

Transforming the care economy through impact investing case study:

Powerstove



The Care Economy
Knowledge Hub

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FOREWORD

Vital for our society to function, the care economy – domestic work and caring for children, elderly people, and people with disabilities – as it is now, operates as one of the most pervasive structural barriers to women’s economic autonomy and gender equality.

Across the world care work is mostly done by women and girls, who perform three-quarters of unpaid care work. Representing more than 11 percent of total global employment, paid care work is also a significant source of employment, particularly for women. However, these jobs are poorly paid, in positions that fall outside of formal employment structures, and insecure due to ingrained gender and racial biases and the work’s perceived value. The precariousness of paid care work and the unequal distribution of unpaid care work restricts women’s time and mobility, as well as their equal participation in social, economic, and political life. And this dynamic is unlikely to change without collective action. The climate crisis is increasing the demand for care and domestic work globally, while the COVID-19 pandemic generated a [care crisis](#) that exacerbated pre-existing gender inequalities.

Both formal structures and informal structures (norms) hold care economy inequalities in place. Gendered norms also shape national policies on how care work is recognized and valued, and how the responsibilities between families, governments, and the private sector are distributed.

While public investment and policies must be at the core of the solution, a renewed role for the private sector is crucial. Announced as a [commitment at the Generation Equality Forum](#), in 2021 Canada’s International Development Research Centre (IDRC) and the Open Society Foundation’s impact investment arm, the Soros Economic Development Fund (SEDF), launched an [action-oriented research initiative to help Transform the Care Economy through Impact Investing](#) (TCEII). Through this partnership, IDRC continues to build on its commitment to transform the care economy and mobilize finance for gender equality.



Erin Tansey



Catherine Cax



Since its launch, a global consortium of partners has built an [extensive knowledge and evidence base](#) to mobilize capital and impact investment to address the care economy's challenges in emerging markets. The program is now launching a collection of 20 case studies on care economy social innovations and impactful businesses, which complements 59 business profiles and mapping of 165 market-based solutions operating in emerging markets in Latin America, Africa, and Asia. The [TCEI program](#) also involves care-economy businesses incubation and acceleration, research on regulatory frameworks and policies, awareness raising, and industry policy dialogues.

As we witness growing momentum and understanding of the urgency of addressing the care crisis, we hope these case studies on pioneering companies will help advance concrete strategies to move from awareness to action. These case studies help to demonstrate viable and impactful business models, ranging from building social security infrastructure to labor-saving products and services. They offer a unique and nuanced understanding of the businesses' theories of change and impact journeys. The case studies also help to share the lessons these innovators have learned on their pathways to scale, and it is our hope that they will attract more capital into the care economy for deepened impact.

We invite you to read this collection of case studies and engage with them, and the other resources and tools developed by the TCEI program, to mobilize investment into the care economy.

Together we can advance [towards a care society](#) where social innovation, entrepreneurship, and investment can be part of the solution for economic justice globally.

Erin Tansey

Sustainable and Inclusive Economies
Director
International Development Research
Council

Catherine Cax

Managing Director, Investments
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INTRODUCTION

The care economy consists of paid and unpaid labor and services that support caregiving in all its forms. In Africa, Asia and Latin America, women spend between three to five times as many hours on unpaid care and domestic work as men. This represents 80 percent of a household's total hours devoted to unpaid care work.

Care economy enterprises can help recognize, redistribute, reduce and reward – also known as the 4 Rs – unpaid and paid care and domestic work in the following ways:



Recognize: Initiatives that increase visibility and recognition of paid and unpaid care and domestic activity as "productive" work that creates real value and contributes to economies and societies.



Redistribute: Services and initiatives that redistribute care work from individuals to public and private sector entities, and redistribute care and domestic work within the household.



Reduce: Products and initiatives that reduce the time spent on and burden of unpaid care and domestic work.



Reward: Products, services and initiatives that ensure that care and domestic workers are paid fairly and have professional growth potential. This provides them with financial reward and security.

The Care Economy Knowledge Hub – the research pillar of the Transforming the Care Economy Through Impact Investing Program – aims to address the knowledge gap around care businesses by showcasing various business models and creating a resource base for relevant stakeholders. It also aims to raise awareness and increase knowledge of the state of impact-driven care economy business models and attract a broad range of funders to invest in care economy solutions by showcasing opportunities.

A curated set of 20 business case studies, of which this case study is one, has been researched and written between October 2021 and January 2024. The case study businesses were selected out of a set of 165 businesses that were mapped between October 2021 and August 2022, and then a further 59 that were profiled between September 2022 and May 2023. They present a wide variety of different ways in which care work can be recognized, rewarded, reduced and redistributed, from different sectors and different

geographies, from different stages of the growth journey and different business models, from different products and services and different impact pathways. Each case study was written based on extensive desk-based research, including a literature review; a review of key business documents; a series of deep conversations with founders, CEOs, and key staff; and impact-focused qualitative research with 8 – 15 consumers of business products and services.

Each case study starts with a 1-page executive summary that provides “at a glance” information on the business and Section 1 provides an introduction. Section 2 describes the ecosystem within which the business operates. The business deep dive can be found in Section 3. Section 4 presents an impact deep dive, including customers’ own experiences of the care economy solution, and a unique set of qualitative impact data. Section 5 outlines the business’s future plans in their look forward.

Shifting attention towards and investment in the care economy is one of the single most important actions that policy makers, investors, and community leaders can take to achieve gender, racial, and climate justice. We hope that these case studies contribute to the much-needed transformation in our economic and social systems.

**Rebecca Calder**

Principal Investigator, Transforming the Care Economy Through Impact Investing
Co-Founder and Co-CEO, Kore Global

This project is supported by Canada's International Development Research Center, in partnership with the Soros Economic Development Fund at the Open Society Foundations. Building on their track record and commitment to transforming the care economy and mobilizing finance for gender equality, they are jointly supporting this action research program to help transform the care economy through impact focused business and investment. This case study is a joint research product, developed by a consortium led by Kore Global, including Intellectap, Core Woman, Busara, Sagana, and Volta Capital. Copy editing and graphic design were done by Strategic Development Group.

This particular case study should be cited as follows:

Intellectap, Busara Center for Behavioral Economics, Kore Global. (2023). *Transforming the care economy through impact investing: Powerstove case study*. Kore Global, International Development Research Centre, and Soros Economic Development Fund.

1 - EXECUTIVE SUMMARY

Powerstove Offgrid Electricity Limited¹ (*henceforth Powerstove*) is a for-profit company based in Nigeria. Powerstove designs and manufactures clean cooking products: a Tier 4² cookstove that is smokeless and more efficient (cooks 5 times faster than traditional cookstoves), and bio pellets made from waste, which are among the cheapest cooking fuel sources in Nigeria. The cookstove also generates a small amount of electricity that can be used to charge phones or light bulbs. Powerstove products are used by low-income communities in urban and semi-urban regions. Powerstove has integrated mobile technology, the Internet of Things (IoT), and blockchain to track the usage of its cookstoves and bio pellets and calculate carbon offset. The usage of Powerstove products generates carbon credits, which are traded in the carbon market. A share of the revenue from carbon credits is remitted to the users of the cookstoves. Since 2018, Powerstove has sold 203,000 stoves. In 2022, Powerstove's revenue was US\$1,861,519. The enterprise has 168 full-time employees. Powerstove is looking for US\$10 million in debt and equity investments to manufacture and distribute 500,000 cookstoves in the next 3 years.



Powerstove at a glance

Established	2018
Country of operations	Nigeria (Main market) Cameroon, Ghana, Zambia (recent expansion)
Offerings	Provides clean cooking products along with financing options and sells its products through a network of distributors and resellers. Each cookstove has the potential to reduce 4 tons of carbon emission annually; the carbon credits are sold in the voluntary carbon market.
Reach	Served 1.6 million customers (80% women) to date
Staff	168 full-time employees
Revenue	US\$1,861,519 (2022)
Investment to date	US\$1 million in equity, US\$400,000 in debt, US\$13 million in blended instruments, and US\$550,000 in grants
Leadership	Okey Esse , Chief Executive Officer, and cofounder
Contact for partnerships	okeyesse@yahoo.com
Website	www.powerstove.africa

2 - ECOSYSTEM

2.1 Nigeria: statistical snapshot

 <p>Demographic information</p>	<p>Total population (World Bank, 2021): 213 million</p> <p>Female population (World Bank, 2021): 105 million</p> <p>Urban & rural population (World Bank, 2021): Urban (56%) Rural (47%)</p> <p>Population in different age segments (% of the total population) (World Bank, 2021): 0-14 years: 43% 15-64 years: 54% 65 and above: 3%</p>
 <p>Unpaid care work</p>	<p>Proportion of time spent on unpaid domestic care work (Apata, T., 2021): Monthly hours of work in unpaid care work spent by women and girls: 49.5 hours</p>
 <p>Social & economic</p>	<p>Literacy level (Global Gender Gap Report, 2021): Females (52.7%) Males (71.3%)</p> <p>Poverty (Statista, 2022): 88.4 million of the total population lived in extreme poverty (less than US\$1.9/day). Nearly 75 million live in extreme poverty in rural areas while 13.5 million live in urban areas.</p> <p>Formal & informal employment (CEIC, 2020): 46 million people were employed in Nigeria</p> <p>Gender-based violence (NCBI, 2018): 33% of women aged 15-49 in Nigeria have faced physical or sexual violence</p>



Labor force participation (% of total labor force) ([The Global Economy, 2022](#)):
Female 52.09% | Male 65.54%.

Unemployment (% of total labor force) ([World Bank, 2022](#)):
Total: 5.8%
Women: 5.5% | Male: 6%

Women entrepreneurship:

- Share of women-owned formal SMEs: 23 % | Micro-business: 41% ([PwC, 2020](#))
- Share of women entrepreneurs ([PwC, 2020](#)): 40%
- Share of women directors on corporate boards ([PwC, 2020](#)): 12%
- Firms with female majority ownership, % firms ([Global Gender Gap Report, 2021](#)): 16.2%

Gender pay gap ([Dataphyte, 2022](#)):
The gender pay gap in the country was 71%

Global gender gap index score ([Global Gender Gap Report, 2021](#)):
Total: 0.627 (0=unequal, 1=equal)

Financial inclusion through banking, formal & informal sources ([PwC, 2018](#)):
Female: 59% | Males: 67%

2.2 Context analysis

Macro context in Nigeria

Nigeria, with a population of 221 million, is the most populous country in Africa.³ Fifty-six percent of the population lives in urban areas and the country has one of the highest rates of urbanization in Africa, growing at 4.3% annually.⁴ Despite being the largest economy in Africa, the country has a high concentration of poverty with as many as 4 in 10 Nigerians living below the national poverty line.⁵ A majority of the population, especially in the country's northern region, lacks access to education and basic infrastructure, such as electricity, safe drinking water, and improved sanitation.

