



CHINA ENERGY 2020



David Sandalow

September 11, 2014

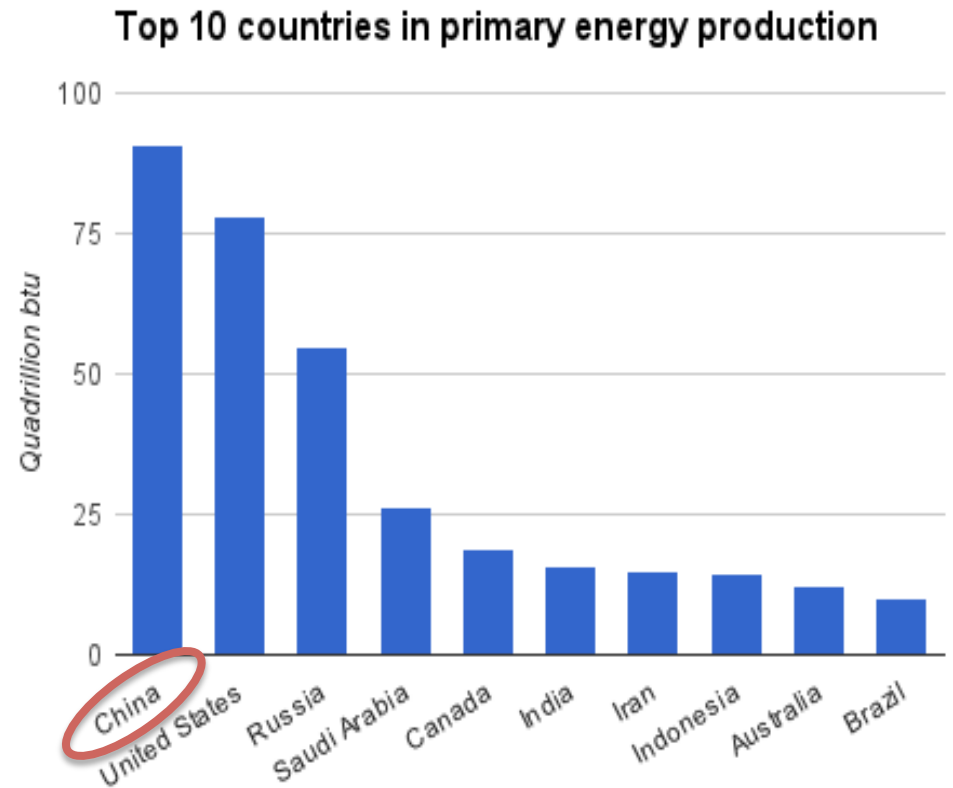
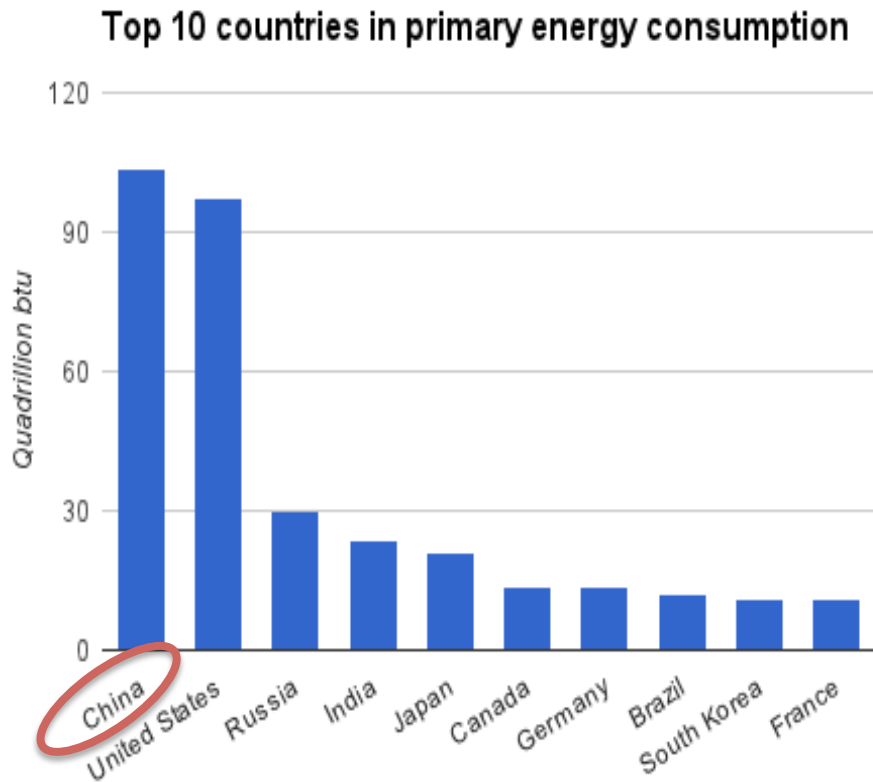
View of Pudong, Shanghai (1983)



View of Pudong, Shanghai (2010)



China Is World's Largest Energy Consumer And Producer

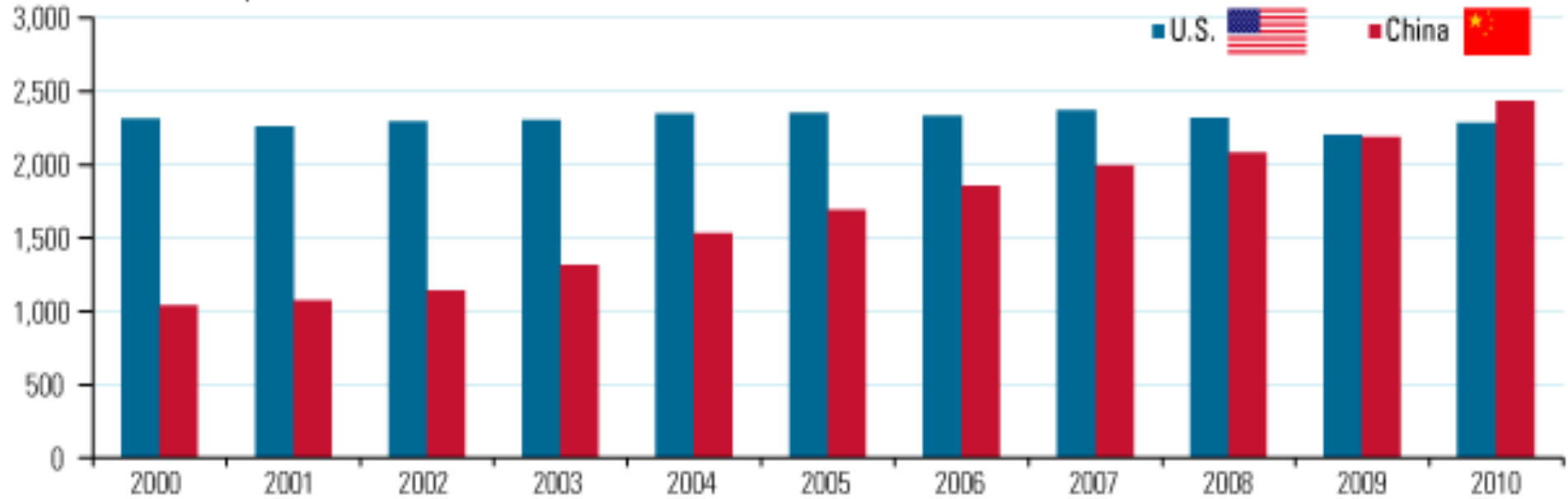


Sources: U.S. Energy Information Agency, International Energy Statistics (2011)

U.S. and Chinese Energy Consumption 2000-2010

Total Energy Consumption in China Surpasses U.S.

