2021

CLEAN COOKING INDUSTRY SNAPSHOT

SECOND EDITION

CLEAN COOKING ALLIANCE

BURN Manufacturing

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Cover photo: Sistema.bio

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Glossary of Terms

Improved Cooking Solutions: Cooking solutions that are cleaner and/or more efficient than the baseline technology/fuel combination. An improved cooking solution can be more efficient without being cleaner. For the purpose of this report, this includes improved wood and charcoal stoves, as well as briquette-based solutions.

Clean Cooking Solutions: Cooking solutions that achieve ISO Tier 4 for PM2.5 and Tier 5 for CO. These generally include solar, electric, liquified petroleum gas (LPG), biogas, alcohol, ethanol, and some processed biomass/pellet stoves. For the purpose of the report, all pellet-based solutions are included under this definition for simplicity.

Clean Cooking Company: A company manufacturing and/or delivering clean or improved cooking solutions.

Processed Biomass: Fuels derived from wood, agricultural waste, or other biomass products that have been processed in some way to improve characteristics for cooking, including but not limited to improved energy efficiency and reduced pollutants. For the purpose of this report, these include briquette- and pellet-based cooking fuels.

Pay-as-you-go (PAYGO): 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.

Foreword

Wanjira Mathai
Vice President and Regional Director for Africa, World Resources Institute

Leadership Council Member, Clean Cooking Alliance

The year 2021 is a critically important year for energy and international development. Events such as the United Nations High-Level Dialogue on Energy and the 26th session of the Conference of Parties (COP) give world leaders an opportunity to make momentous progress on climate protection, health, the environment, and women's empowerment.

With fewer than 10 years until we reach 2030, the world remains far off track to meet Sustainable Development Goal (SDG) 7—ensure access to affordable, reliable, sustainable, and modern energy for all. Approximately one-third of the world's population—2.8 billion people—still lack access to clean cooking solutions, costing trillions of dollars a year in damage to health, the climate, and local economies. The COVID-19 pandemic threatens to reverse progress and further exacerbate inequalities.

It is well documented that household air pollution from cooking increases susceptibility to respiratory infections and aggravates respiratory illnesses, which may, in turn, lead to poorer outcomes after a COVID-19 infection. Even for households that already have transitioned to clean cooking fuels such as electricity, LPG, or ethanol, the current economic slowdown could mean a necessary return to polluting cooking methods.

Changing the way that families cook their food each day will slow climate change, drive gender equality, reduce poverty, and provide enormous health benefits.

Burning kerosene and solid fuels, such as wood and charcoal, for cooking is an important contributor to global climate change through emissions of greenhouse gases and short-lived climate pollutants. As much as 25% of black carbon emissions come from household solid fuel use, and unsustainable wood fuel harvesting further contributes to forest degradation and climate change.

In light of the annual toll on human health, climate, the environment, and local economies, clean cooking solutions should be part of a global forward-looking strategy and integrated into national recovery plans. Local and skilled jobs and livelihood creation, particularly in the all-important informal sector, are a wonderful opportunity to build back better. Changing the way that families cook their food each day will slow climate change, drive gender equality, reduce poverty, and provide enormous health benefits.

This is the year to prioritize access to clean cooking solutions in the global and national arenas, integrate clean cooking in national energy planning, and dramatically scale up public and private financing. This will require quality and reliable data. Geographic information systems (GIS)-based tools such as the Energy Access Explorer (EAE) could play a big role in promoting access to clean cooking, by identifying underserved regions, resource and infrastructure availability, and solution providers. These tools also could identify the support needed from public sector and donor and investment communities. We have what it takes to get the job done.

Letter from the CEO

Dymphna van der Lans
CEO, Clean Cooking Alliance

The level of funding and investment in the clean cooking sector has not matched the global magnitude of the challenge. As evidenced by the data collected for this Industry Snapshot, funding has stagnated in the range of tens of millions of dollars per year—significantly less than the amount that the International Energy Agency (IEA) estimates will be needed to achieve universal access to clean cooking by 2030.

To accelerate progress, the sector needs increased commitment and coordination, and innovative approaches to catalyzing investment and scaling up companies throughout the value chain. One promising initiative is the forthcoming Spark+ Africa Fund, a pioneering impact investment fund that will channel debt and equity financing to companies across sub-Saharan Africa by offering tailored investment instruments throughout the clean cooking value chain.

In the transition to universal access, national governments will be looking at strategies that address the energy needs of their varied populations over time, involving a portfolio of energy carriers and technologies to meet cooking and other household requirements. The inclusion of clean cooking in national integrated energy plans and COVID-19 recovery programs should help funders identify which clean cooking solutions to support and should help solution providers identify which communities to target.

Businesses, investors, governments, and other key stakeholders must align with a greater sense of urgency and innovation.

Carbon markets can also play an increasingly important role in scaling financing for clean cooking solutions. Although the number of household energy projects in carbon project portfolios has increased, they account for only a small percentage of programs. More work is needed to refine carbon financing mechanisms.

Finally, the sector needs to increase the leadership role of women and address gender issues more broadly to scale adoption. The clean cooking sector presents opportunities for women to make their mark in a growing market. Their involvement as employees and entrepreneurs helps businesses thrive. Bringing women to the forefront of the global energy transition is essential for ensuring no one is left behind.

Closing the wide commitment and investment gap will require a sustained, well-coordinated effort that harnesses strengths and resources from a broad range of public and private actors and channels significant funding to the sector. Businesses, investors, governments, and other key stakeholders must align with a greater sense of urgency and innovation, elevating clean cooking within energy, climate, and development agendas. Throughout 2021, high-level discussions related to global energy and climate agendas will be vitally important in achieving this alignment and building further momentum in the clean cooking sector.

Executive Summary

Around the world, an estimated 2.8 billion[1] people continue to lack access to clean cooking solutions. While almost 100 million people gained access to clean cooking between 2015 and 2018, achieving universal access to clean cooking solutions by 2030 will require a major acceleration in the pace of change. However, even the gradual gains achieved thus far by companies and other stakeholders in the sector are under threat of reversal due to the economic fallout from the COVID-19 pandemic.

This second edition of the Clean Cooking Industry Snapshot provides an analysis of the investment and operational performance of approximately 50 clean cooking companies[2] between 2017 and 2019, based on self-reported and publicly available data. The key findings of the report are the following:

Investment Trends

Investment in clean cooking companies has increased but falls significantly short of the annual requirement to achieve universal access by 2030.

Capital flowed to a relatively **small number of high-value deals**.

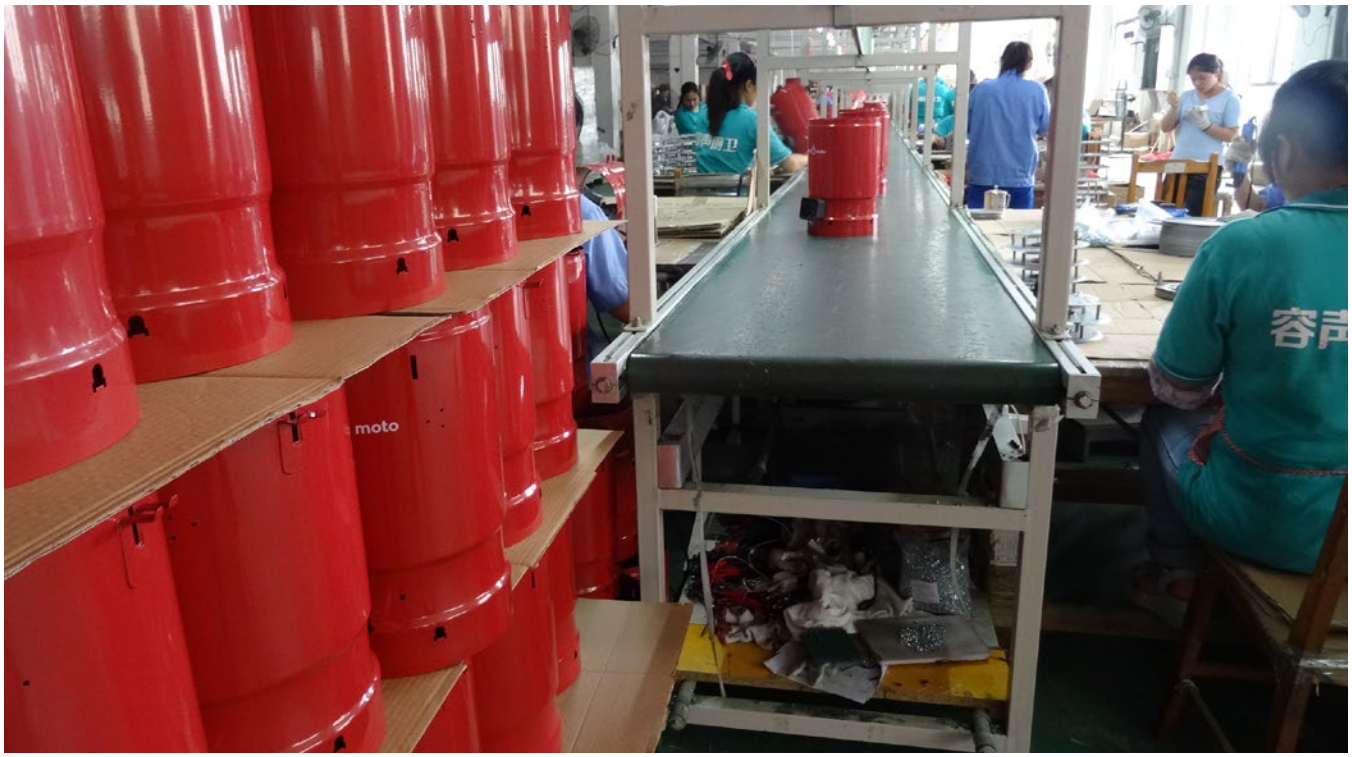
Private investors provided three-quarters of the capital flowing into surveyed companies.

Over half of the capital in the period 2017–2019 went to the LPG and biomass cookstove subsectors.

Clean cooking companies that serve **urban areas** attracted twice as much capital as those serving only rural areas.

Business models that provide **both the cooking appliance and the fuel** consistently attracted more capital.

East Africa-based companies led the world in the amount of capital raised in the last three years.



Mimi Moto

Sales and Operational Trends

Clean cooking solutions have been steadily gaining market share, but **biomass stoves remain dominant** in terms of share of industry revenues.

The reported contribution made by **carbon revenues** has increased sharply since 2017.

An increasing number of clean cooking companies are recording **revenues in excess of US$1 million**.

Direct sales channels account for almost half of all revenues for producers of stoves and fuels.

Led by ethanol and LPG companies, clean cooking companies continue to channel substantial resources into **research and development**.

An **increasing proportion of women** have taken leadership positions in clean cooking companies.

Tax exemption is the top-priority policy area for clean cooking companies.

Introduction

The 2021 Clean Cooking Industry Snapshot aims to provide insights into investment and operational trends and to track progress toward a sustainable, scalable clean cooking industry. The report builds on the inaugural edition, released in 2019, by analyzing data of approximately 50 companies for the period 2017–2019 and highlights recent major events in the sector, including key research released, watershed deals, and notable milestones for companies.

With less than 10 years remaining until 2030, the year by which the Sustainable Development Goals (SDGs) are intended to be achieved, the challenge of attaining universal access to clean cooking remains daunting. New research by the World Bank Program' with 'Energy Sector Management Assistance Program (ESMAP) estimates funding required to achieve universal access to modern energy cooking services[3] by 2030 to be US$148 to US$156 billion annually.[4] Twenty-six percent of this funding will come from public-sector sources, with a further 67% coming from household expenditures. Private-sector financing required for the development of downstream infrastructure essential to the functioning of

Figure 1. Types of Companies Covered in this Industry Snapshot

LPG Distributors
Companies developing innovative technology and business models to sell 'tool and fuel' to customers

Biofuel & Stove Distributors
Companies selling stoves together with a biofuel distribution model (typically either ethanol or biomass pellets)

Biogas System Companies
Companies offering pre-fabricated biogas systems with consumer financing and long-term maintenance

Biomass Fuel Producers
Companies producing biomass fuel (typically pellets, briquettes or ethanol) in industrial-scale manufacturing

Stove Manufacturers
Companies producing stoves (wood, charcoal, pellets, ethanol, electric or gas) in industrial scale manufacturing

Distribution & Financing Companies
Companies selling clean cooking solutions alongside other products, often together with consumer financing schemes

modern energy cooking markets accounts for the remaining 7%, or US$11 billion, of this total. The total amount of private investment required to build a dynamic, financially sustainable industry is undoubtedly higher than this. The data collected for this report tracks investment of US$70 million in clean cooking companies in 2019, and while this total may not be exhaustive, the funding gap clearly remains substantial. In 2020, the situation has worsened due to the COVID-19 pandemic, which has hindered the progress made by clean cooking companies in recent years, while also contributing to a slowing of capital inflows to the sector (see below for impacts of the pandemic on the companies).

