Guatemala

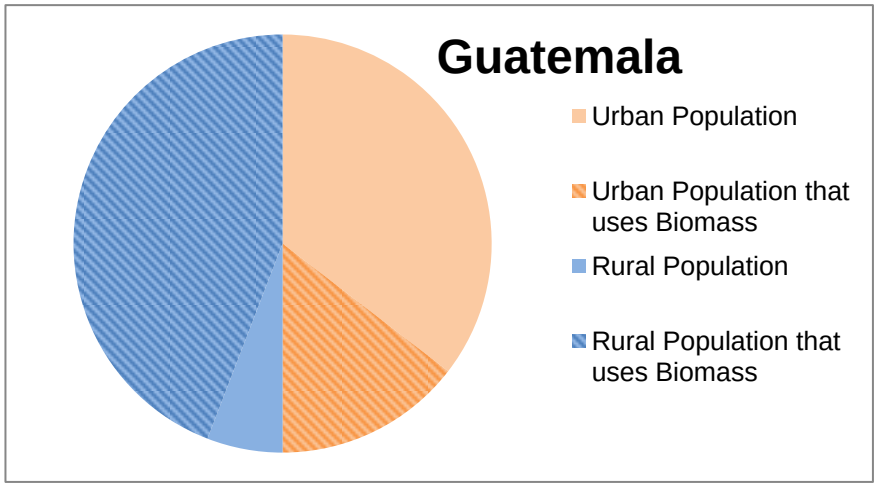
Total population*	**15,468,000**
Urban (%)	**51**
Rural (%)	**49**
% Population that uses biomass*	**64**
% rural**	**88.3**
% urban**	**29.1**
% Population with access to LPG and electricity**	**38**
Number of households that use biomass**	**2,502,093**
Number of annual deaths from HAP*	**5,138**
Number of annual child deaths from HAP*	**1,339**
Price of LPG (25 lb tank)***	**14.16 USD**
Price of electricity (Kw/h)***	**0.23 USD**
Price of Firewood***	**767 USD/year**

HAP: Household Air Pollution

*WHO observatory data base

**GACC (Global Alliance for Clean Cookstoves) web page may 2015

*** September 2015



History of Efficient Cookstoves

Number of efficient cookstoves distributed so far	**150,000**
Type of technology distributed so far **10 models, including plancha, Onil and Noya**	
Cost of the technology	**100 to 180 USD**

Technology performance assessment Where was it evaluated? **El Zamorano Laboratory**	Type of cookstove	**Onil**
	PM concentration in kitchen	**53µg/m^3**
	CO concentration in kitchen	**0.4 ppm**

Stoves models and organizations working in Guatemala[1]

Guatemala has the oldest tradition with Biomass cookstoves (BCS) in CA, being the country were the Lorena stove was developed in the mid-70s. Historically, stove preferences have favored *in situ* constructed stoves with a *plancha* and a chimney, but things are changing. Industrial models are penetrating the market for their mobility, smaller size, and efficiency.

Some of the main stove models distributed in Guatemala:

The Noya stove was designed by Mr. Manuel Tay with the idea to create an ICS easy to use and attractive to women. It is a metal, portable stove, with a rocket elbow in the combustion chamber and a chimney. The stove saves 60% of fuelwood compared to traditional open fires, and sells for 160 USD. The company is basically a family business. Noya stoves are sold at the retail price; credit is available under some circumstances and is given by Mr. Tay himself. The company relays in mouth-to-mouth diffusion and sells the stove by order. In 2011 approximately 6,000 Noya stoves were sold directly to clients *without subsidies*.

