KSU Winter Intersession 2010

Reducing Carbon Emissions: Current World Progress

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Session 1b – Reducing Carbon Emissions: Current World Progress

Start 9:15-10:00am Wednesday

30 min 15 QA then break

Global CO_2 Reductions

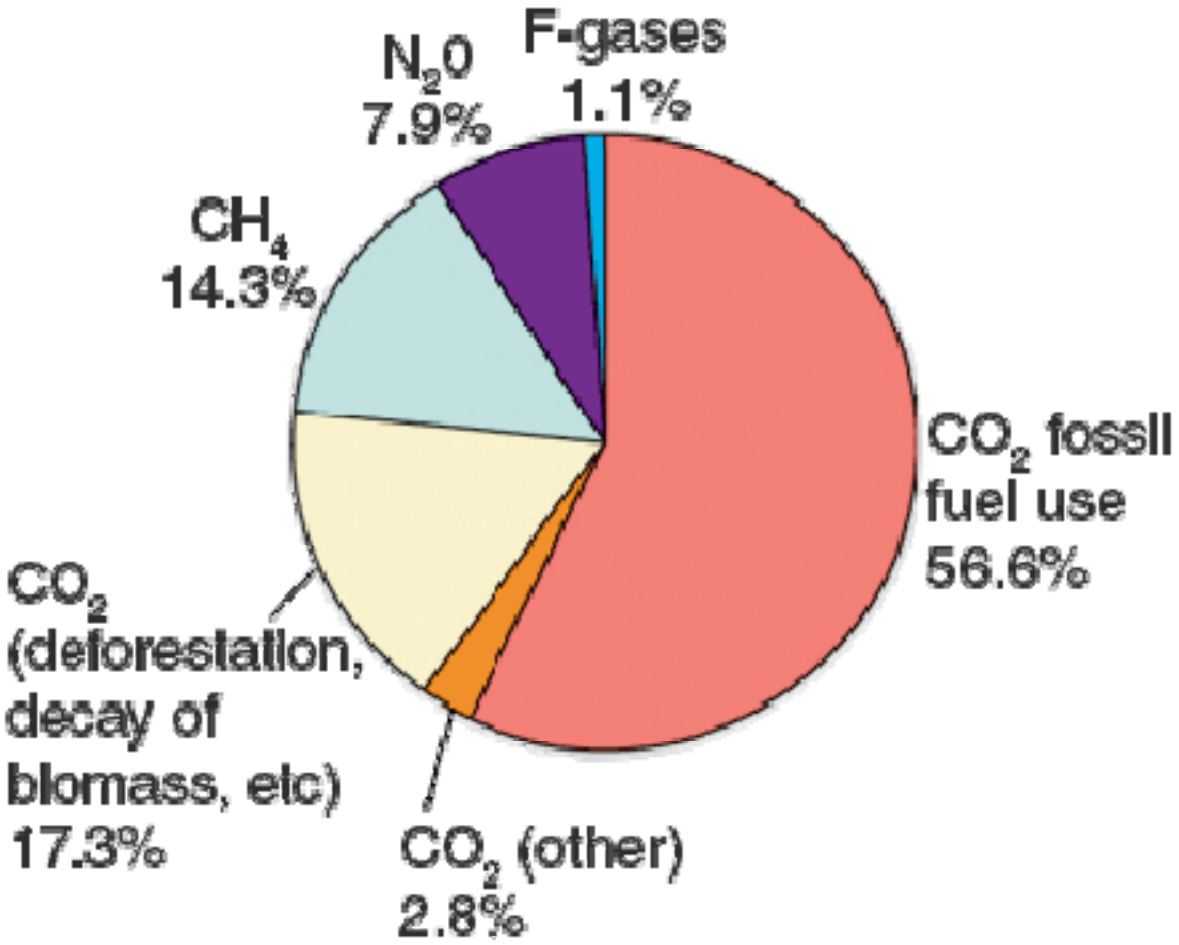
- Fuel switching
- Energy efficiency
- Reforestation/forest sequestration
- Terrestrial sequestration
- Geologic sequestration
- Alternative energy
- Planned/managed urban development

Carbon-Energy-People

Distribution of GHG Sources 2004

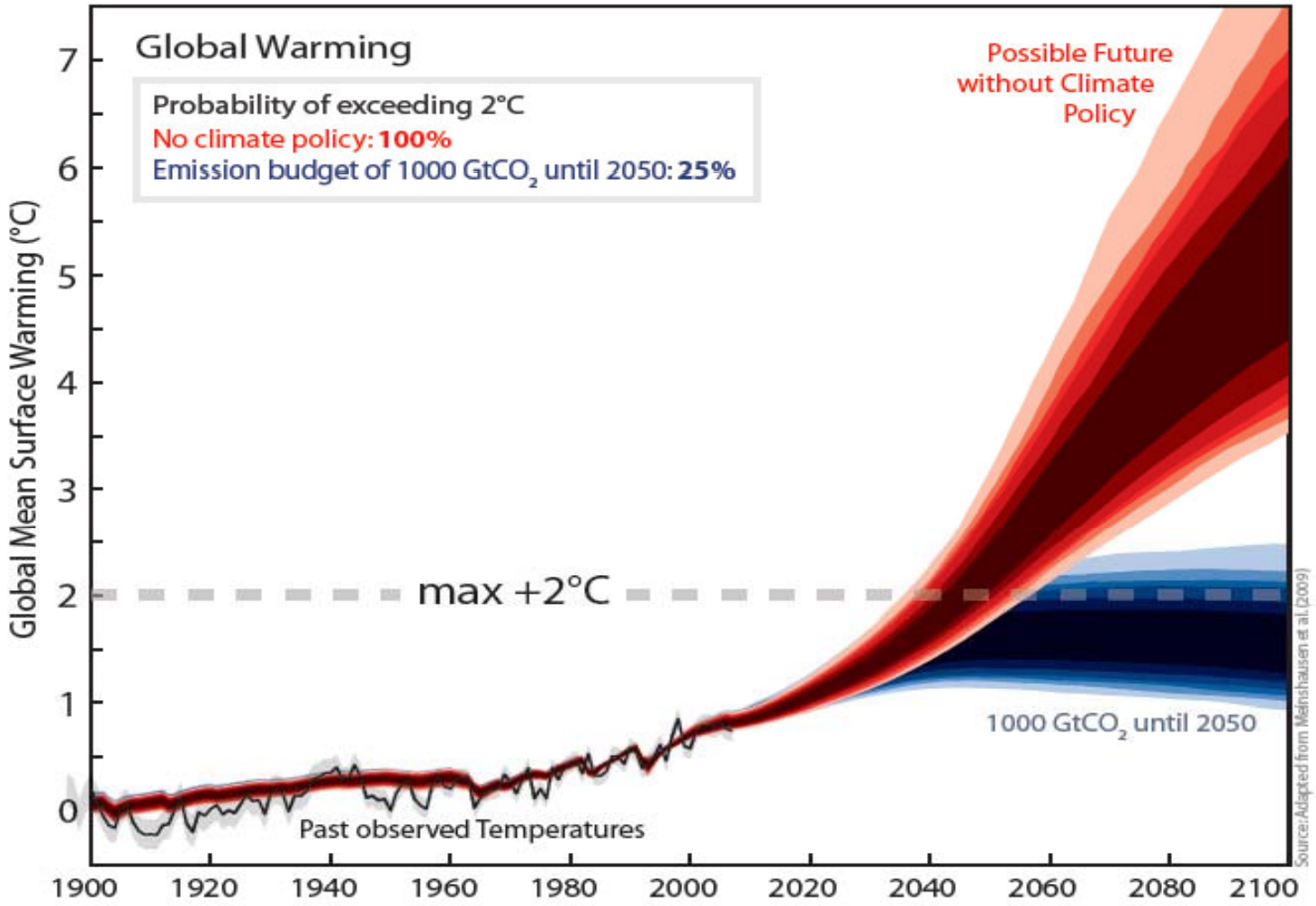
http://www.epa.gov/climatechange/emissions/globalghg.html

IPCC [4th Assessment Report: Climate Change 2007: Synthesis Report]



The “Trillionth Ton”

