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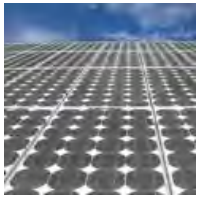

The Role of Natural Gas in the Energy Transition: Lessons from the US?

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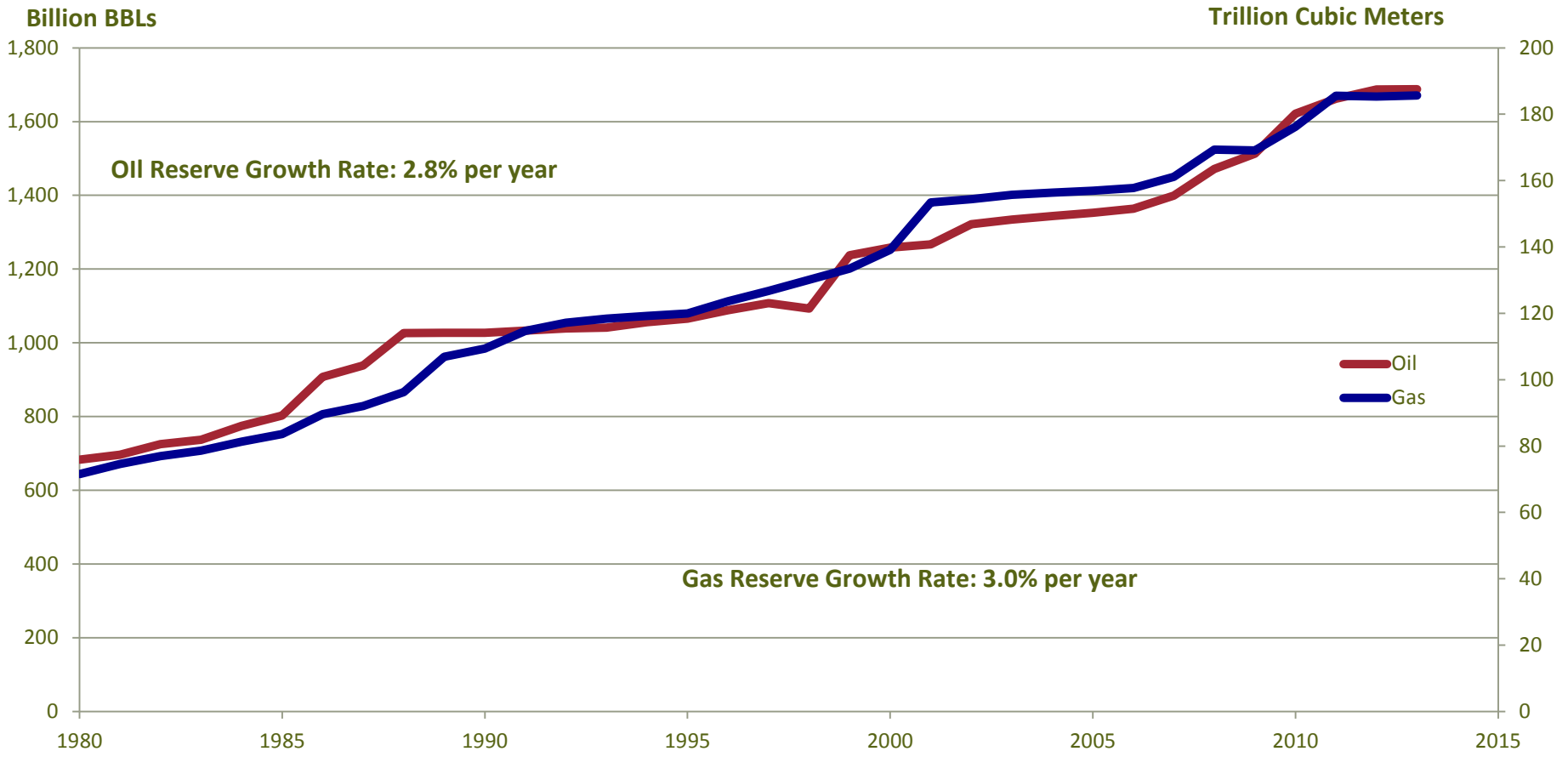
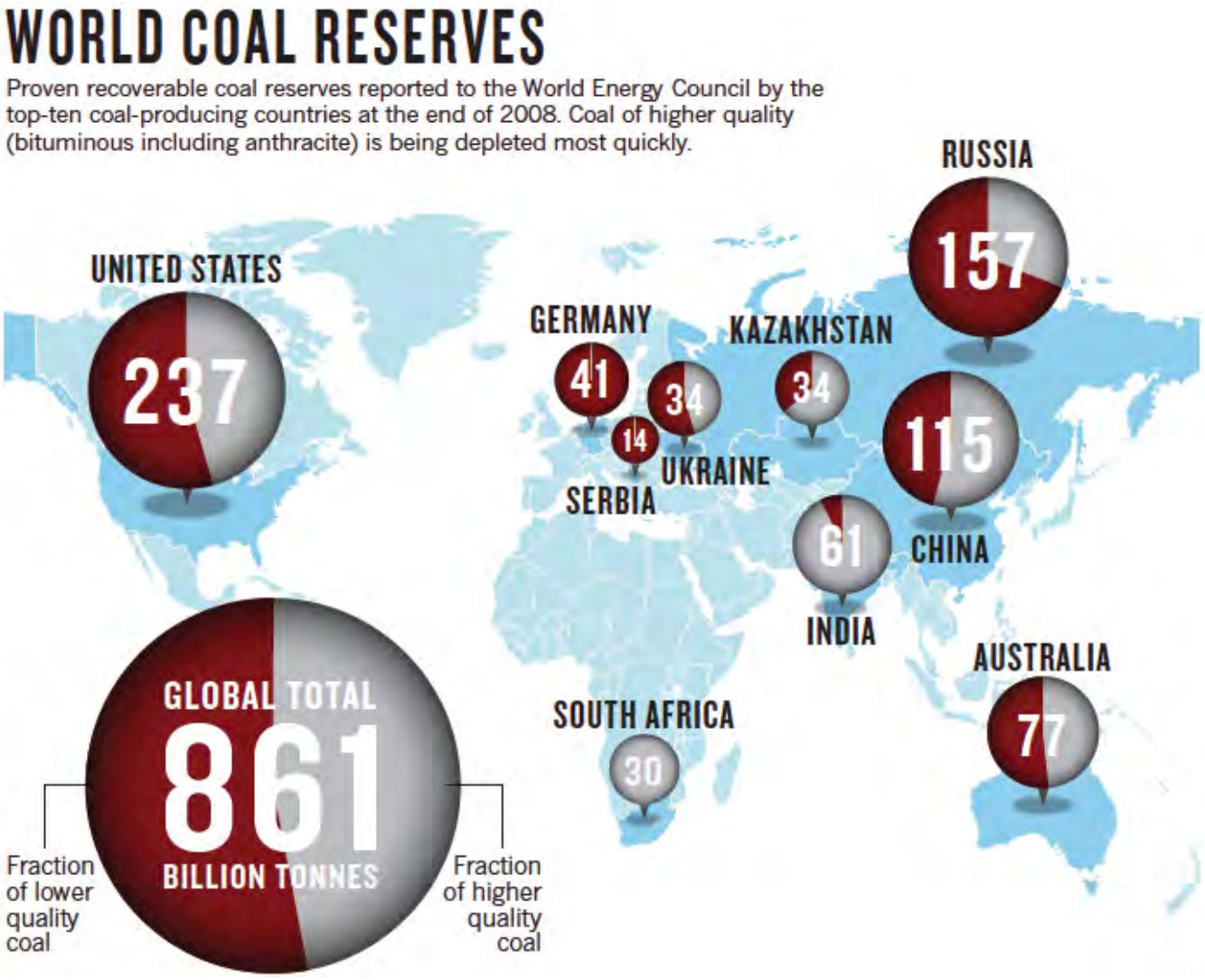
1. The world is awash in hydrocarbons

