charge cellphones.

Bboxx Home Solar Kit



KEY FEATURES:

-  PAYG technology
-  17Ah battery box and control unit
-  50W polycrystalline solar panel with 10m cable & connector
-  Universal mobile phone charger with multiple charging tips
-  Additional accessories: 2 light bulbs, 1 portable light, 1 radio
-  Optional purchase: 16" TV with power consumption < 18W



The Pilot Set-Up Process



Market Assumptions

 **Average Household Income:** \$3,500 per year

 **Primary Income Drivers for Families:**

- Farming (yucca, corn, bananas, potatoes, etc.) during the dry season (May to Oct)
- Fishing during the flooding season, when income is more scarce (Nov to April)
- Other small activities, e.g. owning a small shop, transporting people, selling food in the local market, etc.

 **Average Household Spending on Energy:** \$25 per month
Note: Depends on household size, consumption and ownership of electric generator

 **Number of Families per Community:** 20-30

Selecting Pilot Communities

Thirteen communities were selected for the pilot based on the following characteristics:

Minimum of 30 Households: To ensure a certain critical mass in sales and customers to manage for distributors.

Within a 30km Radius from Iquitos: Without access to roads around Iquitos, communities can only be reached by boat. To ensure quality and timeliness of service in the initial pilot stage, only communities that were less than two hours away by boat and foot (~30km) from town – were considered.

Mobile Phone Coverage: Cell-phone signal is required to monitor customer payments and control the SHS unit remotely.

Presence of a Local Shop (preferred): A retail shop in the community typically signals purchasing power. Shop owners are also potential community-based sales agents.

Total Addressable Market

Based on a census conducted in the field, the total addressable market was estimated to be 561 households. With an average size of 5 people each, this yielded approximately 2,800 people that could potentially be reached by the pilot.

 **Total Households:** 561

 **Total Population:** 2,800

IQUITOS



Iquitos is the capital of the Peruvian Amazon, and also the largest city in the world that is inaccessible by road. Riverboats are the most common form of transportation. For this reason, 13 communities located within a radius of 30km or less from the city, or < 2hr by boat and foot, were selected to pilot sales.

Trialling a Viable Business Model for Iquitos

Key Business Model Drivers

The business model was designed taking into consideration these four important business and financial forces:

(1) Value Proposition: As a socially-driven enterprise, PowerMundo cares about offering an affordable and life-changing renewable energy solution, accessible at the last mile to low-income communities who need it the most.

(2) Gross Margin: Each unit sale needs to not only cover the cost of inventory but also generate a reasonable profit to fund overheads and continuous investments in company operations.

(3) Cashflow Stability: Monthly customer installments need to be high enough to ensure sufficient cashflow, while maintaining customer default risk as low as possible to guarantee PowerMundo's viability in the market.

(4) Operational Feasibility: To limit cash burn and the time to set up a pilot (e.g. hiring staff, establishing an office, etc.) a leaner operating model should be prioritized.



