



Geopolitical implications of Unconventional Oil & Gas



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Outline of Presentation

- **Context: O&G's role in the economy and foreign affairs**
- **What is different about Unconventional O&G?**
- **The North American Experience**
- **Implications for Major producers and consumers**
- **Some cases: Russia, Iran, China, Saudi Arabia,**
- **Uncertainties**



Geopolitical implications of Unconventional Oil & Gas



Old View

- O&G global resources concentrated in Middle East and a few major resource holders.
- Large economies hopelessly dependent on oil and increasingly gas imports.
- The real price of O&G will inevitably increase.

New View

- Unconventional O&G (shales, tight sands, coal bed CH₄) widely available around the world.
- Previously dependent economies will stop being import dependent, e.g. US
- Increased supply may lead to lower real prices for several decades.



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Implications of the changes

- Energy, especially O&G, will continue to be key to economic performance and geopolitical affairs.
- Consumers will benefit from lower prices, e.g. lower cost for home heating with natural gas.
- There will greater demand for O&G due to lower prices
- The shift in relative prices (O&G, coal, nuclear, renewables) will cause shift in energy use, e.g natural gas for electric power generation)



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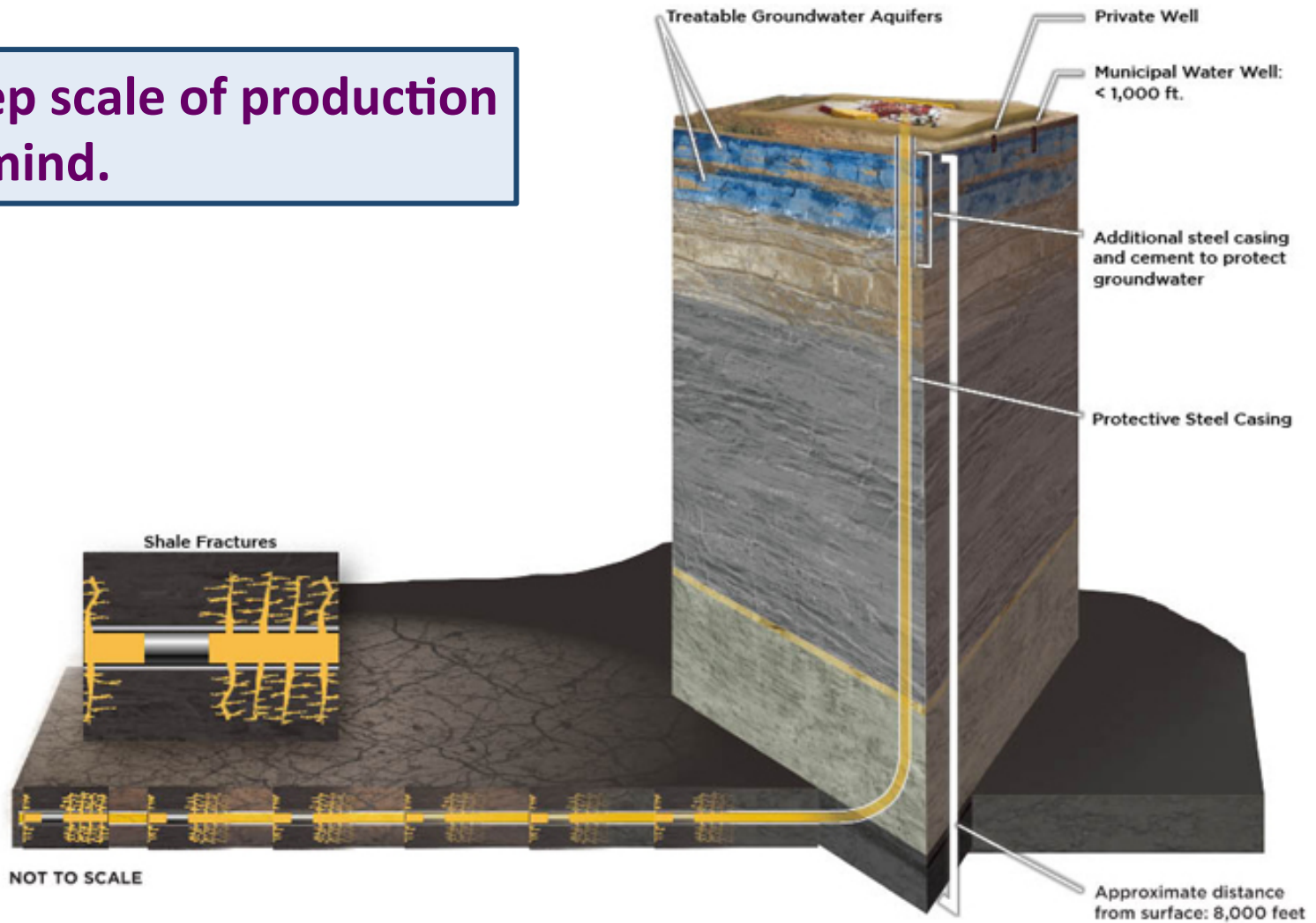
What is different about Unconventional O&G?



