

Shale Resources: Why First in the United States and Can Other Countries Follow?

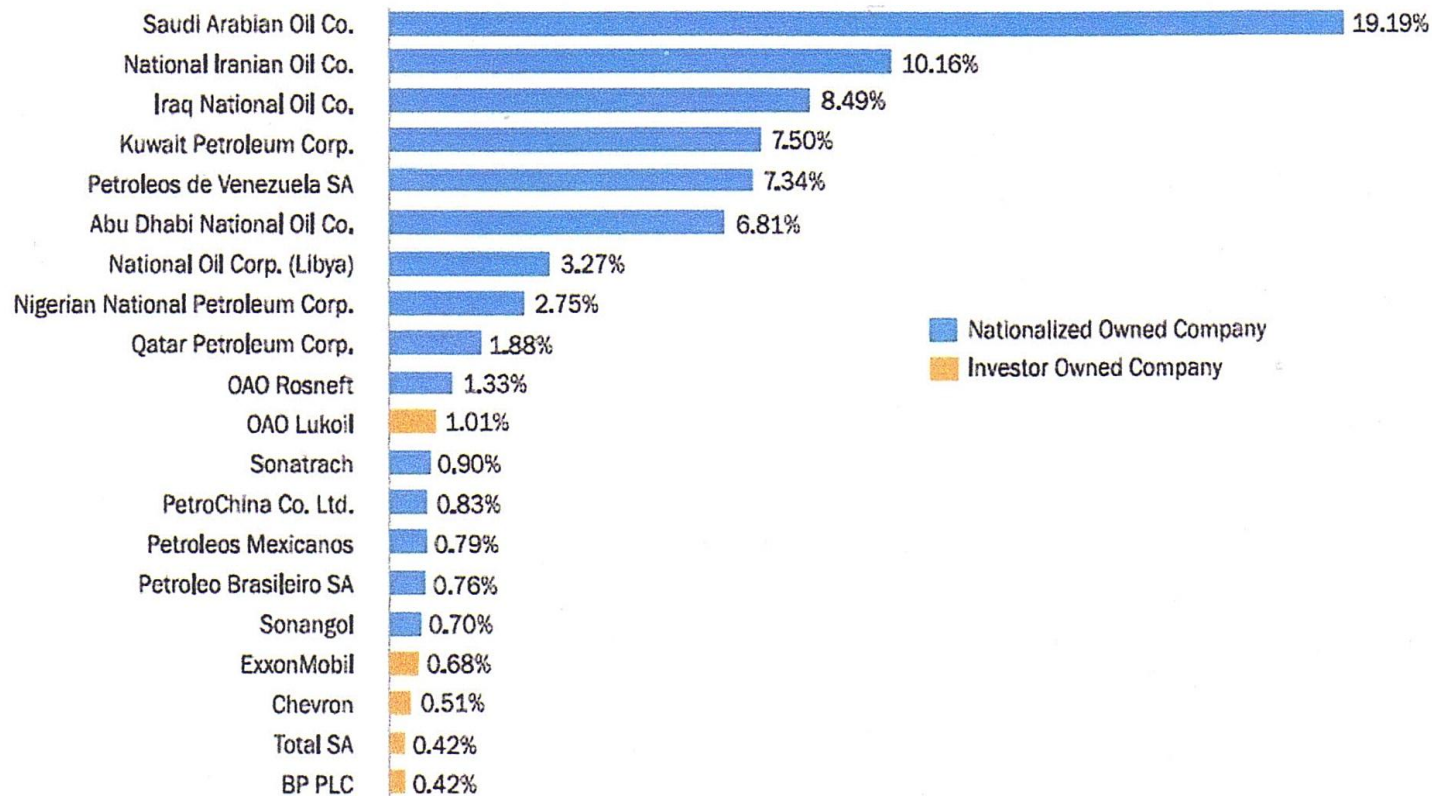
Prof. Francisco E. Gonzalez
Johns Hopkins University
Washington, D.C.

Birth of the shale industry

- Up until early 2000s, consensus was that shale exploitation though possible – the technology had been around for more than 40 years, developed by small service oil companies in Texas to help raise output in maturing oil and gas fields – it remained uneconomic.
- Conjunction of hydraulic fracturing and horizontal drilling plus the price shocks to hydrocarbons since 2003-4 allowed this type of exploitation to become very profitable.
- Under the new global conditions, the bigger private energy companies moved in by creating partnerships, buying-out small players, and starting to lease land on their own to develop shale production.

Paradox: State Companies Control Most World Reserves but Lack the Know-How to Exploit Shale Resources