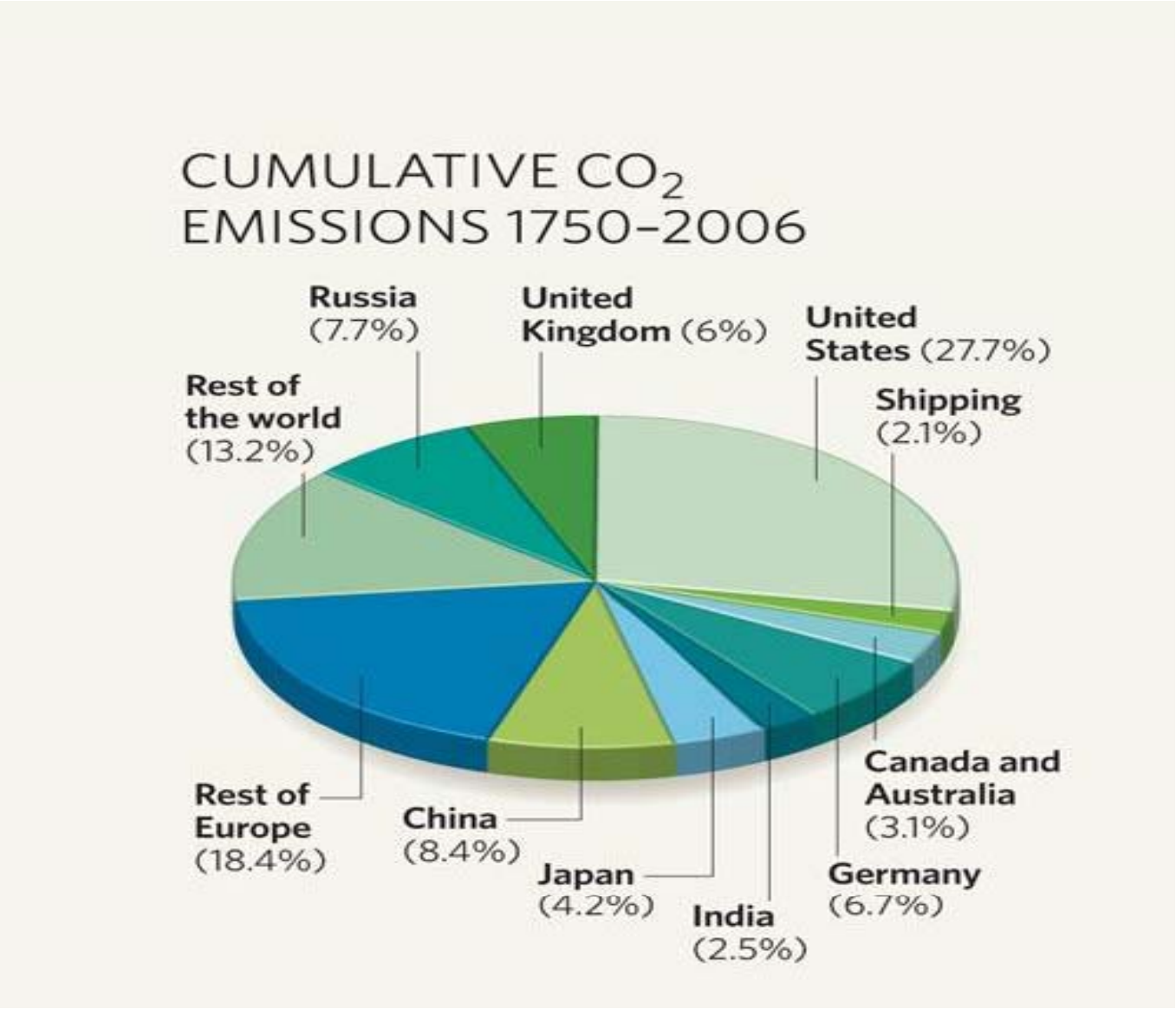
http://www.nature.com/news/2009/090429/full/4581091a.html



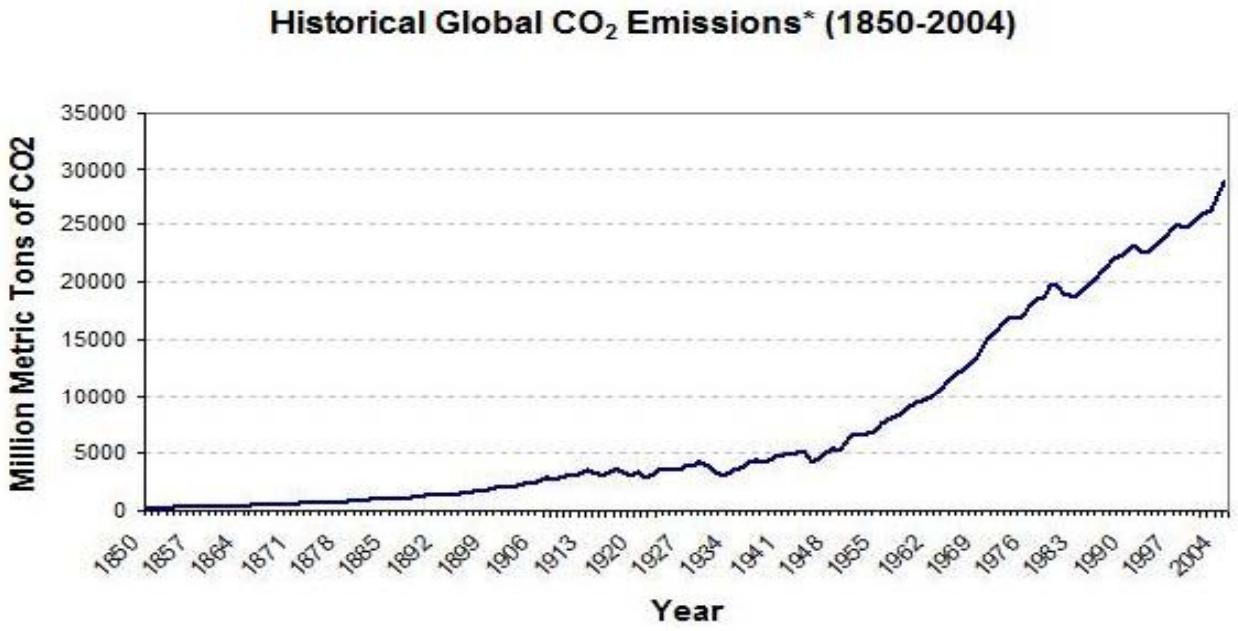
- **If no climate policies are implemented (red) global warming will cross 2°C by the middle of the century. Making sure we don't emit more than 1 trillion (1000 gigatons) of CO_2 in total (blue) would limit the risk of exceeding 2°C to 25% (Image: M. Meinshausen)**

Distribution of Cumulative CO_2 Emissions

http://www.nature.com/news/2009/090429/full/4581091a/box/2.html



Historical Global CO_2 Emissions

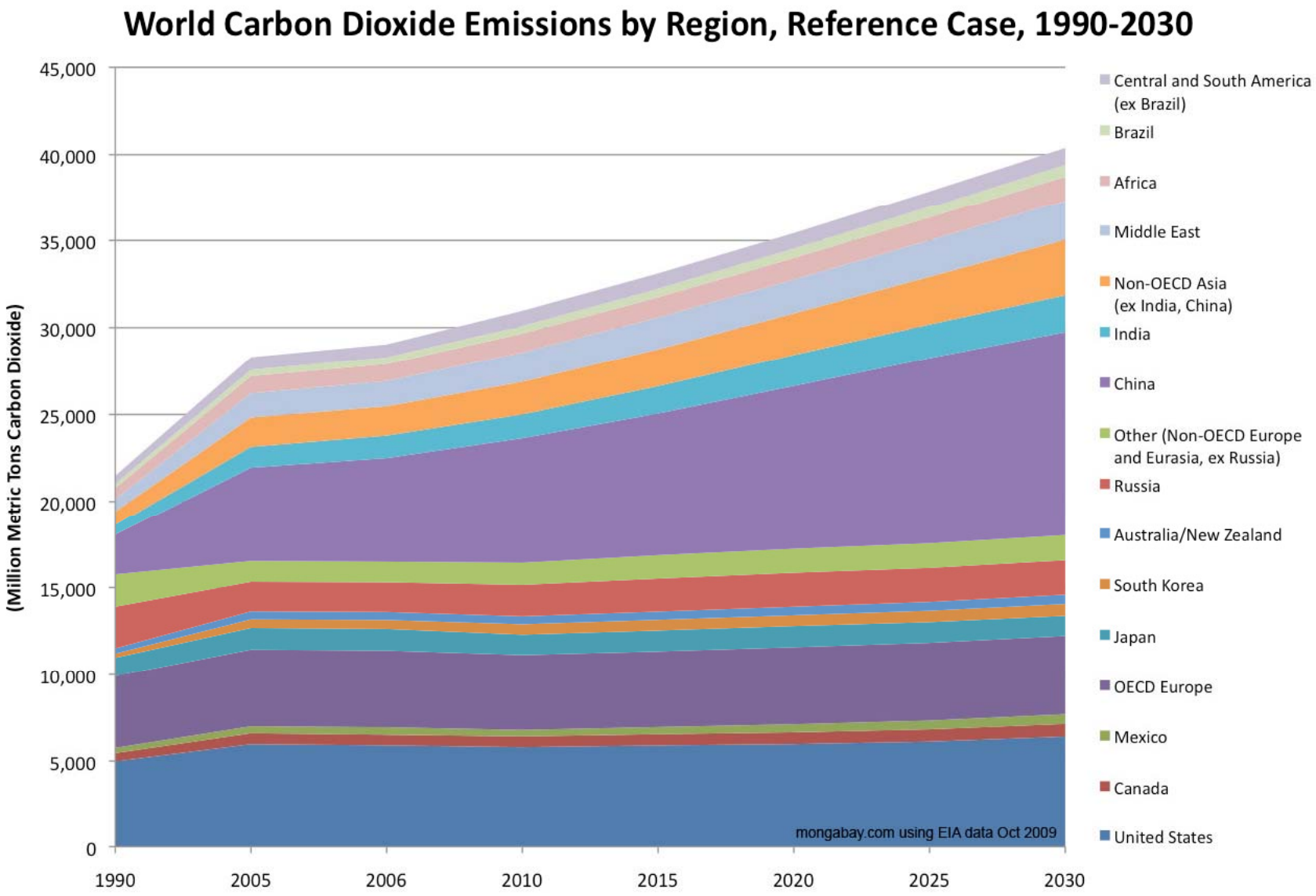


*from Fuel Burning, Cement Manufacture, and Gas Flaring
Source: Marland et. al (2007) Global, Regional, and National CO_2 Emissions. In Trends: A Compendium of Data on Global Change. CDIAC U.S.A.