The Onil stove is semi-portable cement stove; it has an iron *plancha*, chimney, and a rocket elbow in the combustion chamber. The stove is manufactured centrally and is assembled in situ. Onil stoves achieve 67% fuelwood savings, and substantive reductions in IAP because of the use of the chimney and efficient biomass combustion. The stoves are marketed by the non-profit organization Helps International, which also has operations in Mexico. Helps is the largest stove manufacturer in CA, with about 100,000 stoves placed in the last 10 years, plus 20,000 Nixtamal stoves. The retail price of the Onil stove is US$125 (2014). Onil stoves are marketed using a variety of channels: 85% of their sales are through NGOs, foundations, governments or businesses with social responsibility who generally give them for free or with a small component of beneficiary participation; 5% are direct purchases by customers, and 10% are purchased through micro-credits given by the Guatemalan Rural Bank to their clients –mostly in small towns.

The most well-known Plancha stove is the model designed by INTECAP (Instituto Técnico de Capacitación y Productividad). The stove is built in situ, preparing masons and supervisors in each community of intervention. The stove is made with bricks and cement and has a metal Plancha in the top with holes to place the pots to allow direct fire. It needs a base or table generally made with blocks and

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

has a chimney. INTECAP built 90,000 of this model in the 90's (ESMAP, 2004) working with the Guatemalan government and international donors. They cost around 200USdollars depending in the material's cost and labor; the stove was given for free. It was supposed to safe 58% of firewood (Guerra, 2009). Because it is made with clay, it takes a long time to dry (about 20 to 30 days). They faced problems with the quality control and there is no evidence that they have survive till today. Currently INTECAP does not implement stoves. However, they establish the bases for the models to come and some NGOs have continued building Plancha stoves.

The NGO *Hombres y Mujeres en Acción* has developed an industrial model called *Chapina*, inspired in the ONIL model. He works using an integrated participatory community base system, with strong links to people needs and times. His goal is to raise people's awareness through a participatory methodology that includes various workshops throughout a time span of two years. He installed around 2,000 *Chapina* stoves in 2010- 2011. The *Chapina* weighs approximately 200 lbs. and can be used to cook for families of 7 to 10 people. It is installed over 12 blocks and can be moved. It cost is about US$115, which is partially subsidized with donations (with a 25% cost for the final user). The NGO has had the support of different donors. The *Chapina* stove has been sent to Zamorano for testing. After technical inputs from Zamorano, small technical adjustments are being made to achieve higher efficiencies.

Onil Stove

Noya stove

INTECAP Plancha Stove **Chapina Stove**

Attributes	Onil	Noya
Main Features Stove Disseminated	Semi-portable, cement stove with plancha and chimney. Rocket combustion chamber.	Portable metal stove with plancha and chimney. Rocket combustion chamber.
Implementing agency and main partners	Helps International Shell Foundation.	
Duration	2001 - present	2000- present
Achievements (stoves and also other impacts documented)	110,000 ONIL stoves distributed. Two different models	6,000 stoves sold until 2011
Approach	Mass production and stove distribution	Sells the stoves by request.
Challenges	Stove is very heavy (+100 kg). Helps needed to adapt a small table to the stove “plancha” to improve acceptance.	They relay in mouth- to-mouth diffusion.
Financing and subsidies/pricing	50% of HELPS sales are through NGOs, foundations and local governments; 20% through business with social responsibility. 15% through government. 5% direct purchase and 10% with microcredits, given by the rural bank to clients. The ONIL stove program has being certifiedand seeks carbon-credit funds via CDM.	The Noya has been developed in different stages since 2000 to improve customer satisfaction. Stoves are sold at the retail price. Credit is offered but most people prefer to pay in cash. Stoves come with a warranty.
Market Development	HELPS has an integrated market strategy. Works with donors, other NGOs, selling the stoves directly to users and through banks. The project has expanded to Mexico, Nicaragua and Honduras to reach a larger	Works with rural and peri urban users with capacity to pay for the stove. As most of their clients purchase firewood, the ABS has a direct benefit.Ing. Tay emphasizes simplicity and to sell

