

FOURTH EDITION



CLEAN  
COOKING  
ALLIANCE

# 2023 Clean Cooking Industry Snapshot





Peter Irungu / Clean Cooking Alliance

## Contents

- Acknowledgments ..... 2
- Glossary of Terms ..... 3
- Introduction ..... 5
- Forewords ..... 6
- From the CEO ..... 9
- Executive Summary ..... 10
  
- PART ONE**
- Investment Trends ..... 15
- Investment: In Focus ..... 24
  
- PART TWO**
- Sales and Operational Trends ..... 27
- Sales and Operations: In Focus ..... 33
  
- PART THREE**
- Current Carbon Trends in Clean Cooking ..... 37
- Carbon: In Focus ..... 42
- Appendix: Methodology ..... 46
- Endnotes ..... 48

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## Glossary of Terms

<b>Article 6.2</b>	Article 6 of the Paris Agreement allows countries to voluntarily cooperate with each other to achieve emission reduction targets. This means that, under Article 6, countries will be able to transfer carbon credits earned from the reduction of greenhouse gas emissions to help one or more other countries meet climate targets. A subsection, Article 6.2, creates the basis for trading in greenhouse gas emission reductions across countries.
<b>Clean Cooking</b>	Cooking solutions that achieve ISO Tier 4 or 5 for PM2.5 emissions and Tier 5 for carbon monoxide emissions. These generally include solar, electric, liquefied petroleum gas (LPG), biogas, ethanol, and some processed biomass/pellet stoves.
<b>Clean Cooking Enterprise</b>	An enterprise manufacturing or delivering clean or improved cooking solutions.
<b>Customer Challenge Rates</b>	The percentage of customers using the product or service who have experienced a challenge.
<b>Customer Effort Score</b>	A measure that reflects after-sales care and customer services. It is the average rating of customers who have experienced challenges on how easy it was to get their issue handled. The scale runs from 1 to 5, where 1 is “disagree” and 5 is “agree.”
<b>Fraction of Non-Renewable Biomass (fNRB)</b>	The portion of wood fuel used in a carbon project that is unsustainable and contributes to long-term loss of biomass carbon stocks. The fNRB is a critical input into the emission reduction calculation of clean cooking carbon projects as the amount of fuel used before and during the project is multiplied by this share to estimate net changes in emissions.
<b>Nationally Determined Contributions (NDCs)</b>	National climate pledges that have been self-defined by countries under the Paris Agreement. NDCs detail what countries plan to do to help meet the global goal of limiting global warming and ensuring sufficient finance to support these efforts.
<b>Net Promoter Score®</b>	A gauge of customer loyalty. It is measured through asking customers to rate their likelihood to recommend a service to others on a scale of zero to 10, where zero is least likely and 10 is most likely.

<b>Pay-as-you-go (PAYGO)</b>	A pay-per-use service that makes a cooking solution available for households, typically through a smart metering solution. This allows utility subscribers to enroll without a large upfront deposit.
<b>Undergoing Program of Activities (PoA) registration</b>	Different registries use different language to describe their documentation and crediting process, but the process is largely the same across registries. CCA's defines projects as "undergoing PoA registration" if they have been validated but are still at the pre-monitoring stage. The projects are listed on a registry, and the Project Design Document is available online.
<b>Unresolved Issue Rates</b>	The percentage of customers who have experienced a challenge and where a challenge remains unresolved.
<b>Voluntary Project Activity (VPA)</b>	A set of measures to reduce greenhouse gas emissions within a designated area, defined in the baseline methodology.

## Introduction

The 2023 Clean Cooking Industry Snapshot aims to provide insights into investment and operational trends and to shine a spotlight on the significant impact that carbon revenue is having on the sector.

The report is intended to inform prospective and current financiers of the sector, as well as enterprises both in the sector and adjacent to it. The report aims to track progress toward a sustainable, scalable clean cooking industry and highlights recent major milestones in the sector, including notable achievements for enterprises, key watershed deals, and important research that has been released.

This 2023 report builds on the three previous editions by analyzing data for 2021 and 2022 that was submitted by almost 60 enterprises that were eligible for the scope of this report.

This report's scope is on for-profit enterprises serving households in low- and middle-income countries (LMICs). The clean cooking industry is technologically diverse, and this report covers industrial biomass cookstove manufacturers, processed biomass-based fuel producers (including pellets and charcoal briquettes), ethanol cooking fuel and stove suppliers, prefabricated biogas systems

manufacturers, liquified petroleum gas (LPG) downstream distributors, and electric cooking appliance manufacturers, as well as enterprises that provide specialized services within the value chain, such as technology integration and last-mile distribution services. This does not cover informal for-profit businesses (which supply the bulk of local cooking technologies), businesses with operations in high-income markets, fuel and stove producers that exclusively target industrial or commercial applications, upstream and midstream fuel enterprises, or infrastructure developers and operators.



Evans Ahoresu / Clean Cooking Alliance

## A NOTE ON METHODOLOGY

The insights used in this report have been drawn from a database with contributions from 132 enterprises. As such, this report does not claim to be a fully exhaustive representation of the for-profit clean cooking sector.

As a "snapshot," this report is meant to provide an abbreviated understanding of a situation based on a particular range of time. It must also be noted that CCA has not necessarily received data on investment or operations from enterprises referenced in the text or in case boxes. Due to the absence of revenue and investment data from some large enterprises, the observations made of clean cooking revenue, carbon revenue, and total investment are known to be conservative. Please refer to the appendix for further details.

Different enterprises provided data to CCA in different years, so the revenue analysis was based on a set of 29 enterprises for which we have complete revenue data.<sup>1</sup>

## Forewords



**JACQUELINE  
NOVOGRATZ**  
CEO, Acumen

**When we founded Acumen in 2001, we wanted to use the tools of business to combat problems of poverty.** And there are few problems that impact so many—so deeply—as the lack of clean cooking. Polluting stoves account for nearly the same amount of all global carbon dioxide emissions as shipping, and is a major driver of deforestation. It is because of that urgency that, even in a world that is broken, the incredible entrepreneurs working on clean cooking bring me such hope for healing.

When we at Acumen invested US\$ 3 million into three small companies in 2015, the nascent sector raised less than US\$ 30 million that year. This latest edition of the Clean Cooking Industry Snapshot shows exactly how far we have come: over US\$ 200 million invested into companies that are selling high-quality cookstoves, pressure cookers, and induction ranges to households living on little. Through dedication, patience, (and Patient Capital), remarkable solutions have emerged, a testament to the power of perseverance.

The investment world is beginning to see both the social and financial payoffs of the bets we have taken: this has become a financially sustainable, immensely impactful sector, and it is ready for dramatically increased investment. Our cookstove portfolio has been one of Acumen's biggest successes: we have seen deep impact at scale, our projected returns are promising, and we have seen liquidity through acquisition and buyback.

But we still have a long way to go. We need more capital that prioritizes the positive impact companies create, placing people at the heart of business decisions. We need more carbon finance that is validated and trusted, to pay for the just transition. We need more investment, period. And beyond that, we need the partnerships to roll out modern energy cooking and expand solutions into underserved markets.

The impact is real, the opportunity is profound, and now, we have the tools. Let's get to work.



**SHERI HICKOK**  
CEO, Climate Impact Partners

**Seeing the impact of clean cooking projects and realizing the power of carbon finance to deliver both climate and community benefits is what brought me into the voluntary carbon market.** We need to tell these stories and showcase the power of these projects until we have delivered access to clean cooking for everyone.

In 2023, in a world where we have self-driving vehicles, space flights, and are told artificial intelligence will soon be doing our jobs for us, it is a shock to me that nearly one in three people across the world still do not have access to clean cooking technology. About 40% (940 million) are in sub-Saharan Africa, with this figure set to rise to more than one billion people over the next 30 years.

And we must understand the ripple effects of this situation—poor health outcomes from smoke inhalation, women tending to fire for hours a day instead of earning income, children collecting firewood instead of going to school, and one billion tons of annual emissions going into the atmosphere.

Clean cooking was a hot topic at the Africa Climate Summit 2023, with a particular focus on how

to channel sufficient finance to scale solutions. Across the industry there are incredible examples of innovation—electric metered cookstoves, pay-as-you-go options, and digital data collection and management systems—we now need to see the funding to ensure this can be brought to households from urban areas to the remotest regions.

The Africa Carbon Markets Initiative set targets to boost Africa's carbon credit production 19-fold by 2030, to fund the entrepreneurs and businesses that can transform the economy across the continent. Clean cooking projects are part of that transformation. The ambition is high, but the potential supply of credits must be matched by demand. Central to this will be unlocking the full potential of Article 6 and ensuring more countries engage and signal their interest.

A leader of a clean cooking organization in Kenya recently said to me that the reason she loves her job is that she knows that every morning when she wakes up, through the work she does that day, she will be contributing to saving another life. Let's seize the opportunity in front of us, available now, to deliver the funds needed for this life-saving solution and the planet.



### MARCEL RAATS

Manager, Energy and Climate,  
International Development, Netherlands  
Enterprise and Development Agency

**The 2023 Industry Snapshot shows the impressive progress of a lead group of companies in attracting commercial debt and carbon finance.** It's imperative for the sector to continue this growth and to prove to investors that business models are robust.

To achieve Sustainable Development Goal 7, the clean cooking sector must continue to expand. We need new international and local players to bring cleaner cooking solutions into new countries, regions, and market segments, and for customers to embrace the solutions on offer. We need governments to continue to adopt policies and regulations that successfully spur market development.

Carbon finance shows the potential to successfully reinforce business models, and it is pleasing to see the sector moving towards principles that ensure fair and transparent use of the benefits arising from carbon credits, and the use of methodologies backed by the latest science.

Now might also be time to have another look at the role of public funding in clean cooking. This could include strengthening collaboration to better design the interactions between different sources of finance, particularly when it comes to the initiation of services within nascent or fragile markets, strengthening local or new market actors, or launching new technologies. We must ensure that we truly leave no one behind.

## From the CEO



### DYMPHNA VAN DER LANS

CEO, Clean Cooking Alliance

**The year 2022 was an exciting one for the clean cooking sector.** High levels of investment and revenue were recorded, with both metrics breaking through the US\$ 100 million mark for the first time. Investment eclipsed US\$ 200 million. This recent uptick in investment, combined with other positive business trends in the clean cooking industry, sends a clear signal that the sector has hit an inflection point and is growing rapidly.

This positive investment picture has continued into 2023, with several clean cooking enterprises closing investment rounds upwards of US\$ 50 million. As recently as 2018, US\$ 50 million was more than the total amount raised by all 50 clean cooking enterprises tracked in this report.

