

Haiti:

ACTION PLAN FOR THE TRANSFORMATION OF THE COOKSTOVES AND FUELS MARKET

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The Global Alliance for Clean Cookstoves is a public-private partnership hosted by the UN Foundation to save lives, improve livelihoods, empower women, and protect the environment by creating a thriving global market for clean and efficient household cooking solutions. The Alliance's 100 by '20 goal calls for 100 million households to gain access to clean and efficient cookstoves and fuels by 2020. The Alliance works with a network of 1700 public, private and non-profit partners to accelerate the production, deployment, and adoption of clean and efficient cookstoves and fuels in developing countries.

The "Haiti: Action Plan for the Transformation of the Cookstoves and Fuels Market" was prepared by the Global Alliance for Clean Cookstoves based on consultations with the Government of Haiti, cookstove and fuel manufacturers and distributors, women's groups, NGOs, investors, researchers, donors, and other stakeholders living and working in Haiti.

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ABBREVIATIONS AND ACRONYMS

AGB	Above Ground Biomass	INDCs	Intended Nationally Determined Contributions
ATP	Ability to Pay	LCA	Life Cycle Assessment
BAU	Business-as-usual	LPG	Liquefied Petroleum Gas (Propane)
BC	Black Carbon	MJ	Megajoules
BCC	Behavior Change Communications	MFI	Microfinance Institution
BHN	Haiti Bureau of Standards	NGO	Non-Governmental Organization
BME	Bureau of Mines and Energy	PaP	Port-au-Prince
CapEX	Capital Expenditures	PV	Photovoltaic
CDM	Clean Development Mechanism	REDD+	Reducing Emissions from Deforestation and Forest Degradation
CO₂	Carbon Dioxide	R&D	Research and Development
CO_{2e}	Carbon Dioxide Equivalent (emissions)	RFP	Request for Proposals
DFI	Development Finance Institution	S&L	Standards and Labeling
EdH	Haiti Electric Utility (Electricité d'Haïti)	SDGs	Sustainable Development Goals
ESMAP	Energy Sector Management Assistance Program (World Bank)	SEI	Stockholm Environment Institute
FAO	Food and Agriculture Organization	SLCPs	Short-Lived Climate Pollutants
FDS	Faculté des Sciences	SMEs	Small and Medium Sized Enterprises
fNRB	Fraction of Non-Renewable Biomass	TA	Technical Assistance
GoH	Government of Haiti	UEH	Université d'Etat d'Haïti
GDP	Gross Domestic Product	UNEP	United Nations Environment
GHGs	Greenhouse Gases	UNDP	United Nations Development Programme
Alliance	Global Alliance for Clean Cookstoves	USAID	United States Agency for International Development
HAP	Household Air Pollution	WFP	World Food Programme
HAPIT	Household Air Pollution Intervention Tool	WHO	World Health Organization
HH	Households	WTP	Willingness to Pay
HPMT	Haiti Program Management Team		
HTG	Haitian Gourdes		
ICTP	Haiti Improved Cooking Technology Program (USAID/Chemonics)		

EXECUTIVE SUMMARY

Household air pollution from cooking impacts virtually every corner of Haiti. Without access to clean energy, nine out of ten people in Haiti are forced to cook with heavily-polluting solid fuels like wood and charcoal.

This reliance on solid fuels for cooking leads to widespread environmental, economic, gender, and health issues that disproportionately affects those with the fewest financial resources, especially women and girls. In 2015, household air pollution led to 8,000 premature deaths, and it is now the second largest risk factor for mortality in Haiti. Women and girls can spend hours every day breathing in toxic smoke while preparing their families' meals over inefficient stoves or open fires. This method of cooking also further constrains livelihoods, as households spend precious income on fuel that could otherwise be spent on food, medicine, school fees, or other necessities.

Efforts to address this pervasive issue have faced an uphill climb, with hard-fought, but limited progress to date. Recent research (2016) demonstrates that the market for cleaner and more efficient cookstoves and fuels in Haiti remains in the early stages of development. Few enterprises are making products that provide environmental and health benefits. The demand for wood charcoal for cooking, especially in urban areas, is among the highest in the region, and inefficient charcoal production practices are contributing to forest degradation and climate change.

While there are innovative local cookstove and fuel enterprises in Haiti, they face a difficult operating and policy environment with tariff barriers, lack of access to raw materials, and weak sector coordination mechanisms. Consumers' inability to pay for higher performing products and the low awareness of the benefits of clean cooking further complicate prospects. In addition, a rapid transition away from traditional fuels is not only improbable, but also ill-advised as approximately 200,000 Haitians are employed in the charcoal value chain.

In response to these challenges, Global Affairs Canada commissioned this Action Plan (Plan), to serve as a high-level strategic framework for transforming the cookstoves and fuels market in Haiti. The Plan provides a strategy for sector development based on field assessments, research reports, and stakeholder consultations, and should be implemented in close collaboration with the Government of Haiti. The activities outlined in the Plan are intended to align with the Government of Haiti's development objectives for agricultural development and economic growth, climate change mitigation, improved health and energy access, and greater empowerment of rural populations. In addition, the Plan is designed to both build on complementary initiatives in related sectors and draw on the experiences of more than 40 years of cookstove programs in Haiti.

The complexity of the issue in Haiti necessitates a comprehensive approach to market development that considers the unique needs of the country. For any initiative to achieve measurable impact, it must deftly address barriers to the establishment of a thriving cookstoves and fuels market, and the central role that wood charcoal plays in the Haitian economy and rural livelihoods.

The Strategy

Therefore, the Plan proposes a market-based strategy to develop a strong cookstove and fuels market. The objectives of this strategy are to: 1) increase and improve the production and availability of cleaner, affordable, and more efficient cookstoves and alternatives to wood charcoal; 2) improve the efficiency of wood charcoal production; 3) generate demand for cleaner, affordable, and more efficient cookstoves and fuels; and 4) create a strong enabling environment to support sustainable market growth.

Underpinning the proposed strategy is a core belief that impact will be achieved by following six key principles that have been defined based on research conducted in Haiti and best practices gleaned from developing cookstove and fuel markets around the world.

Guiding Principles

Market-based approach. Inclusive market-based interventions have proven more effective than stove giveaways at achieving the adoption of cleaner and more efficient cookstoves and fuels.

Technology and fuel neutrality. While wood charcoal will remain a cooking fuel for the foreseeable future, consumers must be able to choose from a variety of cleaner and more efficient cookstoves and fuels.

Women's empowerment. Capitalizing on women's role as clean energy entrepreneurs and leaders in national and local efforts lead to the development of effective, culturally-appropriate, and sustainable solutions.

Long-term and sustained efforts. The substantial barriers to accessing cleaner and more efficient cooking energy requires a sustained investment to transform the market.

Local expertise. Local ownership drives sustainability; building on lessons learned from past projects, and relying on the expertise of Haitian managers lends itself to more effective program design and implementation.

Collaboration. Building on the ongoing work, knowledge, and expertise of local sector partners – including the many complementary donor, civil society, and private sector initiatives underway in Haiti, prevents duplication and allows for the design of more effective interventions.

Sustainable Market Development

Given the nascent market in Haiti, sustainable development of a robust cookstoves and fuels market is expected to be a lengthy endeavor. A minimum 10-year, phased initiative (Initiative) is recommended to move the market forward. A short-term engagement would be inadequate to develop a market that both meets the needs of the population and simultaneously addresses the potential negative consequences from disrupting the status quo. A phased approach will likewise allow for a rigorous monitoring and evaluation process and the identification of the interventions with the most potential for reaching scale in the long-term.

- **Phase 1 (2018-2022) will build the foundation of the Haitian clean cooking sector, relying on pilots to prove the case for effective market interventions.**
- **Phase 2 (2022+) will drive investments, innovations, and operations to scale to truly transform the sector.**

To establish a strong foundation, Phase 1 will: build a coalition of actors to support the development of the market; identify and support potentially viable cookstoves and fuels enterprises; cultivate a robust evidence-base for market interventions; foster ownership of the strategy within the Government of Haiti; solicit a multi-donor fund that is ideally leveraged by private capital; identify opportunities to reduce the environment and climate impacts of charcoal production; and advocate for the integration of women in the value chain. During Phase 1, a significant “test and learn approach” will be employed across all efforts so that learnings from the pilots can rapidly be integrated into longer term market transformation approaches in Phase 2.

Phase 2 should: scale successful approaches from Phase 1 to strengthen a more focused set of enterprises to reach investment readiness; conduct large-scale behavior change campaigns; expand demand generating efforts; convene the sector around a common understanding of clean cooking impacts; and support the government in executing large-scale regional/department-wide clean cooking efforts.

Understanding that one solution, or one single technology, will not be applicable for all households, the geographic focus of interventions will be principally market-driven, and decided in collaboration with sector actors. During Phase 1, the largest impact is expected among urban and peri-urban households. As the market grows, coverage is expected to expand beyond these areas. Meanwhile, interventions supporting improvements in the wood charcoal value chain and production of alternative fuels will likely have a greater impact in rural areas.

Haiti presents a unique context for the development of a cleaner and more efficient cookstoves and fuel market. The scope and scale of the problem in Haiti should be seen as both a challenge and an opportunity; that many have tried and many have failed should not dissuade future efforts, but instead motivate actors to reach for innovative solutions that capitalize on the pervasive entrepreneurial spirit in Haiti. A comprehensive and funded Action Plan can spur the adoption of clean and efficient cookstoves and fuels in Haiti and bring about measurable benefits.

Document Organization

This document is comprised of two sections. Section 1 presents the impacts of traditional cooking practices, market development challenges and opportunities, and lessons learned from past efforts. Section 2, then lays out the strategy and recommended interventions to move the market forward. This includes an emphasis on the necessary foundational work in Phase 1, an overview of efforts in Phase 2, and a monitoring and evaluation strategy.



The Problem

Haiti meets its energy needs primarily through the consumption of wood. According to the IEA (2014), 78% of national energy demand in Haiti is met by wood consumption (fuelwood and charcoal). Households drive consumption as they rely almost exclusively on wood and wood charcoal to meet their cooking energy needs.

Urban wood charcoal consumption alone is estimated at 800,000 tonnes of charcoal per year, or approximately 4.1 million tonnes of wood.¹ Other large users include bakeries, dry cleaners, laundries, street vendors, and schools. Almost all users burn biomass fuel in relatively poor performing stoves or on open fires, whether at the household, small and medium enterprise (SME), or institutional level. Further, local kilning technology is highly inefficient, resulting in low conversion rates for wood to charcoal.

There has been little progress in Haiti toward the use of more efficient cookstoves, sustainable and efficient wood charcoal production, or alternative fuels to relieve the pressure on wood resources. This dependence on solid fuels and limited availability of higher performing cookstoves leads to a multitude of climate, environment, economic, gender, and health impacts that impede sustainable development in Haiti. Alliance analysis suggests that harvesting wood for household cooking in Haiti contributes to a loss of woody biomass by as much as 800,000 tons per year. Further, GHG emissions from cooking are estimated at 3.3 million metric tons of CO₂e per year. In 2015, over 8,000 premature deaths were attributed to household air pollution (HAP) from solid fuel use in Haiti, making HAP from household energy combustion the 2nd largest risk factor for mortality.

Woodfuel Use and Traditional Cooking Practices

HOUSEHOLDS

Cultural traditions combined with the high price, constrained resources, and limited availability of alternative fuels drive the reliance on woodfuels. Ninety-three percent of household energy for cooking comes from wood charcoal and wood, while only 3% of households use LPG, natural gas, or biogas (DHS 2012). Less than 1% of Haitian households cook with electricity, kerosene, or other fuels. The dependence on wood charcoal and fuelwood for household cooking fuel has remained steady over the past two decades. The use of woodfuels has a disproportionate impact on women in Haitian households because they spend twice as much time on domestic responsibilities compared to men, including firewood collection and food preparation (USAID “Gender Assessment” 2016). The use of fuelwood compared to wood charcoal closely reflects the urban-rural divide. Approximately 72% of rural households use wood as their primary cooking fuel, versus only 7% in urban households, whereas in urban areas, 80% of households use wood charcoal.

1 Based on an average of 20% kiln efficiency

Two trends have been observed in the past decade. First, more wood is now transformed into charcoal than burned as fuelwood. As Haiti continues to urbanize, demand for wood charcoal will grow, putting further pressure on Haiti's biomass stocks. Second, as buying power has increased in urban centers, the use of alternative fuels, specifically LPG, has also increased. While LPG use is only 3% nationally, in urban areas LPG use is estimated at 6% and as high as 8% in PaP (DHS 2012).

The average household's annual income is 815 USD (World Bank 2015), with average fuel expenditures constituting over 10% of annual income. Bottom of the pyramid households, which are predominately female-headed, cannot afford the large upfront cost for alternative fuels that are typically supplied in larger quantities than wood charcoal (USAID 'Gender Assessment' 2016). While some alternative fuels may be comparable to wood charcoal on a daily expenditure basis, charcoal is perceived as the most affordable option. Additionally, cleaner fuels such as LPG and ethanol have limited distribution networks and suffer from inconsistent supply and price fluctuations, whereas wood charcoal is available throughout urban centers within short walking distances of most households.

As seen in other countries around the world, cooking practices are often deeply imbedded in a country's culture and traditions. Consumer preference surveys found that Haitians generally prefer the taste of food cooked over wood charcoal (Nexant 2010). The traditional Haitian meal of rice and beans, an important staple for most households, requires extended cooking times on both low and high heat. The midday meal is normally the largest of the day, requiring several hours to prepare and the highest fuel usage. Other techniques include boiling, frying, sautéing, and grilling—all of which require high heat (ICTP "Longitudinal Study" 2014).

SMALL AND MEDIUM ENTERPRISES (SMES) AND INSTITUTIONS

After households, small and medium enterprises and institutions account for the next largest share of woodfuel consumption.² Similar to the household trend, the division between fuelwood and wood charcoal use follows the rural-urban divide. Fuelwood is the predominant fuel in rural bakeries, dry cleaners, and laundries. Wood charcoal dominates in urban areas and among street vendors. A small number of urban bakeries, dry cleaners, laundries have switched to LPG or diesel, but the exact quantity is unknown.

In the context of high food insecurity (50% of the population is undernourished), many households rely on schools to provide their children's main meal (WFP 2015). Thirty-five percent of Haiti's 13,000-plus primary schools provide lunch for their students, and fuel costs to meet this cooking need are a significant constraint on schools' financial resources. Bakeries and street vendors or "Manjekwits" in Haiti are also an important source of food for both urban and rural communities. Over 1,000 bakeries operate in Haiti using wood, LPG, and diesel. In Port-au-Prince, there are over 10,000 street vendors, mostly women, selling food in marketplaces and along the roads, the majority of whom cook over wood charcoal (Nexant 2010, USAID 2016). Past research identified 2,000 of those street vendors as "heavy charcoal consumers" (Nexant 2010). The USAID/Chemonics Haiti Improved Cooking Technology Program (ICTP) (2014) targeted street vendors for conversion to LPG. Upon completion of the program, around 20% of street vendors in the program area had adopted LPG.

Additionally, Haiti has a culture of dry cleaning and commercial laundry, and there are an estimated 140 operating laundries and dry cleaners using predominately wood and diesel.

WOOD CHARCOAL PRODUCTION

Charcoal production is a significant component of both Haiti's culture and economy. Charcoal, because it can be purchased near peoples' homes and in small quantities, is considered the most affordable and reliable cooking fuel for households in urban areas, and the production of charcoal in rural areas is a convenient and stable source of income (UNEP 2016). Estimates place the value of the industry in the order of magnitude of several hundred million US dollars per

² While anecdotal evidence indicates that SMEs and institutions represent a significant share of woodfuel consumption and best estimates based on the available data places this number between 8 and 20% of total wood consumed, the exact quantity of woodfuel consumed by either is unknown and would benefit from further research in order to better target interventions.

year, and as high as 250 million USD (key informant interview, Sept 2015). Charcoal is produced in rural areas, primarily in *rakbwa* (woodlot) systems that are common throughout the countryside, and then transported to urban centers for sale (Tarter 2015). Women are predominately engaged in the sale and distribution of charcoal, while men are the primary producers; however, for those women who do produce charcoal, it accounts for a higher proportion of their income than it does for men (ENEA 2016; UNEP 2016). While professional *chabonye* (charcoal producers) who dedicate their time to charcoal production exist, most of the production occurs as an occasional activity (Tarter 2015; ESMAP 2007) to mitigate risk and income gaps due to seasonality of other sources of income, such as small-holder farming. Nonetheless, as many as 200,000 people are employed in the charcoal value chain. Charcoal production is especially vital in times of economic hardship—such as when families have unexpected expenses, or when natural disasters occur—because it can be quickly produced and demand for the product is stable. A survey of charcoal producers found that the three main reasons for producing charcoal were to buy food (38%), to pay school fees (28%), or for cash for household needs (27%) (UNEP 2016).

When trees are grown for charcoal production, almost half are cut on the harvester's own land. An additional 8% of producers pay to harvest wood from other's land. This accounts for perhaps a quarter of wood charcoal production. The remaining wood needed for charcoal production is purchased (UNEP 2016). The most common type of kiln is a traditional earth mound kiln, which controls oxygen and prevents wood from burning completely. Earth mound kilns in Haiti have an estimated average dry mass conversion efficiency of around 20% (SEI 2016), meaning it takes approximately five tons of wood to produce one ton of charcoal. Kiln construction, including size and shape vary considerably among different charcoal makers and thus, the conversion efficiency also varies (TARTER 2015).

Some rural communities are now exploring sustainable solutions to restore depleted wood stocks by cutting trees using a method that allows them to naturally regenerate. However, the extent of sustainable domestic charcoal production remains a topic of debate, with little data available. In Haiti's South Department, reforestation initiatives have attempted to regenerate forest cover by educating charcoal producers and community members on sustainable harvesting practices; approximately 27% of surveyed households in the South have previously participated in a reforestation project (UNEP 2016).

Impact of Current Cooking Practices

ENVIRONMENT AND CLIMATE³

Haiti suffers from severe environmental degradation and is highly vulnerable to the impacts of climate change. These environmental impacts impede Haiti's economic development and pose a significant threat to the population (USAID 2017). Historical deforestation from the colonial period has contributed to (or caused in some cases): damage to the riparian systems, soil-silting of lakes and coral reefs; the decline/loss of diversity of flora and fauna; increased climatic drying; and increased vulnerability to the effects of tropical storms and hurricanes (Tarter et al. 2016).

