Opportunities, Trends, and Tradeoffs in Pursuit of Clean Cooking Goals

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Moderator - Sebastian Africano, ETHOS / TWP 25 January 2022







CCA works with a global network of partners to build an inclusive industry that **makes clean cooking accessible** to families around the world

CCA is building an inclusive clean cooking industry

CCA's work is built around three core pillars:

Driving consumer demand

Driving consumer demand for cleaner, more modern stoves and fuels by supporting behavior change and awareness-raising interventions

Mobilizing investment

Mobilizing investment to build a pipeline of scalable businesses capable of delivering affordable, appropriate, high-quality clean cooking products

Fostering an enabling environment

Fostering an enabling environment for industry growth by advocating for effective, predictable policies, providing trusted, relevant data, and serving as the convener and champion of the clean cooking sector



WHO' tools to find solutions to increase access to clean cooking



Defining clean vs. transitional vs. polluting



What are the implications of increasing access to clean fuels, from a public health perspective?

- Public health is focused on reducing the burden of disease
- From this perspective, stoves that comply with WHO guidelines for indoor air quality (Tiers 4 and 5 for PM_{2.5} and Tier 5 for CO emissions) should be prioritized
- Tier 3 stoves have limited health benefits and should only be promoted if clean stoves are not available/feasible
- Standards and testing are essential to classify stoves and identify the cleanest options for promotion

ISO VPT Tier	WHO Category for CO	WHO Category for PM _{2.5}
5	Clean	Clean
4	Transitional	Clean
3	Transitional	Transitional
2	Polluting	Polluting
1	Polluting	Polluting
0	Polluting	Polluting

Use the tools developed by WHO like the CHEST to find solutions to increase access to clean fuels and technologies



https://www.who.int/tools/clean-household-energysolutions-toolkit



Household Energy Assessment Rapid Tool (HEART): A template for conducting a rapid situational assessment and stakeholder mapping

Household Energy Assessment Rapid Tool (HEART)



Costs and benefits of actions to reduce air pollution in homes. BAR-HAP Tool



Benefits of Action to Reduce Household Air Pollution (BAR-HAP) Tool

Assessment of the Impacts of Clean and Transitional Cooking Interventions

Introduction	User Guide	Essentia	Parameters	Advanced Parameters	Summary	Result
	Basic	Transition & Intervention	Multi-Transition	Custom Parameters		
Step 1. Define You	r Country and Time H	orizon For Analysis				
In this section, you first select a d optional but allows for gradual in that you would like to reduce us population to transition fas show Please note that the costs are pr Important: if you do not navigat	ountry, the duration of the cooking tra mplementation over the time duration e of. Once you have selected the fuels t in in the Intro-Juser Guide tab). esented in US dollars. It is not possible e through the buttons in the interface,	nsition program, and the time for sca that is specified. Review which fuels a hat you would like to transition the to calculate costs in another currence the tool's code may not run propert	ale-up of policy interventions. Ti are currently used in the selectr population away from, click the y in this version of the tool. y.	he scale-up phase and duration refer to el country (displayed in Part 1.2). In Par "Advance to Transitions" button to pro	the acceleration period at the beginn t 1.3, select the fuels (e.g. traditional ceed to selecting the transition scena	ing of the program launch – this phase is biomass, charcoal, kerosene, and LPG) rlo: the fuels to which you would like th
ART 1.1 Country Selection and Basic Information						
Select Country From Drop Down List World bank income level WHO sub-region Starting Year	Afghanistan Low-Income EMR 2020	Total Population 2019	Age 15+ 19,282,045	Exchange rate (US\$, 2019) Exchange rate (PPP, 2019)	507.1 13,470.5	r of Provinces Avg. Pop. 1,358,634 Ratio 0.27
Program time horizon (up to 31 years) Is there a scale up phase? (Yes/No)	15 Yes	38,041,757	Children <15 18,759,712	GDP per capita (US\$, 2019) GDP per capita (PPP, 2019)	77.7 2,065.0	
Scale up duration (3, 4 or 5 years) (only relevant if there is scale-up) Costs expressed in	3 US Dollars		View Baseline Burden Su	nmary <u>.ll</u>	Number 322	of Health Districts Avg. Pop. 118,142 Ratio 0.24
ART 1.2 Baseline fuel mix		PART 1.3 Custom Coun	try Fuel Selection			Tips
Unprocessed Biomass, 42% Other, 58%	Electricity, 0%	Tradition	al Biomass Traditi	onal Charcoal Kerc	osene	Select the fuel or fuels that the target population currently uses, which the program aims to reduce. Based on the baseline fuel(s) selected, the tool will automatically unlock possible fuels to which users can transition in the
Ke	Other, 29% Charcoal, 0%	Ad	vance to Transitions	Reset this sheet onl	У	"Transition & Intervention" screen ("Setup-Transition" tab). Refer to the usi guide for information about the transition

https://www.who.int/tools/benefits-of-action-to-reduce-household-air-pollution-tool



