Nicaragua

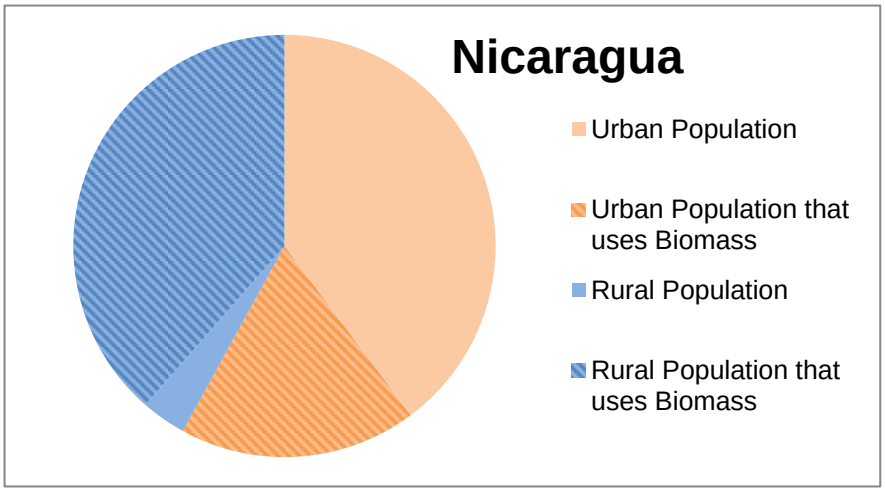
Total population*	**6,080,000**
Urban (%)	**58**
Rural (%)	**42**
% Population that uses biomass*	**53**
% rural**	**91.8**
% urban**	**31.4**
% Population with access to LPG and electricity**	**42**
Number of households that use biomass**	**838,662**
Number of annual deaths from HAP 2012*	**2,805**
Number of annual child deaths from HAP 2012*	**260**
Price of LPG (25 lb tank)***	**7-9.7 USD**
Price of electricity (Kw/h)***	**0.09-0.2 <150kWh**
Average Price of Firewood***	**55 USD/month**

HAP: Household Air Pollution

*WHO observatory data base

**GACC (Global Alliance for Clean Cookstoves) web page

*** September 2015



History of Efficient Cookstoves

Technology performance assessment Where was it evaluated? **El Zamorano Laboratory**	Type of cookstove	**Ecofogón**
	PM concentration in kitchen	**76µg/m^3**
	CO concentration in kitchen	**0.1 ppm**

National Program

Is there a national program? **Yes**	Since when? **2011**	Government goal: **50,000 to 70,000 ICS per year**
Responsible Ministry: **Energy Ministry (MEM)**		
Non-governmental stakeholders	**Strategic alliance with the World Bank for the Centro American Clean Cookstoves Initiative (CACCI), as well as the Sustainable Energy for All initiative in Nicaragua (2014-2030).** **Pro Leña** **GIZ** **IDB**	

Stoves models and organizations working in Nicaragua[1]

Nicaragua has passed from been mainly rural to be more urban (58% of the population lives know in an urban area), which has changed the firewood consumption patterns, resulting on an increase in firewood and charcoal purchases.

In Nicaragua, women like to cook directly with the fire, so *planchas* have to have an opening to place the pot. There are two main Biomass cookstove (BCS) programs working in Nicaragua: The Ecofogón and Mifogón.

Ecofogón stove

Proleña is a Nicaraguan NGO that has worked for 10 years in the construction of BCS and in the training of others NGO and individuals. The *Ecofogón* stove is Proleña´s trademark. Originally designed by the Brazilian Rogeiro Carneiro, the stoves weigh is 100 lb, it saves 50% of firewood and its cost around 115 dollars. The stove has a life expectancy that ranges between 2 to 4 years. The chimney lasts for about 2 years, so when installing stoves in very remote areas a stove built in situ and without a chimney is installed. They have four BCS models that include a stove with a complete plancha for tortilla business and an oven for bread.

Their program includes an awareness campaign, training and follows up. The stove has a 6 months guaranty.