Million Tons of Oil Equivalent



Source: BP Statistical Review of World Energy, June 2011

China Uses HALF of the World's Coal



Photo Credit: Wikimedia Commons

Coal consumption (2012)

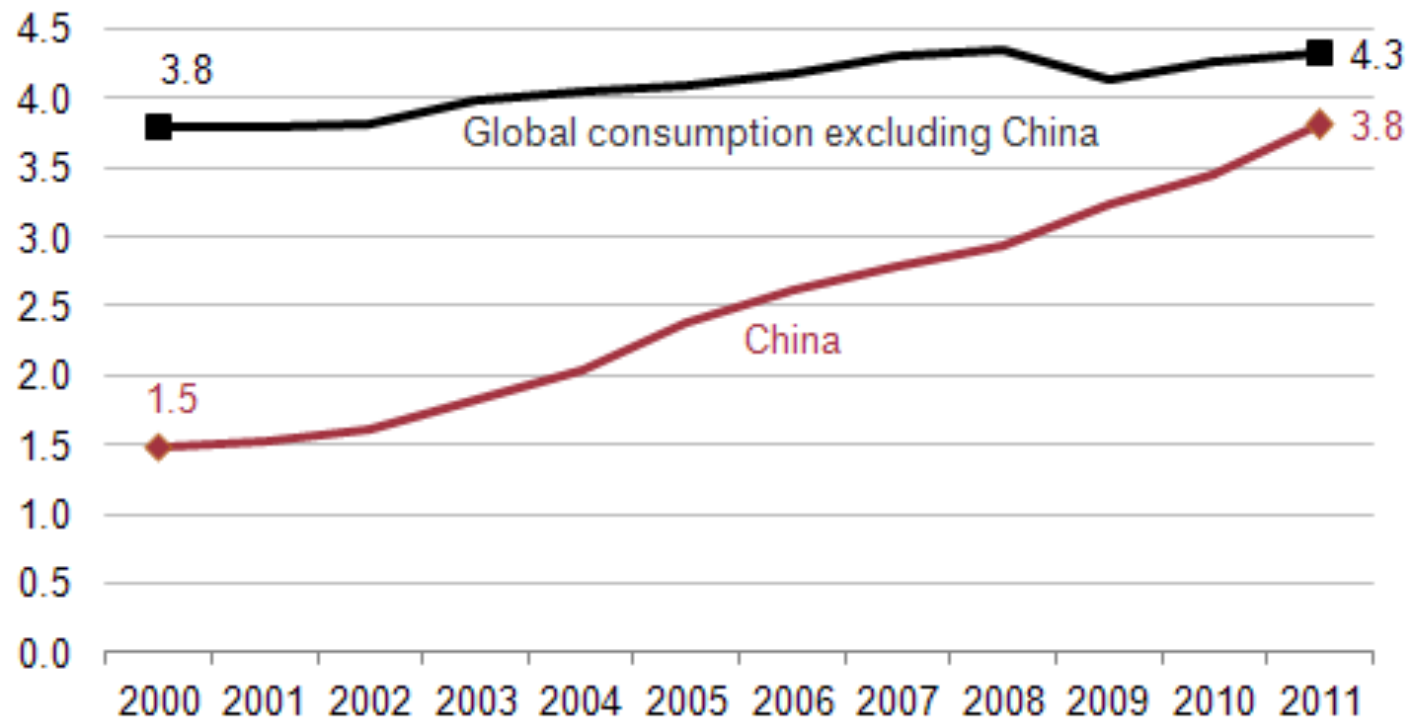
$$\frac{\text{CHINA}}{\text{WORLD}} = \frac{4.15 \text{ bn short tons}}{8.45 \text{ bn short tons}}$$

Sources: U.S. Energy Information Agency, International Energy Statistics (2011)

China Uses HALF of the World's Coal

Coal consumption: China rivals the world

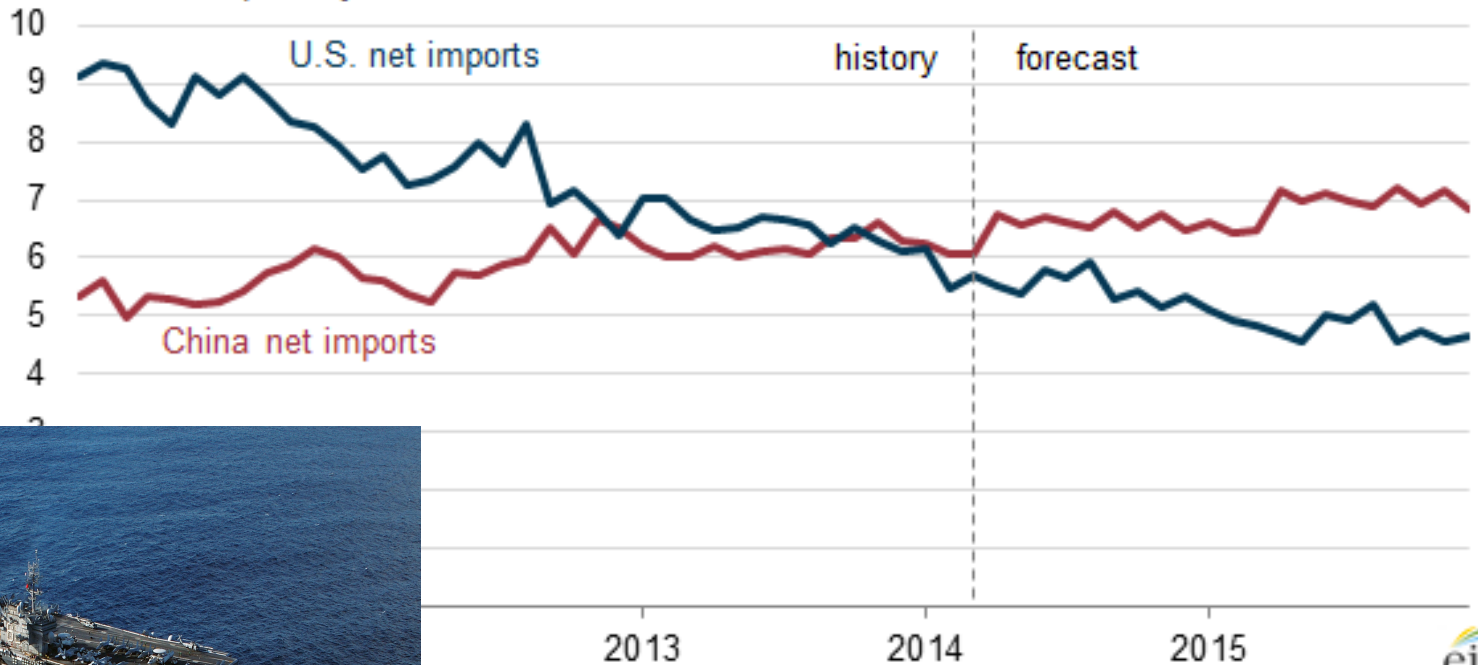
billion tons



Source: U.S. Energy Information Administration, International Energy Statistics

China is World's Leading Oil Importer

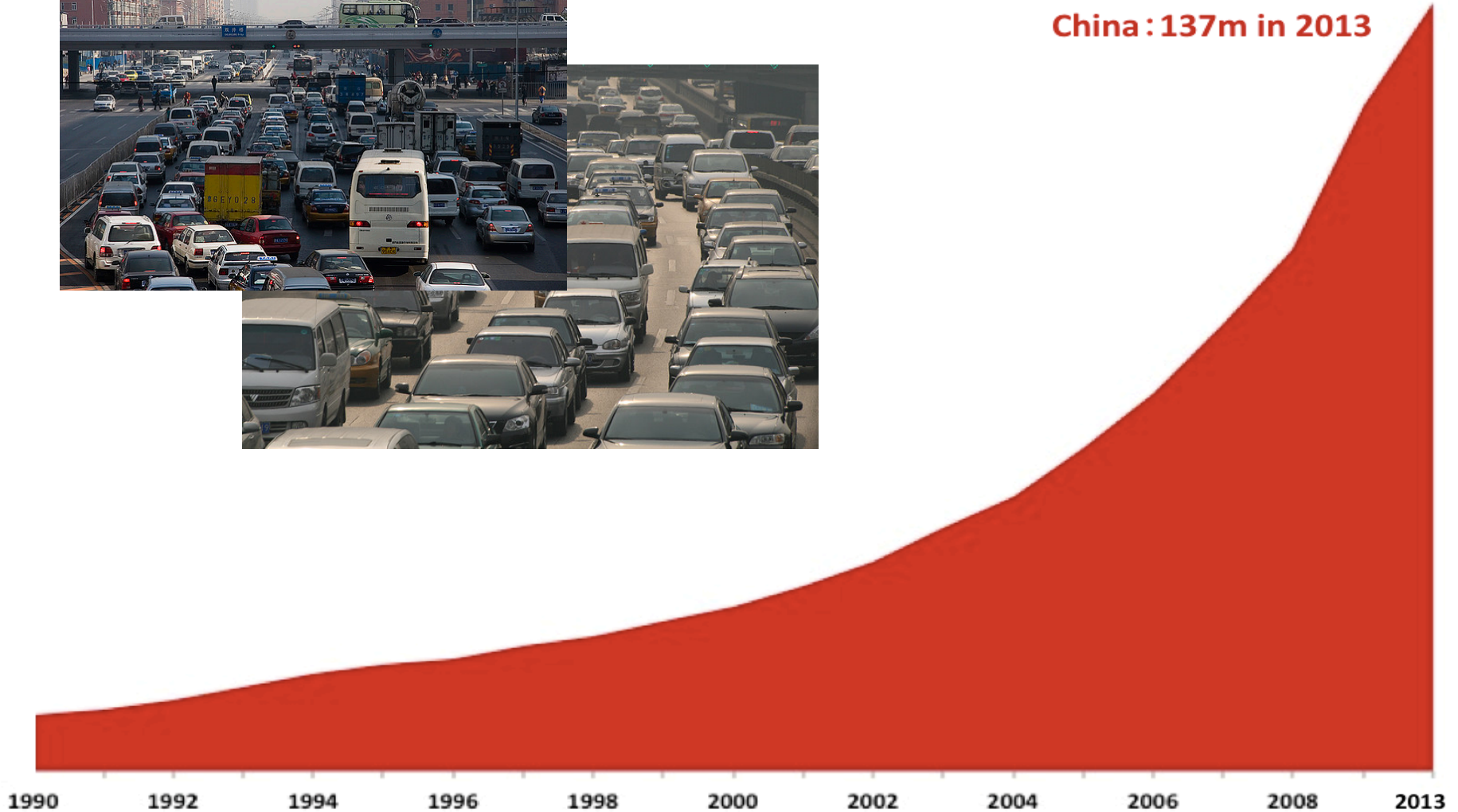
Comparison of net petroleum and other liquids imports for China and the United States
million barrels per day