Energy poverty is significant in both rural and urban regions of Nigeria. Only 22% of Nigeria's low-income population has access to energy.⁶ Lack of energy or power is closely tied to financial difficulty, food shortages, health issues, and the continuation of the cycle of poverty.⁷ In 2020, the percentage of the population with access to electricity was 24.6% in rural areas and 83.9% in urban areas.⁸ Roughly 111 million people, more than half of Nigeria's population, live in urban areas⁹ where lower-income households rely on charcoal, kerosene, cell phone charging stations, and battery-powered torches for energy needs.¹⁰

Wood fuel continues to be the predominant source of energy for cooking and heating for 56% of the population, i.e., nearly 30 million households (more than 100 million Nigerians).¹¹ Nigeria's rate of deforestation, at 3.3% per year, is one of the highest rates in the world, with an estimated 100 million meter³ of firewood being consumed annually.¹¹ In 2020, Nigeria lost 97,800 hectares (377 square miles) of natural forest, equivalent to 59.5 million tons of CO₂ emissions.¹²

Care economy context

Eighty-four percent of Nigerian households lack access to quality cooking and lighting fuel.¹³ The use of solid biomass (firewood and charcoal) is the most common method for cooking in the country for approximately 68.3% of households.¹⁴ Only about 29% of the roughly 15.19 million households in urban areas have access to and primarily use clean cooking fuel.¹⁵ Approximately 50% of the urban households in Nigeria burn wood and charcoal for cooking.¹⁴ Firewood collection is time-consuming and, on average, women and girls in rural areas walk more than 3 hours daily to get firewood to cook. Women sometimes carry heavy loads to reduce the number of trips required to provide fuel wood for their households. They may headload fuel wood as heavy as 35 kilograms or more over a long distance of up to 10 km in often difficult terrain.¹⁶ Carrying such heavy loads over long distances increases risks of spinal and leg injuries, especially among young women.¹⁶ There are also reports of violence against women and girls while walking to collect fuelwood. The regularity of water and fuel collection allows attackers to easily stalk their targets.¹⁷

Additionally, wood-fuel-based cooking leads to respiratory issues among women. Smoke from open fire is the third highest cause of death in Nigeria. As a result, approximately 95,000 premature deaths attributable to household air pollution occur in the country each year.¹⁸ Conjunctivitis, cataracts, lower-back pain from excessive bending, chronic obstructive pulmonary disease (COPD), asthma flare-ups, lung cancer, and acute bronchiolitis in children have all been linked to using firewood and charcoal. Lack of access to clean cooking technologies also impacts other domains of women's empowerment. A regional analysis has found a positive correlation between the introduction of efficient cooking stoves and female workforce participation. While there is a low short-term impact on workforce participation, long-term analyses show that enhanced time efficiency leads to greater possibilities of women participating in the workforce.¹⁹

Market opportunity

The cost of traditional cooking methods is high as they use 90% more wood (because it has a lower calorific value/unit). While most people still use charcoal, there is an increased usage of cooking gas,

which witnessed a 60.5% increase in consumption in 2019 compared to 2018.²⁰ However, cooking gas prices are increasing: in 2021, the price of a 12.5 kg cylinder of cooking gas rose from US\$6.4 to about US\$12 within 6 months.²¹ Across Nigeria, there are over 4 million cooking gas cylinders, and it is estimated that 1.8 million of these cylinders have exceeded their lifespan and yet are still being used, increasing the risk of explosions and loss of life and property.²² Therefore, there is a huge market opportunity for improved cookstoves using biomass pellets for a large consumer segment that is not only looking for efficient cooking solutions but also cost-effective fuel that is easily accessible.

Improved cookstoves are currently used by around 0.5% of households in Nigeria.²³ Start-ups selling biomass cookstoves have become more established with proven business models and agent networks. There are around 30 improved cookstoves producers and suppliers that are currently listed in the Nigerian Alliance for Clean Cooking (NACC); the majority of these are distributors at the wholesale or retail level. There is great potential for more players to enter the market as demand for ICS is high, but supply is limited.²⁴

The Nigerian government has set multiple policy targets for advancing clean cooking in the country. In 2015, the Federal Government set out the target of providing 60% of the population with access to clean cooking by 2030.²⁵ The Federal Ministry of Environment aims to launch a program to reach 10 million

households (or 21% of the population) with clean-cooking solutions by 2025. As part of the Economic Sustainability Plan, the switch of 30 million households from unclean fuels (kerosene, charcoal, and diesel) to LPG is one of the priority goals.

In 2011 the Nigerian Alliance for Clean Cookstoves (NACC) – a public-private partnership – was established, with the goal of delivering 10 million clean cookstoves to Nigerian households by 2021.²⁶ The Alliance works with public, private, and non-profit partners to develop innovative financing mechanisms for user affordability. In 2020, the Global Clean Cooking Alliance launched SPARK+ Africa, the world's first impact fund to finance clean and modern cooking solutions in developing markets to finance pioneering companies that offer life-improving biomass, biogas, ethanol, electric, and LPG-based cooking technologies to low-income consumers.²⁷ This fund was initiated in partnership with Switzerland-based investment advisor Enabling Capital, and Netherlands-based foundation Stichting Modern Cooking. In 2022, Spark+ raised over US\$40 million in a first close and has invested in companies across multiple business models, technologies/fuel types, and markets in sub-Saharan Africa.²⁸

More recently, in April 2023, the Nigerian government, specifically the Nigeria Sovereign Investment Authority in partnership with the Vitol Group, invested US\$50 million in a joint venture, CarbonVista, that will fund carbon avoidance and removal projects in the country. The first set of investments will

focus on household energy efficiency programs involving initiatives for clean cooking and water filtration, creating a

huge market opportunity for enterprises in this space.

3 - BUSINESS DEEP DIVE

3.1 Business headline

Powerstove is a for-profit enterprise, headquartered in Nigeria, that designs and manufactures Tier 4 cookstoves and bio pellets (the latter branded 'Goodlife'). Powerstove's mission is to develop affordable, sustainable, renewable energy solutions to meet the energy demand of people in low-income countries. The company offers 17 different types of cookstoves, designed to cater to different household sizes and power outputs, and to be used for different purposes such as household cooking, as well as in bakeries, agro-processors, etc. Production materials for the cookstoves are imported from foreign markets. The cookstoves are smokeless and cook food 5 times faster than traditional stoves. At the time of cooking, the energy generated produces up to 50 watts of electricity. Users can plug in a charging device in the cookstove to charge their phones and LED lights. Another innovation by the company is bio pellets made from non-recyclable paper, wood, and agricultural waste. The pellets are the cheapest cooking fuel in Nigeria, 80% cheaper than charcoal, firewood, and kerosene.

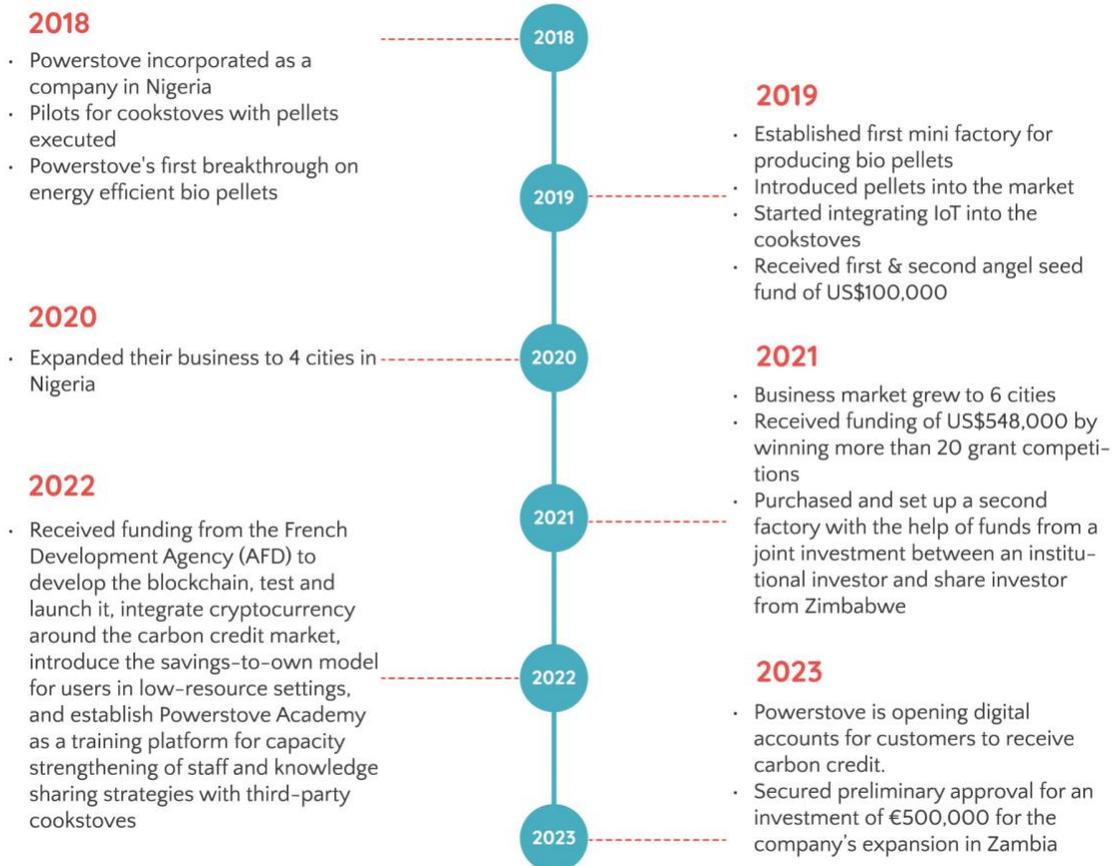
Powerstove's factory in Abuja, Nigeria, has a capacity to produce 25,000 units monthly and 2.5 tons of bio pellets per hour. Powerstove sells the products online and also partners with distributors and community-based organizations for retail selling. The bio pellets consist of readily available raw materials like wood, waste/sawdust gathered from landfills, and agricultural crop waste obtained from farmers. The company further makes cookstoves accessible and affordable for its customers through a series of value-added services: consumer financing, doorstep delivery, and after-sales services including repair, warranty, and replacement services. End-users can pay through installments using schemes such as pay-as-you-cook, rent-to-own, and savings-to-own.

Powerstove's value proposition is that it designs and manufactures Tier 4 cookstoves and bio pellets that can enable households to save 70% on energy costs, resulting in an annual saving of US\$300. Powerstove is also building its value proposition for carbon-credit buyers who seek a transparent and traceable channel to verify carbon offsets. To such buyers, Powerstove intends to offer carbon credit verified through blockchain using digital Measurement, Reporting, and Verification protocol (D-MRV).²⁹ 30% of cookstoves manufactured by Powerstove have Internet of Things (IoT) and Global System for Mobile (GSM) technology that tracks carbon offset based on cooking time data. The company is working towards integrating IoT and GSM for all its devices going forward. The data gathered from IoT and GSM are transferred to a blockchain that can be tracked and traced to each user. The Powerstove project is currently registered under Verra's voluntary carbon market program³⁰ and the data verified through blockchain is used to sell carbon credits. Each cookstove has the potential to reduce carbon emissions by 4 tons annually (confirmed by the Water Boiling Test).³¹ The company has also created a mechanism through which

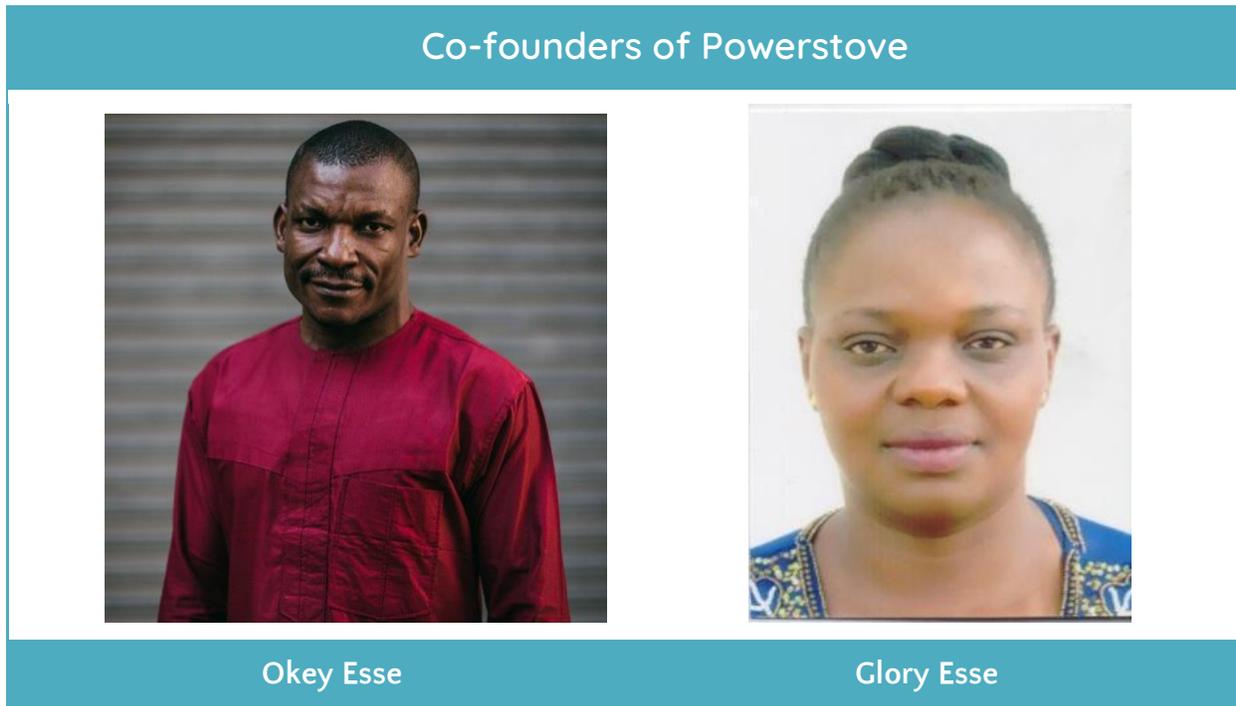
end-users receive an estimated 15% of carbon credit revenue remitted into their mobile money account every quarter.

