5 Facts About Climate Policy: Cause for a Shift in Policy?

Michael Greenstone

3M Professor of Environmental Economics, MIT

Myron Scholes Global Markets Forum

University of Chicago

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Outline

- Fact 1: Temperatures Are Expected to Rise
- Fact 2: Stopping Climate Change Will Be Expensive
- Fact 3: Stopping Climate Change Will Require Tremendous Reductions, Especially in Developing Countries
- Fact 4: Developing Countries Are Poor & Will Be Focused on Income Growth
- Fact 5: The Copenhagen Accord Is Worse Than It Seems

Fact 1:
Temperatures Are Expected to Rise

Temperature Increase

- Under a business-as-usual emissions scenario, the mean annual global temperature is projected to increase by roughly 18% from under 42 °F to about 49 °F between 2000 and 2100

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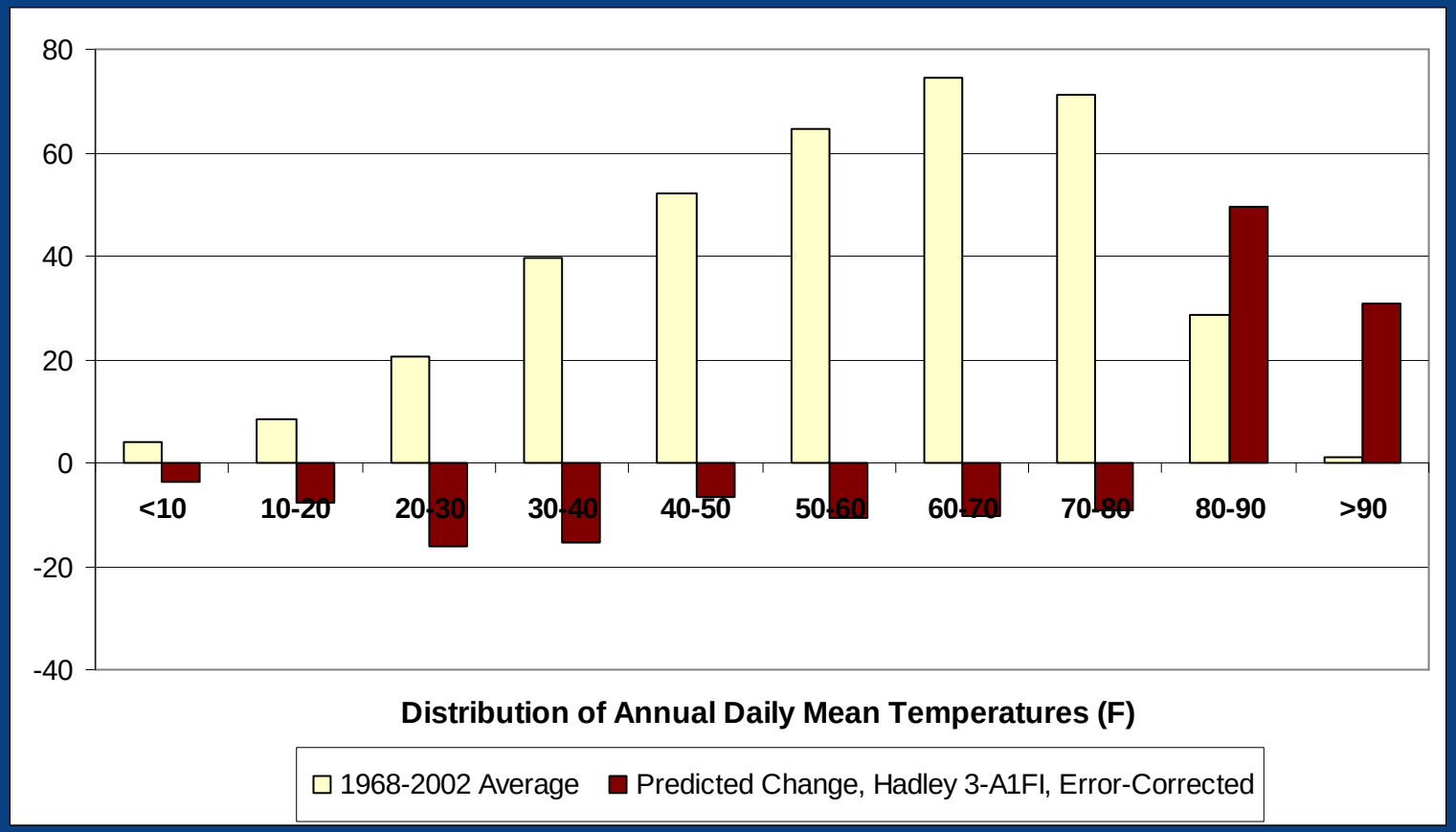
Temperature Increase, Cont.