A Profitable, Customer-Driven Approach



Distribution Strategy

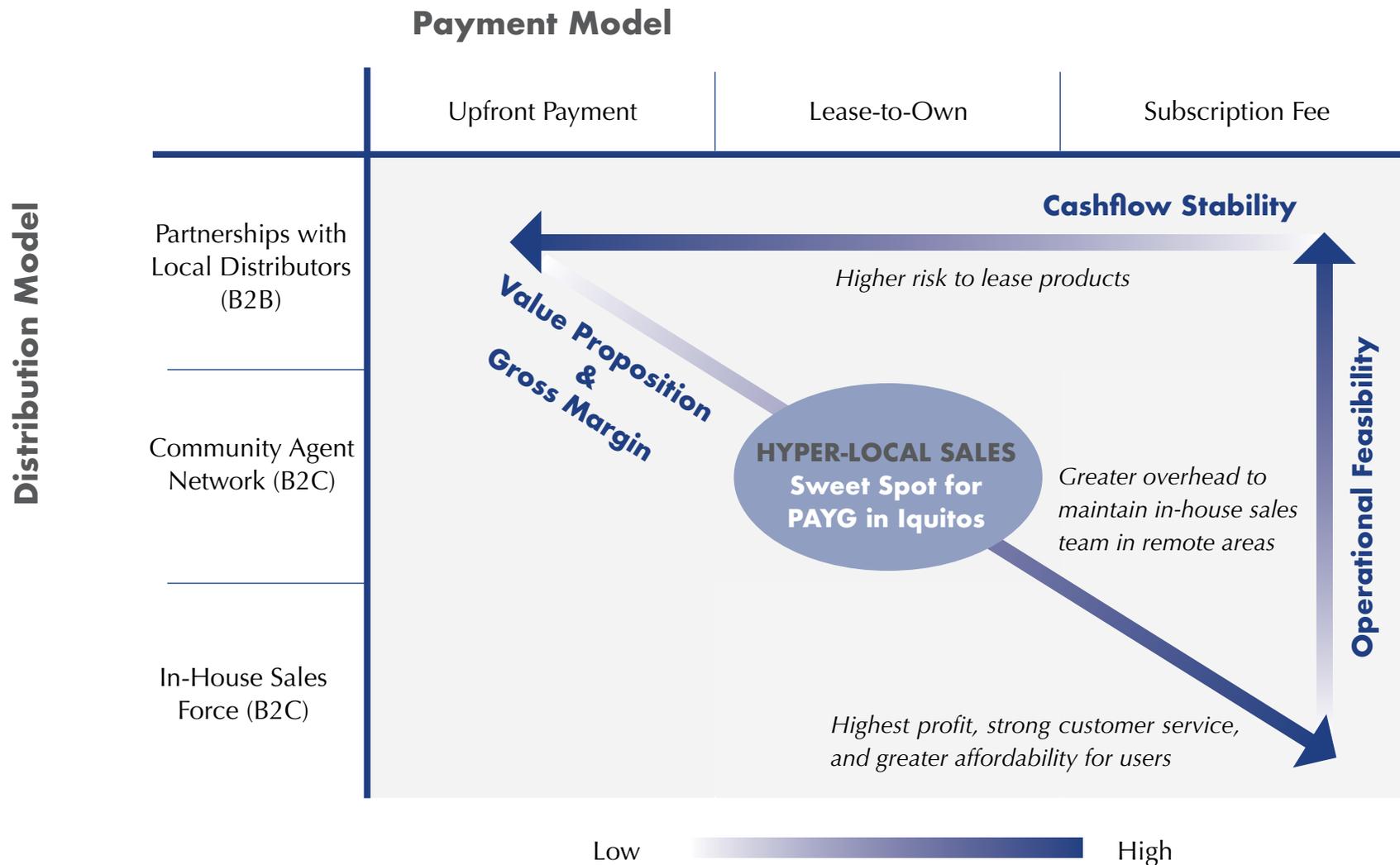
Partnerships with Local Distributors (B2B)	While partnering with established third party distribution companies to take on sales and marketing efforts is the most convenient and less risky market-entry strategy, it would also hamper PowerMundo's ability to build a brand and control marketing, pricing and service to end users. Distributors could also easily choose to go around PowerMundo and import products directly on their own if the company does not add any value in the market. In addition, most local distributors cater to the urban market, and do not have the capacity or willingness to take on customer credit risk, meaning that PowerMundo would need to diversify channels if it wanted to reach off-grid communities.
In-House Sales Force (B2C)	Hiring sales representatives to reach users and service communities on a daily basis implies a significant commitment and high overhead costs that would squeeze already small profit margins, without assurance of success in the market.
Community Agent Network (B2C)	Setting up a network of trained, commission-based agents in communities lined up best with PowerMundo's social mission and service standards, while offering the flexibility to easily be ramped up or sized down according to market demand. Agents ensure product sales, installation, and payment collection, in exchange for a per-unit incentive, considerably reducing overhead costs, while enabling direct ties to communities and bringing access to a larger market, lower lead times, better customer service, and the ability to educate users and create a strong brand image.

\$ Payment Model

Upfront Payment	While upfront payment is always the preferred scenario, limited income and high poverty rates in the region meant that customers would be unlikely to purchase the product without the option of a payment plan.
Subscription Fee	A subscription model (similar to Kingo in Guatemala or M-KOPA in East Africa) is a profitable strategy when high volume sales can offset the volatility of payments and higher cashflow risk. However, due to the dispersion of customers in Iquitos, significant volumes would have to be achieved for monthly utility fees to cover operation costs.
Lease-to-Own	As a result, a lease-to-own payment model appeared as the most financially sustainable option for PowerMundo.

Four Business Model Drivers

In terms of PowerMundo’s value proposition, the lease-to-own model provided an affordable option for customers while increasing the company’s cashflow stability. In addition, the high overhead costs associated with running an in-house sales team made it more favorable to choose the leaner and more flexible community agent network option with the additional benefit of having more direct contact with communities.



“By using a lease-to-own payment scheme, we can stay in line with user expectations of product ownership, and using our network of local entrepreneurs, we can maintain a personal presence in a cost-effective way.”

– Paul Winkel, General Manager for PowerMundo

Revenue Model

In order to maintain product affordability for the target market, three payment plans were designed to fit the monthly budget of customers who could not pay upfront: 15, 18 and 24 months. Ultimately, 90% of the customers chose the 15 month loan.