Powerstove's competitive advantage is diversified revenue sources from the sale of cookstoves, bio pellets, and carbon credits. Powerstove is one of the major players for bio pellets in Nigeria and West Africa. Powerstove sells the bio pellets only to buyers that use its cookstoves. By bundling the 2 complementary products together, Powerstove has ensured a steady rise in revenue from multiple sources - recurring revenue from bio pellets and carbon credits. Powerstove manufactures the cookstoves and bio pellets in Nigeria and sells them at rates cheaper than its competitors who manufacture them outside Nigeria (competitor's products are priced at US\$100/unit, Powerstove's product retails at US\$ 80/unit). The cost of goods sold is estimated to be within US\$10/cookstove but sold at markup. Powerstove generates a recurring revenue estimated at US\$ 6/month/household from the bio pellets. The enterprise is now generating revenue from carbon credits estimated at US\$ 6/carbon credit. The diverse revenue and lower cost of production have resulted in higher gross margins.

Powerstove's journey



3.2 Founder story



Okey Esse and Glory Esse are the co-founders of Powerstove. Okey is the Chief Executive Officer and Glory is the Chief Operating Officer. Okey is a graduate of Physics Electronics from the University of Jos, Plateau State. Glory studied Physics and Chemistry at the Niger State College of Education, Minna, and is a marketing professional with 11 years of experience. She is an expert in analyzing market trends and customer needs to develop highly effective and targeted marketing campaigns. Okey and Glory met while pursuing their graduate studies and began their partnership while working together on a clean cooking project, sharing a passion for addressing the problem of energy poverty and its adverse effects on households, especially women.

Okey decided to pursue Physics with the aim of finding solutions for building efficient cookstoves that not only meet the energy needs of his community but also address the issue of lack of access to electricity that he faced growing up. Okey's motive behind this project stemmed from the unfortunate death of his mother owing to heart disease, which developed due to years of inhaling smoke from cooking on firewood. During his college days, he set out on a mission to build an efficient cookstove and assembled a team of 3, including Glory, to develop the minimum value product. Within 8 months, they built a smokeless cookstove that could also charge electrical devices. Gradually, as people started to take an interest and enquired about the price of the stove, the team decided to incorporate a company and began exploring ways to expand the project to make it a sustainable business venture. Recognizing the harmful effects of charcoal stoves,

Powerstove decided to carve a different path and developed bio pellets as cleaner fuel to distinguish themselves from the competitors.

In the first 2 years, Powerstove worked on increasing the adoption of its products by building awareness about its bio pellets which were more efficient and affordable than other alternatives. The enterprise conducted awareness programs with women-led NGOs and Community-based organizations. With the increased traction in the market for Powerstove's products, other companies also entered the space. However, to retain its market position, Powerstove further innovated its products, increased the capacity of its factory, introduced new models of the stove to target different customer segments, and entered the carbon market space.

The company pioneered integrating IoT and blockchain into its product to understand user behavior, resulting in transparent data collection. Enthused by Powerstove's story, an angel investor offered funding of US\$50,000 to support the company and its cause. This investment was pivotal for Powerstove and enabled the company to refine its technology and undertake advocacy and sensitization campaigns to build community awareness regarding the health risks of indoor air pollution. Gradually, Powerstove began participating in grant competitions, receiving funding from several of them and gaining recognition in the clean cooking sector, paving the way for its growth.



What started as a personal dream to immortalize my mother has turned into a sustainable Pan African business that can scale and solve the problem (of clean cooking) in different markets, across different countries.

Okey Esse, CEO of Powerstove



3.3 Business model

 <p>Customer segment</p>	<p>Powerstove customer segments include</p> <ul style="list-style-type: none"> • Urban and semi-urban households: Urban and semi-urban household consumers in Nigeria are target customers for Powerstove for its cookstoves, bio pellets, and home light systems. • Commercial businesses: It also provides clean cooking products to commercial businesses such as restaurants and cafes. • Distributors: The company's customers also include distributors, NGOs, faith-based organizations, and resellers that buy products in bulk and sell them to retail consumers. <p>Carbon credit buyers: Powerstove has a few carbon credit buyers based in the USA and Japan, with whom the company has pricing agreements.</p>
 <p>Value proposition</p>	<p>Powerstove's value proposition is that it designs and manufactures Tier 4, improved cookstoves and bio pellets that reduce household energy expenditure and time spent on cooking. Powerstove has made this available through a series of consumer financing instruments, and after-sales services.</p> <p>For carbon-credit buyers, Powerstove provides vetted and transparent carbon emission data based on IoT and GSM. These buyers can procure the credits through a registered project in the Verra directory.</p>
 <p>Competitive advantage</p>	<p>In Nigeria, the Powerstove has a market lead with its Standard cookstove (cookstoves that also produce electricity). Powerstove has over 6 patents and copyrights for the built-in IoT systems and the cookstoves to prevent duplication. Further, the popularity of bio pellets due to their affordability has led to a rise in sales of cookstoves as the bio pellets are sold only to users who have Powerstove cookstoves.</p> <p>Powerstove holds a major market share in the pellet segment due to the cost-leadership. Powerstove pellets are 80% cheaper than charcoal, firewood, and kerosene. As per competitor analysis by Powerstove, the bio pellets are 50% cheaper than other pellets sold in the market. For Powerstove, the pellets are cheaper to produce as it is made from waste materials that the company sources at a very low cost.</p>



Channels &
key
partnerships

- The manufacturing of cookstoves and bio pellets is undertaken at Powerstove's factory in Abuja (Powerstove had 2 factories which have now been consolidated into one). Some raw materials to make the cookstoves are imported.
- Powerstove sells the cookstove and pellets through its own website and also partners with distributors and community-based organizations for retail selling. A majority of the sales, about 45%, is through B2B2C partners, such as community-based organizations for retail selling, 25% through resellers, and 20% through distributors. Ten percent of Powerstove's sales happen through their e-commerce channel.
- It has 27 key distributors in Nigeria that buy the cookstoves in bulk and resell them through their sub-dealers and resellers channel.³² Resellers are largely women who have their own shops and are trusted in their community. Powerstove selects and trains village-level entrepreneurs, who work as last-mile distributors and supports them with marketing and training to help them expand their businesses.
- Powerstove also has Distribution Retail Mobile Kiosks (Hubs) that allow customers who cannot order products online to visit any of these kiosks near their community, to make the purchase at the same price as via the website.



Customer
relationships

Product design: Powerstove considers the requirements of users while designing the products. The company conducts a detailed analysis of the users' requirements through interviews and discussions, takes it to the lab to build a prototype, and then undertakes prototype testing to incorporate customer needs and feedback.

After-sales: Powerstove operates through a network of distributors that provides doorstep delivery of products, and after-sales services including repair, warranty, and replacement services. In cities/urban areas, the company has also set up facilities/small office units for undertaking the repair of the products. Powerstove has trained volunteers, part of the distribution network of cooperatives, to offer after-sales support and fix any issues that may arise.



Pricing and
payment
methods

Pricing:

- **Cookstove:** For the household customer segment, the price of a cookstove is US\$24– US\$140 per unit (the price of traditional kerosene cookstove is US\$25/unit, and by other competitors are US\$50–150/unit). For the commercial business customer segment, the cost of a cookstove is around US\$80–US\$100.
- **Solar home light systems:** The price is in the range of US\$34– US\$250 per unit. It has a battery life of 11 hours when all 4 lights are on and takes 4.5 hours to charge.
- **Bio pellets:** The cost of pellets is US\$2–5 per kilogram. It is estimated that a family of 5, uses 20 kilograms of bio pellets each month.

Payment methods by end consumers: Powerstove offers 3 financing mechanisms as per the needs of the customer. These are:

- **Pay-as-you-cook model:** The consumer makes an upfront deposit of 40% of the cost of the cookstove and the balance is paid over 3 months.
- **Savings-to-own model:** The consumer periodically deposits a certain amount to a portal that keeps track of the accruals until 60% of the cost is paid, at which point the consumer gets the product. The balance of 40% is paid over 4 months.
- **Rent-to-own model:** In this model, cookstoves are “rented” to commercial businesses at no cost. However, customers must purchase a minimum quantity of pellets every month for 2 years, after which they secure ownership of the cookstoves.

Payment methods by distributors, resellers, and sub-dealers: The Key distributors pay a minimum of 70% deposit when placing bulk orders to Powerstove, and the balance is paid before delivery. The distributors pay a wholesale rate to Powerstove. The Sub-dealers buy from Key distributors and pay the full price and a markup to the Key Distributor. Community-based organizations and NGOs pay the retail cost of the cookstove and buy in bulk.



Revenue
streams

The entirety of Powerstove’s revenue comes from the sale of products: 51.5% from pellets, 39.5% from cookstoves, 3% from carbon credits, and 6% from other products such as solar home systems.



Cost
structure

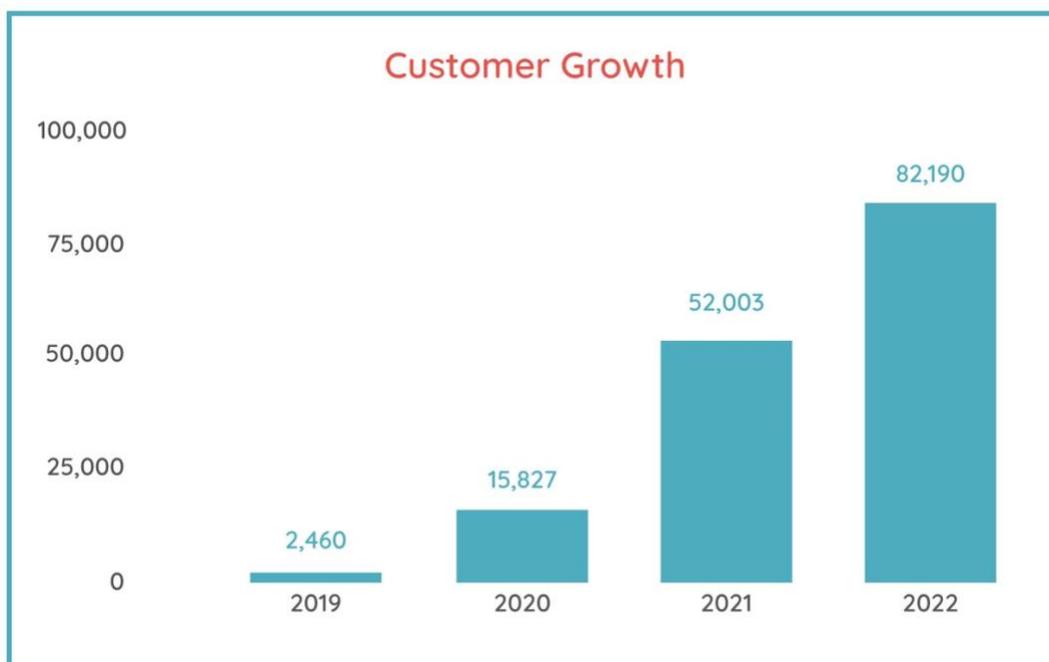
25% of Powerstove’s cost is on the Cost of Goods Sold. The company spends 28% of its cost on personnel. The enterprise invests 25% of its total cost in technology and 5% in research and development. Powerstove incurs 10% of the cost of rent and other operational expenses. The company’s expenditure on marketing is limited to roughly 7%.