China - #1 in New Car Sales

Millions passenger vehicles and trucks

China: 137m in 2013



China -- #1 in Solar Installations

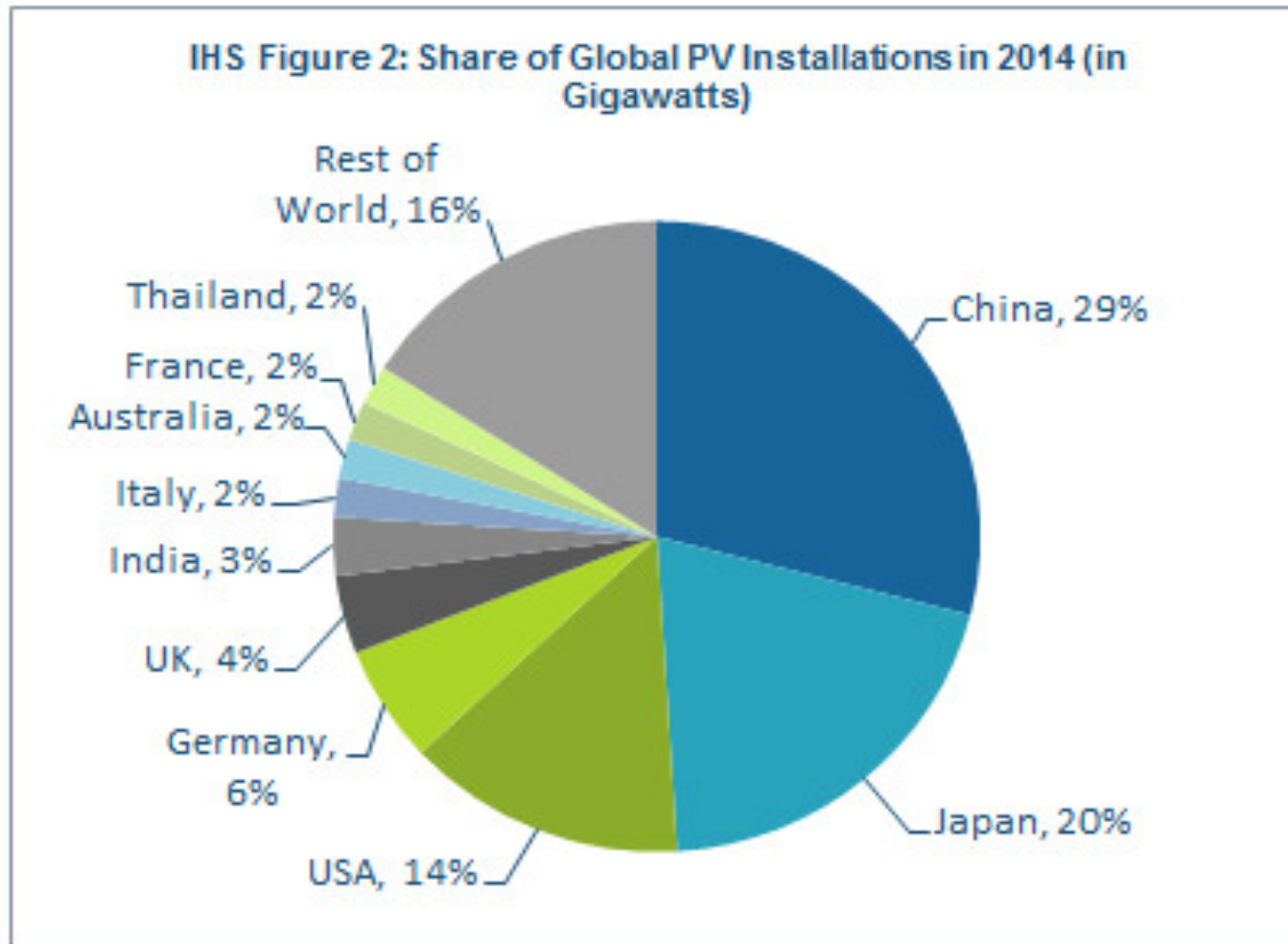
Top 10 countries in amount of solar photovoltaic power installed in 2013

(Megawatts)

Countries	Solar PV installed
1. China	11300
2. Japan	6900
3. United States	4751
4. Germany	3305
5. Italy	1461
6. India	1115
7. Romania	1100
8. Greece	1043
9. United Kingdom	992
10. Australia	848

