NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Reliability Standards

Board of Trustees Meeting
November 3, 2011
Herb Schrayshuen, Vice President Standards and Training

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Standards Actions

- Continent-wide Standards Program
  - Project 2007-07 – Vegetation Management – FAC-003-2
  - Reliability Standard Development Plan 2012-2014
- Regional Standards Programs
  - MOD-025-RFC-1: Reactive Power Capability
  - IRO-006-TRE-1: IROL and SOL Mitigation in the ERCOT Interconnection
  - PRC-006-SERC-1: Automatic Underfrequency Load Shedding (UFLS) Requirements
- CIP Implementation Plan Resolution

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Vegetation Management - FAC-003-2

- FAC-003-2 – Transmission Vegetation Management
- Foundational standard for vegetation management
- Requirements include several significant improvements relative to existing standard
- Revised definitions for:
  - Right-of-Way (ROW)
  - Vegetation inspection
- Includes a new definition for:
  - Minimum Vegetation Clearance Distance (MVCD)
- Approval 86.25% - Quorum 87.17%

Highlights of New Standard

- Results-based additions:
  - Provides background, rationale, and guidelines to support implementation within standard
- Requirement improvements:
  - Expanded vegetation management to include all lands without regard to ownership
  - Subdivided requirement for inspections and communications of imminent threats for improved clarity
  - Retained obligation to report vegetation-related outages but moved out of requirements into compliance reporting
  - Added objective method for calculating vegetation clearances
  - Added time-bound vegetation inspection intervals

Highlights of New Standard

- Includes explicit requirements to manage vegetation:
  - Requires prevention of all vegetation encroachments inside the MVCD
- Uses Violation Risk Factors (VRFs) and Violation Severity Levels (VSLs) to focus work on lines posing greatest risk to reliability

Minority Issues

- Uses objective method to define the MVCD which identifies the minimum flash-over distances but does not provide any margin
  - New standard obliges entities to maintain vegetation appropriately without using a one-size-fits-all approach
- Focuses on managing vegetation on ROWs that could lead to cascading outages, but not other outcomes of vegetation related outages beyond those that cause cascading, uncontrolled separation, and instability
  - SDT feels that the ERO's responsibility is limited to developing standards that prevent cascading, uncontrolled separation, and instability only

Minority Issues

- Requirement for each Transmission Owner to complete 100 % of its annual vegetation work plan is not enforceable as written and also provides entities with reasons for not completing 100% of their work plan
  - New standard ensures that Transmission Owners are not penalized for a failure to complete their annual plan as long as the changes do not lead to any vegetation-related encroachments into the MVCD
- Requirement for vegetation management plan replaced with less detailed requirements and no obligation for document maintenance
  - New standard focuses on actual performance

Minority Issues

- Moderate and High (rather than Severe) VSLs for sustained outages from fall-ins and blow-ins from within ROW “lower” expectations for prevention of these types of vegetation outages even on critical lines
  - VSLs linked to failure to comply with different aspects of management program – not all aspects of program are equal
- Continues to exclude all vegetation fall-ins and blow-ins from outside the ROW, the most significant contributor to vegetation caused sustained outages
  - Couldn’t write requirement applicable to all Transmission Owners when utilities have limited rights to manage vegetation outside ROW

Minority Issues

- Exemptions in footnotes call into question enforcement discretion
  - Provisions prevent Transmission Owners from having to develop burdensome self-reports of violations for conditions that were outside their control. Explicitly noting these concerns should not have any impact on enforcement discretion.

Reliability Standards and Development Plan (RSDP)

- Update Milestones:
  - July 2011 – solicited suggestions for additional projects
  - August 2011 – Standards Committee reviewed and prioritized projects
  - September 2011 – posted draft plan for stakeholder comment
    - Received 15 sets of comments representing views from 63 people, 38 companies, and all 10 of the 10 industry segments.
  - October 2011 – Standards Committee approved the 2012-2014 RSDP

Highlights of RSDP

- Standards Committee considered three separate aspects for prioritization (reliability, time sensitivity, and practicality), and tested a fourth (cost considerations).
  - This allowed the Standards Committee to consider each of the key drivers separately, as well as in aggregate, to determine how best to allocate resources.

Highlights of RSDP

- Standards Committee allocated the throughput capability to three areas:
  - Reliability – 8 projects
  - Time-sensitive projects – 3 projects
  - Practicality projects – 2 projects

Highlights of RSDP

- Projects continuing/starting in 2012 address:
  - Protection systems and associated misoperations
  - Communications
  - Cyber security
  - Real-time operations
  - Frequency response
  - Definition of Bulk Electric System (BES)
- Process will continue to evaluate emerging issues: cold weather, GMD, ROW clearances, etc.
  - Plan is expected to be dynamic, and the Standards Committee may implement differently if needed to respond to emerging issues

Reactive Power Capability MOD-025-RFC-1

- MOD-025-RFC-1 - Verification and Data Reporting of Gen Gross and Net Reactive Power Capability
  - Provides planning entities with accurate generator gross and net reactive power capability modeling data
  - Requires Generator Owner to verify operating range of reactive power capability every five years
  - Requires Generator Owner to provide verification data to its Transmission Planner, Transmission Operator, Reliability Coordinator or Planning Coordinator
  - Developed to supplement MOD-025-1 continent-wide standard (under development)

Minority Issues

- No need for regional standard since continent-wide MOD-025-1 under development
  - Reliability*First* fulfilling its obligation under MOD-025-1 (approved by board, not by FERC)
  - When continent-wide MOD-025 approved, Reliability*First* standard will be reviewed for duplicative requirements
  - Replacement of legacy documents required in Reliability*First*'s Bylaws
  - New standard addresses ambiguities, inconsistencies and deficiencies in legacy documents

Minority Issues

- Attachment 1 Section 2.1 is too rigid; will hinder ability to obtain reactive power test results when plant conditions do not allow the real power to be at the level reported in MOD-024-RFC-01.
  - Reported capability equal to unit's continuous, sustainable output 24/7 without encountering equipment limits (may be different from unit's maximum capacity)

IROL and SOL Mitigation in ERCOT – IRO-006-TRE-1

- IRO-006-TRE-1 - IROL and SOL Mitigation in the ERCOT Interconnection
  - Provides enforceable requirements associated with existing ERCOT congestion management procedures
  - Requires Reliability Coordinator to have and implement procedures for identification and mitigation of exceedances of identified IROLs and SOLs unresolved by automatic actions of ERCOT Nodal market operations system
  - Addresses directive in FERC Order 693 paragraph 964:

    "…Modify … ERCOT procedures to ensure consistency with the standard form of the Reliability Standards including Requirements, Measures and Levels of Non-Compliance."

