Introduction to the Clean Cooking Sector
CCAC Side Event - ECOWAS Sustainable Energy Forum
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Every day,

3 BILLION PEOPLE

(500 million households)

rely on solid fuels to cook their food
A complex history

• Since 2010, **hundreds of different stove designs** have been distributed to an estimated 81 million homes around the world

• Besides PMUY LPG connections in India, most were efficient biomass; many were subsidized or given away so relatively low value recognition

• Studies and randomized trials suggest that **most programs failed to introduce stove designs that were**:
  • Financially viable and scalable
  • Able to substantially reduce air pollution
  • Attractive enough for users to functionally replace traditional stoves

• **Business models were also not scalable**, and most focused on stoves rather than fuel
Household expenditures on traditional solid fuels are increasing due to rising household incomes, increased urbanization, and rapid population growth. This means cleaner, more efficient solutions are becoming relatively more affordable for more people.

The Alliance focuses on supporting, de-risking and scaling-up commercial models, many focused on fuel, which target the actionable market segment: those that already purchase inferior, increasingly expensive biomass fuel.
The opportunity: quantified

According to the World Bank in 2014, in Sub-Saharan Africa alone:

• 50% of households pay for cooking fuels, including 33% for charcoal and wood

• This constitutes a substantial market of $14 billion annually in 2010

• Given population growth, this market could double to $34 billion by 2020
The Alliance mission

Building a sustainable global market, at scale, for **cleaner, more efficient** cooking solutions
Demographic shifts and investment poised to make sector viable

- Poverty alleviation
- Urbanization
- Distribution scale
- Production economies of scale
- R&D capabilities drive innovation

**Greater ability to pay and better business economics (e.g. due to customer density and existing urban distribution channels)**

**Reduced customer acquisition costs**

**Reduced product costs resulting in greater product/market fit for higher-quality products**

**Improved value proposition and greater willingness to pay**
Margins are improving and scalable models emerging due in part to:

• **Shift from artisanal to industrial production** either locally or in China/India depending on business case

• **Combination of stove and fuel** to improve margins, generate recurring revenues, enable purchase of high-cost products

• **Technological improvements** leading to greater consumer value proposition e.g. stoves that provide light, phone charging

• **Meaningful reductions of stove production costs** through technical innovation and stove design refinement

• **Utilization of mobile technology** to enable efficient payment collection, data generation on usage patterns, etc.

• **Bundling and financing of cooking solutions** together other BoP goods such as solar

• **Development of multi-channel approaches to distribution** including 3rd party retail channels, MFIs/local banks, women’s groups, direct B2C /own stores, etc.
Primary barriers to investment at scale remain:

- **Small businesses and transaction sizes**: in many cases with low margins/high risk profiles
- **Pipeline fragmented across markets**: which increases transaction costs
- **New industry with limited track record**: previously development sector dominated, now a hybrid with significant development $$, but increasingly private capital; investments mostly in the last 2-3 years, and still limited investor knowledge
Building the clean cooking space into an ‘impact industry’

- **Globally:** mid to late stage of ‘Create Pioneer’
- **In certain markets:** entering ‘Scale’ stage
  - Profitable models not yet fully de-risked
  - Alliance is working to accelerate the industry’s evolution
  - Focus on supporting the emergence of scalable models
  - This is where meaningful investment will be attracted during the coming years
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Alliance market development strategy

Our goal:
• To support the development of a sustainable, growth sector that delivers increasingly clean and efficient cooking solutions at scale

Our focus:
• High-potential, high-impact companies with viable and scalable business models selling products/services that customers value, in ways they can afford
• High-quality, experienced management teams able to attract investment

Our approach:
• Build the pipeline of investible businesses through grants and TA
• Increase public and private sector investment by providing TA and market intelligence to benefit the decision-making of investors and donors
• Improve the policy environment by developing and utilizing new analytical tools and advocating to relevant policymakers
• Enhance category-level demand by supporting consumer education and behavior change interventions
What we hope to achieve with our market development interventions

Our aims:

• **Improved revenue prospects** through the development of recurring revenue-based models, innovative consumer finance schemes and PAYG solutions

• **Enhanced consumer demand** as a result of better products with increased value propositions and greater consumer awareness

• **Reduced customer acquisition costs** through the provision of consumer preferences insights and demographic information, better generation and analysis of usage data, etc.