- According to the Hadley 3-A1FI, Error-Corrected Model (a business as usual scenario), the distribution of annual daily mean temperatures will shift away from low and moderate temperatures and sharply towards extremely hot days by the end of the century



The Risks of Doing Nothing

- Potential temperature increases in the absence of climate change policy intervention:

Image removed due to copyright restrictions. Take a spin on the Greenhouse Gamble.

Exceeding the Target

- The concentration of CO_2-equivalent in the atmosphere is projected to far exceed the target of 450 ppm, which corresponds to a global temperature increase of about 3.6 °F

Adverse Effects of Climate Change

- According to the 4th Report of the IPCC, the negative impacts of climate change include:
  - Hundreds of millions of people exposed to increased water stress
  - Up to 30% of species at increased for extinction, and significant extinctions around the globe
  - Increased damage from floods and storms, with about 30% of coastal wetlands lost
  - Increased mortality and morbidity from heat waves, floods, and droughts
  - Negative impacts on subsistence farmers and fishers
  - Farming productivity to decrease at low latitudes and potentially decrease at high latitudes
  - Changed distribution of disease vectors
  - Substantial burden on health services

Fact 2:
Stopping Climate Change Will Be Expensive

Alternative Wisdom

“I'd put my money on the sun and solar energy. What a source of power! I hope we don't have to wait until oil and coal run out before we tackle that.”

-Thomas Edison

Costs of Energy Technology

- Cost per Kilowatt Hour for Electricity
  - Coal: $0.04 - $0.06
  - Coal with Carbon Capture & Sequestration: 60 - 80% increase
    - This technology is largely unproven at the necessary scale
  - Wind: $0.05 - $0.10
  - Solar: $0.20 - $0.40
  - Nuclear: $0.08 - $0.11
  - Natural Gas: $0.06 - $0.10
  - Hydroelectric: $0.02 - $0.06
  - Geothermal: $0.05 - $0.08
- Technologies for electric cars require substantial improvement

From *The New York Times* of 10/29/10:

"The competitiveness of large-scale solar thermal plants in California also depends on the cost of natural gas, the state's dominant source of electricity. According to Mr. Bullard, **gas-fueled plants** can produce electricity for about **10 cents a kilowatt-hour. After including the government subsidies, solar thermal plants** are expected to generate power at **13 to 17 cents** a kilowatt-hour, which the industry says is close enough in price to be competitive."

→ 30-70% More Expensive AFTER loan guarantees on 80% of debt and 30% tax credit.

