Master Presentation
January 21, 2014
Shale Gas 101
Marcellus Shale: Introduction

What is the Marcellus Shale?
- Geological formation formed by accumulation of sediment into a sea almost 400 million years ago
- Compressed to produce an organic-rich black shale.
- Starts at NY, Catskills, stretches across toward Marcellus, New York then southwest to PA, West Virginia, Kentucky, and Ohio.

Why Now?
- Success of other shale plays has allowed companies to transfer horizontal drilling and technology to other areas.
- Proximity to high-demand markets along the East Coast make it an attractive target for energy development.
An Elusive Prize | Many nations are believed to have large shale deposits.

North America
1,931 trillion cubic feet

Technically recoverable shale-gas resources
In trillions of cubic feet

China
1,275 trillion cubic feet

Note: Data are shown only for countries included in the survey. Figures are estimates.
Source: U.S. Energy Information Administration

The Wall Street Journal
Shale Gas Revolution Across the U.S.

Source: Energy Information Administration
• Below the Marcellus

• Bigger, deeper, denser

• One of the latest U.S. unconventional energy fields

• Particularly attractive in OH

• Success in the Marcellus has led to success in the Utica
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
Segments of the Oil and Gas Industry

- **Exploration and Production (Upstream)**
- **Gathering, Compression, Treating, Processing, Transportation (Midstream)**
- **Petrochemical and Refining (Downstream)**

**Source:** MarkWest Energy Partners

**diagram details:**
- **Separation**
  - Oil, Gas, Water
  - Well
  - Water Injection Well
  - Oil and/or Gas Reservoir 5,000-16,000 ft deep

**Gas Treating, Processing and Fractionation**
- Gathering Pipelines
- Compression
- Gas
- Water
- Oil

**Oil Refineries**
- Natural Gas (Methane)
- Interstate Gas Pipelines
- Propane, Butanes, Gasoline's

**Petrochemical Plants**
- Ethane
- Propane
- Interests Gas

**Products:**
- Home Heating/Cooking
- Electric Power
- Industrial Boilers/Furnaces
- LNG (Liquefied and shipped)
- CNG (Fleet Fuel, Buses, etc)
- Glad Baggies
- Plastics
- Styrofoam
- Alcohols
- Other Chemicals
- Unleaded Gasoline
- Diesel
- Jet Fuel
- Asphalt
- Other
Exploration/Production, Midstream, and Downstream 101
Land Acquisition/Site Preparation

- Obtain rights from landowner.
- Educated landowner is an ideal partner.
- “Production unit” - contiguous parcels of land combined for development.
- Production unit incorporated into a company’s drilling program.
- Site is prepared for drilling activity.
Steps in Drilling

Horizontal Drilling

- More efficient production, smaller footprint.
- Conductor, surface casing protect drinking water source.
- Well is drilled vertically and horizontally as much as 5,000 feet.
- Wellbore is approximately 20 inches in diameter at its widest.
- 5 ac vs. 24 ac = 1 acre when done
Well Casing

- Multiple layers of steel and cement to ensure redundant protection
  - 1 – through fresh water aquifer
  - 2 – to depths of ~1,500 feet
  - 3 – to final depths

- Cementing to surface at each layer provides stability and protection, preventing the crossflow of hydrocarbons

- 25 PA Code, Chapter 78 rules have further strengthened standards
Hydraulic Fracturing

- Permits from state regulatory agencies for water withdrawal.
- New technologies allow producers to recycle most water.
- 30 State and federal agencies monitor hydraulic fracturing.
- Industrial process; properly encased well, along with proper containment at the surface is critical.
Steps in Completion

Hydraulic Fracturing (HF)

• > 60 years: more than 1 million wells in 27 states

• 90 percent of oil and gas wells use HF technology

• 99.5 percent water/sand mix

• 3 to 5 million gallons of water fractures the shale.

• Well casing protects water supply

• PA Chapter 78 upgrades reflect best practices in well casing

On average 99.5% of fracturing fluids are comprised of freshwater and compounds are injected into deep shale gas formations and are typically confined by many thousands of feet or rock layers.
MSC Commitment to FracFocus.org Bolsters PA Requirements

FracFocus.org is a Project of the Groundwater Protection Council and the Interstate Oil & Gas Compact Commission
The Impact of Marcellus Gas Drilling on Rural Drinking Water Supplies

Center for Rural PA Study

- Comprehensive research over two years, published in 2011
- Suggested private water well standards are needed
- Pre-drill testing by natural gas companies – a public service
- Regulations require testing of all water supplies within 2,500’ of proposed gas well.
- >40% of 1.2 million private water wells do not meet safe drinking water standard, separate from industry activity
- Another 20% percent of wells contained pre-existing methane
**Steps in Production**

**Site Restoration**

- Involves landscaping and contouring the property as closely as possible to pre-drilling conditions.

- Property owners generally see:
  - Small wellheads on a level pad
  - Small amount of equipment
  - Two to three water storage tanks
  - Metering system to monitor gas production

*Courtesy: Range Resources*
Developed in collaboration with:
PA Federation of Sportsmen’s Clubs
Ducks Unlimited
National Wild Turkey Federation
Wildlife for Everyone Foundation
The Nature Conservancy
Ruffed Grouse Society
Western PA Conservancy
PA Outdoor Writers Association
American Chestnut Foundation
Focus on Midstream

• Gathering Line defined in PA state law as a pipeline used to transport natural gas from a production facility to a transmission line
  – Along the way, the lines can lead to a compressor station and possibly a processing plant (in wet gas areas)
• Location of pipelines are subject to negotiation between property owner and pipeline company
• Right of Way Agreements between property owner and pipeline company recorded with county
• Right of Way can contain multiple pipelines and can range from 50-75 feet in width
  – Additional width for construction

Source: MarkWest Energy Partners
Focus on Midstream

• Gathering lines generally buried to a depth of 36” or more
  – So as not to interfere with cultivation

• Right of Way Agreement grants pipeline operator access to the right of way for construction, operation, maintenance, repairs, inspection and more

• Right of Way Agreement generally allows pipeline operator to clear right of way of trees and other obstructions

• Diameter and pressure of gathering lines vary (well lines, trunk lines and discharge lines)

Source: MarkWest Energy Partners
Focus on Midstream

Gathering and Transmission Pipelines

- Critical link between production and consumers
- Pipelines can transport gas before or after processing
- Designed and constructed to the latest pipeline safety standards
- Utilize new construction methods to minimize the environmental impact
- New coating technologies mean pipelines will last even longer
- Geographic Information Systems allow for efficient layout and accurate tracking of pipeline systems
- Subject to regulatory inspection (PAPUC, DOT PHMSA)
• Pipelines are considered the safest mode of transportation for natural gas and hazardous liquids
  – Does not mean that other modes are not safe
  – State and federal regulation of pipelines and safety
• Federal Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011
  – Pennsylvania Gas and Hazardous Liquids Pipelines Act of 2011
  – Pennsylvania Underground Utility Line Protection Law (PA One Call Law)
  – Pennsylvania Act 13 of 2012
• Third party damage is the greatest threat to pipeline safety
  – Pipeline Placement report recommendation for mandatory One Call participation
Focus on Land Reclamation

Gathering Line Construction – Spring/Summer/Fall 2010 Asylum Township, Bradford Co.

Courtesy: Chesapeake Energy, NE Pa.
Compression Systems

Compressor Stations

- State of the art sound attenuation
- Built to the highest welding, fabrication, and material standards
- 24/7 monitoring and control
- Automatic safety systems
- Annual inspections by regulating entities

Compressor Packages

- High tech integrated control systems (engine and compressor)
- 24/7 monitoring and control
- Produced and packaged in the USA
- Operated and maintained by local workers
Marcellus Shale Coalition
Marcellus Shale Coalition

About Us
- Approximately 300 members strong
- From producers to midstream to suppliers

Our Focus
- Long-term development of resource
- Protecting the environment and responsible use of water resources
- Addressing landowner, government and public issues
- Benefits to our region’s future
We recognize that to succeed in business, we not only embrace these principles, we live by them each and every day. This will be our legacy.

- We provide the safest possible workplace for our employees, with our contractors, and in the communities in which we operate;

- We implement state-of-the-art environmental protection across our operations;

- We continuously improve our practices and seek transparency in our operations;

- We strive to attract and retain a talented and engaged local workforce;

- We are committed to being responsible members of the communities in which we work;

- We encourage spirited public dialogue and fact-based education about responsible shale gas development; and

- We conduct our business in a manner that will provide sustainable and broad-based economic and energy-security benefits for all.
We provide the safest possible workplace for our employees, with our contractors, and in the communities in which we operate.
Workplace and Community Safety

Partnership with PA State Fire Academy

- 69 sessions
- >40 counties covered
- More than 3500 trained
- Permanent funding under Act 13

Transportation Safety Days

Partnering with:
- PA State Police
- Dept. of Transportation
- Public Utility Commission
- Dept. of Environmental Protection
We implement state-of-the-art environmental protection across our operations.
We continuously improve our practices and seek transparency in our operations.
Highly regulated. Highly sophisticated.

- Transparency in permitting
- Staffing, permit fee increases
- Advances in water recycling and reuse
- Protective well casing standards
- Focus on best practices
- FracFocus.org
Environmental Regulation – Midstream

• Various environmental permits and clearances may be required for the construction of pipelines
  – Erosion and Sediment Control Permits under the PA Clean Streams Law
  – Stream Crossing Permits under the PA Dam Safety and Encroachments Act
  – PA Natural Diversity Inventory clearances to protect threatened and endangered species
  – PA State Programmatic General Permits (PA DEP- US Army Corps of Engineers) under the Federal Clean Water Act

• Other midstream facilities, such as compressor stations and processing plants, require multitude of permits and clearances
### Less Reliance on Water Resources

<table>
<thead>
<tr>
<th>Source</th>
<th>Gallons per million BTU</th>
<th>Mid-point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep shale natural gas</td>
<td>0.60 – 5.80</td>
<td>3</td>
</tr>
<tr>
<td>Nuclear</td>
<td>8 – 14</td>
<td>11</td>
</tr>
<tr>
<td>Conventional oil</td>
<td>8 – 20</td>
<td>14</td>
</tr>
<tr>
<td>Coal</td>
<td>13 – 32</td>
<td>23</td>
</tr>
<tr>
<td>Fuel ethanol from corn</td>
<td>2,510 – 29,100</td>
<td>15,800</td>
</tr>
<tr>
<td>Biodiesel from soy</td>
<td>14,000 – 75,000</td>
<td>44,500</td>
</tr>
</tbody>
</table>

Source: Ground Water Protection Council, U.S. Department of Energy
Water Use: In Perspective

The 5 million gallons of water needed to drill and complete a typical deep shale gas well is equivalent to the amount of water consumed by:

- New York City in approximately four minutes
- A 1,000 megawatt coal-fired power plant in 12 hours
- A golf course in 25 days
- While these represent continuing consumption, the water used for a gas well is a one-time use.

Source: CONSOL Energy
Land required (acres) to produce fuel to generate enough electricity to serve 1,000 households for one year

Source: CONSOL Energy
Air Quality Standards

- Short-term monitoring in Northeastern, Southwestern, and North Central PA:
  - “Did not identify concentrations of any compound that would likely trigger air-related health issues associated with Marcellus Shale drilling activities.”

- Air quality standards tightly-regulated:
  - Gas Processing Plants: Plan approval/air permit
  - Compressors: Covered by GP-5

- Companies exploring “bifuel” rigs to reduce use of diesel
Environmental, Public Health Benefits of Natural Gas

• When used to generate electricity, natural gas emits just over half of the CO$_2$ per megawatt-hour (MWh) of a traditional power plant.

• Natural gas combined-cycle turbines emit 60 percent less CO$_2$ per MWh than a typical coal plant.

• Natural gas vehicles emit 25% less CO$_2$ than vehicles that run on traditional fuels.

• According to the Congressional Research Service, if U.S. doubled the utilization of combined cycle natural gas capacity to 85%, we could displace approximately 636 million metric tons of CO$_2$. This amounts to an 8.8% reduction of all CO$_2$ emissions in the U.S.
We strive to attract and retain a talented and engaged local workforce.
Natural gas jobs leading PA’s recovery

MINING JOBS VS. TOTAL JOBS IN PENNSYLVANIA

Mining & Logging¹ Compared to Total Employment

Source: PA Department of Labor & Industry, Marcellus Fast Facts, September 2013

¹ Mining & Logging data are seasonally adjusted. Mining data, which are included in Mining & Logging, are not seasonally adjusted.
Diverse Job Opportunities

**Professional Functions Identified in MSC Survey**
Source: MSC Membership Survey, May 2013

![Pie chart showing various professional functions identified in the MSC survey.]

- **Equipment Operations**: 30%
- **Operations and Maintenance**: 20%
- **Commercial**: 13%
- **Engineering and Construction**: 11%
- **Administration**: 8%
- **Environmental Health & Safety**: 4%
- **Land**: 4%
- **Well Services**: 3%
- **Other**: 3%
- **Water Management**: 2%
- **Geology**: 1%
- **Purchasing**: 1%

**Fast Fact**
- 400+ individuals within nearly 150 different occupations needed to complete and produce gas from a Marcellus Shale well (MSETC, 2010)

MARCELLUSCOALITION.ORG | @MARCELLUSGAS
PA Department of Labor and Industry

- 231,969 employees in Marcellus and related industries as of 2013 Q1*
- Core industries were 35.0% higher in 2013 Q2 than in 2010 Q2*
- Core Industry occupations
  - Crude Petroleum & Natural Gas Extraction ($110,119)
  - Natural Gas Liquefied Extraction ($100,841)
  - Drilling Oil and Gas Wells ($84,862)
  - Support Activities of O&G Operations ($70,401)
  - O&G Pipeline & Related Structures ($82,127)
  - Pipeline Transportation of Natural Gas ($85,747)
- $83,300 average core industry wage ($34,800 higher than PA avg.)*

*Source: Marcellus Shale Fast Facts, September 2013, PA Department of Labor and Industry
PA Jobs, PA Workers

- **PA Department of Labor and Industry**
  - **Ancillary Industries**
    - Non residential site preparation contractors ($53,191)
    - Trucking (general freight, specialized freight) ($42,582-$51,771)
    - Commercial & industrial machine and equipment repair ($54,323)
    - Water Supply, Sewage treatment facilities, and infrastructure construction ($45,560-$66,741)
    - Engineering Services ($79,147)

- $65,000 average ancillary industry wage ($16,500 higher than PA avg.)*

*Source: Marcellus Shale Fast Facts, September 2013, PA Department of Labor and Industry
Statewide Job Opportunities

• Department of Labor and Industry: 3,730 Marcellus job postings statewide

• Most found at MSC job portal

• Support for ShaleNET

• Training network responds to market demands
We are committed to being responsible members of the communities in which we work.
Members of the Community
We encourage spirited public dialogue and fact-based education about responsible shale gas development.
Dialogue & Education

• Coalition meetings with legislative and executive officials:
  – PA Department of Environmental Protection
  – PA Department of Community and Economic Development
  – Members of U.S. Congress, PA General Assembly

• Public speaking engagements and presentations:
  – Chambers of Commerce
  – West Virginia University
  – Federal Reserve Bank
  – Sierra Club
  – Pennsylvania Environmental Council

• Outreach to:
  – Agriculture community
  – Organized labor
  – Small and mid-sized businesses
  – Sportsmen’s groups
  – Local government
The Research Collaborative includes the following components:

- **Industry**
  - Nationally-recognized technical experts
  - Representations from state and national trade associations

- **Academia**
  - Nationally-recognized technical experts
  - Leaders of university centers for collaborative research

- **Public Sector**
  - Research institutions such as N.E.T.L.
  - Recognized technical experts from state and federal agencies

- **NGOs**
  - National research leaders such as RAND, Brookings
  - Research funders such as charitable foundations
We conduct our business in a manner that will provide sustainable and broad-based economic and energy-security benefits for all.
Increases in Production

Annual natural gas well starts and production in Pennsylvania

- wells started
- billion cubic feet per day

2005: 2,500
2006: 3,000
2007: 2,700
2008: 3,200
2009: 2,000
2010: 2,500
2011: 3,000
2012: 2,000

- horizontal wells
- non-horizontal wells
- gas production
Economic Impact for Our Region

• More than 4,500 wells drilled between 2010 and 2012, an investment of approximately $31.5 billion

• 2013 projection: $13.5 billion
  - Leasing and bonuses
  - Exploration
  - Drilling and completion
  - Pipelines and processing
  - Royalties

Source: Survey of Marcellus Shale Coalition Board Member Companies
### Revenue for Pennsylvania

#### Paid by Natural Gas Industry

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall taxes since 2006&lt;sup&gt;1&lt;/sup&gt;</td>
<td>&gt; $1.8 billion</td>
</tr>
<tr>
<td>Road construction investments since 2008&lt;sup&gt;2&lt;/sup&gt;</td>
<td>&gt; $700 million</td>
</tr>
<tr>
<td>Royalty payments to state in 2011&lt;sup&gt;3&lt;/sup&gt;</td>
<td>$177 million</td>
</tr>
<tr>
<td>Permitting and enforcement fees to increase DEP personnel since 2009&lt;sup&gt;4&lt;/sup&gt;</td>
<td>$40.5 million</td>
</tr>
<tr>
<td>Impact Fee in first two years&lt;sup&gt;5&lt;/sup&gt;</td>
<td>&gt; $400 million</td>
</tr>
</tbody>
</table>

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1 – Fox News, July 23, 2013
2 – On-going Survey of Marcellus Shale Coalition Members
3 – Pennsylvania Department of Conservation and Natural Resources, 2013
4 – Pennsylvania Department of Environmental Protection, 2013
Act 13 of 2012 amends Title 58 of the Pennsylvania Consolidated Statutes (Oil and Gas Act of 1984)

- Impact Fee - Per well fee assessed and collected on unconventional wells
- Municipal Uniformity – Authority to enact uniform development standards at the municipal level was challenged and this provision uncertain until State Supreme Court issues a decision.

- Substantial revisions to environmental protections for both surface and subsurface activities – including but not limited to:
  - Increased record keeping for transportation of waste water fluids
  - Source reporting for air contaminant emissions
  - Strict spill prevention requirement during drilling and hydraulic fracturing
  - Increased permitting, siting, and protection of water supplies
  - Well control emergency response
Impact Fee Revenue Allocations

Impact Fee Allocations 2011 & 2012
$400MM+

- Local Government
- Marcellus Legacy Fund
- Natural Gas Energy Development Program
- Department of Environmental Protection
- County Conservation Districts & Conservation Commission
- Fish and Boat Commission
- Public Utility Commission
- Department of Transportation
- PA Emergency Management Agency
- State Fire Commissioner
Revenue to Local Government

Impact Fee Payment 2011 & 2012
County and Municipal Government
$200MM

- Boroughs & Cities
  $12MM
- Counties
  $75MM
- Townships
  $112MM

Excludes Housing Affordability and Rehabilitation Fund
Impact Fee Top 10 Earning Counties

Impact Fee Allocations 2011 & 2012
$96.8MM

- Allegheny, $2.3MM
- Philadelphia, $2.6MM
- Fayette, $2.8MM
- Westmoreland, $3.3MM
- Greene, $6MM
- Susquehanna, $8.1MM
- Lycoming, $8.4MM
- Washington, $9.1MM
- Tioga, $9.1MM
- Bradford, $15.8MM
- All Other, $29.3MM

* Includes Impact Fee and MLF payments in 2011 & 2012
Top 10 earning counties 2011 + 2012*

- Philadelphia, $2,581,300
- Allegheny, $2,065,430
- Montgomery, $1,352,056
- Bucks, $1,055,387
- Delaware, $942,756
- Lancaster, $879,153
- Chester, $845,217
- York, $734,780
- Berks, $694,726
- Westmoreland, $615,016

* Excludes Impact Fee and only calculates MLF payments in 2011 & 2012
Savings for Consumers

• Heating
  - EIA: Family of four in an 1,800 sq. ft. home can save about $1,500 a year, or 60%, by switching to gas.

• Electricity

• Natural gas vehicles

• Consumer products

Source: Philadelphia Inquirer, May 19, 2013
Supply Chain 101
Pre-drilling (Exploration)
- Geologic studies, permitting, water management, engineering/design, site preparation, environmental and safety compliance

Drilling (Extraction)
- Pipeline, compressor, well facilities construction, Hydraulic Fracturing & completions, water management, environmental and safety compliance

Production/Reclamation
- Engineering, site reclamation, environmental and safety compliance

Delivery to Market (transport, storage, marketing)
- NG Marketers, commodity traders, logistics, storage, accounting, risk management
Fast Facts

✓ $7+ million investment to produce each well
✓ 400+ individuals within nearly 150 different occupations needed to complete and produce gas from a Marcellus well (MSETC, 2010)
DESCRIPTION: Construct the well pad and access roads

BUSINESSES INVOLVED: Site design professionals (aerial mapping services, surveyors and engineers), Construction and site development contractors (heavy equipment operators, haulers, laborers, electricians), Site preparation supplies (aggregate, fencing, mulch and fertilizer), Manufacturers (pumps, safety equipment, electrical, heavy equipment)

FACT: 5,000 tons of aggregate per location, using full-time operation of dozer, excavator and roller
**DESCRIPTION**: Casing and drilling of the well

**BUSINESSES INVOLVED**: Heavy equipment operators and manufactures (Cranes, haulers, drill bits); steel and associated manufacturers; cement producers; chemical manufacturers; safety equipment manufacturers and suppliers

**FACT**: 125 tons of locally produced cement per well

**FACT**: 17,000 ft. of pipe needed for each well (steel casing and tubing); MSC member companies have invested hundreds of millions dollars to upgrade, expand or build new steel and pipe facilities in the region to meet shale gas industry demand
DESCRIPTION: Moving materials to and from the well site

BUSINESSES INVOLVED: Rail, barge and trucking companies and operators; asphalt producers; road grading and paving contractors; sand and water suppliers; GPS and spatial analysis services

FACT: 180 rail cars of sand used for an 8-well pad site (smaller footprint w/ more production)

FACT: 300 truck loads of recycled water are needed for a new well
DESCRIPTION: Water supply and management

BUSINESSES INVOLVED: Manufacturers and assemblers (tanks, pipe, steel coil, pumps); chemical manufacturers and suppliers; water and sand suppliers; transportation companies and CDL operators

FACT: Shale Gas industry has led to startups and expansions of Pennsylvania companies including mobile treatment equipment for water recycling

FACT: MSC Member Company invested $500,000 to upgrade Johnsonburg Municipal Authority’s public water distribution system
Pipelining & Processing

**DESCRIPTION:** Construction of gathering lines to connect well pads to Compressor Stations and gas distribution systems; Construction and operation of Compressor Stations

**BUSINESSES INVOLVED:** Engineering and site design services (aerial mapping, surveyors and engineers), Construction services (heavy equipment operators, haulers, laborers, electricians), Site preparation supplies (aggregate, fencing, mulch and fertilizer), Steel, vessel, and compressor engine suppliers, designers and manufacturers

**FACT:** More than $1 million invested for each mile of gathering line

**FACT:** More than $1.3 billion invested in pipeline and processing (PSU, 2010)
**DESCRIPTION:** Restoration of the well pad and maintenance of the producing well(s)

**BUSINESSES INVOLVED:** Solar panel and metering device manufacturers; landscaping companies; top soil suppliers; road aggregate suppliers; fencing suppliers

**FACT:** 14,000 Pine and Oak Trees planted for 6.23 miles on edge of ROW in state forests located in Clinton and Lycoming Counties (Williams Companies),
Commitment to Sourcing Locally

Historic opportunity for this generation and beyond

Public acknowledgment of the need and benefits to sourcing and hiring locally

Supports economic growth

Makes good business sense
How do you enter the Supply Chain?

- Understand the Industry
  - Culture
  - Contractual Nature
  - Compliance Component
  - Vendor Requirements

- Know your product/service
- Offer solutions
- Network & build relationships
- Meet and exceed expectations
Understand the Priorities

• Safety 1st
  – Federal, State, and Company: mandatory health and safety training and testing for employees
  – Prime Contractors & Subs must be compliant

• Geographically dispersed worksites
  – < 1 year at each site

• Continuous Operations
  – 24/7
  – Non-traditional hours
  – Weather exposure
  – Travel required
How do you fit?

- **Contractor/Sub-contracting:**
  - Prime Contractor – holds contract with operator
  - Sub-contractor – hired for a particular service/deliver product

- **On-Site Services**
  - Safety sensitive
    - functions completed on or within close proximity to the well, facilities, or pipeline (i.e. drill contractor, well service operations, welder, vacuum truck, roustabout, dirt contractor, etc.).
  - Material supply or other services
    - provided to a site but not hands on work (i.e. supply company, delivery service, etc.)

- **Off Site Services**
How do you get in?

• Contractor Compliance Programs
  − Risk Management Tool
    • ISNetworld
    • Veriforce
    • PEC Premiere

• Vendor Enrollment
  − Company specific requirements

• Master Service Agreement (MSA)
  − Contract that includes most of the terms that govern future transactions

• Contracting Opportunities
  − Long term, Bid event, RFQ, One time
Act 13, §2316 – Small business participation

• Producers shall provide maximum practicable contracting opportunities for diverse small businesses, including minority, women and veteran-owned businesses.

• Producers shall do the following:
  - Maintain a policy prohibiting discrimination in employment and contracting based on gender, race, creed or color
  - Use the Department of General Services’ Internet database to identify certified diverse small businesses
  - Respond to a survey conducted by the Department of General Services
  - Survey shall be sent to all producers within one year to report the producers’ efforts to provide maximum practicable contracting opportunities related to unconventional natural gas extraction for diverse, small business participation
- Directory grouped by classifications
- Search function – name, location
- Receive invitations to vendor education events
The Economics of Shale Gas
“Decoupling” of Oil and Gas Prices

Source: FactSet Research Systems
Clean, Abundant, and Versatile

1. Electricity generation, heating
2. Combined heat and power applications
3. Light and heavy duty transportation applications
4. Feedstock for industries and other liquids use
5. Exports
Energy Consumption Overview

Quadrillion Btu

Clean, Abundant, and Versatile

1. Electricity generation, heating
2. Combined heat and power applications
3. Light and heavy duty transportation applications
4. Feedstock for industries and other liquids use
5. Exports
Monthly coal- and natural gas-fired generation equal for first time in April 2012
1. Electricity generation, heating

2. Combined heat and power applications

3. Light and heavy duty transportation applications

4. Feedstock for industries and liquids use

5. Exports
Combined heat and power (CHP) plant: A plant designed to produce both heat and electricity from a single heat source. The term is being used in place of the term "cogenerator". CHP better describes the facilities because some of the plants included do not produce heat and power in a sequential fashion and, as a result, do not meet the legal definition of cogeneration specified in the Public Utility Regulatory Policies Act (PURPA).
# Pennsylvania CHP Summary

<table>
<thead>
<tr>
<th>Source</th>
<th>Sites</th>
<th>Capacity (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>135</td>
<td>3,276,430</td>
</tr>
<tr>
<td>Boiler/Steam Turbine</td>
<td>54</td>
<td>1,929,075</td>
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<tr>
<td>Combined Cycle</td>
<td>5</td>
<td>1,156,400</td>
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<tr>
<td>Combustion Turbine</td>
<td>10</td>
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<tr>
<td>Fuel Cell</td>
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<tr>
<td>Microturbine</td>
<td>14</td>
<td>4,290</td>
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<tr>
<td>Other</td>
<td>1</td>
<td>231</td>
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<tr>
<td>Reciprocating Engine</td>
<td>47</td>
<td>85,139</td>
</tr>
<tr>
<td>Waste Heat Recovery</td>
<td>1</td>
<td>3,000</td>
</tr>
</tbody>
</table>

Source: ICF International, 2011
1. Electricity generation, heating

2. Combined heat and power applications

3. Light and heavy duty transportation applications

4. Feedstock for industries and other liquids use

5. Exports
# NGV Market Penetration

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>U.S NGV Population</th>
<th>U.S Market Penetration (by vehicle count)</th>
<th>U.S Annual NGV Fuel Use (thousand DGE)</th>
<th>U.S. Market Penetration (by fuel use)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Transit Buses</td>
<td>8,500&lt;sup&gt;b&lt;/sup&gt;</td>
<td>12,200&lt;sup&gt;a&lt;/sup&gt;</td>
<td>12.82%</td>
<td>17.43%</td>
</tr>
<tr>
<td>Refuse Trucks</td>
<td>1,300&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1,500&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.95%</td>
<td>1.09%</td>
</tr>
<tr>
<td>School Buses</td>
<td>1,360&lt;sup&gt;d&lt;/sup&gt;</td>
<td>2,300&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.27%</td>
<td>0.46%</td>
</tr>
<tr>
<td>Medium-Duty Trucks/Vans</td>
<td>10,000&lt;sup&gt;b&lt;/sup&gt;</td>
<td>22,000&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.35%</td>
<td>0.76%</td>
</tr>
<tr>
<td>Other Heavy-Duty Trucks</td>
<td>1,600&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3,651&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.02%</td>
<td>0.04%</td>
</tr>
<tr>
<td>Light Trucks/Vans</td>
<td>41,000&lt;sup&gt;a&lt;/sup&gt;</td>
<td>71,500&lt;sup&gt;f&lt;/sup&gt;</td>
<td>0.05%</td>
<td>0.09%</td>
</tr>
<tr>
<td>Passenger Cars</td>
<td>31,000&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td>0.02%</td>
<td>0.09%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>94,760</strong></td>
<td><strong>144,151</strong></td>
<td><strong>0.04%</strong></td>
<td><strong>0.06%</strong></td>
</tr>
</tbody>
</table>

<sup>a</sup>Energy Information Agency, Alternatives to Traditional Transportation Fuels 2008, 2010

<sup>b</sup>Yborra, S., Growth of the NGV Market: Lessons Learned Roadmap for Infrastructure Development, 2008

<sup>c</sup>Cannon, J., Greening Garbage Trucks: Trends in Alternative Fuel Use, 2006

<sup>d</sup>Monahan, P., School Bus Pollution Report Card 2006, 2006

<sup>e</sup>American Public Transportation Association, 2010 Public Transportation Fact Book, 2010

<sup>f</sup>U.S. Census Bureau, Vehicle in Use Survey, 2002

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

- NOx: 42% Reduction
- CO: 88% Reduction
- SO2: 91% Reduction

lbs/year
MSC Pennsylvania Roadmap Study

- MSC’s contribution to nationwide NGV conversation

- Only 150,000 NGVs in U.S. with millions worldwide

- 17 new fueling stations for fleets

- Begin with fleet conversions and urban infrastructure focus to achieve better air quality, lower noise, lower cost

- $5 million reduction in annual fuel costs for PA fleet operators

- A direct impact on nearly 1,300 PA jobs

- A reduction of NOx emissions, particulate matter emissions, and greenhouse gas emissions
1. Electricity generation, heating

2. Combined heat and power applications

3. Light and heavy duty transportation applications

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Legend

Marcellus Shale Formation

"Wet Gas" Region

Sources: Pace Global; Equitable Resources, MarkWest, Atlas Energy, Range Resources, and Caiman Energy.
Composition in Wet Gas Region

Methane, 74.2%
Ethane, 15.6%
Propane, 5.5%
Iso Butane, 0.7%
Normal Butane, 1.4%
Iso Pentane, 0.5%
Normal Pentane, 0.5%
Hexanes+, 1.1%
Liquids, 25.3%

Source: Pace Global; NiSource Gas Transmission and Storage Presentation to WVONGA Spring Meeting May 6, 2010 p.5
Gas Dehydration, Separation and Fractionation

- Northeast Marcellus is “dry” Southwest is “wet” (contains more Natural Gas Liquids)
- Gas processing is required to condition production gas to proper “pipeline quality” for end users
- Dehydration removes saturated water entrained in production gas (typically to below 7 lbs/MMcf)
- Cryogenic processing separates the NGLs from the production gas lowering the BTUs to proper levels (980 – 1100 BTU/cf)
- Fractionation separates the NGLs into individual marketable products (ethane, propane, natural gasoline)
The Ethane Factor

ETHYLENE CHAIN

- Natural Gas
- Ethane
- Cracker

Intermediate Products
- PVC
- Vinyl Chloride
- Ethylene Glycol
- Styrene
- Polystyrene
- Polyethylene

- 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

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Shale and manufacturing

• About 1/3 of all of the energy used in the USA consumed by manufacturing
• Lower feedstock and energy costs could reduce energy costs by $11.6 billion annually through 2025

Companies returning to USA:
1. Dow Chemical
2. Formosa Plastics
3. Chevron Phillips Chemical Co
4. Bayer Corp
5. Westlake Chemical
6. Shell Oil; CF Industries
7. Santana Textiles

1. Electricity generation, heating
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International joint venture investment in U.S. shale plays (2008-12)

Source: EIA, April 8, 2013
North American LNG Import/Export Terminals

Proposed/Potential

Import Terminal
PROPOSED TO FERC
1. Robbinston, ME: 0.5 Bcfd (Kestrel Energy - Downeast LNG)
2. Astoria, OR: 1.5 Bcfd (Oregon LNG)
3. Corpus Christi, TX: 0.4 Bcfd (Cheniere - Corpus Christi LNG)
POTENTIAL U.S. SITES IDENTIFIED BY PROJECT SPONSORS
4. Offshore New York: 0.4 Bcfd (Liberty Natural Gas)

Export Terminal
PROPOSED TO FERC
5. Freeport, TX: 1.0 Bcfd (Freeport LNG Dev/Freeport LNG Expansion/LNG Liquefaction)*
6. Corpus Christi, TX: 2.1 Bcfd (Cheniere - Corpus Christi LNG)*
7. Coos Bay, OR: 0.9 Bcfd (Jordan Cove Energy Project)*
8. Lake Charles, LA: 2.4 Bcfd (Southern Union - Trunkline LNG)
9. Hackberry, LA: 1.7 Bcfd (Sempra - Cameron LNG)*
10. Cove Point, MD: 0.82 Bcfd ( Dominion - Cove Point LNG)*
11. Astoria, OR: 1.3 Bcfd (Oregon LNG)
12. Lavaca Bay, TX: 1.36 Bcfd ( Excelerate Liquefaction)
13. Elba Island, GA: 0.35 Bcfd (southern LNG Company)
14. Sabine Pass, LA: 1.3 Bcfd (Sabine Pass Liquefaction)
15. Lake Charles, LA: 1.07 Bcfd (Magnolia LNG)
16. Plaquemines Parish, LA: 1.07 Bcfd (CE FLNG)
17. Sabine Pass, TX: 2.1 Bcfd (ExxonMobil - Golden Pass)

PROPOSED CANADIAN SITES IDENTIFIED BY PROJECT SPONSORS
18. Kitimat, BC: 0.7 Bcfd (Apache Canada Ltd.)
19. Douglas Island, BC: 0.25 Bcfd (SNC-Lavalin Export Cooperative)
20. Prince Rupert Island, BC: 1.0 Bcfd (Shell Canada)
POTENTIAL CANADIAN SITES IDENTIFIED BY PROJECT SPONSORS
21. Brownsville, TX: 2.8 Bcfd (Gulf Coast LNG Export)
22. Pascagoula, MS: 1.5 Bcfd (Gulf LNG Liquefaction)
23. Cameron Parish, LA: 0.16 Bcfd (Waller LNG Services)
24. Ingleside, TX: 1.09 Bcfd (Range LNG (North America))
25. Cameron Parish, LA: 0.20 Bcfd (Gazex Development)
26. Cameron Parish, LA: 0.67 Bcfd (Venture Global)

U.S. – MARAD/COST GUARD
27. Gulf of Mexico: 3.22 Bcfd (Main Pass - Freeport McMoRan)
POTENTIAL CANADIAN SITES IDENTIFIED BY PROJECT SPONSORS
28. Goldboro, NS: 0.67 Bcfd (Pieridae Energy Canada)
29. Kitimat, BC: 2.0 Bcfd (LNG Canada)
30. Melford, NS: 1.8 Bcfd (H-Energy)

As of June 3, 2013

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THANK YOU!