



International Institute for  
Applied Systems Analysis  
www.iiasa.ac.at

science for global insight

# Energy Thresholds: A basis for “Equitable Access to Sustainable Development”

Narasimha D. Rao

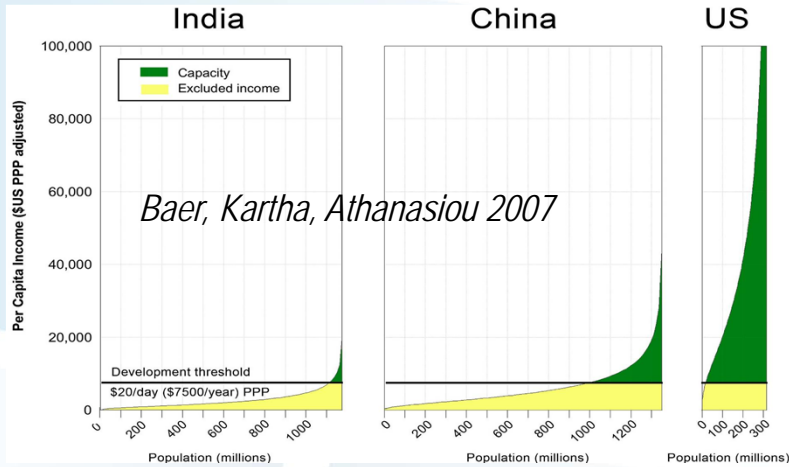
Equity Workshop, Brussels  
November 6, 2012



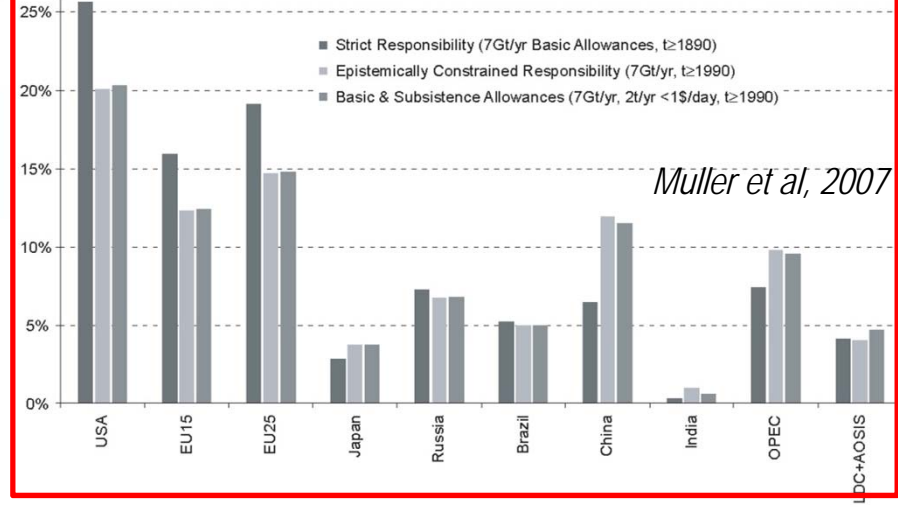
IIASA, International Institute for Applied Systems Analysis

