香港中文大學
The Chinese University of Hong Kong

GEOGRAPHY & RESOURCE MANAGEMENT
地理與資源管理學系

Climate Change as a Great Villain

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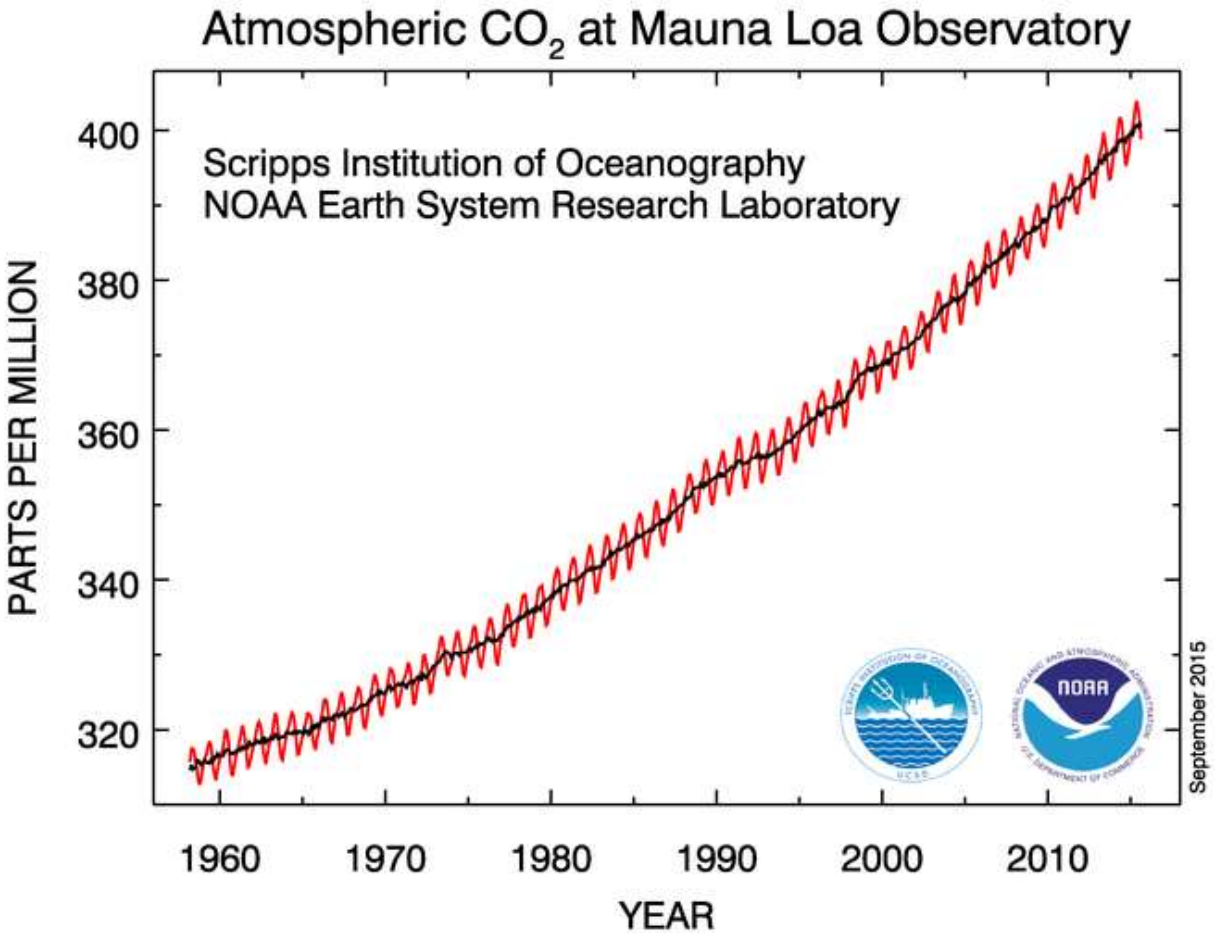
Atmospheric CO_2 concentration at Mauna Loa



1 ppm of CO_2
= 7.9 billion tons CO_2
= 2.1 billion tons C

About half of CO_2 emitted stay in the atmosphere

http://www.esrl.noaa.gov/gmd/ccgg/trends/#mlo_full

What if we face such a villain?

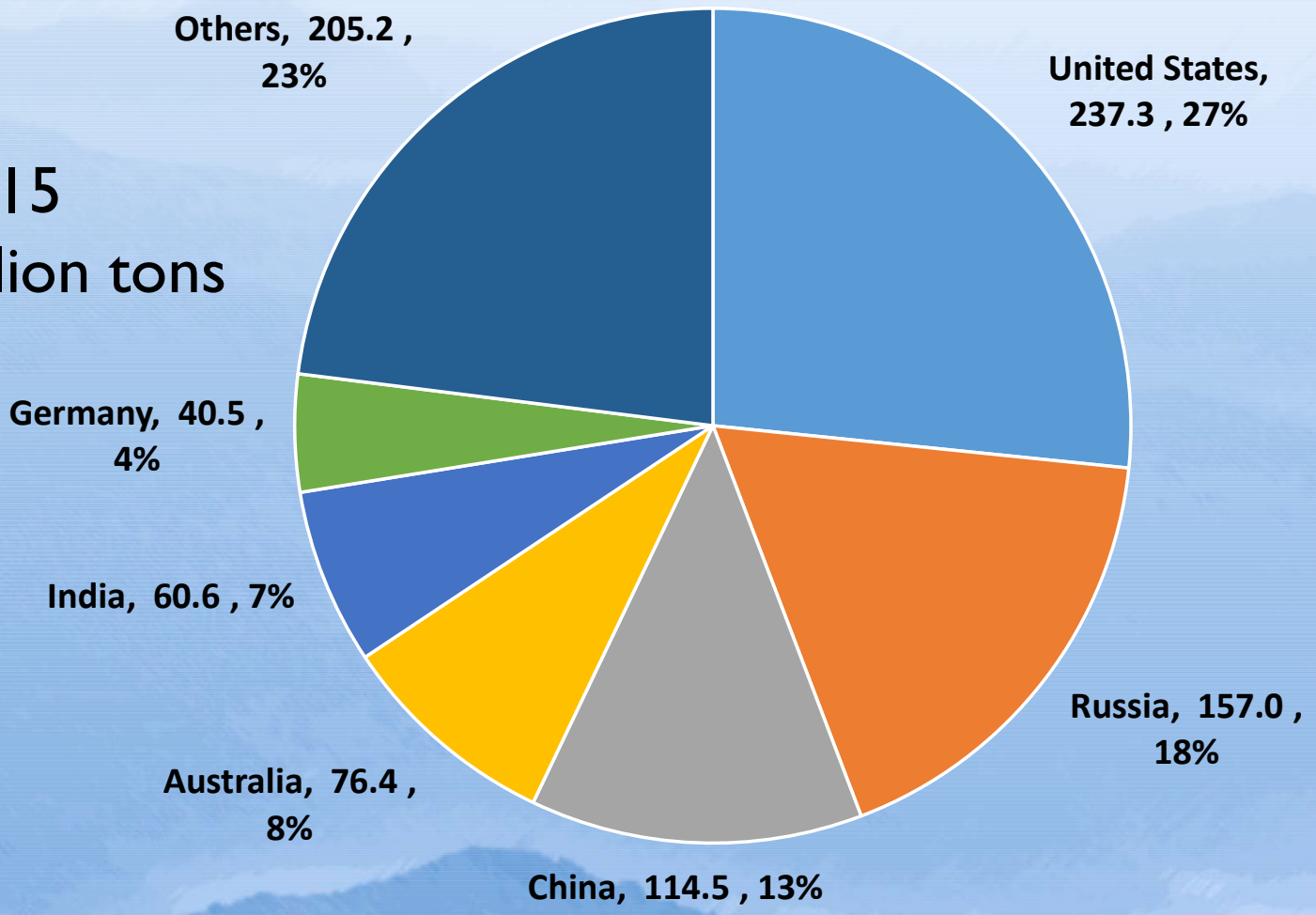
Against the common villain of climate change

