Building the 21st Century: U.S. – China Cooperation on Science, Technology, and Innovation

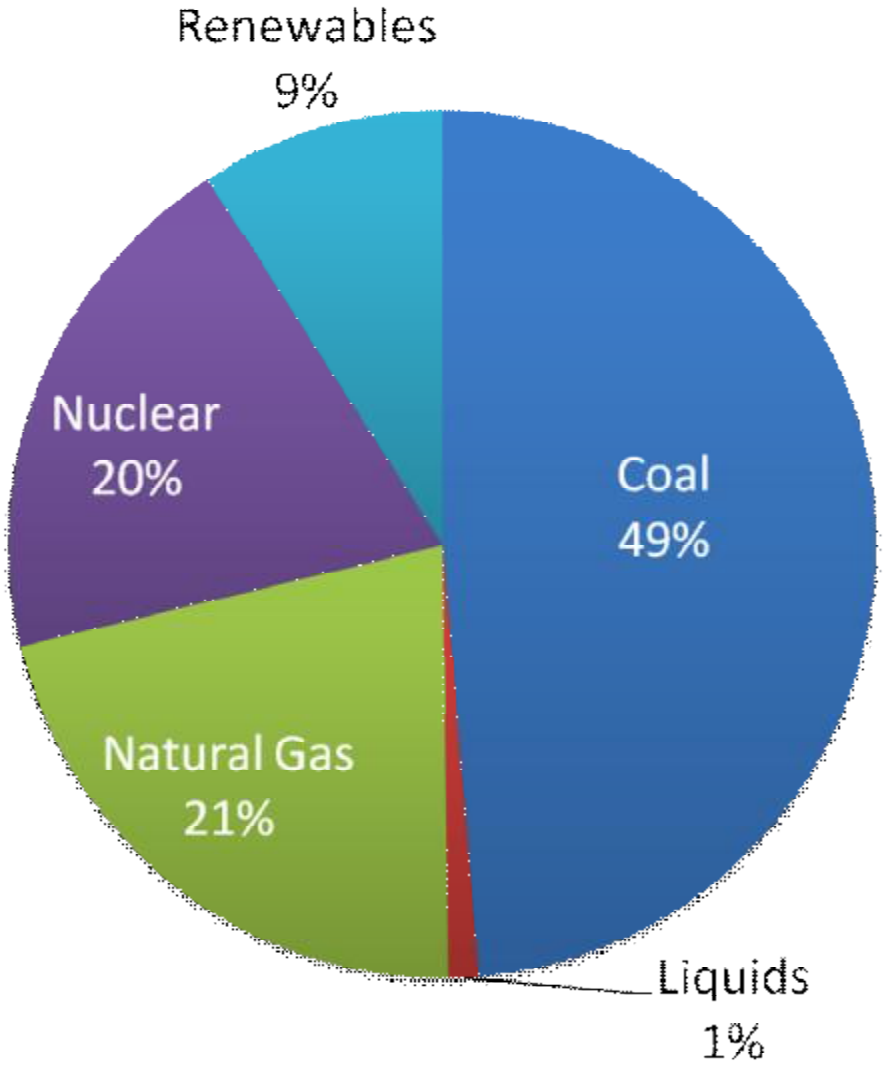
May 18, 2010

Kristina M. Johnson
Under Secretary of Energy

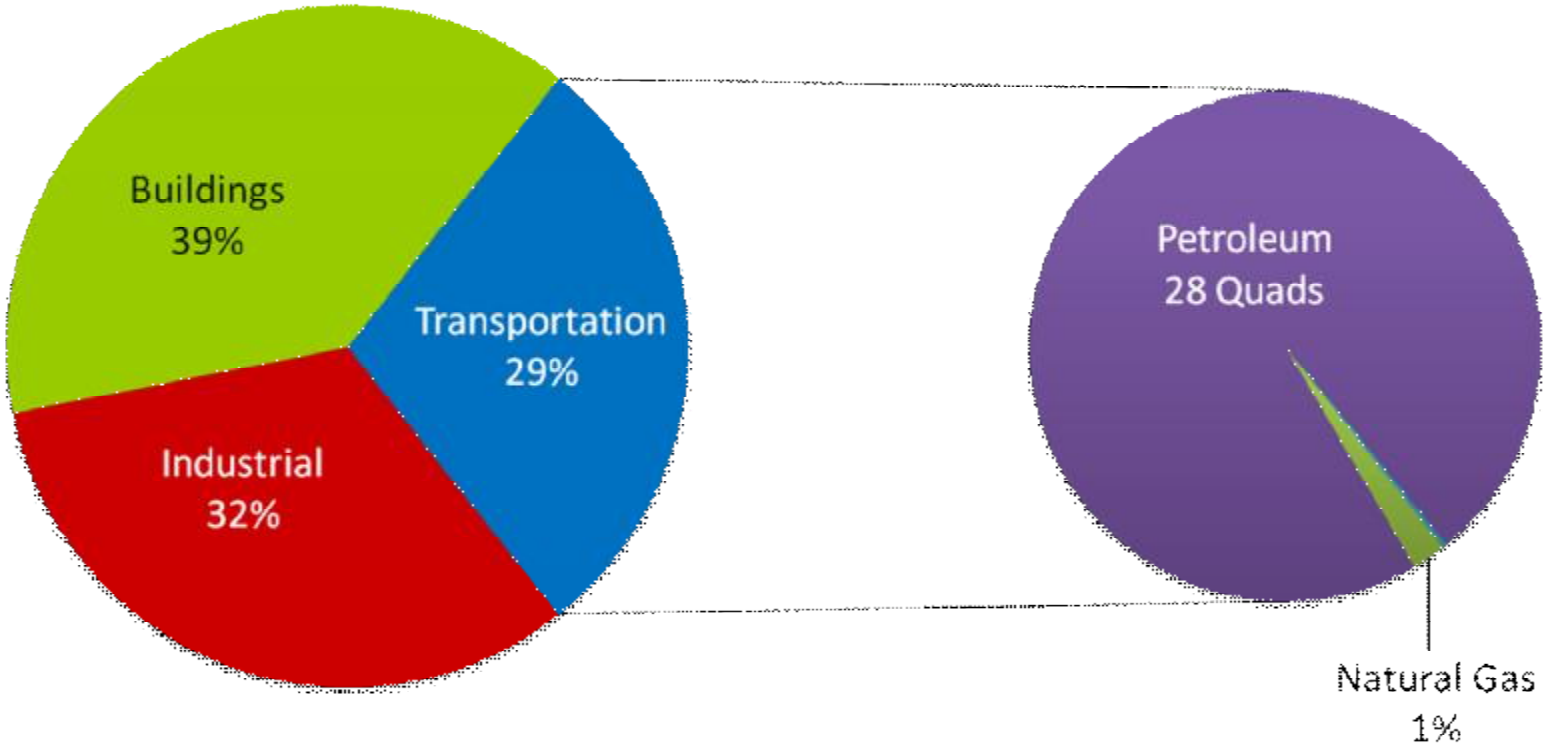
U.S. Energy & Environment Goals

- *Grow the Clean Energy Economy*
- *Secure Our Energy Future*
- *Reduce GHG Emissions 83% by 2050*
