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# Foreign Direct Investment and Climate Policy

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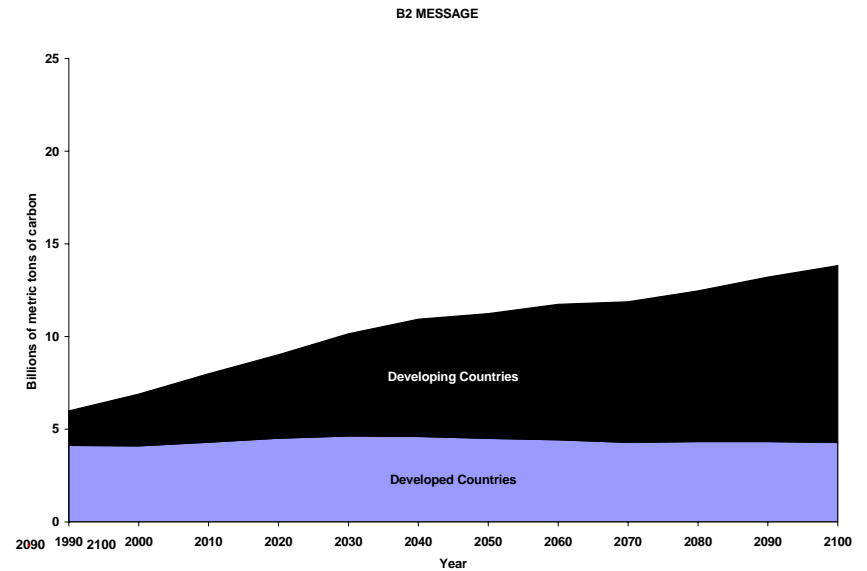
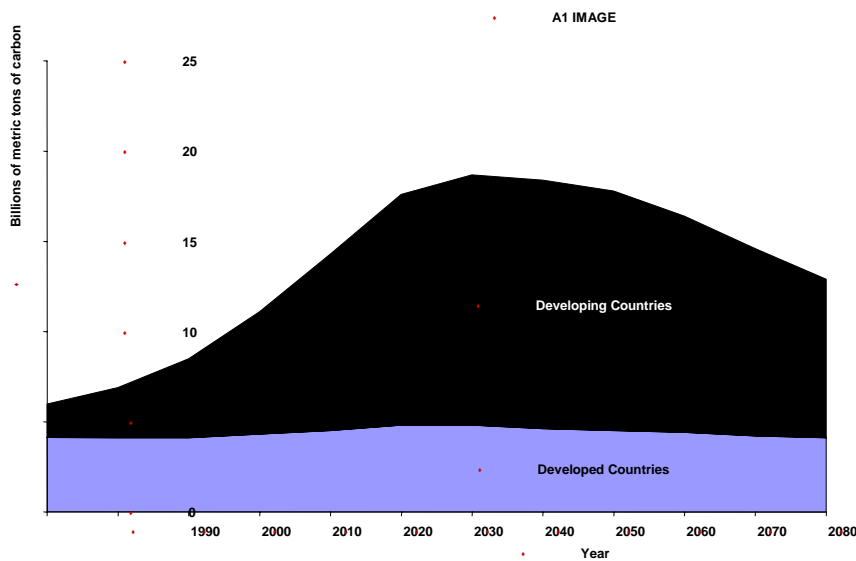


# Increased Investment and Technology Transfer in Developing Countries Can Reduce Poverty *and* GHG Emissions

- **Reasons for focus on developing countries in climate policy**
  - ◆ **Projected rapid growth of developing country share of global CO2 emissions**
  - ◆ **Untapped opportunities for cost-effective reduction of emissions in the near term through modernization of the existing capital stock**
- **What developing countries will support**
  - ◆ **Higher priorities for economic development and other critical health issues in post-WSSD policy environment**
  - ◆ **Policies that provide both improved standards of living, increased economic growth, and reduced emissions**
- **I plan to discuss**
  - ◆ **A model designed to estimate the potential is for reducing developing country emissions through more rapid economic growth**
  - ◆ **Policy implications of the analysis**