Product Summary	Upfront	15 Months	18 Months	24 Months
Initial downpayment (\$)	573.44	46.88	62.50	78.13
Monthly installment (\$)	-	37.50	31.25	26.56
Annual interest rate (%)	0%	10%	15%	25%
Total revenue per unit (\$)	573.44	609.38	625.00	715.63
Additional revenue per unit (%)	0%	6%	9%	25%

Key Operational Costs of the Model

The key operational costs for the business model can be broken down into the following categories:

Inventory: Acquisition cost of the solar home systems that will be sold to customers.

Overheads: Costs not only related to recurring direct labor, but also to general admin, office and travel costs.

Commissions: Commissions to community distributors for sales, maintenance and the collection of monthly payments from customers.

Importation: Landed cost of the product in Lima, i.e. shipping from manufacturing facility in China, customs, import taxes, etc.

Transportation: Cost of shipment by boat of the product from Lima to Iquitos, and from Iquitos to the final community.

Marketing: Costs of radio and printed advertisement, marketing materials for distributors, product demonstrations and showrooms.

Value Chain Snapshot



Duration of Commercial Cycle: 7-10 weeks
From product order to initial customer upfront payment

Critical Success Factors of the Pilot

Partnering with a Community Leader: A well-respected local leader in Belén played a key role in gaining community buy-in by introducing PowerMundo to off-grid communities and spreading information on the company's solar energy solutions.

Setting up a Product Testing Lab: The community leader's home became a testing ground for Bboxx and other solar products for the market (i.e. lamps, headlamps, and radios), allowing us to trial products in existing conditions and obtain user feedback in real time.

Betting on Early Adopters: PowerMundo offered discounts at each product demonstration to spark early purchases. These pioneer customers became model homes in their communities, triggering a “spillover” effect with neighbors who placed follow-on orders.

Adapting a Lean Management Approach: The model was designed to support operational flexibility and enable quick, incremental improvements to the product offering, organizational processes and customer service, as well as adapt to unexpected circumstances such as loss of phone coverage in a community.

Offering Different Payment Options: The option to pay in 15, 18 or 24 months gave customers the comfort to buy the product within their financial capability. This increased trust and loyalty from customers, who felt they had a choice.

Prioritizing Human Relationships: Doing business in Latin America, especially the Amazon, requires creating strong human ties with stakeholders. Activities such as having lunch at a shop owner's home or calling a distributor to ask about their health were central to the company's rapid success in the market.



SECTION 4.

Towards a Profitable Model

The pilot confirmed market demand and commercial viability, and highlighted three priorities to scale up: reduction of overheads, diversification of product portfolio and channels, & mitigation of customer default risk.

Cost Reduction Strategies

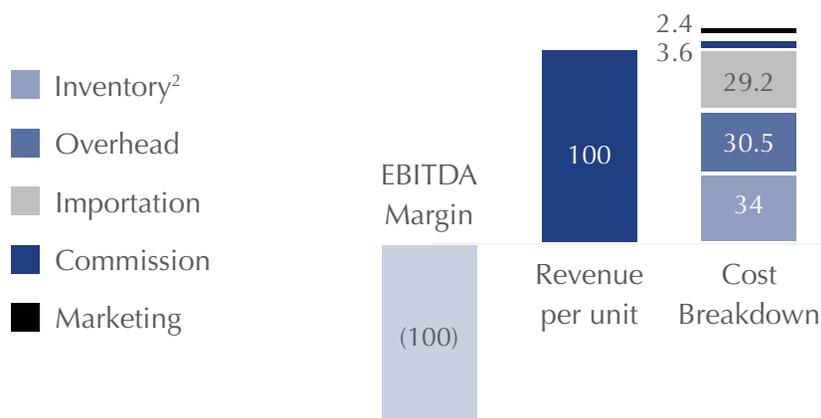
During the pilot phase, several drivers were identified to reduce costs going forward. Firstly, products were no longer imported by air but instead via sea shipping, which increased the forecasted lead time from 8 to 10 weeks but decreased costs by a third. Also, distribution channels were diversified using a mix of distributors and retail chains, as explained in the following section on 'Portfolio & Channel Diversification Strategies.' Lastly, improved demand forecasting considerably reduced logistical costs, while economies of scale decreased other expenses, such as overhead and marketing costs, and improved EBITDA margins.