- **Greenhouse gas emissions, largely CO_2 from the combustion of fossil fuels, have risen dramatically since the start of the industrial revolution. Globally, energy-related CO_2 emissions have risen approximately 145-fold since 1850 - from 200 million tons to 29 billion tons a year.**

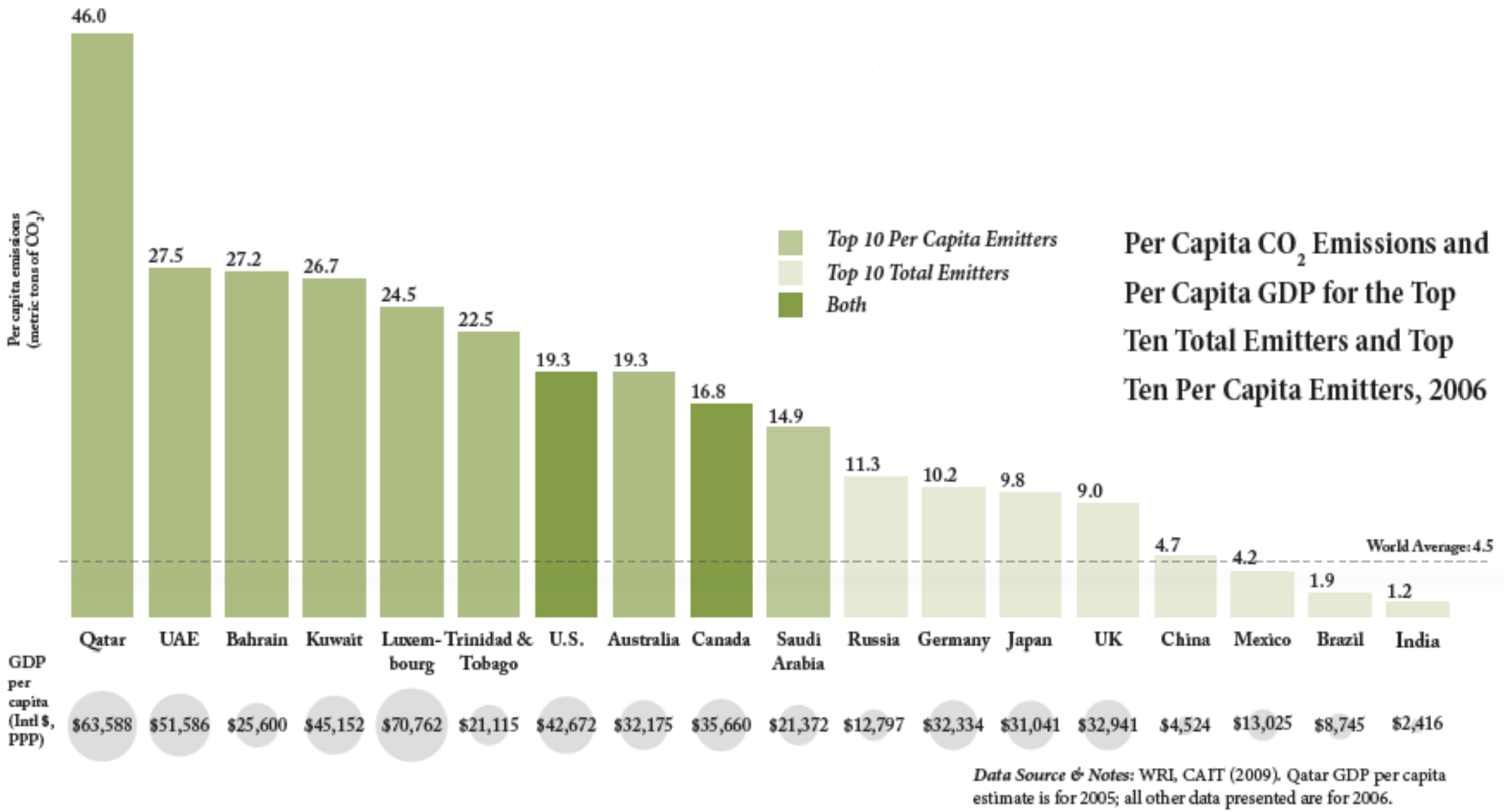
Projected Global CO_2 Emissions

http://rainforests.mongabay.com/09-carbon_emissions.htm



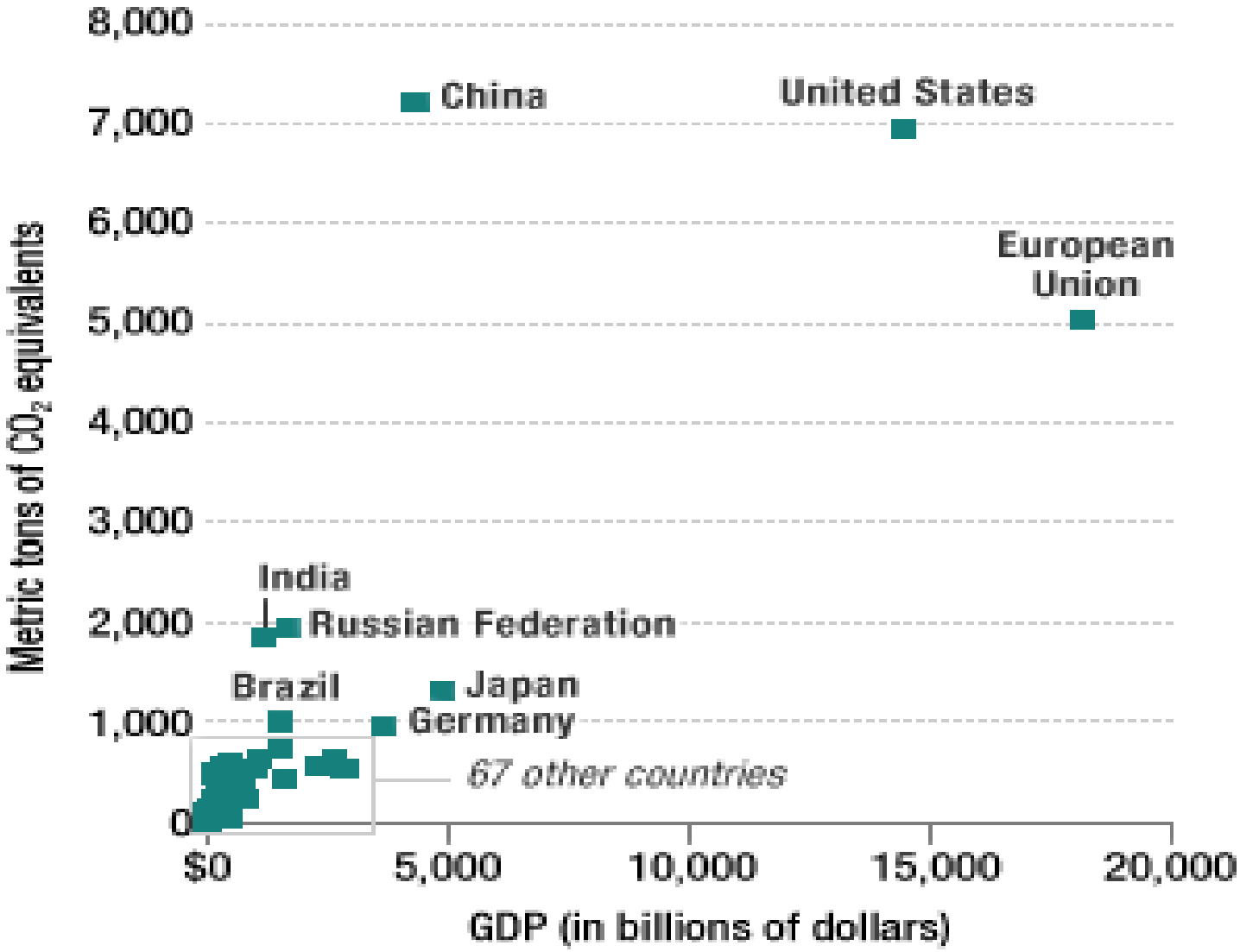
CO_2 Emissions Per Capita

http://cait.wri.org/downloads/CAIT_7.0_COP15.pdf



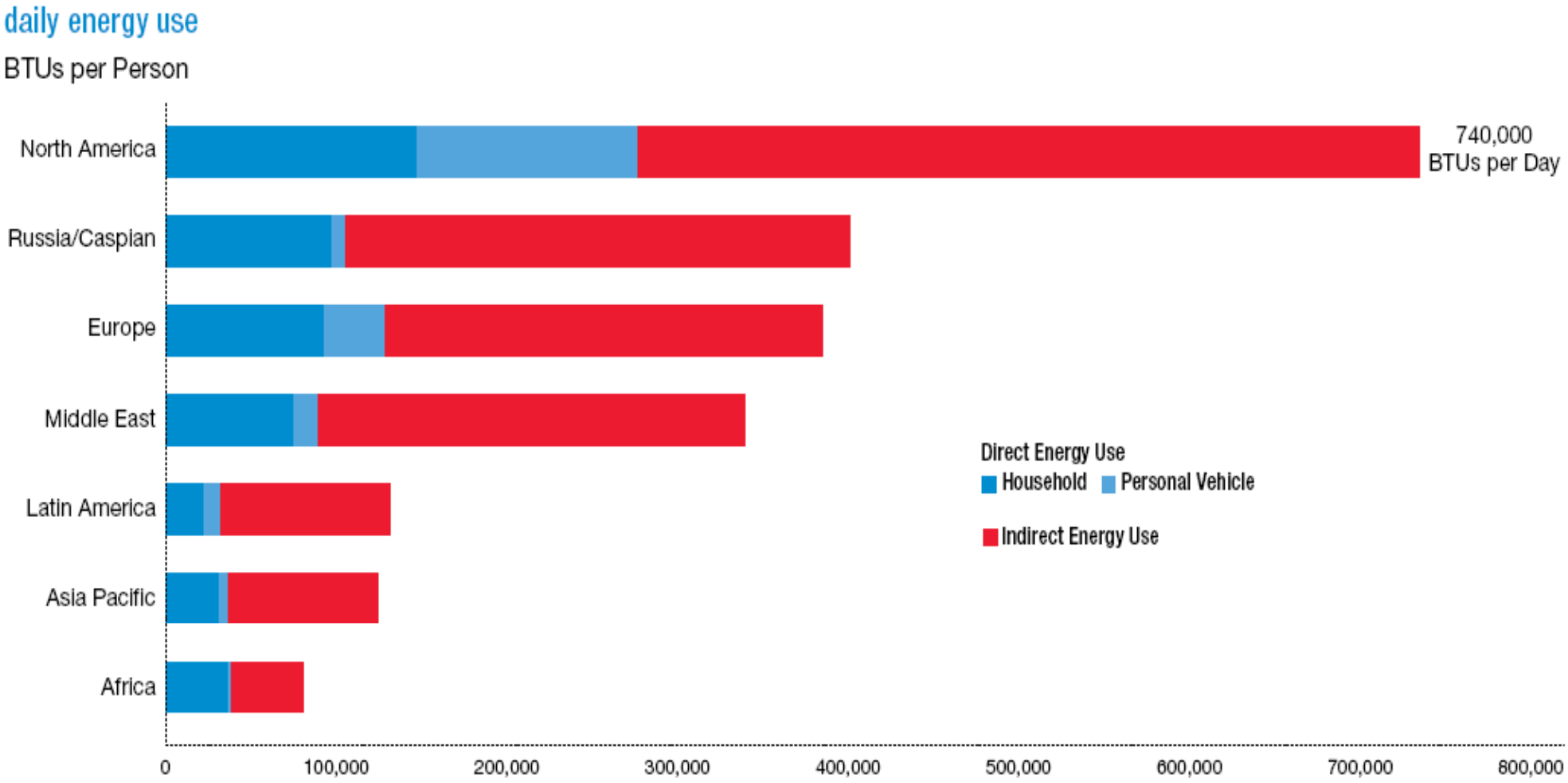
CO_2 Emissions Compared With GDP

World Resources Institute's Climate Analysis Indicators Tool, 2009; CIA World Factbook
http://www.npr.org/templates/story/story.php?storyId=121240453