# Developing Countries Are the Largest Source of Near and Long Term Emissions Growth



Source: IPCC SRES Image A1 and Message B2 Scenarios

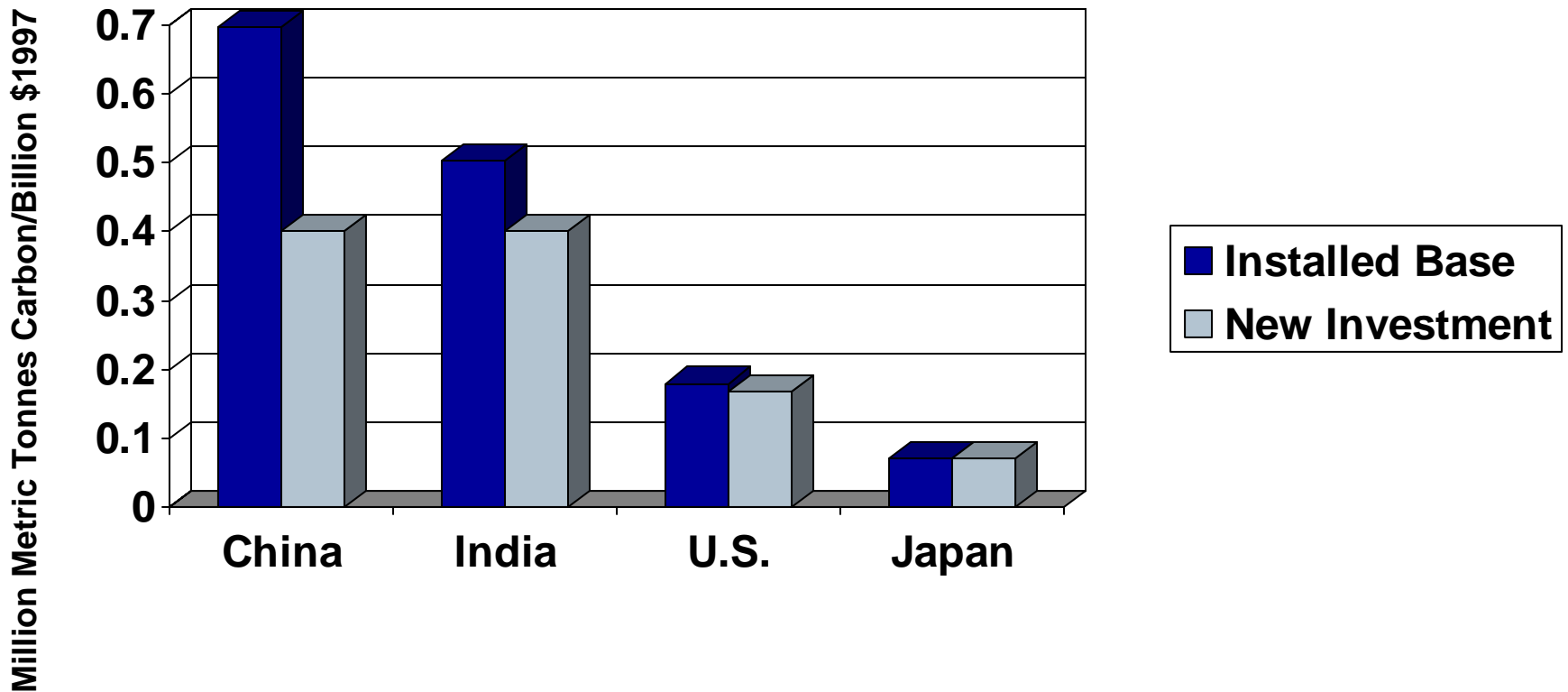
# How Can the Largest and Least Costly Emission Reductions to Be Identified and Achieved?