# Moral Thresholds in Burden-Sharing

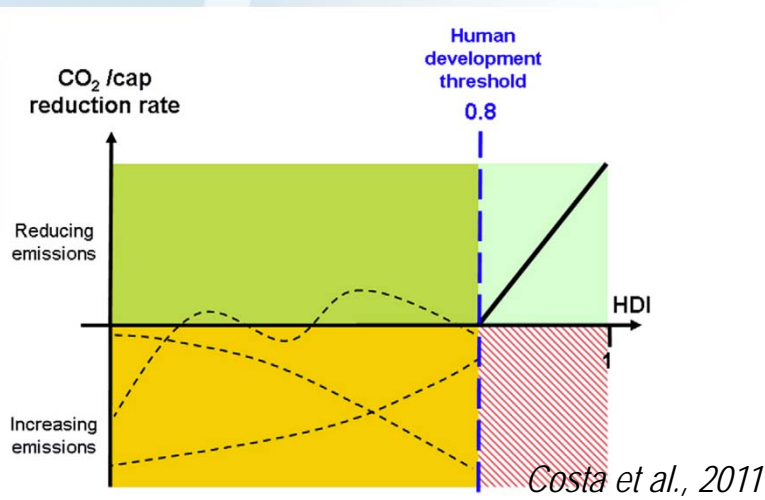
## "Development" (Income) – \$7,500 PPP



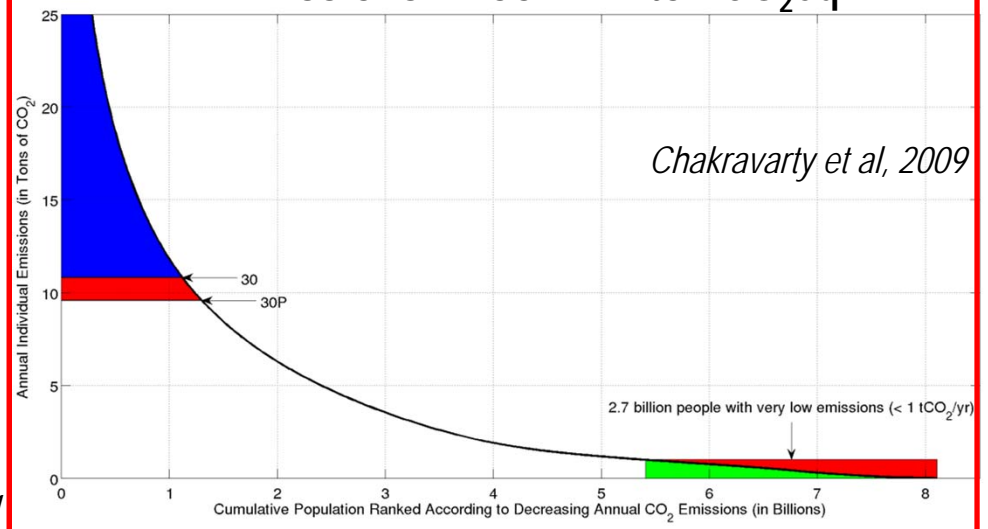
## Subsistence Allowances – 2 tons CO<sub>2</sub>eq



## Human Development Index – 0.8



## Emissions "Floor" – 1 ton CO<sub>2</sub>eq



# Moral Justifications

"Development" (Income) – \$7,500 PPP

Subsistence Allowances – 2 tons CO<sub>2</sub>eq

"Safe" poverty threshold

Developing country average

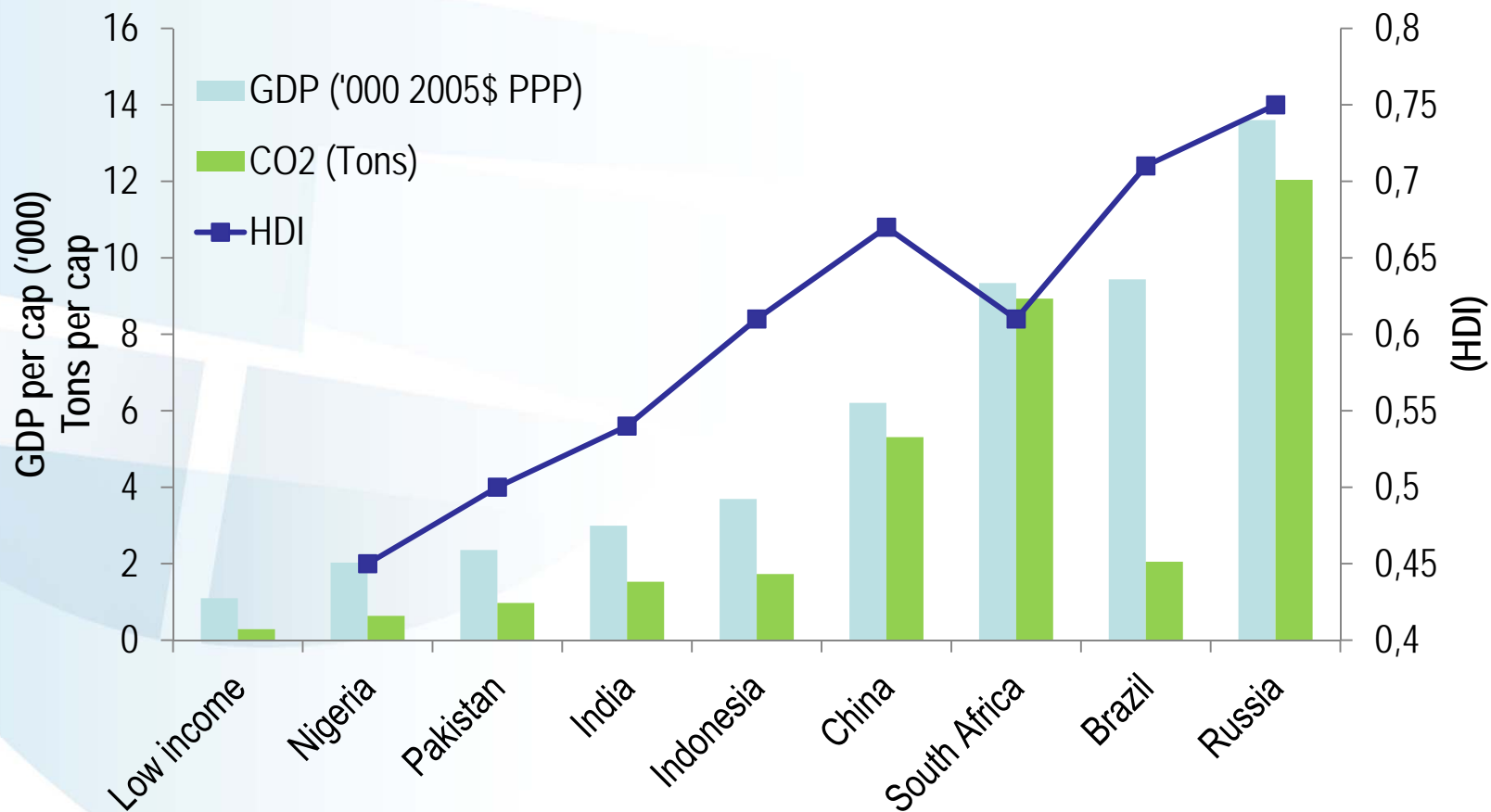
Human Development Index – 0.8

Emissions "Floor" – 1 ton CO<sub>2</sub>eq

UNDP – differentiates  
Industrialized countries  
from others

Direct energy requirements  
"x2"  
(for indirect energy)

