

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

ROAD MAP AND INVESTMENT PROSPECTUS

JUNE 2015



Table of Contents

1	Executive Summary	9
2	Background and Context	11
3	Nature of the Challenge in Nicaragua	14
3.1	What is the Challenge?	14
3.2	Why is the Challenge Difficult to Address?.....	17
3.3	How has this Challenge been Addressed in the Past?	20
3.4	What do we Need to do Differently?.....	21
4	Catalyzing the Transformational Change	24
4.1	Approach to Building the Roadmap to 2030.....	24
4.2	Roadmap Summary: Country Strategy	25
4.3	Detailed Roadmap to 2030	29
5	Investments Needed to Achieve the Transition	39
5.1	Overview of the Investment Plan	39
5.2	Investment Needed by Strategic Line	40
6	Operating Model	46
6.1	Institutional Strengthening	46
6.2	Investment Flows	47
6.3	Monitoring System.....	48
6.4	Risk Mitigation Strategies	49
	Annex 1: Investment Components	51
	Annex 2: Intervention Details	52
	Annex 3: Indicators and Annual Targets	53
	Annex 4: Health and Emission Annual Projected Impact	56

Index of tables

Table 1: Investment by area 2015-2020 (M US\$)	10
Table 2: Consulted organizations.....	11
Table 3: Benefits of clean cooking	16
Table 4: Policies in Nicaragua related to the cookstoves sector	19
Table 5: Nicaragua’s strengths and challenges in scaling up adoption of clean cooking solutions.....	20
Table 6: Nicaragua specific entry points	23
Table 7: Country strategy emphasis	26
Table 8: Investment by area 2015-2020 (M US\$)	40
Table 9: Investment by strategic line and type of investment 2015-2020 (M US\$)	44
Table 10: Investment by strategic line and type of funds 2015-2020 (M US\$)	45
Table 11: Output and progress metrics.	48
Table 12: Risks and mitigations strategies.....	50
Table 13: Main areas of investment by strategic line 2015-2020 (M US\$).....	51
Table 14: Annual goals of output and progress metrics.	53
Table 15: Annual health and emission projected impact.	56

Index of figures

Figure 1: Primary fuel usage for cooking breakdown (2011-2012) (000 households)	14
Figure 2: Effects of cooking with traditional stoves in Nicaragua.....	16
Figure 3: Cuadernillo Popular de Cocinas Mejoradas.....	17
Figure 4: factors why cookstoves are considered not affordable in Nicaragua	18
Figure 5: Monthly cost of cooking with different fuels in Nicaragua	18
Figure 6: Projected evolution of cooking technologies under existing plans (M Households)	22
Figure 7: Transition of different population segments to clean cooking technologies (M Households)	27
Figure 8: Distribution of financing methods by population segment.....	27
Figure 9: Sequencing initiatives across strategic lines.....	28
Figure 10: Projected use of clean cooking technologies under the Roadmap (M Households).....	29
Figure 11: Cost estimated by type of investment and type of funds (M US\$)	39
Figure 12: Cost by area of investment (M US\$)	40
Figure 13: Proposed structure for institutional strengthening.....	47
Figure 14: Financial flows to the Roadmap.....	48
Figure 15: Illustrative structure of monitoring framework.....	49

Acronyms and Abbreviations

~	Approximately
BUNCA	Fundación Red de Energía
CACCI	Central America Clean Cooking Initiative
CONAP	Consejo Nacional de Áreas Protegidas
CONICYT	Consejo Nicaragüense de Ciencia y Tecnología
CSR	Corporate social responsibility
DERA	Direction of Alternative Renewable Energy of MEM
e.g.	For example
ENATREL	Empresa Nacional de Transmisión Eléctrica
EnDev	Energizing Development
FODIEN	Fondo para el Desarrollo de la Industria Eléctrica Nacional
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
ICS	Improved Cookstoves
IDB	Inter-American Development Bank
INAFOR	Instituto Nacional Forestal
LAC	Latin America and Caribbean
LPG	Liquefied petroleum gas
MARENA	Ministerio del Ambiente y Recursos Naturales
MEM	Ministerio de Energía y Minas
MFI	Micro Finance Institution
MHCP	Ministerio de Hacienda y Crédito Público
MIFAM	Ministerio de la Familia, Adolescencia y Niñez
MINIM	Ministerio de la Mujer
MINSA	Ministerio de Salud
NGO	Non-governmental organization
PNESER	National Sustainable Electrification and Renewable Energy Program
R&D	Research and Development
SE4ALL	Sustainable Energy for All
SNV	Netherlands Development Organization
UCA	Universidad Centroamericana

ULSA	Universidad Tecnológica La Salle
UNA	Universidad Nacional Agraria
UNI	Universidad Nacional de Ingeniería
USI	Unidad de Soporte Intersectorial

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.
Mesa de Leña	Institution formed by the stakeholders related to the topic of clean cooking solutions (e.g. MEM, MIFAN, MINIM, MARENA, MINSA, INAFOR, Asociación Renovable, etc.).
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).

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

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 also utilize readily available fuels such as wood or charcoal.

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

1 EXECUTIVE SUMMARY

Today ~900k households or ~70% of the households in Nicaragua cook with traditional stoves. More than 50% of the Nicaraguan households cook only with wood and an additional 25% of households cook with wood in combination with other fuels (referred to as “fuel stacking”). Of the 75% of the households that cook with wood, almost 95% use traditional stoves.

Using traditional stoves for cooking has severe, negative implications. It adversely affects the health of women who cook and the children in their care, causing almost 2,400 deaths every year due to household 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 an improved cookstove; finally, it also impacts household’s finance since Nicaraguan households who use traditional stoves and purchase wood spend on average 60% more each month on overall cooking costs. Additionally, cooking with traditional stoves has implications for various other development dimensions: gender empowerment, since women devote much of their time daily to collecting or purchasing fuelwood and cooking; 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, such as cooking, hinder the ability of rural communities to prosper.

A number of barriers has prevented Nicaragua from massively scaling up the adoption of more efficient and cleaner cooking solutions. Obstacles affect demand, supply, and enabling environment of clean cooking solutions. Some of Nicaragua’s main challenges relate to low levels of demand by users. A number of factors contribute to low demand. First, there is relatively low public awareness of the risks associated with cooking using traditional stoves and biomass, or of the existence of cleaner solutions. Additionally, financing options are not readily available to make cleaner solutions more affordable. At the same time, the clean cooking suppliers’ landscape is limited: only two large manufacturers operate in the country, only a few biomass stove models are offered, and the companies’ distribution and after-sale networks are weak. 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.

The World Bank and the Government of Nicaragua 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 million households to transition to clean cooking solutions³. The Roadmap aims to remove the barriers identified using a holistic and coordinated approach leveraging some of Nicaragua’s key strengths: strong institutional leadership by the Ministry of Energy and Mines (MEM), policies and

³ Throughout this document we refer to “improved cookstoves (ICS)” or “biomass improved cookstoves”. 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.

regulations favoring development of the clean cooking sector, and a strong interest from LPG and biogas players to increase their penetration in the market.

Working closely with stakeholders in Nicaragua, 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, creating financing mechanisms to make these technologies more affordable, and training the users
2. Scaling the supply of improved alternatives by promoting the availability of existing clean fuels and new alternatives for cooking, by making current products more user-appropriate and accessible, by increasing the production capacity 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 \$26.7 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 Nicaragua. Enhancing the supply and improving the enabling environment require more modest investments (US \$3-\$4 million each), but are critical complements to 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	Generate awareness of the negative consequences of cooking with traditional stoves and the existence of alternatives	\$19.6M
	Improve ability of potential users (via training on how to install, use, maintain and fix their stoves)	
	Ensure that different population segments have the capacity to pay for the different technologies (e.g. through microcredits, CSR, Subsidies)	
Supply	Increase availability of different fuels for cooking (e.g. woodfuel, LPG, biogas)	\$3.3M
	Understand the preferences of potential ICS users and broaden the portfolio of stove models available	
	Enhance the productive capacity of ICS	
	Increase and/or reinforce own and subcontracted distribution networks of ICS	
	Increase and/or reinforce own and subcontracted after-sales networks of ICS	
Enabling environment	Ensure new and existing policies to support the clean cooking sector	\$3.8M
	Ensure the Roadmap is correctly implemented; ensure commitments and responsibilities are honored	
	Ensure that stoves meet minimum performance standards	

Create a repository with quality data to facilitate effective decision making	
Total	\$26.7M

Source: Dalberg analysis based on stakeholder input in Nicaragua.

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 Nicaragua, although a separate and similar analysis has been prepared for Guatemala. 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 Nicaragua 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 Nicaragua. 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 Nicaragua. In total, more than 23 organizations have contributed to the development of the strategy presented in this document. 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 Nicaragua.

