

Fracking Forum

Risks and Rewards

A Pro-Business, Pro-Innovation
and Pro-Human Outlook

By:
John Harpole



October 6, 2014

2008 Conventional Wisdom

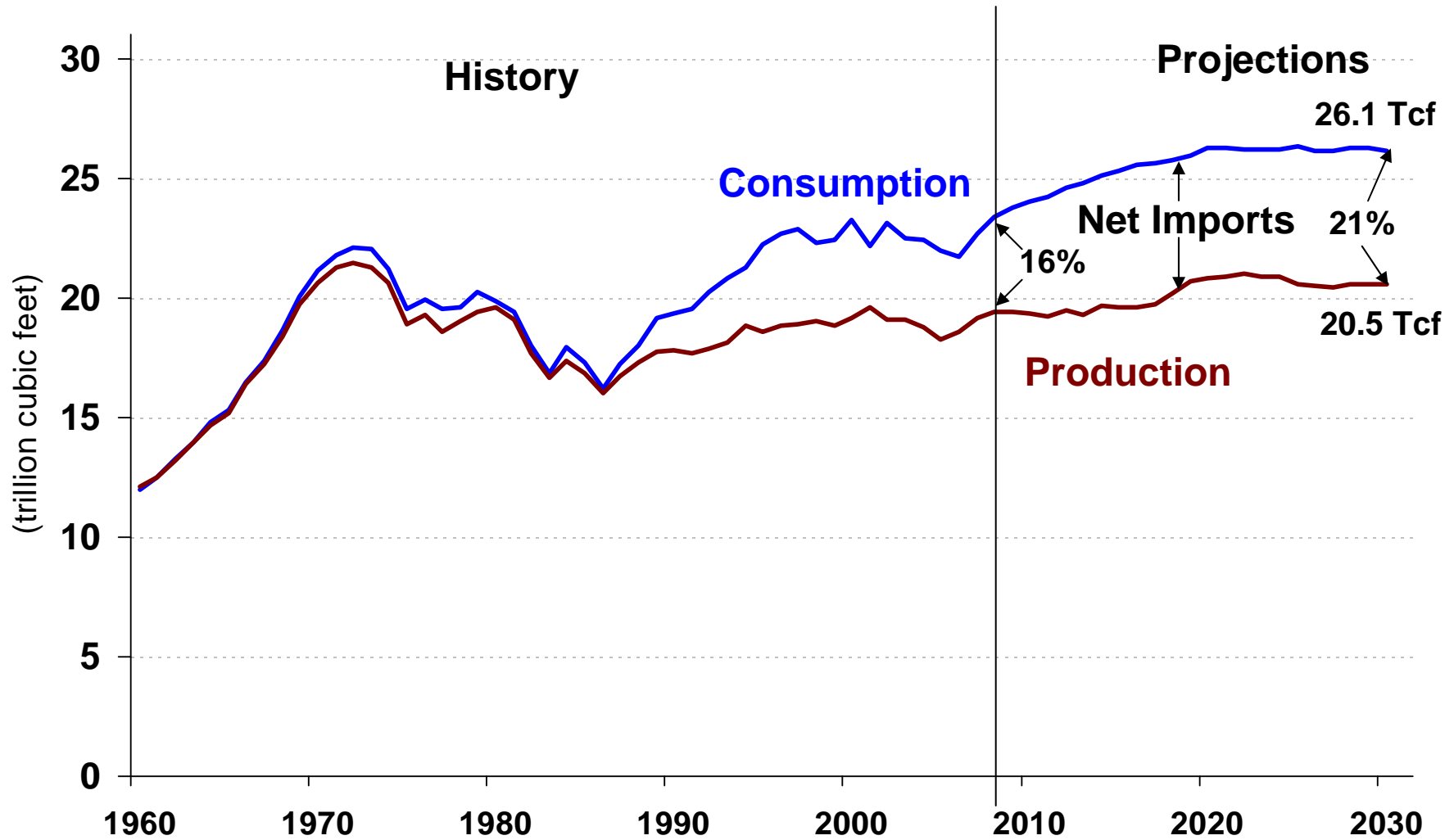
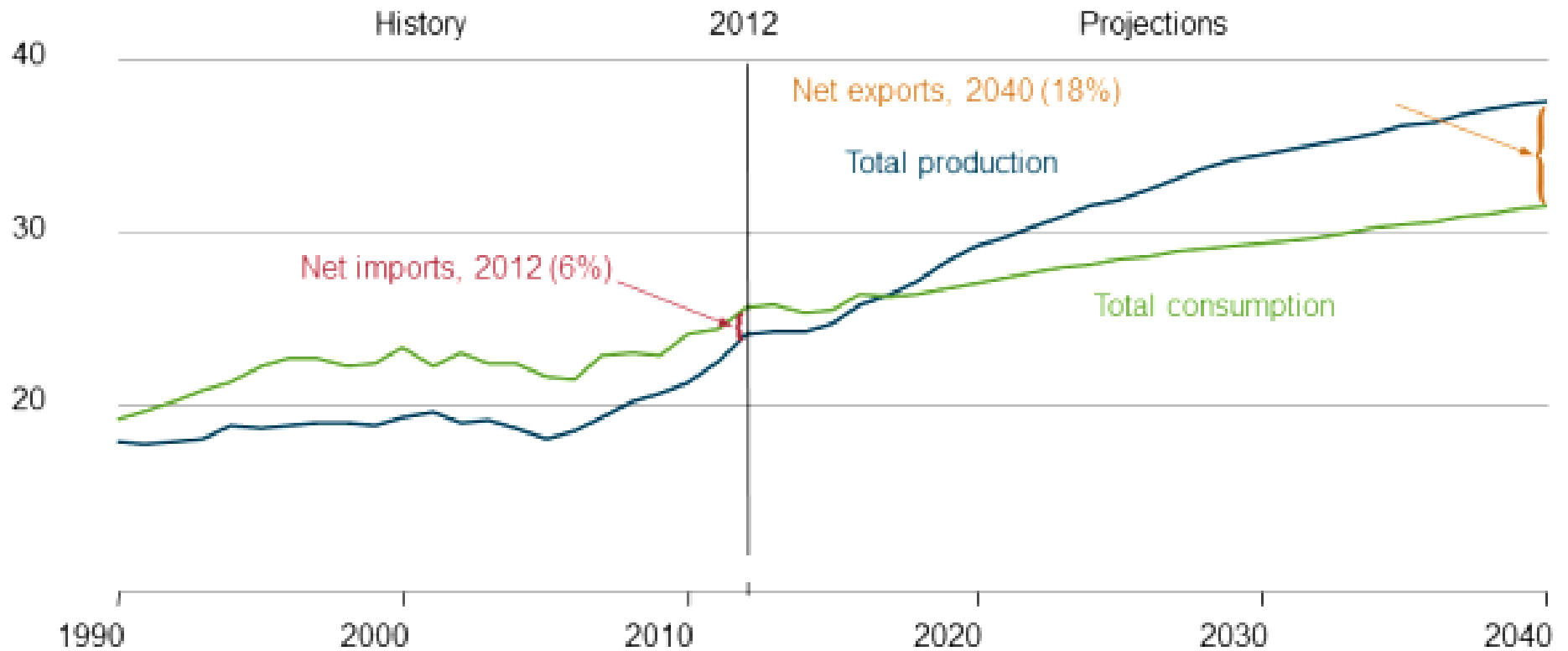


Figure MT-42. Total natural gas production, consumption, and imports in the Reference case, 1990-2040

