The Surprisingly Large Health Benefits of Clean Household Fuels

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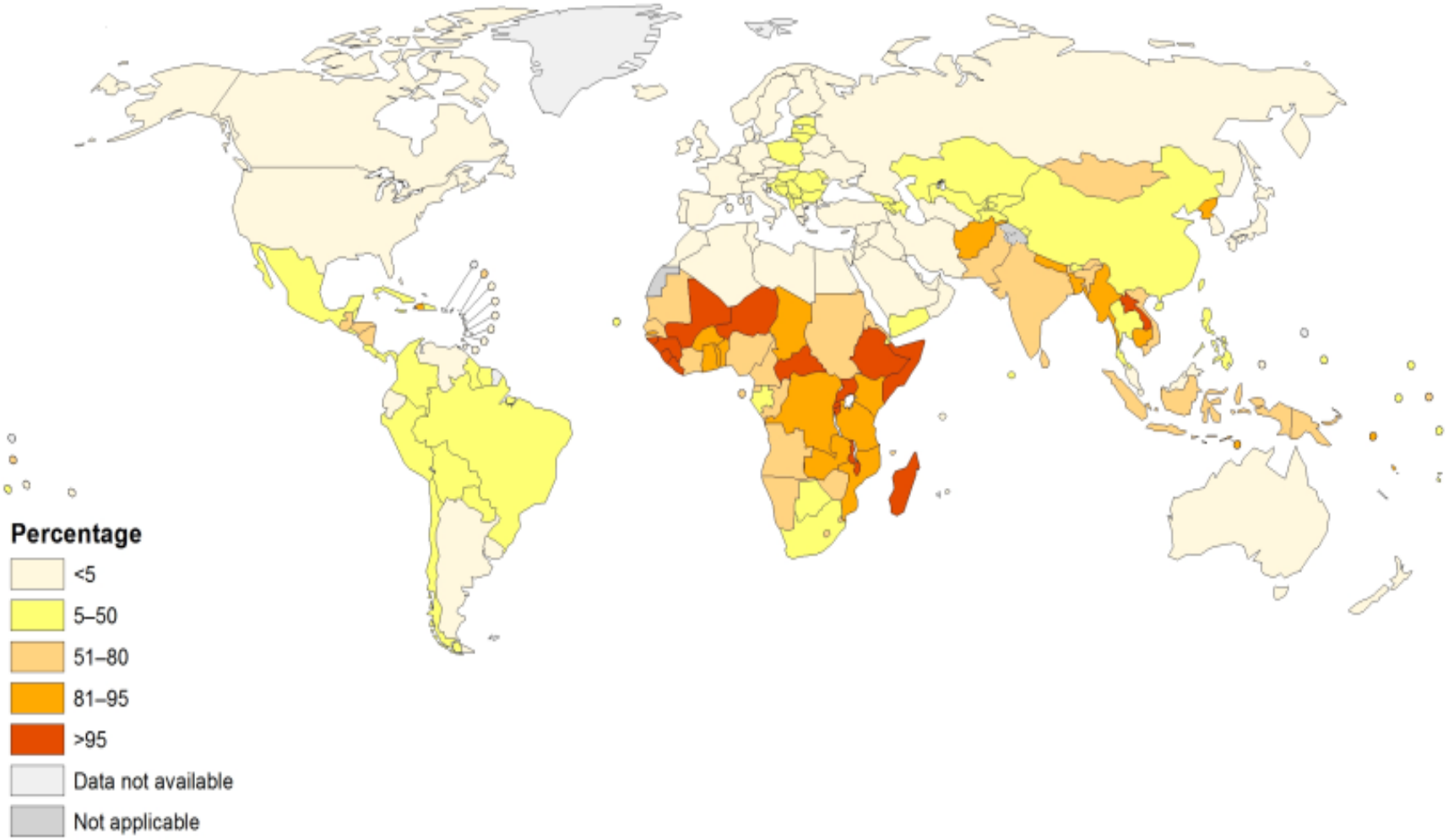
Keynote Address
“Cooking for Life Initiative”

World LP Gas Forum
September 2012
Bali, Indonesia


Cooking with solid fuels
Wood
Coal
Straw

Population using solid fuels (%), 2010
Total



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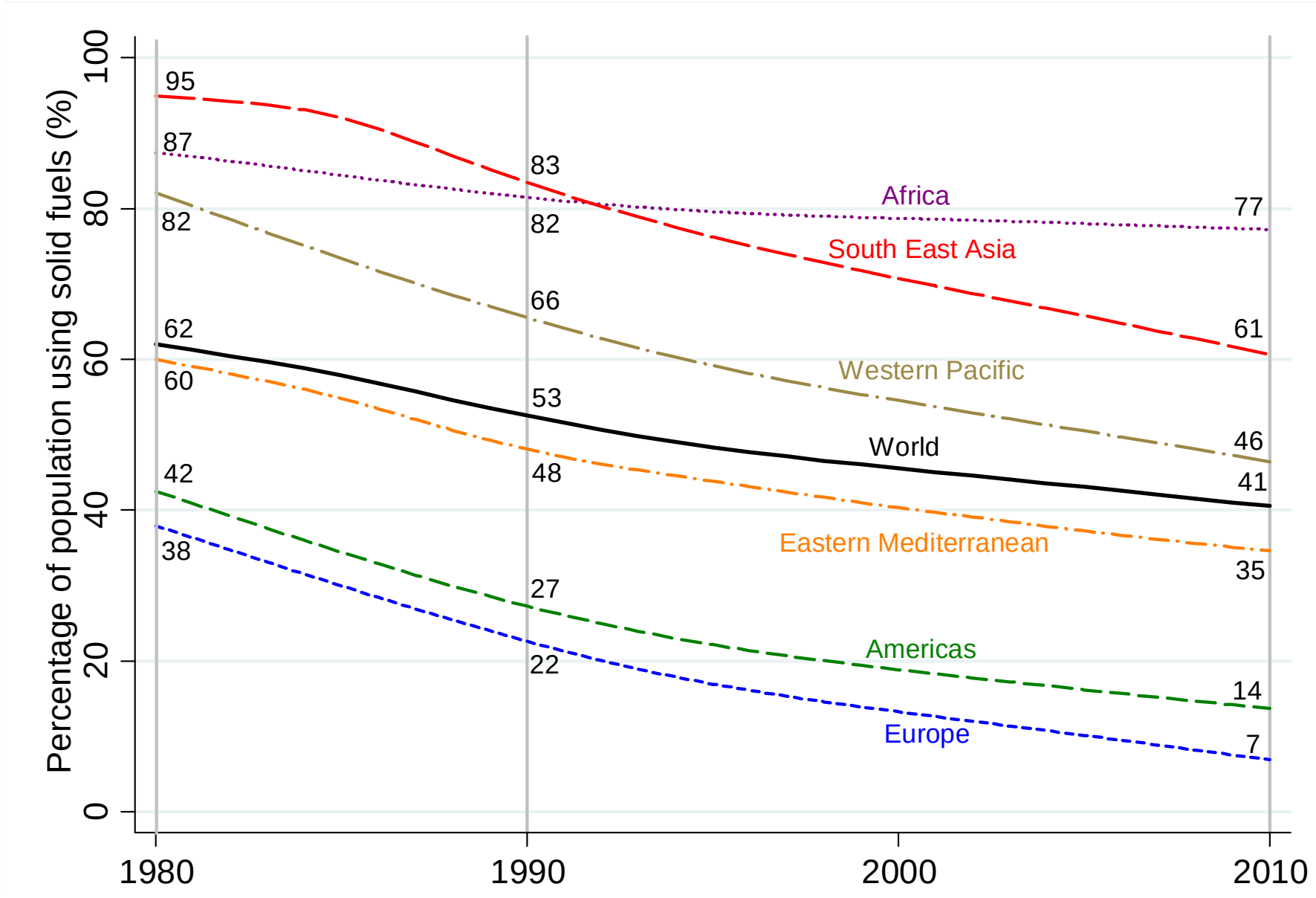
Data Source: World Health Organization
Map Production: Public Health Information and Geographic Information Systems (GIS)
World Health Organization

