

Household and Ambient Air Pollution in India: Five New Paradigms

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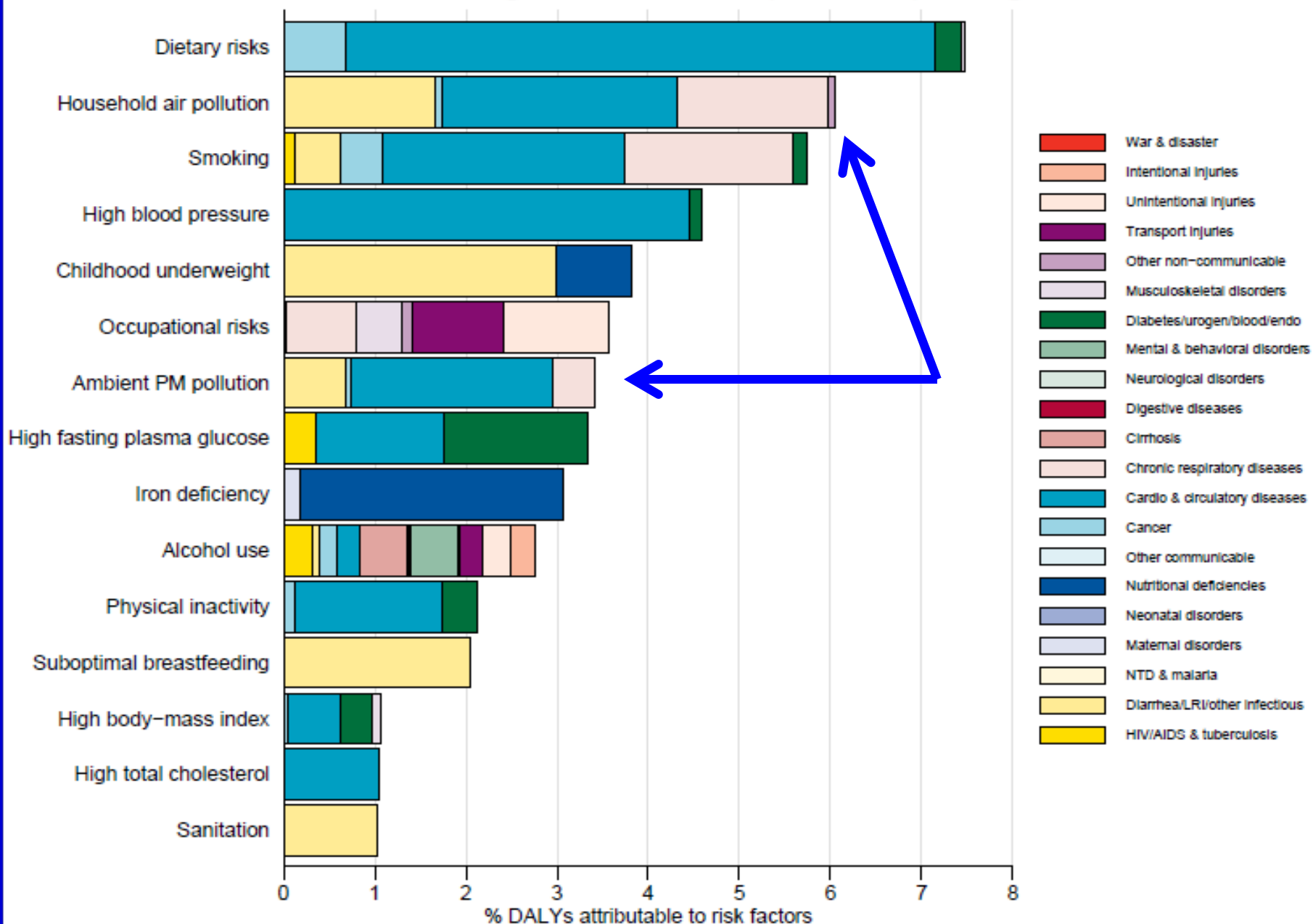
Declarations of Bias

- A focus on health, with other objectives secondary
- A focus on India, which does not represent all parts of the world

Household Air Pollution from Solid Cooking Fuels

- One of the top risk factors in the world for ill-health.
- Biggest impact in adults –3.4 million premature deaths (two-thirds the DALYs)
- Still important for children ~500,000 deaths (one-third the DALYs)
- About one million premature deaths in India
- Biggest single risk factor of any examined for Indian women and girls
- Important source of outdoor air pollution

Burden of disease attributable to 15 leading risk factors in 2010, expressed as a percentage of India DALYs



What has been done-#1

- Wait for development to work.
- Bottom line
 - Percent using solid fuel declines with development
 - But not number of people exposed

