

# Household Energy and Air Pollution in India: What is being done?

Kirk R. Smith

Professor of Global Environmental Health

School of Public Health, UC Berkeley

Collaborative Clean Air Policy Centre

India Habitat Centre, New Delhi

International Conference on Impact of  
Environment on Women's Health

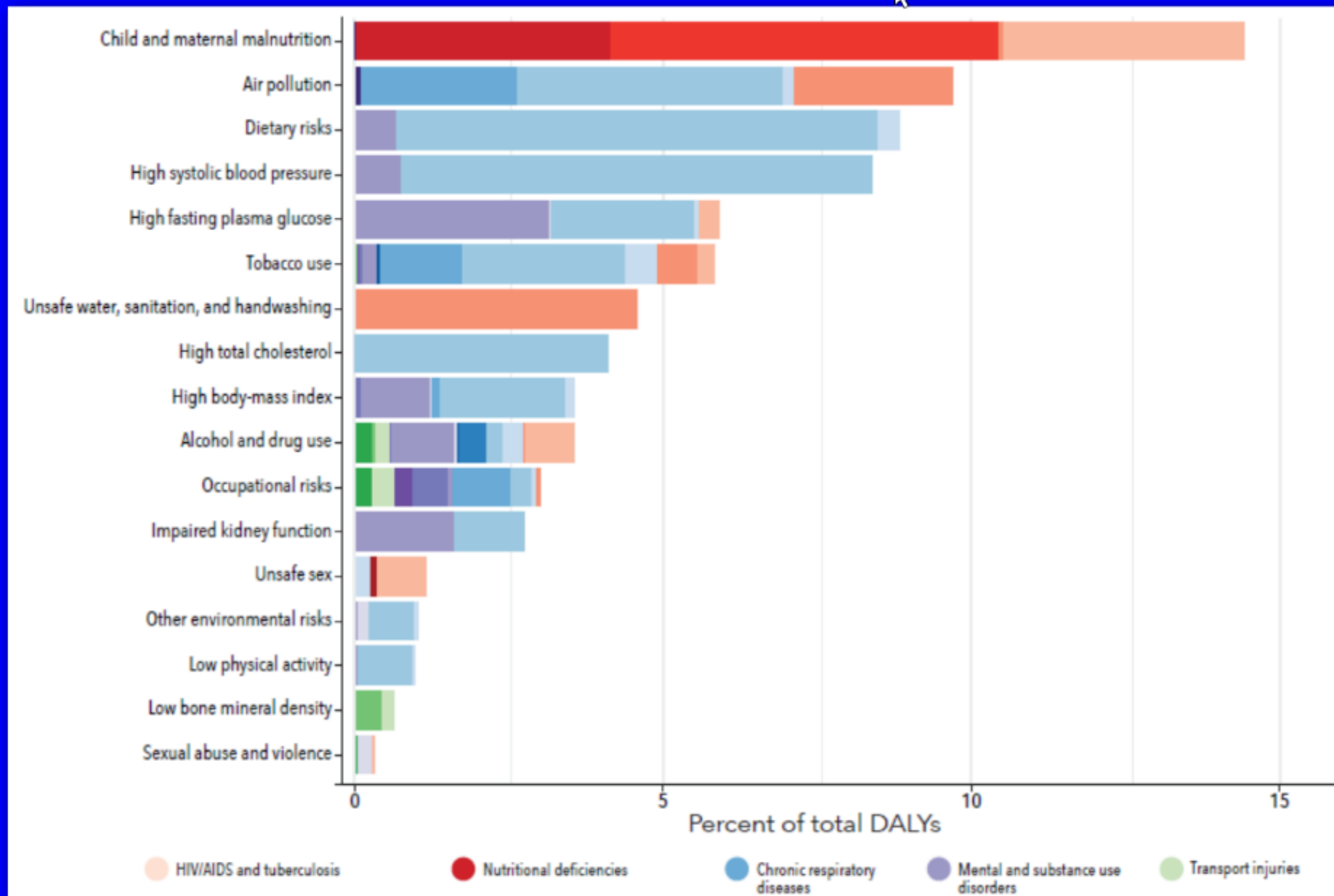
Amity University, Lucknow, Dec 1, 2017

## India Leads the Way: A Health-Centered Strategy for Air Pollution

EHP, 2016

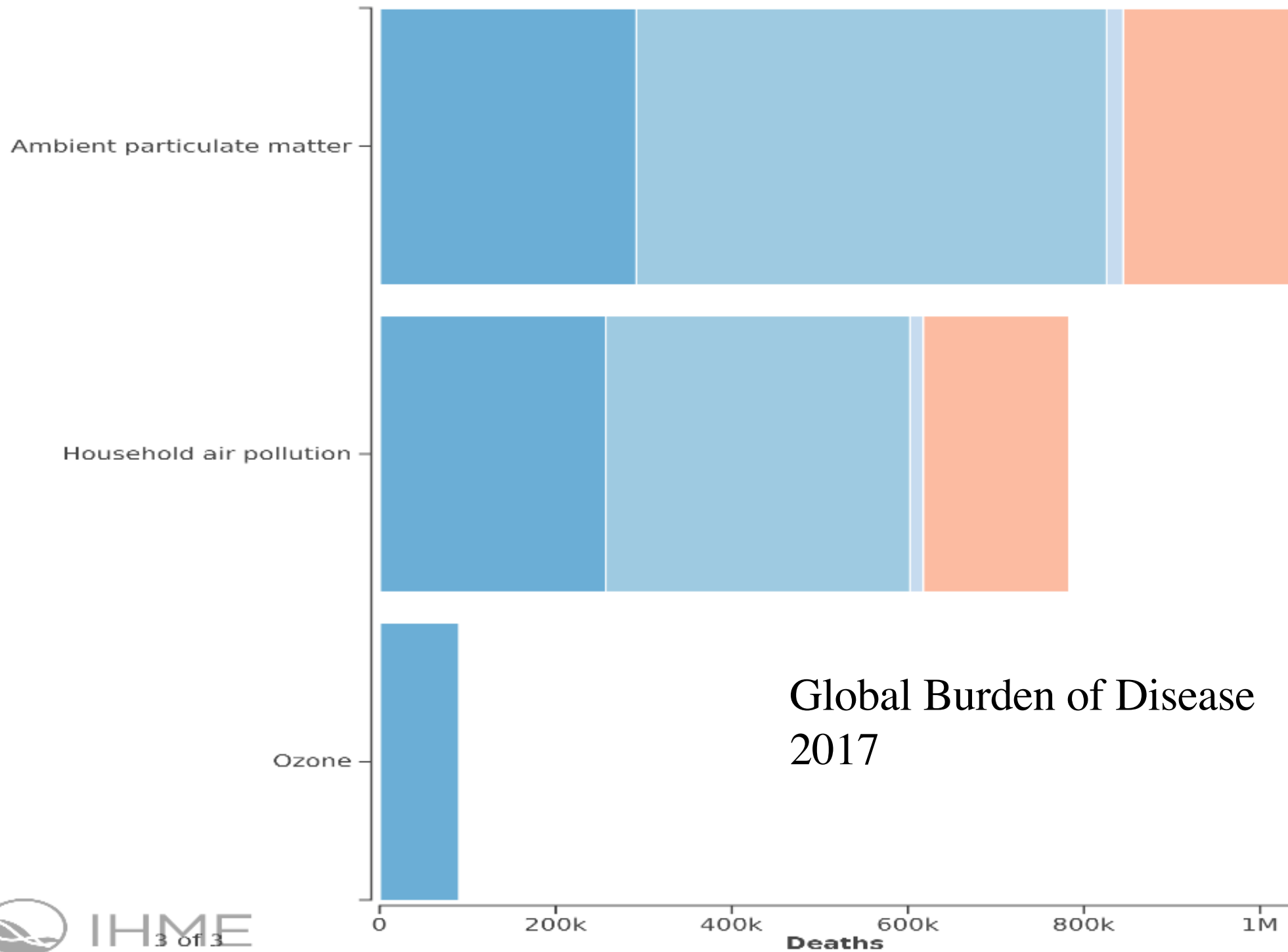
<http://dx.doi.org/10.1289/EHP90>

- Report of the Steering Committee on Air Pollution and Health Related Issues, Ministry of Health and Family Welfare, December 2015
- First Ministry of Health in the world to pay attention to air pollution and put into national health context
- Mandate was health, not pollution from particular sources or in particular places – thus not indoor or outdoor, rural or urban, but integrated human exposure (non occupational)