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Keep scale of production in mind.





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Enormous surface operations

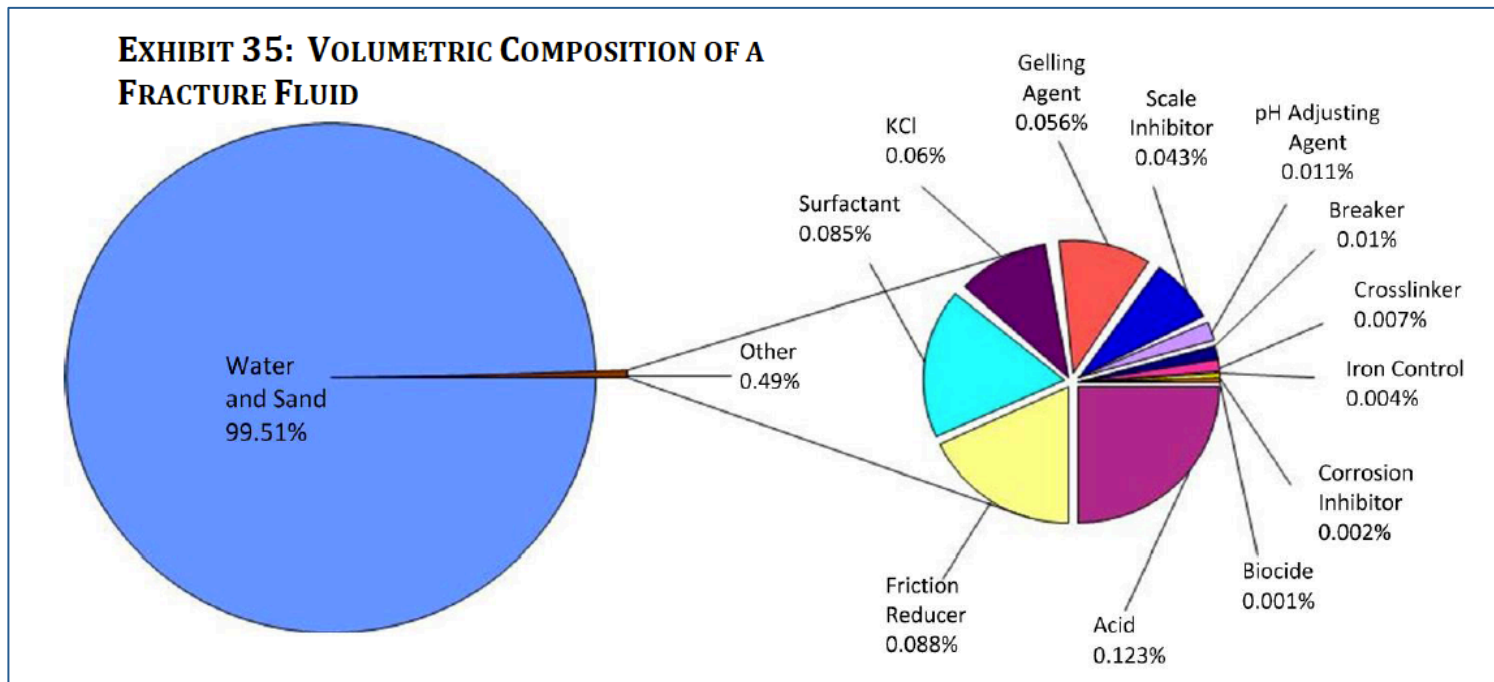




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Initial Environmental Concern - Hydraulic fracturing fluid contaminating drinking water – no longer issue



Full disclosure of all additives – type and quantity



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Principal Environmental impacts:

- ① Water quality
- ② Air quality
- ③ Community impacts
- ④ Land-use impacts
- ⑤ Induced Seismicity

Key points:

- Not just hydraulic fracturing
- All environmental impacts of production should be included
- Different than conventional production
- Expect great diversity



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North American Experience



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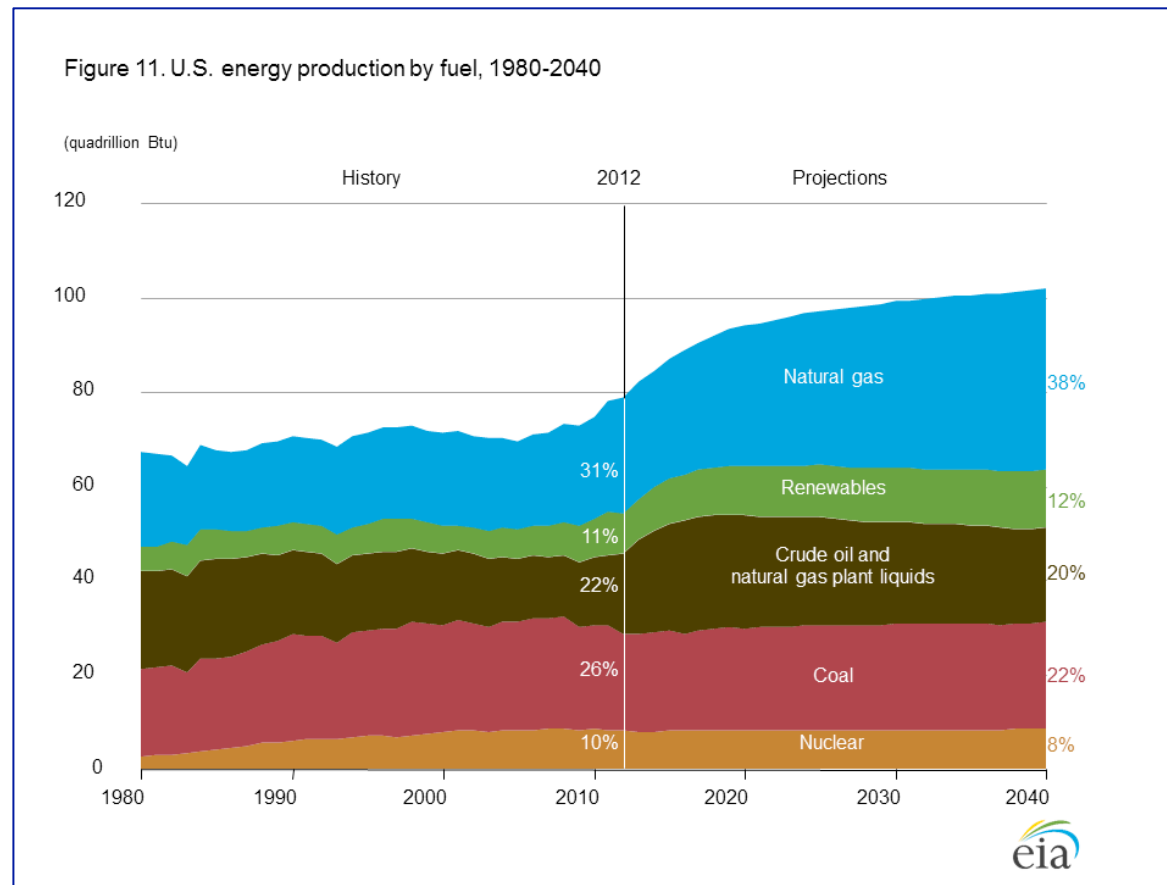




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Rapid growth of US Unconv. O&G production in US