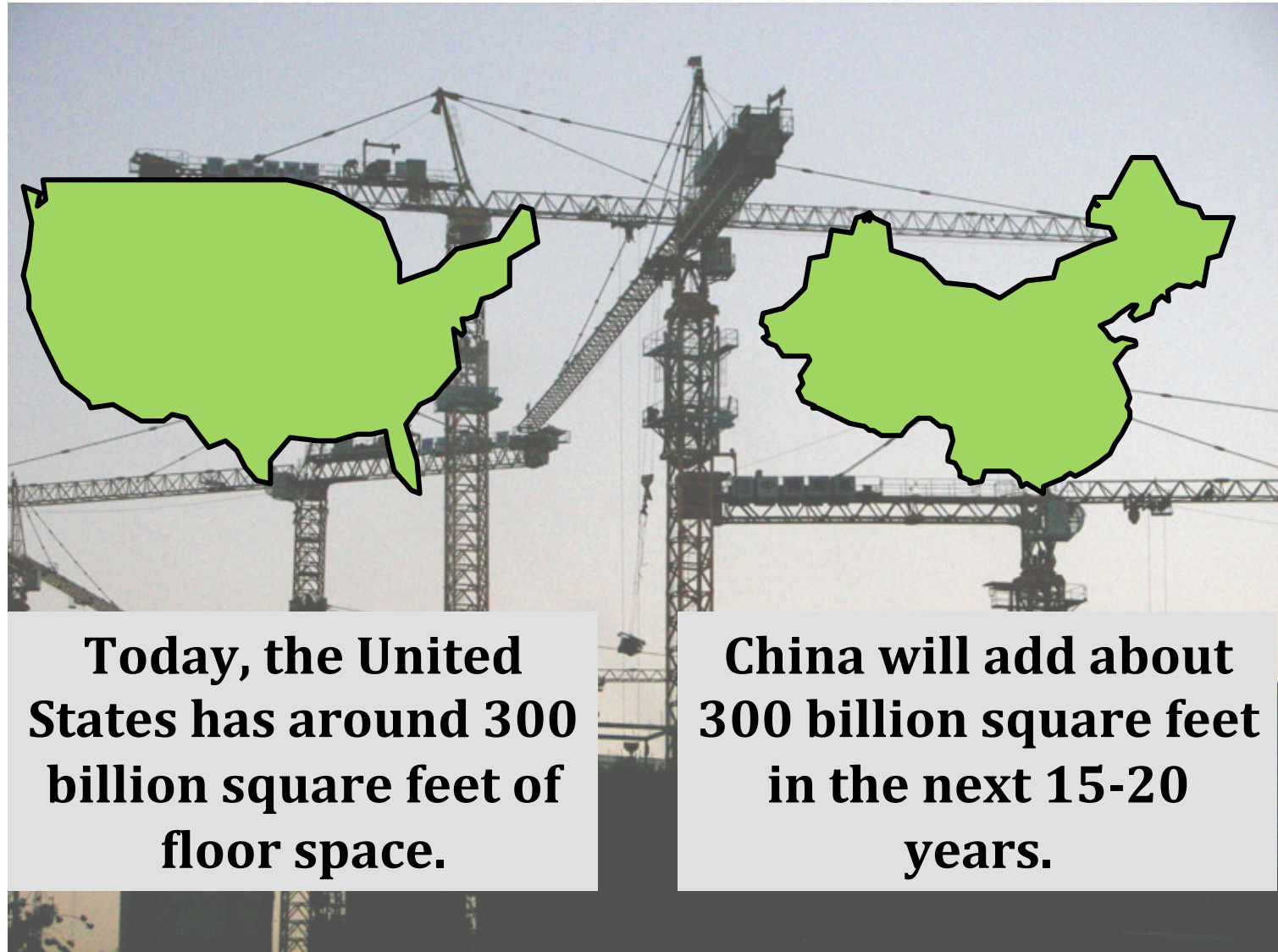


China - #1 in Solar Installations



Source: IHS, April 2014

China Building Construction

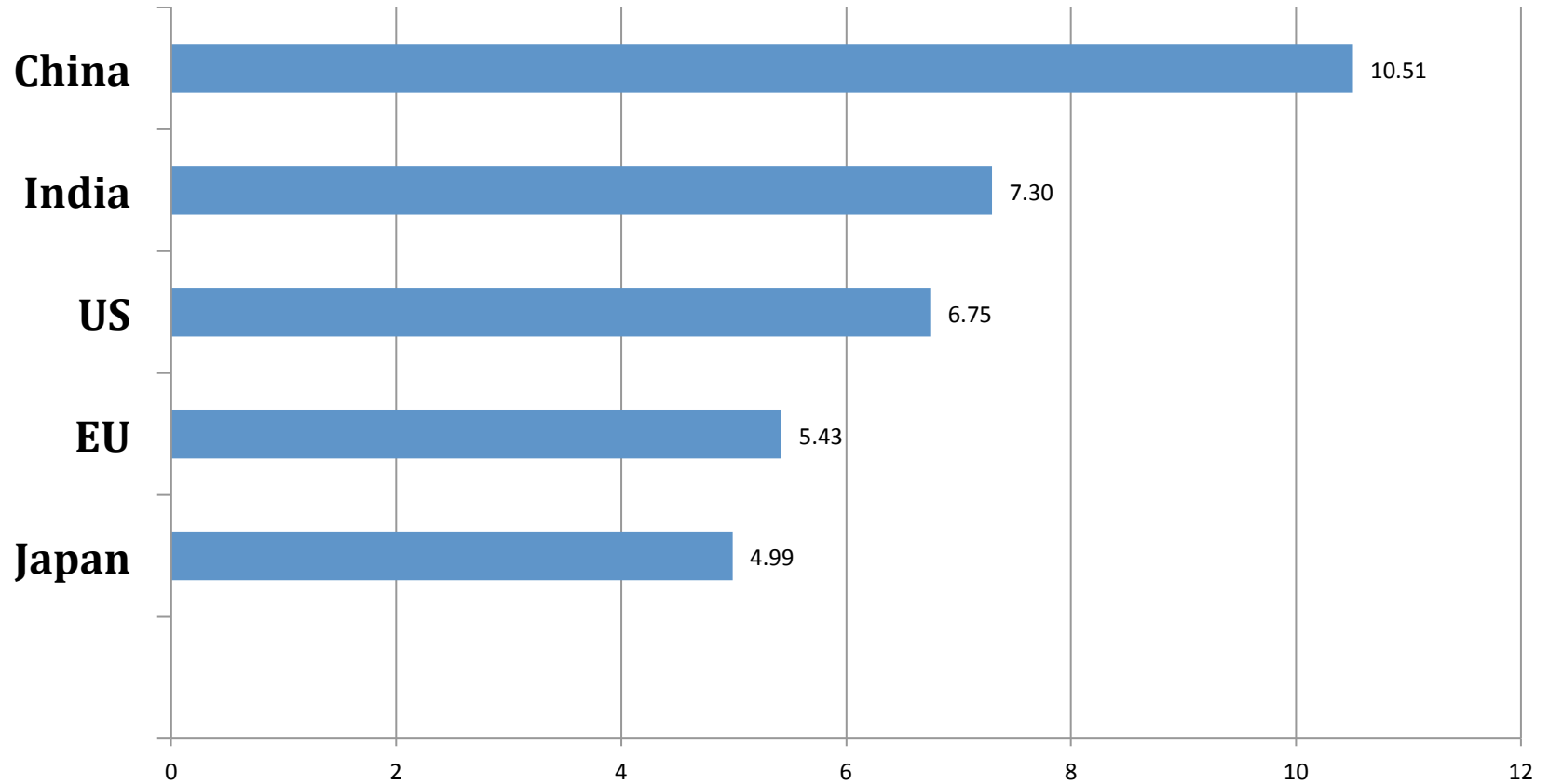


Today, the United States has around 300 billion square feet of floor space.

China will add about 300 billion square feet in the next 15-20 years.

Energy consumed per unit of GDP in 2010

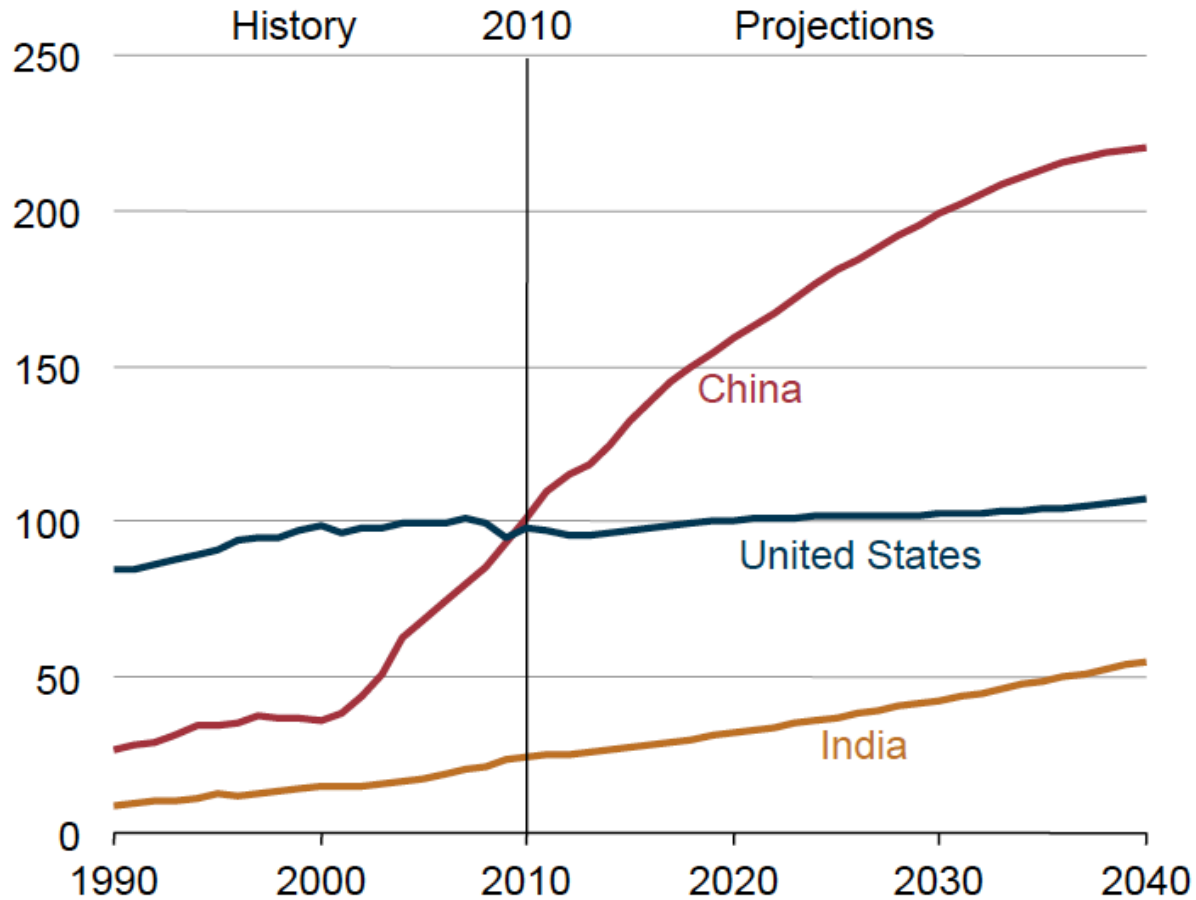
(in Thousand Btu)