	market.	an appliance that looks modern for the user, over technical performance alone.
Improved stove identification and development	Thanks to user feedback, other products have been created to meet household needs: Small hanging boards surrounding the plancha to place the pots; Nixtamal stove[large pot boiler], ONIL Cooker [retained heat cooker] Basic solar lighting [to replace light from the open fire] and ONIL Water filter [in some regions of Guatemala, 40% of firewood is used to boil water)	Ing. Tay has designed two attachments to the Noya, a water heater and an oven.
Communication/ Promotion	HELPS uses radio, newspapers, billboards, rural schools, urban buses, stands at events, and market day events involving rural communities and community distributors.	The promotion works from mouth to mouth. There is no promotion program in place.
Local Perceptions	The stove is well accepted in general as it has both the plancha and the possibility to cook over a direct fire. However, the stove is perceived as small. It can serve a family of 5 members.	Women like the stove because is made out of metal - like a gas stove- and because it looks modern. Has a larger combustion chamber and it is easy to use and maintain.

Government plans[2]:

The Climate Change Act, Article 18, Instrument: National Energy Plan , includes installing Stoves under Reducing Emissions from Deforestation and Forest Degradation (REDD +) and the strategy of Guatemala Footprint Zero.

In 2010 air pollution inside the home was the second leading cause of years of life adjusted for disability (DALYs). The lower respiratory tract infections were the leading cause of DALYs in 2010, in addition to being a high contributor to outdoor pollution.

MORTALITY FOR USE OF SOLID FUELS				
	Mortality for Pneumonia	9.7 %	2013	INE, Health Statistics
	Mortality for Pneumonia Men	5.1 %	2013	INE, Health Statistics
	Mortality for Pneumonia Women	4.6 %	2013	INE, Health Statistics

From the point of view of energy LPG is cheaper than firewood at current prices (when purchased) .

The Ministry of Energy and Mines made an Energy Policy 2013-2027. One of the five specific objectives of the policy is to reduce the use of firewood in the country, with quantitative goals, including:

[2] Source: Ministry of health. Guatemala

• Install 100,000 kitchens and inform the public about sustainable use of firewood,

• Reduce industrial wood consumption by 15%

• Increase forest plantations by 10 %

• Replacing firewood with other energy sources in 25 % of households.

Information on progress in implementing the strategy:

Implementation: Active participation of all agencies of rural extension, of all social and community organizations that exist in the territory and incorporate local power represented by COCODES the Municipalities and governors.

Training: Design and implement programs to disseminate this technology through direct training to all beneficiaries as well as the generation of written materials, radio, television, social networking via the Internet, to disseminate and socialize the new technology.

Monitoring: Active participation of the Central Support Group to the DICORER technology unit of MAGA, and the rural extension managers at the departmental level, as well as the promoters in each municipality.

			PROMOTERS			Families participating SNER.			
No.	Department	No. Agencies	Women	Men	Total	Women	Men	Total	No. of stoves
1	Guatemala	17	143	195	338	3,313	2,490	5,803	323
2	El Progreso	8	91	150	241	975	2,634	3,609	188
3	Sacatepéquez	16	159	152	311	3,068	2,246	5,314	303
4	Chimaltenango	16	189	212	401	3,261	4,017	7,278	408
5	Escuintla	13	139	199	338	2,245	5,247	7,492	293
6	Santa Rosa	14	166	199	365	4,374	4,428	8,802	340
7	Sololá	19	130	120	250	2,025	1,555	3,580	214
8	Totonicapán	8	94	37	131	3,507	704	4,211	186
9	Quetzaltenango	24	254	154	408	5,681	1,346	7,027	593
10	Suchitepéquez	21	898	172	1,070	2,553	2,920	5,473	249
11	Retalhuleu	9	104	111	215	1,913	1,230	3,143	217
12	San marcos	30	228	377	605	6,523	6,722	13,245	666
13	Huehuetenango	32	357	410	767	10,836	6,831	17,667	860
14	Quiché	21	238	377	615	7,764	5,845	13,609	612
15	Baja Verapaz	8	198	244	442	2,910	3,384	6,294	398
16	Alta Verapaz	17	179	333	512	1,873	5,879	7,752	413
17	Petén	14	142	243	385	3,692	4,835	8,527	292
18	Izabal	5	60	98	158	211	554	765	298
19	Zacapa	11	178	164	342	1,738	2,860	4,598	288
20	Chiquimula	11	83	153	236	3,188	4,184	7,372	331
21	Jalapa	7	42	92	134	1,086	1,071	2,157	129
22	Jutiapa	17	254	328	582	2,452	5,845	8,297	599
	TOTAL:	**338**	**4,326**	**4,520**	**8,846**	**75,188**	**76,827**	**152,015**	***8,200***