Personal Energy Consumption

http://www.exxonmobil.com/Corporate/Files/news_pub_eo_2009.pdf



China vs US

- 1.37 *billion* vs 310 million people
- 38 vehicles per 1000 vs 985 per 1000
- 9.6 million square miles vs 3.5 million square miles

Transportation-US

- ~230 million operable cars and trucks
- Primarily gasoline/diesel (~24 mln/bls/day)
- Push towards electric
- Expand urban/regional/national rail systems
- Electrify rail systems
- But where will the required electricity come from?

Reductions by Energy Efficiency

- While the Danish economy has grown approximately 75 per cent over the past 25 years, domestic energy consumption has remained constant and CO_2 emissions have decreased. This has made Denmark one of the world's most energy efficient economies. Denmark has not only improved its use of renewable energy, but has also reduced waste and greenhouse gases.

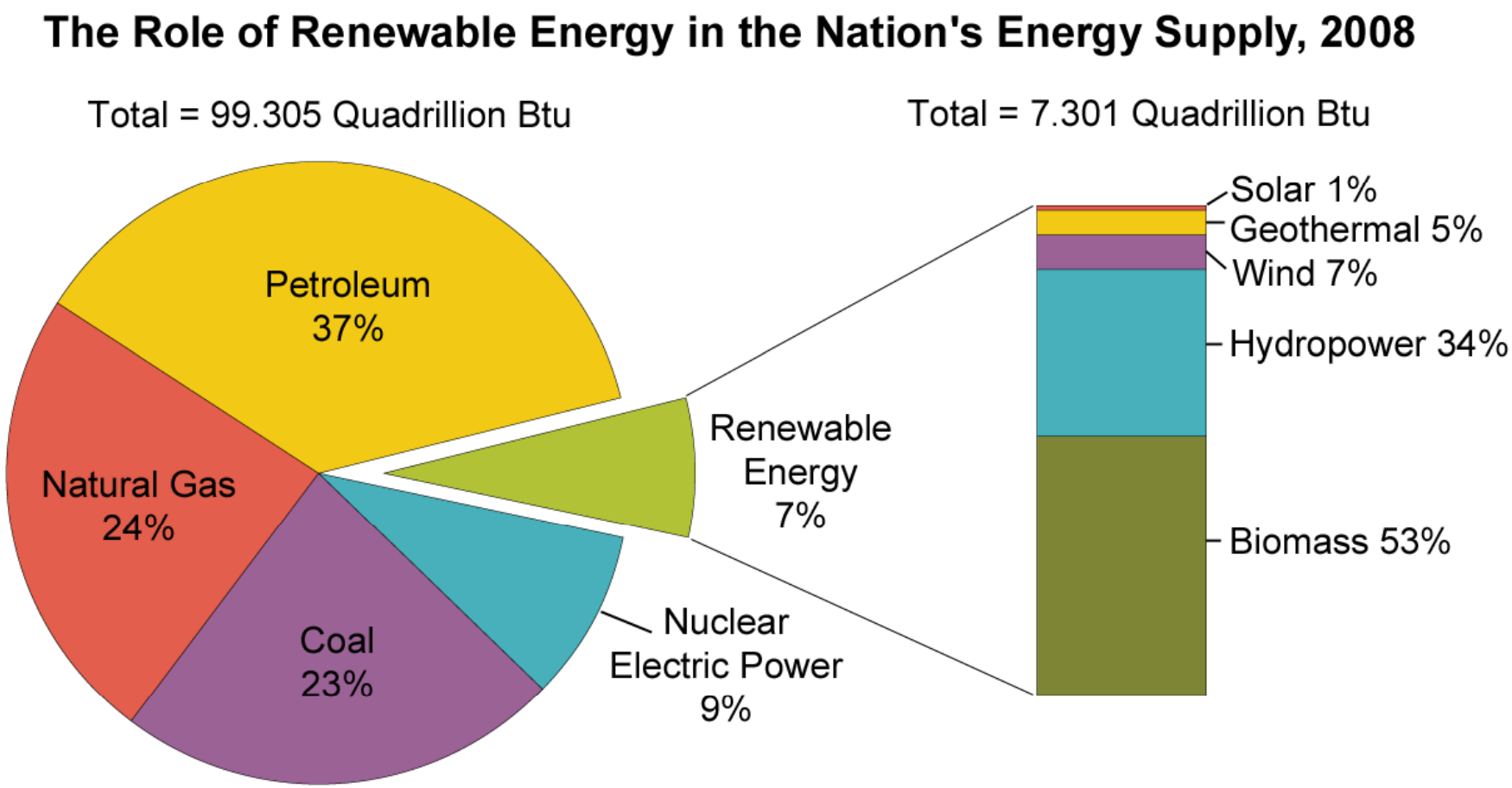
Renewables-US

- Wind
- Solar
- Geothermal
- Biomass
- Hydro
- Oceans-wave energy/temperature differential/salinity differential

- Problems-production does not match demand
- Problems-source does not regionally match demand
- Competing interests on resources
- Expected land and resource uses do not match urban, state or federal rules and regulations
- Distribution infrastructure needs to be reconfigured

US Energy Mix

http://tonto.eia.doe.gov/kids/energy.cfm?page=renewable_home-basics
http://www.eia.doe.gov/cneaf/solar.renewables/page/rea_data/rea_sum.html

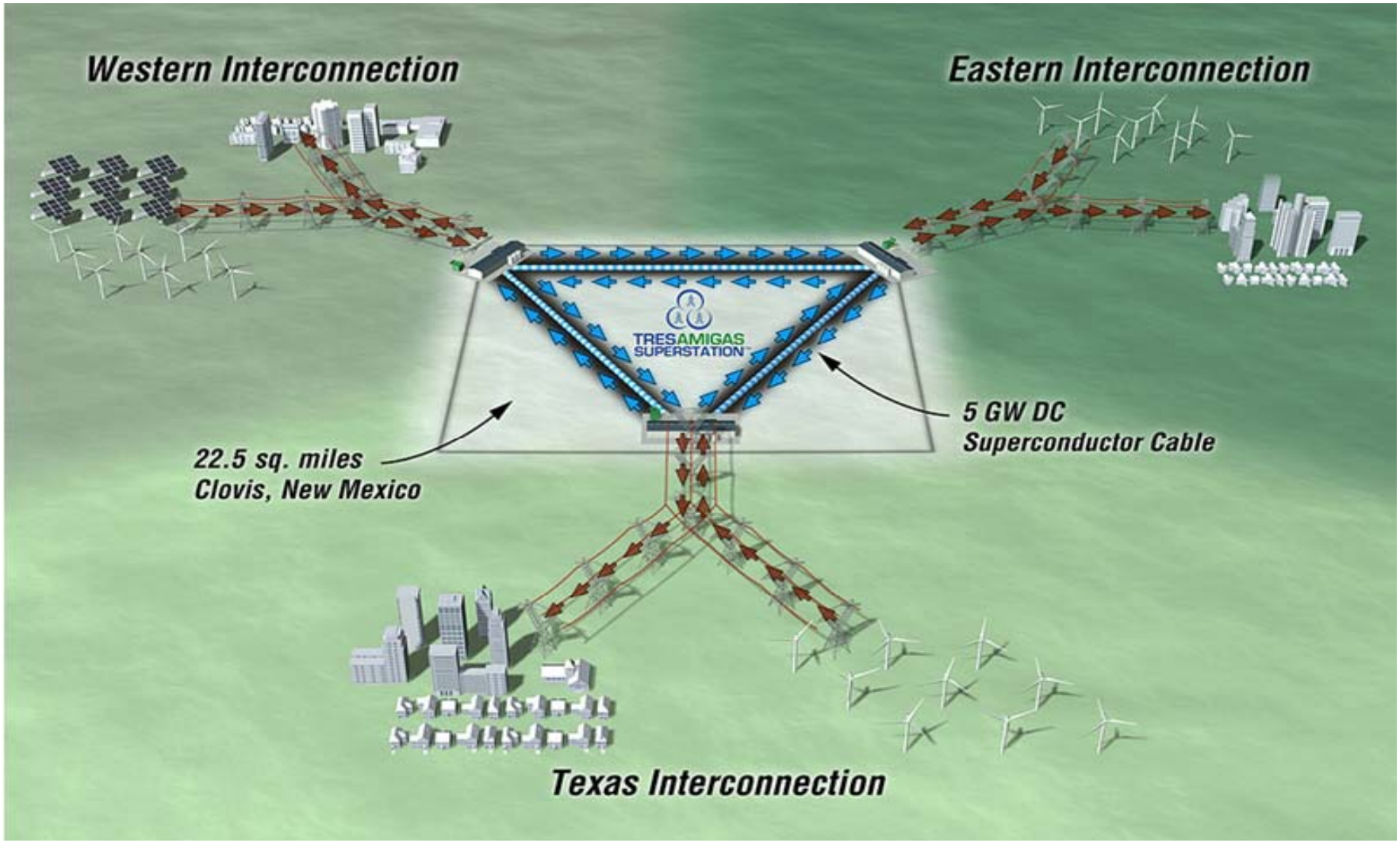


Note: Sum of components may not equal 100% due to independent rounding.
Source: Energy Information Administration, *Renewable Energy Consumption and Electricity Preliminary Statistics 2008*, Table 1: U.S. Energy Consumption by Energy Source, 2004-2008 (July 2009).