Source: United Nations Statistics, U.S. Energy Information Administration

Energy Consumption Projections

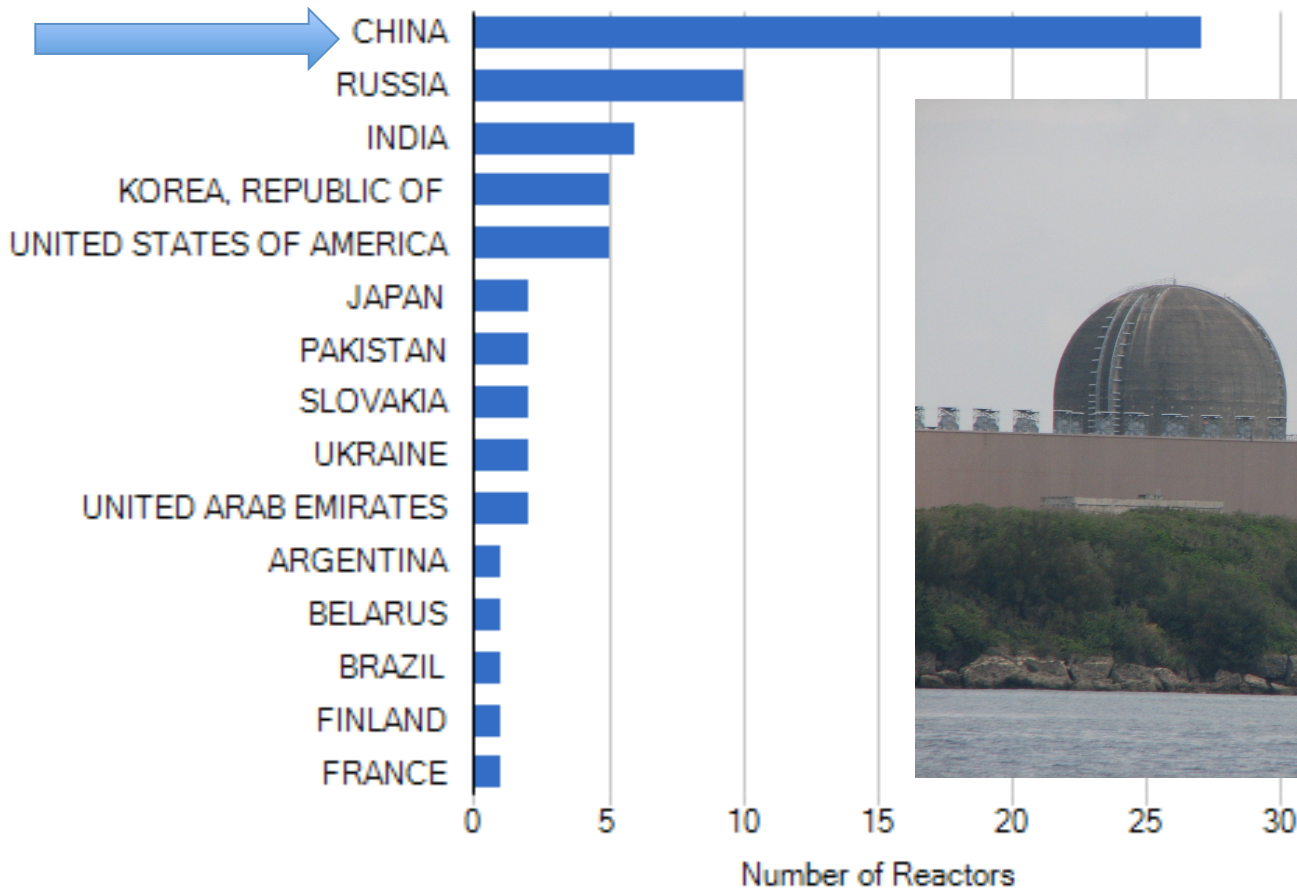
Figure 13. Energy consumption in the United States, China, and India, 1990-2040 (quadrillion Btu)



Source: U.S. Energy Information Administration, *International Energy Outlook*, 2013

China Is Building Half The World's New Nuclear Plants

UNDER CONSTRUCTION REACTORS



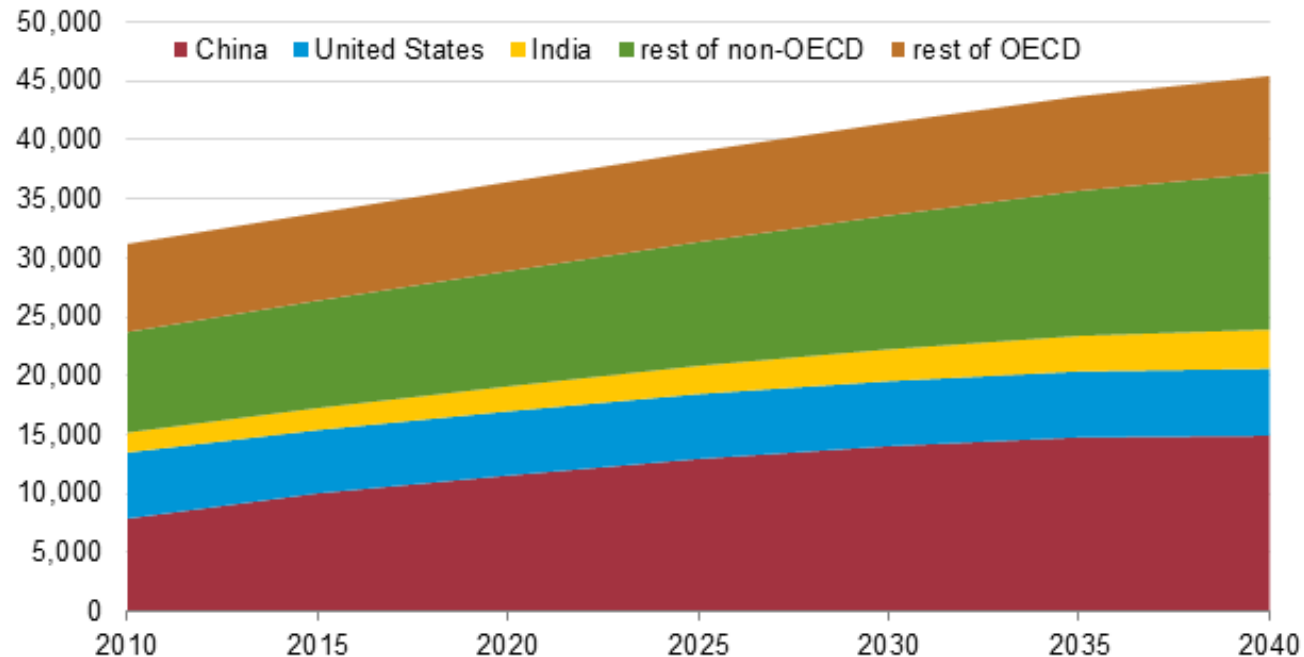
Sources: IAEA Power Reactor Information System

World's Largest CO2 Emitter

From 2010 to 2014, emissions grow by an average of 2.1% per year and counts for 49% of the total world increase in carbon dioxide emissions. Increase is led by coal-related carbon dioxide emissions, and emissions from natural gas and liquid fuels use.