Public health information from different sources:

Issue	Data	Source
Causes of disease in children under one year Respiratory diseases and ear infections, Infectious and parasitic diseases	64% 19%	"Diagnóstico Nacional de Salud del año 2012"; Ministerio de Salud, año 2011
Percentage of rural population of households using coal and/or firewood for cooking their food.	86%	"Diagnóstico Nacional de Salud del año 2012"; Ministerio de Salud, año 2011
Percentage of households that cook with firewood and not have a proper chimney for smoke extraction Percentage of extremely poor families cooking at the same place where they sleep.	Entre 60 y 70% Entre 5 y 20%	Estrategia nacional para el uso sostenible de leña, 2013.
Increased likelihood of developing acute or chronic respiratory diseases in households using firewood.	31%	Estrategia nacional para el uso sostenible de leña, 2013.
Reported cases of IRAS Reported Pneumonias and bronchopneumonia	87,255 (2014) 209,654 (2014)	La información correspondiente al MSPAS y facilitada por el Centro Nacional de Epidemiología indica para el año 2014 y 2015.
Infant mortality per 1000 live births (2012)	25 deaths	(Fuente: Análisis de mercado de estufas y combustibles de Guatemala. Situación del sector. (Julio 2013)
Maternal mortality per 100,000 live births (2012)	120 deaths	(Fuente: Análisis de mercado de estufas y combustibles de Guatemala. Situación del sector. Julio 2013)

Papers published with studies in Guatemala:

1. Alvarez D., Palma C., Tay M. ESMAP. Evaluation of Improved Stove Programs in Guatemala: Final Report of Project Case Studies. Dec. 2004
https://www.esmap.org/sites/esmap.org/files/06004GuatemalaFinalEnglishforWeb.pdf

Abstract: This report presents the results of a study conducted by Fundación Solar—a Guatemalan nongovernmental organization (NGO) that works in the field of renewable energy—on experiences from improved-stove programs in Guatemala. The goal of the study was to systematically evaluate selected projects to determine success factors, sound practices that could be replicated elsewhere, and weaknesses to avoid. Fundación Solar's research team studied three projects, implemented by three respective organizations, on improved, wood-conserving stoves in Guatemala. To acquire needed information, the team conducted interviews and focus groups with stakeholders in the respective geographic regions—Baja Verapaz, Jalapa, and San Marcos—in which the three projects were implemented. This report includes the findings, conclusions, and recommendations that resulted from the three cases studied.

2. Bielecki, C. & Wingenbach, G. Rethinking improved cookstove diffusion programs: A case study of social perceptions and cooking choices in rural Guatemala. Energy Policy, 66, 350-358. doi: 10.1016/j.enpol.2013.10.082

https://www.infona.pl/resource/bwmeta1.element.elsevier-4c2024de-22d2-39d0-a5fc-32766378293c