EBITDA Margin vs. Cost of Revenue¹ Percentage Breakdown

Pilot Stage

Avg. 15 units sold per month

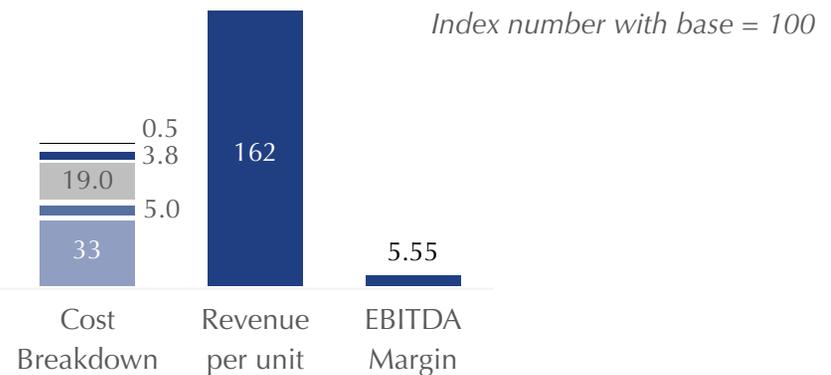
- Products sold only via distributors
- High upfront overhead to establish local distribution network
- Import of products via air cargo



Early Stage

Avg. 40 units sold per month

- Mix of community agents, wholesale and retail channels
- Distribution network and customer brand awareness
- Import via sea shipping



1. Cost of revenue refers to the total cost of importing and delivering the product, it includes COGS and some expenses, such as distribution and marketing
 2. Includes transportation costs

Portfolio & Channel Diversification Strategies

Aside from the Bboxx Home, a series of smaller portable solar products at more comfortable prices for customers – such as solar lamps, radios, battery chargers and headlamps – were added to the product portfolio. This allowed interested customers to begin using solar energy without having to make such a significant investment, opening access to a broader market. Lamps and headlamps in particular were well received in this market to replace battery-powered flashlights used by families in remote areas, as well as fishermen and boat drivers at night. From an operational perspective, it diversified revenue streams and generated more stable cashflows to the company to complement the monthly installments coming in from Bboxx customers.

We also established partnerships with centrally located distributors in the city of Iquitos where the majority of trade in the region took place. By working with urban retail chains, PowerMundo was able to successfully position itself to small businesses from the area (i.e. jungle lodge owners, traders, etc.) and rural farmers who require lighting solutions on a day-to-day basis. There was also an active urban market for residents of the city who used flashlights during frequent power outages and excursions to rural areas.

Supplementary Solar Products

Portable LED lights
Manufacturer: Sun King



Lightweight radios, lanterns, headlamps
Manufacturer: Freeplay



PORTFOLIO & CHANNEL STRATEGY

The Distribution Strategy leveraged 2 channels in order to better service local demand:



1) Urban retailers and shops to position faster moving products (e.g. headlamps, portable radios and small lamps, averaging \$15-100)



2) Community sales agents to sell solar home systems to remote, rural households on a lease-to-own basis

PowerMundo is also exploring partnering with local telephone companies to package the solar kit with a phone or smartphone. This would allow PowerMundo to better identify off-grid communities that have a mobile phone signal – a critical requirement for a PAYG model – and create a stronger value proposition, as customers consider having a phone as a critical necessity and would be more incentivized to purchase an SHS. For the telephone company, partnering with a solar energy provider would open access to new customers, as off-grid communities are not typically considered viable markets to actively sell into if there is no phone charging capability. The partnership would also create win-win synergies between the companies to share distribution and marketing costs.

Risk Mitigation Strategies

During the pilot, several risks related to the local context were identified, and needed to be addressed with specific strategies to ensure they wouldn't threaten the viability of the business.

1) Customer Default Risk: Most banks and even microcredit organizations in the jungle do not lend to remote rural communities due to distance, unsteady income, and a lack of cash and credit culture. As a result, most of our target customers had no credit history and little available information on their income. To mitigate customer default risk, different control mechanisms were put in place such as requiring an initial downpayment on the solar home system, working closely with community peers and leaders to ensure regular payments, and incentives to micro-distributors to consistently collect monthly customer payments.

Mechanisms to Mitigate Default Risk



Down Payment

Request a higher portion of the unit price as an upfront payment

- Reduces pressure on cash flows
- Generates customer commitment while weeding out insolvent candidates



Incentivize Payment Collection

Distributors receive commissions for each customer installment

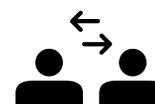
- Ensures that distributors are consistently following through with collecting customer payments until the product is paid for in full



Customer Rewards

"Top" customers are rewarded for punctual payments

- Incentivizes customers to pay on time
- Viable strategy if the cost of the reward to customers is lower than potential loss from default



Peer to Peer Solidarity

Customers purchase products as a group and pay installments together

- Similar to group lending schemes, where one person's default penalizes the rest of the group
- Enforcement through low credit ratings or raised interest rate for the group

2) Community Buy-in & Trust: Communities in the Amazon are culturally more close-knit and self-managed than in other regions, with strong leadership and governance structures of their own. This makes it more difficult for external third parties to enter the community and establish a relationship, without obtaining buy-in and approval from local leaders first. To this end, we partnered with a well-respected representative of 30 off-grid communities in Belén to present our products and gauge customer interest. His buy-in and enthusiasm for PowerMundo's offering was critical in getting community buy-in and establishing trust with residents.