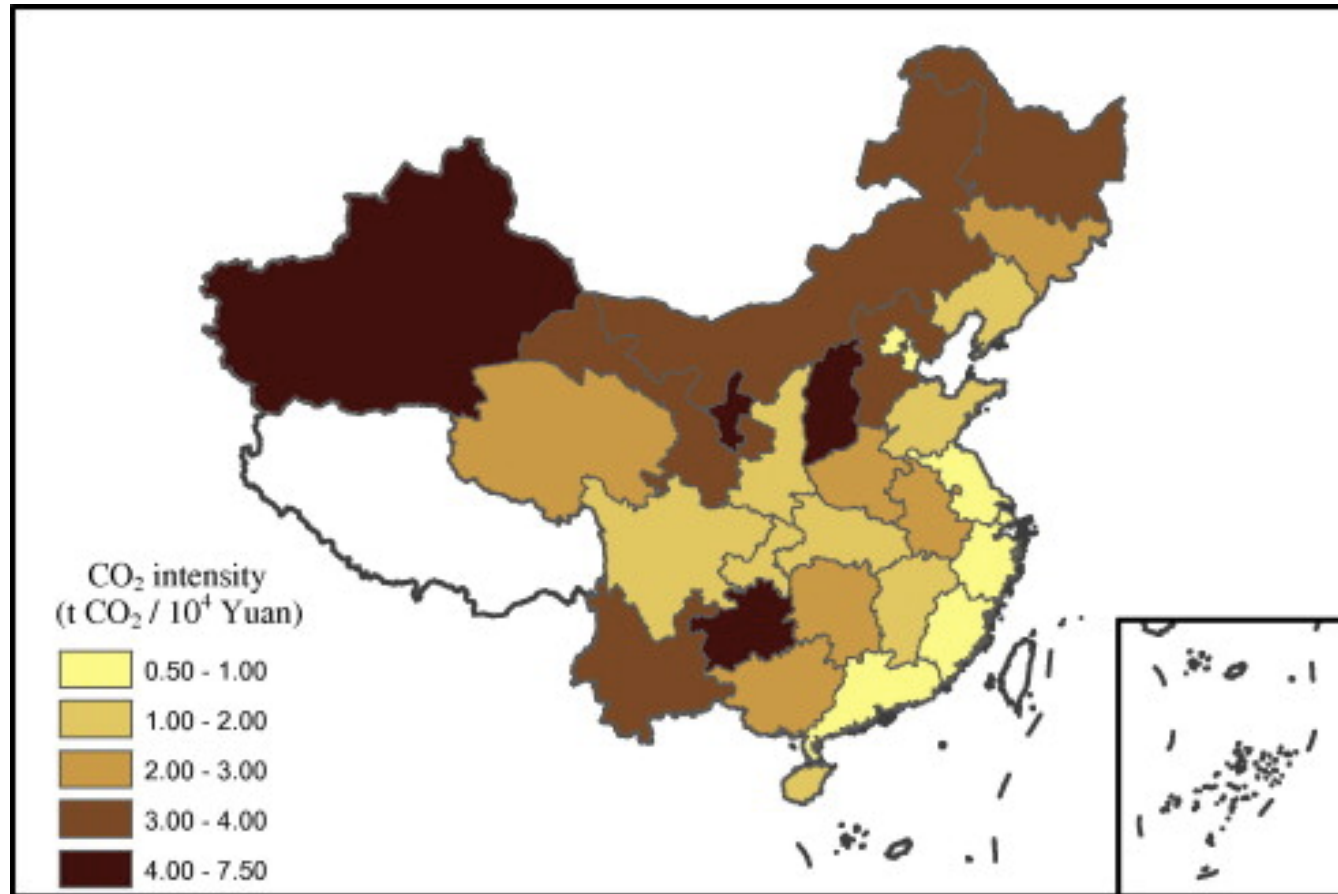
Global energy-related carbon dioxide emissions

million metric tons



Source: U.S. Energy Information Administration, *International Energy Outlook*, 2013.

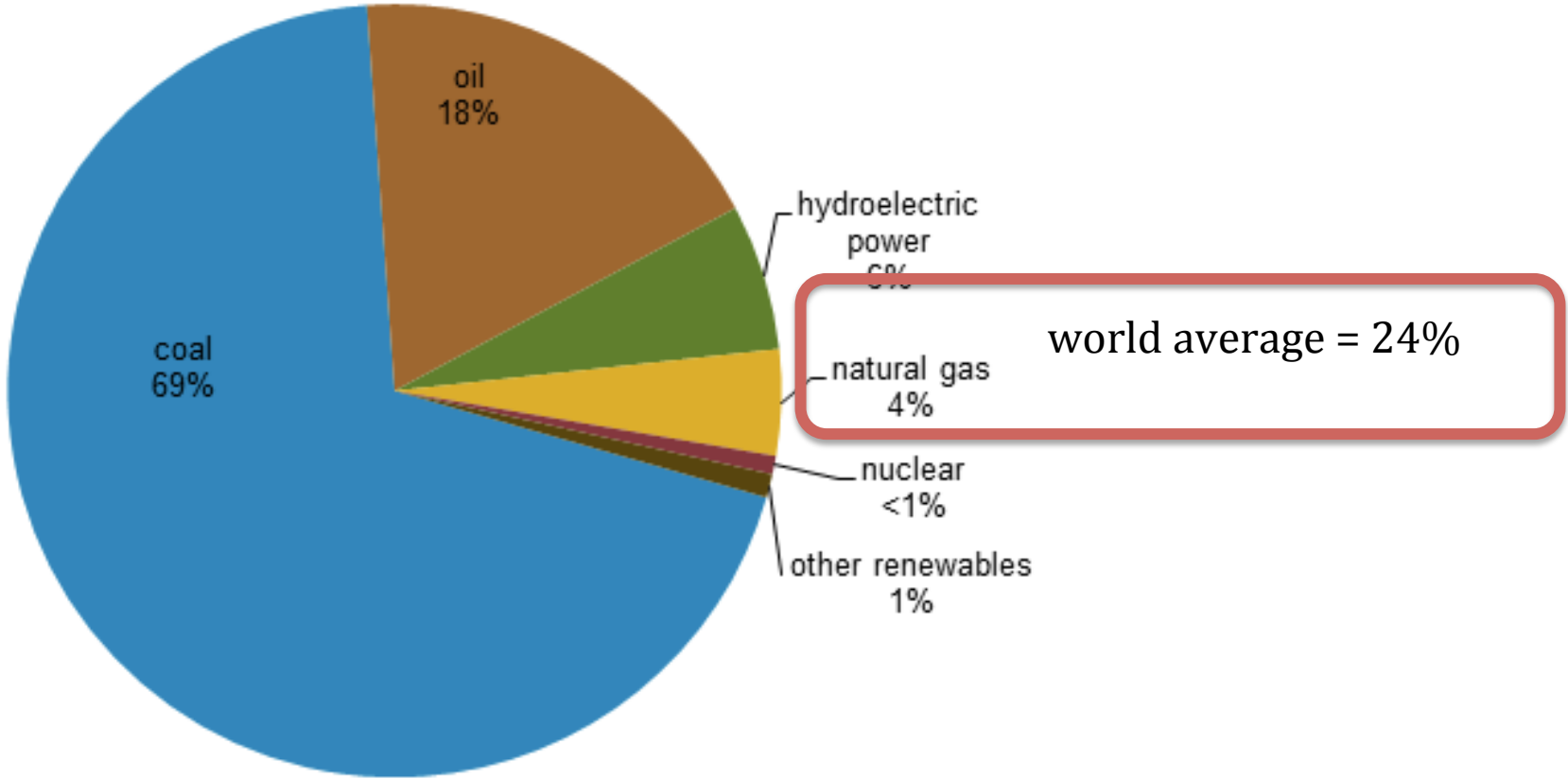
Wide Variations Within China




Spatial distribution of provincial industrial CO₂ intensities (average from 2005 to 2010)

