Natural Gas:
Realizing the Potential

Washington State Academy of Sciences

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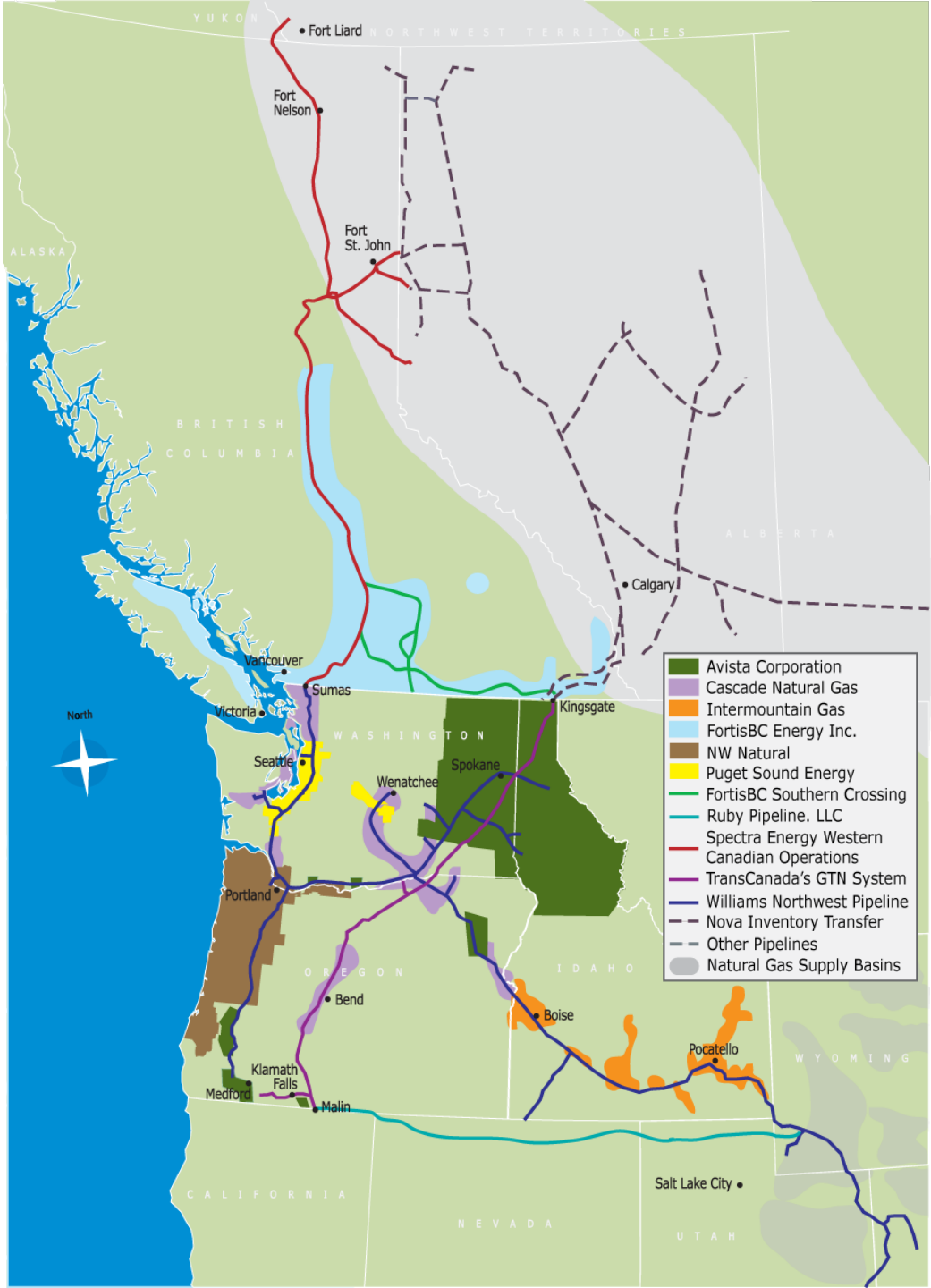
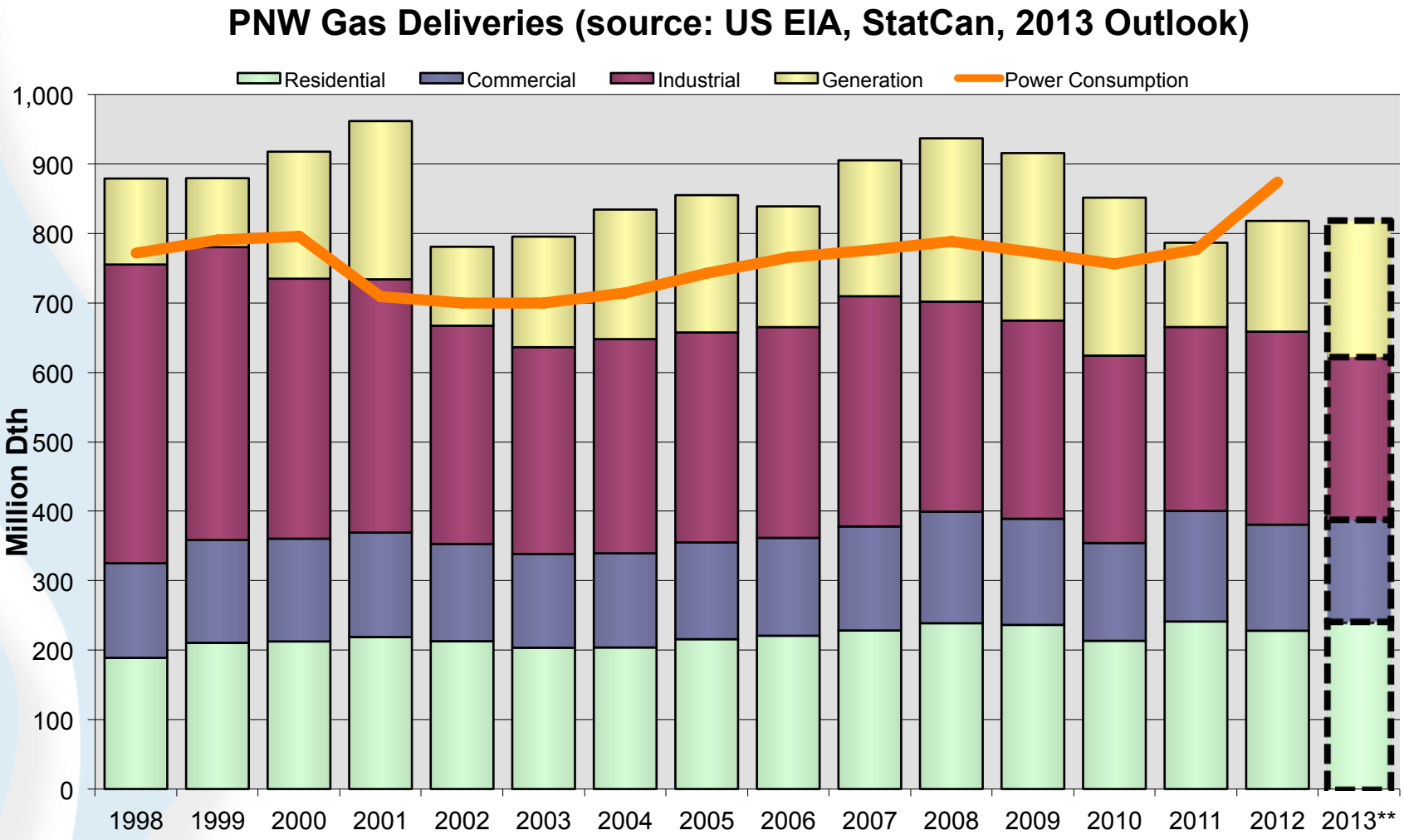