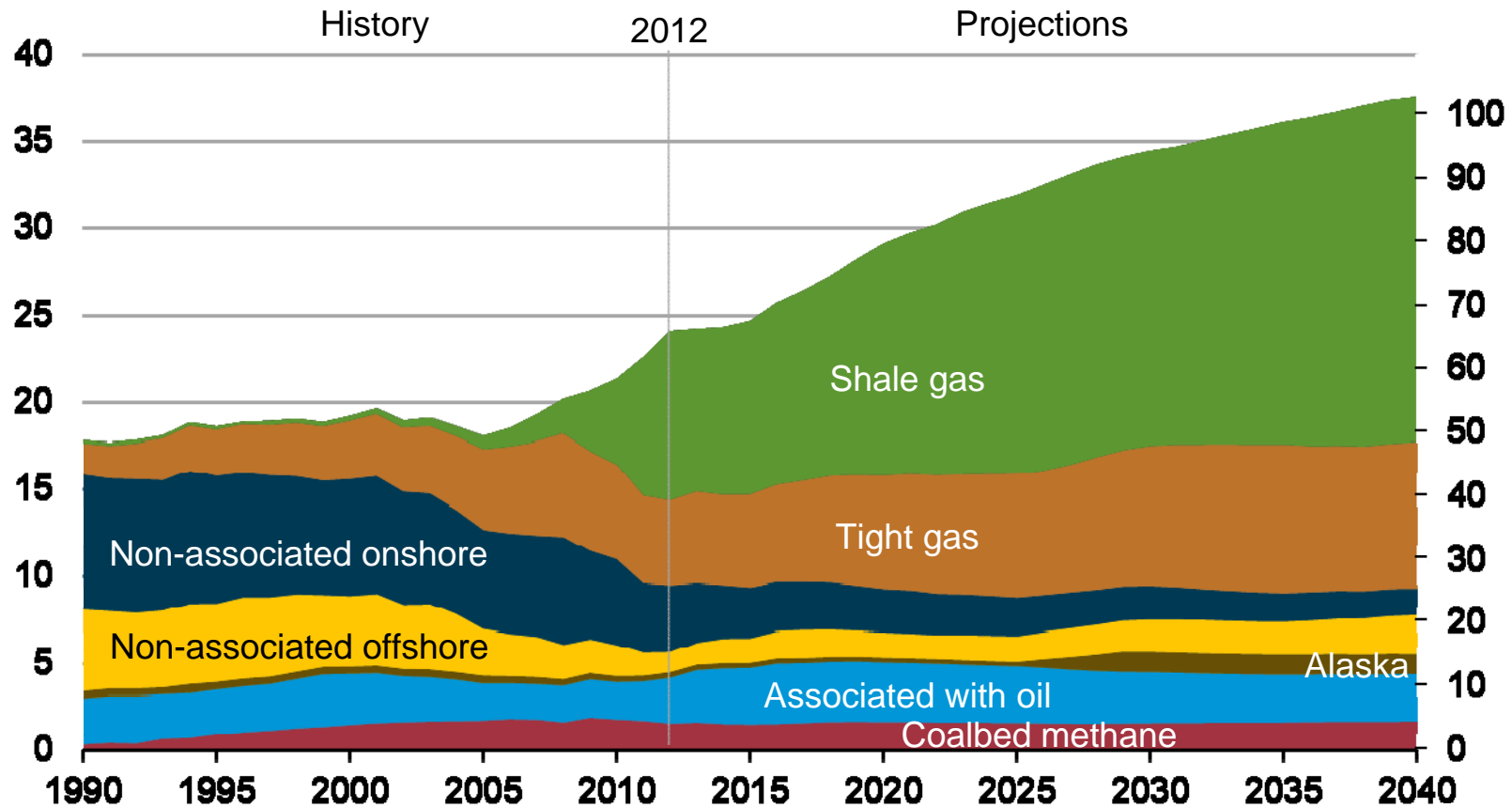
trillion cubic feet



U.S. shale gas leads growth in total gas production through 2040 to reach half of U.S. output

U.S. dry natural gas production
trillion cubic feet

billion cubic feet per day

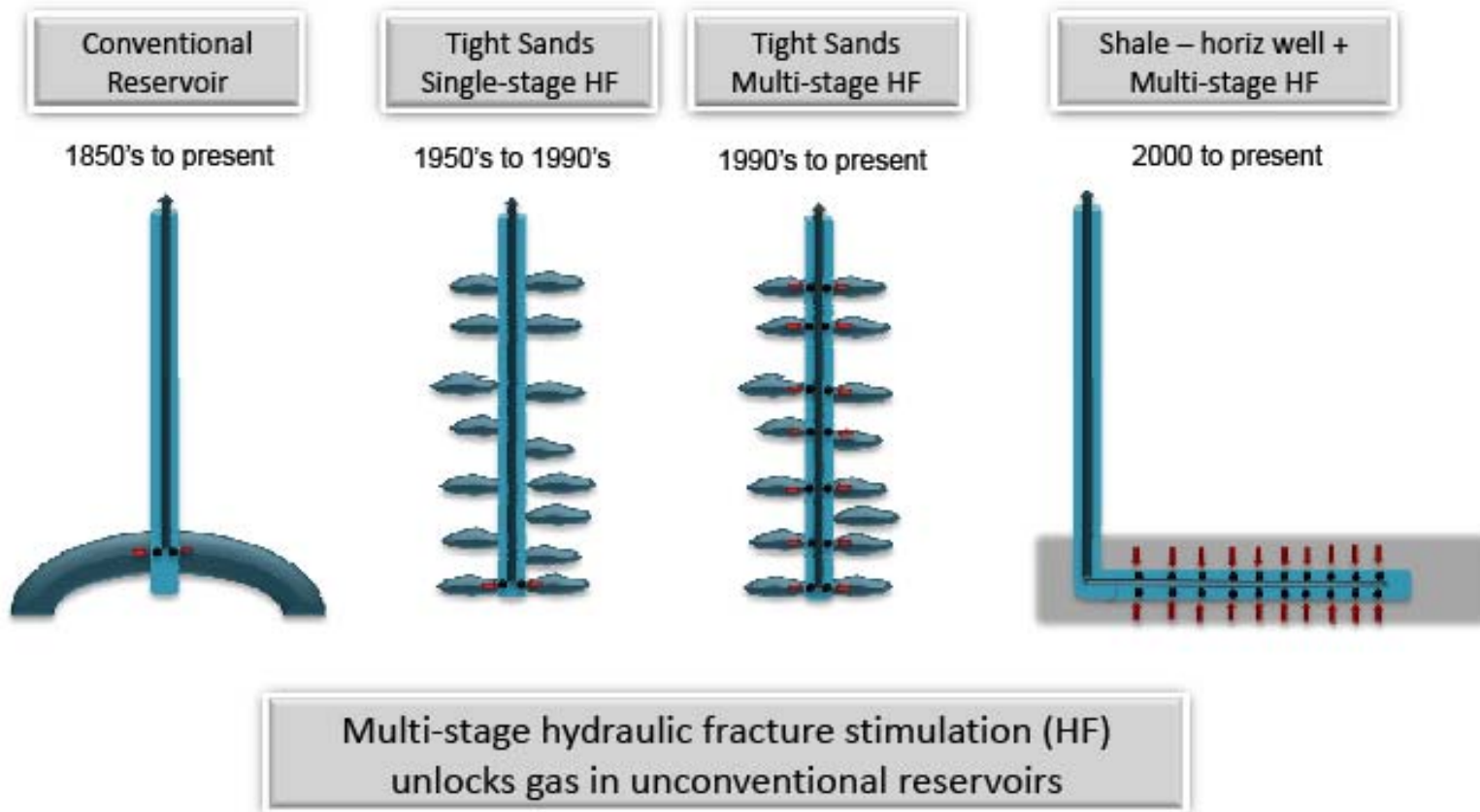


Source: EIA, Annual Energy Outlook 2014 Early Release



Source: Outlook for U.S. shale oil and gas, Presentation to Argus Americas Crude Summit, 01/22/2014, Adam Sieminski, EIA Administrator

EVOLUTION IN GAS WELL COMPLETION TECHNOLOGY - THE KEY TO TODAY'S NATURAL GAS REVOLUTION

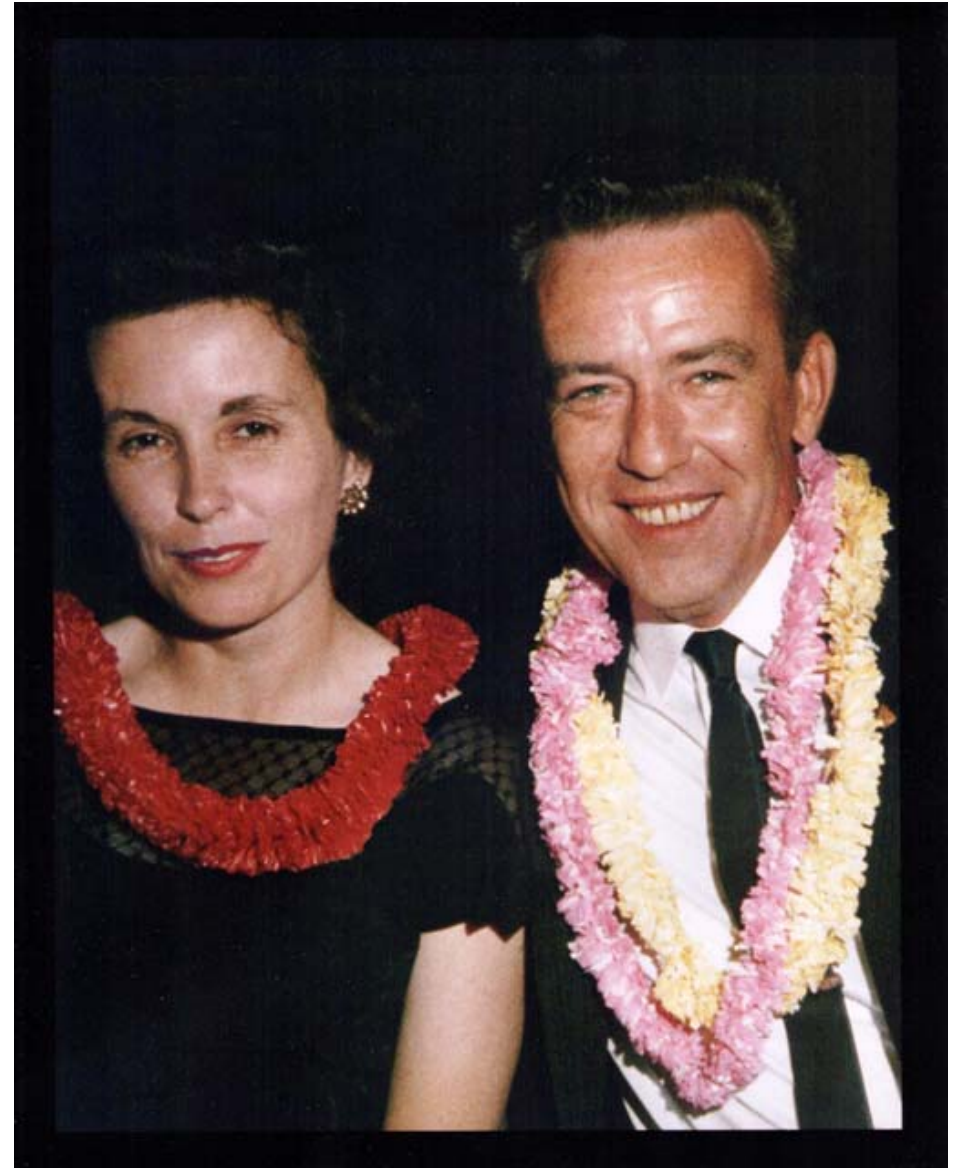


U.S.: Envy of the Energy World

- The Shale Revolution has added some \$473 billion per year to the U.S. economy.
- Consulting firm, IHS, recently estimated that more than 2.1 million U.S. jobs are now supported by shale related oil and gas activity.
- In Colorado, the oil and gas industry generates \$29.6 billion per year. That's 11% of Colorado's GDP or \$80.8 million per day.