This report focuses on for-profit companies operating market-based business models 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 char-briquettes), ethanol cooking fuel and stove suppliers, prefabricated biogas systems manufacturers, liquid petroleum gas (LPG) distributors, and electric cooking appliance manufacturers, as well as companies that provide specialized services within the value chain such as consumer finance, technology, and last-mile distribution services (see Figure 1). The report excludes company operations in developed markets, as well as fuel and stove producers that exclusively target industrial or commercial applications, upstream and midstream fuel companies, and infrastructure developers and operators.

COVID-19 Impacts on the Clean Cooking Industry

The COVID-19 pandemic dominated 2020, causing health and economic crises across the world. In a sector-wide survey covering over 111 companies conducted by CCA in April 2020, shortly after many countries implemented stay-at-home orders or lockdowns, 30% of companies reported that public health measures related to COVID-19 had resulted in a temporary cessation of their operations. Close to two-thirds of companies reported moderate to severe disruptions to their operations.

A wider survey of 600 energy access companies across 44 countries published by EnDev in August 2020 showed that, for many, the situation had not improved compared to the surveys conducted earlier in the year; 70% of the respondents continued to experience at least a significant disruption, and 80% reported lower sales volumes in the second quarter of 2020 compared to the same period a year before. Along the value chains, distributors were more affected compared to manufacturers or vertically integrated companies.

CCA's April 2020 survey also revealed that private investors believed that COVID-19 would lead to a slowdown in funding of clean cooking. Of the investors surveyed about the likely impacts of COVID-19 on their involvement with the clean cooking sector, 60% reported that they would be less likely to fund the sector, and 80% reported having delayed financing decisions. Of the investors already involved in the clean cooking sector, 70% reported that COVID-19 had a significant impact on their portfolio companies.

In response to the pandemic, several funders working in the energy access sector initiated a suite of relief measures. One of the more prominent initiatives is the COVID-19 Energy Access Action Network, a coalition of funders and market enablers providing access to financing and technical assistance for energy access companies (including clean cooking companies) experiencing operational disruptions due to the pandemic. Support from the network focuses on securing employment and minimizing job losses, so that companies are ready to serve their customers again when governments lift COVID-19-related safety restrictions.

The Network led the establishment of the Energy Access Relief Fund, which opened for expressions of interest from companies in December 2020. The Fund, managed by SIMA, will provide between 90 and 100 unsecured, low-cost subsidized loans to smaller to mid-sized energy access companies, including clean cooking companies, to help them overcome liquidity challenges brought about by COVID-19.

Investment Trends

Capital Flows

While data indicates that the investment in clean cooking companies increased between 2017 and 2019, the figure still falls far short of the amount required to achieve universal access to clean cooking. A small number of relatively large deals across clean cooking technology subsectors dominated investment, mostly from private sector sources.

Investment in clean cooking companies has increased but falls significantly short of the annual requirement to achieve universal access by 2030

2019 saw the largest total amount of capital raised since CCA began tracking investment in the industry, with a reported US$70 million raised by 25 clean cooking companies tracked by CCA. This represents a 63% increase compared with US$43 million raised by 32 tracked companies in 2018. A key driver of the increase in 2019 was the biggest private equity deal in clean cooking to date, in which Circle Gas raised over US$26 million in equity and debt, the bulk of which went to fund the acquisition of KopaGas's technology. This represented about 40% of the total capital raised by clean cooking companies in 2019.

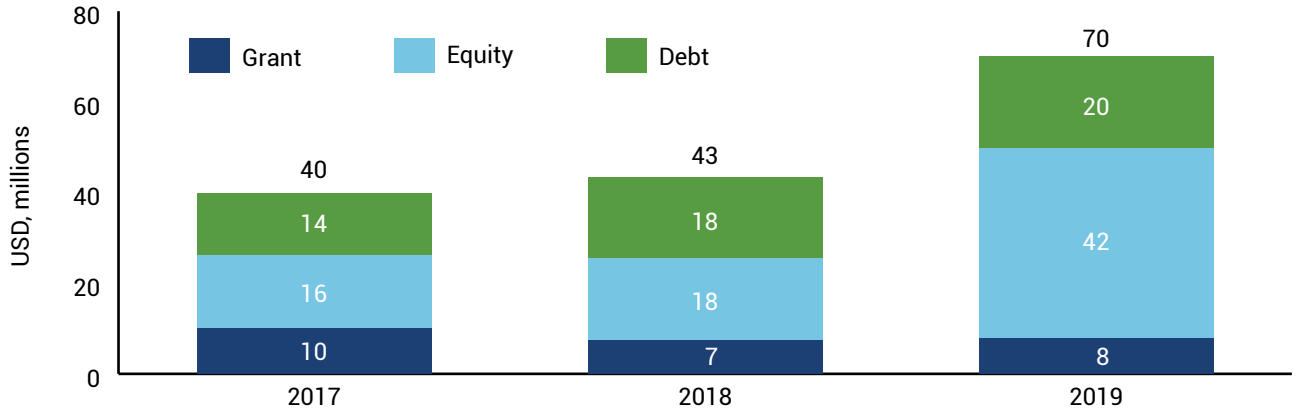
As can be seen in Figure 2, clean cooking companies raised US$20 million in debt funding in 2019. While this is an increase of 11% compared to 2018, the rate of growth slowed compared to previous years. The size of cash grants coming into the companies remained in line with amounts seen in previous years, ending at US$8 million.

Despite these increases in funding, the total amount of financing raised falls well short of the estimated US$11 billion in private sector funding required annually to achieve universal access to modern energy cooking services by 2030.

Capital flow was dominated by a relatively small number of high-value deals

The top 10 companies to have raised capital between 2017 and 2019 accounted for 81% of the total capital raised by the surveyed companies in this time period (see top fundraisers in Figure 3). Just four companies accounted for 56% of the total capital raised: Circle Gas, Sistema.bio, KOKO Networks, and BioLite (see IN FOCUS, pages 16–18). This level of capital consolidation is similar to the off-grid solar sector, where the four largest companies attracted two-thirds of the sector's equity investment between 2012 and 2017.[5]

Figure 2. Capital Raised by Instrument Type in Selected Clean Cooking Companies



Source: Clean Cooking Alliance. The figure is based on tracking data of 51 companies for each year between 2017 and 2019. The data relies on self-reporting by the companies and has been supplemented with publicly available investment data.

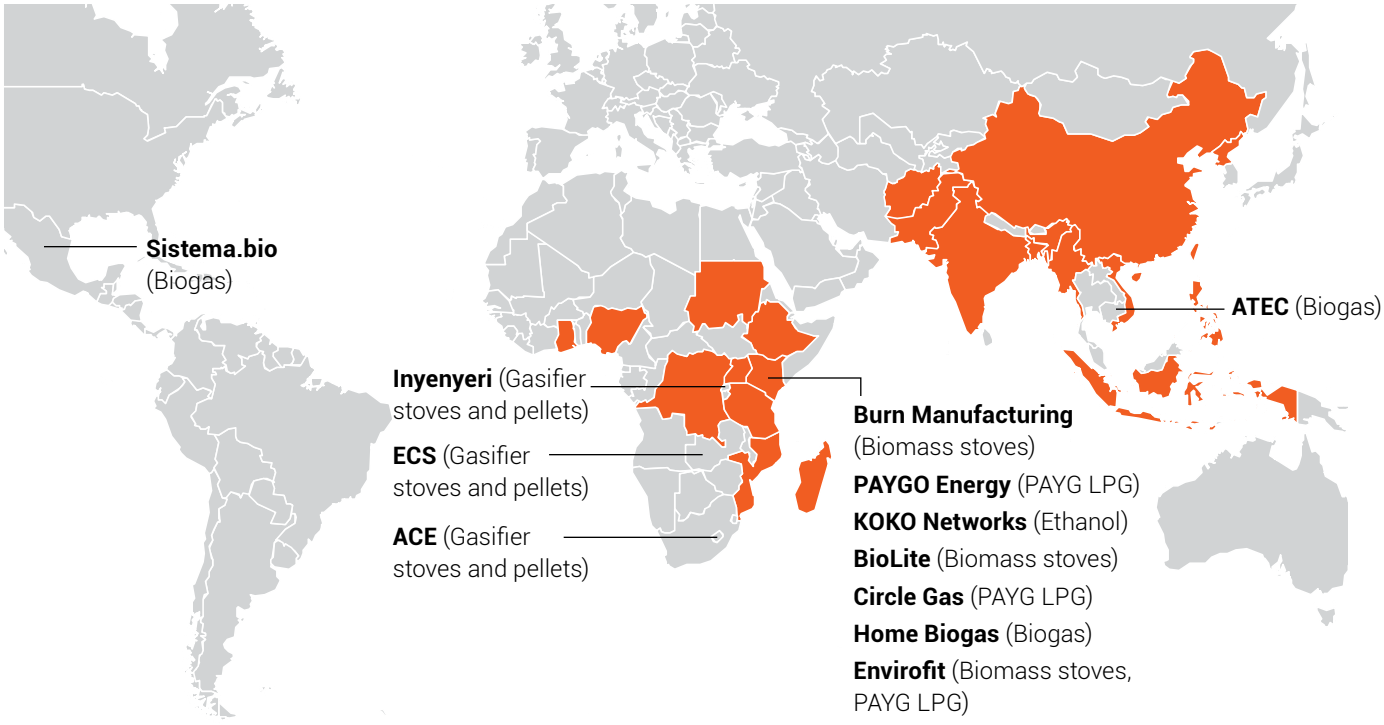
While no single fuel and technology type dominates the amount of capital raised within the clean cooking sector, the capital raised within each fuel and technology subsector tends to be concentrated in one clean cooking company. The proportion of capital raised by the top company exceeded 49% for each technology subsector. For example, in the case of LPG, the top company raised 72% of the capital received by reporting LPG companies; for biogas, the proportion raised by the top fundraiser was 54%.

Private investors were the source of three-quarters of the capital flowing into surveyed companies

Private investors (private equity, venture capital, and angel investors) invested US$114 million in clean cooking companies surveyed between 2017 and 2019. This represented 75% of the total funding, as shown in Figure 4. The next source of funding was multilateral and bilateral development financial institutions (DFIs), with 9%, followed by direct government sources, which contributed 8%. The two other sources were foundations and crowdfunding, which accounted for 5% and 2%, respectively. A list of capital providers active in the sector during 2017–2019 is shown in Figure 5.

A financial return on investment was the primary objective for US$87 million (57% of the total invested). Concessional investment in clean cooking companies—where investors explicitly seek sub-commercial financial along with impact returns—amounted to US$40 million, or just over a quarter of the total investments tracked between 2017 and 2019. The remaining US$25 million (17% of the total capital deployed) was grant funding that did not seek any financial return. Grant funding in the sector was used not only to increase households' access to clean cooking through existing solutions but also to test new product and business model innovations.