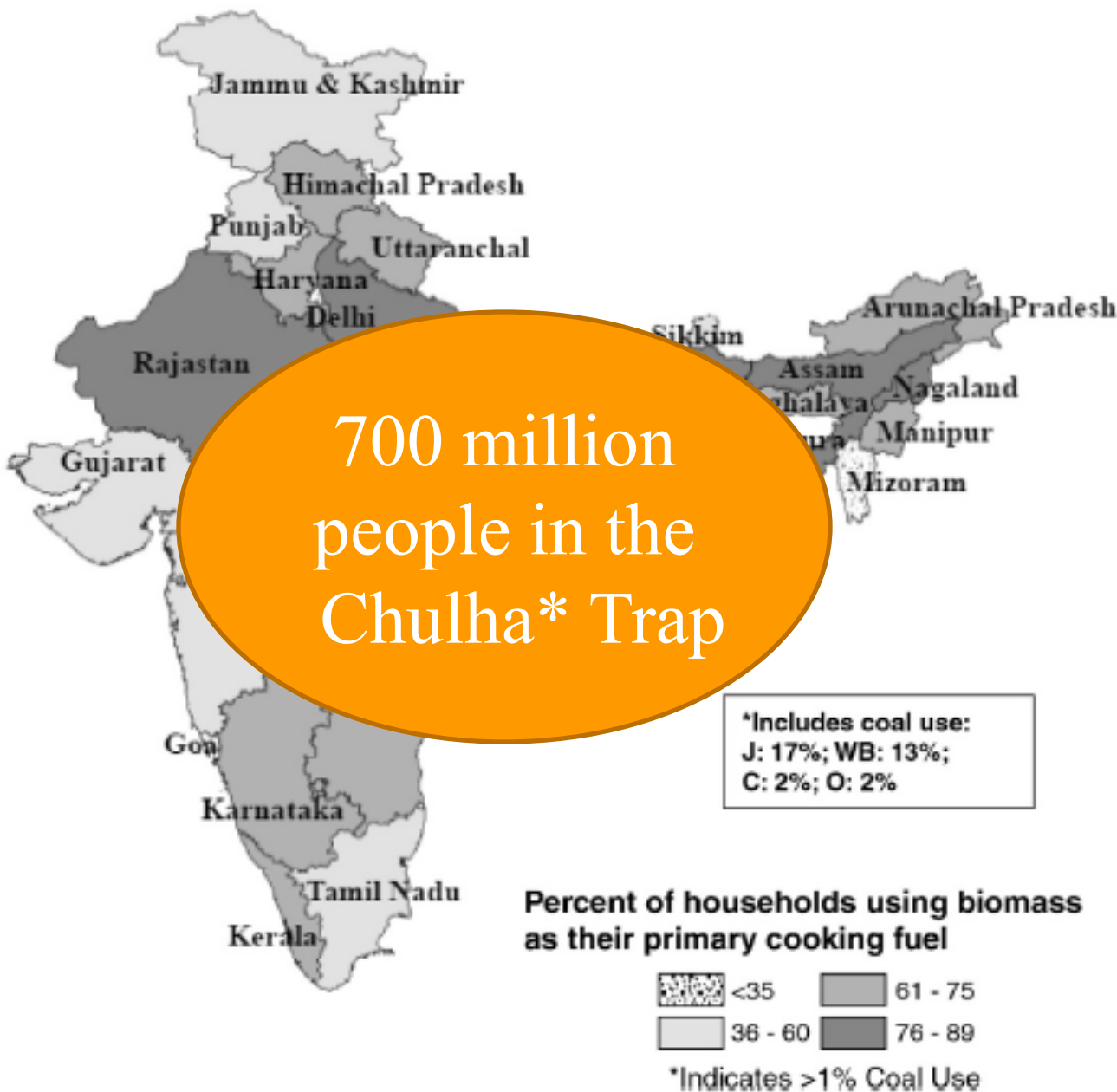


Fig. 1. Distribution by state of households using biomass or coal as their main cooking fuel in 2005. From (IIPS, 2007).

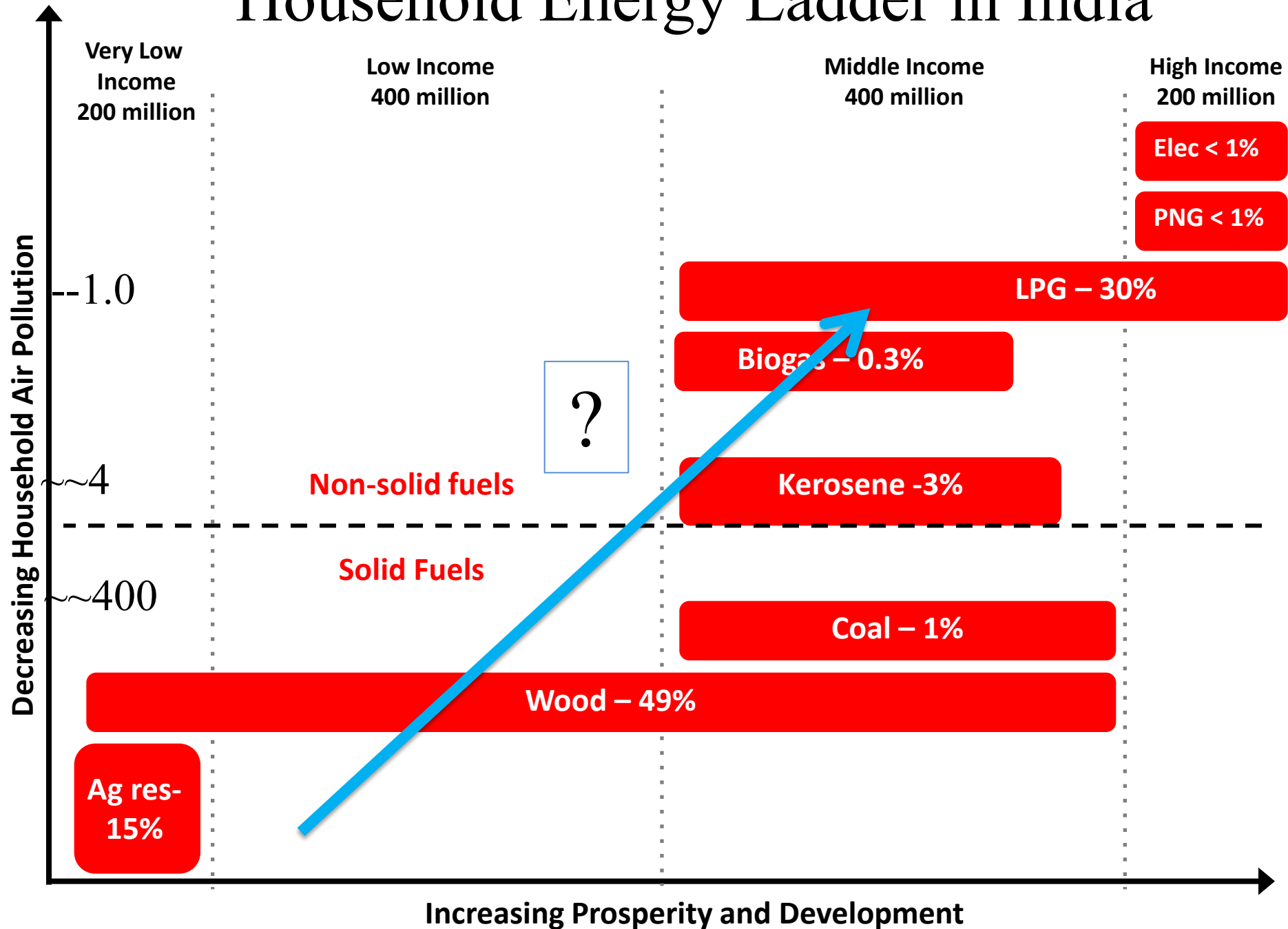
* Primary traditional cook stove in India

