

PREPARATION OF A CLEAN COOKING SOLUTIONS ROADMAP AND INVESTMENT PROSPECTUS FOR GUATEMALA

ROADMAP AND INVESTMENT PROSPECTUS

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Acronyms and Abbreviations

~	Approximately
LAC	Latin American and the Caribbean (LAC)
IDB	Inter-American Development Bank
CACCI	Central America Clean Cooking Initiative
CONAP	Consejo Nacional de Áreas Protegidas
e.g.	For example
ICS	Improved Cookstoves
FAO	Food and Agriculture Organization
FUNDESA	Fundación para el Desarrollo de Guatemala
GACC	Global Alliance for Clean Cookstoves
LPG	Liquefied petroleum gas
R&D	Research and Development
MFI	Microfinance Institution
INAB	Instituto Nacional de Bosques
MAGA	Ministerio de Agricultura Ganadería y Alimentación
MARN	Ministerio de Ambiente y Recursos Naturales
MEM	Ministerio de Energía y Minas
MIDES	Ministerio de Desarrollo Social
Min Educ	Ministerio de Educación
MINECO	Ministerio de Economía
MSPAS	Ministerio de Salud Pública
WHO	World Health Organization
NGO	Non-governmental organization
OPS	Organización Panamericana de la Salud
PRONACOM	Programa Nacional de Competitividad
CSR	Corporate social responsibility
REDIMIF	Microfinance Institutions Network
SE4ALL	Sustainable Energy for All
SESAN	Secretaría de Seguridad Alimentaria y Nutricional
USAID	US. Agency for International Development
USI	Inter-sectoral Support Unit
WWF	World Wide Fund for Nature

Glossary

Biomass	All organic matter produced by living beings as a result of their vital activities (e.g. wood, tree leaves, shells of nuts, pruning).
Clean cooking solutions	Refers to a range of cooking technologies and fuels that generate low or no emissions during use (e.g. some biomass Improved Cookstoves, LPG stoves, Biogas stoves, electric stoves). While more specific standards do exist for rating the cleanliness of stoves based on total emissions and/or indoor emissions (e.g. ISO/IWA tiers), such standards may not be well suited to all country contexts based on variations in cooking practices and preferences. As such, we deliberately use more general terminology in this document to allow each country to follow the standards they find most relevant.
Forest degradation ¹	Changes within the forest which negatively affect the structure or function of the stand or site, and thereby lower the capacity to supply products and/or services
Improved cookstoves	Refers to all stoves with medium/high level of fuel efficiency and lower generation of indoor emissions (compared to traditional stoves). The stoves can use as fuel wood, LPG, biogas, charcoal, among others. While more specific standards do exist for rating the overall quality of stoves based on fuel efficiency, emissions, and safety, (e.g. ISO/IWA tiers), such standards may not be well suited to all country contexts based on variations in cooking practices and preferences. As such, we deliberately use more general terminology in this document to allow each country to follow the standards they find most relevant.
Primary fuel	Primary fuel source used at home (the most widely used at home).
Secondary fuel	Secondary source of fuel used at home (the second most used at home).
Solid fuels	Refers to a type of fuel whose components are presented solidly (e.g. coal, wood).
Traditional stoves ²	Traditional stoves, including rudimentary open fires (e.g. three stone fire), are locally produced using available and low cost materials such as stones, ceramics, clay and bricks. These stoves typically utilize readily available fuels such as wood or charcoal.

¹ Definition from FAO, available in the following web page: <http://www.fao.org/docrep/009/j9345e/j9345e08.htm>, March 2015.

² Definition from GACC, available in the following web page: <http://cleancookstoves.org/technology-and-fuels/stoves/>, March 2015.

1 EXECUTIVE SUMMARY

Today ~2.4M households, or more than 70% of Guatemalan households cook with traditional stoves. More than 50% of the Guatemalan households cook primarily with wood, while an additional 20% of households cook with wood in combination with other fuels (referred to as “fuel stacking”).

Using traditional stoves for cooking has severe and negative implications on health, as well as costly implications on household finances. Traditional cooking adversely affects the health of women who cook and the children in their care, causing almost 5,200 deaths every year due to indoor air pollution; using traditional stoves also contribute to the emissions of pollutants, with each stove producing approximately 3 tons of carbon dioxide annually more than the amount generated by an improved cookstove (ICS). Finally, using traditional stoves also impacts household economics since Guatemalan families who use traditional stoves and purchase wood spend on average 40% more each month on overall cooking costs compared to similar households who use improved, higher efficiency stoves. Additionally, cooking with traditional stoves has implications for various other development dimensions: gender empowerment, since women devote ~11 hours collecting wood and ~13.5 hours cooking per week; forest degradation, since traditional stoves consume more than twice as much wood as improved cookstoves; and rural development, since the depletion of natural resources, negative health effects, and time devoted to non-income generating activities hinder the ability of rural communities to prosper.

A number of barriers have prevented Guatemala from scaling up the adoption of more efficient and cleaner cooking solutions. Obstacles affect demand, supply, and enabling environment of clean cooking solutions. Some of Guatemala’s main challenges relate to low levels of demand by users. A number of factors contribute to low demand. First, there is relatively low willingness to pay for an improved cookstove, as well as little training to users on how to install, operate, maintain and/or repair the stove. Additionally, financing options are not readily available to make cleaner solutions that typically have higher up-front costs more affordable. At the same time, the improved cookstoves distribution and after-sales networks are very weak and their models do not yet totally satisfy the preferences of the families in Guatemala. Additionally, the LPG sector has not shown a strong interest in expanding their distribution network to supply the segments of the population today cooking with wood. Main challenges related to the enabling environment are the lack of up-to-date market information, limited inter-sectoral coordination, and the lack of quality standards. These barriers are more fully detailed in subsequent sections of this document.³

The World Bank and the Government of Guatemala have set the ambitious goal of eradicating dependency on traditional stoves for cooking by 2030. To do so, they have developed, together with key stakeholders in the country, a Roadmap for the next 15 years focused on eliminating these barriers and enabling almost a two and a half million households to transition to clean cooking solutions⁴. The Roadmap aims to illustrate a pathway to remove the barriers identified using a

³ A separate detailed Gap Assessment has been prepared for Guatemala as part of this process.

⁴ Throughout this document we refer to “improved cookstoves” or “biomass improved cookstoves (ICS)” as examples of technologies/solutions for clean cooking. Improved stoves can include a range of technologies and fuels, and are considered to be improved in the sense that they have higher fuel efficiency standards and/or lower harmful emissions. While we are aware that there are established criteria for rating the performance of different technologies (e.g. ISO tiers), these standards are less commonly applied in Central America due to the types of improved stoves (e.g. stoves with planchas) that are common in these countries. Policy makers in Nicaragua and Guatemala are in the process of clarifying their own standards for improved cookstoves. The projections and recommendations we make in this document regarding the uptake of improved cookstoves assume alignment to whatever stove and fuel standards are set by each country.

holistic and coordinated approach leveraging some of Guatemala’s key strengths. Strengths in Guatemala include relatively high awareness of the negative consequences of traditional cooking stoves, the existence of alternative solutions due to almost 40 years of promoting clean cooking solutions, existence of the Cluster of improved cookstoves, large variety of ICS models and manufacturers, high annual production capacity to meet demand, strong institutional leadership by MEM, the existence of the Mesa de Leña, and existing policies and regulations supporting the clean cooking sector.

Working closely with stakeholders in Guatemala, we have developed a Roadmap 2015-2030 to address the critical barriers that have to date limited the transition to clean cooking. The Roadmap includes 12 strategic lines divided into 3 critical areas:

1. Enhancing demand for clean cooking solutions through increasing public awareness of the problems associated with cooking using traditional stoves as well as awareness of better alternatives and the benefits of existing clean cooking solutions, training the users and creating financing mechanisms to make these technologies more affordable
2. Scaling the supply of improved cookstoves by promoting the availability of existing clean fuels and new alternatives for cooking, by making current products more user-appropriate and accessible, and by enhancing the distribution and after-sale network of improved cooking solutions, and finally
3. Improving the enabling environment of clean cooking solutions by ensuring strong institutional support for the sector, up-to-date data and information to improve and support the decision-making process, more favorable policies, regulations, norms, and quality standards for the sector.

We estimate that US \$28.3 million in investments will be necessary to implement the first five years of the Roadmap (2015-2020). This amount takes into account the priority initiatives included in all 12 strategic lines. Overall, we estimate that the majority of investment costs for the first five years (approximately US \$20 million) will need to focus on increasing the demand, which has been identified by country experts as the cornerstone of a strategy to accelerate the transition to clean cooking solutions in Guatemala. Enhancing the supply and improving the enabling environment require more modest investments (US \$5 and \$3 million respectively), but are critical complements to larger investments in demand creation.

The table below summarizes the required investments across the 12 strategic lines outlined in the Roadmap. Further details on each investment area is provided in subsequent sections of this document.

Table 1: Investment by area 2015-2020 (M US\$)

Area	Investments	Total
Demand	1. Generate awareness of the negative consequences of cooking with traditional stoves and the existence of alternatives	\$20.3M
	2. Improve ability of potential users (via training on how to install, use, maintain and fix their stoves)	
	3. Ensure that different population segments have the capacity to pay for the different technologies (e.g. through microcredits, CSR, Subsidies)	
Supply	4. Increase availability of different fuels for cooking (e.g. woodfuel, LPG, electricity, biogas)	\$5.1M
	5. Understand the preferences of potential ICS users and broaden the portfolio of stove models available	
	6. Enhance the productive capacity of ICS	

	7. Increase and/or reinforce own and subcontracted distribution networks of ICS	
	8. Increase and/or reinforce own and subcontracted after-sales networks of ICS	
Enabling environment	9. Ensure new and existing policies to support the clean cooking sector	\$2.9M
	10. Ensure the Roadmap is correctly implemented; ensure commitments and responsibilities are honored	
	11. Ensure that stoves meet minimum performance standards	
	12. Create a repository with quality data to facilitate effective decision making	
Total		\$28.3M

Source: Dalberg analysis based on stakeholder input in Guatemala.

2 BACKGROUND AND CONTEXT

The World Bank Latin American and the Caribbean (LAC) Sustainable Energy group, which is part of the Global Practice of Energy and Extractive Industries, has completed the “Preparation of a Clean Cooking Solutions Roadmap and Investment Prospectus for Guatemala, Honduras and Nicaragua” Project. This document focuses exclusively on Guatemala, although a separate and similar analysis has been prepared for Nicaragua. The Project was funded by the initiative Sustainable Energy for All (SE4ALL) Central America Clean Cooking Initiative (CACCI). CACCI aims to provide technical assistance to the governments of Guatemala, Honduras, and Nicaragua and support them in their efforts to scale up clean cooking solutions by 2030. The World Bank hired Dalberg Global Development Advisors to support these countries throughout this process.

During the project, Dalberg worked closely with key stakeholders in Guatemala to translate country priorities into a comprehensive Roadmap and Investment Prospectus. Concretely, the project followed three phases:

- 1) Identification of the key barriers that have limited broader adoption of clean cooking solutions in Guatemala. Findings from this phase are summarized in a detailed Gap Assessment document, which serves as the basis for the subsequent strategic recommendations and investment planning.
- 2) Development of a strategic Roadmap that articulates the interventions needed to remove these barriers and enable universal access to clean cooking solutions by 2030, and
- 3) Quantification of the investment costs needed to implement this Roadmap to remove the barriers, with a focus on the first five years of the Roadmap (2015-2020).

The process has been highly inclusive and participatory, with frequent consultations with stakeholders from a range of sectors in Guatemala. In total, more than 20 organizations have contributed to the development of the strategy presented in this document (see Table 1 below). The various organizations were engaged throughout the process via workshops, interviews, information sharing, reviews of drafts, and provision of feedback. This synthesis document reflects broadly shared perspectives from public, private, and civil society organizations in Guatemala.

Table 2: Consulted organizations

Government	Donors
<ul style="list-style-type: none"> • Ministerio de Energía y Minas (MEM) • Ministerio de Agricultura Ganadería y Alimentación (MAGA) • Ministerio de Salud Pública (MSPAS) • Ministerio de Ambiente y Recursos Naturales (MARN) • Ministerio de Educación (Min Educ) • Ministerio de Economía (MINECO) • Ministerio de Desarrollo Social (MIDES) • Instituto Nacional de Bosques (INAB) • Consejo Nacional de Áreas Protegidas (CONAP) • Secretaría de Seguridad Alimentaria y Nutricional (SESAN) • Programa Nacional de Competitividad (PRONACOM) 	<ul style="list-style-type: none"> • Mesa de donantes • Inter-American Development Bank (IDB) • World Wide Fund for Nature (WWF) • US. Agency for International Development (USAID)

Manufacturers /distributors	Others
<ul style="list-style-type: none"> • Clúster de estufas mejoradas • Gentegas • Helps International 	<ul style="list-style-type: none"> • Fundación para el Desarrollo de Guatemala (FUNDESA) • Microfinance Institutions Network (REDIMIF) • Food and Agriculture Organization (FAO)

Source: Dalberg analysis based on stakeholder engagement in Guatemala.