Recent Gas Demand



** 2012-2013 Forecast

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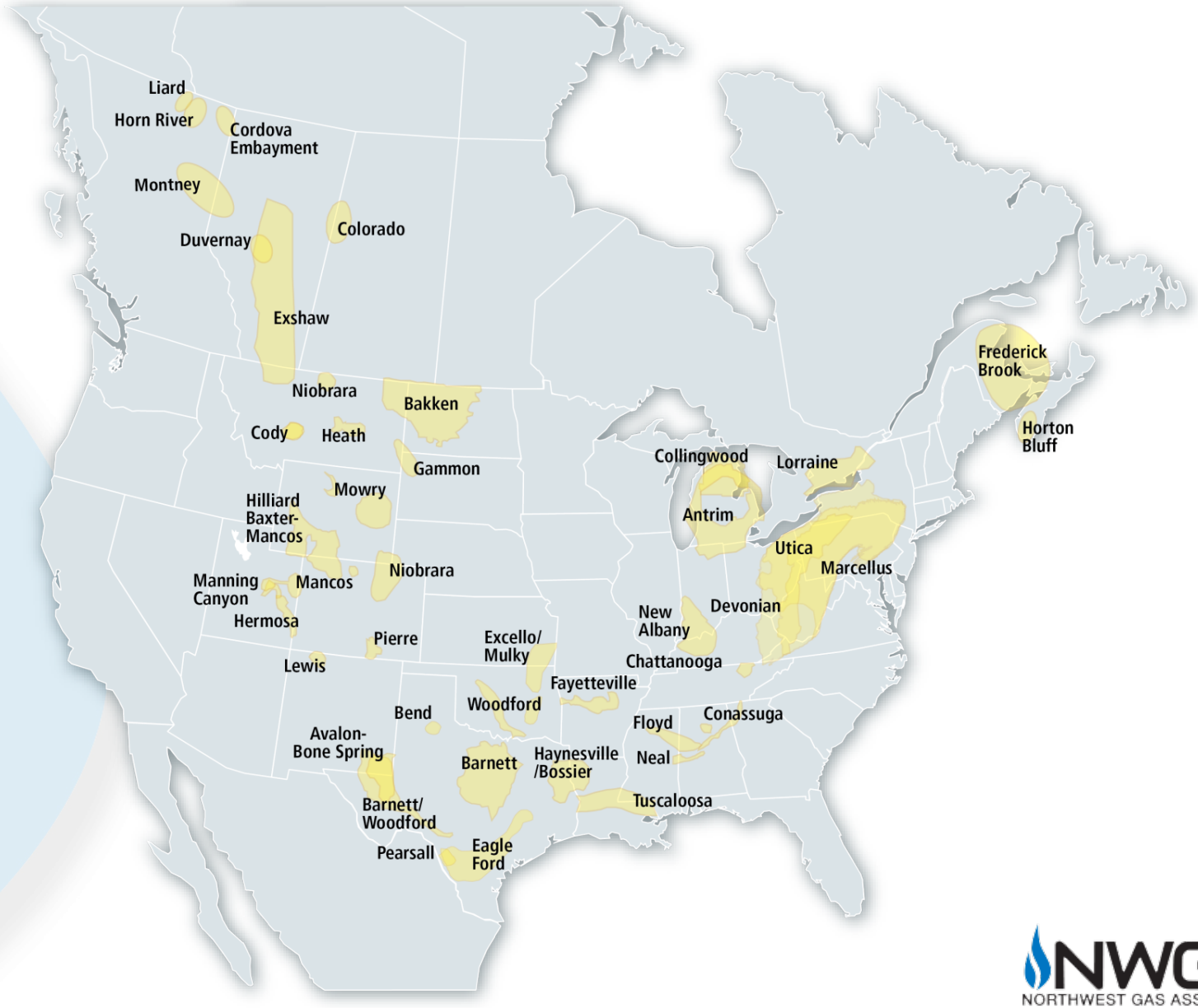
Gas From Shale Has Profound Impact