- Air pollution
- Energy security
- Innovation and technology

AIR POLLUTION

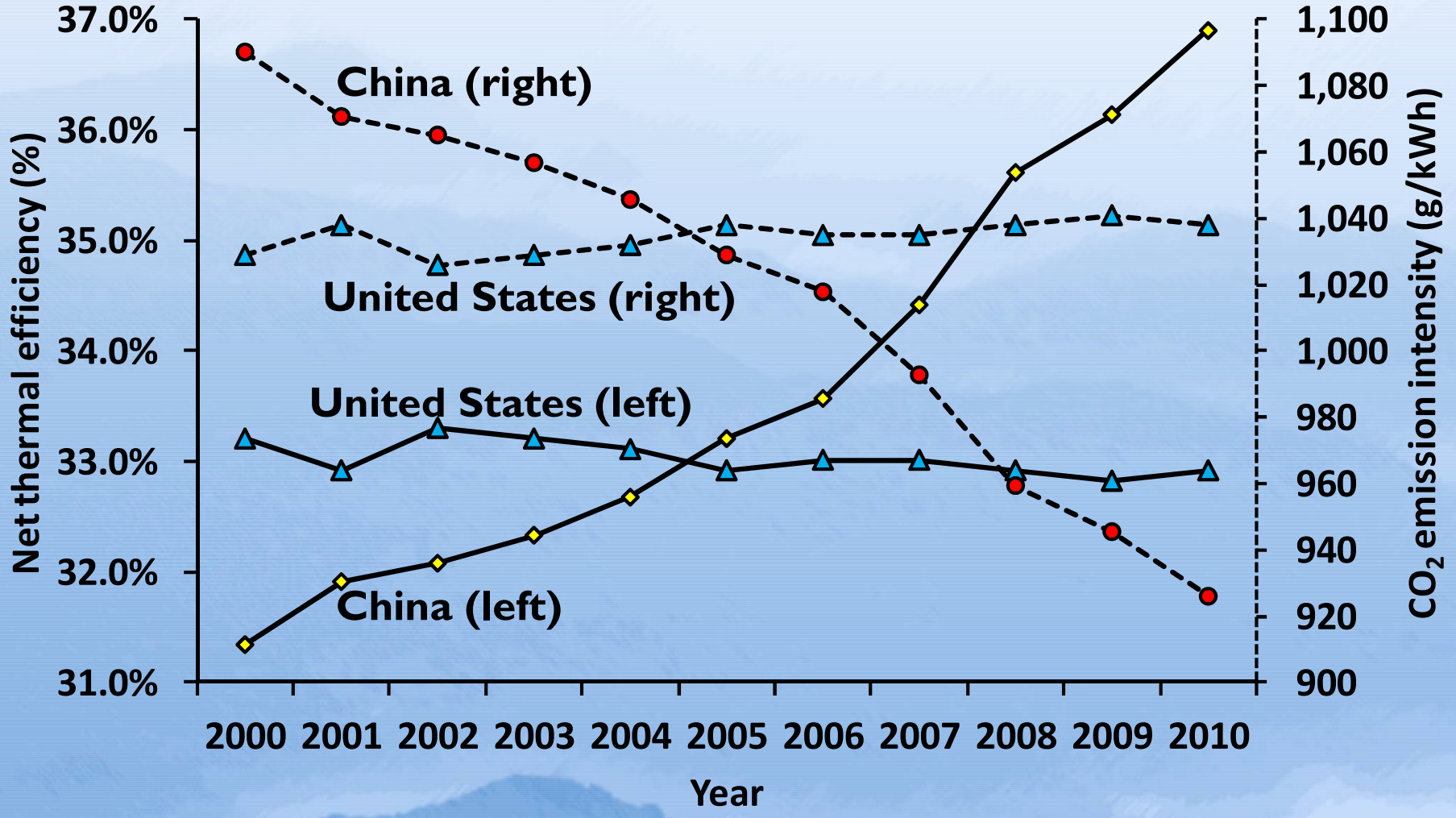
Proven coal reserves

2015
891.5 billion tons



Source: BP, 2016

Net thermal efficiency of coal-fired power generation



Source: Xu, Yang & Xuan, 2013

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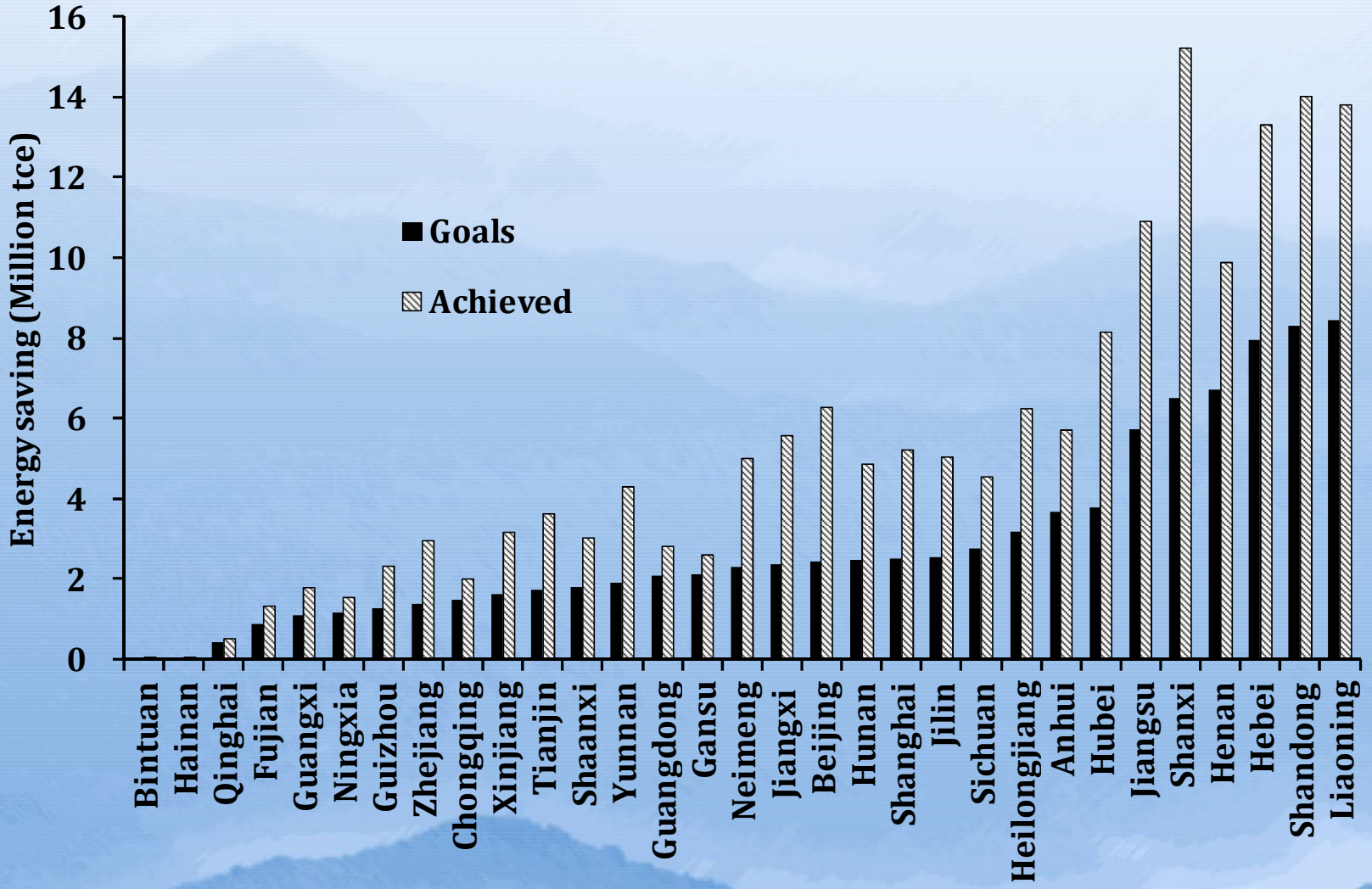
Energy conservation of the “1000 energy-intensive firms” in the 11th Five-Year Plan