This document summarizes the key findings of the Gap Assessment and lays out a comprehensive Roadmap and investment strategy to catalyze the ambitious transition envisioned to ensure universal access to clean cooking in Guatemala by 2030. This Investment Prospectus seeks to raise US \$28 million from public agencies, multilateral organizations, bilateral organizations, foundations, non-governmental organizations (NGOs), the private sector, and impact investors committed to capturing this opportunity to transform the cooking sector in Guatemala. The holistic approach to achieving this objective includes initiatives in the three critical areas related to increasing the demand for cleaner solutions by households, increasing the supply of viable options available in Guatemala, and improving the broader enabling environment so that the ecosystem for clean cookstoves and fuels can thrive.

The remainder of this document is structured as follows:

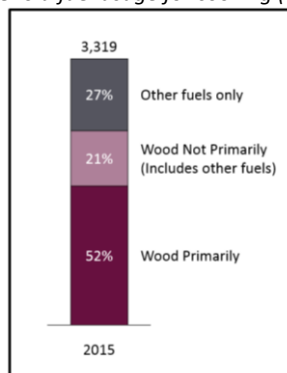
- **Section 3: Nature of the Challenge in Guatemala** – provides context regarding the challenge we are trying to address in Guatemala.
- **Section 4: Catalyze a Transformational Change** – describes the strategic Roadmap for market transformation we envision in Guatemala.
- **Section 5: Investment Needed to Accomplish the Transition** – presents the specific investments needed for the first five years to implement the Roadmap.
- **Section 6: Operating Model** – presents options for a governance structure to oversee the implementation of the Roadmap. It also defines the funding flows at a high level. This section includes an overview of the monitoring and evaluation plan, as well as a chapter on risks and mitigation strategies.
- **Annex 1: Investment Summary** – presents an aggregated summary view of the investments required for Roadmap implementation.
- **Annex 2: Investment Details** – includes detailed information on the investment components introduced in Annex 1, including specific activities, timing, cost, and responsible entities for each.
- **Annex 3: Indicators and Annual Targets** – includes the targets suggested for each of the Roadmap indicators.
- **Annex 4: Health and Emission Annual Projected Impact** – includes the projected impact in terms of health and emissions.

3 NATURE OF THE CHALLENGE IN GUATEMALA

3.1 WHAT IS THE CHALLENGE?

More than 50%⁵ of Guatemalan households cook primarily with wood. An additional twenty percent of households cook with a combination of wood and other fuels (referred to as “fuel stacking”), bringing the total percentage of households who use wood for cooking up to more than 70%⁶.

Figure 1: Household fuel usage for cooking (000 households)



Source: Gap assessment – Guatemala. Preparation of a Clean Cooking Solutions Roadmap and Investment Prospectus for Guatemala, Honduras, and Nicaragua. Dalberg, March 2015.

Similar to the poverty rate, which remains over 50%⁷, the percentage of families cooking primarily with wood has barely decreased over the last 15 years despite the efforts from different stakeholders to address this problem. Guatemala has a long history (almost 40 years) of promoting programs and projects that aim to reduce the use of wood for cooking or include a component related to clean cooking solutions, but the data reflect virtually no impact on the percentage of households cooking with solid fuels. In fact, in rural areas, where 88%⁸ of the households cook with wood, there has been a slight increase in usage of wood for cooking over the last 10 years.

The great majority of those families cooking with wood (~80%⁹) do so using traditional stoves. Despite the existence more fuel efficient and cost effective technologies, households have continued to use traditional stoves in part due to lack of knowledge or awareness of the harmful effects, cultural reasons, availability of free fuelwood, and mistrust of alternative solutions (see further detail in section 3.2).

Cooking with traditional stoves is a multidimensional problem, and has implications in terms of:

- **Gender**¹⁰ – women devote ~11 hours collecting wood and ~13.5 hours cooking per week. Also, more than 90% of the cooking related activities are completed by women.

⁵ Gap assessment – Guatemala. Preparation of a Clean Cooking Solutions Roadmap and Investment Prospectus for Guatemala, Honduras, and Nicaragua, Dalberg, March 2015.

⁶ Ibid.

⁷ Ibid.

⁸ Ibid. Data point for the year 2012, in 1998 the percentage was 86%.

⁹ Ibid.

¹⁰ Guatemala Cookstoves and fuel market assessment (GACC), 2013.

- **Health** – as consequence, women and small children in their care suffer from respiratory diseases caused by the inhalation of household fumes, since more than 90%¹¹ of household cooking related activities occur indoor. Approximately ~5,192¹² annual deaths in Guatemala are attributed to household air pollution.
- **Environmental Degradation** – traditional stoves consume more wood for fuel compared to more efficient biomass stoves (improved biomass stoves in Guatemala save almost 60%¹³ on wood consumption if compared against open fires or three stone stoves). Also, almost 50% of the households that collect wood do so from their own plantings, 20% from national or municipal forests, and the remaining 30% collect it from the ground or from other means not specified¹⁴.
- **Climate Change** – traditional stoves have lower fuel efficiency, therefore they emit more greenhouse gases contributing to climate change. Cooking with open fires in Guatemala results in emissions of gases and particulates (CO, PM2.5, PM10 and STS) that are more than three times as emissions from ICS¹⁵.
- **Household Finances** – Guatemalan families who use traditional stoves and purchase wood spend on average 40% more each month on overall cooking costs.¹⁶ More fuel-efficient stoves will reduce the marginal costs of cooking, as less wood will be necessary.
- **Rural Development** – beyond the impact on the environment through the depletion of natural resources, collecting fuelwood involves significant time that could otherwise be devoted to income generating matters, and this problem happens in most of the rural communities, since 88% of the rural population cooks with solid fuels.

¹¹ Ibid.

¹² According to estimates from the Global Alliance for Clean Cookstoves (GACC), available on the following webpage: <http://cleancookstoves.org/country-profiles/100-guatemala.html>, March 2015.

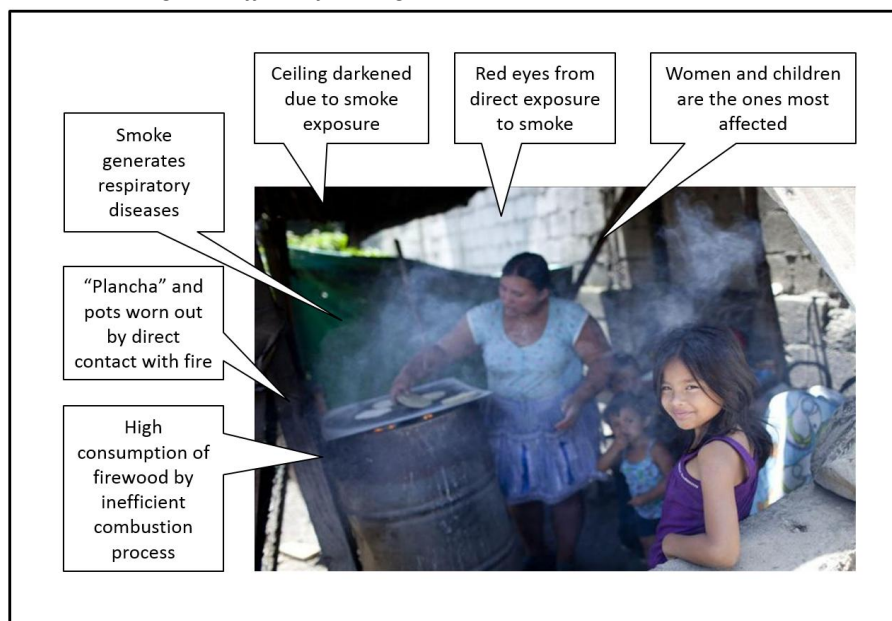
¹³ Gap assessment – Guatemala. Preparation of a Clean Cooking Solutions Roadmap and Investment Prospectus for Guatemala, Honduras, and Nicaragua. Dalberg, March 2015.

¹⁴ National survey of wood consumption in households and small industry in Guatemala (Akianto, CEPAL, GIZ), 2011.

¹⁵ Estimates from Guatemala Cookstoves and fuel market assessment (GACC), 2013.

¹⁶ Compared to monthly expenditure of using LPG stoves, electricity stoves and biomass ICS. Source: Gap assessment – Guatemala. Preparation of a Clean Cooking Solutions Roadmap and Investment Prospectus for Guatemala, Honduras, and Nicaragua. Dalberg, March 2015.

Figure 2: Effects of cooking with traditional stoves in Guatemala



Source: Photo taken from: <http://www.que.es/ultimas-noticias/sociedad/fotos/mujer-cocina-estufa-lena-acompanada-f767519.html>, consulted March 2015.

By increasing the adoption of clean cooking solutions, the above problems will be reduced/eliminated, positively impacting household health and finances, and leading to higher likelihood of poverty reduction and increased prosperity. Experiences and observations from around the world back up the linkage between clean cooking and improved living conditions.

Table 3: Benefits of clean cooking

Improved cooking solution effect	Positive change
Reduction of household air pollution	<ul style="list-style-type: none"> • Decreased incidence of respiratory diseases • Cleaner and more hygienic kitchen
Reduction in woodfuel consumption	<ul style="list-style-type: none"> • Decreased forest degradation • Decreased emissions • Reduction in money/time invested in purchasing/collecting wood
Reduction in cooking time/preparation	<ul style="list-style-type: none"> • More time/independence for women • Possibility for women to allocate time to economically productive activities
Increased safety	<ul style="list-style-type: none"> • Reduction of burns and fire

Source: "Evaluando la implementación de cocinas mejoradas en comunidades rurales del departamento de Jinotega en Nicaragua", ONGAWA, March 2015.

3.2 WHY IS THE CHALLENGE DIFFICULT TO ADDRESS?

The existence of a complex ecosystem of barriers has historically prevented Guatemala from massively scaling up the adoption of clean cooking solutions. Obstacles affect the demand, supply, and enabling environment of clean cooking solutions.

On the demand side...

Guatemala has a history of nearly 40 years promoting the use of improved cookstoves through government programs and projects of foundations, NGOs, local governments, churches, and communities. This has contributed to a relatively **high awareness** of the negative consequences of traditional cooking stoves and the existence of alternative solutions. Some of the most relevant programs promoting cleaner cooking in Guatemala have been:

- **In 1976, the model LORENA** (combination from “lodo” mud and “arena” sand) was launched. The stove was disseminated at scale and became the foundation for subsequent improved models.
- **In 1996, the Fondo de Inversión Social (FIS)** started disseminating ICS (plancha stoves). It is estimated through this program 160,000 stoves were disseminated through 2008, when the FIS was dismantled.
- **Other governmental programs such as FONAPAZ, ProRural, FODIGUA and DICOR** have disseminated cookstoves, although the number and the adoption rate of these programs is unknown.

At the same time, those who know about the technology are **not always properly trained** on how to install, use, maintain and/or repair the stove. This is considered one of the main challenges since proper training is key to increasing the long-term usage and trust in cleaner technologies. According to the Cluster of improved cookstoves, *“after-sale service is costly. So we need to ensure the family knows how to maintain the stove. Otherwise, they go to waste very fast”*. Most of the efforts on this dimension use simple pamphlets with pictures and drawings on how to clean their models as shown in the excerpt below.

Figure 3: Hands for Peace Foundation - Estufa Aler pamphlets



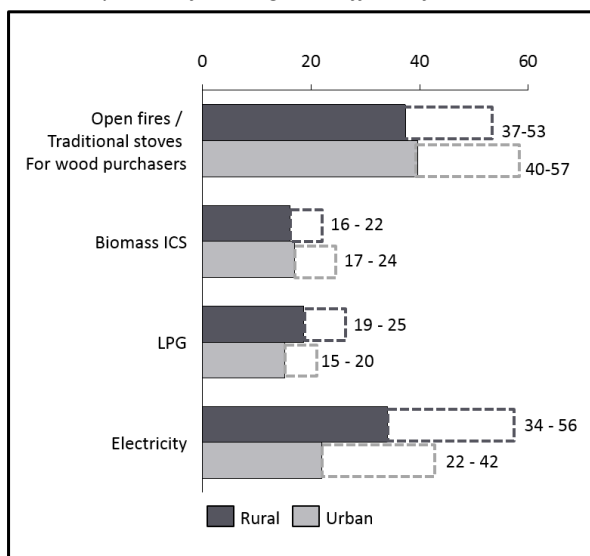
Source: Hands for Peace Foundation, Guatemala.