Automatic Underfrequency Load Shedding (UFLS) Requirements – PRC-006-SERC-1

PRC-006-SERC-1 - Automatic Underfrequency Load Shedding Requirements

- Identifies Planning Coordinator as entity responsible for developing UFLS schemes
- Adds requirements for Planning Coordinators not contained in continent-wide standard PRC-006-1:
  - Include SERC subregion as identified island required by PRC-006-1
  - Select/develop automatic UFLS scheme meeting specified criteria
  - Conduct simulations of UFLS schemes for load and generation imbalances of 13%, 22%, and 25%

Highlights of New Standard

- Transmission Owners and distribution providers required to implement the UFLS schemes developed by Planning Coordinator and changes to those schemes within 18 months of notice
- Planning Coordinators required to provide specified information to SERC
- Generator Owners required to provide specified information to SERC to facilitate post-event analysis of frequency disturbances

Highlights of New Standard

- Clearly defines roles and responsibilities of responsible entities
  - Planning Coordinator responsible for developing UFLS schemes within its Planning Coordinator area
- Requires more granular studies of frequency response than continent-wide PRC-006-1 (three specified load/generation imbalance levels)
- Requires reporting to SERC to aid in post-event analysis

Minority Issues

- Question correlation between Continent-wide and SERC standards and how the two standards work together
  - SERC standard provides regional detail for some of the NERC requirements
  - SERC standard is not stand-alone; works in conjunction with continent-wide UFLS standard

Minority Issues

- No need for a regional standard – continent-wide standard sufficient
  - Regional requirements provide regional consistency and coordination
  - Regional standard more stringent than continent-wide standard

Special Report: Spare Equipment Database System

Board of Trustees
November 3, 2011
Dale Burmester, SEDTF Chair
American Transmission Company

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Spare Equipment Database (SED) Overview

- Catalogs spare transformers
  - Voluntary system
- Catalogs long-lead time (6 months+)
  - Spare transmission transformers:
  - Spare Generator Step-Up (GSU) Transformers
- 24x7 Web-based operations
- Keeps entity information confidential

Spare Transformer Reliability Risk

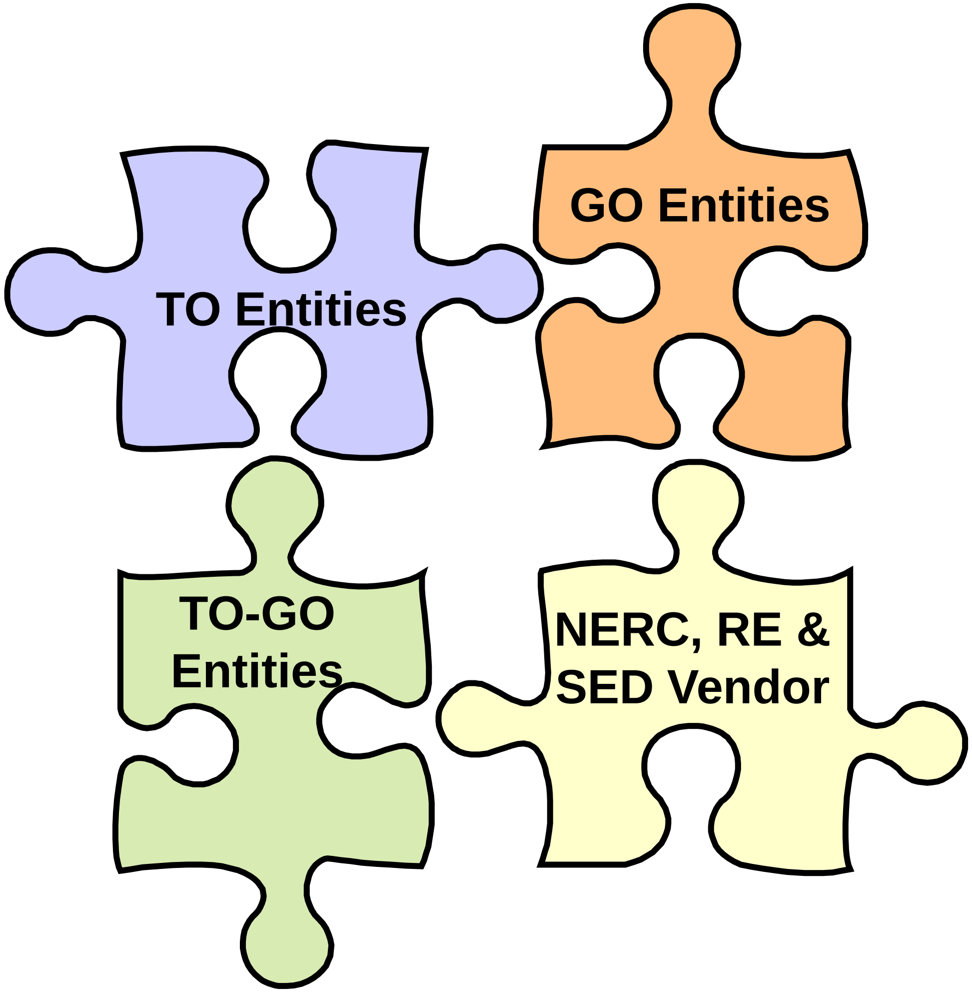
- Small event
  - Entity may need spare transformers
- High impact, Low frequency event (HILF)
  - Many entities may need spare transformers
- Could entity(ies) buy new transformers after event?
  - Yes, but manufacture time is six months+
  - Large events could extend time to one year+

SED Risk Mitigation

- Allows entities to confidentially seek spares
  - Quicker to use someone else's than manufacturer
  - Faster restoration after event
- Provides for faster entity cooperation
  - Entities contact SED instead of everyone
- Balances risk mitigation and freedom
  - Voluntary participation
  - Double-blind requests
  - Entities not forced to commit spares

Participants

- Voluntary participation by up to:
  - ≈165 TO Entities
  - ≈670 GO Entities
  - ≈175 TO-GO Entities
- Minimal RE coordination
- Very low expected industry effort



