



# *Clean Fossil Power Generation in IEA World Energy Outlook 2007*

Brian Ricketts, Energy Analyst – Coal, International Energy Agency

UK Advanced Power Generation Technology Forum Workshop  
*Carbon Abatement Technologies:  
development and implementation of future UK strategy*

BERR Conference Centre, 1 Victoria Street, London, 27 February 2008

# Approach

- Co-operation with China's NDRC & ERI, India's TERI
  - *Workshops / meetings in Beijing, Delhi*
  - *Chinese and Indian experts joined the IEA*
  - *More than 50 Chinese and Indian peer reviewers*
- Scenario approach
  - *Reference Scenario*
  - *Alternative Policy Scenario & 450 Stabilisation Case*
  - *High Growth Scenario (China/India)*
- Full global update of projections (all scenarios)
- Analysis of the impact of China & India on global economy, energy markets & environment



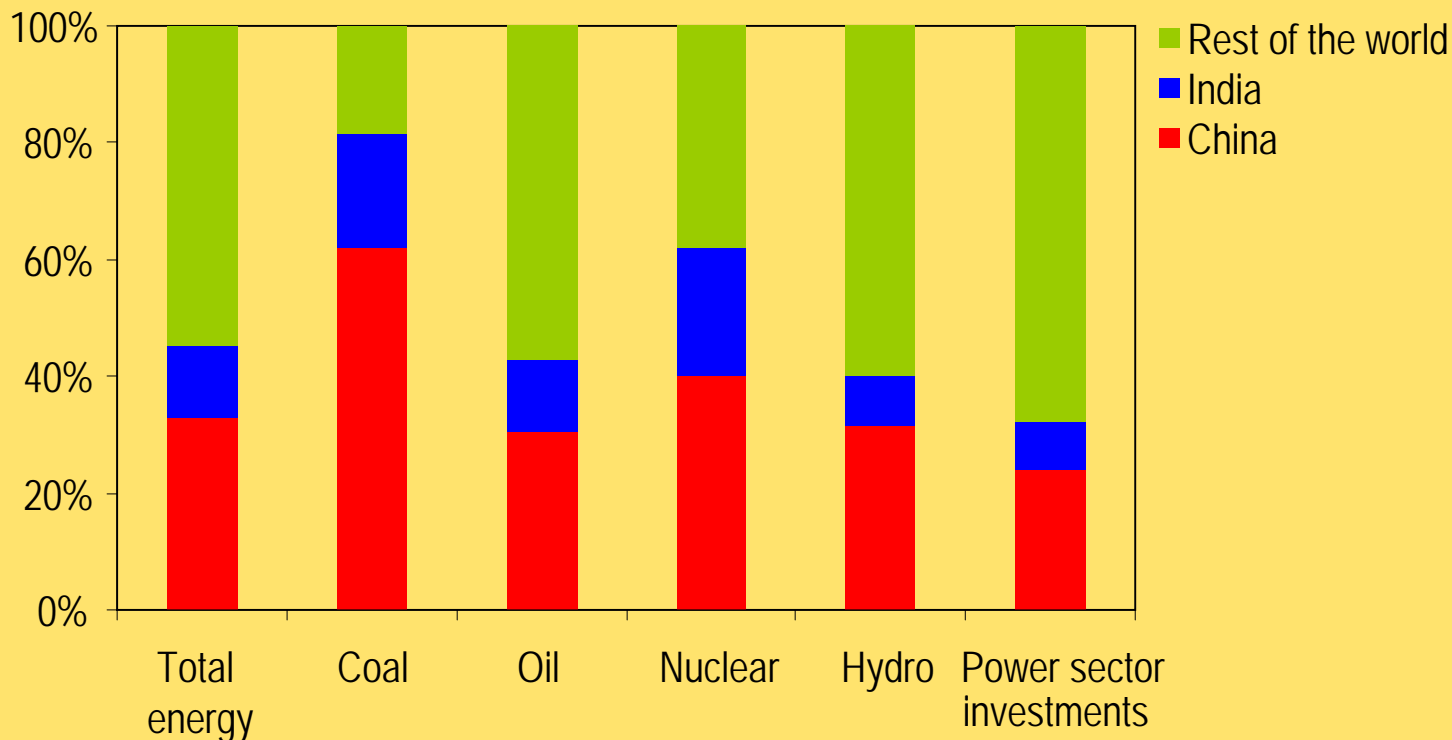
# *Reference Scenario*

# The Emerging Giants of World Energy

WORLD ENERGY OUTLOOK 2007

China and India Insights

Increase in Primary Energy Demand & Investment Between 2005 & 2030 as Share of World Total