Table 2: Consulted organizations

Government	Universities/Academia/Experts
------------	-------------------------------

<ul style="list-style-type: none"> • Ministerio de Energía y Minas (MEM) • Ministerio de la Familia, Adolescencia y Niñez (MIFAN) • Ministerio de la Mujer (MINIM) • Ministerio del Ambiente y Recursos Naturales (MARENA) • Ministerio de Salud (MINSa) • Instituto Nacional Forestal (INAFOR) • Consejo Nicaragüense de Ciencia y Tecnología (CONICYT) • Fundación Red de Energía (BUNCA) • Consejo Nacional de Áreas Protegidas (CONAP) 	<ul style="list-style-type: none"> • Universidad Centroamericana (UCA) • Universidad Nacional de Ingeniería (UNI) • Universidad Nacional Agraria (UNA) • Universidad Tecnológica La Salle (ULSA) • Asociación Renovables de Nicaragua
Manufacturers /distributors	Donors
<ul style="list-style-type: none"> • Tropigas • Asofenix • Proleña • MiFogón • Mujeres Solares 	<ul style="list-style-type: none"> • Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) • Energizing Development (EnDev) • Netherlands Development Organization (SNV) • Inter-American Development Bank (IDB)

Source: Dalberg analysis based on stakeholder engagement in Nicaragua.

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 Nicaragua by 2030. The Investment Prospectus seeks to raise US \$27 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 Nicaragua. The holistic approach to achieving this objective includes initiatives in the 3 critical areas related to increasing the demand for cleaner solutions by households, increasing the supply of viable options available in Nicaragua, 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 Nicaragua** – provides context regarding the challenge we are trying to address in Nicaragua.
- **Section 4: Catalyze a Transformational Change** – describes the strategic Roadmap for market transformation we envision in Nicaragua.
- **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.

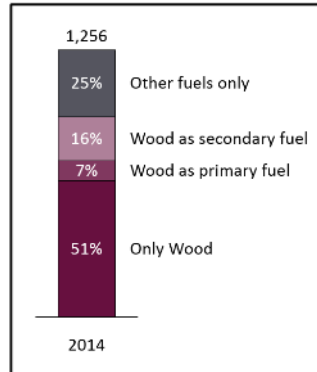
- **Annex 3: Indicators and Annual Targets** – includes the targets suggested for each of the Roadmap indicators.
- **Annex 4: Health and Emission Annual Projected Impact** – includes the projected impact in terms of health and emissions.

3 NATURE OF THE CHALLENGE IN NICARAGUA

3.1 WHAT IS THE CHALLENGE?

Today, more than 50%⁴ of Nicaraguan households cook only with wood. An additional one-quarter 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 ~75%⁵.

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



Source: Gap assessment – Nicaragua. 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 40%⁶, the percentage of households cooking primarily with wood has barely decreased in the last 10 years despite efforts by different stakeholders to mitigate the problem. Whereas in urban areas the percentage of households that cook with wood has decreased 11 percentage points, from 38% to 27%⁷, in rural areas, the percentage has decreased only 3 percentage points, from 92%⁸ to 89%.

Approximately 95%⁹ of households cooking with wood use traditional stoves. The remaining 5%¹⁰ mainly use built-in-place improved biomass stoves. Despite the existence of more 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:

⁴ Gap assessment – Nicaragua. Preparation of a Clean Cooking Solutions Roadmap and Investment Prospectus for Guatemala, Honduras, and Nicaragua, Dalberg, March 2015.

⁵ Ibid.

⁶ Ibid.

⁷ Ibid.

⁸ Ibid.

⁹ Ibid.

¹⁰ Ibid.

- **Gender** – women devote a significant amount of their time cooking, often indoors for many hours each day.
- **Health** – as consequence, women and small children in their care suffer from respiratory diseases caused by the inhalation of household fumes. Approximately ~2,373¹¹ annual deaths in Nicaragua 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 Nicaragua save almost 50% on wood consumption if compared against open fires or three stone stoves). Also, of the households that collect wood, 41% collect wood from cutting tree branches, while 9% get their wood from cutting trees¹².
- **Climate Change** – traditional stoves have lower fuel efficiency, therefore they emit more greenhouse gases contributing to climate change.
- **Household Finances** – Nicaraguan households who use traditional stoves and purchase wood spend on average 60% more each month on overall cooking costs¹³ compared to similar households using improved cookstoves. 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. In Nicaragua, the national average indicates that among households that collect firewood, 32% devote between 1 and 3 hours to this activity, and 13% spend over three hours¹⁴. Additionally, the negative health effects from the burning of biomass hinder the ability of rural communities to prosper.

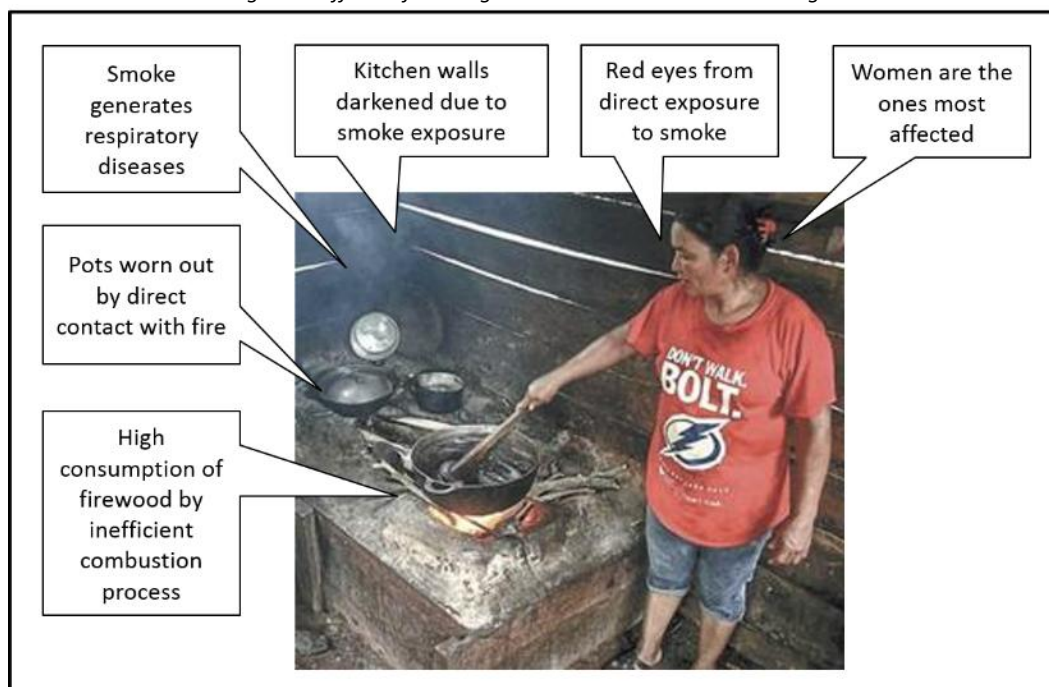
¹¹ According to estimates from the Global Alliance for Clean Cookstoves (GACC), available on the following webpage: <http://cleancookstoves.org/country-profiles/106-nicaragua.html>, March 2015.

¹² Nicaragua National survey of firewood, 2007.

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

¹⁴ Nicaragua National survey of firewood, 2007.

Figure 2: Effects of cooking with traditional stoves in Nicaragua



Source: Photo taken from: <http://www.radiolaprimerisima.com/noticias/157128/nicas-que-usan-lena-expuestas-a-enfermedad-pulmonar>, consulted March 2015.

By increasing the adoption of clean cooking solutions, the above problems will be reduced/solved, and positively impact the household's health and finances, 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 Nicaragua 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...

Unlike other countries in the region, Nicaragua has not historically had massive public programs focused on promoting clean cooking solutions. The lack of public campaigns has led to relatively **low awareness** and knowledge of the negative consequences from cooking using traditional stoves and the existence of alternative solutions among the Nicaraguan population. Today, most of the efforts to raise awareness have been carried out by private sector players (e.g. Proleña, Mifogon, Asofenix), using educational campaigns as shown in the excerpt below.

Figure 3: Cuadernillo Popular de Cocinas Mejoradas



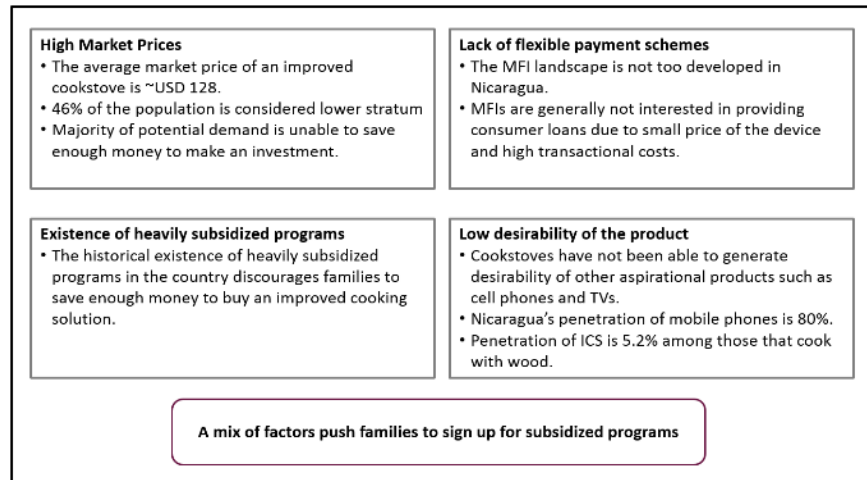
Source: Proleña, Nicaragua.

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. Insufficient training regarding usage and maintenance leads to diminishing performance of the stove, eventual damage, and as a result, mistrust of the technology. Most of the efforts on this dimension are very similar to awareness raising campaigns, mostly through exhibitions and public demonstrations in communities using graphic material.