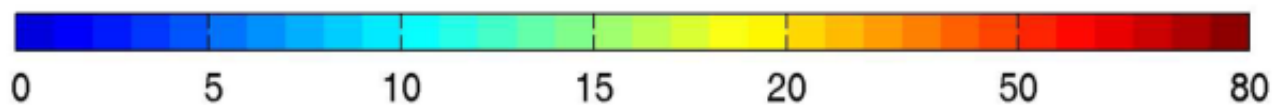
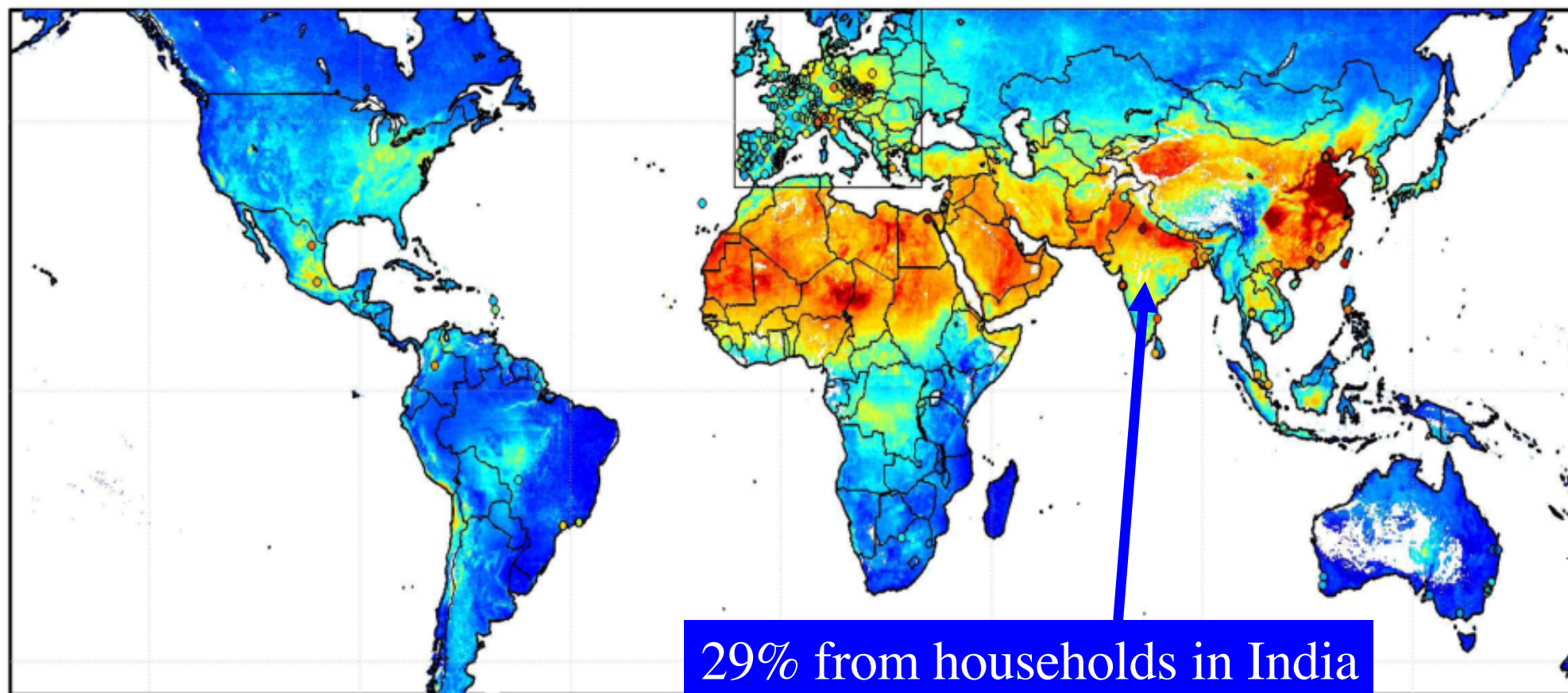
India Burden of Disease, 2017

India, Both sexes, All ages, 2016

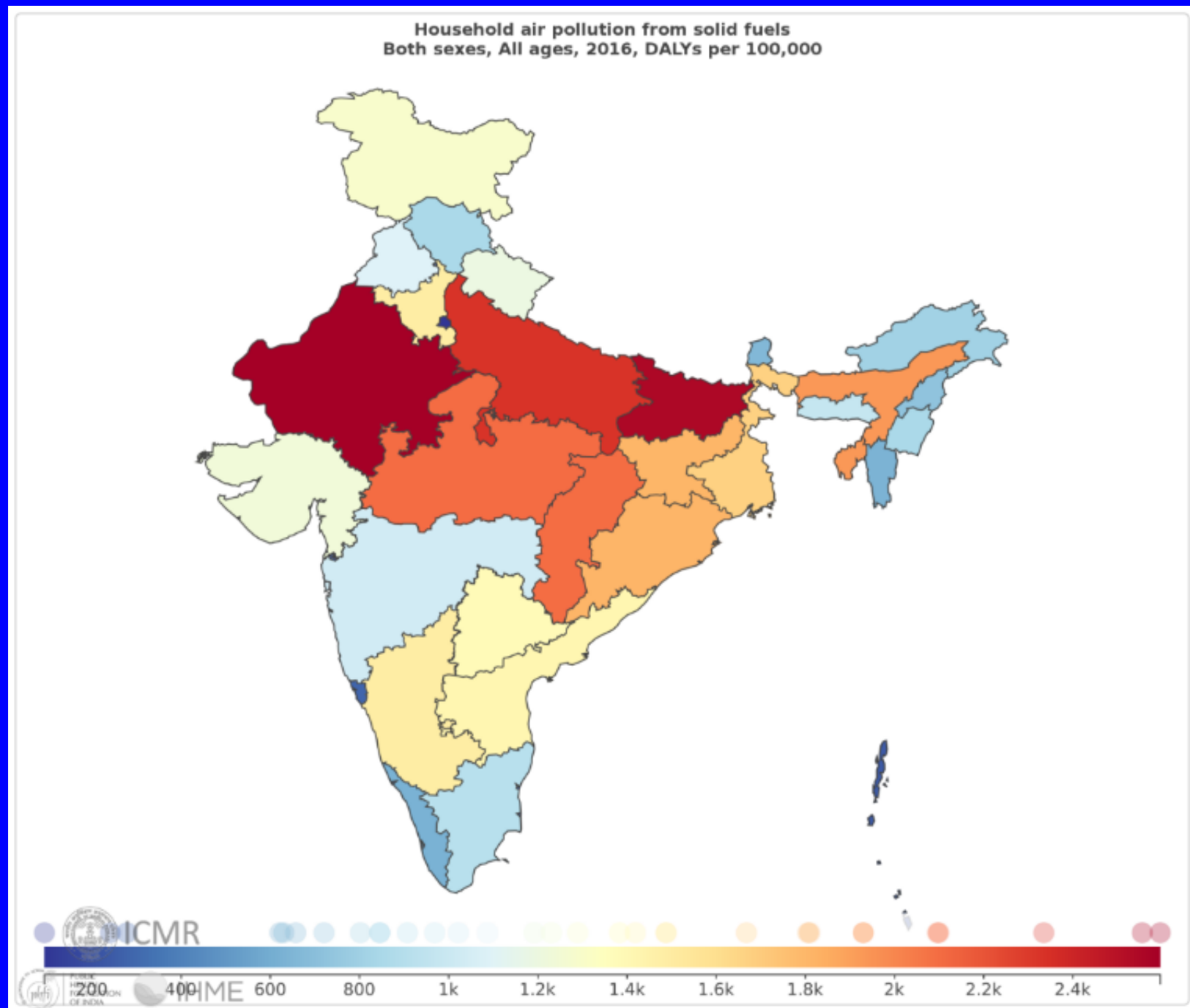


Global Burden of Disease  
2017

# Satellite-based ambient PM<sub>2.5</sub>



Satellite-Derived PM<sub>2.5</sub> [ $\mu\text{g}/\text{m}^3$ ]