# Threshold Metrics Matter to some countries.



# Threshold value matters as well.

Global Burden Share (2020)	EU27	US	NA1	China	India	Lower Middle Income	Africa
(@\$7,500 threshold)	22.0	31.1	33.3	12.7	1.1	20.9	1.9
(@ \$5,000 threshold)	21.2	29.0	36.5	14.1	1.8	24.1	2.3
Change (%)	-4%	-7%	9%	11%	64%	15%	19%

# A More Expansive Moral Threshold

*Increasing Representativeness of Human Conditions*

Emissions

Income

HDI

Decent Living Standards

- Income
- Literacy
- Life Expectancy

- Food
- Shelter
- Health
- Education
- Utilities
- Basic Amenities
- Mobility

Energy Needs

# Development Rights

States should undertake, at the national level, all necessary measures for the realization of the right to development and shall ensure, inter alia, equality of opportunity for all in their access to basic resources, education, health services, food, housing, employment and the fair distribution of income.

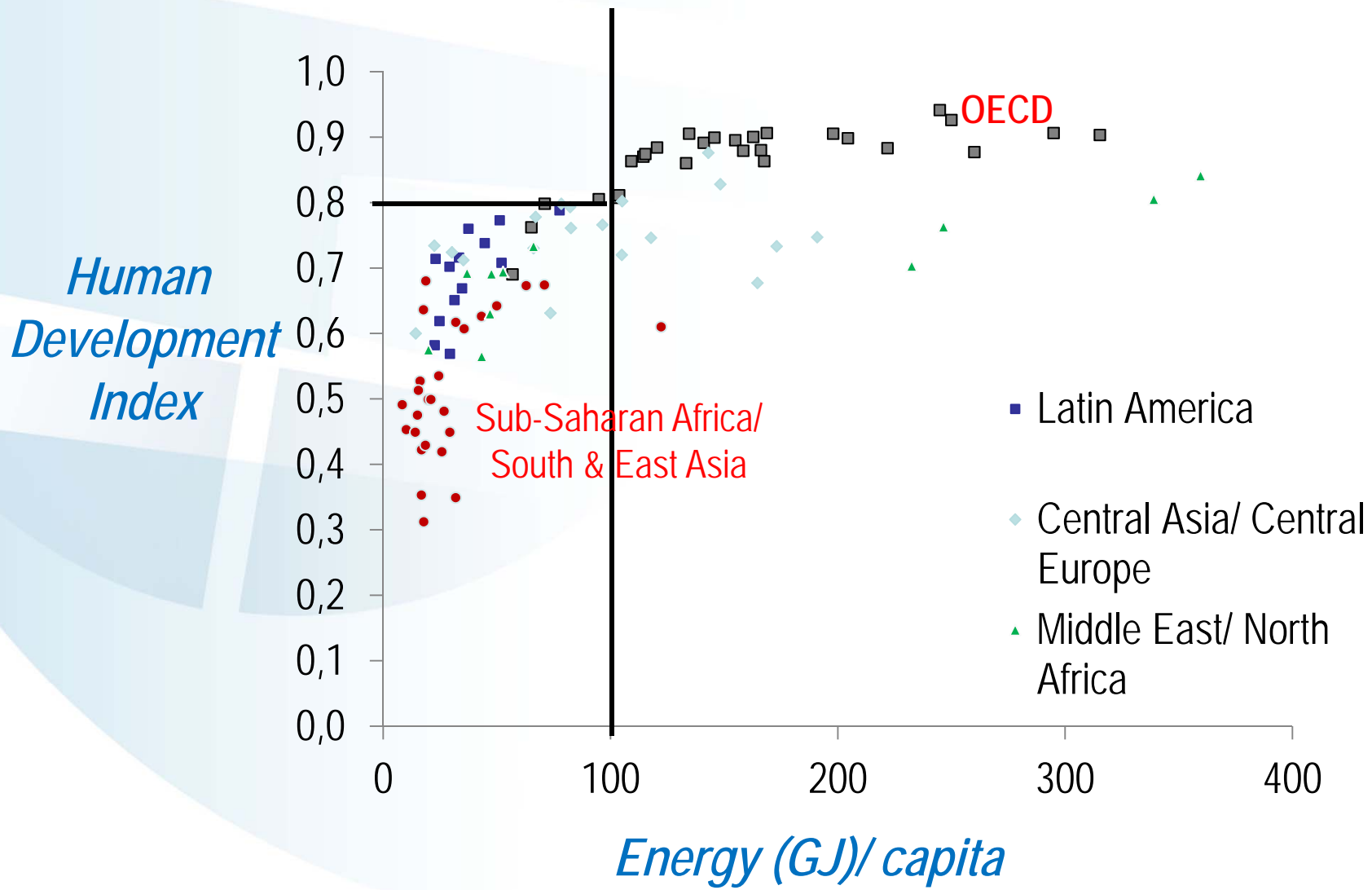
*UN Declaration on the Right to Development, Article 8.*