World Health Organization



Percent of households cooking with solid fuels by region

Bonjour et al., GBD-2010

Energy flows in a well-operating traditional wood-fired Indian cooking stove

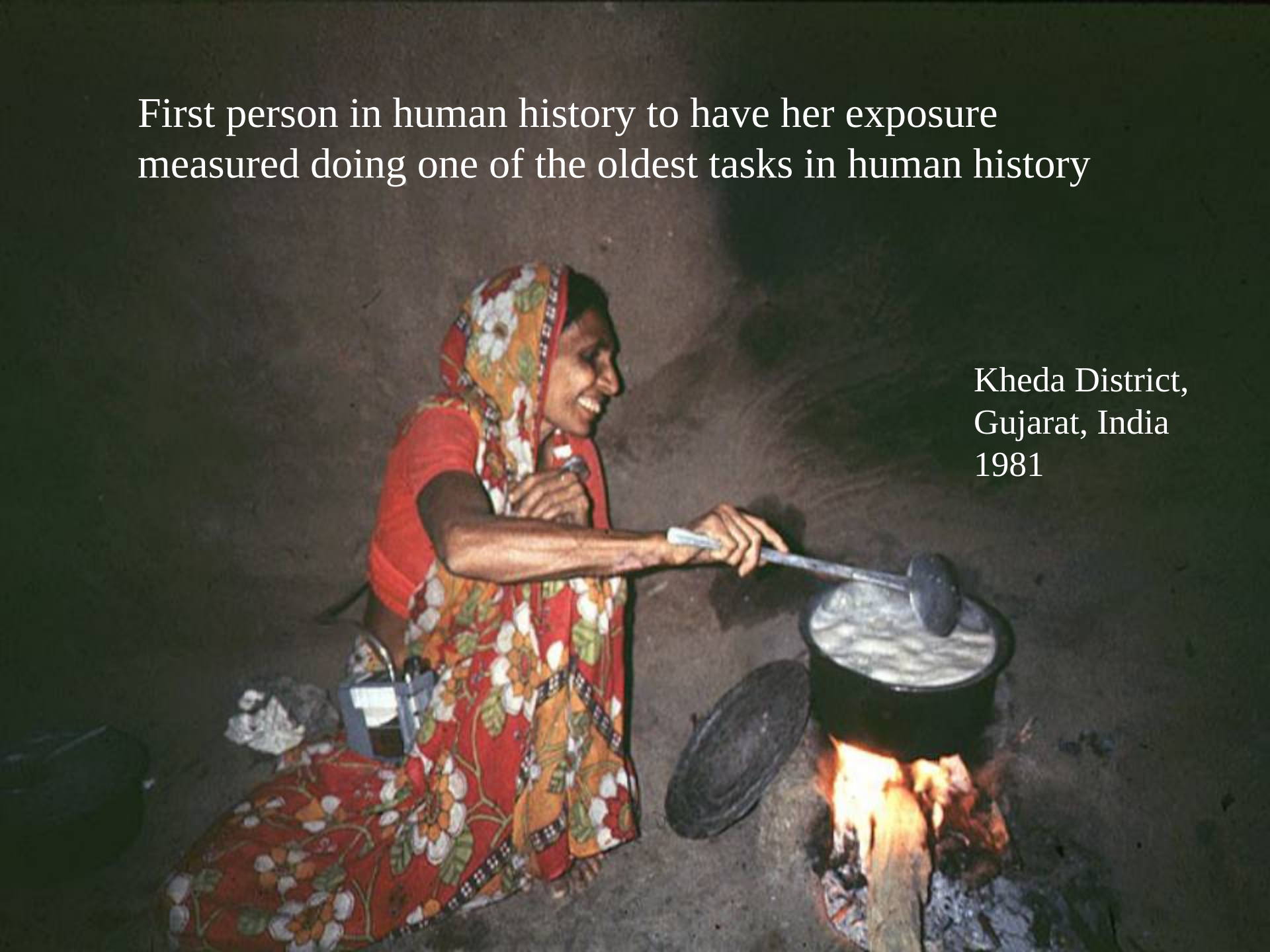
A Toxic Waste Factory!!

Typical biomass cookstoves convert 6-20% of the fuel carbon to toxic substances

PIC = products of incomplete combustion = CO, HC, C, etc.

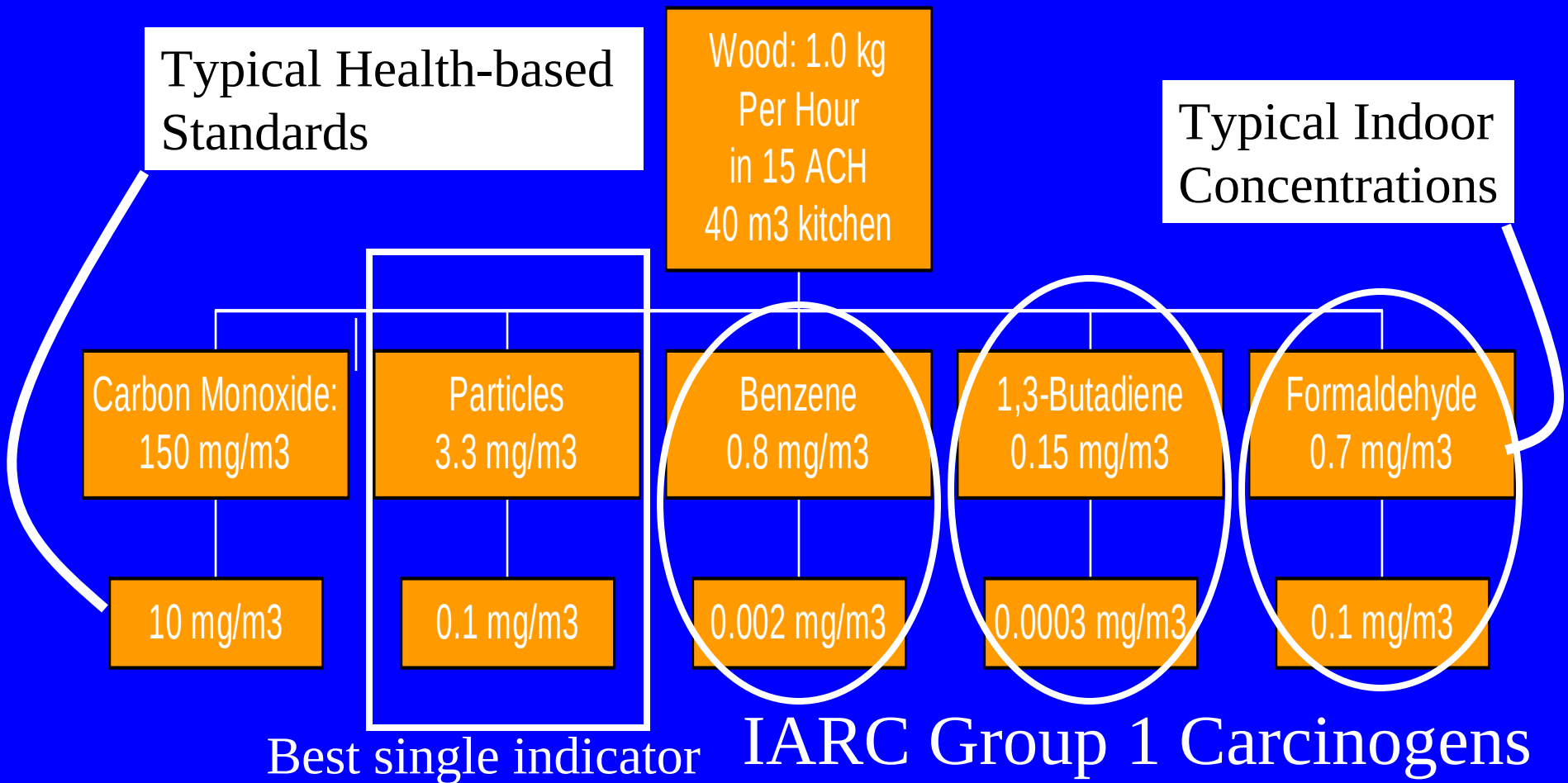
Source: Smith, et al., 2000

First person in human history to have her exposure measured doing one of the oldest tasks in human history



Kheda District,
Gujarat, India
1981

Health-Damaging Air Pollutants From Typical Woodfired Cookstove in India.