Eighty percent of rural Haitians (3.53 million people) depend on agriculture production for their income (World Bank 2015). Rural out-migration has resulted from several decades of national decline in agricultural productivity (Tarter et al. 2016). Between 2014 and 2016, this situation was compounded by severe drought and flash flooding. In 2016, Hurricane Matthew struck the southern region of the country, devastating most of the agriculture zones that survived the previous three years of drought (USAID 2017). Haiti's urbanization over the last decade can be attributed at least in part to the impacts of environmental degradation on rural livelihoods.

In Haiti, as in much of the developing world, the use of solid fuels, traditional cookstoves, and unsustainable harvesting of woodfuel, causes a myriad of environmental problems such as air pollution, climate change, forest degradation, and loss of biodiversity. Burning solid fuels releases emissions of some of the most significant contributors to global climate change: carbon

3 For more information please refer to SEI 2016 final report

dioxide, methane, black carbon, and other short-lived climate pollutants (SLCPs). Unsustainable wood harvesting for charcoal production (as discussed above) also contributes to forest degradation, thereby reducing carbon uptake by forests. Annual greenhouse gas emissions from cooking are estimated at 3.3 million metric tons of CO₂e at point-of-use.

Haiti has long been considered an archetypal case of woodfuel-driven deforestation, and the media has perpetuated the narrative that woodfuel harvesting causes deforestation (Cobb 1987; Diamond 2005; Gronewold 2009; Auch 2014). Official reports of forest cover in the country reinforce the notion that Haiti's tree cover is under extreme stress, and that the country has very little forest remaining (reports fall between 2 and 4% of forest cover remaining) (FAO 2000, 2005, 2010). However, more recent analyses have raised questions about the accuracy of these assessments. For example, by examining higher resolution images that better capture the patchiness of Haiti's existing tree cover, researchers find that forest cover in Haiti could exceed 30% (Churches, Wampler et al. 2014), and other analyses support these findings (Tarter 2016).

Demand for wood charcoal and fuelwood is driven largely by rapid urbanization. The impacts of increasing demand remain uncertain, and may extend beyond Haiti's borders. For example, numerous reports note that large volumes of Haiti's wood charcoal originate from the Dominican Republic (ESMAP 2007; Kheel 2014), which has also experienced high rates of forest loss. Thus, although the condition of Haiti's forest cover may not be as dire as some analyses have portrayed, there is reason for concern as Haitians attempt to meet their growing demand for energy while avoiding additional forest degradation in their own country and in neighboring Dominican Republic.

HEALTH

Globally, daily exposure to toxic smoke from traditional cooking practices is one of the world's biggest killers, particularly for girls and women. Smoke from cooking causes a range of chronic and acute health effects, including chronic obstructive pulmonary disease (COPD), ischemic heart disease, stroke, and acute lower respiratory infections in children. Additionally, babies born to exposed mothers are, on average, almost 90 grams lighter at birth (Amegah et. al 2014). Research shows that when levels of cooking smoke are significantly reduced, women and children are healthier and less likely to suffer from deadly diseases (Ezzati and Kammen, 2002).

In Haiti, the high rate of woodfuel consumption used for cooking leads to negative health impacts. Burning solid fuels in inefficient cookstoves results in incomplete combustion, which produces high levels of household air pollution (HAP). HAP from cooking is the second-leading risk factor for mortality in Haiti; the only greater risk factor being high blood pressure (IHME 2015). In 2015, approximately 8,000 Haitians, including nearly 1,100 children under 5, died from diseases related to exposure to HAP from cooking with solid fuels. The majority of these deaths, are due to COPD; lung cancer; lower respiratory infections; ischemic heart disease; and stroke (IHME 2015).

LIVELIHOODS

While firewood is collected for free in rural areas, the cost of wood charcoal for urban and peri-urban households constitutes a substantial part of household income. Households that purchase fuel (as opposed to collecting it) spend approximately 10% of their annual income on fuel. This is compounded by the use of inefficient stoves. These are resources that could otherwise be spent on food, medicine, school fees, and other household necessities. Furthermore, the poorest households end up paying the most for their fuel as they cannot afford to buy in large quantities. On the other hand, wood charcoal production is an important source of income for many households and the wood charcoal industry as a whole is a significant component of Haiti's economy. Any interventions that displace wood charcoal with alternative fuels should take this into account and seek to mitigate the potential negative effects on rural livelihoods and the economy as a whole.

Gender Equality and Women's Empowerment

Due to existing gender norms and inequalities, the negative impacts (highlighted above) on climate, environment, gender, livelihood, and health fall disproportionately on women and girls. While Haitian women play a central role in Haitian society, they do not have equal decision-making power compared to men when it comes to rights, access to resources, and opportunities (USAID "Gender Assessment" 2016). Women also lack representation in government, from the national level down to the municipal level. Women are more likely to be illiterate than men, which impacts their employment opportunities (DHS 2012); the unemployment rate among women is twice as high as men, and the women who do work in the formal economy are paid on average 32% less than men (World Bank 2014). Ultimately, the combination of time poverty and social subordination restricts women's ability to participate on an equal basis with men in public life and increases their vulnerability to poverty.

In households, women and girls bear the primary responsibility of household tasks including cooking and collecting water, and spend twice as much time on these domestic responsibilities as men with little or no remuneration (USAID 2016).⁴ Additionally, 40% of households are female-headed (DHS 2012). This means women and girls disproportionately suffer the negative health effects from inhaling smoke while cooking over inefficient stoves with traditional biomass. In 2015, women accounted for 58% of the deaths related to exposure to HAP (IHME 2015).

However, women do experience "relative agency and mobility within their households"; 73% of married women participate in decisions about their own health care, and 78% have sole or joint-decision-making power for major household purchases (DHS 2012). This decision-making power when it comes to fuel and food purchases, demonstrates the role women can play as agents of change, especially in the clean cooking sector.

OPPORTUNITIES AND CHALLENGES FOR GENDER EQUALITY AND WOMEN'S EMPOWERMENT IN THE CLEAN COOKING SECTOR

In the context of Haiti, there are both opportunities and challenges for gender equality and women's empowerment in the clean cooking sector. Haiti's cookstoves and fuels market is male-dominated, and women hold few management and decision-making positions in enterprises producing cookstoves and fuels (Alliance 2016). Men dominate segments of the value chain with the highest income-earning potential, such as processing of alternative fuels, while women in Haiti tend to dominate the sales segment of various fuel value chains (ENEA 2016). A study conducted by UNEP (2016) of the South Department found that women were engaged in wood charcoal trading as a main primary and secondary economic activity, but this does highlight a gap in women's leadership and diversification of income.

Women are disadvantaged in becoming more engaged in the value chain, as well as challenged in affording and accessing cleaner and more efficient cookstoves and fuels. According to the USAID 2016 Gender Equality and Women's Empowerment Assessment, there is limited business development and capacity-building support for female business owners. Women face extremely limited access to market and credit systems; only 14% of women, compared to 21% of men, had an account at a financial institution in 2014 (World Bank).

On the other hand, Haiti is dominated by women in the trade and services sectors (70% of those employed in the trade sector are women) (USAID 2016). While these sectors are more vulnerable to economic shocks and provide a lower source of income than the male-dominated sectors, women in these sectors tend to be self-employed, often entrepreneurs and business owners. For example, the network of female business owners called Les Madames Saras presents an opportunity to capitalize on women's potential as agents of change. Les Madame Saras are rural women that purchase and transport agricultural produce from rural areas to larger markets. Many are independent entrepreneurs, while others have a network of employees. These women

⁴ Globally, we know that the opportunity cost of using firewood can be high for women and girls, as they can spend many hours per day collecting firewood. This takes time away from other income-generating opportunities. In the context of Haiti, there is a lack of data to indicate whether or not women and girls are the primary collectors of firewood or how much of a time burden this generates. This area would benefit from further analysis.

provide important links between small-holder farmers and the urban and peri-urban consumers (USAID 2016). Additionally, even though women rarely own land, they dominate the labor force in the agriculture sector, and the 2016 ENEA analysis demonstrated, women could play a key role in the value chain for cleaner fuels such as ethanol and carbonized briquettes, as well as sustainable wood charcoal.

Adoption of cleaner and more efficient cookstoves and fuels can impact women and girls in the most critical areas of their lives. Access to clean cooking solutions can decrease time-intensive cooking and fuel-collection tasks, allowing women and girls to pursue other activities, such as education, earning income, or rest. Reducing and redistributing unpaid care work including cooking and fuel collection is vital to the economic and social empowerment of women and girls and their household, community and national economies. While more comprehensive data collection and analysis is needed regarding changes in workload and time use as a result of clean and efficient cookstoves, the existing research is compelling. One 2016 study in rural northern India showed that the use of liquid petroleum gas (LPG) stoves resulted in an 80% reduction in time spent on fuel collection (Brooks et al, 2016).

Moreover, women play a crucial role in the widespread adoption and use of clean household cooking solutions because of their central responsibility for managing household energy and cooking, and women are a critical component of the sector's ability to scale. Women must be fully integrated into the process of designing products and solutions; without their opinions and input, products will not meet their needs and will not be consistently used. For this reason, it is also important to examine both the impact of using higher quality stoves and fuels on women and girls' income, health, and well-being, as well as the benefits to women's livelihoods as a result of increased engagement along the cookstoves and fuels value chain.

Market Development Challenges and Opportunities

This section examines the current state of the cookstoves and fuels market from the perspective of the enabling environment, supply of and demand for cookstoves and fuels, and identifies key barriers to change and opportunities for progress. Households, institutions, and SMEs are more likely to adopt cleaner and more efficient cookstoves and fuels when there is an available supply of affordable products; strong, informed demand for those products; and an enabling environment that includes national policies and systems that are favorable to clean cooking technologies and fuels. Consultations with key stakeholders, desk research, and consultancies have helped to create a holistic picture of cookstove and fuel production and use in Haiti, as well as the current state of the enabling environment, but further investment in developing the evidence base would fill key information gaps.

Haiti's complex history, high poverty levels, frequency of natural disasters, increasing vulnerability to climate change, and evolving political landscape create overarching challenges to market development. In Haiti, cookstove and fuel enterprises face a difficult operating and policy environment with tariff barriers, lack of access to raw materials, and weak sector coordination mechanisms. Consumers' inability to pay for higher performing⁵ products and low awareness of the benefits of clean cooking further complicates the growth path and investment prospects for the enterprises in the sector. While some of these challenges are similar to those in other developing countries, such as the differences in practices between rural and urban households, other barriers are unique to the Haitian context.

At the same time, while Haiti has historically faced many challenges, there are also many opportunities for progress, and the stable transition to power of the new government is a hopeful harbinger for the future. There is also a strong culture of entrepreneurship that lends itself to innovation, and the strong support for market-based solutions in the new government offers opportunities for the clean cookstove and fuels sector. In the past, lack of coordination among donors, implementers, and government has stymied development efforts. However, over the

5 Throughout this document higher performing is defined as cleaner and more efficient.

past few years there is a renewed motivation to establish coordinated and collaborative action with the Government of Haiti in a leadership role. Despite delayed elections throughout the development of this strategy, the new President came into office with little resistance or unrest. Further, though Hurricane Matthew wrought destruction in the south in the fall of 2016, the aftermath also catalyzed the government, civil society, and private sector, towards concerted action to address climate change and environmental degradation.

This strategy, as articulated in Section II, was designed to respond to the barriers to market development as well as to capitalize on the opportunities for progress.

MARKET ENABLING ENVIRONMENT

Clean cooking is imperative to ending energy poverty and reaching global energy goals. Over 50 countries currently include household cooking energy in their (I)NDCs, which demonstrates increasing interest in clean cooking to deliver health and climate co-benefits. Additionally, clean cooking can contribute to achieving the Sustainable Development Goals (SDGs), directly advancing 10 of the 17 globally adopted goals.

Fostering an enabling environment for a thriving clean cookstoves and fuels market through the development of appropriate plans and policies is crucial for advancing the sector. This often entails a range of activities that can be prohibitively expensive for any one stakeholder to undertake, and are best suited for a collaborative process involving a variety of stakeholders with complementary skills. A strong enabling environment is comprised of sustained government support and engagement on clean cooking, effective advocacy for a policy and regulatory environment that supports investment and growth, and appropriate cookstoves and fuels standards that are enforced by government.

A cookstoves and fuels market cannot thrive in Haiti without stakeholder buy-in. National and local government engagement in clean cooking initiatives are important success factors, even under a largely market-based approach where the private sector undertakes delivery of products and services. Government stakeholders can fast-track or undermine efforts to increase adoption of cleaner and more efficient cookstoves and fuels. Civil society and local commercial enterprises can also make a critical contribution to efforts, as their knowledge of the local context gives them insight into the challenges of market development. This is particularly important in Haiti, where many people cite a history of failed and unsustainable development initiatives and donor-led programs due to a lack of local ownership.

The Government of Haiti at the national level has been involved in addressing the need for cleaner and more efficient cookstoves and fuels. There is a strong cohort of technical experts across the ministries of Environment, Agriculture, and Bureau of Mines and Energy. These experts have led on initiatives with the World Bank, USAID, CARE, etc. The GoH has expressed a high level of interest to engage on clean cooking. Multiple ministries (including Environment, Agriculture, Bureau of Mines and Energy, Women, and the Bureau of Standards), recognize the co-benefits of incorporating clean cooking into their respective climate, environment, gender, energy, and health policies.

However, there are opportunities to strengthen and coordinate across government institutions nationally, and to extend the effort locally to balance potential competing priorities. Given turnover within the government, especially among leadership, greater capacity and coordinated government engagement is needed at multiple levels. To ensure continuity and sustained impact moving forward, building capacity and buy-in at the political and technical levels of government and establishing coordination mechanisms between civil society, development organizations, and government will be critical. This strategy is designed to assist Haiti in reaching the commitments laid out in the SDGs and Haiti's INDC to address climate change.

POLICY AND REGULATORY ENVIRONMENT

The GoH has included clean cooking objectives in several national energy and climate plans, demonstrating an increasing interest in clean cooking. Recognizing clean cooking's contribution to mitigating climate change and sustainable development, the GoH included clean cooking objectives within their INDC in advance of COP21.

The following strategic objectives are included in Haiti's INDCs:

- Increase the share of renewable energy in the Haitian electricity system to 47% by 2030 (hydro 24.5%, wind 9.4%, solar 7.5%, biomass 5.6%);
- Reduce woodfuel consumption by 32% by 2030;
- Put in place well-managed energetic forests (10,000 ha by 2030);
- Develop and implement transport nationally appropriate mitigation actions;
- Promote the use of energy-efficient stoves to replace traditional stoves (energy savings of 25-30% per stove);
- Improving the energy efficiency of wood charcoal kilns (increase yields from 10-15% to 30-45%); and
- Distribute 1 million efficient lamps as substitutes for incandescent bulbs.

Clean cooking has also been included in drafted national plans by the Bureau of Mines and Energy and the Ministry of Environment:

Ministry for Public Works, Transportation and Communications, Bureau of Mines and Energy — Haiti National Energy Sector Development Plan (NESDP) 2007—2017

The BME led the creation of a ten-year plan to radically develop Haiti's energy sector. The approach contains ambitious plans for reducing wood fuel use: 25% of urban biomass-using households to convert from wood and charcoal to alternative fuels by 2015; the dissemination of improved stoves to 17% of the families in the urban area by the year 2015; and an overall goal for 36% of the households using either kerosene, LPG or improved stoves by the year 2015.

National Strategy for Improved Stoves, 2011, UNEP and the BME

In 2011, the BME, with support from UNEP, developed the Government-led Enhanced Stove Working Group that produced the National Strategy for Enhanced Stoves to guide investment in the sector. This strategy was based on a 10-year vision, aimed at a sustainable and large-scale expansion of the market for improved wood and wood charcoal stoves and alternative fuels under the leadership of the Haitian government. The strategy proposed a two-year time frame and a budget of \$10 million.

ESMAP; Haiti: Strategy to Alleviate the Pressure of Fuel Demand on National Woodfuel Resources, 2007 (with support from Ministry of Environment and the Bureau of Mines and Energy)

In 2006, the World Bank's Energy Sector Management Assistant Program (ESMAP) conducted a study on household energy with support from the Ministry of the Environment and the BME to develop a strategy to provide options for improving household energy. The research conducted during this study provides useful data on household energy and woodfuel use. The strategy aimed to:

- 1) improve land management by farmers; 2) promote the efficient use of wood fuels; 3) increase imports and/or local manufacturing of more efficient stoves; 4) develop a mechanism to supply imported substitution fuels; and 5) increase manufacturing and/or imports of equipment required for producing substitution fuels from agricultural origin, such as briquettes (ESMAP 2007).

Though the GoH has indicated an interest in supporting the development of a clean cooking sector through these proposed plans and INDCs, increased capacity and coordination mechanisms are needed to implement and realize impact.

Further, regulation that enables financial inclusion, facilitates investment in the sector, and ensures the safe distribution and use of fuels remains under development or has yet to pass into law. Many of the existing clean cooking related policies are designed to protect local industry, but are difficult to interpret by both local and foreign businesses (Dalberg 2016). For example,

currently no requirements exist for LPG micro-distributors to conform to safety standards and the widespread unregulated filling of cylinders poses risks for consumers. Attempts have been made to regulate the industry and a law has been drafted but not passed. Lack of regulation is a significant barrier to scale for the major LPG players. However, if the legislation were to be passed into law, it would be perceived as disadvantageous to local players because conforming to safety regulation would increase their costs, effectively squeezing them out of the market (Chemonics 2015; key informant interviews).

Wood charcoal production is also not subject to clear regulation, which has led to the propagation of misinformation regarding whether it is a legal activity, and has dissuaded investment in improved charcoal production techniques and alternative fuels (UNEP 2016; USAID 2016; key informant interviews). The Ministry of Agriculture, the Ministry of Environment, and the Bureau of Mines and Energy all have mandates for governing parts of the wood energy sector. At times, all activity has been banned in the charcoal sector, but the government has little enforcement power (UNEP 2016).

TAXES AND TARIFFS⁶

The Haitian government collects an estimated \$1.2m annually in taxes and tariffs on stoves and cooking fuels, amounting to nearly 0.1% of annual revenue. Among fuels, wood charcoal and LPG are exempt, while briquettes face a 10% value-added tax on all sales. Ethanol fuel is most severely disadvantaged since importers face a 10% value-added tax in addition to a 21% custom duty and other fees. While denatured ethanol fuel is exempt from tariffs, incorrect classification renders ethanol fuel subject to medical tariffs which amount to 15%, in addition to administrative and other fees.