Right of everyone to an adequate standard of living for himself and his family, including adequate food, clothing and housing, and to the continuous improvement of living conditions”

*International Covenant on Economic, Social and Cultural Rights.*

*Article 11.1*

# Energy and Human Development





# Previous Literature

## *Climate Equity*

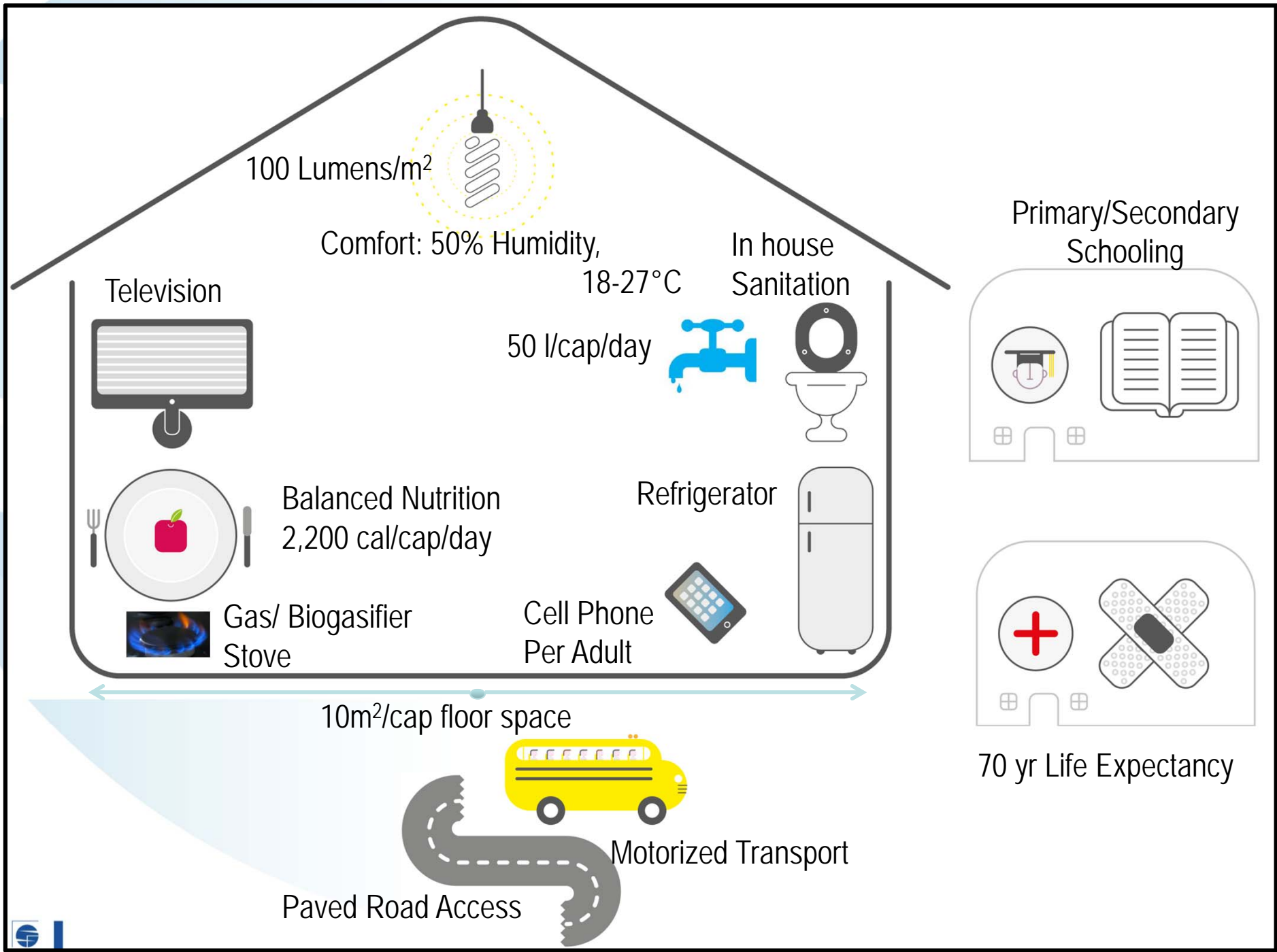
- Birdsall & Subramanian, 2009
  - Historical ‘comparability’ on direct energy growth
  - Technology convergence on carbon intensity