Source: Wu, Xu, Leung & Yung, 2015

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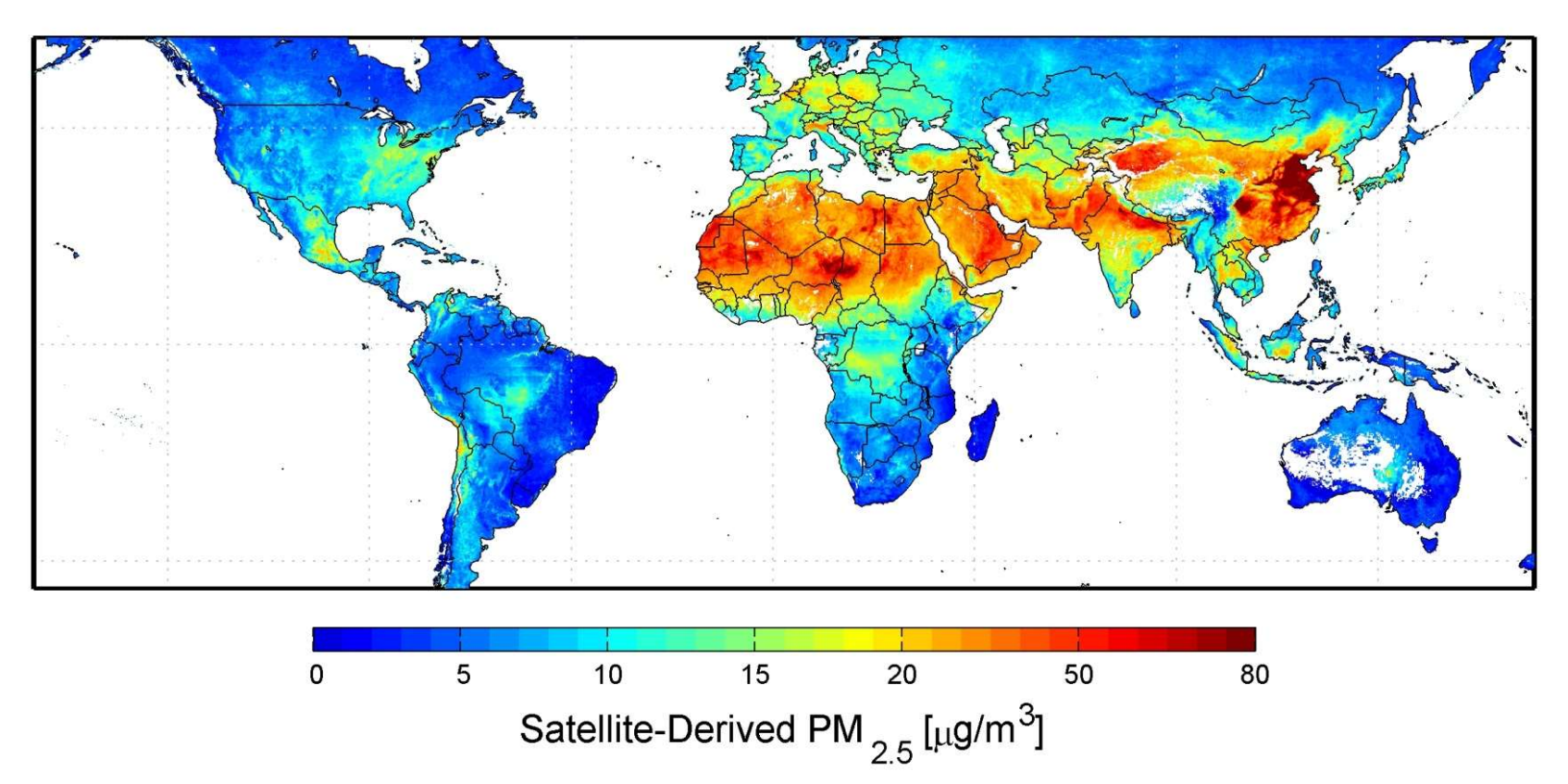
Air pollution and coal consumption