WHO Household Energy Policy Repository

A compilation of policies promoting access to clean energy for household cooking, heating, and lighting

		Sear	ch Q	1) III 1	± n
Title	Description	Country ⊽ ↓	Policy T	Energy	Techno
PERU - Proyecto Nina (2011)	This is a project undertaken by Peru's Ministry of Energy and Mines (MINEM) i	Peru	Direct investment	Cooking	Stove
PERU - El Programa Nacional de Cocinas Familiares (Cocina Perú) (2012)	The 'Programa Nacional de Cocinas Familiares' (National Family Kitchens	Peru	Financial	Cooking, Heating,	Stove
PERU - El Fundo de Inclusión Social Energetico - 'FISE' (Fund for Social Inclusion for Energy) (2012)	This program was created with the passage of law No. 29852 in 2012, with	Peru	Financial	Cooking, Heating,	Stove
EL SALVADOR - Decreto No.698: Reforma Ley reguladora del depósito, transporte y distribución de productos de petróleo [Decree no. 698 - Reform of the Law regulating the deposit, transportation and distribution of petroleum products] (2011)	This law was passed to initiate a reform of El Salvador's long-standing LPG subsidy. The objective was to 'expand the coverage of the benefit of the gas subsidy, to all those people who need it for their survival'. Beneficiaries included domestic	El Salvador	Financial	Cooking	
EL SALVADOR - Acuerdo No.197: Reglas de operación - Subsidio al GLP [Agreement No. 197 - LPG Subsidy Operating Rules] (2014)	This agreement laid the foundation for the current form of El Salvador's LPG subsidy program. The reform process began in	El Salvador	Financial	Cooking	

Model for estimating exposures based on emissions from different sources

World Health Organization Household N	Iultiple Emission Sources Mode	el 🔳		
🗠 Inputs	Household Characteristics	-	Source 1 Characteristics	-
žΞ Run the Model	This model assumes that all emission sour room, labeled as the kitchen . Users can ut	ces are in a single ilize the model for	Emission Rate (mg/min)	50
🛓 Downloads	other rooms, but the model cannot current model multiple emissions sources in multi	tly be used to ple rooms.	25	50 🗘
Documentation	Air Changes / Hour (hour ⁻¹)		Daily cooking time (minutes)	
E References	Arithmetic Mean	SD	Arithmetic Mean	SD
🖬 Acknowledgements	24	6 🗸	252 😴	40 😳
Terms of Use	Arithmetic Mean	SD	Arithmetic Mean	SD
	28	10 😌	100	10 🗘

World Health Performance Target Model

🛎 Inputs

Households Meeting Targets

Run the Mode	1
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- 🛓 Downloads
- Documentation
- dcknowledgements
- Terms of Use

Tier		Emission Rate (mg/min)	Coverage	Emission Factor (mg/MJd)	Pollutant
User Input (10 j	µg/m3)	0.61	50%	14	РМ
Tier 5 - RR 1 (10) µg/m3)	0.19	90%	4.4	РМ
Tier 4 - RR 1.5 (50 µg/m3)	3	50%	68.7	РМ
Tier 3 - RR 2.5 (170 µg/m3)	10.3	50%	236	РМ
Tier 2 - RR 3 (40	00 µg/m3)	24.4	50%	559	РМ
Tier 1 - RR 3.15 µg/m3)	(800	48.8	50%	1118	PM

Model for determining performance levels

https://www.who.int/tools/ performance-target-model

World Health Database of input variables for the WHO Household Multiple Emission Sources (HOMES) and Performance Targets (PT) Models Organization

Air Exchange Rate Data

Overview

Kitchen Volume Data Cooking Time Data Emissions Rate Data Reference and Summary Data Downloads About

This website provides the model input data needed to run the WHO HOMES (Household Multiple Emission Sources) and Performance Target (PT) Models

Select a Sampling Region

or option+click (Mac).

South-East Asia

Africa Americas

Please use the tabs at the top to see

available data for each variable. By

default, all available selections are made.

Select multiple by using control+click (PC)

Air Exchange Rate

Error bars represent the minimum and maximum from literature-derived ranges, dots represent arithmetic means Click on the camera icon above the figure to download an image of the data





Thank you! troncosok@who.int







A (very brief) tale of two studies...