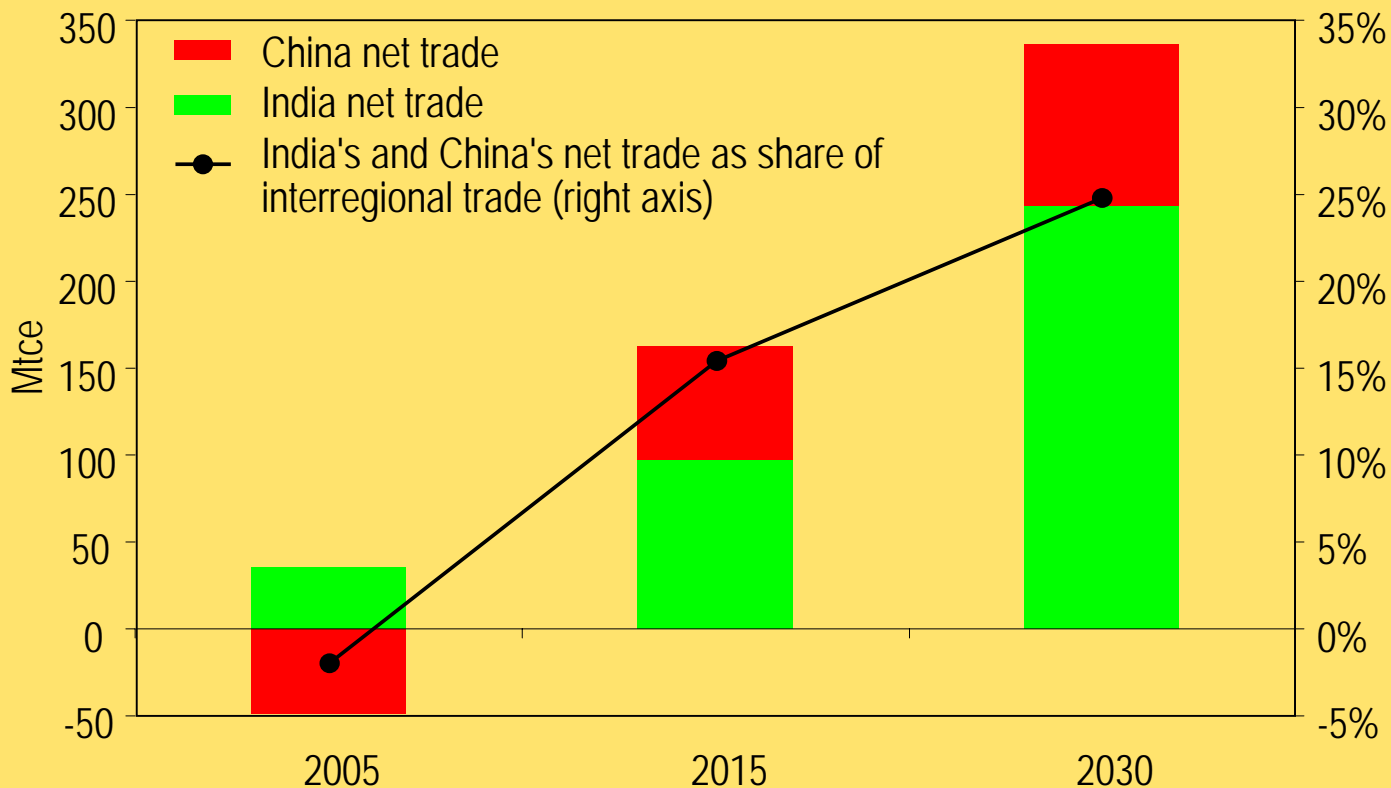


**China & India will contribute more than 40% of the increase in global energy demand to 2030 on current trends**

# China & India Coal Imports

WORLD ENERGY OUTLOOK 2007

China and India Insights



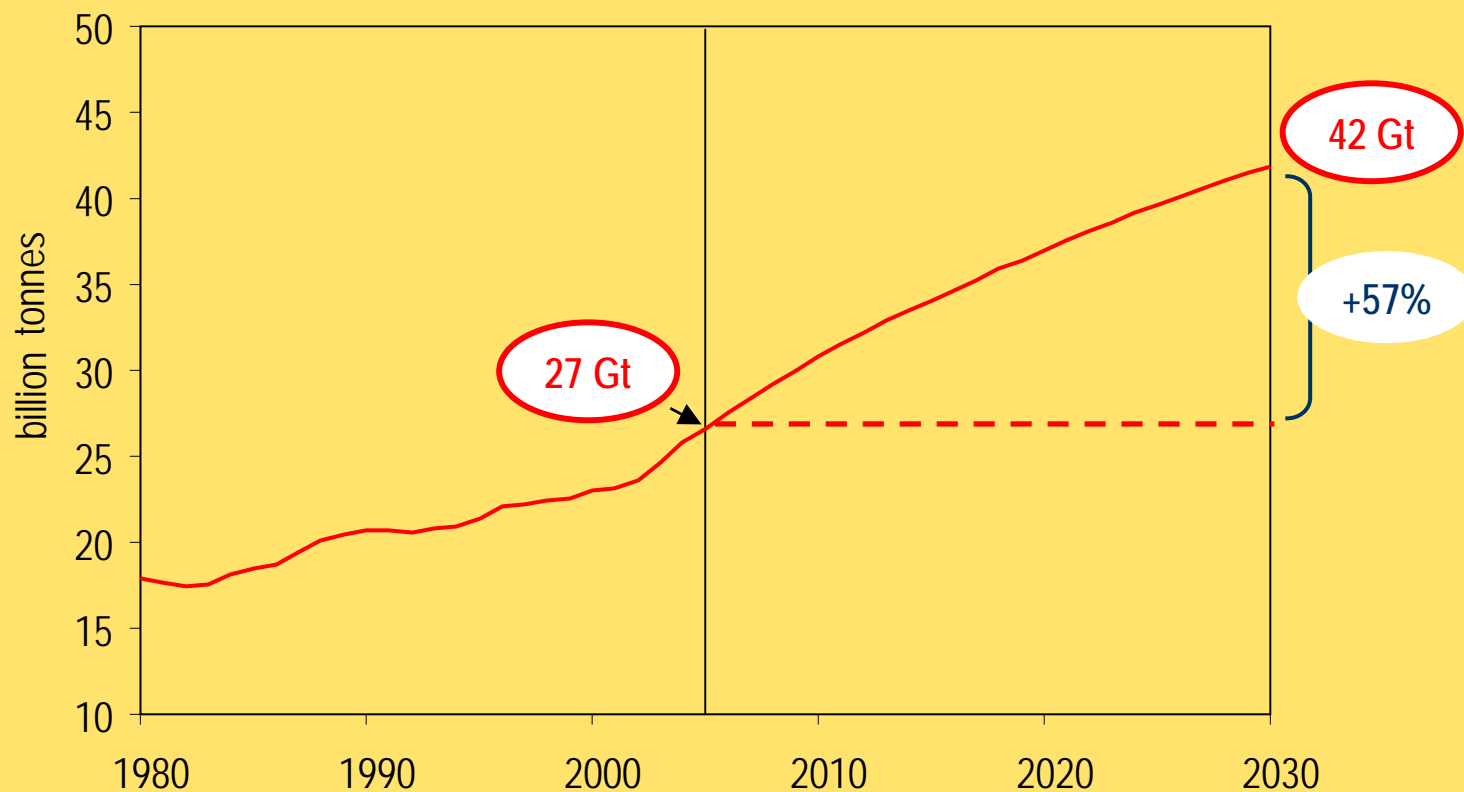
**China recently became a net coal importer like India, with both putting increasing pressure on international coal markets**