Timeline

December 2011

- Vendor Begins Design

1st Quarter 2012

- SED Production Rollout

1st Quarter 2013

- SED Performance Assessment

References

- Special Report: Spare Equipment Database System Report
  http://www.nerc.com/docs/pc/sedtf/SEDTF_Special_Report_October_2011.pdf
- DRAFT SED Mutual Confidentiality Agreement:
  http://www.nerc.com/docs/pc/sedtf/Confidentiality_Agreement.pdf
- SEDTF website:

  http://www.nerc.com/filez/sedtf.html

Questions and Answers

Background Information

Development Background

- Spare Equipment Database Task Force (SEDTF)
  - Planning Committee (PC) Initiated (2010)
- BPS spare equipment uniform approach
- Not intended to replace:
  - Existing utility spare programs
  - Spare pooling agreements
- September 14, 2011
  - Report approved by PC
  - Report endorsed by Operating Committee (OC) and Critical Infrastructure Protection Committee (CIPC)

SED Information

Contact Information to include:

- Name of TO or GO Functional Entity †
- Primary Contact Information †
- Secondary Contact Information
- SED Data Manager

Note: SED reporting is voluntary; however, if a spare is reported the information marked with an † symbol is deemed mandatory.

SED Asset Information to include:

- Transformer Identifier †
- Transformer Type †
- Spare's Physical Location
- Number of Phases †
- Rated Voltage – High Voltage (HV) †
- Rated Voltage – Low Voltage (LV) †
- Maximum MVA rating †
- Percent Impedance & MVA base
- Tertiary Winding – Voltage and MVA
- Connection Type
- Spare Status Category
- Joint Ownership and Sharing Restrictions
- Open Comment Field
- Transformer Voltage Class

Field Information

- All fields confidential
  - Five contact information fields
    - Primary/secondary contact information
  - Fourteen asset information fields
    - Transformer configuration and rating information

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Public Summary Reports

- SED Mutual Confidentiality Agreement limits to:
  - Number of participating:
    - Entities by Regional Entity
    - Transmission power transformer owners
    - GSU transformer owners
    - Transformers by high-side voltage
    - Total MVA amount MVA by high-side voltage
  - Number of eligible:
    - Entities in the aggregate
    - Entities by Regional Entity

SHALE GAS
It's about Energy Independence

Terry Boston

President & CEO
PJM Interconnection

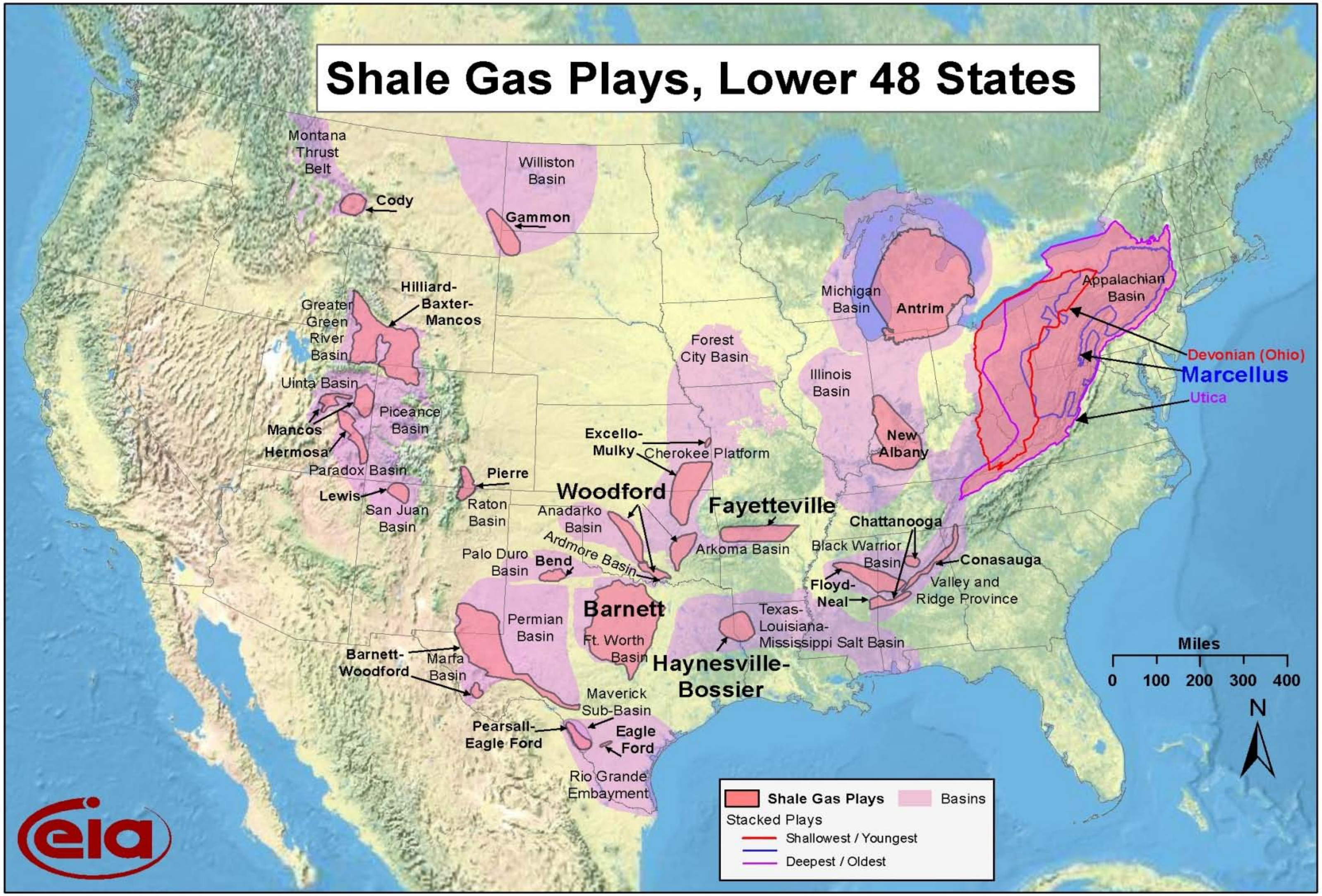
CERTS

October 4, 2011

What is the Marcellus Shale?