3.4 Powerstove's growth story

Powerstove has grown over the years, demonstrating a steady rise in customer reach, sales, and product innovation and maintaining healthy levels of profit (with the exception of 2020 when the company faced challenges due to COVID-19). Over 50% of the company's revenue comes from the recurring sale of bio pellets to existing customers.

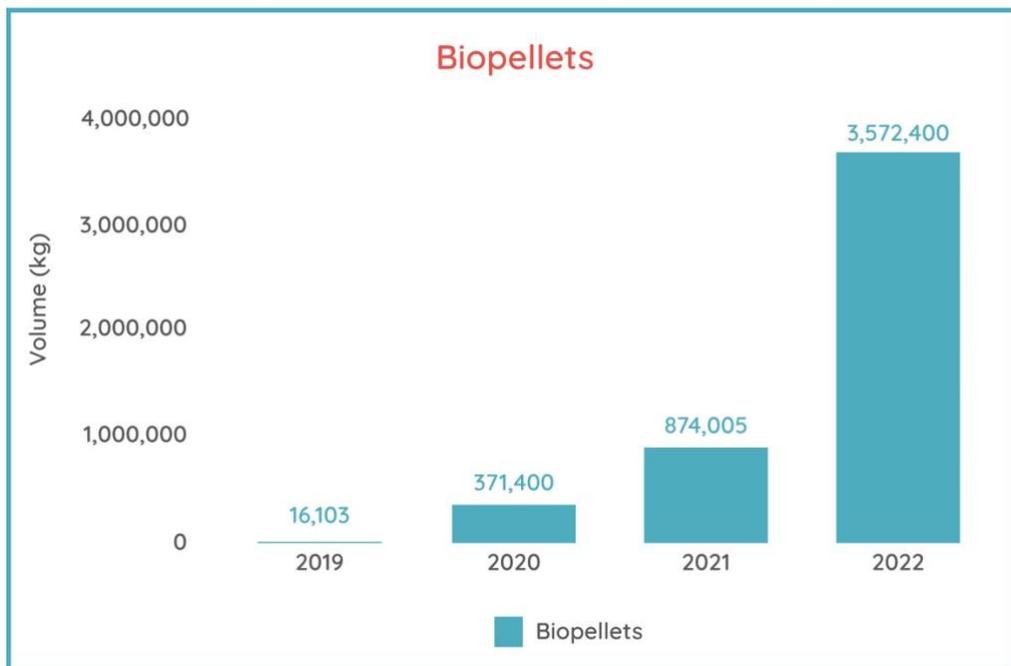
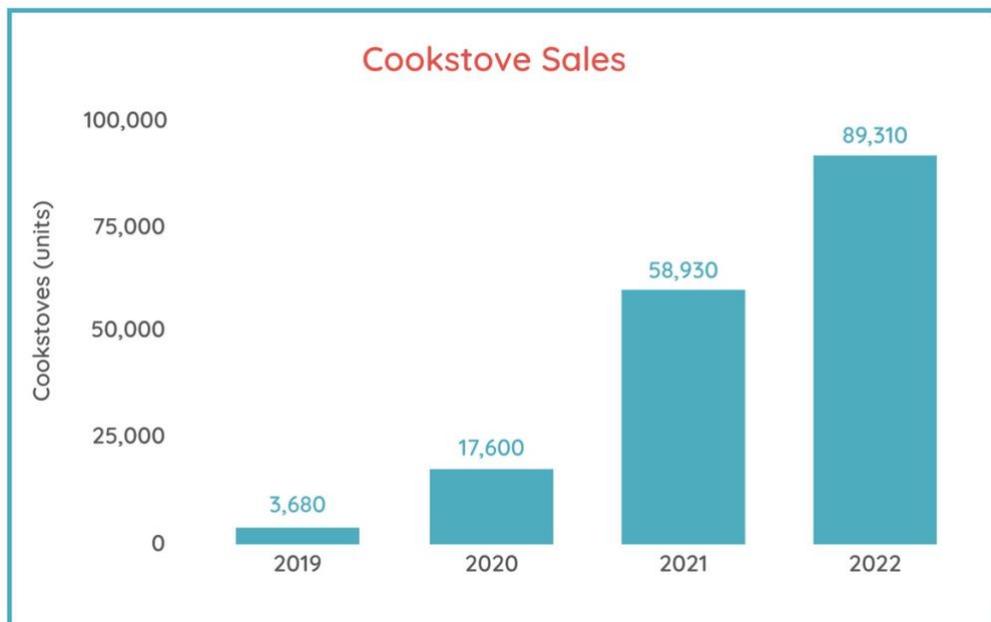
3.4.1 Customer growth:

Powerstove has demonstrated a steady and substantial rise in customers over the years. The company has leveraged community-based organizations, as last-mile distributors, to reach potential customers while maintaining low customer acquisition costs. Its below-the-line marketing strategy³³ and focus on engaging community leaders to adopt clean cooking solutions has helped Powerstove to grow its business.



3.4.2 Product sales:

Since 2019, Powerstove has sold 203,000 cookstove units and 53,80,801 kg of bio pellets. In 2023, Powerstove has already sold 33,480 stoves. Powerstove’s product sales have increased steadily over the years.

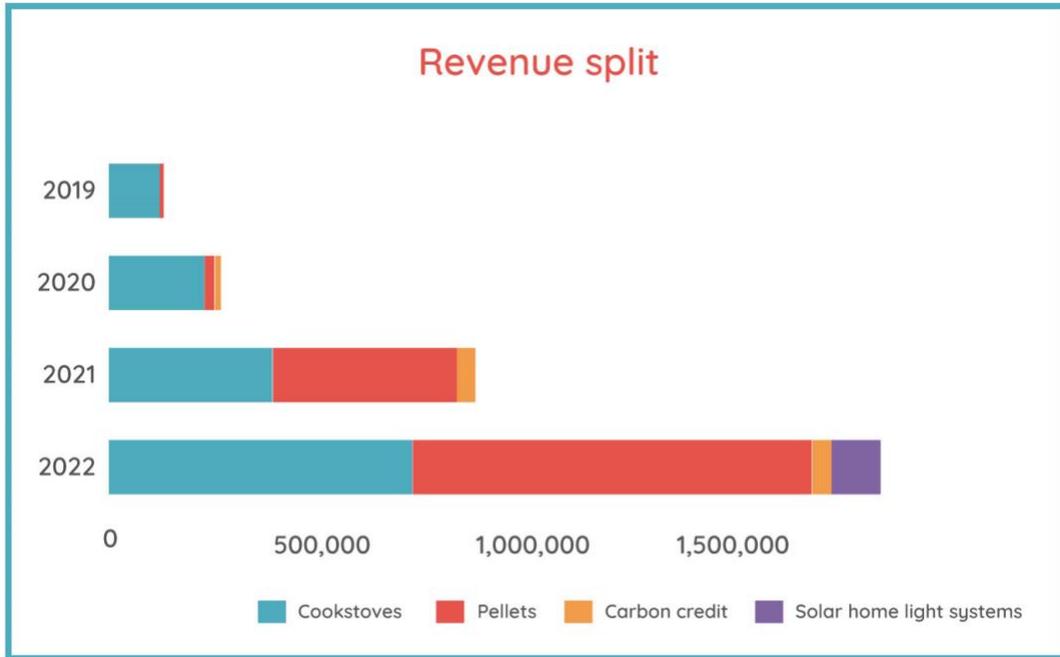


3.4.3 Revenue growth:

Powerstove’s revenue has increased steadily, the majority of which comes from bio pellets. During COVID-19, Powerstove faced a decline in its sales, owing to the pandemic-induced lockdown. In May 2020, the company resumed its operations and adopted a new distribution model. Powerstove started setting up mobile retail kiosks to bring its products near the communities, allowing those customers who cannot order products online to make the purchase at the same price as via the website. In June 2020, sales began picking up and the company decided to increase the number of mobile kiosks in its operations. Post the pandemic, Powerstove recovered substantially and the company’s revenue more than doubled.

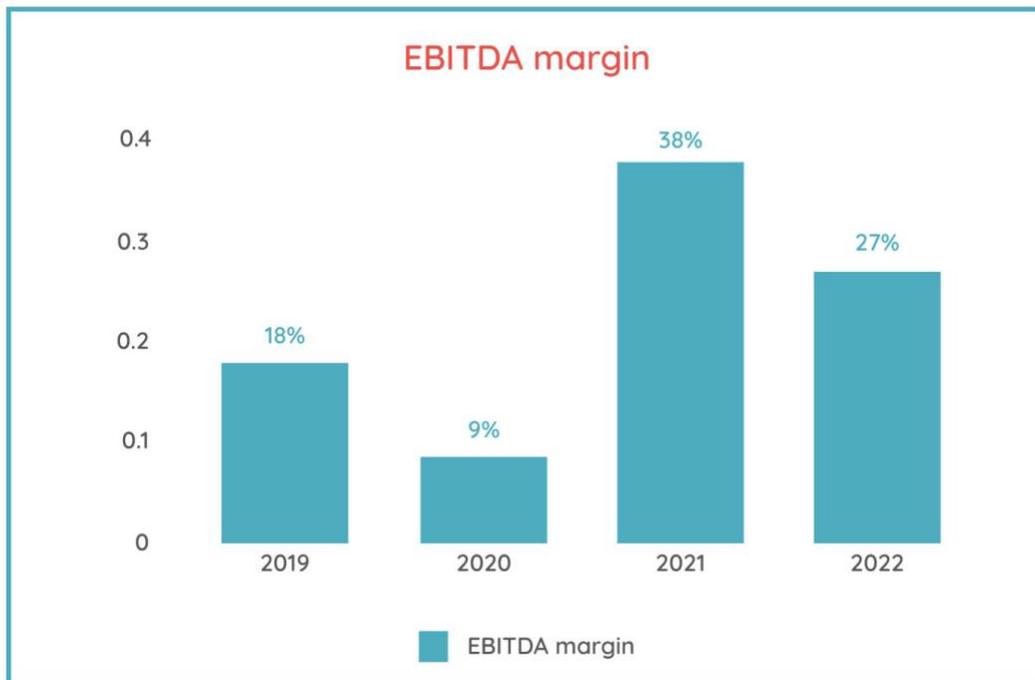


The chart below shows the distribution of Powerstove’s revenue across its key products and services, over the years.



3.4.4 EBITDA margin:

Powerstove has maintained healthy EBITDA margins since its inception in 2018, except when the company suffered a dip in sales during the COVID-19 pandemic.



3.5 People and governance

Powerstove is committed to gender and climate justice and strives to achieve this not only through its product and service offerings, but through its people and governance structures, practices, and policies.