# Reference Scenario: Global Energy-Related CO<sub>2</sub> Emissions

WORLD ENERGY OUTLOOK 2007

China and India Insights



**Global emissions rise inexorably on current policies, driven mainly by China, India & other developing countries**

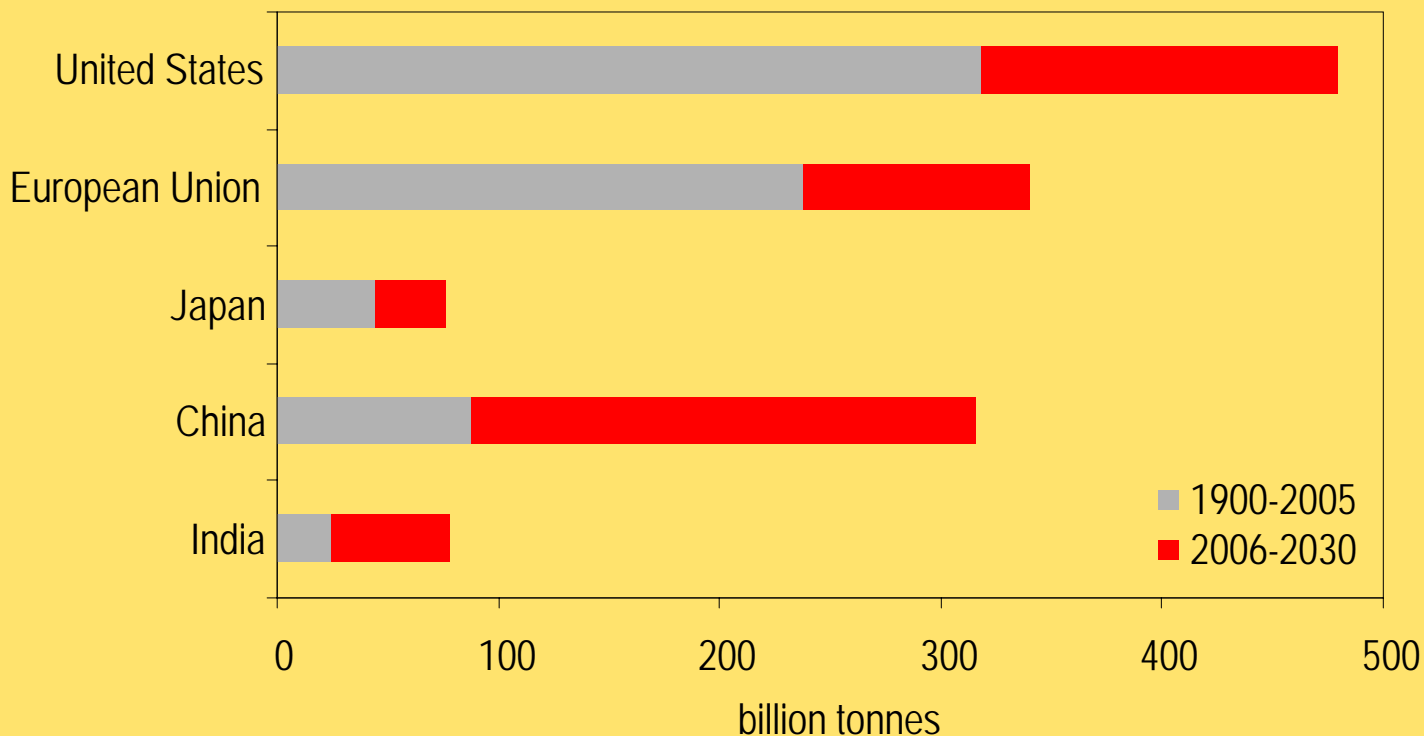


# China & India in Global CO<sub>2</sub> Emissions

WORLD  
ENERGY  
OUTLOOK  
2007

China  
and India  
Insights

Cumulative Energy-Related CO<sub>2</sub> Emissions



***Around 60% of the global increase in emissions in 2005-2030 comes from China & India***

# World's Top Five CO<sub>2</sub> Emitters

	2005		2015		2030	
	Gt	rank	Gt	rank	Gt	rank
<b>US</b>	5.8	1	6.4	2	6.9	2
<b>China</b>	5.1	2	<b>8.6</b>	<b>1</b>	<b>11.4</b>	<b>1</b>
<b>Russia</b>	1.5	3	1.8	4	2.0	4
<b>Japan</b>	1.2	4	1.3	5	1.2	5
<b>India</b>	1.1	5	<b>1.8</b>	<b>3</b>	<b>3.3</b>	<b>3</b>