## *Energy Access*

- Goldemberg et al., “one kilowatt per capita”
- Other estimates: 50-80 GJ/cap

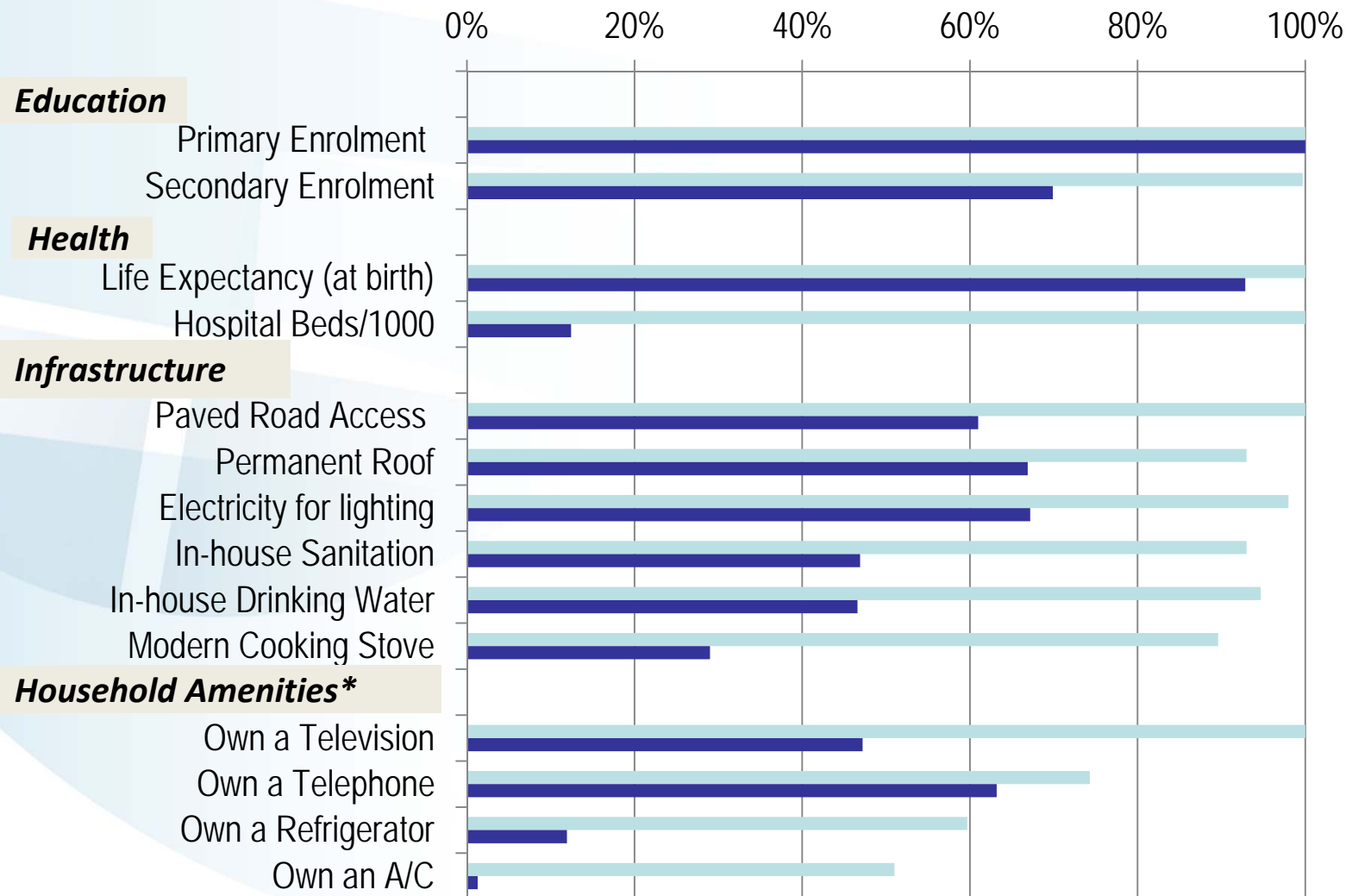
# Decent Living Emissions: An Energy-based Threshold

- Universal Standards, Country-Specific Energy
  - Culture
  - Path dependency
- Maintenance (Annual) and Development (One-time) energy
- Baseline technology – equity ‘neutral’