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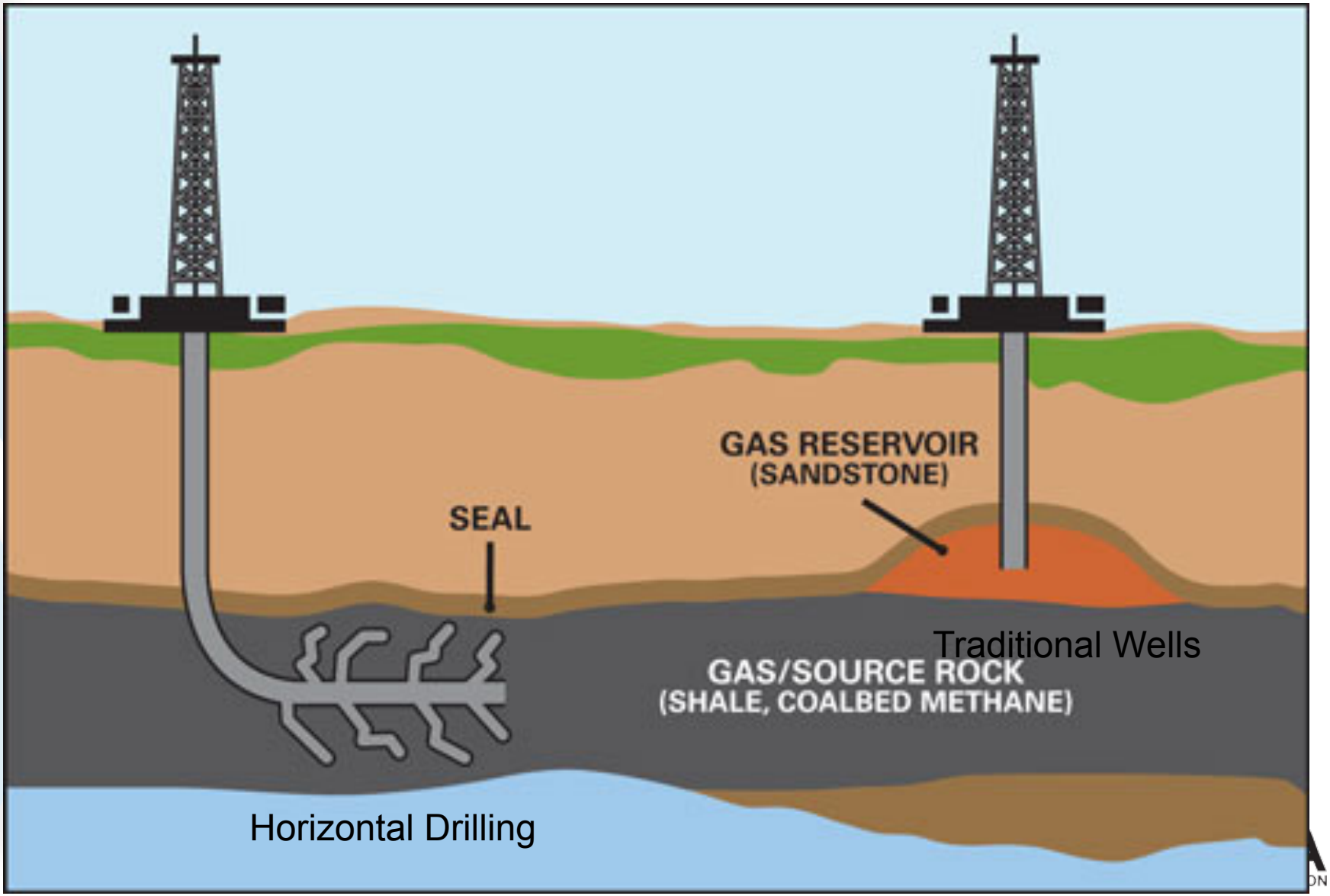
Source: Energy Information Administration (EIA), dated May 9, 2011

Conventional vs. Horizontal Drilling



Shale Video

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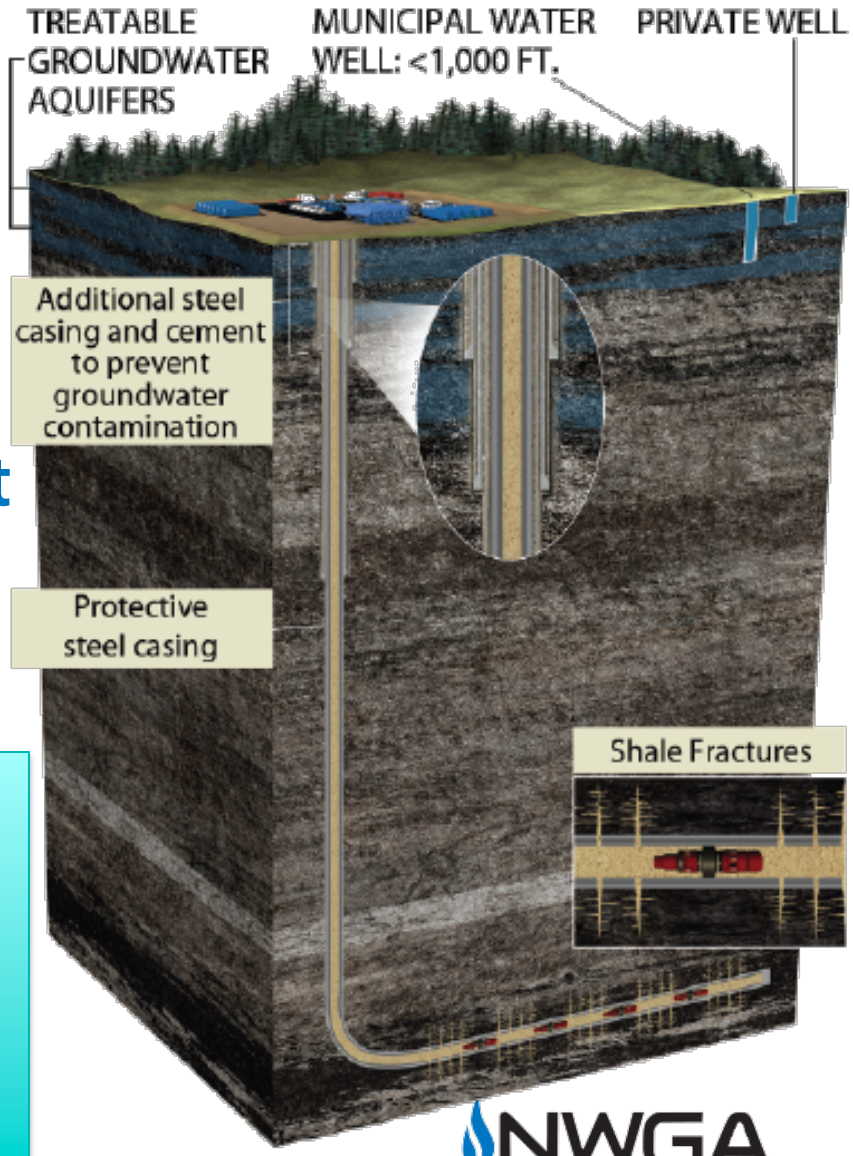
Issues with Shale Production

Drinking Water

- Key is effectively sealing (casing) the well bore
- Well construction subject to state/local oversight



- **FracFocus.org** – Public registry created and managed by state regulators
  - Searchable public database with well-by-well information and glossary of chemicals
  - More than 10,000 wells and over 100 participating companies; several states using as tool for compliance reporting

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Issues with Shale Production

Water Use

Play	Public Supply	Industrial/ Mining	Irrigation	Livestock	Shale Gas	Total Water Use (Bbbls/yr)
Barnett TX	82.7%	3.7%	6.3%	2.3%	0.4%	11.1
Fayetteville AR	2.3%	33.3%	62.9%	0.3%	0.1%	31.9
Haynesville LA/TX	45.9%	13.5%	8.5%	4.0%	0.8%	2.1
Marcellus NY/PA/WV	12.0%	71.7%	0.1%	<0.1%	<0.1%	85.0

How much is 5 Million gallons of water?

It is equivalent to the amount of water consumed by:

- **New York City** in about **seven (7) minutes**
- A 500 megawatt coal-fired **power plant** in **1 day**
- A **golf course** in **25 days**
- **10 acres of cotton** in a season

While these represent continuing consumption, the water used for a gas well is a one-time use.

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Issues with Shale Production

Produced Water

- Handled differently at different shale plays; even at different wells within a play.
  - Recycling
  - Disposal
- Disposal is highly regulated (state and federal)
- Seismic Activity

Emissions

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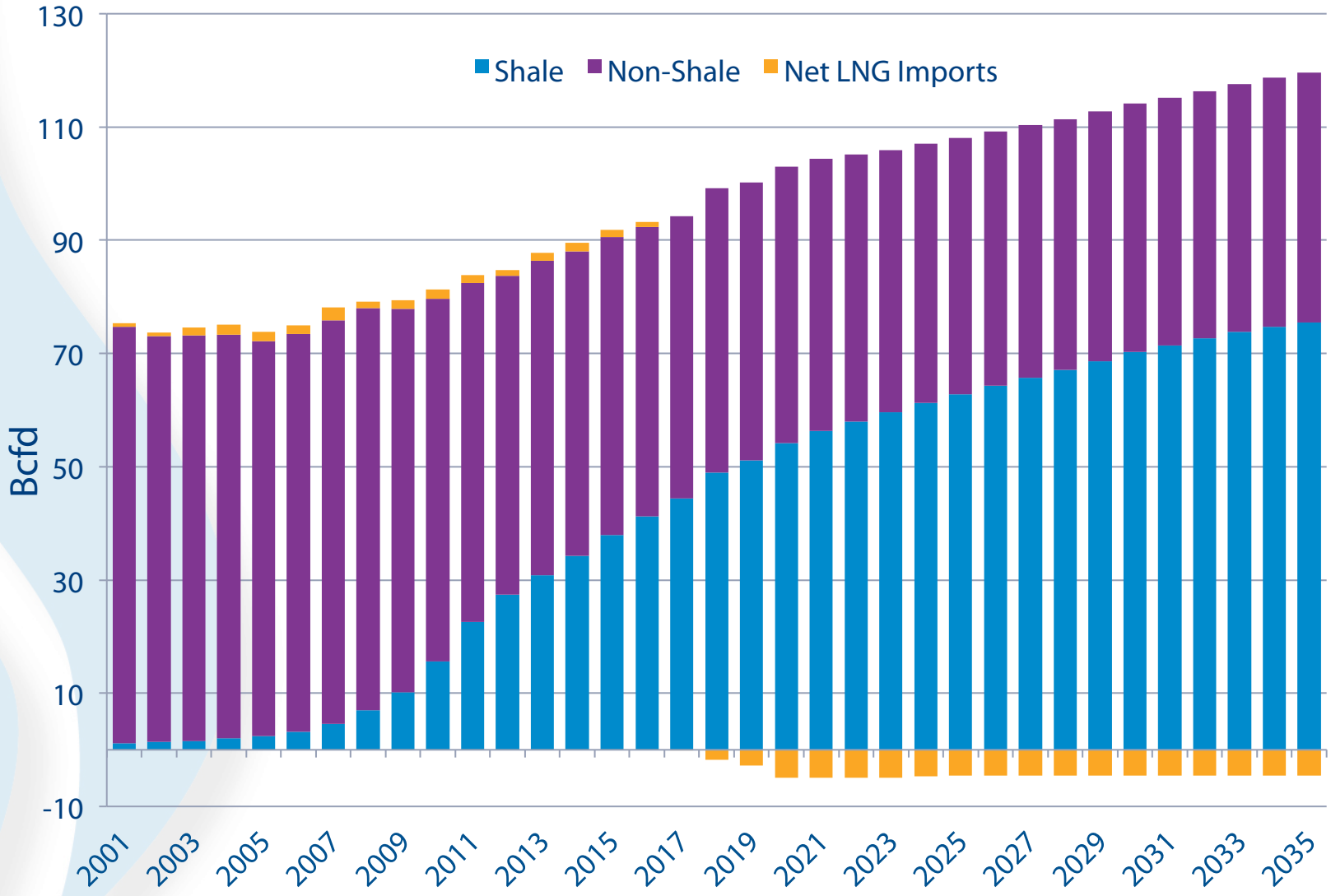
Shale Dominates North American Production



Source: Navigant Consulting, *Fall 2012 Gas Market Outlook*

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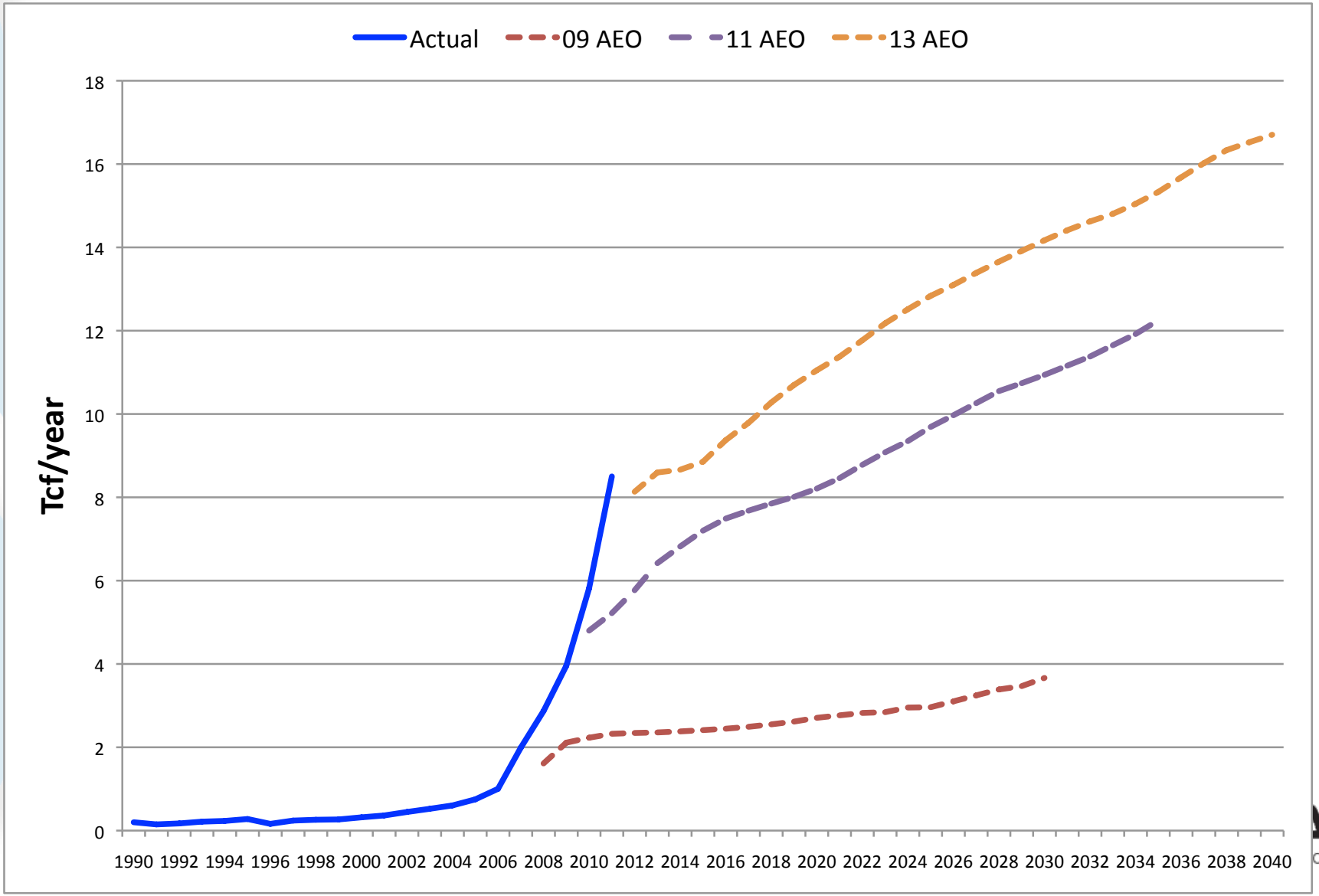
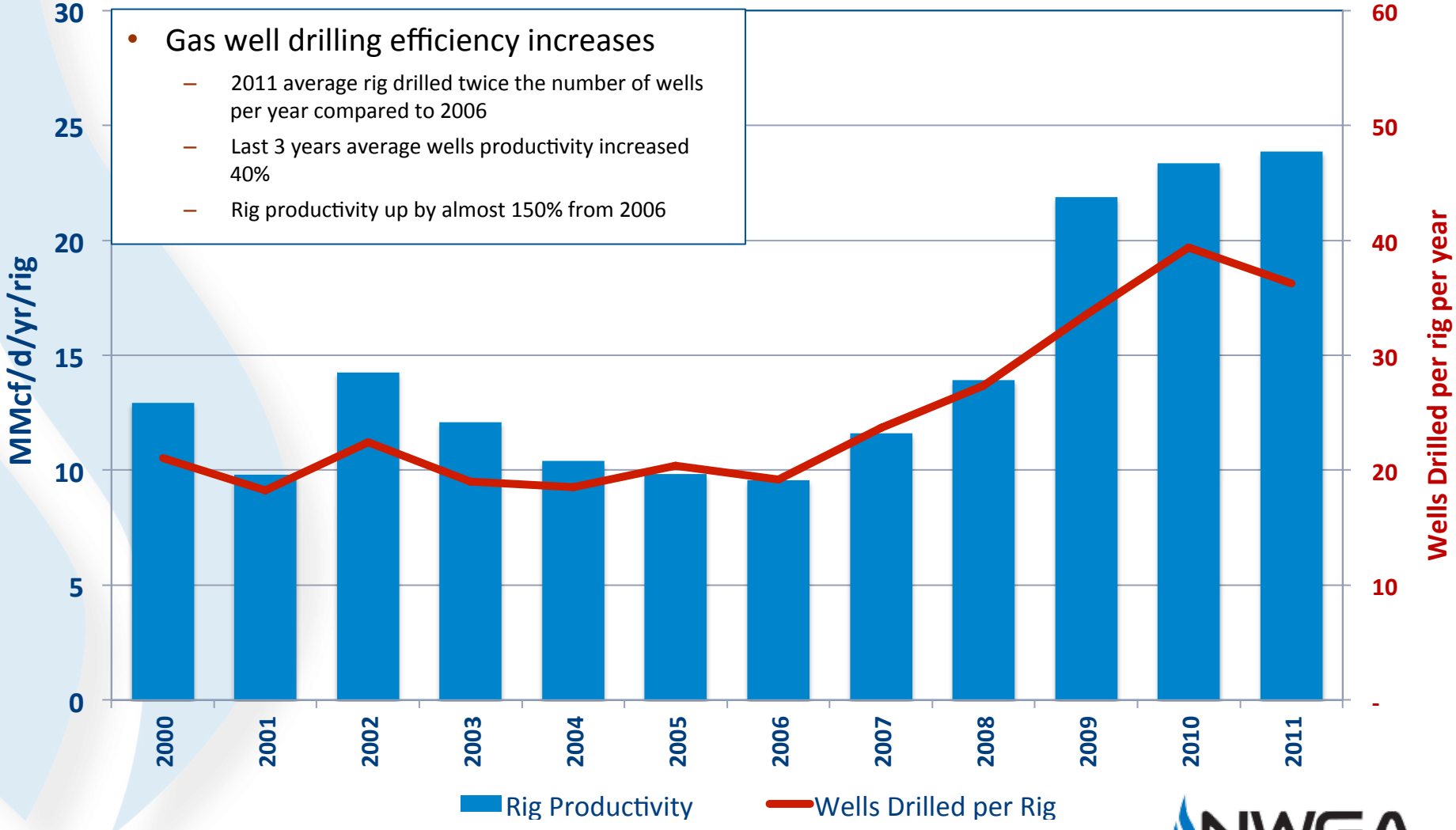
Shale Production (source: EIA Annual Energy Outlook)



Rockies Rig Productivity



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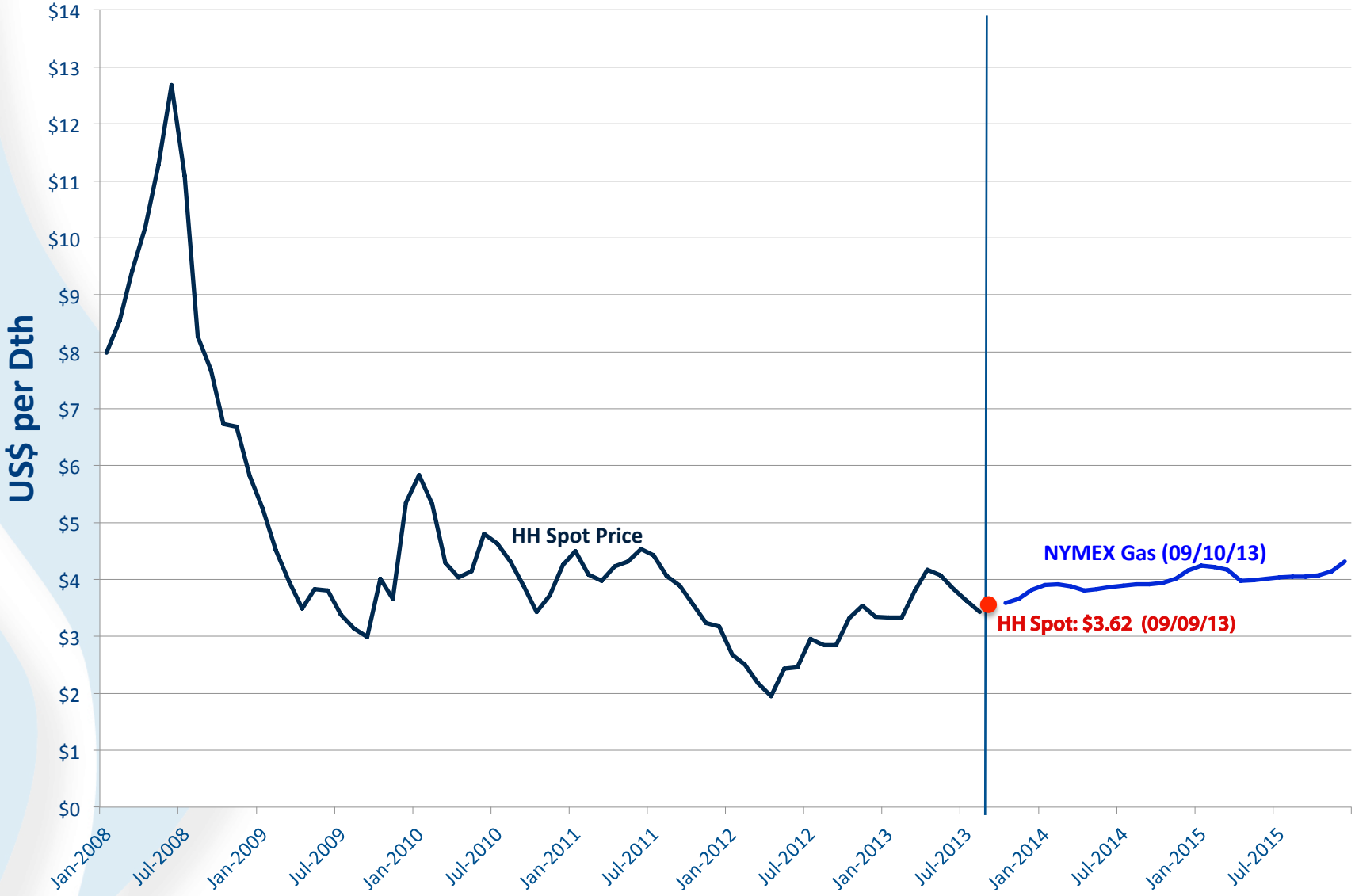
Price Effect



Source: EIA, NYMEX

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Replace Existing Resources

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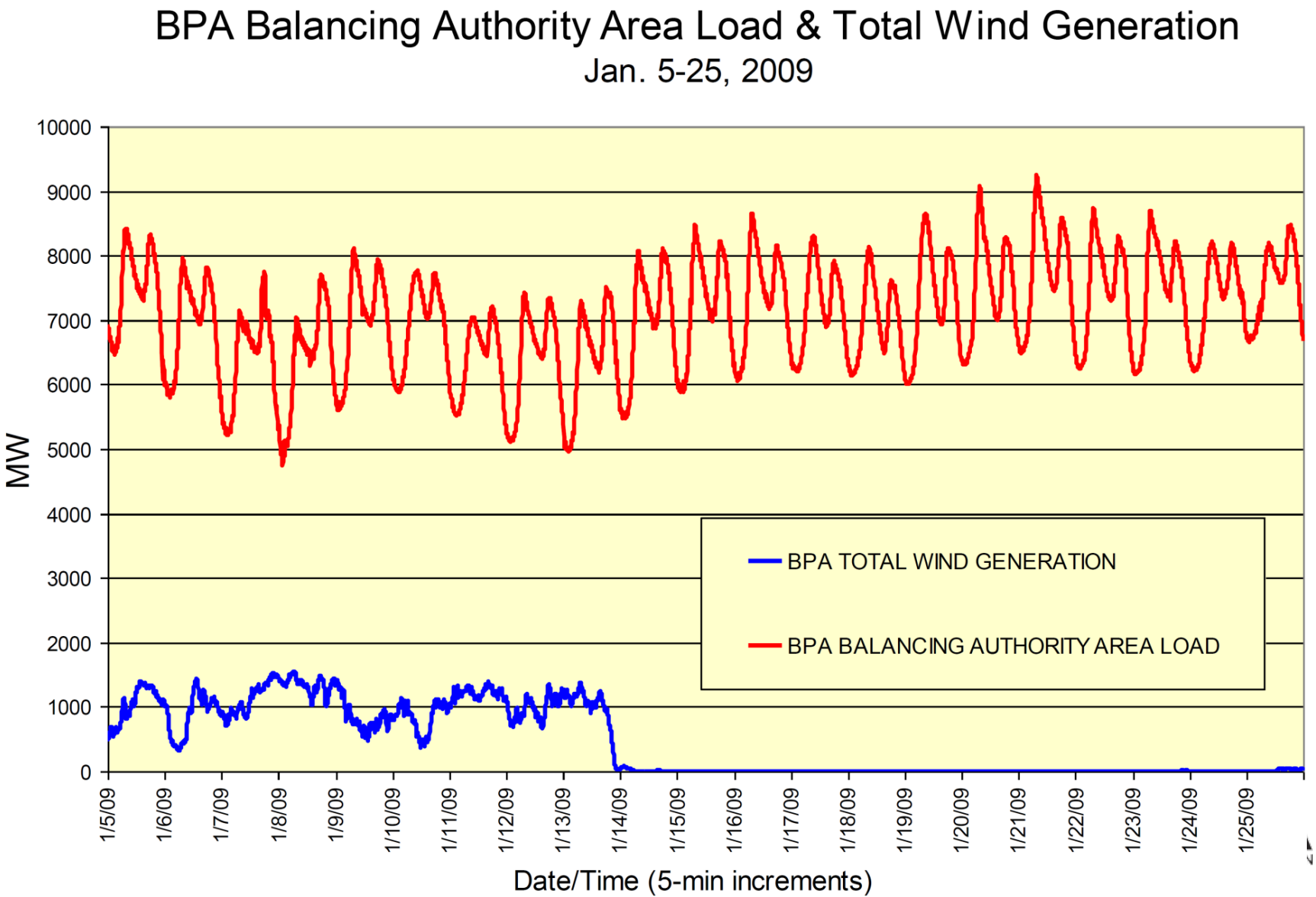
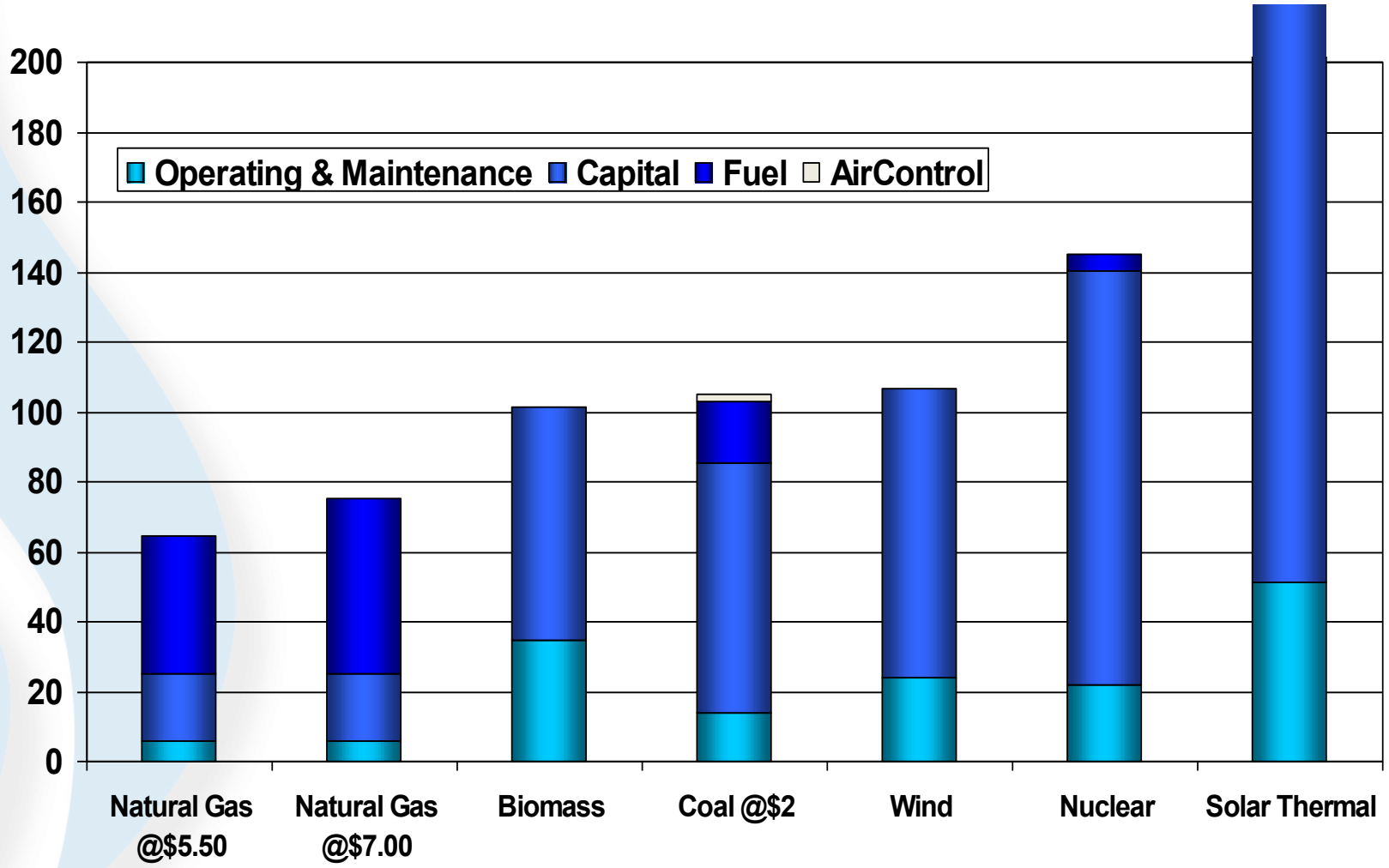
Support Renewable Resources



Most Economic Generation Option



Source: Wood Mackenzie
Renewable sources & nuclear include a federal tax credit
Assumes $2.00/mmbtu coal prices

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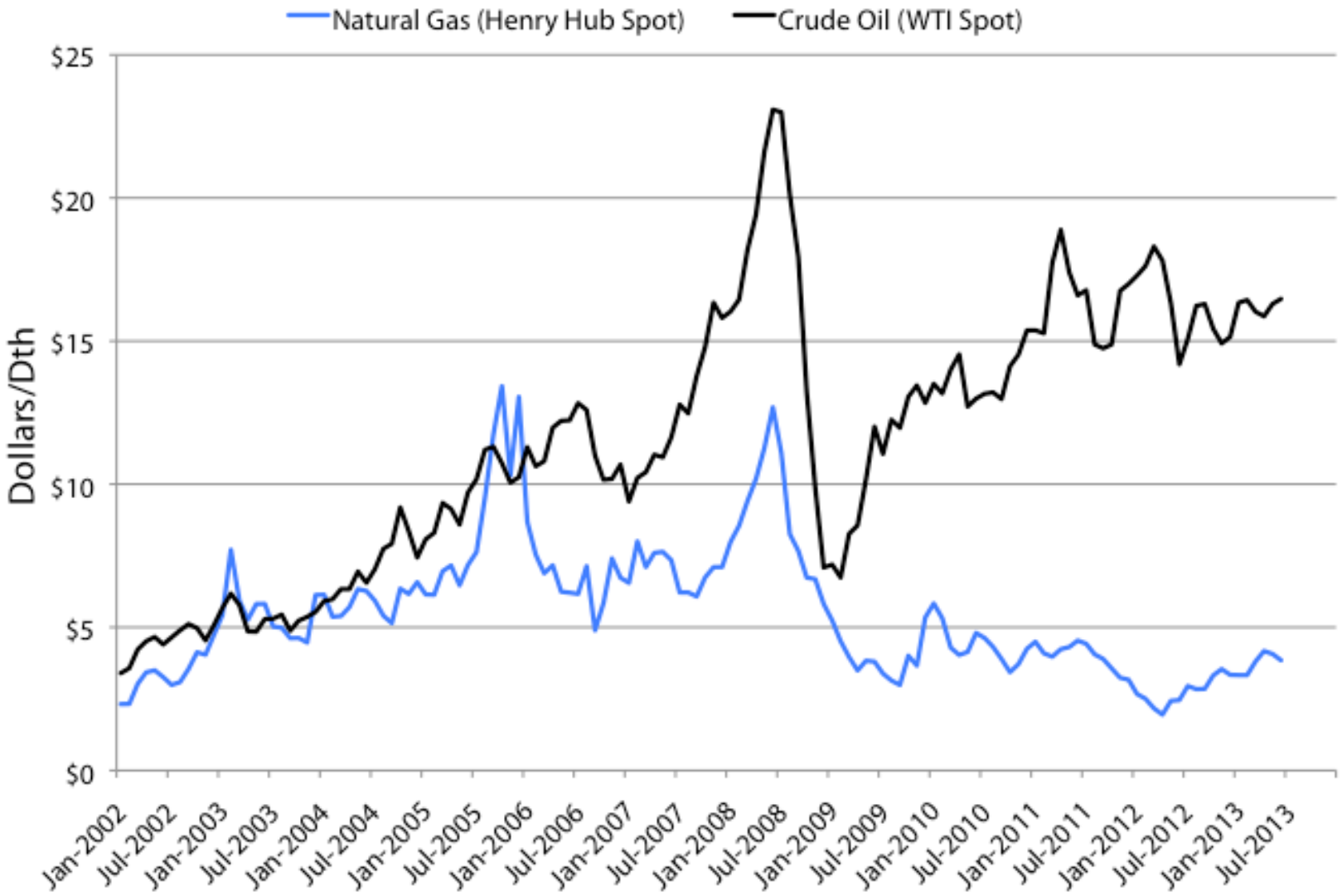
US Natural Gas and Crude Oil Prices



Source: EIA Monthly Spot Prices through June 17, 2013

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Natural Gas Transportation

Natural Gas Use Is Versatile

- Plastics
- Panty hose
- Paints
- Photographic film
- Beer
- Safety glass laminate
- Adhesives
- Solvents
- Carpeting
- Insulation
- Refrigerants
- Windshield washer fluid
- Particle board
- Pigments and dyes
- Frozen french fries
- Pool liners
- Food Packaging
- Metals and recycling
- Glass and recycling
- Bricks
- Lumber
- Paper
- Cardboard
- Fertilizer
- Antifreeze
- Medicines
- Aircraft parts
- Chewing gum

Enormous Economic Impact…

	2010	2015	2035
% of US natural gas production from shale	27%	43%	60%
Jobs supported	600,000	870,000	1.6 MM
Contribution to US GDP	$76.9B	$118.2B	$231.1B

- ✓600K direct jobs in 2010 (up 20% since '07); 870K jobs by 2015; 1.6MM jobs by 2035. In 2010, almost 3 million indirect jobs
- ✓Lower gas prices will add average of $926/yr in disposable household income (2012-2015); $2,000/yr by 2035
- ✓Lower feedstock/energy costs may result in savings of $11.6B/yr; creating 1M additional manufacturing jobs by 2025
- ✓By 2017, lower prices will facilitate 2.9% higher U.S. industrial production; by 2035 industrial production is 4.7% higher
- ✓Lower natural gas prices from shale will result in 10% avg. reduction in power costs nationwide over forecast period

Sources: IHS Global Insight; PwC, Inc.

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Conclusion

- **Natural Gas is:**
  - **Versatile**
  - **Domestic**
  - **Abundant**
  - **Affordable**
  - **Clean**
- **Natural gas serves our interests:**
  - **Energy**
  - **Environment**
  - **Economy**

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