Addressing Renewable Electricity Supply/Demand Dislocations

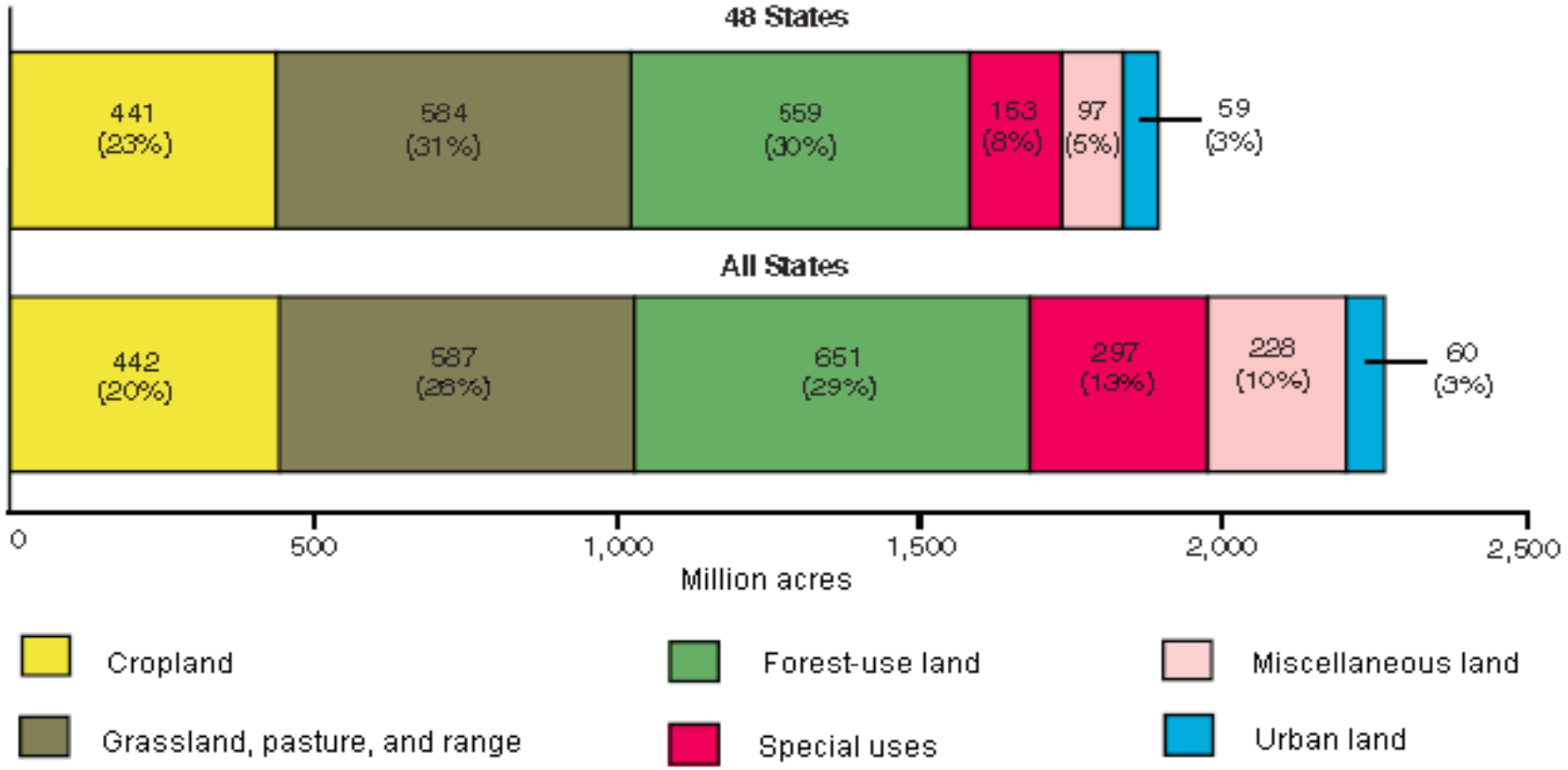
"Tres Amigas Superstation"

http://ksjtracker.mit.edu/2009/12/23/climate-wire-an-electric-superstation-game-changer-is-at-ferc/



Major Land Uses - US

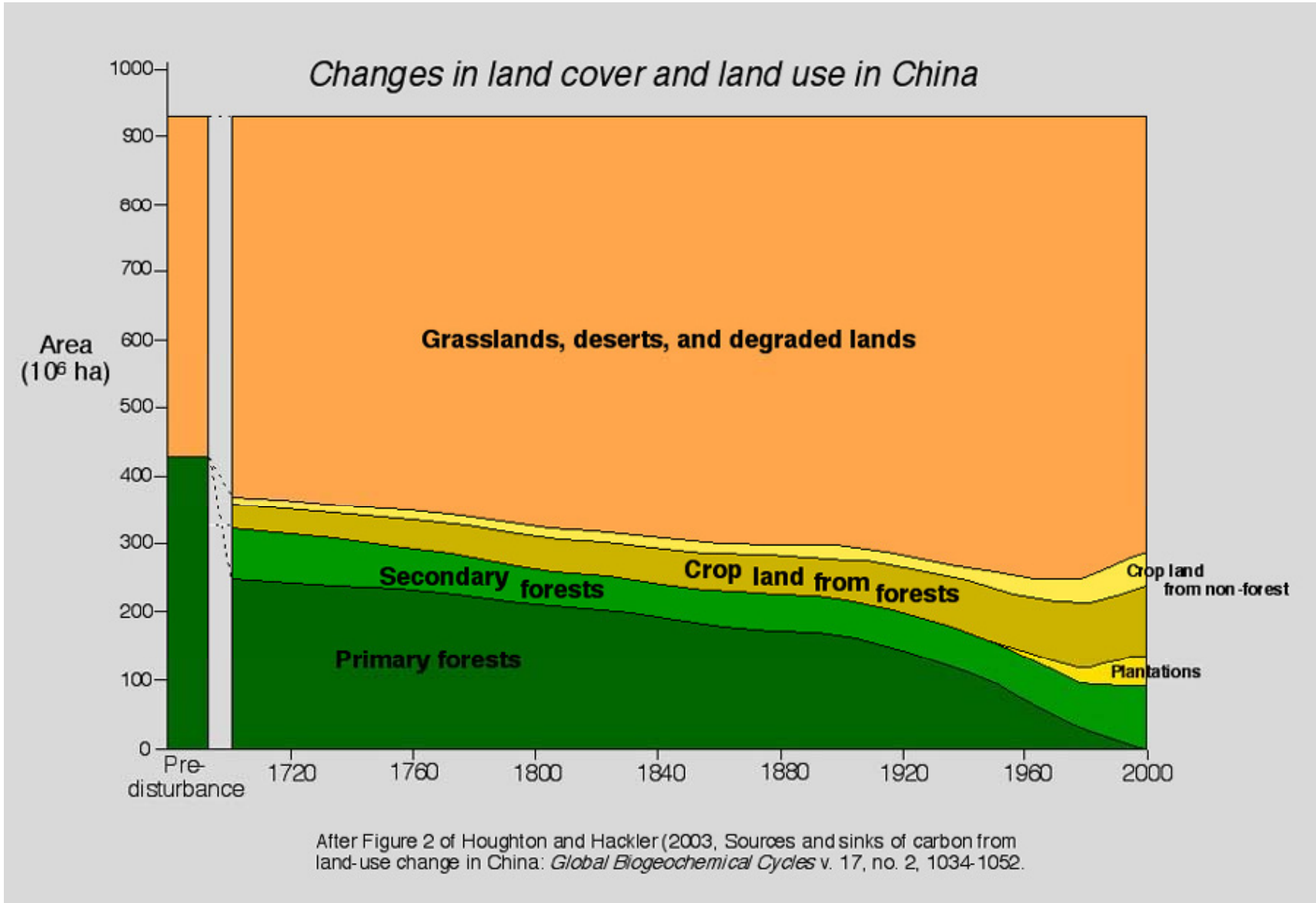
http://cta.ornl.gov/bedb/introduction/Major_Uses_of_Land_in_the_United_States.xls



The United States has a total land area in all 50 states of 2.263 billion acres. Based on the 2002 land use inventory, 20% of that land was categorized as cropland and 29% as forest-use land, thus about 49% of U.S. land is a potential source of biomass residuals or biomass crops for bioenergy. Grassland pasture and range land is, for the most part, too dry to provide much biomass resources. Miscellaneous, special use land and urban land may be a source of post-consumer biomass residuals, but are not areas where biomass crops could be produced on a large scale.