$PM_{2.5}$: 116.1 μg/m^3, 15 April 2013

$PM_{2.5}$: 6.0 μg/m3 , 6 February 2013

$PM_{2.5}$ concentration

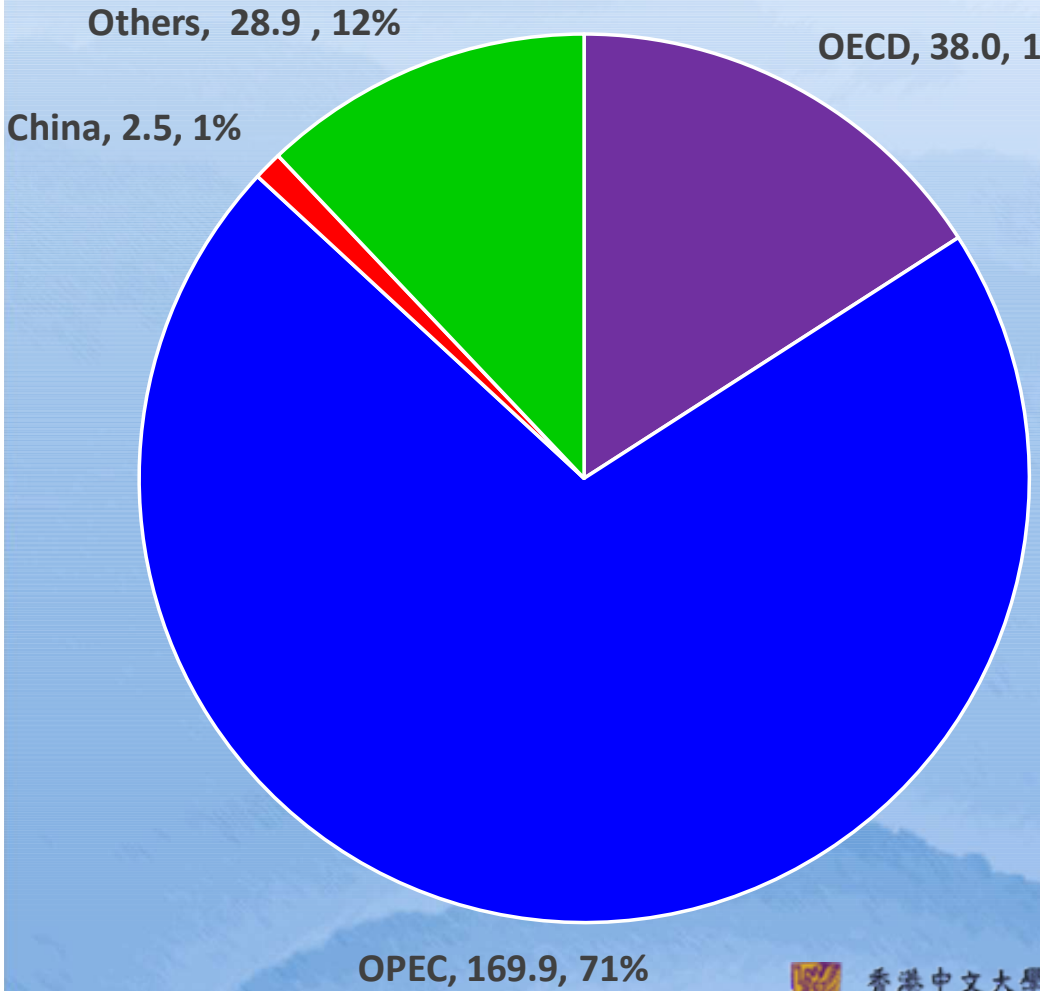


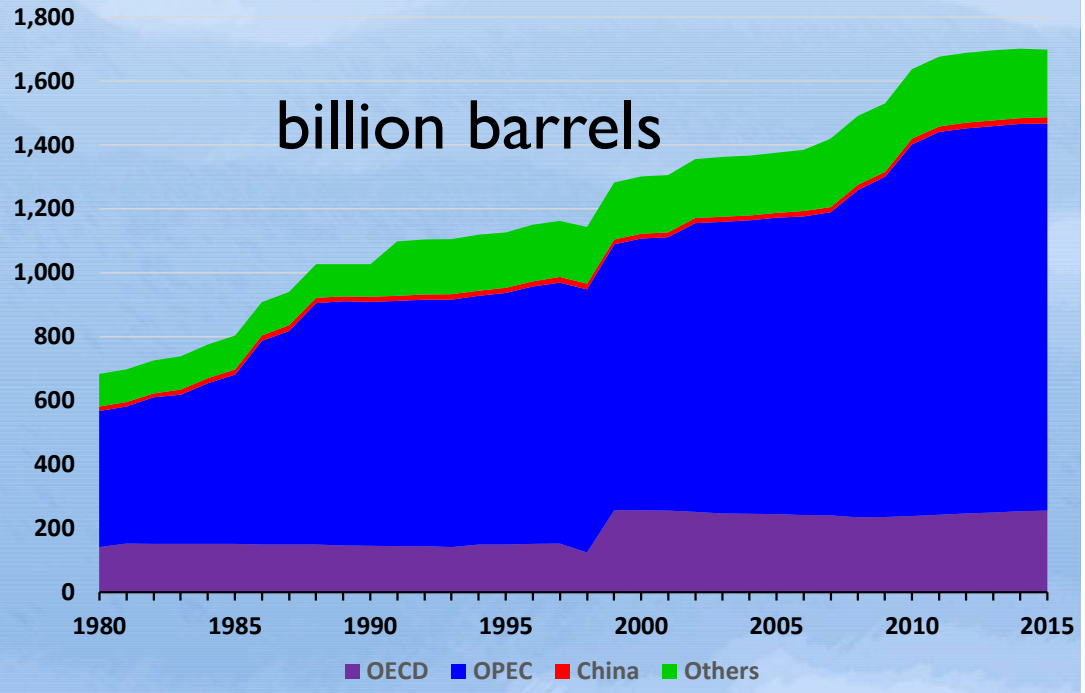
Source: NASA, 2010

ENERGY SECURITY

Proven oil reserves