Source: Colorado Oil and Gas Association (COGA)

Mom and Dad – Before and After







May 13th, 1966



Harpole-Bud



This U.S. energy breakthrough has positive implications for the poor.

Mom and the utility bills



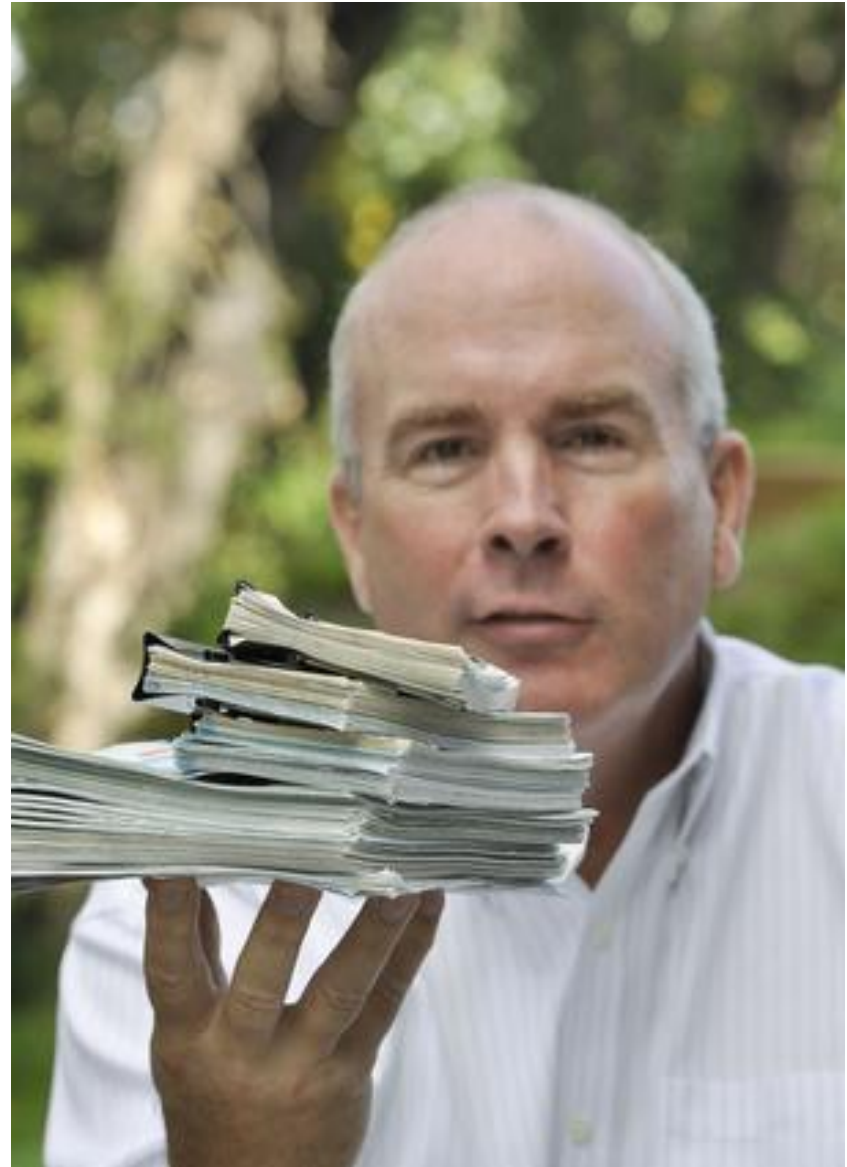
35 Years of Energy Bills



“The test of our progress is not whether we add to the abundance of those who have much. It is whether we provide enough to those who have little.”

- Franklin D. Roosevelt

What Fracking Means to Low Income Households



Wall Street Journal Editorial

September 6, 2013

- Poor households spend four times more of their income on home energy (10.4%) than do non-poor households (2.6%)
- LIHEAP provided roughly \$3.5 billion to about nine million low income households in 2012
- New drilling technologies saved poor households almost 3 times more
- Low gas prices benefit nearly all poor households while LIHEAP helps fewer than one in four

What Fracking Means to Low Income Households

2003-2008 NYMEX ¹ Avg. Price ² /MMBtu	\$7.21	61% Drop
2012 NYMEX ¹ Avg. Price/MMBtu	\$2.80	

Price Differential/MMBtu	\$4.41
	x
Residential Home Heating and Electricity Usage ³ /MMBtu	7,400,000,000

Residential Cash Savings = \$32,634,000,000

1 NYMEX – Average last 3 days of close of Natural Gas Contract as reported in Platts Gas Daily Report

2 See Addendum A for supporting documentation

3 Residential Gas Usage – Energy Information Administration

What Fracking Means to Low Income Households

- Roughly 40 million U.S. residential households (36% of 114 million total⁴) are estimated to qualify for LIHEAP assistance⁵

2012 Residential Cash Savings = **\$32,634,000,000**

Percent of households LIHEAP eligible × **.36**

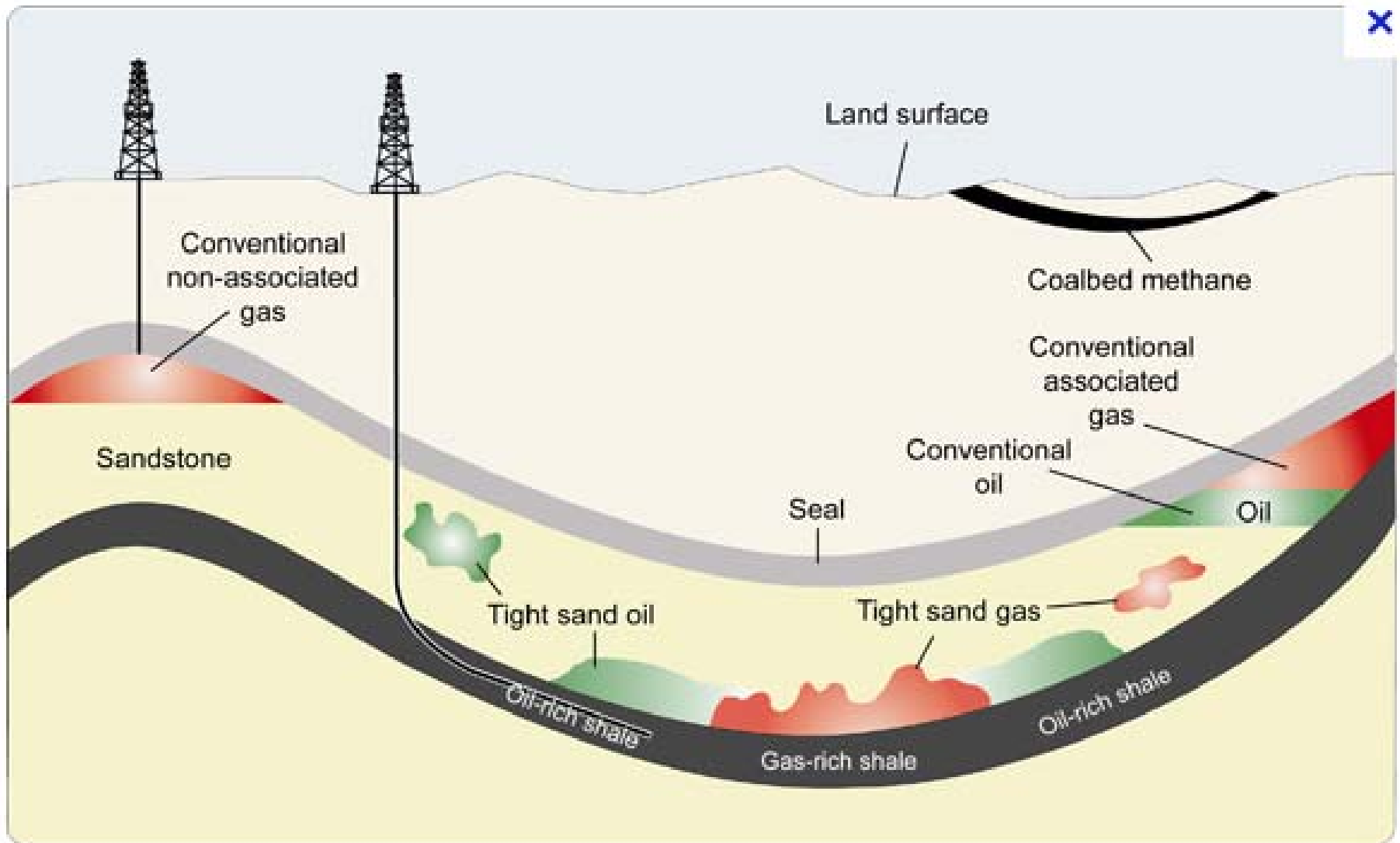
2012 LIHEAP Eligible Cash Savings = **\$11,748,240,000**