- *Global Science & Engineering Leadership*
- *Clean Up Cold War Legacy Waste by 2015*

U.S. Electric Power Generation Mix



U.S. Energy Consumption by Sector

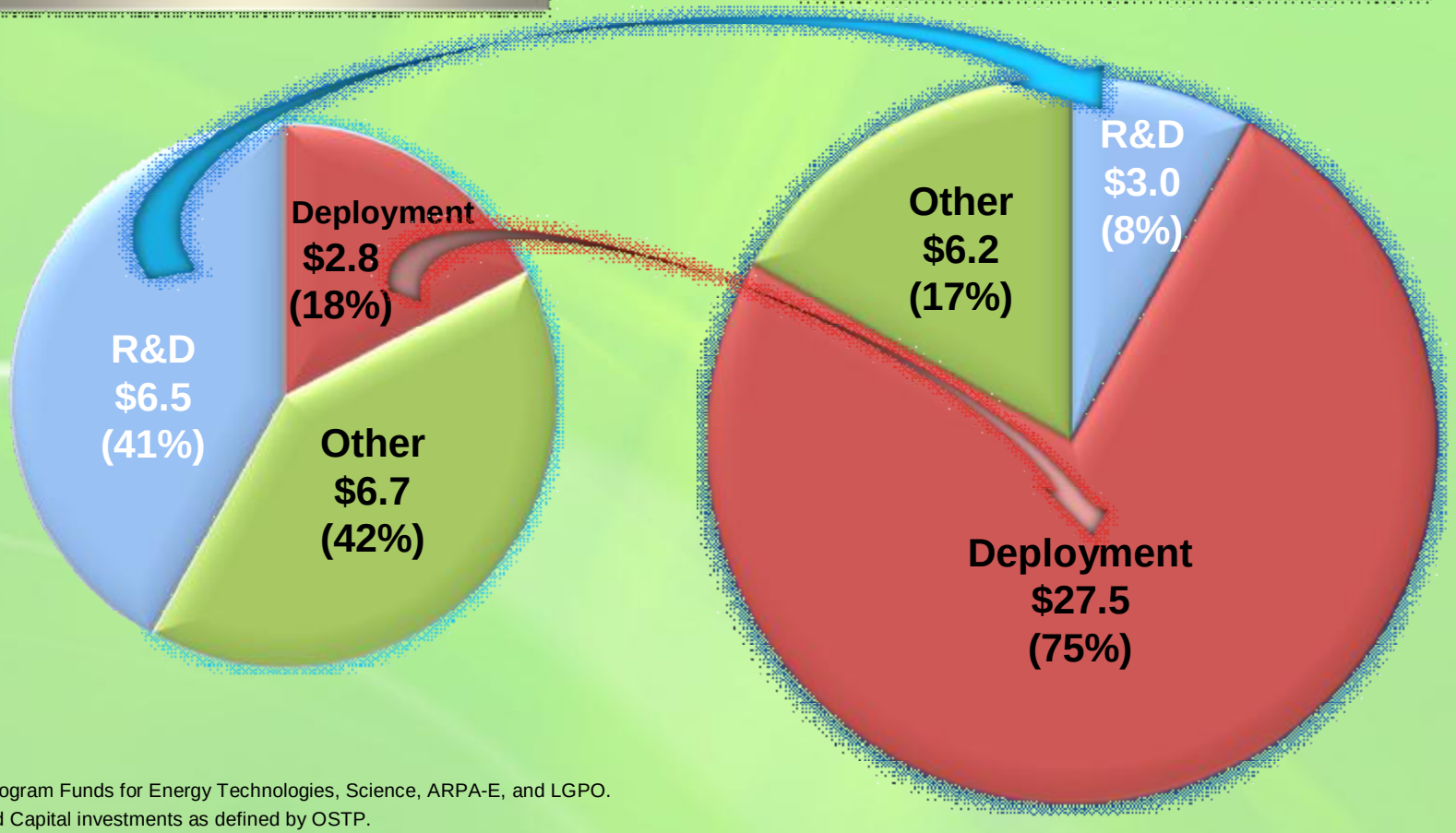


"State Energy Consumption Estimates: 1960 through 2007". Energy Information Administration. (August 2009). Tables 8-12.
(http://www.eia.doe.gov/emeu/states/sep_use/notes/use_print2007.pdf