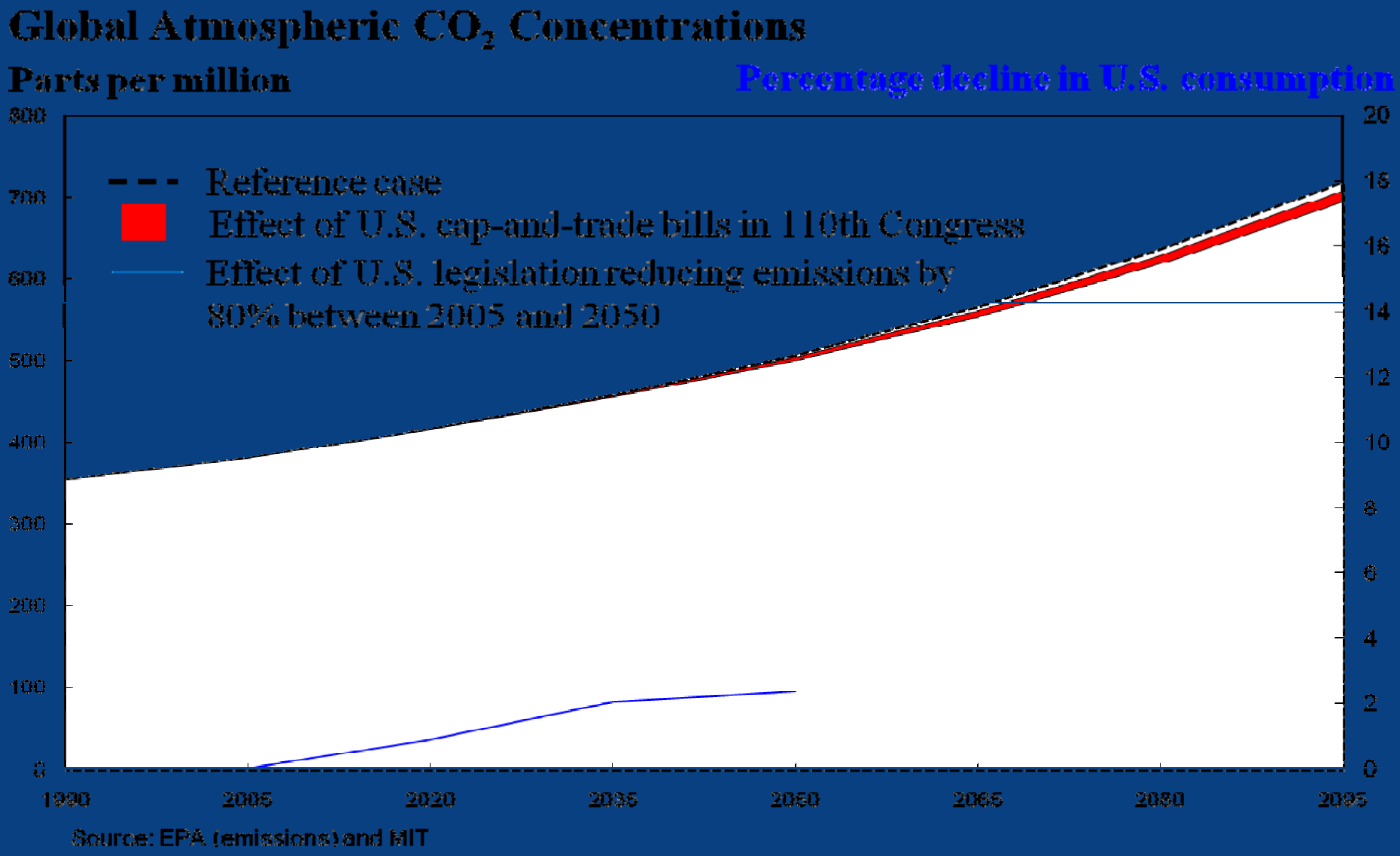
→ Congress Judged this to be too Expensive for the US. Presumably, India and China have made the same judgment.

No Cheap Solutions

- Technology has not yet provided a cheap, large scale solution to decreasing emissions
- "Rapidly developing countries, such as China and India, show ***little interest in abandoning the use of their relatively inexpensive coal reserves***, which constitute 20% of the global total." (Anderson-Newell, 2004)
- Coal Reserves:
  - U.S.: 263 billion short tons of recoverable reserves (at 2008 consumption pace, enough for 234 years)
  - China: 114.5 billion short tons of recoverable reserves (at 2008 consumption pace , enough for 38 years)
  - India: 62.3 billion short tons of recoverable reserves (at 2007 consumption pace, enough for 108 years)

Fact 3:
Stopping Climate Change Will Require Tremendous Reductions, Especially in Developing Countries

The U.S. Can't Do It Alone



Magnitude of CO_2 Reductions Required

- BAU emissions in 2050: about 80 B tons CO_2
- 50% reduction from today: 20 B tons
  - About 2 tons/person

Emissions Required To Achieve 450 ppm Target

- Calculated under a scenario consistent with stabilization at 450 ppm

	Annual Emissions On 450ppm Target Path (Billions of Metric Tons)			Annual Emissions On Business-As-Usual Path (Billions of Metric Tons)			
	2010	2020	2030	2005	2010	2020	2030
Developed World							
U.S.	6.19	4.29	3.94	5.98	5.80	5.98	6.41
OECD Europe	3.82	3.49	3.15	4.42	4.34	4.45	4.52
Developing World							
China	6.54	8.85	8.85	5.43	7.22	9.42	11.73
India	1.25	1.67	1.67	1.19	1.37	1.78	2.12