Carbon finance is transforming the sector. It is fueling enterprises' customer growth by making many clean and improved cooking solutions more affordable. For the immediate term, it represents the best opportunity for delivering pioneering clean cooking technologies at a transformational scale, but the sector must be careful to look beyond carbon revenue to create a sustainable industry over the longer term. A more immediate threat to the industry is to ensure the generation of high-quality carbon credits from clean cooking projects that end buyers can procure with the utmost trust and confidence.

As representatives of the world's governments gather in Abu Dhabi in December for the 28th United Nations Climate Change Conference, known as COP

28, the need for climate solutions that reduce harmful emissions and also address health, economic, and gender inequities is clear. It was heartening to hear Fatih Birol, Executive Director of the International Energy Agency (IEA), acknowledge clean cooking as being "the number one issue in Africa" when it comes to energy and climate. Dr. Birol repeated this important message at the launch of the IEA's World Energy Outlook 2023 and said that 4 billion euros is needed for clean cooking for Africa. In the context of the funding required for a just clean energy transition, he noted that, "This is so little money. ... For Europe, it is a golden opportunity to build a bridge with Africa."

As the clean cooking ecosystem looks toward 2030, our focus must be on scaling the clean cooking industry and turning commitments into results. More than ever, transparent and accessible data on the clean cooking industry's performance and progress, as provided in this Industry Snapshot, is vital for achieving our ambitious goals.

The consequences of inaction loom large; by 2030, 1.8 billion people could still be without access to clean cooking.<sup>2</sup> Fortunately, we have the knowledge and technologies to provide affordable clean cooking to every person in the world—but only if governments, investors, and the private sector make it a priority. Clean cooking is a powerful cross-cutting solution with positive outcomes for climate, nature, women, health, livelihoods, and more. We must continue to build on the market's momentum, for all our sakes.



## Executive Summary

# AROUND THE WORLD, AN ESTIMATED 2.3 BILLION PEOPLE STILL HAVE A PRIMARY RELIANCE ON POLLUTING FUELS AND TECHNOLOGIES FOR COOKING.<sup>3</sup>

Achieving universal access to clean cooking by 2030 will require a significant uptick in the pace of change.

This fourth edition of the Clean Cooking Industry Snapshot has taken the investment and operational performance of approximately 60 enterprises for 2021 and 2022 and combined their data with that received from the three previous publications of the Industry Snapshot, creating a database with contributions from 132 enterprises. The findings in this report come largely from this database, which is based on a combination of self-reported and publicly available data from 2014 to 2022.

The 10 key findings of the report are:

### INVESTMENT TRENDS

**1 Investment in clean cooking enterprises grew dramatically to an all-time high of US\$ 215 million in 2022.** Carbon finance is a key driver behind the uptick in the past two years. Investments tracked by CCA (including equity, debt, and grants) grew by 80% on the levels seen in 2021. Return-seeking capital (debt and equity) dominated the picture, accounting for 97% of the investments recorded in 2022. The volumes of debt raised increased more than tenfold from 2020 to 2022.

**2 Debt has replaced equity as the largest source of funding for the clean cooking industry.** Debt capital was the largest source of capital sourced by clean cooking

enterprises for the second year running and accounted for 79% of investment in 2022. The new influx of debt capital was driven by a combination of large investments in liquefied petroleum gas (LPG) enterprises by the International Finance Corporation (IFC) and availability of new carbon-driven debt facilities. It is potentially indicative of the industry's maturity and need for growth capital, the relative attractiveness of carbon-driven business models for debt investment, and the scarcity of patient equity capital.

**3 Investment continues to be concentrated in a small number of enterprises.** In 2022, the seven largest players by capital raised accounted

for 90% of the total investment in the industry. This is the same number as in 2020. LPG enterprises have dominated funding over the past two years; 59% of the total funding tracked in 2021 and 2022 went to enterprises offering only LPG.

**4 Total funding raised by clean cooking enterprises is still well below the amount required to achieve universal access by 2030, indicating further opportunities for investment in the sector.**

Despite the significant progress in fundraising, more capital is required to achieve universal access to clean cooking by 2030. The International Energy Agency estimates that US\$ 8 billion of annual funding is now required.<sup>4</sup>



Centre for Research in Energy and Energy Conservation



ATEC

## SALES AND OPERATIONAL TRENDS

- 5 **Clean cooking industry revenue grew to a record-breaking US\$ 104 million in 2022—more than double pre-pandemic highs.** The US\$ 104 million in revenue in 2022 was an increase of 115% over 2021, which was itself a record-breaking year. Revenue is 161% more than that recorded in 2020.
- 6 **Clean cooking sales have expanded as a share of revenue. Carbon finance is likely catalyzing this revenue growth.** Clean cooking sales rose to 76% of total revenue in 2022 and have grown by 17% per year on a compounded basis between 2017 and 2022. Revenue from carbon credit sales now accounts for 22% of total revenue in 2022. Revenue from carbon credit sales in 2022 was 45 times the amount recorded in 2017, having shown a compound annual growth rate of 114% in this period.
- 7 **The number of clean cooking enterprises with well-established revenue continues to grow.** In 2022, 11 clean cooking enterprises—the largest number recorded to date—had revenue exceeding US\$ 1 million. These 11 enterprises cover a diverse range of clean and improved cooking technologies and fuels.



Bhumesht Bharti / Clean Cooking Alliance

## CURRENT CARBON TRENDS

- 8 **Carbon markets are cooling, creating a headwind for clean cooking carbon projects.** The average carbon credit spot price for household devices (which includes cookstoves) in 2023 fell to US\$ 5.90 per tCO<sub>2</sub>e, which is 38% below the average price for 2022. The drop in demand has been partly caused by extra buyer scrutiny on carbon credits to avoid accusations of “greenwashing” and supply-side problems with over-crediting from some projects. The upshot is that buyers are becoming increasingly interested in defining and procuring high-quality credits.
- 9 **Efforts are underway to raise the quality of carbon credits from clean and improved cooking projects.** Buyers are willing to commit larger allocations of funding to the most credible, high-quality carbon projects.<sup>5</sup> Efforts are underway that will look to improve the quality of credits being supplied by enterprises, which could help to restore buyer trust and confidence in clean and improved cooking carbon projects.
- 10 **Carbon credit issuances require high utilization rates, conferring an advantage to customer-centric enterprises.** Carbon credits accrue only when clean cooking technologies are used. Enterprises that are customer-centric and that listen to customer feedback and adapt their products will generate more carbon revenue, have higher lifetime customer values, and likely win more customer referrals.



## PART ONE

# Investment Trends

## INVESTMENT IN CLEAN COOKING ENTERPRISES GREW DRAMATICALLY TO AN ALL-TIME HIGH OF US\$ 215 MILLION IN 2022.

Despite the backdrop of a global slowdown in investment in 2022, investments in clean cooking enterprises surged to an all-time high.<sup>6</sup> As shown in Figure 1, investments tracked by CCA totaled just over US\$ 215 million—80% higher than in 2021, and over 250% higher than in 2020.

All types of investment (equity, debt, and grants) increased in 2022, but return-seeking capital dominated the picture, accounting for 97% of the investments recorded in 2022. “Return-seeking capital” refers to equity and debt, which includes financing for carbon projects. The large increase in funding in 2021 and 2022 was largely driven by debt; in 2022, debt capital raised by clean cooking enterprises increased dramatically to US\$ 169 million—over 10 times 2020’s figure of almost US\$ 16 million.

Equity investment grew to US\$ 39 million in 2022, an increase of 4% over 2021. This increase is particularly encouraging given that it is counter to negative global equity investment trends. Global venture capital funding fell by 30% in 2022 due to macroeconomic pressures.<sup>7</sup>

Grant funding fell to one of its lowest points in 2021 (US\$ 3 million) but bounced back in 2022 with just over US\$ 7 million in funds raised, close to the average seen between 2016 and 2020.

### Carbon revenue is a key driver behind the uptick in investment seen in the past two years.

The commercial and social prospects of carbon project development is attracting more investment toward the clean cooking enterprises that have immediate or near-term prospects of generating carbon credits. Two-thirds of the investment tracked coming into clean cooking enterprises during the past two years went into enterprises that are generating carbon credits or are in the process of certifying a Program of Activities (PoA) with a carbon registry. The growth in investment going into enterprises with active carbon plans can be seen in Figure 2.

Clean cooking enterprises that are generating carbon credits have access to additional revenue streams. This flow of new private money into clean cooking enterprises from carbon can crowd in additional private capital because company balance sheets are healthier. In theory, this can create a virtuous cycle where enterprises use carbon finance to achieve or improve their economies of scale, making them more attractive prospects for local banks and other forms of private capital.

Figure 1. Capital Raised by Enterprises



Source: Clean Cooking Alliance. (N=110 for 2014–16, N=51 for 2017–19, N=61 for 2020, N=43 for 2021, N=61 for 2022.) The data relies on self-reporting by the enterprises. N relates to the number of enterprises that answered CCA’s Industry Snapshot survey (of which there have been five surveys: 2014–16, 2017–19, 2020, 2021, and 2022) plus any enterprises added from research of publicly available materials, such as press releases or enterprise accounts; not all these enterprises raised investment each year. The number of enterprises recorded raising investment each year from 2014 to 2022 are 46, 51, 50, 39, 32, 25, 29, 25, and 42, respectively.

Figure 2. Capital Raised by Enterprises, by Carbon Profile



Source: Clean Cooking Alliance. (N=110 for 2014–16, N=51 for 2017–19, N=61 for 2020, N=43 for 2021, N=61 for 2022.) The data relies on self-reporting by the enterprises. N relates to the number of enterprises that answered CCA’s Industry Snapshot survey (of which there have been five surveys: 2014–16, 2017–19, 2020, 2021, and 2022) plus any enterprises added from research of publicly available materials, such as press releases or enterprise accounts; not all these enterprises raised investment each year. The number of enterprises recorded raising investment each year from 2014 to 2022 are 46, 51, 50, 39, 32, 25, 29, 25, and 42, respectively. The data on carbon profile is taken from public data on carbon registries; analysis by CCA.



KM Asad / Clean Cooking Alliance

**Debt has replaced equity as the largest source of funding for the clean cooking industry.**

The significant increase in debt investment in 2021 and 2022 made debt the largest source of capital for clean cooking enterprises in both of these years, as can be seen in Figure 3. Until 2021, equity had been the largest funding source for six consecutive years.