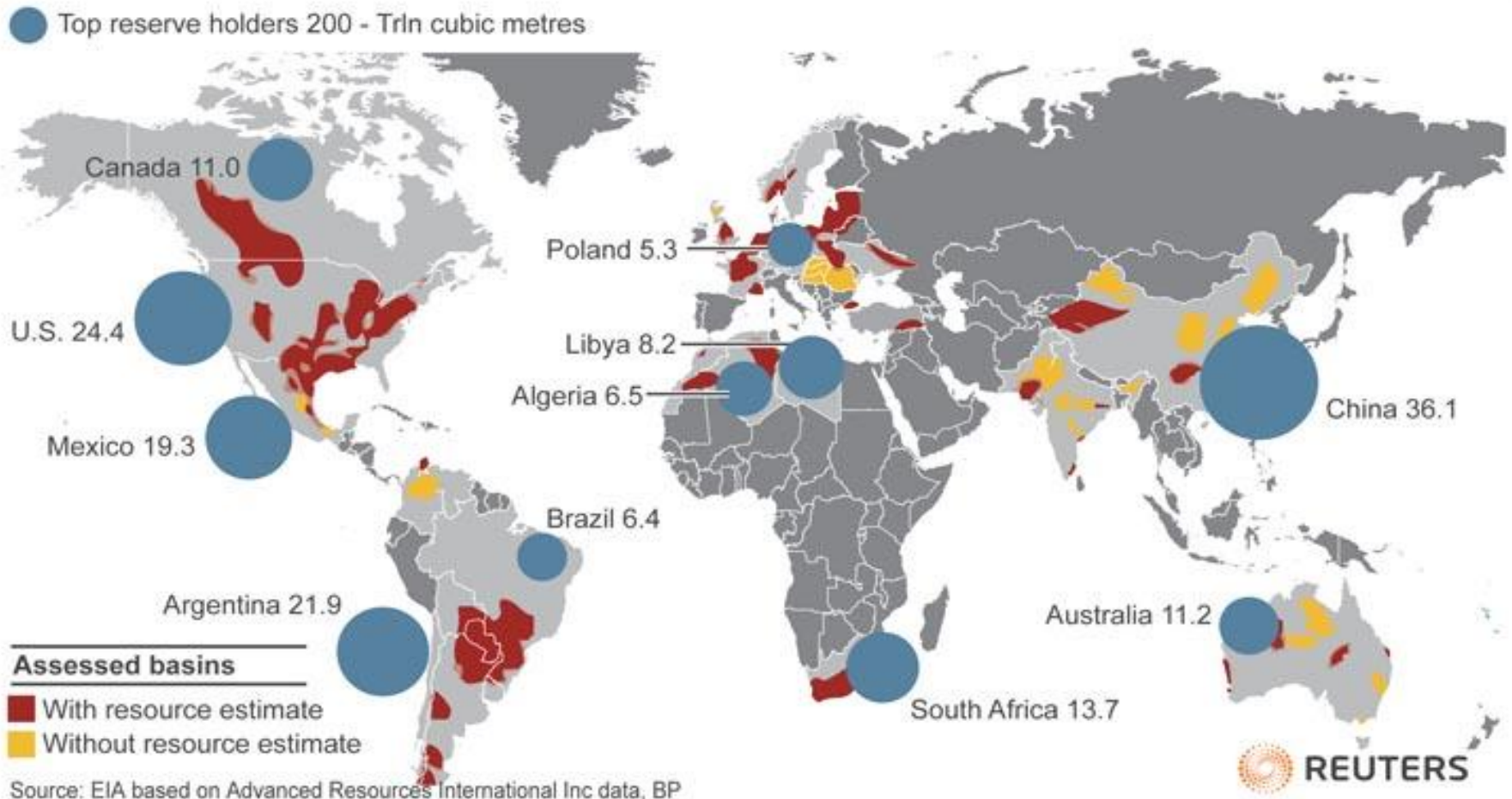
2009 Largest Oil and Gas Companies (percent of worldwide reserves)



Source: Calculated from World Reserves of 1.3 trillion barrels as of January 1, 2010 according to *Oil & Gas Journal*, December 6, 2010 and leading companies according to: *Oil & Gas Journal*, September 6, 2010.

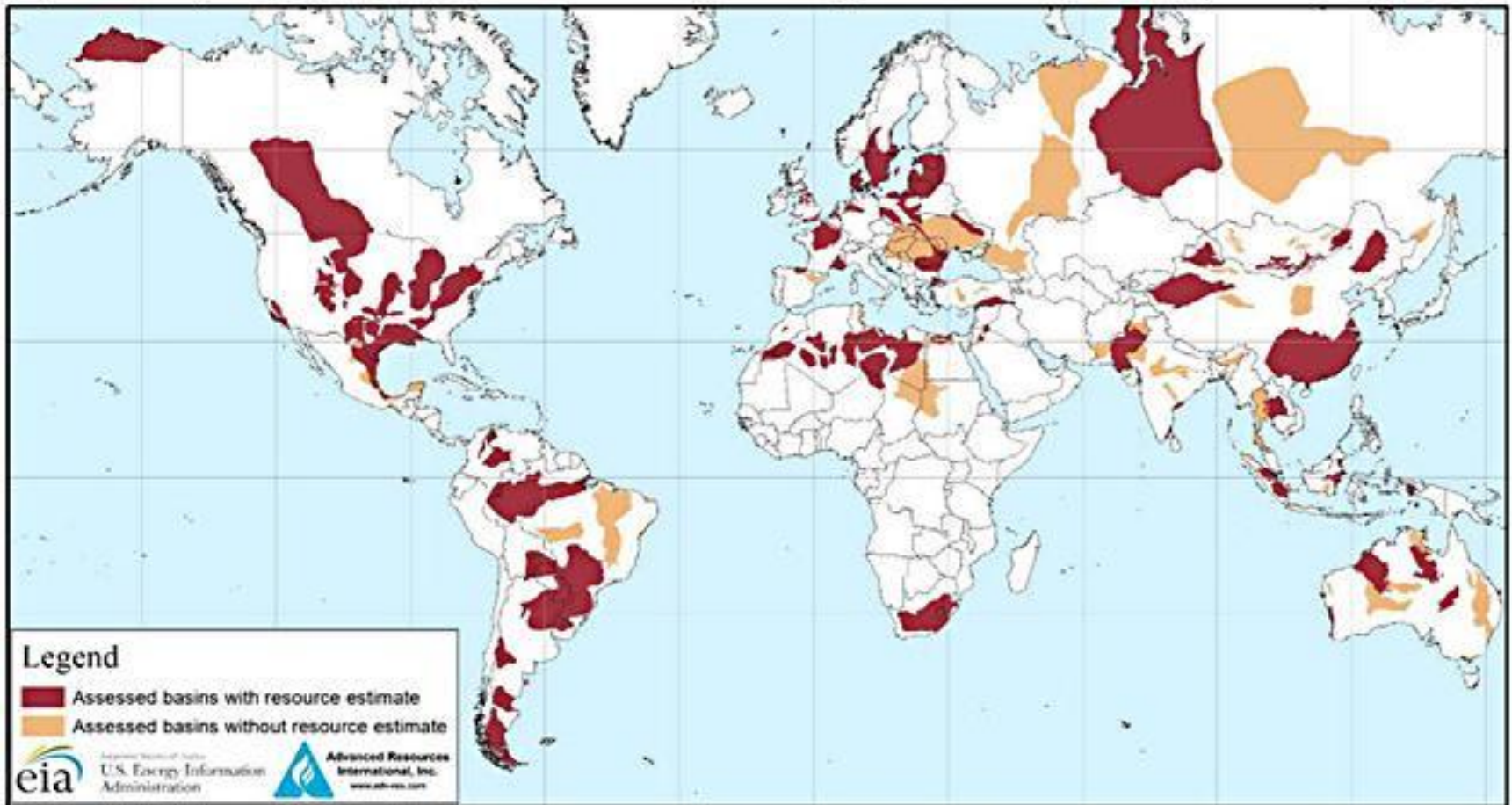
Mapping a new energy resource:

Global shale gas basins, top reserve holders



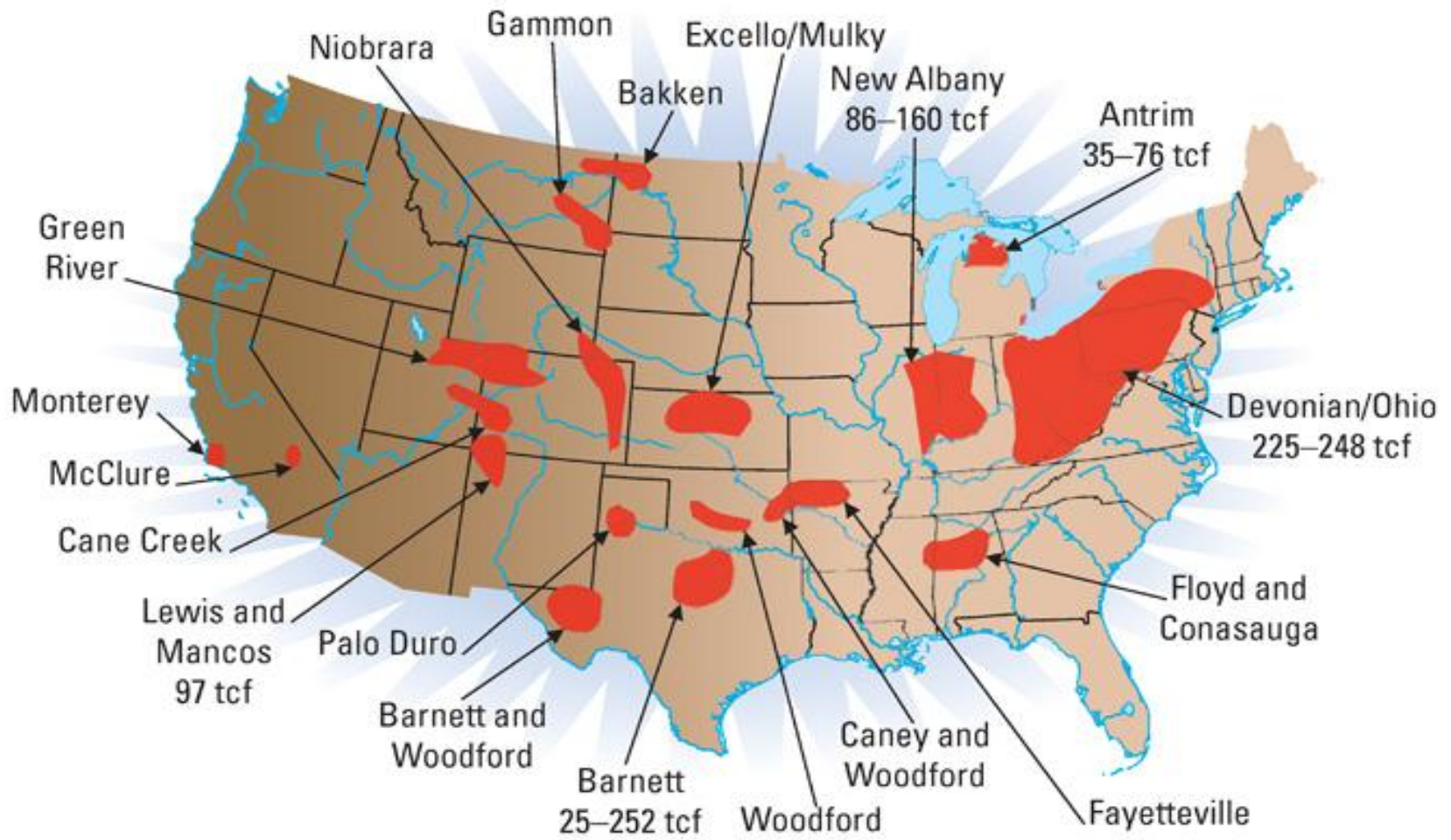
Adding oil to gas makes exploitation of the resource much more appealing to private and state companies

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 Survey; other basins from ARI based on data from various published studies

The hegemonic producer:



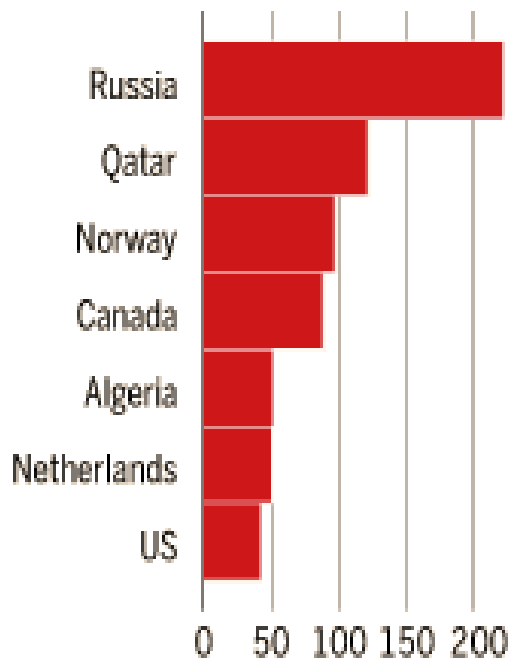
Source: Schlumberger

Importers, Exporters, and the U.S. turnaround

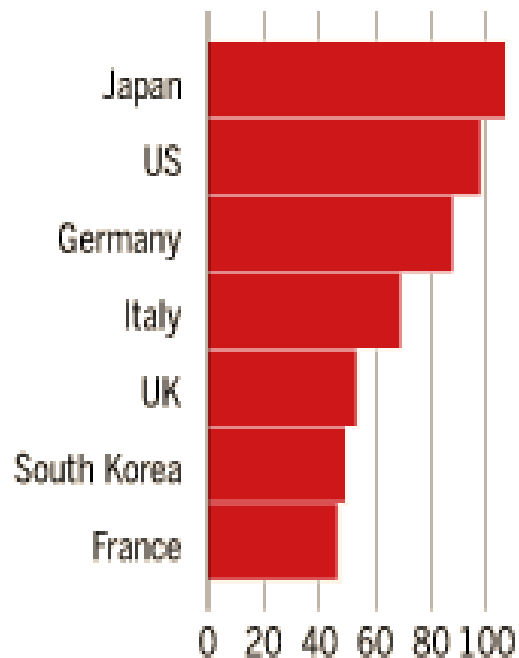
The world's largest natural gas exporters/importers

