

North American Regional Meeting

Transforming the North American Natural Gas Market – LNG Exports, Regulation of Hydraulic Fracturing and Strategies for Reducing Emissions of Greenhouse Gases - The Need for an Integrated Regional Strategy

MODERATOR

Andrew D. Weissman, *Senior Energy Advisor*, Haynes and Boone, LLP

PANELISTS

Mindy Walls, *Senior Director - Corporate Development*, Chesapeake Energy Corporation

James Walls, *Managing Member*, Spilman Thomas & Battle, PLLC

World Services Group – 2013
North American Regional Meeting

Transformation of the North American
Natural Gas Market – Part I



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haynesboone

Setting precedent.

*This presentation is for informational purposes only and is not intended to be legal advice.
It is not intended to establish an attorney-client relationship. Legal advice of any nature should be sought from legal counsel.*

About Andy Weissman

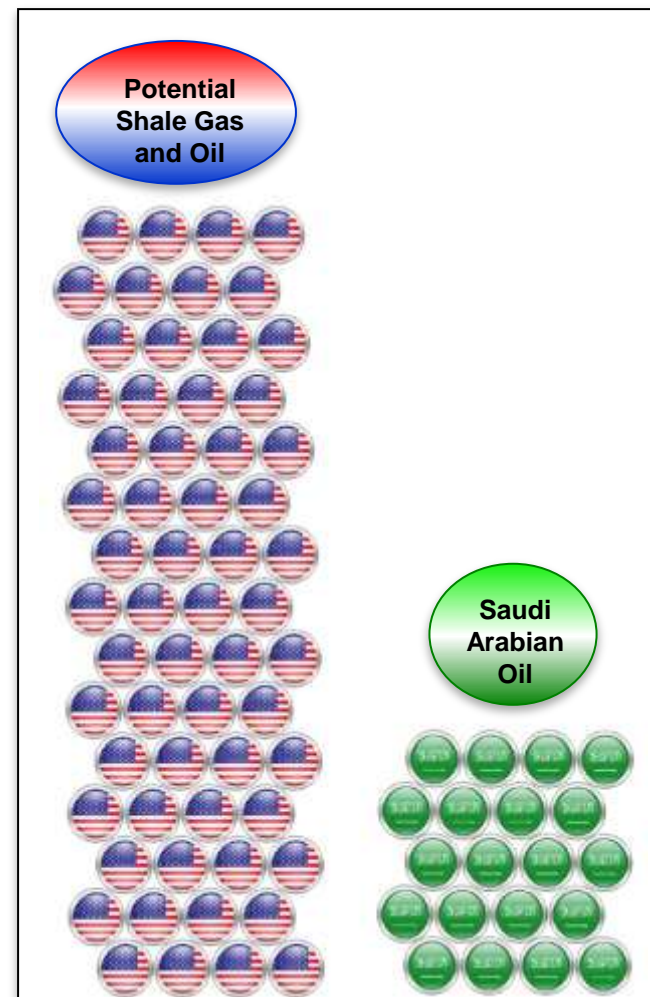
- Senior Energy Advisor at Haynes and Boone, LLP
 - 30+ years experience
 - Attorney and energy domain expert
 - Focuses on high stakes energy and Clean Air Act issues
 - Develops innovative new corporate transactions and deal structures
 - Expert witness in numerous regulatory proceedings
- Founder and CEO of EBW AnalyticsGroup www.EBWAnalytics.com
 - Premier energy market analysis service
 - Consistently among first to spot emerging price trends
 - Developing new interactive, web-based energy market analysis platform
 - Publishes weekly research reports on electricity, natural gas and oil markets
- Helped to pioneer emissions trading in United States
- Andrew.Weissman@haynesboone.com or 202-654-4515



Transformational Event

- **Shale revolution creates potential to re-shape the North American economy and usher in a new North American century**
 - 19th Century – Age of coal
 - 20th Century – Age of oil
 - 21st Century – Shale revolution
- **Most disruptive new technology since IT and telecom revolution of '90s**
- **Energy independence has become realistic goal**
- **Impact extends deeply throughout U.S. economy**
 - New era of low-cost energy
 - Natural gas, Natural Gas Liquids, oil and power
 - Renaissance for U.S. manufacturing
- **Potential to become prime driver for economic growth**
 - Trillions of dollars of new capital investment and 3+ million new jobs
- **Far-reaching geopolitical and environmental benefits**

POTENTIAL SHALE PRODUCTION VS.
TOTAL SAUDI OIL PRODUCTION PAST 20 YEARS
(Energy Equivalent Terms)



Source: EBW

Fundamentally Different Resource

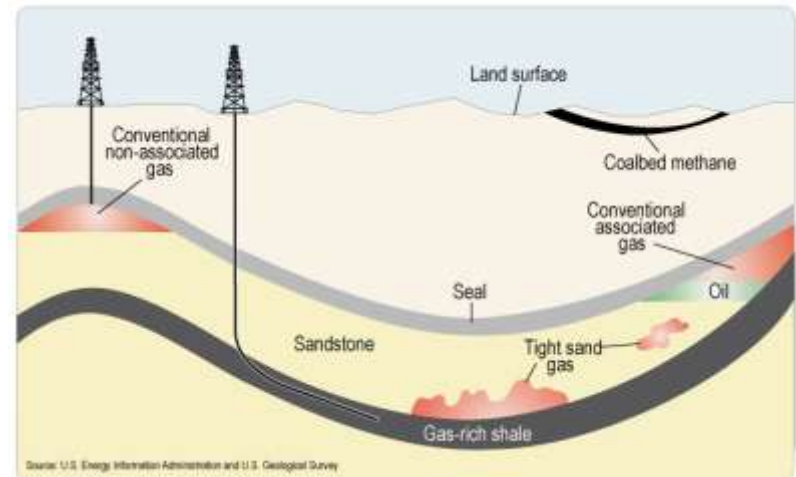
- **Extends over large portions of North America in seams 200 to 1,000 feet thick**
 - Source rock for hydrocarbons deeply embedded at microscopic level
- **Extracted using fundamentally different techniques**
 - State-of-the-art technology play
- **U.S. and Canada far ahead of the rest of the world**
 - Reserves among the best in the world
 - Huge lead in technology, human resources and infrastructure required to develop

NORTH AMERICAN SHALE PLAYS, AS OF MAY 2011



Source: EIA

CONVENTIONAL NATURAL GAS WELLS AND SHALE GAS WELLS

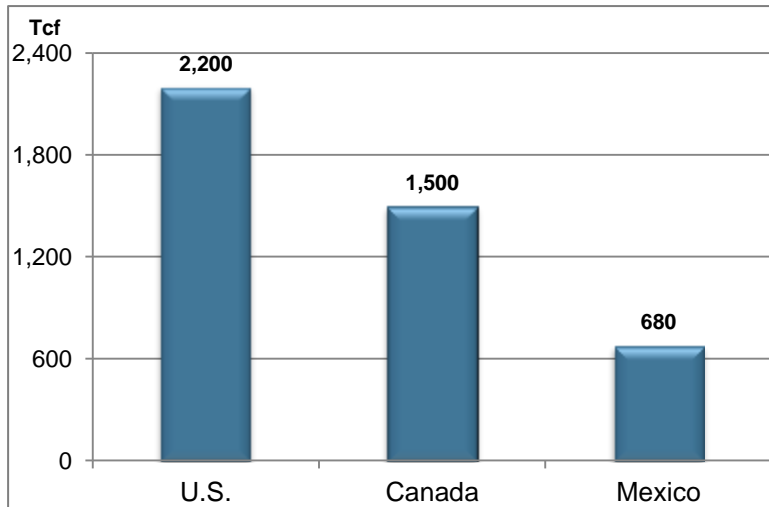


Source: EIA

Region-Wide Potential: Off the Charts

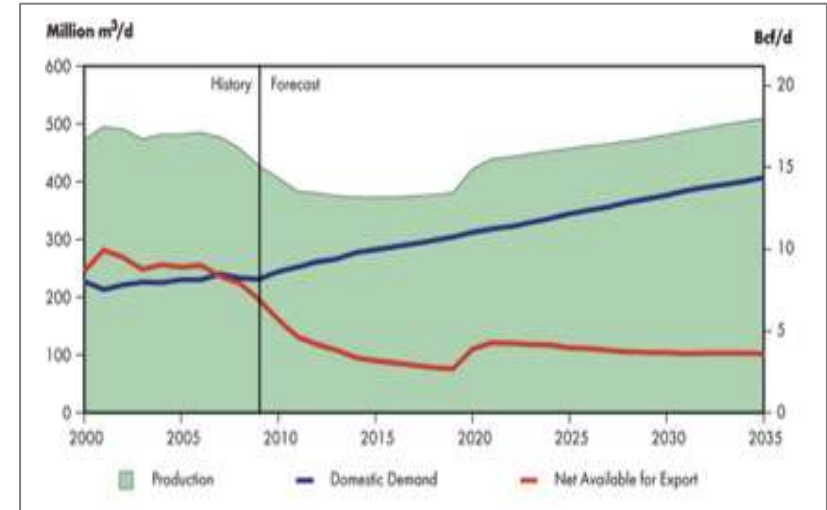
- **Nearly 4,400 Tcf of technically recoverable reserves**
- **Canadian potential not currently expected to be heavily tapped**
- **No current development plan for Mexico**
 - 4th largest reserves of any nation

TECHNICALLY RECOVERABLE RESERVES (Tcf)



Source: EIBW

CANADIAN NATURAL GAS DEMAND AND PRODUCTION



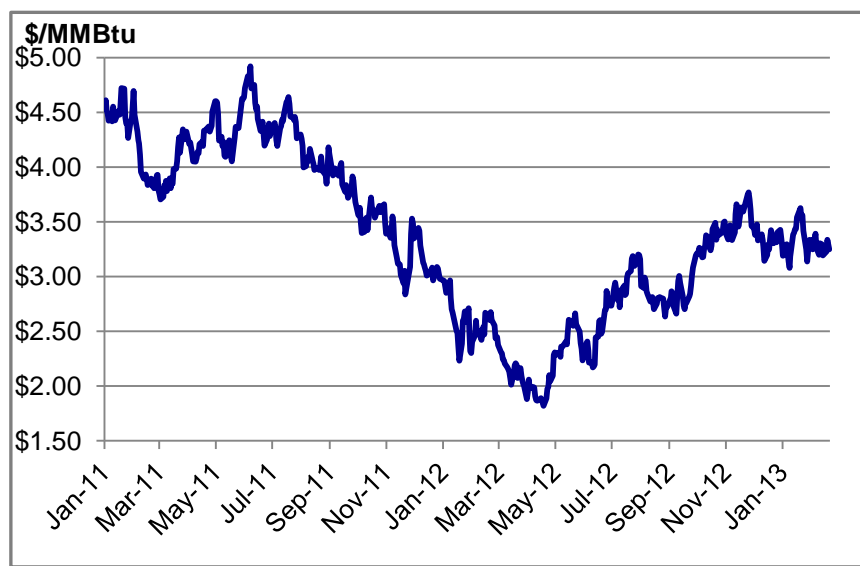
Source: National Energy Board

Hurdles to Overcome

- **Industry has been a victim of its own success**
- **Prices have plunged**
 - Particularly for natural gas and ethane
- **Over past 24 months, top five independent producers have lost \$50 billion in market cap**
- **Increased demand critical to success**

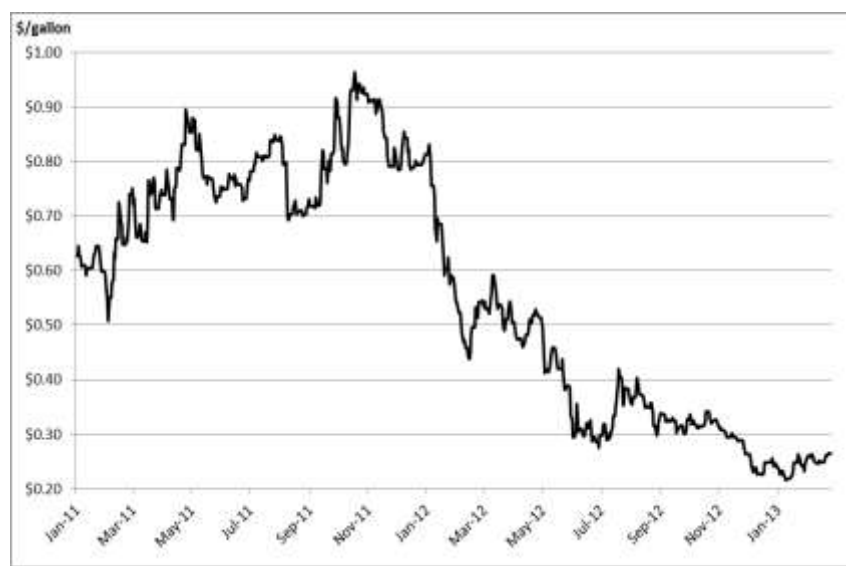


NG PRICES AT HENRY HUB – 1/1/11 TO 2/22/13



Source: EBW

NORTH AMERICAN SPOT LPG PURITY ETHANE PRICE/MONT BELVIEU – 1/1/11 TO 2/22/13

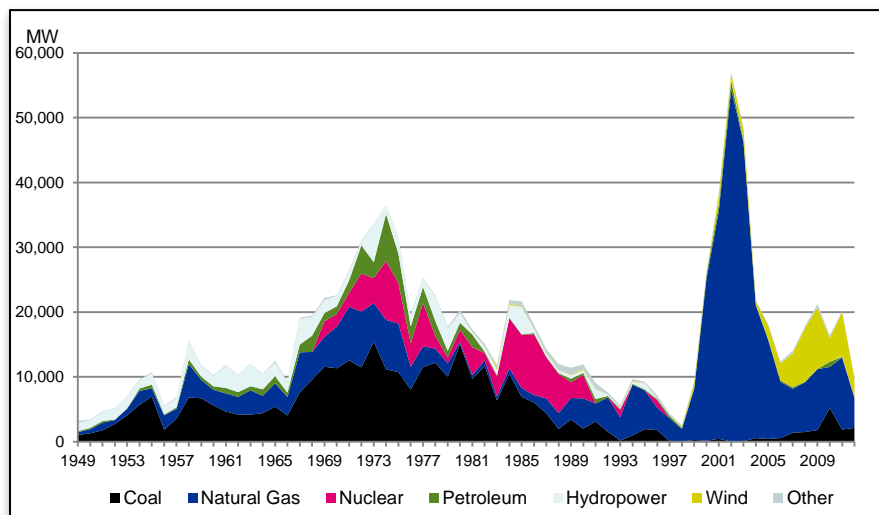


Source: EBW

Train Wreck During Past Decade

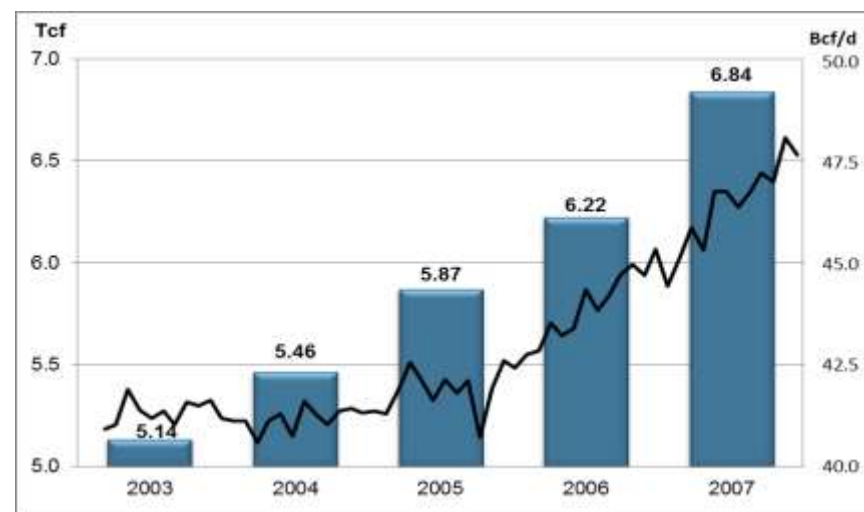
- **Root cause of steep natural gas and electricity price increases combined impact of:**
 - Surge in power sector demand for natural gas
 - Inability to increase supply rapidly enough to meet market needs pre-shale
 - Sharp decline in availability of oil-to-gas fuel switching
 - Lack of adequate storage capacity to meet winter needs

**ELECTRIC GENERATION CAPACITY ADDITIONS
BY FUEL TYPE SINCE 1949**



Source: EIA, EBW

**TOTAL U.S. NATURAL GAS PRODUCTION IN LOWER 48 STATES
FROM JANUARY 2003 TO DECEMBER 2007**

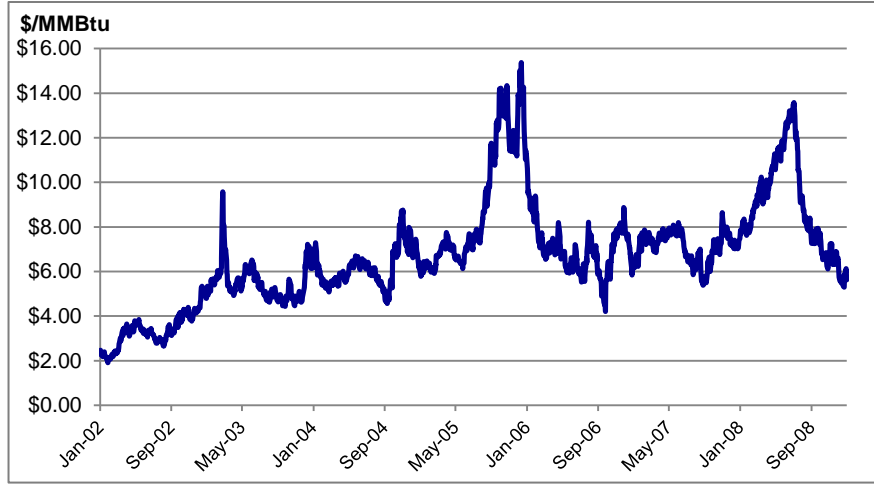


Source: EBW

Demand Destruction Driven Market

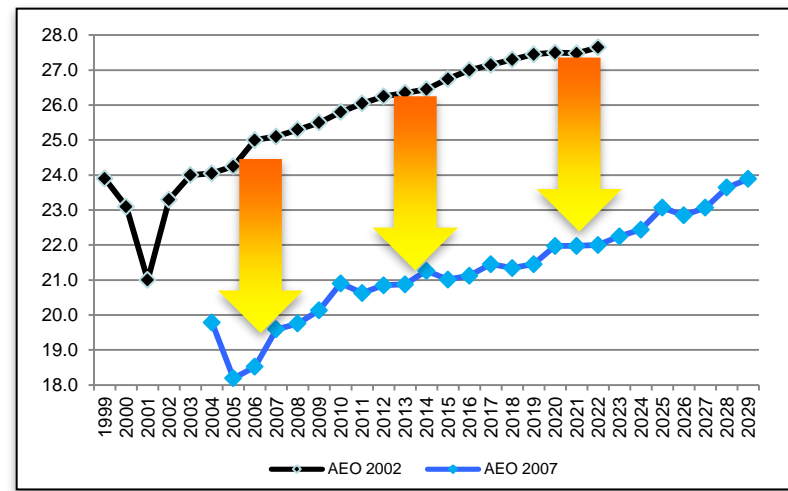
- To balance supply and demand, needed to drive out price-sensitive users
- Brutal impact on manufacturing sector and increases in electricity rates
- Inflamed by lack of adequate storage capacity
 - Greatly increased vulnerability to severe price spikes in peak demand months
- Risk premium of up to \$2.00-\$4.00/MMBtu added to natural gas futures
- Price shocks created searing memory
 - Need to ensure stable prices to attract new demand and facilitate financing

**NYMEX FRONT-MONTH NATURAL GAS,
JANUARY 1, 2002 TO DECEMBER 31, 2008**



Source: EBW

REDUCTIONS IN PROJECTED INDUSTRIAL DEMAND (BCF/D)

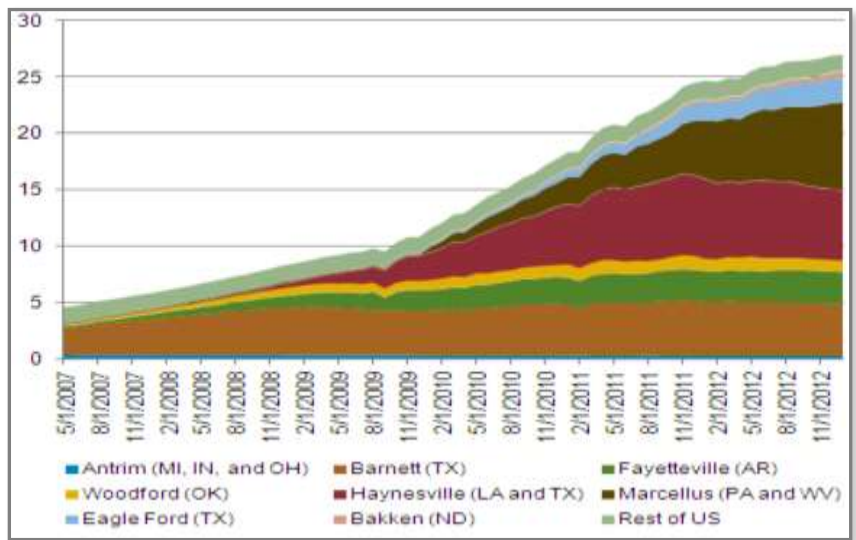


Source: EBW

Dynamics of Past Decade Permanently Reversed

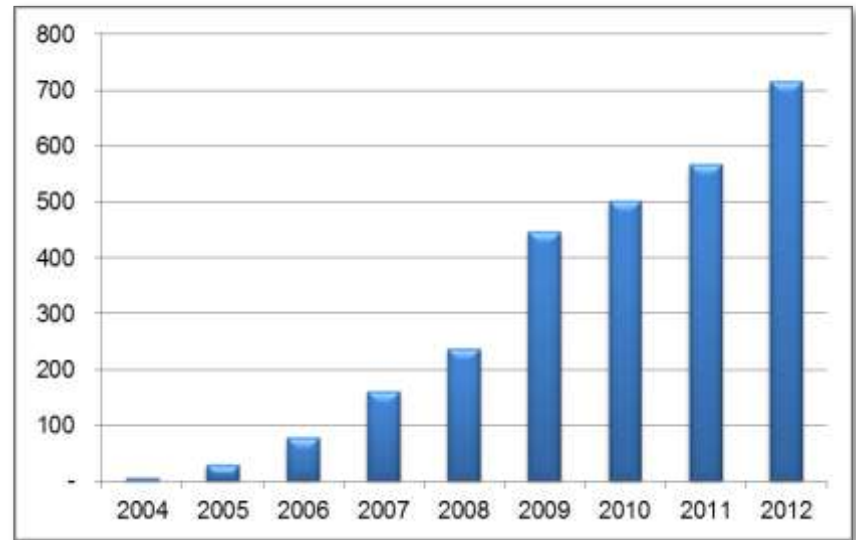
- **Market has been changed by (i) shale gas and (ii) much bigger storage capacity**
 - Natural gas production has been greatly increased due to shale
 - Crisis of past decade was due to a gradual 5.4 Bcf/day increase in power-sector demand over a multi-year period
 - Increases like this can now be achieved in less than twelve months
 - Huge storage cushion offers additional time to respond to demand increases
- **Risk of sustained price spikes has been almost entirely eliminated**
 - Reduces risk premium to minimal level

GROWTH IN NORTH AMERICAN SHALE PRODUCTION, 2007 TO 2012 (BCF/D)



Source: EIA

CUMULATIVE STORAGE ADDITIONS SINCE 2003 (BCF)

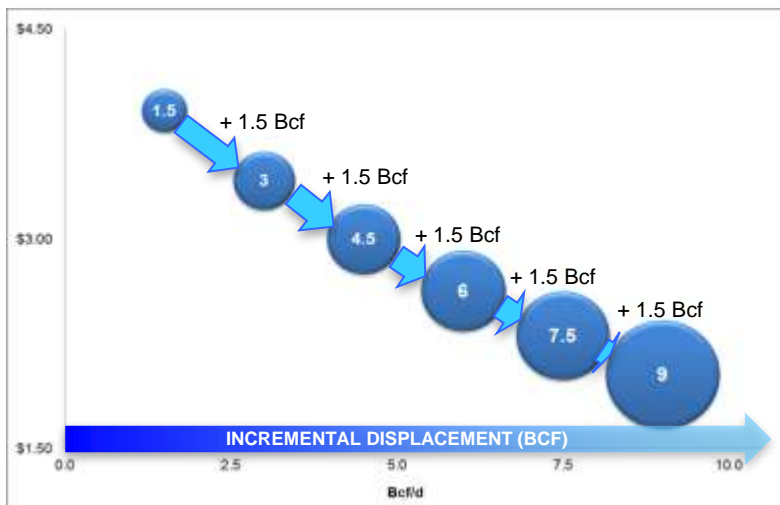


Source: EIA

Coal Displacement Drives Prices For Natural Gas and Electricity

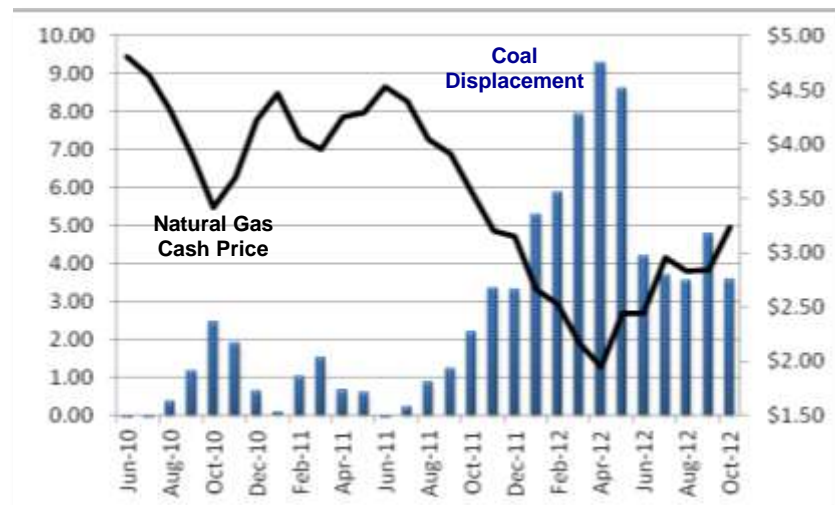
- Natural gas supplies far exceed market needs if NG priced above coal
- Coal displacement only effective way to balance the market
- Prices must fall far enough to cause sufficient substitution of natural gas for coal to absorb available gas
- Electricity, natural gas and coal now permanently linked
 - Creates downward price pressure in all three markets
- If gas prices rise, coal-fired units will quickly take back market share
 - Limits potential for natural gas prices to rebound

REQUIRED COAL DISPLACEMENT – TWELVE-MONTH CYCLE



Source: EBW

COAL DISPLACEMENT VS \$4.50/MMBTU NATURAL GAS

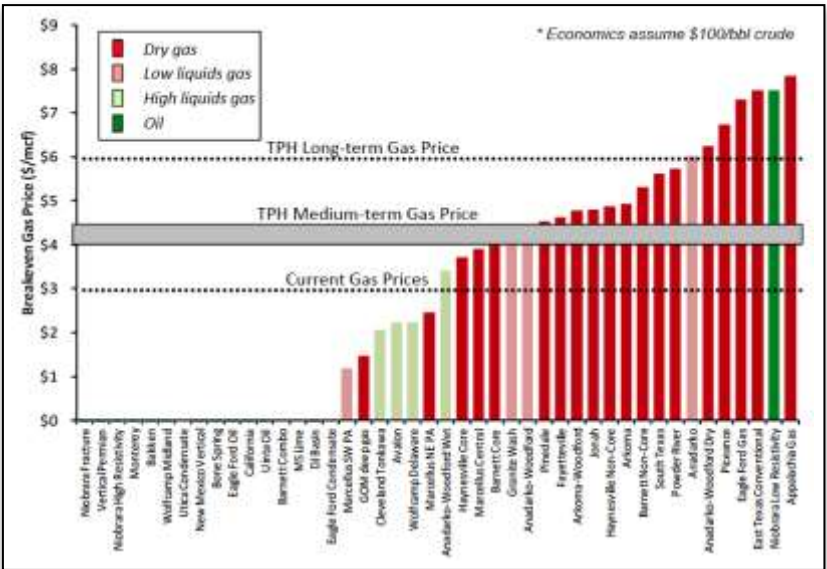


Source: EBW

Asymmetrical Price Risks

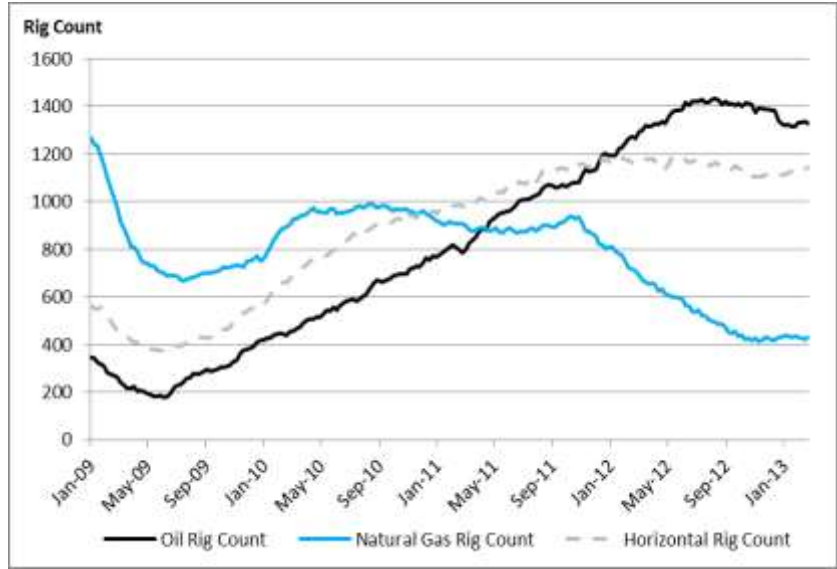
- New market dynamic creates low – and declining - price ceiling for natural gas
- Market vulnerable to frequent downward price swings due to:
 - Inevitable periods of mild weather
 - Over-production by exploration and production companies
- Natural gas rig count has become meaningless and misleads market
- Continued increases in drilling liquid-rich plays could increase downside risk
 - But some liquid-rich plays profitable even at rock-bottom natural gas prices
- If demand for natural gas starts to increase, supplies likely to quickly catch up

GAS PRICE REQUIRED FOR 10% ATROR



Source: Tudor Pickering Holt & Co

BAKER HUGHES RIG COUNT OF OIL, NATURAL GAS, AND HORIZONTAL RIGS, JANUARY 2009 TO FEBRUARY 2013

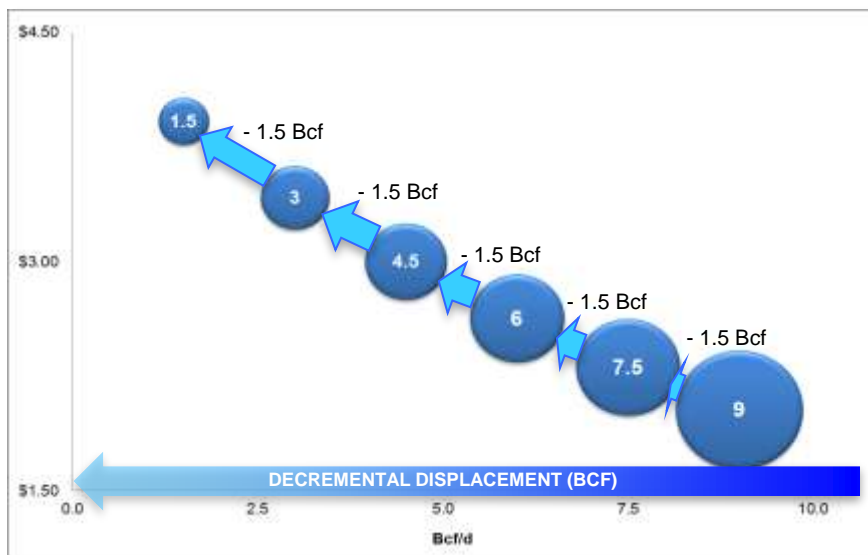


Source: EBW

Implications for Price Forecasts and Hedging

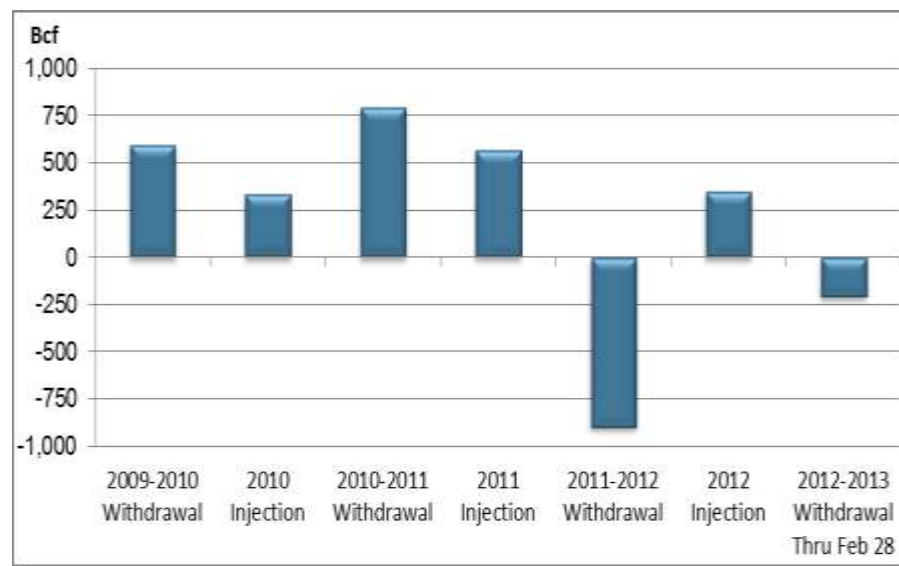
- **Potential price outcomes can be predicted with more confidence**
 - Key is to fully understand implications of convergence between natural gas, coal and electricity markets
- **Requires new analytical tools to assess how coal displacement and weather drive market**
- **Scenario analysis critical**

REDUCTIONS IN NATURAL GAS USE FROM SWITCHING BACK TO COAL IF GAS PRICES RISE



Source: EBW

DEVIATION FROM NORMAL WEATHER-DRIVEN DEMAND (BCF)



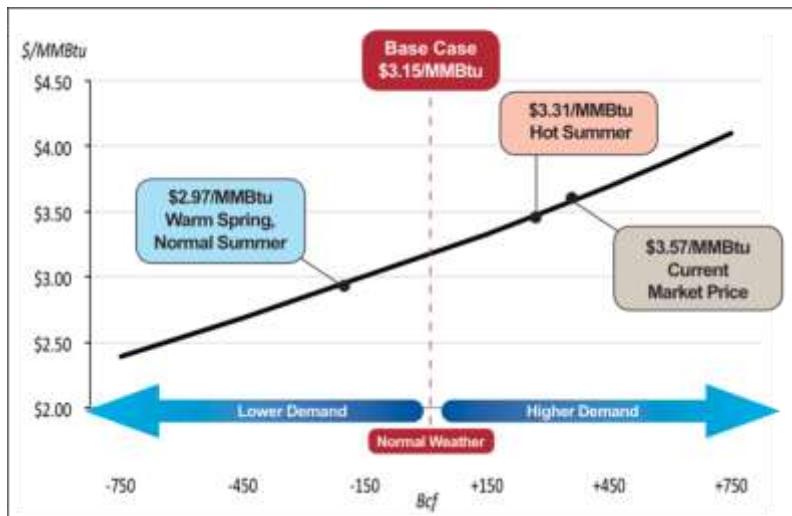
Source: EBW

EBW MarketPro™ Provides Transparency

- **Eliminates need to guess**
- **Includes weekly price forecast curves and interactive web-based market analysis platform**
 - Uses cutting-edge proprietary models developed over a period of 10+ years
 - Enables users to evaluate unlimited number of scenarios
- **Public launch scheduled for early April**
 - 3% of all natural gas production in U.S. already hedged using this tool

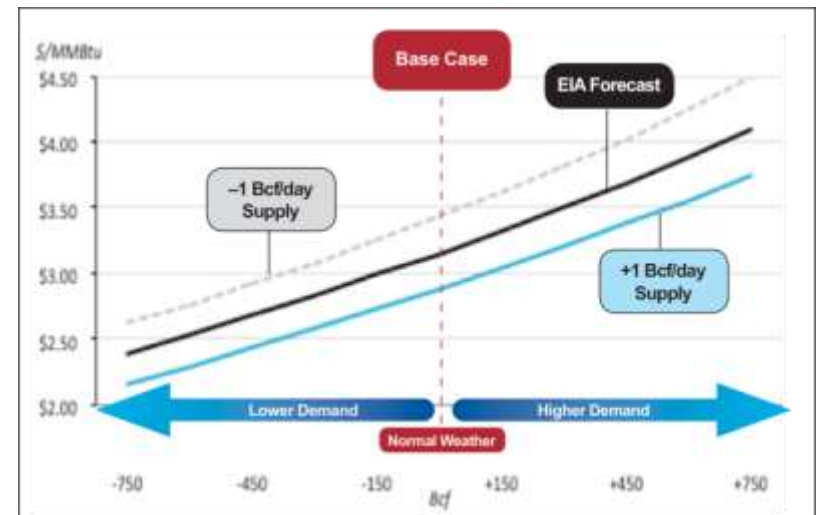


MARKET EQUILIBRIUM PRICE FOR STORAGE TARGET OF 3,950 BCF ON OCTOBER 31, 2013



Source: EBW

IMPACT OF 1 BCF/DAY SHIFT IN PRODUCTION (3,950 BCF STORAGE TARGET)

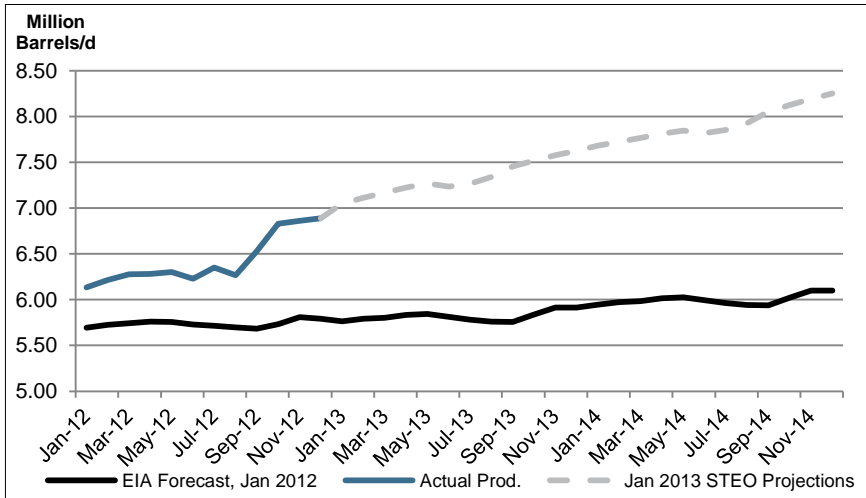


Source: EBW

Price Path for Petroleum Liquids Uncertain

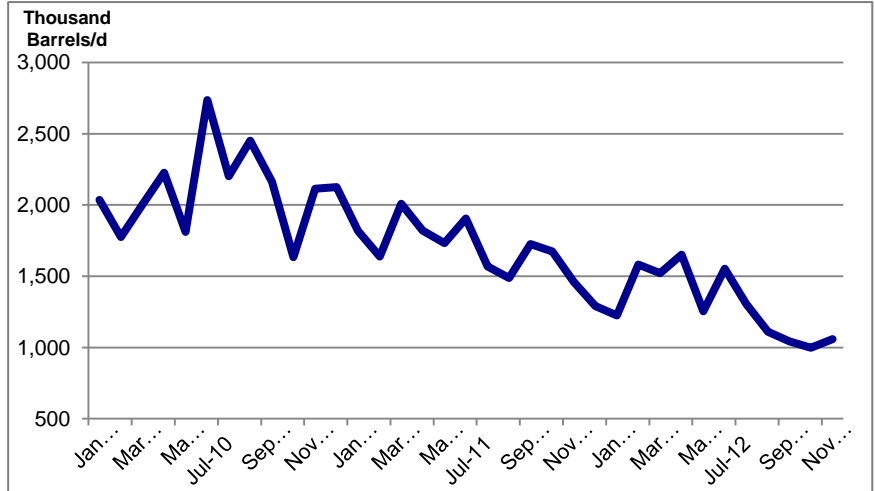
- **Global market will continue to influence prices – but by how much?**
- **New wells continue to be added at ferocious rate**
 - U.S. imports of light sweet crude cut in half past 12 months
- **EIA warns of potential glut of light sweet crude next year**
- **Key issues:**
 - Transportation infra-structure and refinery modifications
 - Rate at which product exports can continue to be expanded
- **Increasing value of natural gas portion of hydrocarbon stream critical to maximize growth in production**

U.S. PRODUCTION OF CRUDE OIL VS EIA PROJECTIONS



Source: EIA

MONTHLY IMPORTS OF LIGHT SWEET CRUDE OIL, JANUARY 2010 THROUGH NOVEMBER 2012



Source: EBW

For more information, please contact:

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Also check out:

www.EBWMarketPro.com

www.EBWAalytics.com

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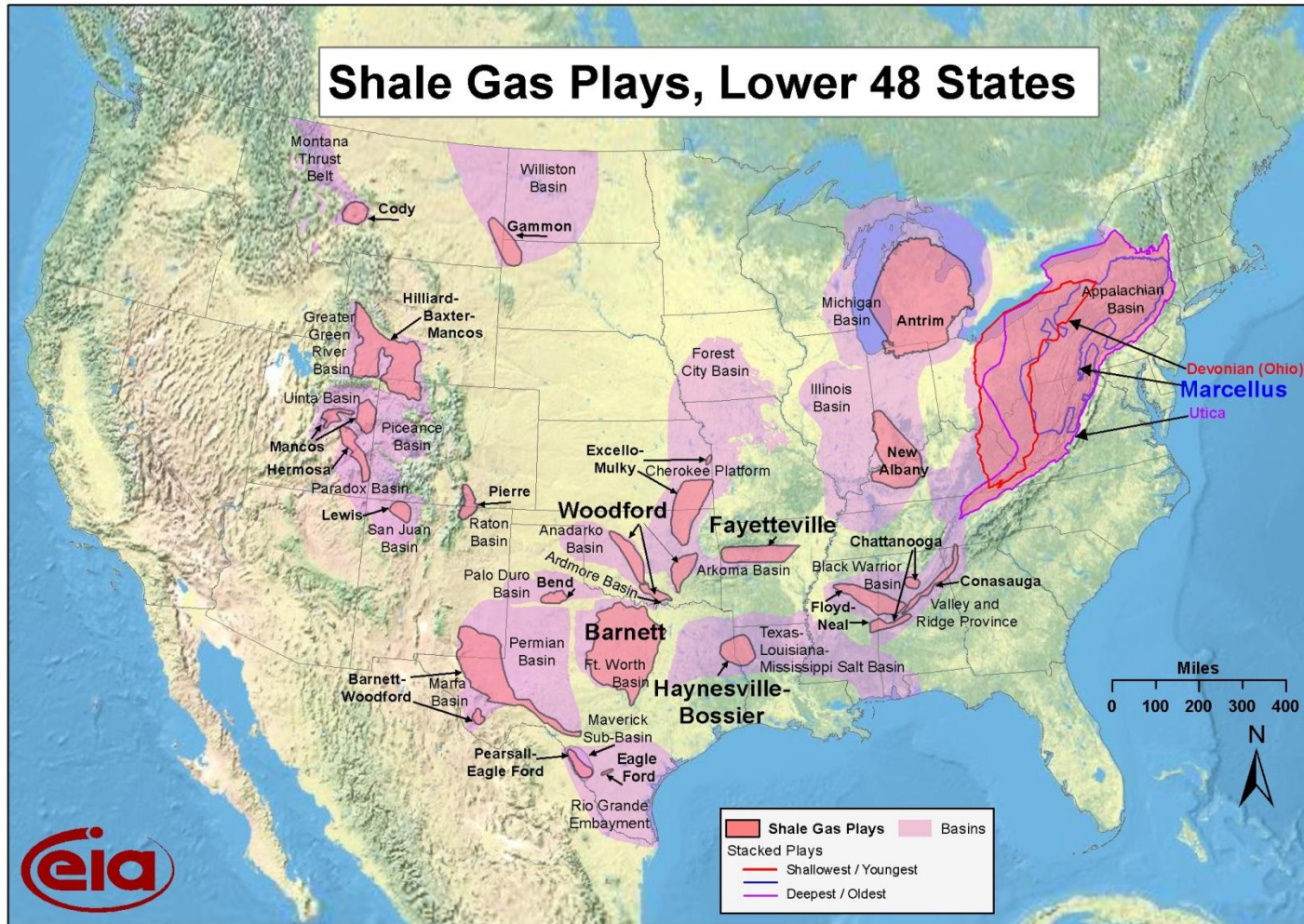
INTRODUCTION TO NATURAL GAS EXPLORATION AND PRODUCTION AND INDUSTRY OVERVIEW



MINDY WALLS
SENIOR DIRECTOR, CORPORATE DEVELOPMENT
CHESAPEAKE ENERGY



SHALE GAS REVOLUTION ACROSS THE U.S.



Source: Energy Information Administration

INDUSTRY SEGMENTS

UPSTREAM



Exploration and Production

- Gas Field Exploration
- Well Drilling and Hydraulic Fracturing
- Gas Recovery and Production

MIDSTREAM



Gathering and Gas Processing

- Gas Collection and Transportation Systems (Gathering Pipelines)
- Gas Processing (Dehy, Separation, Fractionation)
- Compression (Well Head, Gathering)

DOWNSTREAM



Selling and Distribution

- Interstate and LDC Transportation Systems (Transmission and Distribution Pipelines)
- Compression (Transmission)
- Regulation
- Metering

OIL AND GAS REGULATIONS

FEDERAL



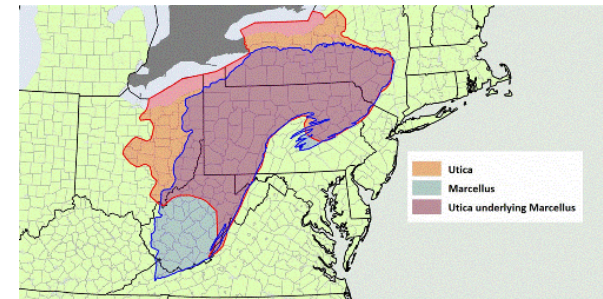
Site Construction



Reclaimed/Completed Site



STATE



The Utica underlies the Marcellus in many areas, coming closer to the surface in eastern Ohio. (Source for Marcellus and Utica outlines: Energy Information Administration.)



Drilling



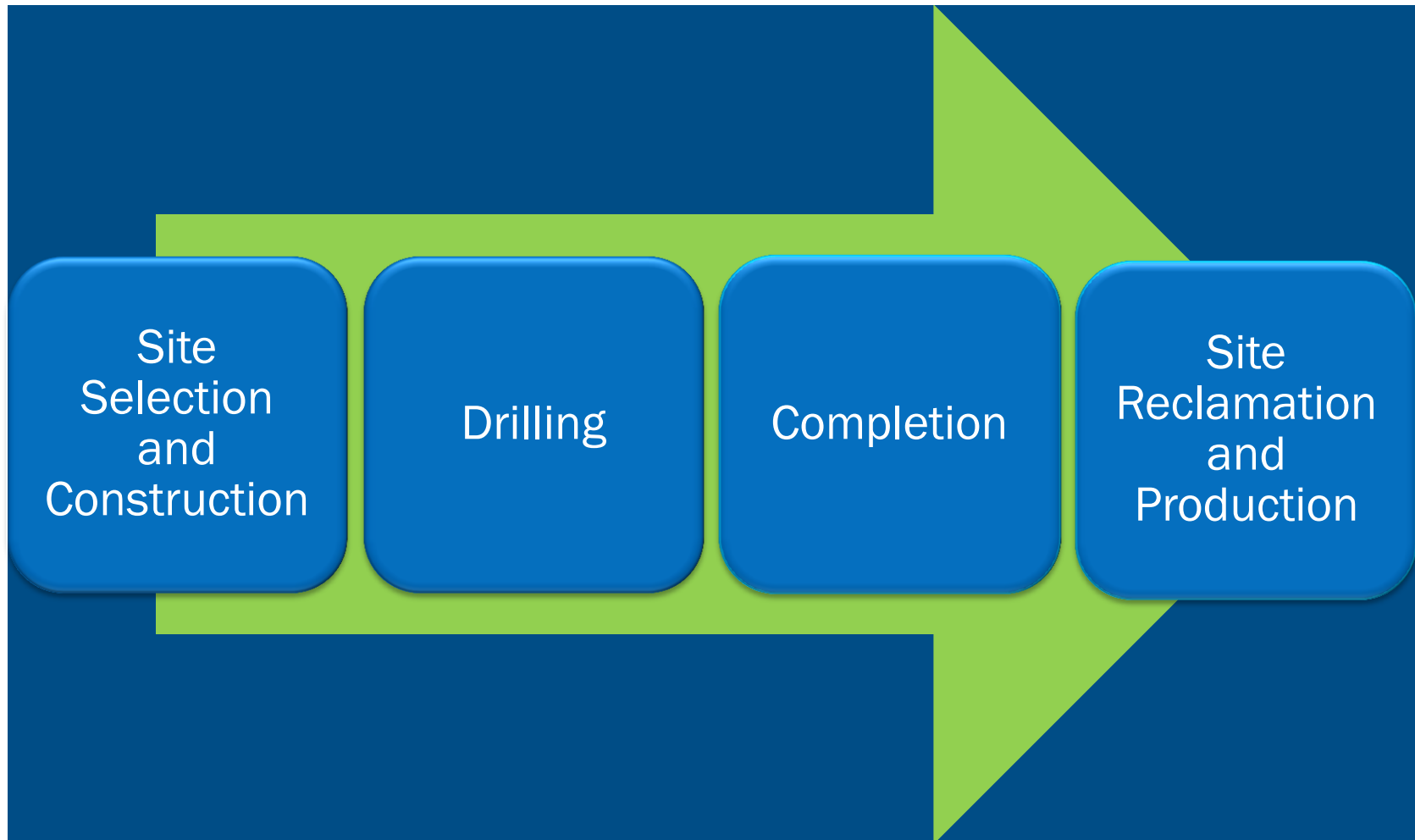
Hydraulic Fracturing



Midstream

Federal, state, and local regulations apply to Chesapeake and the oil and natural gas industry. States play the primary regulatory role.

Stages of Development



Factors in Site Selection



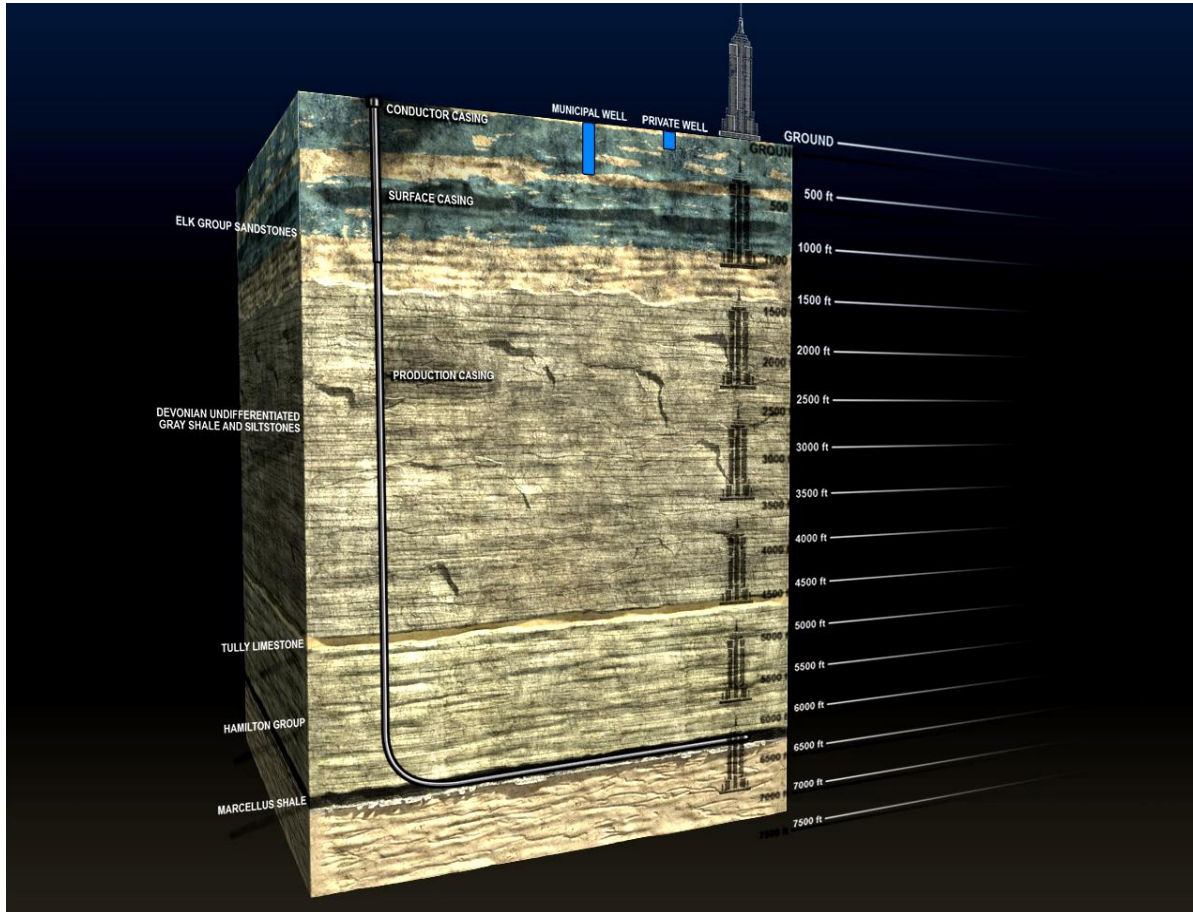
- Leasehold
- Favorable geology
- Topography
- Access Roads
- Routes for pipelines and utilities
- Environmental factors such as wetlands and sensitive wildlife habitat
- Available water source(s)

DRILLING ANIMATION

<http://www.chk.com/Media/Educational-Library/Animations/Pages/default.aspx>

How Deep Do We Drill?

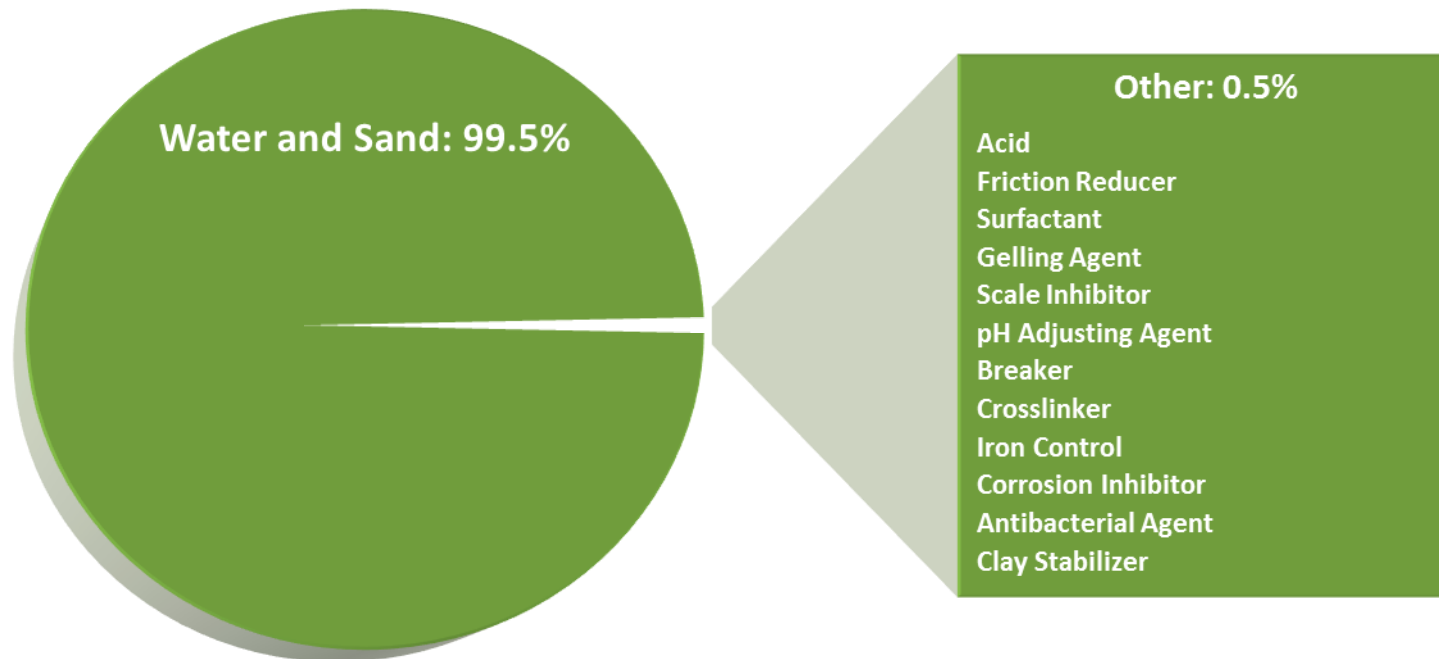
- The Empire State Building is 1,250 feet from the base to the roof.



COMPLETIONS

<http://www.chk.com/Media/Educational-Library/Animations/Pages/default.aspx>

TYPICAL DEEP SHALE GAS HYDRAULIC FRACTURING MIXTURE



Not ALL of the chemicals are used in every well.
Chesapeake actively participates in a national publicly accessible web-based registry to report the additives used in the process on a well-by-well basis.

www.fracfocus.org

RAW FUEL SOURCE WATER USE EFFICIENCY

Energy resource	Range of gallons of water used per MMBtu of energy produced
Chesapeake deep shale natural gas*	0.84-1.32
Conventional natural gas	1-3
Coal (no slurry transport) (with slurry transport)	2-8 13-32
Nuclear (processed uranium ready to use in plant)	8-14
Conventional oil	8-20
Synfuel – coal gasification	11-26
Oil shale petroleum	22-56
Tar sands petroleum	27-68
Synfuel – Fisher Tropsch (Coal)	41-60
Enhanced oil recovery (Coal)	21-2,500
Biofuels (Irrigated Corn Ethanol, Irrigated Soy Biodiesel)	>2,500

Comparative Use of 5.6 Million Gallons

- New York City in 8 Minutes
- Golf Course in 28 Days
- Nine Acres of Corn in a Season
- A 1,000 MW coal-fired power plant in 13 hours

Source: USDOE 2006 (other than CHK data)

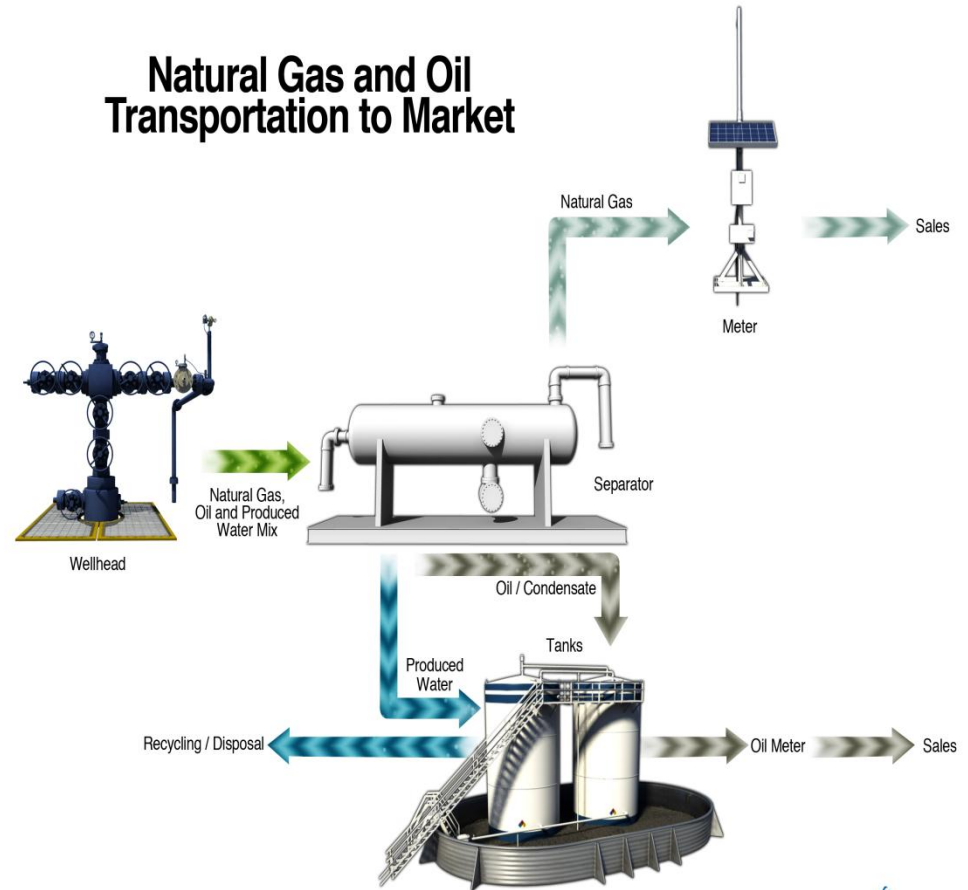
*Does not include processing which can add from 0 - 2 gallons per MMBtu

Solar and wind not included in table (require virtually no water for processing)

Values in table are location independent (domestically produced fuels are more water efficient than imported fuels)

MARKETING/PRODUCTION TO SALES

- ❖ Gas and produced water reach surface
- ❖ Gas and water are separated by the “Separator”
- ❖ Gas travels through sales meter to pipeline
- ❖ Pipeline carries gas to market
- ❖ Produced water is retained on location in tanks until removed via truck



Gathering Line Construction



Spring 2010 -Asylum Township, Bradford County



Summer 2010-Asylum Township , Bradford County

Compressor Stations

- Moves the gas from Point A to Point B
- Brings gas flow to the right pressure for transmission
- Water vapor filtered out of natural gas stream
- Compression can occur at either:
 - The wellhead
 - A centralized location



NATURAL GAS USES



ENERGY INDEPENDENCE!

PROBLEM.

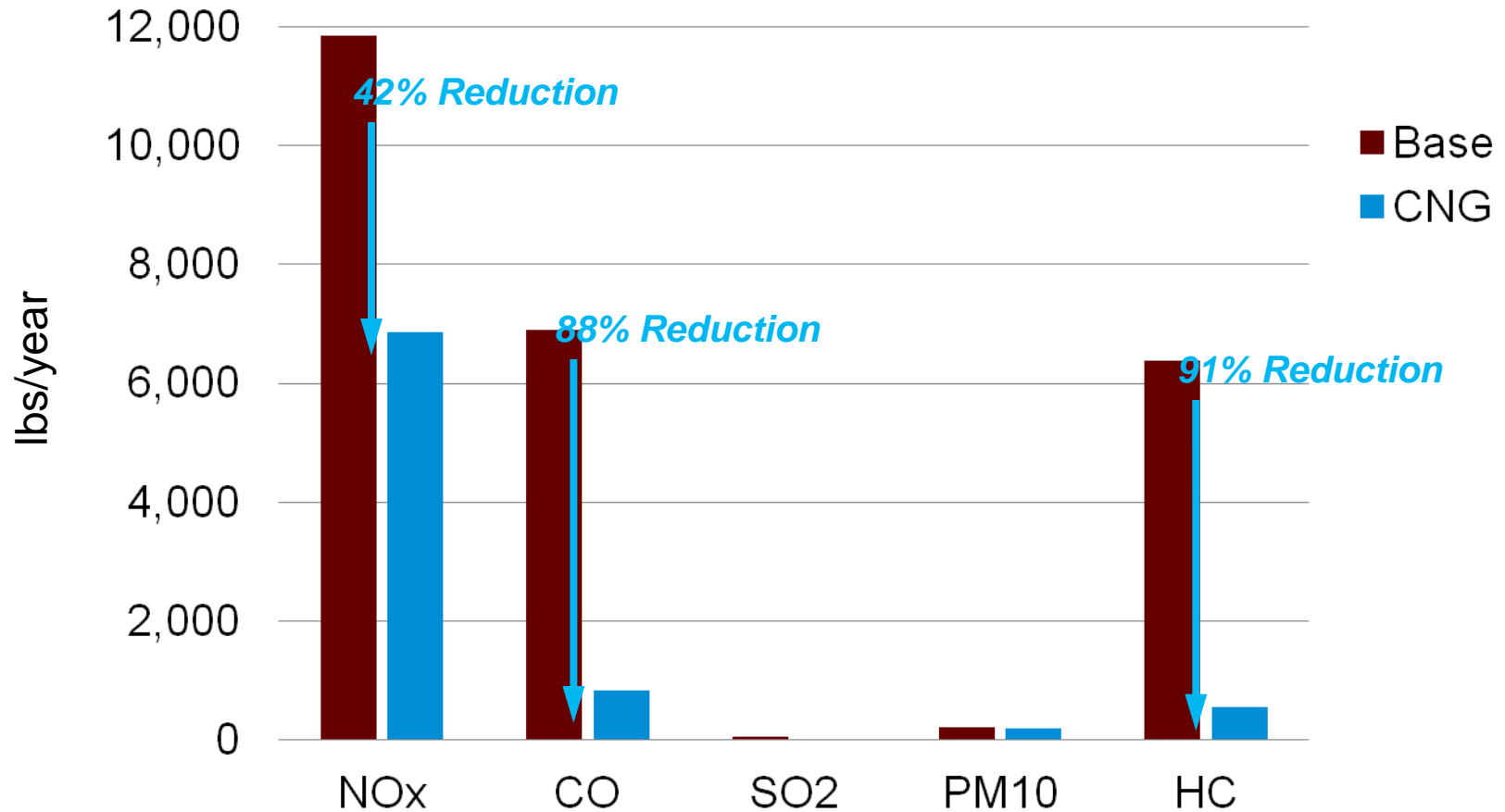


SOLUTION.



NEIGHBORHOOD AIR EMISSIONS

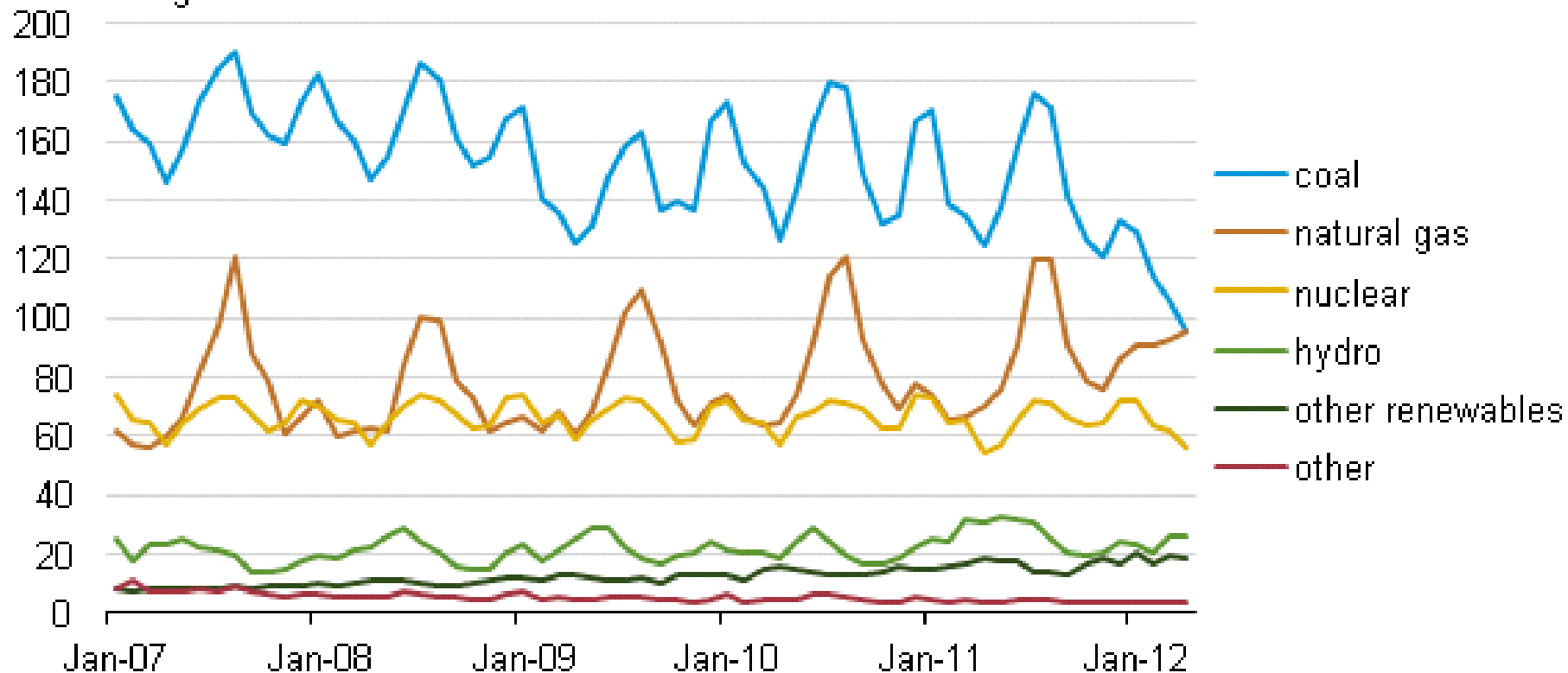
Neighborhood Air Emissions Base Case (Diesel) vs. CNG Case



U.S. Power Generation

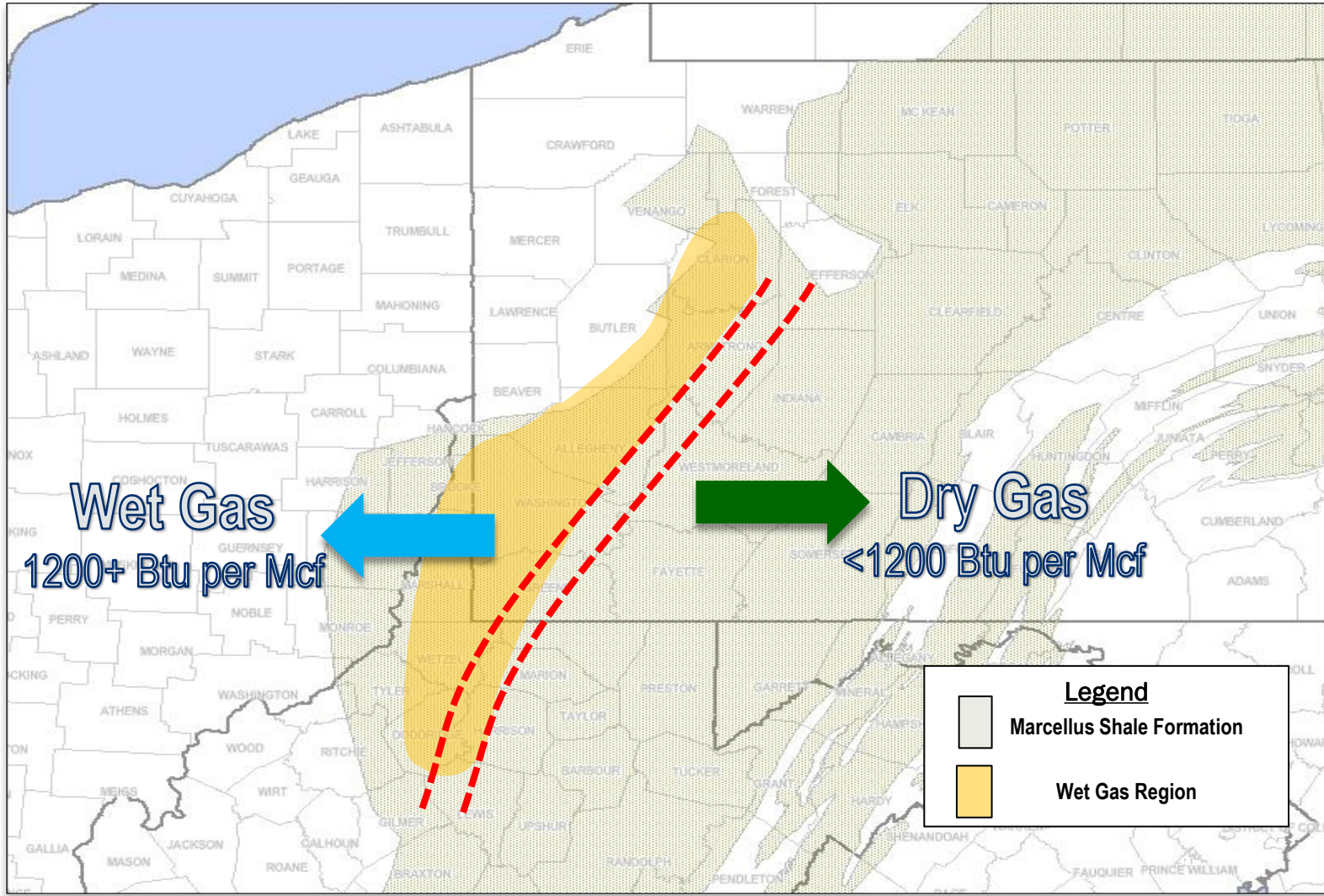
U.S. monthly net electric power generation, January 2007 – April 2012

million megawatthours



Monthly coal- and natural gas-fired generation equal for first time in April 2012

“WET GAS” REGION OF MARCELLUS SHALE



Sources: Pace Global; Equitable Resources, MarkWest, Atlas Energy, Range Resources, and Caiman Energy.

ETHYLENE CHAIN



Natural Gas



Cracker



Intermediate Products

- PVC
- Vinyl Chloride
- Ethylene Glycol
- Styrene
- Polystyrene



- Pool Liners
- Window Siding
- Trash Bags
- Sealants
- Carpet Backing
- Insulation
- Detergent
- Flooring
- Pipes



- Food Packaging
- Bottles
- Cups
- Housewares
- Crates



- Footwear
- Clothes
- Diapers
- Stockings
- Toys
- Textiles



- Tires
- Sealants
- Paint
- Antifreeze

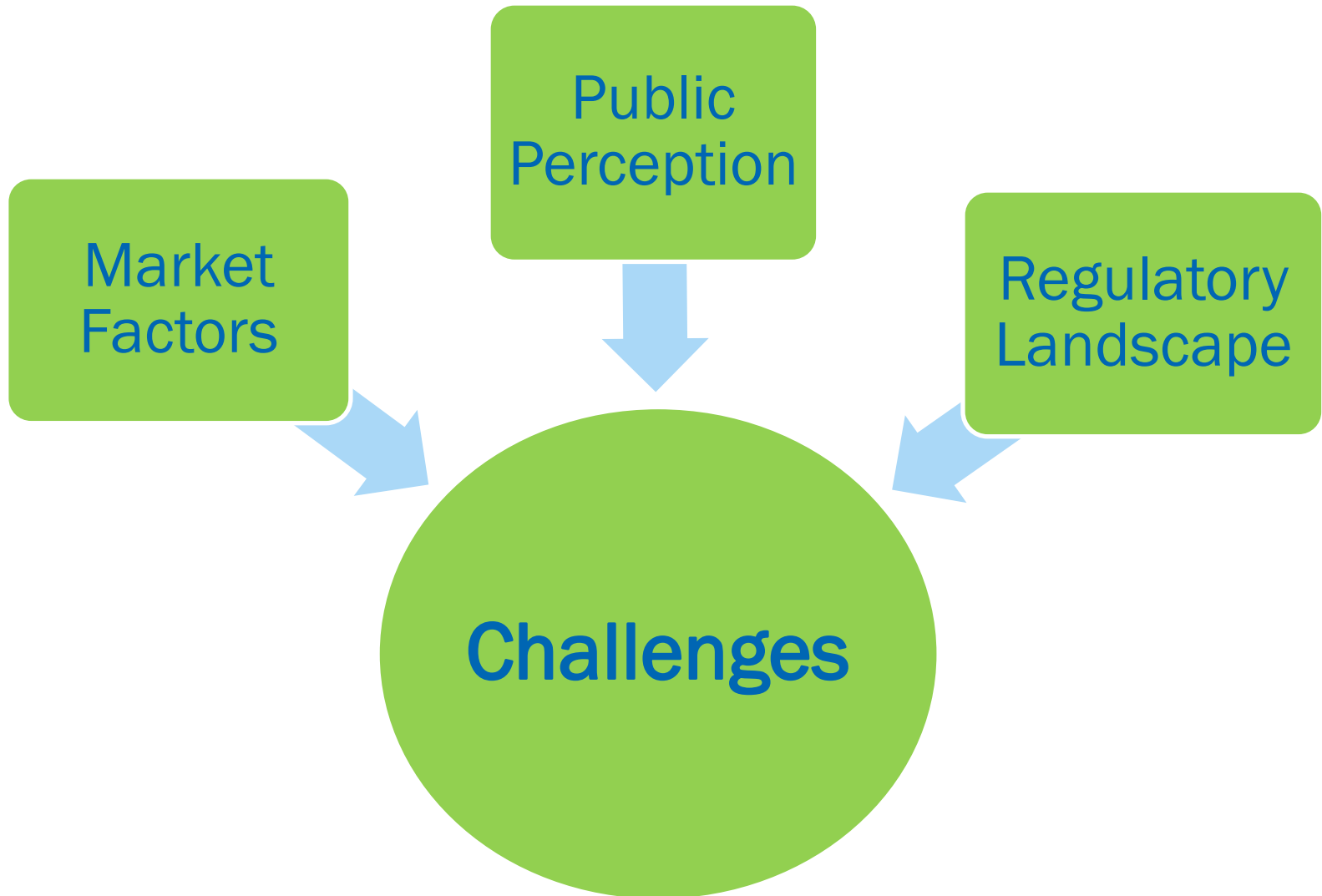


- Adhesives
- Coatings
- Films
- Paper Coatings
- Models
- Instrument Lenses





CHALLENGES





SPILMAN THOMAS & BATTLE, PLLC

ATTORNEYS AT LAW

Drilling Down on Regulatory Challenges

February 28, 2013

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Spilman Thomas & Battle, PLLC

48 Donley Street, Suite 800

Morgantown, WV 26501



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The First Oil & Gas Boom



PIONEER FURNACE



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The Second Oil & Gas Boom

History Repeats Itself









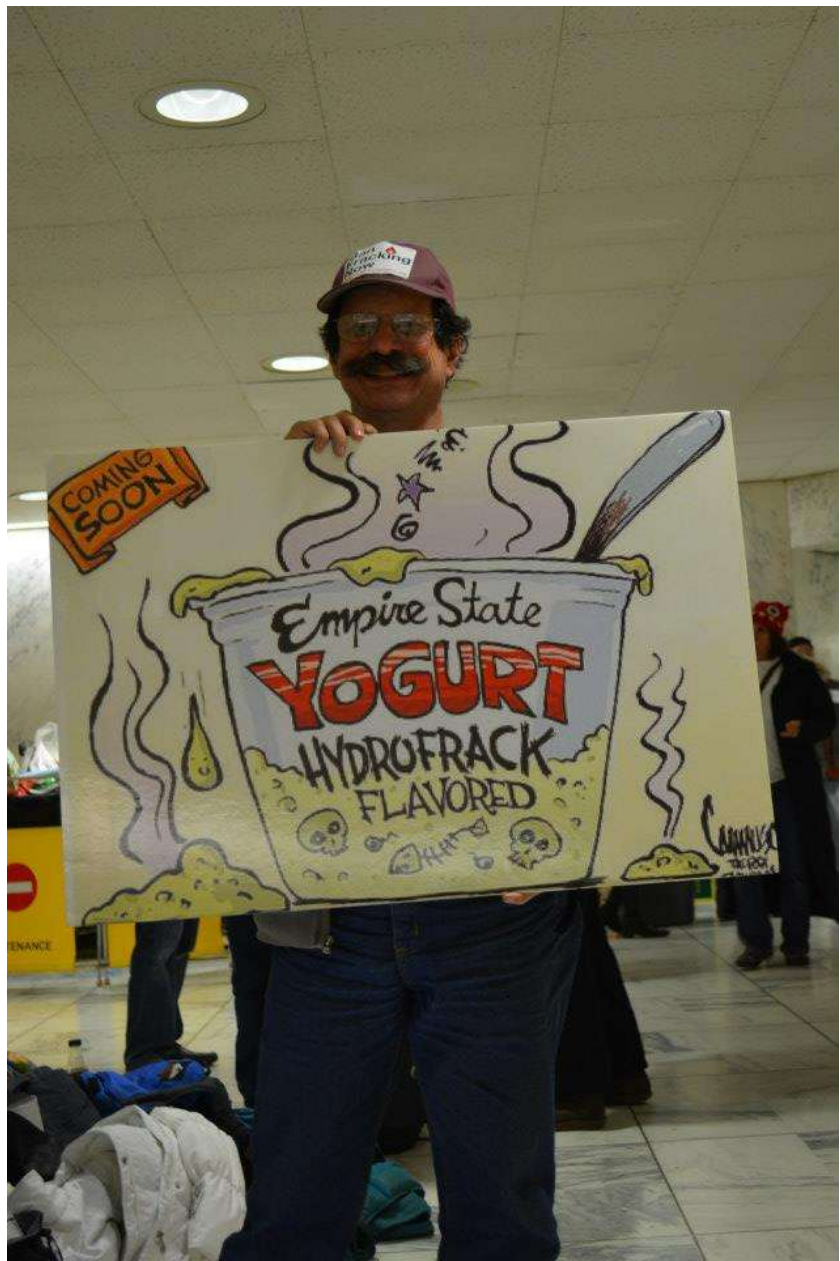












A close-up, black and white photograph of a woman's face, focusing on her eyes and nose. She has a serious, somewhat distressed expression. Her hair is dark and wavy. The background is dark and out of focus.

IN **FRACKING** TOWNS

“Many [women] said they felt **unsafe.”**

“Prosecutors and the police note an increase in crimes against women, including domestic and sexual assaults.”

- New York Times, 1/15/13



**KEEP
CALM
AND
BAN
FRACKING**



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Unique Regulatory Structure



OIL AND GAS ACTIVITIES ARE PRIMARILY REGULATED BY THE STATES

Notable Exceptions:

- Underground Injection Control (UIC) Program under the Safe Drinking Water Act (SDWA)
- Offshore drilling
- Drilling on federal lands



States React

STATE	YEAR
WEST VIRGINIA	W.Va. Code § 22-1-1 et seq. (updated 2011)
PENNSYLVANIA	58 P.A.C.S. Chaps. 23, 25, 27, 31, 32, 33, & 35 (Act 13, updated and amended 2012)
OHIO	Ohio R.C. 1509 & 4906 (S.B. 315, updated and amended 2012)
NEW YORK	<i>De facto</i> Moratorium
MARYLAND	<i>De facto</i> Moratorium



CELDF

“We believe that we are in the midst of an escalating ecological crisis, and that the crisis is the result of decisions made by a relatively few people who run corporations and government... [C]ommunities must challenge and overturn legal doctrines that have been concocted to eliminate their right to self-government, including the doctrines of corporate constitutional rights, preemption, and limitations on local legislative authority.”



Pittsburgh's Ban

“Whereas, this ordinance establishes a Bill of Rights for Pittsburgh residents and remove [sic] legal powers from gas extraction corporations within the City”



“Findings and Intent”

“Meaningful regulatory limitations and prohibitions concerning Marcellus Shale natural gas extraction, along with zoning and land use provisions, are barred because they conflict with certain legal powers claimed by resource extraction corporations. The City Council recognizes that environmental and economic sustainability cannot be achieved if the rights of municipal majorities are routinely overridden by corporate minorities claiming certain legal powers.”



“Findings and Intent”

“Thus, the City Council hereby adopts this ordinance, which bans commercial extraction of Marcellus Shale natural gas within the City of Pittsburgh, creates a Bill of Rights for the residents and communities of the City, and removes certain legal powers from gas extraction corporations operating within the City of Pittsburgh.”



618.04(b) “Corporations in violation of the prohibition against natural gas extraction, or seeking to engage in natural gas extraction shall not have the rights of ‘persons’ afforded by the United States and Pennsylvania Constitutions, nor shall those corporations be afforded the protections of the commerce or contracts clauses within the United States Constitution or corresponding sections of the Pennsylvania Constitution.”



618.04(c) “Corporations engaged in the extraction of natural gas shall not possess the authority or power to enforce State or federal preemptive law against the people of the City of Pittsburgh, or to challenge or overturn municipal ordinances adopted by the City Council of Pittsburgh.”



ACT 13

- Comprehensive update to Pennsylvania's Oil and Gas Act
 - Environmental protection / setback requirements
 - Implementation of impact fee
 - Codification of preemption
 - Establishment of Public Utility Commission review of local ordinances



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ACT 13

Current status...



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Morgantown & the Northeast Natural Energy Case

Fracking is a curse on humanity

What kind of Judas
would sell out
the health of this city
for 12 pieces of silver?

If Bin Ladin had thought of
fracking, he would have
rejoiced at the opportunity
it is providing.



Stop Marcellus
Shale drilling
under the
Superfund site
next to
Morgantown's
water supply.



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**Morgantown banned horizontal
drilling and hydraulic fracturing on
June 21, 2011**



Morgantown's Ban

- Prohibits horizontal drilling & hydraulic fracturing in the City limits
- Prohibits horizontal drilling & hydraulic fracturing up to 1 mile outside the City limits



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**Northeast sued the City of
Morgantown on June 23, 2011**



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**On August 11, 2011, Morgantown's
ban was struck down on preemption
grounds**



STATE	LOCAL RESOLUTIONS/BANS
West Virginia	4* (2 repealed/overturned)
Pennsylvania	16
Ohio	31
New York	180
Maryland	1

Source: Food and Water Watch



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“end runs” around
the science

World Services Group – 2013
North American Regional Meeting

Transformation of the North American
Natural Gas Market – Part II



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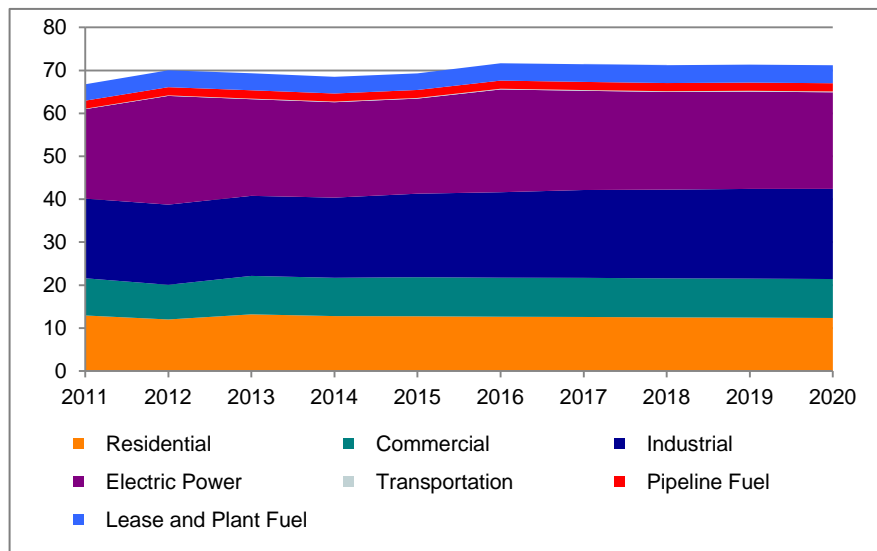
Setting precedent.

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It is not intended to establish an attorney-client relationship. Legal advice of any nature should be sought from legal counsel.*

Industry's Health Depends Upon LNG Exports

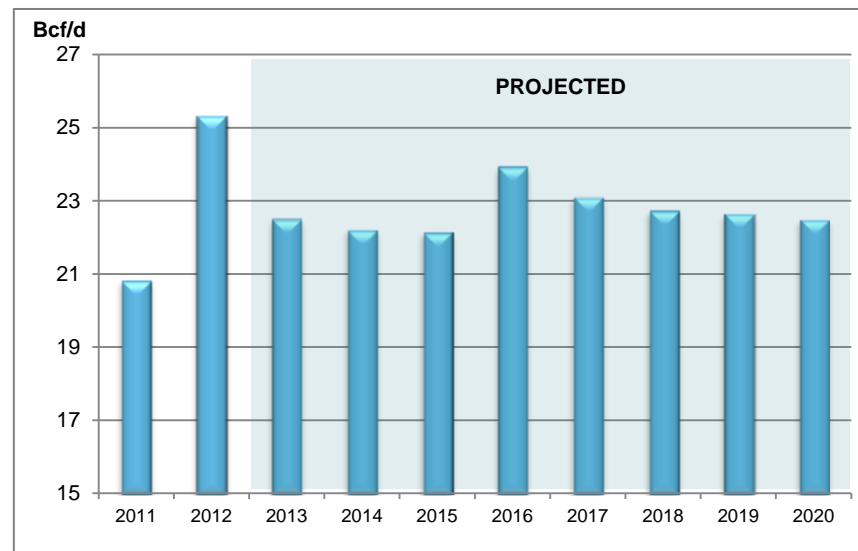
- **Moving domestic demand needle difficult**
- **LNG exports offer huge potential market**
 - Potential 15% to 20% increase in total U.S. demand
 - 1 to 2 Bcf/day per project
- **No other comparable opportunity to grow demand as rapidly between now and end of decade**
 - Other potential sources of demand take just as long but much smaller scale

NATURAL GAS DEMAND BY SECTOR (BCF/D)



Source: EIA AEO 2013 Early Release

POWER SECTOR DEMAND (BCF/D), 2011 TO 2020

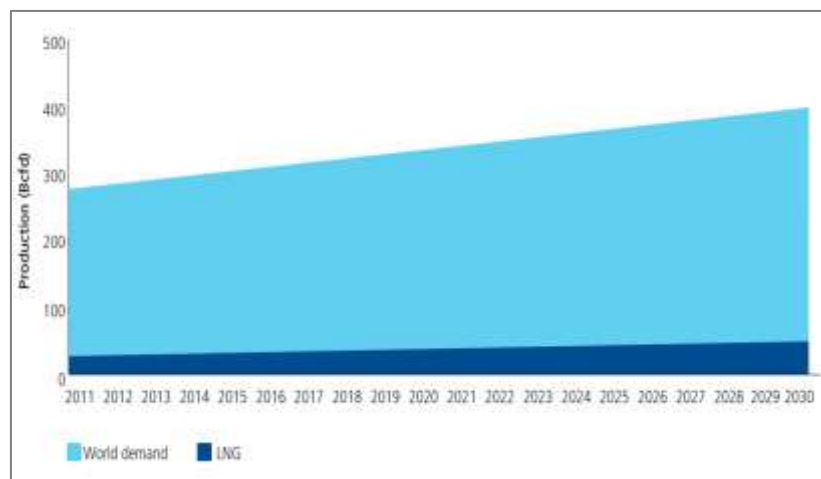


Source: EBW

Time of The Essence

- **Capturing market share not a slam dunk**
- **Huge potential market for natural gas imports**
 - But numerous competing supply sources (including pipeline gas)
- **By acting quickly, U.S. suppliers can become major players**
 - Studies may underestimate potential
- **Huge potential geopolitical and environmental benefits**
 - Also may be key to maximizing oil production

WORLD GAS DEMAND AND LNG PRODUCTION



Source: DMP World Gas Model projection (October 2012)

EXISTING AND PROPOSED LNG LIQUEFACTION PROJECTS (LNG SUPPLY CAPACITY)



Source: The Galway Group

So What's the Catch?

- Exports require permits from U.S. Department of Energy (DOE)
- Has triggered political firestorm
- Pitched battle before Congress and DOE
 - Strong opposition from odd bedfellows
 - Industrial manufacturers seeking to maximize competitive position and major natural environmental groups
- Outcome uncertain



NEGATIVE PUBLIC RELATIONS CAMPAIGN BY “AMERICA'S ENERGY ADVANTAGE”

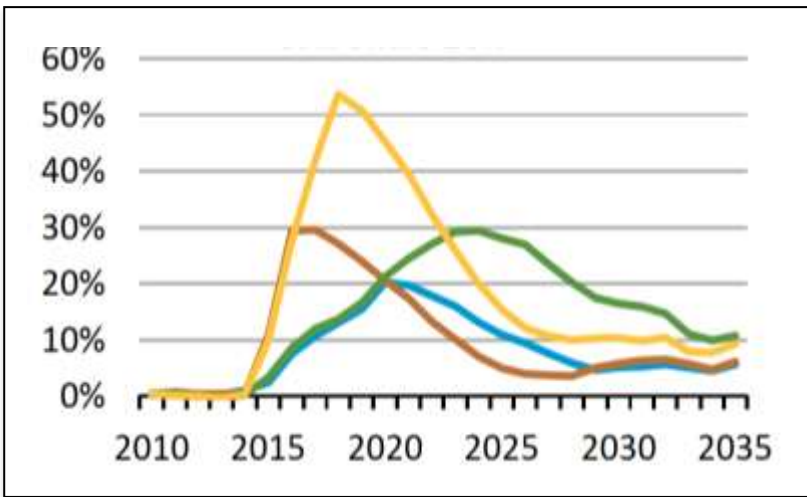


<http://www.americasenergyadvantage.org/>

DOE Legal Proceeding Critical

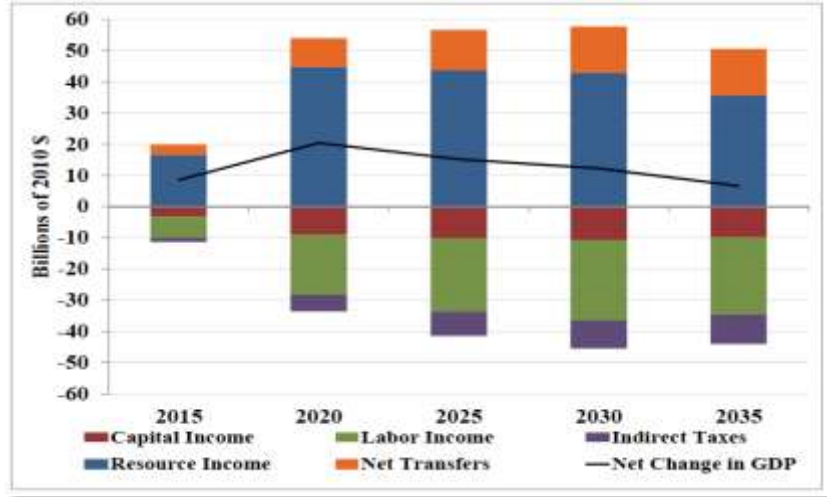
- “Public interest” standard
- Three issues likely to be pivotal:
 1. Cumulative impact of multiple export licensees on U.S. energy costs
 2. Competitive impact on U.S. manufacturers and jobs
 3. Weight given to other risks and benefits
- DOE cost impact studies harshly criticized
 - Attack data as outdated and estimates of other sources of demand much too low
- Strength of industry’s response *will* matter – in all likelihood dispositive

NATURAL GAS WELLHEAD PRICE DIFFERENCE FROM BASELINE CASE – LOW SHALE EUR



Source: EIA

CHANGE IN INCOME COMPONENTS AND TOTAL GDP IN USREF_SD_HR (BILLIONS OF 2010\$)



Source: NERA

Other Major Source of New Demand

- **Three primary sources:**

<i>Sector</i>	<i>Potential Demand</i>	<i>Realistic Timing</i>	<i>Government Involvement</i>
Industrial Manufacturers	11 Bcf/day announced*	4–6 years	Primarily state and local permits
Power	4–10** Bcf/day	4–10 years	Often Crucial
Natural Gas Vehicles	3-7 Bcf/day	8–12 years	Critical

- **Significant growth in demand takes many years**
- **Regulatory issues often critical for power plants additions**
- **Federal action required to achieve critical mass for NGVs**

**EIA estimates 2 Bcf/day will come online*

***At low end, will not offset demand reductions due to increased renewables and higher prices for natural gas*

For more information, please contact:

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Also check out:

www.EBWMarketPro.com

www.EBWAalytics.com

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