1990:
85%: 700
million people
using solid fuels

2010:
60%: 700
million people

~1980
700 million
people
in entire country

Household Energy Ladder in India



What has been done-#2

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

Diversity of improved cook stoves



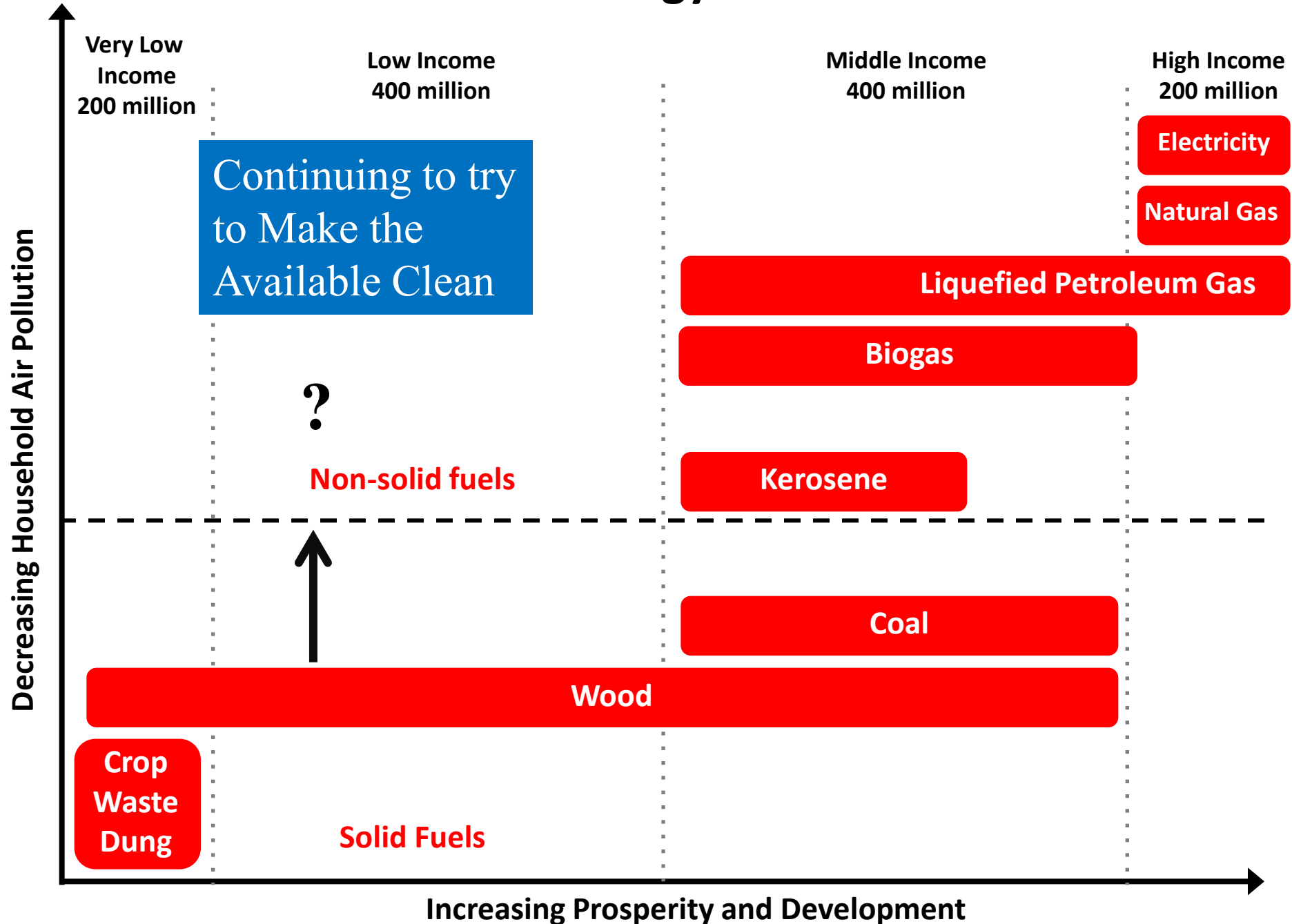
27.0



Bottom Line - #2

- The cleanest stove models have been disseminated to only a few 100s of thousands of households
- And, as yet, no biomass stove in the world comes close to the boundary – is clean enough to be truly health protective in household use
- Based on our current understanding of the exposure-response relationships

Indian Energy Ladder

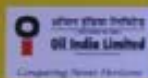


Five New Paradigms

Paradigm #1

Making the clean
available

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)

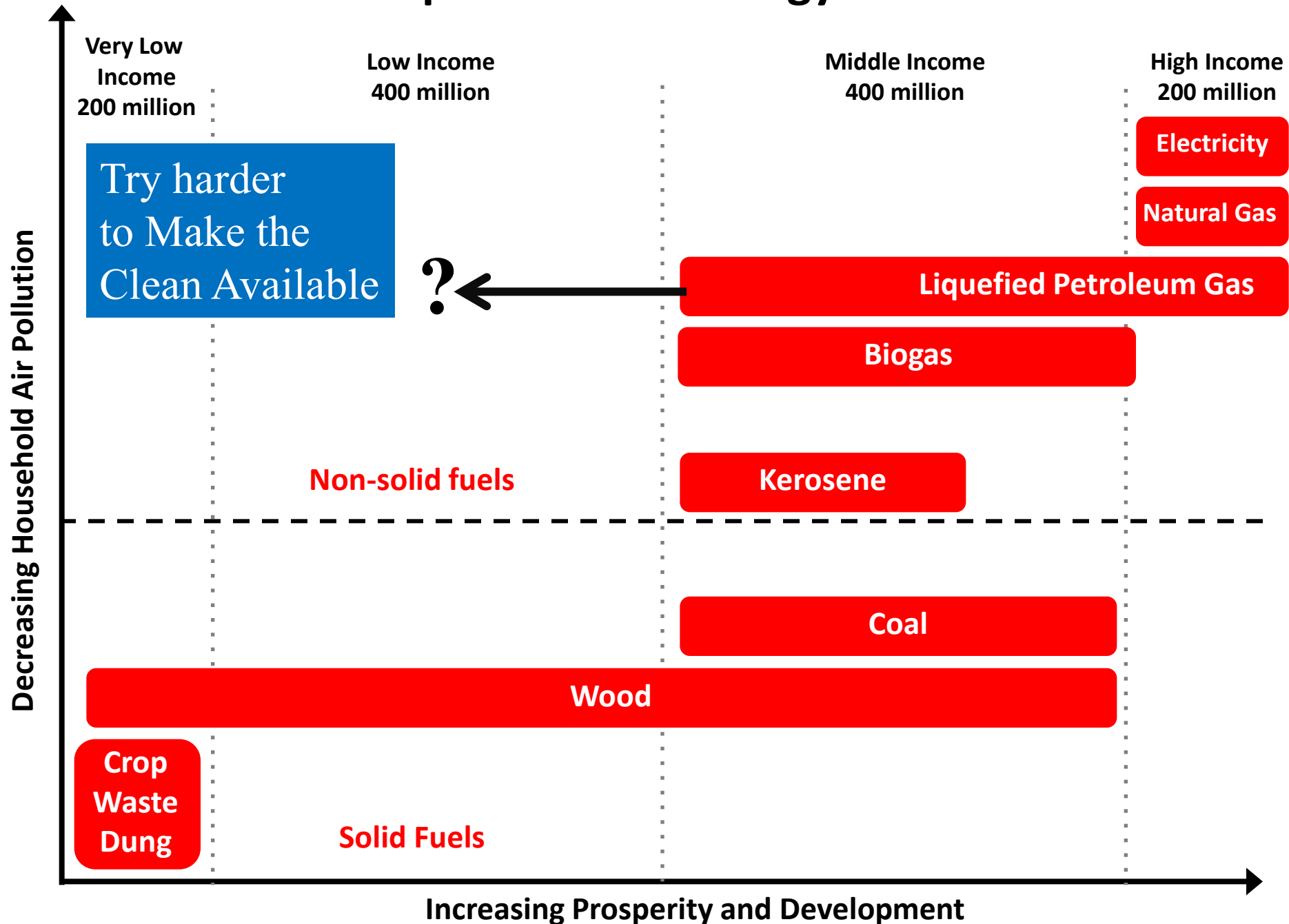
International Conference
on
Occupational and
Environmental Health



Secretary Vivek Rae

- Doubled number of LPG distributors for the next year ~10 million new people by adjusting requirements for distributors
- Ministry now developing plan to increase access in rural India to 90+% by 2027.
- Requires a major effort related to imports, finances, infrastructure, distribution modes.
- And, importantly, by gradual introduction of smarter subsidy schemes using modern technology, actually decrease LPG subsidies over time.