Abstract
Promoters of improved cookstoves (ICSs) argue they provide the "triple benefits" of improving health outcomes, preserving local ecosystems, and reducing greenhouse gas emissions. The majority of ICS research reveals a strong pro-diffusion bias toward proving these benefits. Few studies have examined ICSs from the adopters' point-of-view. The purpose of this case study was to describe how culture and social perceptions affect the adoption and use of ICSs. Results showed that stoves in this rural Guatemalan community had several layers of practical importance beyond cooking food. Most prominently, household members valued stoves as heat and light sources, and as a social gathering point for families. Most ICS models have been purposely designed in controlled conditions to deliver maximum heating efficiency at the lowest production cost. However, this case study revealed that the fuel-efficient designs sacrificed important functional, social, and cultural needs. Efforts to increase adoption rates of ICSs will be more successful if the macro-level "triple benefits" paradigm is adapted to include functional consumer-centric benefits beyond heating food, such as providing heat and ambient light. Adoption programs should account for the cultural and social needs of users, such as recognizing that stoves often serve as a gathering point for families.

3. Encuesta nacional de leña consumo de leña en hogares y pequeña industria en Guatemala informe final. Mayo 2011.

El principal propósito de realizar la encuesta es la cuantificación, en forma sistemática y actualizada, del consumo de leña en hogares y pequeñas industrias de Guatemala, que refleje la realidad ante el crecimiento poblacional, el uso combinado de la leña con otros combustibles, el uso de estufas mejoradas y la sustitución de la leña por otros energéticos.

Entre los resultados obtenidos se encontró que el 89,1% utiliza la leña como combustible para cocinar, y únicamente un 18% de los encuestados recolecta la leña (el 47,7% de los que recolectan lo hacen en bosques propios) de quienes a su vez, el 83,5% no cumple con ningún tipo de compromiso de reforestación. La leña vendida por camiones que la comercializan representa el mayor proveedor de

leña, tanto para el área doméstica como el de pequeña industria. Los resultados totales de la encuesta permitirán medir el impacto del consumo de leña en Guatemala, en aspectos como la deforestación, la incidencia en enfermedades causadas por la inhalación de gases y partículas generadas por su combustión en el interior de las viviendas, así como las características de este consumo en aspectos como el precio, origen, preferencias por especies forestales y formas de obtención de la leña. La información sistematizada y la base de datos que la contiene, serán entregadas por la CEPAL a tomadores de decisión, prioritariamente al Ministerio de Energía y Minas de Guatemala para definir la participación de la leña en el balance energético del país, ajustar las series de los años recientes y proyectar el consumo futuro; así como a instituciones y organismos nacionales, regionales e internacionales, centros de investigación y universidades, para que sea de utilidad en las investigaciones, estudios y trabajos que realizan. Akianto desarrollo la encuesta a partir del diseño y planificación de la CEPAL, quien en coordinación con el Ministerio de Energía y Minas supervisó el proceso de forma permanente, mediante visitas, videoconferencias e intercambios de información, haciendo conjuntamente los ajustes y modificaciones requeridos en cada fase para garantizar la mejor calidad de los resultados. Durante los días del 29 al 30 de marzo, la CEPAL organizó en Guatemala un Seminario Nacional de leña, en el que Akianto participó a petición de la CEPAL para presentar los principales hallazgos de la investigación ante autoridades del MEM y otras instituciones relacionadas con el tema a fin de retroalimentar la investigación. Adicionalmente colaboró en la organización de las capacitaciones para el manejo de la base de datos.