Billions of cubic metres, 2011

Exports

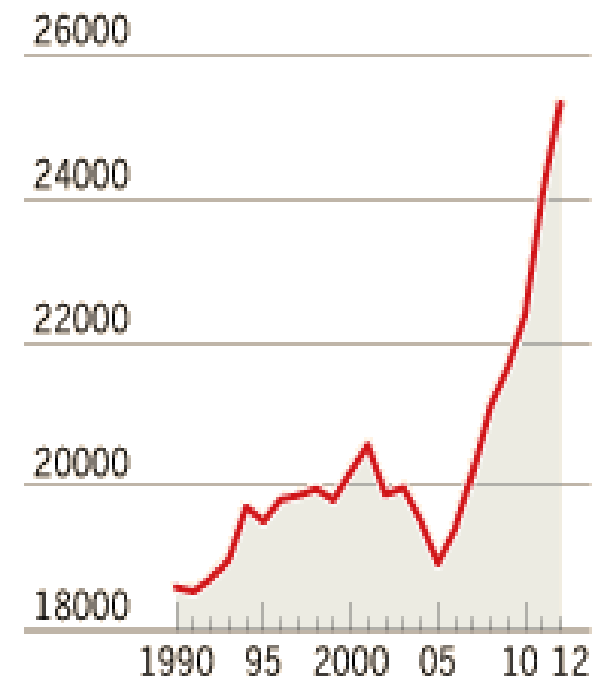


Imports



US natural gas production

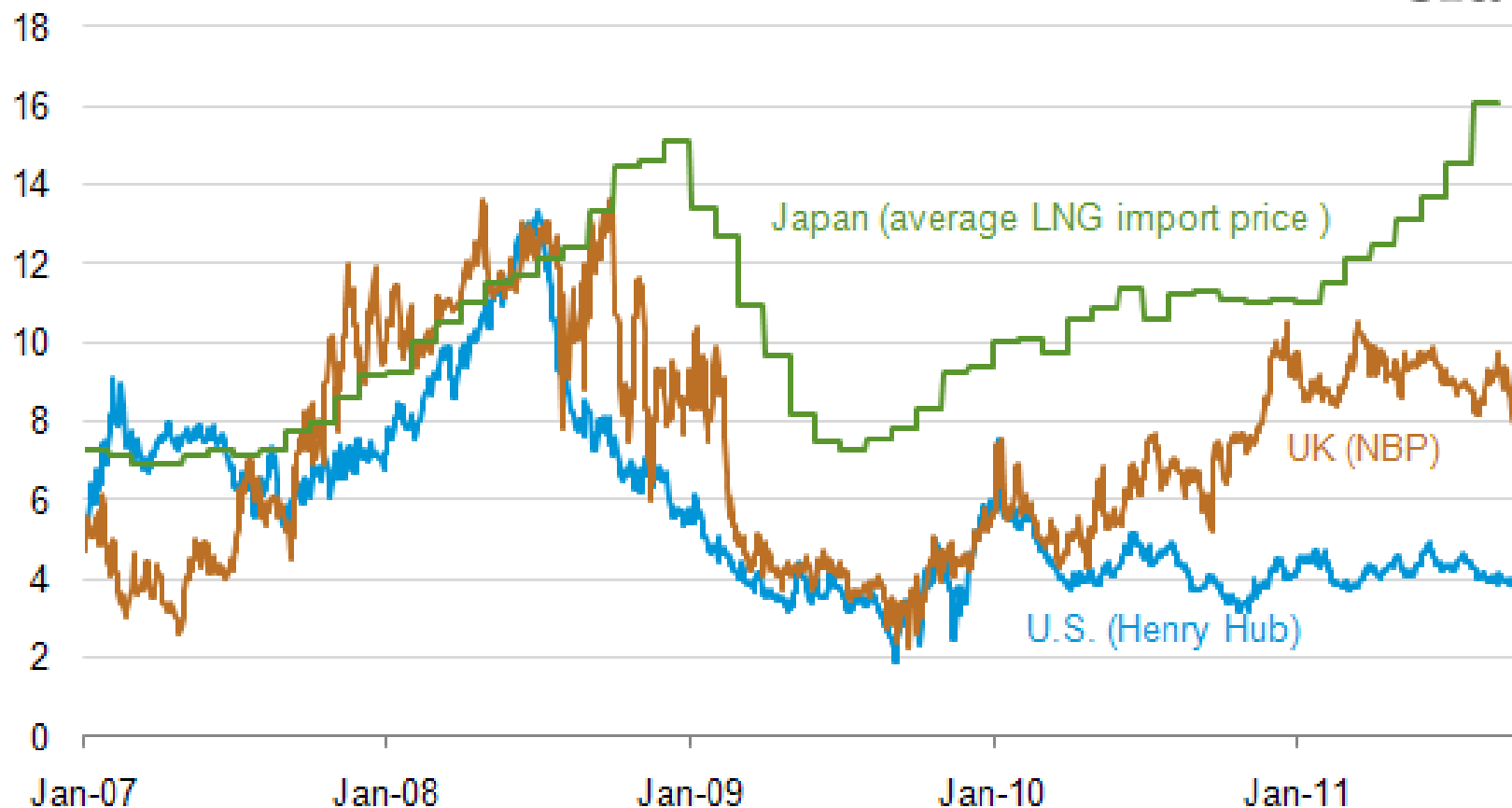
Billions of cubic feet



Sources: EIA, BP statistical review

Spectacular Short-Term Results and New Comparative Advantage

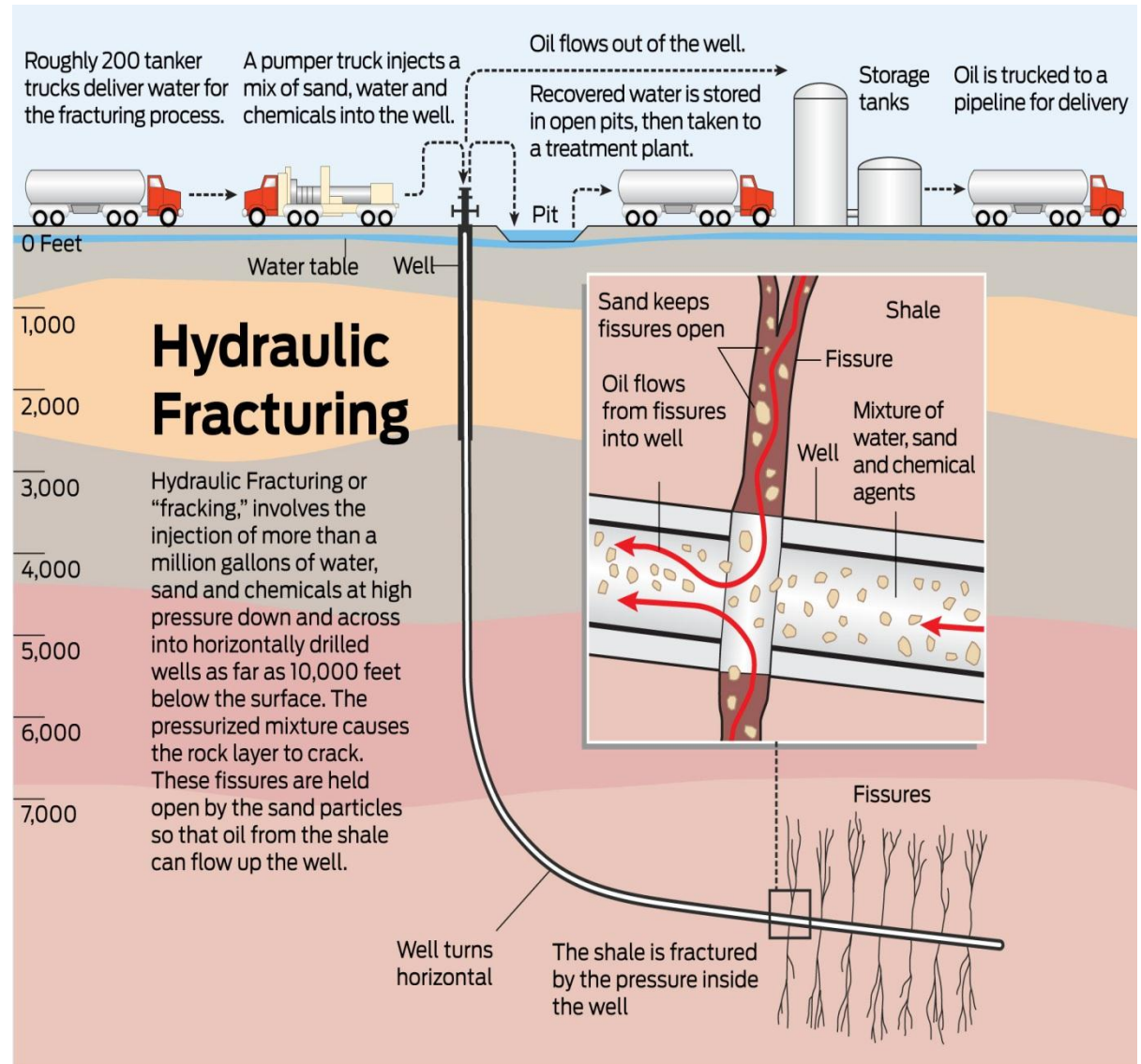
Trends in natural gas spot prices at major global markets