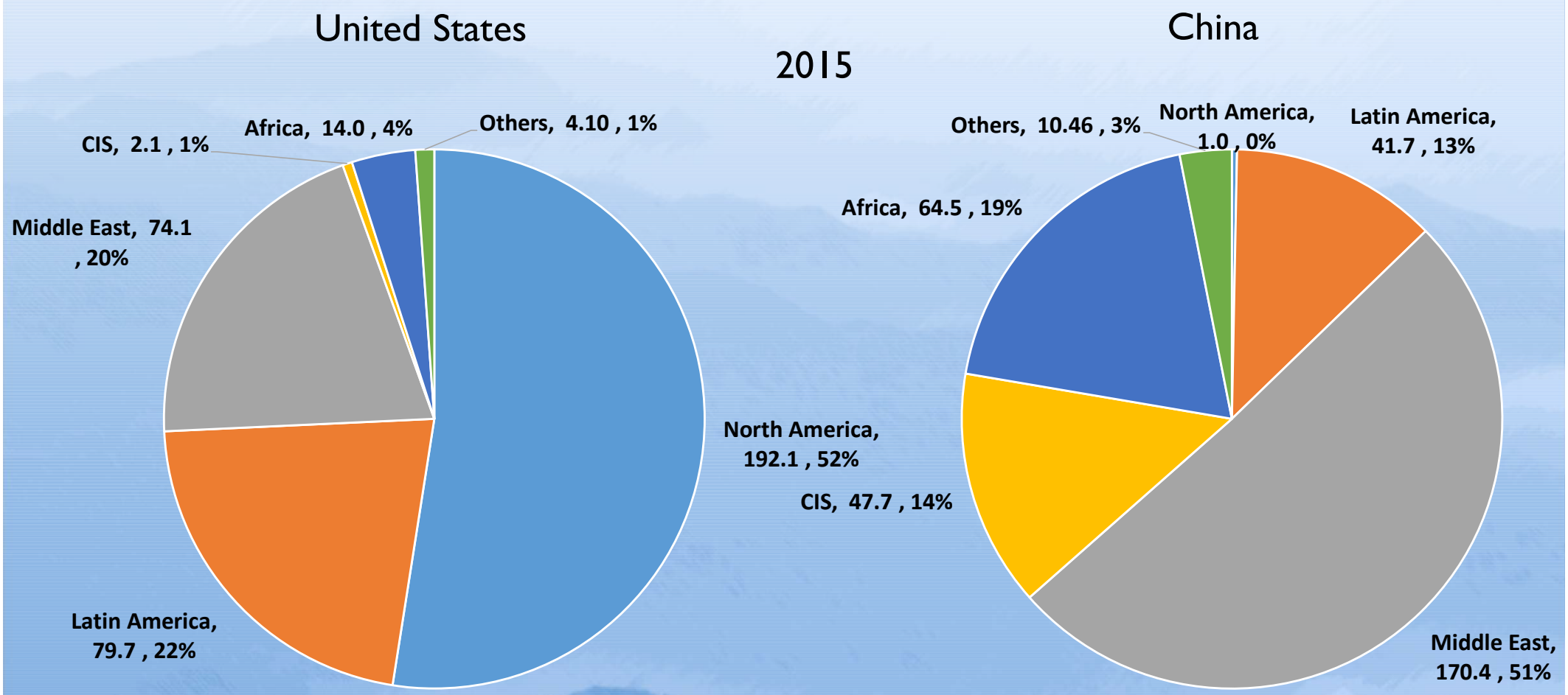
2015
239.4 billion tons





Source: BP, 2016

Oil import origins

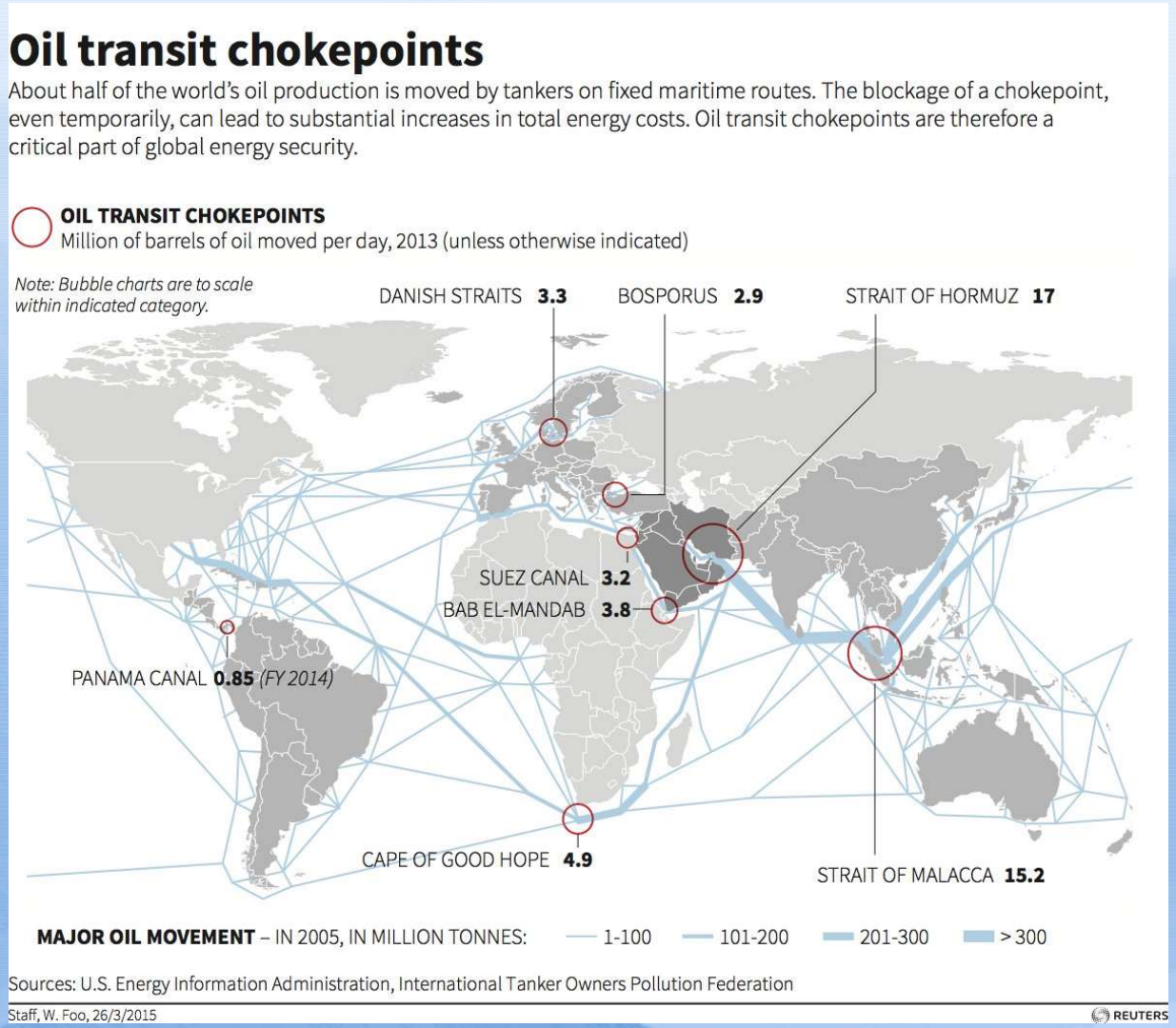


Source: BP, 2016

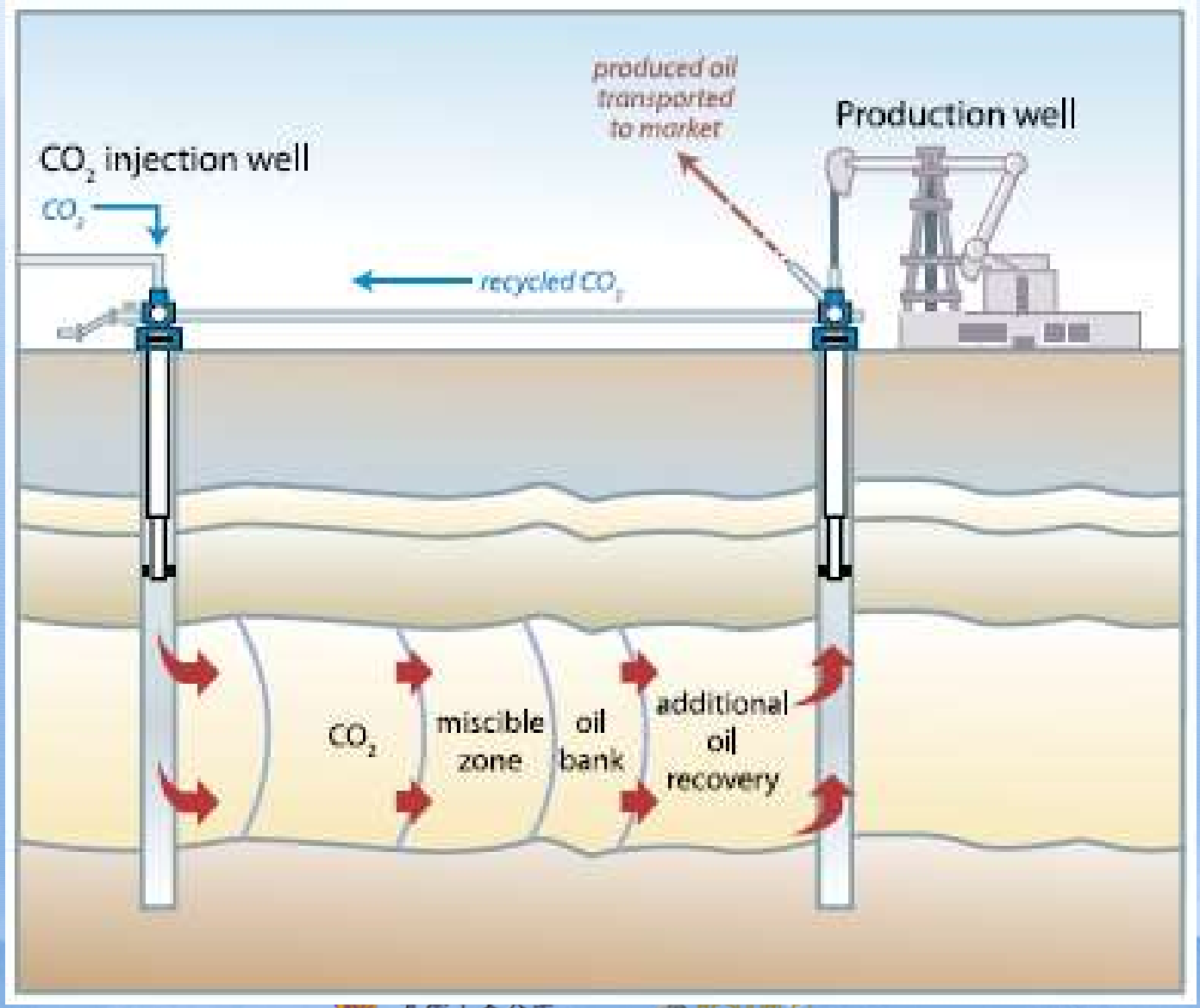
East China Sea and South China Sea