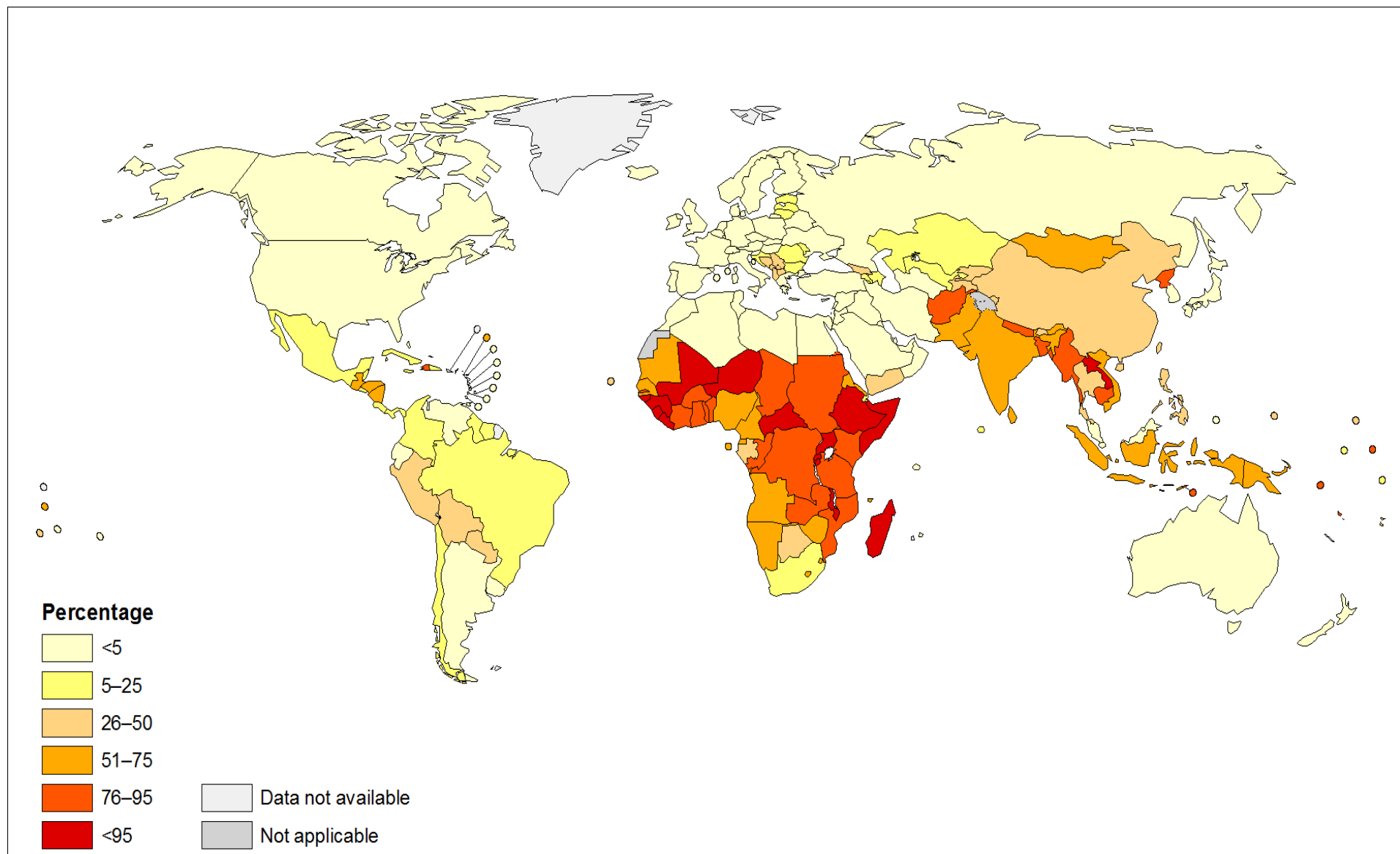


India Burden of Disease, 2017

# Remember

- Numbers are highly uncertain – here are central estimates
- And changing with new models and databases
- Some health outcomes not included
  - Low birth weight/prematurity
  - TB/asthma
  - Other cancers: cervical, etc.
  - Diabetes, arthritis, low IQ

## Population using solid fuels (%), 2010 Total



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

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



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The three major solid fuels



# Toxic Pollutants in Wood Smoke from Simple (poor) Combustion

- Small particles, CO, NO<sub>2</sub>
- Hydrocarbons

Typical biomass cookstove  
releases

- 300-400 cigarettes per hour  
worth of smoke

- 25+ alcohols and acids such as *methanol*
- 33+ phenols such as *catechol* & *cresol*
- Many quinones such as *hydroquinone*
- Semi-quinone-type and other radicals