U.S. dollars per million British thermal units (MMBtu)



WHY DEVELOPMENT AND GROWTH IN THE UNITED STATES?

1) Great number of small service oil companies in the U.S.

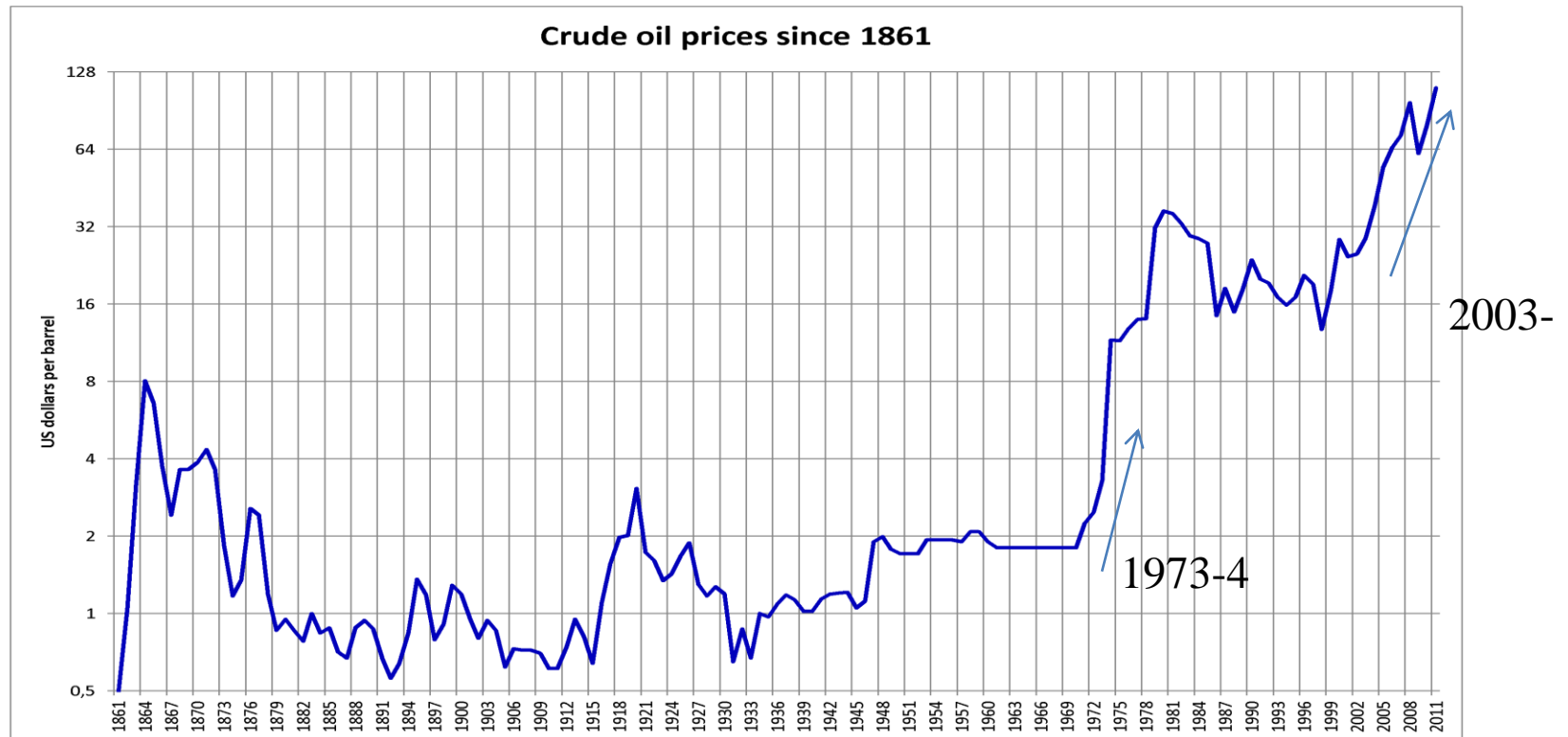
- Abundance trial-and-error to develop technologies.
- Spread risk rather than concentrated in few operators.
- Small companies forced into regular innovation to service constant new needs of bigger players.