Finally, those who are aware of the problem, know how to use, maintain, and/or repair technology and want to access alternative solutions usually consider them to be **unaffordable** given the relatively high market prices and lack of flexible payment schemes (e.g. consumer loans) for this type of product. Also,

it is important to consider that beyond the capacity to pay, NGO programs that heavily subsidize improved cookstoves have undermined consumers’ willingness to pay market prices.

Figure 4: factors why cookstoves are considered not affordable in Nicaragua

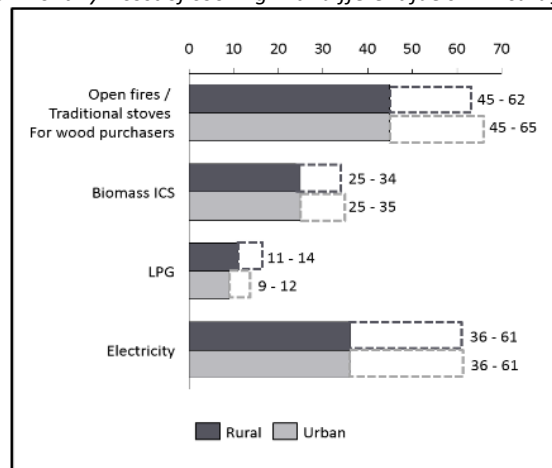


Source: Gap assessment – Nicaragua. Preparation of a Clean Cooking Solutions Roadmap and Investment Prospectus for Guatemala, Honduras, and Nicaragua. Dalberg, March 2015.

On the supply side...

The relatively easy **availability** of “free” woodfuel lessens the imperative to shift to other fuels such as LPG. In particular, it is estimated that 45% of the households that uses wood for cooking does not purchase but rather collects wood¹⁵. 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 Nicaragua.

Figure 5: Monthly¹⁶ cost of cooking with different fuels in Nicaragua (US\$)



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

¹⁵ Nicaragua National survey of firewood; 2007.

¹⁶ Includes cost of usage and monthly upfront investment.

Despite government plans to increase penetration of LPG for cooking, it is expected that wood will continue to be one of the primary fuels for cooking in Nicaragua. Nevertheless, LPG and biogas players have shown interest in increasing their market penetration among segments of the population cooking with wood.

Unlike other countries in the region, there is a relatively limited number of improved biomass cookstove manufacturers and stove models in Nicaragua (only 2 main players, Proleña and Mifogon). Imports of improved stove models from neighboring countries has been limited, largely due to limited demand. Domestic manufacturers face resource constraints that have limited their ability to invest in research and development (R&D) or to **develop new designs** of improved stoves (different stove models), as well as constraints to **scaling up their production**. Presently in Nicaragua, annual joint maximum production is estimated to be ~17,000 ICS, although less than 20% of this maximum are sold. Largely as a result of this limited demand, also, **manufacturers and distributors have not invested in improving/expanding their distribution and after-sales networks**, which mainly depend on traditional models. In particular, the distribution network for improved cookstoves (ICS) is usually limited to the geographic areas and timeframes where NGOs or Government programs are active.

On the enabling environment side...

The **institutional support** in Nicaragua 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 National Strategy for the Sustainable Use of Firewood and Charcoal (2011-2022), and the National Program for the Sustainable Use of Firewood and Charcoal (2014-2022), which is currently being validated, and plans to deploy 400,000 improved cookstoves over the next ten years. Other related policies can be found in the table below.

Table 4: Policies in Nicaragua related to the cookstoves sector

Type of policy and year	Main stakeholders ¹	Goal	Dedicated investment (MUSD)
National Program for Sustainable Electrification and Renewable Energy (2012-2016)	• MEM	• Reduce poverty through addressing Nicaragua's lack of electricity in rural areas, insufficient transmission and grid infrastructure, system inefficiencies, high dependence on fossil fuels, and lack of investment in renewable sources	• 22.0
Electricity Generation Expansion Plan (2013-2027)	• MEM • CNDC • ENARTEL	• Replace non-renewable energy sources with renewable energy sources (increasing renewable energy sources from 51% in 2013 to 91% in 2027)	• N.A.
National Strategy for Fuelwood and Charcoal (2011-2022)	• MEM • INAFOR • MARENA • MAGFOR	• Increase energy efficiency to reduce firewood consumption in homes and industries by 10% by 2020 • Inform 25,000 people on the sustainable use of firewood	• 16.3
National Program for Sustainable Use of Firewood and Charcoal (2014-2022; under validation)	• MEM	• Deploy 400,000 improved cookstoves over the next ten years	• 108.5

1. MEM = Ministerio de Energía y Minas; CNDC = Centro Nacional de Despacho de Carga; ENARTEL = Empresa Nacional de Transmisión Eléctrica; INAFOR = Instituto Nacional Forestal; MARENA = Ministerio del Ambiente y los Recursos Naturales; MAGFOR = Ministerio Agropecuario y Forestal
2. Only includes goals related to cookstoves sector.
Source: National plan documents; Dalberg analysis.

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

The Ministry of Energy and Mines (MEM) has effectively orchestrated efforts to scale clean cooking solutions. Nevertheless, the country has not yet passed **quality standards** for stoves that determine certain performance and fuel consumption thresholds, which country experts believe has contributed to the low level of overall demand for improved stoves in the country. The MEM is currently working on developing these standards by adapting those from Bolivia. A preliminary version of the “Norma Técnica” has already been drafted and the final version should be approved during the first half of 2015. Nicaragua is also working on setting up a testing lab that will be part of the Universidad Nacional de Ingeniería (UNI) who will be in charge of running it. Up to now, all the stoves tested in Nicaragua have been sent to the Zamorano testing lab in Honduras (e.g. Proleña have sent models).

Finally, the lack of centralized quality **data and information** prevents stakeholders from making informed decisions. The last available information related to clean cooking solutions is Nicaragua’s wood fuel consumption survey conducted in 2007, which contains some of the most relevant data and disaggregated in urban/rural, stratum and by state. Other related studies/surveys/data sources are: Survey of Living Standards Measurement 2009 by INIDE and Continuous Household Survey 2012 by INIDE, but they don’t provide the detail needed in terms of the demand and supply of clean cooking solutions that would support appropriate policy reform or improve data availability for consumers or producers.

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

Table 5: Nicaragua’s strengths and challenges in scaling up adoption of clean cooking solutions

	Strengths	Challenges
Demand	<ul style="list-style-type: none"> Recent attention globally related to clean cooking has sparked some new demand in Nicaragua 	<ul style="list-style-type: none"> Relatively low awareness of the problem and the existence of alternative solutions Almost non-existent consumer financing options to purchase ICS
Supply	<ul style="list-style-type: none"> Interest of LPG (e.g. tropigas) and biogas players to increase their market penetration Low LPG stoves and cylinder prices (US\$7-13 for a 12kg cylinder and ~US\$100 for a stove) 	<ul style="list-style-type: none"> Limited number of biomass ICS suppliers/stove models Limited production capacity of biomass ICS Almost non-existent ICS distribution or aftersales networks
Enabling environment	<ul style="list-style-type: none"> Strong institutional leadership by the MEM Existing policies and regulations supporting clean cooking 	<ul style="list-style-type: none"> Lack of updated information of the clean cooking sector (last wood consumption survey was in 2007) Lack of quality standards on emissions and efficiencies Lack of inter-sectoral institutions

Source: Dalberg analysis.

3.3 HOW HAS THIS CHALLENGE BEEN ADDRESSED IN THE PAST?

Several public institutions in Nicaragua are interested in promoting the adoption of clean cooking solutions. The MEM and the Ministry of Women (MINIM) have been among the most vocal of institutions advocating for this change. But unlike other countries in the region, this interest has not

been translated into massive public programs focused on giving away or heavily subsidizing improved cookstoves. The closest public strategy to that end is the National Program for the Sustainable Use of Firewood and Charcoal (2014-2022), which made the National Strategy operational. This program aims to disseminate 400 thousand improved biomass stoves in the next ten years, but does not clearly define a path or model to pursue market-focused or socially-inclusive development that would be sustained beyond the initial stove dissemination.

NGOs and local communities have taken the lead in promoting clean cooking solutions. These initiatives have been rather isolated and on a modest scale. The majority of these initiatives involve NGOs buying improved cookstoves from manufacturers and either giving them away to the end users in rural communities, or selling them at heavily discounted rates. This operating model, which promoted the installation of built in-situ improved biomass stoves, required the NGO 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. While these programs have had some limited success, longer term usage by households has been mixed. Similarly, because these programs involved free or heavily subsidized stoves, the overall scale of the programs has been limited, and have to date failed to catalyze a more financially sustainable market for improved stoves or maintenance services.

The private sector in Nicaragua has not been deeply involved in promoting the adoption of clean cooking solutions. In Nicaragua, private corporations do not usually contribute to the adoption of clean cooking via emission compensation programs or Corporate Social Responsibility (CSR) programs, unlike in other countries where the private sector is more involved. Nevertheless, and based on the findings of this project, this is mainly due to a lack of awareness among the private sector of the existence and severity of this challenge.