- Chlorinated organics such as *methylene chloride* and *dioxin*

Source: Naeher et al,  
*J Inhal Tox*, 2007



Does Not Take Much Time in Villages  
to See Smoky Households



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

Typical Health-based Standards

Wood: 1.0 kg  
Per Hour  
in 15 ACH  
40 m<sup>3</sup> kitchen

Typical Indoor Concentrations

Carbon Monoxide:  
150 mg/m<sup>3</sup>

10 mg/m<sup>3</sup>

Particles  
3.3 mg/m<sup>3</sup>

0.1 mg/m<sup>3</sup>

Benzene  
0.8 mg/m<sup>3</sup>

0.002 mg/m<sup>3</sup>

1,3-Butadiene  
0.15 mg/m<sup>3</sup>

0.0003 mg/m<sup>3</sup>

Formaldehyde  
0.7 mg/m<sup>3</sup>

0.1 mg/m<sup>3</sup>

Best single indicator

IARC Group 1 Carcinogens

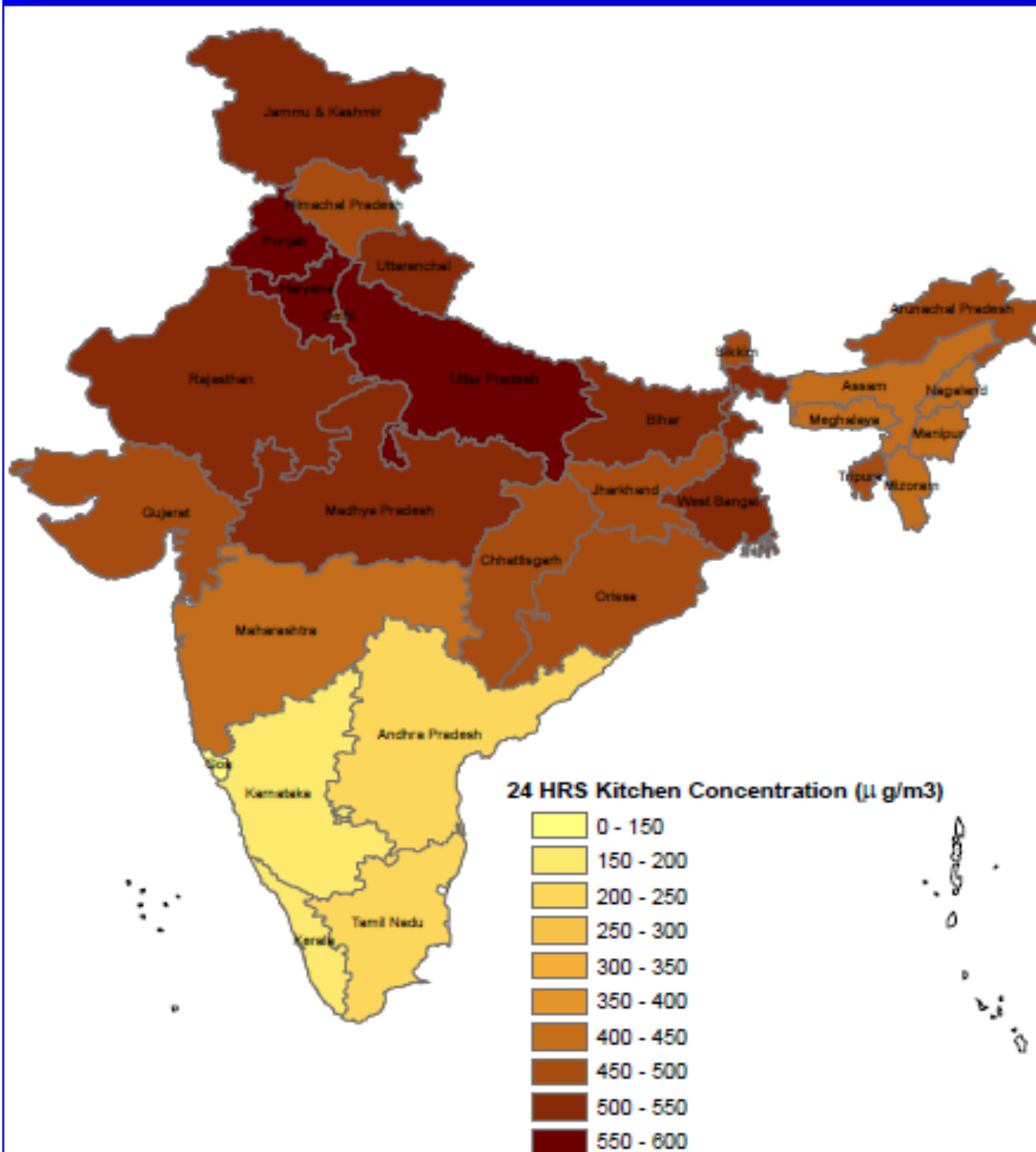


First person in human history to  
have her exposure measured  
doing the oldest task in human history

~6900 ug/m<sup>3</sup>  
during cooking  
>500 ug/m<sup>3</sup> 24-  
hour  
--50 times WHO  
guideline



Kheda District,  
Gujarat, 1981



State-wise  
estimates of  
24-h kitchen  
concentrations  
of PM<sub>2.5</sub>  
in India

Solid-fuel using  
households

Balakrishnan et al.  
2013 (SRU group)

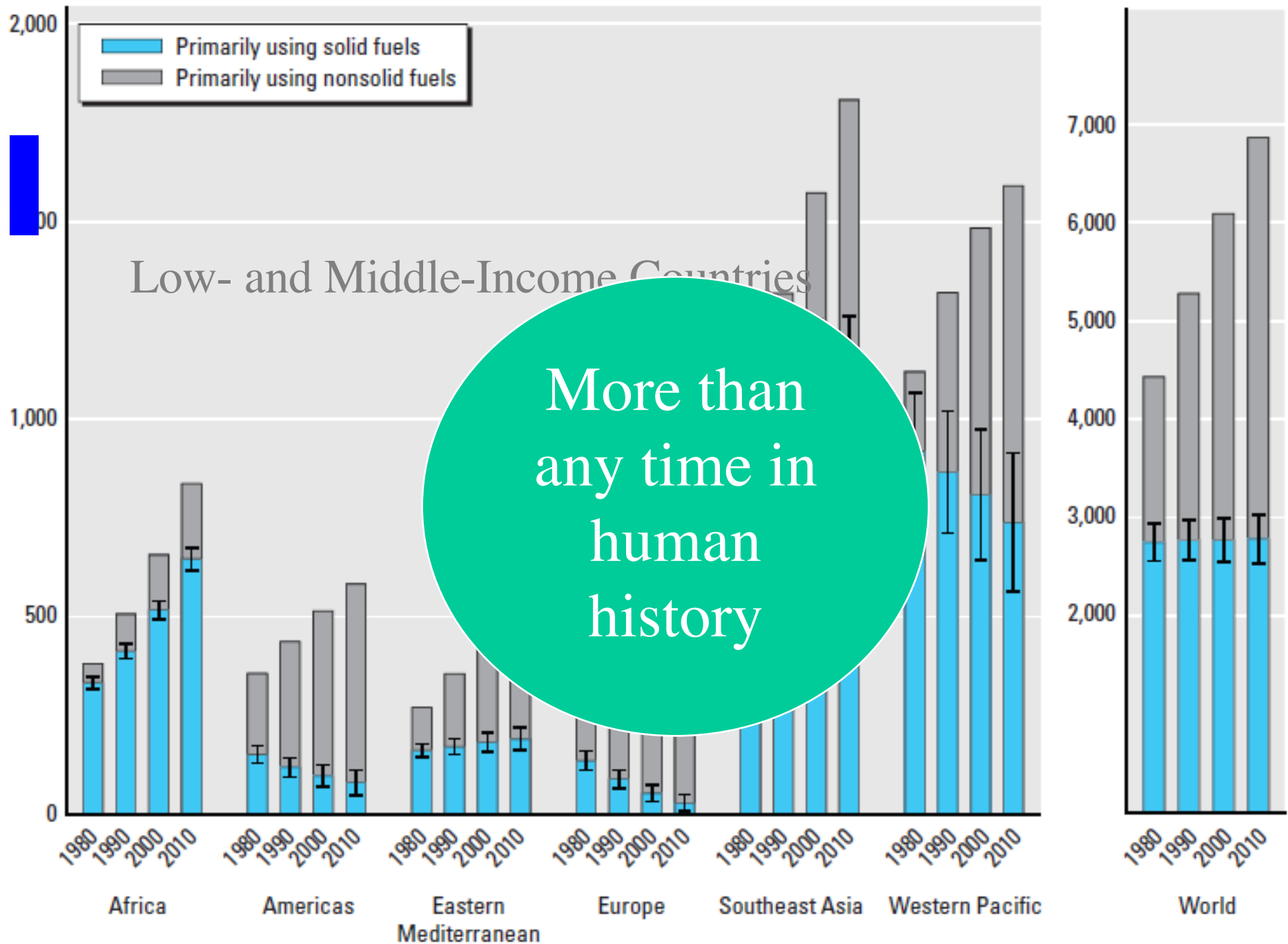
# What has been done-#1

## Wait for development to work.

- Percent using solid fuel slowly declines with development alone (no special policies)
- But in India, the number of people exposed has never declined