Developing Countries' Contribution

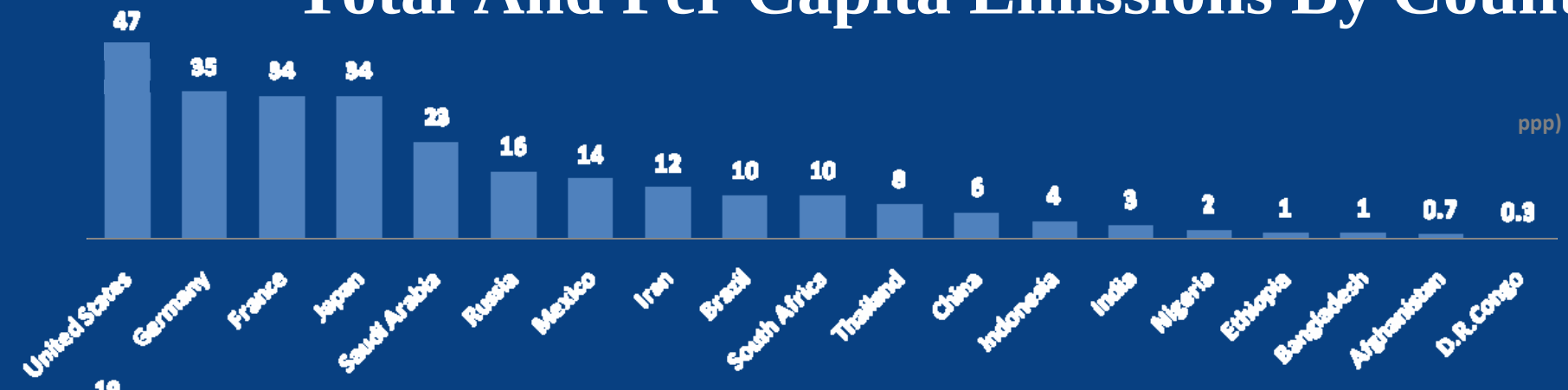
- Developing countries will have to undertake substantial reductions in emissions
- In domestic legislation, roughly 40% of emissions reductions are projected to occur outside the U.S.
- While the vast majority of emissions reductions will occur in developing countries, technologies to verify reductions are unavailable and politically problematic.

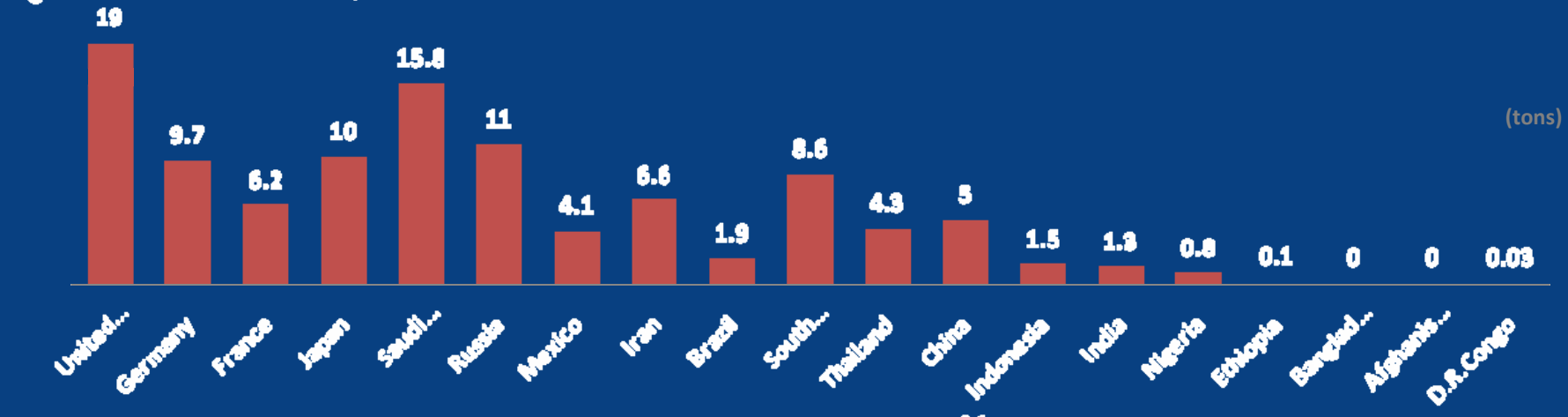
Fact 4:
Developing Countries Are Poor and Will Be Focused on Income Growth