Finally, Nicaragua has a limited number of manufacturers and distributors of clean cooking solutions. Nicaragua has only two large manufacturers of improved biomass stoves: PROLEÑA and Mifogón. Since the early 2000s, both manufacturers have focused on distributing in-situ models, called Ecofogón and Mifogón respectively. The LPG sector is controlled largely by Tropicás (an LPG distributor), that has a physical presence in the main urban areas of Nicaragua. Nicaragua is also one of the few countries in the region with a plan, led by SNV, to increase the use of biogas. The lack of a solid and consolidated landscape of manufacturers limits Nicaragua's potential to reach the nearly one million households cooking with traditional stoves today.

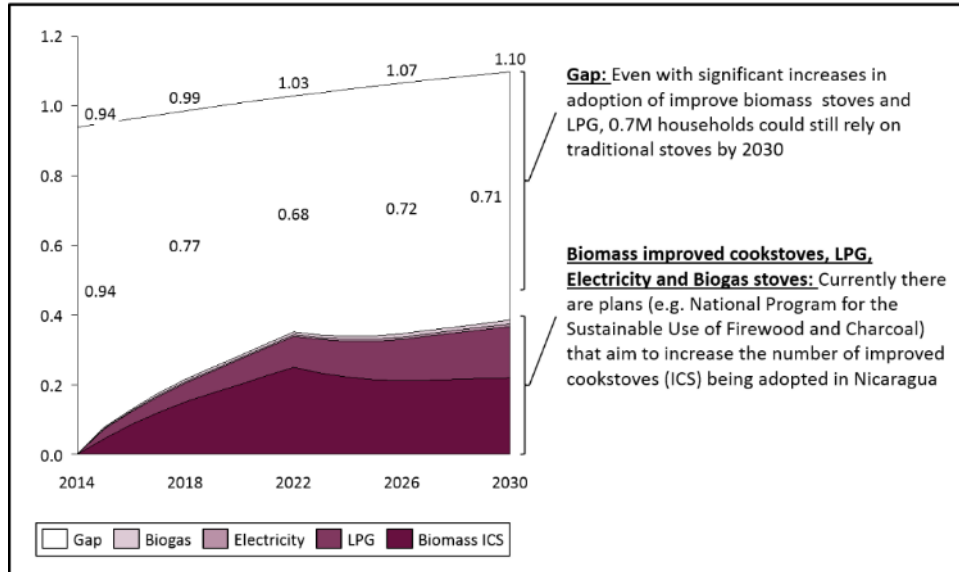
3.4 WHAT DO WE NEED TO DO DIFFERENTLY?

If no action is taken, the number of households cooking with wood will likely increase from 0.94M in 2014 to 1.10M in 2030¹⁷. The existing national plans and those in the process of validation, such as the National Program for the Sustainable Use of Firewood and Charcoal included in the National Strategy for the Sustainable Use of Charcoal and Wood (which aims to disseminate 400 thousand stoves in ten years), 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

¹⁷ Gap assessment – Nicaragua. Preparation of a Clean Cooking Solutions Roadmap and Investment Prospectus for Guatemala, Honduras, and Nicaragua, Dalberg, March 2015.

traditional stoves and fuels, we estimate that approximately 0.71M¹⁸ Nicaraguan households will still be cooking with traditional stoves by 2030.

Figure 6: Projected evolution of cooking technologies under existing plans (M Households)



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

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 Nicaragua.

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

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

Table 6: Nicaragua 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 MINIM, MINSA, MIFAM and MARENA to include in their programs a clean cooking solution component Coordinate with INIFOM in order to generate awareness about Clean Cooking Solutions in local governments of the 153 municipalities of Nicaragua Raise awareness through national and targeted advertising/awareness campaigns in coordination with “los medios del Poder Ciudadano” from the government of Nicaragua Coordinate with Proleña, Mifogon and other ICS distributors to organize cookstoves exhibitions in all municipalities to train consumers 	<ul style="list-style-type: none"> Work with INAFOR to design system of incentives to promote hectares of forest for firewood and promote the establishment of hectares of forest for firewood Coordinate with Tropigas and other LPG distributors to design incentives and implement pilot programs and scale initiatives to expand the distribution network of LPG Work with Proleña, Mifogon and other ICS manufacturers and academia (e.g. UNI) to conduct a study of design preferences and to expand models according to findings from study Create and activate a guarantee fund for loans to support the ICS manufactures (e.g. Proleña, Mifogon, Asofenix) increase their production capacity to be able to supply the projected demand 	<ul style="list-style-type: none"> Review and update policies, laws and specific strategies related to Clean Cooking Solutions (e.g. Política Nacional de Energía, Estrategia Nacional de Leña y Carbón, Programa Nacional de la Leña y el Carbón vegetal, Plan Nacional de Desarrollo Humano) Strengthen the MEM’s Biomass Department of the Direction of Alternative Renewable Energy 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 in the UNI Update Nicaragua’s Wood fuel consumption survey periodically

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 Nicaragua¹⁹ 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 Ministry of Tax Revenue and Public Credit (MHCP) and the Ministry of Energy and Mines (MEM) of Nicaragua.

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 remove all the barriers that have historically prevented broader adoption of clean cooking solutions in Nicaragua.

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). Nevertheless, and given the current situation of the country, the Roadmap defines logical and expected transitions to cleaner technologies and fuels for each of the population segments in Nicaragua (see Figure 7 below).

The Roadmap defines priorities, initiatives, responsibilities, and recommended timing. The consulting process allowed the key stakeholders in Nicaragua 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.

¹⁹ 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 0.94 million in 2014 to 1.1 million in 2030, as we saw in chapter 4.1. The potential demand for clean cooking solutions is very diverse. In the case of Nicaragua, ~50% of households that cook with traditional stoves live in rural areas and the remaining ~50% in urban areas²⁰. Today, traditional stoves prevail as the dominant technology for the poorest segments of the population, although some better-off 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 Nicaragua 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 Nicaragua and improve their designs, for example, by adapting models to the different needs and preferences of the population, 3) scaling up their production, and 4) enhancing their distribution and 5) 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 a system of centralized information, and lastly, 4) strengthening the Biomass department of the Direction of Alternative Renewable Energy of the MEM to ensure the Roadmap is implemented effectively.

The initiatives proposed aim to address the specific challenges identified in Nicaragua in the previous chapter. Although work is required within the 12 dimensions identified in the paragraph above, the Roadmap for Nicaragua draws particular attention to five main areas of emphasis, as highlighted in the table below. 1) The Roadmap underlines the need to raise awareness of the issues associated with using traditional stoves and the existence of alternative solutions. To that end, the Roadmap recommends initiatives such as a national awareness campaign and campaigns targeting priority segments of the population. 2) The Roadmap stresses the need to strengthen the capabilities of clean cooking solutions manufacturers. As mentioned, there are only two large cookstove producers in Nicaragua. In order to increase the reach and the adoption of this technology, the Roadmap suggests initiatives that reinforce the producers' design, production, distribution, and after-sale capabilities. 3) And as in many countries of the region, Nicaragua has not instituted quality standards that ensure stoves comply with thresholds on emissions and efficiency. To that end, the Roadmap highlights the need to develop standards and set

²⁰ Gap assessment – Nicaragua. Preparation of a Clean Cooking Solutions Roadmap and Investment Prospectus for Guatemala, Honduras, and Nicaragua, Dalberg, March 2015.

up a lab to test the stoves. 4) And as previously identified, Nicaragua does not currently have a “Mesa de Leña”. And 5) the Roadmap also accentuates the need to create an organization that coordinates inter-sectoral that will be led by the biomass department of the DERA of the MEM.

Table 7: Country strategy emphasis

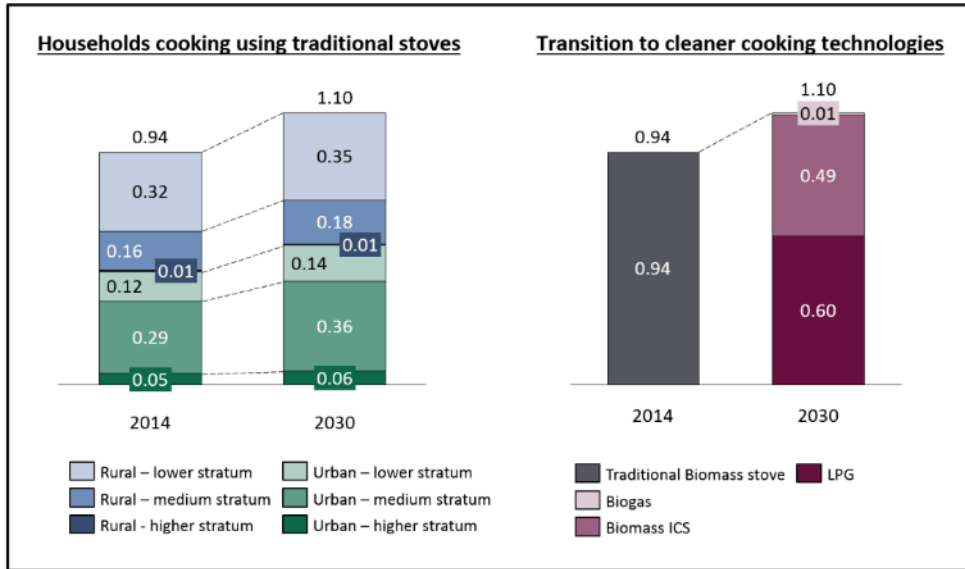
	Strengths	Challenges	Country Strategy Emphasis
Demand	<ul style="list-style-type: none"> Recent attention globally related to clean cooking has sparked some new demand in Nicaragua 	<ul style="list-style-type: none"> Relatively low awareness of the problem and the existence of alternative solutions Almost non-existent consumer financing options to purchase ICS 	Raise awareness: <ul style="list-style-type: none"> National campaigns Targeted campaigns Review the education curricula Review the existing public programs
Supply	<ul style="list-style-type: none"> Interest of LPG (e.g. tropigas) and biogas players to increase their market penetration Low LPG stoves and cylinder prices (US\$7-13 for a 12kg cylinder and ~US\$100 for a stove) 	<ul style="list-style-type: none"> Limited number of biomass ICS suppliers/stove models Limited production capacity of biomass ICS Almost non-existent ICS distribution or aftersales networks 	Reinforce manufacturers' capabilities: <ul style="list-style-type: none"> Design Production Distribution After-sale
Enabling environment	<ul style="list-style-type: none"> Strong institutional leadership by the MEM Existing policies and regulations supporting clean cooking 	<ul style="list-style-type: none"> Lack of updated information of the clean cooking sector (last wood consumption survey was in 2007) Lack of quality standards on emissions and efficiencies Lack of inter-sectoral institutions 	<ul style="list-style-type: none"> Support the definition and enforcement of quality standards Promote the creation of a Mesa de Leña led by the MEM Support the Roadmap implementation led by the Biomass Department of the DERA of the MEM