***China becomes the largest emitter in 2007 & India the 3rd largest by 2015***

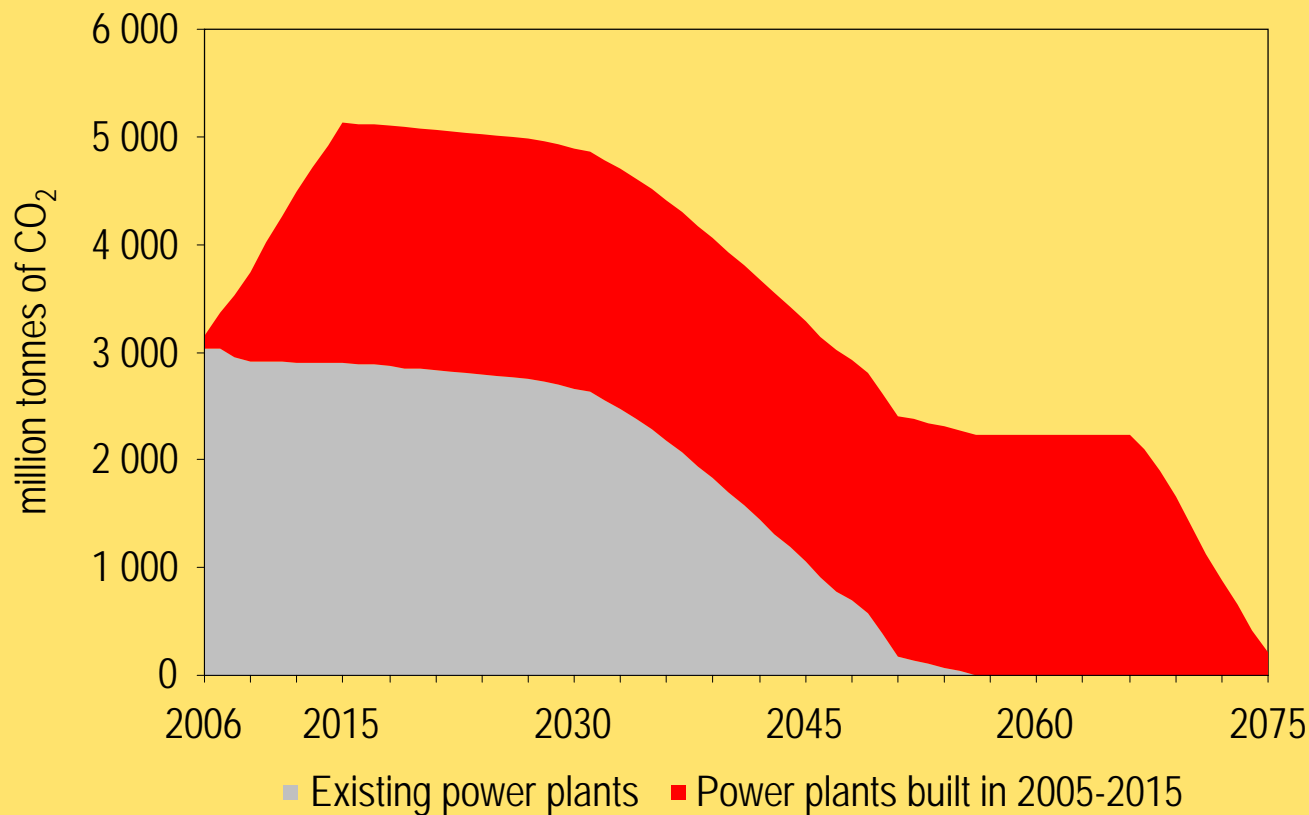




# CO<sub>2</sub> Emissions from Coal-Fired Power Stations built prior to 2015 in China & India

WORLD ENERGY OUTLOOK 2007

China and India Insights



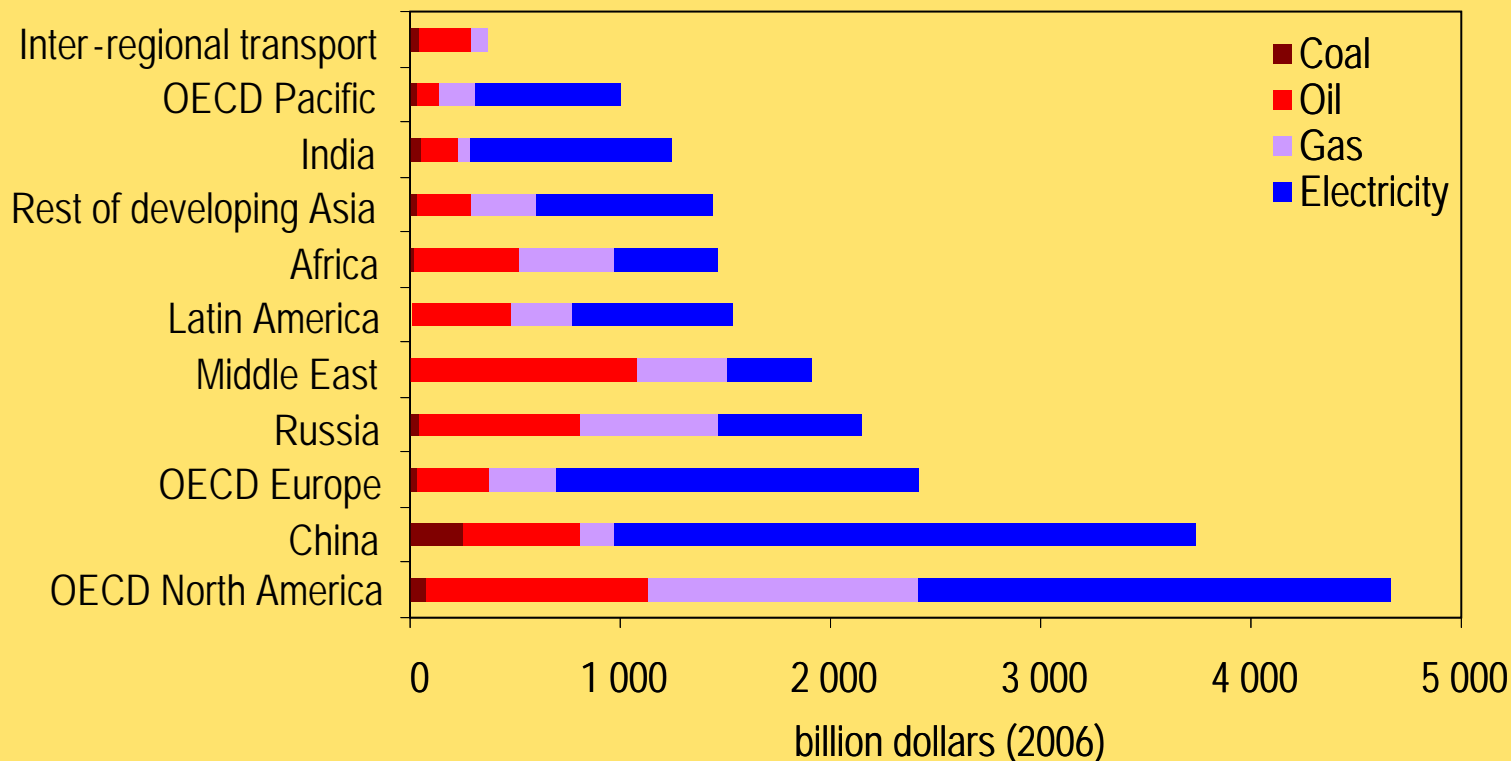
**Capacity additions in the next decade will lock-in technology & largely determine emissions through 2050 & beyond**



# Cumulative Investment in Energy-Supply Infrastructure, 2006-2030

WORLD ENERGY OUTLOOK 2007

China and India Insights



***Just over half of all investment needs to 2030 of \$22 trillion are in developing countries, 17% in China & another 5% in India alone***