Diseases for which we have many epidemiological studies

ALRI/ Pneumonia

Chronic Lung Disease

Lung cancer

Blindness

Heart disease

These diseases are included in the 2010 Comparative Risk Assessment Being released in Fall 2012 as part of the Global Burden of Disease Project

There is some evidence for these other diseases, but considered insufficient to include in the 2010 Comparative Risk Assessment

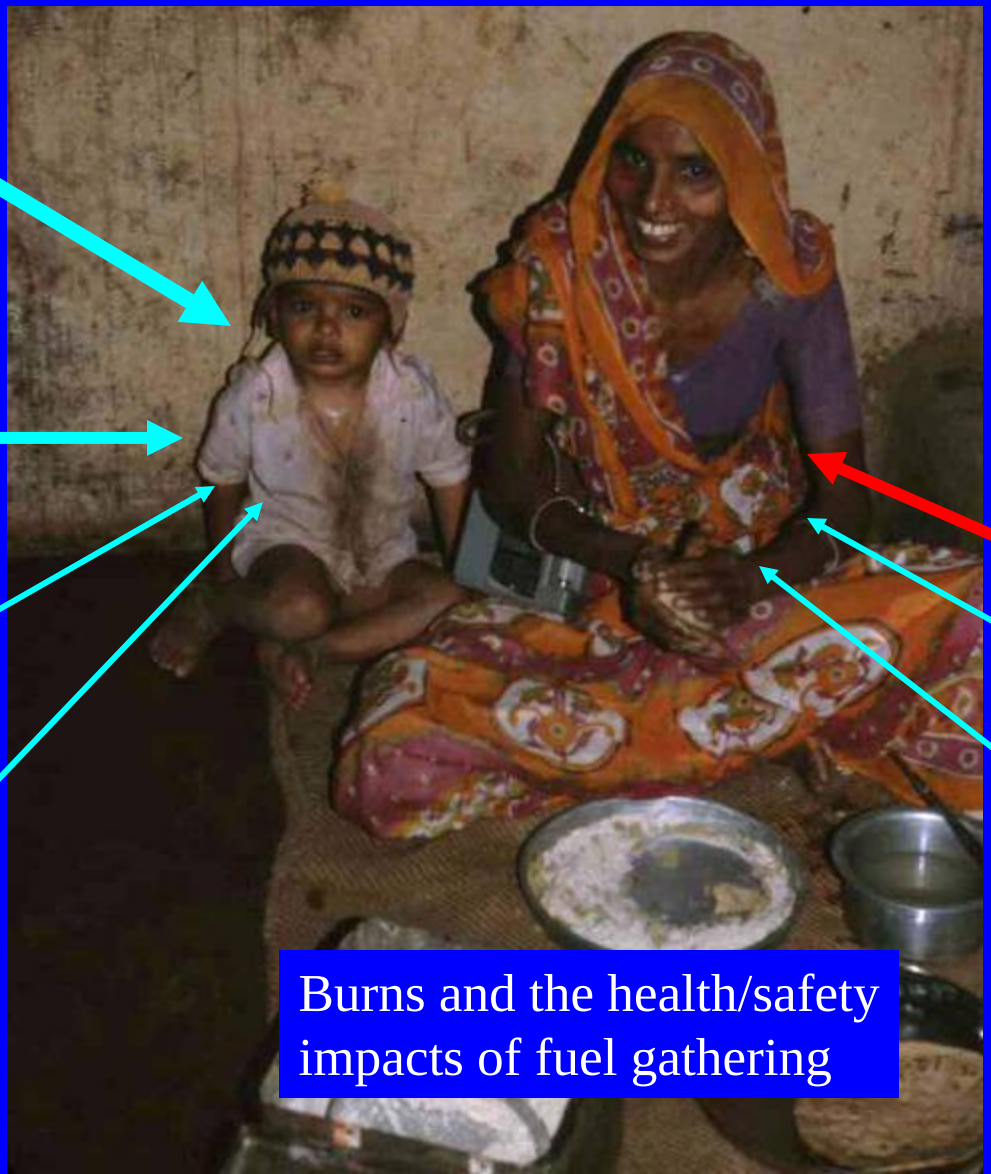
Low birth weight

Stillbirth

Cognitive Impairment

Birth defects

Asthma?



Burns and the health/safety impacts of fuel gathering

Tuberculosis

Pneumonia

Other cancers (cervical, NP, upper airway)

How to compare across diseases, risk factors, and age groups?

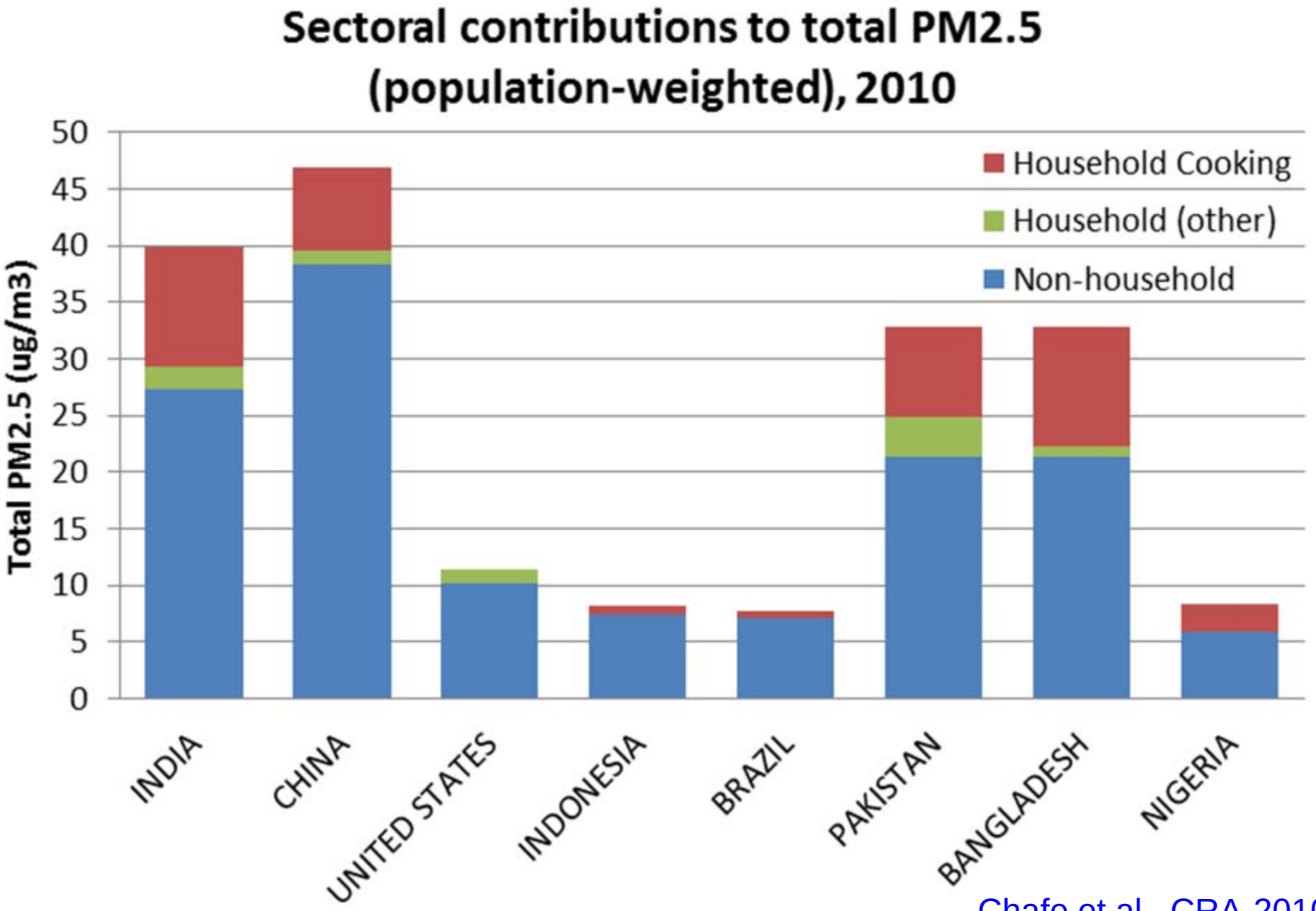
- International health metric – the DALY
- Disability-Adjusted Life Years
- Basically, the number of healthy life years lost to a disease or risk
- Includes allowance for lost of life expectancy and the severity of the disease
- Global Burden of Disease – 2010
- Being published this fall, 2012