Taxes and tariffs on cookstoves are more problematic since accessing an affordable cookstove remains the biggest barrier to adoption of cleaner and more efficient options in Haiti. All stoves are subject to a 10% value-added tax, although some companies have secured exemptions. LPG and ethanol stoves face other trade barriers, rendering their effective rates at 26% and 27%, respectively. Cookstoves and fuel companies struggle to advocate for trade exemptions because disaggregating each specific tax/tariff that comprise the effective rate is challenging, and customs officials exercise high degrees of discretion in applying these fees (Dalberg 2016). However, as of 2017 at least one enterprise had gained a tax-exempt status as part of a policy to promote “socially impactful businesses” and another is in the process of applying. There may be opportunities to support other businesses to take advantage of similar tax relief programs.

STANDARDS AND LABELING⁷

Standards and standards implementation policies are in the early stage in Haiti, indicating the need for gradual implementation of standards to encourage industry and consumer investment in cleaner and more efficient cookstoves and fuels. Initially, S&L efforts may have the most impact on the demand for cleaner and more efficient biomass stoves, as switching to them is the easiest transition for most consumers. Currently, clean fuels are already deemed quality products simply because they are more expensive, and the distributor brand name serves as the mark of quality. Any label would likely have little impact on these products at this early stage since they are already widely recognized.

The ambiguity in roles, responsibilities, and interactions between and within institutions complicates the establishment and enforcement of standards. The Bureau of Mines and Energy (BME) has responsibility over cookstove policy, but their efforts are affected by limited funding and challenges in passing regulation. The Bureau of Standards (BHN) has been recently set up with foreign funding to build a culture of quality in Haiti—through the implementation of standards development, certifications, and conformity assessments. However, they are not yet engaged in cookstove policy and have not implemented standards. The GoH is motivated to make strides towards achieving their INDCs, and S&L policies for cookstoves are a potential mechanism to meet the climate targets. Instead of attempting to develop new S&L programs or institutions,

6 For more information refer to Dalberg 2016 report

7 For more information refer to CLASP 2016 Report

there is an opportunity for future efforts to support and build on existing programs and projects within both the BME and BHN to increase capacity to develop and implement standards.

TESTING FACILITIES⁸

Under the ICTP, a testing laboratory for cookstoves and fuels was established in Haiti's Faculté des Sciences (FDS) at the Université d'Etat d'Haïti (UEH). FDS test laboratory staff have developed a certification procedure manual for stakeholders, and they train students to conduct tests of cookstoves and analyze the test results. However, due to limited staff, testing often takes several months after the original request to complete. Staff would benefit from increased capacity and training, and the test laboratory equipment and facility also need updating.

SECTOR COORDINATION

Haiti's clean cookstoves and fuels sector is small, yet the enterprises and NGOs are not coordinated with each other or the government in a systematic way. The sector could benefit from a coordination mechanism that could organize regular meetings and lead on advocacy efforts to the Government of Haiti.

SUMMARY OF BARRIERS TO AN ENABLING ENVIRONMENT

1. **High taxes and tariffs on stoves and fuels is a barrier to market entry and scale.** Taxes and tariffs on cookstoves are problematic since accessing an affordable cookstove remains the biggest barrier to adoption of cleaner and more efficient options in Haiti and prevents producers from lowering prices.
2. **Regulation and enforcement of wood charcoal production lacks clarity and consistency.** The lack of a clear policy and enforcement mechanisms for the charcoal industry makes it difficult to identify opportunities to increase supply-chain efficiency and creates a disincentive for investment in improved charcoal production techniques.
3. **Lack of a coordinating association for clean cookstoves and fuels limits the ability of enterprises and NGOs to effectively advocate for changes in regulations and policies.** Lessons from other countries suggest that civil society and private sector coordination is critical for alignment of interventions by various actors and for the sector to speak with one voice in prioritizing government action.
4. **Government, donors, and investors do not provide long-term financing, which limits the growth and sustainability of projects/investments.** Efforts to improve the cooking sector in Haiti have never received long-term donor support, which has resulted in relatively incremental and short-term gains.
5. **Absence of enforced regulations on LPG limits the willingness of LPG importers and distributors to scale their investments in the sector.** For safety reasons, the major LPG players are reluctant to scale up imports and distribution while the sector is unregulated.
6. **There is no standards system in place to inform consumers, government, and other stakeholders about the quality of products.** The burgeoning standards and labeling policy in Haiti, spearheaded by the BHN has not yet been applied to the cookstoves and fuels industry.
7. **Clean cooking initiatives have not effectively engaged organizations from other sectors (agriculture, health, etc.), which has limited their effectiveness in achieving impact at scale.** The cookstoves and fuels sector in Haiti remains heavily "siloed" due to the limited appreciation of the integrated impacts of using traditional cookstoves and fuels by donors and implementers (key informant interviews).

8 Ibid.

8. **The business environment is challenging for startup enterprises and investment.** Haiti has a difficult business environment; the World Bank scores Haiti 181 out of 190 countries for ‘ease of doing business’ (World Bank 2017).
9. **The prevalence of NGOs and other charitable organizations in Haiti.** Many organizations have for many years pursued non-market based social interventions, including the donation of clean cooking solutions, which has distorted market dynamics and impacted consumer expectations in some areas – this poses challenges to businesses pursuing for-profit models.
10. **Lack of coordination on clean cooking among government ministries and limited capacity** make it difficult to leverage supportive government programs and establish policies to enable market growth.

SUPPLY OF COOKSTOVES AND FUELS

Ensuring sufficient supply of high-performing products that customers want at a price they can afford is a necessary component for advancing the adoption of clean cookstoves and fuels. This requires several conditions to be in place, including: adequate capital for enterprises to finance product development and business growth; access to raw materials; access to support for improving business models; better market intelligence; and women’s engagement in the value chain. When these conditions are in place, there will be a strong production capacity that is able to respond to increases in demand, and there will be a wide range of clean and efficient products available at different price points.

The following section examines challenges and opportunities for scale within the cookstoves and fuels supply chains, as well as the viability of different fuel pathways. Though each supply chain faces distinct problems, producers and distributors face common barriers to scale. The preliminary market analysis (2016) concluded that sector development is hampered by limited access to capital, capacity constraints, women’s underrepresentation in the value chain, and lacks strong distribution networks. However, opportunities exist that provide a path forward for scaling the clean cooking sector.

FUEL AVAILABILITY AND VIABILITY

Haiti presents a diverse set of fuel options with unique challenges and tradeoffs for consumer affordability, production and distribution costs, and scalability. (For detailed information on the supply chains of available fuels refer to Appendix IV)

PRICE

Most Haitians consider wood charcoal the least expensive cooking fuel, excluding fuelwood collected for free in rural areas. Analysis of the average daily cost of household cooking indicates that several alternatives to wood charcoal are cost competitive. The price dynamics were examined from two perspectives: 1) the actual retail price of available fuels in the market and 2) the estimated production costs of locally produced fuels.

AVERAGE HOUSEHOLD FUEL EXPENDITURE (RETAIL PRICE)

Currently, with a traditional stove and traditional wood charcoal kilning technology, the average household spends approximately 58-67 HTG/day on fuel. Approximately 10% of annual household income (assuming annual household income of 225,170 HTG) is therefore spent on cooking fuel alone. With cleaner and more efficient charcoal stoves and improved kilning technology, the average household fuel expenditure can be reduced to approximately 41-48 HTG/day, which is approximately 7% of annual household income. This would be a ~29% reduction in fuel spending. Liquid and gas-fuels are even more efficient. For LPG, the average household fuel expenditure can be reduced to approximately 29-37 HTG/day, which is approximately 5% of annual household income. This would be a ~47% reduction of fuel spending from traditional cooking.

Based on this analysis, LPG is less expensive than traditional options although LPG does have higher upfront costs. Briquettes, especially when used with a cleaner and more efficient cookstove, are also comparable to the cost of cooking with wood charcoal. Imported ethanol is

currently quite expensive due to limited scale, and import tariffs. Ethanol's high price may be a limiting factor unless costs for importing, local production, or retail margins can be reduced to competitive levels.

FUEL PRODUCTION VIABILITY⁹

The potential to scale different fuel options is a critical consideration for market development. A fuel may be attractive from a consumer price perspective, but production or sales may not be able to scale due to limitations in the available feedstock. Historical agricultural yields show significant variability from natural disasters, climate change, and disease (ENEA 2016). Dispersed farming makes crop residue collection challenging given the high transportation costs, non-existent storage facilities, transport networks, or agricultural extension services. The theoretical potential for biomass-based fuels locally produced in Haiti varies depending on crop output. If

⁹ For more information refer to ENEA 2016 final report

TABLE 1: FUEL AVAILABILITY

FUELS	PRODUCTION	DISTRIBUTION	AVAILABILITY	UNITS	PRIMARY USERS
CHARCOAL (WOOD)	Mostly by rural households using traditional methods, on either a full-time basis, or on occasion when extra money is needed; percentage of supply may come from DR but exact quantity unknown	Sold on roadside and markets often by women in rural areas and transported to cities by truck; highest profit to transporters	Very widely available (multiple vendors on every street and on all roads and markets in rural areas)	Marmite (occasionally other single servings), small, medium, and large sack	Urban and rural households, urban food vendors, urban schools with feeding programs.
WOOD	Mostly from trees grown on rural, privately owned land	Rural households collect from nearby fields/forests Vendors cut on privately owned land	Widely available for free collection in rural areas Specialized vendors sell wood to institutions/ industries in rural areas and some urban areas	Wood typically collected for free by rural households. Purchase is usually only by institutions in units of 28-30kg (called 'large packet,' 'charge,' & 'macoute')	Rural households, rural schools with feeding programs, rural bakeries.
LPG (PROPANE)	Imported from international sources	Most LPG is transported by truck from PaP, with a small amount imported from the DR by smaller LPG companies	Widely available in urban areas (especially PaP and Cap Haitien), but supply very limited in rural areas.	Bip (5lb), 12lb, 25lb, 50lb, 100lb	Wealthy urban households; some urban schools; and urban bakeries
CARBONIZED BRIQUETTES (FROM BAGASSE)	Produced in Cap Haitien	Distribution from Cap Haitien to bulk buyers (who distribute to small vendors) and Carbon Roots International-branded shops	Available in urban areas of PaP and Cap Haitien	Sold by marmite or large sack	Urban households previously using wood charcoal
ETHANOL	Produced in USA by POET, shipped to Haiti	Distribution at designated retail shops in PaP	Available only in PaP	Sold in 20oz, 1.5L, and 5L containers	Urban households

Adapted from USAID/Nexant 2010 report, updated with 2016 project research and key informant interview

low output conditions, such as existed in 2014, persist, then as little as 10% of urban household needs would be met. However, between 25%-50% of urban household cooking energy needs could be met in a middle-range output scenario. On the upper end, expanding sugar cane production and dedicating it to fuel production could enable local resources to play a more significant role in the cooking sector, potentially meeting as much as 90% of urban cooking energy needs.

COOKSTOVES

Traditional wood charcoal cookstoves produced by artisans are the most commonly used stoves in Haiti. Few cleaner and more efficient biomass cookstoves are available and are generally not high performing or long lasting due to the climate (due to high levels of salt in the air) and lack of durable materials. No commercial imported biomass cookstoves are currently available. Imported LPG stoves are readily available in urban areas but are sold at too high a price point for many households. Imported ethanol stoves that are assembled in country are available in some neighborhoods in PaP but are also sold at a price point that most bottom of the pyramid customers cannot afford. (For detailed information regarding available cookstoves refer to Appendix IV).

TABLE 2: COOKSTOVE AVAILABILITY

STOVE TYPE	FUEL	EFFICIENCY	OVERALL EMISSIONS (AT POINT-OF-USE)	INDOOR EMISSIONS (AT POINT-OF-USE)	AVAILABILITY
THREE STONE FIRE	Wood	Tier 0	Tier 0	Tier 0	N/A
TRADITIONAL CHARCOAL (ROUND AND REBAR)	Charcoal (wood) or briquettes	Tier 1	Tier 0	Tier 0	Widely available for purchase on the street and in markets
IMPROVED WOOD	Wood	Tier 2-3	Tier 2	Tier 2	Not commercially available
IMPROVED CHARCOAL	Charcoal (wood) or briquettes	Tier 2-3	Tier 1-2	Tier 1-2	Availability largely limited to Port-au-Prince through a network of distributors
GASIFIERS	Wood or pellets	Tier 2-4	Tier 2-4	Tier 2-4	Not commercially available
LPG	LPG	Tier 4	Tier 4	Tier 4	Available in urban areas (mostly Port-au-Prince)
ALCOHOL	Ethanol	Tier 4	Tier 4	Tier 4	Availability limited to Port-au-Prince
ELECTRIC	Electricity	Tier 4	Tier 4	Tier 4	Available in urban areas (mostly Port-au-Prince)
SOLAR COOKERS	Solar	N/A	Tier 4	Tier 4	Not commercially available

Note: Cookstove efficiency and emissions vary by model and by fuel; average values are provided here for reference; The Alliance defines (1) stoves that achieve Tier 2 or higher for efficiency as efficient, (2) stoves that achieve Tier 3 or higher for overall emissions as clean as it relates to potential environmental impacts, and (3) stoves that achieve Tier 3 or higher for indoor emissions as clean as it relates to potential health impacts.

SUMMARY OF SUPPLY-SIDE BARRIERS

1. **Low demand for cleaner and more efficient products.** Producers often face low demand for their products due to consumers' limited ability to pay, lack of awareness of new products, and the difficulty of changing traditional practices. Ability to pay for the improved products is by far the most cited barrier for producers, however the fear of consistent access to improved fuels and the behavior change required for higher performing products can also prevent technology switching.
2. **Cookstove and fuel enterprises have difficulty securing required investment.** There is a shortage of equity and debt capital interested and willing to finance the growth of early-stage companies. There is also limited local investment in-country, limited foreign direct investment, and an underdeveloped entrepreneurial ecosystem. The startup and growth costs faced by enterprises in the country are also high compared to competing markets. The situation is likely even more difficult for women who wish to start businesses but tend to lack collateral and assets, and consequently cannot access loans with the same frequency as their male counterparts.
3. **Cookstove and fuel enterprises have limited technical capacity.** Small, early-stage businesses have limited capacity to fund R&D to make products more affordable, more durable, and more desirable. Current cookstove models are not durable, lasting as little as six months due to the lack of consistent access to quality components and raw materials, combined with environmental factors such as the harsh climate which causes rapid deterioration of metal, and lack of standardized production. These factors limit the durability, performance, and potential for scale amongst those businesses attempting to deliver clean cooking solutions to consumers.
4. **Women are not fully integrated into the clean cooking value chain.** This further limits the pool of talent available to enterprises. Women are the fastest-growing cohort of entrepreneurs and business owners in the developing world, and when supported appropriately, women's involvement in the value chain may increase sales.
5. **Improved production techniques are risky for wood charcoal producers due to small profit margins.** Because wood charcoal is a necessary secondary income for many households, it is risky for producers to try a new production method, even if it could lead to greater production efficiencies. Additionally, the informality of the supply chain, make efforts to formalize and improve the efficiency of the supply chain challenging.
6. **Potential sector participants lack a consistent supply chain.** As mentioned above, there is a lack of consistent access to quality components and raw materials, which negatively impacts the ability of producers to deliver consistently high-quality, durable products.
7. **Fuel availability remains a challenge.** As with many similar markets, the availability and consistency in pricing, as well as the affordability, of fuel remains a meaningful barrier for consumers. For fuel producers, inconsistent access to feedstock can be an issue for a variety of reasons: 1) historical trade liberalization policies undercut local agriculture production leading to dependence on foreign imports of staple crops and decreasing local production; 2) Haitian agriculture producers tend to be relatively small-scale and dispersed; and 3) competition for feedstocks that have other uses, such as for alcohol production and fertilizer (ENEA 2016). For fuel distributors, several other factors can inhibit reliable business growth including end-user pricing (e.g. with globally-priced commodities such as LPG), reliability of supply for foreign imports (e.g. with ethanol), as well as production challenges (e.g. with efficient production of carbonized briquettes).

DEMAND FOR COOKSTOVES AND FUELS

Sustainable market growth occurs when consumers are both motivated to and capable of seeking out, purchasing, and consistently using higher-performing cookstoves and fuels. Consumers must first, be aware of the options and the benefits of high-performing products and second, be able to afford them. Most of the elements critical to drive consumer motivation and financial accessibility are performing at a low-level (or are altogether absent) in Haiti, and there has been little funding to date to address these needs.

CONSUMER MOTIVATION

Limited data exists on consumer awareness and motivation to adopt new cooking practices in Haiti. A nationally-representative survey on current behaviors and practices is necessary to fill this knowledge gap.

Following the culmination of the ICTP's communication campaign in 2013, a household survey implemented among a sample in PaP showed high exposure rates to certain communication channels. For example, 66.1% of respondents recalled having seen a television advertisement on "improved" cookstoves and 69.2% recalled radio advertisements. This suggests that the channel selection and message delivery were effective on a short-term basis. Presumably, awareness within rural populations is considerably lower since no large-scale clean cooking awareness campaign has targeted rural populations in Haiti.

Evidence from other countries confirms that awareness of the concept of "improved cookstoves" and some of the risks associated with traditional cooking practices are not sufficient to trigger behavior change. This was also true in the case of the ICTP campaign in Haiti, as only a small percentage of households purchased and used "improved" cookstoves afterwards, despite high awareness.

In addition, woodfuel's pervasive use in Haitian cooking practices presents a challenge for behavior change. Haitians report that alternative fuels do not create the same taste in prepared foods. Further, it is common practice to cook the staple meal of rice and beans over many hours. Many consumers do not believe that alternative stoves and fuels are suited to prolonged use due to the perceived cost of fuel for cooking over an extended period. Many households using alternative fuels practice fuel and stove stacking, using the alternative fuels or higher performing cookstoves for quick cooking while returning to traditional methods for prolonged use. (ESMAP 2007; key informant interviews). Anecdotal evidence from Haiti and other countries also suggests that the safety of clean-fuel burning technologies is a major barrier to adoption. Often, it only takes a single "horror-story" (LPG tank explosion, poisoning from ethanol) to distort perception of safety.

It is therefore critical that future campaigns go beyond building awareness, and focus on key messages and concepts that resonate with the target audience and trigger a desire to change. This includes addressing fears about the safety of clean-burning fuels, as well as their suitability in preparing the local cuisine. Additional research is needed to identify other key messages and approaches that will be effective in stimulating purchase and sustained use.