Source: goodyearlake.org

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2) International price shocks since 2003 enabled search for alternatives to conventional hydrocarbons

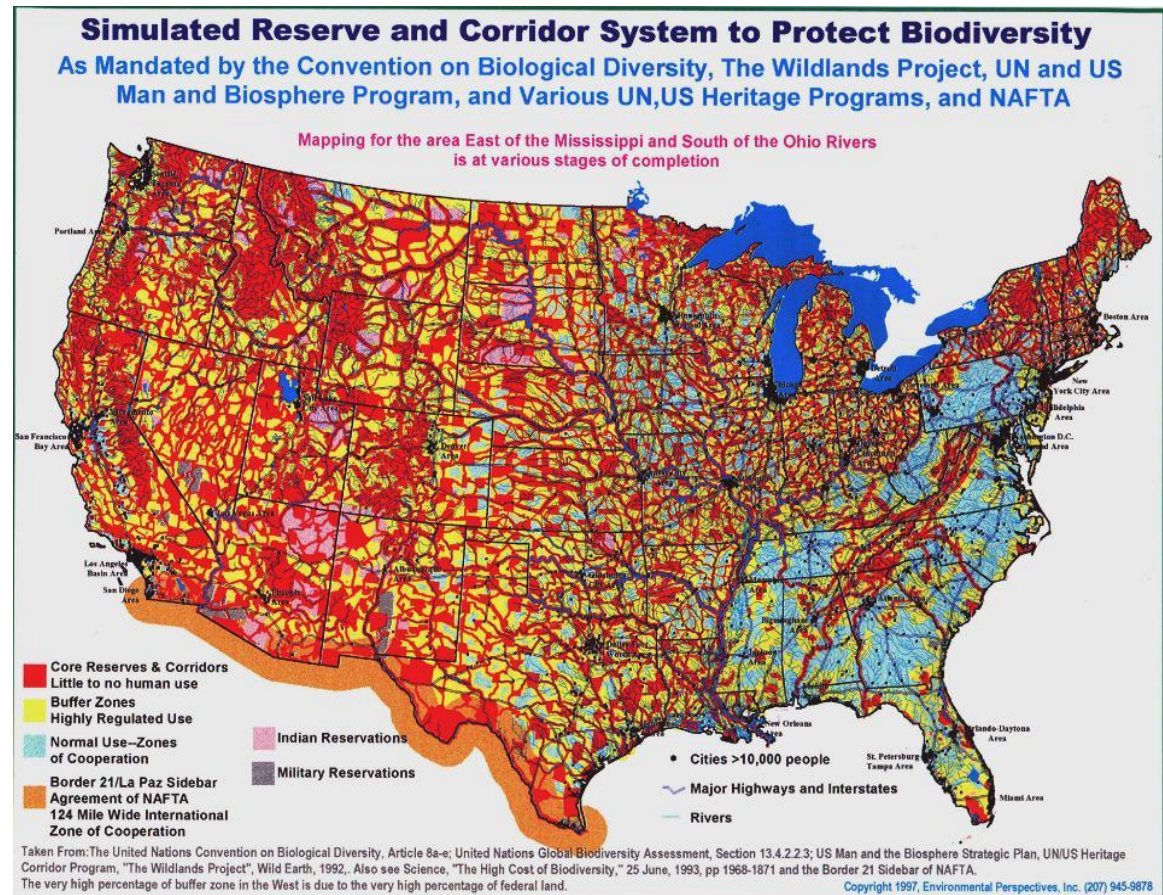


3) Property rights easily transferable

Property owners have rights over natural resources on their lands.

Private ownership of natural resources given property laws have allowed energy companies to lease directly land for exploration and production with minimal state intervention.

Still, significant parts of the U.S. territory remain highly regulated so image of country being paradise for drillers is overstated.



DISTRIBUTION OF US LAND OWNERSHIP

Table 4

State	Federal	State %	Private
California	40.10	2.35	57.55
Colorado	35.46	4.39	60.15
Louisiana	4.97	2.67	92.36
Montana	29.28	5.58	65.14
New Mexico	29.42	11.20	59.38
North Dakota	3.11	1.84	95.05
Texas	1.43	0.49	98.08
Wyoming	48.43	6.22	45.35

Source: Rodgers Oil & Gas Consulting, March 2013

Additional Advantages in the United States

- 4) Low taxation – incentives for growing production.
- 5) Very liquid financial markets – many actors, particularly private equity.
- 6) Low drilling costs

Main Challenges for the Development of Shale Resources

- 1. Intensive drilling required because there are **many disappointing wells that fail to break even.**
- 2. **Great variability given each play.** Impossible to know beforehand which will be very successful and which will not. A great proportion of production comes from relatively few wells.
- 3. **High rates of short-term depletion** of resource so key to keep drilling to exploit new finds and grow the industry.
- 4. **Significant social opposition** to ‘fracking’ and its potential environmental consequences (i.e. surface water contamination, aquifers’ contamination, greenhouse gas emissions, environmental degradation): see protests in Europe and in some U.S. states like Pennsylvania.