3) Informality: Because the informal sector is quite prevalent in the local economy in the Amazon, the risk of products being sold on consignment to customers, damaged or lost in transportation, or plainly disappearing was one that we needed to take seriously. We prioritized building strong human relationships and loyalty with community distributors who were in charge of the product from the moment it left PowerMundo's warehouse until it reached the customer's home, through regular phone communication, group meetings and training sessions, and a generous compensation structure that incentivized distributors to provide quality service and follow-up with customers throughout their payment plan.



We prioritized building strong human relationships with community distributors to provide quality service and follow-up with customers

SECTION 5.

IMPACT

The pilot showed that PAYG solar represents a scalable model for the Amazon – and potentially other regions in Latin America – to increase access to energy for off-grid communities, reduce household spending, and create viable livelihoods.

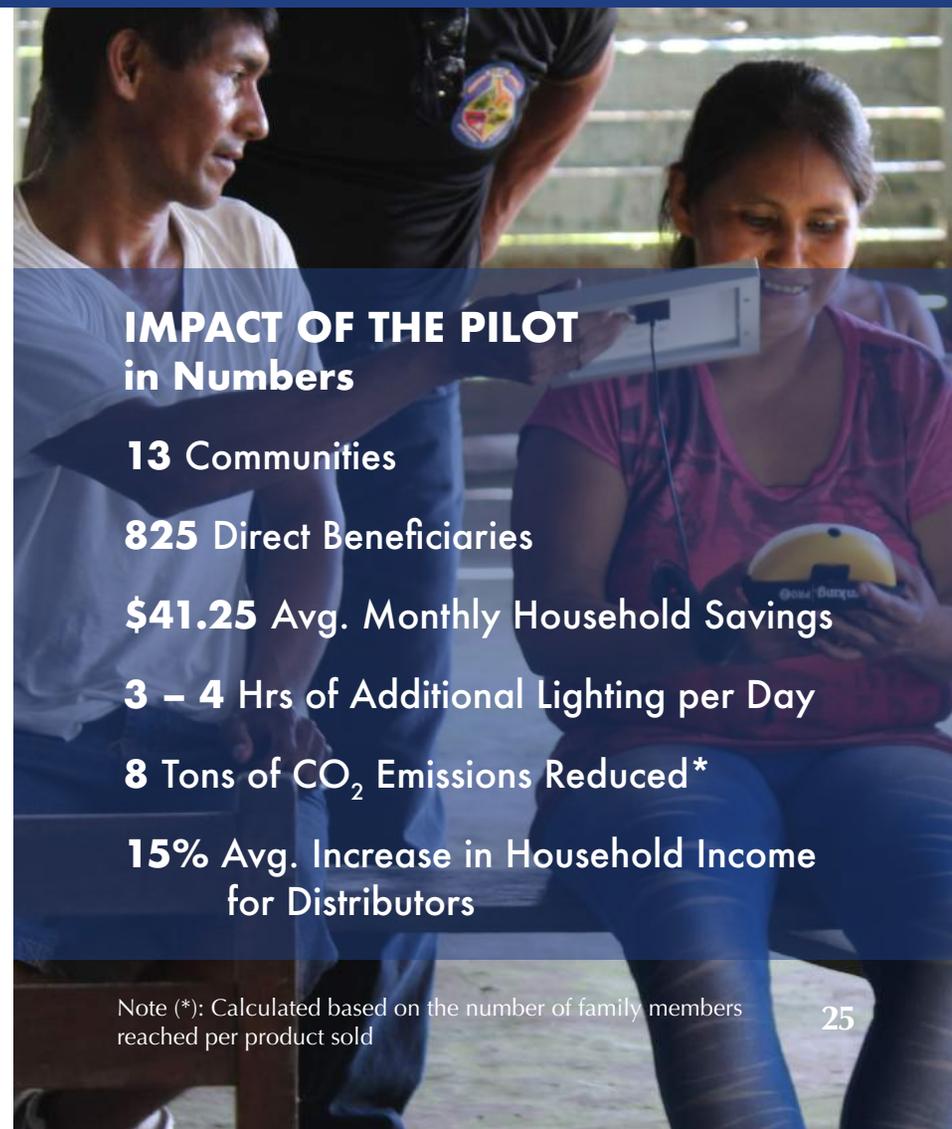
The Customer's Story

While the monetary savings generated by a solar home system – on average \$41 per household per month in reduced spending on energy post-investment – are what customers highlight first and foremost in terms of impact, the intangible value of clean and renewable energy for families is just as significant.