Several drivers are behind this new influx of debt capital. Debt investments can be interpreted as a sign of maturity indicating that investees have proven that they have solid business models, ability to scale, and good governance. Meanwhile, part of the shift toward debt is driven by the supply side, with the relative dearth of equity also reflecting the difficulty enterprises face in tapping into a limited pool of funders making equity investments in frontier markets.<sup>8</sup>

The increasing importance of carbon in the clean cooking industry also contributes to the shift toward debt. Carbon revenue often lends itself to debt financing, such as Standard Bank’s debt facility for The African Stove Company (TASC) in South Africa (see the “In Focus” case at the end of this section).

Increased debt funding presents an opportunity for growth, but it also introduces risks that must be managed. Debt can help enterprises to scale proven business models, expand working capital, or undertake major capital intensive projects such as factory facility expansion to improve unit economics and grow revenue (see the BURN case in the “In Focus” part of the Sales and Operational Trends section). However, enterprises taking on debt investments need to carefully

manage their level of indebtedness: Overleveraged firms can be left at risk of bankruptcy in case of market shifts, such as carbon price swings or foreign exchange volatility.

Although equity and grants both grew in absolute terms during the past two years, they fell significantly in terms of the overall share of capital raised in those years, when debt grew much more rapidly. Equity investments made up 18% of capital raised in 2022—well down from a historic high of 62% in 2015.

Grants accounted for around 3% of funding in 2022 and 2021. In relative terms, this is a significant drop; from 2018 to 2020, grants made up 15% of investment on average. It is also low compared to the broader climate finance sector, in which 5% of climate finance in 2021–22 came from grants.<sup>9</sup> This indicates there are further

opportunities for grant funders in the clean cooking industry.

**The number of enterprises securing funds grew significantly in 2022, accounting for part of 2022’s strong growth in investment.**

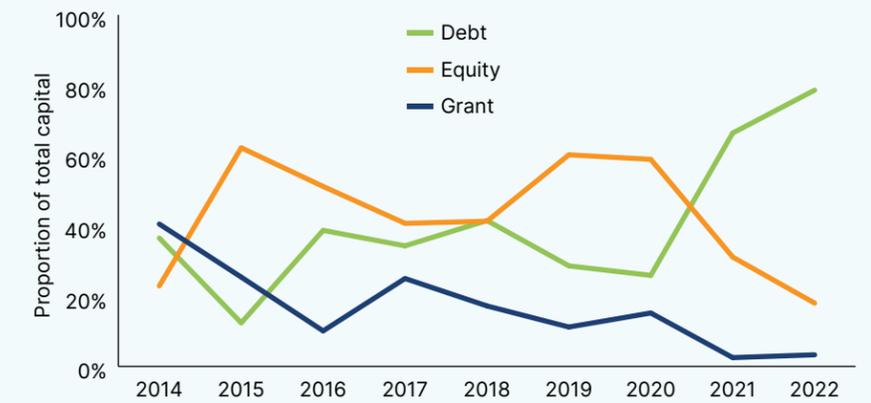
The number of clean cooking enterprises receiving capital investment grew across all types of capital in 2022, as shown in Figure 4.

A total of 18 enterprises received debt investments in 2022, up from a historic low of eight enterprises. This followed back-to-back years of 50% growth in the number of enterprises taking on debt during 2021 and 2022. As in most years, slightly more enterprises received debt than equity investments.

The number of enterprises receiving equity investments fell slightly in 2021 before jumping to 16—an increase of 78%—in 2022. This was the largest-ever increase and the highest number since 2015.

Grants continued to reach the largest number of enterprises in 2021 and 2022. The number of enterprises receiving grants fell slightly in 2021 before increasing by 61% to 29 enterprises in 2022. This was the largest number of enterprises receiving grants since 2016.

**Figure 3.** Split of Capital Raised by Investment Type



Source: Clean Cooking Alliance. (N=110 for 2014–16, N=51 for 2017–19, N=61 for 2020, N=43 for 2021, N=61 for 2022.) The data relies on self-reporting by the enterprises. N relates to the number of enterprises that answered CCA’s Industry Snapshot survey (of which there have been five surveys: 2014–16, 2017–19, 2020, 2021, and 2022) plus any enterprises added from research of publicly available materials, such as press releases or enterprise accounts; not all these enterprises raised investment each year. The number of enterprises recorded raising investment each year from 2014 to 2022 are 46, 51, 50, 39, 32, 25, 29, 25, and 42, respectively.

**Figure 4.** Number of Enterprises Reporting Having Received Grant, Equity, or Debt Investments, by Year



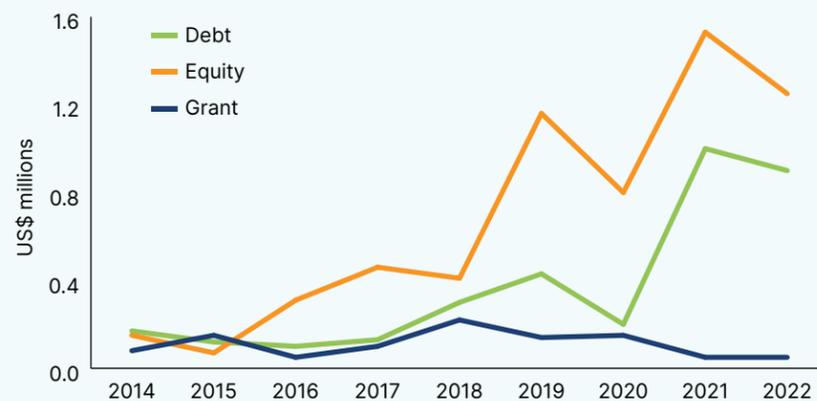
Source: Clean Cooking Alliance. (N=110 for 2014–16, N=51 for 2017–19, N=61 for 2020, N=43 for 2021, N=61 for 2022.) The data relies on self-reporting by the enterprises. N relates to the number of enterprises that answered CCA’s Industry Snapshot survey (of which there have been five surveys: 2014–16, 2017–19, 2020, 2021, and 2022) plus any enterprises added from research of publicly available materials, such as press releases or enterprise accounts; not all these enterprises raised investment each year. The number of enterprises recorded raising investment each year from 2014 to 2022 are 46, 51, 50, 39, 32, 25, 29, 25, and 42, respectively.

**Figure 5a.** Average Amount of Capital Raised by Enterprises



Source: Clean Cooking Alliance. (N=110 for 2014–16, N=51 for 2017–19, N=61 for 2020, N=43 for 2021, N=61 for 2022.) The data relies on self-reporting by the enterprises. N relates to the number of enterprises that answered CCA’s Industry Snapshot survey (of which there have been five surveys: 2014–16, 2017–19, 2020, 2021, and 2022) plus any enterprises added from research of publicly available materials, such as press releases or enterprise accounts; not all these enterprises raised investment each year. The number of enterprises recorded raising investment each year from 2014 to 2022 are 46, 51, 50, 39, 32, 25, 29, 25, and 42, respectively.

**Figure 5b.** Median Amount of Capital Raised by Enterprises



Source: Clean Cooking Alliance. (N=110 for 2014–16, N=51 for 2017–19, N=61 for 2020, N=43 for 2021, N=61 for 2022.) The data relies on self-reporting by the enterprises. N relates to the number of enterprises that answered CCA’s Industry Snapshot survey (of which there have been five surveys: 2014–16, 2017–19, 2020, 2021, and 2022) plus any enterprises added from research of publicly available materials, such as press releases or enterprise accounts; not all these enterprises raised investment each year. The number of enterprises recorded raising investment each year from 2014 to 2022 are 46, 51, 50, 39, 32, 25, 29, 25, and 42, respectively.

**The average amount of debt capital raised increased almost fivefold since 2020, contributing significantly to last year’s strong funding growth.**

The average amount of debt capital raised is now far higher than other types of investment. After experiencing slow but steady growth from 2015 to 2020, the average amount of debt capital raised per enterprise grew significantly in 2021 and 2022. Figure 5a shows the average amount of capital raised by clean cooking enterprises by type of investment. On top of the increase in number of enterprises raising debt, the average amount of debt raised grew to over US\$ 9 million in 2022, more than four times the 2020 average. This strong growth started in 2021 when average debt capital rose to almost US\$ 7 million in 2020—then an all-time high.

The median amount of debt capital raised, shown in Figure 5b, has increased much more modestly since 2020. The median amount of debt investment in 2022 was US\$ 900,000—just 10% of the 2022 average. This is an increase from 2020’s figure of US\$ 200,000, but a decrease of US\$ 1 million from 2021. This indicates that while the number of debt deals of all sizes has risen over the past few years, the dramatic increase in debt investment amounts since 2020 has been largely driven by a few large

deals. See the “In Focus” section for further details on two of the largest debt deals seen in 2022.

In terms of sources of capital seen in 2022, private sources of capital (including local and international banks, large corporations, and private fund managers) provided 54% of the debt and 62% of the equity. At 43%, multilaterals were the second-biggest source of debt funding. Private equity firms were the second-largest source of equity capital, at 31%. The largest source of grants in 2022 was philanthropic foundations (41%), followed by impact investors (34%).

The average amount of equity investment per enterprise fell in 2022. Average equity investment size grew in 2021 to reach a high of US\$ 4.1 million before falling to US\$ 2.4 million in 2022—below 2020 levels. The growing number of relatively smaller equity investments could benefit the smaller, early-stage growth enterprises in the clean cooking sector.

Grants continued to have the smallest average investment size in 2021 and 2022. The average amount of grant capital raised per enterprise fell from a high of US\$ 480,000 in 2020 to US\$ 160,000 in 2021, then partially recovered to US\$ 250,000 in 2022. The data indicates that while grants remain small in size, they are also

becoming more inclusive, going “upstream” to an increasing number of smaller players. Although their average size is small, grants continue to play a catalyzing role in newer and smaller enterprises.

**Investment continues to be concentrated in a small number of enterprises.**

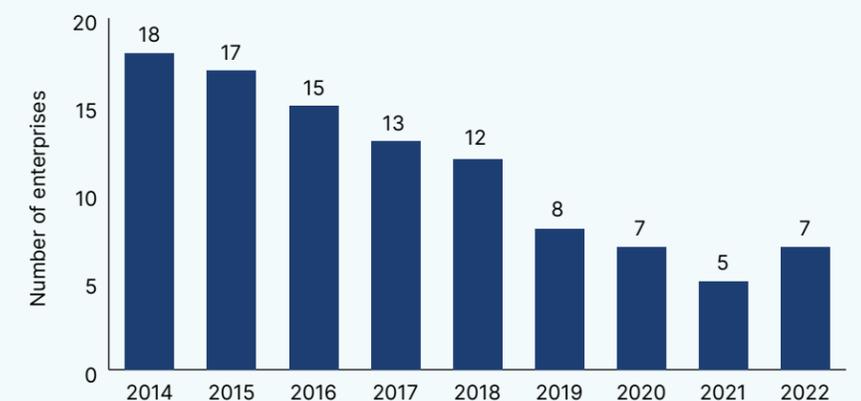
Over the past eight years, funding has become increasingly concentrated in fewer enterprises. In 2022, just seven clean cooking enterprises raised 90% of the total investment in the industry, the same number as in 2020, but an increase from 2021 when five enterprises raised 90% of total

investment. This trend can be seen in Figure 6.