## Low- and Middle-Income Countries

More than  
any time in  
human  
history





700 million  
people in the  
Chulha Trap

1990:  
85%: 700  
million people  
using solid fuels

2010:  
60%: 700  
million people

~1980  
700 million  
people  
in entire country

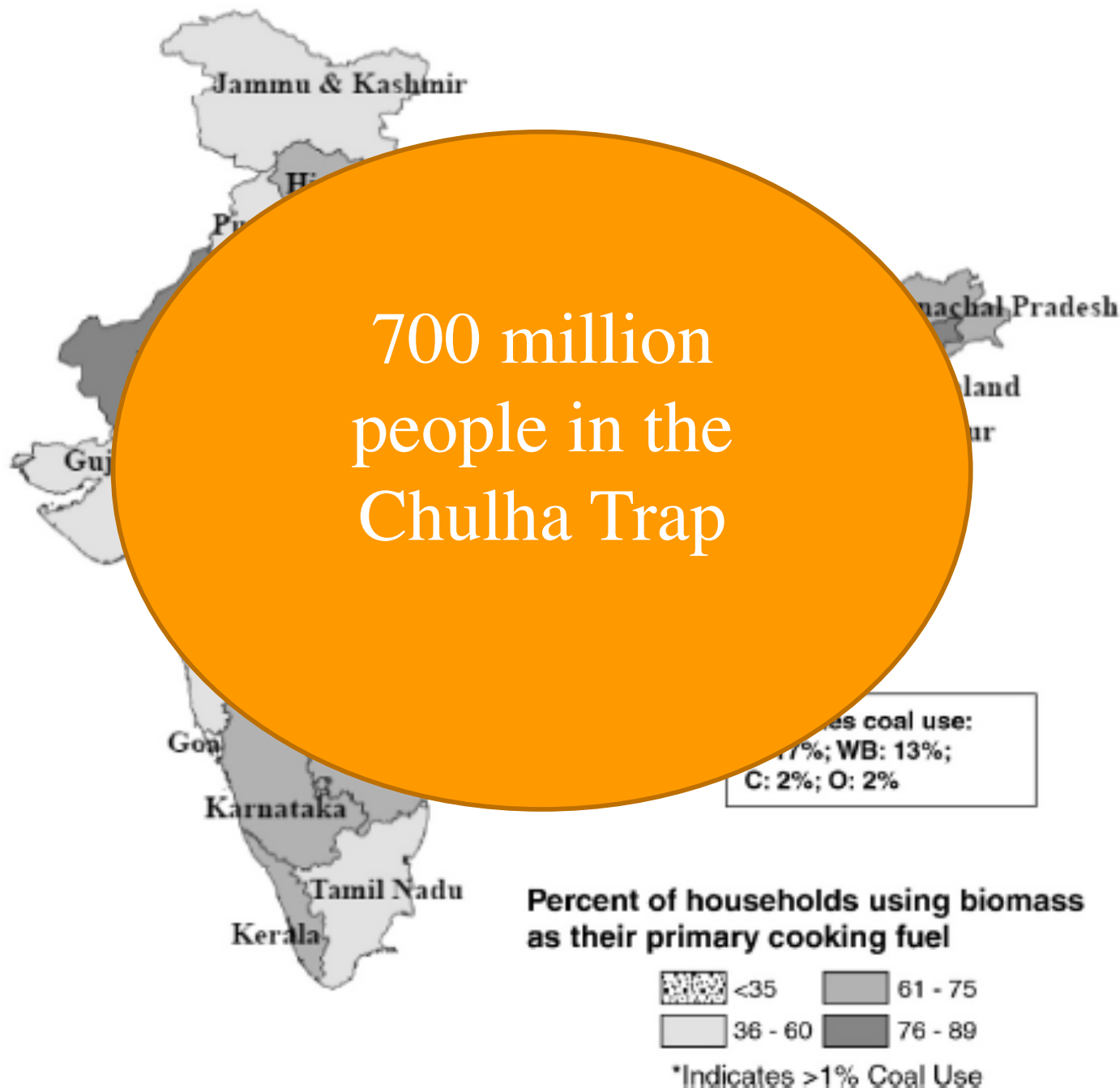


Fig. 1. Distribution by state of households using biomass or coal as their main cooking fuel in 2005. From (IIPS, 2007).

# What has been done #2:

## Make the available clean

- Many hundreds of “improved” biomass stove programs over ~60 years
- Including major national programs in China and India in the 1980/90s covering ~200 million households in all
- And in India, Peru, Mexico, Nepal, Honduras, and other countries today
- Hundreds of NGOs, big and small, promoting stoves around the world over the decades