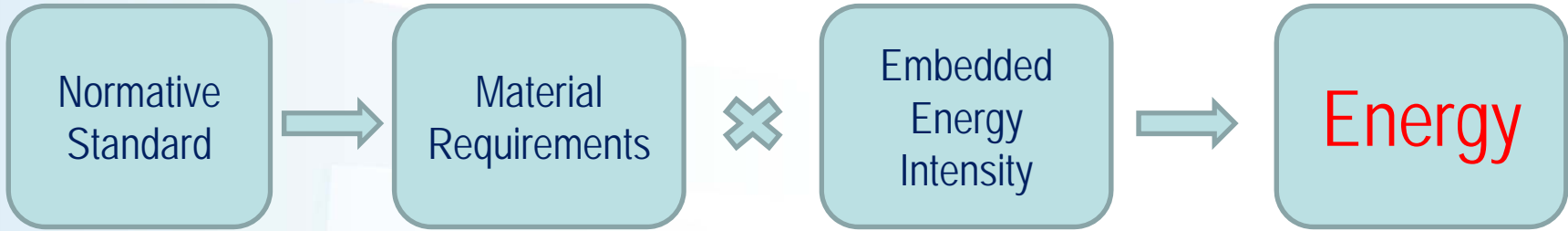
# China & India – Current Conditions

Decent Living Standards: China & India

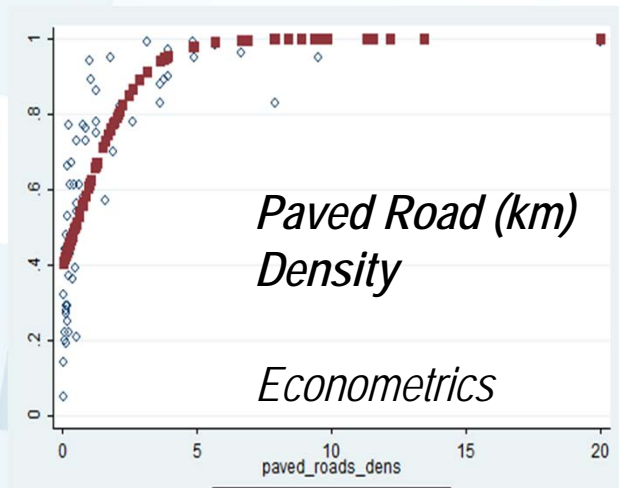


\* Data for China reported is appliances per 100 households, not access penetration

# Methodology



Access to Paved Roads



Access to Electricity (24/7)