Conceptual Indian Energy Ladder



Paradigm #2

Stepping out of the box

If you don't need your father's land line, why your mother's stove?

- Electrification, although having been slow and unreliable, is picking up in India – 4 states plus big cities now close to 24/7 – others on the way
- Electrification allows a wide range of highly efficient cooking devices – every time a switch is flicked, instead of a match, it is good for health



What is an induction cookstove?

- Electric, yes, entirely different technology from traditional electric stoves
- High frequency magnetic field induces heat in pot alone
- More efficient ~90% instead of ~60%
- Faster cooking ~1.5x
- Safer and cooler— surface is warm but does not burn or cause fires
- Long-lived, easy to clean
- Large economies of scale in manufacture like other electrical devices

Induction Cooktop Market in India 2012-2016

Published: March 2013
Infiniti Research Limited

35.4% per year growth
predicted: 2012-2016

Factor of nearly
five increase!

- Bajaj Electrical Ltd.
- Compton Greaves Ltd.
- Eurolux
- Glen Appliances Pvt. Ltd.
- Inalsa
- Jaipan Industries Ltd.
- Kenwood Ltd.
- Khaitan Electrical Ltd
- Morphy Richards
- Panasonic Corp.
- Phillips
- Preethi Kitchen Appliances, Ltd.
- Sunflame
- TTK Prestige Ltd.**
- Usha International Ltd.
- Westinghouse

Flying off the shelves in China



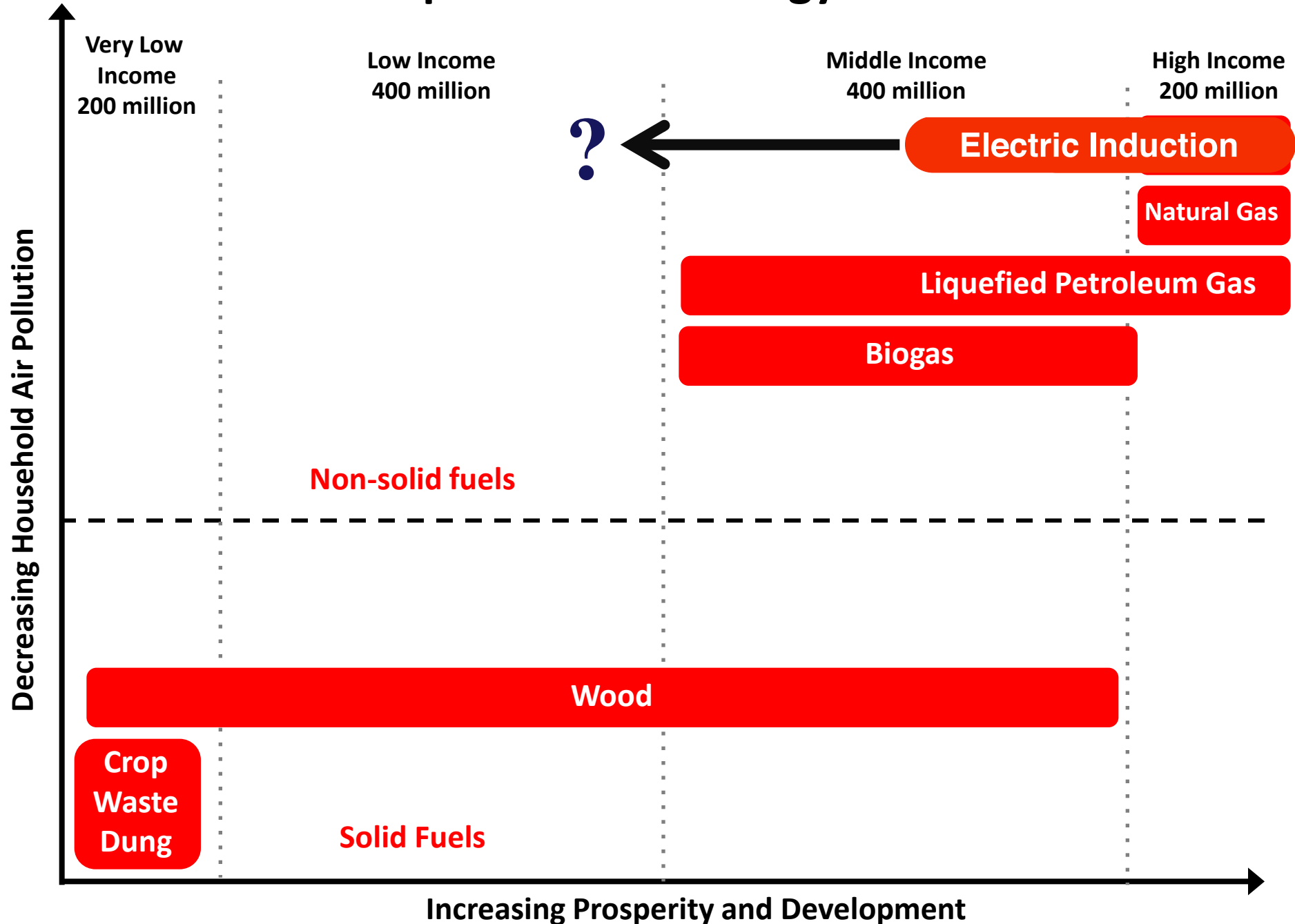
Costs coming down dramatically

US \$7.80 each (with warranty):