Finally, for those who are aware of the benefits, are properly trained in usage, and who want to access alternative solutions, often they consider improved stoves to be **not affordable** due to several factors:

- **High up-front costs:** The average market price of an improved biomass cookstove is ~USD 114, a significant sum for many households.
- **Existence of heavily subsidized programs:** The historical existence of heavily subsidized programs in the country discourages families from saving enough money to buy an improved cooking solution.
- **Lack of flexible payment schemes:** only 3 MFIs (Banrural, Genesis and Cooperativa San José) offer microloans to buy specific improved cookstove models, and manufacturers do not have the capacity to provide customer finance.
- **Low desirability of the product:** Cookstoves have traditionally had limited desirability compared to other aspirational products such as cell phones and televisions.

On the supply side...

The relatively easy **availability** of “free” woodfuel lessens the imperative to shift to other fuels such as LPG or electricity, which has limited investment in the expansion of supply for these fuels. For those who do purchase wood, the estimated total costs of cooking with a traditional stove are much higher than the cost of cooking with LPG or biomass ICS in both urban and rural communities in Guatemala.

Figure 4: Monthly¹⁷ cost of cooking with different fuels in Guatemala (US\$)

Source: Gap assessment – Guatemala. Preparation of a Clean Cooking Solutions Roadmap and Investment Prospectus for Guatemala, Honduras, and Nicaragua. Dalberg, March 2015.

Despite government plans to increase the penetration of LPG and electricity, it is expected that wood will continue to be one of the primary fuels for cooking in Guatemala. Therefore, it is important to ensure sustainable production of wood which has been led by institutions such as Consejo Nacional de Áreas Protegidas (CONAP) and Instituto Nacional de Bosques (INAB) through the incentives PINPEP and PINFOR and the Probosques act (pending approval). These programs for sustainable wood cultivation have not yet reached the necessary scale. On the LPG side, it is necessary to increase the distribution network of suppliers to reach a broader population. Today there are three big LPG players in Guatemala: 1) Z Gas, 2) Gas TOMZA (Tropigas) and 3) DA-Gas. In recent years we have seen the entry of new players specialized in segments of the population currently cooking with wood, such as GenteGas.

On the improved biomass cookstove sector, Guatemala is one of the strongest and more organized in the region, thanks to the existence of the Cluster of improved cookstoves and a large number of manufactures and distributors of improved cookstoves (e.g. Helps international, Doña Dora, Ing. Manuel Tray, Ecocomal, Soluciones apropiadas) that have the scale to **produce almost ~150,000 ICS annually** and offer over 15 different models of biomass ICS. Nevertheless, the manufacturers face resource constraints which have limited their ability or desire to:

- Invest in research and development (R&D) to create new **designs** of improved cookstoves that better fit the needs of the Guatemalan households.
- Expand or reinforce their **distribution and after-sales** networks, which today mainly depend on the existing networks of different NGOs or Government programs.

On the enabling environment side...

The **institutional support** in Guatemala for the promotion of clean cooking solutions is relatively high and has been translated into **policies** to regulate the sustainable use of wood. The main policies are the Guatemala Country Action Plan for cookstoves and fuels (2014-2024), and the National Strategic Plan for the Sustainable Use of Wood (2013-2023) which plans to deploy 650,000 improved

¹⁷ Includes cost of usage and monthly upfront investment.

cookstoves over the next ten years. More information related to policies can be found in the table below.

Table 4: Policies in Guatemala related to the cookstoves sector

Type of policy and year	Main stakeholders	Goal	Dedicated investment
National Energy Policy (2013-2027)	• MEM	<ul style="list-style-type: none"> • Install 100,000 clean biomass stoves, and conduct training on efficient use of firewood • Reduce the consumption of industrial firewood by 15% • Replace fuelwood with other energy sources in 25% of the households • Increase energy forest plantations by 10% 	• N.A.
National Strategic Plan for the Sustainable Use of Wood (2013-2023)	<ul style="list-style-type: none"> • MEM • PRONACOM • Cluster of Improved Cookstoves and Clean Fuels • MAGA • MIDES • MSPAS • MARN • FAO 	<ul style="list-style-type: none"> • Deploy 65,000 improved cookstoves per year over the next ten years • Inform 70% of the population on the sustainable use of firewood 	• ~USD 5.5M (Q 42M)
Guatemala Country Action Plan for cookstoves and fuels (2014-2024)	<ul style="list-style-type: none"> • MEM • PRONACOM • Cluster of Improved Cookstoves and Clean Fuels • MIDES • MSPAS • MAGA • MARN • MINECO • INAB • Wood Roundtable² • FAO • Global Alliance • World Bank • Universities 	<ul style="list-style-type: none"> • The action plan combines the goals of the national energy policy and the national strategic plan for the sustainable use of wood 	• N.A.

Source: Gap assessment – Guatemala. Preparation of a Clean Cooking Solutions Roadmap and Investment Prospectus for Guatemala, Honduras, and Nicaragua. Dalberg, March 2015.

However, this support from the public sector has not always been coordinated. For example, the Ministry of Agriculture (MAGA) is implementing a project that aims to disseminate 12,000 highly subsidized cookstoves a year, but other institutions like the MEM or Cluster of improved cookstoves have not participated in the design or operation of the project. Nevertheless, this situation looks to be solved through the newly established Cluster of improved cookstoves and “Mesa de leña”, which bring together the actors involved in the sector, in the private and public side respectively.

Similar to other countries in the region, Guatemala does not yet have **quality standards** that determine performance and fuel consumption thresholds of improved cookstoves, although the Ministry of Energy is working together with stakeholders from the Cluster of improved cookstoves, on developing a “Norma Técnica” using Mexico’s regulation as a foundation and adapting it to Guatemala’s idiosyncrasy, which should be official in 2015. Guatemala is also working on setting up a testing lab for improved cookstoves that will most likely be part of the MEM’s existing lab for fuel testing. Up to now, all the stoves tested in Guatemala have been send to the Zamorano testing lab in Honduras.

Finally, the lack of centralized quality **data and information** prevents stakeholders from making informed decisions and investments to build the market. The latest information available related to clean cooking solutions in Guatemala is the Cookstoves and Fuel Market Assessment from the GACC in 2013. This study uses information from other sources such as the National Survey of Living Conditions (ENCOVI) by INE, but does not provide the detail needed to comprehensively characterize the demand and supply of clean cooking solutions and needs for market strengthening. In order to try to solve this issue, institutions such as the Secretaría de Seguridad Alimentaria y Nutricional (SESAN) have opened the doors to sharing their information platform (SIINSAN), which would allow different stakeholders to upload and centralize data relevant for ICS.

The table below summarizes Guatemala’s most relevant strengths and challenges related to scaling up the adoption of clean cooking solutions:

Table 5: Guatemala's strengths and challenges in scaling up adoption of clean cooking solutions

	Strengths	Challenges
Demand	<ul style="list-style-type: none"> • Relatively high awareness of the negative consequences of traditional cooking stoves and the existence of alternative solutions 	<ul style="list-style-type: none"> • Low willingness to pay for ICS • Low availability of flexible payment schemes and financing • Little training to users on how to install, operate, maintain and/or repair the stove
Supply	<ul style="list-style-type: none"> • Existence of the Cluster of improved cookstoves • High number of manufacturers, models and high annual production capacity to meet demand 	<ul style="list-style-type: none"> • Almost non-existent ICS distribution or aftersales networks • Low investment in research and development (R&D) for developing new ICS models • Low interest of the LPG sector in expanding the distribution network
Enabling environment	<ul style="list-style-type: none"> • Strong institutional leadership by MEM and existence of the Mesa de leña • Existing policies and regulations supporting clean cooking 	<ul style="list-style-type: none"> • Lack of coordination of efforts of the public sector • Lack of updated information of the clean cooking sector • Lack of quality standards on emissions and efficiencies

Source: Dalberg analysis

3.3 HOW HAS THIS CHALLENGE BEEN ADDRESSED IN THE PAST?

Guatemala's public sector has more experience in promoting the installation of clean cooking solutions than other governments in the region. However, the challenge has not yet been fully addressed in the nearly 40 years that the government has been pushing programs and projects promoting improved cookstoves. In Guatemala there have been massive public programs focused on giving away or subsidizing stoves. A good example is the Social Investment Fund (FIS) that was active between 1996 and 2008 and is estimated to have installed around 160,000 stoves. Other programs, such as FONAPAZ, ProRural, FODIGUA and DICOR have also subsidized the dissemination of stoves, but the number of stoves disseminated and the adoption rate is unknown. Unlike other countries, Guatemala has the National Strategic Plan for the Sustainable Use of Wood (2013-2023), which includes the target of disseminating 650,000 improved biomass cookstoves over the next ten years. Nevertheless, the plan does not establish exactly how or who will provide the stoves and how to make the efforts sustainable beyond the initial stove dissemination.

Initiatives to promote clean cooking solutions in Guatemala have been led not only by the government but also by NGOs and local communities. These initiatives have been individual projects and have not been able to scale. As in the case of government programs, most of the initiatives led by NGOs and local communities have focused on providing improved biomass cookstoves that are heavily subsidized. These operating models, which promoted the installation of built in-situ improved biomass cookstoves, required the NGOs to typically subsidize ~70-80% of the total stove cost, with households contributing the remaining ~20-30% by providing the labor and basic materials to build the stoves. These approaches, while effective at enabling initial adoption, have proved less viable as models to build financially sustainable markets for improved solutions or to achieve impact at national scale.

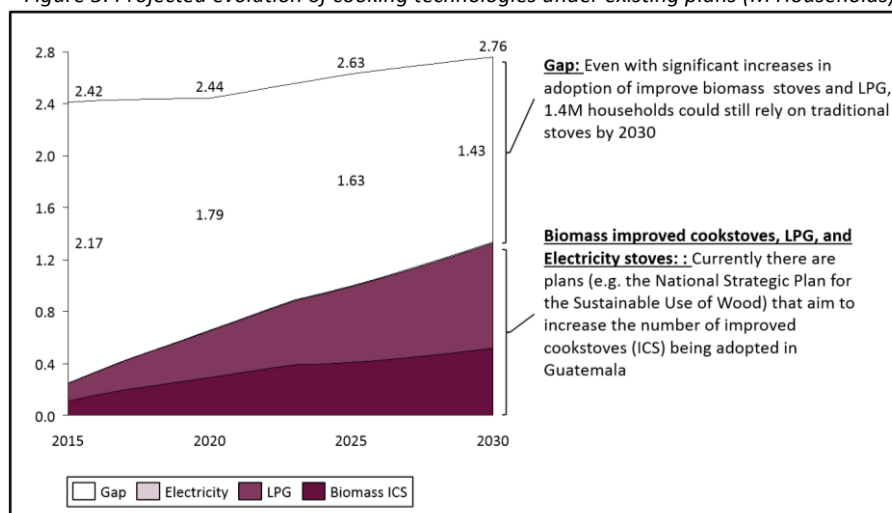
The private sector in Guatemala has not been deeply involved in promoting the adoption of clean cooking solutions. Historically, private corporations have not contributed significantly to this sector, neither through Corporate Social Responsibility (CSR) programs, nor through emissions offsetting programs. There are only few examples: Jaguar Energy, which has reached an agreement with Helps International to install 286 stoves to offset the company’s emissions, and the 21 companies that joined the “Alianza por la Nutrición”, which has a component related to improved cooking solutions.

Guatemala has a strong ecosystem of suppliers of clean cooking solutions and has the Cluster of improved cookstoves. In Guatemala, there are several manufactures of improved cookstoves with remarkable scale, such as: HELPS International, Ecocomal, Doña Dora, and Hands for Peacemaking, among others. Since early 2000, manufacturers have been building mainly in-situ models, but mobile/ prefabricated models are becoming more common. As discussed previously three large companies control most of the LPG market with presence in major cities throughout Guatemala. Furthermore, new players with a focus on lower income segments have entered the market, as is the case GenteGas.