Experience from decades of behavior change communication in the health field suggests that sustained interventions are necessary to change deeply-entrenched cultural practices. Future campaigns should be sustained over multiple years and employ a variety of channels to ensure repeated and mutually reinforcing messages. Efforts should involve channels with high reach such as mass media, as well as more targeted efforts at the community level, such as engagement of women's groups. Lastly, campaigns should be implemented when there is a reasonable expectation that supply of cookstoves and alternative fuels could respond to increases in demand.

CONSUMER WILLINGNESS TO PAY (WTP)

The relatively limited research on WTP for cookstoves in Haiti suggests that most Haitians see a cleaner and more efficient stove as an aspirational good. Though more research on WTP is necessary to make definitive claims, the value placed on higher performing stoves by consumers indicates the motivation to switch to cleaner stoves exists.

A 2014 study (Sagbo) found that WTP for a cookstove depended on factors like stove type, location, and income level. They also found that WTP for a higher performing charcoal cookstove was greater in a rural area like Les Cayes than in more urban areas like Jacmel. The study concluded that rural users may compare a higher performing cookstove to the baseline of a traditional stove or three-stone fire, whereas urban residents are more exposed to and likely to compare the stove to high-end alternatives like gas. Interestingly, the study also found that consumers valued the stove's materials more than its fuel savings or size.

Other WTP estimates for a higher performing charcoal stove range from \$18.86 to \$43.70. These WTP results are encouraging as most improved biomass stoves in Haiti are within or below

this range. However, key informant interviews from cookstove manufacturers and distributors showed a lower WTP, indicating the need for more research.

CONSUMER FINANCE

Affordability of cleaner and more efficient stoves is the most often cited barrier to changing practices in the cooking sector. Past project evaluations, informant interviews, and research found that most consumers have insufficient liquidity to make the upfront investment in a higher performing stove. In 2012, over 50% of the population lived on less than \$2 per day (World Bank 2012). Even though many cleaner fuels, such as LPG and briquettes, are already competitive with wood charcoal in terms of daily costs (see Supply Section), purchasing a higher performing cookstove that costs even as little as \$10 is still challenging for most Haitian households.

Access to consumer financing will be vital for households to overcome the upfront investment cost of purchasing higher performing stoves. Globally, it is more evident that consumer finance is one of the critical enablers of expanding market access. The following section explores access to consumer finance in some detail as it will play a critical part in expanding the Haitian market.

MICROFINANCE INSTITUTIONS (MFIS) IN HAITI

Haiti's MFI sector is in an early stage of development. Though there are multiple active micro-finance institutions, MFIs only reach about 200,000 Haitians (MixMarket). Only 4.6% of individuals over 15 years had borrowed from a financial institution in 2015, and only 9.4% had saved with a financial institution (Global Microscope). The limited access to financial services in Haiti will likely limit any cookstove finance program that requires loans to be issued and managed by MFIs.

EMPLOYER FINANCING PROGRAMS

Employer finance is becoming a more common way for cookstove companies to provide financing for their products. This model usually involves a cookstove company and a large-scale employer such as a factory or agricultural cooperative collaborating to distribute stoves to employees, sometimes under a broader package of health interventions (water filters, solar lanterns, cookstoves, bed nets, etc.). The employer pays for the stoves up front and deducts a set amount of funds from each employee's paycheck. The cookstove company is responsible for marketing the stove to employees and providing after-sales service. Two cookstove companies in Haiti have initiated partnerships with employers such as multinational clothing company Levi Strauss to sell their stoves. They report that this model has been challenging to scale for two reasons. First, it is time-consuming—it takes time to establish a relationship with employers, find the right corporate decision-maker, and build trust in the product. Second, one cookstove company noted that many employers do not have the working capital to finance cookstoves for their employees up front. Furthermore, when companies approach local banks for loans, the banks require detailed information on all employees participating in the program, creating a significant administrative and cost burden for employers. This model is interesting to explore as part of consumer finance for cookstoves in Haiti. Since it is estimated that only about 10%-33% of Haiti's labor force is formally employed, only a limited number of households can be reached through this program.

IN-HOUSE FINANCING

Relying on MFIs or other external parties for consumer financing mechanisms is a challenging way to build a business, particularly one at scale, because they often have incentives and priorities that do not align with the enterprises' own goals. In-house asset financing approaches have proven a beneficial alternative in other markets. For example, in-house financing has been critical to the scale up of the solar sector in East and West Africa. Solar enterprises sell products to consumers on credit using leasing or pay-as-you-go approaches. Recognizing that providers of clean cooking solutions face even greater challenges related to demand and gross margins compared to solar companies, however, retailers that sell multiple products including cookstoves have significant potential to offer in-house financing to consumers. Additionally, the successful launch of a mobile money in Haiti in 2010, reaching over 800,000 users (~10% of the population) in two years, offers an attractive mechanism to scale pay-as-you-go distribution

models in the country, leveraging best practices from mobile money enabled distribution models in East and West Africa.

SUMMARY OF DEMAND-SIDE BARRIERS

1. **Consumers lack sufficient cash for the upfront cost of purchasing a cleaner and more efficient stove.** With incomes around a few dollars per day, the purchase of a cookstove at a price even as low as \$10, is a challenge for many Haitian households.
2. **A history of humanitarian aid and unsustainable development efforts has undermined consumers trust.** Past development efforts have undermined local industry and weakened local economies. Many Haitians are resistant to interventions that are perceived as promoting foreign imports, and in areas that have seen frequent stove giveaways, consumers may be unwilling to pay for what has previously been given away for free.
3. **Consumers have limited knowledge about the alternative cookstove and fuel options available to them or how to choose between them.** Outside of the metro area there is low awareness of alternative cookstove and fuel options. Even within PaP, distributors are concentrated in a few neighborhoods and have not yet invested in marketing to larger areas.
4. **Consumers do not know or believe that alternative fuels can be cheaper than wood charcoal or purchased fuelwood.** Because most consumers purchase charcoal daily and in small quantities, alternative fuels, which are sold in larger quantities, inherently appear more expensive to consumers.
5. **Some consumers associate safety risks with cleaner fuels like LPG and ethanol.** Due to the lack of safety regulation for filling points, there is a fear that LPG canisters that are not subject to safety checks might explode. Ethanol distributors must combat fears that people will consume ethanol fuel. These perceptions largely come from very exceptional cases, but are sufficient to dissuade some consumers from switching fuels.

LESSONS LEARNED FROM PAST PROJECTS

Since the 1980s, there have been over 20 cookstoves and fuels projects and national strategies of various scope and scale. Projects ranged in volume from a few thousand stoves to 80,000. The vast majority of projects targeted populations in the PAP metropolitan area. Large-scale projects and national strategies were most often developed between a multilateral organization such as the World Bank, a UN Agency, or a large INGO in conjunction with either the Ministry of Environment or the Bureau of Mines and Energy, or both GoH agencies. A significant number of projects and strategies were never implemented, and several were terminated early due to external factors. Yet, even when projects continued to the end of their timelines, the majority fell short of their projected impacts. The literature evaluating these projects and strategies, in combination with key informant interviews, identified three common barriers to realizing sustained impacts: 1) price—all projects noted the price of the stoves compared to traditional stoves coupled with consumer's low-ability to pay as the principal barrier to entry in the market; 2) limited time-frame—many projects lasted less than three years; 3) lack of institutions and regulation—the lack of standards and regulations, as well as the coordinating mechanisms, institutions, and distribution channels necessary to support the market have prevented enterprise scale-up.

KEY LESSONS LEARNED FROM PAST PROJECTS INCLUDE:

1. Sustained, long-term financing is needed for a large-scale cookstoves and fuels strategy to succeed in Haiti.
2. Coordination and buy-in across sectors is imperative to ensure that the impacts on health, environment, agriculture, livelihoods, and women are measurably achieved.
3. Government support is crucial to ensure that the policy environment in Haiti is conducive to the scale up of cleaner, more efficient cookstoves and fuels.

USAID/CHEMONICS IMPROVED COOKING TECHNOLOGY PROGRAM (ICTP) 2012-2015, 8.2 MILLION USD

The Chemonics/USAID Improved Cooking Technology Program (ICTP) was the most recent large-scale cookstoves and fuels project implemented in Haiti. The Chemonics project followed several years of research and market evaluation conducted by Nexant (Nexant 2010). The project was implemented in the metropolitan area of PaP with mixed results. The final evaluation found that 6% of households in the program area adopted improved cookstoves, and 44% of orphanages, 12% of schools, and 22% of street food vendors adopted LPG (Chemonics 2015). The final evaluation of the project identified five areas on which future projects should improve:

- (1) The financial burden associated with purchasing/switching to ICS is the most significant factor preventing adoption of the stoves as well as supporting the sale of products that have been shown to not be durable in the local environment.
- (2) The perceived explosion risk and the question of funding prevented users from switching to LPG.
- (3) A more focused awareness project on benefits to health and the environment of fuel switching is needed.
- (4) External factors, i.e. the lack of a functional parliament and ineffective government prevented the establishment of a regulatory framework for LPG. The project recommended that a team of technicians be set up to reconcile and contextualize various draft bills.
- (5) Projects should include all potential partners from the beginning of any process to prevent friction and promote transparency (Chemonics 2015).

Before USAID/Chemonics, there were two projects of significant scale in the late 1980s and early 1990s that still influence stakeholder views today. In the 1980s, the Bureau of Mines and Energy (BME), with support from the World Bank and the Government of Canada, developed the Recho Mirak improved charcoal cookstove. Between 1996 and 2003, CARE, in partnership with the BME, implemented a large-scale promotion and awareness campaign and distribution of the Recho Mirak improved charcoal stoves that included a “Mirak” label certification program. Even though the distribution of the stoves stalled in 2003 due to funding shortfalls, the Recho Mirak stove is still referenced today.

In the same period, a public-private partnership between the LPG industry (Shell and Sodigaz) and the Haitian and French governments attempted to increase the demand for LPG. The Shell-Sodigaz project (1988-1993) developed and distributed the Bip Ti Cheri LPG stove that was subsidized by the French government. The stove initially received widespread popularity due to the low price and the innovative nature of the technology. However, the 1991 international embargo forced the French government to end the subsidy for the stove, causing prices to rise and strangling sales. Critics note that the project was also hurt by the fact that the stove was not well adapted to the cooking needs of the Haitian household. Although the ownership of gas stoves increased from 1 in 10 households to 1 in 4 after the project, the sales of gas remained low (Ducasse 2008).

Strategy For Market Development

The ultimate goal of developing a market for cleaner and more efficient cookstoves and fuels is to reduce the negative climate, environment, health, and economic impacts from traditional cooking practices, particularly the disproportionate impacts felt by women and girls.

The complexity of the issue in Haiti necessitates the development of a comprehensive approach to strengthen the sector that considers the unique needs of the country. For a strategy to be effective, it must address the barriers to the establishment of a thriving cookstoves and fuels market, and the central role that wood charcoal plays in the Haitian economy and rural livelihoods. Therefore, this Action Plan proposes a market-based strategy to develop a strong cookstove and fuels market.

The objectives of the strategy are to:

1. Increase and improve the production and availability of cleaner, affordable, and more efficient cookstoves and alternatives to wood charcoal;
2. Improve the efficiency and ensure the sustainability of wood charcoal production;
3. Generate demand for cleaner, affordable, and more efficient cookstoves and fuels; and
4. Create a strong enabling environment to support sustainable market growth.

Underpinning the proposed strategy is a core belief that impact will be achieved by following six key principles that have been defined based on research conducted in Haiti and best practices gleaned from developing cookstove and fuel markets around the world.

GUIDING PRINCIPLES

Market-based approach. Inclusive market-based interventions have proven more effective than stove giveaways at achieving the adoption of cleaner and more efficient cookstoves and fuels.

Technology and fuel neutrality. While wood charcoal will remain a cooking fuel for the foreseeable future, consumers must be able to choose from a variety of cleaner and more efficient cookstoves and fuels.

Women's empowerment. Capitalizing on women's role as clean energy entrepreneurs and leaders in national and local efforts lead to the development of effective, culturally-appropriate, and sustainable solutions.

Long-term and sustained efforts. The substantial barriers to accessing cleaner and more efficient cooking energy requires a sustained investment to transform the market.

Local expertise. Local ownership drives sustainability; building on lessons learned from past projects, and relying on the expertise of Haitian managers lends itself to more effective program design and implementation.

Collaboration. Building on the ongoing work, knowledge, and expertise of local sector partners—including the many complementary donor, civil society, and private sector initiatives underway in Haiti, prevents duplication and allows for the design of more effective interventions.

SUSTAINABLE MARKET DEVELOPMENT

Given the nascent market in Haiti, sustainable development of a robust cookstoves and fuels market is expected to be a lengthy endeavor. A minimum 10-year, phased initiative (Initiative) is recommended to move the market forward. A short-term engagement would be inadequate to develop a market that both meets the needs of the population and simultaneously addresses the potential negative consequences from disrupting the status quo. A phased approach will likewise allow for a rigorous monitoring and evaluation process and the identification of the interventions with the most potential for reaching scale in the long-term.

- **Phase 1 (2018-2022) will build the foundation of the Haitian clean cooking sector, relying on pilots to prove the case for effective market interventions.**
- **Phase 2 (2022+) will drive investments, innovations, and operations to scale to truly transform the sector.**

To establish a strong foundation, Phase 1 will: build a coalition of actors to support the development of the market; identify and support potentially viable cookstoves and fuels enterprises; cultivate a robust evidence-base for market interventions; foster ownership of the strategy within the Government Haiti; solicit a multi-donor fund that is ideally leveraged by private capital; identify opportunities to reduce the environment and climate impacts of charcoal production; and advocate for the integration of women in the value chain. During Phase 1, a significant “test and learn approach” will be employed across all efforts so that learnings from the pilots can rapidly be integrated into longer term market transformation approaches in Phase 2.

MARKET INTERVENTIONS

Phase 1 will be focused on a combination of sector-wide market enabling interventions. The interventions recommended to move the market forward in Phase 1 can be broadly categorized as activities to enhance the market enabling environment, strengthen the supply of cookstoves and fuels, and to drive demand for cookstoves and fuels.

Interventions intended to **enhance the enabling environment** for the market include: capacity-building support for government and stakeholders; applied research, advocacy, and technical assistance to support government policy and regulation development and enforcement; and support for sector coordination. These interventions should help create an environment in which all market players benefit from greater coordination and a policy environment that favors growth and positive change. Phase 1 will also advocate for the inclusion of the voices of women and girls in the design of policies where they have historically been excluded.

Interventions intended to **strengthen supply** include: financing for enterprises engaged in the cookstoves and fuels value chains; support for technology improvement, including improvements in wood charcoal value chains; and piloting of various innovative customer finance approaches. Funding will expand the supply of cleaner and more efficient cookstoves and fuels by identifying and supporting the most promising enterprises capable of scaling production and distribution, assisting enterprises to engage women more effectively in the value chain, and applying a gender lens to their business models.

Interventions targeted to **drive demand** include: developing innovative models for consumer financing to increase the ability to pay for higher quality stoves; behavior change communication (BCC) to strengthen demand through an evidence-based approach timed to take advantage of progress on the supply side; gender-informed approaches to awareness raising; technical and financial support for those organizations and enterprises targeting school kitchens and SMEs for conversion to cleaner and more efficient fuels; and technical support to integrate clean cooking messaging into complementary initiatives.

Phase 2 should involve scaling successful approaches piloted in Phase 1; strengthening a more focused set of enterprises to reach investment readiness; launching large-scale awareness, behavior change, and consumer financing efforts; and supporting the government in executing larger scale regional/department wide clean cooking efforts.

Understanding that one solution, or one single technology, will not be applicable for all households, the geographic focus of interventions will be principally market-driven, and decided in collaboration with sector actors. During Phase 1, the largest impact is expected among urban and peri-urban households. As the market grows, coverage is expected to expand beyond these areas. Meanwhile, interventions supporting improvements in the wood charcoal value chain and production of alternative fuels will likely have a greater impact in rural areas.

The inter-connected set of interventions presented below requires a robust approach to monitoring and evaluation (M&E). The proposed approach to developing the cookstoves and fuels market is an inherently iterative process; the early learnings will progressively inform the direction and weight of subsequent efforts. M&E activities will be essential to both the success of the proposed Initiative and the demonstration of impact of Phase 1 and will guide the implementation of a Phase 2.

Phase 1 (2018-2022): Laying the Foundation

Toward this goal, Phase 1 will work to set the foundation for the development of a thriving market for cleaner and more efficient stoves and fuels through a combination of sector-wide market development interventions. The detailed design of interventions should be elaborated in close collaboration with a coalition of actors from the public and private sectors, local experts, and the relevant government ministries.

Phase 1 will support producers and distributors to supply a variety of high-performing cookstoves and fuels to the market, including sustainable charcoal as well as cleaner alternatives. A thriving market cannot be realized without consumer demand for cleaner and more efficient cookstoves and fuels. Raising consumer awareness of the negative impacts of traditional cooking practices, ensuring that consumers have access to cleaner and more efficient products and that they have the ability to pay for those cleaner technologies and fuels are critical to driving demand. Supply and demand must be fostered by a strong enabling environment that supports sustainable market growth. To this end, government ministries must have the capacity to affect smart policy reforms, and sector actors must have the ability to effectively advocate for favorable policies and regulation.

CREATING A STRONG ENABLING ENVIRONMENT TO SUPPORT SUSTAINABLE MARKET GROWTH

A supportive policy and regulatory environment for enterprises within the cookstove and fuel sector can accelerate growth of the market and increase coverage for those most in need. Further, fostering government leadership and ownership of clean cooking is vital to the sustainability of the market. This strategy is designed to assist Haiti in reaching the commitments laid out in the SDGs, Haiti's INDC to address climate change, and the GoH's various goals related to energy access, health, climate change, environmental sustainability, gender equality, and economic growth. Integrating clean cooking into ministries' policies and plans can achieve impact across multiple policy objectives.

Though the GoH has indicated a strong interest in supporting the development of a clean cooking sector and has included clean cooking in previously proposed plans and in their INDC, increased capacity and coordination mechanisms to implement and realize impact are needed. Current financing and technical capacity does not match the demand and necessity. Additionally, the development and implementation of regulation and policy takes time. Therefore, Phase 1 will focus heavily on capacity development, and Phase 2 should focus on implementation of policy and regulation.

To foster a strong market enabling environment, the GoH would benefit from strengthened capacity in three areas (Figure 1)—1) technical capacity to design and implement policy reform and regulation, 2) coordination capacity to facilitate cooperation between ministries and with sector actors, and 3) financial capacity to implement policy reform and regulation. Throughout

Phase 1, support will be tailored to address the specific capacity needs within the Ministries of Environment, Agriculture, Health, Bureau of Mines and Energy within the Ministry of Public Works, Women, the Bureau of Standards, and within other ministries where relevant.