2012 LIHEAP Total Cash Assistance = **\$3,500,000,000**

⁴ US Census Bureau State and County Quickfacts

⁵ LIHEAP Home Energy Notebook for FY 2009: Appendix B: Income Eligibility Household Estimates; See Addendum A

Conventional vs Unconventional Reservoirs



Source: Chris Wright, Liberty Resources Tuesday Lunch Club Presentation, 3/5/13

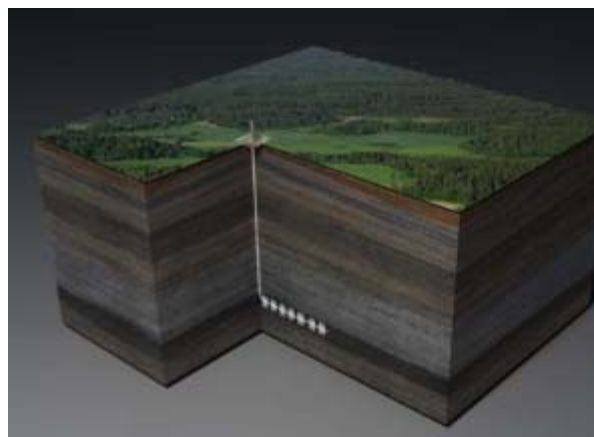
Fracture Treatment in 1949



12 Miles East of Duncan, OK

Definition

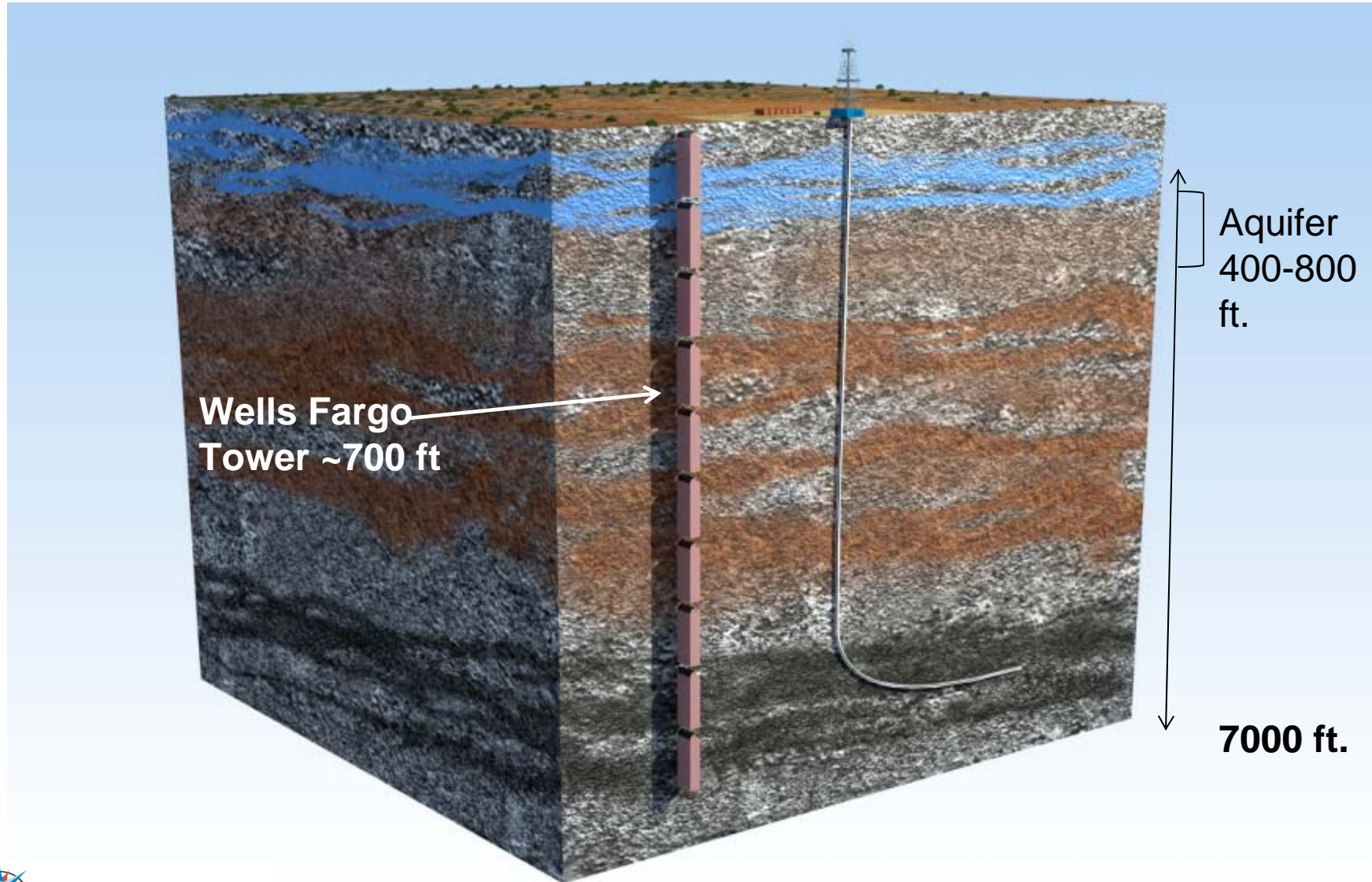
- The use of fluids to create a crack by hydraulic pressure
- The continued injection of fluids into the created crack fracture to make it grow larger
- The placement of small granular solids into the crack to ensure the crack remains open after the hydraulic pressure is no longer applied



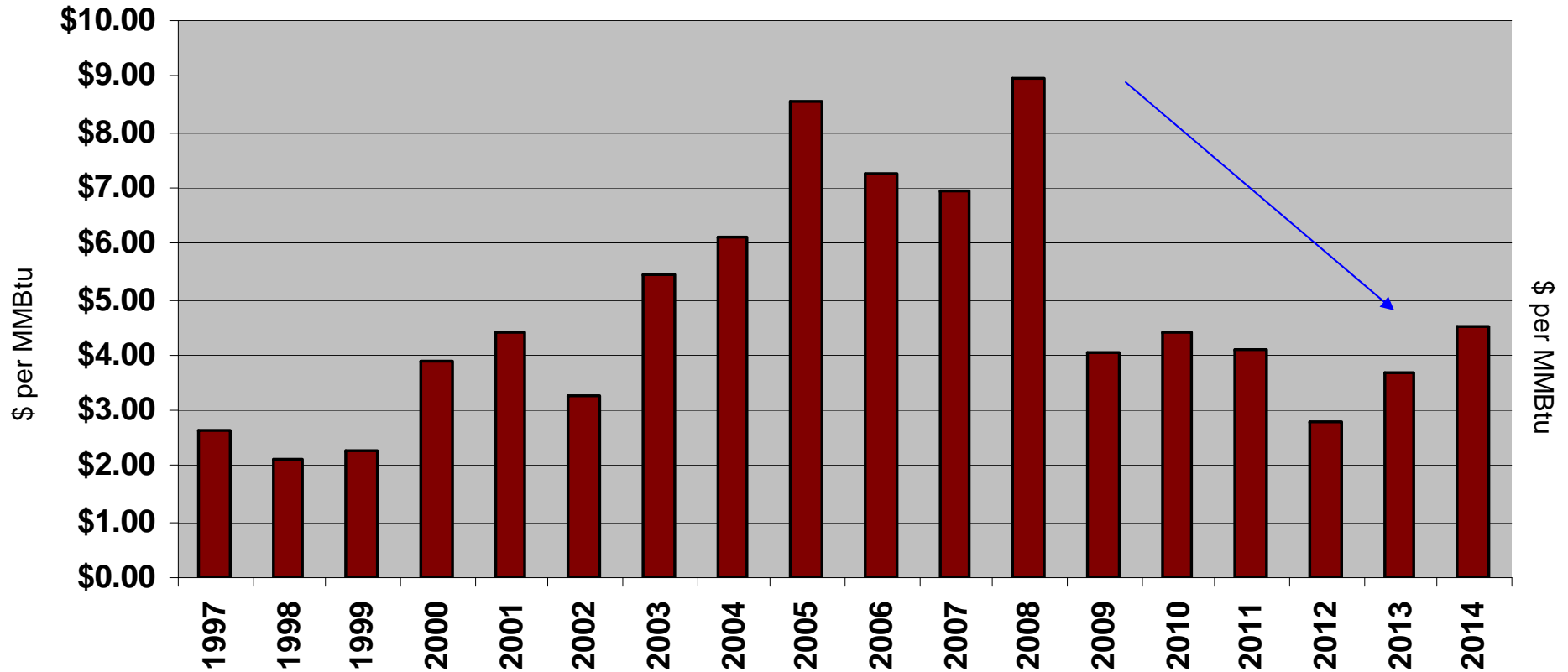
Why HF a Well?