Slides removed

- From the Global Burden of Disease 2010, now under peer review
- Please watch my website or the journal Lancet for the papers, which should be published by December 2012
- http://ehs.sph.berkeley.edu/krsmith/

Actually even worse

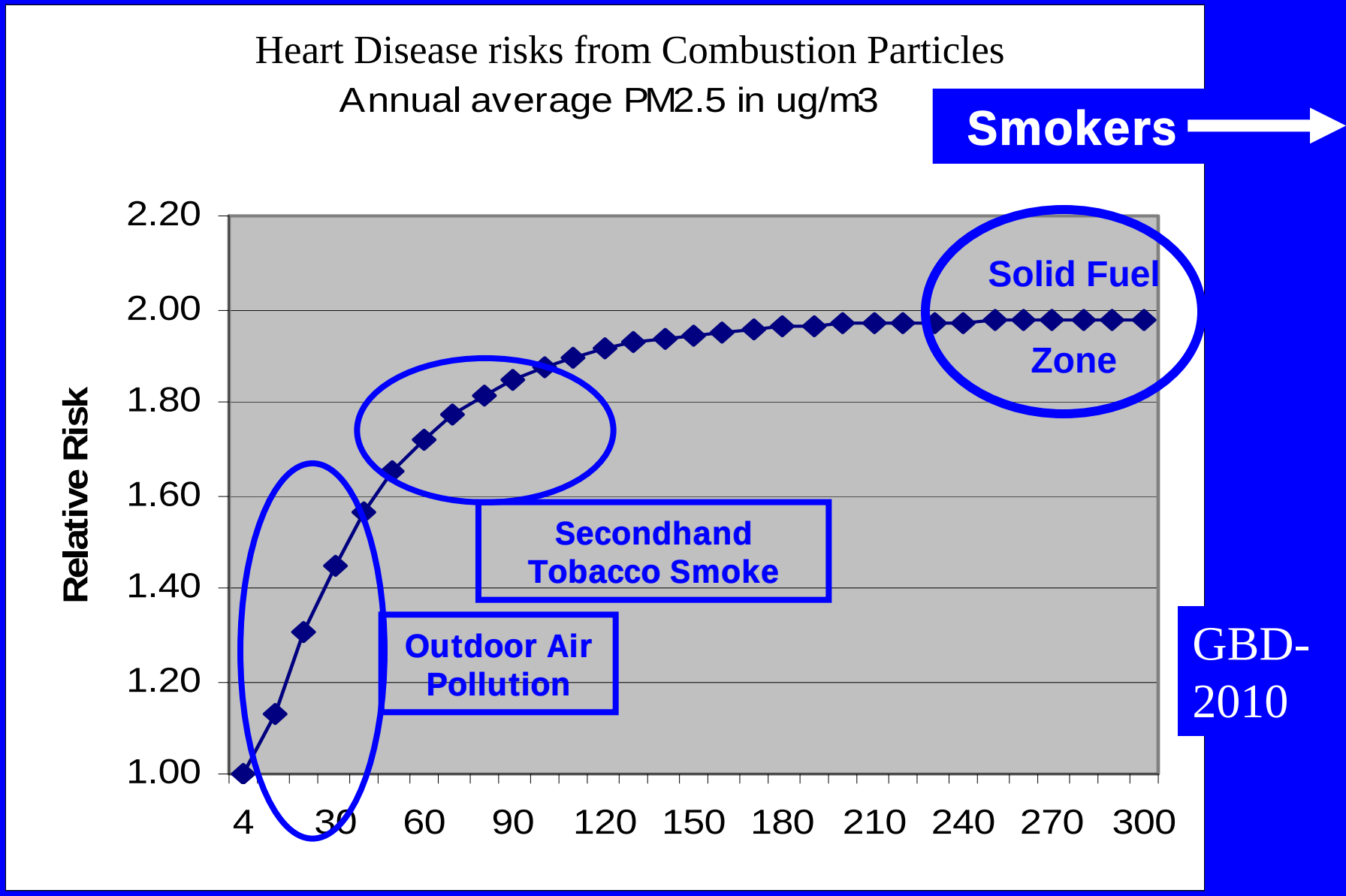
- Because household solid fuels add significantly to outdoor air pollution as well
- As well as emit climate-altering pollutants such as black carbon



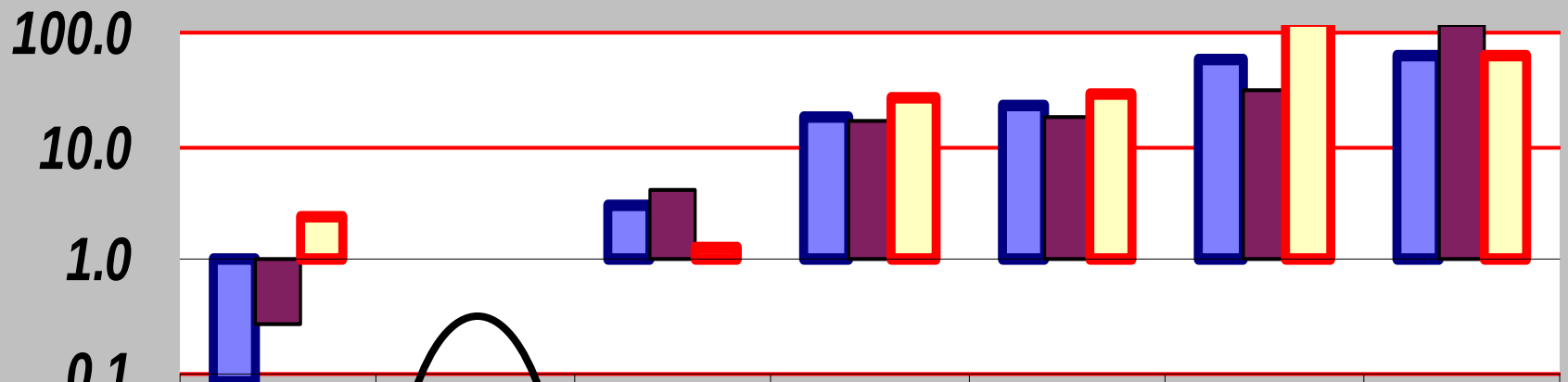
Chafe et al., CRA-2010

How Clean Does It Have to be?