2X Criteria ³⁴	Climate and Gender Justice ³⁵
<ul style="list-style-type: none"> ● One out of 2 founders is a woman. ● 40% of senior leadership (executive level/C-suite positions) is women. ● 4 out of 8 board members are female. ● 79% of full-time employees and 85% of part-time staff are female. ● Products specifically benefit women. 	<ul style="list-style-type: none"> ● To a large extent, the company provides affordable clean energy and fuel solutions to energy-poor households in urban and semi-urban areas, which improves women's health outcomes and economic participation. ● To a large extent, the company has improved access to affordable and reliable clean energy, which has reduced women's care responsibilities and allows more time for leisure, education, and economic activities. ● To a large extent, the company supports local economic regeneration and just transition, reducing the health impacts from environmental pollution and the care workload on women in vulnerable communities.
<p>Powerstove is a gender-transformative business.³⁶</p>	<p>Powerstove is a gender-transformative business.³⁷</p>

Powerstove has 168 full-time and 29 part-time employees. About 79% of the full-time employees are women and work in the Sales and Marketing, Operations Management, Quality Assurance, and Research and Development teams. The part-time employees work in the factory and manufacture the cookstoves and bio pellets. Powerstove has various policies to support its team and the management, which include equal pay for equivalent work, diversity, and inclusion/equal employment opportunity, employee grievance mechanism, protection against sexual harassment at work, and paid maternity/paternity leave. The company also has policies related to safeguarding vulnerable groups (children, elderly people, people with disabilities) as well as policies related to safeguarding the environment or reducing detrimental impacts to the environment.

The company has an HR Consultant on retainer for their hiring needs. While the HR professional shortlists potential employees for recruitment, the CEO makes the final decision on selection based on his assessment of the person's suitability to the culture and ethos of Powerstove. Powerstove has an employee handbook that outlines details of the welfare package for the staff, the code of conduct at the company, the audit policy, etc.

The company has also set up an online training platform for employees viz. Powerstove Academy, with funding support from the French Development Agency (AFD). Every staff member logs into the Academy which includes a library and sometimes conducts learning sessions for employees delivered by domain experts. Powerstove regularly updates the Academy and provides an avenue for the staff to watch informative videos, ask questions, and continue to be informed about the company's foray into new avenues such as carbon credit markets, etc.

3.6 Support received to date

The company has received both financial and non-financial support in the form of grants, equity, debt, technical advisory, and mentorship. The key items of support received are as follows:

Financial	
Angel investment	Powerstove received US\$50,000 from an angel investor in April 2019. The investment was used to develop the first product and create sensitization in the community.
Equity funding	The enterprise has raised US\$450,000 in multiple equity rounds. The equity funding enabled Powerstove to build its first factory and test the product-market fit. Recently, the company has raised an additional US\$500,000 in equity financing from an investor (undisclosed) for the expanding operations in Zambia.
Debt funding	Powerstove has received debt funding of US\$400,000 for business development and research from various sources including a) Participating and winning in a grant competition (US\$5,000); b) Debt funding from Charm Impact (£150,000) and from; c) USAID (US\$50,000) and from an undisclosed investor (US\$100,000).
Blended instrument	In 2022, Powerstove received an investment of US\$13 million from JUA Fund, combining private equity and debt financing from JUA, an early-stage, Pan-African, Venture Capital Fund. This funding enabled Powerstove to build a new factory, meet operating expenses during COVID-19, and avail working capital.

<p>Grant funding</p>	<p>The enterprise received US\$550,000 in grants from awards and challenges from DEMO Africa, Startup of the Year Africa 2018, GIST, CISCO, The Tony Elumelu Foundation, UN Solution Summit 2018, Startup Battlefield Africa, Africa Energy Indaba, SOCAP 18, TechPoint Africa, Global Innovation Exchange and Change Now.</p>
<p>Non-financial</p>	
<p>Capacity strengthening and mentorship</p>	<p>Powerstove has participated in 4 accelerator programs for mentorship and capacity strengthening including</p> <ul style="list-style-type: none"> • Westerwelle Foundation Program (2019): The founder attended learning sessions on growth hacking, investor pitching, and corporate governance. • Forbes Nigeria Accelerator Program (2020): This program served as a convening of entrepreneurs in the country to understand the challenges in the Nigerian market, and build on solutions to address the local contextual constraints as well as to scale the business in the global market. • UrbanX Basecamp Accelerator Program (2020): This program helped the company to understand how Chinese startups have been able to tap into the global market. Powerstove also received training on developing financial models, as part of this accelerator. • Land Accelerator (2021): The program exposed Powerstove to revenue-driven business models of nature-based projects, that are often considered to be not-for-profit ventures. The accelerator helped Powerstove fine-tune its business model to incorporate nature-based solutions into its work, embedded in afforestation/preventing deforestation.
<p>Technical assistance</p>	<p>Powerstove participated in the Senegal Startup Bootcamp which helped the founder in learning how to approach the carbon market with other sector experts.</p>

*A full summary of the support received is [here](#).

3.7 Key business drivers and challenges to growth

Powerstove foresees certain challenges to growth and has also identified business drivers for its growth.

Key business drivers

<p>Technology-driven business</p>	<p>Powerstove has designed an innovative range of cookstoves, which was enabled by the co-founders' educational background and competency in physics and chemistry. Powerstove invested in Research and Development right from the beginning, driven by Okey's vision for building a technology-backed platform. All of the company's decisions are based on data collected through IT.</p>
<p>Low production cost of bio pellets</p>	<p>Powerstove produces bio pellets from easily and freely accessible raw materials such as wood, waste/sawdust collected from landfills, and agricultural crop waste collected from farmers. The only significant cost that the company incurs for accessing raw material is the logistics of procuring it from the field and taking it to the factory. As a result, Powerstove is able to produce low-cost cooking fuel, a major source of Powerstove's revenue.</p>
<p>B2B2C model for lowering the cost of customer acquisition</p>	<p>Powerstove has built partnerships with NGOs, faith-based and community organizations, etc. to have access to their members as potential new customers. Powerstove identified that leveraging the power of social capital held by the heads of these associations was a more effective strategy for customer acquisition than investing in social media marketing through Facebook and Instagram ads that incur huge costs and have low conversion rates. For instance, for every 8-10 organizations that a company engages with it gets access to 10,000-20,000 members, which could lead to 500-1,000 new customers. As the bulk of the distribution is handled by B2B2C partners, Powerstove is able to concentrate on its core competency: designing and building modern clean cooking products.</p>

Challenges to growth

<p>Ecosystem</p>	<p>Limited access to business incentives offered by the government: Powerstove has not been able to benefit from policy incentives to startups owing to the time-consuming, bureaucratic administration ecosystem that impedes access to these schemes, such as training and capacity strengthening under the Nigeria Startup Act. There are limited schemes to support enterprises with fundraising or propel commercial capital and financiers to invest in clean cooking enterprises.</p>
<p>Financial</p>	<p>Availability of capital: Powerstove has raised most of its capital from international investors as it has faced challenges in raising funds locally from Nigerian investors. Impact investing is still a nascent area in Nigeria with not many Nigerian investors using this asset class for deploying their capital. Further, the entrepreneur reports that in Nigeria, the cookstove industry is not seen as an attractive investment opportunity as it is difficult to measure the impact and confirm whether a user is using the cookstove. Powerstove is, therefore, trying to make consumer usage data more transparent through blockchain. Additionally, other sectors such as Fintech attract more investments and interest from tech-focused investors.</p>

	<p>Accessibility of capital: Traditional lenders such as Nigerian banks and investment institutions have a limited understanding of Powerstove's technology, distribution model, and carbon trading and thus, hesitate to lend to Powerstove. Powerstove is currently looking to raise debts from regional or international investors who are willing to consider carbon credits as collateral.</p> <p>Currency exchange fluctuations: Powerstove faces challenges in accessing foreign currency to purchase imported raw materials to produce cookstove, especially amidst the growing inflation and depreciation of the local Naira. For instance, in 2021, US\$1 was equivalent to 409 Naira, in 2023, it is equivalent to 768 Naira. Due to the forex fluctuation, the cost of capital also increases as Powerstove has to service the debt in dollars.</p>
<p>Operational</p>	<p>Production: As per estimates, Nigeria has 3–6 hours of electricity per day. The national electricity grid collapsed more than 200 times in the past 9 years.³⁸ Load rejection by distribution companies in Nigeria has been a problem since 2018. The rejection is partly due to the poor state of the transmission and distribution network and faulty power lines. Irregular electricity supply affects production capacity resulting in. Powerstove uses diesel generators to operate machines for most of the production. In the past few months, the cost of diesel has significantly increased in Nigeria and, consequently, Powerstove has to spend approximately US\$1,000 daily on diesel. As a result of irregular power supply and increased diesel costs, Powerstove had shut down one of its factories and merged it with another to build a bigger facility to optimize production costs.</p> <p>Transportation: Powerstove has to transport goods from the production centers to warehouses and distributors. As a result of high diesel/fuel costs, logistics and transport costs also account for significantly higher costs of goods sold.</p>
<p>Human resource</p>	<p>Hiring and retaining talent: Initially Powerstove faced difficulties in hiring the right personnel, especially for IT and digital infrastructure. There has been a boom in hiring talent from European countries who pay higher salaries for people trained in engineering but enterprises like Powerstove cannot offer them competitive salaries. Therefore, Powerstove decided to outsource the IT development work for the company. At the factory level, workers are often hard to retain and have the propensity to leave if another factory offers to pay them extra.</p>

4 - IMPACT DEEP DIVE

4.1 The impact theory of change of the enterprise

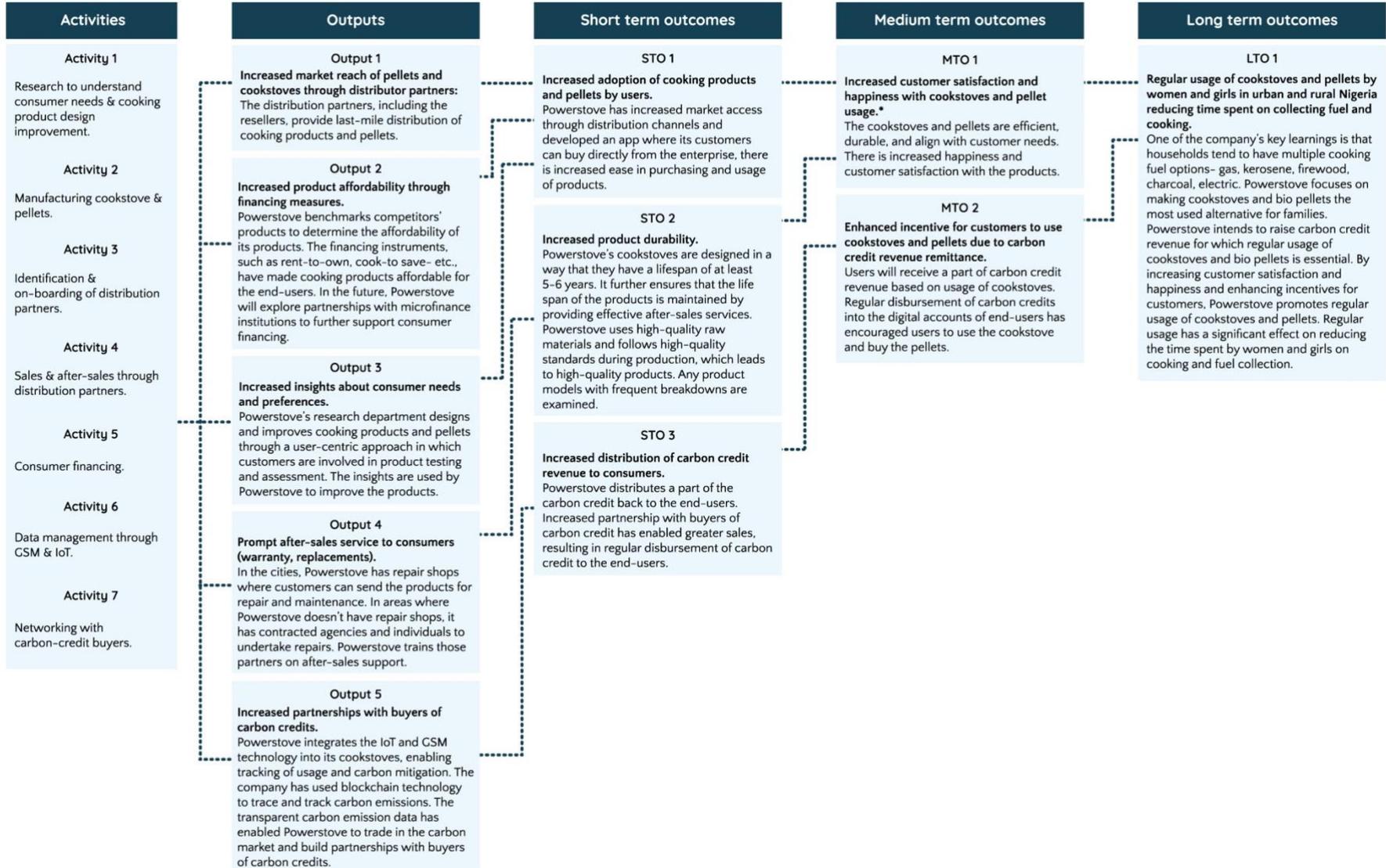
Mission statement

Powerstove's mission is to develop affordable and sustainable renewable energy solutions to meet the energy demand of every community and household in low-income countries.