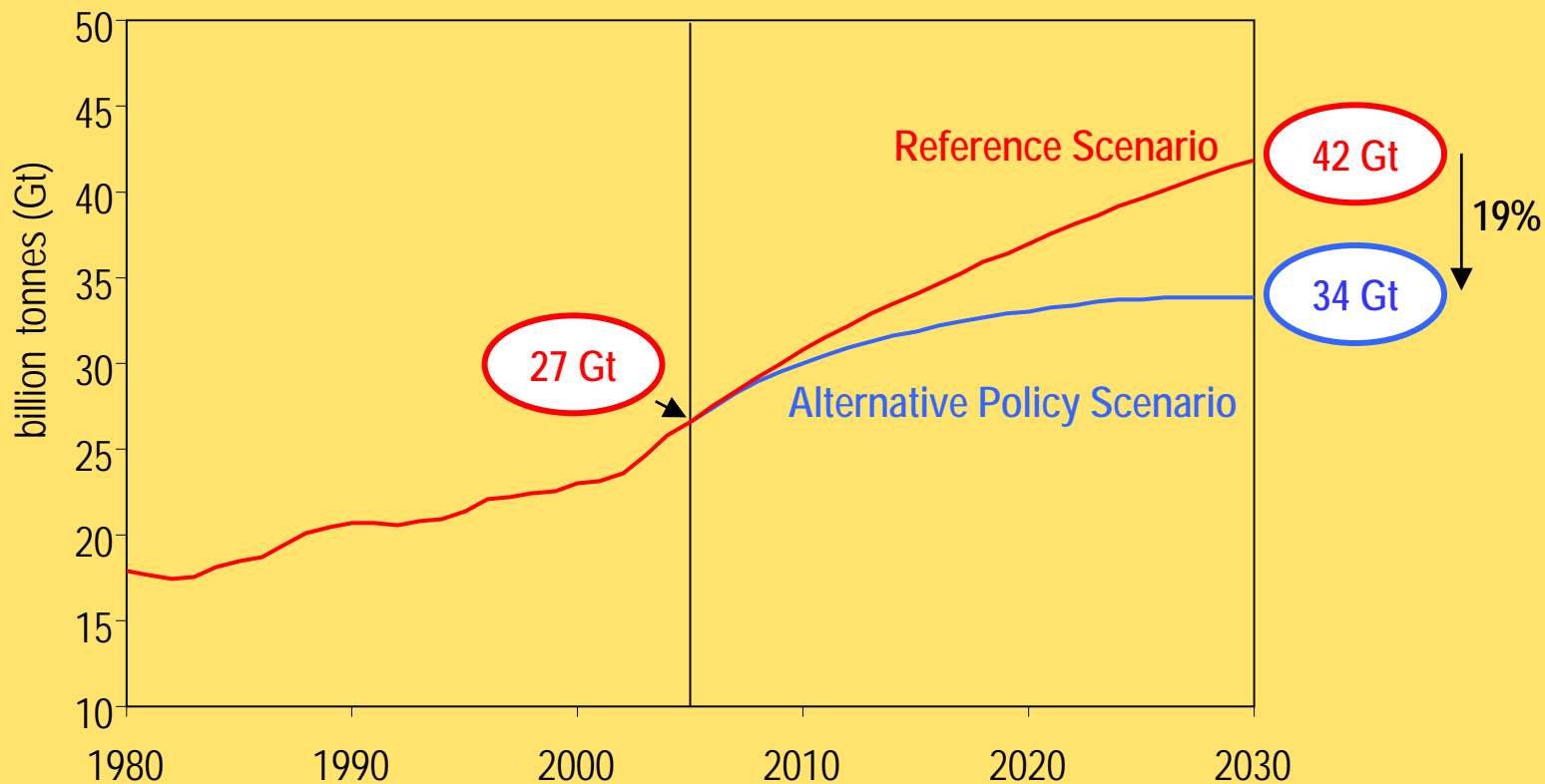


# *Alternative Policy Scenario*

# Global Energy-Related CO<sub>2</sub> Emissions

WORLD  
ENERGY  
OUTLOOK  
2007

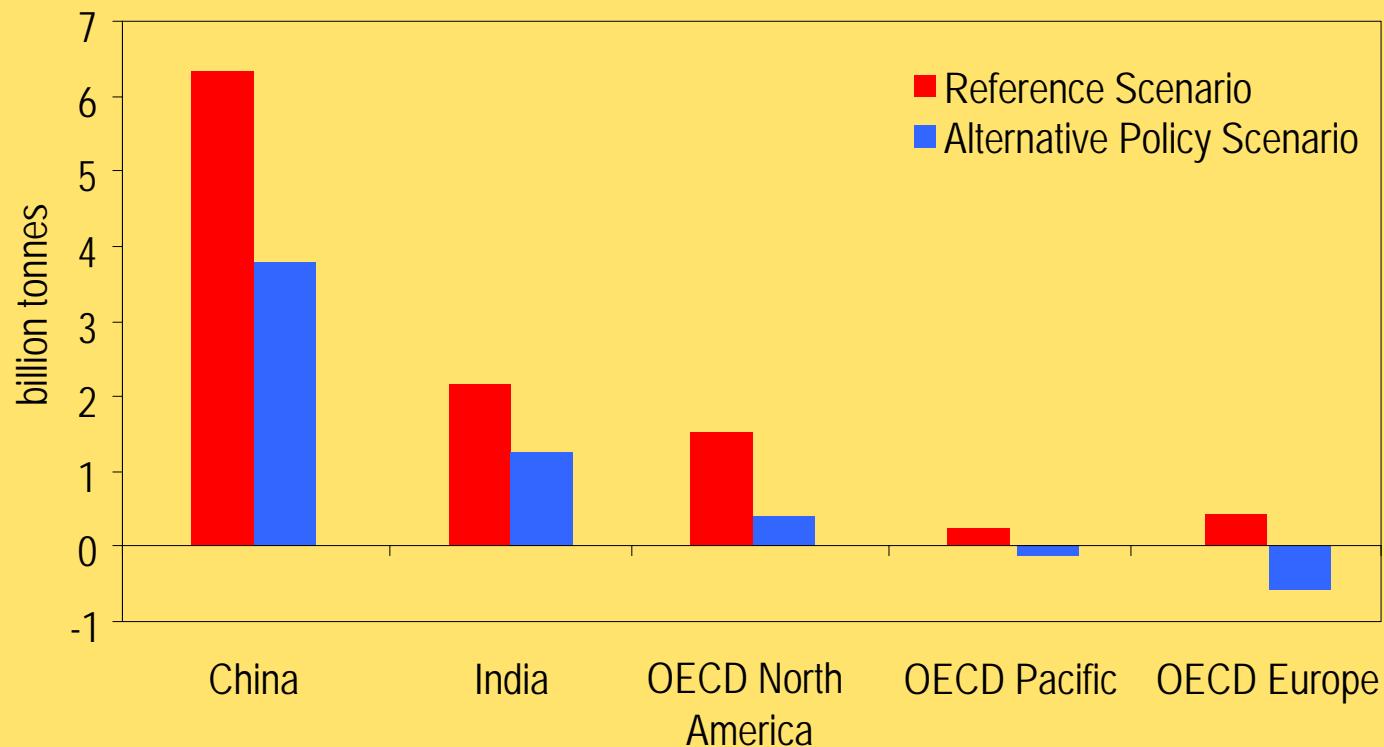
China  
and India  
Insights



**Global emissions will increase by 57% in the Reference Scenario, but they level off in the Alternative Policy Scenario**



# Alternative Policy Scenario: Incremental Energy-Related CO<sub>2</sub> Emissions, 2005-2030



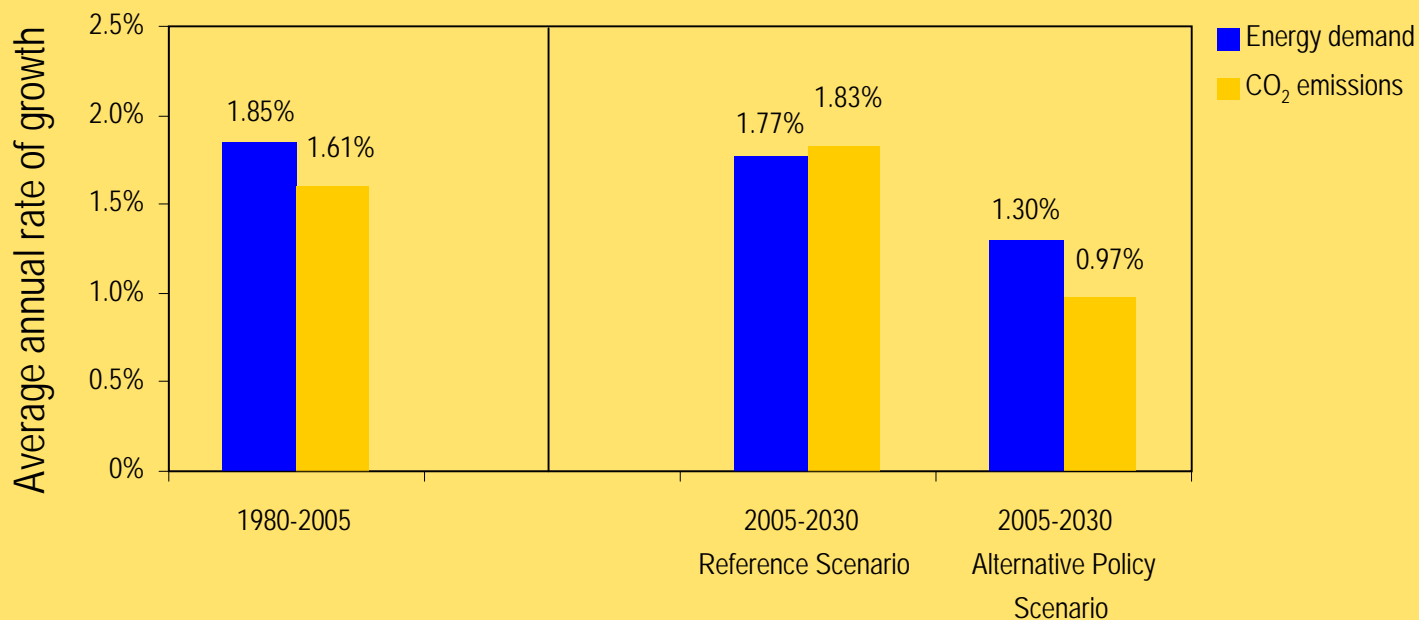
***Emissions grow much more slowly as a result of new policies,  
and even fall in OECD Europe***