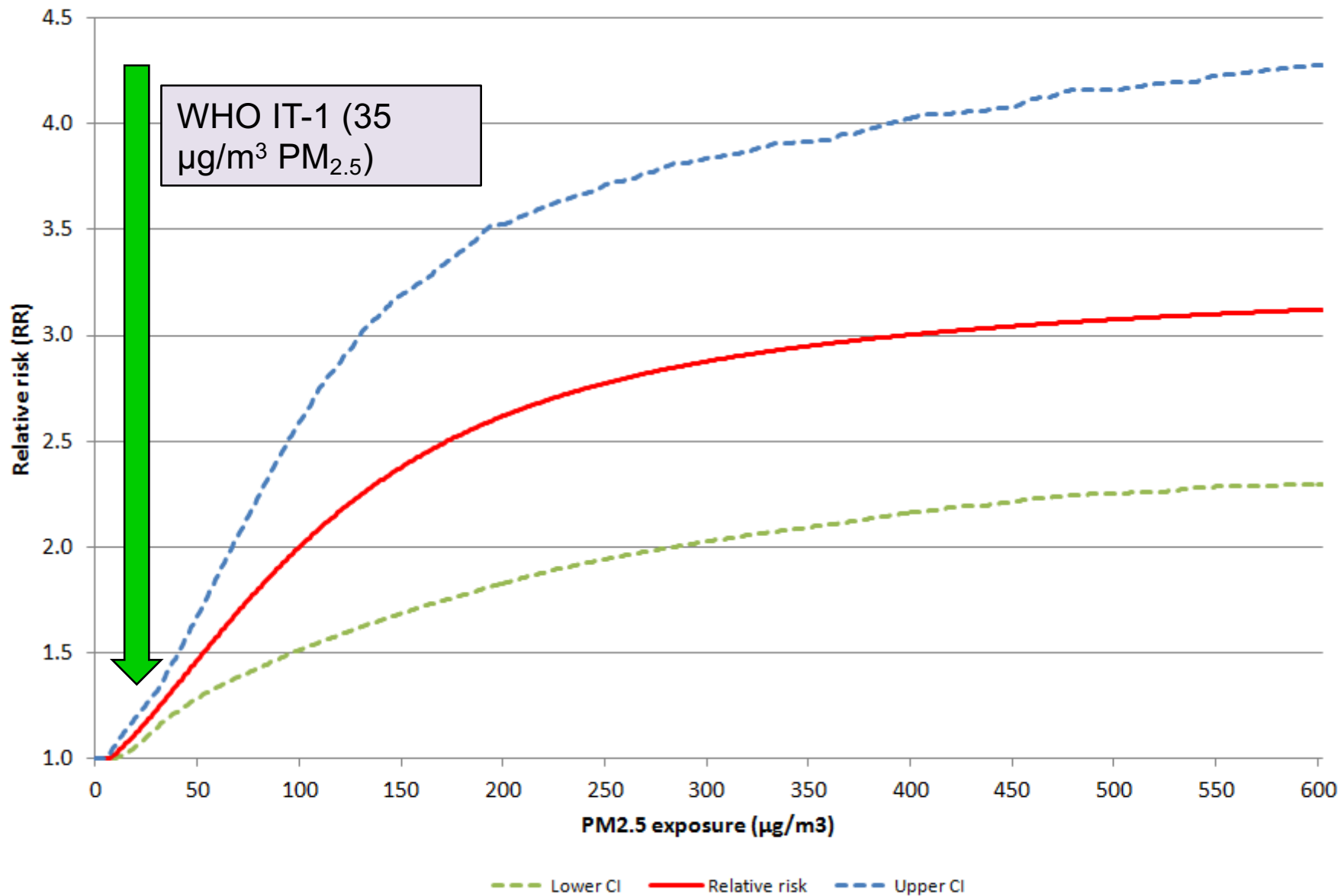
# Diversity of improved cook stoves



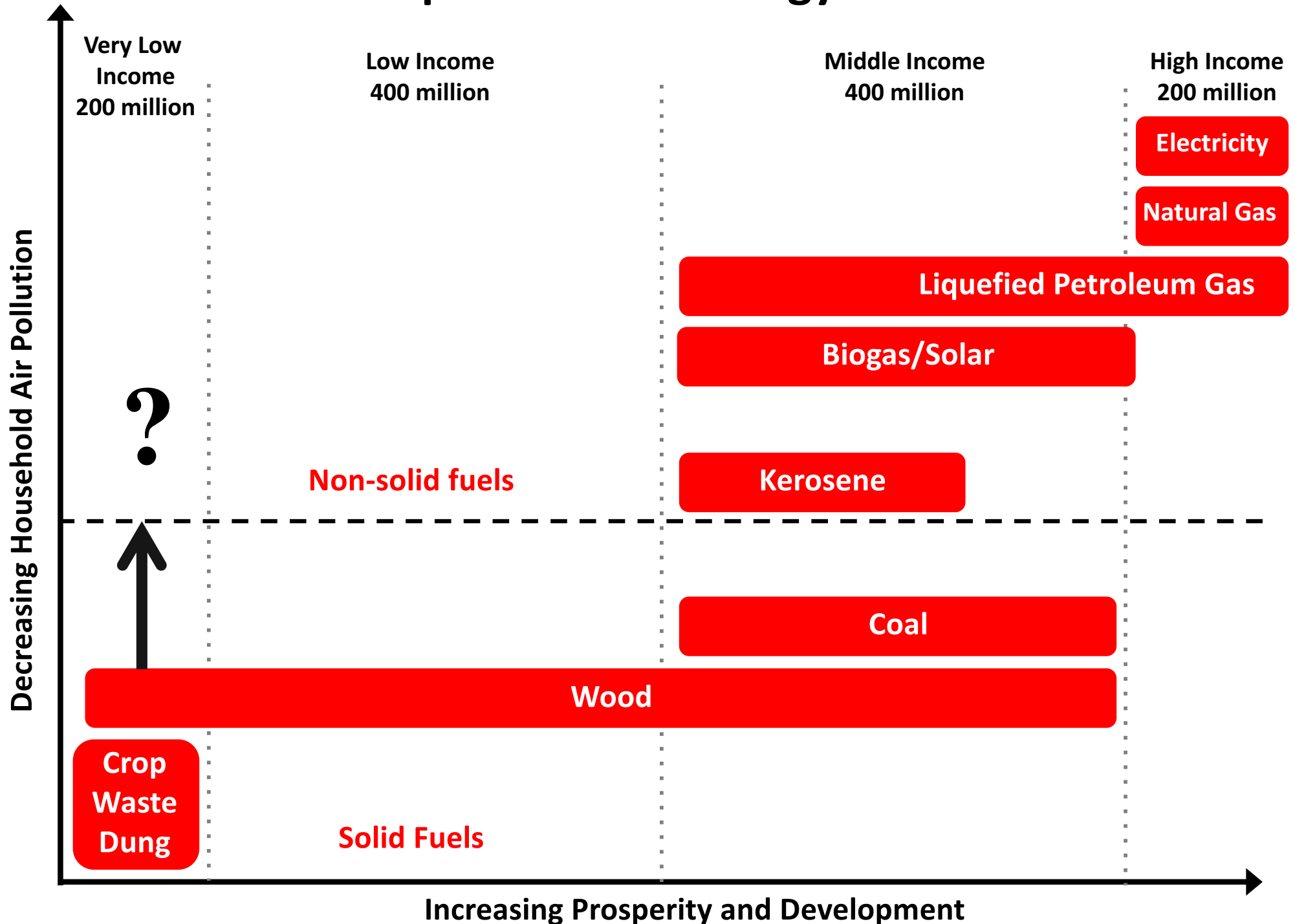
# Unfortunately

- The cleanest “improved” biomass stoves have been disseminated to only a few tens of thousands of households in the world
- And, in spite of much progress, as yet, no “improved” biomass stove in the world comes close to the boundary between solid and non-solid fuels
- Thus, none seem clean enough to be reliably truly health protective in household use
- But more effort is still warranted.

# Risk Curve for PM<sub>2.5</sub> and Child ALRI risk



# Conceptual Indian Energy Ladder



New Paradigm

Making the clean  
available



The background of the slide is a photograph of a kitchen. On the left, a stove is visible with several pots and pans on it. The wall behind the stove is a mottled green and brown color. On the right, there is a large blue rectangular area that serves as a background for the title and some text.

## Liquefied Petroleum Gas - LPG

Except in USA, a mixture of butane and propane

Liquefies just above ambient pressure and thus easy to store and ship

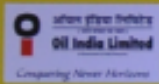
Derived from natural gas production and off-gases from oil refining

World supply greatly increased due to “fracking”

Classic  
LPG Cylinder  
and Stove



Associates



तेल उद्योग सुरक्षा निदेशाल  
OIL INDUSTRY SAFETY DIRECTORATE

&

Centre for Occupational and Environmental Health (MAMC)

# International Conference Occupational and Environmental Health

13-14 December 2013 New Delhi



OIL INDUSTRY SAFETY DIRECTORATE

and



Centre for Occupational and  
Environmental Health (MAMC)

International Conference  
on  
Occupational and  
Environmental Health



# Give It Up campaign

- Middle class gives up their LPG subsidies
- Health is the message – “make a poor man’s kitchen clean”
- Extensive social marketing
  - Modi and other celebrities in speeches, media ads, bill boards, etc
  - SMS messages
  - Fairs, athletic events, posters, skits, etc
  - Website linking those giving up to those receiving: middle class to poor



Feel the Joy of Giving

: Initiated by



**Ministry of Petroleum & Natural Gas**  
Government of India







“ Now no more  
smoke-induced tears  
for our mothers  
while cooking ”

- Shri Narendra Modi, Hon'ble Prime Minister

**Shri Narendra Modi**

Hon'ble Prime Minister

shall distribute

**LPG connections to 5000**

**BPL families under the**

**GiveltUp campaign**



Date: 2<sup>nd</sup> October 2015 | Venue: Dumka Airfield Ground, Dumka, Jharkhand | Time: 1:00 pm



[www.facebook.com/petroleummin](https://www.facebook.com/petroleummin) | [www.MyLPG.in](http://www.MyLPG.in) | [www.twitter.com/PetroleumMin](https://www.twitter.com/PetroleumMin)

Times of India  
Oct 2, 2015

Gandhi's  
Birthday

MyLPG website: Feb 24, 2016



## Scroll of Honour

## Total no of customer who have Giveitup subsidy

We appreciate your action of giveitup. It truly demonstrates your care and concern towards the less privileged.

Your example will surely motivate millions. Annual Savings accrued till now (₹ 13976740800)



State :

All States ▼

Consumer No :

SUBMIT

Consumer Name

Consumer No

State

Sankar Baidya

52311

Andaman And Nicobar

Ratan Chandrakar

13006

Andaman And Nicobar

Y.md. Shahul Hameed

45830

Andhra Pradesh

Search By: ☒ Giveitup Champion ☐ Beneficiary

Search Name:

LPG Id:

SEARCH

SHOW ALL

#Giveitup CHAMPION	BENEFICIARY
MUNIAMMAL	MISHRI DEVI GURJAR
J.RAY CHOUDHARY	BALE . MALLAIAH
KALAISELVI. V. MRS.	SHIV . KUMAR
SHREE RAJA GOVIND SINGH KHANDELA	RIYAJ . AHMAD
MOHD.SHAHID	A. RASHID S/O KARIMULLA
SAFIQ	EESVAR . SINGH
MAHENDRA PRASAD TRIPATHI	VIJENDRA . JATAV