Theory of change

In order to reduce the care workload on women and girls, Powerstove has developed the following theory of change.

Powerstove's pathway to reduce the care workload of women and girls



*MTO1³⁹



4.2 Current impact and measurement practices

Powerstove has established 3 ways of collecting data to gather actionable insights for the company. First, it monitors real-time data from the IoT-enabled cookstove devices that record the frequency of cookstove usage. Second, the company has a robust network of distribution partners that collect information on customer experience with products, including functionality or delivery challenges. Third, the company's mobile-based application captures customer satisfaction data.

Customer data on usage of cookstoves and/or expenditure on pellets:

Powerstove measures product usage, by number of hours recorded through the IoT, GSM-enabled cookstoves. This data enables Powerstove to estimate the weekly quantity of pellets bought by the household by estimating the number of days that their cookstove has been used in a week. Usage data enables Powerstove to understand consumer needs, preferences, and patterns, and thus informs focused marketing strategies. For instance, specific marketing activities are best to improve traction for households that use the cookstove for less than 5 days a week or buy less than 10kg of pellets per week.

Customer feedback on experience with products, collected from distributors and partners:

Powerstove gathers after-sales information on products such as the stove's functioning, users' ease of operability, and experience. This feedback is collected quarterly. Customer reviews recorded by Powerstove's local partners have helped the company to enhance its products and service offerings. For instance, distributors recorded a high volume of customer requests for replacing stove handles, which helped identify an issue with stove handles malfunctioning within 8 months of purchase. Powerstove thus upgraded the material and thickness of the stove handle to help it withstand higher temperatures. Powerstove also observed that some customers found it challenging to operate the technology components of their new stove. Thus, Powerstove created informative videos that could be shared over WhatsApp or communicated to customers through their vendors. Finally, Powerstove used post-production information from their local partners to identify issues with clay-built models suffering wreckage during the transport of stoves to customers. Powerstove addressed this issue by changing its logistics provider.

Customer satisfaction on Powerstove's mobile-based application:

The company has integrated a rating poll to measure user contentment with the product and services on a scale of 1-10. Powerstove also randomly selects customers to provide



feedback, especially about their non-performing products, and uses this to make decisions regarding continuing distribution or making improvements to modify select stoves.

Powerstove business impacts (*as per internal measurement system*)

- Number of cookstoves sold: 203,000
- Quantity of pellets sold (in kgs): 53,80,801
- Number of individual lives improved: 913,500
- Number of trees saved: 8,932,000⁴⁰
- Carbon emission prevented: 609,000 tons CO2 emissions
- Number of jobs created (businesses, households, resellers): 250 new jobs
- Amount saved by consumers: US\$60 million⁴¹
- Number of people who have benefitted (cookstove users, workers, suppliers): 1.6 million, 80% of them women
- Number of households that switched to bio pellets for cooking: 134,811
- Total time saved in weeks: 341,958 weeks

In the future, Powerstove plans to undertake upgrades to improve current measurement practices. Specifically, Powerstove intends to introduce a robust, user-friendly mobile application to collect customer feedback. This would also enable the company's partners to more effectively gather information to help inform Powerstove's production and distribution processes.

Powerstove has experienced some limitations on measurement: Not all of the cookstoves are GSM and IoT enabled, therefore, Powerstove isn't able to capture information pertaining to usage for all the systems. Going forward, Powerstove intends to provide a standalone GSM technology that can be used in any cookstove model.

4.3 Customer's own experiences of the solution

Understanding the social context, emotional needs, preferences and barriers faced by customers of Powerstove is key for potential investors to understand where Powerstove excels and where it has room to grow. The following sections provide insights into the foundation of the business market success and its impact on the lives of Powerstove customers, with the aim of helping investors make informed investment decisions.

To inform this analysis, the research team conducted 12 in-depth interviews to gather insights about the lived experiences and realities of Powerstove customers. This section presents the results of the qualitative impact deep dive, starting with a snapshot of the



customer, followed by an examination of different customer personas and their journeys to using Powerstove products. This section concludes with a qualitative overview of Powerstove's impact on the daily lives of domestic workers.

4.3.1 Customer snapshot

Nigeria represents a paradox of abundant energy resources while much of the population still experiences energy poverty. About 72% of the population depends on traditional firewood for cooking, which leads to negative health outcomes (emphysema, cataracts, cancer, heart disease, etc.), increased economic burden, and deforestation. Energy poverty disproportionately impacts women and girls, as they are more frequently engaged in tasks involving fuel and energy consumption within the home (such as cooking).

Powerstove aims to provide cleaner, more efficient cookstoves and clean fuel to women in Nigeria. Gaining insights into the social, emotional, and demographic features of Powerstove customers offers a window into understanding the needs, preferences, and barriers faced by the user base, and thus an opportunity to identify ways the business can better adapt to meet customer needs.

Powerstove offers 17 different types of cookstoves which are designed to cater to different household sizes and for different purposes. The customers interviewed are using the commercial cookstoves or the smallest-sized clean stoves, which use bio pellets as their source of fuel. The price of the standard cookstoves ranges from 12,000 NGN to 40,000 NGN (US\$16–US\$52).

The interviewed Powerstove customers were all female, ranging in age from 25 to 54 years. The majority of the customers were married while a small percentage were single. A majority of the sample lived in an average 5-person household with two children.

All customers were literate, and more than half the sample received some form of post-secondary education, while a minority of the sample had only received primary education.

About half of the sample had engaged in business as a primary source of income, including selling or making clothes or offering hair and beauty services. Slightly less than half the sample had professional experience working as teachers or in the civil service. The remaining customers reported unemployment and financial reliance on families or spouses. The household income for the average Powerstove customer varied from 5,000 NGN to 450,000 NGN (US\$7–US\$586)⁴² per month, with an average of 54,000 NGN (US\$70). A minority of customers earn below the average national household income in Nigeria and the international poverty line, whereas the majority of customers surpass the national household income of Nigeria. It is important to note that some women reported only their own income and not of



other earning members in the household. About a third of the women interviewed declined to disclose their household monthly income.

Powerstove customers mostly bought and used the stoves because they are considered faster and more economical compared to traditional charcoal stoves. Most customers discovered the stove through friends, social media, or public product demonstrations and promotions. Several customers have expressed satisfaction with reduced time spent cooking, preparing meals, and collecting firewood and charcoal. Traditional charcoal and kerosene are quite expensive compared to Powerstove pellets. Overall, the product is considered affordable and safe.

The majority of the customers were given an allowance by their husbands to purchase the cookstove. However, the female customers first researched the product and initiated the decision-making process for purchasing it, indicating eagerness to enjoy the benefits of an innovative and clean cooking solution.



4.3.2 Customer personas

The qualitative research revealed two distinct Powerstove customer personas. The personas are identified by their motivations to purchase the Power Stove cooking solution. The two types of customer personas are:

- ❖ **The Cost-Conscious Buyer:** This persona discovered the cookstove while looking for a cost-effective cooking solution. These customers were dissatisfied with the high price of gas, kerosene, and traditional charcoal. They are inclined to use the cookstove because the pellets last longer and are more cost-effective than gas and charcoal.
- ❖ **The Follower:** This persona purchased the cookstove following positive recommendations by friends and family members.

We are able to group Powerstove customers into these personas through a qualitative understanding of their characteristics, beliefs, attitudes, and behaviors. These personas are distinct from one another, representing the customer's main motivation, pain points, and levels of awareness regarding the benefits of the cookstove by Powerstove. They will enable the Powerstove team to concentrate on what matters most to customers in terms of context, motivations, and needs. Powerstove will then be able to improve its offerings and support services.

Below is an in-depth examination of these two distinct personas.



Chioma's Bio

Chioma is a 38-year-old woman who works as an employee for a business. She is married and lives in her home with her two children. She earns about 70,000-80,000 NGN (US\$91- US\$104) every month.

Chioma struggles with the rising prices of gas, kerosene, and charcoal across Nigeria. She is looking for cheaper, user-friendly cooking products. After discovering the Powerstove advertisement on social media, she was eager to take advantage of its features to save on cost and time.

Chioma Abidemi

The Cost-Conscious Buyer

Demographic information (of the persona she represents)

Age: 31-45 years old

Marital status: Married

Children: 2 children

Education: University degree

Income: 70,000-80,000 NGN / US\$91-104

Occupation: Likely to be working for a business

Average hours spent on care and domestic work: 7.5 hours per day

Motivation

Chioma was motivated to purchase the new stove when she saw an advertisement for the stove on Facebook. The advert stated that the cookstove burns five times faster than charcoal at a lower cost. This resonated with her desire for a more time and cost-efficient cooking solution.

As Chioma already spends a lot of time on care and domestic work, a stove that might save her time was very appealing. Ideally, she could cook faster to then redirect her time and effort to other responsibilities.

Chioma's behavior reflects a "cost-conscious buyer," as she is looking for a cost-cutting solution.

I wanted to reduce the cost as much as possible. It is cost effective, since I can use 100 pellets twice, unlike other charcoal pots where 100 charcoal won't be enough to cook one meal, but with the Powerstove half of the pellets is enough

The Cost-Conscious Buyer, 37 yrs old

Some behavioral traits

- Chioma saw the Facebook advertisement by Powerstove and then decided to purchase the stove herself. She was drawn to the stove's potential for time savings, as the brand's pellets last longer than traditional charcoal, and the stove cooks food faster. Dishes that used to take 5 hours to cook can now be cooked in an hour, which frees up more of her time to focus on other things.
- Because the pellets are much cheaper than charcoal or gas, she can now afford to use the stove to cook breakfast, lunch, and dinner. She does not have to incur recurring maintenance costs and the pellets are available for as little as 100 NGN.
- The cookstove has given her more financial autonomy, as she is now able to plan and allocate fuel-related spending.



Ayo's Bio

Ayo Grace is a 30-year-old woman who lives with her husband and her two children. She runs a dress-making business, from which she earns 40,000–50,000 NGN (US\$52–US\$65) per month. Ayo values the views and perspectives of her immediate social circle, friends, and family members.

Ayo had complained to her neighbor about how expensive charcoal has been. The neighbor showed her the Powerstove cookstove and she was amazed. She shared the good news with her husband who then gave her the money to purchase it so she could enjoy the benefits herself.

Ayo Grace

The Follower

Demographic information (of the persona she represents)

Age: 29–54 years old

Marital status: Married

Children: 2–3 children, lives with her husband

Education: Likely to be a university graduate

Income: 40,000–50,000 NGN (US\$52–US\$65)

Occupation: Likely to be businesswoman

Average hours spent on care and domestic work: 5.5 hours per day

Motivation

Ayo's motivation to purchase the cookstove by Powerstove stemmed from her neighbor's recommendation for the quality and cost-effectiveness of the cookstove.

In the rainy season, Ayo was struggling to light firewood and the charcoal alternatives stained her pots black. Much of her time was occupied by dealing with the consequences of inefficient fuel products. The cookstove recommendation from her neighbor was timely, and her purchase was enabled when her husband agreed on the benefits and gave her the money to purchase the stove.