**The industry’s largest players raised much more capital than previously, driving most of the investment growth.**

Although the number of clean cooking enterprises accounting for 90% of investment raised has stayed constant over the past two years, the average amounts of capital raised by the industry’s largest players grew significantly, as can be seen in Figure 7. The seven enterprises that received 90% of total investment in 2022 raised an average of US\$ 29 million during the year—almost

**Figure 6.** Number of Enterprises That Raised 90% of the Total Capital Each Year



Source: Clean Cooking Alliance. (N=110 for 2014–16, N=51 for 2017–19, N=61 for 2020, N=43 for 2021, N=61 for 2022.) The data relies on self-reporting by the enterprises. N relates to the number of enterprises that answered CCA’s Industry Snapshot survey (of which there have been five surveys: 2014–16, 2017–19, 2020, 2021, and 2022) plus any enterprises added from research of publicly available materials, such as press releases or enterprise accounts; not all these enterprises raised investment each year. The number of enterprises recorded raising investment each year from 2014 to 2022 are 46, 51, 50, 39, 32, 25, 29, 25, and 42, respectively.

quadruple 2020's figure of US\$ 8 million. Investments of this size in the industry are a relatively new phenomenon, but since 2019, the number of enterprises raising more than US\$ 10 million in a year has become more commonplace, with six enterprises achieving this feat in 2022 alone.

**LPG enterprises have attracted most of the investment in the past two years.**

Circle Gas, a new last-mile distributor of liquefied petroleum gas, raised US\$ 29 million in 2019, the largest investment seen in the clean cooking industry at the time. This record has since been surpassed, most recently, in 2022, by IFC's US\$ 50 million debt investment in BOCOM Petroleum (Cameroon), another enterprise serving urban households with LPG.

LPG enterprises have started to dominate the funding being received. The past two years of data show that 59% of the total funding tracked into enterprises went into enterprises where LPG was the only clean cooking fuel being offered to customers. This is an acceleration compared to the overall picture from the past four years, where half of the US\$ 234 million was tracked going into enterprises selling LPG to households.

Figure 7 shows the number of



enterprises that raised 90% of the funds in a year, compared to the number of enterprises that raised the remaining 10% of the funds, and the average amounts raised by these groups. It should be noted that among the seven enterprises to raise more than 90% of the capital in 2022 was a mixture of technologies, including LPG, ethanol, and improved cookstove manufacturers.

**Funding from public sources hit an all-time high in 2022, driven by involvement from the International Finance Corporation.**

In 2022, the share of public funding for clean cooking enterprises grew significantly to 34%. This is another historic high, as can be seen in Figure 8. Public funding had accounted for a steady 11% to 13% of funding from 2018 to 2020. In 2021, public funding fell to an all-time low of 3%, which could have been caused by the diversion

of public money in the wake of the COVID-19 pandemic.

The increase in public funding for 2022 was driven by two large debt investments in LPG providers by IFC: €50 million (US\$ 55 million) in blended finance for BOCOM in Cameroon and a €16.2 million (US\$ 17.6 million) deal with Zener in Togo. This type of large-scale public financing is relatively new to the industry.

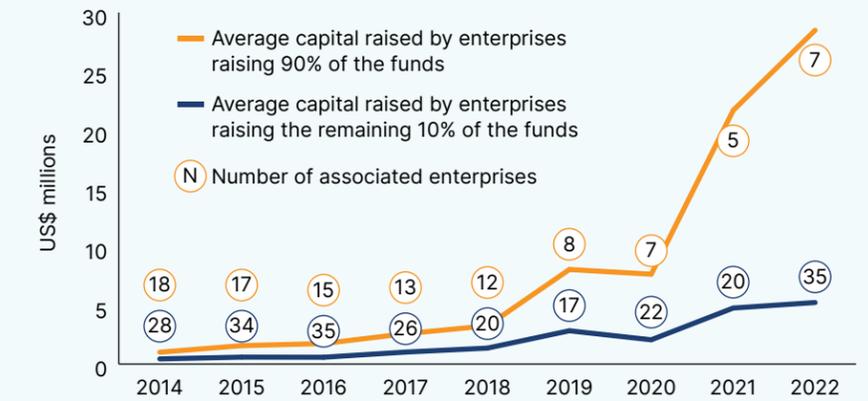
The increase in public funding in 2022 brought the clean cooking industry's share of capital from public sources closer to what is seen in in the climate finance sector more broadly, though a gap still exists. Research from the Climate Policy Initiative (CPI) shows that an average of US\$ 1.26 trillion of investment was made available for climate projects across 2021 and 2022 and that 51% of this amount came from public sources.<sup>10</sup> While

the clean cooking industry's share of 34% in 2022 is still lower than the benchmark indicated by CPI, it should be noted that CCA's analysis is likely to significantly underreport public funding because CCA's data considers only the entity directly investing into enterprises and does not consider the entity's sources of funds, which often contain public money.

**Total funding raised by clean cooking enterprises is still well below the amount required to achieve universal access by 2030, indicating further opportunities for private investment and public funding.**

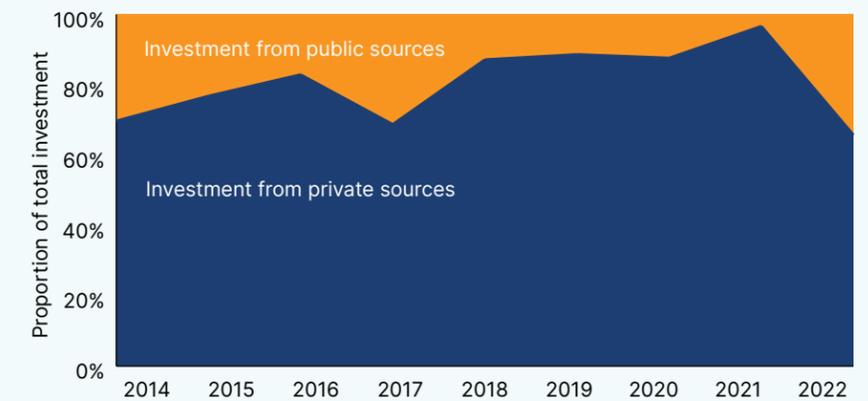
The increase in funding for clean cooking enterprises is an encouraging sign of growth in the sector. However, significantly more funding is required to achieve Sustainable Development Goal 7: to ensure access to affordable, reliable, sustainable, and modern energy for all. The International Energy Agency estimates that US\$ 8 billion of annual funding is required to achieve universal access to clean cooking by 2030. Of this amount, 21% is needed for infrastructure and 79% for end-use equipment. Around half of the US\$ 8 billion needed each year in clean cooking investments would have to be concessional finance, and around three-quarters of this would need to flow to sub-Saharan Africa.<sup>11</sup>

**Figure 7.** Average Capital Raised by Enterprises



Source: Clean Cooking Alliance. (N=110 for 2014–16, N=51 for 2017–19, N=61 for 2020, N=43 for 2021, N=61 for 2022.) The data relies on self-reporting by the enterprises. N relates to the number of enterprises that answered CCA's Industry Snapshot survey (of which there have been five surveys: 2014–16, 2017–19, 2020, 2021, and 2022) plus any enterprises added from research of publicly available materials, such as press releases or enterprise accounts; not all these enterprises raised investment each year. The number of enterprises recorded raising investment each year from 2014 to 2022 are 46, 51, 50, 39, 32, 25, 29, 25, and 42, respectively.

**Figure 8.** Contributions to Capital Raised Each Year by Private Versus Public Sources



Source: Clean Cooking Alliance. (N=110 for 2014–16, N=51 for 2017–19, N=61 for 2020, N=43 for 2021, N=61 for 2022.) The data relies on self-reporting by the enterprises. N relates to the number of enterprises that answered CCA's Industry Snapshot survey (of which there have been five surveys: 2014–16, 2017–19, 2020, 2021, and 2022) plus any enterprises added from research of publicly available materials, such as press releases or enterprise accounts; not all these enterprises raised investment each year. The number of enterprises recorded raising investment each year from 2014 to 2022 are 46, 51, 50, 39, 32, 25, 29, 25, and 42, respectively.

## INVESTMENT SPOTLIGHT: IFC'S INVESTMENTS IN BOCOM PETROLEUM AND ZENER SA

The International Finance Corporation (IFC) made two significant debt investments in LPG distributors in 2022: US\$ 55 million (€50 million) in BOCOM Petroleum (Cameroon) and US\$ 17.6 million (€16.2 million) in Zener (Togo). These landmark deals accounted for roughly 40% of the debt investment in clean cooking enterprises in 2022 and 90% of the public funding tracked by CCA.

Both investments will be used to expand the enterprises' downstream LPG supply chains, especially chokepoints such as port storage. They will also allow BOCOM and Zener to build more regional storage and refilling facilities, improving access across Cameroon and Togo.<sup>12</sup> Both enterprises will have much higher capacity to serve LPG customers, enabling revenue growth. The investment in Zener also came with advisory support for

potential future expansion as part of IFC's "Local Champions" program, which intends to provide additional support to high-potential domestic enterprises in low-income markets.<sup>13</sup>

In both cases, IFC's intent was to improve access to LPG as a cooking fuel, citing the environmental and health benefits of replacing fuels like charcoal and wood fuel with LPG. When announcing the investment in Zener, IFC officials wrote of

Togo: "More than 90 percent of the country's population uses biomass, such as charcoal and firewood, as its primary energy source for cooking, contributing to high levels of deforestation, greenhouse gas emissions, and negative health impacts from indoor air pollution, especially for women and children. Carbon emissions are cut by half when LPG replaces wood or coal, and about a third when it replaces fuel oil or kerosene."<sup>14</sup>



## STRATEGIC ACQUISITION BRINGS ANOTHER OFF-GRID ENERGY ENTERPRISE INTO CLEAN COOKING

In April 2023, Sun King acquired PayGo Energy to explore broadening its portfolio of clean energy solutions.<sup>16</sup> Sun King, known for delivering solar products to millions in underserved regions, stands as the leading off-grid energy company across Africa and Asia. PayGo Energy has made its mark through innovative pay-as-you-go technology that facilitates cleaner cooking practices with efficient fuel use and smart payment systems.

This strategic acquisition unlocks synergies by combining Sun King's reach, underpinned by 27,000 field agents who have sold and installed 22 million solar products globally, with PayGo's expertise in clean cooking with LPG.