Recovery Act Spending

DOE 2009 Base Budget for Energy and Science $16.6 Billion

American Recovery and Reinvestment Act $36.7 Billion

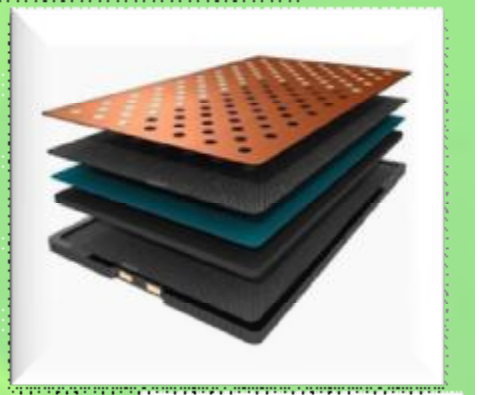


*Includes DOE Program Funds for Energy Technologies, Science, ARPA-E, and LGPO.
**R&D and related Capital investments as defined by OSTP.
**, Environmental Cleanup, and other DOE program management funds.
Source: FY 2011 DOE Budget Request and R&D crosscut.

Restructuring our Transportation Infrastructure

Committed over $3.4B to 120 companies. **Deployment** **…and….** **Innovation**

envia



FASTCAP SYSTEMS™

Discovering Advanced Sources of Fuel

Deployment--$600 M to build 19 pilot, demonstration, and commercial-scale bio-refineries

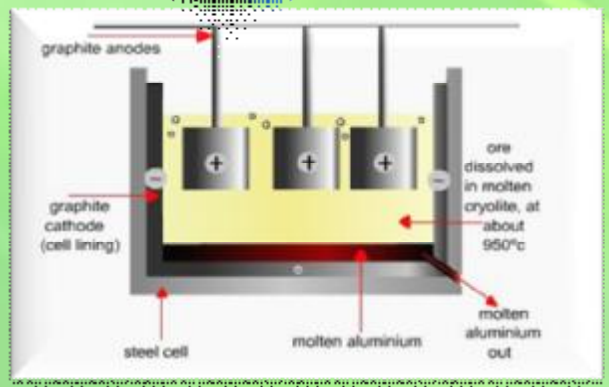
Innovation to create generation three and generation four biofuels—Direct Sunlight to Fuel

Discovering Next Generation Renewables

Committed over $23B to 300 companies.

Doubling Renewables Deployment

Innovation is Raising Performance Expectation to Grid Superiority



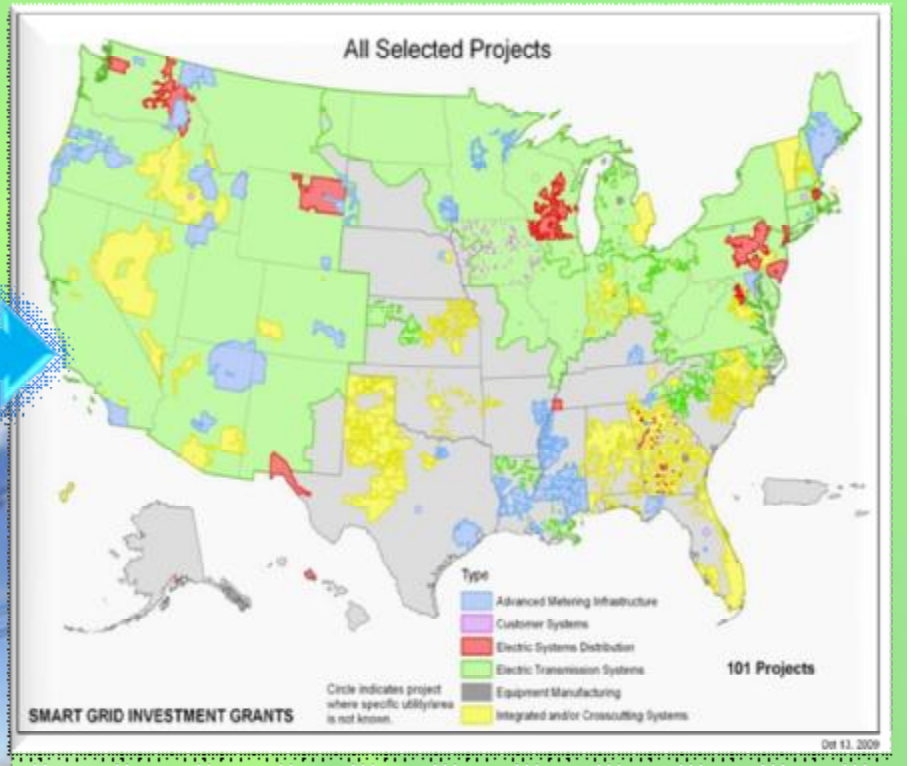
Increasing Energy Efficiency

$11 billion to deploy commercial effeciency technologies

Driving Innovation in the Next Generation in Building Products

Rebuilding the Nation's Grid Infrastructure

Deployment
18 million Smart Meters
(2x current number in service)
200,000 Smart Transformers
877 Digital Sensor
Nearly 700 Automated Substations



Innovation to Create Grid Scale Storage to Enable Transportation Electrification and Renewables Integration

A Global Challenge

"To protect our planet, now is the time to change the way that we use energy. Together, we must confront climate change by ending the world's dependence on fossil fuels, by tapping the power of new sources of energy like the wind and sun, and calling upon all nations to do their part.