- Increase the **Rate** at which the well is capable of producing oil or gas
- Most unconventional formations **Require** hydraulic fracturing to be economic
- Does not increase total **Reserves**

Drilling Distance



NYMEX Henry Hub Natural Gas Price* 1996 - 2014 Actual



Source: *Average of last three days of trading as published in the Platts Gas Daily Report

World LNG Estimated September 2014 Landed Prices



Source: Waterborne Energy, Inc. Data in \$US/MMBtu

This U.S. energy breakthrough has positive implications for national security.

Russia, Iran and Qatar Form Natural Gas Cartel

10/21/2008 in Tehran, Iran



Qatar's Deputy Premier and
Minister of Energy and Industry,
Abdullah bin Hamad Al-Attiya

Iranian Oil Minister,
Gholam Hossein Nozari

Alexei Miller, Chief of
Russia's state gas
monopoly - Gazprom

NATO Chief: Putin Behind Anti-Fracking Campaign

June 19, 2014



Source: *Russia 'secretly working with environmentalists to oppose fracking'* The Guardian, Fiona Harvey, June 19, 2014

Mercator Energy

Putin Behind Anti-Fracking Campaign

Anders Fogh Rasmussen, secretary of the North Atlantic Treaty Organization (NATO) said, “I have met allies who can report that Russia, as part of their sophisticated information and disinformation operations, engaged actively with so-called non-governmental organizations – environmental organizations working against shale gas – to maintain European dependence on imported Russian gas.”

Source: *Russia 'secretly working with environmentalists to oppose fracking'* The Guardian, Fiona Harvey, June 19, 2014

Gazprom's Current Near-Monopoly Supply Position

% of Supply from Gazprom/Russia

Slovakia	100%
Macedonia	100%
Finland	99%
Bulgaria	97%
Serbia & Montenegro	87%
Lithuania	84%
Hungary	80%
Czech Republic	79%
Greece	76%

Source: "Domestic Consumption" EIA International Energy Annual, 2007; "Exports 2006 and 2007" Gazexport as cited by Energy Intelligence, March 2008

Gazprom's Current Near-Monopoly Supply Position (cont'd)

% of Supply from Gazprom/Russia

Austria	74%
Slovenia	64%
Poland	62%
Ukraine	66%
Turkey	60%
Germany	40%
Croatia	37%
Italy	30%
France	25%

Source: "Domestic Consumption" EIA International Energy Annual, 2007; "Exports 2006 and 2007" Gazexport as cited by Energy Intelligence, March 2008

This U.S. energy breakthrough has positive implications for addressing air pollution world-wide.

Harpoles In China: 2010 & 2012







Reducing Greenhouse Gas Emissions

	Natural Gas	Coal
Carbon Dioxide	117,000	208,000
Carbon Monoxide	40	208
Nitrogen Oxide	92	457
Sulfur Dioxide	0.6	2,591
Particulates	7	2,744
Formaldehyde	0.750	0.221
Mercury	0.000	0.016

Source: EIA – Natural Gas Issues and Trends

Pounds of air pollutants produced per billion Btu energy





ENVIRONMENTAL IMPACTS OF COAL

2008

For Educational Purposes Only - Copyrighted

2013



Kyoto Protocol

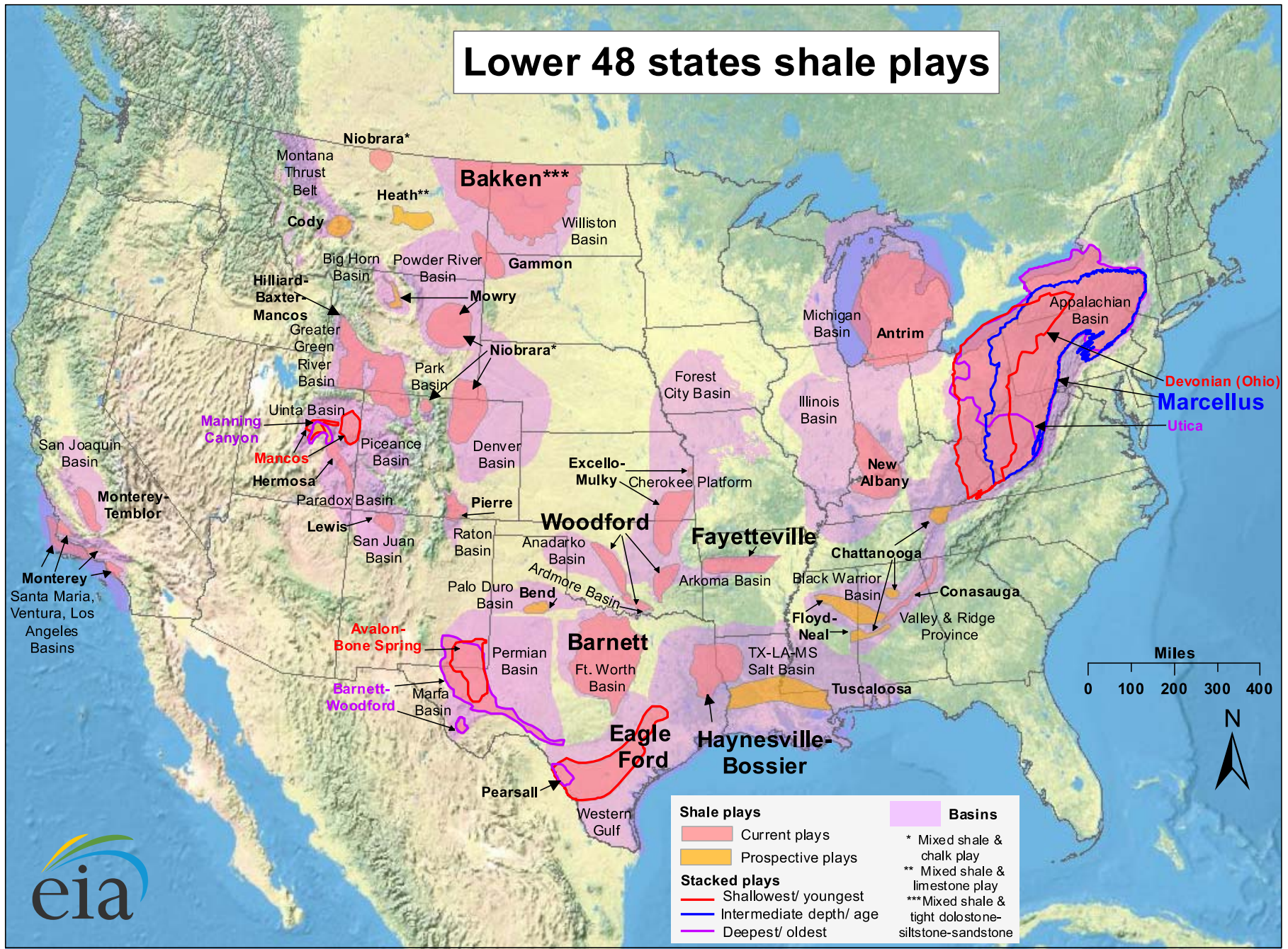
U.S. Energy Information Agency reports that America's greenhouse gas emissions have **fallen 7 percent to 1992 levels.** US, a non participant in Kyoto Protocol Treaty, is the only nation to meet 1999 forecasted reduction

Forecasts for Shale Gas Resource?

- 2008 - **347 TCF** - Energy Information Administration (EIA)
- 2008 - **840 TCF** - Navigant for Clean Skies Foundation
- 2009 - **616 TCF** - Potential Gas Committee (PGC)
- 2011 - **827 TCF** - Energy Information Administration (EIA)
- 2013 – **1,073 TCF** - Potential Gas Committee (PGC)