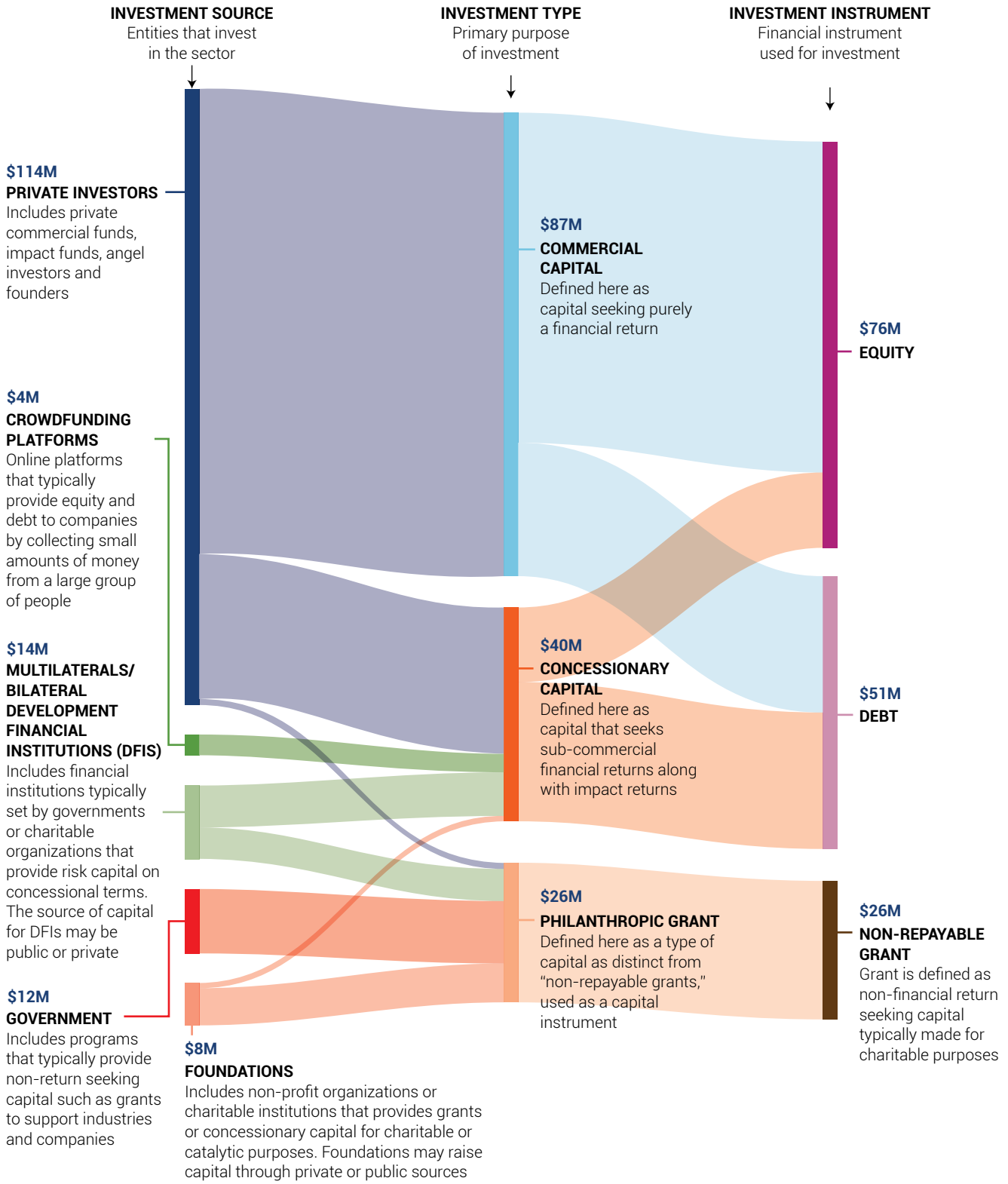
Figure 3. Clean Cooking Companies that Raised Largest Volume of Capital, 2017–2019



Top 20 access deficit countries (India, China, Nigeria, Bangladesh, Pakistan, Ethiopia, Democratic Republic of the Congo, Indonesia, Philippines, Tanzania, Kenya, Uganda, Myanmar, Vietnam, Mozambique, Madagascar, Afghanistan, Democratic People's Republic of Korea, Ghana, Sudan) are included as per Tracking SDG 7 Progress Report, World Bank

Source: Clean Cooking Alliance. The figure is based on tracking data of 51 companies for each year between 2017 and 2019. The data relies on self-reporting by the companies and has been supplemented with publicly available investment data.

Figure 4. Capital Raised by Source and Type, 2017–2019



Source: Clean Cooking Alliance. The figure is based on tracking data of 51 companies for each year between 2017 and 2019. The data relies on self-reporting by the companies and has been supplemented with publicly available investment data.

Figure 5. Selected List of Capital Providers to Clean Cooking Companies, 2017–2019

Private Investors (Private Equity Funds, Venture Capital funds, Angels, Debt Funds, Banks)

Acumen
Alphamundi
Althelia Climate Fund
Co Capital
Danir AB
DILA Capital
EcoEnterprises Fund
Engie
Fondation Ensemble
Oikocredit
Open Road Alliance
PG Impact Investments
Safaricom
Saisan
SIMA
Triodos Bank

Crowdfunding Platforms

Bettervest
Kiva
Lendahand
StartEngine
Trine

Multilateral/ Bilateral DFIs

Agence Française de Developpement (AFD)
DEG
EEP
EU Electrifi Fund
FMO
Infrastructure Development Company Limited (IDCOL), Bangladesh
Inter-American Development Bank
United Nations Capital Development Fund

Government Entities, Programs and Initiatives

Beyond the Grid Fund for Africa
Cambodian Ministry of Agriculture
Department of Foreign Affairs and Trade, Australia
Grand Challenges Canada
Innovate UK
Innovation Norway
Kenya Off-Grid Solar Access Project (KOSAP)
United States Agency for International Development (USAID)
United States Environmental Protection Agency (US EPA)

Foundations

Elea Foundation
Habitat for Humanity
Lundin Foundation
Red Cross Canada
Shell Foundation
SNV Netherlands Development Organization
Swiss Re Foundation
United Nations Foundation/Clean Cooking Alliance
Whole Planet Foundation

Source: Clean Cooking Alliance. The entities tracked in the list are financiers who fund companies directly. There are several more investors and funders who invest or provide financing to clean cooking sector intermediaries that have not been included in this list.

The figure is based on tracking data of 51 companies for each year between 2017 and 2019. The data relies on self-reporting by the companies and has been supplemented with publicly available investment data.

Figure 4 shows that over the three-year period, equity accounted for slightly less than half the total capital deployed, debt accounted for just over one-third, and grants accounted for 17%.

High Performing Segments

Private-sector investors have been highly selective in determining the types of clean cooking companies in which they invest. The data suggests that companies in the LPG and biomass subsectors, companies targeting urban markets, and companies with integrated tool and fuel models (offering customers both the cooking hardware and the cooking fuel) have been relatively successful in raising capital compared with other subsectors and business models.

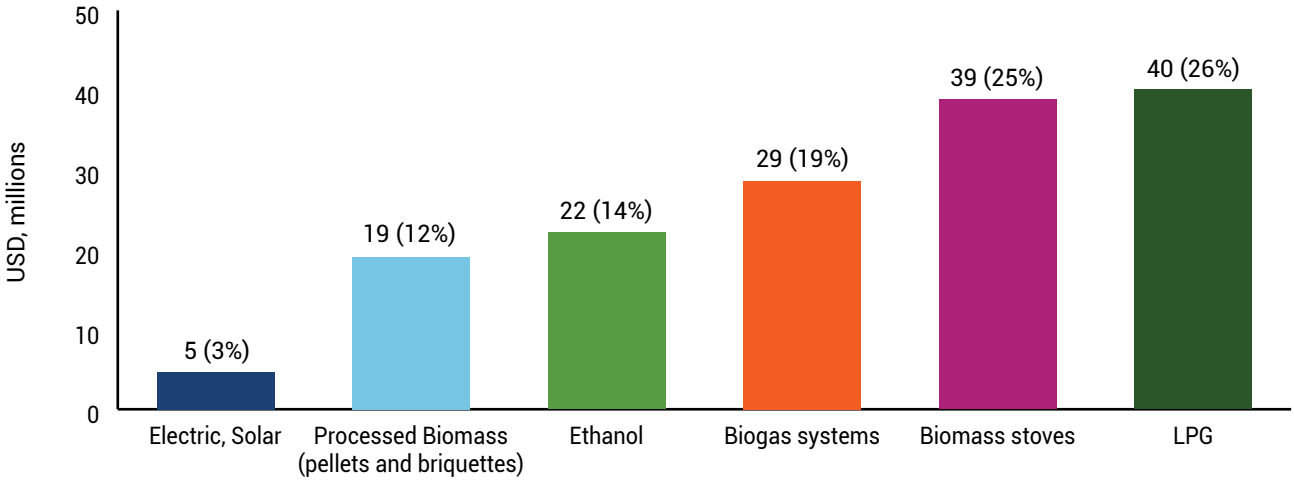
Over half of the capital in the period 2017–2019 went to the LPG and biomass cookstove subsectors

Companies distributing LPG in primarily urban and peri-urban centers raised the most capital across the three-year period, accounting for one-quarter of the total raised, as shown in Figure 6. Within the LPG subsector, almost 90% of the investment was made in three companies, all of which have integrated PAYGO technology into their customer offerings: KopaGas (technology recently acquired by Circle Gas), PayGo Energy, a pureplay PAYGO LPG-focused last-mile distributor, and Envirofit, an improved cookstove manufacturer that expanded its product offering into PAYGO LPG. During this period, a few off-grid solar companies, including Bboxx, have also started developing and piloting PAYGO LPG solutions. These early pilots, and the associated investment in PAYGO LPG, are primarily in East Africa.

In the coming years, funding to LPG may remain restricted, as some funders continue to grapple with the dilemma of LPG being an important transition fuel for clean cooking while also being a non-renewable fossil fuel.

Peter Irungu/KopaGas

Figure 6. Capital raised by fuel and technology



Source: Clean Cooking Alliance. The figure is based on tracking data of 51 companies for each year between 2017–19. The data relies on self-reporting by the companies and has been supplemented with publicly available investment data.

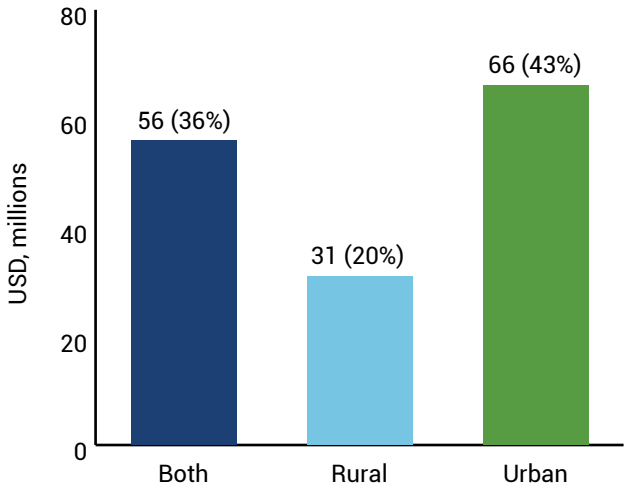
Industrial manufacturers of biomass stoves were a close second to last-mile LPG distributors in terms of total capital raised. BioLite was the prominent fundraiser in this category, having raised US$25 million to date (N.B. the majority of this funding has been allocated to the company's lighting business).

Biogas was the third-largest category and was dominated by the capital raised by Sistema.bio. The company raised close to US$14 million in debt, equity, and grants during the three-year period. A sizable portion of this capital is being used to expand the company's international footprint. Since 2017, the company has entered two high-potential regions: Kenya and India. Similarly, Cambodia-based ATEC Biodigesters, which closed their Series B equity round in 2019, has used its new capital infusion to enter the Bangladeshi biodigester market.

Ethanol was the fourth-largest category in terms of capital raised, with almost all of the capital tracked by CCA going into KOKO Networks.

Between 2017 and 2018, pellet and briquette-based cooking companies received a total of US$13 million, most of which was raised by Inyenyeri, a company in Rwanda that has since filed for bankruptcy. In 2019, however, pellet and briquette-based cooking companies raised just over US$3 million. Inyenyeri's bankruptcy raised questions about the viability of pellet-based models when it comes to scaling sustainably to serve hundreds of thousands of customers. While there continues to be interest in pellet-based business models in the market, none have yet managed to scale above 10,000 customers.