- **What near term actions have the greatest potential?**
  - ◆ **First candidate – improving greenhouse gas intensity of developing country economies through investment, tech transfer and market reforms**
  - ◆ **Second candidate – R&D that provides economic energy technologies with carbon emissions lower than the most cost-effective available today**
- **Are these actions cost-effective?**
  - ◆ **Examples of emission reductions from growth strategies in developing countries compared to Annex B reductions of similar magnitude**
  - ◆ **Conditions under which increased investment and technology transfer is cost-effective**
- **What policies are required to bring them about?**
  - ◆ **Are there win-win possibilities for policy design?**
    - ◆ Remedy market distortions in developing countries that hinder investment & technology transfer
    - ◆ Increase (profitable) foreign direct investment where growth is constrained by lack of capital
  - ◆ **What is needed from Annex B countries**
  - ◆ **What is needed from non-Annex B countries**



# What Technologies Are Key Developing Countries Using Today?

## Greenhouse Gas Emissions Per Dollar of Output



# Solving the Growth Problem Can Solve the Climate Problem

- **New technology is embodied in new capital equipment**
- **Changing technology to reduce emissions requires investment to replace existing capital with newer technology**
- **Higher rates of investment will accelerate replacement of old capital with the current level of technology**
  - ◆ Higher rates of economic growth will push emissions up
  - ◆ Lower emissions per dollar of output will push emissions down
- **Combining higher rates of investment with better technology will provide the greatest gains**
- **Effects of R&D on long term technology are represented in a scenario with continuously improving technology**

# Growth Models – A Tool for Analysis

- **Embodied Technical Progress:** improvements in productivity and energy efficiency are achieved by installing new capital equipment
- **We can estimate energy efficiency of new investment compared to**
  - ◆ Existing capital in the developing country
  - ◆ New investment in industrial countries
- **Data requirements**
  - ◆ True depreciation rate
  - ◆ Capital-output ratio
  - ◆ Gross investment as a fraction of GDP
  - ◆ Rate of improvement in energy-GDP ratio
- **A model of economic growth with embodied technical progress can be used to**
  - ◆ Estimate energy efficiency of new investment
  - ◆ Project future emissions for different scenarios of investment and technology