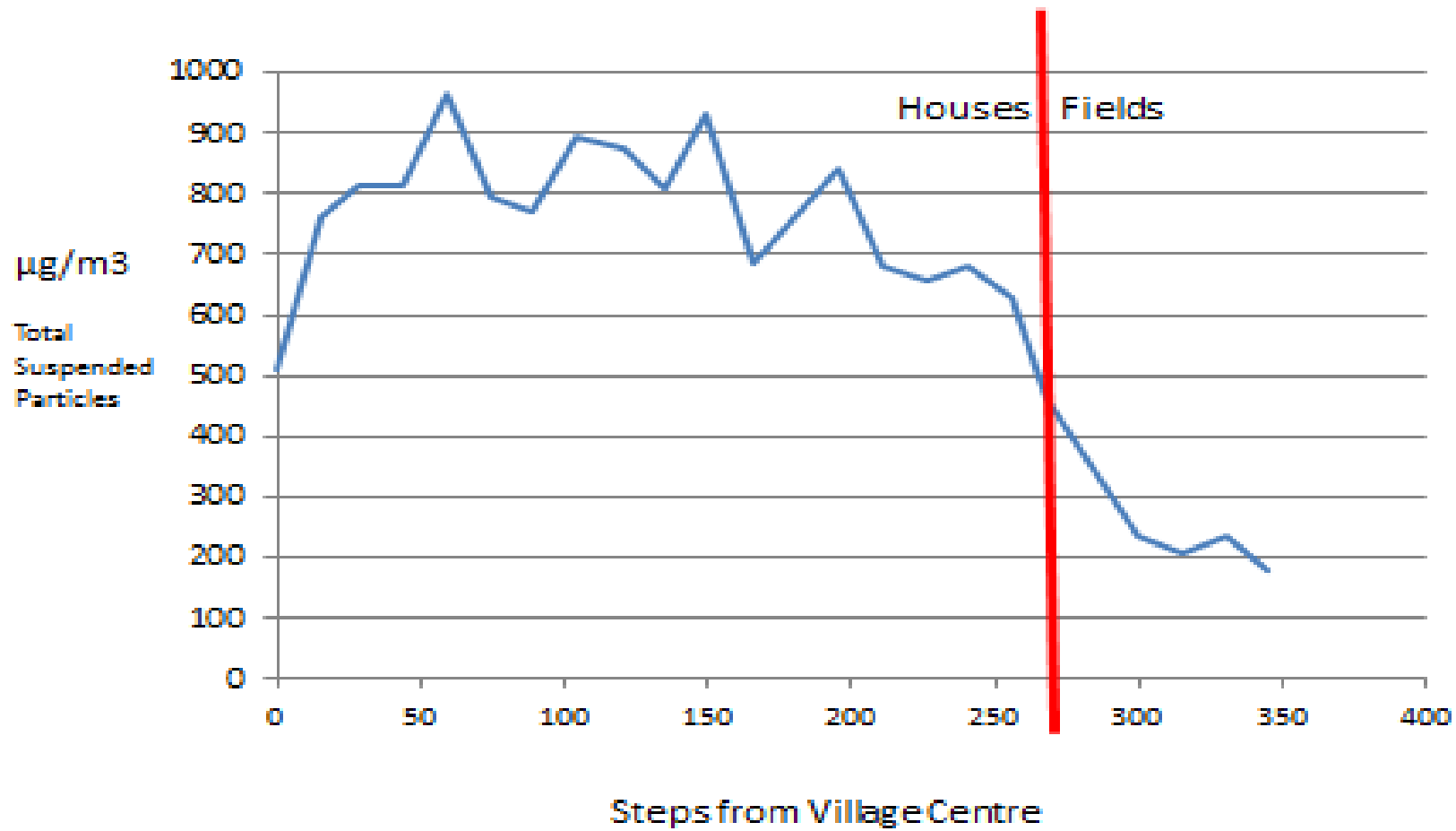
The cost of two coffee lattes

Ecuador has \$250 million loan from
Chinese Export Bank to
change out every stove
in the country to induction

Conceptual Indian Energy Ladder



Paradigm #3: It takes a village



Gujarat, Feb Evening

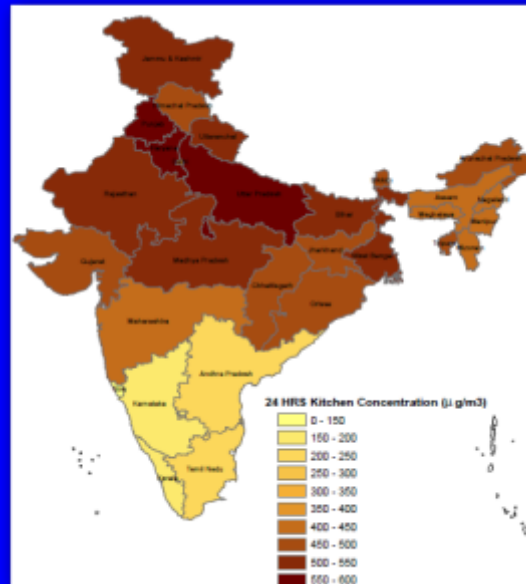
Changing out one chulha at a time is not as effective as changing out whole villages

- Learned in sanitation programs years ago
- There are both household and community benefits to clean fuels/stoves and latrines.
- And with community interventions, a new set of incentives and social pressures become possible.
- And more efficient provision of service

Nirmal Gram Puraskar

- Government of India has been promoting sanitation coverage to ensure better health and quality of life for people in rural India.
- In 2005, it launched an award-based Incentive Scheme for open-defecation-free villages, blocks, etc called “Nirmal Gram Puraskar”
- Need parallel or coordinated “Smokeless Village Schemes”

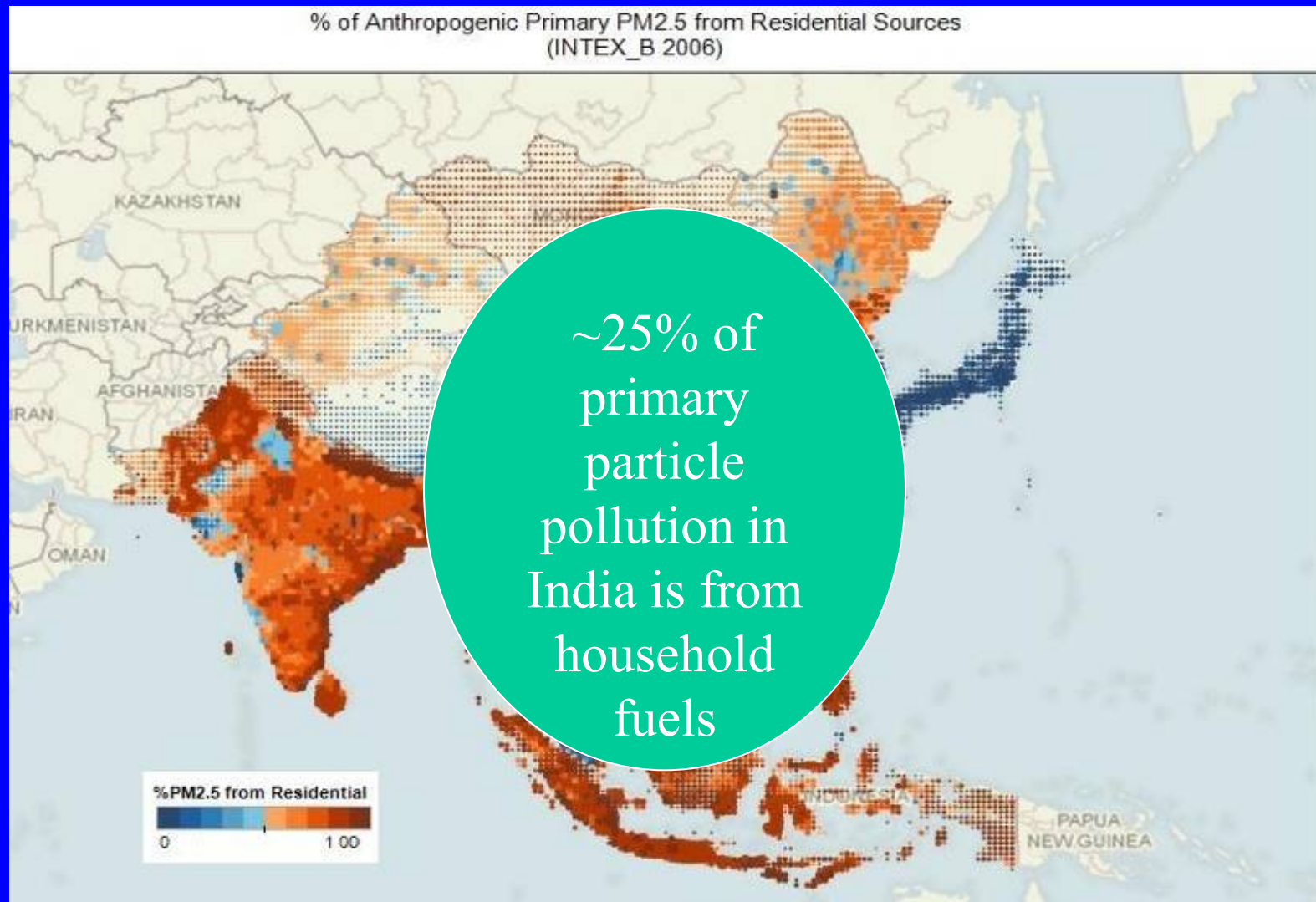
Paradigm #4: All Indians cook in the same kitchen!