Source: Various resource estimates

Lower 48 states shale plays

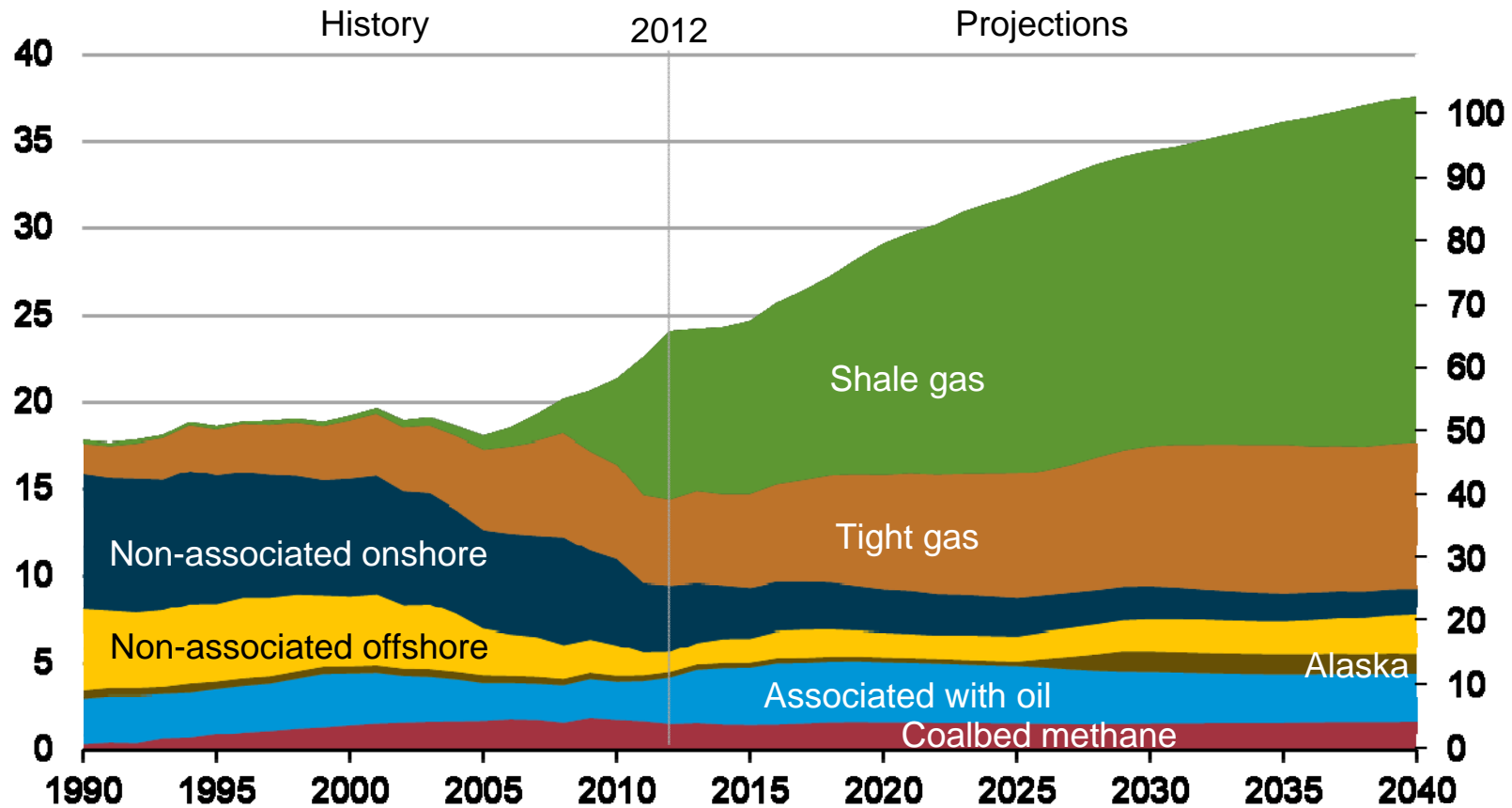


Source: Energy Information Administration based on data from various published studies. Updated: May 9, 2011

U.S. shale gas leads growth in total gas production through 2040 to reach half of U.S. output

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Source: EIA, Annual Energy Outlook 2014 Early Release

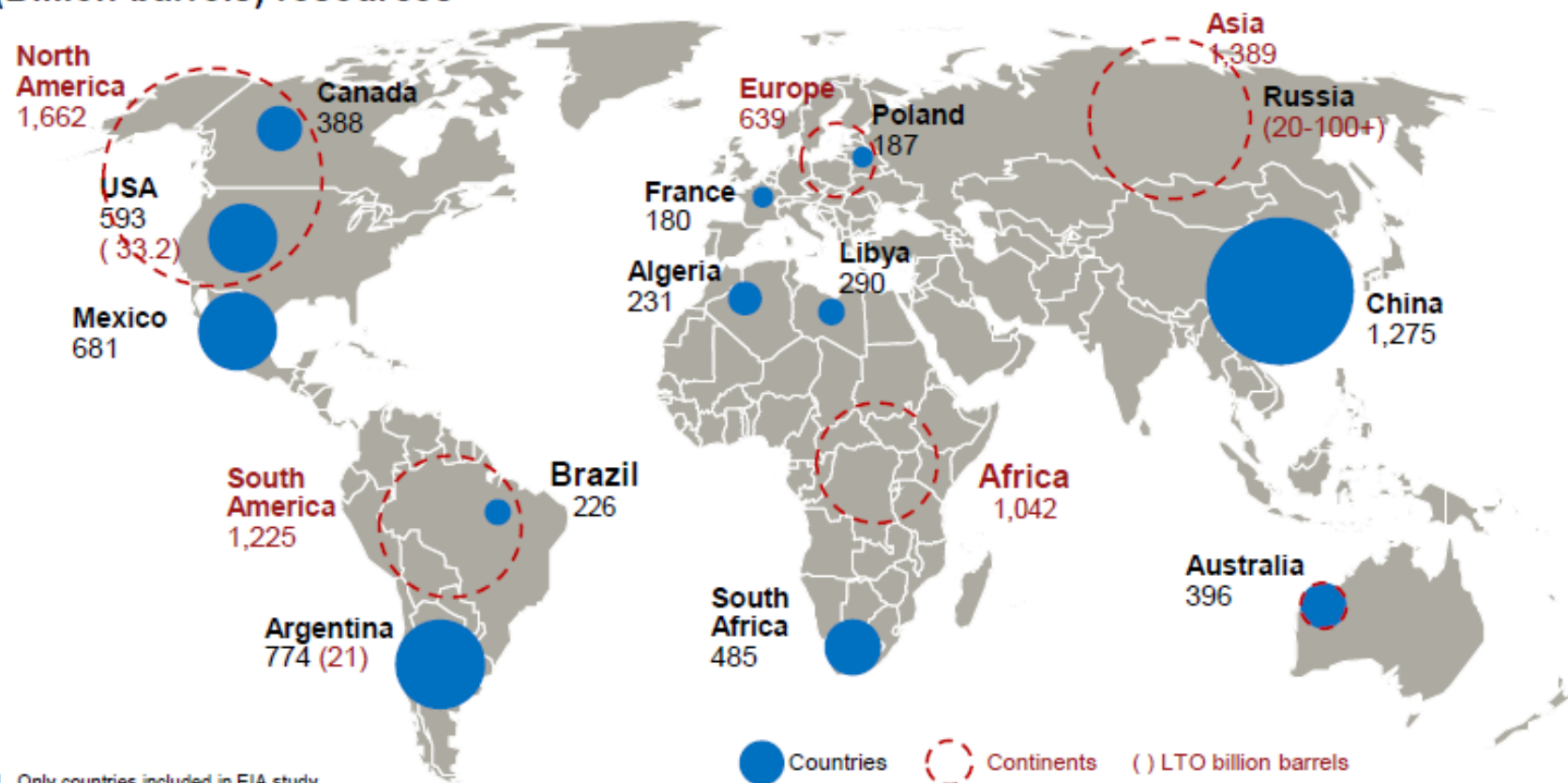
World Gas Reserves 2003 vs. 2013

2003 Rank	Country	Proved Reserves, Trillion Cubic Feet (2003)	Proved Reserves Trillion Cubic, Feet (2013)	2013 Rank
1	Qatar	910.1	890	3
2	Iran	970.8	1187	2
3	United Arab Emirates	213.9	215.025	7
4	Saudi Arabia	238.4	287.844	5
5	Russia	1694.4	1688	1
6	Algeria	160.4	159.05	10
7	Turkmenistan	102.4	265	6
14	United States	186.9	308.436	4
15	Canada	56.6	68.166	18

Resource potential in North America is massive – with the Rockies accounting for a significant fraction

Major global shale gas and LTO opportunities¹

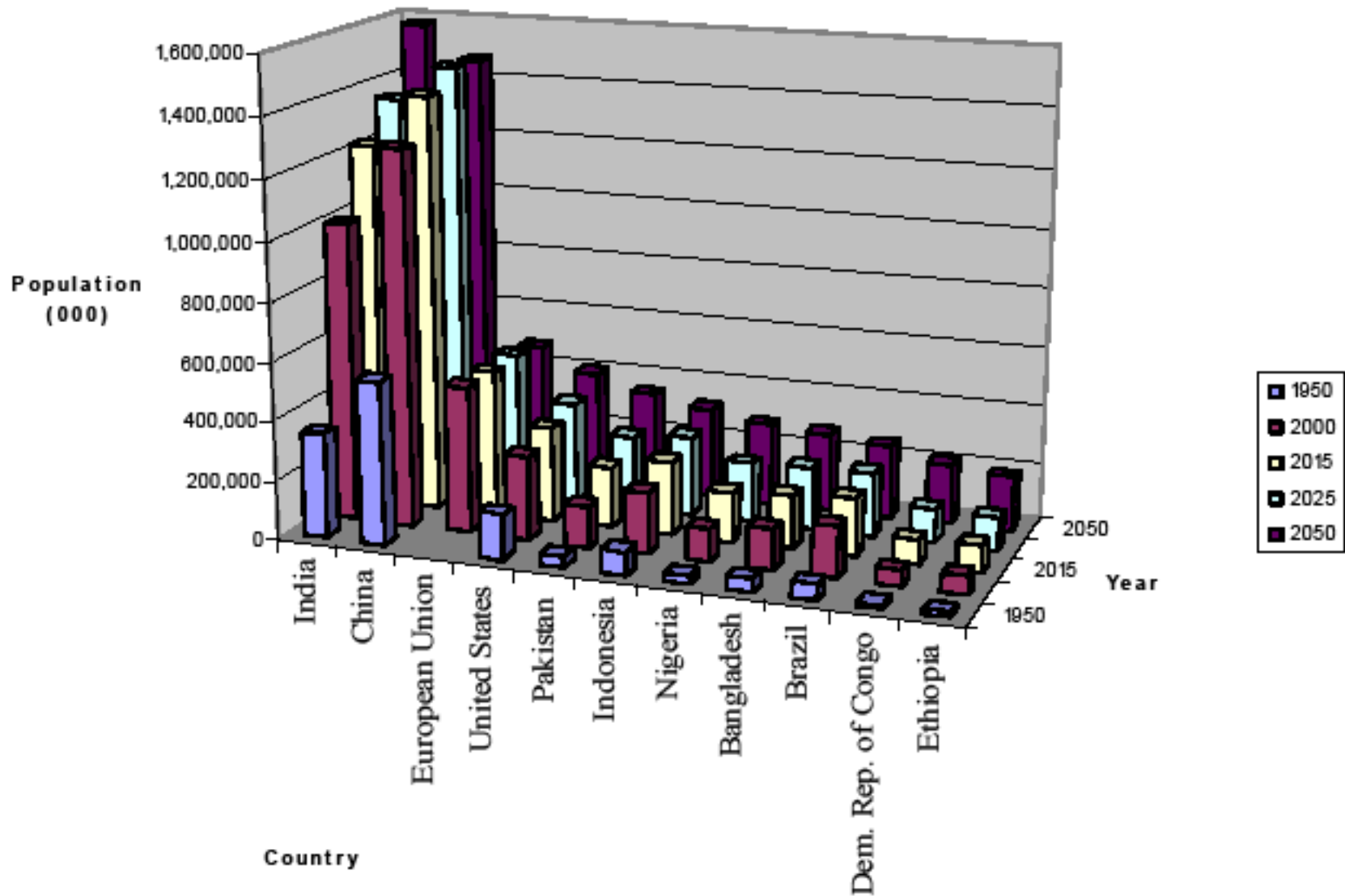
Technically recoverable shale gas (trillion cubic feet) and LTO (Billion barrels) resources