[1] Source: What have we learned about Household Biomass Cooking in Central America? ESMAP, The World Bank, 2013

It is important to notice, that Proleña has worked mainly in urban areas and they identify the cities as a key area to target in the country. In their opinion Nicaraguans that live in hot weather regions cook outside, in the center they prefer in situ stoves without a chimney and in the Atlantic region people are using more charcoal than firewood.

In their experience, publicity by local television has an immediate effect in the sales, but is expensive. This positive experience came from invitations to local talk shows, where after showing and explaining the benefits of the different stoves, they started receiving phone calls to buy their products. They perceive that there is demand for BCS stoves.

They have documented women' perceptions of the stoves and they have found that the main driver for BCS adoption is to save firewood. Ones they are using a BCS, women like the stove because they no longer smell smoked and they can use a perfume or invite visitors into their kitchen.

Proleña has trained artisans to produce a charcoal stove called "rapidita". The stove is based on a Kenyan model. They are sold for 20 USD with a very small profit margin[2]. The *Rapidita* is used mainly to cook beans and other food that can be made in one burner and mostly used by people that transfer from cooking with LPG. According to manufacturers, there is a great demand, but the production is limited by the ceramic body of the stove that is produced by craft artisans that don´t see stoves as a profitable business. A *comal* can be placed on the stove to make *tortillas*. Under current circumstances they can produce 10 stoves per day. People that use them are very happy with their performance. They have sold around 700 rapidita stoves in Managua without promotion.

Industrial Ecofogon

Ecofogon for tortilleras

[2]The option for charcoal consumers is a metal container with legs. It price range from 2 to 11 USD. It last around 6 months, but people prefer them for their price.

Ecofogon in situ

Bread Oven

Rapidita stove

MiFogón Stove

The stove Mifogón was developed by Mr. Bonilla. He was trained by Proleña.

In 2002, 1300 "*Mi Fogón"* stove type were implemented with support of ESMAP, who financed a study. The stove has one open pot for cooking with direct fire and a *plancha*. They are still selling it from their manufacturing plant. Coffee growers and private agribusiness have purchased *Mifogón* stoves for their workers in rural areas.

Mi fogón stove

According to data from the National Survey of Firewood Use 2007, 54.5 % of the firewood users collect firewood, 45% buy it, and 1.5 % collects it and purchase. 80 % urban users buy it, and 68.4 % rural users collect it. The Central American Integration System (SICA) within the framework of the Central Strategy for Sustainable Energy 2020, boost the development of the Regional Program profile with the goal of distributing one million BCS and save at least 10 % of the consumption of firewood in the region by 2020.

General Attributes of a Selected Stove Program in Nicaragua

Attributes	Ecofogón
Main Features Stove Disseminated	Portable (metal) and in situ (brick), with chimney. Rocket combustion chamber
Implementing agency and main partners	Proleña. Rotary Club, JP Morgan
Program Duration	2001- present
Achievements (stoves and other impacts documented)	Around 25,000 stoves distributed. Three different models
Approach	Their customers are mainly urban. They have trained others to build the Ecofogon.
Challenges	Chimney last 2 years. Plancha has an iron "parche" that last 6 to 12 months in place.
Financing and subsidies/pricing	PROLEÑA has worked with different financing approaches. Some of the stoves have been bought directly by users. Others have a 40-50% subsidy by the Rotary Club; 1,600 stoves had a small subsidy by JP Morgan; and the rest have been given for free by the government without any further follow up.
Market Development	PROLEÑA has worked mainly in urban areas and makes the stoves mostly by request. Their stoves have been promoted in the news and TV shows with success.
Improved stove identification and development	PROLEÑA currently gives a 6- month stove warranty. Stoves are sold with or without chimney depending on the conditions of the customer.
Communication/ Promotion	PROLEÑA is thinking to give a bottle of perfume as a gift with the stove, to show that women will no longer smell of smoke when using an ecofogon.
Local Perceptions	Nicaraguan people prefer a hole in the plancha to have a direct fire. Users are more concerned about fuel savings, and not smelling to smoke than to improving their health.