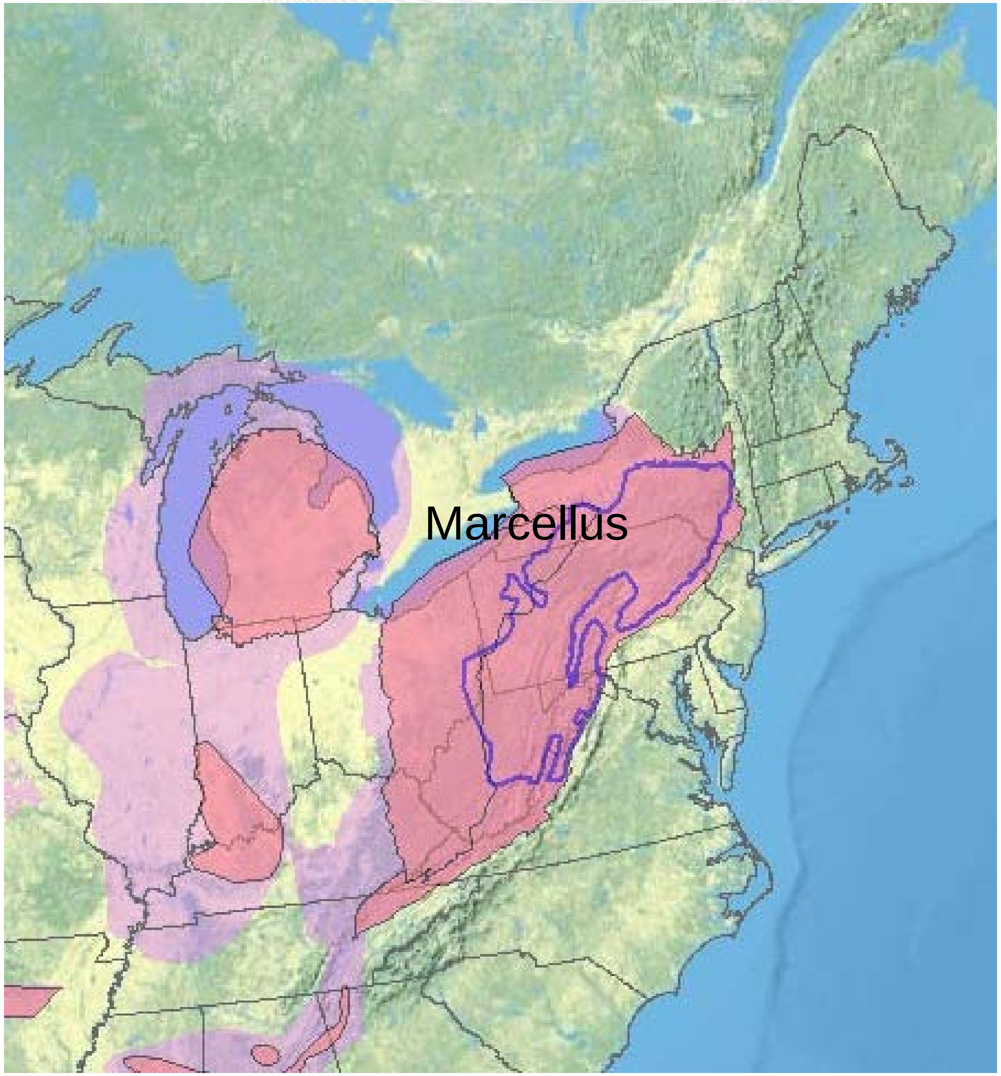
- Large, natural gas rich, shale formation spanning tens of million of acres
- Natural gas and hydrocarbons are trapped inside the solid shale

Source: Range Resources



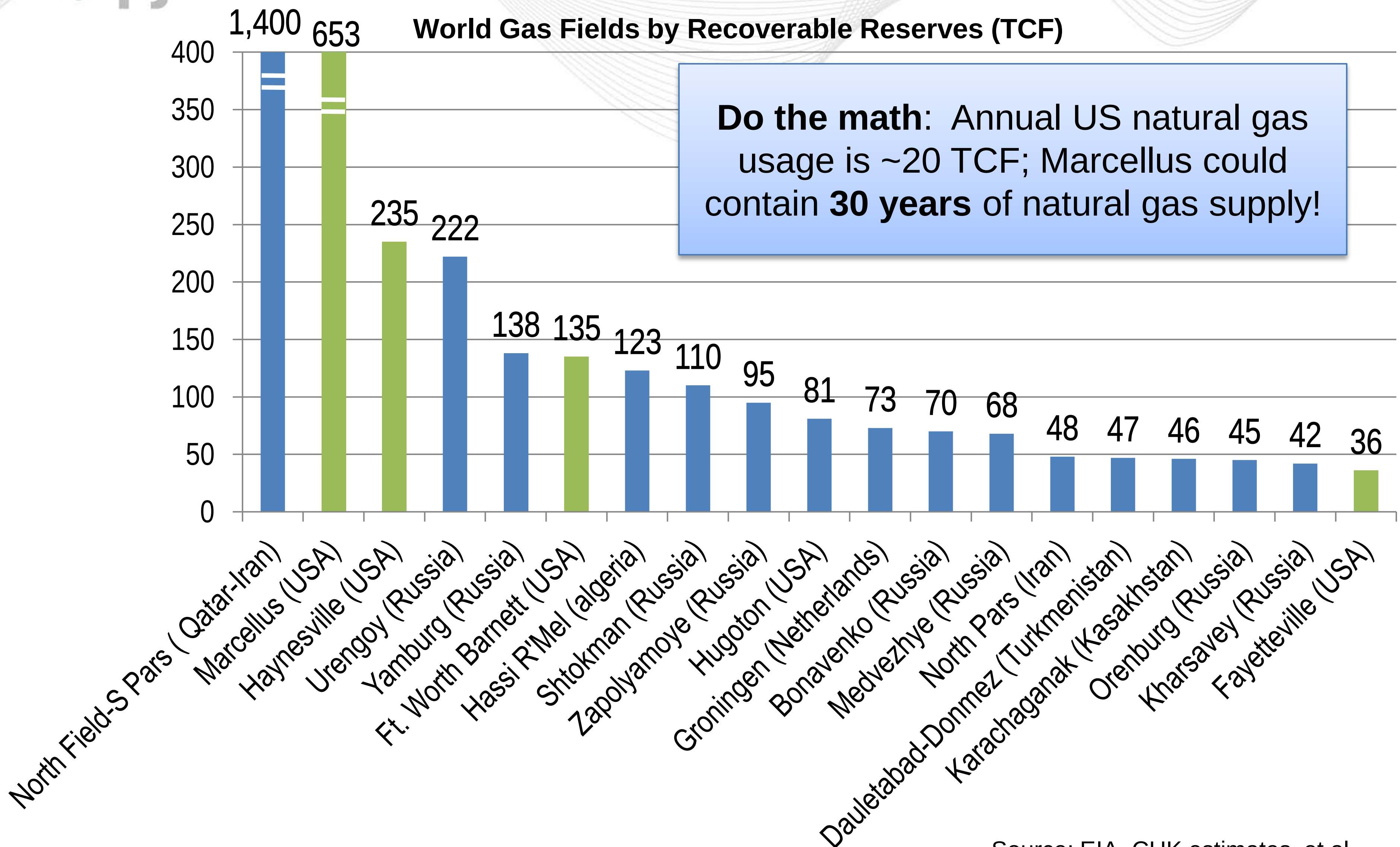
Source: Energy Information Administration based on data from various published studies.
Updated: March 10, 2010