3.4 WHAT DO WE NEED TO DO DIFFERENTLY?

If no action is taken, the number of households cooking with wood will likely increase from 2.42M in 2015 to 2.76M by 2030¹⁸. The current national plans, such as the National Strategic Plan for the Sustainable Use of Wood (2013-2023) which plans to deploy 650,000 improved cookstoves over the next ten years, and the National Energy Policy (2013-2027) which has the goal to migrate 25% of woodfuel users to LPG by 2027, will only partially address the challenge of transitioning households to cleaner technologies. As we analyze in the figure below, despite existing plans to bridge the gaps in household cooking with traditional stoves and fuels, we estimate that approximately 1.43M¹⁹ of Guatemalan households will still be cooking with traditional stoves by 2030.

Figure 5: Projected evolution of cooking technologies under existing plans (M Households)



Source: Gap assessment – Guatemala. Preparation of a Clean Cooking Solutions Roadmap and Investment Prospectus for Guatemala, Honduras, and Nicaragua. Dalberg, March 2015.

¹⁸ Gap assessment – Guatemala. Preparation of a Clean Cooking Solutions Roadmap and Investment Prospectus for Guatemala, Honduras, and Nicaragua, Dalberg, March 2015.

¹⁹ Ibid.

There is a need to take coordinated action in a holistic way to address this challenge and bridge the expected gap. Given the multidimensionality and complexity of this challenge, efforts of the different actors to tackle the problem must be planned and aligned to ensure efforts are effective. This document presents a plan to address the current situation with a focus on an integrated strategy and coordinated action. This integrated approach aims to achieve positive health, economic, and environmental impacts at scale in Guatemala.

As will be further elaborated in the section to follow, there are a number of specific entry points for actions in Guatemala. The table below summarizes the entry points that we see as most viable in the short term. Details regarding implementation are further explained in section 4.3 of the document.

Table 6: Guatemala specific entry points

	Demand (strategic lines 1-3)	Supply (strategic lines 4-8)	Enabling Environment (strategic lines 9-12)
Recommended entry point	<ul style="list-style-type: none"> • Coordinate with MAGA, MIDES, INAB, CONAP, MSPAS and MARN to include in their programs a clean cooking solution component • Coordinate with COCODES and COMUDES in order to generate awareness about Clean Cooking Solutions in local governments of all the municipalities of Guatemala • Coordinate with the Ministry of Education to include a clean cooking solution component in the performance indicators of the “Currículo Nacional Base (CNB)” • Coordinate with the Cluster of improved cooking solutions and other manufacturers (e.g. Helps international) to organize cookstoves exhibitions in all municipalities to train consumers • Work with MINECO and the MFI’s (e.g. Banrural) to provide microcredits to cover the potential demand for Clean Cooking Solutions 	<ul style="list-style-type: none"> • Carry out a characterization study of supply and demand of LPG by region of Guatemala (e.g. differences between urban and rural distribution channels, cost structures, sales growth of LPG, potential areas for expanding LPG) • Work with the Cluster of improved cooking solutions , other manufacturers (e.g. Helps international) and academia to conduct pilot programs to identify the design preferences and to expand models according to findings from the pilots • Work with the Cluster of improved cooking solutions , other manufacturers (e.g. Helps international) to create subcontracted distribution networks (e.g. with FACCSA) and strengthen their own networks 	<ul style="list-style-type: none"> • Review and update policies, laws and specific strategies related to Clean Cooking Solutions (e.g. Política energética, Política de desarrollo rural integral, Política forestal, Política de cambio climático, ley Pro bosques (pending approval), Política de leña) • Strengthen the MEM to give institutional support to the Roadmap of clean cooking solutions • Finalize normative for testing biomass ICS (led by the MEM) and implement the testing facility • Use the information platform (SIINSAN) to collect and centralize all information related to demand and supply of clean cooking sector

Source: Dalberg analysis

4 CATALYZING THE TRANSFORMATIONAL CHANGE

4.1 APPROACH TO BUILDING THE ROADMAP TO 2030

Key stakeholders in the clean cooking sector in Guatemala²⁰ have come together to create a plan to ensure universal access to clean cooking solutions by 2030. Private and public sector institutions, including representatives from multilateral and bilateral institutions, NGOs, sector experts, and academics across the cooking and heating, fuels, environment, health, gender, and rural development sectors have contributed to building a Roadmap that aims to eliminate the number of households cooking with traditional stoves. The consulting process lasted 5 months and was led by the World Bank and Dalberg in coordination with the National Competitiveness Program (PRONACOM) and the Ministry of Energy and Mines (MEM) of Guatemala.

The Roadmap has been designed to holistically, strategically, and systematically address the obstacles impeding the growth and improvement in the demand, supply, and enabling environment for clean cooking solutions. The Roadmap focuses on the key constraints identified by the stakeholders and includes strategies carefully designed to address all the primary barriers that have historically prevented broader adoption of clean cooking solutions in Guatemala.

The Roadmap follows a strategy of neutrality when it comes to technologies and fuels for cooking. Thus, the Roadmap does not favor any particular technology (e.g. particular stove models/brands, or in-site stove vs. mobile stoves) or fuel (e.g. firewood, LPG, biogas, electricity, etc.). Nevertheless, and given the current context of the country, the Roadmap defines expected transitions to cleaner technologies and fuels for each of the population segments in Guatemala (see Figure 6 below).

The Roadmap defines priorities, initiatives, responsibilities, and recommended timing. The consulting process allowed the key stakeholders in Guatemala to discuss and agree on the most important interventions, as well as the appropriate timing for each activity. As a result of this process, the team created a concrete strategy for how to address the complex challenges presented in the previous chapter that have to date limited the uptake of clean cooking solutions in the country.

Concretely, the stakeholders articulated 12 strategic lines for action and investment, each containing a number of specific components and initiatives. Each strategic line aims to tackle one of the major barriers identified. The strategic lines contribute directly or indirectly to transitioning households currently cooking with traditional stoves. Some strategic lines contribute directly by addressing the willingness to adopt/buy an improved cookstove, capacity to adopt, and ability to use the cookstove over time. Other strategic lines contribute indirectly by ensuring that different initiatives are effective. One example of a strategic line with a direct effect is “consumer financing,” while an indirect strategic line would be “setting quality standards for stoves.” Both types of initiatives are needed to transition households to cleaner cooking technologies.

²⁰ For more detail about the stakeholders engaged, please see the list of organization consulted in section 2.

4.2 ROADMAP SUMMARY: COUNTRY STRATEGY

If no additional measures are taken, the number of households cooking with traditional stoves could increase from 2.42 million in 2015 to 2.76 million in 2030, as we saw in chapter 3.1. The potential demand for clean cooking solutions is very diverse. In the case of Guatemala, ~60% of households that cook with traditional stoves live in rural areas and the remaining ~40% in urban areas²¹. Today, traditional stoves prevail as the dominant technology for the poorest segments of the population, especially in rural areas, although some higher income segments in rural and urban areas also cook with traditional stoves for cultural reasons. It is expected that demographic growth in the next fifteen years will chiefly occur in urban areas.

The Country Strategy for Guatemala proposes a number of specific initiatives to strengthen the demand, support the supply, and improve the enabling environment. This strategy is summarized in the Roadmap. On the demand side, the holistic strategy focuses on: 1) increasing awareness and knowledge among potential improved cookstove consumers of the problems associated with cooking using traditional stoves, as well as the benefits of existing alternatives, 2) training users on how to install, maintain, and fix their stoves, and 3) increasing affordability and/or financing options for consumers to adjust prices of different technologies to better match the capacity to pay of various population segments.

From the supply perspective, the Roadmap emphasizes: 1) availability of modern and/or more sustainable fuels, such as LPG or firewood produced in (renewable) forests to be used for fuelwood. In addition, the Roadmap aims to 2) support the suppliers of stove and fuel technologies in Guatemala and improve their designs, for example, by adapting models to the different needs and preferences of the population, 3) scaling up local production, 4) enhancing their distribution and 5) improving after-sale services.

Finally, the Roadmap includes several actions to improve the enabling environment. These include: 1) investing in the creation and enforcement of quality standards for improved cookstoves, 2) updating the relevant regulations and policies to include components to promote clean cooking, 3) developing or adapting a system of centralized information, and lastly, 4) creating an Inter-sectoral Support Unit to ensure the Roadmap is implemented effectively.

The initiatives proposed aim to address the specific challenges identified in Guatemala in the previous chapter. Although work is required within the 12 dimensions identified in the paragraph above, the Roadmap for Guatemala draws particular attention to 6 main areas, as highlighted in the table below.

The six main areas of focus are:

- 1) The Roadmap underlines the need to increase the willingness to pay for an ICS. To that end, the Roadmap recommends initiatives such as targeted awareness/advertising campaign that will highlight the benefits of improved cooking technologies.
- 2) Need to train user on how to install, operate, maintain and repair the stove in order to increase the adoption rate of the technology over time.

²¹ Gap assessment – Guatemala. Preparation of a Clean Cooking Solutions Roadmap and Investment Prospectus for Guatemala, Honduras, and Nicaragua, Dalberg, March 2015.

In the supply side, the Roadmap emphasizes the need to 3) reinforce and strengthen the distribution and after-sale networks of clean cooking solutions in order to increase the reach and the adoption of this technology and 4) work closely with the LPG sector to better understand the sector, to do so, the Roadmap recommends initiatives such as a characterization study of the supply and demand of LPG in Guatemala by area, a diagnosis of the current state of the LPG cylinders among others initiatives.

In the Enabling environment side, Guatemala as in many countries of the region, has not instituted quality standards that ensure stoves comply with thresholds on emissions and efficiency. To that end, the Roadmap 5) highlights the need to develop standards and set up a lab to test the stoves. Finally and as previously identified, Guatemala does have a centralized information system that includes updated market information and allows interested parties to make informed decisions, so the Roadmap draws special attention to 6) Identifying or creating a centralized information system for the clean cooking sector that includes updated information of the demand and supply.

Table 7: Country strategy emphasis

	Strengths	Challenges	Country Strategy Emphasis
Demand	<ul style="list-style-type: none"> Relatively high awareness of the negative consequences of traditional cooking stoves and the existence of alternative solutions 	<ul style="list-style-type: none"> Low willingness to pay for ICS Low availability of flexible payment schemes and financing Little training to users on how to install, operate, maintain and/or repair the stove 	<ol style="list-style-type: none"> Increase willingness to pay of potential demand Train final users on how to install, operate, maintain and/or repair the stove
Supply	<ul style="list-style-type: none"> Existence of the Cluster of improved cookstoves High number of manufacturers, models and high annual production capacity to meet demand 	<ul style="list-style-type: none"> Almost non-existent ICS distribution or aftersales networks Low investment in research and development (R&D) for developing new ICS models Low interest of the LPG sector in expanding the distribution network 	<ol style="list-style-type: none"> Reinforce manufacturers' distribution and after-sale networks Strengthen the LPG sector
Enabling environment	<ul style="list-style-type: none"> Strong institutional leadership by MEM and existence of the Mesa de leña Existing policies and regulations supporting clean cooking 	<ul style="list-style-type: none"> Lack of coordination of efforts of the public sector Lack of updated information of the clean cooking sector Lack of quality standards on emissions and efficiencies 	<ol style="list-style-type: none"> Support the definition and enforcement of quality standards Support the implementation of a centralized information system with updated information of the demand and supply

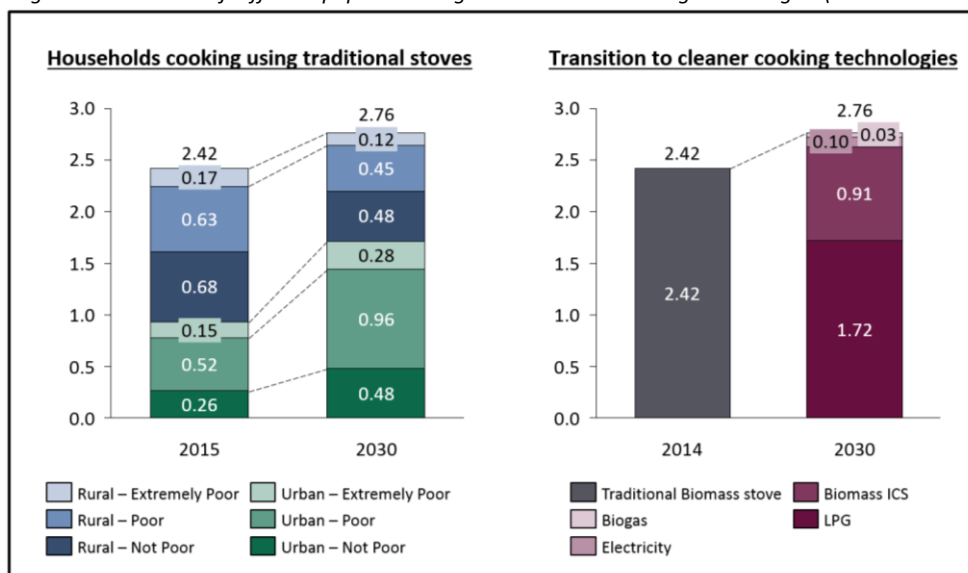
Source: Dalberg analysis.