Figure 7. Capital Raised, by Consumer Demographics



Source: Clean Cooking Alliance. The figure is based on tracking data of 51 companies for each year between 2017 and 2019. The data relies on self-reporting by the companies and has been supplemented with publicly available investment data.

Clean cooking companies that serve urban areas attracted twice as much capital as those serving only rural areas

Of the total US$153 million raised over the three-year period, companies serving urban and peri-urban populations raised 43%, compared to 21% raised by those servicing rural customers, as shown in Figure 7. Clean cooking companies serving both urban and rural areas raised US$56 million, or 36% of the total capital.

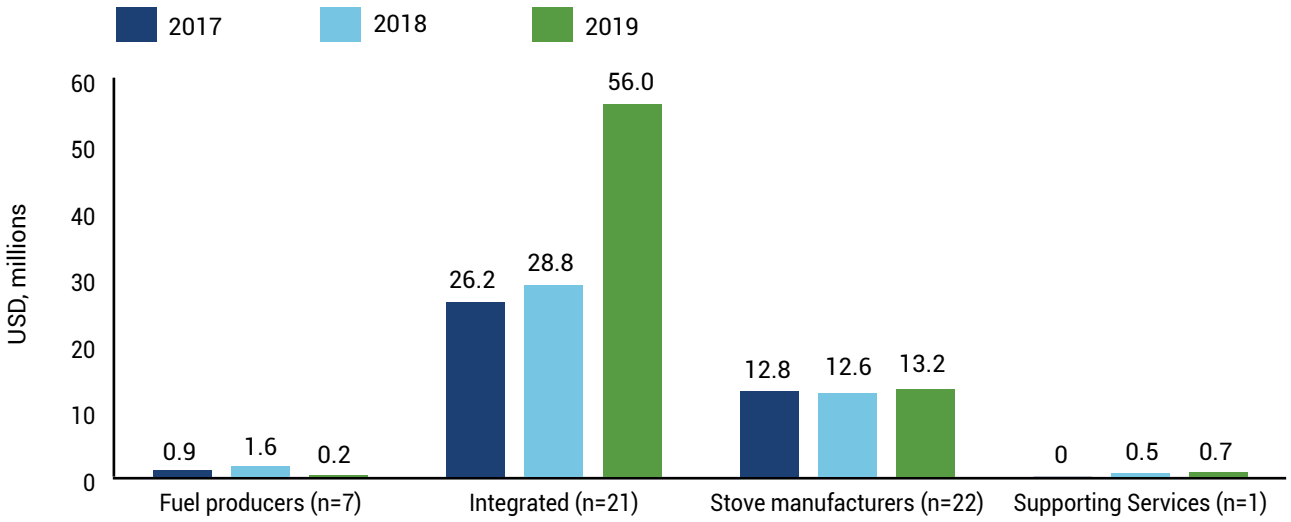
The location and density of customers are primary factors in determining the suitability of a given technology to an area. LPG and ethanol are more suitable to urban areas, where incomes and population density are higher, supporting affordability and unit distribution costs, respectively. As a result, investment in the LPG and ethanol subsectors has been in companies targeting urban customers. By contrast, biogas investments primarily target companies serving customers in rural areas, where customers have ready access to animal or organic waste, and more use for produced fertilizers. Biomass stoves and processed biomass (pellets and briquettes) typically serve both urban and rural customers, depending on the prevalence of charcoal or wood fuels in the region.

Business models that provide both the cooking appliance and the fuel consistently attract more capital

Integrated clean cooking, or tool-and-fuel business models, have captured at least two-thirds of the capital raised each year since 2017, continuing a trend observed in the previous Snapshot.

As shown in Figure 8, in 2019 the share of capital directed toward integrated business models was over four times that raised by standalone stove manufacturers, skewed by the impact of the Circle Gas transaction. The trend for the relatively strong performance of integrated business models in attracting capital continues, even when the Circle Gas transaction, and differences in sample sizes, are considered. Across the three-year period between 2017 and 2019, integrated business

Figure 8. Capital Raised, by Business Model



Source: Clean Cooking Alliance. The figure is based on tracking data of 51 companies for each year between 2017 and 2019. The data relies on self-reporting by the companies and has been supplemented with publicly available investment data.

models made up 45% of companies in the data set and accounted for 71% of the overall capital raised.

In addition to attracting less capital overall than integrated models, capital is starting to consolidate across a smaller number of companies that are focused solely on biomass cookstove manufacturing. In 2017, US$12.8 million was raised across 19 biomass cooking companies. In 2018, US$12.6 million was raised by 15 manufacturers, and in 2019, US$13.2 million—a 5% increase over the capital raised in the previous year—was raised by just 10 cookstove manufacturers. This increase in average deal size might indicate an interest on the part of investors to focus more on economies of scale among existing biomass cookstove manufacturing companies.

Only seven clean cooking companies sharing data with CCA exclusively sell fuels. The majority of them are nascent, relying heavily on grants and concessionary debt. Only one reported raising equity during the period.

East Africa-based companies lead in the amount of capital raised in the last three years

Twenty-three of 51 companies (45%) reported their primary operations as being in East Africa, but together they received almost 75% of the overall capital raised during 2017–2019. So, while the data suggest a greater concentration of clean cooking companies operating in East Africa, these companies have also been relatively more successful in raising capital. However, there is insufficient data available to draw firm conclusions as to the relative differences in total capital raised in other regions.

IN FOCUS: Investment Trends

Circle Gas

Circle Gas Acquisition of KopaGas Technology

Early in 2020, Circle Gas, a UK-based LPG distributor, announced its acquisition of the technology of KopaGas, a Tanzania-based LPG distributor, in a transaction worth US$25 million. The transaction is the largest private equity deal to date in the clean cooking sector. By acquiring the KopaGas technology, Circle Gas gained a proprietary, patented, high-tech LPG smart meter technology solution and pay-as-you-go (PAYGO) business model, which enables consumers to switch from polluting fuels, such as charcoal and kerosene, to a cleaner solution by purchasing cooking gas in smaller quantities. The smart meter also provides the company with the ability to remotely manage its assets and proactively dispatch refills to customers before they run out.

The Circle Gas investment will support the scale-up of the innovative PAYGO technology developed by KopaGas, accelerating its market penetration in East Africa. Circle Gas plans to grow KopaGas's business in Tanzania and has introduced its PAYGO platform in Kenya through its Kenyan subsidiary M-Gas, while also leveraging Safaricom's popular M-Pesa system to process mobile payments. Safaricom is also a strategic investor in Circle Gas.

Most of the smart meter devices Circle Gas/M-Gas has installed in Kenya are NBIoT-enabled. NBIoT is a cutting-edge radio technology that enables low-power connectivity to millions of devices. According to the company, this deployment is the first commercial rollout of this technology in East Africa and one of the largest in Africa.

For Acumen, a global impact investor and one of KopaGas's early equity backers, the transaction resulted in a successful exit after just two years—a rare occurrence in the energy access sector and a significantly shorter timeframe than Acumen's typical hold period of seven to twelve years.

KOKO Networks Fundraising Success

KOKO Networks (KOKO) is a technology company that distributes bioethanol cooking fuel to customers in Nairobi. Consumers use their KOKO Smart Canisters to buy fuel from a dense network of KOKO Fuel ATMs in local corner stores, which are supplied by a fleet of smart micro-tankers that undertake the last-mile distribution from petrol stations. This "drop-in fuel" approach leverages the existing liquid fuels infrastructure investments that have been made by the transportation fuel industry in developing countries. KOKO's first network of ATMs was launched in Nairobi in Q4 2019, in partnership with Vivo Energy Kenya (Shell licensee), and as of end-2020 served over 300,000 Nairobi residents. KOKO employs 700 staff and owns and operates high-tech manufacturing facilities in Kenya and India.

KOKO has raised close to US$55 million in equity and debt since 2015 from a wide range of family office and venture capital investors. Encouragingly for the sector, a significant proportion of this capital was from family offices in eastern, southern, and western Africa, a capital pool not yet tapped in a major way by the sector.

KOKO Networks

KOKO has also closed structured carbon finance deals with blue chip institutional traders globally, enabling it to lower consumer hardware prices to accelerate demand. The company has plans to develop, build, and license new networks globally, and aims to raise growth capital rounds in the years ahead to fund this rollout.

Sistema.bio Fundraising Success

Sistema.bio, a Mexico-based manufacturer and distributor of biodigester technology founded in 2010, has successfully raised close to US$14 million in debt, equity, and grants from multiple sources during the three-year period of this report. Working with smallholder farmers to address the challenges of poverty, food security, and climate change, Sistema.bio provides access to innovative biodigester technology, training, and financing to make farmers more productive, efficient, and sustainable. Along with the digester itself, the company develops affordable and high-quality biogas equipment customized for small farms, making them more environmentally friendly and profitable.


Sistema.bio

In 2019, Sistema.bio raised US$12 million in a Series A equity investment round. This equity investment helped Sistema.bio expand throughout Mexico, South America, Kenya, and India, with potential to bring their biodigester technology to over 200,000 smallholder farmers in these countries.

Sistema.bio has also successfully raised working capital from funders including an impact investing debt fund Beneficial Returns and crowdfunding platform Lendahand. Crowdfunding platforms offer European investors (large and small) the opportunity to support high-growth, high-impact companies with compelling risk/return profiles. For social enterprises such as Sistema.bio, they help unlock capital that is otherwise prohibitively expensive.

BioLite Fundraising Success

BioLite is a manufacturer of biomass stoves and solar lighting solutions that implements a parallel innovation model catering to both the energy access market in Africa and to the recreational camping market in North America. Since its founding in 2009, BioLite has raised over US$25 million (the majority of this funding has been allocated to the company's lighting business) and distributes its products across 17 countries. It has partnerships in emerging markets, with more than 30 distributors.

BioLite sells the wood burning HomeStove and the Jiko Malkia charcoal stove. BioLite also sells EcoZoom charcoal stoves in Kenya as part of a strategic partnership between the two companies.

A marquee transaction for the company was securing a US$5 million loan from SIMA's Off-Grid Solar Fund I in 2018, one of the largest debt deals in the biomass cookstove manufacturing industry to date. In 2020, the company secured an additional US$5 million investment from KawiSafi Ventures—a US$70 million fund focused on energy access investments in East Africa. This investment is expected to support BioLite's plans to increase distribution of its products, develop new products, and streamline its supply chains.

Biolite

ATEC Series B Raise to Expand PAYGO Biogas

ATEC Australia International Pty Ltd. is a manufacturer and distributor of biodigesters in Cambodia and Bangladesh. Since beginning operations in 2017, the company has sold over 1,600 patented, small-scale farm biodigesters in Cambodia and carried out pilot programs in seven other countries.

ATEC

In 2019, the company raised US$1.6 million in a Series B equity round, led by ENGIE Rassembleurs d'Energies. The broader investor consortium included Fondation Ensemble, IIX Growth Fund, and Phitrust Asia. The investment is expected to support ATEC's international expansion and the rollout of the world's first PAYGO model for biodigesters.

In 2020, ATEC patented a PAYGO-enabled magnetic induction cooker which allows customers living in on-grid regions of Cambodia and Bangladesh to cook with these stoves for as low as US$5 per month. Besides managing remote access, the innovation generates and shares household electricity consumption profiles with the company via GSM connectivity.

Inyenyeri Bankruptcy

In April 2020, Inyenyeri—one of the most visible companies in the clean cooking sector—announced that it was entering bankruptcy and would wind up its operations. Inyenyeri was established in 2011, raised close to US$12 million, and was one of the early pioneers of the pellet-based "tool and fuel" business model, charging customers for regular sales of biomass pellets to be used in a Mimi Moto stove that was leased with no upfront payment. Rather than prioritize serving a more profitable urban customer base, the company looked to serve urban, peri-urban and rural customers simultaneously, with revenues from urban customers subsidizing rural customers. Inyenyeri predicted that this model needed an estimated 100,000 customers to achieve financial sustainability. When the company formally ceased operations, it had acquired just over 5,000 customers. As an early mover in the Rwandan pellet market, the company was stretched across a wide range of simultaneous activities to raise market demand, ensure sufficient supplies and demonstrate, through randomized controlled tests, the health and environmental benefits of cooking with pellets.