# Alternative Policy Scenario: Growth in World Energy-Related CO<sub>2</sub> Emissions & Primary Energy Demand

WORLD  
ENERGY  
OUTLOOK  
2007

China  
and India  
Insights

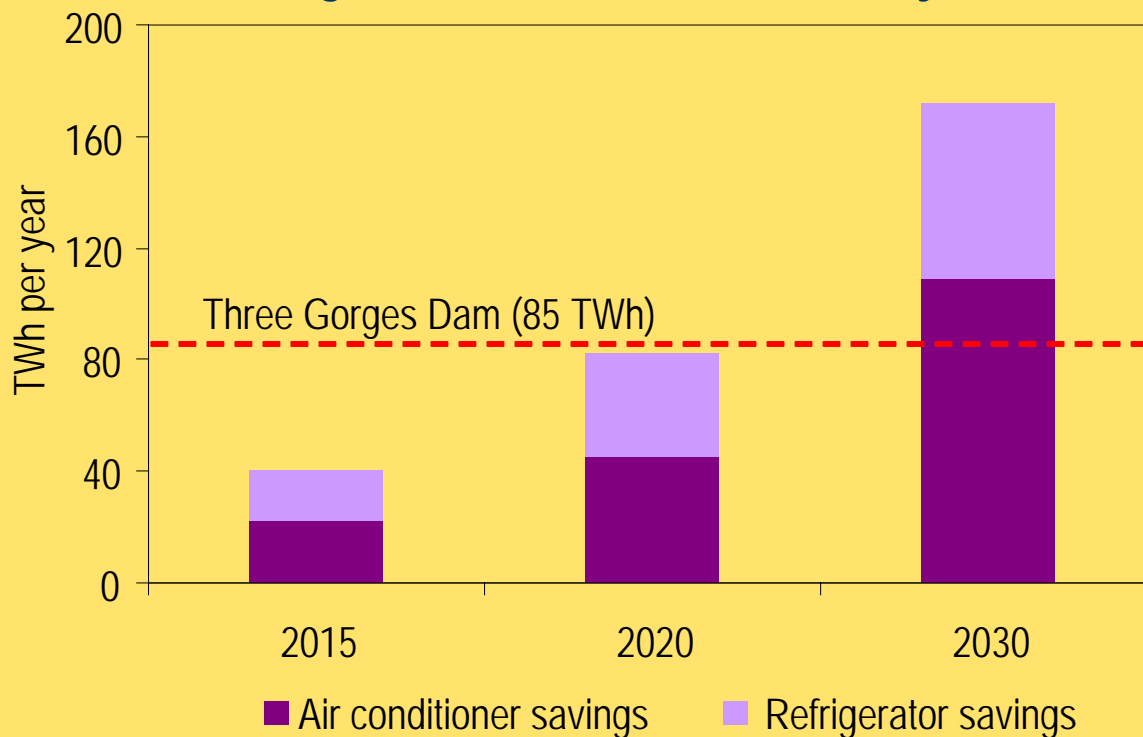


***New policies in the Alternative Policy Scenario reverse the rising trend in carbon intensity seen in the Reference Scenario***



# Effectiveness of Policies to Promote Energy Efficiency in China

Electricity Savings from More Efficient Air Conditioners & Refrigerators in the Alternative Policy Scenario