The Roadmap's final objective is to transition the 2.42 million households that currently cook with traditional cookstoves, and new population segments that would otherwise cook with traditional stoves and fuels, to improved cooking solutions. To that end, the Roadmap includes specific initiatives targeting different population segments. While some interventions target all population segments, some are tailored to address specific ones. For instance, the Roadmap proposes including in the school curricula information about clean cooking solutions to reach all Guatemalans; at the same time, the Roadmap envisions offering specific financing options for distinct population segments.

With this differentiated strategy, the Roadmap expects that in 2030 ~62% of the households that currently cook with wood will mainly use LPG for cooking, ~33% will use improved biomass stoves, ~4% electricity stove and the remaining 1% biogas. This transition, illustrated in Figure 6, focuses on pushing segments with more economic resources in rural areas to mainly use LPG and Biogas, and

similarly middle/upper income households in urban areas to LPG and electricity. At the same time, it promotes the transition of extremely poor households to mainly use biomass ICS in urban and rural areas. The left side of Figure 6 (an excerpt from the Gap Assessment analyses) demonstrates the current and future distribution of the population cooking with wood by income segment; the right-hand side envisions the transition of this population to clean cooking solutions.

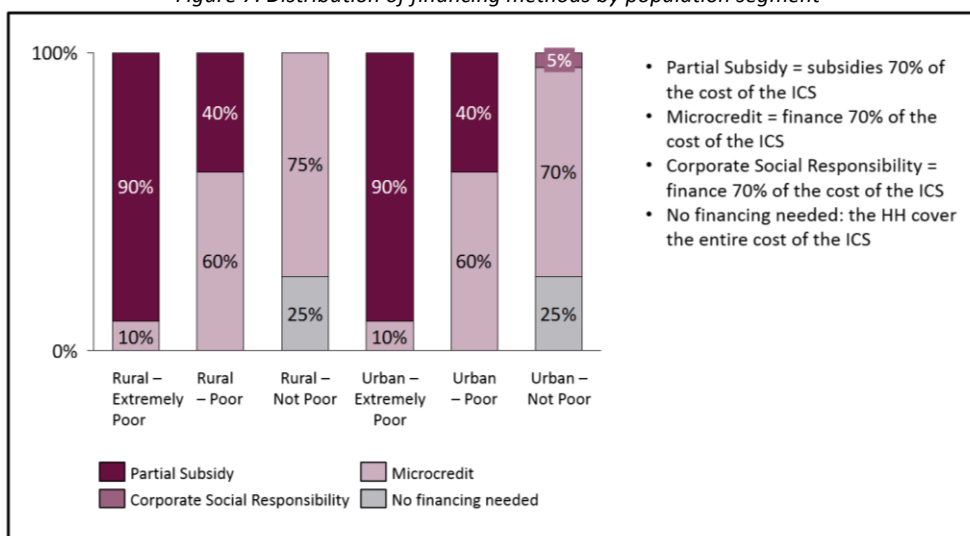
Figure 6: Transition of different population segments to clean cooking technologies (M Households)



Source: Workshop "Desarrollo de un Plan de Acción e Inversión para promover el uso de soluciones limpias para cocinar" held in Guatemala city on March 16, 2015.

Additionally, the Roadmap proposes a differentiated financing strategy for each population segment, as illustrated in Figure 7 below. For instance, it is expected that populations in extreme poverty will mostly need a subsidy that partially covers the cost of the improved stove, while sections of the poor households may still require partial subsidies, and others can access the technology via micro loans. Finally, microcredit is expected to be the main financing mechanism for non-poor households, although some portion of this segment will also be able to access the technology via Corporate Social Responsibility (CSR) initiatives or without need of financing.

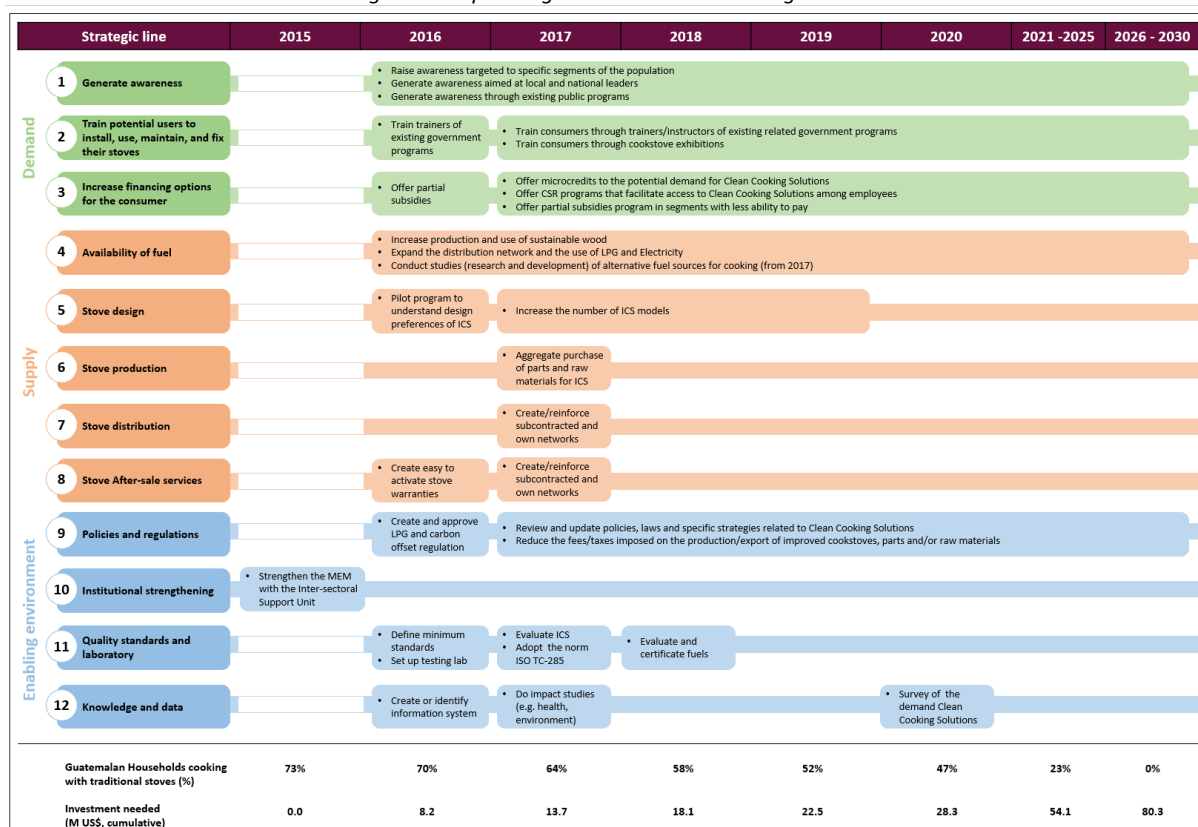
Figure 7: Distribution of financing methods by population segment



Source: Dalberg analysis.

While all strategic lines are important, stakeholders in the clean cooking sector in Guatemala have defined the appropriate logical sequence among them to maximize the impact of investments and activities. The sequencing of the strategic lines, illustrated on the figure below, is crucial as it defines the long term strategy for the country and immediate funding needs. As the figure illustrates, more immediate investments in institutional strengthening, demand creation, creating or identifying a centralized information system for the clean cooking sector, and policy reform (among others), should be followed by focus and investment in scaling up supply and distribution. Importantly, many of the areas of focus will remain as priorities for a number of years.

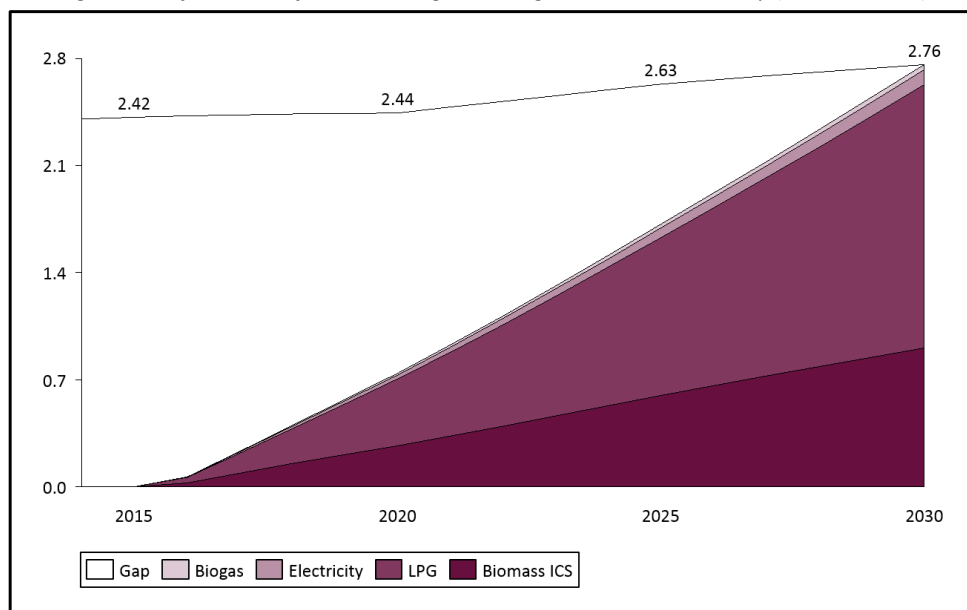
Figure 8: Sequencing initiatives across strategic lines



Source: Workshop “Desarrollo de un Plan de Acción e Inversión para promover el uso de soluciones limpias para cocinar” held in Guatemala city on March 16, 2015.

With the effective implementation of the initiatives included in the Roadmap, we expect that Guatemala will transition fully away from traditional stoves by 2030. Taking into consideration the demographic growth and urbanization projections, it is expected that the potential demand for clean cooking solutions will grow from 2.4 million households in 2015 to 2.8 million in 2030. By implementing the Roadmap defined in this document, stakeholders expect to increase adoption of clean cooking technologies such as improved biomass stoves, LPG stoves, electricity stoves and biogas stoves and close the gap by 2030. The figure below summarizes the projected transition path we envision for closing the gap in Guatemala. While we recognize that the linear path may be overly stylized, the more important conclusion from our analysis relates to the mix of technologies we expect to dominate in Guatemala, namely improved biomass cookstoves and LPG stoves.

Figure 9: Projected use of clean cooking technologies under the Roadmap (M Households)



Source: Dalberg analysis.

Moreover, it is expected that the correct implementation of the Roadmap will generate social, environmental, and economic benefits and co-benefits (e.g. health, gender, household finance, rural development, environment degradation, and emissions). Using existing studies as a reference, it is estimated that implementation of the Roadmap and subsequent eradication of traditional stoves will yield the following outcomes (more detail on Annex 4: Health and Emission Annual Projected Impact):

- **Health:** Will reduce deaths from household air pollution (HAP) by 45,000 people, including 15,000 children (from 2016-2030)²².
- **Household finance:** Will reduce household expenditure on fuels for cooking ~40% per month (US\$21)²³.
- **Emissions:** Will reduce emissions of carbon dioxide by nearly 53 million tons (from 2016-2030)²⁴.

4.3 DETAILED ROADMAP TO 2030

²² Estimated by projecting the number of deaths that will occur with the actual ratio of deaths from Household Air Pollution (HAP) and estimates the new number of deaths that will occur by closing the gap of people cooking with traditional stoves.

²³ Estimated by comparing the monthly cost of HH that buy wood and cook with traditional wood stoves vs. those using biomass ICS, LPG stoves.

²⁴ Estimated by projecting annual savings of 2.6 Tons of carbon dioxide gases for each HH that transitions to an ICS (Source: Proyecto Mirador).