Integrated Exposure-Response: Outdoor Air, SHS, and Smoking



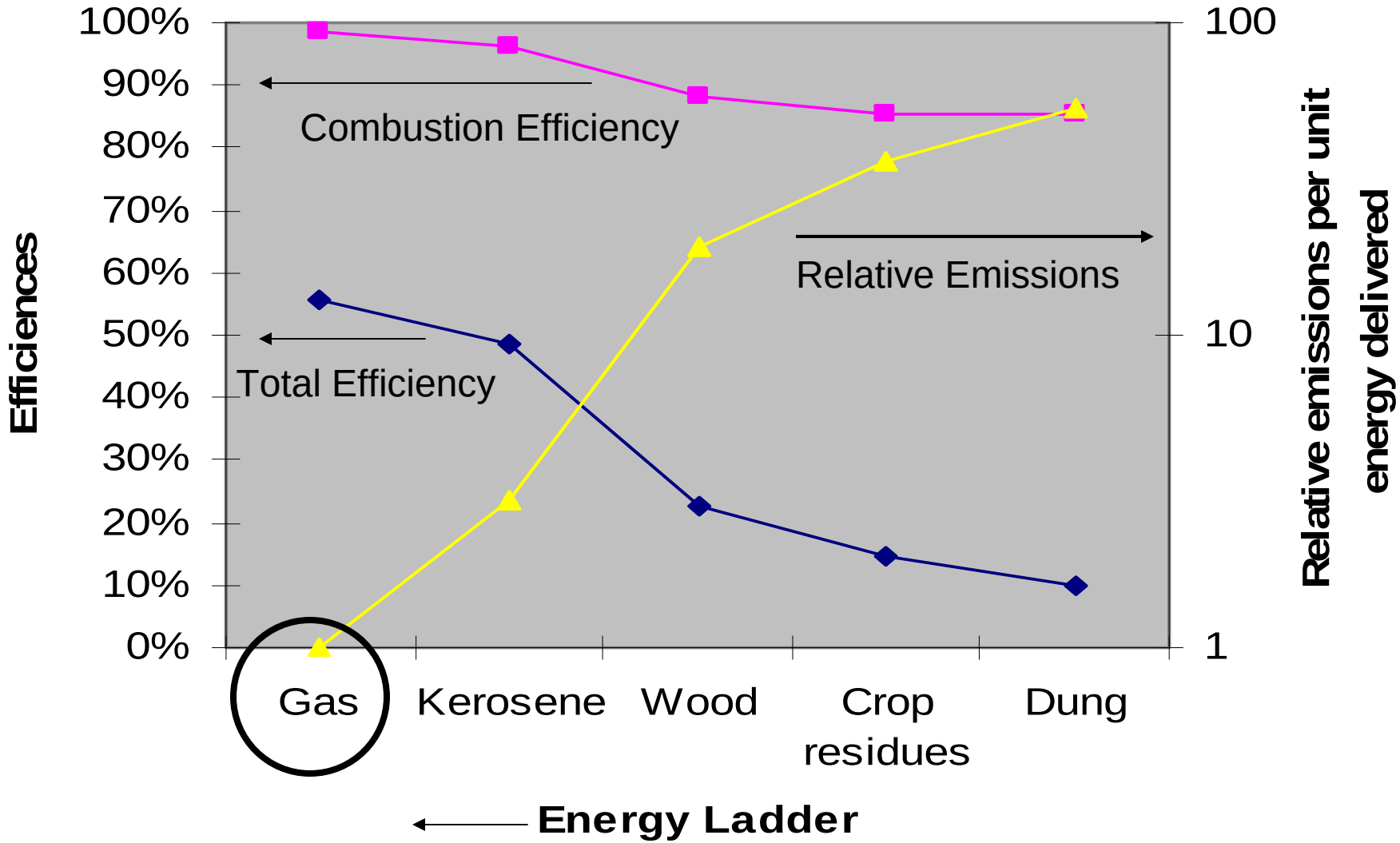
The Energy Ladder: Relative Pollutant Emissions Per Meal



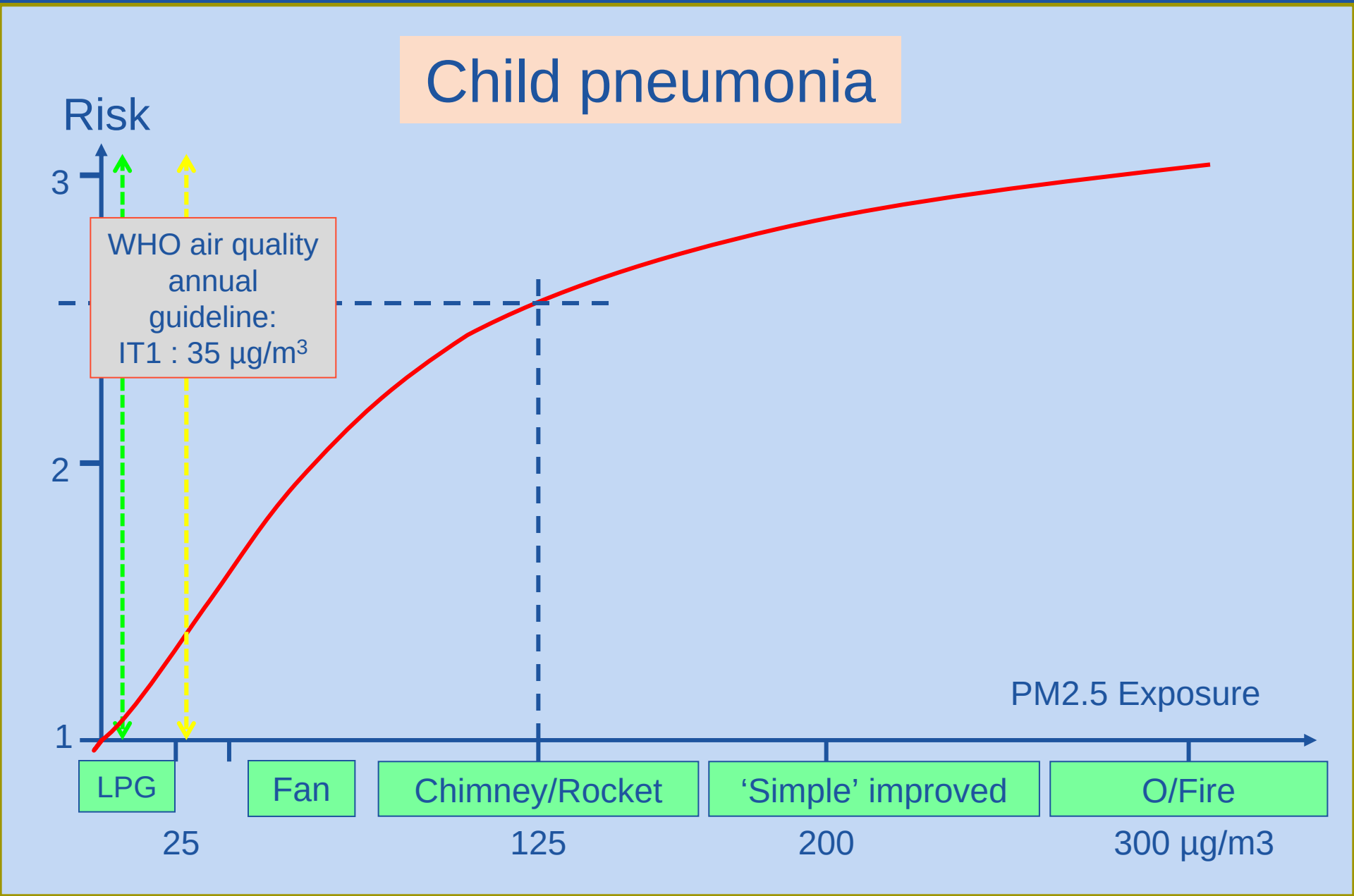
	Biogas	LPG	Kerosene	Wood	Roots	Crop Residues	Dung
CO	0.1	1.0	3	19	22	60	64
Hydrocarbons	0.3	1.0	4.2	17	18	32	115
PM	2.5	1.0	1.3	26	30	124	63

CO Hydrocarbons PM

Emissions and Energy Characteristcs of Household Stoves



Exposure-response relationship



Is LPG Cookstove Technology Perfect?

- No, old and out of date: does not use modern technology
- Now that the lack of gas cookfuel is understood to be such a major risk
- The LPG industry needs to respond with a new range of products oriented toward the needs of the poor.

Uganda: August 2012

Note: Both stoves are in good visual condition.

Blue Flame
Nominal Combustion Efficiency:

> 99%

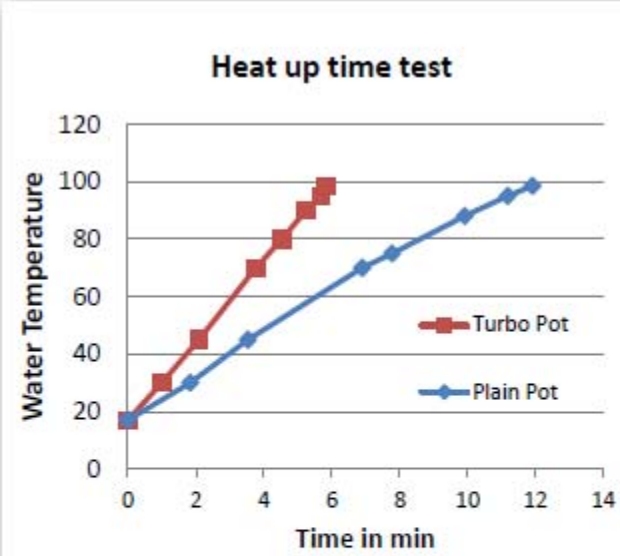
Yellow Flame
Nominal Combustion Efficiency:

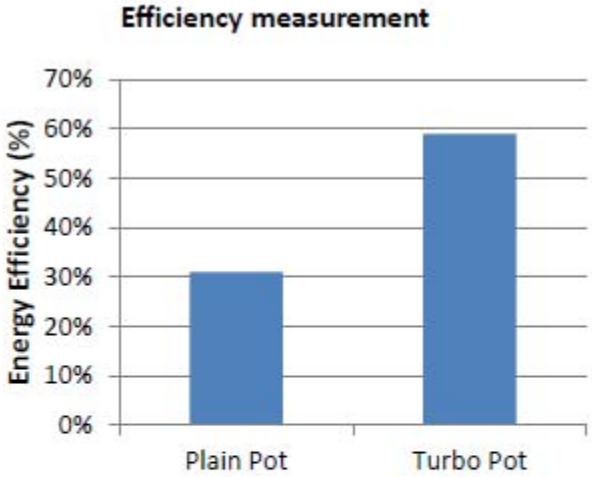
96-97%

Courtesy M. Johnson, BAMG

Better Heat Transfer

For example, the Turbo Pot™

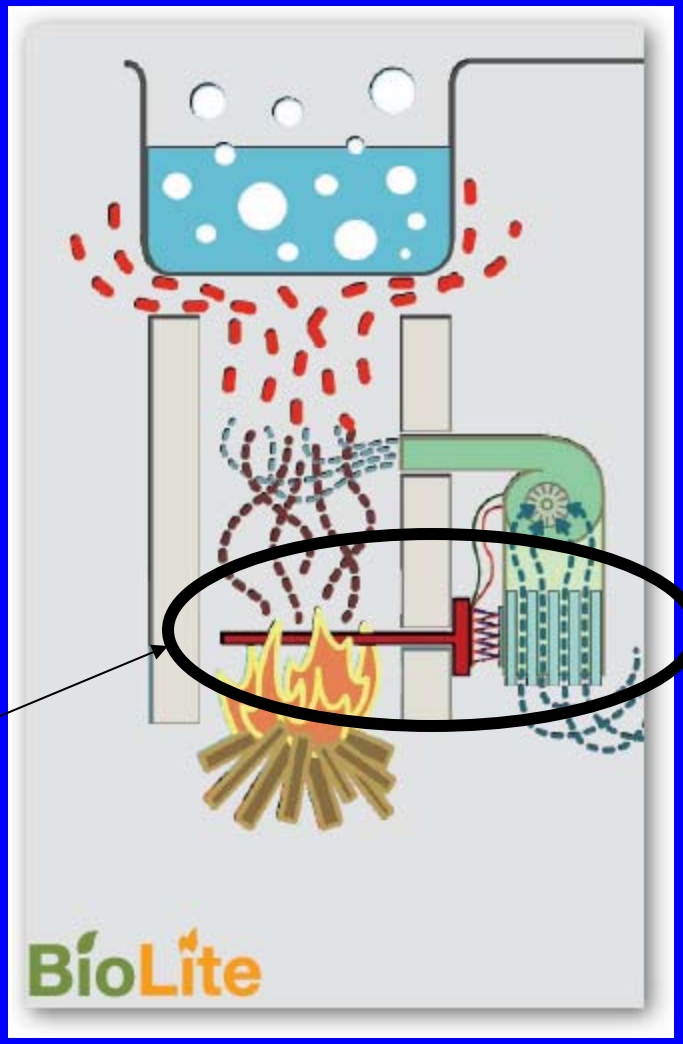




Use the Waste Heat

For example, the BioLite™

Thermal Electric Generation (TEG)



BioLite Home™ Stove
Being test-marketed in India

Is Kerosene a Clean Alternative?

Journal of Toxicology and Environmental Health, Part B, 15:396–432, 2012

ISSN: 1093-7404 print / 1521-6950 online
DOI: 10.1080/10937404.2012.710134

Taylor & Francis
Taylor & Francis Group

KEROSENE: A REVIEW OF HOUSEHOLD USES AND THEIR HAZARDS IN LOW- AND MIDDLE-INCOME COUNTRIES

Nicholas L. Lam, Kirk R. Smith, Alison Gauthier, Michael N. Bates

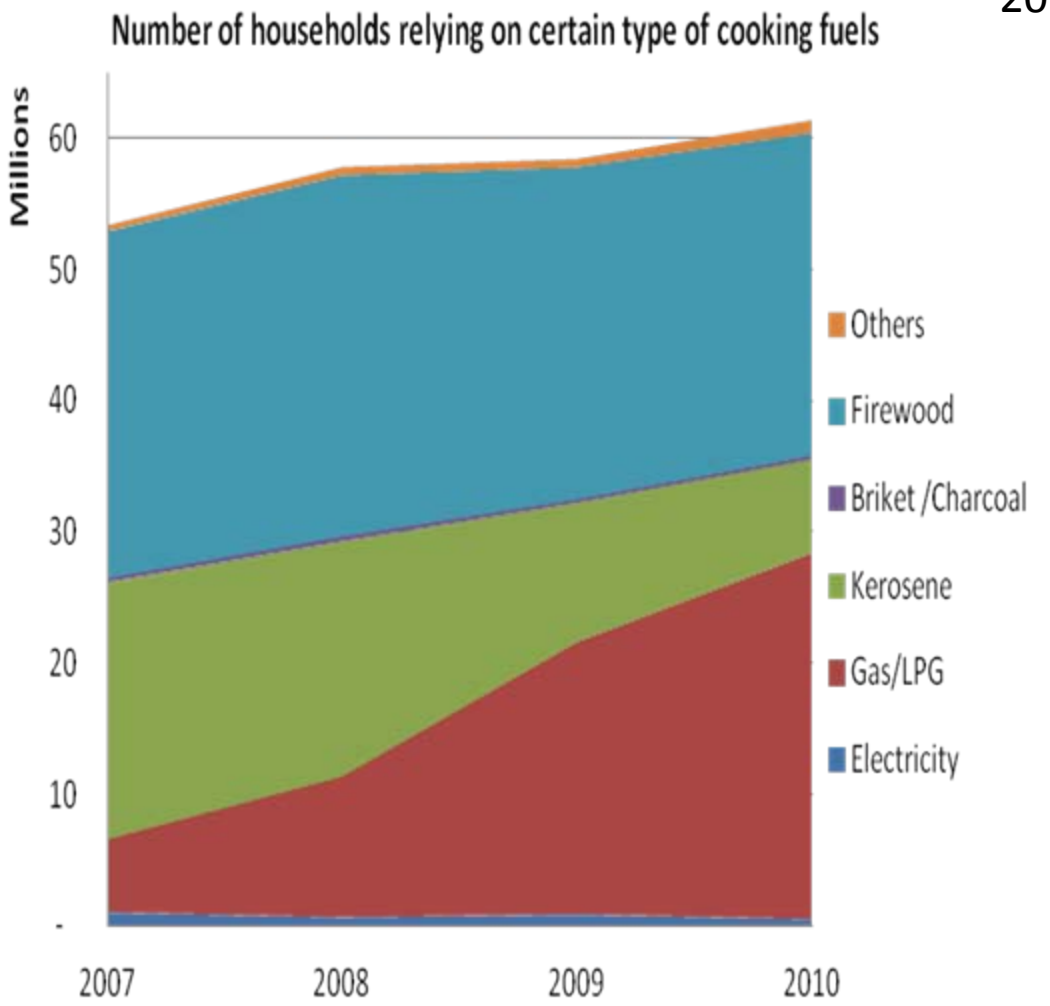
Division of Environmental Health Sciences, School of Public Health, University of California, Berkeley, California, USA

- In India, kerosene cooking associated with
  - 108 gram reduction in birthweight (secondhand tobacco smoke - ~35 g)
  - And probably a doubling of early infant deaths
- In Nepal,
  - 70% increase in child pneumonia
  - 3 times the risk of tuberculosis

Indonesia Cooking Fuel Situation 2007-2010

YDD, 2012

- LPG users rapidly increase after 2007, in replacement of the kerosene users
  - 10.6% to 45.6% (5.6 million to 27.6 million)
- Kerosene users decrease significantly, accounting for only 11.7% of all households in 2010. : 36.6% to 11.7% (19.5 to 7.1 million)