And I pledge to you that, in this global effort, the United States is now ready to lead."

President Barack Obama
Prague, Czech Republic
5 April, 2009

A Long History of Cooperation

2009 is the 30th Anniversary of the U.S.-China Agreement on Cooperation in Science and Technology

Longest-standing accord between our countries

Led to an era of robust government-to-government collaboration

We continue that tradition today

The Strategic and Economic Dialogue (S&ED)

The S&ED is an umbrella mechanism for engaging China on energy and climate-related issues at the highest levels of government

Buildings

Goal: Advance the understanding and development of green buildings, incorporate building-integrated renewable energy, approach or reach zero net energy use

- *Demonstration Projects*
  - Mayor's Training Center
  - Shanghai Energy Conservation Supervision Center
  - Beijing Olympic Village
  - Tianjin Eco-City
- *Codes, software design tools, labeling*
  - Windows and building envelope ratings, labels, and standards
  - Commercial and residential building codes
  - EnergyPlus interface for China
  - Public sector efficiency toolkit
- *Partnership building*
  - Greensburg-Sichuan cooperation on post-disaster planning and sustainable redevelopment
  - Technical assistance for establishing and maintaining the US-China Partnership for Sharing US Best Practices in Clean Urban Development, Energy and Environment
  - Other city opportunities (e.g., Shanghai-Chicago, Chicago-SF-Philadelphia, Tianjin, etc)

Industrial

Goal: Improve energy efficiency of the 1000 most energy-intensive enterprises in Chinese industry to meet China's 2010 energy intensity reduction goals

- *Policy and comparison benchmarking study* -- Comparison of large US and Chinese manufacturing plants on energy efficiency strategies, laws, policies, standards and energy management.
- *Industrial plant assessments* -- Identify greatest opportunities for improvements in energy efficiency for replication.
- *Software conversion* -- Of existing software for use by Chinese engineers in the top energy-consuming enterprises
- *Outreach materials* -- On the Save Energy Now industrial efficiency program.

Biofuels

Goal: Advance biofuels production, conversion and use in China.

- *R&D on biochemical conversion of corn stover* -- Characterize and develop state-of-the-art technology
- *R&D on thermochemical conversion processes including biomass gasification and pyrolysis, Fischer Tropsch and other topics*

The Strategic and Economic Dialogue (S&ED)

Wind

Goal: Support the successful deployment of large-scale wind power in China through comprehensive wind analysis, policy, and integration support to help achieve China's 100GW goal and expanded 300GW scenario.

- *100 GW Wind Scenario* -- Use basic 3Tier wind map to develop initial conceptual scenario
- *Refinement of "geospatial supply curve" assessment and planning methodology* – For use at provincial and regional level
- *Analysis of Xinjiang prospect area* – Assess wind base
- *Consideration of wake effects in wind farms* – Analysis and consultation to support policymaking

Transportation

Goal: Advance electric drive vehicles for China, train on modeling and tools, and expand knowledge of biofuels combustion for automotive engines.

- *Denver-Chongqing Eco-Partnership* -- Support the Ten Year Framework of the US-China Strategic Economic Dialogue is on implementing electric and plug-in hybrid vehicles
- *Software modeling and simulation training* -- Train engineers from MOST's China Automotive Technology and Research Center (CATARC) in the use of PSAT and GREET
- *R&D on sprays and combustion of biofuels for transportation engines* -- Improve combustion and reduce emissions with biofuels

U.S.-China Clean Energy R&D Center

- Annouced by Secretary Chu, Chinese Minister of Science Wan Gang, and Administrator of National Energy Administration Zhang Guo Bao in July

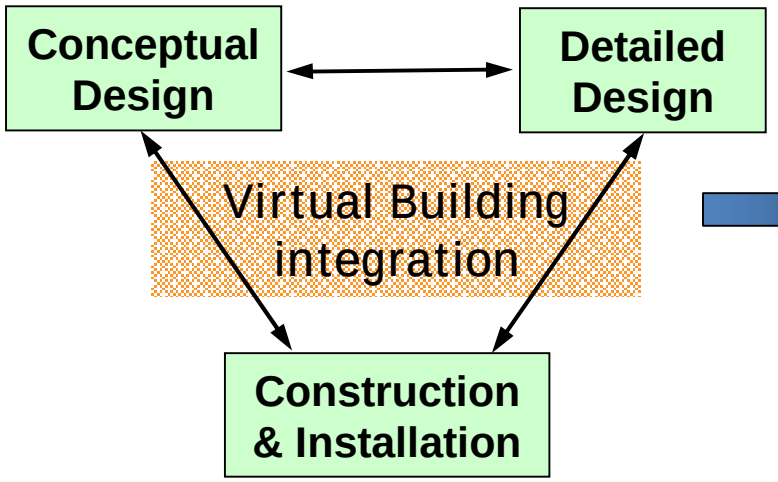
- Goal: to facilitate joint research and development on clean energy by teams of scientists and engineers from the U.S. and China, as well as serve as a clearinghouse to help researchers in each country.