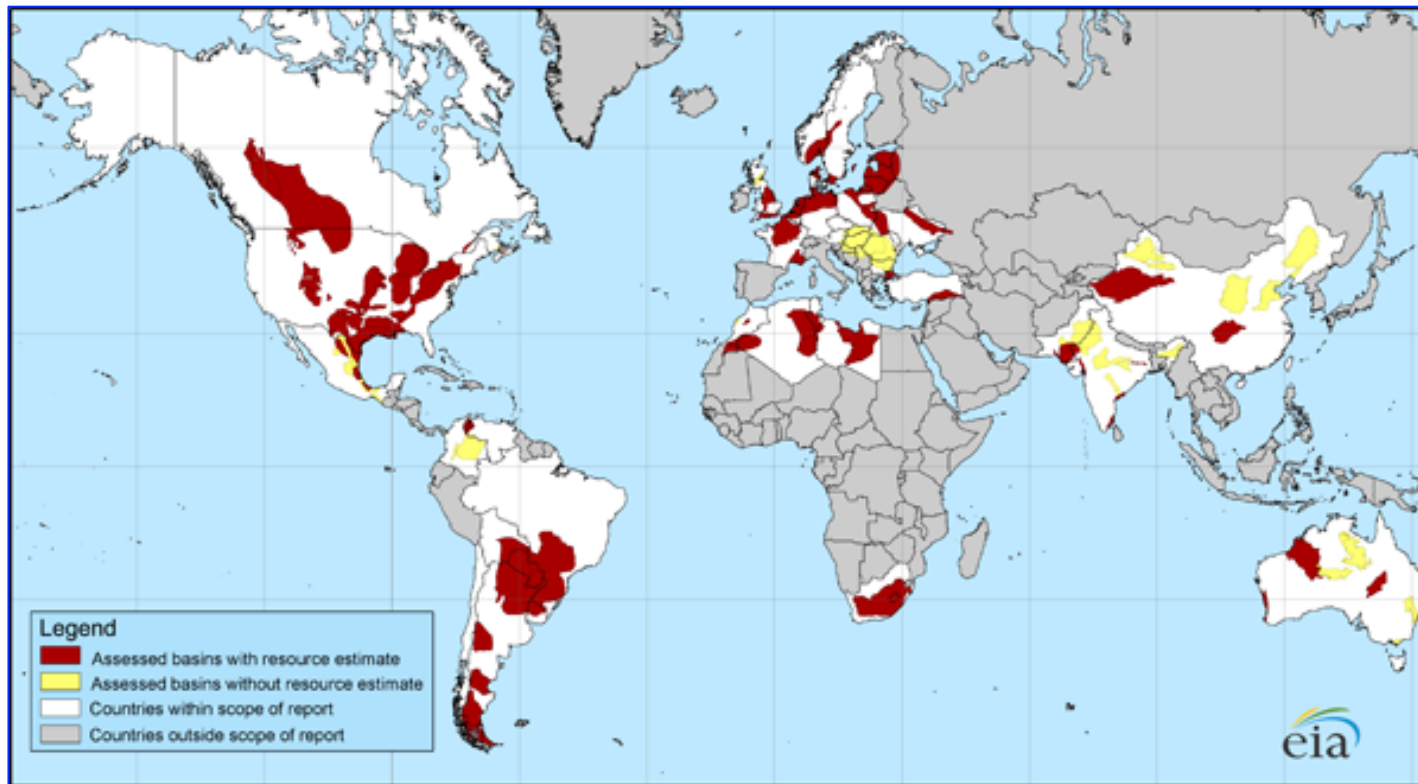




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Explosion of Shale gas resource is world-wide





Geopolitical implications of Unconventional Oil & Gas



- ***Global Resource Base Potential Huge***
- Potential Economic Benefit Enormous (jobs, domestic supply, export earnings)
- **Uncertainties Large**
 - High variability within resource play – Oil/Gas/Water
 - Environmental impacts and production costs
 - Oil/Gas price uncertain both in local economy and globally
 - Economics of global LNG trade uncertain
 - O&G infrastructure is huge and expensive so pace of commercial development will be slow
 - Hard to predict relative economic value of oil/gas for domestic use compared to export.



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Geopolitical Implications



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Effect on producers and consumers

- More supply and greater diversity of supply benefits consumers.
- Traditional producers must anticipate lower prices and less market power.
- Import dependence influences the foreign policy of states, e.g. Iran oil exports influences countries willingness to impose sanction of Iran's nuclear program.