China Natural Gas Use Is Small

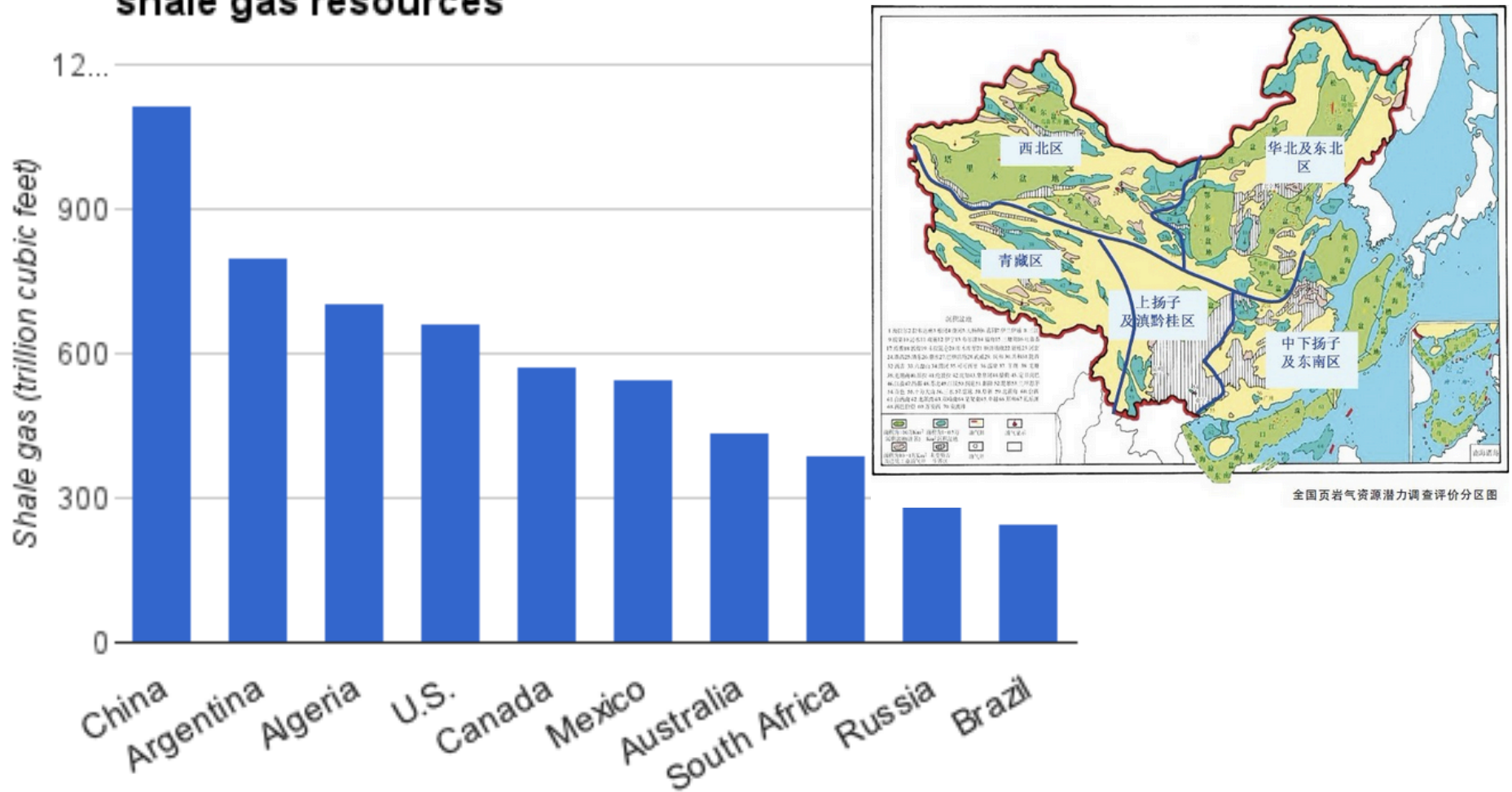
Total energy consumption in China by type, 2011



 Note: Numbers may not add due to rounding.
Source: U.S. Energy Information Administration *International Energy Statistics*.

Chinese Shale Gas Resources Are Vast

Top 10 countries with technically recoverable shale gas resources



Sources: U.S. Energy Information Agency; Ministry of Land and Resources (MLR), National Survey and Assessment of Shale Gas Resource Potential 2013



Drilling furiously: Chinese energy giants turn upbeat on shale gas

Fri, Aug 29 2014

By Charlie Zhu

HONG KONG, Aug 29 (Reuters) - China's energy heavyweights Sinopec Corp and PetroChina have upgraded their outlook on the country's shale gas industry, citing steadily declining costs, but stopped short of predicting a near-term boom.

China, estimated to hold the world's largest technically recoverable shale resources, is hoping to replicate the shale boom that has transformed the energy landscape of the United States. Industry experts caution that it would be much more difficult for China to monetise its shale gas reserves than the U.S. as it faces serious challenges from water shortages to complicated geological structure and a lack of infrastructure.

The
Economist

Natural gas in China Shale game

China drastically reduces its ambitions to be a big shale-gas producer

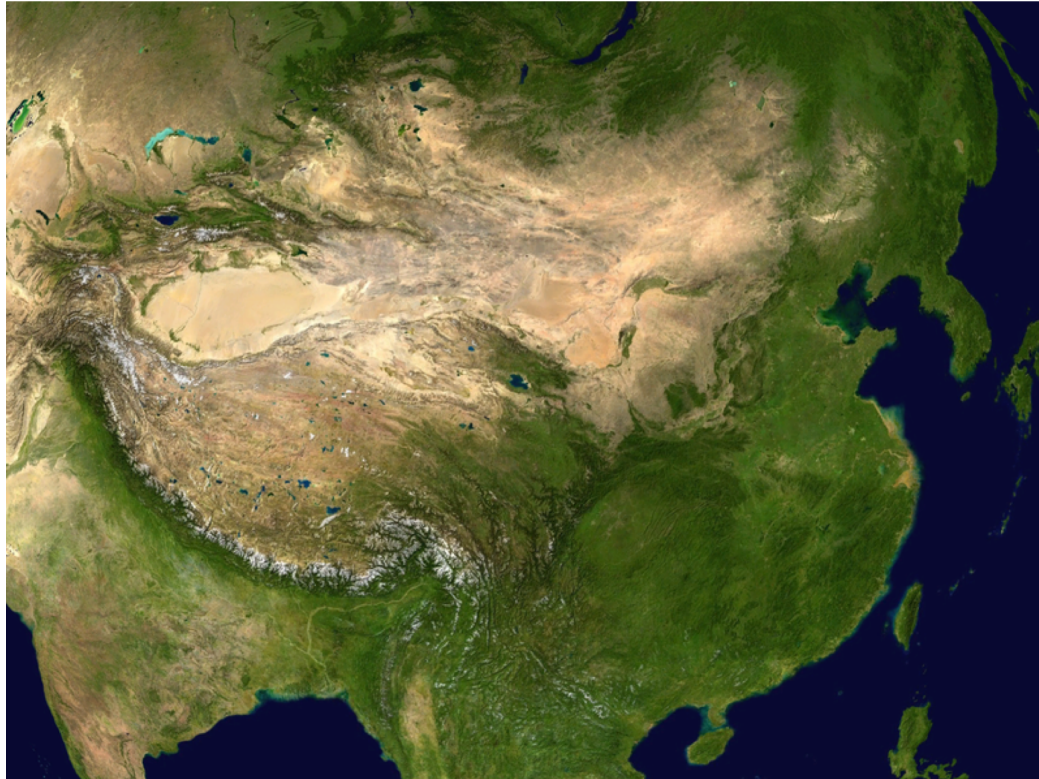
Aug 30th 2014 | From the print edition

IN 2012 China's main planning agency, the National Development and Reform Commission, declared that the country would produce 60 billion-100 billion cubic metres of shale gas a year in 2020. It needed those forecasts to be accurate.

They weren't. Wu Xinxiong, the director of China's National Energy Administration, recently predicted that only 30 billion cubic metres a year will come on stream by 2020. That would barely meet 1% of China's energy needs now, let alone in 2020.