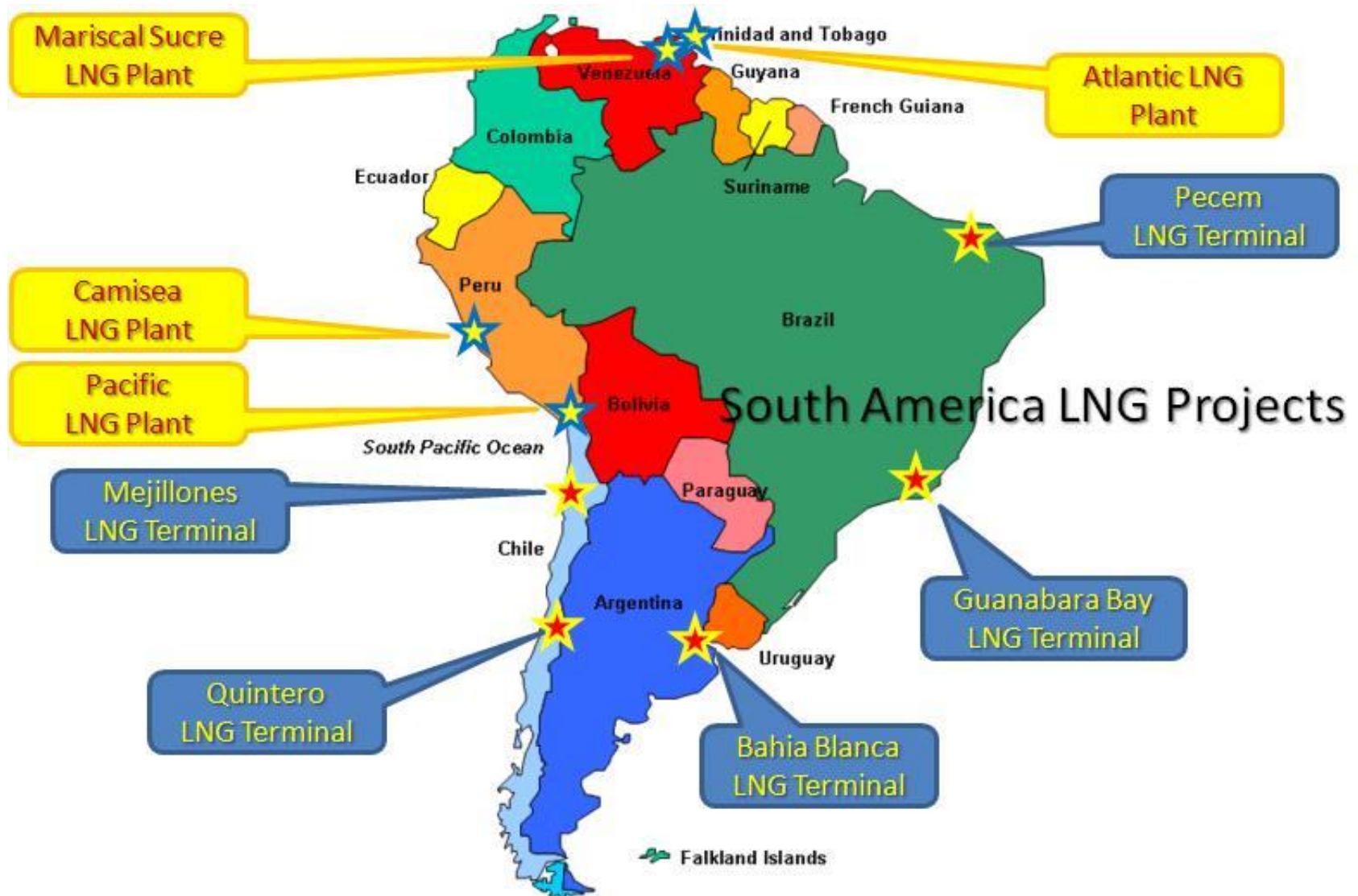
- Shale Resource Exploitation Would Make a Big Contribution to Promote Energy Security in South America.

- HOWEVER, EVEN WITHOUT THIS IN THE SHORT-TERM, THE SUBCONTINENT HAS VERY SIGNIFICANT UNMET POTENTIAL GIVEN CURRENT EXPLOITABLE RESOURCES.

Natural gas could be a catalyzer of regional integration (source: The Economist, 2006)