1. Policy Reform and Regulation—enhancing technical capacity to develop policy reforms and effective regulation

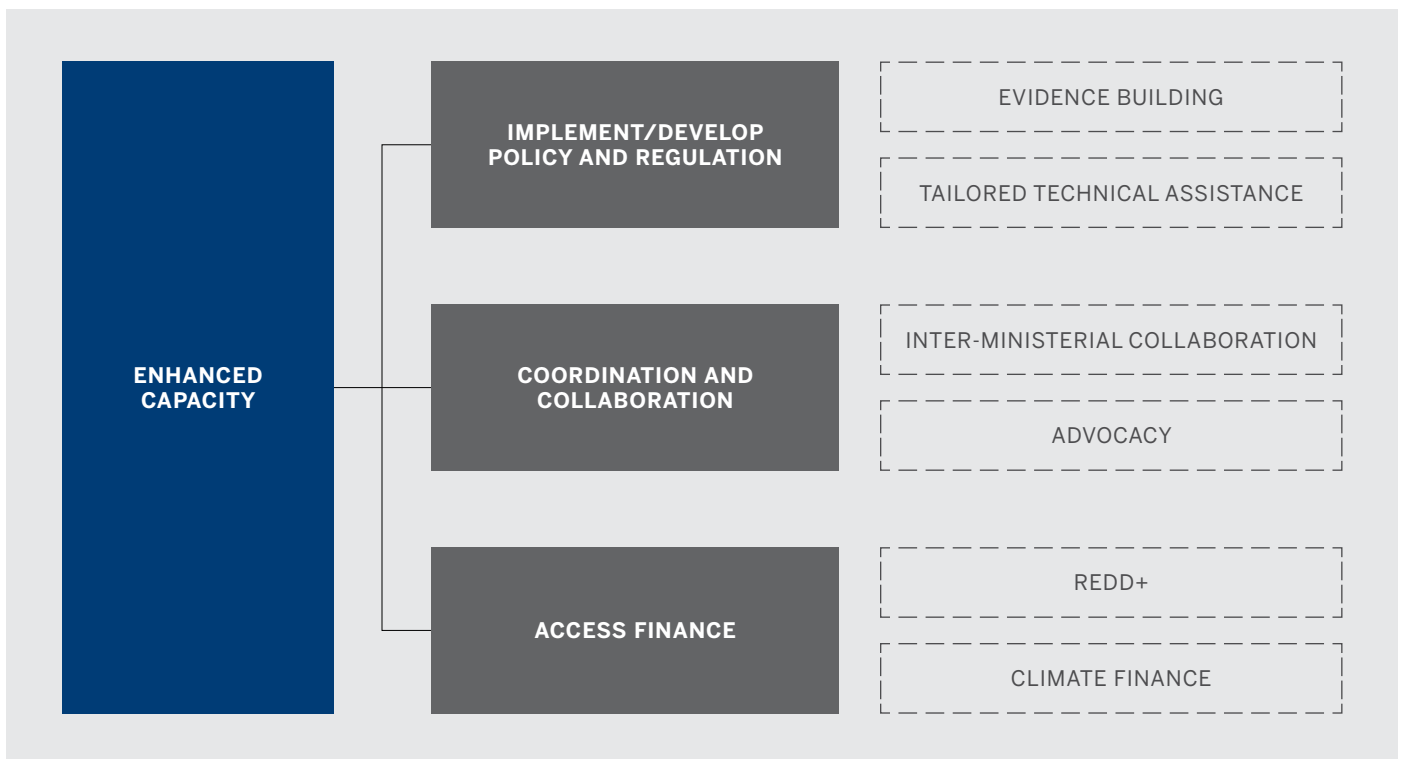
The Initiative will support the relevant ministries (highlighted above) to develop effective policy and regulation to enable the sector and to include clean cooking in their respective climate, environment, gender, energy, and health policies and plans. Building the technical capacity to develop and eventually implement effective clean cooking related policy and regulation initially requires that the government has access to compelling evidence for the multiple benefits of clean cooking and subsequently is supported with tailored technical assistance to design effective policy and regulation.

Building the Evidence

While there is a motivation within the GoH to address clean cooking, there is a need for further targeted research to build the case for government action in key areas where there are substantial information gaps. For example:

- **The environmental impact of wood charcoal production:** There is a lack of clear data around the environmental impacts of charcoal production in Haiti. The World Bank, Haiti Takes Roots, UNEP, and others are working to build a greater understanding. During the development of this Action Plan, the Stockholm Environment Institute (SEI) was funded to conduct an initial assessment of the environmental impacts of woodfuel harvesting and charcoal production. A deeper dive assessment should be conducted to fully understand the environmental impacts and identify “high risk areas” (areas where biomass sustainability is a major concern) in the country for targeted action.
- **The climate impacts of improved kilning technology:** There is very little country-specific evidence on the impacts of improved kilning technology. A study should be conducted on the potential emissions reductions from switching from traditional to improved kilns.

FIGURE 1: GOVERNMENT CAPACITY BUILDING



- **The health and climate impacts of available cookstoves:** For the cookstove and fuel enterprises operating in Haiti that are likely to go to scale, targeted in-field emissions testing on stoves should be conducted to understand the health and climate benefits.
- **The impact of clean cooking on gender equality and women's empowerment:** There is little country-specific data available on the impact of clean cooking on gender and women's empowerment. A full gender analysis should be conducted to determine the specific issues facing women in Haiti and the most effective means to design clean cooking and fuel programs to meet their needs, improve their lives, and promote gender equality and empowerment.

Tailored Technical Assistance

Throughout Phase 1, the Initiative will work with the relevant ministries (listed above) to identify areas in which regulatory change is critical to sector growth and key government priorities towards which clean cooking can contribute. The Initiative will then provide technical assistance for developing effective policy. This could include standards and labeling (S&L), VAT exemptions, and integrating clean cooking into relevant policies. The Initiative will advocate for including the voices of women and girls in the design of policies where they have historically been excluded.

Technical assistance will, in part, be provided to ministry representatives through domestic and international technical workshops and roundtables. Further, exposing ministries to the latest sector developments and opportunities and challenges, and to approaches that other countries have taken can help inform the design and effective implementation of policy and regulation.

- **Technical workshops:** The Initiative will conduct a series of periodic workshops to share the learnings from conducted research and to provide ministry-specific training. For the Ministry of Health, the Initiative will conduct trainings on household air pollution. For the Ministry of Environment, Agriculture and the Bureau of Mines and Energy, the Initiative will conduct trainings on the environmental impacts of wood charcoal production and exposure assessments. For the Ministry of Women, the Initiative will conduct trainings on the gender equality benefits of integrating women into the clean cooking value chain.
- **Roundtables:** The Initiative will facilitate periodic roundtables as a forum for sector actors to present current developments in the domestic and international cookstoves and fuels market to government representatives.
- **South-South workshops:** The Initiative will support government participation in South-South Cooperation to identify lessons learned and best practices from countries around the world. South-South Cooperation workshops include participants from up to a dozen countries that included clean cooking in their INDCs, as well as practitioners and global technology experts on key components of delivering these commitments. These workshops assist countries to strengthen national capacity building efforts, improve climate and clean cooking policies, and to develop plans to carry out the clean cooking components of their INDCs. Participation will allow the GoH to gain a deeper understanding of how Haiti can realize the clean cooking commitments included in their climate plans and will be able to return with more contacts, tools, and understanding of the broader ecosystem of those supporting the clean cooking sector so that they can devise implementation plans to achieve their national clean cooking objectives.

2. Coordination and Collaboration—enhancing capacity to coordinate and collaborate across ministries and with the sector as a whole

To enhance coordination and collaboration between ministries and within the sector, the Initiative will identify sector champions among the ministries and support the establishment of **an Inter-Ministerial Coordination Mechanism** that meets regularly to establish priorities for facilitating sector growth.

The Initiative expects to work closely with Haiti Takes Root (HTR) to facilitate inter-ministerial collaboration. HTR is a public-private partnership that was launched by J/P Haitian Relief Organization to promote reforestation and they may serve as a key partner for collaboration. HTR has

set up a coordination mechanism between the Haitian government, donors, development organizations, and local stakeholders. HTR has spent several years setting up a coalition of actors and developing a strong working relationship with the Ministries of Agriculture and Environment.

To build the capacity of sector actors to advocate for government action, the Initiative will conduct periodic roundtables and advocacy trainings. Roundtables will provide a forum to share the findings from targeted research with sector actors to help them better advocate for government action. In addition, the Initiative will establish a gender-balanced **Technical Working Group** that is inclusive of the private sector, NGOs, and other select actors to facilitate effective advocacy that is inclusive of all voices. The Initiative will work throughout Phase 1 to identify and encourage the cultivation of local Haitian champions, business and civil society stakeholders that can lend their support to long-term support for market development.

3. Access to finance—enhancing capacity to access international finance to support the development of policy reforms and regulation

The GoH has articulated the need to access various climate change mitigation and resilience funding mechanisms such as the Green Climate Fund, Clean Development Mechanism, and the REDD+ in order to develop and implement climate change mitigation and environmental sustainability policies and programs. Clean cooking can be integrated as a component in many of the applicable international funding mechanisms for environmental sustainability and climate change mitigation. The Initiative will work to strengthen the government's capacity to apply for international climate and environment financing.

- **REDD+:** Due to the reliance on wood charcoal, Haiti is a prime candidate to develop a REDD+ program that would be eligible for funding under the UN-REDD Programme. A REDD+ program is also in alignment with Haiti's climate change adaptation plan and its INDCs due to the emphasis on well-managed energetic forests, watershed rehabilitation, and on reducing woodfuel consumption. The Initiative will work with the Ministry of Environment and the Ministry of Agriculture to establish a consensus on developing a REDD+ program.
- **Climate Finance:** Beyond UN-REDD, there are other funding mechanisms, including the Green Climate Fund and other relevant climate finance opportunities that could support Haiti's efforts to mitigate and adapt to climate change. The Initiative will identify applicable climate finance mechanisms and provide joint training to the Ministry of Environment and the Ministry of Agriculture on how to incorporate clean cooking and the application process.

INCREASING AND IMPROVING THE PRODUCTION AND AVAILABILITY OF CLEANER, AFFORDABLE, AND MORE EFFICIENT COOKSTOVES AND ALTERNATIVES TO WOOD CHARCOAL

Adequate supply of and demand for cleaner and more efficient cookstoves and fuels in the Haitian market will only occur when there are financially-sustainable enterprises operating at scale that serve consumers with a variety of innovative and desirable solutions. Additionally, research has shown that fully incorporating women into supply chains not only positively impacts gender equality and women's empowerment, but also helps businesses grow (Ernst & Young, 2012; Coleman, 2010; [Canadian Feminist International Assistance Policy](#); World Bank, 2013, IFC Jobs Study).

ENTERPRISE DEVELOPMENT SUPPORT — INCREASING THE CAPACITY OF COOKSTOVE AND FUEL ENTERPRISES TO DELIVER AFFORDABLE SOLUTIONS TO CONSUMERS, PARTICULARLY WOMEN, AND TO OPERATE IN A SUSTAINABLE MANNER AT SCALE

The majority of cookstove and fuel enterprises in Haiti do not yet have the investment capital or technical, financial, and operational capacity to profitably provide cleaner and more efficient cooking solutions to households, institutions, and SMEs. These enterprises require risk-tolerant and concessional funding to develop their capacity, to pilot technologies, and to scale their operations. However, capital is limited given the lack of track record, low financial returns, and risks currently associated with the manufacture and distribution of cookstoves and fuels.

To address this lack of available capital, the Initiative will provide funding for early-stage enterprises engaged in cookstoves and fuels supply chains through a series of competitive grant

programs designed to help market actors mature beyond their current stage of development. To tailor grant funding to the needs of the market, the Initiative will conduct a thorough market assessment based on the gaps identified in 2016. This assessment will endeavor to understand key barriers to sector growth at the regulatory, market/industry, and firm levels to inform the detailed design of sustainable and financially viable interventions for enterprise development.

Upon completion of the market assessment, the **Enterprise Development Grant (EDG)** program will be developed and launched for Haitian businesses that are looking to expand their operations in the cookstoves and fuels market or enter the sector, and for businesses that have identified Haiti as a potential expansion market. Informed by the results of the market assessment, the Initiative will focus support on businesses that show a credible strategy for long-term market expansion and financial sustainability. Funds from the EDG program will be provided to businesses for:

- **Sales, marketing, and distribution:** funding for marketing strategy development, agent network recruiting/training, and marketing efforts to improve consumer awareness/brand recognition;
- **Partnership development:** funding to develop partnerships that create new distribution channels, consumer finance options, etc.; and
- **Technical Assistance:** technical assistance related to technical, financial, and operational issues that enable enterprises to strengthen their business models, improve their management team capabilities, enhance their sales and marketing approach, pilot new technologies, etc.

The Initiative will also consider funding market-oriented capital expenditures (CapEX) or working capital. However, it is expected that the Haitian market will not need this type of capital until Phase 2.

TECHNOLOGY INNOVATION AND R&D — INCREASING THE ABILITY OF COOKSTOVE AND FUEL ENTERPRISES TO PRODUCE CLEANER AND MORE EFFICIENT PRODUCTS

A high priority during Phase 1 is to ensure that products in the Haitian market not only meet consumers' needs, but provide environmental and health benefits. To this end, the Initiative will provide TA and financial resources through a **Technology Innovation Grant** program to cookstove and fuel enterprises to improve stove performance (emissions and efficiency) and usability, which in turn will increase consumer adoption. TA will be designed to help fuel enterprises optimize their products, taking into consideration consumer preferences and specifically the preferences of women; ensure quality control, and sustainably source raw materials. The Initiative will also provide competitive grant funding to cookstove and fuel enterprises to help them achieve carbon credit certification. This **Carbon Credit Certification Grant** program will be designed for enterprises with products that have low emissions by international standards of cookstove and fuel performance. This will encourage a robust supply of products and fuels that will mitigate further environmental degradation while reducing emissions of greenhouse gases and short-lived climate pollutants and delivering health benefits.

GENDER EQUALITY AND WOMEN'S EMPOWERMENT — INTEGRATING WOMEN INTO THE COOKSTOVES AND FUELS VALUE CHAIN

For the Initiative to be successful at engaging and empowering women in Haiti, implementers must understand the specific gender dynamics in Haitian communities. It is critical to conduct a gender analysis and develop a gender strategy to understand cultural and social values and all potential impacts of the project. As such, the Initiative will conduct a gender analysis early in Phase 1 to understand the Haiti-specific opportunities and constraints for women's involvement in the sector. This analysis will include formative research on time saving and time use to understand the specific dynamics in Haiti related to unpaid care work.

As the Initiative develops, the gendered reality of women's lives in Haiti will be considered when introducing new interventions to avoid unintended negative consequences, such as adding more work to already oppressed or impoverished women. Introducing more efficient stoves and alternative fuels in Haiti can significantly reduce the time women spend on unpaid work related to meal preparation through faster cooking times and reduced firewood collection trips, as well as promote financial savings in the long term through cost-efficient fuels. The time and

income recovered from these activities will allow more space and opportunity for activities that improve the well-being of women and girls and help to lift them out of poverty.

To increase the number of women engaged in market activities in Haiti and to address gender inequalities that prevent the adoption of clean cooking solutions, the Initiative will promote the application of best practices in every aspect of the value chain. The universal best practices to engage women include:

- Conduct analysis to understand community gender roles and dynamics;
- Develop a strategy to engage men;
- Schedule times and locations of meetings and activities around women's availability;
- Identify and build strong local partnership with trusted individuals and organizations, including women's groups; and
- Conduct gender-sensitive trainings and offer continuous training opportunities and mentorship.

During Phase 1, the Initiative will support women entrepreneurs and employees in the clean cooking sector with capacity building, training, grants, and technical assistance to enhance their ability to succeed in the clean cooking value chain. During a recent Alliance-hosted global workshop on women's energy entrepreneurship, the majority of women entrepreneurs and CEOs present noted the importance of empowerment, leadership, and business skills training to enhance the role of women in the value chain. They also highlighted the need for continued support through mentorship, coaching, and peer-to-peer connections to overcome the challenges they face and effectively grow their businesses. This feedback along with a Haiti-specific gender analysis and results from pilot projects will inform the Initiative's work with women entrepreneurs. For example, the Madame Sara network presents the opportunity to increase the capacity of women entrepreneurs engaged in the transport and sale of agricultural commodities, including wood charcoal.

To increase the participation and empowerment of women through the clean and efficient cookstoves and fuels value chain, the Initiative will support the development of a **Women's Empowerment Grant** program that provides funding and capacity building to enterprises. Grants will target business models that strengthen women's livelihood opportunities by bundling household energy products and diversifying the suite of products for women to design, produce, distribute, and maintain. This includes scaling existing, proven gender and empowerment approaches and strengthening income-generating opportunities for women. This type of targeted assistance will help to make the business case for gender-informed approaches in Haiti by demonstrating that there is a positive impact on business performance and social and economic impact outcomes when women are engaged in the value chain. Given the nascent stage of most clean cooking businesses in Haiti, the Initiative will focus on enterprises that are interested in introducing gender best practices that have not previously been used in their business models. For organizations that have already demonstrated the ability to implement fundamental best practices, the Initiative will look for opportunities to further innovate or scale effective approaches.

RURAL INNOVATION – INCREASING ACCESS TO CLEANER AND MORE EFFICIENT COOKSTOVES AND FUELS IN THE RURAL AREAS

Currently, there are limited viable options for cleaner and more efficient cookstoves and fuels in rural areas due to the limited infrastructure and ability to pay for higher performing products (most rural households collect firewood). Further, there are currently no commercially available higher performing biomass cookstoves on the market. In other rural markets, viable options for rural households have included pellet production, briquettes (carbonized and non-carbonized), improved wood stoves, PV micro-grids, etc. During Phase 1, the Initiative will explore innovative solutions for rural households and consider pilots for those that have potential to reach scale. For example:

Solar PV microgrids powering electric cookstoves: A promising area for clean cooking is using cooking appliances with electricity generated by solar microgrids. The Initiative will assess the feasibility of such a system to provide sufficient supply to meet household cooking energy needs

at an affordable price point. The Initiative will consider innovative technical solutions to bring costs to a competitive range; for example, smart distribution of electricity from microgrids to the household level to minimize or obviate battery storage, which is traditionally a high-cost component of solar microgrid systems. Other innovations could include optimizing electric cooking appliances to maximize efficiency and compatibility with power generated by solar grid and the inherent supply variability. The Initiative will identify and work with relevant partners who bring technical innovation expertise, and partners with practical implementation experience. The Initiative will focus on the rural south or other areas that have limited infrastructure, and therefore limited access to cleaner cooking options.