Major Land Use – China

http://www.gly.uga.edu/railsback/CTW/ChinaLandUseThruTime.jpeg



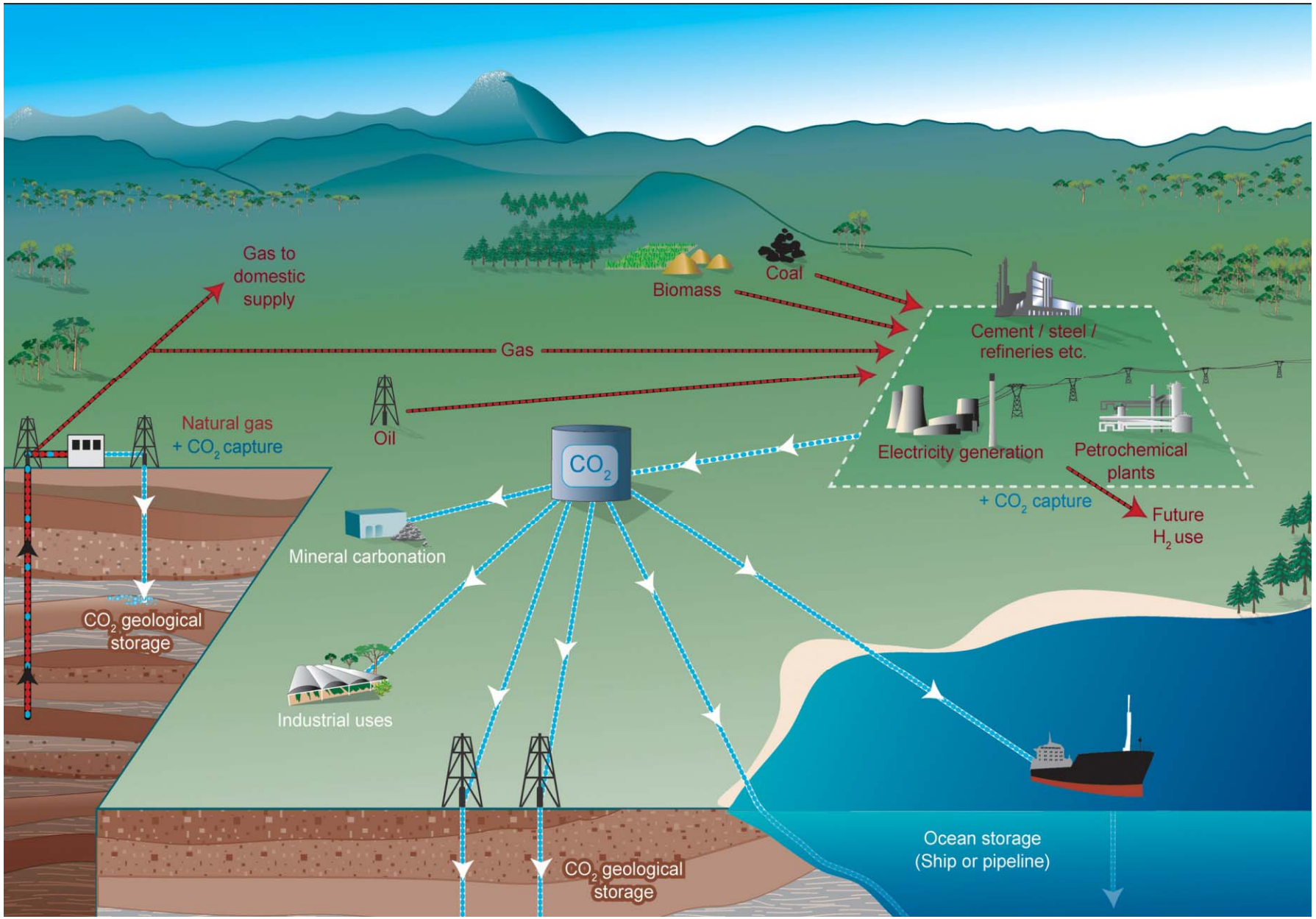
After Figure 2 of Houghton and Hackler (2003, Sources and sinks of carbon from land-use change in China: *Global Biogeochemical Cycles* v. 17, no. 2, 1034-1052.

Geologic Sequestration

Geologic Sequestration

http://www.co2crc.com.au/images/imagelibrary/gen_diag/spm1_media.jpg

http://www.netl.doe.gov/technologies/carbon_seq/core_rd/storage.html



NETL Seven Regional Partnerships

http://www.netl.doe.gov/technologies/carbon_seq/partnerships/links.html

BIGSKYCARBON SEQUESTRATION PARTNERSHIP	**Montana State University** http://www.bigskyCO2.org/
MGSC	**University of Illinois,** **Illinois State Geological Survey** http://www.sequestration.org/
MRCSP MIDWEST REGIONAL CARBON SEQUESTRATION PARTNERSHIP	**Battelle Memorial Institute** http://www.mrcsp.org
The Plains CO2 Reduction Partnership PCOR	**University of North Dakota,** **Energy & Environmental Research Center** http://www.undeerc.org/pcor/

Southeast Regional Carbon Sequestration Partnership	**Southern States Energy Board** http://www.secarbon.org/
SWP SOUTHWEST PARTNERSHIP CO2 SEQUESTRATION	**New Mexico Institute of** **Mining and Technology** http://www.southwestcarbonpartnership.org/
WEST COAST REGIONAL CARBON SEQUESTRATION PARTNERSHIP westcarb.org	**California Energy Commission** http://www.westcarb.org/

Houston-CCS Capital of North America

Greater Houston Partnership **March 4, 2009**

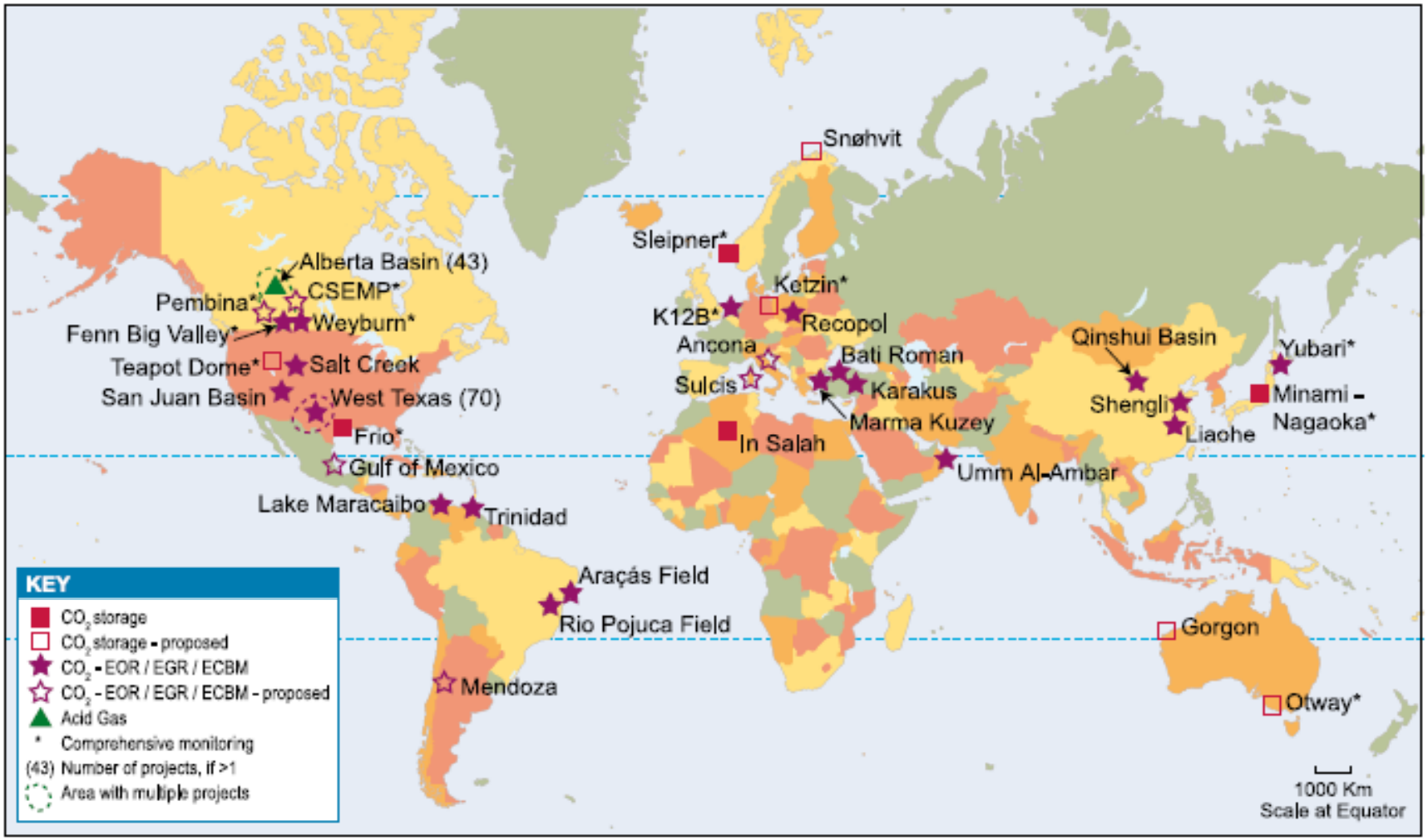
Resolution of the Board of Directors in Support of Carbon Capture and Storage Projects

The Houston region is establishing itself as the leading center of large scale carbon capture and storage projects, a leading knowledge center in energy and environmental security and a global center in renewable energy projects.

The Greater Houston Partnership supports legislative efforts to address climate change in a practical and competitive manner. The Partnership encourages further progress to bring more carbon capture and storage projects to Texas with favorable legislation and practical incentives.