• **Reduced COGS** through technical innovation and improved product design, as well as the development of economies of scale

• **Enhanced development and execution of strategic plans for scale** with supportive market, regional, and country knowledge and tools

• **Successful investment of growth capital** made possible by preparatory investment-readiness support and investor connections
In short, the Alliance Aims to bridge the investor risk-return gap
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<th>Enterprise Type</th>
<th>Description</th>
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<tr>
<td>High Growth Ventures</td>
<td>Small number of high growth, disruption-driven businesses in large/growing market</td>
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<tr>
<td>Niche Ventures</td>
<td>Small, high ambition niche businesses in modest-sized markets</td>
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<td>Dynamic Enterprises</td>
<td>Mature, medium sized and growing in “bread and butter” business activities</td>
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<tr>
<td>Livelihoods-sustaining Enterprises</td>
<td>Small, often family run in low-growth traditional business</td>
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• Needs-based business/investment support to high-growth ventures is our priority
  • These companies must establish themselves as viable and deliver proven tech for clean cooking sector to scale
  • Given the magnitude of the problem, we believe high-growth ventures comprise the highest and best use of our resources
• We may also directly support dynamic enterprises and niche ventures where they are likely to achieve investibility and relative scale
• Livelihoods-sustaining enterprises will be supported through sector-level interventions and public goods, and cooperation with other organizations that target this market segment (e.g. EnDev)
Sector mapping – PAYG LPG

• Envirofit in Kenya and Ghana, PayGo Energy in Kenya, KopaGas in Tanzania, BBOXX in Rwanda

• ‘Pay-as-you-cook’ solutions to make increase LPG affordability by allowing users to decrease upfront purchase price; similar principle to PAYG solar home systems

• Companies are exploring various business models including:
  • Direct B2C sales with ownership of retail shops & management of PAYC
  • Indirect sales and distribution by existing dealers; management of PAYC
  • Meter/software-as-a-service; sell hardware/software to 3rd parties

• Model may scale where mobile money is prevalent and where LPG infrastructure is present; will create impetus for further LPG infrastructure investment

• Focus on consumers that purchase fuel, for whom LPG is aspirational and cost competitive with existing fuels e.g. in large cities where free biomass is non-existent and charcoal/kerosene are high-cost

• Currently being piloted in various countries including Kenya, Tanzania, Rwanda, and Ghana
• Inyenyeri in Rwanda, Green Elephant in Uganda, Emerging Cooking Solutions in Zambia

• Combining gasifiers with wood/other biomass (e.g. ag-waste) pellets can rival ‘clean fuels’ such as LPG, while allowing for local production which reduces trade imbalance and price fluctuations, and enables bartering

• Stoves may be provided free to cashless rural customers via bartering of collected biomass

• In urban areas, pellets can be sold at a 30-40% savings to charcoal, while reducing emissions by 90%+ and overall wood consumption by 85-90%¹

• Model may scale in most rural and urban areas; with various income segments
  • Major current challenges are related to reliability of pellet production/supply and associated capex; stove designs have improved significantly in the past years, but room for add’l design improvement

• Pilot efforts at differing scale in Southern and Eastern Africa, SE and South Asia

Sector mapping – ethanol

- **KOKO Networks in Kenya, Green Energy Biofuels in Nigeria, Ndzilo in Mozambique**

- Clean solution that rivals LPG from a health standpoint, and is more impactful from an environmental perspective given that it is a biofuel

- Potential for local distillation from starch crops and significant production capacity exists in the sugar and maize industry

- That said, most cooking ethanol in SSA to date has been imported due to lower cost/supply reliability

- Also possibility for cellulosic ethanol production from agricultural products such as water hyacinth, but current initiatives have not yet been proven cost-effective/economic

- Most ethanol distribution has been small-scale; a select few scalable commercial players now beginning to emerge to drive down costs through distribution efficiency and scale
  - KOKO Networks developing a tech-enabled integrated distribution supply chain in Nairobi; aims to expand into several African cities in next 12-24 months
• **Sistema Biobolsa in Kenya, SimGas in Tanzania, HomeBiogas in Kenya**

• Attractive in agricultural locations due to readily available feedstock – agricultural residues or animal/human waste – and organic fertilizer as a valuable by-product

• 50 million biogas stoves worldwide, growing at 10% annually; China leads the world in biogas digesters for cooking, accounting for half of global installations, but significant growth potential in Africa¹

• Historically, biogas systems cost e.g. $1,500; prices decreasing with portable pre-fab units ($350-750) due to lower COGS, easier installation, reduced transport costs

• Stoves typically $50-100, though Chinese manufacturers now selling for as low as $25

• Significant lifetime cost-saving even after accounting for the high upfront costs; 60–80% savings in fuel expenses and fuelwood collection times²

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1. IRENA, 2014
2. Putti et al., 2015
Sector mapping – briquettes