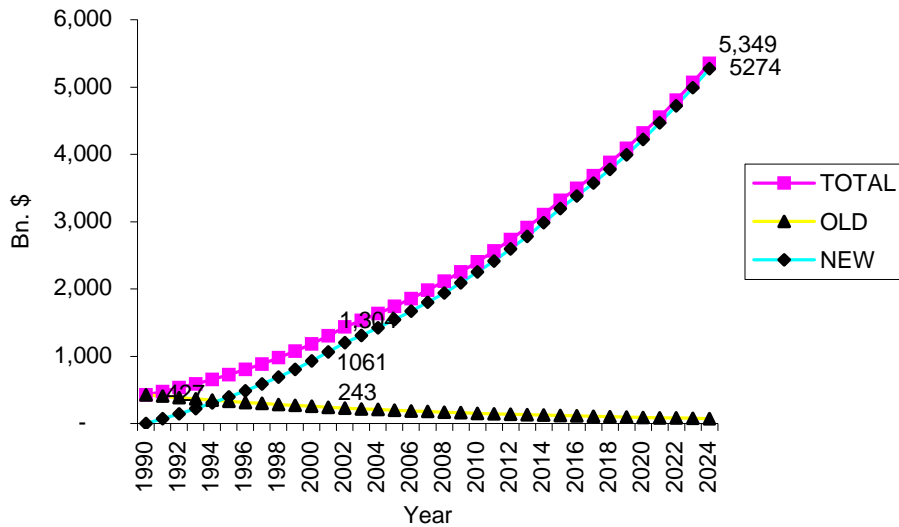


# Cumulative Emission Reductions Possible In Developing Countries Could Exceed the Most Achievable through Kyoto

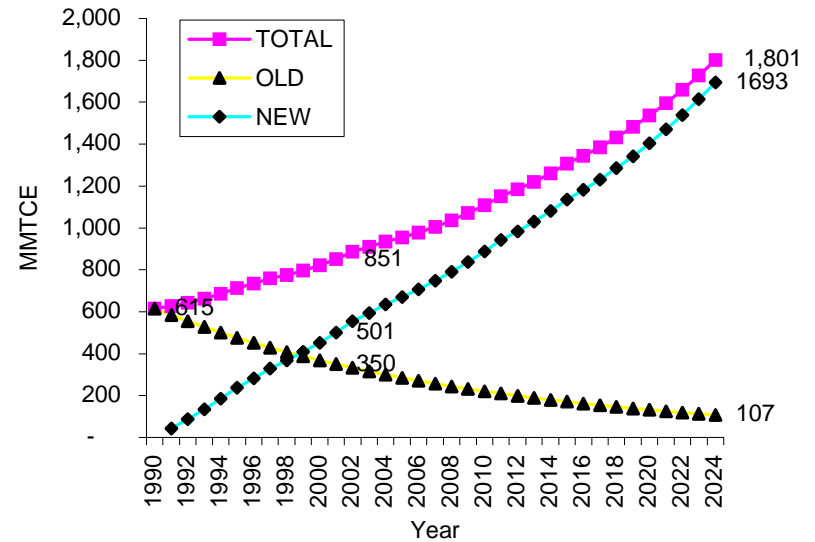
	To 2012 (MMTCE)	To 2017 (MMTCE)
<b>Adopt US technology for new investment in China and India</b>	<b>2600</b>	<b>5200</b>
<b>Adopt US technology with accelerated replacement in China and India</b>	<b>4200</b>	<b>7700</b>
<b>Adopt continuously improving technology with accelerated replacement in China and India</b>	<b>5000</b>	<b>9800</b>
<b>EU under Kyoto Protocol (without hot air)</b>	<b>600</b>	<b>1400</b>
<b>All Annex B countries under Kyoto Protocol (including US and hot air)</b>	<b>2800</b>	<b>7300</b>

# Unless Something Changes, Developing Country Emissions Will Triple by 2025 Despite Gradually Improving Technology

China: Output  
(Normal Replacement)

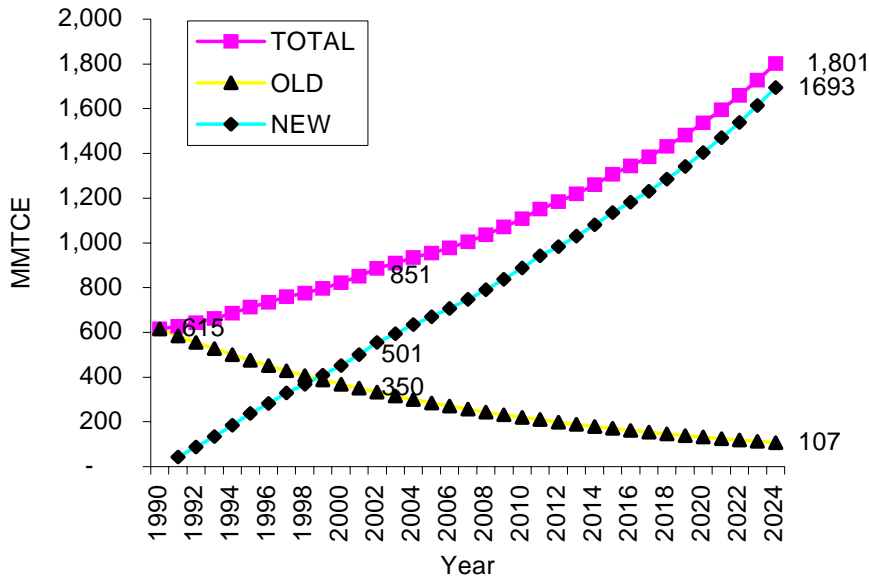


China: Emissions  
(Normal Replacement, China Technology)