Household air pollution (HAP) from burning solid fuels is a major risk factor for adverse human health

- HAP: top 10 risk factor for premature death and disability in 2019
 Premature deaths: 2.3 million (95% CI: 1.6 to 3.1 million)
 Lost years of "healthy" life (DALYs): 91.5 million (95% CI: 67 to 119 million)
- State-of-the-science: While large % reductions in air pollutants have been observed with stove/fuel interventions, most interventions have not resulted in attainment of WHO guidelines



Photos: Joanna B. Pinneo

Sources: Murray et al., GBD 2020

Comparison to stoves in Pope et al. 2021 review



Chimney Stove Intervention to Reduce Long-term Wood Smoke Exposure Lowers Blood Pressure among Guatemalan Women

John P. McCracken,^{1,2} Kirk R. Smith,³ Anaité Díaz,⁴ Murray A. Mittleman,^{1,5} and Joel Schwartz^{1,2}

VOLUME 115 | NUMBER 7 | July 2007 • Environmental Health Perspectives

- Daily average PM_{2.5}
 - Control: 264 μg/m³
 - ο Intervention: 102 µg/m³
- Intervention impacts on BP:
 - o 3.7 mm Hg lower SBP (95% Cl, -8.1 to 0.6)
 - 3.0 mm Hg lower DBP (95% CI, -5.7 to -0.4)

Effects of a Household Air Pollution Intervention with Liquefied Petroleum Gas on Cardiopulmonary Outcomes in Peru A Randomized Controlled Trial

William Checkley^{1,2}, Kendra N. Williams^{1,2}, Josiah L. Kephart^{2,3}, Magdalena Fandiño-Del-Rio^{2,3}, N. Kyle Steenland⁴, Gustavo F. Gonzales^{5,6}, Luke P. Naeher⁷, Steven A. Harvey⁸, Lawrence H. Moulton⁹, Victor G. Davila-Roman¹⁰, Dina Goodman^{1,2}, Carla Tarazona-Meza^{2,11}, Catherine H. Miele^{1,2}, Suzanne Simkovich^{1,2}, Marilu Chiang¹¹, Ryan T. Chartier¹², Kirsten Koehler^{2,3}, and the CHAP Trial Investigators

American Journal of Respiratory and Critical Care Medicine Volume 203 Number 11 | June 1 2021

- 48-hr time weighted means, PM_{2.5}
 - Control: 98 μg/m³
 - ο Intervention: 30 µg/m³
- Intervention impacts on BP:
 - 0 0.7 mm Hg higher SBP (95% Cl, -2.1 to 3.4)
 - 0 0.3 mm Hg higher DBP (95% Cl, -1.5 to 2.0)



- Where do we go from here?
- Our Honduras Intervention results demonstrate that woodburning stoves like the *Justa* can reduce exposures
- Cleaner cookstoves often reduce exposures but typically have not improved health in the context of randomized trials
- Why is this? Exposures not reduced enough? Short study timeframes? Underlying context of the population?
- What else can we do?



Towards Cleaner Cooking Systems





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Bioenergy and Ecotechnology Innovation Group

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Grupo Interdisciplinario de Tecnologia Rural Apropiada MEXICO



local - learning - ingenuity





LAROBATORIO DE ININOVACIÓN Y EVALUACIÓN EN ESTURAS DE BIOMASA

The perfect storm... economic crisis/gas prices rocketting/subsidies removal

 Massive switch back from LPG to... "open fires" in urban and rural areas

High oil prices and restricted supplies (climate change, peak oil) will be the norm in the future!

[Video] Fogones y leña sustituyen gas LP

La Comisión Reguladora de Energía fijó el décimo aumento al precio del combustible en apenas dos meses



Ya más amas de casa usan leña para cocinar | José Luis Tapia

India/Mexico/Brasil...







That's how kitchen gas is burning a bigger hole in our pockets

LIVE TV

BUSINESS TECH MOVIES SPORTS SCIENCE HEALTH

NFWS

News / India / That's how kitchen gas is burning a bigger hole in our pockets

The Pathway to Clean(er) Cooking Systems

- Understanding users needs and priorities STACKING IS THE NORM!!
 - Cooking practices, other needs and cultural aspects;
- Tailor solutions to local socio-environmental context
 - Segmentation of users: *urban-rural, income level, biomass availability;*
 - User-centred design
- Foster local innovation -- Regional Testing-Innovation Centers
 - Universities/Govt/NGOs/Private Sector partnerships
 - More emphasis on local materials/knowledge/shorter supply chains











The Pathway to Clean(er) Cooking Systems -Implementation

- Promoting integrated portfolios of "cleaner stacking" options:
 - <u>improved practices</u> (moving the open fire outside, drying wood, use of pressure cooker),
 - devices (stoves, water heaters, space heating)
 - fuels (biomass!!!, solar (thermal also!)
- Participatory approaches; longer-term program monitoring and results-based incentives

No one should be left behind, particularly the poorest!!!