- **GreenBioEnergy in Uganda, Acacia Innovations in Kenya, BrightGreen in Kenya**
- Direct substitute for charcoal; mainly used by households and small businesses
- If high quality and production at scale, cleaner and cheaper than traditional biomass; reduced emissions, significant production-related environmental impact
- Most manufacturers/distributors in Africa have not scaled and lowered production costs; therefore many uncompetitive with illegally produced, untaxed charcoal
- Market-leader SGFE in Cambodia has developed proprietary technology/production processes to scale; seeking to expand into Africa through joint ventures
- Model could scale in most countries where charcoal is an incumbent fuel; requires relatively low capital expenditure to establish
- Existing briquette and stove producers throughout East, West and Southern Africa; significant potential for improved production quality and cost reductions with scale brought about by capital investment and industrialized manufacturing
-sector mapping – industrially-produced charcoal stoves

- Envirofit (global); Burn, EcoZoom, Biolite in Kenya; African Clean Energy in Lesotho and Cambodia

- Basic ICS are typically artisanal and retail for US$5-20 – they provide limited improvements over traditional solutions e.g. reduced combustion chamber, basic chimney improvements, ceramic liner
  - May result in 20-40% fuel reduction and 10-50% emission reduction

- Intermediate/advanced ICS are more expensive, modern-looking devices for richer households and often require financing. They include charcoal stoves and wood rocket stoves, retailing at US$20-60, and gasifiers and forced air stoves that start at US$50
  - May result in 40-70% fuel reduction and 50-90% emission reduction

- Key constraints are product awareness and appeal, as well as consumer finance – without consumer finance, industrially produced stoves are typically unaffordable

- However, several companies including Envirofit, Burn and EcoZoom are EBITDA positive with robust growth prospects in existing and expansion markets
Artisanal wood and charcoal stoves
- Lack of business model scalability and profitability
- Limited impact, particularly in terms of health

Solar thermal cookers
- Lack of business model scalability; little private sector traction to date
- Expensive for end-users and significant behavior change required

SHS to power electric (including induction) cookers
- Not economically viable: cost of sufficiently spec’d SHS is EUR 1,000-5,500, though this is likely to evolve in the coming years with decreasing cost of storage
- While induction is far more efficient (90% vs. 70%), prices are 2-8x electric hotplates
- Deeper discharges shorten SHS battery life
Mini-grids to power electric (including induction) cookers

- Not economically viable: high peak load resulting from concurrent cooking would increase storage requirements significantly
- Concurrent cooking also may put rapid and significant strain on system operations and reliability, including:
  - Depleting battery systems
  - Accelerating wear and tear
  - Shortening the mini-grid’s operating life
  - Increasing maintenance costs
  - Forcing reliance on alternatives such as diesel (or shutting system entirely)
- Low income/ability to pay by mini-grid users for even modest use (lighting, phone charging, etc.) would be exacerbated in that cooking would likely quadruple or more their usage
• Renewably-generated power to gas (P2G) with conventional gas stoves

  • High upfront cost (electrolyser and associated power plant) may make it difficult for investors to put so much capital at risk in the early stages, particularly with uncertainty over future availability and taxation/subsidization of other fuels (e.g. LPG)

  • Securing sustainable and cost-effective CO2 to fuel the methanation process may be challenging

  • Renewably generated gas would compete head-to-head with LPG, which is likely to be more affordable

    • Even more so where subsidies are offered; viability of P2G would require an entire revamp of subsidy schemes in many markets
In conclusion: reasons for optimism

- **Cost efficient distribution of LPG**, with gas sold on a pay-as-you-cook basis through mobile money and GSM-enabled meters for gas cylinders. This dramatically improves affordability for those who cannot afford the $75-100 upfront cost. Subsidy redistribution schemes like in India have potential to also help overcome upfront cost barriers.

- **Integration of bioethanol into existing fuels supply chain** e.g. tanks at service stations and consumer facing distribution via mobile money enabled fuel kiosks/fuel vending machines. Again, this can dramatically improve fuel economics for consumers and make ethanol a clean and affordable alternative cooking fuel relative to charcoal, wood, and kerosene.

- **Clean burning gasifier stoves** leased with sale of wood pellets; some even offer bartering models where rural consumers receive pellets for free in exchange for raw biomass. This provides for greater inclusion, even for fuel collectors who are typically considered un-addressable through market-based approaches.

- **Prefabricated biogas systems** continue to scale in certain markets, targeting a specific consumer segment and integrating greater technology which enhances PAYG/asset financing, usage monitoring, etc.

- **And better, more efficient industrially-produced biomass stoves** also continue to make progress and growing in scale and impact in certain markets, particularly in East Africa, and players are now looking to scale into new regions.
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