How is that?

- All breathe the pollution coming from kitchens
- Clean fuel availability for cooking linked nationally
- Health impacts directly affect all – families, migration, worker productivity, etc.

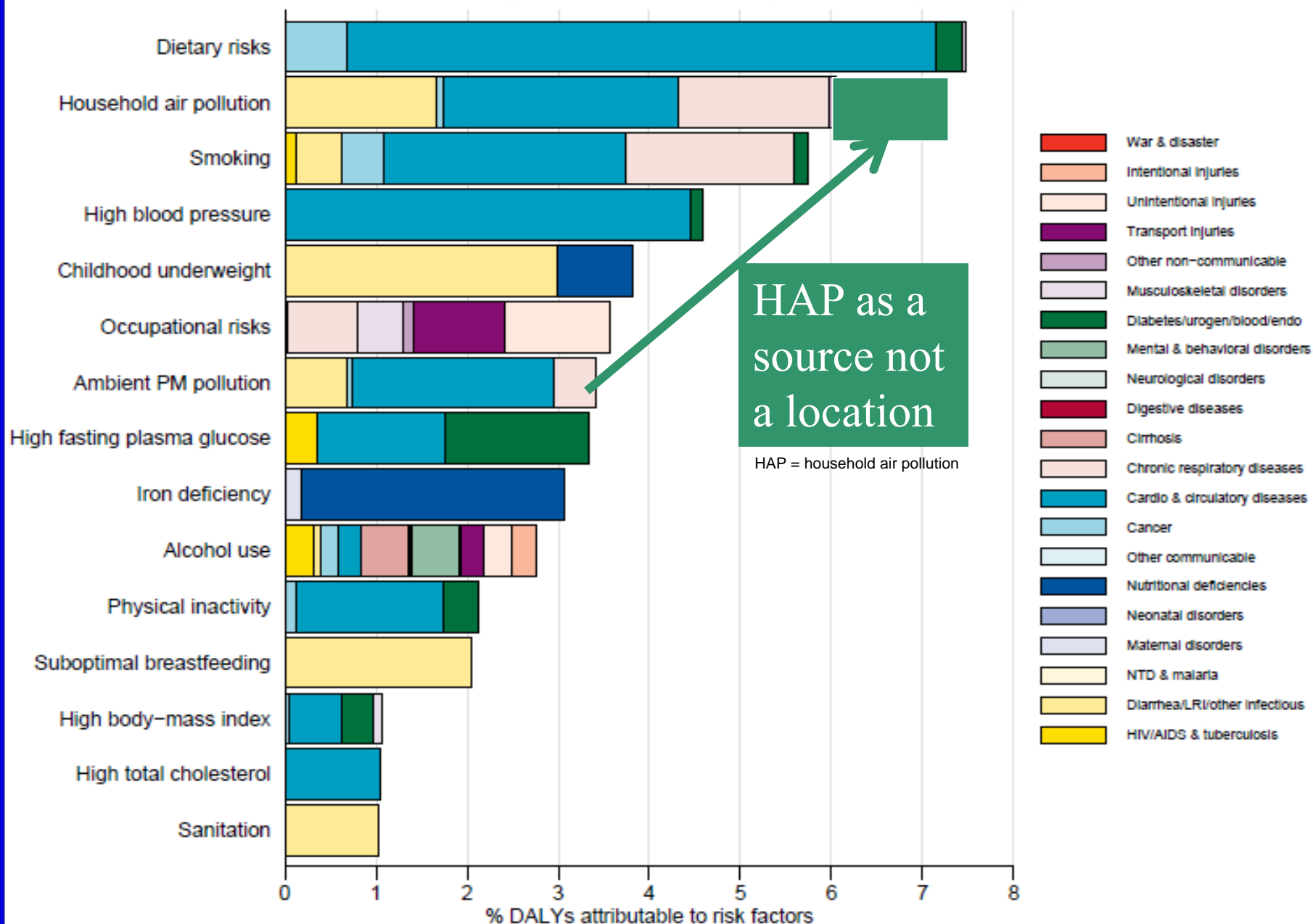
%PM_{2.5} from “Residential” Emissions : NASA



Source: Asian Emission Inventory for NASA INTEX_B 2006 (accessed 2010)

Chafe, 2010

Burden of disease attributable to 15 leading risk factors in 2010, expressed as a percentage of India DALYs



Paradigm #5: It is a health issue

- Not primarily an energy, climate, or employment issue
- Health sector finds the most effective solutions possible and makes them available
- Treats all the same: we do not have rural vaccines and urban vaccines
- Not stopped by taste, custom, poverty, special interests, or political correctness
- Not afraid of advanced tech that works