EIA, 2010

Oil transport chokepoints

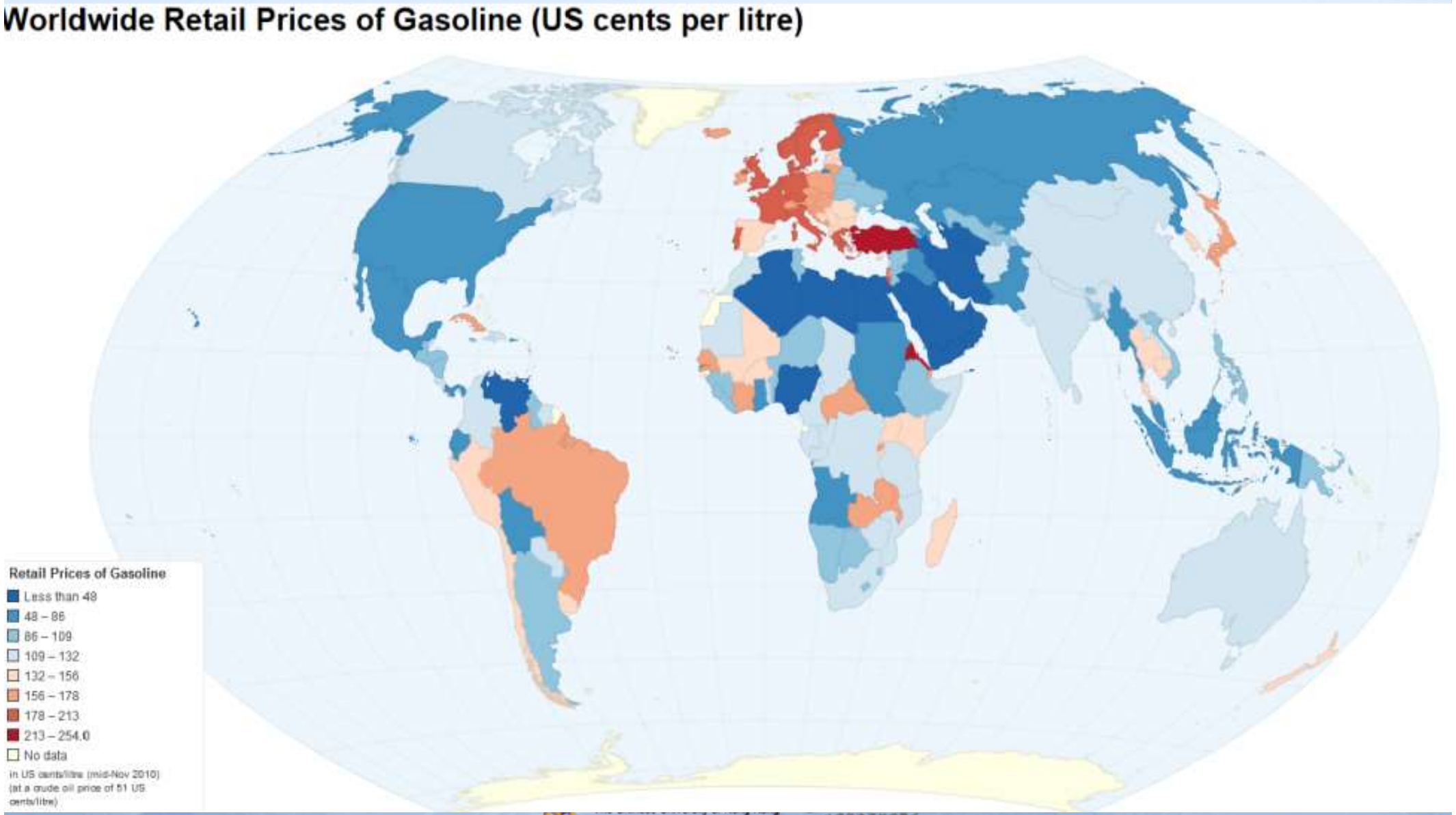


Enhanced Oil Recovery (EOR) for domestic oil production



Source: IPCC, 2005

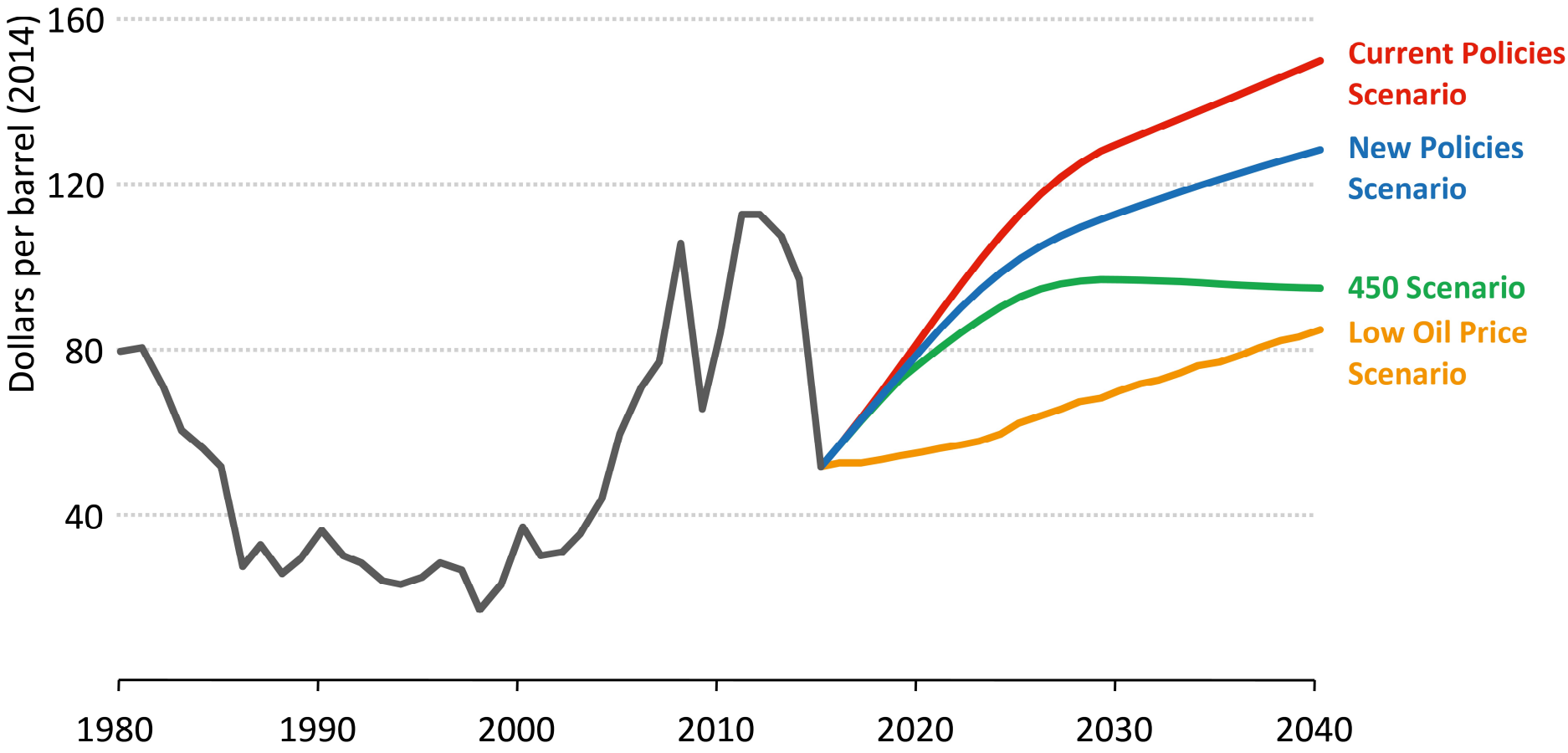
Incentives to discourage oil consumption