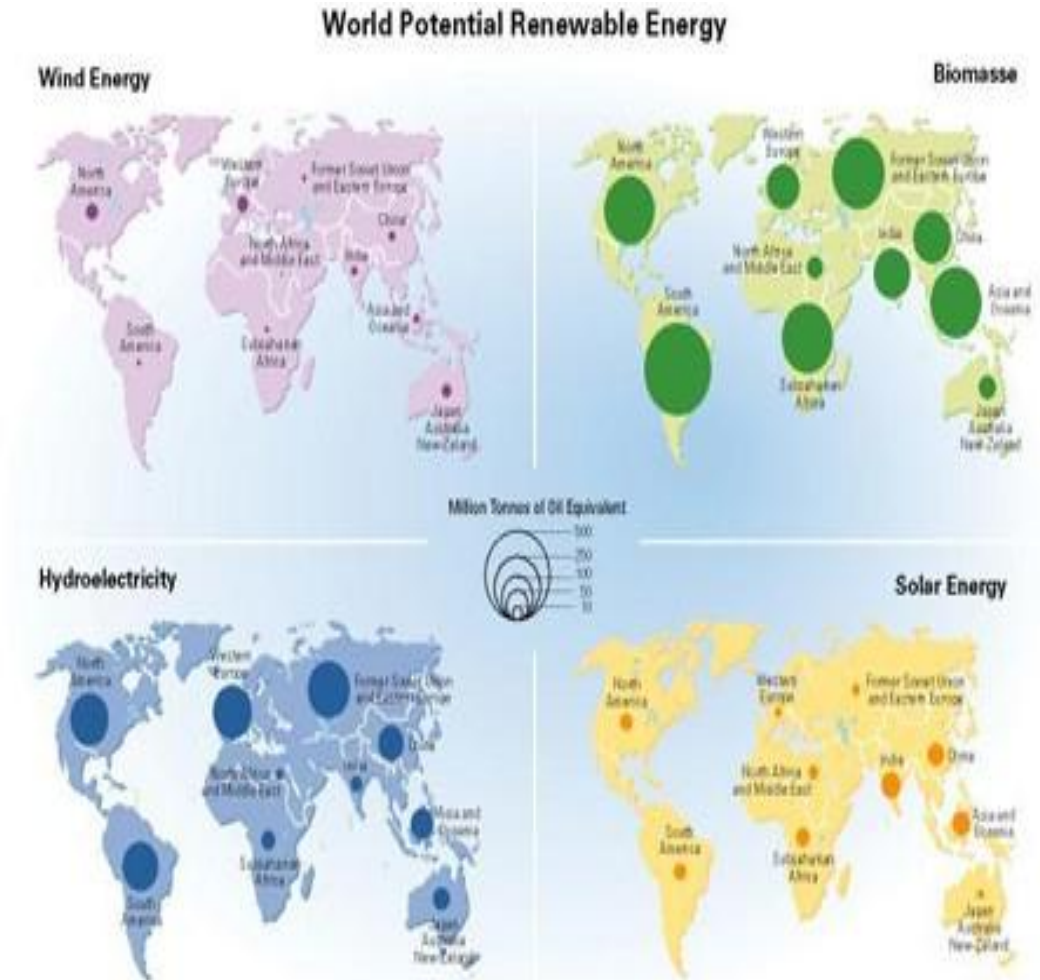


**Liquefied Natural Gas (LNG) has broadened the region's horizons,
making it part of global gas trade
(source: LNGpedia)**

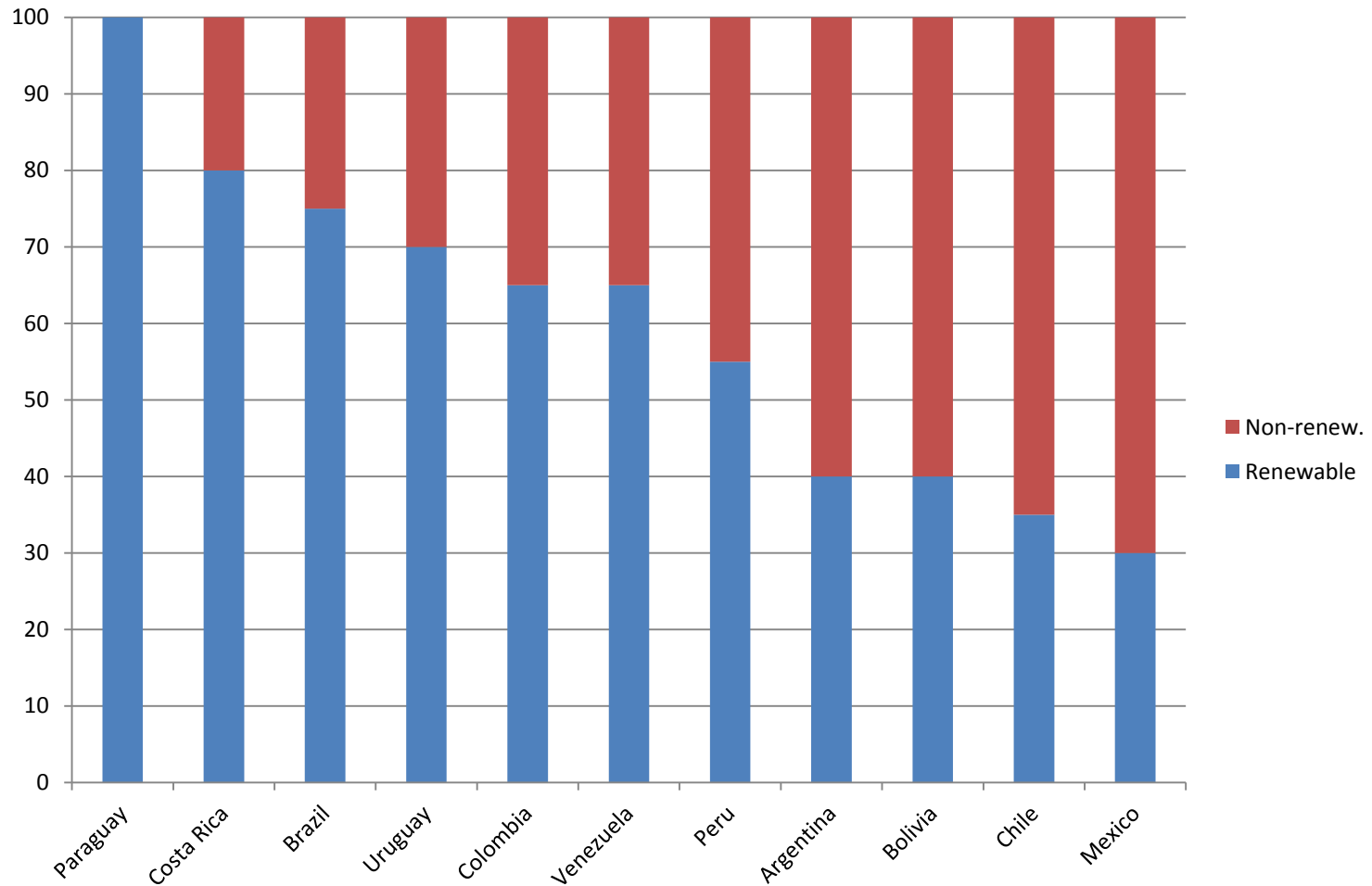


Natural Gas and Renewables, Complements rather than Competitors:

- Prioritizing growth of natural gas makes great sense for countries with a high proportion of renewable energy.
- Natural gas can be used as back-up fuel to keep base-load power given intermittency problem with main renewables.
- Critical addition for reliable, cost-effective supply of electricity to major sectors of countries' economies.



Renewable and non-renewable sources for electricity generation (2010): significant intra-regional variation



Conclusion

- 1) Shale revolution forced reassessment about energy potential, prices, and impacts on economic growth, development, and issues of environmental sustainability.
- 2) Conditions unique to the United States allowed this revolution to be initiated there. Replication is not impossible but yet quite hard.
- 3) It makes sense for state and private energy companies that cannot exploit shale to partner with those that can to develop basic capabilities.
- 4) Even without shale gas (oil), South America has very significant untapped natural gas potential via conventional exploitation and pipeline transportation, and more recently through additions of LNG.
- 5) For a region with high participation of renewables in power generation, growth of natural gas exploitation is an enabling, complementary strategy rather than a competing one.