Sun King's integration of PayGo's team into its new clean cooking

division paves the way for advanced research and the development of diverse clean cooking products, accompanied by consumer financing services to overcome the hurdle of high upfront costs. By merging PayGo's clean cooking product, hardware, and software expertise with Sun King's technology and manufacturing capabilities and distribution channels, the merger looks to deliver modern, affordable cooking appliances and energy to families living across Africa and Asia.

This is the latest entry by an off-grid energy company into clean cooking. Other off-grid energy product manufacturers that provide clean cooking products to customers include BioLite and Bboxx.

## INCREASING INVOLVEMENT FROM LOCAL BANKS IN CLEAN COOKING

Standard Bank is the sole funder of the debt facility for The Africa Stove Company's (TASC) improved cookstove distribution project in South Africa. In Q4 2023, Standard Bank provided R 194 million (US\$ 10.6 million) of senior debt funding to be repaid from TASC's future carbon revenue, demonstrating its capability to fund against carbon credits as a commodity.

The transaction financed TASC's South African cookstove project, which distributes improved cookstoves to rural

communities in the northern regions of South Africa where many households use traditional open wood fires for cooking. The project is set to distribute 750,000 cookstoves by the end of 2023. The carbon credits generated

are sold to enterprises that want to contribute to combating climate change and offset their emissions. The TASC improved cookstoves project finance deal serves not only as



Standard Bank's first carbon credit project funding but also as the first carbon credit project funded by a commercial bank in Africa. The deal is set to provide a framework for future carbon credit projects in South Africa and Africa more broadly, and it could ignite commercial banks' interest in the African carbon credits market—potentially a significant new source of capital for the clean cooking industry.

In June, Spark+ Africa Fund made a US\$ 3.5 million debt investment in a Mauritius Special Purpose Vehicle,

established by TASC, to distribute BURN's electric ECOA stoves to households in rural Zambia. Spark+ Africa Fund was launched in 2022 by CCA in partnership with Swiss impact investor Enabling Capital and is dedicated to investments that scale up access to clean cooking solutions in Africa.<sup>15</sup>

The investment leveraged an existing carbon program and a fixed-price carbon credit offtake agreement with a global commodities trader. Spark+ pre-financed the distribution of 90,000 modern, efficient, clean cookstoves on the basis that revenue generated from the sale of carbon credits would repay the loan.



## PART TWO

# Sales and Operational Trends

## CLEAN COOKING INDUSTRY REVENUE GREW TO A RECORD-BREAKING US\$ 104 MILLION IN 2022—MORE THAN DOUBLE PRE-PANDEMIC HIGHS.

Revenue tracked from a consistent set of clean cooking enterprises showed significant growth in 2021 and 2022. Total revenue reached an all-time high of over US\$ 104 million in 2022, as seen in Figure 9. The total revenue in 2022 is significantly above the 2014 to 2022 average (US\$ 42 million) and median (US\$ 38 million). This was an increase of 115% over 2021, which was a record-breaking year at the time, and 161% more than the revenue recorded in 2020.

Most of this increase was driven by growth in clean cooking sales—core revenue involving the sale of clean cooking equipment and fuel. Between 2020 to 2022, clean cooking sales increased by almost US\$ 54 million, reversing a trend of annual declines from 2018 to 2020, as can be seen in Figure 9. Clean cooking revenue grew by 32% to almost US\$ 35 million in 2021. In 2022 the growth accelerated, jumping 130% to almost US\$ 80 million.

Following a period of rapid growth from 2018 to 2020, the total carbon revenue received by the surveyed enterprises grew by just 4% between 2020 and 2021, before doubling in 2022 to over US\$ 23 million. This increase was driven primarily by an increase in the volumes of carbon credits sold and was partly aided by the higher carbon credit prices seen in the first half of 2022 (see Figure 13 for more details on carbon credit prices). Revenue from carbon credit sales in 2022 was 45 times the levels recorded in 2017, a compound annual growth rate of 114%.

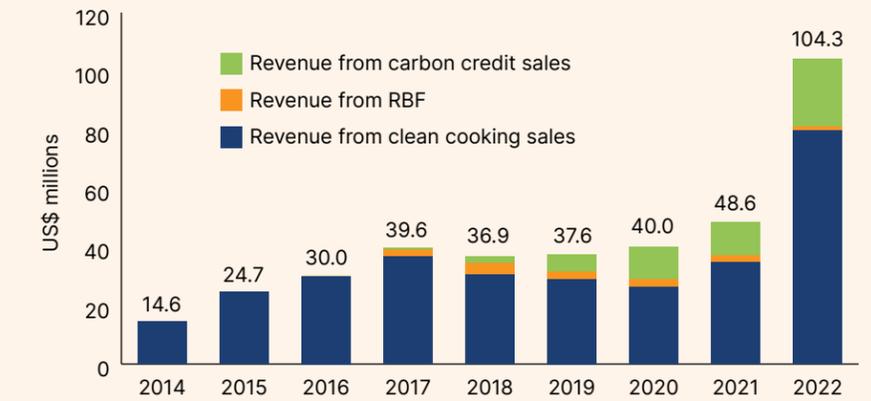
The unprecedented revenue growth in 2021 and 2022 indicates significant momentum in the clean cooking industry. A big portion of this revenue growth came from established players that raised large amounts of capital over the past few years, showing that these larger and more mature players can convert large investments into business growth and value. The impressive revenue growth in 2022 also points to carbon’s role in increasing enterprise revenue and customer affordability, enabling growth of core revenue as it potentially allows enterprises to sell at prices more affordable to the mass market.

**Clean cooking sales have expanded as a share of revenue. Carbon finance is likely catalyzing this revenue growth.**

Carbon credit revenue can come directly from the pre-sale of carbon credits or from the sale of carbon credits on the spot market. Between 2020 and 2022, carbon revenue decreased slightly in its share of total revenue, from a high of 28% in 2020 to 22% in 2022, as can be seen in Figure 10.

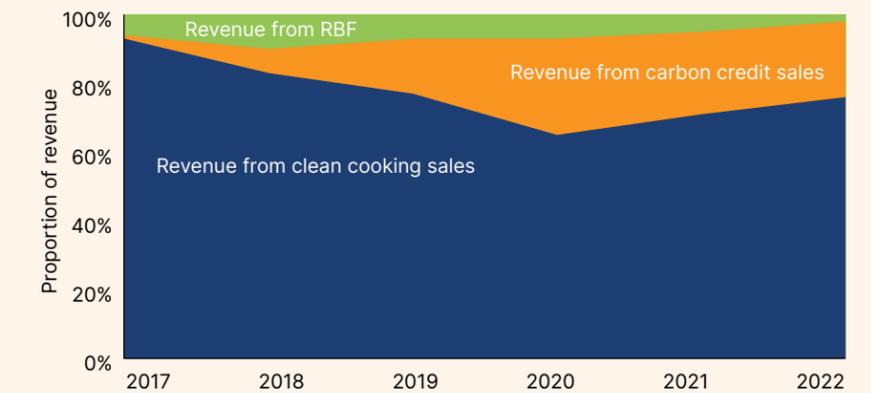
Clean cooking sales revenue comes from the sale of appliances or fuels to businesses or customers. Some clean cooking sales revenue reported to CCA will be for the

Figure 9. Enterprise Revenue, by Source



Source: Clean Cooking Alliance. (N=29; consistent set of enterprises from 2014 to 2022.) The data relies on self-reporting by the enterprises.

Figure 10. The Rise of Carbon Credit Sales as a Source of Revenue for Enterprises



Source: Clean Cooking Alliance. (N=29; consistent set of enterprises from 2014 to 2022.) The data relies on self-reporting by the enterprises.

sale of cooking appliances to other carbon project developers that subsequently are used to generate carbon credits for the project developer. While this revenue is counted as clean cooking sales, it is one direct way that the carbon market is driving increased aggregate clean cooking sales revenue. Another factor that suggests carbon markets are catalyzing revenue growth of clean cooking sales is that enterprises need to provide better customer

experiences to achieve high usage rates, which in turn generates more carbon credits. This could lead to more customers making repeat purchases of clean fuels or clean cooking sales increasing through more positive word-of-mouth referrals. This is discussed further in the Current Carbon Trends section.

The share of revenue attributed to results-based finance has been declining since 2018, accounting for just 1% of revenue in 2022.

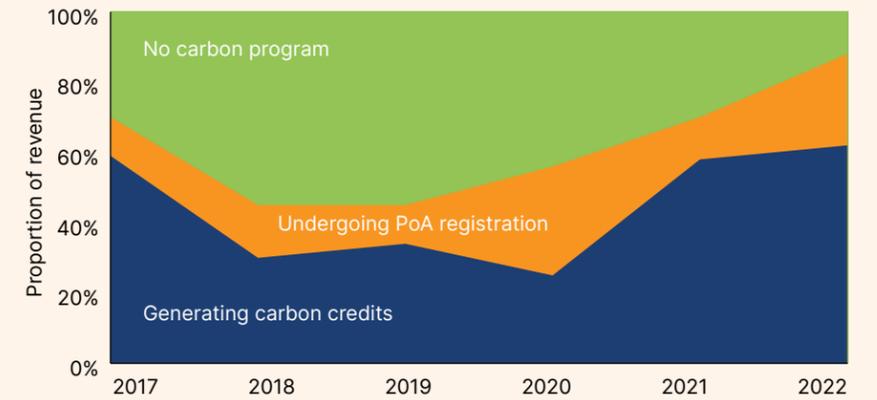
**Carbon finance generated by clean cooking enterprises is stimulating latent demand for clean cooking solutions.**

As identified in Figure 10, just over three-quarters of clean cooking revenue reported by clean cooking enterprises in 2022 comes from the actual sale of clean cooking products or services (76%). Revenue from the receipt of pre-sold carbon credits or from spot market sales accounted for 22% of the annual total.

As shown in Figure 11a, enterprises actively issuing carbon credits dominate total revenue, accounting for 62% of the total revenue generated in 2022. One hypothesis that could be drawn from this is that enterprises with access to carbon finance could be using carbon revenue to reduce local prices for improved and clean cooking solutions to levels at which consumers are willing to buy these products or services and that this is helping to drive sales. The revenue received by enterprises issuing carbon credits more than doubled between 2020 and 2021, then more than doubled again in 2022, as can be seen in Figure 11b. If capital continues to flow into these enterprises, they are likely to continue to improve their unit economics and scale further.

KOKO Networks, an ethanol distributor and technology company, is one such company using carbon revenue to bring down the cost of its clean cooking solution. KOKO has reduced the cost of the ethanol stove, typically by around 85%, and lowered the fuel price by 25% to 40%, effectively (as of October 2023) providing US\$ 100 million of subsidized costs to its customers through carbon finance.<sup>17</sup> KOKO's growth in customer acquisition is covered in more detail in the "In Focus" section.