http://chartsbin.com/view/1115

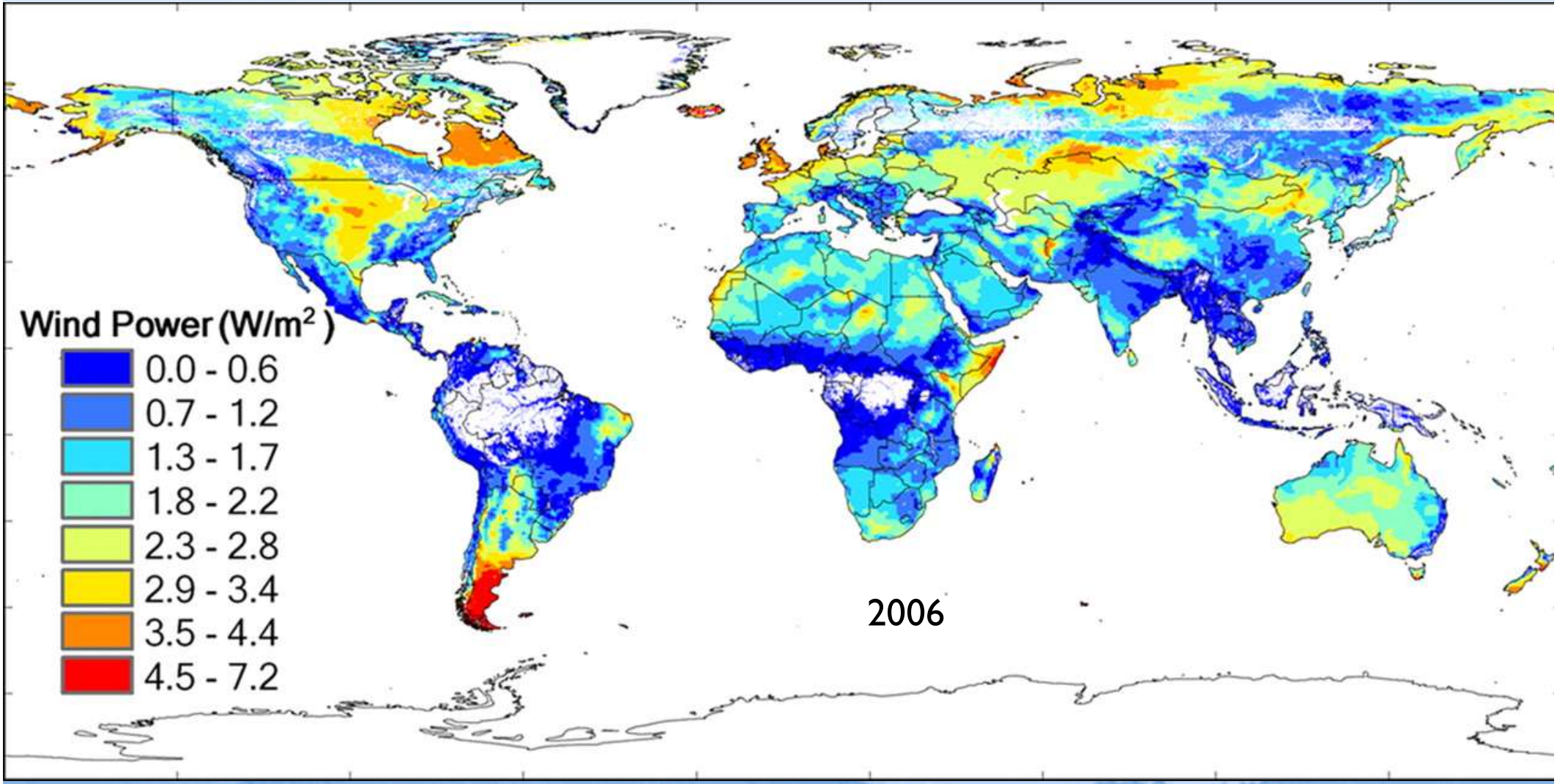
Lower oil prices, fewer conflicts

Figure 1.5 ▷ Average IEA crude oil import price by scenario



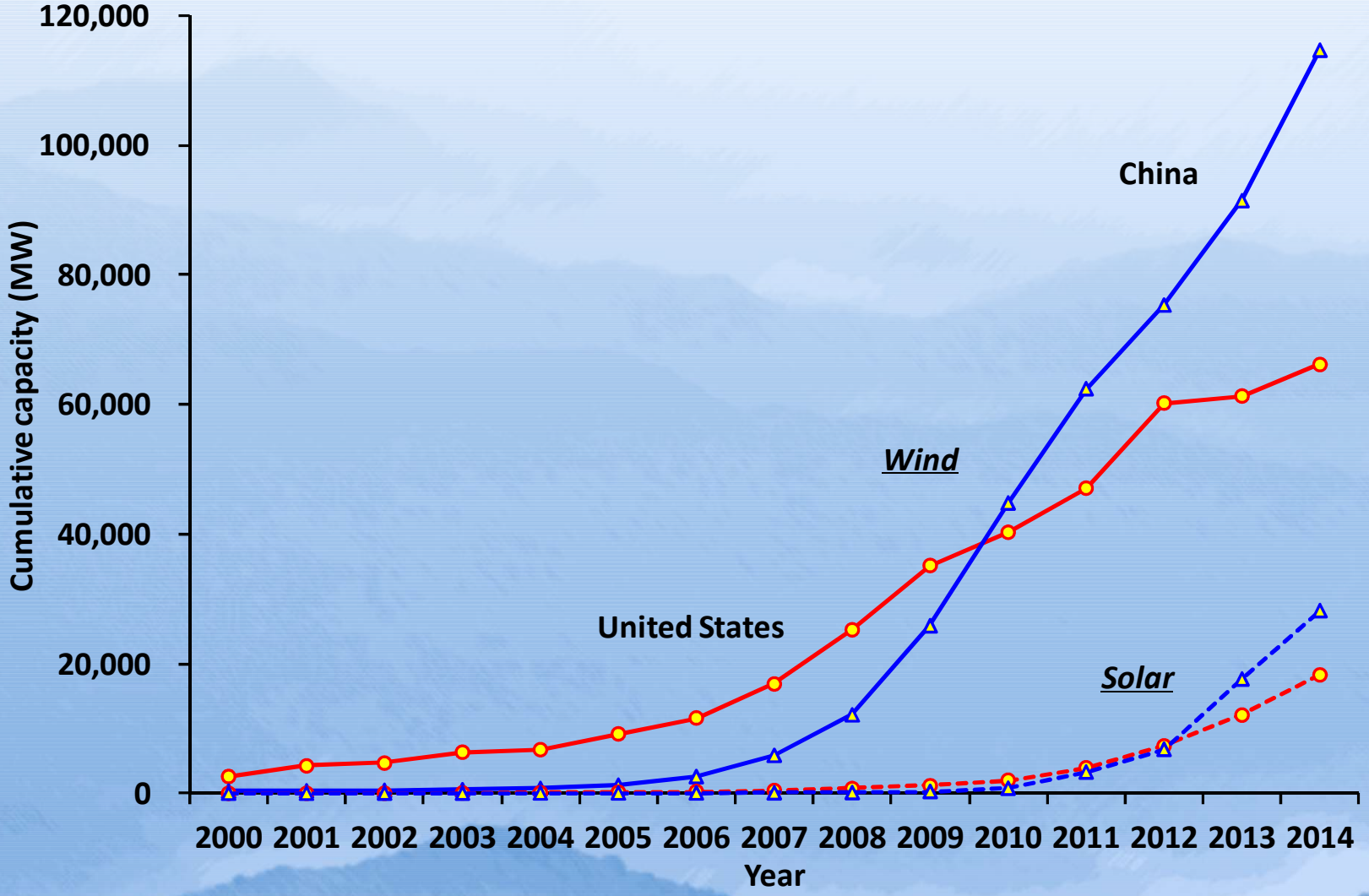
INNOVATION AND TECHNOLOGY

Wind energy resources

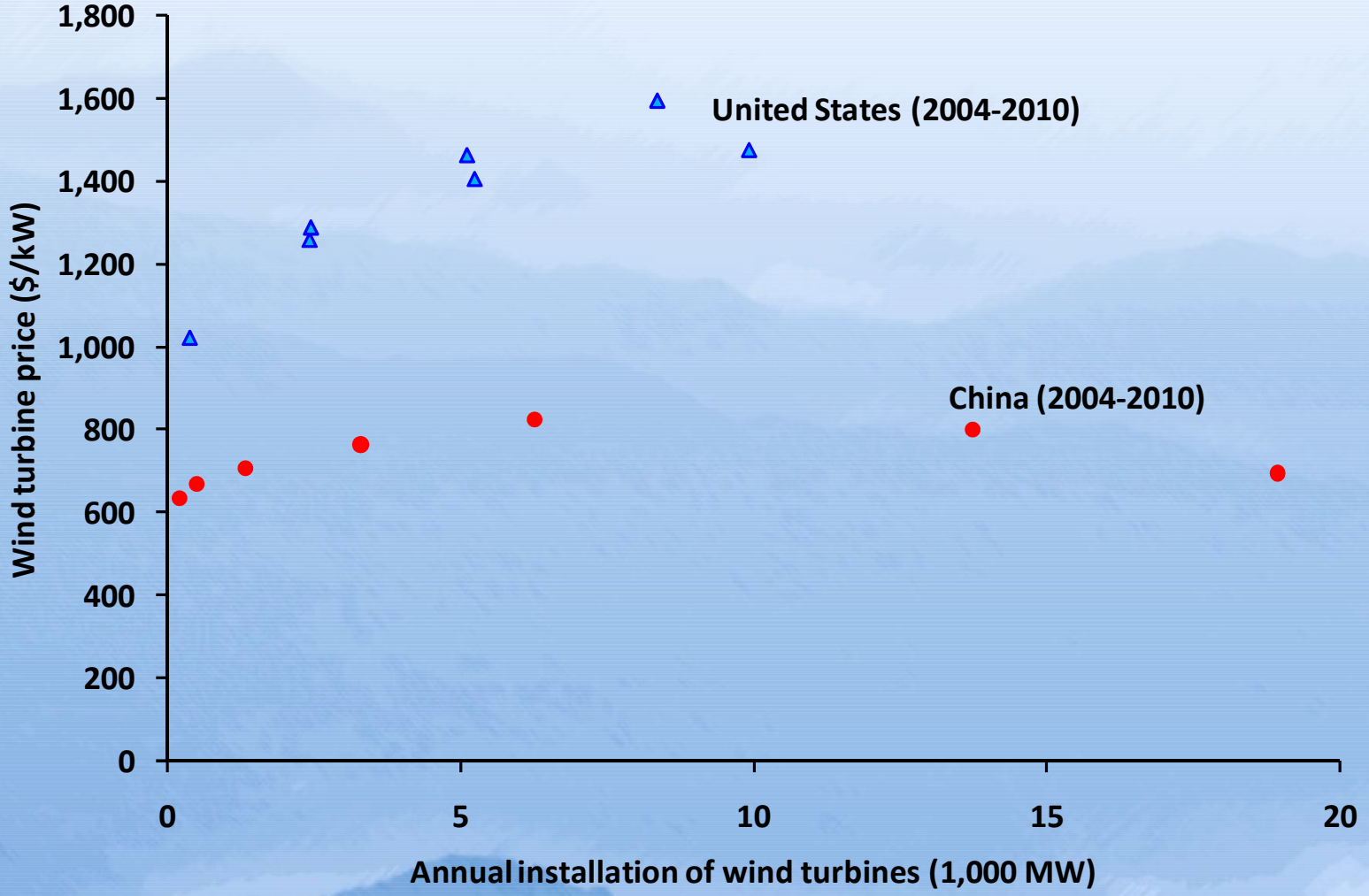


Source: Lu, et al, 2009

The development of wind and solar energy

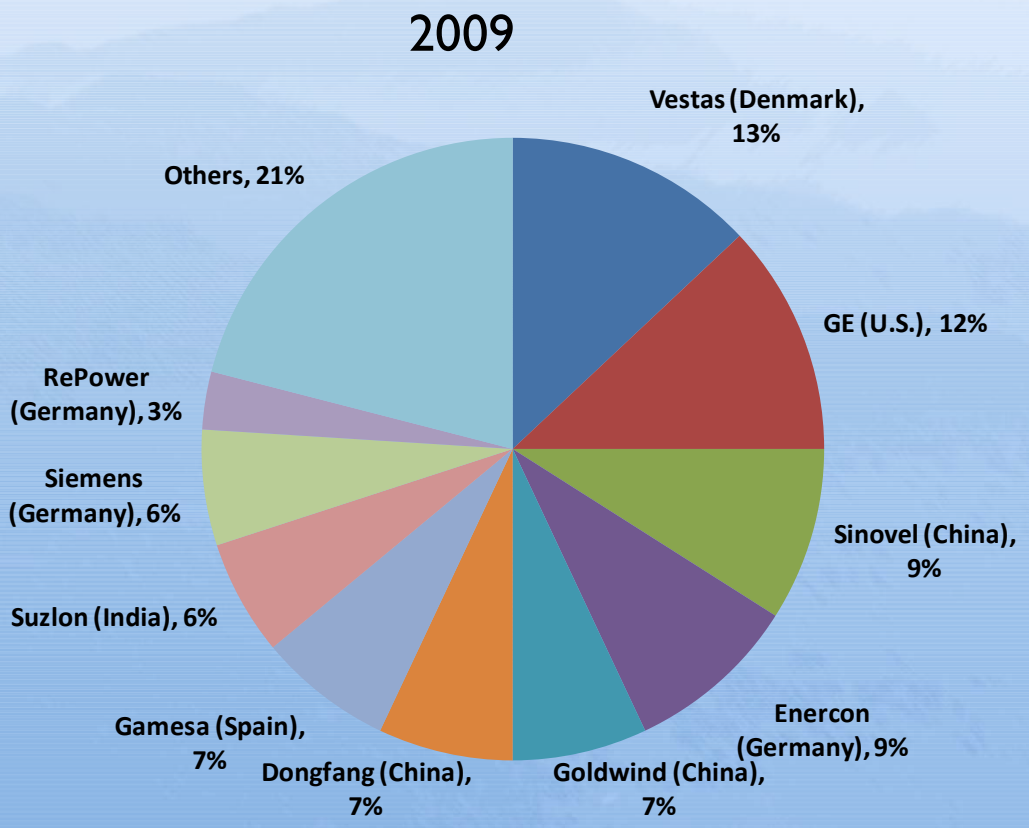


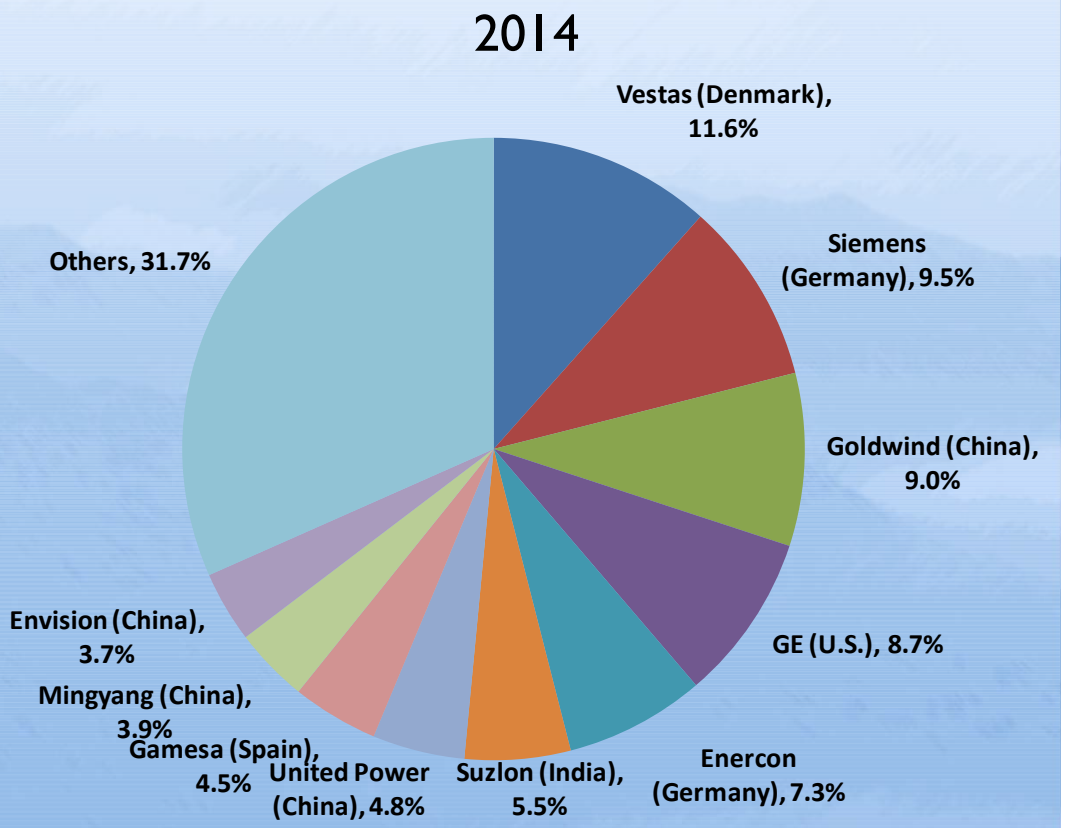
Competition on innovation and technology



Source: IEA, 2011; Wiser & Bolinger, 2012