Number of wood users remains large and not much affected by the LPG program

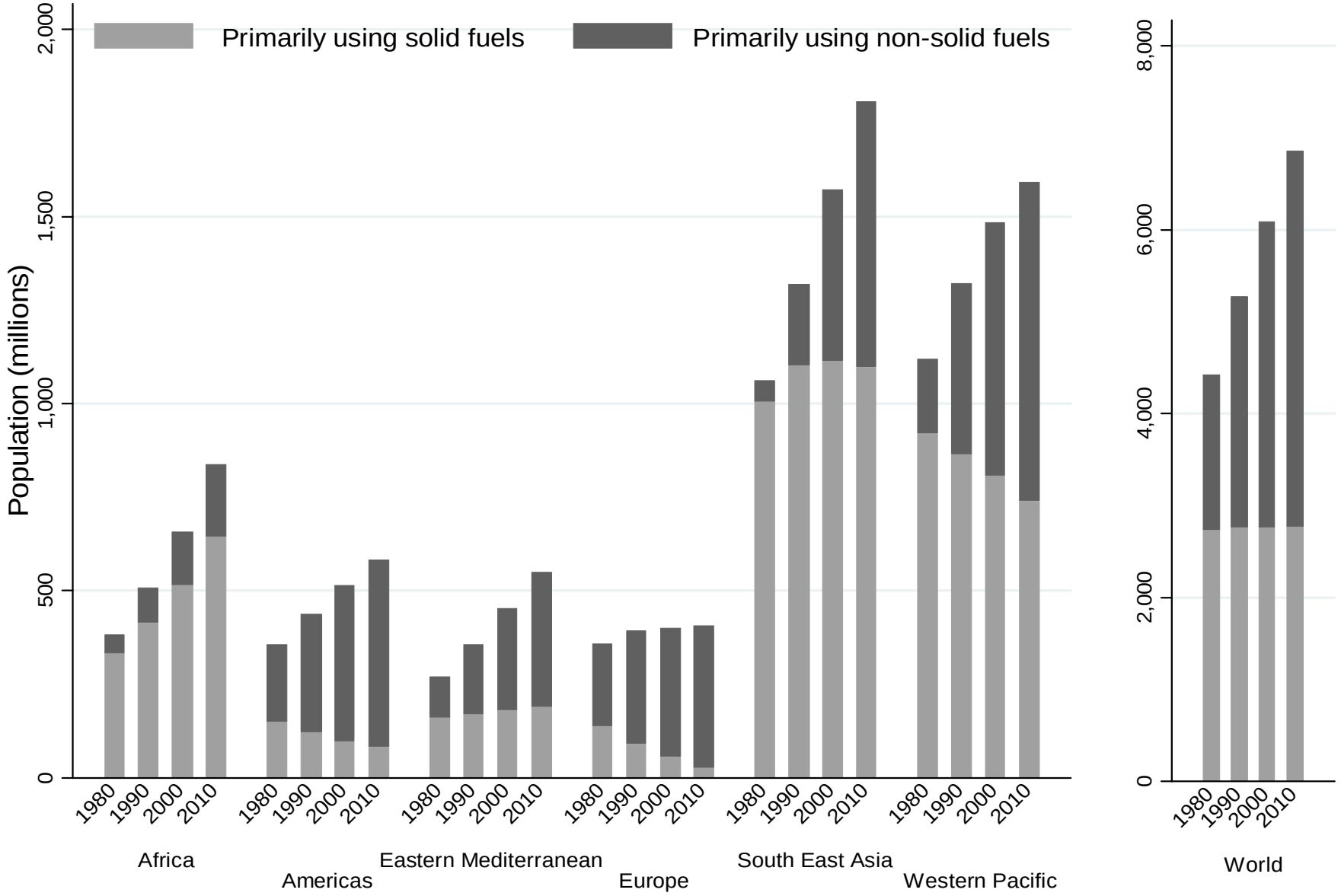
Source: National Socio-Economic Survey, BPS 2008-2011

Why not eliminate kerosene subsidies everywhere?

- It is used for lighting in those many areas where there is no electricity or it is very unreliable, i.e., South Asia
- New LPG technology thus needed to respond to lighting as well as cooking needs

The Problem

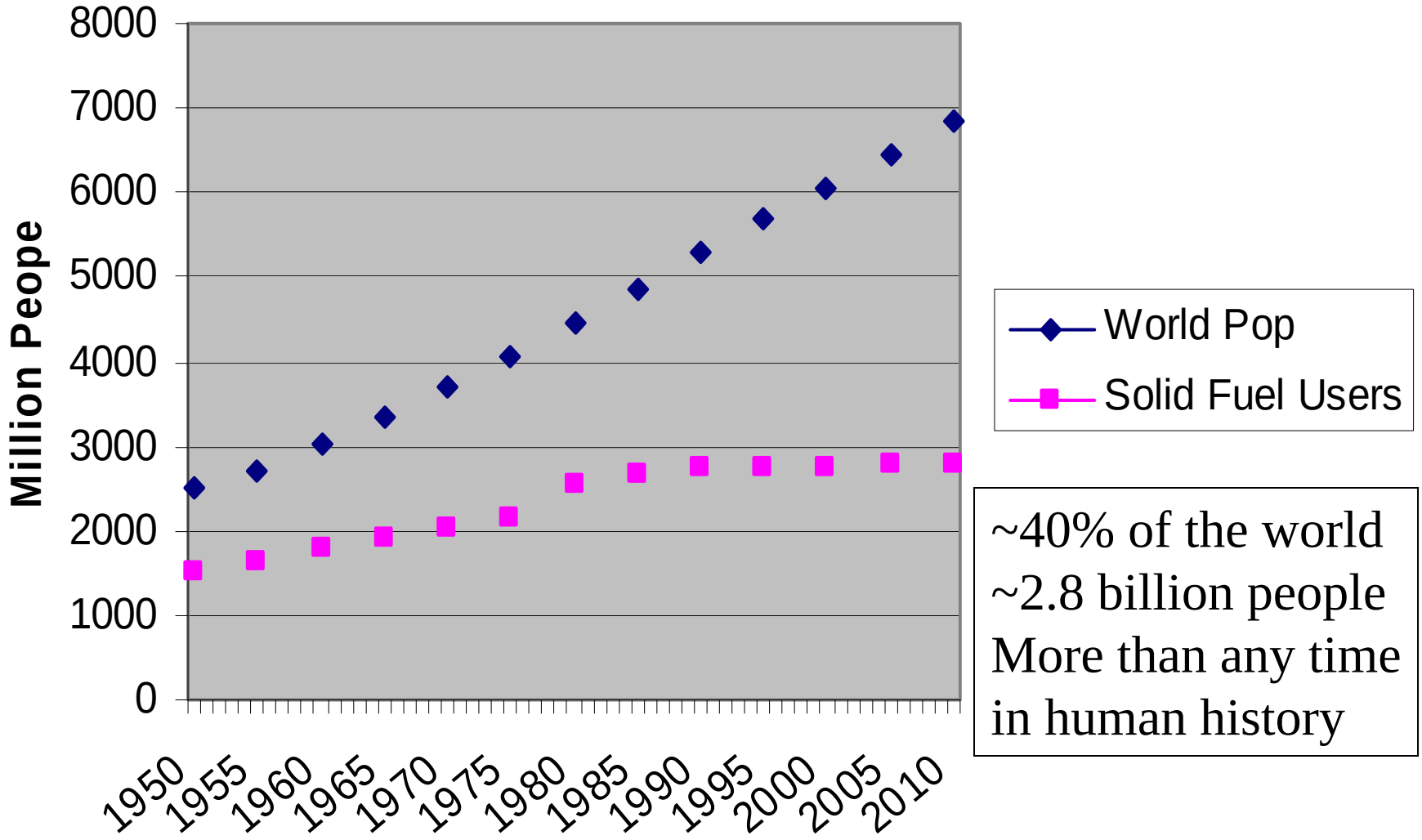
- 41% of the human race still relies on solid fuels (biomass and coal) for household cooking fuel
- Such fuels produce large amounts of health-damaging pollution in households exposing women and children in particular
- The resulting human exposure is a major cause of ill-health in the world.
- It is not going away by itself.