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Major economic questions

- Will natural gas prices maintain regional difference ?
NA \$4/MCF Europe \$10/MCF Asia \$16/MCF
- Will the energy equivalent difference between oil and gas continue ? Oil \$100/b = \$15/MMBTU NA nat gas \$4/MMTU
- Tremendous economic incentive for technology change:
 - Natural gas in power generation (displacing nuclear, renewables, coal)
 - Natural gas in transportation sector: CNGVs or bifuel?
 - Gas to Liquids (GTL) transform CH_4 to CH_3OH



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Some country examples

- MRHs such as Iran, Venezuela, Russia have suffered negative wealth effect – the value of their conventional O&G resources have gone down.
- Expensive conventional O&G projects are now underwater: Australian CBM, Gulf of Mexico deep off shore, and Arctic oil
- Europe less dependent on Russian NG imports.
- Lower revenue can introduce instability in export dependent country – Saudi Arabia,



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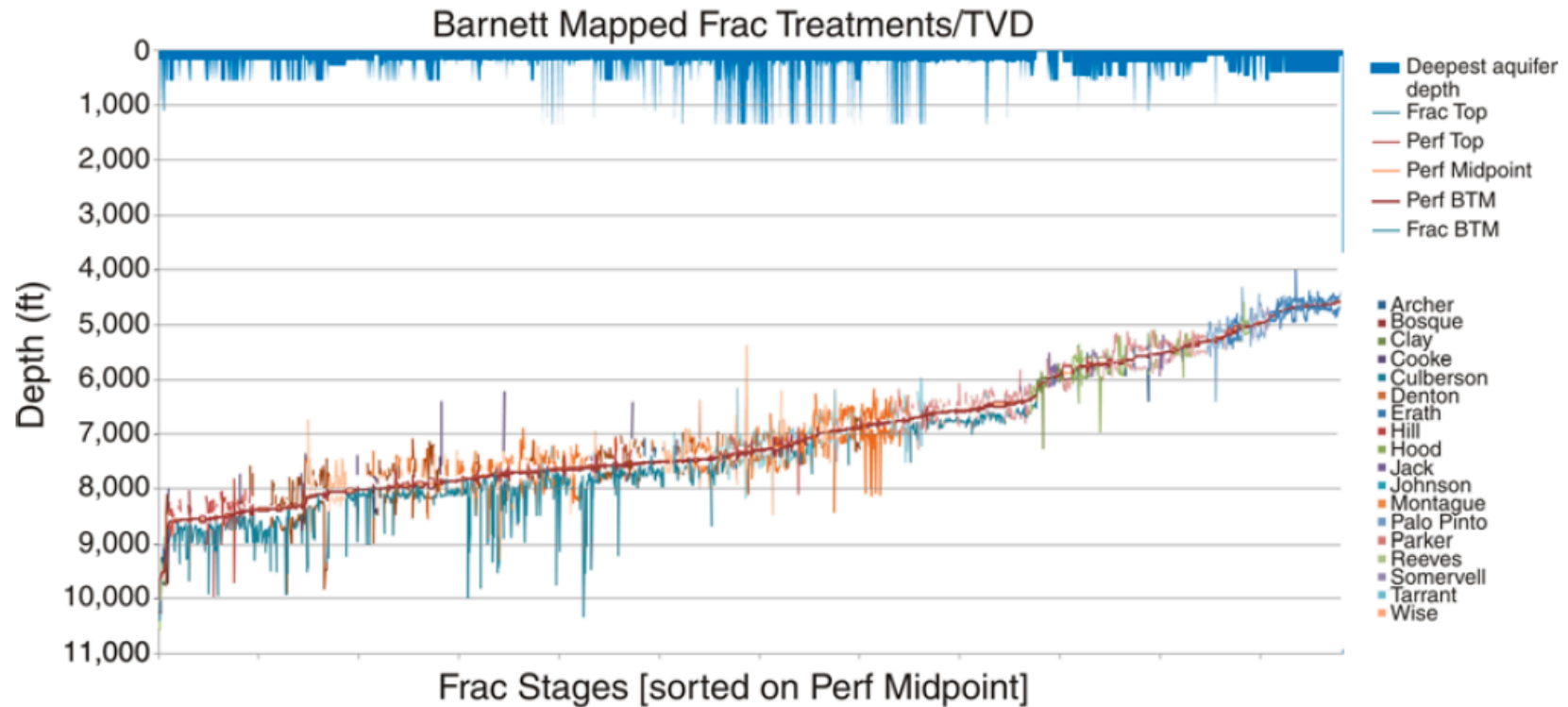


Fig. 2—Barnett shale measured fracture heights sorted by depth and compared to aquifers.

SPE 145949

Hydraulic Fracture-Height Growth: Real Data

Kevin Fisher and Norm Warpinski, SPE, Pinnacle—A Halliburton Service