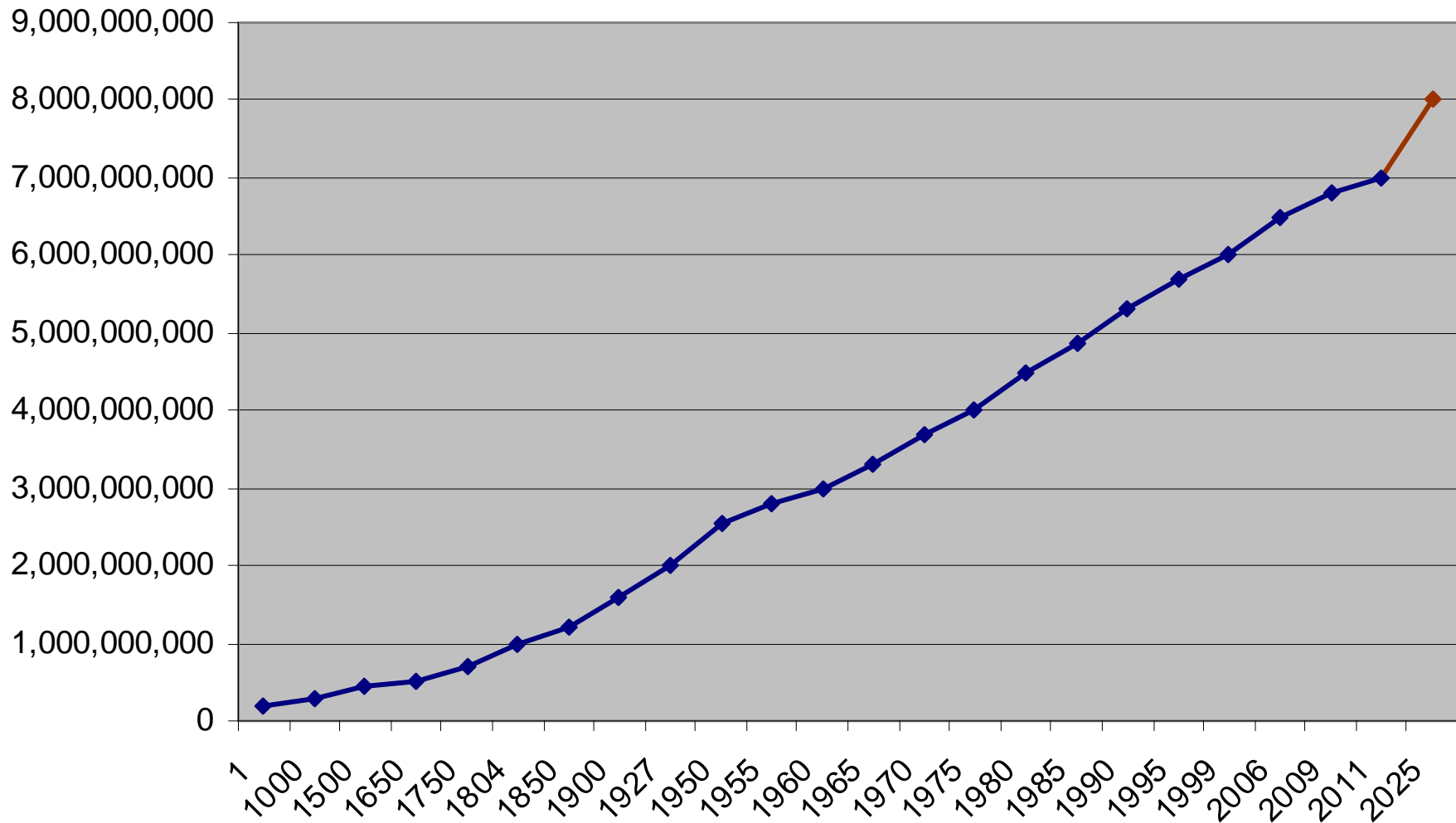
1. Only countries included in EIA study
Source: EIA, Forbes, <http://www.shale-gas-tight-oil-argentina-ii.com/>

This U.S. energy breakthrough has positive implications quality of life.