LARORATORIO DE INVOVACIÓN Y EVALUACIÓN EN ESTURAS DE BIOMASA

gira

Thank you



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ETHOS: Opportunities, Trends, and Tradeoffs: Cooking, Health, and Climate

What are the most important factors when seeking best outcomes from a clean cooking intervention?



The ISO 19867 Voluntary Performance Targets include Thermal Efficiency, PM2.5, CO, Safety, and Durability.

The World Bank added Convenience, Availability, and Affordability.

ARC suggests completing a multi-tiered framework with Climate.

Stoves that score well enough on these eight metrics might be more successful interventions?

Corn cobs? LPG?



The Energy Progress Report defines clean fuels and technologies as "electricity, LPG, natural gas, biogas, solar, and alcohol fuels" (IEA et al. 2020). Biomass is not included.

However, most electricity and all LPG, natural gas, and alcohol derived from fossil fuels emit dangerous amounts of CO2, responsible for climate change.

New York City just became the largest city in the US to ban natural gas in new buildings. (SF, and 51 cities in California enacted similar laws.)

The Sustainable Development Goal (SDG) 7.1.2 indicator, access to clean fuels and technologies for cooking, uses a proxy of whether households cook primarily with "clean" fuels.

Since the "clean" fuels are largely fossil fuels that are being banned:



What would Kirk Smith recommend we do now?

Does carbon neutral biomass rise up an "energy ladder?"



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Appendices

Additional Material

A caution note from the world's largest LPG subsidy program in India

According to many early studies, **the PMUY scheme** did not result in <u>widespread adoption</u> of LPG in poor households as the primary cooking fuel. The scheme was short-term oriented with one-time subsidies that <u>targeted voters</u> in poll bound states. Spending on PMUY fell by more than 50 percent from INR29.9 billion in 2015-16 to about INR12.93 billion in 2019-20.

As there was no improvement in incomes of households receiving LPG connections under PMUY, they were unable to purchase <u>replacement cylinders</u>.

Phasing out of subsidies for LPG has made it even more difficult for PMUY recipients to purchase refill cylinders. This often means reverting to burning biomass.



Observer Research Foundation Jan 2022 https://www.orfonline.org/expert-speak/lpgsubsidies-a-quiet-phase-out/

PM Results in Context

Intent-to-treat models with 6 repeated measurements for each household

Large percent reductions in exposures

WHO IT-3 target for 24-hours of 37.5 µg/m³

 For personal samples, 41% (dry season) and 53% (rainy season) of *Justa* stoves reached the target

PM _{2.5} by assigned stove type	Percent reduction in PM concentrations		
Personal PM _{2.5} μg/m ³			
Justa	32.3% (19.8, 42.9)		
Traditional	reference		
Kitchen PM _{2.5} µg/m ³			
Justa	56.0% (45.7, 64.7)		
Traditional	reference		

HbA1c by study arm, assigned stove, and visit number



Results: HbA1c by visit, study arm, and stove type



HbA1c total obs=1,208 (without diabetes medication use) Arm 1: n=114, obs=621; Arm 2: n=113, obs=587

PM _{2.5} by assigned stove type	n	Mean (SD)	Geometric Mean (GSD)	Median (25th, 75th percentile)
Personal PM _{2.5} μg/m ³				
Justa	585	83 (216)	45 (2.5)	43 (27, 73)
Traditional	622	141 (281)	87 (2.4)	81 (50, 141)
Kitchen PM _{2.5} μg/m ³				
Justa	578	107 (211)	58 (2.7)	53 (29, 103)
Traditional	629	427 (724)	182 (3.7)	178 (69, 440)
24-hour Personal PM _{2.5} (μg/m³) Β	Visit 1 Rainy 0000 100 10 10 1 2	Visit 2 Dry Rainy	Visit 4 Dry Rainy Dry	Perso 24-Ho W Guide 37.5
	Assian	ed Stove: 📄 J	Justa 븜 Traditional	

 $PM_{2.5}$

BC by	n	Mean (SD)	Geometric	Median (25 th , 75 th	Percent reduction in BC
assigned			Mean (GSD)	percentile)	concentrations ¹
stove type					
Personal BC (µg	/m³)				
Justa	582	23.3 (121.9)	3.6 (6.4)	3.5 (1.5, 11.7)	53% (95% Cl: 35-65%)
Traditional	612	33.6 (71.7	11.5 (4.6)	11.8 (5.0, 29.4)	Reference
Kitchen BC (µg/ı	m ³)				
Justa	579	52.3 (169.5)	7.7 (6.7)	6.6 (2.3, 26.1)	76% (95% CI: 66-83%)
Traditional	609	130.6 (201.3)	39.7 (6.1)	46.7 (11.8, 160.3)	Reference

Personal BC by study arm, assigned stove, and visit number

Black Carbon