PJM and NYISO are Sitting Atop the Largest Shale Gas Discovery



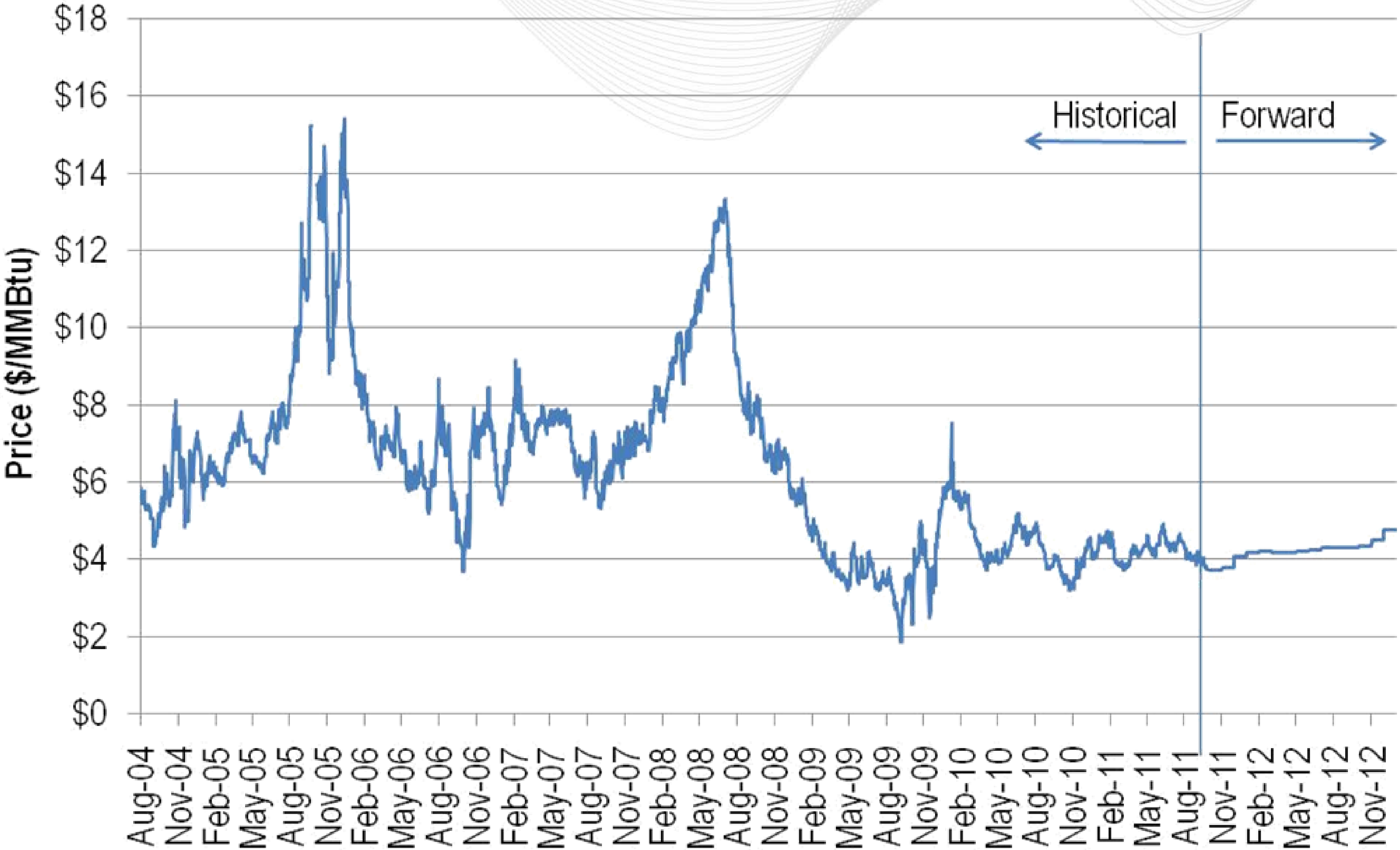
Source: Energy Information Administration based on data from various published studies.
Updated: March 10, 2010