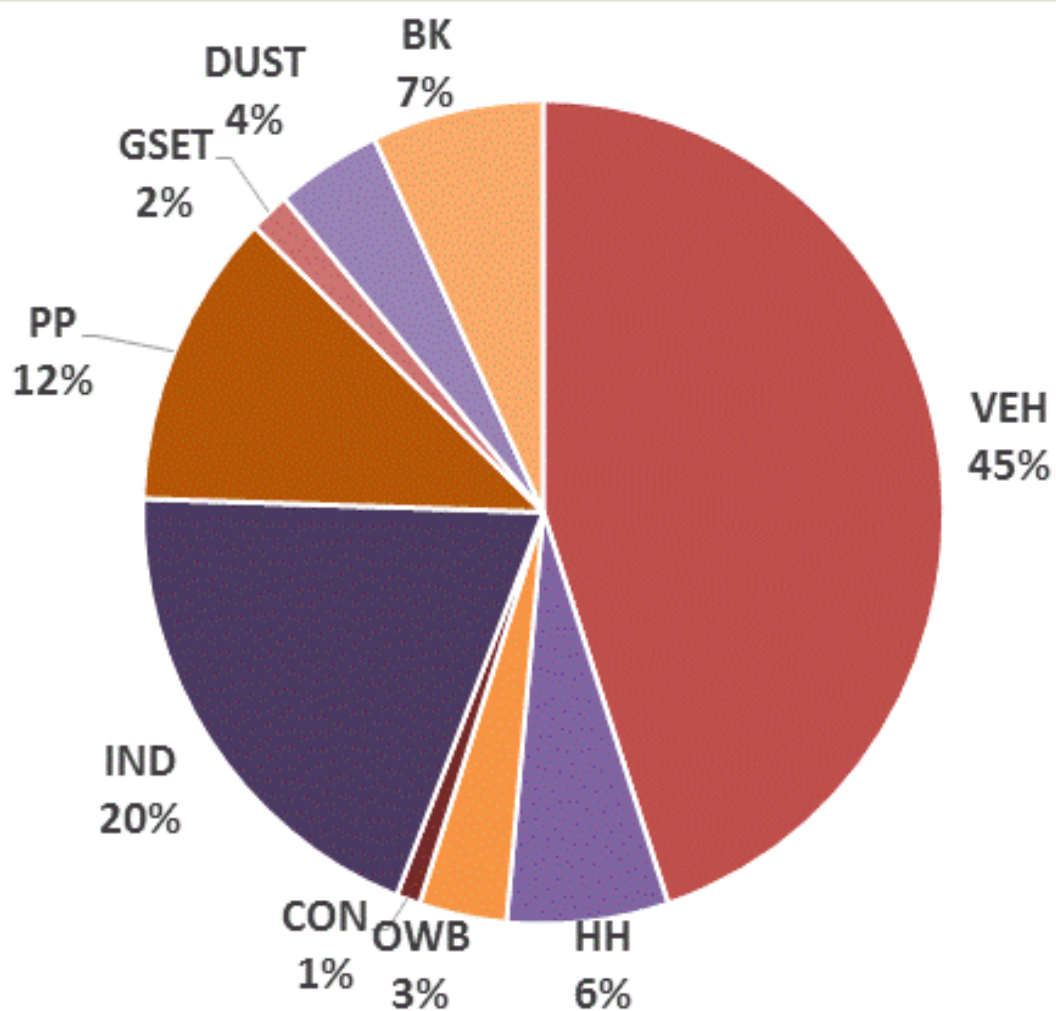
Ministry of Health and Family Welfare Air Pollution Task Force (MoHFW)

- First Ministry of Health in world to treat AP as one of its major priorities and consider along with other risk factors in its mission
- First government agency in the world not to address AP by location, but by total exposure – a true health focus
- Thus, not indoor/household, not outdoor, but by what will give the most health benefit

MoHFW AP Task Force

- Total exposure approach requires utilizing estimates of intake fraction by source category.
- Broken into “near field” and “ambient” intake fractions
- Emissions weighted essentially by proximity to population
- Goal is to change source apportionment to exposure apportionment

Chennai-2012



Emissions – PM_{2.5}

Draft MoHFW Report
estimates by Guttikunda

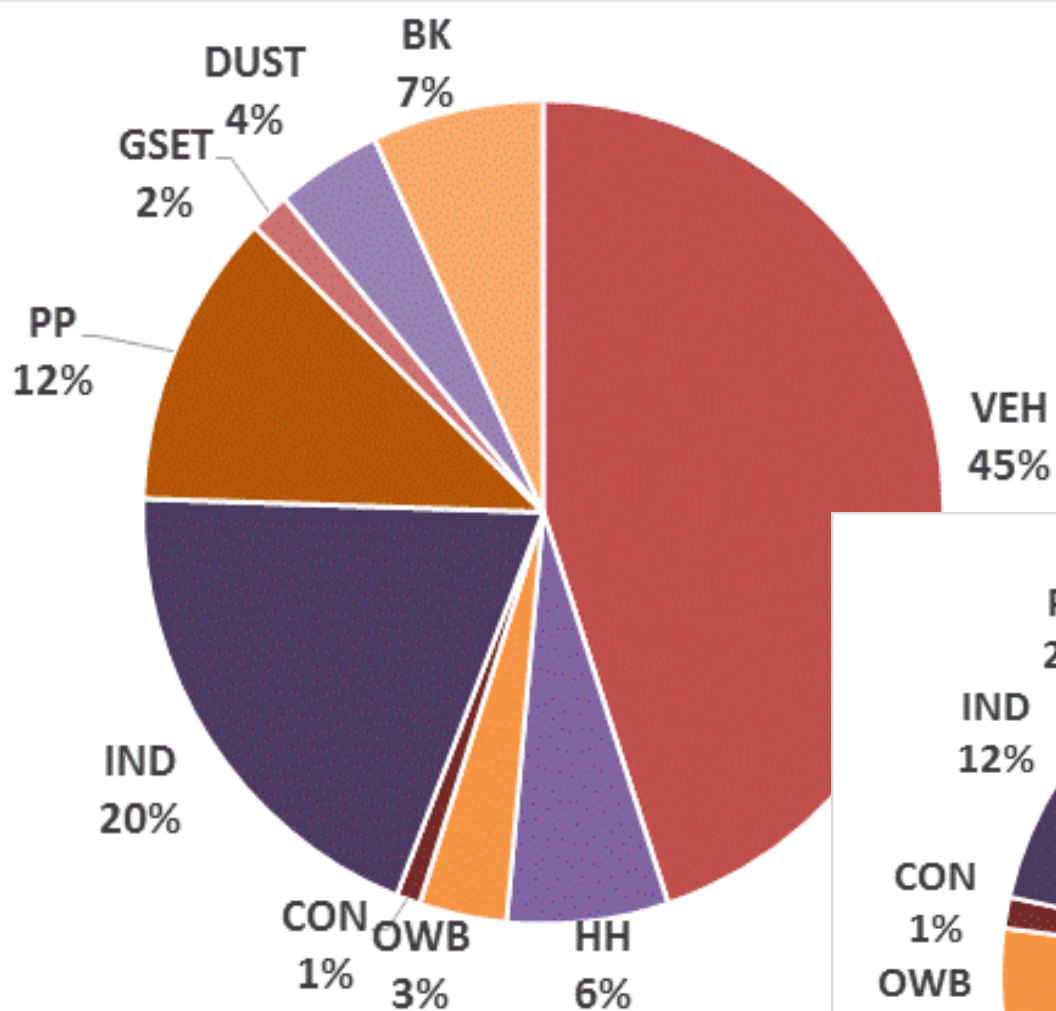
Ambient Intake Fractions in Chennai

ppm – grams inhaled per tonne emitted

	Average	SD
Waste.burn	109.9	14.6
Veh.exhaust	89.4	11.6
Gen.sets	89.1	14.6
Construction	85.9	10.4
Households	76.3	12.0
Dust	63.2	9.6
Industries	36.9	11.0
Brick.kilns	11.6	17.8
Power plants	8.1	8.4