Acumen's Focus on East Africa

Acumen, a global impact investor active in the energy access sector, focuses on the "pioneer gap," where innovative pioneer companies in low-income and emerging markets often struggle to access funding. This issue is particularly acute in the clean cooking sector. Acumen has invested over US$5 million in early-stage equity across six clean cooking companies spanning East Africa, West Africa, and India. Acumen was one of KopaGas's early equity backers and as a result of the Circle Gas deal had a successful exit after just two years. In 2020, Acumen also joined the MECS partnership to support a portfolio of companies in testing and piloting innovative financing mechanisms to scale modern energy cooking solutions.

Peter Irungu/KopaGas

Acumen has identified the need for more local founders in East Africa in clean cooking to be supported and is looking closely at supporting more local founders across the energy access sector. According to Acumen, East Africa remains a center of innovation for energy access technologies and business models. The population in East Africa is growing rapidly, just as Africa has the fastest growing population in the world. With the off-grid lighting market paving the way for renewable energy access in key markets, East Africa in particular is poised to embrace productive use appliances (technologies that result in the production of goods or the provision of services, typically in agricultural and industrial settings) that are powered by renewable energy, including electric cookstoves and other innovative forms of cooking. The opportunity in East Africa remains large: of the 600 million people without access to reliable power, more than 25% live in four countries: Ethiopia, Kenya, Uganda, and Tanzania.

Sales and Operational Trends

Revenue and Sales

Companies selling clean cooking solutions such as LPG, biogas, and ethanol have seen steady growth in market share from 2017 to 2019. By contrast, revenues accrued from improved biomass cookstove sales have declined since their peak in 2017, as shown in Figure 9. During that same period, carbon revenues have sharply increased.

Eight companies reported to CCA that in 2019 they captured sales revenues in excess of US$1 million. Of these eight companies, six use commercial partners as their primary distribution channel. Of these eight companies, 75% use commercial partners as their primary distribution channel.

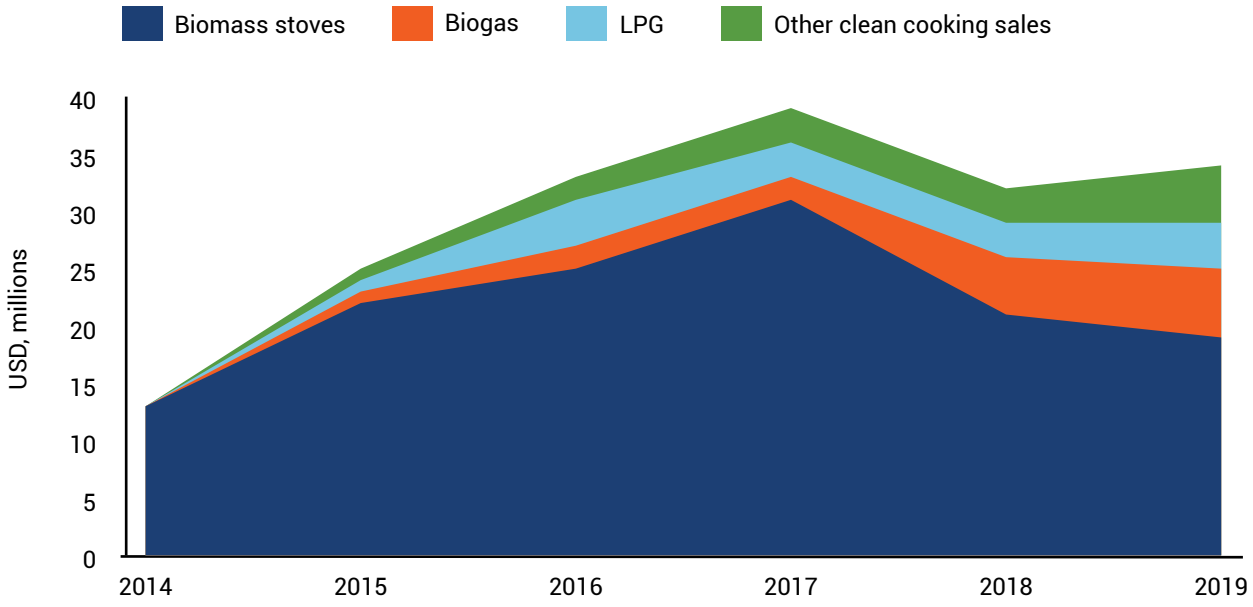
Clean cooking solutions have been steadily gaining market share, but biomass cookstoves remain dominant in terms of industry revenue share

Clean cooking solutions, which include LPG, ethanol, biogas, pellet and gasifier combination, electric, and solar are increasing their share of the revenues tracked by CCA. In 2019, these solutions accounted for 42% of the total revenues tracked by CCA—with the other 58% of revenues coming from the sale of biomass cookstoves, as can be seen in Figure 9.

Aggregate revenues from improved biomass cookstove manufacturers' sales declined from a high of US$31 million in 2017 to US$19 million in 2019. In relative terms, biomass cookstove manufacturers' sales declined from 81% of sector sales in 2017 to 57% in 2019, as shown in Figure 9. Some of this slowdown in subsector sales coincided with the substantial operational scale-down of Envirofit, one of the largest biomass cookstove manufacturers, which contributed 50% of the clean cooking sector's overall revenues in 2017.

Prefabricated biogas stove companies captured just 2% of sector revenues in 2014. In the five-year period ending in 2019, biogas companies tracked by CCA have collectively demonstrated a compound annual growth rate of 85%, albeit from a low base. As a result, by 2019, five biogas companies held 19% of the total revenues recorded by Snapshot respondents.

Figure 9. Sales Revenue by Technology



Source: Clean Cooking Alliance based on self-reported data by 35 companies reporting each year between 2014 and 2019.

Throughout the period 2017–2019, absolute revenues in the LPG subsector remained constant. However, the market share increased from 3% in 2017 to 11% in 2019 due to a fall in overall revenues reported by other clean cooking companies.

The reported contribution made by carbon revenues has increased sharply since 2017

In 2017, companies reported just over US$500,000 in carbon revenues, representing 1.2% of total revenues. As demonstrated in Figure 10, this increased almost five-fold in 2018 to US$ 2.4 million, or 6% of total revenues, and more than doubled to US$ 5.2 million, or 12% of total revenues, in 2019. Almost all of the carbon revenues generated between 2017 and 2019 were by biomass stove manufacturers as part of the Clean Development Mechanism (CDM) or voluntary carbon market. Carbon revenues in the coming years are expected to increase even more, considering the emergence of the South Korean Emission Trading Scheme, where several clean cooking projects are already registered, and the upcoming dialogue on Article 6 of the Paris Agreement. In addition, updates to the carbon methodologies that allow continuous monitoring of stove or fuel usage via smart devices will encourage more project registrations by reducing the transaction costs associated with monitoring and verification.

An increasing number of companies are recording annual revenues in excess of US$1 million

As indicated in Figure 11, eight out of 31 clean cooking companies tracked by CCA between 2014 and 2019 recorded total sales revenues of more than US$1 million in 2019. One company, BURN Manufacturing, recording revenues in excess of US$5 million in 2019.

Almost half of all sales revenues for producers of stoves and fuels are derived from direct sales channels

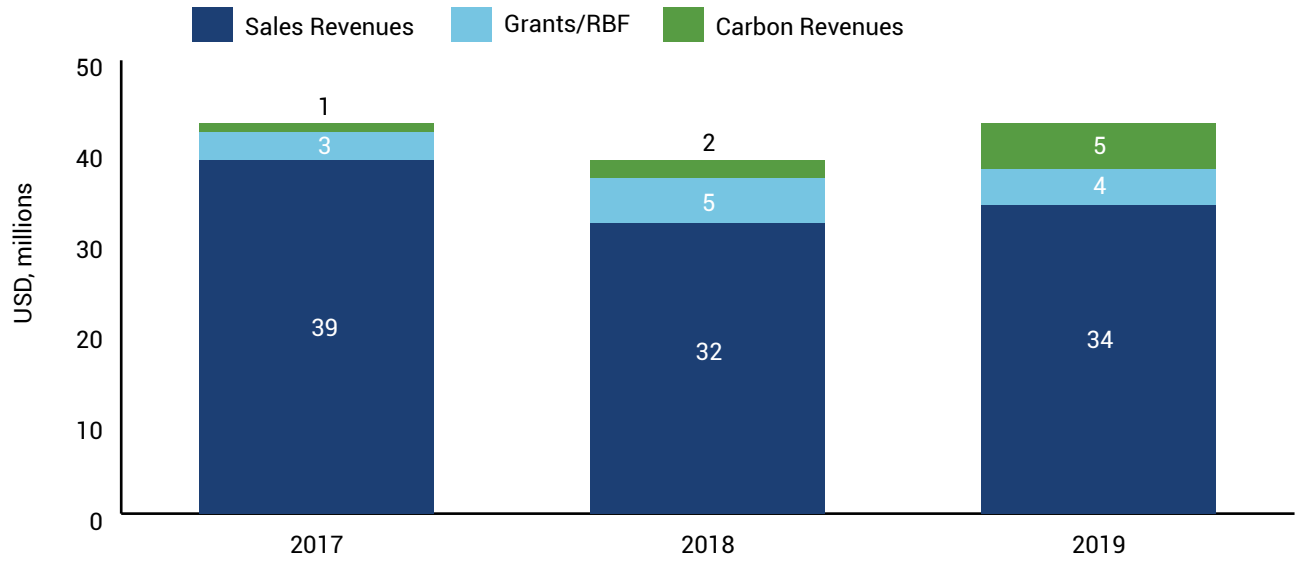
In terms of how companies reached customers with their products in 2019, 48% of them made direct sales and sales to retail stores, as shown in Figure 12 (see IN FOCUS, page 24, about ACE's direct sales approach). A further 46% used commercial distribution partners, and the remaining 6% leveraged distribution channels through programs run by nongovernmental organizations and governments.

Research and Development

Led by key ethanol and LPG companies, clean cooking companies continue to channel substantial resources into research and development

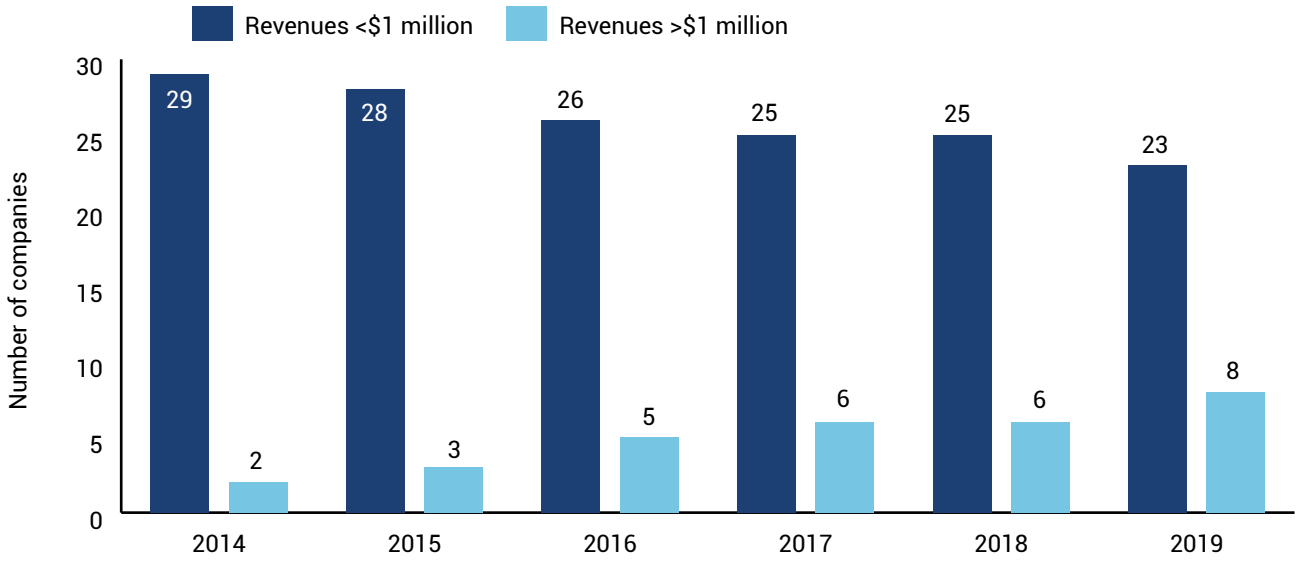
Of the 37 companies that participated in the Snapshot survey, 30 introduced new products or services during the 2017–2019

Figure 10. Proportion of Total Revenues, by Revenue Source



Source: Clean Cooking Alliance based on self-reported data by 32 companies reporting each year between 2017 and 2019.