IMPROVING THE EFFICIENCY AND THE SUSTAINABILITY OF WOOD CHARCOAL PRODUCTION

Understanding that charcoal will remain important part of the fuel mix for the foreseeable future, the Initiative proposes to provide TA and financial support to increase the capacity of charcoal entrepreneurs, both charcoal producers and woodlot owners and managers, to implement improved land management practices and more efficient kilning practices. Addressing the charcoal value chain will help to achieve positive environmental and climate impacts, as well as mitigating any job loss due to transitioning consumers away from charcoal.

In September 2016, UNEP published the results of an evaluation of the charcoal supply chain in the South Department. The findings of this evaluation make a clear case for addressing multiple environmental and socioeconomic issues through interventions that included: 1) increasing the scope and scale of sustainable charcoal production based on successful examples; and 2) introducing improved kiln technologies to groups and associations of charcoal producers.

Sustainable Charcoal Production and Woodlot Management

The Initiative will build upon the planning already underway within the Ministry of Environment and UNEP to improve wood charcoal production in Haiti. The two components of this activity will include pilots in the south of Haiti to:

1. Increase the energy efficiency of charcoal production through improved kilning, and
2. Increase the sustainable growth of wood for charcoal through the support of well-managed wood lots, and energetic forests (where appropriate).

Wood charcoal producers have expressed interest in improving their technologies, but have limited R&D expertise and resources. An innovation process is ideally suited to this type of challenge and would improve technology using available materials and resources. Training workshops and grants can disseminate R&D lessons from other areas, bring in new design perspectives, incorporate feedback from users and testing, and support breakthroughs that can be carried forward by charcoal producers in Haiti. Increased financial and technical support could play a critical role in accelerating the implementation of the recommendations in the UNEP report and in expanding the area covered while also contributing to learning that will inform future investments. The Initiative will design and deliver a series of technical trainings to charcoal producers and woodlot owners, and provide grants to charcoal producers to spur technological improvements in current kilning practices. A detailed gap analysis of the charcoal value chain, combined with lessons learned in other countries will inform the development of training guides that are adapted to the Haitian context with an emphasis on sustaining rural livelihoods. The Initiative will work closely with other players actively involved in land and ecosystem management in Haiti, including the World Bank, UNEP, IDB, USAID, Haiti Takes Root, and the relevant government ministries, to identify synergies and to collaborate to achieve results.

GENERATING DEMAND FOR CLEANER, AFFORDABLE, AND MORE EFFICIENT COOKSTOVES AND FUELS

To increase use of cleaner and more efficient cookstoves and fuels, consumers must be both aware of the benefits and availability of cleaner technology and must be motivated and able to pay the upfront cost of the cleaner and more efficient technology. The Initiative will raise awareness and increase motivation through large-scale behavior change communication intervention(s) aimed at facilitating the ability of women and household decision-makers to make informed decisions to adopt cleaner and more efficient cookstoves and fuels. Ability to pay is

the most cited barrier to adoption in Haiti and therefore, BCC campaigns will be paired with support for the development of innovative consumer finance mechanisms.

ABILITY TO PAY – INCREASING CONSUMERS', PARTICULARLY WOMEN'S, ABILITY TO PAY FOR CLEANER AND MORE EFFICIENT COOKSTOVES AND FUELS

Cookstove and fuel businesses in Haiti, as in many other potential markets, lack the capital and capability to effectively structure and manage in-house consumer financing programs with appropriate incentives and oversight to manage risk and ensure low default rates. Additionally, MFIs and other external financing partners often lack the capital, technical expertise, or incentives necessary for functional and sustainable partnership at scale. Therefore, through the aforementioned EDG programs, the Initiative will seek to support grantees to address the lack of affordable solutions. This may be addressed through a range of support activities including funding of CapEx to reduce production (and therefore retail) costs; the provision of working capital to support the extension of consumer credit, sales, and marketing support to more effectively sell and increase willingness to pay; support to develop partnerships relevant to consumer finance mechanisms, or various other measures to increase affordability and consumer accessibility.

There have been various successful approaches tested in other markets such as pay-as-you go/leasing/asset finance, leveraging mobile money activity to facilitate lending and payments, as well as the use of bundling a range of products relevant to target consumers currently being tested in Haiti. The grant programs will ensure that there is adequate focus and will work closely with grantees on this most critical element of increasing demand for solutions.

The Initiative will also explore viable consumer finance models that specifically consider the different needs of men and women and their often-disparate purchasing power. Technical assistance will be given to increase the ability of potential lenders (employers, cookstove and fuel enterprises, or MFIs) to develop appropriate, inclusive loan products, thereby decreasing the cost of developing and rolling out these products to customers.

BEHAVIOR CHANGE COMMUNICATION – USING COMMUNICATION TO MOTIVATE HAITIAN HOUSEHOLDS TO PURCHASE AND USE CLEANER AND MORE EFFICIENT COOKSTOVES AND FUELS CAMPAIGN

Behavior change communication can increase consumer motivation to purchase and use cleaner and more efficient cookstoves and fuels by increasing awareness of the benefits of switching to higher-performing options, increasing knowledge about where to find alternatives, and addressing cultural barriers to change. Importantly for Haiti, BCC can also increase demand by addressing consumer concerns about the durability of cleaner and more efficient cookstoves and the safety of alternative fuels such as LPG and ethanol. Previous BCC efforts have raised awareness but on a limited scale that did not drive a substantial increase in purchase and use, in part because the efforts were not coordinated with effective supply-side activities.

During Phase 1, the Initiative will start by conducting research to inform the development of a BCC strategy. As a first step, a detailed mapping of previous BCC interventions undertaken in Haiti, both cooking and non-cooking related, will be conducted to understand best practices and lessons learned. Second, and in close coordination with supply side stakeholders, the Initiative will assess the potential consumer base for cleaner and more efficient cookstoves in Haiti to determine priority segments for BCC activities. Once the target segments are identified, formative research will be conducted with these segments to fill gaps in the current understanding of key drivers of current fuel and stove usage, barriers to future adoption of clean and efficient cookstoves and fuels, and how these segments currently access and respond to information (e.g. product labels). The Initiative will also analyze the marketing strategies of cookstove and fuel enterprises to better understand current efforts and how they can be improved, and determine how BCC interventions can best complement and enhance enterprise level marketing efforts.

Based on findings from the research, the Initiative will produce a BCC strategy and accompanying implementation and evaluation plan. The strategy will be developed in response to the research, but based on experiences in other countries and sectors, will likely include a multi-channel **Behavior Change Communication Campaign** likely to include a mix of mass-media, interpersonal [door-to-door and small group] communication and demonstrations phased alongside

supply-side interventions to ensure products are accessible and tailored to specific geographic regions. The campaign will build from the formative research conducted with consumers to ensure that the approaches and messages developed are gender-responsive and compelling to the target population and delivered appropriately.

The interventions will be sustained over multiple years, with multiple channels providing mutually reinforcing messages that evolve over time from awareness and calls to initial action (in this case make a purchase) to ensuring sustained use. The Initiative will also provide capacity building support and direct grants to enterprises to enhance their marketing efforts.

Integrating Messaging

In addition, the Initiative will seek to leverage the work of organizations that are already in communication with the target segments (including those that work specifically with SMEs and institutions) through women's empowerment, health promotion, livelihood creation, and environmental sustainability initiatives by providing TA and financial support to help them integrate messaging on clean cooking into their work. This will not only allow for more messaging to reach the target segments, but also importantly, this messaging will come from already trusted sources.

Institutions and Small and Medium Size-Enterprises

School kitchens and SME's are large consumers of woodfuel. The conversion of school kitchens to cleaner and more efficient stoves and fuels not only offers health benefits to the female cooks and children, but also provide the opportunity to influence behavior change at a young age by exposing children to the benefits of using cleaner and more efficient technologies. Further, street vendors in Haiti provide an important source of food for low-income households and a vital source of income for many women entrepreneurs. There are several cookstove and fuel enterprises currently operating in Haiti that produce stoves and fuels for both institutional and commercial use. Additionally, there are several organizations such as the World Food Program (WFP), who are interested in converting school kitchens. Many enterprises already have or are in the processes of developing innovative mechanisms for converting schools and SMEs to better performing cookstoves and fuels. While the primary goal of this strategy is to see change at the household level, the enterprise development and technical support activities will include actively assisting enterprises to develop better performing institutional products and services. For example, the development of innovative consumer finance mechanisms will include those mechanisms that are tailored for street vendors.

Additionally, given the importance of addressing woodfuel consumption in institutions, further research will be conducted during the early stage of Phase 1 to design an appropriate pilot to address institutional woodfuel consumption. The Initiative will design a pilot project to convert school kitchens to cleaner and more efficient fuels in the Port-au-Prince area. During Phase 1, through local partners, complementary programs will also be identified that target SMEs and institutions. Local experts will be engaged to help design and tailor appropriate interventions to be scaled in Phase 2.

Complementary Initiatives

The Initiative will benefit from engaging with multiple local country partners and ongoing complementary projects in Haiti, such as Haiti Takes Root, Oxfam International, Care, and the Small-Holder Farmers Alliance. These complementary initiatives will provide an effective platform for partnership, advocacy, and market development. Building off the work already underway by others will allow the Initiative to more effectively implement proposed activities and leverage funding for greater impact.

During the design of the Action Plan, the active engagement and support of local, national, and global enterprises—Haitian policy-makers, researchers, the private sector, donors, and investors was solicited to build and strengthen the market for cleaner and more efficient cookstoves and fuels. UN agencies (including UNEP, UNDP), WFP, the World Bank, USAID, and the FAO among others, will play important advisory roles under the effort, including interfacing with the public health and environmental communities, addressing the clean cooking needs of marginalized populations, and ensuring regional coordination and complementarity.

SUMMARY OF RECOMMENDED INTERVENTIONS

TABLE 3: INTERVENTION AREAS, SUGGESTED PARTNERS, AND OUTCOMES

INTERVENTION AREAS	SUGGESTED PARTNER	OUTCOME
INTER-MINISTERIAL COLLABORATION	Government of Haiti, Haiti Takes Root	Enhancing the ability of government ministries to design and implement policies conducive to market growth of cookstove and fuel sector
EVIDENCE BUILDING	Haitian Energy Institute, international research institutes, local experts, local universities	Enhancing the ability of government ministries to design and implement policies conducive to market growth of cookstove and fuel sector
POLICY AND REGULATION DEVELOPMENT	Government of Haiti	Enhancing the ability of government ministries to design and implement policies conducive to market growth of cookstove and fuel sector
ACCESSING FINANCE	Government of Haiti	Increasing the capacity of the Ministry of Environment and Ministry of Agriculture, and other ministries to implement climate change mitigation and resilience building strategies
NON-GOVERNMENTAL STAKEHOLDER LEARNING AND ADVOCACY	Government of Haiti, women's organizations, sector working group	Increasing the capacity of sector actors to advocate at the local, regional, and national level for policy reform, especially on safety regulation and tax relief
ENTERPRISE DEVELOPMENT SUPPORT	Cookstove and fuel enterprises	Increasing the capacity of cookstoves and fuels enterprises to deliver affordable solutions to consumers, particularly women, and to operate in a sustainable manner at scale
TECHNOLOGY INNOVATION AND R&D	Cookstove and fuel enterprises, Haitian Energy Institute, universities	Increasing the ability of cookstove and fuel enterprises to produce cleaner and more efficient products
CARBON CREDIT CERTIFICATION	Cookstove and fuel enterprises, Haitian Energy Institute	Increasing the ability of cookstove and fuel enterprises to produce cleaner and more efficient products
RURAL INNOVATION	Cookstove and fuel enterprises, international research Institutes	Increasing access to cleaner and more efficient cookstoves and fuels in the rural areas
ABILITY TO PAY AND CONSUMER FINANCE	Cookstove and fuel enterprises, MFIs, local businesses	Increasing the capacity of cookstoves and fuels enterprises to operate in a self-sustaining manner
WOMEN'S EMPOWERMENT	Women's organizations, networks of female entrepreneurs, cookstove and fuel enterprises	Increasing and improving the production and availability of cleaner, affordable, and more efficient cookstoves and alternatives to wood charcoal
SCHOOL CONVERSIONS	Cookstove and fuel enterprises, World Food Program, organizations working with schools	Generating demand for cleaner, affordable, and more efficient cookstoves and fuels
SMALL-AND-MEDIUM SIZED ENTERPRISES	Cookstove and fuel enterprises, networks of entrepreneurs, women's organizations	Generating demand for cleaner, affordable, and more efficient cookstoves and fuels
SUSTAINABLE WOOD CHARCOAL PRODUCTION AND WOODLOT MANAGEMENT	UN agencies, Haiti Takes Root, local experts, NGOs, multi-laterals, Government of Haiti	Improving the efficiency and ensuring the sustainability of wood charcoal production
BEHAVIOR CHANGE COMMUNICATION	Cookstove and fuel enterprises, media and communications organizations, women's organizations	Creating awareness of the benefits of cleaner and more efficient cookstoves and fuels among the Haitian population
INTEGRATED MESSAGING	(I) NGOs, women's organizations, Government of Haiti, multi-laterals, UN agencies	Creating awareness of the benefits of cleaner and more efficient cookstoves and fuels among the Haitian population

Phase 2 (2022+): Scaling the Market

While Phase 1 will build a solid foundation for market development through a “test and learn” approach, the objective of Phase 2 should be to drive investments, innovation, and operations to scale. The results of Phase 1 will guide the detailed design of Phase 2 and should be developed through close collaboration with the GoH and with the support of a coalition of actors from the public and private sectors. To sustainably grow the market, Phase 2 will focus on four key areas: **government engagement, women’s empowerment, and supply strengthening and demand creation.**

Strong monitoring and evaluation will be vital to proving the effectiveness of interventions throughout Phase 1 and to determine the specific design of Phase 2. The Initiative must remain flexible and willing to course-correct, to achieve a strong end-term evaluation. Demonstrating impact during Phase 1 will justify which interventions should be scaled during Phase 2.

Phase 2 should include:

- Refining the Phase 1 Action Plan in collaboration with the Government of Haiti and the coalition of sector actors;
- Sharing lessons learned in Phase 1 to prioritize Phase 2 interventions;
- Building a robust multi-donor fund comprised of philanthropic and private sector capital;
- Implementing a variety of investment de-risking instruments that support growth needs for enterprises in the sector;
- Scaling up support for viable cookstove and fuels enterprises;
- Scaling up successful innovation pilots that drive next stage market growth;
- Driving development of and adherence to internationally-recognized ISO cookstove standards; and
- Advocating for the GoH to continue scaling up their clean cooking efforts by creating favorable regulatory and policy environments.

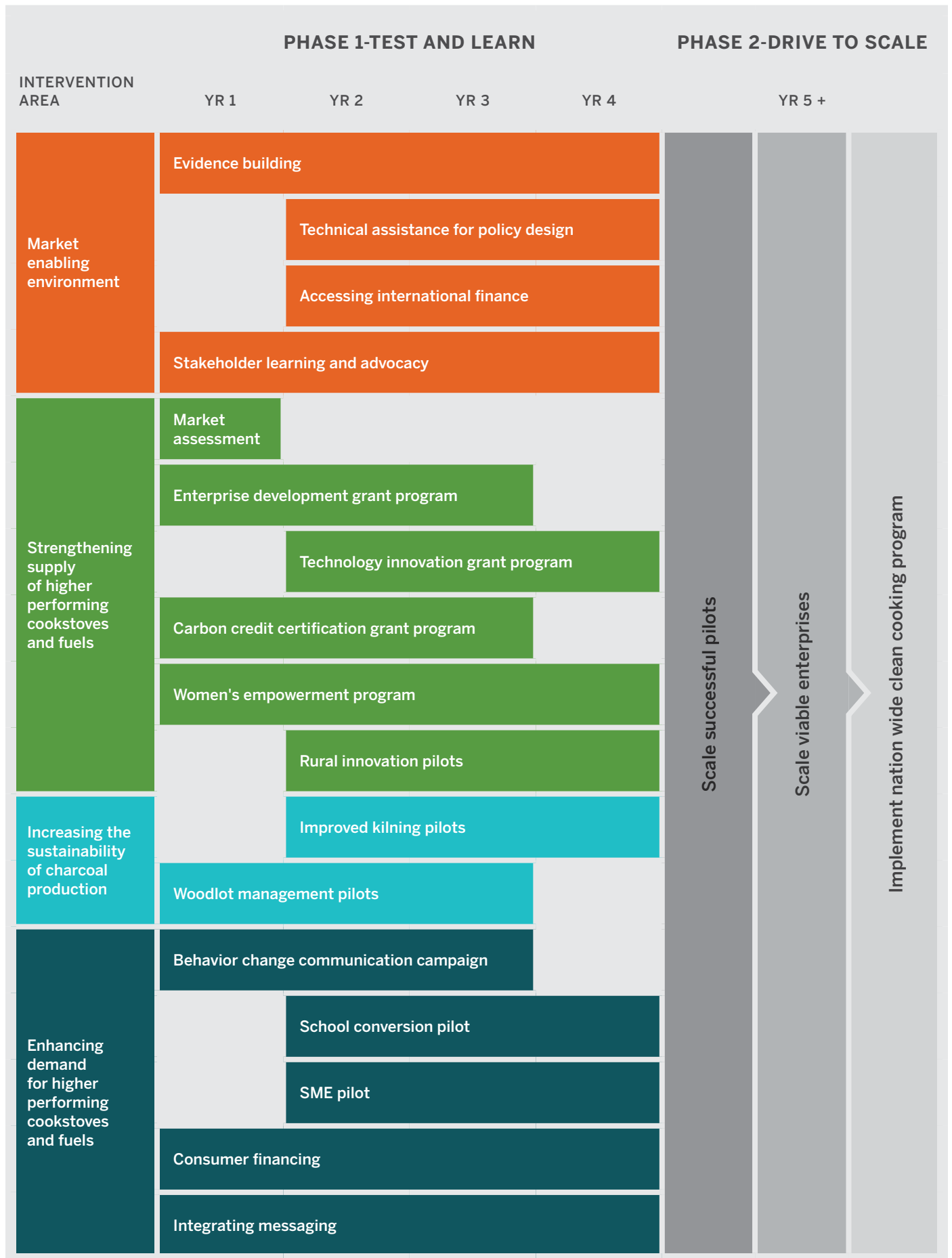
GOVERNMENT ENGAGEMENT

Throughout Phase 1, the GoH should be engaged to take both ownership over developing a long-term clean cooking strategy and policy, and be supported to take a leadership position in driving sector growth.

