Broadening the Marcellus Discussion –
Overview of the Play

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How big is the Marcellus Shale?

- ...now estimated that potential recoverable gas could be 363 trillion cu. ft. w/current technology.
- U.S. consumption annually is 20 trillion cu. ft.
Shale Gas Basins in the U.S.

Source: U.S. Dept. of Energy, 2009
Natural Gas Facts

• Geologists estimate there may be a 100+ year supply of natural gas at current use rates
• Marcellus is largest shale play in U.S.
  – 53,000 sq. miles+
  – Lifespan to drill and extract is likely decades
• Companies reporting increasingly strong yields on Marcellus wells -2 to 10 Mmcfd
• Transportation costs add up to 50% onto cost of gas at delivery
• Proximity to market is key for Marcellus
• 500 Marcellus wells planned for ’09
• Rig count climbing in PA
U.S. Energy Consumption

Natural Gas Production Future
Unconventional Sources

Source: American Clean Skies, 2008
Why here? Why now?

* New technology.
* Favorable economics
Process

- Acquire permits
  - DEP/SRBC/others
  - Water access
- Construct well site
- Drill well
- Completion process
- Pipeline
Issues Associated with Marcellus

- Leasing to landowners unfamiliar with process
  - tens of thousands
- Legal uncertainties w/lease documents
  - few trained attorneys
- Financial decisions lasting generation(s)
- Limited understanding of economics of the process
Impacts on Communities

- Rural and urban
- Long term road impacts
- New “haves” and “have nots”
- Local officials
  - new decisions
  - new skill sets
  - various legal agreements
    - road
    - water access
    - equipment storage
    - rental rates
Environmental Issues

- Groundwater
- Surface waters
- Headwater streams
- Gas migration
- Sound
- Wildlife
- Erosion & Sediment
- Forest fragmentation
- Aesthetics – viewsheds
Common Marcellus well bore construction

-Well is drilled in stages with each section of the process grouted with concrete to prevent intrusion of water from deeper rock strata from reaching groundwater layers.

Illustration courtesy Range Resources
Education

• Huge demand for education from non-biased source such as land-grant Universities
  – Landowners
  – Elected officials
  – Agency personnel
    • Including workforce entities
  – Environmental groups
  – School teachers
  – Non-impacted residents
  – Media
Programs Offered:

- Leasing
- Water quality/testing
- UIC
- Road use agreements
- Environmental (broad)
- Wildlife considerations
- Forestry
- Economic development
- Real estate
- Regulatory
- Natural gas economics
- Legal community (PBI)
- Schools/teachers
- Workforce development
  - MSETC PSU/Penn College
- Elected officials training
- Others
Delivery

- Public webinar series
- Video conferencing
- Marcellus print materials
- Web site
- WPSU
- Media

- Multi-state outreach
  - NY, OH, WV, MD, KY
- Trusted local connections w/stakeholders
- Bridge between industry and groups
- Resources of University
  - COAS, EMS, Business, etc
Build Out of Infrastructure

Key components:

– Pipeline
– Compressors
– Gas Processing Plants
– Water Treatment/Injection (availability)
– Oil Field Service Companies
– Regulatory Agencies – monitoring the process
– Work force needs
Pipelines

Source: MarkWest Corp., 2009

Challenge: Moving Gas to Market

- Historically, PA’s gas supply focused in western PA
- Pipeline network built around this supply hub
- Typically accommodates low pressure low volume gas

North East Pipeline Network
Pipelines

- Critical to development of well
- Little high pressure gathering capacity in PA
- No eminent domain for gathering lines
- FERC for interstate transmission lines.
- Placement of lines
- Various impacts & considerations
Water

- Cradle to grave permit(s)
- Thousands of gals. to drill, millions to frac
- Lease opportunities for landowners
- Sourced from:
  - mainly larger streams/rivers
  - impoundments
Treatment

• Very expensive
• Weak link in process
  – Limited options
  – Limited final disposal
• New regs in PA
• Reclaiming supplies
  – Wastewater
  – Acid Mine Drainage
• Reuse/recycle
Deep Well Injection

- Industry prefers option due to cost and env’tl reasons
- Multiple wells already
- Does geology support additional sites?
- Deeper formations
- Wells planned for ’09?
- Strategic locations
  - highly profitable
  - truck traffic
Oil Field Services

- Most needed drilling services scaled for Marcellus were not in Appalachian basin
  - New regional centers in WV/PA/Southern Tier NY
- Critical link in development
- Many new high tech positions
- New short line rail demand, commercial real estate interest, airport traffic, engineering offices, road re-construction, housing development.
Marcellus Economics

• 35+ energy companies looking at Marcellus and increasing
  – $5 Billion+ collectively for Marcellus activity
  – Some selling other assets to reposition here

• Ancillary businesses
  – Millions in private investment already
  – Ex: water treatment, food services, transport, retail sales, diesel repairs, equipment rental
Opportunities/challenges in Pennsylvania:

Economic & Workforce

• **Businesses**
  – Existing local businesses benefit?
  – ‘New’ local businesses?
  – Attract outside businesses?

• **Workers & Residents**
  – Local residents/workers HAVE the skills?
  – Locals LEARN the skills?
  – Youth LEARN the skills & stay?
  – Newcomers to move into state?

Impacts on other sectors – tourism?
Community and Local Government Issues

- Roads & Bonding
- Water
- Population growth and change
- Infrastructure
  - emergency preparedness
  - human service, education
- Housing needs
- Cultural change (conflicts?)
- Economic development
- Environmental impacts
- Workforce development opportunities
Ultimate Impacts...

- People
- Communities
- Environment
www.naturalgas.psu.edu

www.pct.edu/msetc