- Any we should expect to always be



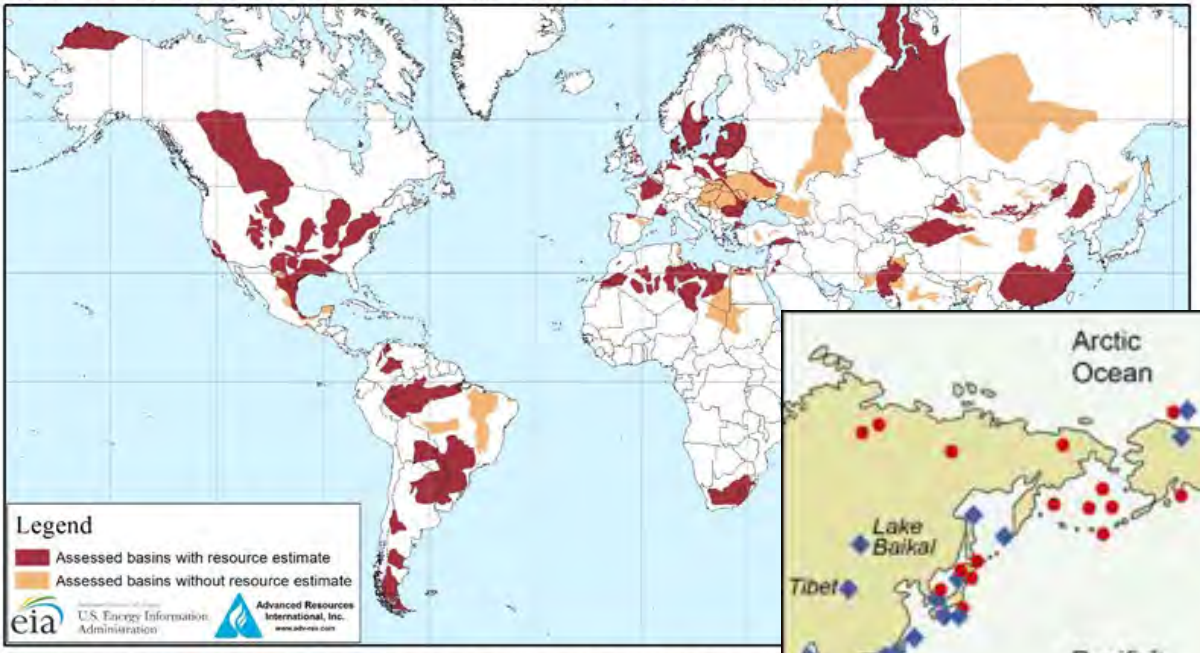
Source: Covert, Greenstone, Knittel. "Will we ever run out of fossil fuels?", 2015
Compiled from BP Statistical Review of World Energy, various years