Total Population Cooking with Solid Fuels

Bonjour et al., GBD-2010

World Population Using Solid Fuels



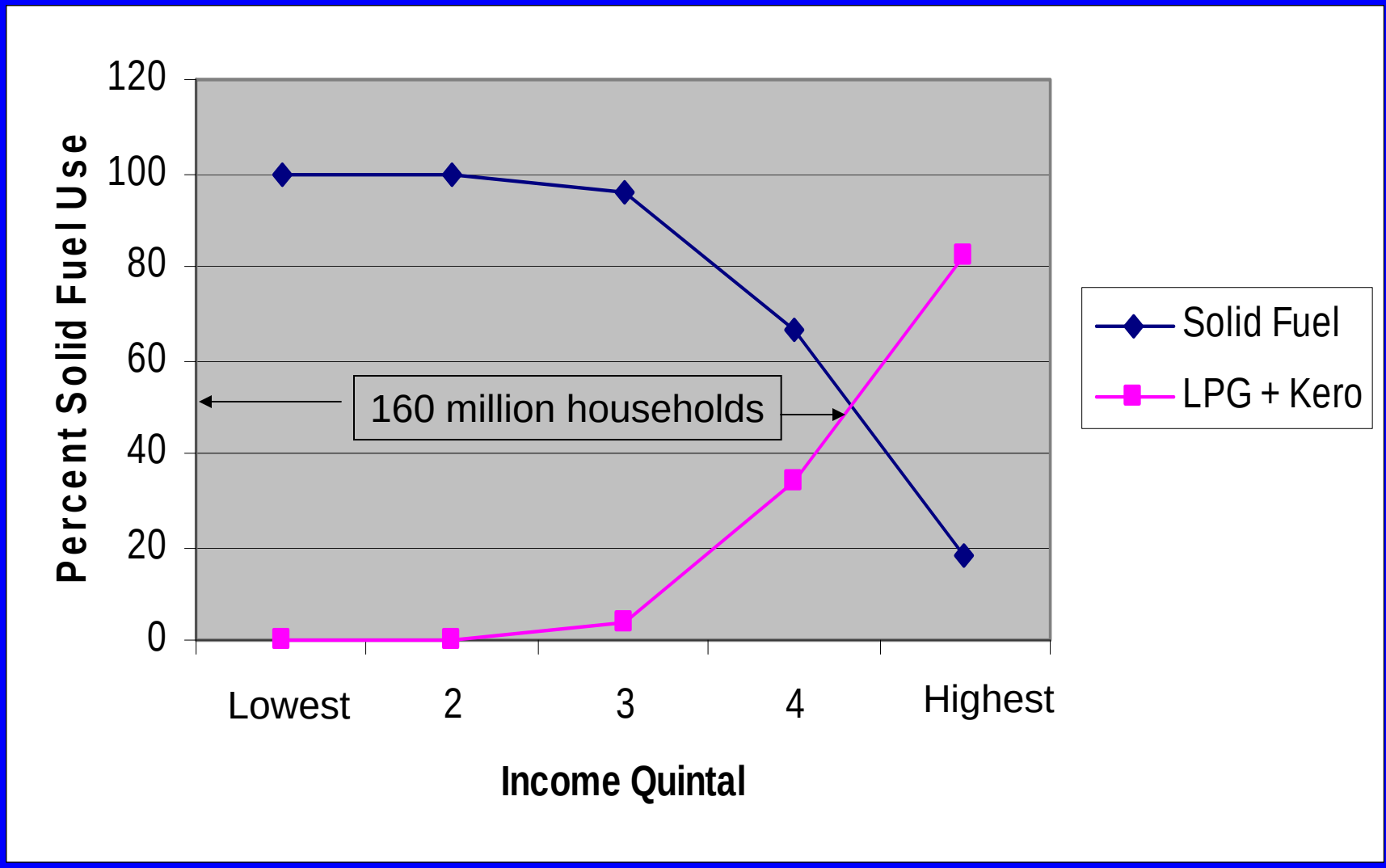
~40% of the world
~2.8 billion people
More than any time in human history

Extractive Industries for Development Series #25
December 2011

The Role of Liquefied Petroleum Gas in Reducing Energy Poverty

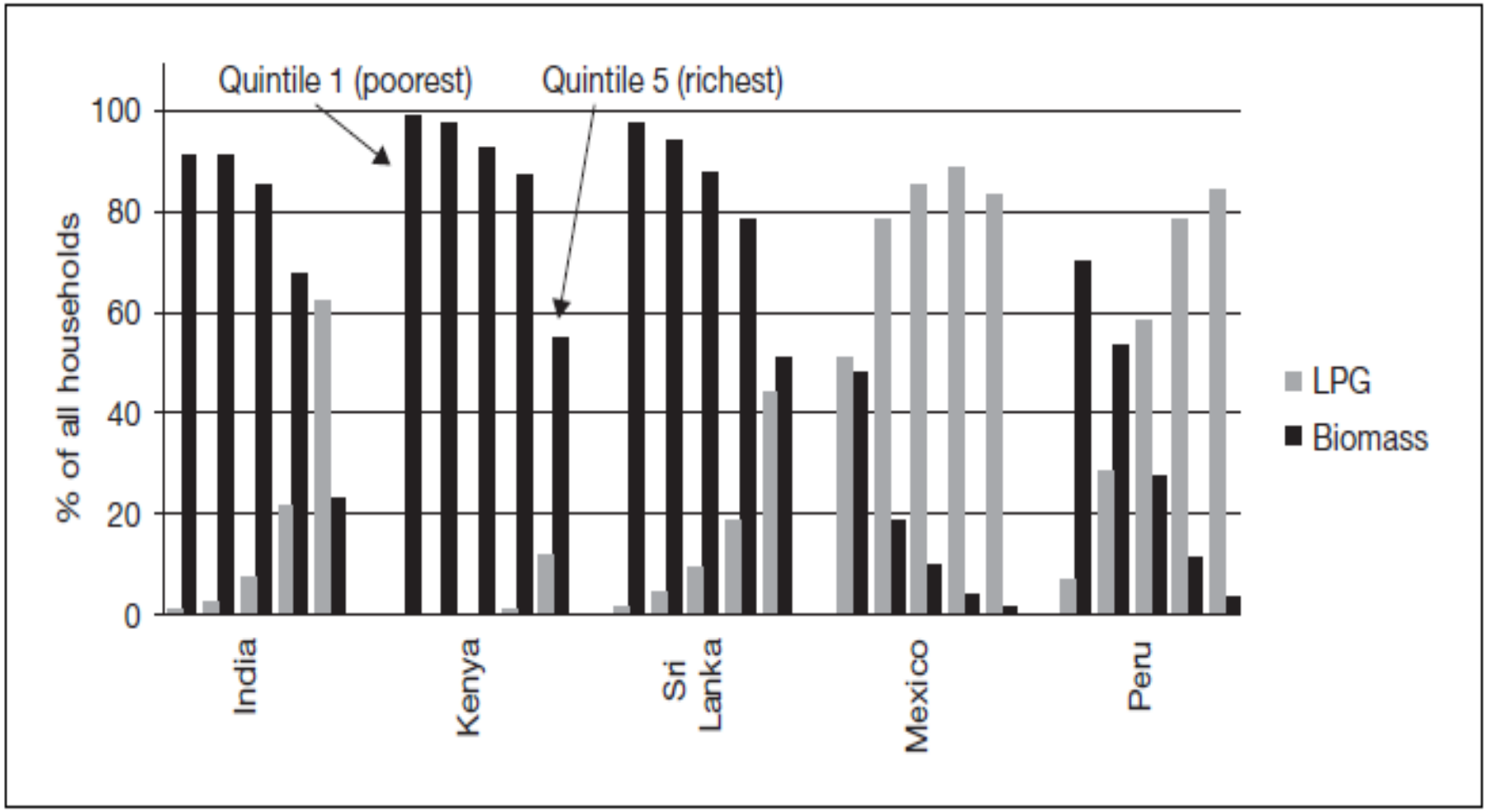
Masami Kojima
World Bank

Distribution of Household Cooking Fuel by Income in India



NFHS, 2006

Figure 3.1 LPG and Biomass as the Primary Cooking Fuel



Source: Kojima, Bacon, and Zhou 2011.

What needs to be done.

- 3 billion people need clean cooking fuel
- All poor, but some more than others
- The poorest one billion probably have to have significant public assistance to obtain better biomass stoves
- The middle one billion might be able to adopt clean advanced biomass stoves and fuels such as biogas and ethanol on a semi-commercial basis
- With better technology and better reliability LPG could extend its market to serve the top billion of the current population using biomass
- Millions of premature deaths of women and children could be averted
- This should be the target of the Cooking for Life Program of the WLPGA

Thank you

Publications and presentations at my website

Just Google "Kirk R. Smith"