Figure 11a. Enterprise Revenue, by Carbon Profile



Source: Clean Cooking Alliance. (N=29; consistent set of enterprises from 2014 to 2022.) The data relies on self-reporting by the enterprises. The data on carbon profile is taken from public data on carbon registries; analysis by CCA.

Figure 11b. Proportion of Enterprise Revenue, by Carbon Profile



Source: Clean Cooking Alliance. (N=29; consistent set of enterprises from 2014 to 2022.) The data relies on self-reporting by the enterprises. The data on carbon profile is taken from public data on carbon registries; analysis by CCA.



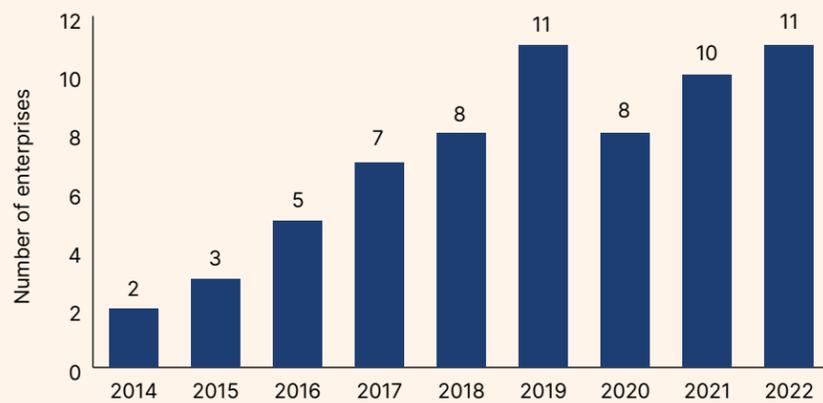
Another example is from BURN Manufacturing, a vertically integrated modern cookstove company operating within sub-Saharan Africa, which has been able to lower the cost of its Kuniokoa woodstove by 30% to 80% due to carbon revenue.<sup>18</sup>

**The number of clean cooking enterprises with well-established revenue continues to grow.**

In 2022, 11 clean cooking enterprises—the largest number recorded to date—had revenue exceeding US\$ 1 million, as can be

seen in Figure 12. These enterprises cover a diverse range of clean and improved cooking technologies and fuels. While the number of enterprises with more than US\$ 1 million in revenue fell in 2020, it returned to its pre-pandemic level of 10 enterprises in 2021. In 2022, all 10 of the enterprises with more than US\$ 1 million in 2021 revenue stayed above that threshold, and one other enterprise grew revenue significantly to join the list.

**Figure 12.** Number of Enterprises Reporting Revenue of More Than US\$1 Million



Source: Clean Cooking Alliance. (N=32; consistent set of enterprises from 2014 to 2022.) The data relies on self-reporting by the enterprises, supplemented with industry knowledge from CCA.



**KOKO'S JOURNEY TO 1 MILLION CUSTOMERS**

KOKO Network's business model is designed to be a complete solution to the growing problem of charcoal for cooking. However, replacing a polluting and unhealthy fuel with a safe and sustainable clean fuel can be achieved commercially only at large scale. KOKO tackled this challenge by building a high-tech bioethanol fuel distribution utility taking advantage of efficient use of existing fuel infrastructure and sales channels, innovative financing, investment in research and development, and the economies of scale of a fully nationwide plan. With this approach, KOKO is now providing its ongoing clean fuel solution to over 1 million households in Kenya encompassing approximately 4 million people. The enterprise provides clean fuel to 30% of the households of the three counties in the Nairobi metro area (Nairobi, Kiambu, and Kajiado) and is operating in more than 10 cities and towns across the country.

Bioethanol has distinct advantages that support its wide-scale adoption for cooking. With a user experience similar to cooking with gas, bioethanol can be produced locally and, as a liquid, can be stored in petrol and diesel tanks. KOKO worked with petrol station chains and fuel sourcing companies

for a nationwide agreement supporting its fuel distribution. Instead of taking the time to open its own retail outlets, KOKO supports thousands of existing small shopkeepers to act as agents to sell fuel on its behalf. This also provides a vital communication link to the communities using KOKO fuel and supplements KOKO's additional customer service channels.

As is noted elsewhere in this report, KOKO uses carbon financing to heavily subsidize its cooking solution. This enables even the poorest households to purchase clean fuel for less than the price of charcoal. Customers receive immediate and ongoing benefit from the creation of carbon credits—an innovative and highly additional use of carbon. To enable these carbon innovations, KOKO built customized technology including smart fuel canisters, fuel dispensing machines, and new generations of bioethanol cooking appliances after incorporating significant feedback from users and stakeholders.

KOKO is looking to replicate its success in Kenya by developing plans for nationwide fuel distribution utilities across other countries with significant use of charcoal and other polluting fuels for cooking.

## BURN ESTABLISHES NEW FACTORIES IN EAST AND WEST AFRICA

For the past 10 years, BURN Manufacturing has produced clean cookstoves at its facilities in Ruiru, Kenya. In 2022, BURN expanded its factory there from the original 20,000 square feet to over 200,000 square feet. This has enabled BURN to rapidly increase its manufacturing capacity from 20,000 stoves per month to 450,000.

BURN also launched an assembly facility in Kano, Nigeria, in October 2023. It plans to launch full manufacturing operations in Lagos, Nigeria, in mid-2024 to serve the West African region.

These significant factory expansions will allow BURN to drive a greater

impact on communities. With an agent network of over 1,400 people, BURN does door-to-door distribution in six countries and has distributed stoves in over 18 countries. BURN's expanded manufacturing facilities allow the company to capitalize on this widespread distribution and growing demand for its clean and improved cooking products.

To deliver BURN's mission to save lives and forests, and to further embrace the growing electrification in sub-Saharan Africa, the company recently launched its electric ECOA product suite. This product suite is locally designed and assembled in Kenya. BURN is conducting an initial commercial

rollout of its electric ECOA products across seven key markets: the Democratic Republic of Congo, Mozambique, Ghana, Kenya, Tanzania, Uganda, and Zambia, while pursuing further scale across sub-Saharan Africa.

Since launching operations in 2013, BURN has distributed over 4.2 million stoves that serve over 22.5 million people. BURN says its fuel-efficient and affordable wood and charcoal stoves have reduced greenhouse gas emissions by over 17 million tCO<sub>2</sub>e. Through an expanded product portfolio and manufacturing footprint, BURN is set to continue transitioning more households to clean cooking.

## AN INVESTOR'S VIEW ON CUSTOMER CENTRICITY

A good customer experience is critical to any enterprise achieving sales growth and sustainability. In the context of clean cooking, where grants have played an outsized role in enterprise sustainability, there existed the risk that a focus on customers could become secondary to the priorities of foundations, governments, and other nonmarket stakeholders. In some cases, this has led to products that did not sufficiently appeal to consumers or remained unaffordable relative to their value proposition.

Fortunately, this dynamic has shifted over the past few years, and enterprises now recognize that business models are sustainable only when products are adopted and used regularly. It is now more important than ever for impact funds such as Spark+ Africa Fund to robustly assess the value proposition of the products its investees are delivering to the market.

For Spark+, this forms an important part of its extensive and highly structured due diligence process. Key aspects of

its product evaluation pertaining to customer centricity include accessibility (the operational footprint and distribution capacity of the enterprise), affordability (in terms of upfront costs, running costs, consumer financing terms, and technology-based pay-as-you-go integration), user experience (with regard to convenience at the point of use and the adaptation of the product or fuel to cultural norms and cooking habits), and customer protection (in the context of microfinance).



## COMPARING CLEAN COOKING TO OTHER ENERGY SECTORS ON CUSTOMER CARE BENCHMARKS

Between Q4 2021 and Q2 2023, CCA funded 60 Decibels to survey 4,812 customers from 18 clean cooking enterprises, operating across nine countries, and across nine product lines.<sup>19</sup> The goal of this work was to provide insight into customer profiles and their experiences, and to share these findings directly with enterprises to help them improve their customer-facing operations. The data created from this substantial project has been assimilated into the 60 Decibels Off-Grid Energy Benchmarks, which also includes mini-grids, solar home systems, solar lanterns, and appliances. The Off-Grid Energy Benchmarks can be found online.

In clean cooking, analysis from 60 Decibels indicates that measures

of customer satisfaction and loyalty are getting close to the scores that 60 Decibels typically sees in its Energy Benchmark. The average Net Promoter Score® (NPS), which ranges from -100 to +100, is 53 for the clean cooking enterprises. That is just above 60 Decibels' Energy Benchmark NPS of 49, but it should be noted that there is wide variability in results on this metric across clean cooking enterprises, with the best-performing one scoring 86 and the lowest-performing company having a NPS of minus 12.

Further work is needed for clean cooking enterprises to continue to improve on customer service measures, such as customer challenge rates, unresolved issue rates, and customer effort scores.

At the time of publication, clean cooking had a slightly better performance than the Off-Grid Energy Benchmark for customer challenge rate (26% in clean cooking vs. 31% in the benchmark), but the industry lagged behind the Off-Grid Energy Benchmark on both unresolved issue rates (70% vs. 79%) and customer effort scores (2.9/5.0 vs. 3.2/5.0). Reducing challenge rates, improving issue resolution, and lowering the perceived effort needed by customers to solve their issues are important leading indicators for driving up consumption rates of existing customers and for increasing penetration rates across new consumers.

The clean cooking industry is reaching an underserved customer base, with 83% accessing a clean cooking product for the first time, on par with 60 Decibels' Energy Benchmark of first access at 80%. However, around one-third (31%) of clean cooking customers in the database live below the US\$ 3.20 per day poverty line, which is below the 60 Decibels Energy Benchmark of almost half (49%) of the customers in the dataset living below the poverty line. This indicates that more could be done to make clean cooking products or services affordable and available to low-income customers in their respective markets.



Maura Vombe / Clean Cooking Alliance

**PART THREE**

# Current Carbon Trends in Clean Cooking

## CARBON MARKETS ARE COOLING, CREATING A HEADWIND FOR CLEAN COOKING CARBON PROJECTS.

Globally, US\$ 36 billion has been invested in carbon projects since 2012, half of which was in 2020 to 2022.<sup>20</sup> Having recovered from the global uncertainty caused by the COVID-19 pandemic, carbon markets were booming in 2021: The value of the primary voluntary carbon market (VCM) grew by 190% from 2020 to 2021, to just under US\$ 1 billion.<sup>21</sup>

The two main indicators of demand for carbon credits are the prices paid for carbon credits and the volume of credits being retired.