And, let's not forget about all of the coal

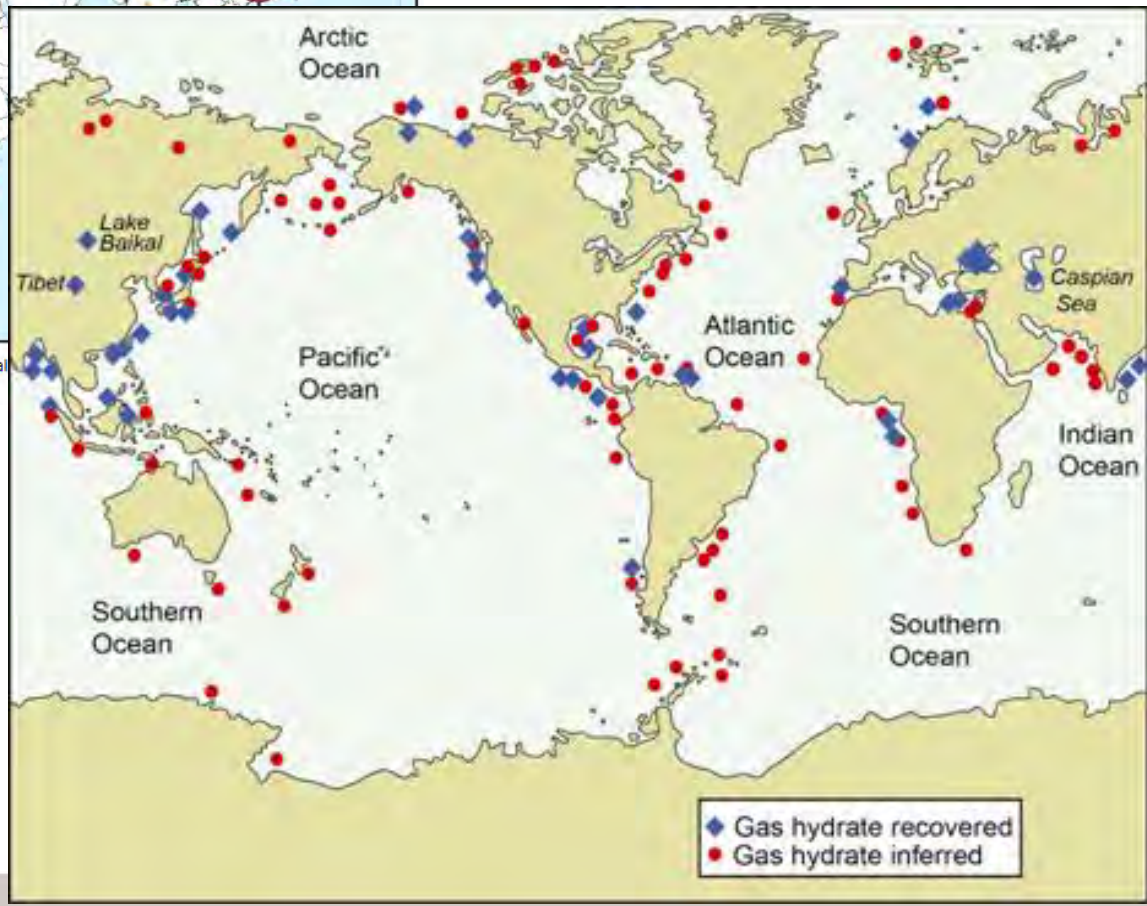


Constant battle between demand and technological progress

Figure 1. Map of basins with assessed shale oil and shale gas formations, as of May 2013