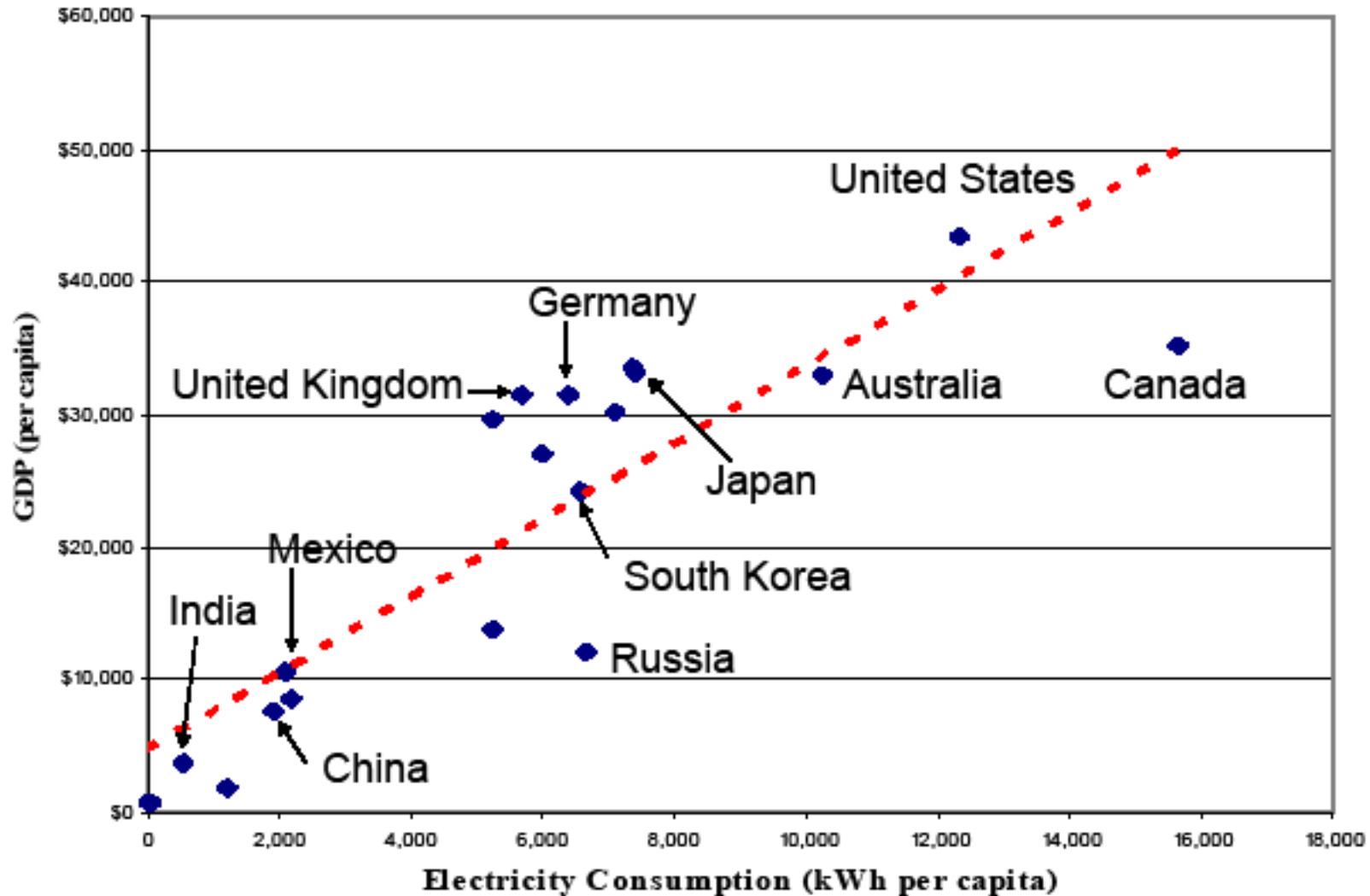
Population Growth from 1950-2050



World Population Growth

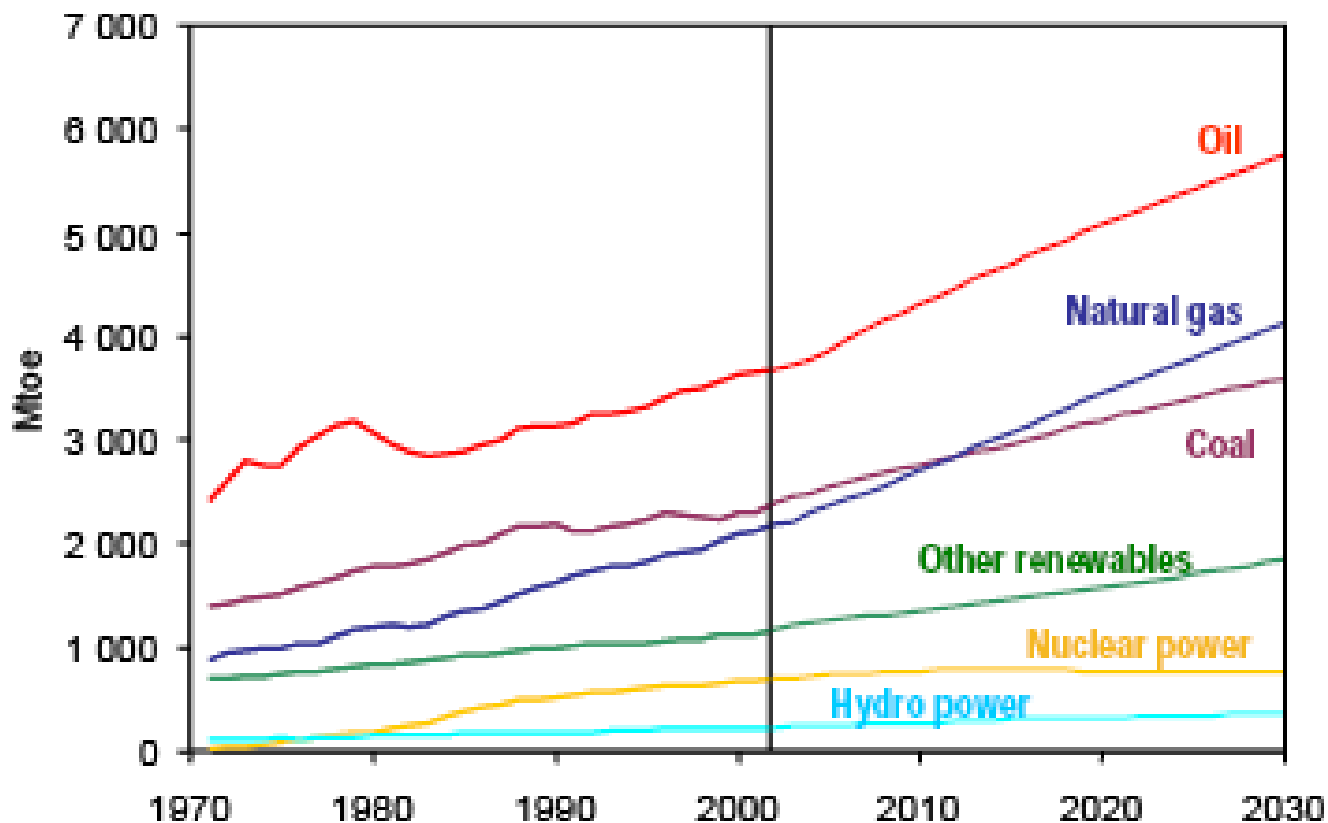


Quality of Life is Strongly Correlated with Electricity Consumption



Source: CIA World Factbook, 2007

World Primary Energy Demand



Fossil fuels account for almost 90% of the growth in energy demand between now and 2030

WORLD
ENERGY
OUTLOOK

INTERNATIONAL
ENERGY AGENCY



The essentiality of electricity to modernity

Over 1.2 billion people – 20% of the world's population – are still without access to electricity worldwide, almost all of whom live in developing countries. This includes about 550 million in Africa, and over 400 million in India.



Source: The World Bank, *Energy – The Facts*

Scale on Electricity

- The entire continent of Africa uses the same amount of electricity as Canada.
- The average Chinese uses about five times as much electricity as the average Indian, while the average American uses about 20 times more.

Source: *When 600 Million People Lost Power*, Robert Bryce, August 5, 2012

Indoor air pollution

About 2.8 billion people use solid fuels – wood, charcoal, coal and dung – for cooking and heating. Every year fumes and smoke from open cooking fires kill approximately 1.5 million people mostly women and children, from emphysema and other respiratory diseases.



Source: The World Bank, *Energy – The Facts*

Mercator Energy

This U.S. energy breakthrough
has positive implications for the
cost of food.

Natural gas – fertilizer – food

“If we all ate simple vegetarian diets and farmed every acre of arable land as wisely as possible using the best techniques of the late 1800s, the earth could support a population of around 4 billion people. In theory, the other 2 billion-plus inhabitants should be starving, the natural result of population out-stripping food supply, as doomsayers from Thomas Malthus to Paul Ehrlich have long predicted.”

- Thomas Hager

Nihilistic Ecotheology

“...apocalyptic fears of ecological collapse, disenchanting notions of living in a fallen world, and the growing conviction that some kind of collective sacrifice is needed to avoid the end of the world”

Source: Breakthrough Institute, Ted Nordhaus and Michael Shellenberger, September 2011

Example – Bill McKibben

- “perhaps the nation’s most effective grass-roots environmental advocate” (New York Times)
- ...“our systems and economies have gotten too large...we need to start building them back down. What we need is a new trajectory, toward the smaller and more local.” (Bill McKibben)

Sierra Club and Scale

- “Sierra Club, Greenpeace, and many other groups want to pave the world with low-density wind turbines.”*
- The world currently get 50 times as much energy (from coal, oil, natural gas, nuclear and hydropower) as we do from wind, solar geothermal and biomass.

*Source: *Smaller, Faster, Lighter, Denser, Cheaper*, Robert Bryce, May 2014

A Question of Scale

- 32% growth in CO2 emissions since 2002 (8.4 billion ton increase) nearly all of this in the developing world
- To replace the U.S. 300 billion watts of coal fired capacity would require placing wind turbines over 116,000 square miles...a footprint roughly the size of Italy
- Last year's increase in U.S. oil production is roughly equal to twice the energy equivalent of every solar energy installation on the planet.

Proponents of Fracking



“We produce more natural gas than ever before...and nearly everyone’s energy bill is lower because of it...[T]he natural gas boom has led to cleaner power and greater energy independence.”

- President Barack Obama

“We should strengthen our position as the top natural gas producer...[I]t not only can provide safe, cheap power, but it can also help reduce our carbon emissions.”

- President Barack Obama

“There’s nothing inherently dangerous in fracking that sound engineering practices can’t accomplish.”

- Gina McCarthy, Current EPA Administrator





“I’m not aware of any proven case where the fracking process itself has affected water.”

- Lisa Jackson, Former EPA Administrator

“I still have not seen any evidence of fracking per se contaminating groundwater.”

- Ernest Moniz, Secretary of Energy



“This [hydraulic fracturing] is something you can do in a safe way.”

- Steven Chu, Former Secretary of Energy



“Fracking has been done safely for decades.”

- Sally Jewell, Secretary of Interior

“I would say to everybody that hydraulic fracturing is safe...[it] is creating an energy revolution in the United States.”

- Ken Salazar, Former Secretary of Interior



“I know and you know that fracking is not a threat to our communities when it is done safely and responsibly.”

- Mark Udall, Senator of Colorado

“We believe oil and gas development can thrive while also meeting our high standards for protection of health, water and the environment.”

- John Hickenlooper, Governor of Colorado



Conclusions

- Inexpensive energy translates to:
 - Jobs
 - Affordable heat
 - Affordable light
 - Affordable food
- All of those conditions can significantly contribute to an environment conducive to a far better world.
- The U.S. must export its success in product, technology and nation security.

Conclusions

- By arguing against fracking and natural gas, one op-ed writer has characterized this as a battle of “Greens v. the poor: It’s a movement of the ‘haves.’”*
- The Sierra Club seems to espouse anti-human life environmentalism: Pitting people against the planet, embracing radical depopulation as a key to saving the planet.

*Source: New York Post, Naomi Schaefer Riley, September 17, 2014

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Citations for Report

All of the information utilized for this report is a compilation of information pulled from the following data sources:

Energy Information Administration (EIA)
Bentek Energy, Jack Weixel
American Petroleum Institute (API)
Ponderosa Advisors LLC
The Washington Post
Office of Energy Projects
Potential Gas Committee (PGC)
Office of Fossil Energy
Fox News
Bloomberg
Office of Oil Gas Global Security Supply
U.S. Department of Energy
Raymond James and Associates, Inc.
U.S. Federal Energy Regulatory Commission (FERC)
Institute for Energy Research (IER)
Bernstein Research
Western Energy Alliance
Platts Gas Daily Report, A McGraw Hill Publication
Colorado Oil and Gas Association
America's Natural Gas Alliance
Colorado Oil and Gas Association (COGA)
Coloradans for Responsible Energy Development (CRED)
Robert Bryce
The Wall Street Journal
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