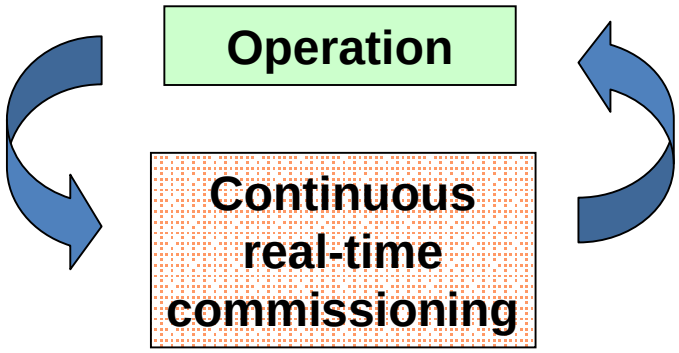
- $15M in joint funding, split evenly across three initial priority areas:

  - ✓ Building energy efficiency
  - ✓Vehicle technologies
  - ✓Carbon capture and sequestration

BACKUP SLIDES

Areas of Collaboration: Building Efficiency





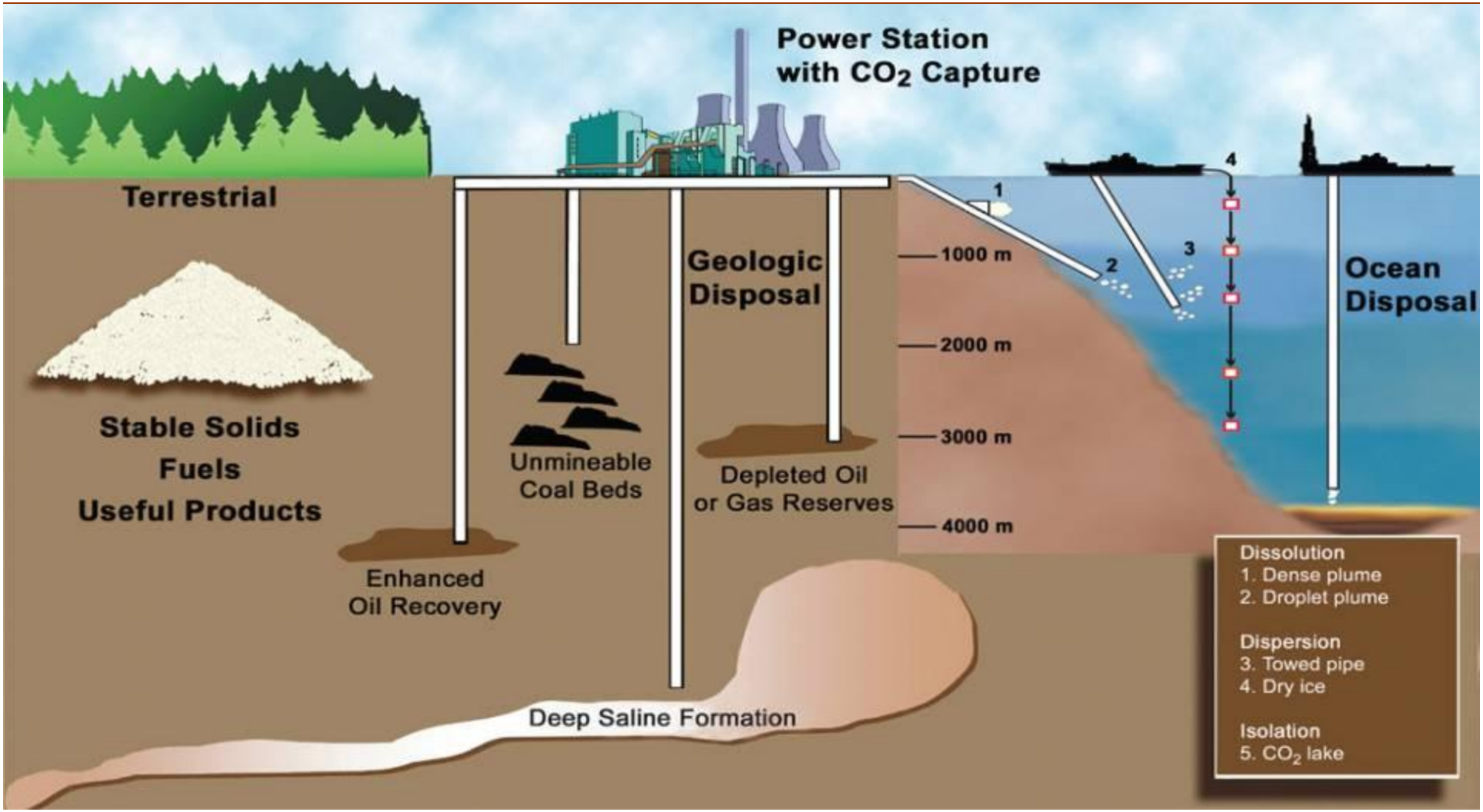
Computer-aided design tools with Embedded Energy Analysis

Computer-controlled operation with Sensors and Controls for Real-Time Optimization