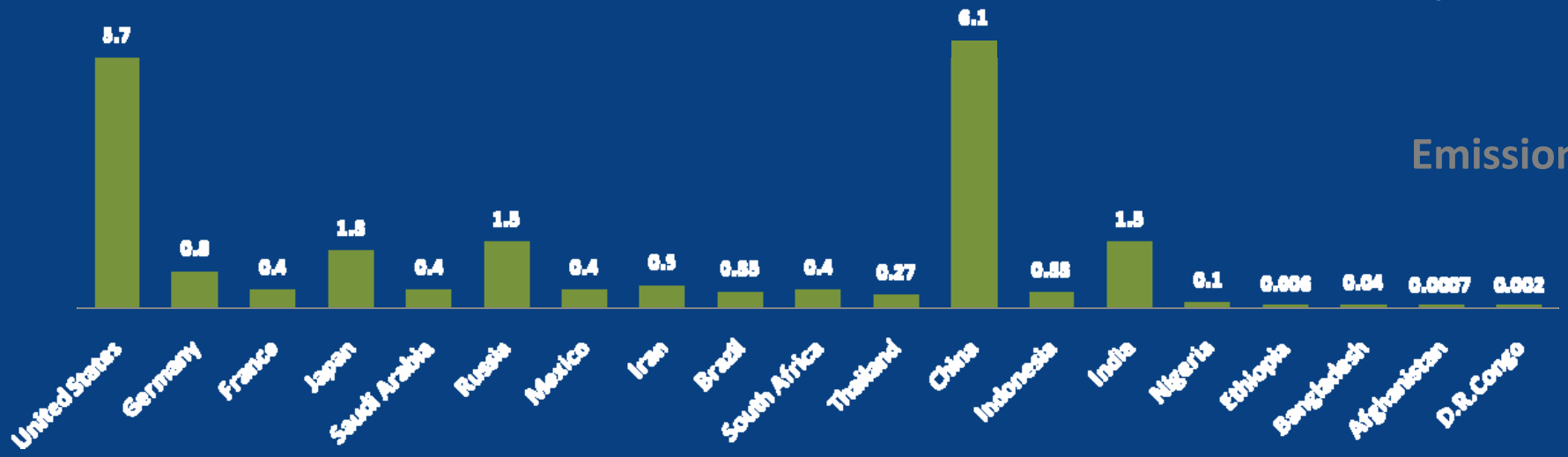
Per Capita Income for Developed vs. Developing Countries

- Developed:
  - United States: $46,443
  - United Kingdom: $35,165
  - European Union: $32,700
- Developing:
  - Brazil: $10,456
  - China: $6,546
  - India: $2,932
- Figures for 2009

Total And Per Capita Emissions By Country







Source: MIT Energy Initiative

Focus on Income Growth

"We should cooperate in achieving the peaking of global and national emissions as soon as possible, recognizing that the ***time frame for peaking will be longer in developing countries*** and bearing in mind that social and ***economic development and poverty eradication are the first and overriding priorities of developing countries***."

-Copenhagen Accord, Paragraph 2

Why Developing Countries Are Focused On Growth

- Extreme weather has a larger effect on mortality in developing countries, since they often lack the infrastructure to protect themselves from it

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Why Developing Countries Are Focused On Growth

- On the other hand, the developed world is more able to increase its consumption of energy in order to combat the health effects of extreme weather

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Agreement on a Global Price for Carbon Will Be Difficult At Best

Fact 5:
The Copenhagen Accord Is Worse Than It Seems

Copenhagen Accord Promised Reductions for the U.S.

- CO_2 emissions 17% below 2005 by 2020 (roughly 1990 levels)
- 83% by 2050
- Depends on Congressional action
  - Prospects for legislation are poor
  - "The cap-and-trade bills in the House and Senate are dead. The concept of cap-and-trade is going to be replaced" -Senator Lindsey Graham
  - "It is my assessment that we likely will not do climate change this year, but will do an energy bill instead" -Senator Byron Dorgan

Other Copenhagen Accord Promised Reductions

- China
  - 40-45% lower CO_2 /GDP by 2020
  - 15% non-fossil by 2020
  - 40M additional hectares forest by 2020
- India
  - 20-25% lower CO_2 /GDP by 2020
  - Near term implementation of standards on fuel efficiency and building energy use
  - 20% non-large-hydro renewables by 2020 (now 8%)
- Brazil
  - 36-39% less CO_2 than BAU in 2020 (roughly 1994 levels)
  - Reduce deforestation by 80% vs historical practice in 2020
- European Union
  - CO_2 emissions 20% below 1990 levels by 2020
  - 30% if others play hard

Misleading Promises

- Promised reductions in China and India are misleading for two reasons:
  - They promise to reduce CO_2 emissions per unit of GDP, even though total CO_2 emissions is what matters for climate change
  - Countries get more energy-efficient over time, so reductions in CO_2 /GDP do not necessarily require the country to change its emissions path

Misleading Promises, Cont.