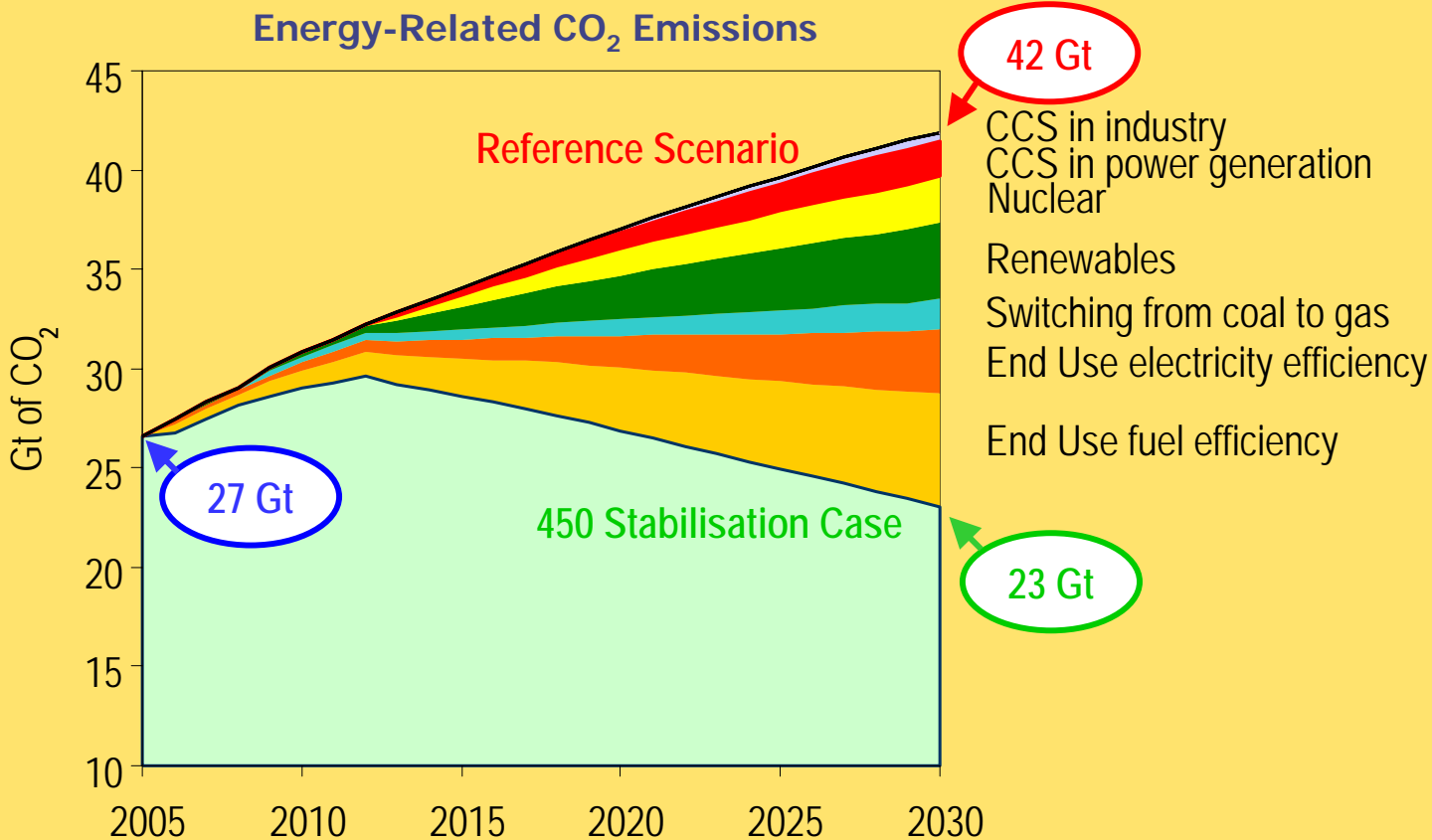


***Tougher efficiency standards for air conditioners & refrigerators alone would save the need to build a Three Gorges Dam by 2020***