Marcellus Shale Gas Is A Game Changer

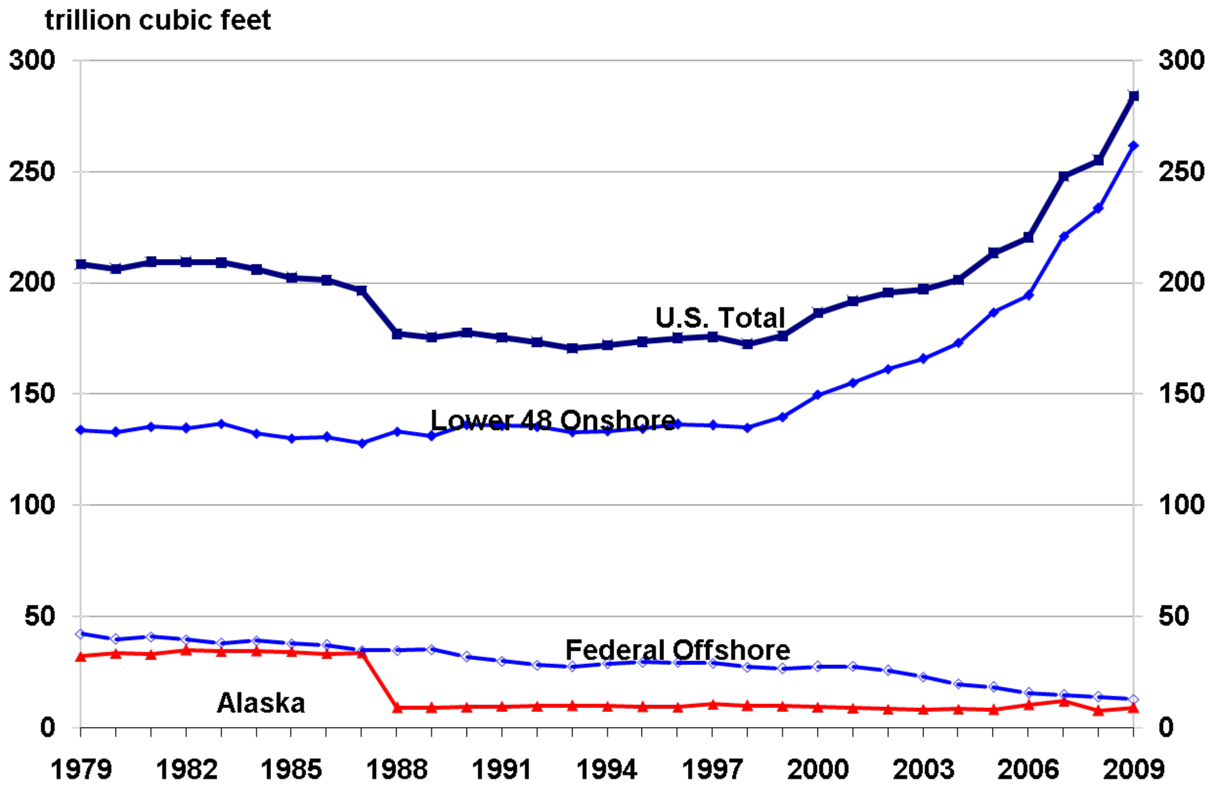


Source: EIA, CHK estimates, et al

Natural Gas Prices (Henry Hub)



U.S. proved reserves of natural gas at the end of 2009 were at their highest level since 1971



Source: Energy Information Administration

Howard Gruenspecht, U.S. – Canada ECM, Dec 2 2010

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Marcellus Shale Development

State-of-the-Art Technology - Proven Approach - Industry Expertise

Preparation → **Drilling** → **Completion & Production** → **Reclamation**

Source: Range Resources

How Do You “Drill Horizontal”

- Small bend in drilling motor assembly
- roughly 1-2°
- drills the curve over the course of 900’
- at a rate of 10° per 100’ to achieve a 90° turn horizontally

It’s not abrupt, rather a gradual sweeping motion.