- China agreed to reduce CO_2 emissions per GDP by 40-45% from 2005 levels by 2020, yet had already reduced CO_2 emissions per GDP by 35% from 1990-2005 without restrictions

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Trust But Verify

- Current technologies to monitor emissions are poor
- Monitoring emissions reductions in Non-Annex I countries, like China and India, is very difficult
  - The Copenhagen Accord allows countries to self-monitor and report their emissions
  - The promised reductions for which China and India registered did not even reference the Accord, further weakening its authority over their emissions

Trust But Verify, Cont.

"Mitigation actions taken by Non-Annex I Parties ***will be subject to their domestic measurement, reporting and verification***, the result of which will be reported through their national communications every two years .... with provisions for international consultations and analysis under clearly defined guidelines that ***will ensure that national sovereignty is respected.***"

-Copenhagen Accord, Paragraph 5

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5. New technologies are necessary

Policy Recommendations

Policy Recommendation 1: Devote Substantial Resources to Developing Monitoring Techniques. No Global Trading System Will Survive Without Substantially Improved Techniques

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Policy Recommendation 2: R&D for Low Carbon Energy Sources, Carbon Capture and Sequestration, and Other Geo-Engineering Techniques

U.S. Should Undertake a Substantial R&D Program Focused on BASIC R&D that Underpins Low Carbon Energy Sources and Capture Techniques

- Currently Spend 1/100 of 1% of GDP on Basic Energy Research. 12th Place Among OECD Countries
- Higher Levels of Funding Justified in Absence of Global Carbon Price
- Reduce Low Costs of Climate Policy to Point Where It is Easier for India and China to Join in
- Political Independence is Crucial (e.g., NSF, NIH)

** NB: Distinct from Current Green Jobs Strategy.

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- A MIT study projects that the cumulative loss from current climate change legislation is about $2.2 trillion between 2012 and 2050

- An alternative is to devote a substantial fraction (e.g., half) to basic R&D, but a new approach to R&D is necessary

  - Basic research generates spillovers

  - Development of new and innovative technologies

    - Carbon capture and sequestration techniques (CCS)

    - Geo-engineering

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Carbon Capture & Sequestration

- Description: Separating CO2 from production byproducts, and transporting and depositing it in depleted oil and gas fields, deep aquifers and the ocean

- Progress: Different parts of the process are currently present in various industries, but have not been successfully combined

- Issues: Cost-prohibitive, as coal power plants incur additional 60-80% of the cost of generating electricity to capture, transport, and store Carbon dioxide. Uncertainty about the effects of storing Carbon dioxide in the ocean.

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Ocean Fertilization

- Description: Depositing nutrients into the ocean to stimulate the growth of CO2-absorbing phytoplankton. Examples include urea (nitrogen-rich compound), phosphorus, and iron

- Progress: Results have been mixed, with some experiments showing that the amounts of CO2 absorbed could be negligible

- Issues: There are many concerns about effect of ocean fertilization on oceanic acidity and ecosystems if done on massive scale

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Reforestation

- Description: Replenishing and creating forests to encourage absorption of CO2 through photosynthesis. Genetically-modified fast-growing trees with a high capacity for carbon absorption could increase the effects of reforestation efforts

- Progress: Many companies have invested in genetically-modified tree plantations in an attempt to acquire carbon credits

- Issues: Success is location-sensitive, and concerns abound over invasive species, lack of genetic diversity, and susceptibility to fires and disease

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Advanced Market Commitments

- One approach to incentivize R&D on new technologies to offer a substantial prize to those who develop, for example:
  - Ability to capture half of an average power plant's emissions over 10 years and store it successfully
  - Development of organisms that can sustain Carbon absorption over a long horizon without doing significant damage to their surrounding environment

Policy Recommendations

Policy Recommendation 4: Use the Clean Air Act to Regulate Carbon Intelligently

There are a Wide Variety of Carbon Abatement Policies, including: Deployment of Low Carbon Energy; Energy Efficiency Standards for Buildings and Transportation; Anti-Deforestation Policies; and Renewable Portfolio Standards.

- All Policies Must be Judged on the Cost per Ton of Carbon Abated.
- Use Randomized Control Trials to Measure Cost per Ton of Carbon Abated. Gold Standard Evidence as with Drug Trials
- Use USG's Social Cost of Carbon (SCC to Identify Regulations and Policies where Cost per Ton Abated < SCC)

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Policy Recommendation 3: Secondary Focus on Global Carbon Market

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11.202 Planning Economics

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