Papers with studies in Nicaragua:

1. Terrado EN, Eitel B (2005) Pilot commercialization of improved cookstoves in Nicaragua. Energy Sector Management Assistance Programme (ESMAP). Technical Paper Series No. 085. Washington, DC: World Bank.

https://openknowledge.worldbank.org/bitstream/handle/10986/18063/477330ESMAP0no10Box338864B01PUBLIC1.pdf?sequence=1

Abstract

About 3 billion people in developing countries still rely heavily on traditional biomass fuels. In Central American countries, particularly Guatemala, Honduras, Nicaragua and Haiti, many poor people use wood almost exclusively for cooking and heating. Where the wood burned for energy comes from unsustainable sources, the long term impact on surrounding forest resources could be devastating. Equally serious is the negative impact on the health of women and other household members caused by indoor air pollution from cookstoves used in enclosed traditional kitchens.

The advent of modernization and improved access to modern fuels in these countries are not likely to significantly reduce dependence on biomass by majority of the populations in the coming decades. The problem must be met head-on by a combination of measures that promote sustainability of supply (e.g., forest management, renewable plantations) and improve efficiency of use. If biomass production and use could be carried out in a sustainable manner, it has the potential of generating much-needed employment opportunities in rural areas and contributing to energy self-reliance in petroleum-poor countries.

One problem is that biomass, as a “renewable” energy source, is commonly perceived as a “free good” that will continue to be available to all indefinitely. But urbanization and industrialization has, in many countries, already irreversibly constrained the availability of biomass resources. Peri-urban areas, in particular, have come under increasing pressure to use scarce land for both biomass energy and agricultural products.

In many areas, biomass scarcity has already forced people to use low quality residues as cooking fuel. Rising demand for commercially-traded fuelwood in towns and cities, on the other hand, has put pressure on supplies in nearby rural areas. As rural supplies become monetized, traditional “free” sources for poor rural dwellers are drastically diminished

A survey of several urban areas of Nicaragua in 1998 showed 59% of the population as daily wood users, consuming almost 500,000 tons of wood per year.

According to the energy profile report published by the Nicaraguan Energy institute for 1997, fuelwood represented about 47% of the internal gross primary supply of energy, while petroleum represented 24%, electricity 25% and other biomass residues 3%. The fuelwood consumption in Nicaragua is predominantly for household use, since 90% of it is used for home cooking, while the other 10% is for rural and artesanal industries (bakeries, lime and brick production and charcoal).

2. Clark ML, Bachand AM, Heiderscheidt JM, Yoder SA, Luna BR, Volckens J, et al. Impact of an improved biomass stove intervention on blood pressure in Nicaraguan women. Indoor Air. 2013; 23(2): 105–14.

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3528797/

Abstract

Few studies have evaluated the cardiovascular-related effects of indoor biomass burning or the role of characteristics such as age and obesity status, in this relationship. We examined the impact of a cleaner-burning cookstove intervention on blood pressure among Nicaraguan women using an open fire at baseline; we also evaluated heterogeneity of the impact by subgroups of the population. We evaluated changes in systolic and diastolic blood pressure from baseline to post-intervention (range: 273–383 days) among 74 female cooks. We measured indoor fine particulate matter ($PM_{2.5}$; n=25), indoor carbon monoxide (CO; n=32), and personal CO (n=30) concentrations. Large mean reductions in pollutant concentrations were observed for all pollutants; for example, indoor $PM_{2.5}$ was reduced 77% following the intervention. However, pollution distributions (baseline and post-intervention) were wide and overlapping. Although substantial reductions in blood pressure were not observed among the entire population, a 5.9 mmHg reduction (95% confidence interval [CI]: −11.3, −0.4) in systolic blood pressure was observed among women 40 or more years of age and a 4.6 mmHg reduction (95% CI: −10.0, 0.8) was observed among obese women. Results from this study provide an indication that certain subgroups may be more likely to experience improvements in blood pressure following a cookstove intervention.