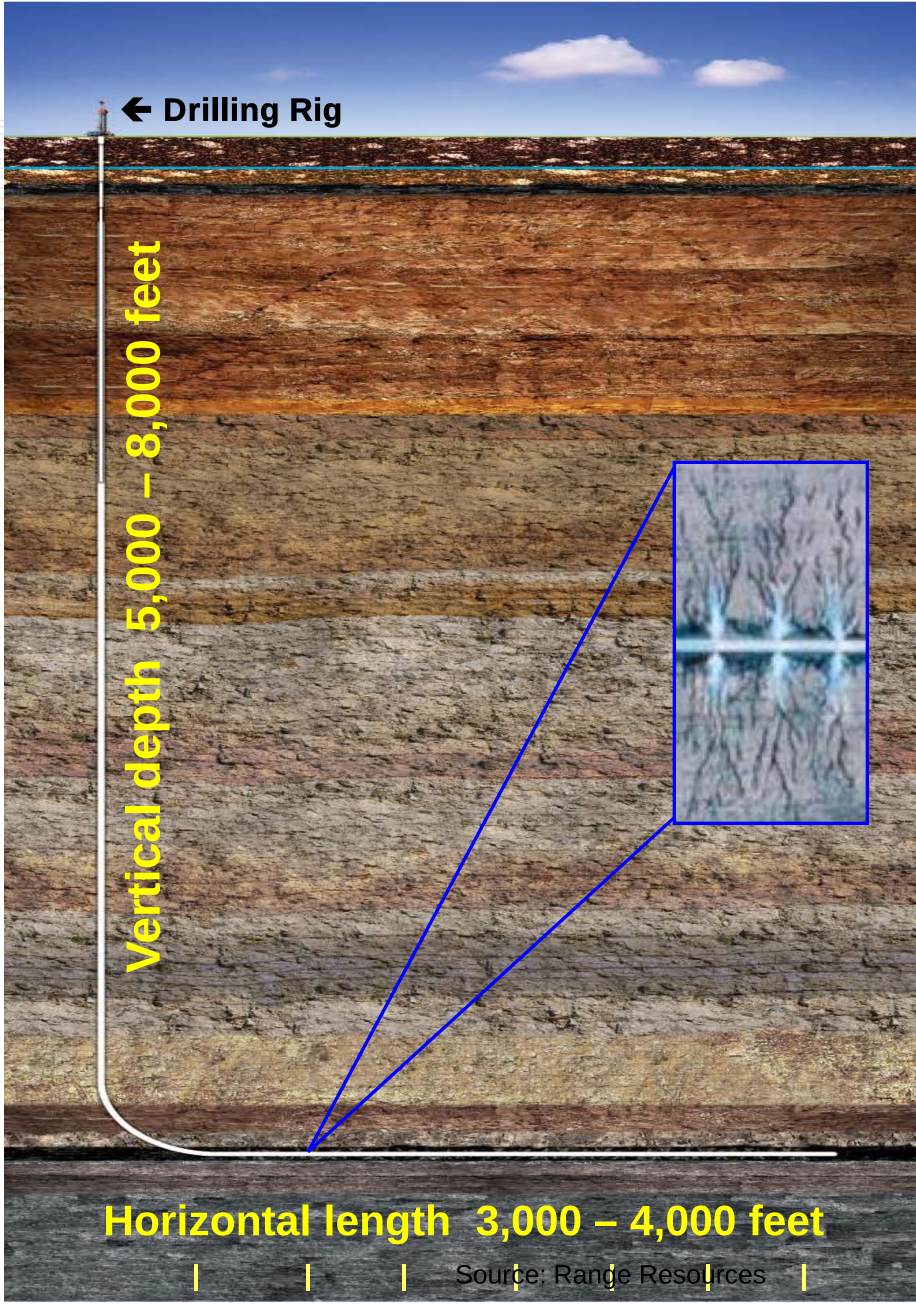
Weatherford drilling technology

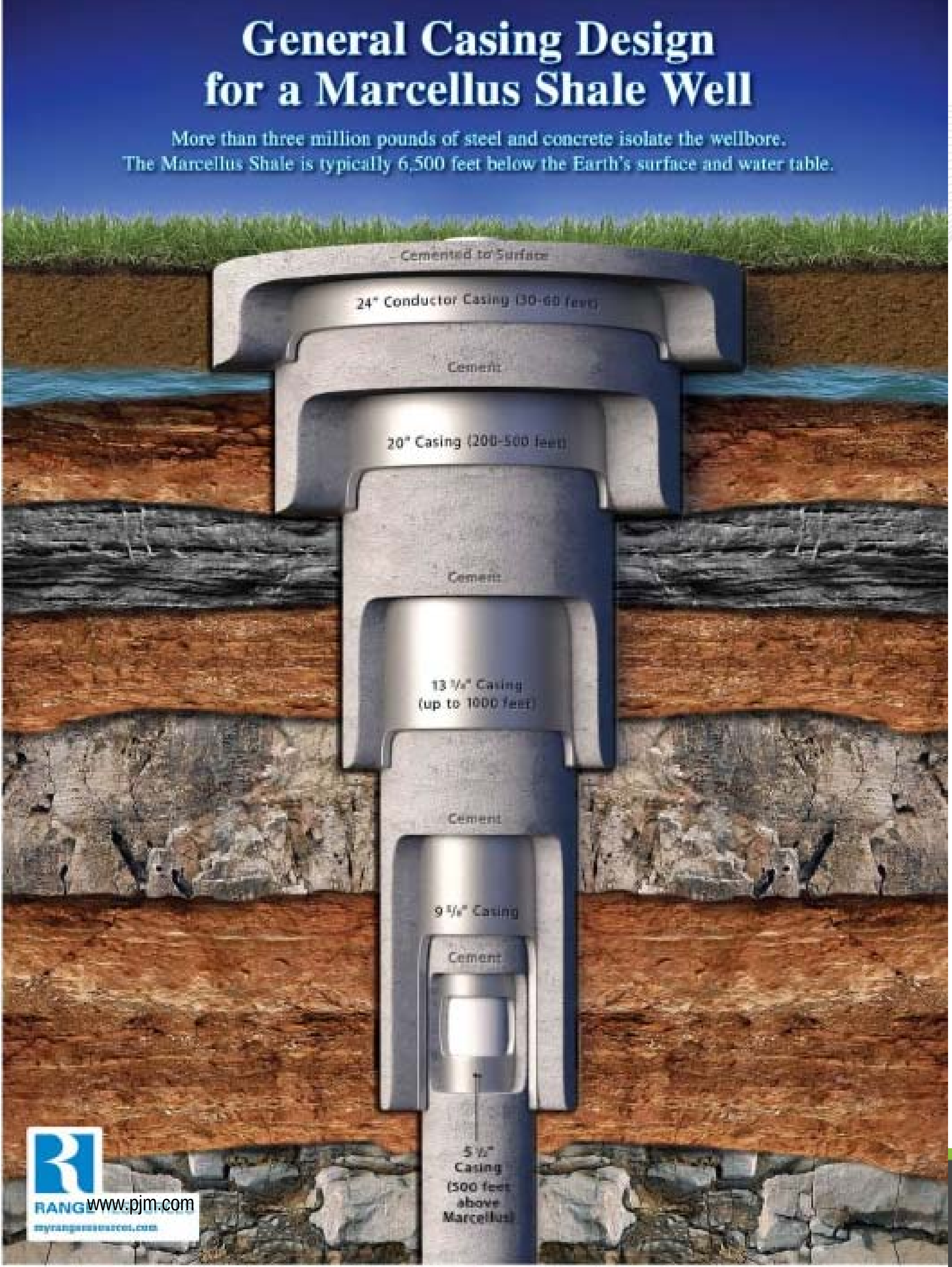
Source: Range Resources

Fresh water aquifers - generally less than 500 foot depth ➔

The same several thousand of feet of impermeable rock that have kept oil and gas in deeper rocks for hundreds of millions of years – also prevent fracturing fluids from contacting fresh ground water aquifers

Marcellus Shale ➔
(100 – 300 feet thick)