By replacing oil burners and generators, SHSs contribute to a cleaner and safer living environment for families. In many of the pilot communities, there had been fatal accidents due to oil burners being knocked over and burning houses down, or generators exploding due to improper use. The impact on the environment is also considerable: an SHS could reduce a household's CO₂ emissions by 8 tons per year!¹

Access to lighting at night also allowed families to become more productive – for example by being able to do household chores at night, women were able to use more hours during the day to generate income. Children were able to do homework and concentrate better without the dangerous fumes of oil burners. Families were even able to start small income-generating activities, for example by setting up a phone charging kiosk for their family.

1. Each solar product sold replaces 1 kerosene lantern, and each lantern with a weekly fuel consumption of 1 liter produces 100kg of CO₂ each year



IMPACT OF THE PILOT in Numbers

13 Communities

825 Direct Beneficiaries

\$41.25 Avg. Monthly Household Savings

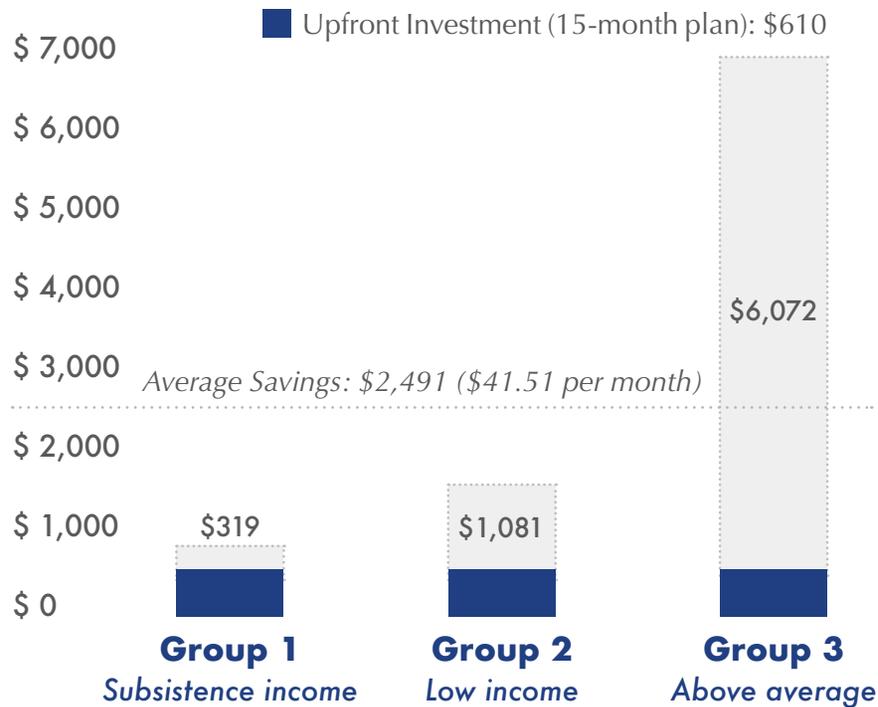
3 – 4 Hrs of Additional Lighting per Day

8 Tons of CO₂ Emissions Reduced*

15% Avg. Increase in Household Income
for Distributors

Note (*): Calculated based on the number of family members reached per product sold