*T&D km, capacity*

*Global Energy Model w/ Spatial Resolution (IMAGE)*

*Material Flow Analysis*

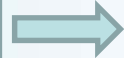
*Life Cycle Analysis*

*Input/Output Analysis*

*Primary*

# Methodology

Normative  
Standard



Material  
Requirements



Embedded  
Energy  
Intensity



Energy

Universal

Country-specific

Country-specific

*Climate  
(HDD, CDD)*

*Economic Structure  
(Labor intensity)*

*Culture  
(Diet)*

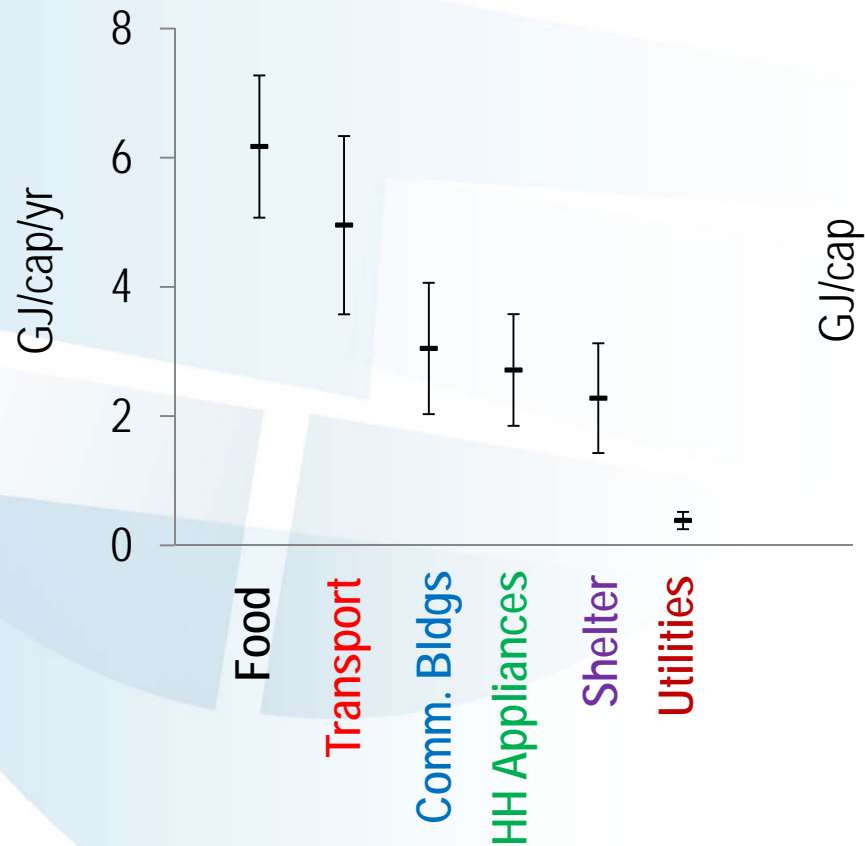
*Technology  
(Mechanization)*

*Geography  
(Pop Density)*

*Culture  
(Recycling)*

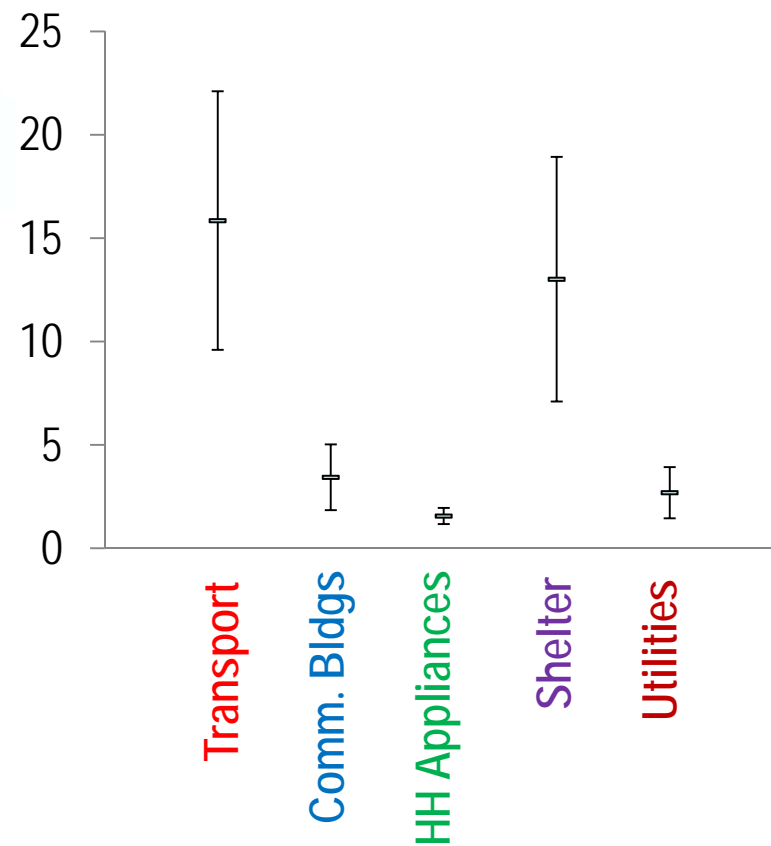
# India Decent Living Energy Needs

Maintenance Energy (Annual)



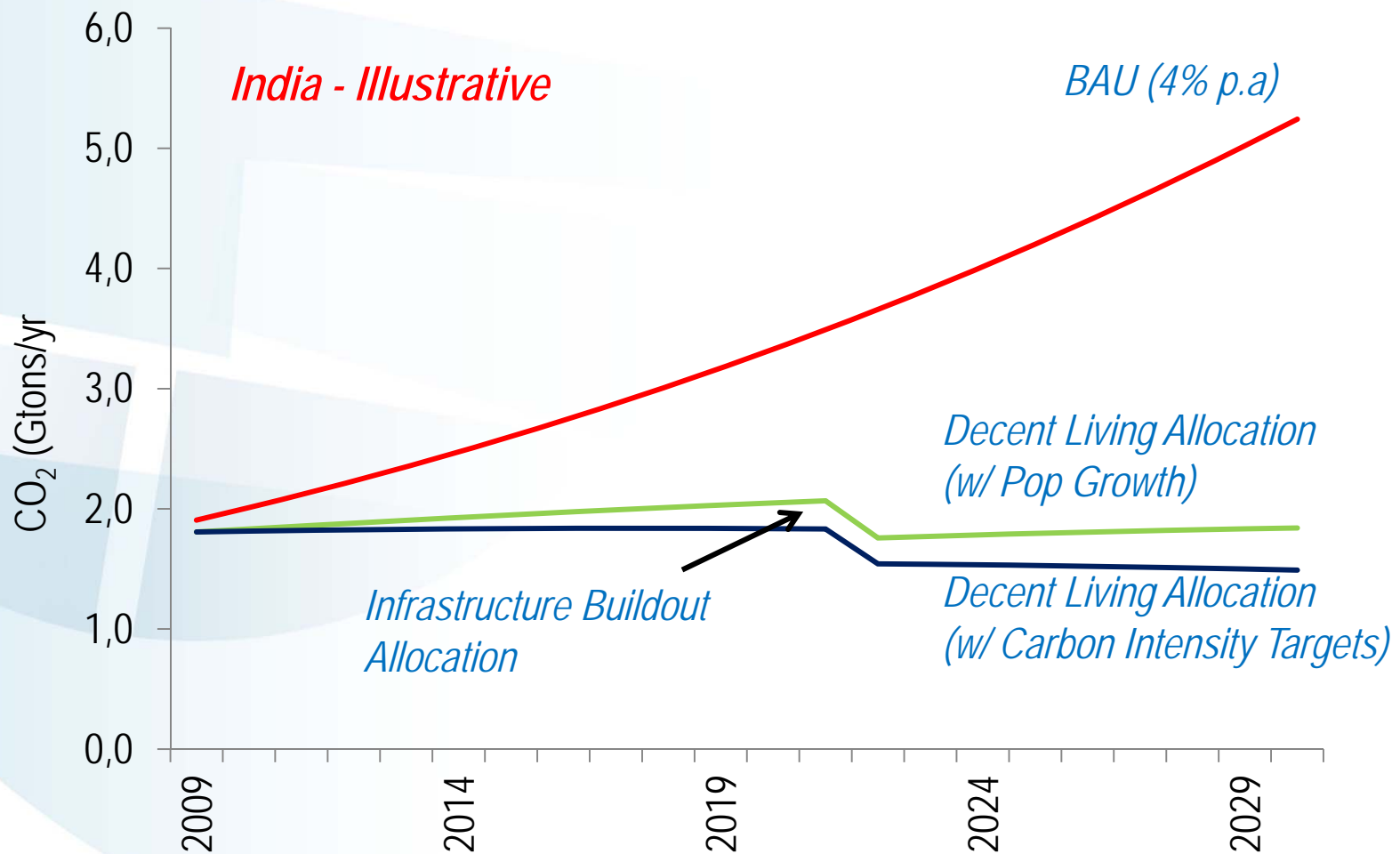
Total ~20 GJ/cap/yr  
(1.3 Tons CO<sub>2</sub>/cap/yr)