Figure 11. Companies Sharing Snapshot Data with Clean Cooking Alliance, by Annual Sales Revenues



Source: Clean Cooking Alliance based on self-reported data by 31 companies reporting each year between 2014 and 2019. This chart also includes data from the previous Snapshot, which is the reason why it goes back to 2014.

period, and 12 companies spent more than US$200,000 on research and development (R&D) in 2019 alone.

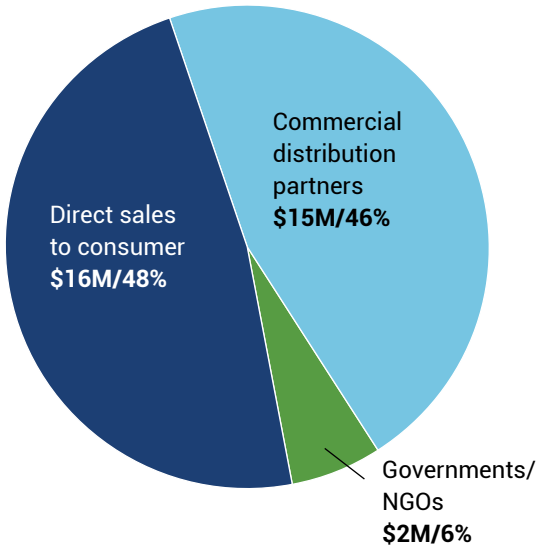
The total amount spent on R&D for clean cooking products and services during 2019 (including direct cash expenditures and the value of R&D-related staff time) was US$21.3 million, representing 63% of the sales revenues raised by clean cooking companies that year (see IN FOCUS, page 25, about R&D at KOKO Networks). To put this in perspective, the pharmaceutical and biotechnology industry typically invests 15% of its annual revenues in R&D.[6]

The clean cooking sector's relatively higher level of spending in R&D reflects the early development stage of the sector and the need to continue to explore ways to improve product-market fit, investing heavily in product innovation, delivery methods, researching new markets to tap, and iterating existing offerings.

As shown in Figure 13, the R&D expenditure in 2019 was driven by early-stage companies in the LPG and ethanol subsectors, which accounted for 81% of the total sector R&D expenditure, despite accounting for just 16% of total revenues. In contrast, the biomass subsector accounted for 57% of total revenues but just 11% of R&D expenditure.

In terms of the type of capital that companies rely on for their R&D, grants were the primary source for 52% of companies, 37% financed the majority of their R&D through

Figure 12. 2019 Industry Revenues, by Distribution Channel



Source: Clean Cooking Alliance, based on self-reported data by 29 companies.

equity and 11% primarily relied on debt. This sample confirms the continued importance of grants to foster innovation in the clean cooking sector.

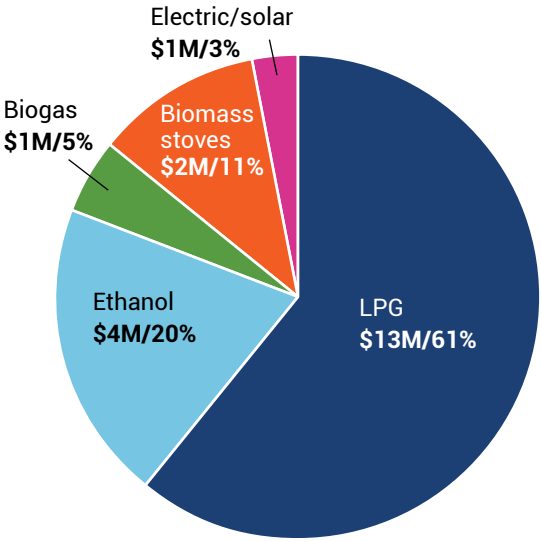
Employment

As of the end of 2019, seven companies reported having more than 100 full-time staff.[7] Twenty-three companies had more than 10 employees, and all but one had at least one woman occupying a leadership position.[8]

An increasing proportion of women have taken leadership positions in clean cooking companies

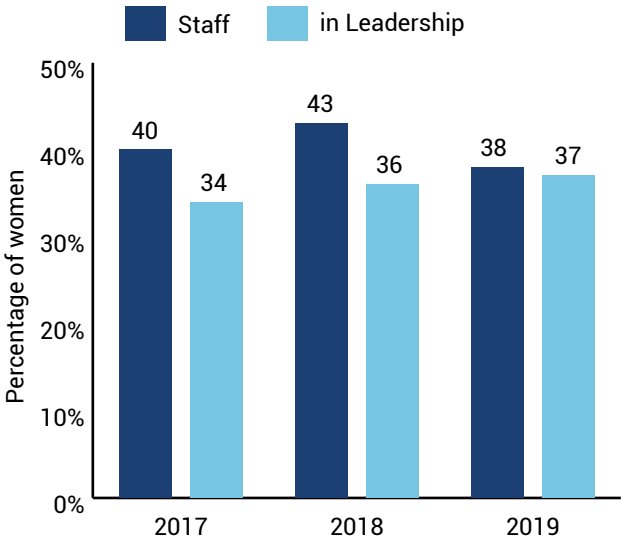
The number of women holding leadership positions more than doubled, from 28 in 2017 to 73 in 2019. As can be seen in Figure 14, this growth resulted in women occupying a similar proportion of leadership positions (37%) as they do full-time staff positions (38%). See IN FOCUS (page 25) for details on two recent initiatives launched to support the development of women leaders in the clean cooking sector.

Figure 13. Research and Development Expenditures for 2019, Grouped by Technology



Source: Clean Cooking Alliance, based on self-reported data by 37 companies.

Figure 14. Proportion of Jobs for Women in Clean Cooking Companies



Source: Clean Cooking Alliance, based on self-reported data by 28 companies reporting each year between 2017 and 2019.

IN FOCUS: Sales and Operational Trends

Operational Scale-down and Strategic Shift at Envirofit

Having sold over 2 million biomass stoves worldwide since 2007, Envirofit underwent a critical transition during 2019–2020. During this period, the company's biomass stove revenues, which had partially supported its newly launched PAYGO LPG business, fell sharply. At the same time, the company was unable to raise new capital to finance its PAYGO LPG business in Kenya. The reduced operating cashflow forced the company to make strategic changes, resulting in leaner operations and a reduced headcount. Despite these cash challenges, Envirofit has managed to sell close to 100,000 stoves in 2020, and the company's PAYGO technology has logged more than 2 million cooking hours in Kenya.

Going forward, Envirofit plans to leverage its broad range of clean cooking products (wood, charcoal, and LPG) to serve consumer demand through large-scale carbon project development. In addition, the company is seeking capital to grow its PAYGO LPG business in sub-Saharan Africa, Asia, and Latin America.

ACE Drives Customer Acquisition via Direct Sales

ACE is a manufacturer and distributor of a hybrid energy system that provides households with both forced-draft biomass combustion for cooking and basic electricity. ACE has integrated activities across the value chain, from production, distribution, and after-sale services for rural off-grid communities. Its primary product, the ACE One, is a biomass cookstove that comes with a smart phone and the ability to charge it, and power LED lighting. It is made affordable to customers through a partnership with Kiva, a non-profit microloan marketplace, through which customers can obtain loans to fund cookstove purchases. ACE's direct sales approach leverages an in-house sales team that travels to rural areas to give product demonstrations and set up microloan contracts. The sales agents are incentivized by a progressive commission structure.

African Clean Energy

ACE runs call centers to support customers with microloan management, as well as product maintenance and assistance. Salesforce manages product performance monitoring and after-sale service, helping ACE maintain a real-time overview of their loan portfolio, maintenance requests, and product performance.

Research and Development Investments at KOKO Networks

KOKO has invested over US$20 million in applied R&D over the last six years. It recognized that to solve the dirty cooking fuel challenge at scale required new technologies to be invented and built for a wide ecosystem of actors, including households, retailers, logistics providers, manufacturers, infrastructure owners, fuel traders, and regulators.

KOKO owns and operates hardware and software labs in India and Kenya, integrating a wide range of capabilities. These include human-centered product and service design, mechatronics and firmware, rapid prototyping, internet-of-things (IoT) and machine learning, mobile and cloud software design, product management and engineering, and IP management and standards development. Hardware products are then manufactured at scale in-house.

Technologies taken from concept to scale include the two-burner KOKO Cooker, smart KOKO Canister with customized safety valve, myKOKO customer app, Smart Tanker System for MicroTanker Fleets, Smart Depot System for petrol stations, KOKO Cloud platform for Network Operations Centres; KOKO Media platform for targeted interactive in-store video, and a range of internal apps for managing the flow of fuel, payments, safety data, and appliances.

KOKO continues to invest heavily in R&D across fintech, climate-tech, retail-tech, and logistics-tech in order to maintain its leadership position in the clean fuels industry.

Greenway Appliances

Cultivating Women Leaders in Clean Cooking

While the survey data reveals an increase in the proportion of women in leadership positions for the broader sector, more support is needed to cultivate the leadership pipeline for women in companies.

In an effort to provide targeted professional development support, CCA, in partnership with SEforALL and the Global Women's Network for the Energy Transition, launched a 12-month mentorship program that will pair early- to middle-management women employees with seasoned women mentors and role models in the sustainable energy sector. Through virtual networking engagements, knowledge-transfer webinars, and other career-enhancing activities, this annual program will accelerate the personal and professional development of talented women in the sector.

With the goal of increasing women-led projects in their portfolio, EEP Africa, a clean energy financing facility hosted and managed by the Nordic Development Fund (NDF) with funding from Austria, Finland and NDF, held a gender-focused call for proposals in 2019. The gender-themed call aimed to promote gender-inclusive innovation and create economic and leadership opportunities for women. Seventy-nine percent of the applications submitted by clean cooking companies were from women-led organizations, the highest proportion of any sector. Furthermore, four out of five of EEP's Africa Rising Energy Leader award winners in 2020 were women, including the East Africa director of Sistema.bio and the founder of Acacia Innovations, a clean cooking startup in Kenya.

Policy Priorities

Tax exemption is the top-priority policy area for clean cooking companies

The Snapshot survey invited respondents to select their top three priority policy areas from a list of six options, shown in Figure 15. Almost half (46%) of the 37 respondents expressed their belief that lowering the tax and duties on clean cooking products or raw materials, namely through tax exemptions or reductions, would be most beneficial to them. Taxes increase the price to the consumer of products sold in the formal sector. However, fuels and stoves sold in the informal sector become relatively cheaper, encouraging the lowest-income customers to turn away from cleaner fuels and technologies toward informally produced charcoal and artisanal stoves. For an overview of the government of Kenya's recent decision to reinstate the value-added tax (VAT) on clean cooking stoves and fuels, see IN FOCUS (page 27).

Companies indicated a high degree of interest in participating in government financial assistance programs, such as results-based financing (RBF). Recent RBF programs that are designed to pay for verified climate, health, and gender impacts, such as the SDG7 Results Scheme by the Netherlands Enterprise Agency (RVO) and ESMAP's Clean Cooking Fund (CCF), cater to this interest. CCF, launched in 2019, aims to leverage at least US$1 billion in investments to support a sizable number of businesses and catalyze technology and business innovations by linking incentives with verified results.

The implementation of standards and labeling programs was the fourth-highest ranked priority, as can be seen in Figure 15. For an overview of the government of Kenya's implementation of smart metering standards in Kenya, see IN FOCUS (page 27).