Globally, markets that have reached next stage growth have done so in part through the support of government policies and programs. For example, in Ghana, the Petroleum Minister launched a program to provide households with cooking gas connections; to date the program has distributed 70,000 LPG cylinders to families across six regions. The Ministry of Petroleum also partnered with National Petroleum Authority, the Alliance, and the Global LPG Partnership to develop and implement a new cylinder re-circulation LPG policy. In India, the Government recently launched the world’s largest program for free connections to clean cooking fuels, the Pradhan Mantri Ujjwala Yojana (PMUY) Initiative. The program will connect 50 million women in households living below the poverty line to LPG by 2019. In Kenya, the government has taken strides to foster an environment that enables the growth of the clean and efficient cooking market. The Kenyan government addressed barriers to clean cooking through adopting new finance policies that reduced the import duty on clean cookstoves from 25% to 10%, and eliminated the VAT on LPG.

Not only have supportive government policies in other countries enabled sector growth, but inter-government cooperation has led to increased access and uptake of cleaner cooking methods. In Kenya, an Inter-Ministerial Committee on clean cooking has brought together ten ministries and agencies, as well as a newly-launched Technical Working Group on Health, Energy and Climate Change.

FIGURE 2: ROADMAP



During Phase 2, the GoH should be supported to implement a nationwide clean cooking policy and to fully integrate clean cooking into complementary climate, environment, gender equality energy access, and health policies. Sector actors should continue to advocate for inter-ministerial collaboration. As part of a nationwide clean cooking policy, the GoH should strive to implement cookstove standards and a complementary labeling program. The GoH has expressed a desire to further standards and labeling efforts for the cookstove and fuel sector. Standards and labeling (S&L) policies, such as product testing, performance evaluations, and labels, can help consumers make more informed decisions. S&L policies are proven market transformation tools and have been used to enhance product markets for over 40 years in developed and developing countries. However, the development of a strong S&L program is a long-term effort. Therefore, while Phase 1 activities will support the development of a S&L program, Phase 2 should support the GoH's efforts to implement the program.

Policy reform is also essential for the cookstoves and fuels market in Haiti to thrive. Taxes and tariffs are problematic since accessing affordable products remains the biggest barrier to adoption of cleaner and more efficient options in Haiti. While Phase 1 will provide technical assistance to government ministries to assess the tax and tariff burden and to build the case for tax and tariff relief for cookstoves and fuels enterprises, Phase 2 should strive towards implementing a tax and tariffs policy that does not hinder market growth.

Further, within any nationwide cookstove program a clean fuels policy is essential, as the ultimate goal of such a program is to reach as many consumers with the cleanest and most efficient stoves and fuels on the market. Within a clean fuels policy program, a timeline and roadmap for reaching consumers should be designed with clear vision for market transformation.

WOMEN'S EMPOWERMENT

Empowering women to be full participants in the economic lives of their families and communities can lead to broader economic growth and lasting change. When women are able to develop their full economic potential—whether as agricultural producers, employees, entrepreneurs—economies thrive and the benefits of growth reach more people. Additionally, women and girls are disproportionately impacted by climate change. Women are often the primary collectors of water and fuel, which becomes a more onerous task as extreme weather events reduces water and fuel availability. Women also find employment in the sectors that are more vulnerable to climate change; in Haiti, women dominate in the agriculture and trade sectors, both of which are susceptible to shocks caused by extreme weather events. Throughout Phase 2, the Government of Haiti should be supported to ensure that their clean cooking programs are gender inclusive, and that policies related to clean cooking also take into consideration the needs of women and girls.

SUPPLY STRENGTHENING AND DEMAND CREATION

In Phase 2, supply strengthening and demand creation activities should move from pilots to larger scale activities. Geographically, activities should expand beyond Port-au-Prince to all urban and peri-urban areas. Efforts should continue to mobilize resources, promote awareness, integrate clean cooking into complementary initiatives, increase consumer's access to cleaner and more efficient products, and grow viable enterprises. Cookstoves and fuels enterprises should be supported to transition from grant to investment capital. Grants will most likely still be required in Phase 2 to drive technical and business model innovation and ensure that high-impact, life-changing solutions are accessible and adopted by consumers who need them most, but enterprise development support should not stop there. Phase 2 should refine the strategy to mobilize investment capital.

Monitoring and Evaluation

Monitoring and evaluation activities are essential to both the success of the proposed Plan and the demonstration of impact during Phase 1 that will justify and direct the implementation of a Phase 2. Program evaluations serve several purposes including ensuring the intended services/interventions are being delivered according to plan, improving processes by identifying their strengths and weaknesses, measuring the program's effectiveness for achieving the desired outcomes, and assessing replicability and/or feasibility of scaling up.

The proposed approach to transforming the Haitian cookstoves and fuels market is an inherently iterative process in that early learnings will progressively inform the direction and weight of subsequent efforts. The gradual and responsive nature of this program design demands a robust and synchronized M&E strategy to: 1) capture the effectiveness and efficiency of processes throughout the course of the program, 2) course-correct interventions as needed to maximize desired outcomes, and 3) measure changes across different outcome levels over time.

An in-depth monitoring and evaluation strategy will be developed prior to program launch. Drawing on the suite of evaluation frameworks and impact assessment tools that have been developed for a wide variety of clean cooking programs, the Initiative management team, working with the GoH and partners, will generate a comprehensive list of indicators corresponding to each outcome in the logic model. Immediate and intermediate outcomes are specific, measurable, achievable, relevant, and time-bound (S.M.A.R.T.) and will be measured diligently throughout the course of program implementation and beyond. These data will serve as parameters for robust, evidence-based impact modeling exercises for estimating the less measurable ultimate outcomes (change of state for the target population).

Ultimately, the Initiative will aim to assess the extent to which climate, environment, women's empowerment, livelihoods, and health, are impacted by a clean cooking program in Haiti. The types of tools that will be used to measure impact may include, but are not limited to, the following: The Social Impact Measurement toolkit developed by the Alliance and ICRW, the fNRB modeling tool that evaluates the impacts of supply-side and demand-side interventions on fuelwood sustainability, and the Household Air Pollution Intervention Tool (HAPIT) that compares the impacts of various cooking technologies on human health at the national level.

The Initiative will undertake the following framework of monitoring and evaluation activities:

- A. Administration of nationally representative baseline (Year 1), midline (End of Year 2), and endline (Years 4) household cooking surveys to capture changes in knowledge, attitudes, and practices (KAP) at the consumer level;
- B. Administration of nationally representative baseline, midline, and endline cookstove and fuel market surveys to capture changes at the enterprise level (including harmonized WHO questions);
- C. Routine monitoring and periodic process evaluations (unique frequency for each intervention) of implementation strength, quality control, and identification of limiting factors for provision of immediate feedback for course-correction. Activities include:
 - Documentation: e.g. policy briefs, accounting ledgers / invoices, training manuals & testing results, etc.;
 - Quantitative data collection: e.g. stove-use monitoring, stove performance tests, customer surveys, sales logs, etc.;
 - Qualitative data collection: e.g. program team's interviews, customer focus groups, observations, etc.

Nationally representative surveys will be designed to capture population-level changes in immediate outcomes (access, abilities, and skills) and intermediate outcomes (behaviors and practices), providing insight on whether the overall program is on track to achieve the ultimate outcomes (climate, environmental, women's empowerment, livelihoods, and public health). Routine monitoring and process evaluations, however, provide critical short-term feedback on the effectiveness of each unique intervention in achieving the immediate and intermediate outcomes and allow for mid-course improvements and/or prioritization of interventions to maximize the benefits according to continually emerging evidence. Intervention-specific monitoring activities and data collection instruments will be developed during the inception phase.

The execution of the proposed M&E strategy is as important as the implementation of the proposed program. A robust M&E platform will elevate the program's success through its ability to demonstrate measurable achievements and make the case for replication or scale-up in Phase 2. Additionally, a M&E platform will provide a continual feedback loop and support the

program's ability to course-correct as successes and failures emerge. Given the intensive nature of monitoring the progress and evaluating the effectiveness of each intervention, the proposed M&E strategy will require substantial resources for execution.

Estimated Impacts

The strategy includes a mix of activities that will lay the foundation for a sustainable market for cookstoves and fuels. Developing this market and transitioning Haiti to modern cooking practices will in turn contribute towards the ultimate objective of reducing forest degradation and greenhouse gas emissions, reducing adverse health effects of traditional cooking practices, and improving livelihoods as well as empowering women. These impacts will be apparent at different levels and the impact of Phase 1 will also largely depend on the scale of the investments made in transforming the market. Phase 1, supported by an initial \$20-30 million investment, will make significant strides towards the ultimate objective.

The impacts presented are, by necessity, estimated at a high level. Estimating impacts of a large portfolio of interventions in a complex operating environment is challenging. Plan execution and intervention implementation face considerable operational risks. Data gaps in Haiti require estimates and assumptions about key impact model parameters. M&E activities supporting plan implementation would help fill those gaps and reduce the uncertainty of the impact estimates presented here. The impact of the proposed plan will also largely depend on the scale of the investments made in transforming the market. Given this context, the modeled effects and impacts described below are conservative, but show promise to achieve considerable impact for the Haitian cooking sector in the long-term.

SUPPLY EFFECTS

Based on the current state of technology in Haiti and what has been achieved in other contexts, as well as the planned technology innovation and enterprise investments, it is estimated that half of locally-produced charcoal stoves would increase in thermal efficiency by 9 percentage points (from 25% to 34%). While charcoal will continue to dominate the market in the near-term, there will also be an increase in accessibility to other options (such as briquettes, ethanol, LPG, and electricity). The impact of interventions in the charcoal value chain through the introduction of improved kilning technologies is expected to increase the yield by 20 percentage points (from 20% to 40%) in the intervention area.

DEMAND EFFECTS

Phase 1 includes a number of interventions to generate demand for more affordable, higher performing cookstoves and fuels. It is estimated that in Phase 1 approximately 150,000 households will begin using higher-performing cooking options and reduce use of traditional ones. Over time, it is estimated that within these households, cooking tasks will shift more and more to the higher performing stoves and fuels, which will increase health benefits and reduce impacts on the environment and climate.

ENABLING ENVIRONMENT

While it's more difficult to estimate a direct line of causality from the proposed policy and regulatory initiatives to the desired outcomes, they are necessary to ensure that the planned supply and demand activities are successful and at an impactful scale.

ESTIMATED IMPACTS

Based on the above estimated changes in environment, supply and demand, the following impacts were modeled:

Critical Parameters

From desk research, stakeholder interviews, and consultancies, as well as existing research and expert input, several critical model parameters were determined. The average urban household consumes 2.3 kilograms of charcoal per day (EDM 2013). Based on this, traditional charcoal stove efficiency (CSU 2016), and the energy content of charcoal (CSU 2016), the average household

requires approximately 5000 MJ of cooking energy each year. Stove and fuel performance was based on direct testing of Haitian technologies (CSU 2016) for the majority of options estimated to be adopted. Where direct testing was not available, average performance by type was used (Clean Cooking Catalog 2016); these were primarily liquid- and gas-fueled stoves, which have a lower variation of performance than biomass stoves. Retail prices of fuel were determined through stakeholder interviews.

Household-level impacts

Currently, the average urban household spends approximately 58-67 HTG/day on wood charcoal. With higher performing charcoal stoves, the average household fuel expenditure can be reduced to approximately 41-48 HTG/day. Liquid and gas-fuels are even more efficient. As an example, for LPG, the average household fuel expenditure can be reduced to approximately 29-37 HTG/day. This would be approximately a 47% reduction of fuel spending from traditional cooking.

There is an increased upfront cost to higher performing options, but these stoves are more durable. Traditional charcoal stoves cost 75 to 500 HTG, and have a lifespan of less than a year. Households are spending 500 HTG per year on traditional cookstoves. Higher performing charcoal stoves cost 500 to 2000 HTG, and have lifespans of 2-4 years, or approximately 250-500 HTG per year. Liquid and gas stoves cost 2500 and up, and have a life span of 4-6 years, or approximately 600 HTG per year.

As rural households largely collect fuelwood, a similar switch in technology would result in time-savings, as opposed to fuel expenditure savings. There is limited data available on fuel-collection times in Haiti, so the magnitude of these savings was not modeled.

Phase I National-level Impacts

To build a strong foundation, it is estimated that Phase 1 should be supported by a \$20-30 million investment. Such an investment would spur the adoption of higher performing stoves and fuels (as estimated above) resulting in a reduction of biomass use of 1.2M metric tons (including a reduction of charcoal use of 251,000 metric tons), as well as a GHG emissions reduction of 160,000 metric tons of CO₂e¹⁰. In addition, based on the estimated increase in adoption of cleaner cooking options, 12,400 DALYs and 375 premature deaths would be averted.

Each year that a household uses higher-performing options will see benefits for fuel expenditure savings, GHG emission reductions, biomass use reductions. Beyond the four-year Phase I timeframe, the number of households transitioning will continue to increase, further increasing benefits. It should also be noted that strengthening cookstove and fuels enterprises, building the capacity of dozens of other institutions, reaching several million people with behavior change messages, and providing support to improve the policy and regulatory environment, will lay the foundation for a sustainable cookstoves and fuels market poised to meet the needs of several hundred thousand additional households and institutions. A successful Phase 1 will lead to a higher-performing market that will be able to sustain increased production, purchase, and use of cleaner and more efficient cookstoves and fuels, as well as improved practices for harvesting and converting wood into charcoal. These impacts are often difficult to capture over the short term, but represent a substantial return on the first four-years investment.

Anticipated Impact on the Environment and Climate

Using the approach developed by SEI, it will be possible to estimate the impact of the interventions on forest degradation and woody biomass cover. In the short term, it is likely that this impact would be modest, given the scale of wood charcoal production in Haiti and the change in production techniques necessary for large scale impact. Additionally, though the program will initially be unable to monitor secondary benefits of reducing forest degradation, reducing deforestation and forest degradation through sustainable forest management can have impacts on climate change mitigation and adaptation. Reducing deforestation and forest degradation increases forest carbon stock, which in turn contributes to carbon sequestration. Reducing for-

¹⁰ This does not include the emissions and wood reductions due to improved kilning technology due to insufficient baseline data to accurately model the national level effects of adopting improved kilning technology.

est degradation also preserves biodiversity and helps prevent desertification. Intact mangroves protect coastal areas against major storms (hurricanes) and waves. Additionally, healthy forests provide erosion control and storm flow regulation (flood protection).

Anticipated Impact on Women's Empowerment

The program's estimated impact on women would be established after completion of baseline surveys to fill in data gaps regarding current practices and women's inclusion in the value chain. Further analysis would also be required to estimate the impact on rural livelihoods resulting from changes in charcoal value chain (production methods, volumes, etc.). The gradual transition to alternative fuels, and the subsequent employment opportunities should help mitigate negative impacts.

Phase 2 National-level Impacts

The impacts in Phase 2 will be highly dependent on several factors, including the level of impact realized during Phase 1, the size of the investment for Phase 2, and the duration of the Initiative, and therefore cannot be modeled at this time. However, given that Phase 1 is expected to establish a strong foundation for market growth, the impacts during Phase 2 are anticipated to increase exponentially.

CONCLUSION

In conclusion, Haiti presents a unique context for the development of a cleaner and more efficient cookstoves and fuel market. The scope and scale of the problem in Haiti should be seen as both a challenge and an opportunity; the high rate of woodfuel use alone makes transformation of the sector a development, environment, and health imperative. Unaddressed, traditional cooking will continue to put pressure on natural resources, lead to high amounts of GHGs and SLCs emissions, and pose an unacceptable health risk to the Haitian population. As urban populations grow, the pressure on natural resources will only increase, and the health impacts will affect greater numbers of vulnerable women and children. Transformation of the cookstoves and fuels sector in Haiti has enormous potential to advance a range of development goals, including decreased degradation of forests and land, reductions in emissions of greenhouse gases and short-lived climate pollutants, improved health, and greater women's empowerment. Further, in a country that experiences severe vulnerability to climate change, and has suffered repeated natural disasters and setbacks to sustainable development efforts, addressing the cookstoves and fuels market will not only help the GoH achieve its climate change mitigation and adaptation priorities, but will also align with the country's health access objectives and goals for strengthening the economic empowerment of rural and post-hurricane affected populations.

That said, a long-term investment is needed to overcome the substantial barriers to sustainable change in the way cooking energy needs are met in Haiti. Over the years many well-intentioned programs sought to transform the market but fell short of delivering the necessary sustained impact. The lessons learned from these projects offer insight into the pitfalls of short project timelines, ineffective government engagement, and the risk of not harnessing local expertise. The complexity of the issue—cultural, societal, behavioral, and economic—necessitates a comprehensive approach as well as investment that addresses the variety of barriers to a thriving market and harnesses the collective capacity of the private sector, government, and civil society to bring about systematic change. Moreover, such an approach should build on the work of the many complementary government, donor, civil society, and private sector initiatives underway in Haiti, especially those in the health, sanitation, environment, forestry, gender, and agricultural sectors, to leverage lessons learned and ensure replication of best practices in Haiti's unique context.

That many have tried and many have failed over the years should not dissuade future efforts. The challenges in the market, while daunting, are not insurmountable, and this document highlights the necessity of intervening in the market in a strategic and sustainable manner. A comprehensive and funded Action Plan comprised of market-based enterprise development, product innovation, applied research, policy, women's empowerment, and behavior change components can spur the adoption of clean and efficient cookstoves and fuels in Haiti and bring about measurable, climate, environmental, gender equality and women's empowerment, livelihood, public health, and development benefits.