Global Geologic Sequestration

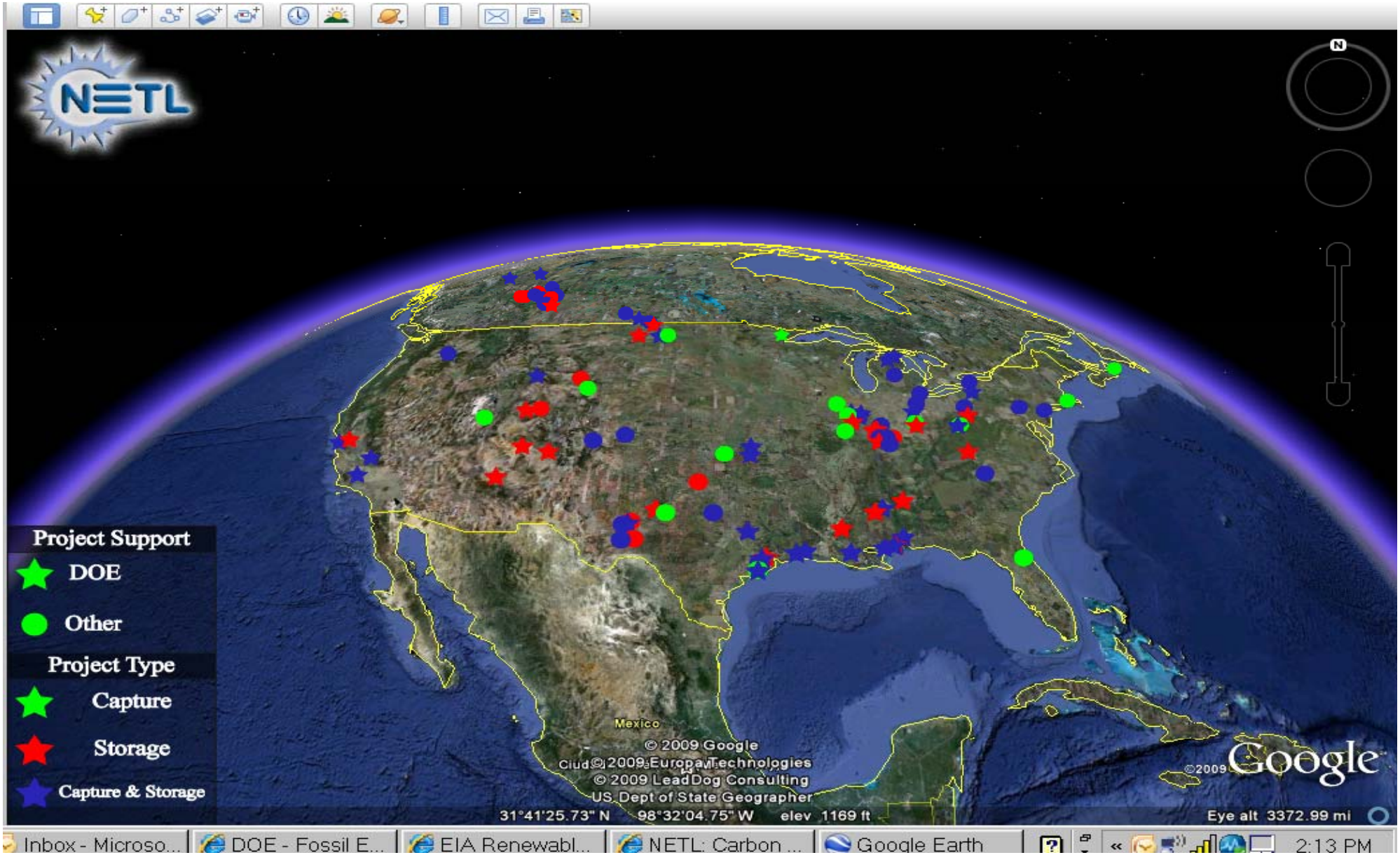
Special Report on Carbon Dioxide Capture and Storage pge 198 fig. 5.1
http://www.ipcc.ch/activity/srccs/SRCCS_Chapter5.pdf



192 proposed and active CCS projects worldwide. The projects are located in 20 countries across five continents. The 192 projects globally include 38 capture, 46 storage, and 108 for capture and storage.

Geologic Sequestration

http://www.netl.doe.gov/technologies/carbon_seq/database/index.html



Issues

- Liability
- Land rights issues: storage space, mineral rights, surface rights and access
- Regulatory-Federal and State
- Environmental
- Water use and access
- Infrastructure
- Funding
- Human Resources
- Geographic
- Geologic
- Public Acceptance
- Energy

Public Acceptance is Crucial

http://sites.google.com/site/noco2wasteindarke/

Public Acceptance is Crucial

- **Shell's CO2 stocking plans under fire**
  Posted: 03 January 2010 1056 hrs
- **http://www.channelnewsasia.com/stories/afp_world_business/view/1028244/1/.html**
-
- BARENDRECHT, Netherlands: A plan by oil giant Shell to store 300,000 tonnes of carbon dioxide a year in a depleted gas reservoir beneath a Dutch city has drawn the ire of residents and local officials who have vowed to thwart it.

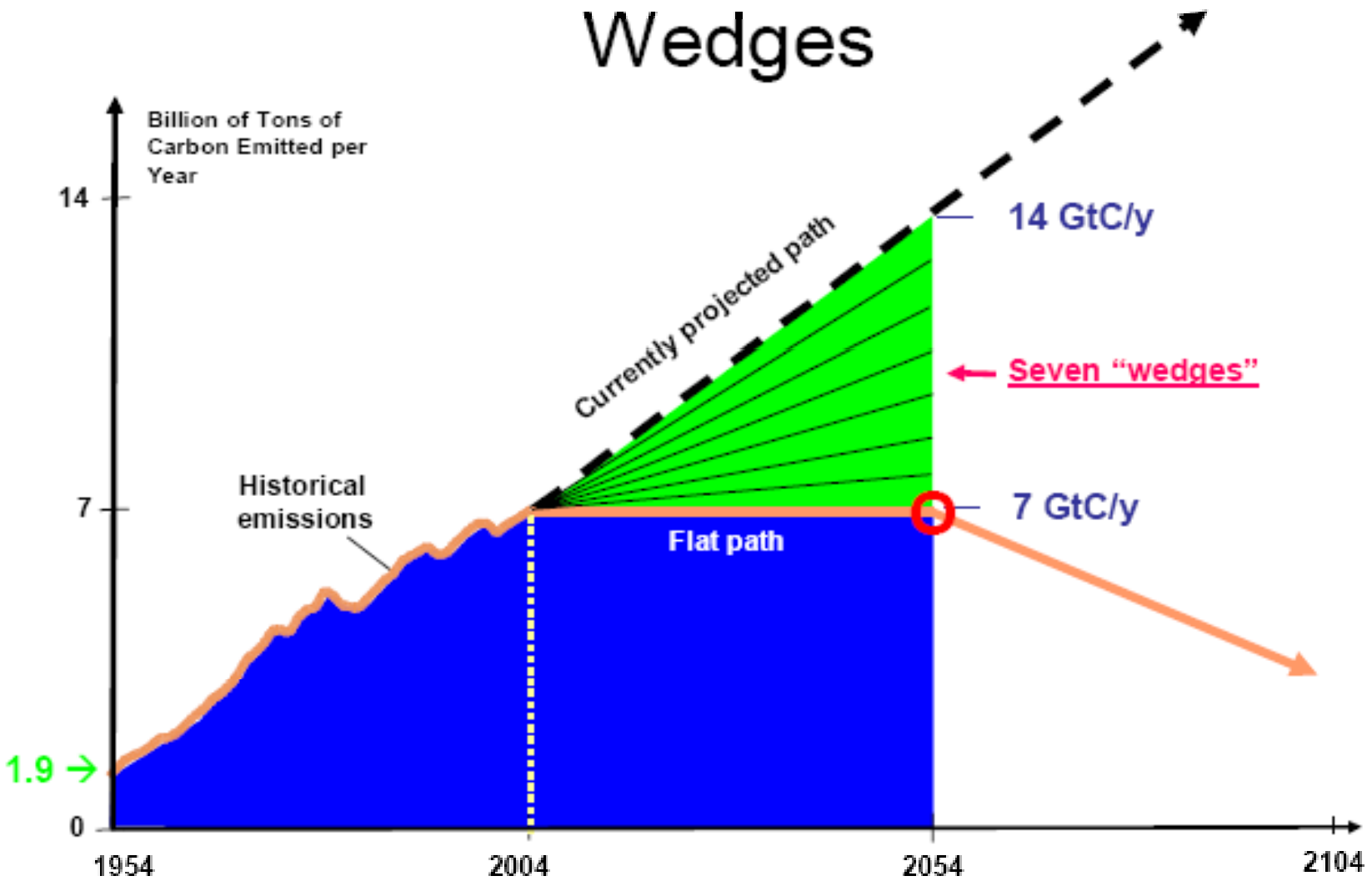
  "We are going to do everything to oppose this project," declared Barendrecht deputy mayor Simon Zuurbier, who voiced fears for the safety of the city's 50,000 inhabitants.

  "We are taking legal action to get it cancelled and we'll approve none of the required permits." ……

Getting there and Issues

"Wedges" for CO_2 Reductions

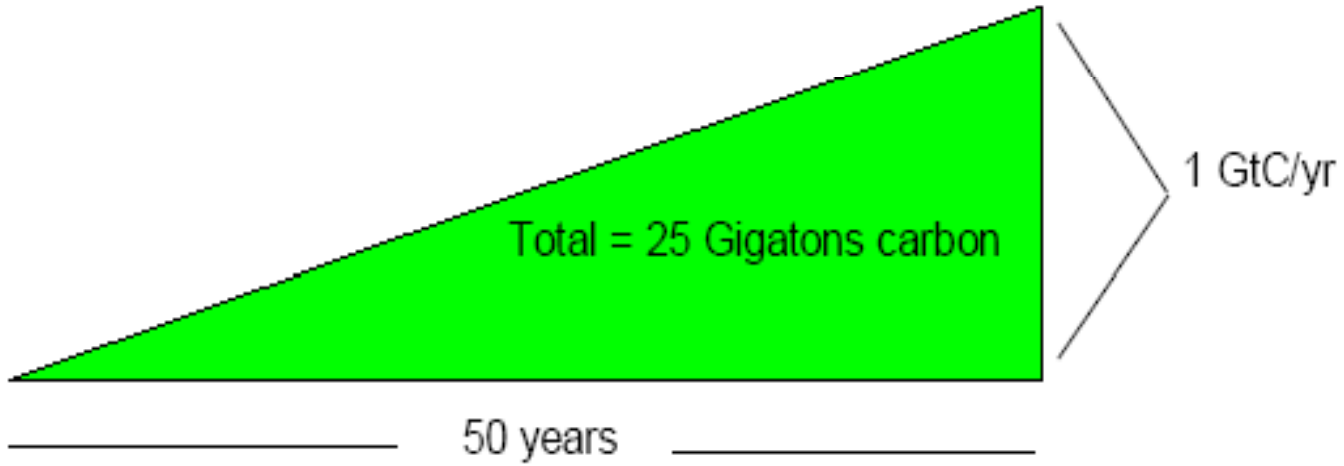
http://www.stabilisation2005.com/day3/Socolow.pdf



What is a “Wedge”?

http://www.stabilisation2005.com/day3/Socolow.pdf

A “wedge” is a strategy to reduce carbon emissions that grows in 50 years from zero to 1.0 GtC/yr.