Figure 15. Top Priority Policies for Surveyed Clean Cooking Companies

1	Tax exemptions
2	Government financial assistance
3	Regulation on dirty fuels
4	Implementation of standards and labeling programs
5	Consumer awareness programs
6	Public funding to support innovation

Source: Clean Cooking Alliance, based on self-reported data by 37 companies, 2020.

IN FOCUS: Policy Priorities

Reinstatement of VAT on Clean Cookstoves in Kenya

In July 2020, the government of Kenya passed the Finance Bill 2020, which included several VAT measures directed at clean cooking stoves and fuels. Despite intense lobbying, the VAT was reintroduced on biomass cookstoves and LPG, although implementation of the latter is delayed until July 2021. While the government was under pressure to increase fiscal revenues due to the economic impact of COVID-19, there is a risk that VAT increases are passed on in their entirety to consumers, with higher prices leading to lower demand for clean cooking solutions. Prior to enacting this legislation, Kenya had been at the forefront of establishing policies that support clean cooking sector growth, having introduced an exemption on the VAT for clean cooking stoves and fuels in 2016. This bill was a major setback to the clean cooking sector, particularly for importers of fully assembled stoves. CCA and its partners continue to advocate for reconsideration of this decision.

Smart Metering Standards in Kenya

In 2019, the government of Kenya introduced the world's first smart metering standard for LPG, helping to demonstrate the impact—and potential—of LPG companies driven by smart metering technology, which informs users and operators how much fuel they are using and how much fuel they have left. This standard ensures compliance and quality and also creates a platform for further innovations that deliver convenience to the consumer and increase access to LPG safely.

KopaGas

Emerging Opportunities

Several promising innovations have been developed since the last Industry Snapshot was published in 2019. These new product and business model innovations have the potential to create a commercially viable clean cooking industry that attracts significant commercial and concessionary capital through a variety of investment mechanisms such as Spark+ Africa, a promising new investment fund (see IN FOCUS, page 32).

Biogas

Biogas cooking fuel produced from waste is a large addressable market, which is expected to build on strong growth in the period 2017–2019. Having recently unlocked the application of PAYGO technology to biodigesters, the biogas sector is well positioned for growth, particularly as momentum builds within the circular economy movement, with biogas digestors converting agricultural or municipal solid wastes into biogas for cooking and fertilizers for crops.

Harnessing biogas for productive use has traditionally involved the construction of brick dome enclosures built by local artisans. However, in recent years prefabricated biogas digesters, sold by companies such as ATEC, Home Biogas, and Sistema.bio, have entered the market. In one of the most significant transactions in the clean cooking sector, Sistema.bio closed its Series A investment round of US$12 million in July 2019. The market growth for standardized, prefabricated products provides the opportunity for technology integration. In 2019–2020 there were some important flows of capital at the nexus of biogas and IoT development. Furthermore, new biogas-powered productive use appliances are under development. These products, which include milking machines, crop grinders, cold storage and driers, offer the possibility of improving incomes in rural and agrarian communities.

In 2019, ATEC introduced PAYGO integration into its biogas digester product, in partnership with Angaza, a company enabling distributors to make products accessible and affordable to individuals in emerging markets through their PAYGO technology (see IN FOCUS, page 32), which provides payment management. Toward the end of 2019, ATEC closed its Series B fundraising effort, which raised US$1.6 million to scale up the business, including rolling out PAYGO in Cambodia and Bangladesh.

In 2020, Connected Energy launched its Smart Biogas product, a standalone IoT-connected smart meter specifically designed for biogas systems. The Smart Biogas platform also powers PAYGO business models and reduces operating costs by facilitating remote management and monitoring. Connected Energy also attracted capital in 2020, closing its Seed B round of US$1.25 million in July. These integrations reduce the cost of operating biogas systems, improve the customer experience and, when combined with the appropriate financing mechanisms, can increase affordability of a product that is often out of reach for low-income consumers.

Biomass Cookstoves

Notwithstanding recent advances made by new fuel technologies, cooking with biomass will continue to be a necessity for many for the foreseeable future. This means that developing ways to burn wood fuel and charcoal in cleaner and more efficient stoves is an important and worthwhile focus area in the clean cooking sector.

Despite growing at a slower rate than the sector as a whole, there is continued innovation in the biomass cookstoves subsector. Companies have been seeking greater sustainability and scale through leaner business models and have identified new opportunities to increase the affordability of their solutions, as well as greater integration of technology into products and operations.

In 2021, Greenway Appliances is expected to launch a new woodstove, Greenway Uno. Made with new materials and an allied production process, it will reduce costs while delivering the same efficiency and emissions performance as higher-tier, more expensive options. This will also allow for quicker expansion via decentralized manufacturing centers that are closer to consumers.

In 2019, Aprovecho Research Center (ARC), in partnership with Zhejiang Huiwenmei Stove Company (formerly Shengzhou Stove Manufacturer), developed and marketed a new biomass stove accessory, Jet-Flame—an electrically powered fan mounted in a one-inch-thick sheet metal slab that forces air under the char at the bottom of the fire. As

SSM

an accessory, the Jet-Flame can be used with a range of cooking solutions, including open fires and artisanal stoves, dramatically improving their performance. Lab tests as per International Standards Organization guidelines showed the stick-fed Jet-Flame,[9] when added to an artisanal mud-brick stove in favorable laboratory conditions, was able to achieve Tier 4 levels of fine particulate matter (PM 2.5) and carbon monoxide emissions, as well as Tier 4 thermal efficiency. Other low-cost technologies that utilize the principle of directing, or enabling, air flow at the bottom of cooking fires and artisanal cookstoves are also present in a few countries.

In 2019, ACE upgraded ACE One to make it capable of connecting with a smart phone through ACE's proprietary Android app pre-installed on it. The ACE Connect package enables PAYGO functionality through remote device management and improved customer service through better communication channels and can quantify stove use. This has implications for real-time tracking of social and environmental impact generated by stove usage of end users and opens the ability to directly incentivize end users for their impact through externality financing options. The consumer traction of the product depends on the company's ability to provide financing for a relatively higher-priced product compared to other improved biomass stoves.

Biomass Fuels (Processed Biomass)

Pellets, briquettes, and char-briquettes are made by drying and compressing biomass fuel sources. Briquettes made out of wood waste tend to be used as fuels in electric power generation, rather than in homes for cooking. Pellets have a smaller diameter and a higher surface-to-volume ratio compared with briquettes, meaning that it is easier to dry them to levels that allow cleaner combustion in cookstoves. A charcoal briquette is made from charred biomass, which has a higher energy density than non-carbonized briquettes. This property allows it to burn at higher temperatures for longer and with less smoke than the non-charred version.

OTAGO is a leading producer of char-briquettes. It has engineered a continuous production process to convert coconut husk waste into high-quality char-briquettes on an industrial scale in Cambodia.

When pellets are paired with the right biomass cookstove and used consistently, the combination can deliver positive health and climate impacts due to reductions of as much as 90% in emissions and 85–90% in biomass consumption. However, questions remain as to whether a business model with pellets can scale with commercial sustainability. Following the closure of Inyenyeri, several companies have emerged that seek to refine the processed biomass business

model into one which is optimized for growth. BioMassters, a Rwanda-based venture, seeks to operate at a realistic minimum viable volume of local pellet production and source high-quality biomass from sustainably managed forests.

Emerging Cooking Solutions, a Zambia-based venture launched in 2012, operates a pellet production facility with a capacity of 600 tons per month and sells its pellets in urban and peri-urban Lusaka under the SupaMoto brand. The company also distributes the Mimi Moto stove and manufactures its own SupaMoto-branded stove for institutional customers.

Electric

Cooking with electricity in off-grid and other low-power environments offers a potentially transformative solution to transitioning cooking away from biomass fuels. The cost per meal cooked may be cheaper than other cooking fuels in some markets, especially with foods that take longer to cook. A number of mini-grid companies are exploring electric cooking as a way to increase demand for electricity at a household level.

However, there are some significant hurdles facing widespread adoption. On the infrastructure side, reliable access to electricity can be sporadic. Some countries have transmission and distribution systems that will struggle with the increased loads. Voltage fluctuations in national grids can damage appliances. There are also behavioral changes required to achieve widespread use, while up-front switching costs for low-cost PAYGO electrical appliances or magnetic pots for induction cooking discourage uptake.

Much of the R&D work in electric cooking is driven by the modern energy cooking services (MECS) program funded by the United Kingdom's Foreign, Commonwealth & Development Office (FCDO) (and formerly by the Department for International Development). This GBP 40 million program in modern energy cooking solutions was launched in 2019 and has funded several research efforts through its challenge fund.

Other efforts in electric cooking are also focused on testing product affordability and reliability in off-grid or unreliable power environments. In 2020, Empowering Villages, with financing from EEP Africa, launched a new pilot to bring 150 highly efficient electric pressure cookers (EPCs) to on-grid and mini-grid-connected households in Rwanda. A product assembly workshop is planned as a women's cooperative at a micro-industrial park. The project will ultimately aim to deliver 5,000 EPCs and create jobs for 200 women.

A significant country-level initiative to transition to electric cooking is currently underway in Nepal (See IN FOCUS on page 33).

Ethanol

Ethanol is a liquid or a gel-based fuel that burns cleanly, provides heat control, and performs with an energy efficiency similar to gas when burned in a custom-designed stove. Unlike gas, ethanol is not pressurized and thus is often perceived by consumers as a safer alternative to gas cylinders. Ethanol cooking fuel is a denatured alcohol, produced from a variety of feedstocks, including corn, molasses, sugar cane, and cassava. While some local production occurs in sub-Saharan Africa, the largest-scale production comes from the United States, Brazil, China, Canada, and Europe.

KOKO continues to be a pioneer in the ethanol cooking sector, with its Fuel ATM business model, where users take KOKO canisters to refilling points located inside retail stores. Other ethanol stove and fuel distributors retail ethanol in various sized bottles which are filled and distributed from a centralized bottling facility. KOKO has experienced growing demand and sold its 50,000th stove in August 2020, less than a year after launching the model in Nairobi and despite the challenges posed by the COVID-19 pandemic. KOKO's partnership with Vivo Energy in Kenya has ensured a reliable supply of stably priced ethanol through a combination of locally sourced and imported ethanol.

LPG

LPG is attracting significant investment and is projected to achieve high revenue growth rates in the coming years. LPG is a clean burning fuel more commonly used by middle- and high-income consumers. LPG faces some big hurdles in reaching scale, not least the affordability barrier associated with the high cost of LPG stoves, cylinders, regulator valves, and the gas itself. These upfront costs can put the fuel out of reach for a large portion of low-income potential customers, even if the cost on a per-meal-cooked basis is lower than available alternatives.

Several innovations in the LPG sector seek to make LPG more accessible by reducing the upfront costs associated with switching to LPG. PayGo Energy is implementing a PAYGO model in Kenya that uses a smart meter to unlock small amounts of gas from the cylinder on a PAYGO basis.

Circle Gas

This means that customers do not have to pay for all of the gas in a 15kg cylinder in one purchase. The system tracks remaining cylinder volumes and triggers replenishment orders to be dispatched when the cylinder is running low, ensuring the customer has ready access to a supply of fuel. This ensures high levels of customer satisfaction and, therefore, customer retention. In 2020, PayGo Energy received a strategic investment from the Japanese energy company Saisan, adding to prior investments from Energy Access Ventures, CDC Group, and Global Innovation Fund. Note that this transaction is not captured in the data for this report.

An alternative approach being pursued by PayGas in South Africa is to provide partial refilling of gas cylinders to meet the customer's ability to pay, in a way that is safe and certified. Customers use contactless mobile payments to refill a cylinder with precisely the amount of gas they can afford. This prepaid approach avoids the need for investment in connected smart meters and reduces the working capital needed by the company for providing an inventory of gas that sits, unpaid for, at the customer's premises.