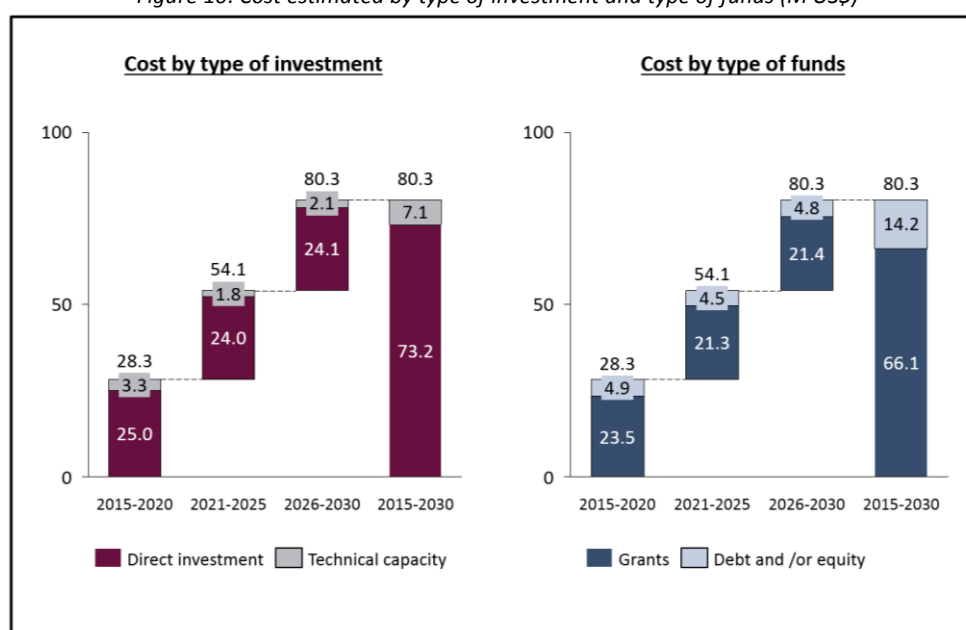
5 INVESTMENTS NEEDED TO ACHIEVE THE TRANSITION

5.1 OVERVIEW OF THE INVESTMENT PLAN

Guatemala's stakeholders have quantified the investment cost of the associated priorities identified in the Roadmap. With support of the World Bank and Dalberg and in coordination with the National Competitiveness Program (PRONACOM) and the Ministry of Energy and Mines (MEM) of Guatemala, the stakeholder team has estimated the necessary resources to carry out the initiatives included in the Roadmap. The estimated costs are divided between short term (2015-2020) and long term (2021-2030). Additionally, the financing needs have been disaggregated by 1) type of investment: direct investment and technical capacity; and 2) type of funds: grants, debt and/or equity²⁵. The figure below provides an overall summary of the investment needs. These estimates are further detailed in subsequent sections.

US \$28 million is needed to implement initiatives of the Roadmap's first five years. This amount takes into account initiatives included in all strategic lines from 2015 to 2020. Although the strategic lines previously described define the country strategy up to 2030, this section of the document focuses on the activities to be carried out during the next five years, until 2020. The Roadmap and the Investment Prospectus must be updated by 2020, with the objective of capturing the financing needs for the period 2021 to 2030.

Figure 10: Cost estimated by type of investment and type of funds (M US\$)



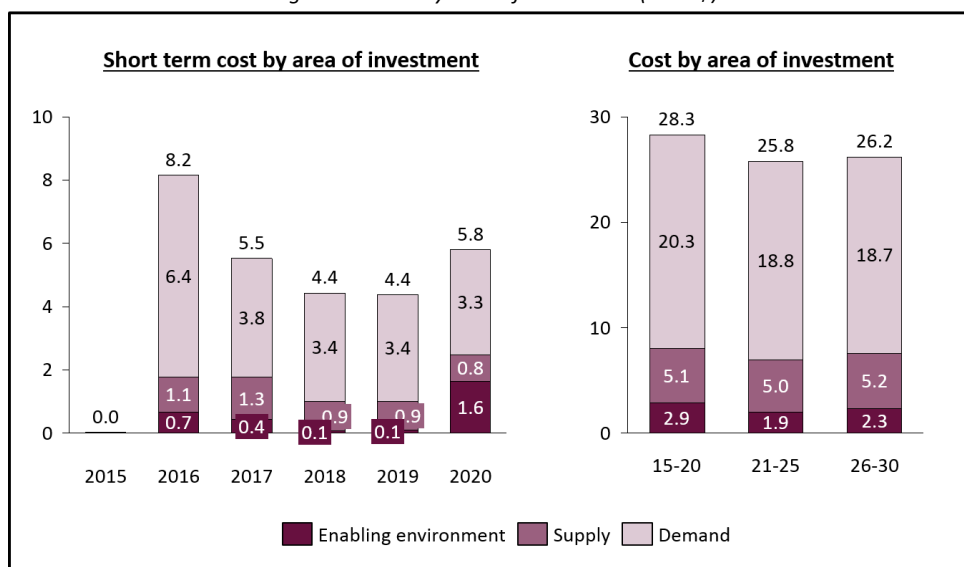
Source: Dalberg analysis.

Overall, the majority of the costs in the Roadmap's first five years will go towards investments to strengthen demand for improved cooking solutions. When disaggregating the estimated costs in

²⁵ We consider the delineation between grants, debt and equity to be indicative at this stage. Additionally, we recognize that within debt and equity investments there is likely to be a range between more impact-oriented investors/funders and more commercially-oriented investors.

the short term by area of investment (demand, supply, and enabling environment), Guatemalan stakeholders have prioritized the need to strengthen demand for clean cooking solutions. The underlying perspective of stakeholders is that strengthening demand is the cornerstone to developing the clean cooking sector in the near term, hence the allocation of approximately US \$20M to demand building investments. Additional investments in broadening the supply of solutions, as well as strengthening the overall enabling environment are critical as well during this period, but require less investment over this period.

Figure 11: Cost by area of investment (M US\$)



Source: Dalberg analysis.

5.2 INVESTMENT NEEDED BY STRATEGIC LINE

~70% of the funds (~US \$20M) needed would fund strategic lines that seek to increase demand. Enhancing the supply and improving the enabling environment require investments of around \$5 and \$3 million respectively.

Table 8: Investment by area 2015-2020 (M US\$)

Area	Investments	Total
Demand	1. Generate awareness of the negative consequences of cooking with traditional stoves and the existence of alternatives	\$20.3M
	2. Improve ability of potential users (via training on how to install, use, maintain and fix their stoves)	
	3. Ensure that different population segments have the capacity to pay for the different technologies (e.g. through microcredits, CSR, Subsidies)	
Supply	4. Increase availability of different fuels for cooking (e.g. woodfuel, LPG, Electricity, biogas)	\$5.1M
	5. Understand the preferences of potential ICS users and broaden the portfolio of stove models available	
	6. Enhance the productive capacity of ICS	
	7. Increase and/or reinforce own and subcontracted distribution networks of ICS	
	8. Increase and/or reinforce own and subcontracted after-sales networks of ICS	
Enabling environment	9. Ensure new and existing policies to support the clean cooking sector	\$2.9M
	10. Ensure the Roadmap is correctly implemented; ensure commitments and responsibilities are honored	

	11. Ensure that stoves meet minimum performance standards	
	12. Create a repository with quality data to facilitate effective decision making	
	Total	\$28.3M

Source: Dalberg analysis based on stakeholder input in Guatemala.

Specifically, to increase demand, the Investment Prospectus suggests investing in the following areas:

- **Generate awareness:** Generate awareness of the negative consequences of cooking with traditional stoves and the existence of alternatives. This strategic line aims to:
 - Generate awareness through existing government programs that can potentially integrate clean stove programs (e.g. capacitadores y extensionistas from MAGA, MIDES, INAB, CONAP).
 - Educate local and national government officials in coordination with Instituto de Fomento Municipal (INFOM), Asociación Nacional de Municipalidades (ANAM), Consejos Comunitarios de Desarrollo (COCODES) and Concejos Municipales de Desarrollo (COMUDES) in all municipalities in Guatemala to ensure buy-in and long term. The number of persons to educate per municipality will be define giving priority to areas where there is a strong preference for cooking with wood.
 - Integrate information on clean cooking solutions into school curricula (Currículo Nacional Base (CNB)) in coordination with MINED.
 - Increase awareness and willingness to buy an improved cookstove through awareness/advertisement campaigns targeting specific population segments (e.g. women, households living in geographic areas with more wood consumption for cooking).

- **Train potential users to install, use, maintain, and fix their stoves:** This strategic line aims to increase the capacity of potential users. Given the lack of a mature after-sales network in Guatemala, users need to learn how to keep their stoves in good condition. By improving users' ability to maintain and fix their stoves properly, the Roadmap aims to increase the technology adoption rate over time. Today, usage rates are decreasing dramatically year after year, and it is estimated that only 50%²⁶ of users who adopt an improved cookstove continue to use it five years later. To improve user capabilities, the Roadmap suggests investment that will:
 - Train consumers using "instructors" from existing government programs (e.g. capacitadores y extensionistas from MAGA, INAB) in order to use existing programs and networks.
 - Train consumers during cookstove exhibitions. Such exhibitions will be led by the Cluster of improved cookstoves and other manufactures such as Helps international (and with involvement from local governments) with coordination with MINECO in order to provide users all the options available in the market for them to be informed and to learn how to better use different technologies.

- **Increase financing options for the consumer:** The objective of this initiative is to ensure the prices of the different technologies are adjusted to the capacity to pay of different population segments. In this sense, the Roadmap aims to:
 - Strengthen the role of microfinance institutions in the clean cooking sector by promoting the design of specific financing products and features (e.g. interest rates, amounts, terms) with a warranty fund that will allow more favorable financing

²⁶ From interviews with stakeholders in the region.

options for the consumers. Today only three MFIs have shown interest in providing products aimed at the cooking sector, and even those who are in the market provide consumer loans with limitations (e.g. not for all stoves models) and with less favorable terms for consumers (e.g. high interest rate).

- Promote the existence of corporate social responsibility (CSR) programs working closely with the Centro para la Acción de la Responsabilidad Social Empresarial (CentraRSE) to allow employees to access new technologies at a subsidized cost.
- Design a strategy to encourage a partial subsidy-based program to target populations that really need them and can't afford improved solutions any other way. The targeted populations have to be selected using information available from sources like ENCOVI from INE and the segmentation study from the GACC.

From the supply side, the Investment Prospectus outlines initiatives targeting fuels as well as initiatives focused on cookstoves.

- **Availability of fuel:** The Roadmap aims to increase availability of different fuels for cooking. To that end, the Investment Prospectus estimates the respective funding needs of initiatives that aim to:
 - Support existing incentives like PINFOR and PINPEP from INAB and CONAP respectively, which aim to increase the production of sustainable woodfuel. Also, support for the approval of the Probosques act.
 - Expand the distribution network and usage of LPG for cooking through 1) a characterization study of the supply and demand of LPG in each region Guatemala, 2) running a diagnosis of the state of LPG cylinders on the market and 3) designing incentives to increase the usage of LPG for cooking (e.g. cylinders of better quality, pay per use financing schemes).
 - Develop a study to explore the possibility of diversifying sources of energy, looking specifically at natural gas, biogas, and ethanol. These efforts would be led by Consejo Nacional de Ciencia y Tecnología (CONCYT) and conducted most likely by academic institutions.
- **Stove design:** To overcome cultural barriers to adopting improved stoves and better fulfill the needs of the Guatemalan households, the Investment Prospectus has quantified support needed to:
 - Conduct pilot programs with improved cookstoves in Guatemala by area and economic strata to identify design preferences of the population, which will yield insights that can be used by manufacturers to improve their stoves.
 - Broaden the portfolio of stove models available in Guatemala and meet consumer needs according to findings from the pilots programs to understand design preferences. To support the process an incentive fund will be designed by the MEM to help fund innovative designs from manufacturers, including those in the Cluster of improved cookstoves, as well as others such as Helps International.
- **Stove production:** To enhance the productive capacity of manufacturers of improved cookstoves in Guatemala, the Investment Prospectus estimated funds needed to:
 - Train national manufacturers in best practices and managerial skills in order to be able to scale their production to satisfy higher projected demand in the coming years.
 - Support manufacturers to purchase in bulk so as to achieve economies of scale. To do so, it is proposed that MINECO will, in coordination with the Cluster of improved cookstoves and other manufacturers, design a warranty fund that will allow producers to have the resources to purchase materials in bulk.

- **Stove distribution:** To increase access to cleaner technologies, the Investment Prospectus quantified investment needed to provide a solid distribution network that does not depend only on temporary programs, but one that will last over time. To do so, the Investment Prospectus estimated funds needed to:
 - Train distributors in marketing and managerial skills.
 - Create subcontracted distribution networks that will have all available ICS models from different manufactures in the same channel/store, and also have certified builders for in-situ stoves (e.g. FACCSA, Asociaciones de mujeres lideres comunitarias).
 - Reinforce or expand existing distribution networks of manufactures by providing financial incentives to manufacturers that expand them.