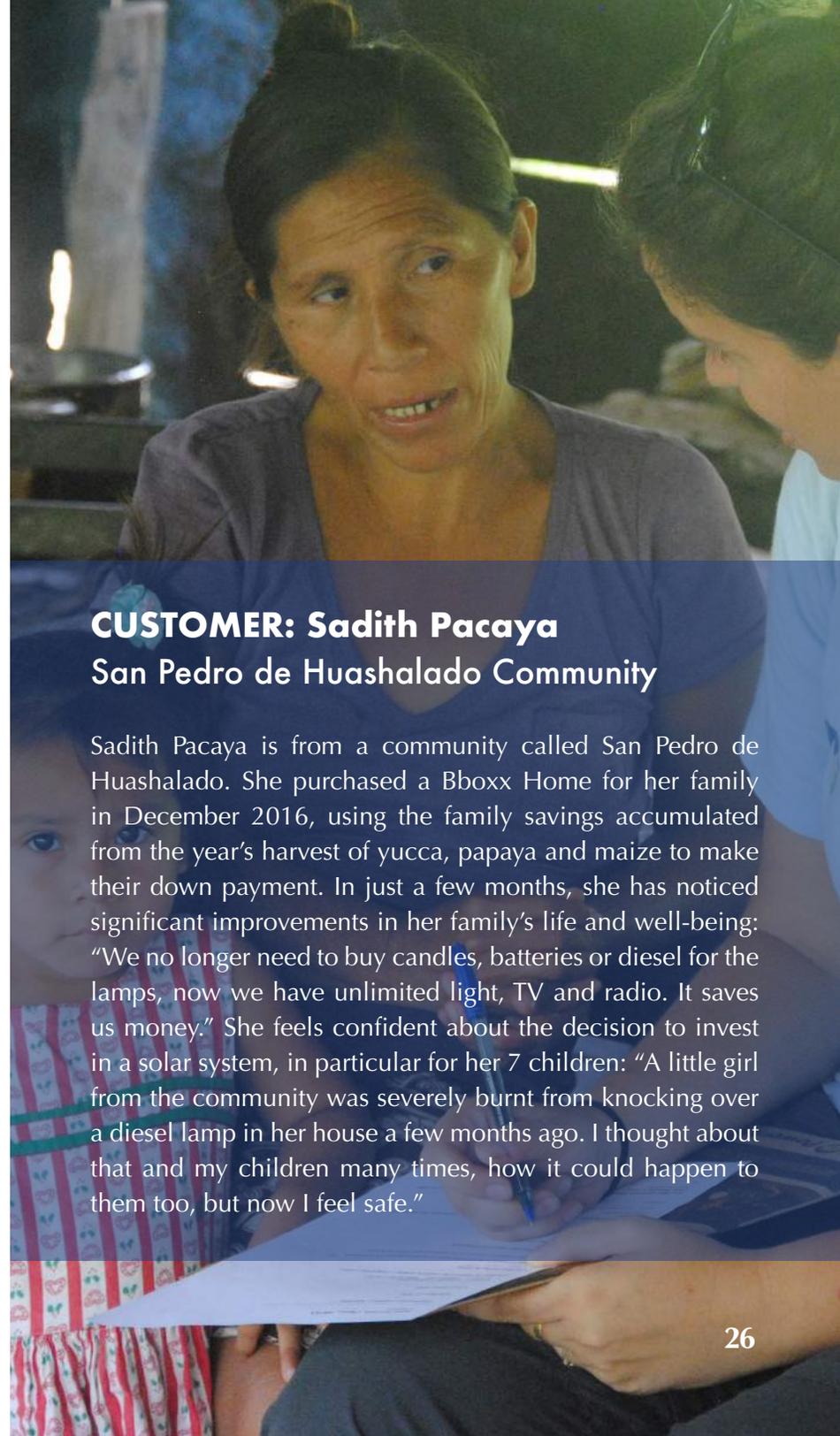
Estimated Five-Year SHS Savings



Having a TV bundled in the product offer strongly appealed to families and drove demand. Even though it raised the price of the kit by approximately \$200, it gave households access to regular information and entertainment they previously did not have.

The Distributor's Story

The pilot did not only create impact for customers; it also generated new jobs and income opportunities for communities by creating a community-based distributor network. Distributors were compensated for selling products, providing maintenance and collecting payments, earning a 13% commission per unit sold, or on average \$150 per SHS



CUSTOMER: Sadith Pacaya San Pedro de Huashalado Community

Sadith Pacaya is from a community called San Pedro de Huashalado. She purchased a Bboxx Home for her family in December 2016, using the family savings accumulated from the year's harvest of yucca, papaya and maize to make their down payment. In just a few months, she has noticed significant improvements in her family's life and well-being: "We no longer need to buy candles, batteries or diesel for the lamps, now we have unlimited light, TV and radio. It saves us money." She feels confident about the decision to invest in a solar system, in particular for her 7 children: "A little girl from the community was severely burnt from knocking over a diesel lamp in her house a few months ago. I thought about that and my children many times, how it could happen to them too, but now I feel safe."

over the time of the payment plan (depending on plan selected).¹ In the scale-up phase, distributors could expect to earn \$1.50 per day (not including additional commissions from smaller product sales), generating up to \$45 per month on average for 4 units sold.

Community distributors were provided with support and training in sales, marketing, business management and basic accounting skills, but were responsible for finding and managing their own customers. Many of them valued this entrepreneurial opportunity.