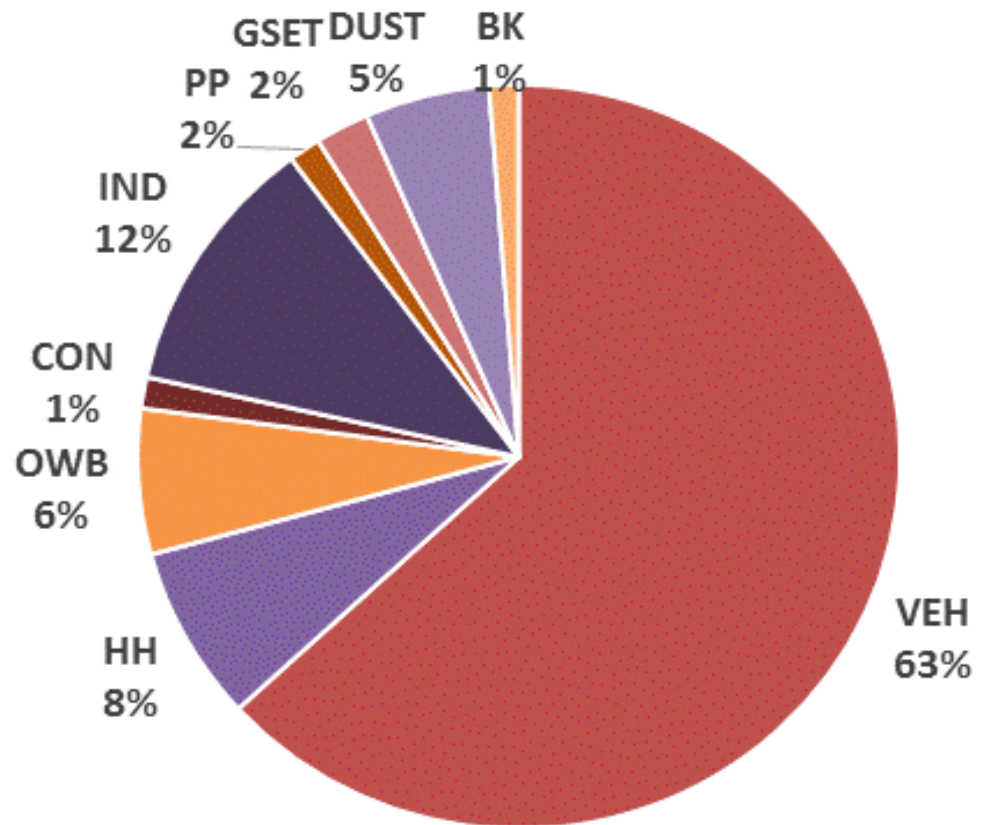
Chennai-2012

Exposures – PM_{2.5}



Emissions – PM_{2.5}

Draft MoHFW Report
estimates by Guttikunda



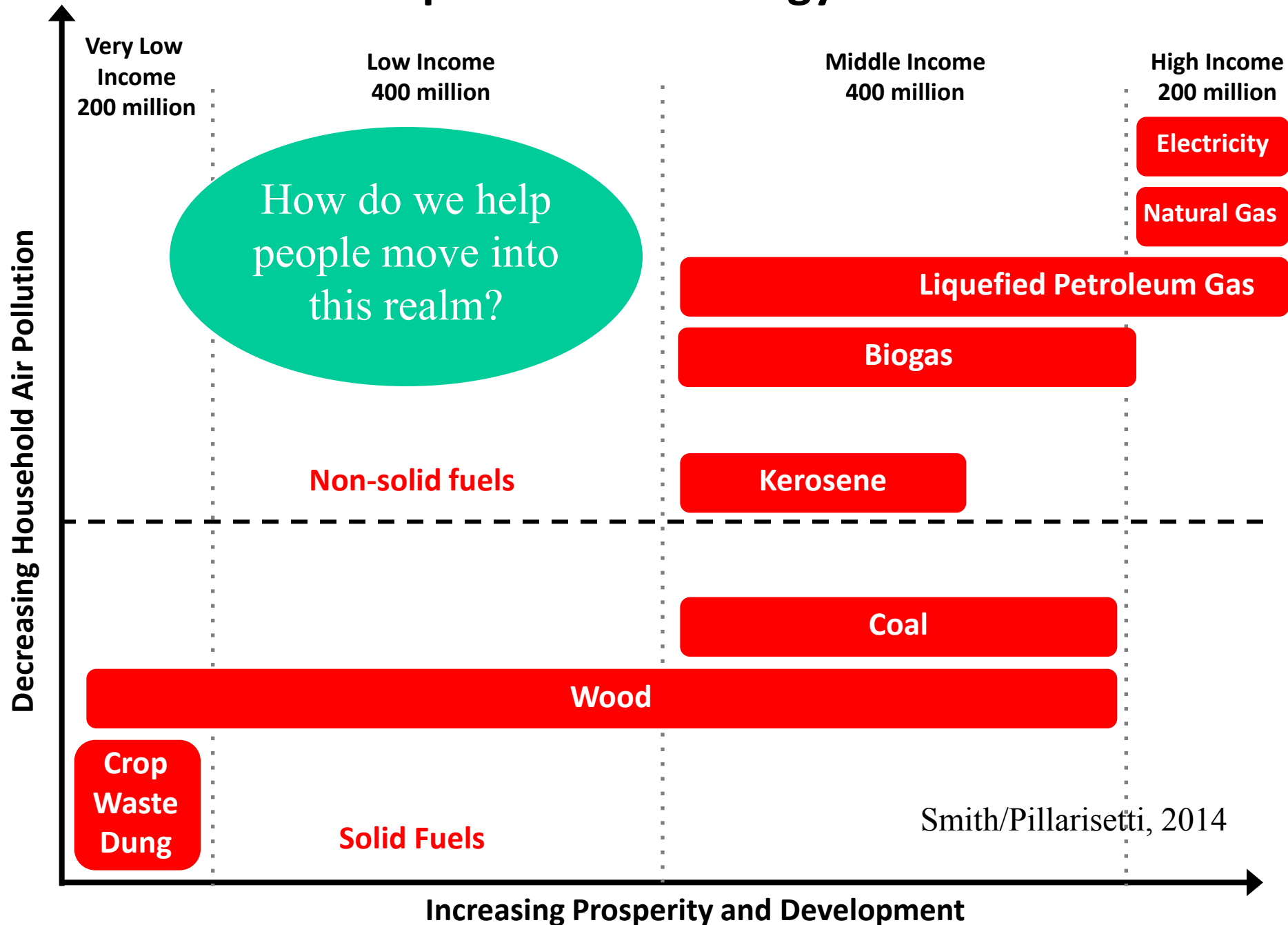
MoHFW AP Task Force, cont.

- Nearfield intake fractions not as well developed but important for local sources
 - Vehicles
 - Neighborhood waste burning
 - Gen sets
 - Households
- Preliminary estimates of household nearfield intake fractions are about 10x those from ambient (downwind exposures) in Chennai (750 vrs 76 ppm)

Paradigm Shifts

- **Make the clean available**, as well as make the available clean
- Embrace/enhance transformational leap-frog technologies
- Look for community solutions
- Move subsidies for clean fuels from richer to poorer households
- Act recognizing that it is primarily a health issue and thus treat on an exposure basis

Conceptual Indian Energy Ladder



Many thanks

Publications and
presentations on website
– easiest to just
“google” Kirk R. Smith