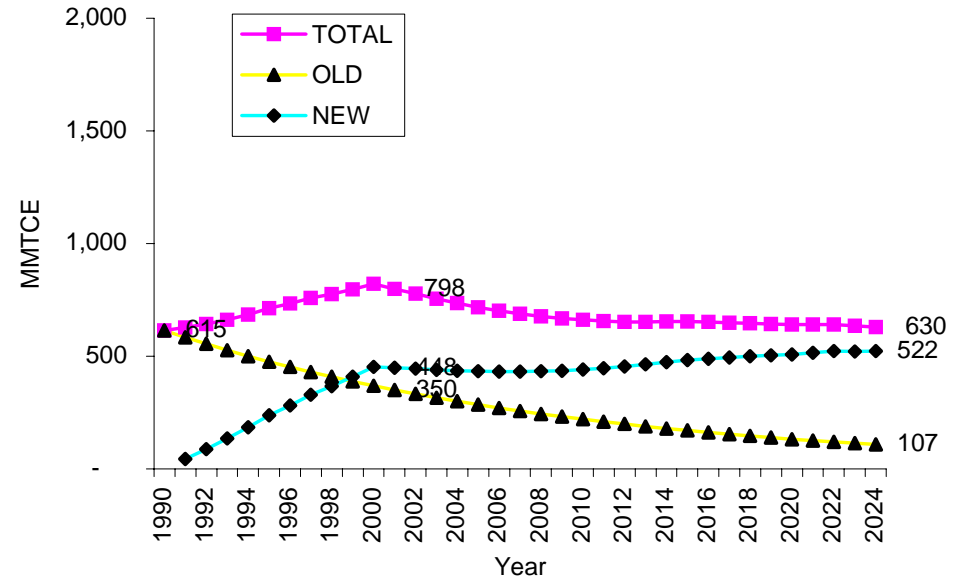


# Technology Transfer Along With R&D to Continue Technology Improvement Can Stabilize Emissions

China: Emissions  
(Normal Replacement, China Technology)

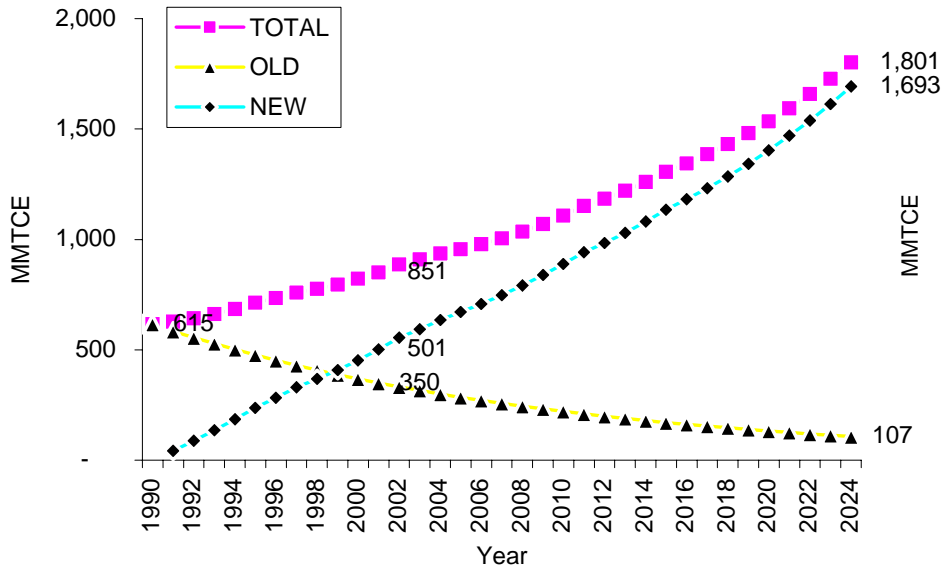


China: Emissions  
(Normal Replacement, Exponential Technology)