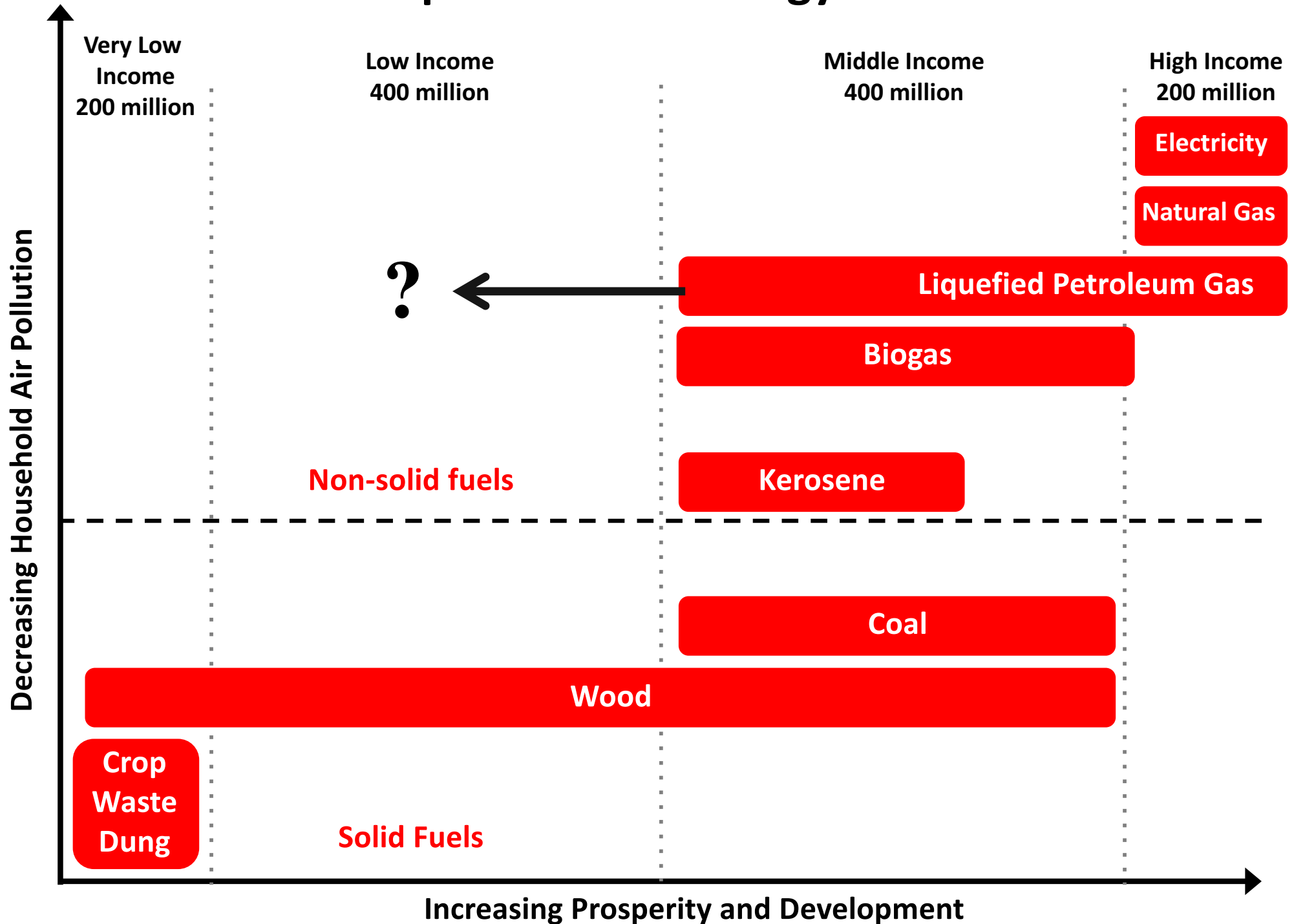
GO

# LPG expansion, cont.

- Ujjwala Campaign: April 1, 2016
  - Extend past GIU with more incentives
  - To reach a total of 50 million below poverty line households in 3 years
  - Plus 50 million other households
  - 1.2 billion USD devoted by Indian Gov
  - 250 million USD/year from middle class
  - 10,000 new distributors being hired
  - A huge enterprise!