- **Stove after-sales services:** The lack of a strong after-sales network negatively impacts the usage rate of stove technology over time. Experience has shown that if or when a cookstove breaks down, users typically do not have easy access to spare stove parts or repair services, and therefore typically stop using the stove. To avoid this, the Investment Prospectus has estimated the support required to strengthen these after-sales networks, with similar investments as are required to build the distribution network for first sale:
 - Train distributors in after-sales best practices.
 - Promote easy to activate and access stove warranties.
 - Create subcontracted after-sale networks that will have spare parts for all available ICS models from different manufactures in the same store and also have certified builders in order to repair in-situ stoves (e.g. FACCSA, Asociaciones de mujeres lideres comunitarias).
 - Reinforce or expand existing after-sale networks of manufactures by providing financial incentives for expansion.

Finally, the Investment Prospectus includes 4 strategic lines related to the enabling environment. These include:

- **Policies and regulations:** To successfully implement the Roadmap, new and existing policies must support the clean cooking sector. To that end, the Investment Prospectus considers the need to fund activities to:
 - Review the relevant policies, regulations, norms, and strategic plans of existing public institutions involved in cookstoves and/or fuels (e.g. Política energética, Política de desarrollo rural integral, Política forestal, Política de cambio climático, ley Pro bosques (pending approval), Política de leña).
 - Examine the possibility to reduce tariffs and taxes on the production, import, and export of stoves, parts, raw materials and fuel in order to decrease stove prices for end users and increase the financial sustainability of manufacturers.
 - Work on a regulation that incentivizes usage of LPG for cooking (e.g. ownership of the cylinders, lifespan of cylinders, size of the cylinder).
 - Work on a regulation and methodology for carbon offset projects through improved cookstoves.
 - Institutionalize the Comisión Interinstitucional para la Reducción de Leña (Mesa de leña).

- **Institutional strengthening:** To ensure the Roadmap is effectively implemented and commitments and responsibilities are honored, the Investment Prospectus has estimated the funds to:

- Strengthen the MEM through capacity building, equipment and the creation of the Inter-sectoral Support Unit that will be supported by two full time staff who will be in charge of the following 4 activities.
 1. Socializing the Roadmap.
 2. Monitoring progress.
 3. Updating and reviewing the Roadmap periodically.
 4. Managing and supervising the financial resources for the implementation of the Roadmap.
- **Quality standards and laboratory testing:** To ensure the stoves meet minimum performance standards, quality standards need to be created and enforced. The Investment Prospectus quantified the necessary financial support to:
 - Define minimum quality standard and a technical norms. (The MEM is working together with stakeholders from the Cluster of improved cookstoves to develop a Norma Técnica using Mexico's regulation as a foundation and adapting it to Guatemala's local context. This should become official in 2015)
 - Develop a lab to test the technologies. There are 2 options for the implementation of such a lab: 1) use the existing MEM fuel testing lab, or 2) use a university to implement the lab. Both options will be evaluated and they will select the most appropriate for the country.
 - Evaluate existing stoves.
 - Adopt the norm ISO TC-285 to fulfill international standards.
 - Fuel certification using the fuel testing lab from the MEM.
- **Knowledge and data:** Finally, it is crucial to create a repository with quality data to facilitate effective decision making. The Investment Prospectus estimates the resources needed to:
 - Identify or create a system able to collect, organize and search all necessary subsector information online. This initiative will start evaluating the existing options like the SIINSAN in order to identify if an existing platform is useful and easy to adopt, if not, then a resource have been estimated to create a new information system.
 - Develop a list of different manufacturers and distributors, and their sales levels by stove model and geography.
 - Develop a study to better segment and understand the demand for clean cooking technologies in Guatemala. The 2015 segmentation study from the GACC will be used as a starting point, to be updated by using the ENCOVI as a mechanism to update the information from the demand side.
 - Develop impact evaluations to redefine the strategies promoted by the public and private sectors; this evaluation would also serve as a marketing tool to attract further investment in the future. The impact evaluations are proposed to start in 2017, and would include evaluation dimensions such as household health, forest degradation/deforestation, and greenhouse gas emissions, among other dimensions.

The majority of direct investments are focused on making the technologies more affordable to the potential users. When disaggregating the investments by strategic line and investment type (see table below), one can see that the direct investments are mostly focused on increasing the financing options for the consumer. This includes the cost of launching microloans, and the cost of partial subsidies for population segments with very limited resources. In terms of technical capacity, the main investments are focused on knowledge and data, which include impact evaluations and

availability of fuel. Fuel availability studies will include studies for better understanding the expansion potential of the LPG sector in Guatemala.

Table 9: Investment by strategic line and type of investment 2015-2020 (M US\$)

	Strategic line	Direct Investment	Technical Capacity	Total
Demand	1. Generate awareness	1.9	0.0	1.9
	2. Train potential users to install, use, maintain, and fix their stoves	1.4	0.0	1.4
	3. Increase financing options for the consumer	17.0	0.0	17.0
Supply	4. Availability of fuel	2.9	0.7	3.6
	5. Stove design	0.2	0.2	0.4
	6. Stove production	0.9	0.0	0.9
	7. Stove distribution	0.1	0.0	0.1
	8. Stove after-sales services	0.1	0.0	0.1
Enabling environment	9. Policies and regulations	0.0	0.4	0.4
	10. Institutional strengthening	0.2	0.0	0.2
	11. Quality standards and laboratory	0.2	0.0	0.2
	12. Knowledge and data	0.0	2.0	2.0
Total		25.0	3.3	28.3

Source: Dalberg analysis.

The majority of investments are likely to be debt; equity investments would likely be more relevant for investments to enhance supply. When disaggregated by type of funds, one can see how the majority of debt and/or equity funds are focused on increasing the availability of alternative fuels (e.g. investing in expanding the LPG network), and organizing cookstove exhibitions to train potential user install, use, maintain, and fix their stoves and also sell ICS. On the other hand, grants would be most likely be used to increase demand by creating awareness and improving affordability of clean cooking solutions.

Table 10: Investment by strategic line and type of funds 2015-2020 (M US\$)

	Strategic Line	Grants	Debt and/or equity	Total
Demand	1. Generate awareness	1.9	0.0	1.9
	2. Train potential users to install, use, maintain, and fix their stoves	0.6	0.8	1.4
	3. Increase financing options for the consumer	17.0	0.0	17.0
Supply	4. Availability of fuel	0.2	3.4	3.6
	5. Stove design	0.2	0.2	0.4

	6. Stove production	0.9	0.0	0.9
	7. Stove distribution	0.0	0.1	0.1
	8. Stove after-sales services	0.0	0.1	0.1
Enabling environment	9. Policies and regulations	0.4	0.0	0.4
	10. Institutional strengthening	0.2	0.0	0.2
	11. Quality standards and laboratory	0.0	0.2	0.2
	12. Knowledge and data	2.0	0.0	2.0
Total		23.4	4.9	28.3

Source: Dalberg analysis.

It is important to note that the strategic lines are highly interdependent. Hence, all strategic lines need to be implemented as part of the Roadmap. While some investment areas and strategic lines need more financial resources than others, all of them are necessary given this holistic approach.

6 OPERATING MODEL

6.1 INSTITUTIONAL STRENGTHENING

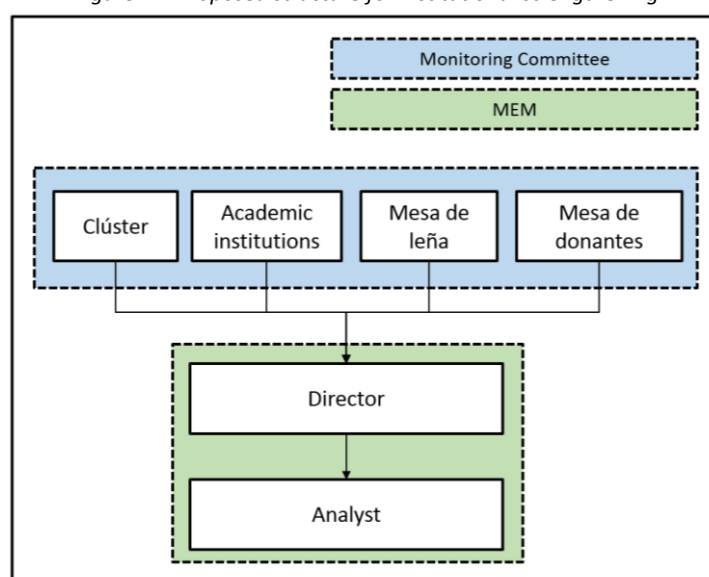
To ensure successful implementation of the Roadmap, it is recommended that a unit to support the roadmap is established starting in 2015. This will enable more effective execution, coordination, and monitoring of the Roadmap to 2030. To implement this unit, two different models are suggested as options for consideration:

Alternative # 1: The model suggested aims to take advantage of MEM's existing organizational structure, and considers building a unit that will be in charge of managing Roadmap execution, named the "Inter-sectoral Support Unit" (USI in Spanish). The USI will comprise of a full-time director, who will be supported by a full-time analyst. This unit will work as the executing and coordinating team of the Roadmap. Some of the unit's responsibilities would include:

- Coordinate the different activities stakeholders participate in
- Carry out the process of selecting and contracting advisory and consulting firms and other technical capacity support
- Monitor financing needs and keep accounts updated
- Compile, store, and keep the necessary information on the indicators and parameters of the Roadmap
- Prepare and present regular monitoring and update reports on the Roadmap
- Prepare and present ad-hoc monitoring and update reports on the Roadmap as required by donors

Additionally, the creation of a Monitoring Committee is suggested. This committee will be formed by the Cluster of improved cookstoves, academic institutions, Mesa de leña and Mesa de Donantes. The Monitoring Committee will be in charge of approving the reports prepared by the USI and soliciting and approving modifications to the Roadmap.

Figure 12: Proposed structure for institutional strengthening



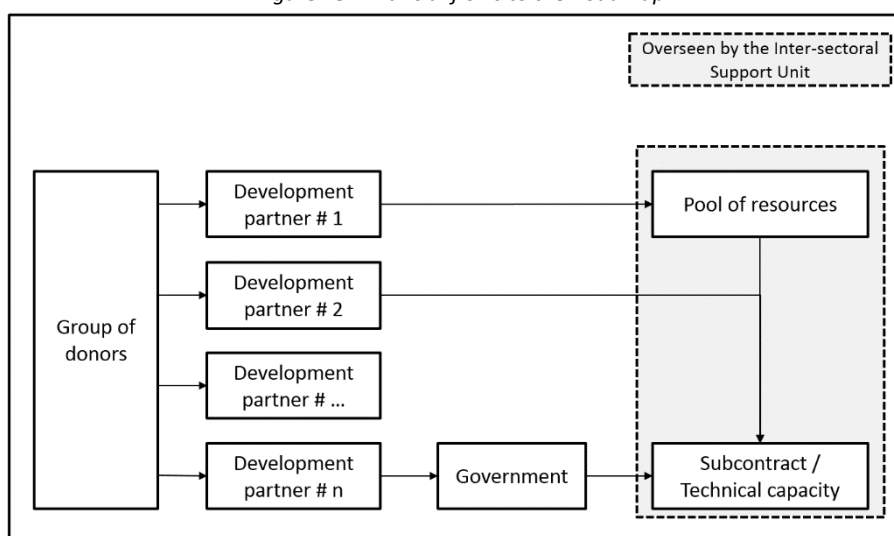
Source: Dalberg analysis.

Alternative # 2: An execution and coordination model similar to the one created by PRONACOM and Millennium Challenge Corporation. Similarly, the unit would adopt the same systems for managing funding flows and monitoring and evaluation.

6.2 INVESTMENT FLOWS

The funding flows for execution of the Roadmap will be supervised by the USI. The following figure presents a high-level view of how funding flows will be managed. It is expected that a combination of funding mechanisms will be used, from pooled funds, to earmarked funds, to technical capacity, etc. The USI will supervise funding flows to guarantee that donors’ contributions are assigned to the corresponding Roadmap components. The USI will track deployment of the funds and their usage. The transactions, the fund allocations, and usage will be subject to review, including internal and external audits, if stakeholders involved in the Roadmap are amenable.

Figure 13: Financial flows to the Roadmap



Source: Dalberg analysis.

6.3 MONITORING SYSTEM

The monitoring system will allow the World Bank and Guatemala to track progress towards the objective of eliminating traditional stoves use by 2030. A set of output and progress indicators have been designed to monitor the Roadmap and the progress made in each strategic line year after year. Annual targets have been determined for each strategic line, although the lack of a baseline will require comparison of the results year-on-year.

The inter-sectoral unit defined will be in charge of monitoring the progress made.

Table 11: Output and progress metrics.