### PRICES PAID FOR CLEAN COOKING CARBON CREDITS

According to data from S&P Commodity Insights (Platts), the price of one tCO<sub>2</sub>e offset by household devices (which includes cookstoves and water filters) increased steadily throughout 2021 and peaked in Q2 2022 before falling consistently in each subsequent quarter, as can be seen in Figure 13.<sup>22</sup> The average price seen in Q3 2023 was US\$ 5.47 per tCO<sub>2</sub>e, a 46% drop from the peak of US\$ 10.14 per tCO<sub>2</sub>e in Q2 2022.

Demand has been affected by negative media coverage and the potential quality and reputational issues at play. One publication of note was a preliminary manuscript from University of California, Berkeley. The paper, which was posted Feb. 23, 2023,<sup>23</sup> and (as of the publication date of this report) has not yet been peer reviewed, asserts that over-crediting is likely an issue for clean and improved cooking carbon projects and that key project parameters, including fraction of non-renewable biomass (fNRB), fuel consumption, stove adoption, and usage, should be tighter.<sup>24</sup>

### RETIREMENTS

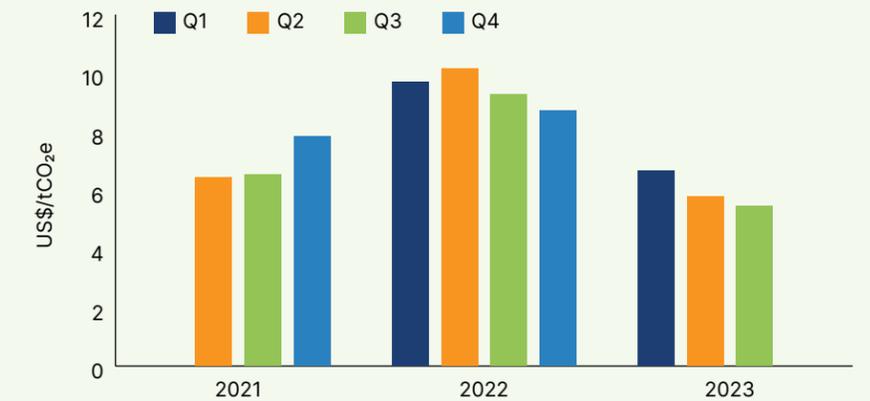
A buyer of a carbon credit can choose to hold, trade, or retire that credit. Once the credit has been retired, the buyer can claim the carbon offset against their own carbon commitments, and the carbon credit can no longer be traded. Across the whole of the VCM, annual retirements climbed by just 2% in 2022 over 2021, and as of the first 10 months of 2023, retirements of carbon credits were 17% lower than they were at that time in 2022.<sup>25</sup>

Compared with this broader market context, retirements of clean cooking credits have remained relatively healthy, with retirements having grown for six consecutive years. Retirements of clean cooking carbon credits are on course to continue to increase in 2023, as can be seen in Figure 14.

### Efforts are underway to raise the quality of carbon credits from clean and improved cooking projects.

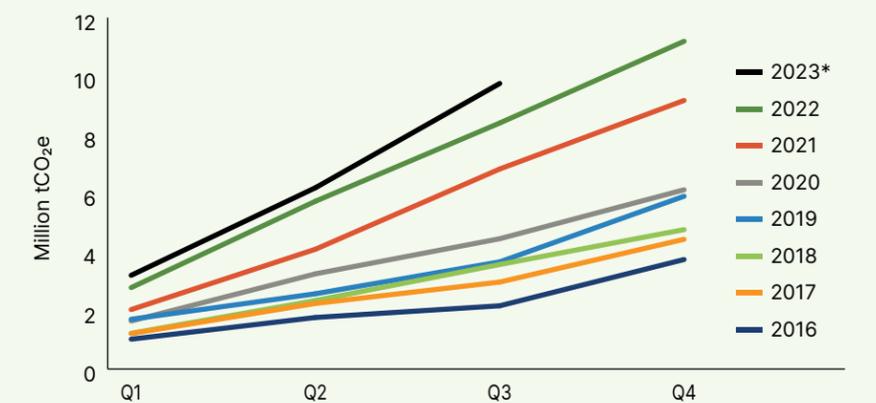
Research suggests that buyers are willing to commit larger allocations of funding to the most credible, high-quality carbon projects.<sup>26</sup> A growing ecosystem is emerging to help buyers define quality and to navigate carbon credit selection accordingly.

Figure 13. Average Carbon Spot Prices for “Household Devices”



Source of price data: S&P Commodity Insights (Platts). Analysis by CCA.

Figure 14. Retirements of Carbon Credits from Clean Cooking Projects



\*Year to date

Source of data: ©2023 MSCI Inc. All rights reserved. Subject to [Terms of Use & Disclaimer](#). Analysis by CCA.

Demand signals from carbon credit buyers will continue to guide the supply side of clean cooking carbon projects toward cleaner technologies and the use of more robust methodologies with tighter emissions calculations. In particular, fNRB values continue to be refined. While changes to fNRB values will cause many projects' economics to suffer considerably in the short term, this market correction may be needed to ensure the quality of carbon claims in the future.<sup>27</sup>

CCA leads the Clean Cooking and Climate Consortium (4C), which is providing technical support to LMICs to facilitate the implementation of clean cooking goals related to the countries' nationally determined contribution.<sup>28</sup> 4C's primary focus in 2023 has been on developing the first methodology for crediting emission reductions from cooking projects to be applicable to all cooking transition scenarios. 4C is working in close collaboration with the United Nations Framework Convention on Climate Change, Gold Standard, Verra, project developers, and other key stakeholders across the ecosystem and intends for the new methodology to ultimately become the standard for cooking projects under Article 6 of the Paris Agreement, as well as in the VCM, pending approvals.

As part of its 2023 cookstove carbon methodology review, Abatable, a platform that connects climate investors with carbon projects, noted that projects that adhere to the 4C or to Gold Standard's Metered and Measured methodologies are most likely to be eligible for the Integrity Council for the Voluntary Carbon Market's Core Carbon Principles and to comply with emerging Article 6 criteria.<sup>29</sup>

In Q4 2023, CCA also produced a set of 12 interim principles for responsible carbon finance in clean cooking.<sup>30</sup> The principles were informed by industry consultation and provide the first step toward a potential voluntary code of conduct that will set out the elements of high-quality carbon financing in the industry, helping carbon credit buyers to participate in clean cooking or improved cooking carbon markets with more confidence.

**Carbon credit issuances require high utilization rates, conferring an advantage to customer-centric enterprises.**

Carbon credits accrue only when clean cooking technologies are used. The issuance of carbon credits depends, then, on enterprises being strongly customer-centric, selling high-quality cooking technologies at affordable prices, listening to

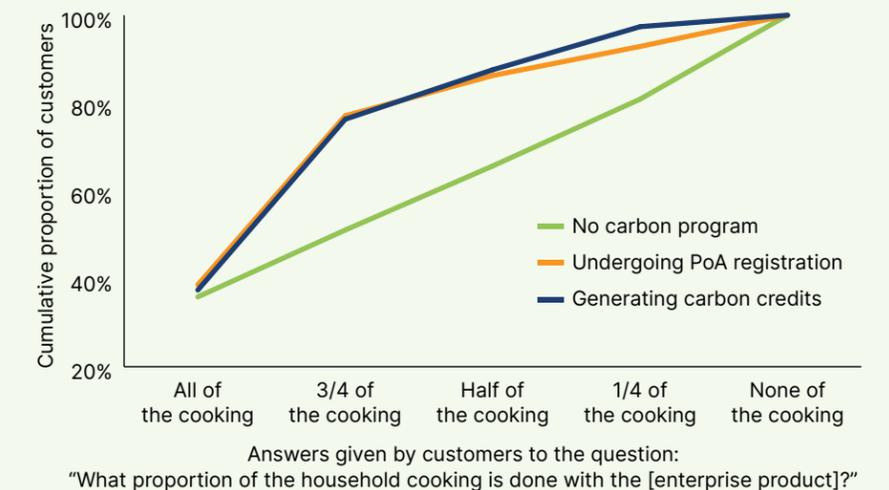


customer feedback, and revising products accordingly.

A project's emission reductions depend on the extent to which customers adopt and use the cooking technology and reduce their fuel consumption. This means that clean cooking enterprises with carbon programs have an extra financial incentive to ensure that their customers are using their products or services as much as possible and that they are satisfied when doing so. Satisfied customers could also lead to higher sales revenue through increased customer retention and referrals.

Figure 15 suggests that enterprises with active or planned carbon programs have very similar customer utilization rates and that these rates are higher than enterprises with no carbon program. Customer-centric enterprises will continue to listen to their customers and find ways to improve their offerings, which will translate into improved customer utilization rates. It seems likely that clean cooking enterprises with active or planned carbon programs will do this more quickly than enterprises without carbon programs, given the extra financial incentive to do so.

Figure 15. Cooking Utilization Rates Split by Carbon Profile



Source: Clean Cooking Alliance. (Number of enterprises=17, Number of customers=4,806.) Data captured, anonymized, and provided by 60 Decibels; data analysis by CCA. The data was collected between January 2022 and April 2023, by phone interviews with a random sample of consenting customers. Cooking technologies covered in this analysis are improved wood cookstoves, improved charcoal cookstoves, ethanol coking, briquettes, charcoal briquettes, pellets with gasifier cookstoves, LPG, biogas, and e-cooking appliances. The data on carbon profile is taken from public data on carbon registries; analysis by CCA. The lines are the averages of the enterprises found under each of the three carbon profiles. (No carbon program N=6, undergoing PoA registration N=7, generating carbon credits N=4.)



## AFRICA'S FIRST EVER E-COOKING CARBON CREDITS

Between 2014 and 2019, over 115 million people in sub-Saharan Africa gained access to electricity.<sup>31</sup> Malawi, Mozambique, and Zambia source over 90% of their power from renewables, predominantly hydropower.<sup>32</sup> Despite this, 81% of urban African households still rely on biomass energy for cooking.<sup>33</sup>

In March 2023, UpEnergy, a Kampala-based social enterprise, introduced the world's first emission reductions linked with electric cooking (e-cooking) in sub-Saharan Africa. Working with PowerUP, a Ugandan clean

technology product developer, UpEnergy seeks to replace biomass stoves with e-cookers designed for low-income families. The reductions, verified by Earthood Services, a third-party auditor, and certified by Gold Standard, deliver a significant leap to the cleanest, healthiest, potentially zero-emission fuel: electricity.