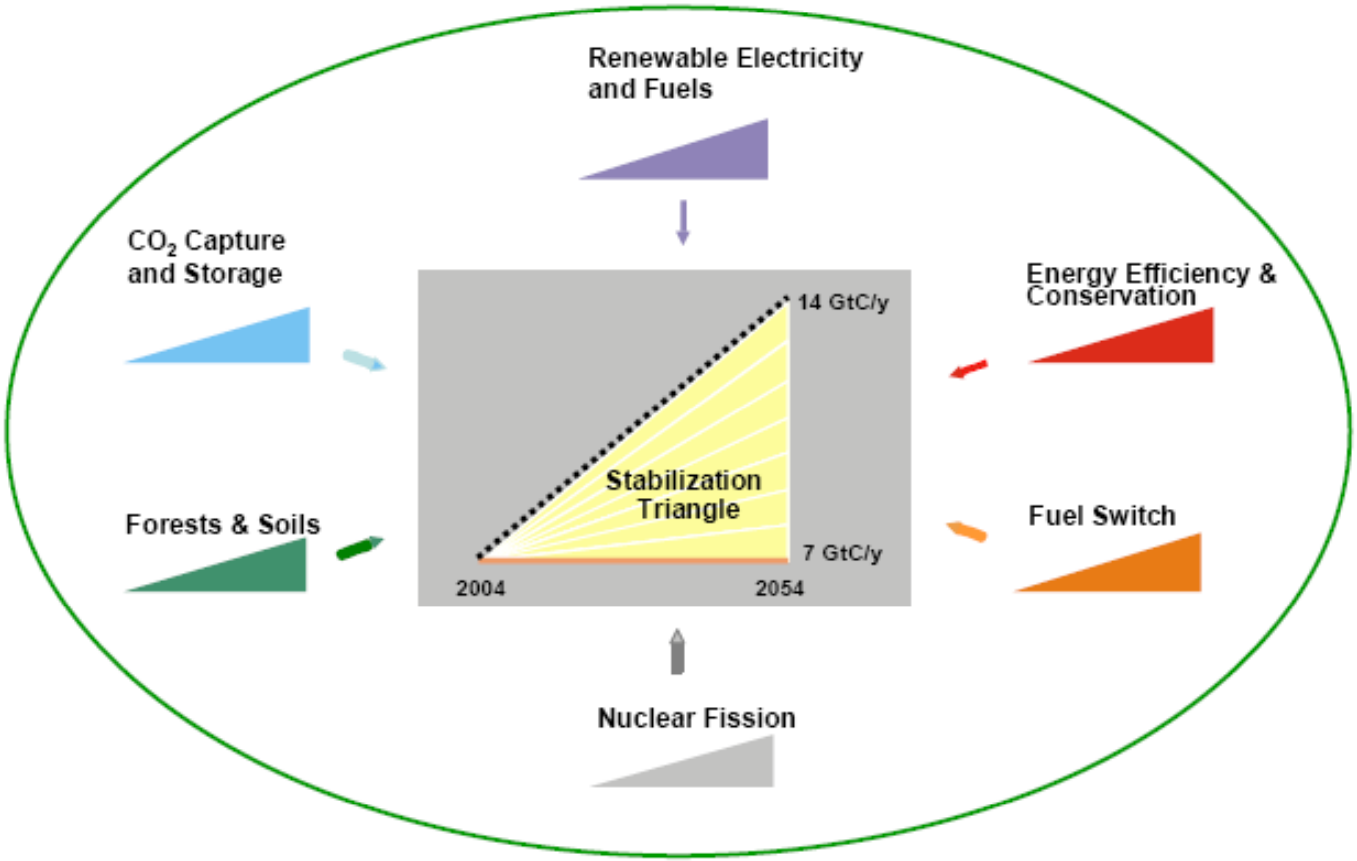
Cumulatively, a wedge redirects the flow of 25 Gt(C) in its first 50 years. This is 2.5 trillion dollars at $100/t(C).

A “solution” to the Greenhouse problem should have the potential to provide at least one wedge.

"We have to look everywhere in the economy" Robert Sokolow

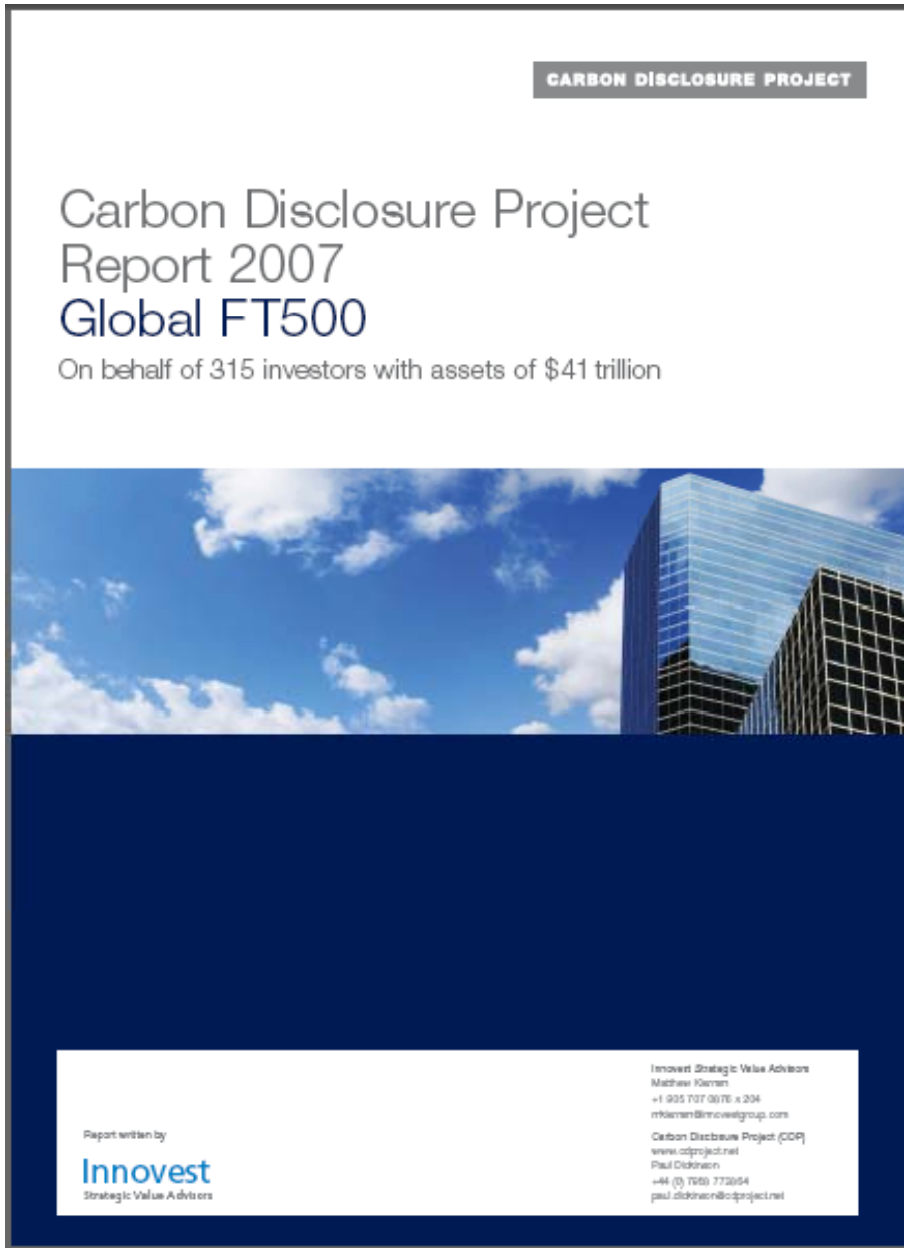
The Seven Wedges

http://www.stabilisation2005.com/day3/Socolow.pdf



Carbon Disclosure Project

https://www.cdproject.net/en-US/Pages/HomePage.aspx



- The *"Carbon Disclosure Project"* is having a profound effect on the global carbon market development. CDP provides a coordinating secretariat for 475 institutional investors with a combined (*today) $55 trillion* of assets under management. On their behalf it seeks information on the business risks and opportunities presented by climate change and greenhouse gas emissions data from the world's largest companies: 3,000 in 2008.

"Ignorance is no longer bliss"

Globally vs US

- Most countries have powerful federal systems or centrally planned governments-hence government can press its intentions to the people
- Not so easy in the US-democratic process requires many inputs
- States have strong regional inputs
- Public vs private interests also need to intersect
- Many legal challenges in the US system not necessarily found elsewhere

What is Needed

- A global price on carbon

- Actions engaged:
- Kyoto now need post Kyoto after 2012
- EU-ETS functional and operating
- US Cap and Trade or carbon tax-now not expected legislatively until late or after 2010
- Other national programs

Issues

- Who pays or not?
- To whom?
- By what mechanism?
- And how?
- Beginning when?

Issues

- Some governments now view carbon as a revenue tool
- Large impacted industries deeply engaged
- Lesser developed countries want the right to catch up to the developed ones on emissions/capita, emissions/GDP
- When should China be considered a developed nation?
- Mitigation programs not always globally accepted
- Competing regional and national interests at play
- Who will enforce a global program?
- National sovereignty issues huge

Contact Information

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- **VP and Founding member Board of Directors**
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