Output metrics
% of households in Guatemala cooking with traditional stoves (as primary or secondary stove)
of biomass ICS adopted

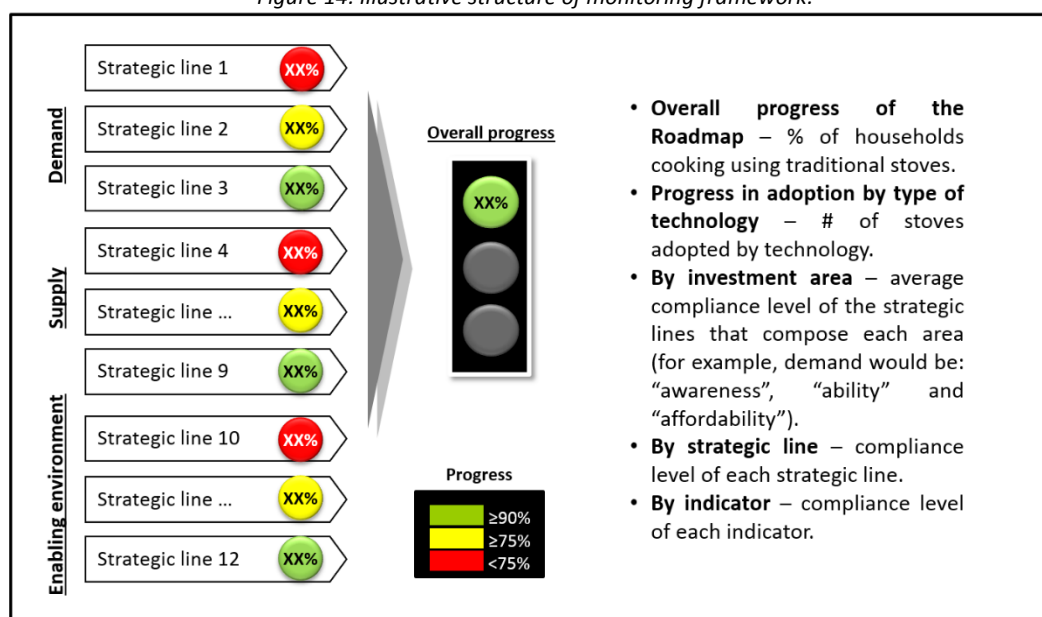
of LPG stoves adopted
of electricity stoves adopted
of biogas stoves adopted

	Strategic line	Progress metrics
Demand	1. Generate awareness	Annual # of prioritized households made aware of the problems associated with cooking with traditional stove and the benefits of ICS
	2. Train potential users to install, use, maintain, and fix their stoves	# of training workshops in Clean Cooking Solutions for trainers/instructors of existing public programs
		Annual # of municipal ICS exhibitions
3. Increase financing options for the consumer		Annual # of households that access an ICS through microcredit
		Annual # of households that access an ICS through CSR
		Annual # of households that access an ICS through partial subsidies
Supply	4. Availability of fuel	N.A.
	5. Stove design	Annual # of new ICS models finance through the incentive fund
	6. Stove production	Annual # of biomass ICS produced
	7. Stove distribution	Total # of ICS distribution and after-sales stores operating
	8. Stove after-sales services	
Enabling environment	9. Policies and regulations	Policies, strategies and regulations are revised
		Regulation of LPG approved
	10. Institutional strengthening	Annual # of follow up reports on the Roadmap
	11. Quality standards and laboratory	Annual # of biomass ICS models evaluated
	12. Knowledge and data	% of implementation of the information system
# of surveys targeting the demand for Clean Cooking Solutions		
Annual # of impact studies conducted		

Source: Dalberg analysis.

For each of the indicators above, a traffic light system can be used to track progress and generate different reports depending on the level of detail needed, for example:

Figure 14: Illustrative structure of monitoring framework.



Source: Dalberg analysis.

6.4 RISK MITIGATION STRATEGY

The most important risks potentially affecting the Roadmap are summarized in the following table, which also includes descriptions of mitigation strategies:

Table 12: Risks and mitigations strategies

Risk	Mitigation Strategy
Change in the level of political support after national elections in September 2015	The Roadmap has broad political support. In order to ensure its continuity independent of the national election results, the Inter-sectoral Support Unit (USI) will be created in 2015. The unit will report to representatives of the public and private sectors, as well as donors. Also the implementation of a model like the one of PRONACOM and the Millennium Challenge Corporation would also help mitigate this risk.
Insufficient demand for improved cookstoves at current market prices	The Roadmap considers several initiatives to strengthen demand for improved cookstoves. On one hand, it aims to generate purchase intent through targeted awareness/advertising campaigns and also to expand financing options to make the technologies more affordable. Additionally, it recommends conducting pilots to identify the preferences of potential users and their price elasticity. With this information in hand, stove manufacturers should be able to adjust their portfolio of products, including prices, to better meet consumer needs.
Insufficient supply of improved stoves	The existing production capacity of local players could satisfy this demand. Nevertheless, if for some reason that were not the case in the future, the USI should ensure that other players can enter the Guatemalan market. The Roadmap includes an initiative to examine tariffs for import and export of clean cooking technologies. The objective of the study is to advocate for regulations that stimulate the expansion of the improved cookstoves supply.
Price volatility (e.g. LPG)	Guatemalan households that used to purchase woodfuel and have migrated to other fuels will have slightly greater saving capacity than they have today. This can serve as a buffer against fuel price increases. Additionally, fuel stacking will likely continue to persist, implying that households will adjust usage of different fuels based on price and access.
Insufficient execution capacity	The USI plans to employ a director and analyst full time to execute and coordinate the activities outlined in the Roadmap. Eventually the team could be supported by more staff. The adoption of an execution and coordination model similar to that of PRONACOM and the Millennium Challenge Corporation would also help mitigate this risk.
Failing to reach the funding goals required by each area	The Roadmap presents a holistic approach, which is why investments are required in all three areas: demand, supply, and enabling environment. In the case that the US \$28 million target for funding to execute the first five years of the Roadmap is not met, existing funds will have to be redistributed so activities can still be carried out in the three areas. To do so, the USI will have to prioritize and focalize in specific geographic areas.

Source: Dalberg analysis.

ANNEX 1: INVESTMENT COMPONENTS

The most relevant investment needs include:

Table 13: Main areas of investment by strategic line 2015-2020 (M US\$)

	Strategic line	Investment Component	Total
Demand	1. Generating awareness	Generate awareness about Clean Cooking Solutions through existing public programs related to Clean Cooking Solutions	0.02
		Generate awareness about Clean Cooking Solutions, targeting local and national leaders	0.39
		Inclusion of a component of Clean Cooking Solutions within the school curriculum (CNB) strategy for all levels of education	0.91
		Launch awareness and advertising campaigns	0.60
	2. Train potential users to install, use, maintain, and fix their stoves	Train consumers through training of trainers/instructors of existing related government programs (e.g. gender empowerment programs)	0.64
		Train final users	0.77
	3. Increase financing options for the consumer	Strengthen the role of the IMF through a guarantee fund	1.35
		Implement Corporate Social Responsibility programs	0.06
		Implement subsidy programs	15.57
	Supply	4. Availability of fuel	Increase production and use of sustainable wood
Expand the distribution network and the use of LPG			3.44
Conduct studies (R&D) of alternative fuel sources for cooking			0.18
5. Stove design		Pilot program to better understand users designs ICS preferences	0.18
		Encourage R&D of new ICS models	0.24
6. Stove production		Train producers of Clean Cooking Solutions on production best practices	0.01
		Increase access to finance to scale production	0.00
		Increase bargaining power to aggregate purchase parts and materials	0.87
7. Stove distribution		Train stoves distributors on best practices of distribution models and marketing	0.00
		Strengthen own and subcontracted distribution networks	0.11
8. Stove after-sales services		Train stoves distributors on best practices for after-sales services	0.00
		Strengthen own and subcontracted after-sales services networks	0.11
		Train producers of Clean Cooking Solutions on production best practices	0.00
Enabling environment	9. Policies and regulations	Review related policies and regulations	0.04
		Analyze taxes and fees	0.03
		Develop LPG regulations	0.21
		Develop carbon offset regulation	0.10
	10. Institutional strengthening	Create a unit which owns the Roadmap, which socialize, review, and monitor its implementation	0.24
	11. Quality standards and laboratory	Define standards and regulations, testing procedures and tiers for improved cookstoves to ensure quality	0.04
		Laboratory to evaluate and certify improved cookstoves	0.19
	12. Knowledge and data	Create a centralized information system and virtual	0.15
		Define, collect, upload and update information on the supply and demand of clean cooking solutions	1.16
		Do impact studies (e.g. health, environment) of families using firewood in traditional stoves vs improved stoves	0.70
Total			28.3

Source: Dalberg analysis.

“Annex 2: Intervention Details” defines the concrete activities within each component and the estimated costs.

ANNEX 2: INTERVENTION DETAILS

ANNEX 3: INDICATORS AND ANNUAL TARGETS

Table 14: Annual goals of output and progress metrics

Output metrics							
Metric	Base line 2015	Goal 2016	Goal 2017	Goal 2018	Goal 2019	Goal 2020	Goal 2030
% of households in Guatemala cooking using traditional stoves (as primary or secondary stove)	73%	70%	64%	58%	52%	47%	0%
# of biomass ICS adopted	0	24,812	89,539	151,707	210,968	266,975	907,860
# of LPG stoves adopted	0	34,807	130,290	229,353	331,957	438,065	1,720,191
# of electricity stoves adopted	0	2,286	8,412	14,550	20,684	26,796	99,091
# of biogas stoves adopted	0	1,228	4,323	7,124	9,602	11,731	34,504

Progress metrics							
Metric	Base line 2015	Goal 2016	Goal 2017	Goal 2018	Goal 2019	Goal 2020	Goal 2030
1. Generate awareness							
Annual # of prioritized households made aware of the problems associated with cooking with traditional stove and the benefits of ICS	0	61,638	166,930	168,234	169,324	169,995	N.A.
2. Train potential users to install, use, maintain, and fix their stoves							
# of training workshops in Clean Cooking Solutions for trainers/instructors of existing public programs	0	145	0	0	0	0	N.A.
Annual # of municipal ICS exhibitions	0	44	44	22	22	22	N.A.

Progress metrics							
Metric	Base line 2015	Goal 2016	Goal 2017	Goal 2018	Goal 2019	Goal 2020	Goal 2030
3. Increase financing options for the consumer							
Annual # of households that access an ICS through a microcredit	0	0	68,851	67,547	66,065	64,302	N.A.
Annual # of households that access an ICS through a CSR	0	0	265	282	300	317	N.A.
Annual # of households that access an ICS through a partial subsidies	0	46,418	45,509	45,103	44,614	43,939	N.A.
4. Availability of fuel							
N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
5. Stove design							
Annual # of new ICS models finance through the incentive fund	0	6	6	6	6	0	N.A.
6. Stove production							
Annual # of biomass ICS produced	0	26,424	70,517	68,225	65,786	62,987	N.A.
7. and 8. Stove distribution and after-sale services							
Total # of ICS distribution and after-sales stores operating	0	0	40	40	40	40	N.A.
9. Policies and regulations							
Policies, strategies and regulations are revised	N.A.	Yes	Yes	Yes	Yes	Yes	N.A.
Regulation of LPG approved	N.A.	Yes	Yes	Yes	Yes	Yes	N.A.

Progress metrics							
Metric	Base line 2015	Goal 2016	Goal 2017	Goal 2018	Goal 2019	Goal 2020	Goal 2030
10. Institutional strengthening							
Annual # of follow up reports of the Roadmap	0	12	12	12	12	12	N.A.
11. Quality standards and laboratory							
Annual # of biomass ICS models evaluated	0	0	27	6	6	3	N.A.
12. Knowledge and data							
% of implementation of the information system	0	100%	100%	100%	100%	100%	N.A.
# of surveys targeting the demand for Clean Cooking Solutions	1	0	0	0	0	1	N.A.
Annual # of impact studies conducted	0	0	1	0	0	1	N.A.

Source: Dalberg analysis.

ANNEX 4: HEALTH AND EMISSION ANNUAL PROJECTED IMPACT

Table 15: Annual health and emission projected impact

Projected impact							
Metric	2015	2016	2017	2018	2019	2020	2030
Health: Deaths from inhaling household air pollution (# of People, cumulative)	0	140	654	1,544	2,811	4,455	44,855
Emissions: Emission gases of carbon dioxide reduced (M Tons, cumulative)	0.00	0.16	0.77	1.82	3.31	5.24	22.36

Source: Dalberg analysis.