MEETING CHINA'S SHALE GAS GOALS

David Sandalow, Jingchao Wu, Qing Yang, Anders Hove and Junda Lin

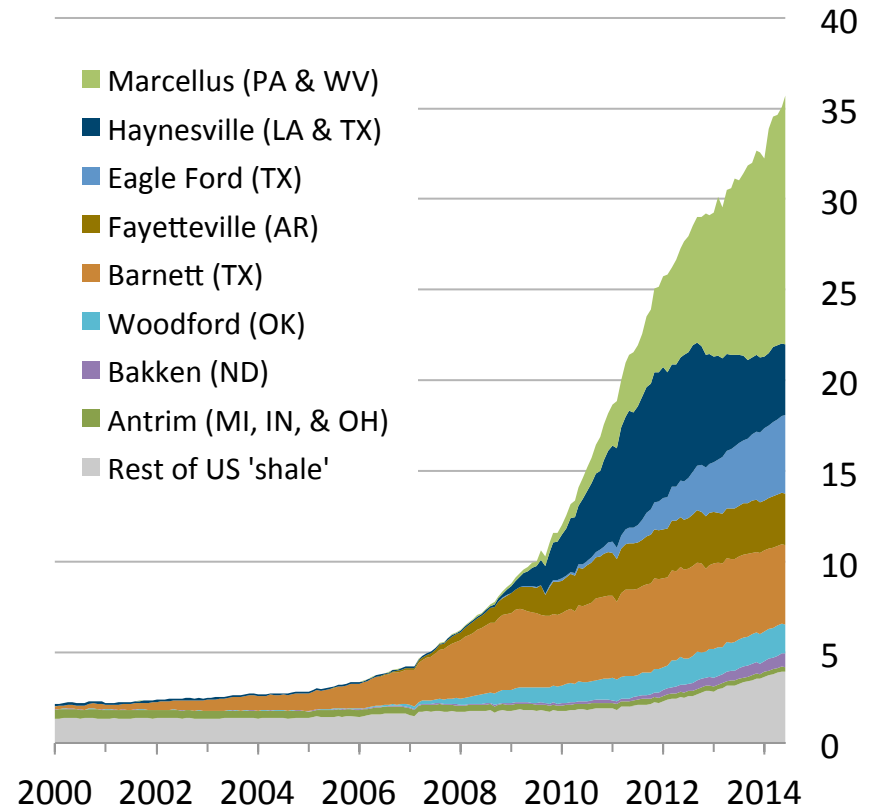
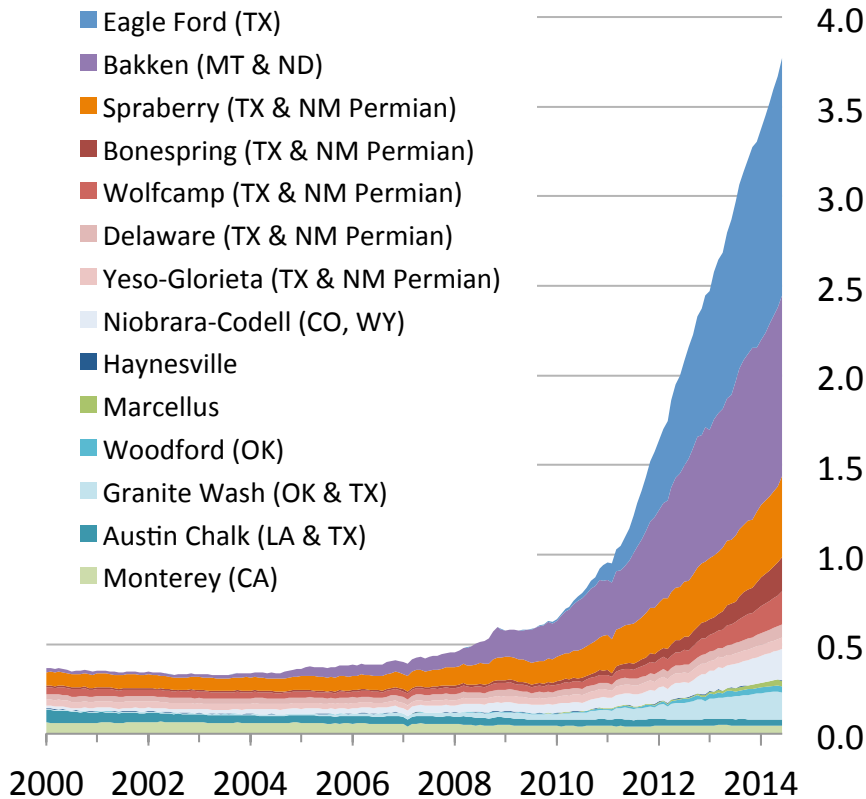


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US Tight Oil and Shale Gas Production 2000-2014

U.S. tight oil production
million barrels of oil per day

U.S. dry shale gas production
billion cubic feet per day

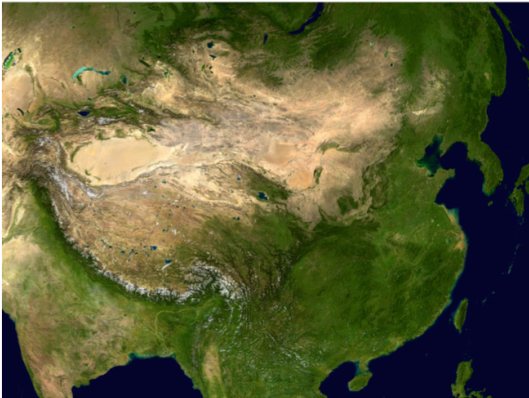


Sources: EIA derived from state administrative data collected by DrillingInfo Inc. Data are through June 2014 and represent EIA's official tight oil & shale gas estimates, but are not survey data. State abbreviations indicate primary state(s).

What Led to the US Shale Revolution?

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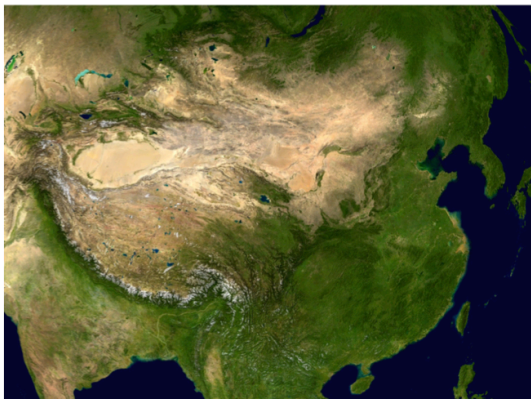
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- a large and high-quality shale resource
- a competitive market system
- private property rights
- federal government support for R&D
- federal tax incentives
- publicly available data
- an extensive pipeline network
- an entrepreneurial culture

Findings

MEETING CHINA'S SHALE GAS GOALS

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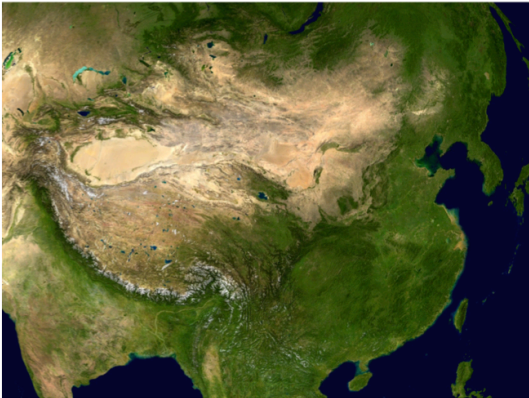
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- *In the next few years, **Chinese shale gas production** will not be substantial. After that, high growth and low growth scenarios are both plausible.*
- ***Key barriers** to growth include high production costs, weak incentives for state-owned enterprises, lack of competition, restrictions on foreign businesses and limited data availability.*
- ***Policies are key***

Chinese Shale Gas Policies

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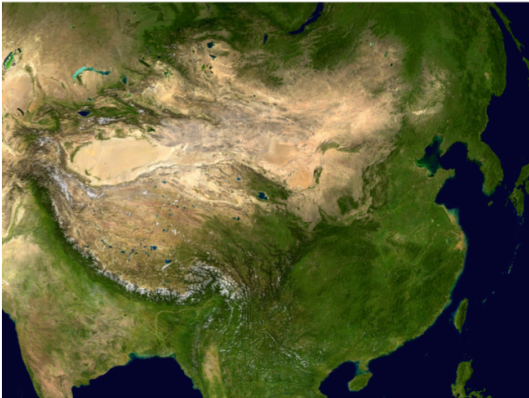
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- Annual **production targets** of 6.5 bcm in 2015 and 60-100bcm in 2020.
- **Production subsidy** of 0.4RMB/cubic meter (roughly \$1.83/thousand cubic feet), which expires in 2015
- **Waivers of price controls and fees**
- **Provincial policies** (including shale gas development plans in Sichuan, Chongqing and Guizhou)

Findings (cont.)

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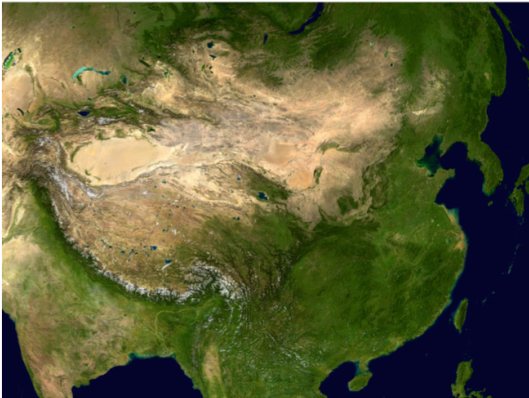
- *Environmental impacts could range from very positive to very negative*
- *Water supply constraints could be a factor in medium and long term*
- *U.S. and Chinese governments share common goals with respect to shale gas.*

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Recommendations

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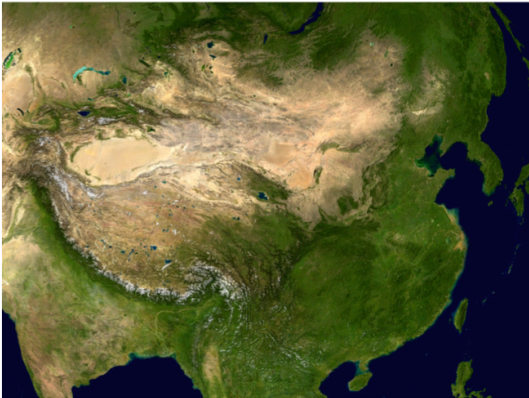
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- Accelerate market-based reforms
 - Continue natural gas price reforms
 - Speed pipeline reforms
 - Encourage competition for mineral rights
 - Improve data availability

Recommendations

MEETING CHINA'S SHALE GAS GOALS

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- Accelerate market-based reforms
- Provide clear roadmap for foreign companies
- Build regulatory capacity
- Invest in innovation
- Coordinate among ministries