4. Ahmed, K., Yewande, A., Barnes, D., Cropper, M., Kojima, M. Environmental Health and Traditional Fuel Use in Guatemala. The International Bank for Reconstruction and Development/The World Bank, 2005.

https://www.esmap.org/sites/esmap.org/files/SR_Guatamala_EnvironmentalHealthandTraditional.pdf

Abstract: Recognition of the problem of indoor air pollution (IAP) and its harmful effects on health is growing worldwide as efforts increase to understand and articulate the complex health–air pollution links. Half the world's population is exposed to IAP, mainly from burning solid fuels for cooking and heating. A recent World Health Organization (WHO) report concluded that consistent evidence exist that exposure to biomass smoke increases the risk of a range of common and serious diseases in both children and adults (WHO 2002). Most notable among these diseases are acute lower respiratory infections (ALRIs) in childhood, in particular, pneumonia. The report also identified IAP from solid fuels as one of the 10 leading risk factors responsible for a substantial proportion of the leading causes of death and disability. Indoor smoke from solid fuels causes an estimated 1.6 million deaths annually and accounts for 2.7 percent of the global burden of disease. The literature and experience from various countries indicate that mitigation of the health impacts of IAP can be achieved as households move up the energy ladder, from wood to cleaner liquid or gaseous fuels such as kerosene and liquefied petroleum gas (LPG), and ultimately to electricity. At the lower end of the energy ladder, better ventilation and the use of improved biomass stoves that vent smoke through a chimney and away from the cooking area can decrease exposure to emissions of harmful pollutants. Policy options that would facilitate the penetration of these improvements are cross-sectorial and include fuel pricing and distribution policies, small business development, income generation activities, and health education. Behavioral and cultural factors are important when considering the technical mitigation options and, along with lack of information, often are the greater barriers that need to be addressed to achieve positive health effects.

5. World Bank (2004) *Evaluation of improved stove programs in Guatemala: final report of project case studies.* ESMAP Technical paper No. 60. Washington, DC: World Bank.

https://openknowledge.worldbank.org/bitstream/handle/10986/18077/349040PAPER0GUA0ESM0Technical0060.pdf?sequence=1

6. Edwards JHY, Langpap C (2005) Startup costs and the decision to switch from firewood to gas fuel. *Land Economics* 81(4): 570–586.

http://le.uwpress.org/content/81/4/570

Abstract:

Firewood remains a key source of energy for households in developing countries, contributing to forest degradation and deforestation. The adoption of alternative fuels may be hindered by high startup costs, and this problem may be compounded by restrictions in credit availability. We use survey data to examine how credit access affects firewood consumption in Guatemala. Our results suggest that access to credit plays a statistically significant role in determining firewood consumption through its effect on the ability to purchase a gas stove. However, simulations suggest that these effects are small and that subsidizing stoves would be a more promising policy for reducing firewood consumption. *(JEL O13, Q23, Q48)*

7. Heltberg R (2005) Factors determining household fuel choice in Guatemala. *Environment and Development Economics* 10(3): 337–361.

http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=303660

Abstract:

This paper discusses the factors guiding household choices of cooking fuels. This is crucial for policies to combat indoor air pollution. Household income is an important, but not the only, factor. Opportunity costs of firewood also play an essential role. Empirical results are based on the 2000 Guatemalan LSMS survey, which includes a detailed section on energy use. Patterns of fuel use, energy spending, Engel curves, multiple fuels, the extent of fuel switching, and the determinants of fuel choice are analyzed.

It is common in Guatemala to use multiple fuels for cooking – 48 and 27 per cent of urban and rural households do so. Modern fuels are often used alongside traditional solid fuels; modern fuels thus fail to displace solid fuels in many cases, particular in rural areas and the urban bottom half. This is paradoxical since a significant share of firewood users buy wood from the market, incurring costs that are substantial, also in comparison with the costs of modern fuels.