Source: Dalberg analysis.

The Roadmap’s final objective is to transition the 0.94 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 launching a country-wide awareness and advertisement campaign to reach all Nicaraguans; 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 ~55% of the households that currently cook with wood will mainly use LPG for cooking, ~45% will use improved biomass stoves, and the remaining 1% biogas. This transition, illustrated in Figure 7, focuses on pushing segments with less economic resources in urban and rural areas to mainly use improved biomass stoves. At the same time, it promotes the transition of medium and high income strata segments of the population to mainly use LPG in urban and rural areas and also some biogas in rural areas. The left side of Figure 7 (an excerpt from the Gap Assessment analyses) demonstrates the current and future distribution of the households cooking with wood by income segment; the right-hand side envisions the transition of this population to clean cooking solutions.

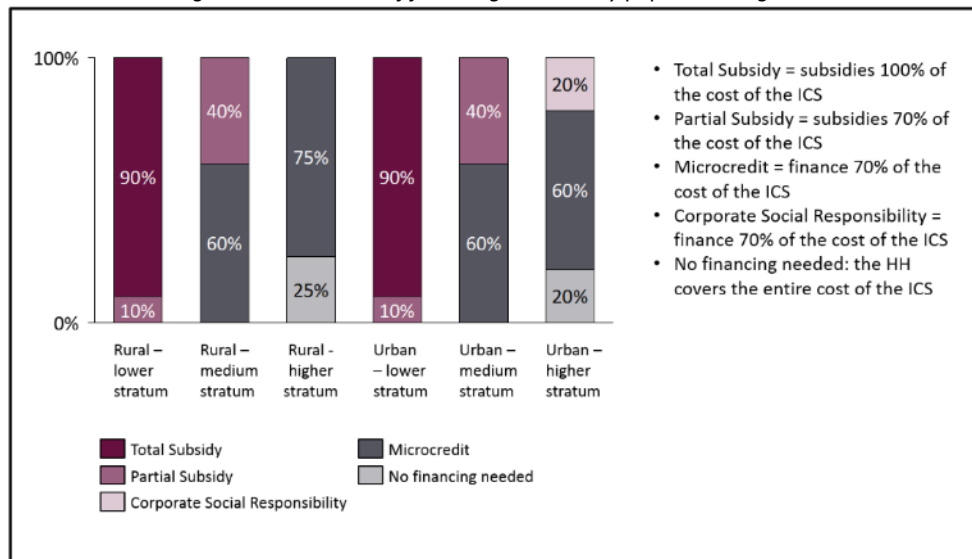
Figure 7: Transition of different population segments to clean cooking technologies (M Households)



Source: Workshop “Desarrollo de un Plan de Acción e Inversión para promover el uso de soluciones limpias para cocinar” held in Managua on March 18, 2015.

Additionally, the Roadmap proposes a differentiated financing strategy for each population segment, as illustrated in Figure 8 below. For instance, it is expected that populations from the lowest income strata will need a subsidy that covers the full cost of the improved stove, while sections of the medium income strata may require partial subsidies, and others can access the technology via micro loans. Finally, microloans are expected to be the main financing mechanism for higher income strata, although some portion of that segment will also be able to access the technology via Corporate Social Responsibility (CSR) initiatives.

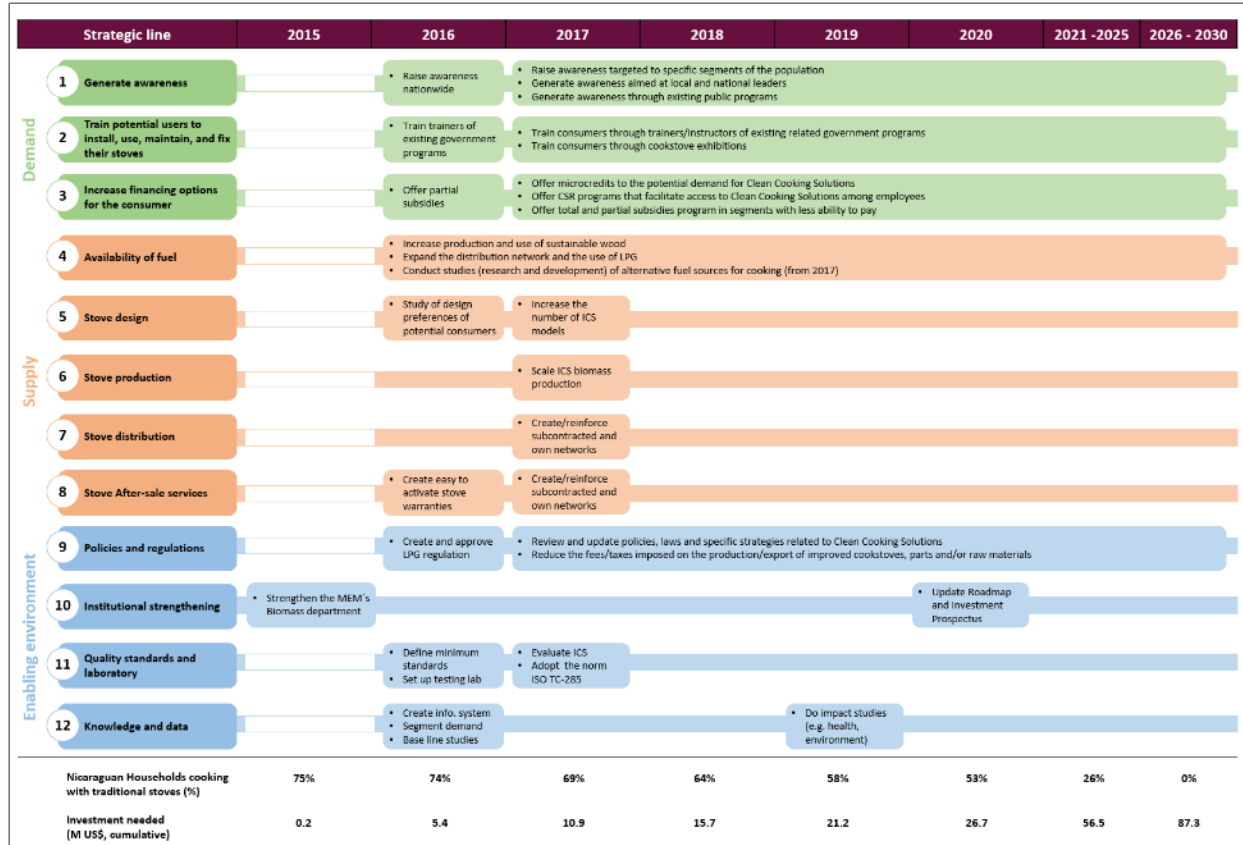
Figure 8: Distribution of financing methods by population segment



Source: Dalberg analysis.

While all strategic lines are important, stakeholders in the clean cooking sector in Nicaragua 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, consumer segmentation, 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.