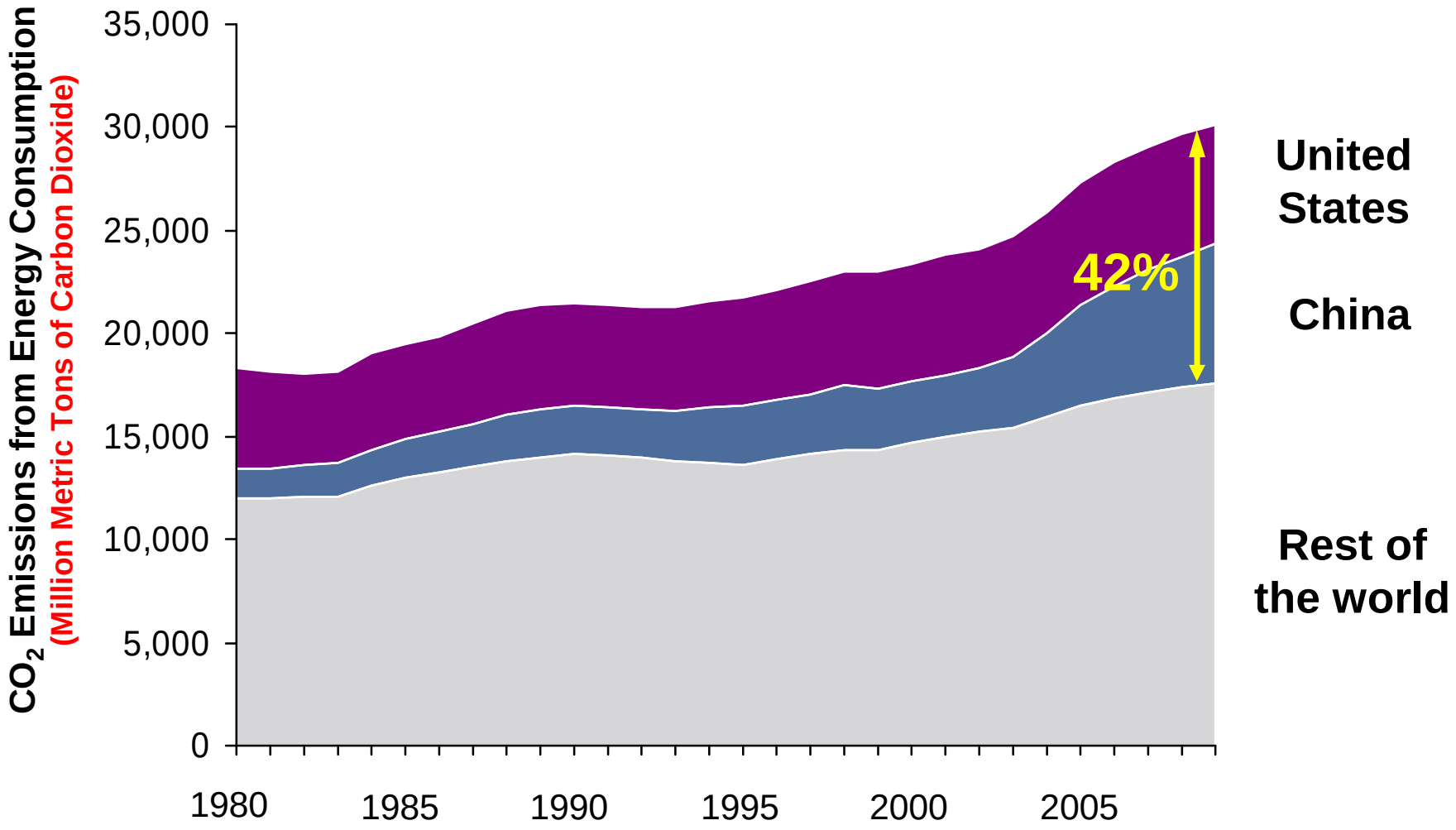
- Oxygen sensor
- Air pressure sensor
- Air temperature sensor
- Engine temp. sensor
- Throttle position sensor
- Knock sensor

Areas of Collaboration: Carbon Capture

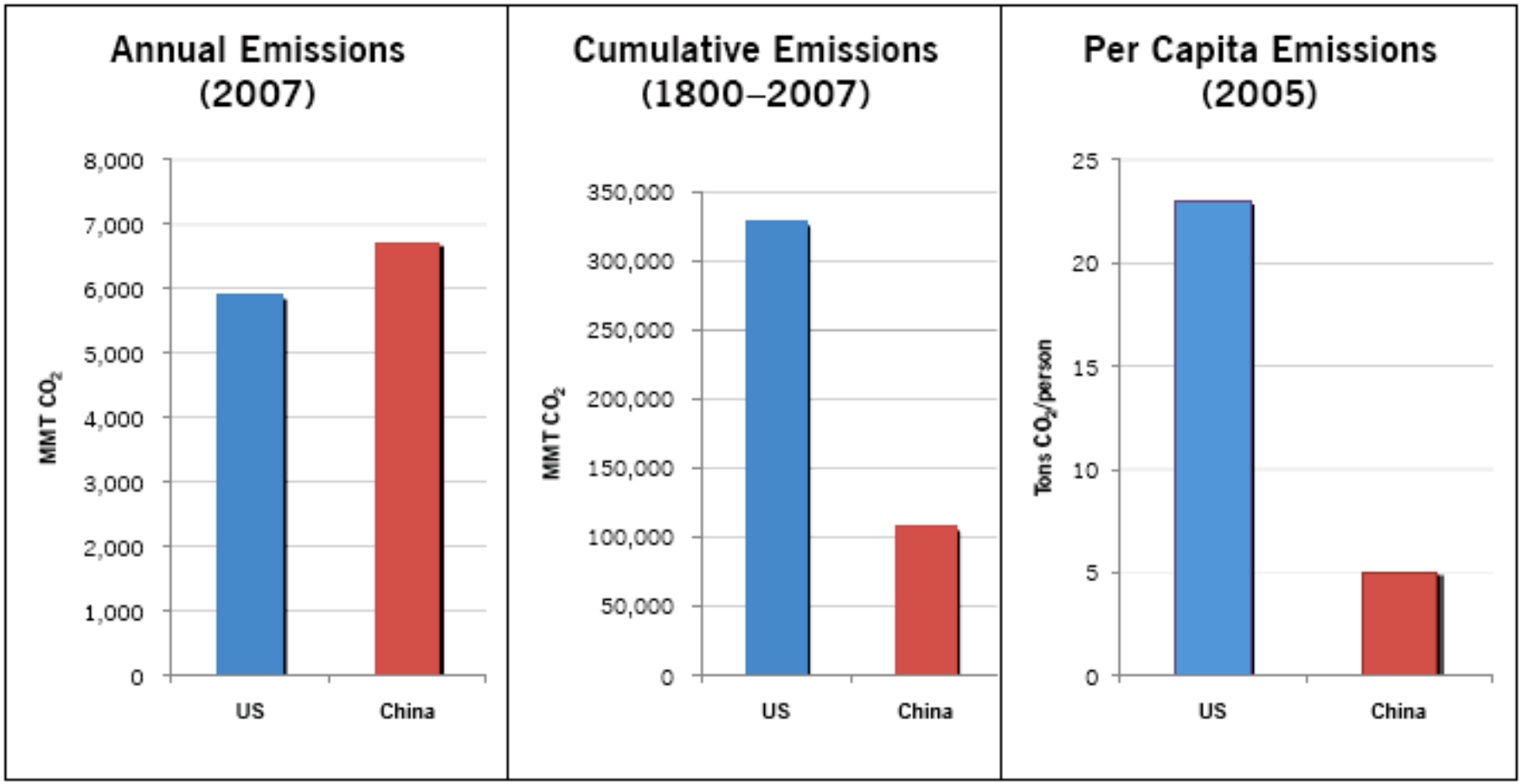
US, China, Russia, and India have 2/3 of the world's known coal reserves.