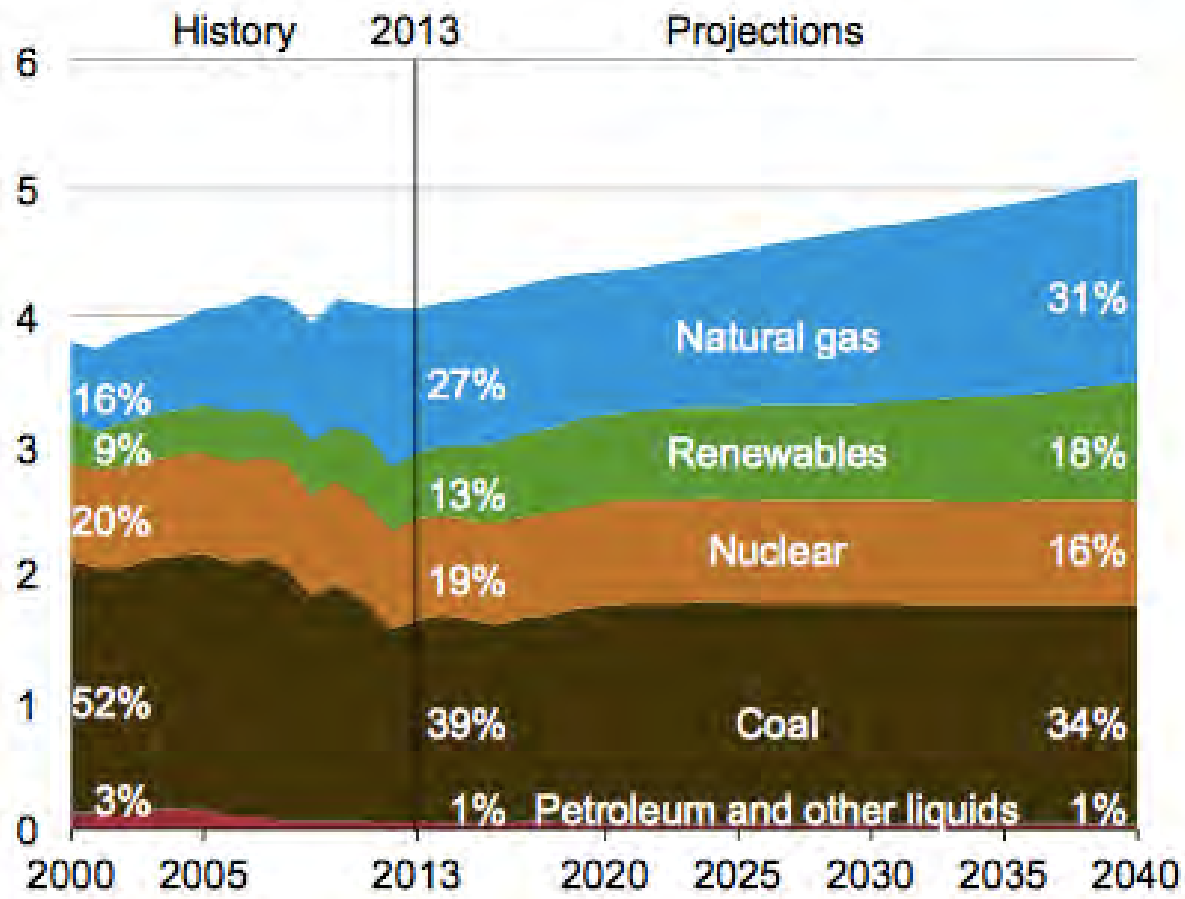


Source: United States basins from U.S. Energy Information Administration and United States Geological various published studies.



2. Natural gas *can* play a role

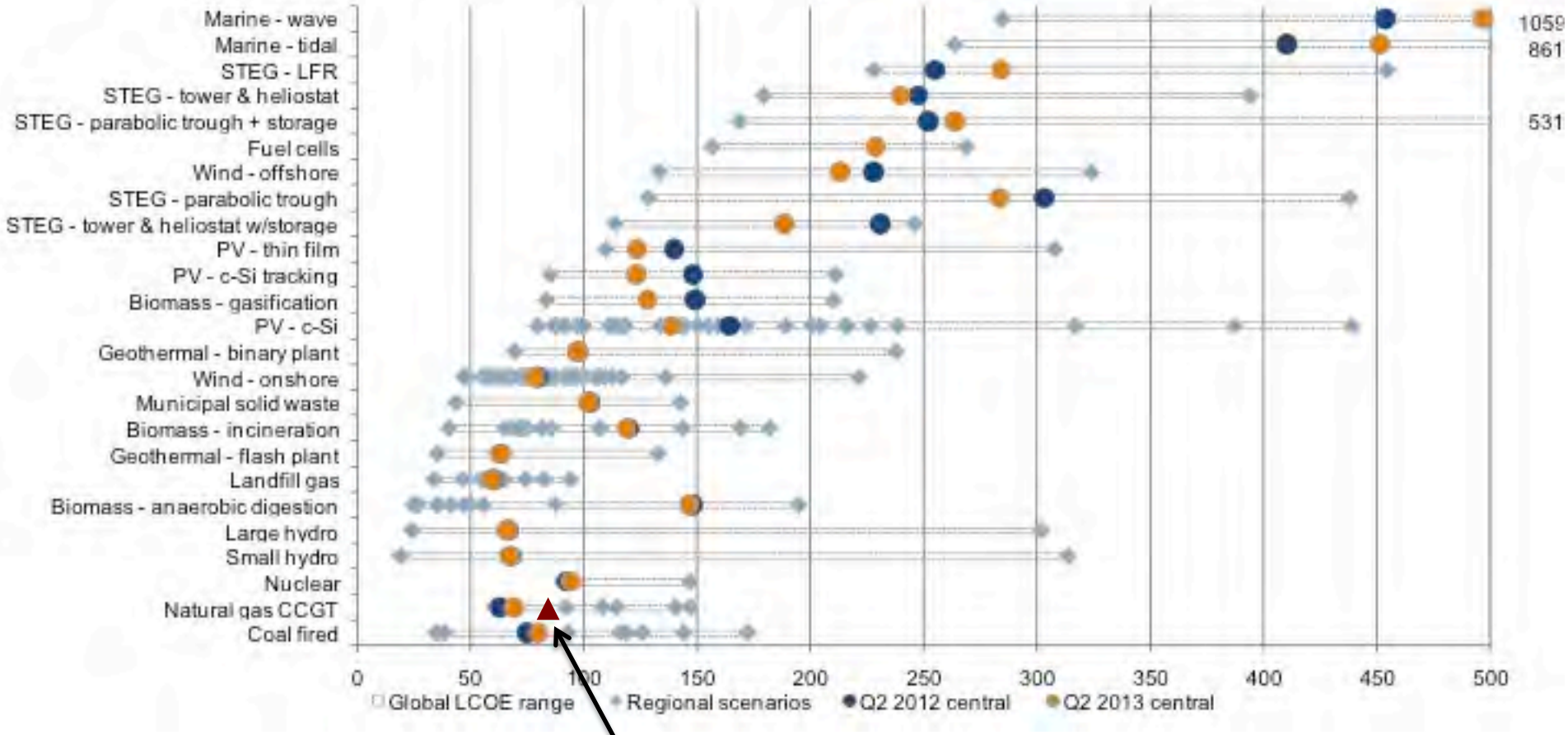
- The recent drop in NG prices has had an effect