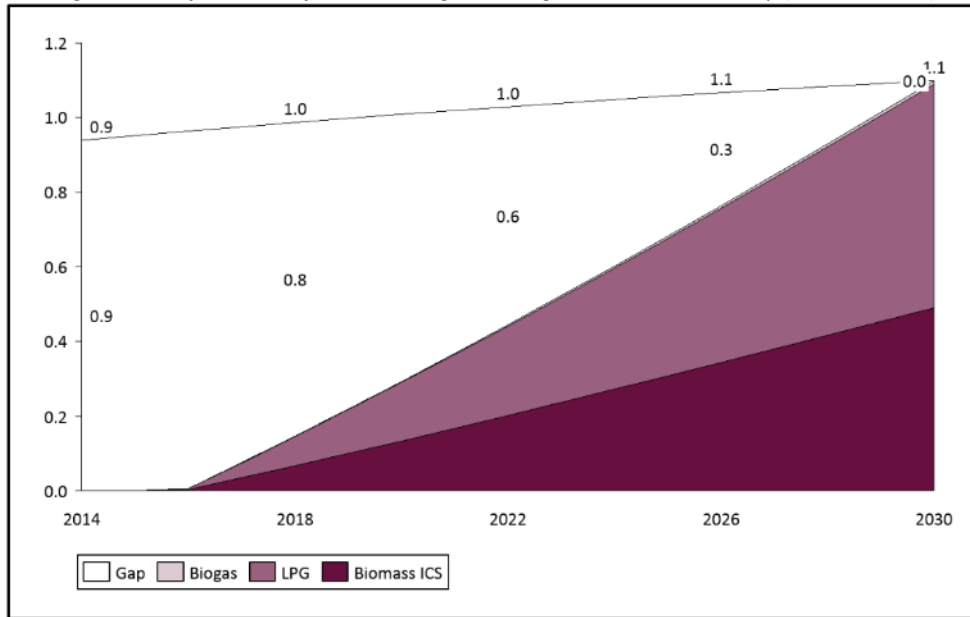
Figure 9: Sequencing initiatives across strategic lines



Source: Workshop “Desarrollo de un Plan de Acción e Inversión para promover el uso de soluciones limpias para cocinar” held in Managua on March 18, 2015.

With the effective implementation of the initiatives included in the Roadmap, Nicaragua expects to eliminate dependency on 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 0.9 million households in 2014 to 1.1 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, and biogas stoves and close the gap by 2030. The figure below summarizes the projected transition path we envision for closing the gap in Nicaragua. 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 Nicaragua, namely improved biomass cookstoves and LPG stoves.

Figure 10: 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:** Will reduce deaths from household air pollution (HAP) by 21,000 people, including 2,500 children (from 2016-2030)²¹.
- **Household finance:** Will reduce household expenditure on fuels for cooking ~60% per month (US\$34)²².
- **Emissions:** Will reduce emissions of carbon dioxide by nearly 21 million tons (from 2016-2030)²³.

4.3 DETAILED ROADMAP TO 2030

²¹ 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.

²² Estimated by comparing the monthly cost of HH that buy wood and cook with traditional wood stoves vs. those using biomass ICS, LPG stoves.

²³ Estimated by projecting annual savings of 2.6 Tons of carbon dioxide gases for each HH that transitions to an ICS (Source: Proyecto Mirador).

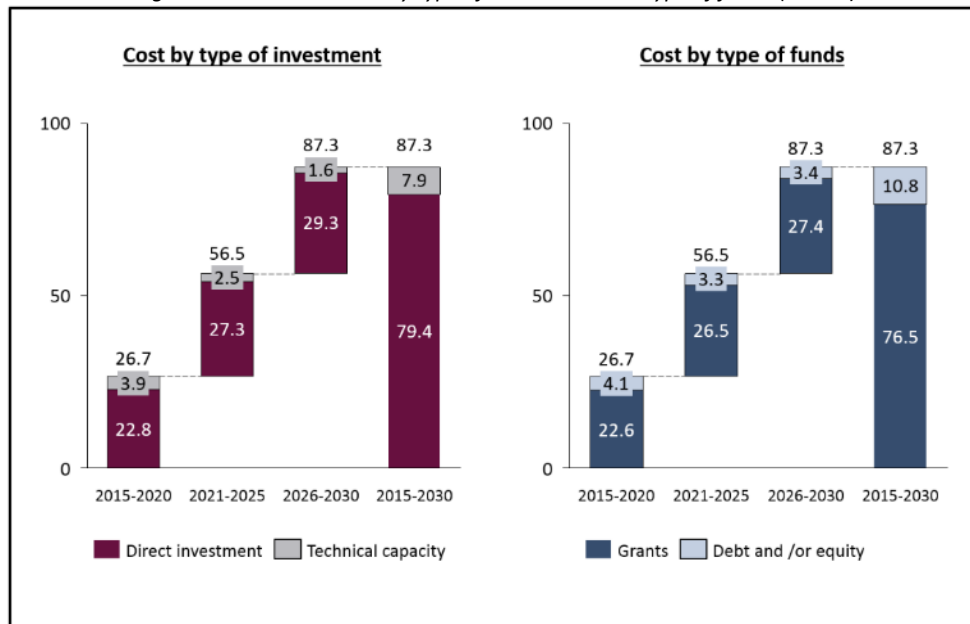
5 INVESTMENTS NEEDED TO ACHIEVE THE TRANSITION

5.1 OVERVIEW OF THE INVESTMENT PLAN

Nicaragua’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 Ministry of Tax Revenue and Public Credit (MHCP) and the Ministry of Energy and Mines (MEM) of Nicaragua, 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 equity²⁴. The figure below provides an overall summary of the investment needs. These estimates are further detailed in subsequent sections.

US \$27 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 11: Cost estimated by type of investment and type of funds (M US\$)

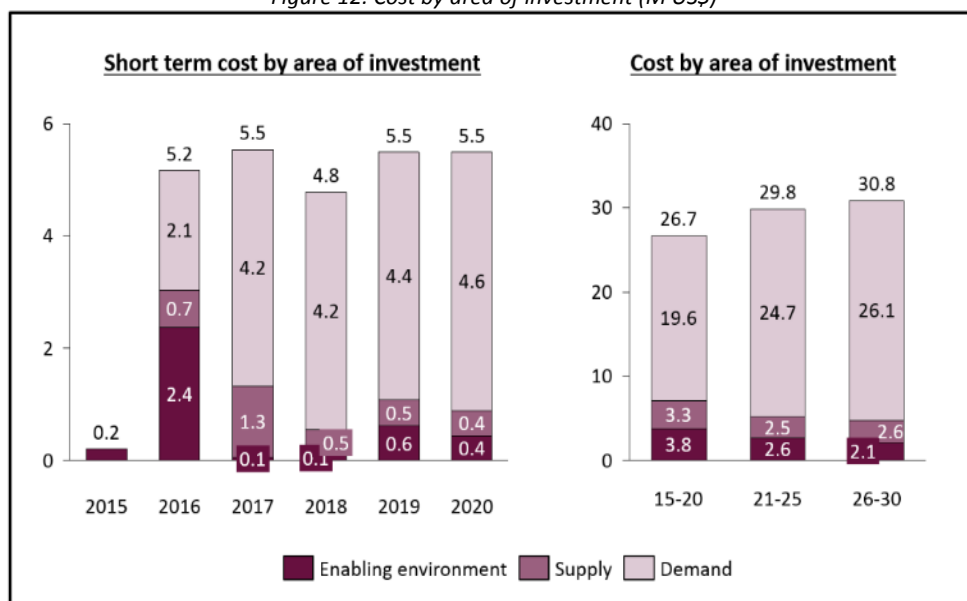


Source: Dalberg analysis.

²⁴ 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.

Overall, the majority of the costs in the Roadmap’s first five years will go towards boosting the demand. When disaggregating the estimated costs in the short term by area of investment (demand, supply, and enabling environment), the data shows a clear focus on strengthening demand for clean cooking solutions. The underlying perspective of stakeholders in Nicaragua is that strengthening demand is the cornerstone to developing the clean cooking sector in the near term.

Figure 12: Cost by area of investment (M US\$)



Source: Dalberg analysis.

5.2 INVESTMENT NEEDED BY STRATEGIC LINE

~75% of the funds needed would fund strategic lines that seek to increase demand. Enhancing the supply and improving the enabling environment require investments of around \$3.5 million each.

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

Area	Investments	Total
Demand	Generate awareness of the negative consequences of cooking with traditional stoves and the existence of alternatives	\$19.6M
	Improve ability of potential users (via training on how to install, use, maintain and fix their stoves)	
	Ensure that different population segments have the capacity to pay for the different technologies (e.g. through microcredits, CSR, Subsidies)	
Supply	Increase availability of different fuels for cooking (e.g. woodfuel, LPG, biogas)	\$3.3M
	Understand the preferences of potential ICS users and broaden the portfolio of stove models available	
	Enhance the productive capacity of ICS	
	Increase and/or reinforce own and subcontracted distribution networks of ICS	
	Increase and/or reinforce own and subcontracted after-sales networks of ICS	

Enabling environment	Ensure new and existing policies to support the clean cooking sector	\$3.8M
	Ensure the Roadmap is correctly implemented; ensure commitments and responsibilities are honored	
	Ensure that stoves meet minimum performance standards	
	Create a repository with quality data to facilitate effective decision making	
Total		\$26.7M

Source: Dalberg analysis based on stakeholder input in Nicaragua.

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

- **Generate awareness:** Generate awareness of the negative consequences of cooking with traditional stoves and the existence of alternatives. This strategic line aims to:
 - Explore existing government programs that can potentially integrate clean stove programs (e.g. MINIM’s women empowerment programs, MINSA health programs).
 - Educate local government officials in coordination with INIFOM in all 153 municipalities in Nicaragua and national leaders to ensure buy-in and long term.
 - Integrate information on clean cooking solutions into school curricula in coordination with MINED.
 - Increase awareness through massive awareness/advertisement campaigns in coordination with “medios del poder ciudadano”.
 - Increase awareness through targeted awareness/advertisement campaigns to specific population segments (e.g. geographic areas with more wood consumption for cooking according to woodfuel consumption survey from 2007 (e.g. Nueva Segovia, Jinotega, Madriz)).

- **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 solid after-sales network in Nicaragua, 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%²⁵ of users who adopt an improved cookstove continue to use it five years later. To improve user capabilities, the Roadmap will:
 - Train consumers using “instructors” from existing government programs (e.g. gender empowerment programs from MINIM) in order to use existing programs and networks.
 - Train consumers during cookstove exhibitions, this cookstoves exhibitions will be led by the MEM (and with involvement from local governments) with coordination with Proleña, Mifogon and other ICS manufactures in order to provide users all the options available in the market for them to be inform and learn how to 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:

²⁵ From interviews with stakeholders in the region.

- Strengthen the role of micro finance institutions (today MFI are not interested in providing consumer loans due to small price of the device and high transactional costs) in the clean cooking sector by promoting the design of specific financing products (e.g. interest rates, amounts, terms) and with a warranty fund that will allow better conditions for the consumers and get the MFI buy-in.
- Promote the existence of CSR programs to allow employees to access the technology at a subsidized cost (e.g. a mining company B2Gold has express interest in preliminary conversations to fund CRS programs related to Clean Cooking Solutions).
- Design a strategy to encourage subsidy-based programs (total and partial) to target populations that really need them (according to data from woodfuel consumption survey from 2007 or more recent information available).

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

- **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:
 - Increase production of sustainable woodfuel, which will be coordinated by INAFOR and contemplates the design of incentives to promote hectares of forest for firewood in order to increase the distribution of certified wood (from hectares of forest for firewood).
 - Expand the LPG distribution network led by LPG distributors (e.g. Tropigas) in coordination with the MEM in order to design incentive model to expand the supply of LPG (e.g. production of smaller cylinders, cylinders of better quality, i.e., safer, pay per use) and pilot programs to test the initiatives and scale.
 - Develop a study to explore the possibility of diversifying sources of energy, looking specifically at charcoal and natural gas and that would be conducted by academic institutions (UCA, UNI, UNA).
- **Stove design:** To overcome cultural barriers to adopting improved stoves, the Investment Prospectus has quantified support needed to:
 - Develop a study to understand the preferences of potential users, which will yield insights that can be used by manufacturers.
 - Broaden the portfolio of stove models available in Nicaragua and meet consumer needs according to findings from the study of design preferences. To support the process an incentive fund will be design by the MEM to help fund innovative design from the manufactures like Proleña, Mifogon and others.
- **Stove production:** To enhance the productive capacity of improved cookstoves in Nicaragua, the Investment Prospectus estimated funds needed to:
 - Train national manufacturers in best practices and managerial skills.
 - Increase manufacturers' access to financing options through the creation of a warranty fund that will allow producers to get funding to increase their production capacity in order to supply the projected demand for ICS.
 - Support manufacturers to purchase in bulk so as to achieve economies of scale.

- **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 that will last on 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 store and also have certified builders for In-situ stoves (e.g. through hardware stores)
 - Reinforce or expand existing distribution networks of manufactures.

- **Stove after-sales services:** The lack of a solid after-sales network negatively impacts the usage rate of stove technology over time. If or when a cookstove breaks down, the user does not have access to spare stove pieces or repair services, and typically stops using the stove. To avoid this, the Investment Prospectus has estimated the support required to:
 - Train distributors in after-sales best practices.
 - Promote easy to activate stove warranties.
 - Create/Reinforce subcontracted after-sales networks.
 - Strengthen networks owned by the distributor or manufacturer.

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

- **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 (e.g. Política Nacional de Energía, Estrategia Nacional de Leña y Carbón, Programa Nacional de la Leña y el Carbón vegetal, Plan Nacional de Desarrollo Humano).
 - Examine the possibility to reduce tariffs and taxes in the production, import, and export of stoves, parts, raw materials and fuel.
 - Work on a regulation that incentivizes usage of LPG for cooking (e.g. ownership of the cylinders, lifespan of cylinders, size of the cylinder).

- **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 Biomass Department of the Direction of Alternative Renewable Energy of the MEM through technical assistance, capacity building, and equipment – the department will report to a board supervising the Roadmap (formed by MEM, MHCP, two representatives from the donor community, and representatives from the Mesa de Leña). Additionally, the department will be supported by two full time staff who will be in charge of the following 3 activities.
 - Socialize the Roadmap.
 - Monitor progress.
 - Update and review the Roadmap periodically.

- **Quality standards and laboratory:** 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 standards and tiers (already work in progress by the MEM).
 - Create a technical norm (the MEM is also working on it and expect to have it ready by end of 2015 based on the norms from Bolivia).
 - Develop a lab to test the technologies that will be part of the UNI who will be in charge of running the test to ICS defined in the norm.
 - Evaluate existing stoves.
 - Adopt the norm ISO TC-285 to fulfill international standards.

- **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.
 - Develop a list of different manufacturers and distributors, sales by stove model, and geographic area.
 - Develop a study to segment the demand of clean cooking technologies by periodically updating the wood consumptions survey in Nicaragua.
 - Develop an impact evaluation 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 evaluation will include baseline studies in 2016 on 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 focused on increasing the financing options for the consumer. This includes the cost of launching microloans, and the cost of total and 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 baselines studies.

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		1.6	0.0	1.6
	2. Train potential users to install, use, maintain, and fix their stoves		1.3	0.0	1.3
	3. Increase financing options for the consumer		16.8	0.0	16.8
Supply	4. Availability of fuel		2.0	0.2	2.2
	5. Stove design		0.1	0.4	0.5
	6. Stove production		0.0	0.0	0.0
	7. Stove distribution		0.3	0.0	0.3
	8. Stove after-sales services		0.3	0.0	0.3
Enabling environment	9. Policies and regulations		0.0	0.3	0.3
	10. Institutional strengthening		0.2	0.6	0.8

	11. Quality standards and laboratory	0.2	0.0	0.2
	12. Knowledge and data	0.0	2.5	2.5
Total		22.8	3.9	26.7

Source: Dalberg analysis.

The majority of investments likely to be debt/equity would be focused on enhancing the 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 forests intended to produce wood fuel or expanding the LPG network), and reinforcing the distribution and after-sales networks. 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	1.6	0.0	1.6
	2. Train potential users to install, use, maintain, and fix their stoves	0.1	1.2	1.3
	3. Increase financing options for the consumer	16.8	0.0	16.8
Supply	4. Availability of fuel	0.2	2.0	2.2
	5. Stove design	0.4	0.1	0.5
	6. Stove production	0.0	0.0	0.0
	7. Stove distribution	0.0	0.3	0.3
	8. Stove after-sales services	0.0	0.3	0.3
Enabling environment	9. Policies and regulations	0.3	0.0	0.3
	10. Institutional strengthening	0.8	0.0	0.8
	11. Quality standards and laboratory	0.0	0.2	0.2
	12. Knowledge and data	2.5	0.0	2.5
Total		22.6	4.1	26.7

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

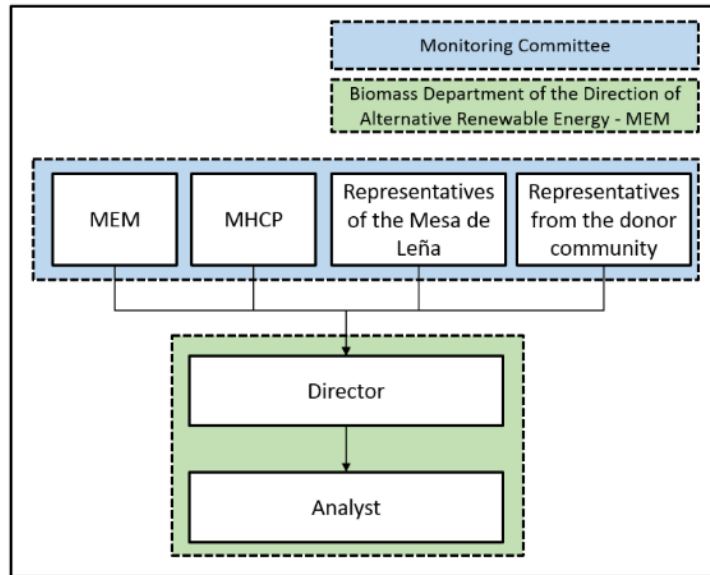
To ensure successful implementation of the Roadmap, it is necessary to strengthen MEM’s Biomass Department of the Direction of Alternative Renewable Energy, starting immediately. This will guarantee effective execution, coordination, and monitoring of the Roadmap to 2030. To support the MEM, two different models are suggested:

Alternative # 1: The model suggested aims to take advantage of MEM’s existing organizational structure, and considers building a unit within the Biomass Department of the Direction of Alternative Renewable Energy that will be in charge of managing the 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 a MEM representative, a MHCP representative, two representatives from the donor community, and two representatives of the Mesa de Leña. The Monitoring Committee will be in charge of approving the reports prepared by the USI and soliciting and approving modifications to the Roadmap.

Figure 13: Proposed structure for institutional strengthening



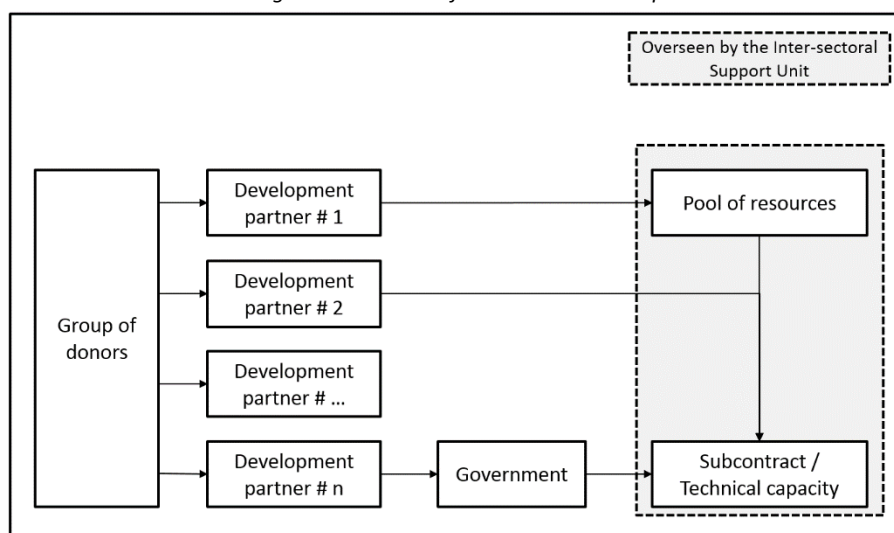
Source: Dalberg analysis.

Alternative # 2: An execution and coordination model similar to the one created by MEM and ENARTEL as part of the PNSER program. To achieve this, this Investment Prospectus will complement current plans to promote access to energy and strengthen current operational structures (ENATREL-FODIEN). 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 14: Financial flows to the Roadmap



Source: Dalberg analysis.

6.3 MONITORING SYSTEM

The monitoring system will allow the World Bank and Nicaragua 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 Nicaragua cooking using traditional stoves (as primary or secondary stove)	
# of biomass ICS adopted	
# of LPG stoves adopted	
# of biogas stoves adopted	

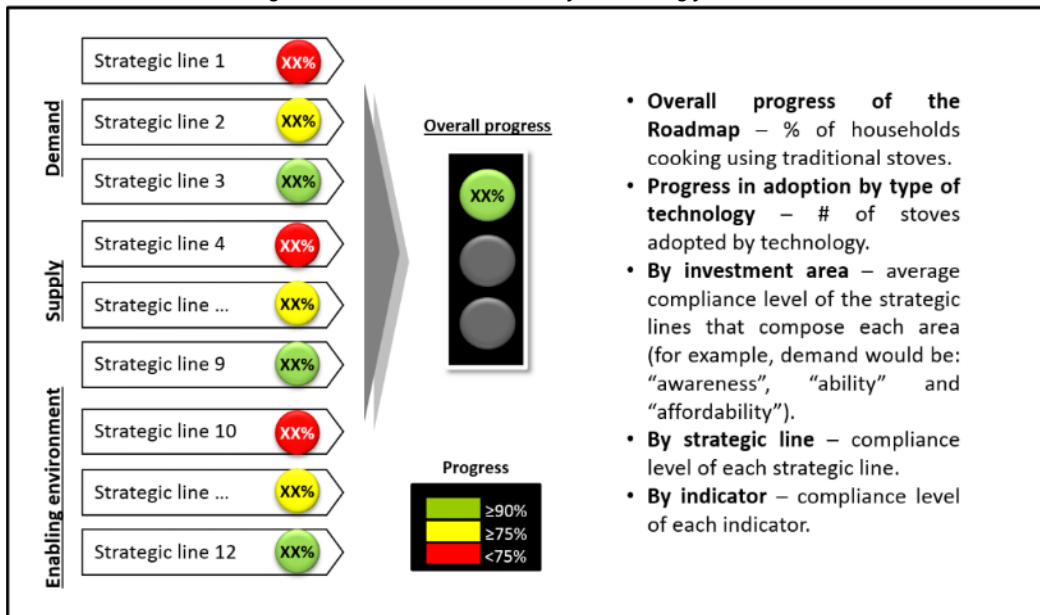
	Strategic line	Progress metrics
Demand	1. Generate awareness	Annual # of national awareness campaigns
		Annual # of prioritized households made aware of the problems associated with cooking using traditional stove and the benefits of ICS
	2. Train potential users to install, use, maintain, and fix their 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 total subsidies
		Annual # of households that access an ICS through partial subsidies

Supply	4. Availability of fuel	Annual # of new hectares of sustainable woodfuel	
	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 15: Illustrative structure of monitoring framework.



Source: Dalberg analysis.

6.4 RISK MITIGATION STRATEGIES

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

Table 12: Risks and mitigations strategies.

Risk	Mitigation Strategy
Change in the level of political support after national elections in 2016	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. The adoption of an execution and coordination model similar to that of MEM and ENARTEL as part of PNESER 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 expand financing options to make the technologies more affordable. Additionally, it recommends a study to identify the preferences of potential users and their price elasticity. With this information in hand, stove manufacturers should be able adjust their portfolio of products, including prices, to better meet consumer needs.
Insufficient supply of improved stoves	The Roadmap is based on the premise that 0.7 million stoves can be produced over the next 15 years. The existing production capacity is not able to satisfy this demand, but the Roadmap includes investment to increase the production capacity of local player to be able to satisfy the demand. Nevertheless, if for some reason that were not the case in the future, the USI should ensure that other players can enter the Nicaraguan 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)	Nicaraguan 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 MEM and ENARTEL as part of PNESER would also 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 \$27 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	0.04
		Inclusion of a component of Clean Cooking Solutions within subjects in the curriculum/educational strategy for all levels of education	0.23
		Launch awareness and advertising campaigns	1.29
	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)	0.08
		Train final users	1.19
	3. Increase financing options for the consumer	Strengthen the role of the IMF through a guarantee fund	0.22
		Implement Corporate Social Responsibility programs	0.08
		Implement subsidy programs	16.46
Supply	4. Availability of fuel	Increase production and use of sustainable wood	1.06
		Expand the distribution network and the use of LPG	0.93
		Conduct studies (R&D) of alternative fuel sources for cooking	0.18
	5. Stove design	Conduct a study of design preferences of the potential consumers of ICS	0.35
		Encourage R&D of new ICS models	0.14
	6. Stove production	Train producers of Clean Cooking Solutions on production best practices	0.01
		Increase access to finance to scale production	0.01
		Increase bargaining power to aggregate purchase parts and materials	0.00
	7. Stove distribution	Train stoves distributors on best practices of distribution models and marketing	0.00
		Strengthen own and subcontracted distribution networks	0.30
	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	0.30
Enabling environment	9. Policies and regulations	Review related policies and regulations	0.04
		Analyze taxes and fees	0.03
		Develop LPG regulations	0.21
	10. Institutional strengthening	Create a unit which owns the Roadmap, which socialize, review, and monitor its implementation	0.78
	11. Quality standards and laboratory	Define standards and regulations, testing procedures and tiers for improved cookstoves to ensure quality	0.02
		Laboratory to evaluate and certify improved cookstoves	0.17
	12. Knowledge and data	Create a centralized information system and virtual	0.29
		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	1.05
Total			26.66

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 Nicaragua cooking using traditional stoves (as primary or secondary stove)	75%	74%	69%	64%	58%	53%	0%
# of biomass ICS adopted	0	2,380	34,045	66,335	99,219	132,659	490,207
# of LPG stoves adopted	0	2,779	39,890	77,983	117,031	156,996	599,751
# of biogas stoves adopted	0	43	614	1,195	1,785	2,383	8,670

Progress metrics							
Metric	Base line 2015	Goal 2016	Goal 2017	Goal 2018	Goal 2019	Goal 2020	Goal 2030
1. Generate awareness							
Annual # of national awareness campaigns	0	1	0	0	0	0	N.A.
Annual # of prioritized households made aware of the problems associated with cooking using traditional stove and the benefits of ICS	0	3,547	47,480	49,276	50,889	52,474	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	56	0	0	0	0	N.A.
Annual # of municipal ICS exhibitions	0	34	34	17	17	17	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	13,531	13,945	14,352	14,747	N.A.
Annual # of households that access an ICS through a CSR	0	0	314	323	332	341	N.A.
Annual # of households that access an ICS through a total subsidies	0	0	23,112	23,847	24,568	25,269	N.A.
Annual # of households that access an ICS through a partial subsidies	0	3,690	11,354	11,762	12,171	12,580	N.A.
4. Availability of fuel							
Annual # of new hectares of sustainable woodfuel	0	1,564	1,564	1,564	1,564	1,564	N.A.
5. Stove design							
Annual # of new ICS models finance through the incentive fund	0	7	7	0	0	0	N.A.
6. Stove production							
Annual # of biomass ICS produced	0	2,519	33,097	34,226	35,339	36,427	N.A.
7. and 8. Stove distribution and after-sale services							
Total # of ICS distribution and after-sales stores operating	0	0	50	52	54	54	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	28	3	3	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	0	1	0	0	0	0	N.A.
Annual # of impact studies conducted	0	1	0	0	1	0	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	14	207	585	1,151	1,909	20,774
Emissions: Emission gases of carbon dioxide reduced (M Tons, cumulative)	0.00	0.01	0.21	0.59	1.15	1.91	20.81

Source: Dalberg analysis.