She exhibits the behavior of a "follower" as she trusts and acts upon the recommendations of others.

Like I said my neighbor told me about the stove because I complained to her how the charcoal that I used is giving me stress and how it is expensive, she told me about the stove, so when I got home, I told my husband and he gave me money to go and buy it

The Follower, 30 yrs old

Some behavioral traits

- Ayo values the recommendation of her peers and is receptive to what they have to say. She follows the crowd and believes that the quality of a product is likely to be assured when people like her are using it.
- After hearing the recommendation from her neighbor, she consulted with her husband - indicating that she values the perspectives of those close to her. The husband agreed to give her the money to purchase the stove.
- She uses the cookstove to cook all three meals a day. Its efficient cooking time has given her more free time. She says that she now has adequate time to spend with friends and family without having to worry about cooking.
- She also now has the freedom to cook from indoors because there is much less smoke emitted by the pellets. She feels her children benefit the most from this, as they were particularly affected by the smoke of firewood. Both Ayo and her husband have recommended the stove to their friends and neighbors so they can also enjoy the benefits.
- Buying the cookstove has changed the way some of her friends perceive her social status. She reported that when friends visit her house, they interpret the cookstove by Powerstove as a sign of wealth.



4.3.3 Journey maps

These personas are illustrative of how different customer groups discover and decide to use the Powerstove product. In this section, we use journey maps to provide additional detail on the emotional experience of customers from awareness to purchase.

Journey maps are a visual representation of the highs and lows experienced by customers as they access and use the Powerstove. In this way, customer journey maps can help Powerstove to identify opportunities for improvement and ensure that the needs, wants and constraints of various customer segments are considered in the expansion and refinement of their products, services, or reach.

The journey to using the Powerstove starts with awareness, in which potential customers discover the product. Consideration follows as they weigh their options and gather more information. Decisions are made in the third stage, where customers discuss with their families and decide to purchase the product. This is followed by purchase and payment. The next stage, Product Usage, marks their first experience using the product and experiencing its impact on their day-to-day life. This is followed by the customer maintaining the product for continued use. The journey ends with Loyalty and Advocacy, where the customer remains an active user of the cooking stove and recommends it to others.

Table 1: The process a customer goes through while purchasing the Powerstove.

	Pre-product purchase		Product purchase		Post-product purchase		
Stage (customer activities)	Awareness (Customer seeks information or is made aware of the product)	Consideration (Customer evaluates the need for the product and discusses their purchase decision)	Decision (Customer approaches the source to make the purchase)	Payment and purchase (Customer makes the first payment for the product, registers their details and brings the product home)	Product usage (Customer begins using the product and the family experiences its impact)	Product maintenance (Customer makes any recurring purchases required to continue using the product)	Loyalty and advocacy (Customer reviews the product after its sustained use and promotes it)
Customer goals	Potential customers want to learn more about the new cookstove and its features.	Potential customers look to verify the effectiveness of their product through their network. Women consult with their partner to support purchase.	The customer seeks to purchase the stove.	The customer looks to make the payment for the product and receive some demonstration on how to use it.	The customer incorporates the product into their daily routine and experiences its benefits.	The customer regularly purchases the pellets to sustain usage habits and maintain the product.	The customer evaluates their satisfaction with the product and their willingness to continue using it. Customers look into other products released by the brand.
Emotions	 Curious, attracted	 A mix of excitement and caution, requires effort	 Eager and anxious	 Excited	 Overjoyed	 Happy but slightly stressed about recurring purchases	 Relaxed and satisfied
Levers	<i>Social network</i> The product benefits from high trust by existing customers who introduce and recommend the product to potential customers, enabling the brand to gain better reach.	<i>Initial perception</i> The product comes across as affordable, attractive, and beneficial. Hence the initial interest in the product is high. The general perception of the product is positive		<i>Flexible payment</i> The brand has multiple payment options, which allows a customer to obtain the product and pay later.	<i>Ease of use</i> Customers find it easy to learn how to use the new cookstove and incorporate the stove into their existing cooking routine.	<i>Reduction in health costs</i> Customers note a reduction in their trips to the pharmacy to purchase eye drops and cough drops caused by smoke from traditional	<i>High satisfaction</i> Most women are satisfied after using the Powerstove and recommend it to other people who would benefit. Some women were encouraged by their favorable

	Pre-product purchase		Product purchase		Post-product purchase		
		<p>in that it is faster for cooking and safe.</p> <p><i>Lack of alternatives</i> Traditional cookstoves are less efficient and create smoke, which causes health problems, damages kitchen pots, and is bad for the environment. Traditional fuels are also much more expensive. Hence the Powerstove presents a favorable alternative.</p>			<p>Stove maintenance is also easy, as it can quickly be cleaned or wiped after use.</p> <p><i>Favorable to weather</i> Unlike traditional cookstoves which can only be used outdoors due to the smoke and cannot be used in the rain, the Powerstove can be used indoors and in any weather.</p>	stoves.	<p>experience to purchase other products from Powerstove as well.</p> <p>Those who own the stove are perceived to be wealthy.</p>
 <p>Barriers</p>	<p><i>Low product penetration</i> Customers mentioned not knowing about the product or actively seeking out information about it. This could be explained by the fact that not many people know about it and there are not many accessible advertisements.</p> <p><i>Unavailability of information</i> Customers do not</p>	<p><i>Path dependency</i> Some women feel hesitant to try out new cooking technologies since they are used to traditional methods of cooking with firewood or charcoal. Adopting a new cooking method could present a risk if it doesn't work out.</p> <p><i>Negative Experiences with Charcoal</i> Women ascribe the</p>	<p><i>Perception of high cost</i> Customers feel that they need to save in advance and hence cannot make the purchase immediately. Some found the product to be costly for its size.</p> <p>Customers are not aware of the different payment plans available to purchase the cookstove.</p>		<p><i>Learning curve</i> Some customers need more time to learn how to use the stove. Some mentioned requiring help with starting it and learning how to position the pellets correctly.</p> <p><i>Product quality</i> Customers felt that the product was too small to cook in large quantities. Some customers were concerned about the durability</p>	<p><i>Recurring costs</i> Customers are required to purchase the brand's pellets weekly or bi-weekly to use the stove, which was a point of fear for several low-income customers. They prefer switching back to gas cookstoves if the prices in the market are not too high.</p> <p>Customers are often unaware of where</p>	<p><i>Inaccessibility</i> Not all potential customers were aware of a retail outlet where they could purchase the product.</p> <p>Younger customers might prefer a more modern solution as they believe they are going back to traditional methods of cooking.</p>

	Pre-product purchase	Product purchase		Post-product purchase	
	know which contact number or physical store to reach out to get more information about the product.	same hesitancy to use the Powerstove pellets as they did to the charcoal ones, due to the similarity in shape, size, and way of use.		of the product when they saw the inner layers of the stove peeling off.	to purchase stove pellets.

4.3.4 Powerstove's impact

This section presents the impact of the Powerstove products on customer's daily lives, based on qualitative data. The quotes below are the customer's own words.

All customers reported experiencing positive changes in their lives since using the Powerstove, including reduced time spent preparing meals, improved health conditions, and increased free time. The impact has been consistent across all customer personas - the Cost-Conscious Buyer and the Follower.

Qualitative evidence of theory of change

Long-term outcome

LTO1: Regular usage of cookstoves and pellets by women and girls in urban Nigeria, reducing time spent on collecting fuel as well as on cooking.

- **Reduced time spent on collecting fuel:** Customers of Powerstove reported using less time collecting fuel and cooking. On average, women reported saving 1-3 hours.

"Sometimes you have to struggle to make fire from firewood, the fire may not start easily but with the cookstove it is almost instant. If I did not have good firewood or when it rained and the woods were wet I could spend four hours cooking but with the cookstove I can cook in about one hour".

The Cost-Conscious Buyer, 31 years old

"Before I spent one and half hours and sometimes two hours cooking, but now, with the power stove, 30 minutes I am done cooking. When we had gas, we don't cook beans in the morning, we only do that in the night".

The Cost-Conscious Buyer, 37 years old

"The time I would have used to get the fuel, I can quickly use the time to do other home chores".

The Cost-Conscious Buyer, 45 years old

- **Regular use of products:** Most households reported regularly using the Powerstove for cooking three meals a day for their family, boiling water for their children before sending them to school, and for efficiently preparing a meal when they have guests over. Respondents reported a 1-3-hour reduction in cooking. However, some also noted that the stove can only accommodate medium-sized pots which can create a need to use other types of stoves.

Because of the size, only a medium pot can sit on it. It cannot take a very big pot so we cannot use it for cooking".

The Follower, 29 years old

Medium-term outcomes

MTO1: Increased customer satisfaction and happiness with product and pellet usage.

MTO2: Enhanced incentive for customers to use cookstoves and pellets due to carbon credit revenue remittance.

- **Trust and customer satisfaction:** Majority of those interviewed reported high levels of satisfaction with Powerstove products. Most women reported the speed and convenience of cooking as their primary reason for satisfaction, while others appreciated the time and money saved while cooking. A few customers wondered about the durability and

longevity of the stove. Some women hoped that the Powerstove company would lower the price of the stove and make it more widely available. Respondents expressed these complaints freely and openly, knowing that their feedback would be taken seriously – indicating trust in Powerstove and a desire to continue to engage with the business. Overall, the Powerstove product has been well-received by the women who have used it with a few minor complaints.

“I was anxious about it spoiling, I was not sure how long it would last and what to do if it got spoiled”.
The Follower, 29 years old

“I think there should be more awareness, because I never got to know about this product until 2 years ago and I believe other people are there that don’t know about this product”.
The Follower, 40 years old

Short-term outcomes

STO1: Increased adoption of cooking products and pellets by users.
STO2: Increased product durability.
STO3: Increased distribution of carbon credit revenue to consumers.

- **Wider adoption of products:** Powerstove cookstoves have been adopted by households in Nigeria, with customers recommending them to their neighbors, family, friends, colleagues, and members of their church group. Problems with the stove are promptly addressed by Powerstove representatives and there is only a slight learning curve for using the stove.
- **Efficient product:** The majority of participants reported that the Powerstove and its pellets are cost- and time-efficient. Customers reported reduced expenses on charcoal, electricity, gas, and travel to purchase charcoal. Powerstove uses affordable pellets which enables customers to save between 100–300 NGN per month on average.

“If I buy like 500 NGN charcoal it could last for 3 hours, but for this cookstove if I put 200 NGN it would last me longer”.
The Cost-Conscious Buyer, 42 years old

Outputs

O1: Increased market reach of pellets and cookstoves through distributor partners.
O2: Increased product affordability through financing measures.
O3: Increased insights about consumer needs and preferences.
O4: Prompt after-sales service to consumers (warranty, replacements).
O5: Increased partnerships with buyers of carbon credits.

- **Affordability:** All respondents appreciated affordability as one of the primary reasons customers purchased the product. Powerstove awareness and training efforts were successful in conveying the utility, cost, and time-saving benefits of the product.

“It is cost effective, I can use 100 NGN charcoal twice, unlike other charcoal pots where 100 NGN charcoal won’t be enough to cook one meal, but with the power stove half of the charcoal is enough”.
The Cost-Conscious Buyer, 37 years old

- **Maintenance:** Customers did not report spending any money on product maintenance although many thought they would have to. They all mentioned that they clean and maintain the products themselves. They found the available support service from Powerstove to be simple and easy to access, however, they just had to dial the number of the call center and would be connected to a repair person. Most customers found the training they received from the representative when purchasing the stove to be useful and effective.

“Since I bought the stove, I have not spent money to maintain it”.



The Follower, 48 years old

- **Value addition of the products:** The product has provided value in terms of cost, time, and social and environmental changes. Customers reported feeling more empowered to manage their time. More women reported being conscious of the choices they made with regard to the environment and the harm caused by the use of charcoal and wood. There was increased awareness that the choice to use a Powerstove was a sustainable choice.