8. Mounkaila (1989) Niger - The Promotion and Dissemination of Improved Stoves. In: Cáceres R (ed.) *Stoves for people. Proceedings of the 2nd International Workshop on Stoves Dissemination*, Antigua, Guatemala, 4–10 October. Exeter: IT Publications, pages 46–50. Accessible at:

http://catalog.loc.gov/vwebv/search?searchType=7&searchId=3938&maxResultsPerPage=25&recCount=25&recPointer=0&resultPointer=0&

9. Smith K.R., McCracken J.P., Weber M.W., Hubbard A., Jenny A., Thompson L.M., Balmes J., Díaz A., Arana B., Bruce N. Effect of reduction in household air pollution on childhood pneumonia in Guatemala (RESPIRE): a randomized controlled trial. Thelancet **Vol 378 November 12, 2011.**

http://www.tractionproject.org/sites/default/files/Effect%20of%20reduction%20in%20household%20ai%20pollution%20on%20childhood%20pneumonia%20in%20Guatemala%20%28RESPIRE%29%20-%20a%20randomized%20controlled%20trial.pdf

Abstract:

Pneumonia causes more child deaths than does any other disease. Observational studies have indicated that smoke from household solid fuel is a significant risk factor that affects about half the world's children. We investigated whether an intervention to lower indoor wood smoke emissions would reduce pneumonia in children.

We undertook a parallel randomized controlled trial in highland Guatemala, in a population using open indoor wood fires for cooking. We randomly assigned 534 households with a pregnant woman or young infant to receive a woodstove with chimney (n=269) or to remain as controls using open wood fires (n=265), by concealed permuted blocks of ten homes. Fieldworkers visited homes every week until children were aged 18 months to record the child's health status. Sick children with cough and fast breathing, or signs of severe illness were referred to study physicians, masked to intervention status, for clinical examination. The primary outcome was physician-diagnosed pneumonia, without use of a chest radiograph. Analysis was by intention to treat (ITT). Infant 48-h carbon monoxide measurements were used for exposure-response analysis after adjustment for covariates.

During 29 125 child-weeks of surveillance of 265 intervention and 253 control children, there were 124 physician-diagnosed pneumonia cases in intervention households and 139 in control households. After multiple imputations, there were 149 cases in intervention households and 180 in controls. ITT analysis was undertaken for secondary outcomes: all and severe fieldworker-assessed pneumonia; severe (hypoxaemic) physician diagnosed pneumonia; and radio logically confirmed, RSV-negative, and RSV-positive pneumonia, both total and severe. We recorded significant reductions in the intervention group for three severe outcomes—fieldworker-assessed, physician-diagnosed, and RSV-negative pneumonia—but not for others. We identified no adverse effects from the intervention. The chimney stove reduced exposure by 50% on average (from 2·2 to 1·1 ppm carbon monoxide), but exposure distributions for the two groups overlapped substantially. In exposure-response analysis, a 50% exposure reduction was significantly associated with physician-diagnosed pneumonia (RR 0·82, 0·70–0·98), the greater precision resulting from less exposure misclassification compared with use of stove type alone in ITT analysis.

In a population heavily exposed to wood smoke from cooking, a reduction in exposure achieved with chimney stoves did not significantly reduce physician-diagnosed pneumonia for children younger than 18 months.

The significant reduction of a third in severe pneumonia, however, if confirmed, could have important implications for reduction of child mortality. The significant exposure-response associations contribute to causal inference and suggest that stove or fuel interventions producing lower average exposures than these chimney stoves might be needed to substantially reduce pneumonia in populations heavily exposed to biomass fuel air pollution.

10. Bielec C., Wingenbach G. (2014). Rethinking Improved Cookstove Diffusion Programs: A Case Study of Social Perceptions and Cooking Choices in Rural Guatemala. Energy Policy volume 66 March 2014, Pages 350‑358

http://www.sciencedirect.com/science/article/pii/S0301421513011099

Abstract: Promoters of improved cookstoves (ICSs) assert that they can provide the "triple benefits" of improving health, preserving local ecosystems, reducing emissions linked to climate change. The majority of ICS research reveals a strong pro-diffusion bias toward proving these benefits. Few studies have examined ICSs from the adopters' point-of-view. The purpose of this case study was to describe how culture and social perceptions affect the adoption and use of ICSs. Results showed that stoves in this rural Guatemalan community had several layers of practical importance beyond cooking food.