Source: EIA Annual Energy Outlook, 2014

3. There are three effects from cheaper natural gas

- First, the relative price of natural gas (lower CO2) and oil/coal (higher CO2) falls
  - This leads to the previous figure---a shift from coal to natural gas
  - In the longer run, a shift from oil to natural gas
- Second, the relative price of natural gas (higher CO2) and renewables (lower CO2) falls
  - This slows the transition to renewables
  - Also, reduces R&D in renewables
  - Reduces the appetite for renewable subsidies
- Third, the relative price of coal and other generation methods falls outside of the US



Adding a $40/CO2 ton Social Cost of Carbon

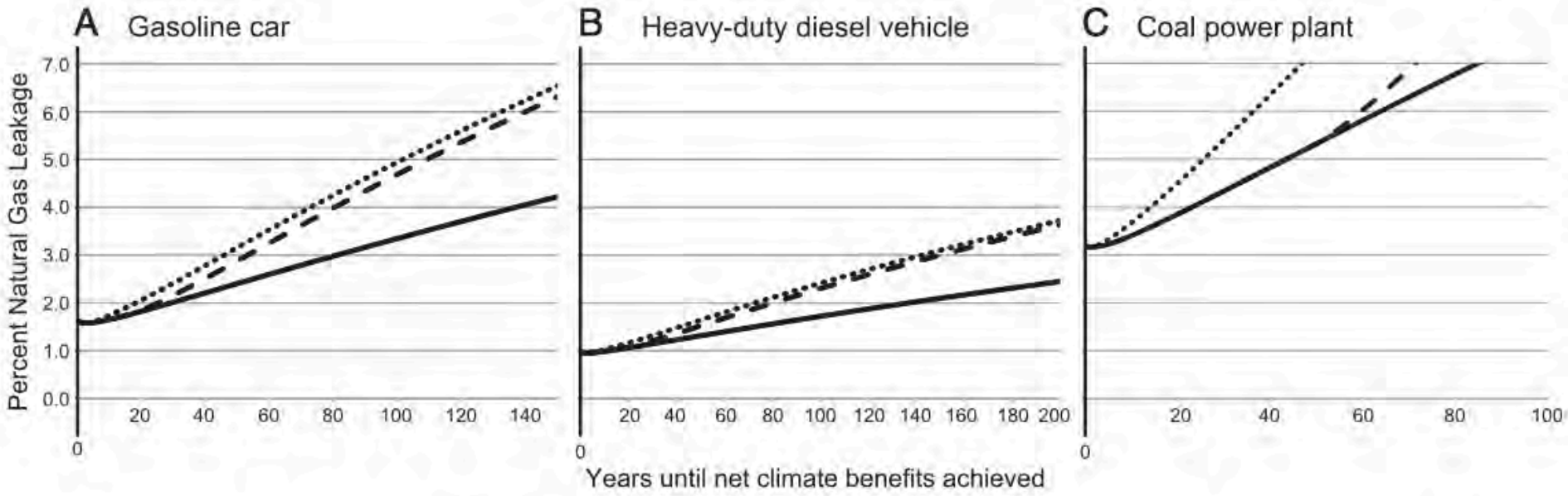
US exports to Germany

4. Absent *coordinated* policy, the market will get it wrong

- Much of the discussion has been about increases in US exports of natural gas
  - We are likely to see these exports increase
- But, there is an easier way to export our “natural gas”
  - Export our BTUs as coal instead
    - US Coal exports have fallen since their peak in 2012
  - A real transition from natural gas to coal requires other countries not increasing their coal use
- This is where coordination is key

5. We need to know more about fugitive emissions

- Despite their importance, we know very little about the extent of fugitive emissions
- For us to be sure of natural gas' potential as a bridge fuel we need to know more about scale and **cost** of abatement



Source: Alvarez, et al. "Greater focus needed on methane leakage from natural gas infrastructure" *PNAS,* 2012