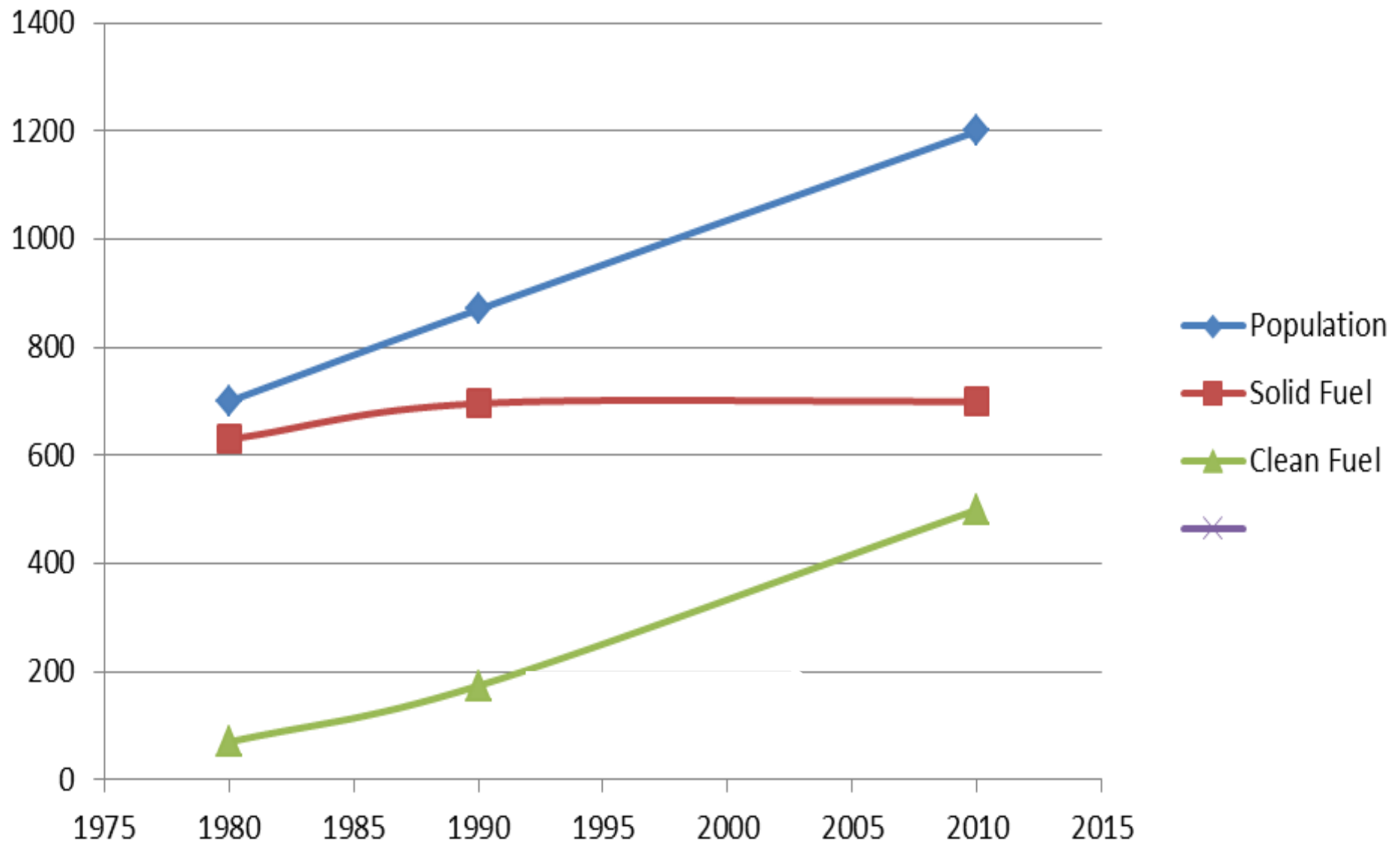


# Conceptual Indian Energy Ladder



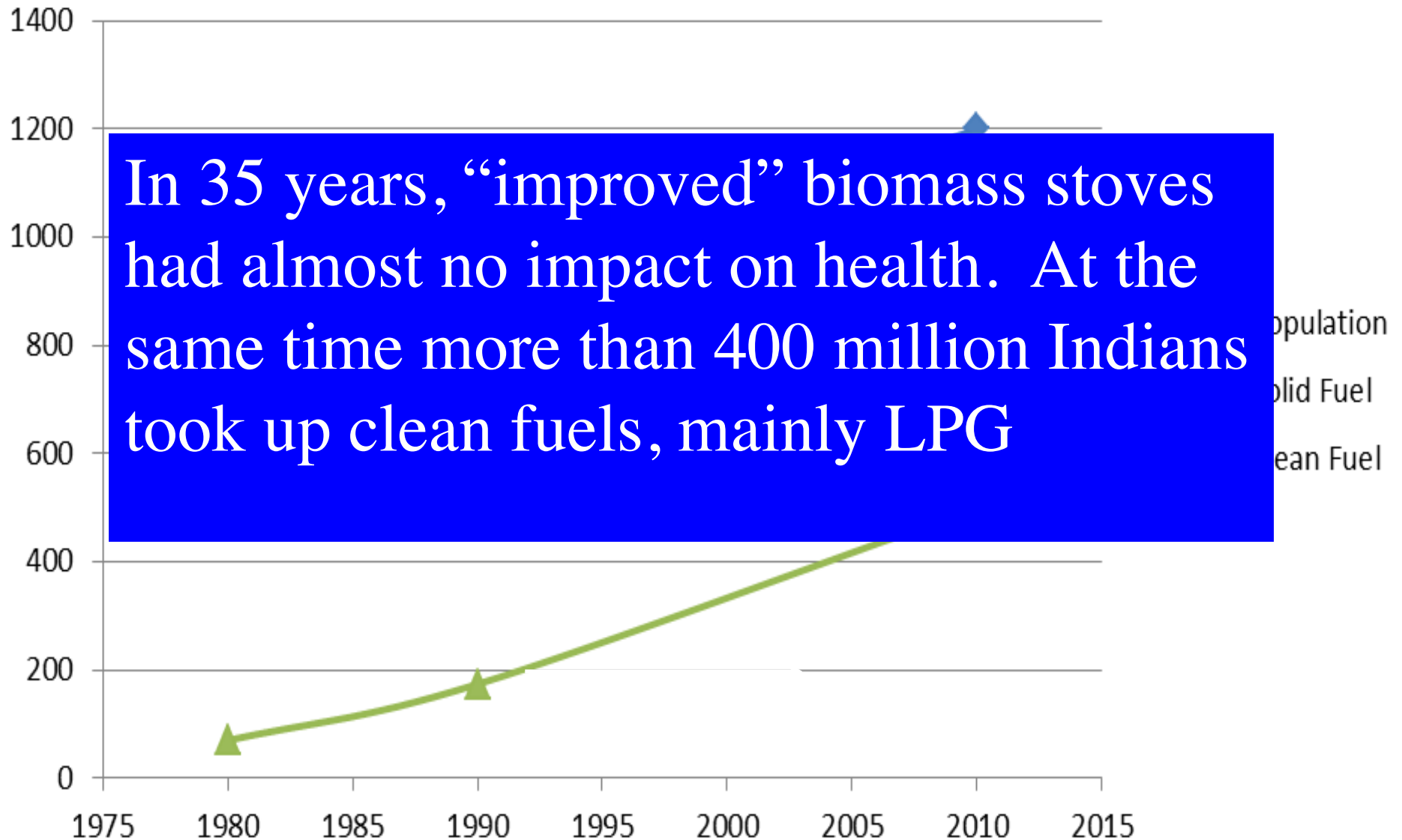
# India: What happened?

Millions



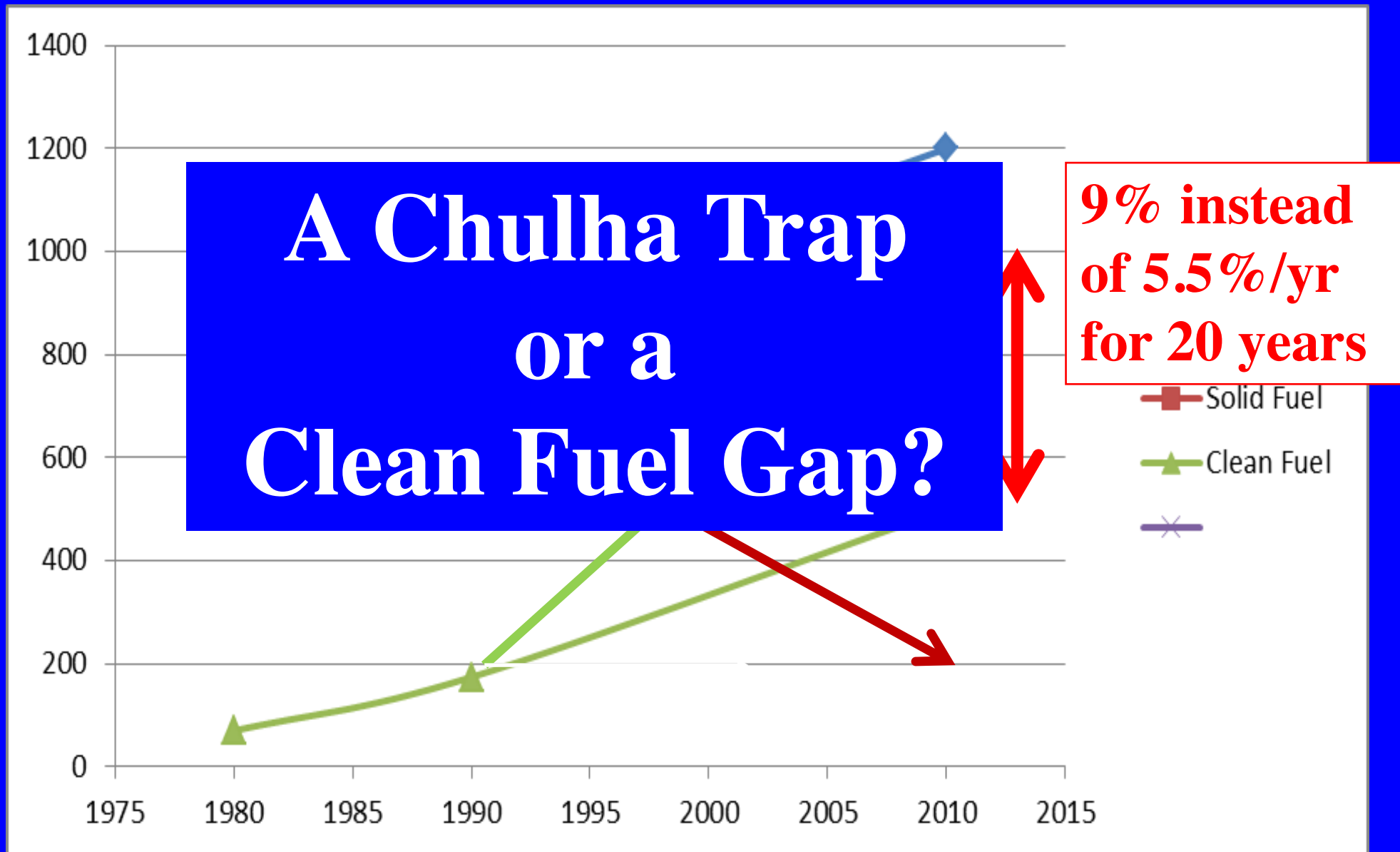
# India: What happened?

Millions



# India: What If?

Millions



## Of course

- Just providing affordable access to LPG or other clean fuel does not mean people instantly switch 100%
- However, since 60% of world uses gas and/or electricity it argues strongly that the others will eventually follow.
- Is clearly what is needed in long term – why not sooner rather than later using techniques learned from other health sectors?

# Subsidy or ?

- In order for public support of clean fuels to be termed social investments, they need to be far better targeted than in the past.
- Give it up helps, but far more targeting is needed
- Insufficient income tax coverage to use this metric
- Use of modern asset-based indicators from national surveys offer some hope
- Embrace modern IT to do so
  - JAM: bank accounts, ID card, mobile phone

# What have we learned?

- Health sector used to promoting usage – indeed it is common – latrines, TB drugs, bednets, condoms, low salt foods, etc.  
Access is just the start
- Smart subsidies to focus on specific financial barriers that can be termed social investment
- Conditional cash transfer – pay for the behavior desired



# Collaborative Clean Air Policy Centre

The background of the slide is a high-angle photograph of a valley. In the foreground, there are rocky, brownish hills. Below them, a town with many small buildings is visible, surrounded by green trees. In the distance, there are more mountains under a bright blue sky with scattered white clouds and a large, bright sun in the upper center.

New Delhi  
[info@ccapc.org.in](mailto:info@ccapc.org.in)  
<http://ccapc.org.in/>





# Collaborative Clean Air Policy Centre

Joint Activity of  
Indian Institute of Technology Delhi  
Sri Ramachandra University Chennai  
The Energy and Resources Institute (TERI)  
University of California Berkeley  
and  
UrbanEmissions.com – knowledge partner

[info@ccapc.org.in](mailto:info@ccapc.org.in)  
<http://ccapc.org.in/>



Many thanks

For publications  
& presentations:  
Just “Google”  
Kirk R. Smith