"I save my time, cooking with it is faster, it keeps the environment clean, it is also good for my health since it does not generate smoke".

The Cost-Conscious Buyer, 42 years old

5 - LOOK FORWARD

5.1 Growth and sustainability plans

Powerstove intends to scale up in Nigeria by increasing its carbon credit revenue. It is also looking to expand its operations in Zambia and Kenya by increasing its customer base.



Carbon credit project that will increase carbon credit revenue by 10 times in Nigeria

In 4 years, Powerstove's core plan is to accelerate the carbon credit revenue by manufacturing and distributing 500,000 cookstoves. This project will be divided into 5 phases, with 100,000 cookstoves to be manufactured in each phase. As part of its growth plan in Nigeria, the company is currently in talks with 3 investors to raise US\$10 million. Powerstove will utilize the investment to undertake the following activities:

- i) **Enhance the capacity of the factory:** Powerstove will increase the production of bio pellets commensurate with the increased number of cookstoves in the market. The company also plans on buying new machines to improve the quality of the products, including the overall finishing.
- ii) **Distribute cookstoves through local partners at cost price:** Powerstove's strategy is to rapidly sell its cookstoves at the cost price, within 5 weeks of production, in order to create a market for the distribution of bio pellets, the company's main source of recurring revenue.
- iii) **Enhance logistics for the movement of products:** The company plans on buying a mini delivery truck to cater to the movement of inventories from suppliers to factories and households.
- iv) **Recruitment of workers as well as supervisors:** Powerstove will be hiring more factory staff as well as workers to undertake packaging, loading, and unloading of products. Moreover, the company will recruit supervisors to oversee the work and ensure the production of high-quality products.
- v) **Building partnership with carbon credit buyers:** Powerstove is also offering competitive prices to carbon-credit buyers who are willing to pre-finance the carbon credit project i.e. investment that goes towards manufacturing 500,000 cookstoves. A typical carbon credit pricing for nature-based solutions (such as clean cookstoves) is US\$5 per ton. Thus, Powerstove can generate an estimated US\$20 per cookstove. Powerstove has a few buyers (USA and Japan-based buyers) and pricing agreements on carbon credit are to be generated within these years.



Geographic expansion

The company has also initiated its expansion plan in Zambia and Kenya and will offer multiple stoves in these markets. Powerstove has secured preliminary approval for an investment of €500,000(US\$533,248).

5.2 Ask of investors and stakeholders

Financial needs

Powerstove Energy intends to raise US\$10 million in debt and equity. It has already made progress in pitching and is in talks with a few investors on deal finalization. The company is offering its investors carbon credits in the form of security or collateral for the debt financing that will be provided. The investment will be used for expanding operations in Nigeria through the following allocations.

- 70% of the fund for the working capital to manufacture 100,000 cookstoves. The carbon credit generated from the usage of 100,000 cookstoves will be used to finance the manufacturing of the remaining cookstoves.
- 11% of the funds for the integration of blockchain technology as well as the development of the carbon marketplace.
- 7% of the funds for capital expenditure to increase the capacity of the factory and adopt better machinery to meet its production target of 500,000 cookstoves in the next 3 years.

- 7% of the funds to further enhance its below-the-line marketing strategy by engaging with more community-based organizations, NGOs, etc. as last-mile distributors for increasing acquisition of customers.
- 5% of the funds to hire more workers and supervisors to drive the enterprise's growth in the coming years.

Non-financial needs

- Powerstove requires technical assistance in the form of market research and feasibility studies to understand the local contextual requirements of different communities and regions. The company requires actionable reports to identify the best suitable stove model for distribution, from among the 17 different models that it has developed.
- For international expansion, Powerstove is looking for partners who can assist in understanding the market, potential business models,

tax systems, and registration processes.

5.3 Lessons learned

Powerstove addresses the challenges associated with energy poverty in Nigeria, as well as the care workload undertaken by women and girls. Powerstove focuses on the urban and peri-urban markets and offers its products and services to customers. The company has made its products affordable by offering financial instruments to help its users pay for the cookstove in installments after receiving the product. For rural customers, Powerstove has yet to develop and distribute cookstoves at an affordable rate and has, therefore, not expanded in the rural market, where the need is significant. Instead, Powerstove seeks to expand its market in urban areas of other countries such as Zambia and Kenya and has recently received funding of US\$500,000 for its growth plans in Zambia.

One of the significant learnings that Powerstove has gained through its work over the years is to constantly align the products and services with customer's needs. Powerstove's initial understanding was that the main driving force for communities to switch to clean and smokeless cookstoves was the positive health outcomes through reduction in indoor air pollution. For the first 18 months, the company's marketing strategy focused on the benefits of moving to a smokeless stove with bio pellets as fuel. However, over time, Powerstove realized that 'cost savings' was the main determinant for households to pivot to bio pellets. This view is also supported by evidence collected from customer insights. The company's informed understanding of customers' requirements helped alter its marketing strategies.

Powerstove's model underlines the importance of technology in building a business. Headed by co-founders who are working towards integrating blockchain, GSM, and a carbon credit platform as part of its business model, Powerstove is a true technology-centric company that scans market opportunities to adapt its product offerings. For example, Powerstove overcame competition by designing and developing cookstoves that produce electricity. Powerstove's IoT-enabled cookstoves generate useful data on consumer use and experiences, generating actionable insights for the company. The company's digital infrastructure with tech-based mechanisms for monitoring data regarding their operations, utilization of funds received from investors, and progress of outcomes have made Powerstove appealing to investors.

Powerstove demonstrates a business model with a focus on circularity, from sourcing raw materials to creating local employment opportunities and contributing to carbon offsetting. The enterprise utilizes available agricultural waste and sawdust to produce its bio pellets, while also providing contractual employment to waste collectors. Powerstove, through its products



as well as community engagement activities, contributes to preventing deforestation by building awareness among communities and enabling them to switch to clean cooking. The company also trains local youth and women to become the last-mile distributors of their products, especially insurgency-affected communities in Nigeria.

Given its growth plan to sell 500,000 cookstoves and carbon credits to its buyers, Powerstove has to enhance the measurement mechanism. It is essential for Powerstove to forge stronger ties with its distributor partners to capture bio pellet consumption data as well as information on cookstove usage from households that do not have GSM-enabled products.

5.4 Recommendations for policymakers, investors, and entrepreneurs

Labor-saving technologies, such as clean cookstoves, have a significant impact on reducing the care workload on women and girls. They play a significant role in reducing indoor air pollution and better living conditions. The Powerstove model incentivizes users to use carbon-offsetting products that earn revenue through the sale of carbon credits and reduce their energy expenses. These are positive steps toward increased adoption of clean cookstoves and pellets.

Recommendations for policymakers

Promote local manufacturers through financial incentives: Powerstove is a domestic enterprise built by innovators from Nigeria. Policymakers should promote local entrepreneurship by safeguarding Nigerian enterprises against international competition and protecting enterprises from foreign exchange fluctuations. There are several cookstove companies that offer products in the sub-Saharan region. Powerstove's founders suggest that local manufacturers should be supported through tax incentives. At present, most of the cookstove companies in Nigeria either import the entire cookstove or parts of it. Tax incentives to local manufacturers in the form of subsidies and rebates will promote local manufacturing, resulting in the lowered retail prices of cookstoves. As a result, more customers will switch to cleaner cookstoves. Due to a shortage of forex from official sources, enterprises have to source forex from the parallel market where exchange rates are quite high compared to the central bank's rates. For enterprises that have to repay debt in US dollars or procure raw materials in dollars, it is difficult to service debts or meet operating costs. Policymakers can support enterprises by setting up a blended finance facility in which enterprises buy forex at rates regulated by the government.

Invest in local innovations, companies, and models: Most of the funding for addressing climate change is channeled to projects and initiatives in the Global North. The enterprises in the Global South may not have the kind of social and



	<p>financial networks as their counterparts in the North. Investors and funders can create platforms where local entrepreneurs are provided exposure to international investors and create corridors through which Nigerian/African entrepreneurs get opportunities to visit and network in investor hubs, such as Silicon Valley. Additionally, investors can establish teams on the ground in respective countries. A local team will enable the investors to identify and develop a bigger deal flow consisting of home-bred good businesses. This will enable greater resources and technical capacity of the local enterprises. .</p>
<p>Recommendations for investors</p>	<p>Adopt a community-wide approach to impact measurement: Investors should measure and value the impact on the wider community that care businesses and care-aligned businesses have. This will enable investors to identify innovative business models that have a care impact and invest in them. Investors can do this by conducting customer studies during due diligence in their portfolio companies and enabling investees to enhance their care impact. Often, investors make investment decisions around technology and earmark resources to make the technology work. Sometimes a technology-centric approach makes investors lose sight of the care problems the technology is also solving.</p>
<p>Recommendations for entrepreneurs</p>	<p>Integrate technology in the business model: Powerstove's model demonstrates the use of technology to attract capital investment and revenue generation. Integrating technology has played a pivotal role in enabling transparency and trust in the utilization of investment provided by investors. Powerstove's founders emphasize that entrepreneurs should use technology to demonstrate the impact of their work. Data, such as reduction in carbon emissions, hours of cooking saved, etc. strengthens the impact story. The existence of monitoring mechanisms for the use of investor funds and actionable insights generated from such information can make investors more amenable to the clean cooking sector.</p>



ENDNOTES

¹ Popularly known as Powerstove Energy.

² The Tier is assigned as per the Multi-Tier Framework which measures cookstoves on 6 attributes: (i) exposure, (ii) efficiency, (iii) convenience, (iv) safety, (v) affordability, and (vi) fuel availability. “Modern energy cooking services” refers to a household context that has met the standard of Tier 4 or higher across all six measurement attributes. <https://www.worldbank.org/en/topic/energy/brief/fact-sheet-multi-tier-framework-for-cooking>

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²⁹ D–MRV is a protocol to ensure the accuracy, consistency, traceability, and integrity of mitigation outcome data throughout the monitoring, reporting, and verification process to measure the amount of greenhouse gas (GHG) emissions reduced by a specific mitigation activity.

³⁰ Verra is a leading non-profit that manages the Verified Carbon Standard Program which is one of the most widely used greenhouse gas crediting programs. <https://verra.org/programs/verified-carbon-standard/#how-it-works>

³¹ The Water Boiling Test is a laboratory-based test that can be used to measure how efficiently a stove uses fuel to heat water in a cooking pot and the quantity of emissions produced while cooking.

³² Key distributors are businesses that buy the cookstoves in bulk and resell them through their sub-dealers and resellers channel.

³³ Below-the-line marketing is an advertising strategy where products are promoted in media other than mainstream radio or television. It targets specific groups of people and seeks to reach consumers directly, instead of casting a wide net to reach mass audiences.

³⁴ 2X criteria can be found [here](#).

³⁵ We assessed businesses that worked in the sectors of energy and emissions or water and sanitation against 4 climate and gender justice criteria related to: environment and land use; health, safety and security; education and training; and time use.

³⁶ Businesses were assessed on a 21-point scale, with scores of 0-7 being gender unintentional, scores of 8-14 being gender intentional, and 15-21 being gender transformative.

³⁷ Businesses were assessed on a 12-point scale where 0 - 4 is gender unintentional, 5 - 8 is gender intentional and 9 - 12 is gender transformative.

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³⁹ Powerstove will use Net Promoter Score and qualitative surveys to measure customer satisfaction and happiness. Satisfaction relates more to product quality and usage, whereas happiness is about things that cookstove usage enables leisure, rest, time for the family, etc.

⁴⁰ Powerstove internal estimates show that 1 cookstove can save more than 12kg of wood per day and 44 trees a year.

⁴¹ Powerstove internal estimates show that each cookstove user saves US\$300 per annum.

⁴² US\$1 = 768.500NGN. [-https://currency.world/convert/USD/NGN_769](https://currency.world/convert/USD/NGN_769)



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