# CO<sub>2</sub> Emissions - 450 Stabilisation Case

WORLD ENERGY OUTLOOK 2007

China and India Insights

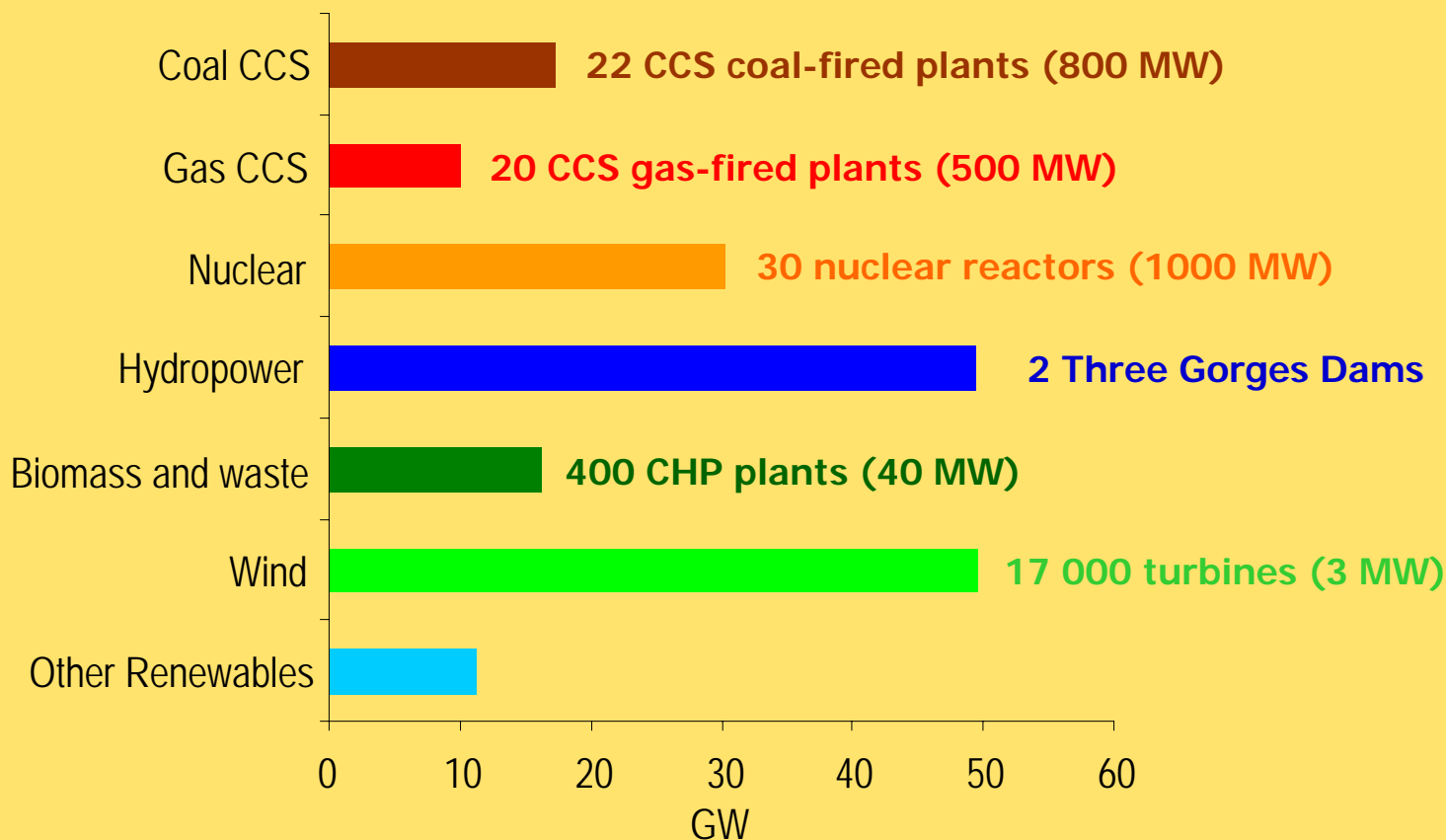


**By 2030, emissions are reduced to some 23 Gt, a reduction of 19 Gt compared with the Reference Scenario**





# Average Annual Power Generation Capacity Additions in the 450 Stabilisation Case, 2013-2030



***A large amount of capacity would need to be retired early, entailing substantial costs***

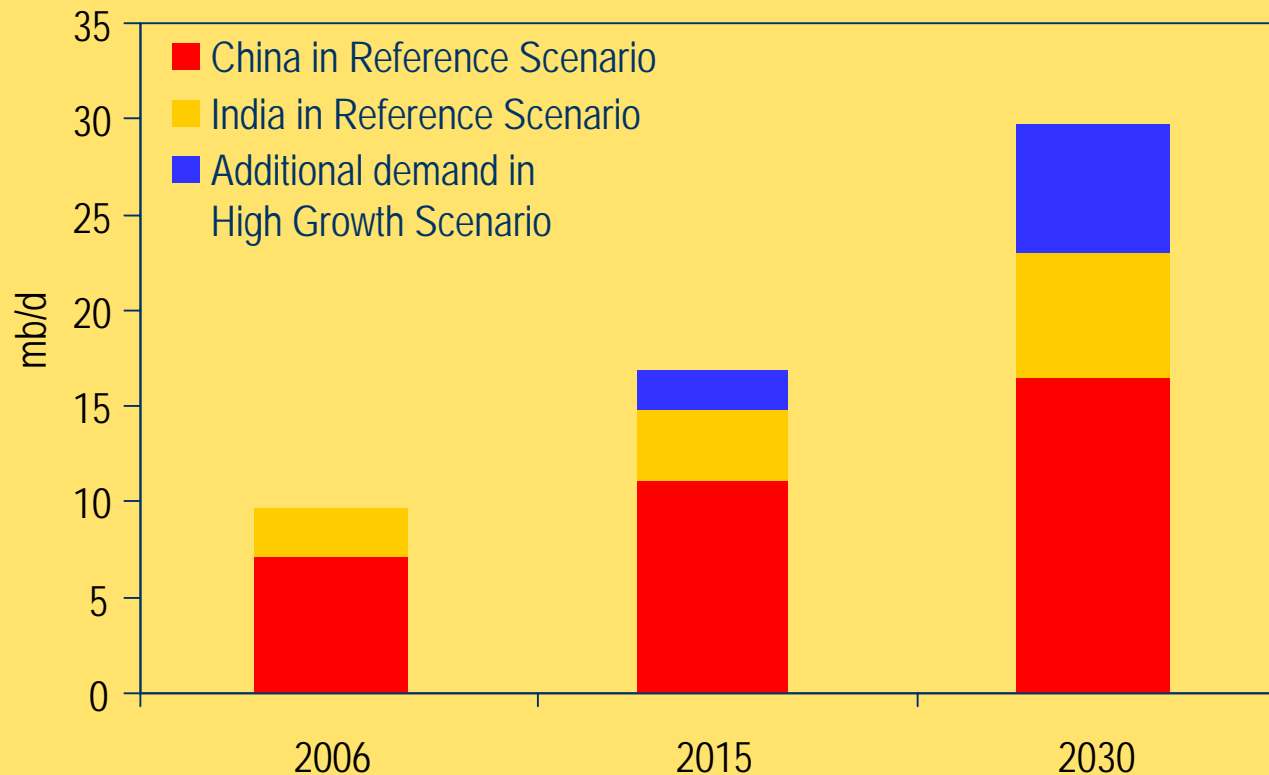
The background of the slide features a world map with a grid overlay. The map is rendered in a color gradient from red to yellow. A horizontal white band with a yellow-to-white gradient is positioned across the middle of the slide, containing the title text. Below this band, a decorative horizontal line of yellow dots separates the title area from the lower map section.

# *High Growth Scenario*

# China & India Oil Demand

WORLD  
ENERGY  
OUTLOOK  
2007

China  
and India  
Insights



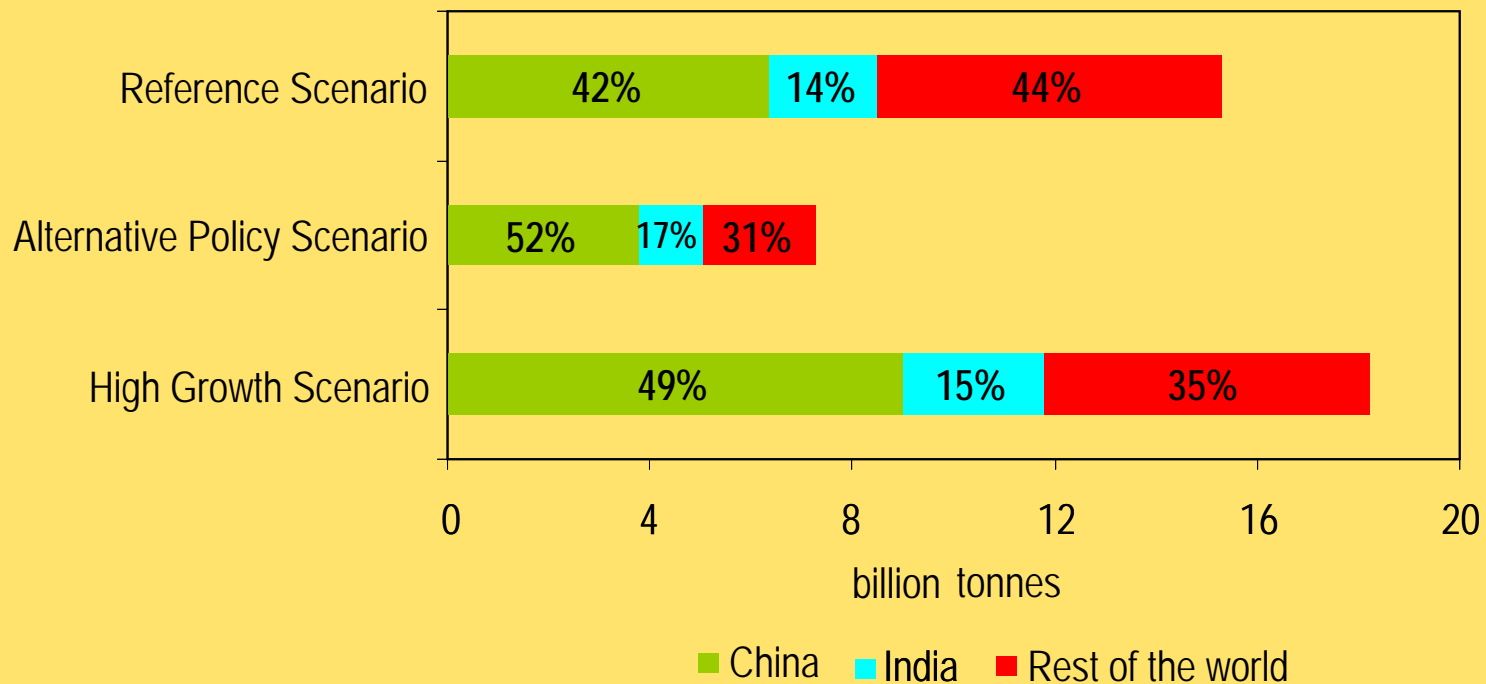
***Faster economic growth in China & India would have major implications for energy security & climate***



# Incremental Energy-Related CO<sub>2</sub> Emissions, 2005-2030

WORLD  
ENERGY  
OUTLOOK  
2007

China  
and India  
Insights



***Most of the increase in emissions will come from China & India, driven mainly by coal-fired power generation***



# *Summary & Conclusions*



# Implications for Global Climate

- Reference & High Growth Scenarios trends are consistent with dramatic climate effects
  - *Atmospheric concentration of greenhouse gases would rise to 850 - 1 130 ppm of CO<sub>2</sub>-equivalent*
  - *Implies a rise in global average temperature of more than 4.9 - 6.1°C above pre-industrial levels*
- Increase in concentration & temperature is much less marked in the Alternative Policy Scenario
- The 450 Stabilisation Case is very ambitious
  - *Would require early retirement of energy-related capital on a large scale & at high cost*
  - *Would hinge on much stronger policy action than currently envisaged*



## Conclusions

- Global energy system is on an *increasingly* unsustainable path
- China and India are transforming the global energy system by their sheer size
- Challenge for *all* countries is to achieve transition to a more secure, lower carbon energy system
- New policies now under consideration would make a major contribution
- Next 10 years are critical
  - *The pace of capacity additions will be most rapid*
  - *Technology will be "locked-in" for decades*
  - *Growing tightness in oil & gas markets*
- Challenge is global so solutions must be global