U.S. and China CO_2 Emissions



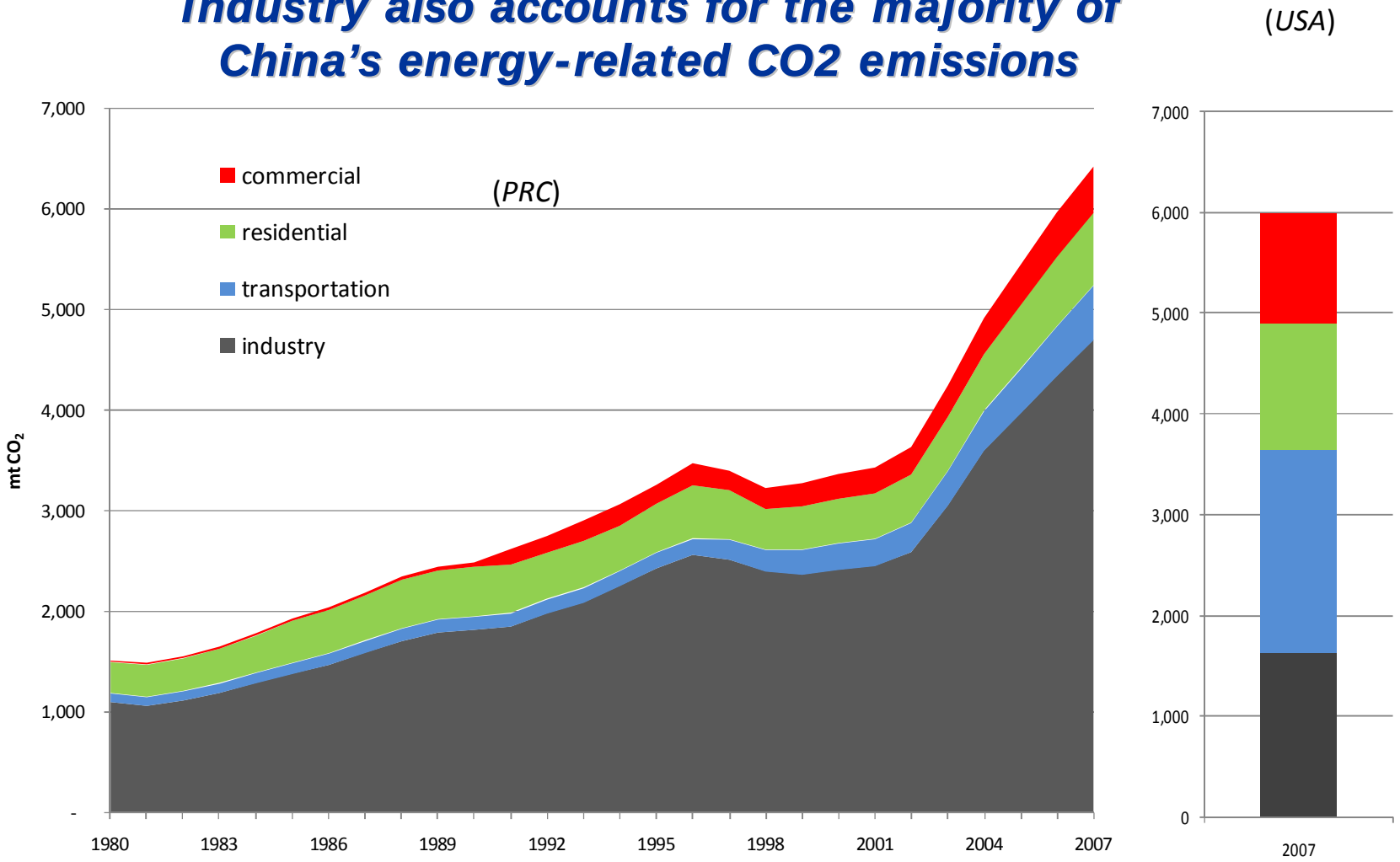
Comparison of U.S. and China Energy-Related Emissions – Three Perspectives



Source: Asia Society, 2008. *Common Challenge, Collaborative Response: A Roadmap for U.S.-China Cooperation on Energy and Climate Change*. http://www.asiasociety.org/taskforces/climateroadmap/US_China_Roadmap_on_Climate_Change.pdf

[25] Data sources: "CO_2 Emissions From Fossil Fuels," Oak Ridge National Laboratory, Carbon Dioxide Information Analysis Center (CDIAC), 2007; The Netherlands Environmental Assessment Agency (MNP), 2007; Statistical Review of World Energy, BP; IEA, 2007; World Bank database (population data), 2007; CDIAC-ORNL, MNP, BP, USGS (cement), IEA, World Bank.