3. Clark ML, Bazemore H, Reynolds SJ, Heiderscheidt JM, Conway S, Bachand AM, et al. A baseline evaluation of traditional cook stove smoke exposures and indicators of cardiovascular and respiratory health among Nicaraguan women. Int J Occup Environ Health. 2011; 17(2):113–21.

http://www.maneyonline.com/doi/abs/10.1179/107735211799030942

Abstract

Biomass-derived indoor air pollution has been associated with increased risks of respiratory diseases; however, relatively few studies have examined the cardiovascular effects of biomass burning. We measured 48-hour indoor fine particulate matter and indoor and personal carbon monoxide (CO) concentrations in 124 households using open-fire cook stoves in Nicaragua. We also examined the cross-sectional relationship of air pollution and health. High air pollutant concentrations with considerable variability were measured. Nonsignificant elevations in systolic blood pressure were associated with increases in CO concentrations. These associations were stronger among obese participants; an 8.51 mmHg (95% confidence interval [CI]: 3.06, 13.96) increase in systolic blood pressure per 24 ppm increase in 48-hour average indoor CO levels was observed. Although the cross-sectional design of this study limits the interpretation, we observed evidence of a relationship between indoor air pollution and blood pressure and heart rate, two indicators of cardiovascular health.

4. Buitrago M., Mayorga L., Sotelo R. *Diseño, Fabricación y Diseminación de Estufas Mejoradas a Base de Carbón*. Junio 2010. Pro Leña. Informe

Abstract

Se desarrollaron, para el uso en los hogares, dos prototipos de estufas mejoradas a base de carbón vegetal, que son energéticamente eficientes, construidas con materiales locales, de fácil construcción y de bajo costo de producción.

Las actividades de la consultoría comprendieron: diseño, validación, estrategia de diseminación, transferencia de tecnología y la producción de estufas con asistencia técnica.

Para la introducción y diseminación de esta tecnología EMCV a la cual se le denominó "Rapidita", se diseñó una campaña de comunicación para comercializar la primera producción de 100 unidades de EMCV, que comprendía acciones de comunicación escrita y oral a través de: 2 presentaciones en el canal 4 y canal 11 de T.V., 25 rótulos, 6 demostraciones públicas, 1000 volantes, 50 poster, 3000 trifolios y 6 perifoneos en los alrededores de los centros de fabricación de las EMCV, así como 46 donaciones de EMCV para el proceso de validación. La campaña de comunicación fue modificándose de acuerdo con las ventas de las estufas y con los informes de mercadeo realizados durante el desarrollo de la campaña. Considerando que el producto es nuevo en el mercado, se obtuvo un total de 121 ventas de las cuales 101 fueron del modelo Okelo mejorada y 20 de la KCJ mejorada.

5. McCracken J. and Charron D. *Evaluation of the Efficacy and Effectiveness of the EcoStove for Reducing Indoor Air Pollution Exposures Among Nicaraguan Women*. Center for Entrepreneurship in International Health and Development. 2003

http://berkeleyair.com/wp-content/publications/evaluation-of-the-efficacy-and-effectiveness-of-the-ecostove.pdf

Abstract

In 2002, CEIHD researchers conducted a study in Ciudadela de San Martin, Nicaragua, to evaluate the efficacy and effectiveness of two models of the EcoStove in reducing indoor air pollution (IAP).

IAP exposure is widely accepted as a valid and reliable indicator of health risk. CEIHD evaluated the influence of stove type on kitchen air pollution levels and women's exposures to particle matter less than 2.5 micrometers in aerodynamic diameter (PM2.5) through a randomized stove intervention trial. After the initial round of measurements among the 60 study participants, half the participating households received an entirely closed EcoStove while the others received a newer, slightly less expensive model with a semi-open design. The randomization was successful, with the two intervention groups proving very similar on all of the household variables and time-activity data collected.

Both the closed and semi-open EcoStove models achieve large reductions in indoor air pollution and exposure among Nicaraguan women cooking in enclosed kitchens. Adjusting for the effects of study group, duration of cooking, burning trash and average daily temperature, introduction of the closed Eostove was associated with an 86% reduction in PM2.5 exposure, while the introduction of the semiopen model was associated with an 80% reduction. The difference between the effects of the two EcoStove models on PM2.5 exposures was not significant (p-value = 0.285). However, the two EcoStove models did have significantly different effects on kitchen levels of PM2.5 (p-value = 0.028), with the closed EcoStove reducing kitchen PM2.5 levels by 94% and the semi-open EcoStove reducing kitchen PM2.5 levels by 87%. The magnitude of the exposure reductions for both EcoStove models is expected to have great health benefits for Nicaraguan families. Since the health benefits will be multiplied by the amount of time the exposure reductions are maintained, an important next step would be to evaluate whether these reductions in exposure are sustained over time.