Another approach that attempts to address the problem of high-cost barriers is the retail of smaller cylinders that contain enough gas for approximately three days of cooking. The smaller cylinders are also easier to distribute via door-to-door sales, meaning that more customers can be reached per dispatch agent, helping sale volumes. Other companies are exploring ways to operate PAYGO business models while avoiding the large expense of smart meters to remotely control access to the cooking fuel. Non-metered PAYGO is an approach where a business uses a pre-existing metered PAYGO product, such as a solar home system, to manage the payments for non-metered cooking solutions. As described in the next IN FOCUS section on page 32, the leading stoves on Angaza's PAYGO platform are non-metered biomass cookstoves. M-KOPA has done this in the past to facilitate installment payments for biomass cookstoves, and Bboxx is currently experimenting bundling LPG with its solar home system offering in the Democratic Republic of the Congo. In February 2021, Bboxx sold a minority stake in the company to Trafigura, a multinational commodity trading company that is one of the largest LPG suppliers in Africa, delivering around 1 million metric tons to the continent each year.[10] Note that this transaction is not captured in the data for this report.

Scaling up these business models relies on technology and distribution innovation but is also predicated on having the financing structures and levels of investment to overcome large capital expenditures on infrastructure. Addressing the affordability challenge also requires working capital facilities that enable companies to meet growing consumer demand for their products and scale up their operations.

IN FOCUS: Emerging Opportunities

CLASP

Spark+ Africa – The First Clean Cooking Investment Fund

In 2019–2020, CCA collaborated with Enabling Qapital, a Switzerland-based fund manager, to design and raise funds for a US$50–70 million fund (Spark+) to invest debt, quasi-equity, and equity in companies throughout the clean cooking ecosystem in sub-Saharan Africa. These include manufacturers, distributors, financing providers, vertically integrated companies, and others that expand access to clean cooking solutions.

In November 2020, the African Development Bank announced its commitment to Spark+ Africa's first loss tranche with US$5 million from its Sustainable Energy Fund for Africa multi-donor trust fund, as well as EUR 10 million from the European Union via its blending facility. On the basis of this substantial tranche of high-risk capital, numerous investors are in due diligence for additional investments in the lower-risk mezzanine and senior debt tranches.

EEP S&EA

PAYGO Growth in the Clean Cooking Sector

Over the last few years, PAYGO business models have transformed the off-grid solar industry. Consumer financing of energy access products is poised to do the same for the clean cooking industry in the next couple of years.

Based on data provided by Angaza, a software platform that supports 200 distribution partners in over 50 countries, PAYGO cookstove sales registered on the platform have been growing exponentially since 2017 at a compounded annual growth rate of over 150%. The volume of cookstove sales tracked on Angaza's platform in 2020 was almost double that of 2019.

The two leading stoves on the Angaza platform—the Mimi Moto pellet gasifier stove and BURN Manufacturing's Jikokoa charcoal stove—accounted for over 90% of sales. The largest proportion of stoves was sold in Zambia (62%), followed by Uganda (17%) and Kenya (14%).

Data-driven Planning using Geospatial Platform in Nepal

The government of Nepal (GoN) intends to provide 100% electricity access in Nepal driven by the installation of 5,000 MW of hydropower in five years and 15,000 MW of hydropower in 15 years. The National Planning Commission's five-year plan (2019/20–2023/24) also targets a minimum of 1 million electric stoves, an upgrade of electricity supply infrastructure, an adjustment of electricity tariffs to support uptake, and the development of standards for electric cookstoves.

To support this vision, CCA and partners plan to launch an online, open-source, and interactive geospatial data platform for integrated energy planning tool beginning in 2021. This initiative will provide the GoN and other public and private stakeholders with spatial data and tools needed to inform their strategies for a robust clean cooking transition in Nepal. By 2022, this platform will allow integrated energy planning by assessing opportunity and feasibility for promoting electric cooking based on defining and linking supply (e.g., regions where electricity supply infrastructure exists, access to market) and demand (e.g., communities with characteristics of early adopters).

Conclusion

This Industry Snapshot corroborates some of the trends and observations made in the inaugural Industry Snapshot. In particular, CCA notes the following three points of consistency between the two reports:

1. Companies continued to invest time and resources in innovating and honing their offerings, to continue to tighten market fit with consumers.
2. Companies serving urban areas attracted more capital than companies serving only rural areas.
3. Companies with business models incorporating both the cooking appliance and the fuel are relatively more successful at attracting capital than companies that sell only fuels or only appliances.

There are also some points of divergence emerging between this Snapshot and the first one. In particular, CCA underlines the following three differences:

1. The top four companies to have raised capital between 2017–2019 accounted for 56% of the total capital raised by the surveyed companies, compared with 36% in the 2019 Snapshot.
2. Revenues from some clean cooking solutions (LPG, ethanol, and biogas) have been gaining market share steadily from biomass cookstoves, which still leads in share of industry revenues. The biomass cookstove subsector itself appears to be consolidating, with 10 companies raising a combined US$13 million in 2019, compared with 20 companies raising slightly less capital in 2017.
3. The contribution made by carbon to overall sector revenues has increased sharply, from 1.2% in 2017 to 12% in 2019.

The landscape of companies has slightly shifted during the timeline covered across the two Snapshots, with noteworthy closures, operational scale-downs, and consolidation of companies occurring in this reporting period. CCA aims to track and analyze such meaningful shifts in the sector, as customers and capital markets continue to provide direct feedback to companies through their cash allocations in the coming years.


KOKO

Appendices

Appendix A: Notable Industry Research and Findings

Modern Energy Cooking Solutions (MECS) State of the Sector Report, published in September 2020, estimates that achieving universal access to MECS by 2030 will require investment of approximately US$150 billion annually. Achieving the less ambitious target of universal access to improved cooking solutions by 2030 will require investment of US$10 billion annually. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/937141600195758792/the-state-of-access-to-modern-energy-cooking-services

Sustainable Energy for All (SEforAll) Energizing Finance Report, published in November 2020, found that, among other findings related to energy access more generally, private sector commitments in the clean cooking sector increased only marginally, from US$21 million in 2017 to US$32 million in 2018. Unlike public sector financing, private sector financing was more likely to flow to modern energy cooking solutions rather than to improved cookstoves. The report highlighted the lack of public sector investment in generating consumer demand and otherwise reducing the risk of private investment in the clean cooking industry. https://www.seforall.org/data-and-evidence/energizing-finance-series/energizing-finance-2020

Renewables 2020 Global Status Report, published in June 2020, found that access to clean cooking globally had increased from 45% to 54% between 2010 and 2018. Some regions saw more modest increases. Sub-Saharan Africa, the region with the lowest level of access in 2010 at 13%, had increased to only 17% by 2018. https://www.ren21.net/wp-content/uploads/2019/05/gsr_2020_full_report_en.pdf

RISE 2020: Sustaining the Momentum, published in December 2020, for the first time included a full pillar on clean cooking. The report found disparities in policymaking for clean cooking within and among regions and income groups. While the number of countries scoring in the report methodology's 'green zone' increased from zero in 2010 to eight in 2019, half of the world's population that lacks access to clean cooking live in 'green zone' countries with advanced policy frameworks. Countries experiencing fragility, conflict, and violence have seen few policy changes in the clean cooking sector. https://rise.esmap.org/data/files/reports/2020-full-report/RISE-FullReport-121020.pdf

ATEC

Appendix B: Methodology

For the 2021 Clean Cooking Industry Snapshot, CCA used self-reported data on investment, financial, and operational performance from clean cooking companies. A survey was sent to 120 companies that are part of CCA's company database. Of these, 37 companies responded to the survey providing data for the period from 2017 to 2019. This self-reported data was then supplemented with investment data on 14 additional companies from past surveys and publicly available data, including press releases and news articles. 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 companies reporting to CCA include 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. Companies which combine stove sales with fuel such as ethanol, pellets, and briquettes
4. Prefabricated biogas system companies
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. Companies 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

Companies producing stoves that are targeted for recreational markets, other non-household-oriented fuel producers, larger upstream and midstream fuel companies, and infrastructure developers and operators are excluded from the scope.

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 company 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, companies, 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 companies have entered the market, while others have downsized or ceased operations. As CCA's partner base grows, there are new respondents each year, not all of whom are just beginning operations. There are also companies that have not reported each year. Yearly variation in responses suggests that much sector activity is unreported every year, even among CCA partners. For 2017–2019, the Alliance received data from 37 companies and supplemented it with publicly available data and other surveys. This report relies only on reported data in addition to publicly available data; hence, the investment and financial performance data of many companies in the sector is not captured.

Each survey response has been carefully reviewed to ensure completeness and, to the degree possible without engaging in any due diligence. 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 companies operating in CCA's focus countries and beyond, there are always unavoidable gaps in reporting. These gaps and strategies to address them are described below. Additionally, several assumptions have been made while analyzing the data; they are also listed below.

Data Gaps

i. Regional Gaps

For 2017–2019, Africa and South Asia-based companies (23 and 6 companies, respectively) have reported far more information than those based in Central and South America (one company). In addition, CCA received reports from seven companies operating in multiple regions across Asia, Africa, and Latin America. A number of relevant East Asian countries are almost completely absent. CCA has attempted

to acknowledge and account for this regional bias in its reporting and narrative. The report excludes China in the analysis altogether, notwithstanding the fact that some of the companies operating in other regions are designing and distributing products manufactured in China.

ii. Gaps in Financial and Operational Performance Data

Data on the financial and operational performance of sector companies remains limited, and in many cases inadequate to draw substantial conclusions. Understandably, many companies 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. That said, CCA has received consistent, reliable, and meaningful annual data from 35 companies. Accordingly, all analysis of financial performance has reflected this universe of companies.

iii. Gaps in Investment Data

Based on self-reported data, East Africa attracted the most significant share of investment from 2017 to 2019. While this may be influenced by CCA's large regional network, based on discussions with those with extensive knowledge and networks across other regions, CCA discerns that there is greater private sector activity in this region than in others.

Data Analysis Assumptions

i. Investment Data

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

Investment data is reported at the firm level. Several companies have additional, non-clean cooking-oriented business activities. CCA has attempted to segregate investment data by business line in some cases, where possible. In a few cases, this segregation has not been possible. However, most companies in the analysis are primarily focused on clean cooking, with the majority of their sales 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 "impact investor." Investment data includes various types of debt, equity, and grant funding. It does not include carbon-related revenues, but it could include debt which prefinances such carbon revenues.

ii. Financial and Operational Performance Data

Several clean cooking companies have additional business lines beyond cookstoves, while others sell products in recreational markets as well. Including sales data from these additional lines of companies would overestimate cookstove sales. For companies with multiple business lines or in developed markets, only clean cooking-related revenues in developing markets have been included. Reasonable estimates and assumptions such as past year trends or comparable company analysis were used where data was unavailable.

For companies with sales data missing for certain years, CCA conservatively estimated based on earlier volume trends.

For more detailed information on this subject, contact: investment@cleancookingalliance.org

Notes

1. ESMAP Tracking SDG7 Database, 2020 and Tracking SDG7 Report 2020, IEA World Economic Outlook 2019.
2. This includes 37 companies that reported financial and investment data to CCA. This self-reported data has been supplemented with investment data on 14 companies compiled from past surveys and publicly available sources, including press releases and news articles. The survey was sent to 120 companies.
3. Modern energy cooking services (MECS) refers to a household context that has met the standards of Tier 4 or higher across all six measurement attributes of the Multi-Tier Framework (ESMAP, 2020).
4. ESMAP (2020). The State of Access to Modern Energy Cooking Services (English). Washington, D.C.: World Bank Group.
5. Acumen (2018). Accelerating Energy Access: The Role of Patient Capital. New York, NY: Acumen.
6. https://www.efpia.eu/publications/data-center/innovation/rd-spending-as-a-percentage-of-net-sales/
7. Twenty-eight companies provided employment data for 2017–2019.
8. A leadership position is defined as one that belongs to the company's management team.
9. The fuel used in the lab test was not traditional firewood, but kiln-dried Douglas fir strips.
10. https://www.trafigura.com/brochure/2020-trafigura-lpg-brochure

CLEAN COOKING ALLIANCE

The Clean Cooking Alliance works with a global network of partners to build an inclusive industry that makes clean cooking accessible to the three billion people who live each day without it. Established in 2010, the Alliance is driving consumer demand, mobilizing investment to build a pipeline of scalable businesses, and fostering an enabling environment that allows the sector to thrive. Clean cooking transforms lives by improving health, protecting the climate and the environment, empowering women, and helping families save time and money.

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