Most prominently, household members valued stoves as heat and light sources, and as a social gathering point for families. Most ICS models have been purposely designed in controlled conditions to deliver maximum heating efficiency at the lowest production cost. However, this case study revealed that the fuel-efficient designs sacrificed important practical needs. Efforts to increase adoption rates of ICSs will be more successful if the macro-level "triple benefits" paradigm is modified to include household-level, consumer-centric benefits, such as providing heat, ambient light, and recognizing that a stove can serve as a central gathering point for a household.

11. Taylor M.J., Moran-Taylor M.J., Castellanos E.J., Elías S. Burning for Sustainability: Biomass Energy, International Migration, and the Move to Cleaner Fuels and Cookstoves in Guatemala. Annals of the Association of American Geographers, 101:4, 918-928

http://dx.doi.org/10.1080/00045608.2011.568881

Abstract: More than a century after the introduction of electric power transmission, almost 3 billion people still rely on biomass fuels to meet their energy needs. Use of this renewable fuel in unvented cooking stoves results in disastrous consequences for human health and global warming. These negative outcomes have led governmental and nongovernmental organizations (NGOs) to push for improved wood-burning stoves and cleaner burning, but nonrenewable, alternatives like liquefied petroleum gas (LPG). The move up the energy ladder to cleaner fuels and improved stoves is thought to be associated with rising income and increased levels of urbanization.

Increased income in developing countries often comes in the form of remittances from millions of migrants working abroad. Thus, migrants and their money could arguably be agents of change in the transition to cleaner fuels or the more efficient use of existing renewable energy sources. This article examines the case of Guatemala, where 88 percent of rural households use firewood for cooking, and where almost 15 percent of the country’s 14 million population migrates to the United States. A continued preference for firewood, despite increased income, can be explained as a rational decision based on cost, experience, and cooking methods. Additionally, through an analysis of forest cover in firewood source areas, we demonstrate that this energy source is, for the most part, used in a fashion that makes it renewable. Recognizing these patterns of, and reasons for, this resource use permits us to make realistic recommendations for sustainable livelihoods and use of this renewable energy source.

Resúmen: Más de un siglo después de que se introdujera la transmisión de energía eléctrica, casi 3 mil millones de personas aún dependen de combustibles de biomasa para satisfacer sus necesidades energéticas. El uso de este combustible renovable en estufas para cocinar sin desfogue termina en desastrosas consecuencias para la salud humana y en calentamiento global. Estos resultados negativos han llevado a organizaciones gubernamentales y no gubernamentales (ONGs) a presionar por el uso de estufas mejoradas a base de la quema de madera y por alternativas de combustión más limpia, aunque no renovables, como el gas de petróleo licuado. El ascenso en la escala de la energía hacia combustibles más limpios y estufas mejoradas se toma como asociada con mejores ingresos y niveles

incrementados de urbanización. El aumento del ingreso en los países en desarrollo viene a menudo en la forma de remesas de millones de migrantes que trabajan en el extranjero. Así pues, los migrantes y su dinero podrían ser considerados como agentes de cambio en la transición hacia combustibles más limpios o al uso más eficiente de las fuentes existentes de energía renovable. Este artículo examina el caso de Guatemala, donde el 88 por ciento de los hogares rurales usan leña para cocinar y donde casi el 15 por ciento de los 14 millones de habitantes del país migra a los Estados Unidos. Una preferencia continuada por la leña, a pesar de la mejora del ingreso, puede explicarse como una decisión racional basada en costo, experiencia y métodos de cocinar.

Adicionalmente, a través de un análisis de la cubierta de bosque en las áreas de donde procede la leña, demostramos que esta fuente de energía es, en su mayor parte, usada de una manera que la hace renovable. Reconociendo estos patrones del uso de este recurso, y las razones para hacerlo, nos permite hacer recomendaciones realistas de medios de vida sustentables y el uso de esta fuente de energía renovable.

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