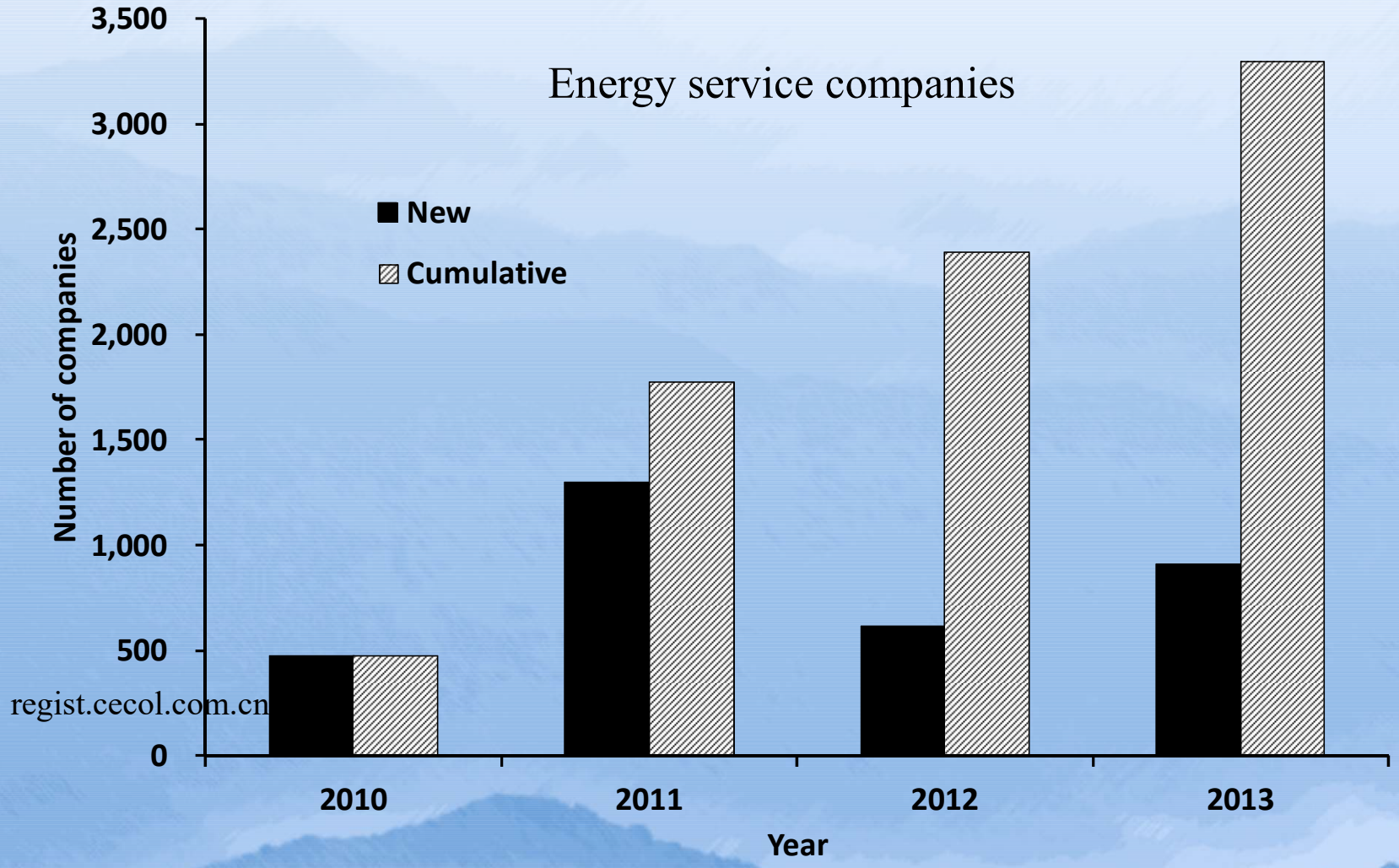
Market shares of wind turbine manufacturers



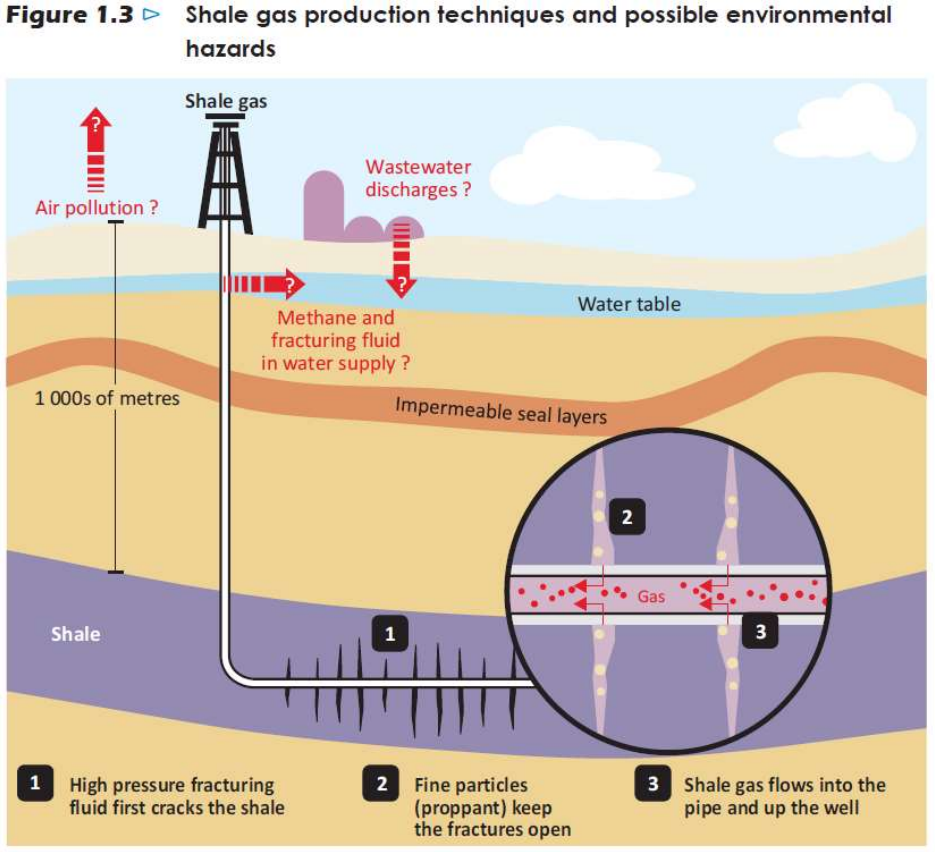


Data source: REN21

Innovation and technology for energy conservation



Innovation and technology for shale gas development



Source: IEA, 2012

Shale gas basins in China

Source: Chang, Liu and Christie, 2012

Conclusion

- If we take climate change as a common, great villain
  - Less environmental pollution
  - Fewer conflicts on energy resources
  - More innovation
- A villain *could* make the world a better place