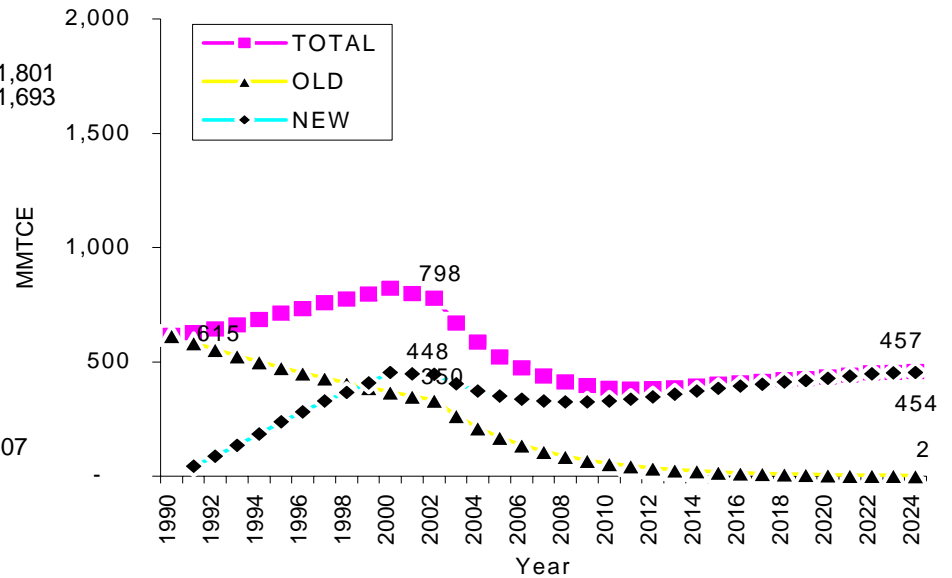


# Technology Transfer and Increased Investment Can Combine to Increase Growth Rates and Reduce Emissions

China: Emissions  
(Basecase: Normal Replacement, China Technology)



China: Emissions  
(Accelerated Replacement, Exponential Technology)



# Is There A Way to Accomplish Technology Transfer and Accelerated Replacement That Provides Benefits for All?

## ■ Policy must address:

- ◆ How to accelerate retirement of old capital
- ◆ How to promote technology transfer in new capital
- ◆ How to increase rate of investment
- ◆ How to keep technology improving

## ■ Some serious thought is required

- ◆ Why do particular countries continue using high carbon technologies?
- ◆ What actions by Annex B countries will be effective in inducing change?
- ◆ What changes in non-Annex B countries are required?
- ◆ How can mutually advantageous actions be arranged?

## ■ The deep question is: are current technology choices best given local costs of labor and energy, or are they driven by market distortions?

- ◆ If current choices are economic, then reducing emissions will be costly
- ◆ If market distortions exist, then growth and environment are compatible



# Microeconomic Evidence—Power Generation in China

- **“The low energy efficiency of Chinese powerplants is due to:”**
  - ◆ **Size**
  - ◆ **Low efficiency even after controlling for unit size**
  - ◆ **Poor coal quality**
  - ◆ **Lack of peaking capacity leading to inefficient cycling of coal units**
  - ◆ **Suboptimal management due to bureaucratization, lack of competitive market pressures, and bottlenecks in T&D**
- **New powerplants built with FDI have better energy efficiency than powerplants built by domestic investors and comparable to US**
  - ◆ **“The principal factor that has hampered the contribution of FDI to energy-efficiency is an institutional bias in favor of small-scale plants...[that] can bypass the convoluted and costly ... approval and regulatory processes...**
  - ◆ **“...the most important barriers to FDI are uncertainty associated with the approval process..., electricity sector regulation, and the risk of default on power purchase contracts**
  - ◆ **“If China hopes to boost FDI it will have to mitigate barriers ... regarding contract enforcement, regulation, and project approval”**

# There Are Pervasive Market Imperfections in Developing Countries that Hinder Technology Improvement

- Legacy of plant, equipment and infrastructure from pre-industrial or pre-market era
- Insulation from world prices and internal subsidies that distort energy costs
  - ◆ Distorted internal pricing mechanisms and lack of markets
  - ◆ Subsidies administered through State-run enterprises
  - ◆ Protection of inefficient industries and technologies
- Internal policies that make markets inhospitable to foreign investment with world class technology
  - ◆ Contract law and protection of property rights
  - ◆ Regulatory hurdles and bureaucracy
  - ◆ Protection of intellectual property
- Lack of infrastructure
- Inadequate education and skills to handle technology



# Framework for Implementing A New Approach – A Policy Toolkit

- **Active cooperation between business and governments in the U.S. and other willing partners is required — bilateral or multilateral**
- **Activities for developing countries**
  - ◆ **Legal and judicial reforms**
  - ◆ **Market reforms**
  - ◆ **Governance reforms**
  - ◆ **Opening of capital markets**
  - ◆ **Human resource capacity development**
  - ◆ **Basic infrastructure development**
- **Activities for developed countries**
  - ◆ **Incentives or risk sharing for private direct investment and tech transfer**
  - ◆ **Programs like Millenium Challenge to induce needed reforms**
  - ◆ **Incentives for appropriate R&D to sustain long term emission reductions**
  - ◆ **Multilateral institutions to facilitate investment and encourage reform**

