Sustainable Development Pathways
Foundations and Frontiers

Narasimha D. Rao
Infrastructure and Living Standards

3 billion people burn solid fuels in homes...

2.2 million deaths in 2005...

1.7 billion people face water shortages due to a lack of delivery infrastructure...

1.4 billion people lack electricity access...

1 billion lack access to all-season roads...
Energy (Services) Growth is Imperative

Human Development Index

Energy (GJ)/ capita

Data: World Development Indicators, UNDP
Historical Growth was Fossil-Driven

Schneider, 2010
Developing Countries Don’t Have That Option!

CO$_2$ from Energy (GTons)

2°C Stabilization Pathways

Non Annex 1 Countries

Annex 1 countries

Global Energy Assessment, IIASA
Vehicle Growth is Explosive in Asia

- US 2009: 812 vehicles per 1000
- India 2030: 56 vehicles per 1000
- China 2030: 127 vehicles per 1000
- China 2009: 33 vehicles per 1000
- India 2009: 18 vehicles per 1000

S. Asia:
- 4% walking
- 5% cycling
- 71% others
- 18% public transport
- 2% air transport

Rao et al, 2009; International Energy Agency
Urban Pollution Severe TODAY

Particulates $\mu g/m^3$

WHO GUIDELINES for Particulates (PM10)

Fatalities, Congestion…

Cities

Data: World Health Organization 2012
How do we Leapfrog to Sustainable Growth?

Technology R & D

& Deployment

Context-driven
How do we Leapfrog to Sustainable Growth?

Technology R & D & Deployment

Context-driven

Well-governed
Disparity in Electricity Access is known
Electricity *reliability* is neglected

- Fewer businesses, less income...

Rao 2012 forthcoming, IIASA
How do we Leapfrog to Sustainable Growth?

Technology R & D & Deployment

Context-driven
Well-governed
Support Policy Objectives
Global Transition to Modern Cook Stoves

Riahi et al, 2012, IIASA
Unless we change direction, we are likely to end up where we are going.

Anonymous
THANK YOU