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APPENDIX

TABLE 1: UNITS AND CONVERSIONS

FUEL	COMMON RETAIL UNIT	KILOGRAMS PER RETAIL UNIT	LOWER HEATING VALUE (MJ/KG)	AVERAGE DAILY HOUSEHOLD DEMAND FOR ALL COOKING TASKS	NOTES
WOOD	stere	400-500 kg	16-20 MJ/kg	5 kg	1 stere ≈ 1 cubic meter
CHARCOAL	marmite	1.1-1.3 kg	28-31 MJ/kg	2 kg	Marmite is not a standardized unit
	large bag	35-50 kg			
CARBONIZED BRIQUETTES	marmite	1 kg	22 MJ/kg	3 kg	Marmite is not a standardized unit
KEROSENE	gallon	3 kg	36-43 MJ/kg		
ETHANOL	liter	0.79 kg	23-28 MJ/kg	0.9 kg	Sold in 20 ounce, 1 liter and 1.5 liter bottles
	ounce	0.02 kg			
LPG	pound	0.45 kg	46-50 MJ/kg	0.6 kg	Sold in 5-100 pound cylinders, but can be refilled by the gallon
	gallon	2.11 kg			
Exchange Rate US\$1 = 66.58 Haitian Gourdes (as of November 2016) Haitian \$1 = 5 Gourdes					

TABLE 2: IMPACT PROJECTION INPUTS

INPUTS	2017 BASELINE PROJECTIONS	
POPULATION	2,31 million households	
% POPULATION RURAL	39.6%	
% POPULATION URBAN	60.4%	
HOUSEHOLD SIZE (AVG)	4.4	
GDP (PER CAPITA)	51175 HTG	
DAILY CHARCOAL CONSUMPTION (HOUSEHOLD)	Urban/trad stove = 840kg/hh/yr	Rural/trad stove = 803kg/hh/yr
DAILY WOOD CONSUMPTION (HOUSEHOLD)	Urban/tsf = 1891 kg/hh/yr	Rural/tsf = 1808kg/hh/yr
CHARCOAL UNIT PRICE (AVG)	34.36HTG/marmite	

TABLE 3: SUMMARY OF PRIOR TESTING DATA

From 2010 to 2015, several projects and programs focused on cookstoves in Haiti have conducted qualitative and quantitative testing. These data are available from four USAID reports¹¹, two Lawrence Berkeley National Laboratory (LBNL) reports¹², and one MIT D-Lab report¹³. The table below summarizes the tested stove-fuel combinations, test protocols, and measured metrics in each report.

REPORT	TESTED STOVE-FUEL COMBINATIONS	TEST PROTOCOL	METRICS MEASURED
USAID-NEXANT - 2010	<p>Traditional: Traditional tole – charcoal TSF – wood</p> <p>Improved Charcoal: Char-beau – charcoal EcoRecho – charcoal Envirofit unspecified – charcoal LaPaix – charcoal Mirak – charcoal Prakti Rouj – charcoal Prakit Kreol – charcoal</p> <p>Rocket: Envirofit unspecified – wood Jiko poa – wood Prakti Bleu – wood Recho Lokal – wood StoveTec Two door – wood</p> <p>Kerosene: Recho Kreyol – kerosene Verte China – kerosene</p> <p>LPG: African LPG – kerosene</p>	Controlled Cooking Test	<ul style="list-style-type: none"> • Amount of food cooked • Amount of fuel consumed • Cost of fuel • Qualitative observations
LBNL – 2011	<p>Traditional: Traditional – charcoal</p> <p>Improved Charcoal: EcoRecho – charcoal Prakti Rouj – charcoal StoveTec Two-door – charcoal Mirak – charcoal</p>	Water Boiling Test (Haitian charcoal was not used)	<ul style="list-style-type: none"> • Time to boil • Thermal efficiency • Specific fuel consumption • CO, CO₂, CO/CO₂ • Qualitative observations
LBNL – 2011	<p>Traditional: Traditional – charcoal</p> <p>Improved Charcoal: EcoRecho – charcoal Prakti Rouj – charcoal Mirak – charcoal Envirofit CH-2200 - charcoal</p>	Controlled Cooking Test (Haitian charcoal was not used)	<ul style="list-style-type: none"> • Total burn time • Specific fuel consumption • CO, CO₂, CO/CO₂ • Qualitative observations

11 Nexant 2010; Chemonics Year1 2012; Chemonics Year2 2013; LeFebvre, Oliver 2015. "Improved cooking Technology Program (Recho Paw): Longitudinal Study of Eight Improved Cookstoves in Port-au-Prince," USAID.

12 2011: <https://pubarchive.lbl.gov/islandora/object/ir:157010/datastream/PDF/download/citation.pdf>
2011: <http://cookstoves.lbl.gov/haiti/lbnl-5341e.pdf>

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TABLE 3: CONTINUED

REPORT	TESTED STOVE-FUEL COMBINATIONS	TEST PROTOCOL	METRICS MEASURED
USAID-CHEMONICS YEAR 1 - 2012	<p>Traditional: Traditional round – charcoal Traditional rebar – charcoal</p> <p>Improved Charcoal: EcoRecho – charcoal Prakti Rouj – charcoal Mirak – charcoal Envirofit CH-2200 Men Recho – charcoal Mirak knockoff – charcoal ZPB – charcoal Burn Charbelle - charcoal</p>	Controlled Cooking Test	<ul style="list-style-type: none"> • Cooking time • Amount of food cooked • Amount of fuel consumed • Specific fuel consumption • Focus group
USAID-CHEMONICS YEAR 2 - 2013	<p>Traditional: Traditional round – charcoal Traditional rebar – charcoal</p> <p>Improved Charcoal: EcoRecho – charcoal Prakti Rouj – charcoal Mirak – charcoal Envirofit CH-2200 Men Recho – charcoal Burn Charbelle – charcoal Alvache – charcoal Eco Zoom – charcoal GIZ Éclair – charcoal Plop Plop – charcoal Rena 1 – charcoal Rena 2 - charcoal</p>	Controlled Cooking Test	<ul style="list-style-type: none"> • Cooking time • Amount of food cooked • Amount of fuel consumed • Specific fuel consumption • Focus group
USAID-LEFEBVRE – 2013/14	<p>Improved Charcoal: EcoRecho – charcoal Prakti Rouj – charcoal Envirofit CH-2200 - charcoal Men Recho – charcoal Burn Charbelle – charcoal Eco Zoom – charcoal GIZ Éclair – charcoal Plop Plop – charcoal</p>	Kitchen Performance Test & monitoring with SUMS	<ul style="list-style-type: none"> • Fuel savings • Cooking time • CO emissions • Usage
MIT D-LAB - 2014	<p>Traditional: Traditional (multiple models) – CRI Briquettes Traditional (multiple models) – charcoal TSF – wood</p> <p>Improved Charcoal: Multiple models – charcoal Multiple models – CRI Briquettes</p> <p>Improved Charcoal with 3 stone pot support: Multiple models – CRI Briquettes</p>	Water Boiling Test (ignition emissions were not necessarily captured; PM10 measured as opposed to PM2.5)	<ul style="list-style-type: none"> • Time to boil • Fuel consumed • Thermal efficiency • Fire power • Burn rate • Specific fuel consumption • CO, CO2 (indoor & overall) • PM10 (indoor & overall)

Supplementary Information: Available Cookstoves and Fuels

FUEL SUPPLY CHAINS

Charcoal (Wood)

Charcoal is produced in rural areas and then transported to urban centers for sale. Production is inefficient, largely informal, and disorganized. Improving the wood-to-charcoal conversion rate could significantly impact the environment by reducing the amount of wood needed, leading to a reduction in forest degradation and emissions. Switching to more efficient carbonization kilns can reduce emissions by 1.3 to 1.8 kg CO₂e/MJ_{delivered} (ENEA 2016). However, producers currently lack the technical capacity to improve production, and most of the profit made in the charcoal value chain comes from transportation from rural to urban markets (UNEP 2016). Organizing charcoal producing communities around sustainable wood lots can overcome these issues and have a positive impact on forest degradation and emissions.

Wood

Fuelwood is primarily collected by rural household members near their homes. There is not a strong culture of fuelwood purchase in households. Fuelwood for sale to institutions is primarily sourced from a vendor's own land. In a study by UNEP in the South Department, over 66% of fuelwood vendors sourced their product from their own land, traveling between one and three kilometers to gather the wood (UNEP 2016).

LPG

The LPG market includes four broad categories of companies: sea importers¹⁴ (Total and Sodigaz); land importers¹⁵ (Ecogaz and Gazel); large distributors (Ecogaz); and small distributors (Progaz, Gazel, and others). Traditionally, the sea importers set LPG prices, but increasing importation of LPG by land from the Dominican Republic has lowered prices. As of 2010, the LPG port terminals for Sodigaz and Total had the capacity to handle up to 50,000 tons of LPG annually. Sodigaz accounted for 60% of sea imports (about 9,000 tons annually). Sodigaz has 850 tons in total storage capacity. Because of limited capacity, in 2010 Sodigaz imported LPG by ship every 2-3 weeks. Total, which accounted for the remaining 40% of sea LPG imports, has 1,000 tons of working capacity and received 900 tons of LPG every two months (Nexant 2010). Gazel and Ecogaz account for an estimated 70% of final distribution to customers, which includes other smaller distributors. Gazel's and Ecogaz's models are based on micro-filling sales and developing independent, smaller micro-filling operators. Ecogaz and Gazel both provide and install micro-filling equipment in return for exclusive long-term supply contracts (Nexant 2010). Most attempts at developing LPG on a larger scale have failed due to two main factors: the high cost of purchasing the cylinder and LPG stove for middle- and low-income households; and the lack of a robust regulatory framework for the LPG sector that contributed to the opening of hundreds of independent micro-filling centers not subject to safety standards (ENEA 2016). Cross-filling of cylinders by these actors has led the largest LPG marketers to postpone further investments.

Ethanol

Ethanol is currently imported from the United States to Haiti through a partnership between POET (the supplier) and Novogaz (the local distributor). Access to ethanol fuel and cookstoves is limited to PaP. Ethanol's potential as a cooking fuel in Haiti remains largely unexplored due to lack of consumer awareness, few existing players, and the high price point of the stoves, which makes them inaccessible to many Haitians. However, if taxes and tariffs were lowered, ethanol fuel would be at parity with other cooking fuels. Currently ethanol is taxed at 31% (VAT, customs, and other fees) (Dalberg 2016). ENEA (2016) analysis shows that some volume of ethanol could be produced locally with low environmental impacts. Preliminary analysis of

14 Sea importers are those with storage terminals in Port-au-Prince.

15 Land importers are importer via trucks from the Dominican Republic

production costs shows higher costs to produce ethanol compared to carbonized briquettes and wood charcoal due to the capital expenditures related to intensive processing equipment and micro-distilleries. Novogaz is working to increase the market uptake of ethanol through a network of female distributors.

Carbonized briquettes

Carbonized briquettes from sugarcane waste are currently being produced by Carbon Roots International (CRI) located in Cap Haitien at moderate scale. ENEA analysis has indicated that a combination of existing agricultural crop residues and byproducts from maize, rice straws, sugarcane, and sweet sorghum could allow for the production and use of carbonized agricultural briquettes by up to 95,000 households. Current production is only from sugar cane bagasse (by CRI) and would cover only 3% of the population. This limited production level is also due to seasonality effects on crop yields. Any company looking to reach scale will need to consider how to use additional feedstocks (ENEA 2016).

Other

Given the lack of **biomass pellet** producers, stoves, or distribution in Haiti, creating a new fuel's supply chain would be difficult. Due to the need for new capital expenditures for equipment, production costs are expected to remain significantly higher than fuels currently in the market (ENEA 2016). Achieving high usage rates is critical for making the household pellet market commercially viable, but adoption has been limited in other developing countries due to high upfront costs for pellet stoves and the behavior change needed to alter cooking practices from the use of solid fuel. The usage levels needed for a commercially-viable pellets market require financing mechanisms and significant investment in awareness creation.

A range of solar cookers have been promoted throughout Haiti over the past decade, mostly contributed via charitable donations. While a free energy source, solar energy is limited by time of day, season, and weather. In the near term, scalability of solar cooking, especially as a primary energy source for household cooking, is not considered viable due to these limiting factors and high investment costs, extended cooking times, and need to significantly shift cooking behavior. In the longer term and with more research, innovation, and financing options, it presents opportunities for no-emission cooking solutions that can complement other stove and fuel types.

Solar microgrids, such as those run in Les Anglais by EarthSpark, represent a promising opportunity to reach households with renewable energy. However, ENEA analysis concluded that cooking with electricity from a solar microgrid could be up to ten times more expensive than using wood charcoal. The ENEA modeling also showed that solar electricity energy demand is relatively high (equivalent to improved charcoal pathways), due to the energy demand in solar panel and battery manufacturing processes. Electricity from Haiti's grid is more affordable than electricity from a solar microgrid, but the current levels of supply are too unreliable to enable cooking with electricity at scale (ENEA 2016).

Biogas in Haiti faces several challenges common to other countries, including construction costs, proper siting of digester, limited gas storage, and lack of available feedstock. These challenges exist for small or large industrial scale production. Biogas production requires a significant and consistent amount of raw material and water to maintain the digester process. Feedstock resources (crop wastes and animal manure) are not always available or consistent. Haitian animal rearing practices are unlikely to yield enough manure in most places. Haiti also has limited infrastructure for waste collection, which contributes to the lack of biogas market penetration. Options for large-scale biogas waste-to-energy (WTE) projects require cooperation with waste management authorities. Opportunities for small-scale community-level WTE systems exist but require further exploration to determine the most appropriate scale, technology, and cost feasibility.

COOKSTOVES

Charcoal Cookstoves

Traditional

Local artisans make traditional charcoal stoves throughout Haiti, and these stoves are readily available in any market. Traditional stove models vary slightly by region—the square model

dominates the PaP market, while the round model is more popular within Cap Haitien. Traditional cookstoves generally have lower efficiency (20% - Tier 1) and high emissions (Tier 0) (CSU 2016; Sweeney 2015). These stoves must be replaced regularly (every 3 to 12 months).

The Recho Mirak was the first non-traditional charcoal stove introduced in Haiti in the 1980s. The Bureau of Mines and Energy (BME) developed it with support from the World Bank and the Government of Canada. Between 1996 and 2003, the non-profit CARE partnered with BME to promote and distribute Recho Mirak stoves. Though distribution stalled in 2003 due to a lack of project funding, the Recho Mirak stove remains the most referenced improved cookstove in Haiti, and subsequent projects have proposed reviving it (ESMAP 2007). Currently, a limited number of artisans produces the Mirak stove in PaP. Without external quality control, the current Mirak stoves differ from the original design and do not offer performance benefits over traditional options (informant interviews).

Cleaner and more efficient

Two formalized businesses, D&E Green Enterprises (D&E) and Haiti Metal, have been leaders in producing cookstoves for household use. These companies import high quality steel and manufacture stoves at centralized facilities in PaP. Distributors sell small volumes of stoves to urban centers in Haiti, but the bulk of the sales are focused on PaP. D&E is currently the largest non-traditional cookstoves seller. They currently produce the Echo Recho (500+ HTG) and the Plop Plop (550 HTG) models. The Plop Plop appears to offer only modest performance advantages over traditional stoves when used with wood charcoal, but use with briquettes yields higher efficiency (Tier 2) and lower indoor emissions (Tier 1) (CSU 2016). Non-traditional charcoal stoves in other markets generally have higher efficiency (Tier 2 on average).

Regardless of these cookstoves' actual efficiency, when presented with a range of options users reported that cooking is faster than with traditional stoves (LeFebvre 2012). According to the ICTP longitudinal study (2012), D&E's charcoal stoves were also perceived as easier to use. In qualitative testing, users generally valued D&E cookstoves; 20% of users were willing to borrow money to purchase one, but consumer financing options are not widely available. As with traditional stoves, durability is a major issue with cleaner and more efficient cookstoves. In a study conducted by CQuest as part of the ICTP, only 30% of non-traditional stoves remained in good condition after one year of use due to combustion chamber corrosion and cracks in clay-based liners.

The likelihood of counterfeiting may also deter cookstove manufacturers from investing in better technology. Project evaluations noted that manufacturers were disinclined to invest in higher performing technology because of the high rates of local artisans counterfeiting the Mirak stove. The BME attempted to combat counterfeiting with an official "Mirak" label, but the program lacked an enforcement mechanism and has since fallen into disuse (CLASP 2016; Chemonics 2015; Thivillion 2015).

Wood Cookstoves

There are no higher performing wood cookstoves currently on the commercial market. Wood users in Haiti, primarily in rural areas, typically collect their own fuel and cook on three-stone fires. There are many different models of wood-burning stoves available internationally that generally offer some efficiency (Tier 2 on average) and emissions (Tier 2 on average) advantages. Given the distribution challenges of reaching rural wood users, and that these consumers do not currently pay for a cookstove or fuel, there is not a strong value proposition for enterprises to import cleaner and more efficient wood stoves or to adapt a model to produce locally. There is greater potential for larger commercial cleaner and more efficient wood stoves for rural bakeries and other SMEs.

LPG Cookstoves

LPG cookstoves are widely available in urban markets through large and small retailers. LPG stoves are high performing, achieving Tier 4 for emissions and efficiency. Models include 1-burner, 2-burner, and 3-burner cooktops, as well as a 4-burner cook top/oven combination that is popular among SMEs and wealthier households. LPG stoves and burners are imported from China through PaP by major import companies such as Valerio Canez (VC) and Matelec,

and these stoves typically last for several years. There are smaller local manufacturers of LPG stoves such as Switch and Franck Machine who rely on VC and Matelec for burners. VC is the largest importer and distributor of LPG stoves and stocks several WestPoint models made in China. LPG stoves are subject to high taxes upon import: 21-26% (Dalberg 2016). Tariffs for stove components are lower than those for finished stoves to encourage domestic assembly. However, if stove components arrive together (i.e. in the same box), then importers face the same tariff rates as for finished stoves (Dalberg 2016). LPG cylinders are exempt. Lowering taxes on LPG stoves would increase the cost competitiveness. Local manufacturing could reduce the price of the LPG stove by 25%; however, the biggest constraint to expanding is lack of working capital.

Ethanol Cookstoves

Ethanol stoves, like LPG stoves, perform well in terms of both emissions and efficiency. Novogaz is currently the only company to import and distribute ethanol fuel and stoves in Haiti. Other market players have expressed interest and at least one other manufacturer is considering producing ethanol stoves locally. Market actors agree that sufficient demand for ethanol fuel is required prior to investment in local production. Three stores, serviced by stocking points, exclusively sell stoves and fuel and host agents that promote ethanol stoves in the community. The stocking points also serve a few larger retail outlets such as grocery stores. Financing for ethanol cookstoves is limited to a few stores that allow select customers to make payments over time. Since both stoves and ethanol are imported, the company requires large amounts of cash up front and long lead times before product can reach the country. Distribution is challenging because the product must be located within a few meters of a household to compete with wood charcoal's convenience. Presently, the lack of consumer demand presents the biggest challenge in the ethanol supply chain. The fuel switch requires a large upfront cost and consumer education. Novogaz is investigating the production of flat-packed ethanol stoves, with lower ex-factory costs and lower import duties to pass the cost savings to the consumer.

Other

Kerosene stoves are also available on the market in Haiti, but are not popular. Electric cookstoves are imported from China and sold by Valerio Canez in PaP, but supply of these are limited outside of PaP due to lack of access to reliable electricity.





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