The transition to e-cooking in sub-Saharan Africa, while promising, is a complex and often costly endeavor that requires significant support and on-the-ground expertise. Carbon financing is critical in this

context, providing the necessary backing to bridge the financial gaps in manufacturing, distribution, and household adoption that enable UpEnergy to deliver fuel-switching technology at scale.

To date, UpEnergy has deployed over 5,000 e-cookers across Ghana, Tanzania, Uganda, and Zambia. PowerUP's e-cookers have been designed according to local cooking behaviors and include in-built metering. The metering technology provides usage data that promotes accurate, transparent reporting of emission reductions.

## CONNECTED COOKING DEVICES OFFER IMPROVED DIGITAL MONITORING, REPORTING, AND VERIFICATION FOR CARBON CREDITS

African Clean Energy (ACE) was one of the first enterprises to list a Program of Activities (PoA) under Gold Standard's Methodology for Metered and Measured Energy Cooking Devices (M&M). The M&M methodology is limited to cooking technologies that measure carbon emission reductions from metered cooking devices or from clean cooking fuel sales. Version 1.2 of the M&M methodology was issued in December 2022. One year on from this date, ACE has registered a PoA along with a first Voluntary Project Activity in Uganda.

For each ton of offsets ACE can claim, there must be a corresponding set of usage data from its Internet of Things (IoT)-enabled ACE One systems representing a reduction in carbon emissions through thermal efficiency improvement. Additionally, reductions can be generated when a household where a unit is registered purchases pellet or briquette fuel. The optimal result is when the combined device usage and fuel purchase data show a full migration to sustainable household energy.

Basing carbon claims on actual data means that ACE will not be extrapolating any assumptions across a cohort of units. The IoT-enabled monitoring and issuance system gives ACE's carbon credit buyers the confidence that the reductions they are paying for are real. It also serves to keep customer experience central for ACE, as unhappy customers or systems requiring maintenance do not generate value. To date, ACE's proof of concept has accumulated data underwriting an avoidance of nearly 40,000 tCO<sub>2</sub>e.

## HOW CARBON RATING AGENCIES ASSESS PROJECT QUALITY FOR COOKSTOVE PROJECTS

BeZero Carbon, a global ratings agency for the VCM, has developed frameworks to rate carbon credits on their likelihood of delivering on their promised carbon emission reductions.

It is unlikely that any carbon reductions project can be 100% accurate in its emission estimates, given that credits are generated against a counterfactual baseline. However, BeZero Carbon acknowledges that there are best practices, with conservative measures, that can be taken to reduce uncertainty.

These include adopting household level accounting, using the latest available datasets, and transitioning to metered monitoring and other improved practices.

Following these practices and being transparent in how values are obtained should increase the quality of cookstove projects. However, it should be noted that increased robustness will likely result in increased project expenditure and fewer issuances. In this scenario, there is the potential that buyers will

pay a premium for these higher quality carbon credits. This is where ratings agencies can play a key role, lending greater assurances of quality to buyers.

Currently, BeZero Carbon finds some issues with the small sample of cookstoves projects it has analyzed, but these are by no means irreconcilable. Continued progression related to robust standards, conservative measurements, and transparent accounting will continue to lift the benchmark for quality for carbon credits coming from the sector.

## EARLY LEARNINGS FROM A CLEAN COOKING 'ARTICLE 6.2 PROJECT'

Switzerland, through the KliK Foundation, has been actively signing bilateral agreements with other countries and approving projects to contribute to its NDC via Internationally Transferred Mitigation Outcomes. In the clean cooking space, it has approved projects in Ghana, Malawi, and Peru.

Sistema.bio started to participate in the voluntary carbon market in 2019, initially by partnering with a large project developer in Kenya. Since then, the enterprise has significantly increased the number of projects in its portfolio that are generating carbon credits, becoming the developer for its own carbon projects in India, Mexico, and Uganda.

With so much uncertainty surrounding the health and future of the VCM, Sistema.bio decided to explore opportunities in Article 6.2 projects. These compliance-based projects could have lower regulatory risks associated with them, since projects need to be fully approved by both country governments from the outset.

The Malawi Dairy Biogas Program, recently approved by KliK's board,

will install 10,000 systems in the country. Sistema.bio is working closely with its local partner, EcoGen, which will identify the farmers, install the systems, and provide long-term after-sales services.

The project will issue around 500,000 carbon credits until the end of 2030, the cutoff date at which KliK Foundation has agreed to buy credits. The hard stop of this cutoff point makes the project's economics particularly sensitive to any delays that effect the issuance of credits.

Venturing into Article 6.2 projects means that Sistema.bio has had to learn new processes that are not entirely the same as those in the voluntary carbon market, work closely with government authorities, and deal with ongoing uncertainties as countries build up their internal mechanisms to engage in Article 6.2. However, Sistema.bio is now recognized as an early mover, and this initial project is opening doors to develop more so-called 6.2 projects elsewhere, including Ghana, Morocco, Thailand, and Uruguay.



## WHAT IS BEHIND THE DOWNWARD TREND ON COOKSTOVE CARBON CREDIT PRICES?

### A view from S&P Commodity Insights (Platts)

Prices in the household devices segment shed consistent value in 2023 despite being one of the types of credits with the highest level of price stability across 2022.

Impacting factors included reports, such as the draft issued at the start of the year by faculty at the University of California, Berkeley. The draft report questioned the real environmental impact of clean cookstove projects and dented end buyers' confidence in this type of credits.<sup>34</sup>

Verra, the largest certifier of carbon projects, announced plans in the first half of 2023 to review its cookstoves projects methodology. Market participants, both project developers and buyers, started to question whether credits already issued under the existing version of the methodology would be considered of sufficient quality and whether end buyers' preferences would shift toward credits issued under the new, more stringent, methodology.

In 2023, the UNFCCC supported fraction of non-renewable biomass (fNRB) research that was published in the fourth quarter along with new regional, national, and subnational fNRB default values for sub-Saharan Africa. This disaggregated data is intended to replace the current 30% global average, allowing for important geographic contextualization, and to address the wide variability in estimates that can be generated by the Clean Development Mechanism's Tool 30 and can lead to over-crediting. While these revised numbers might put further pressure on the price of existing cookstove credits, in time, these more realistic fNRB values could renew confidence in the clean cooking segment.

## Appendix: Methodology

For the 2022 Clean Cooking Industry Snapshot, CCA used self-reported data on investment, financial, and operational performance from clean cooking enterprises. A survey was sent to over 700 contacts working at enterprises that are part of CCA's enterprise database.

To look at long-running trends back to 2014, some reporting gaps were supplemented with investment data on four additional enterprises from past surveys and publicly available data, including press releases and news articles, to increase the number of enterprises that could be included in the analysis.

The annual self-reporting process has data reaching back to 2012 and has served as an important database to track sector progress. Partners voluntarily submit their data online, with technical support from CCA. Clean cooking enterprises reporting to CCA encompass the following:

- 1 Biomass cookstove manufacturers, including industrial and semi-industrial producers.
- 2 Producers of processed biomass fuel, such as briquettes and pellets for household use.
- 3 Enterprises that combine stove sales with fuel such as ethanol, pellets, and briquettes.
- 4 Prefabricated biogas system enterprises.
- 5 Last-mile LPG distributors, whose technology or business model intends to increase access among consumers in low- and middle-income countries, e.g., through PAYGO solutions.

- 6 Distributors of electric and solar solutions.
- 7 Enterprises that provide specialized services that focus on optimizing specific aspects of the value chain, such as providers of consumer finance, technology, or last-mile distribution services.

Enterprises producing stoves that are targeted for recreational markets, other non-household-oriented fuel producers, larger upstream and midstream fuel enterprises, and infrastructure developers and operators are excluded from the scope. One enterprise that provided data to CCA was removed from the analysis for being an LPG bottling facility (i.e., a midstream fuel player).

As a "snapshot," this report is meant to provide an abbreviated understanding of a situation based on a particular range of time. As such, the data may not be representative, and there will be inherent gaps and limitations around the depth, scope, and rigor of the information.

The enterprise data that was received and tracked was rich in providing insights but not robust or consistent in quantity or geography. This also illuminates the need to develop better and smarter data sources, tools, publications, and informational resources that will increase transparency into markets, technologies, business models, enterprises, consumers, and impacts. This type of market intelligence is an important catalyst for stimulating investment and sector development.

### DATA CONSISTENCY AND GAPS

The voluntary nature of the self-reporting survey comes with challenges in data consistency and completeness. Some longstanding partners have reported every year, while others have been less consistent. New enterprises have entered the market, while others have downsized or ceased operations. As CCA's partner database grows, there are new respondents each year, not all of which are just beginning operations. There are also enterprises that have not reported each year. Yearly variation in responses suggests that much sector activity is unreported every year, even among CCA partners.

Each survey response has been carefully reviewed to ensure completeness and has undergone one round of data validation with the enterprises directly on anomalous data points that are reported in the survey. However, CCA does not engage in any due diligence with this data. The online survey form contains some basic automated data validation and verification checks. From this and other CCA knowledge, the report's statistics and narrative were developed. Although every effort is made to gather complete data from key enterprises operating in CCA's focus countries and beyond, there are always unavoidable gaps in reporting. These gaps and strategies to address them, along with several assumptions made when analyzing the data, are described below.

### DATA GAPS

Data on the financial and operational performance of sector enterprises remains limited, and in many cases inadequate to draw substantial conclusions. Understandably, many enterprises are reluctant to provide sensitive information when it is not under consideration for an investment or grant. This is particularly true in the early stages of growth, when sometimes large amounts of grant money or even debt or equity have not produced commensurate business growth.

### DATA ANALYSIS ASSUMPTIONS

Annual investment data is based on reported investment flows each year and is not adjusted for inflation.

Investment data is reported at the firm level. Three enterprises providing data for this report have additional business activities unrelated to clean cooking. CCA has attempted to segregate investment data by business line in some cases, where possible. In one case, this segregation has not been possible. However, most enterprises in the analysis are primarily focused on clean cooking, and most of their sales are from clean cooking products.

For classifying the investment's funder type, the direct investor has been considered relevant. For example, a philanthropic foundation making a direct investment in a business is reflected as a "philanthropic foundation." An investment of capital from a philanthropic foundation that has invested as a limited partner in a fund managed by an impact investor, which has then invested in a business, would be reflected as "a private investor." Investment data includes various types of debt, equity, and grant funding. It does not include carbon-related revenue, but it could include debt that prefinances such carbon revenue.

For more detailed information on this subject, contact: [investment@cleancookingalliance.org](mailto:investment@cleancookingalliance.org).

## Endnotes

- 1 The number of enterprises whose data is in the analysis have been shown in each chart in this report. There is not a consistent set of enterprises across different years; some enterprises have exited the sector and new ones have entered.
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