Development Energy (One-time)



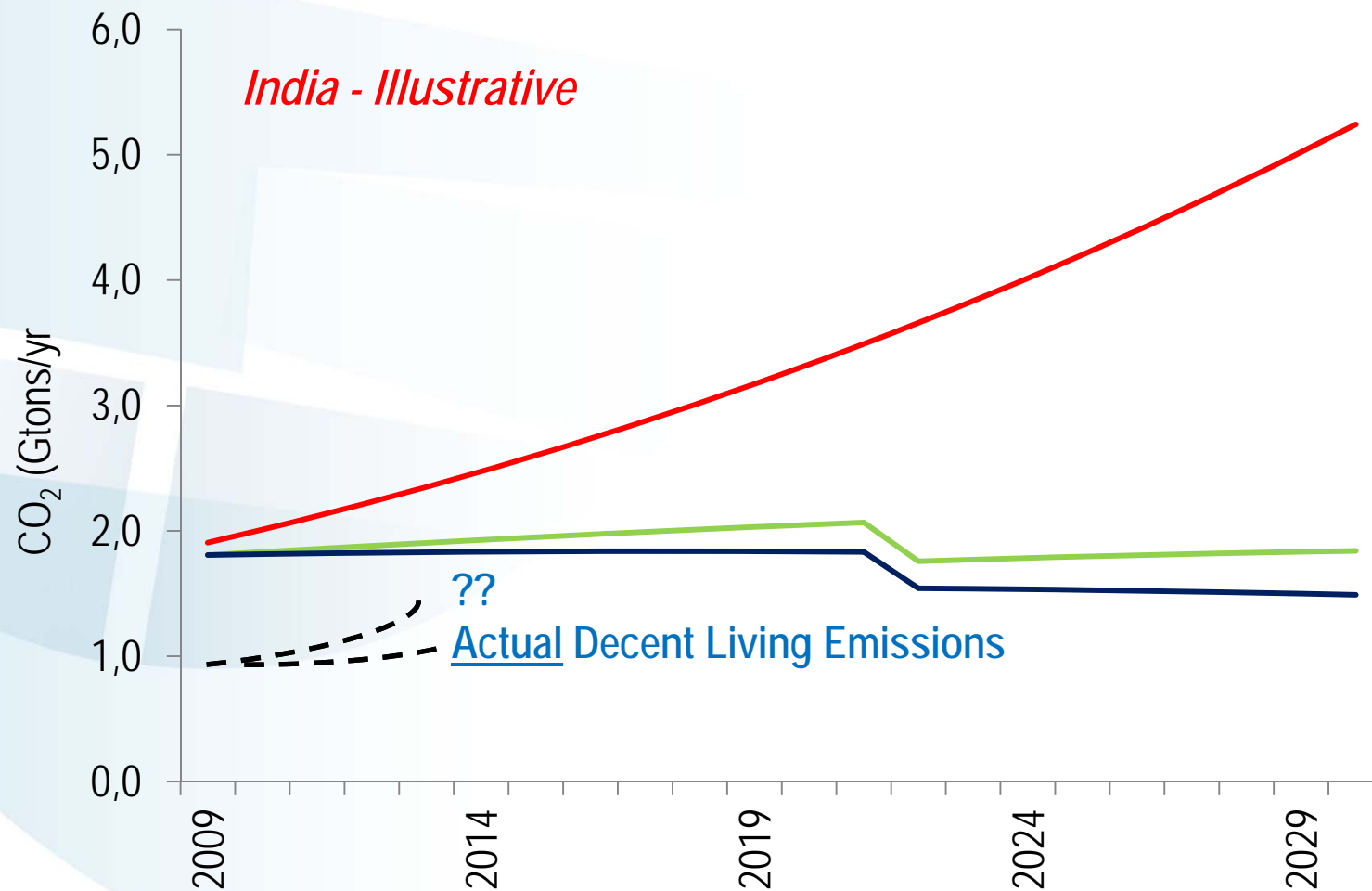
Total ~2.5 GTONS CO<sub>2</sub>  
(0.2 Tons/cap over 10 yrs)

# Application to Climate Policy





# Application to Climate Policy



# Further Issues for Climate Policy

- Carbon Intensity Trajectories
- Standardize / Replicate Framework
- How do we tax 'Indecent' emissions
- Non-CO<sub>2</sub> decent living emissions

**THANK YOU**  
**nrao@iiasa.ac.at**

**Collaborators: P. Baer, S. Pachauri**

**Reference: Rao, N., P. Baer (2012), Decent Living Emissions: A  
Conceptual Framework, *Sustainability* 4, 656-681**