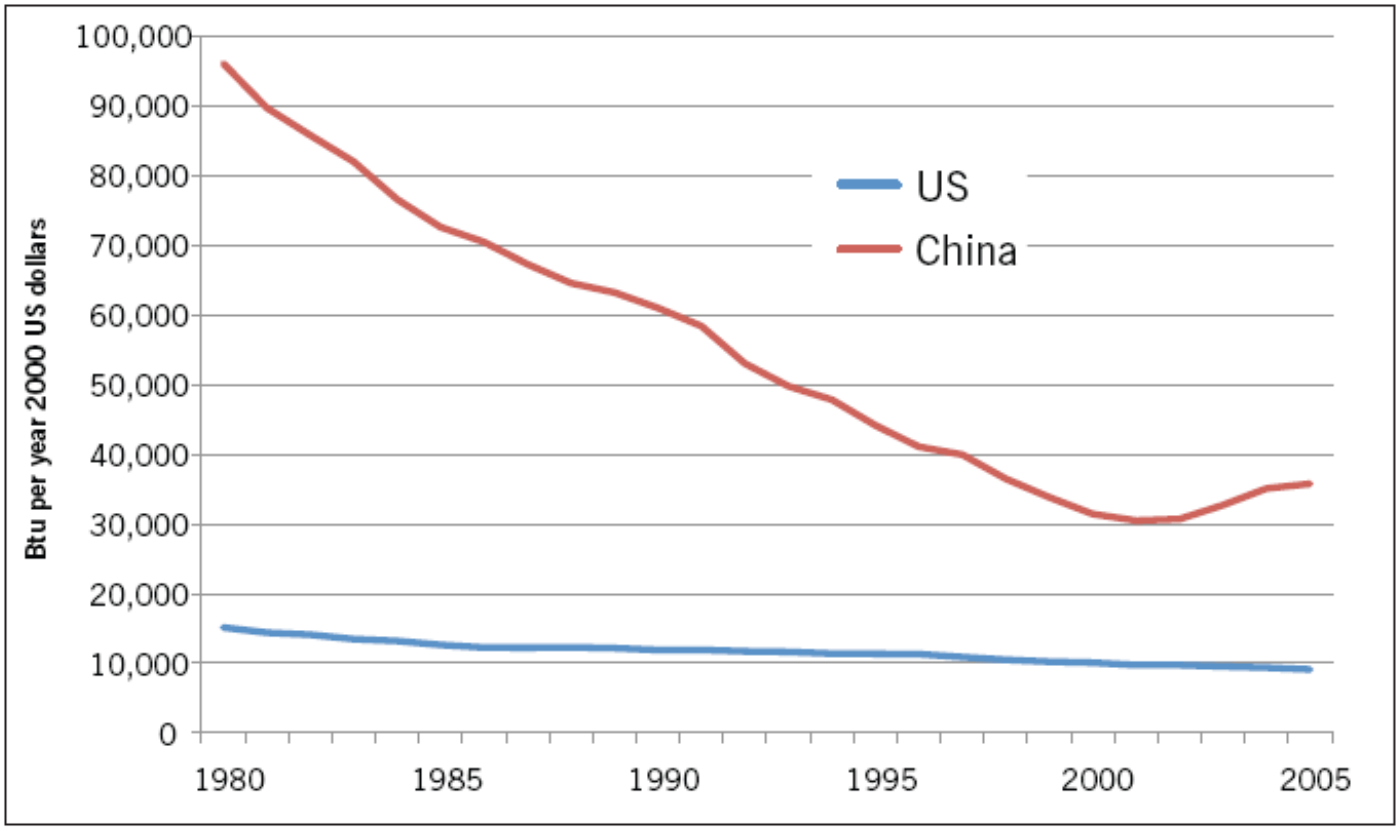
Industry also accounts for the majority of China's energy-related CO2 emissions



Source: EIA, 2008, Emissions of Greenhouse Gases Report, available at: http://www.eia.doe.gov/oiaf/1605/ggrpt/carbon.html; China emissions calculated using 1996 revision of IPCC default carbon emission factors; commercial fuels only, not including biomass.

China's Energy Intensity Compared to the U.S.

Comparison is based on current market exchange rates and thus not reflective of physical energy intensities



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Data source: "International Energy Outlook, 2007," Energy Information Administration, U.S. Department of Energy.

EERE International Priorities

Key Bilateral Activities
China
India
Brazil
Sweden
Israel
New priorities: Canada, Japan, Mexico

Key Multilateral Activities

- Biofuels – Global sustainability analysis
- ECPA – Energy and Climate Partnership for the Americas
- EDIN – Energy Development in Island Nations
- APEC – Asia-Pacific Economic Cooperation
- APP – Asia-Pacific Partnership on Clean Development & Climate
- MEF – Major Economies Forum on Energy and Climate
- IPEEC – International Partnership for Energy Efficiency Cooperation
- IPGT – International Partnership for Geothermal Technology
- IEA Working Groups and Implementing Agreements
- IPHE – International Partnership for the Hydrogen Economy

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THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine