MARYLAND

Department of the Environment

The Marcellus Shale

Briefing to Advisory Commission

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Secretary,

Maryland Department of the Environment

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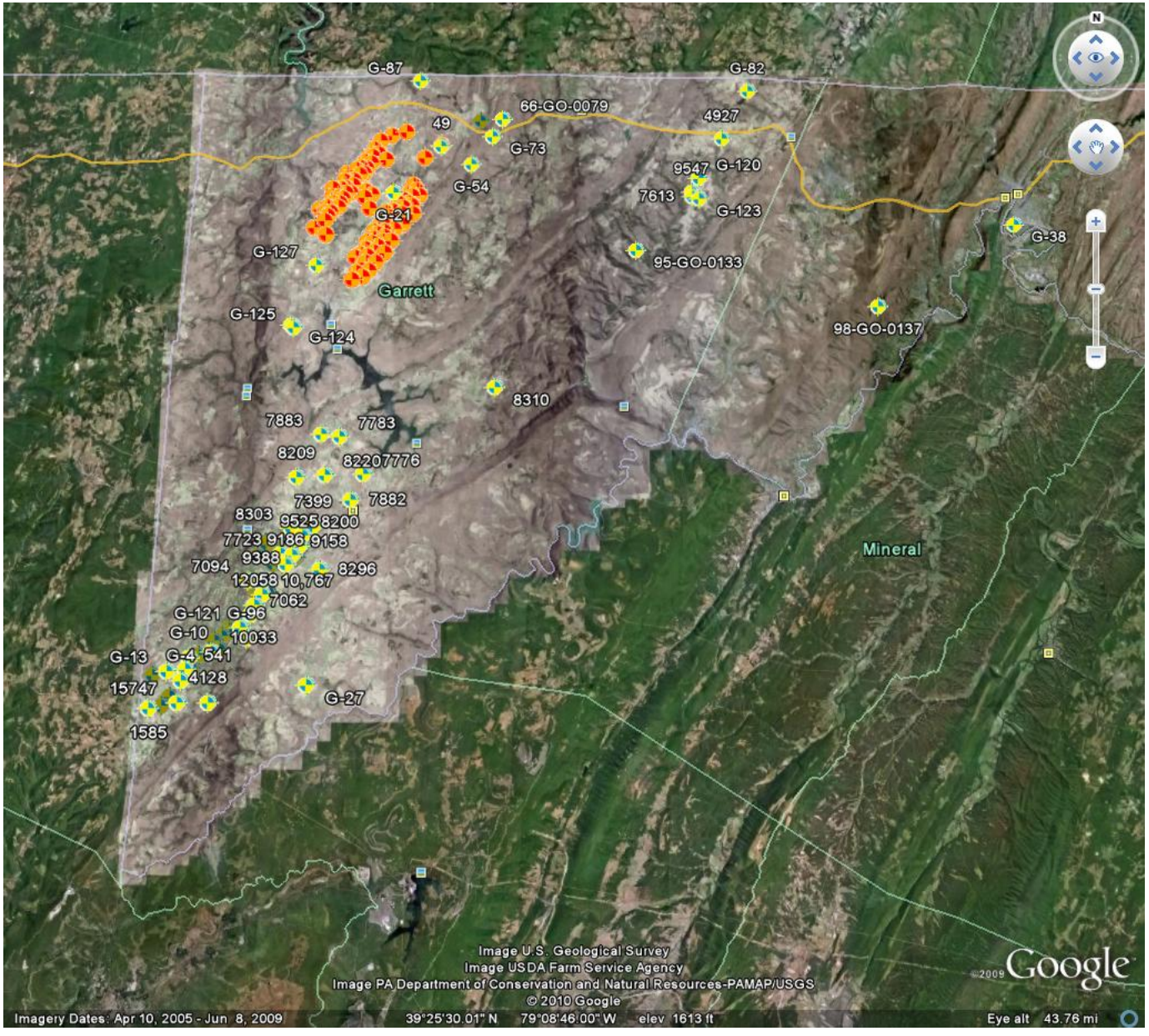
MDE

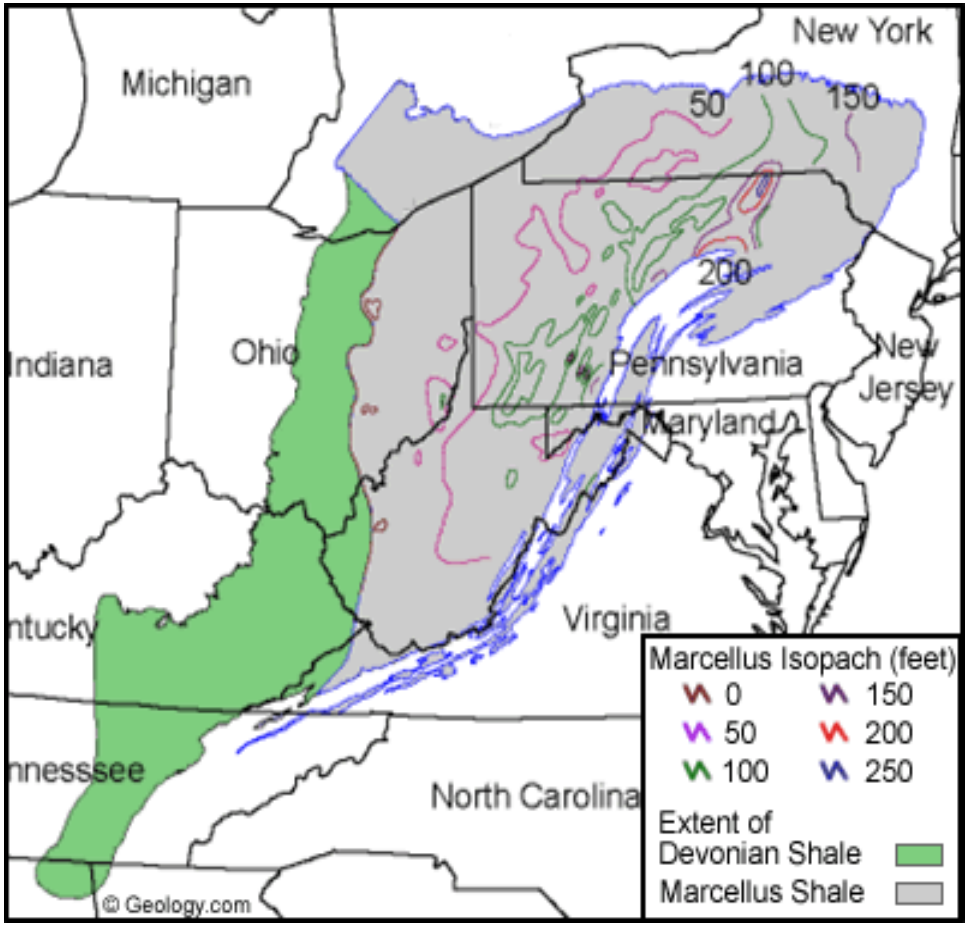
Drilling Activity in Maryland

- Gas drilling in Maryland is not a new activity.
- Several hundred producing wells were drilled in Western Maryland in the 1950's and 60's. (yellow)
- 10 Gas production wells are currently permitted.
- Approximately 90 permitted sites are being used for gas storage. (orange)



The Marcellus Shale

- Found throughout the Allegheny Plateau region of the northern Appalachian Basin
- In Maryland, it is found in Garrett County and part of Allegany County
- Recovering gas from the Marcellus has become economically feasible
  - Advances in horizontal drilling and hydraulic fracturing
  - Higher wellhead prices for gas



The Marcellus Shale

- The Marcellus Shale covers an area of 95,000 square miles in NY, PA, MD, WV and Ohio
- Depth of 4000 to 8500 feet
- Average thickness of 50 ft to 200 ft
- An average well spacing in the Marcellus is 40 to 160 acres per well

Source: Modern Shale Gas Development in the United States, prepared for the US Dept. of Energy (April 2009), http://www.netl.doe.gov/technologies/oil-gas/publications/epreports/shale_gas_primer_2009.pdf

Potential Production

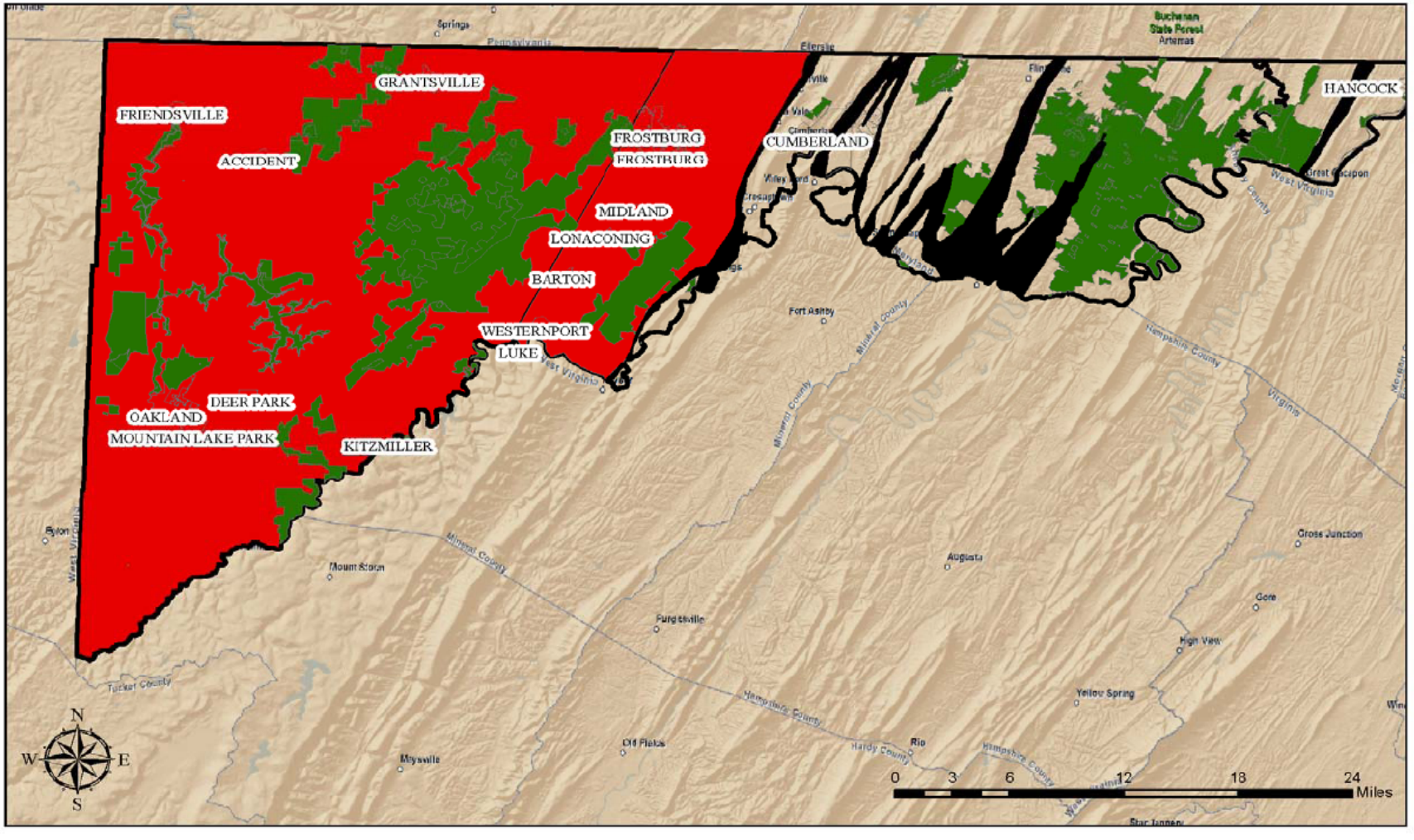
- The Marcellus Shale is thought to be the largest gas reserve in the United States
- All of Marcellus Shale is estimated to contain 363 trillion cubic feet – enough to supply the needs of the US for 15 years at the current rate of consumption
- Over its lifetime, each horizontal well on an 80-acre surface spacing can be expected to produce a total of about 2.5 BCF (billion cubic feet) of gas

Water Resources and Natural Gas Production from the Marcellus Shale, USGS FS-2009-3032, D.J. Soeder et al., http://md.water.usgs.gov/publications/fs-2009-3032/fs-2009-3032.pdf

Opportunities and Challenges

- Opportunities
  - Improved energy independence
  - Lower greenhouse gas emissions from production of electricity
  - Economic development in Garrett and Allegany Counties
- Challenges
  - Operations pose potential risk of harm to the public health and safety and the environment
  - Community and Social Impacts

Marcellus Shale in Maryland



MDE Gas Well Permit

- A permit is required before a person drills any gas well
- MDE has broad statutory authority to impose reasonable and appropriate permit conditions to protect public safety and the State's natural resources
- Regulations establish application requirements and criteria for construction and operating gas wells
  - Have not been amended since 1993
  - Not specific to Marcellus shale, horizontal drilling or high volume hydraulic fracturing

Other Permits May Be Needed

- State
  - Water Appropriation permit
  - Air Quality permit for drill and support equipment
  - Wastewater discharge permit
  - Wetlands and Waterways permit
- Local
  - Planning and zoning requirements
  - Grading
  - Erosion and sediment control

Economic Impacts

- Income from leases and royalties
- Employment
  - New jobs
  - High wages in skilled gas industry jobs
  - Can raise wages in other sectors
- Existing businesses
  - Opportunities for some
  - What effect on tourism
- Cost of Living
  - Rental housing can become scarce and expensive
  - Inflation rate may rise

Environmental Concerns

- Contamination of drinking water supplies by migrating gas and fracturing fluid
- Contamination and depletion of streams and groundwater
- Damage to aquatic living resources
- Erosion and sediment from road, drill pad and pipeline construction
- Fragmentation of forest and habitat

Environmental Concerns (con't)

- Spills, leaks or improper disposal of
  - Fuel
  - Drilling mud and cuttings
  - Fracturing fluids
  - Flowback
  - Chemicals
- Air pollution
  - Fuel burning equipment (stationary and mobile)
  - Blowouts
  - Emissions of methane and other GHG

Public Health & Safety Concerns

- Heavy truck traffic
- Impact on roads and bridges
- Noise
- Risks of fires and explosions
- Stress on local emergency responders

Social and Cultural Concerns

- Boom and bust economic cycle
- Winners and losers
- Effects on:
  - aesthetics
  - recreational activities
  - public investment for open space and agriculture
  - regional character
  - quality of life
  - rural towns

Artist's Drawing of Landscape

Source, Chief Oil & Gas, LLC website

Artist's Drawing of Landscape

Source, Chief Oil & Gas, LLC website

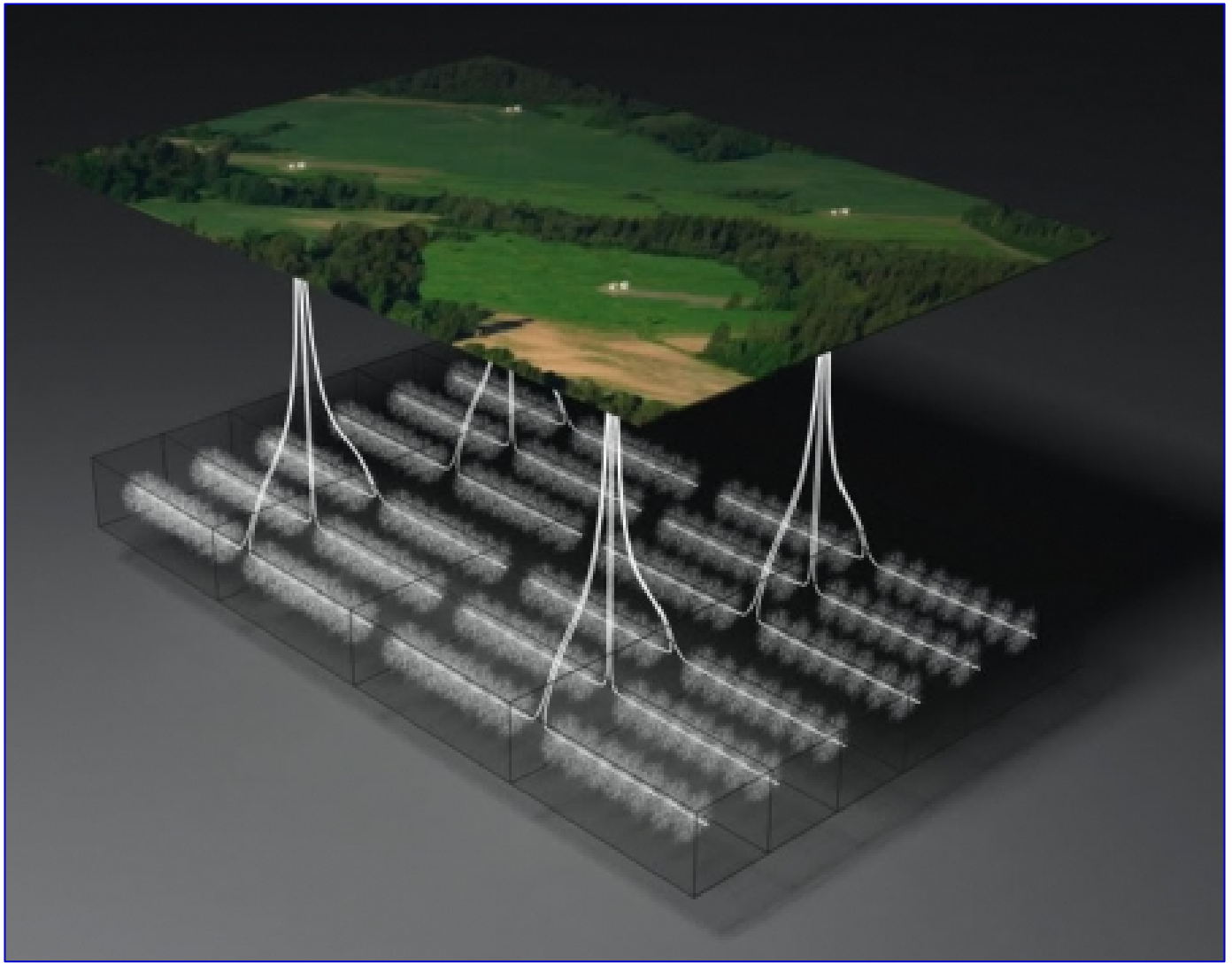
Artist's Drawing of Landscape

Source, Chief Oil & Gas, LLC website

Actual Landscape

Hydro-Fracking Drill sites in Dimock, PA, © 2010 J. Henry Fair

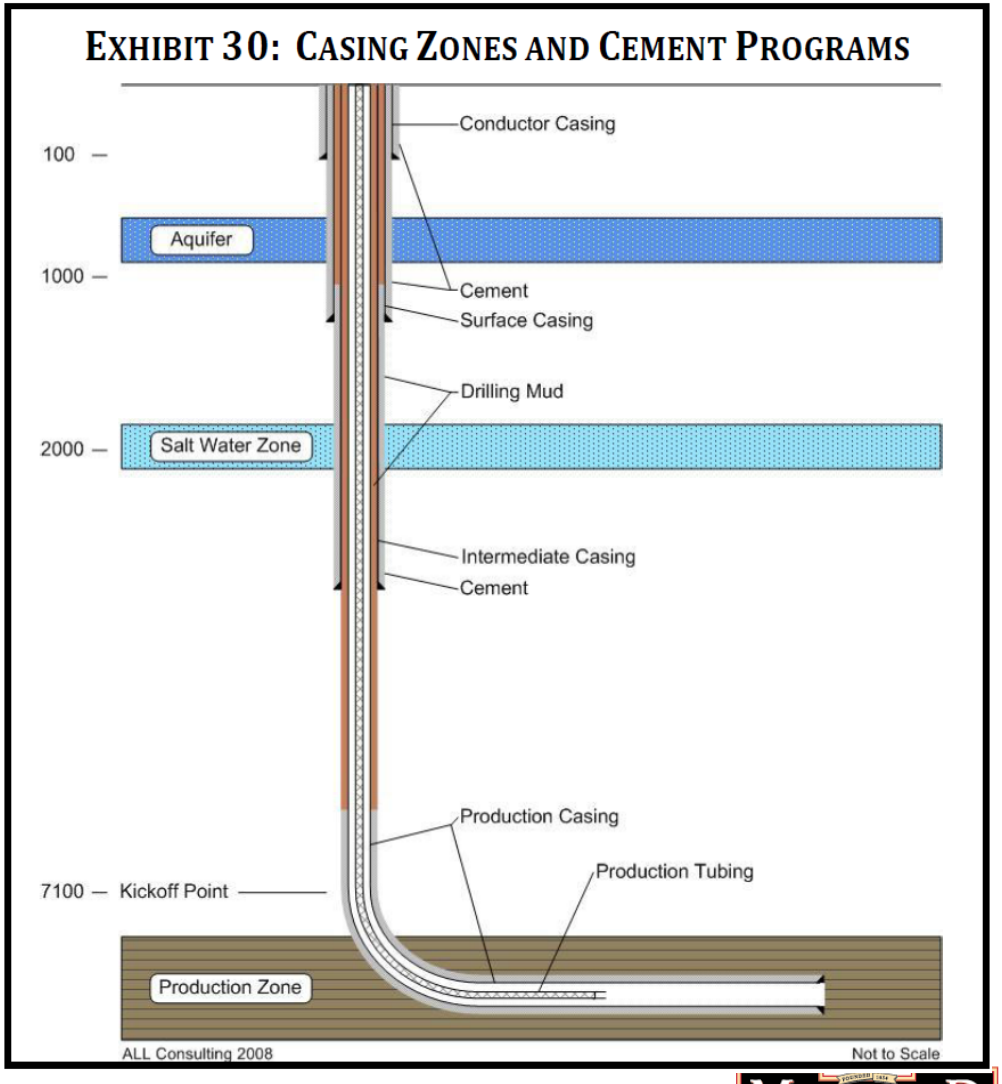
Conceptual Development Plan



Protection of Aquifers

A well is drilled vertically past potential drinking water aquifers, then horizontally in the shale.

- The vertical portion of the well is cased and cemented to a depth at least 100 feet below the deepest fresh water zone.
- A mechanical integrity test (a pressure test) is required to verify there are no leaks in the casing or grout.



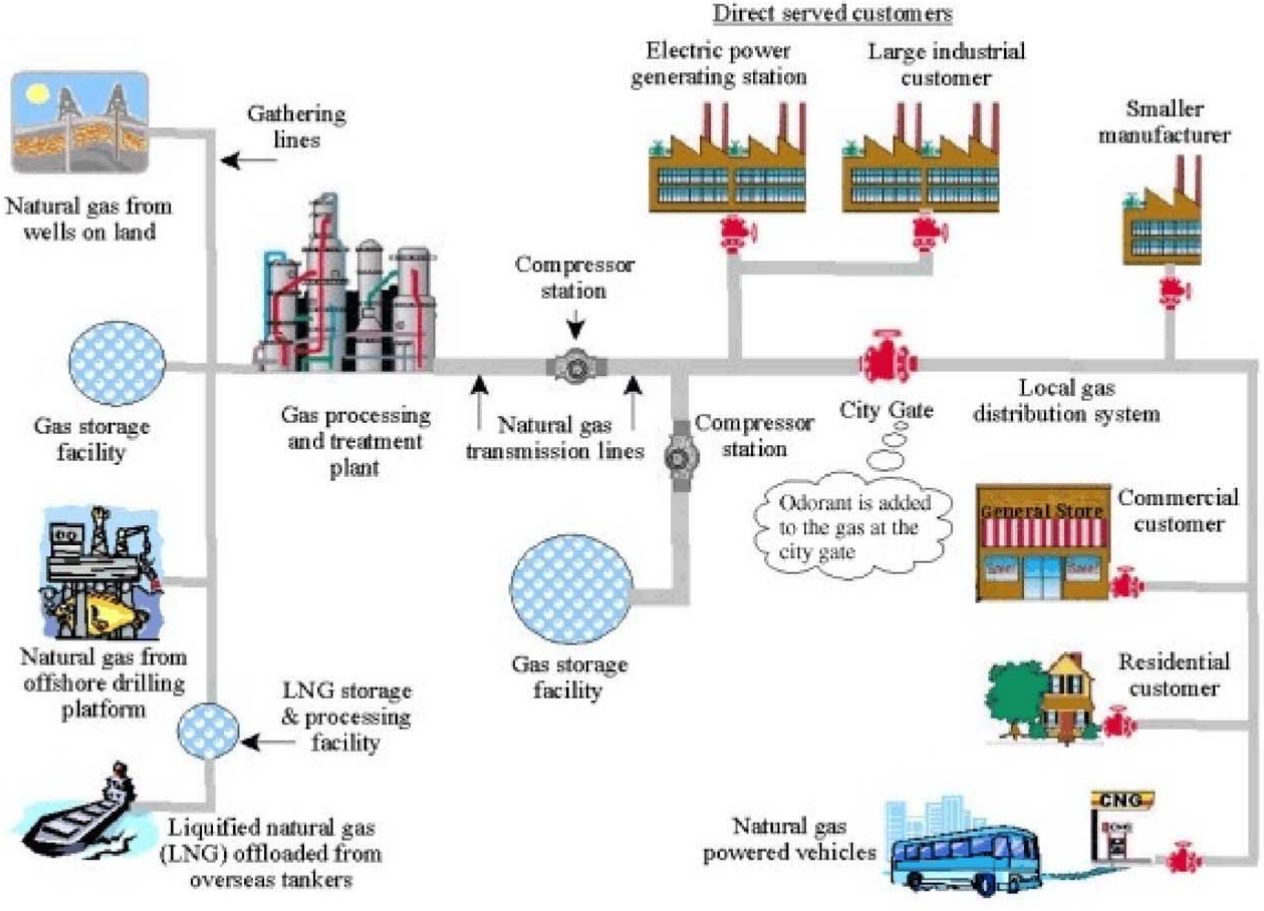
Sequential Activities – Well Site

- Building the location and installing fluid handling equipment
- Setting up the drilling rig and ancillary equipment and testing all equipment
- Drilling the hole; logging the hole (running electrical and other instruments in the well)
- Running casing; cementing the casing; logging the casing
- Removing the drilling rig and ancillary equipment
- Perforating the casing
- Hydraulic fracturing or stimulating the well
- Install surface production equipment
- Putting the well on production
- Reclaiming the parts of the drilling location that are no longer needed and removing equipment no longer used.

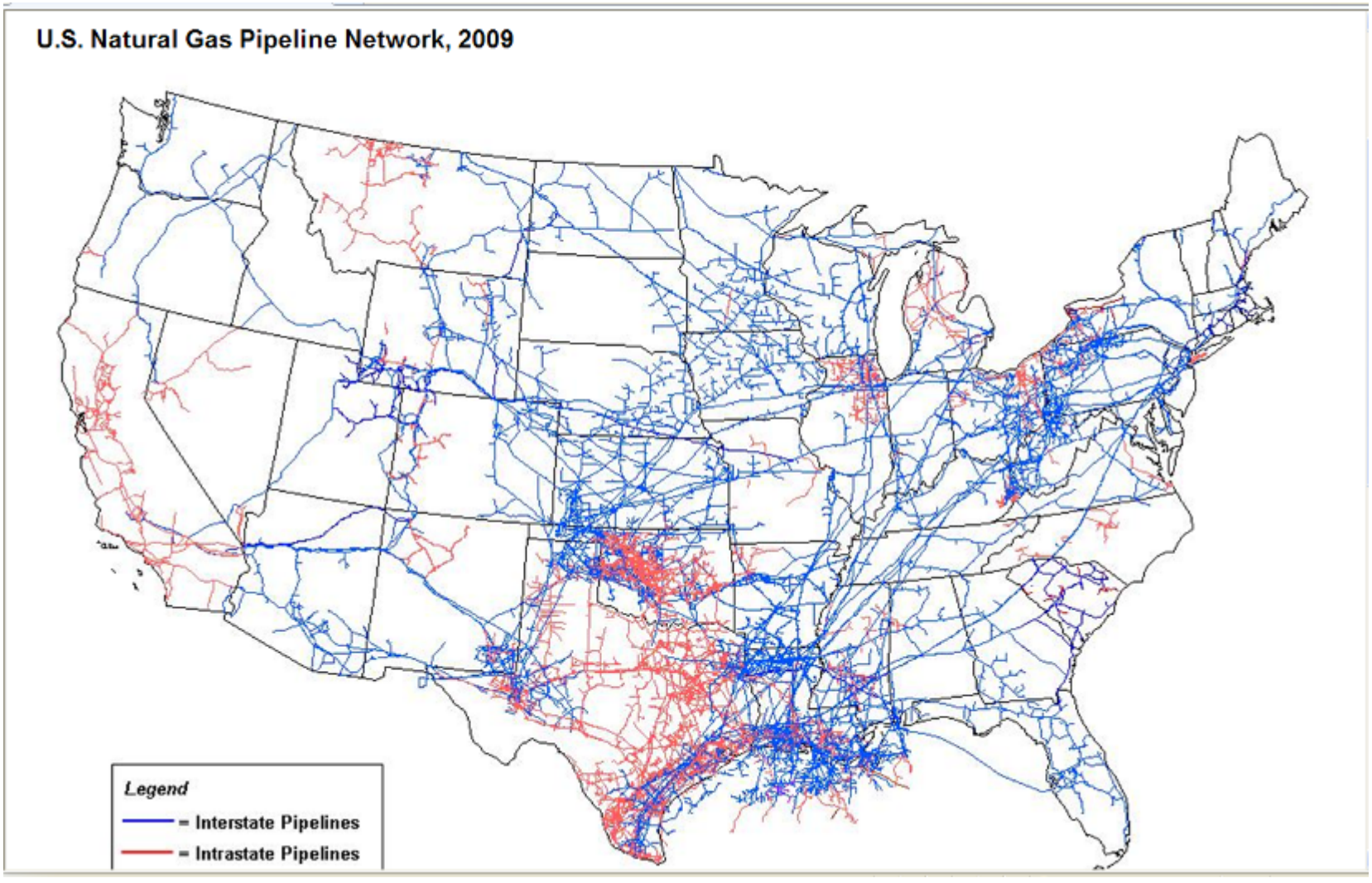
Getting the Gas to Market

- Gathering lines
- Pipelines
- Compressors
- Processing

The Natural Gas Industry



Pipeline Network



Source: Energy Information Administration, Office of Oil & Gas, Natural Gas Division, Gas Transportation Information System

Drill Site

Source: Chesapeake Energy Corporation, 2008
Hydraulic Fracturing of a Marcellus Shale Well, West Virginia

Aerial Photo of Fracking

Source: USGS fact Sheet 2009-3032 (May 2009)

Site Over Time

Pipeline Construction

2011 Legislative Session

- Senator Edwards and Delegate Beitzel
  - Bill would have required MDE to propose regulations regarding natural gas exploration and production in the Marcellus Shale formation on or before December 31, 2011
- Senator Frosh and Delegate Mizeur
  - As introduced, bill would have prohibited MDE from issuing permits for the drilling of wells in the Marcellus Shale until certain conditions were met
  - As amended, bill would have required a study and assessed fee against gas lease holders to finance the study

Gov. O'Malley's Executive Order

The Executive Order creates an Advisory Commission that, working with DNR and MDE, will conduct a three-part study including:

· By December 31, 2011, findings and recommendations regarding the desirability of legislation to establish revenue sources, such as a State-level severance tax, and the desirability of legislation to establish standards of liability for damages caused by gas exploration and production.

· By August 1, 2012, recommendations for best practices for all aspects of natural gas exploration and production in the Marcellus Shale in Maryland.

· No later than August 1, 2014, a final report with findings and recommendations relating to the impact of Marcellus Shale drilling including possible contamination of groundwater, handling and disposal of wastewater, environmental and natural resources impacts, impacts to forests and important habitats, greenhouse gas emissions, and economic impact.

Departments Shall

- Consult with:
  - Advisory Commission
  - Other Maryland agencies
  - Other states
  - Federal agencies
- Review results of other studies

Advisory Commission

- Fourteen members
- Broad range of stakeholders
- Open process
- First meeting August 4, 2011
- Sunsets May 1, 2015

Questions?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