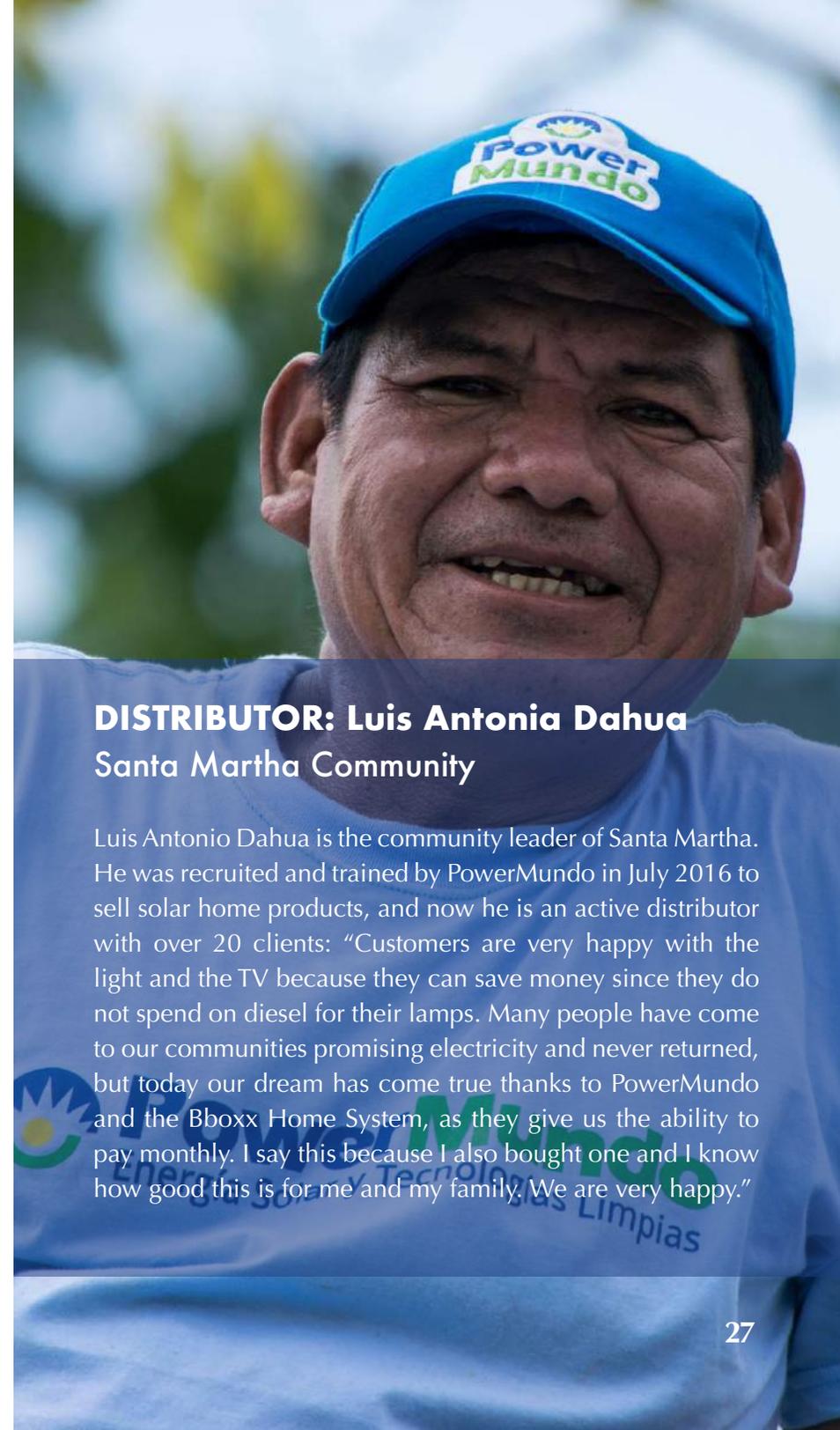
The Way Forward

This initial pilot has carved out a clear opportunity and path for PowerMundo to scale using PAYG technology, not only in the Amazon but also throughout Peru. The pilot provided valuable initial feedback on the product and model, pinpointing areas for improvement in the technology and operations to simplify sales and payment processes.

With the opportunities unlocked by PAYG technology and Peru's new mobile money platform Bim which simplifies the recovery of payments from last-mile customers, PowerMundo expects to roll out this new range of products through its national distribution network.

While customer payment plans increase the affordability of products that most households previously could not have purchased upfront, they are also expected to increase PowerMundo's revenue sustainability through modest interest rates, while generating credit insights for its customer base and creating more business for its distributors via follow-on purchases from customers with greater energy demands. More importantly, they will also enable PowerMundo to provide new services to end users and thus gain increasing power to improve lives.

1. Each distributor sells 2 products per month and receives 2 incentives per product: (1) Sales commission, \$15, and (2) Payments collection commission, \$60



DISTRIBUTOR: Luis Antonio Dahua Santa Martha Community

Luis Antonio Dahua is the community leader of Santa Martha. He was recruited and trained by PowerMundo in July 2016 to sell solar home products, and now he is an active distributor with over 20 clients: "Customers are very happy with the light and the TV because they can save money since they do not spend on diesel for their lamps. Many people have come to our communities promising electricity and never returned, but today our dream has come true thanks to PowerMundo and the Bboxx Home System, as they give us the ability to pay monthly. I say this because I also bought one and I know how good this is for me and my family. We are very happy."



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