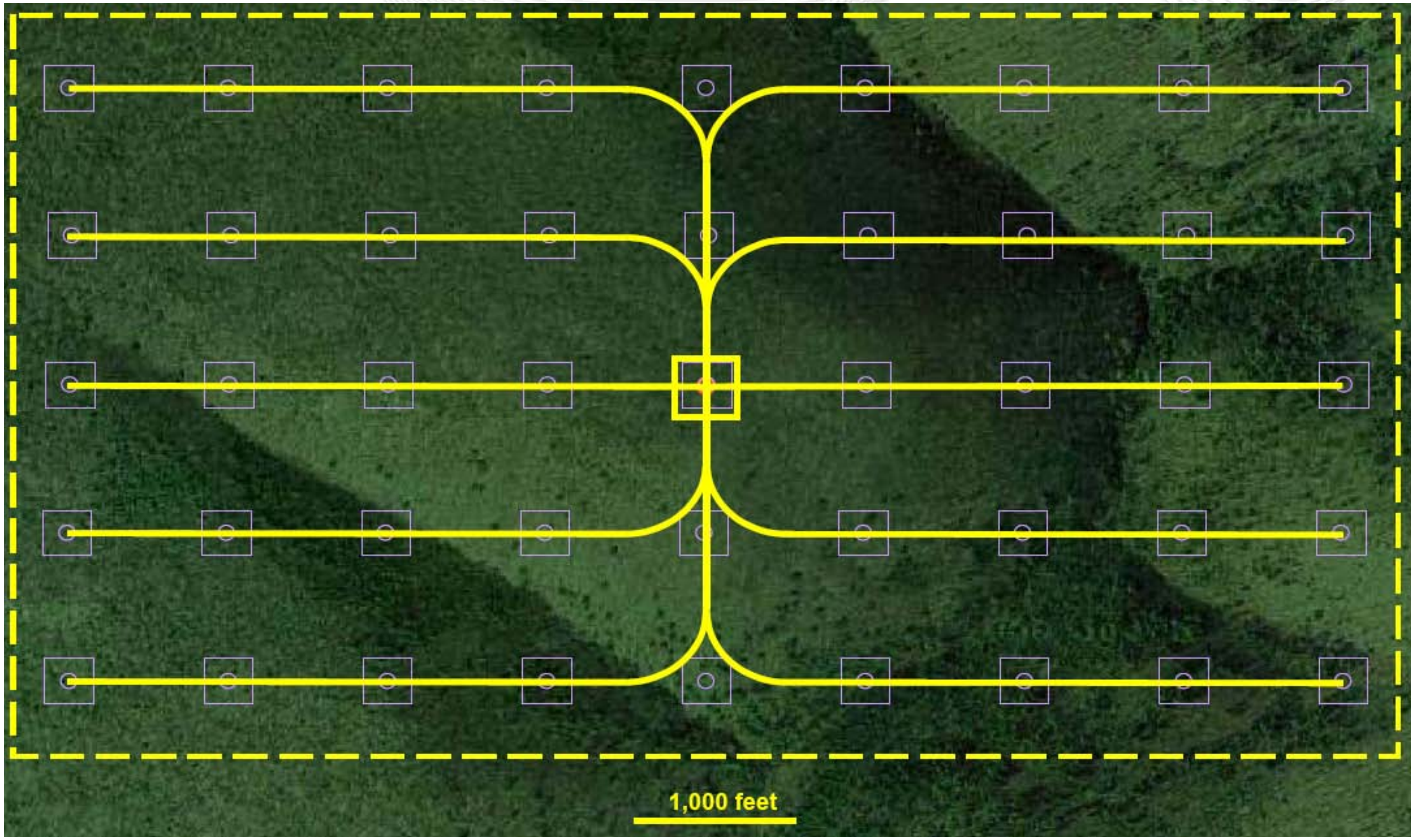
Water Protection

"The simple reality is that stimulation using this technique does not impact ground-water bearing zones."

– **Robert W. Watson** PhD PE is Emeritus Associate Professor of Petroleum and Natural Gas Engineering and Environmental Systems Engineering at The Pennsylvania State University

Source: Range Resources

Horizontal Drilling



Total surface disturbance during drilling, including access road, drilling pad and required pipeline infrastructure:

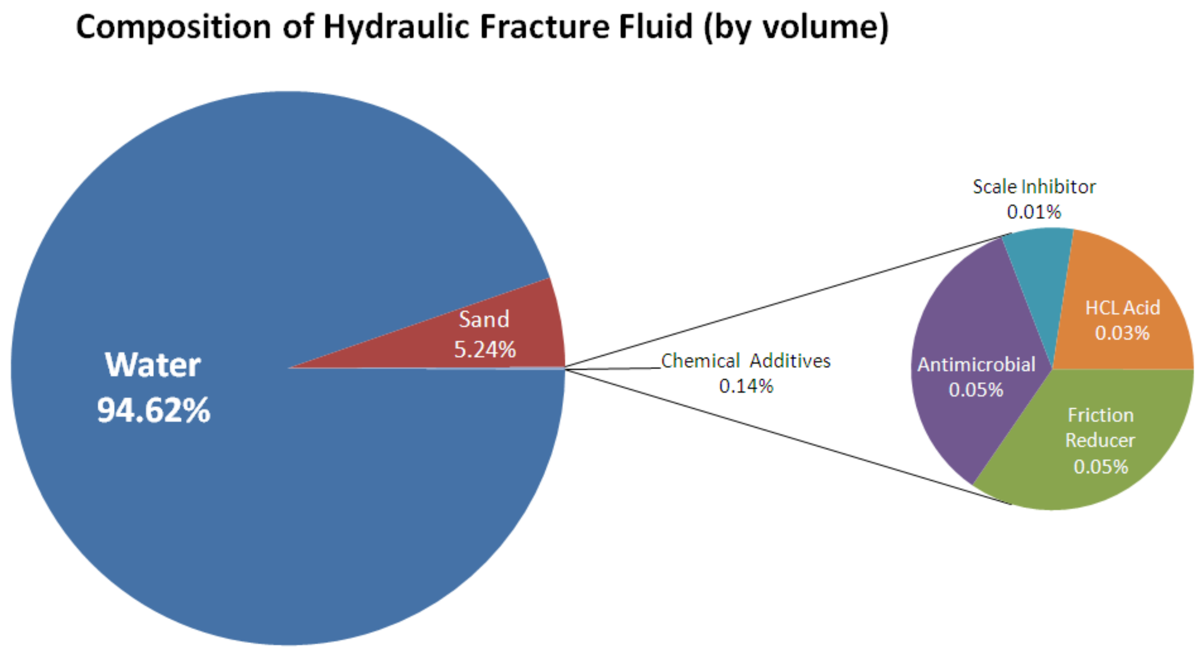
- Horizontal (yellow) develop 1,000 acres per pad with 1% surface disturbance
- Vertical (purple) on 1,000-foot spacing develop 23 acres per well with 19% total surface disturbance

Source: Range Resources

Environmental Issues with Marcellus Shale Development in PA

- Natural gas infiltration in Dimock, PA – 19 homes with contaminated water wells
- GasLand – presented natural gas drilling as a danger to water and human health
- NY Times Article on Feb. 27, 2011
- EPA letter of Mar. 7, 2011 to PA DEP requesting immediate testing of drinking water for radium
- Since 1941 over 1.2 million wells drilled using hydraulic fracturing with only two known failures

Frac Mixture - What goes into the well?



Primarily fresh water, with some sand, and a very small proportion of common chemicals, representing 0.14% of the mix. The chemicals are in very small quantities, low concentrations, used in highly supervised environments, and injected through multiple layers of cemented steel casings

Source: Range Resources

1. Environmental risks exist to shale gas drilling, but appear manageable
2. Everything is pointing to more gas-fired electric generation
3. Marcellus Shale gas will impact PJM and electricity markets in the years to come

- No N-1 criteria for pipeline network (ISO-New England 2004 had 7,000+ MW loss)
- Almost all generators are on non-firm NG contracts
- February 2 & 3, southwest rotating outages – some NG compressor stations were not on critical electric service list
- Some gas compressing stations are on interruptible electricity contracts
- Gas line pressure can be an issue when starting several generators (TVA lost 2,600 MW 2003 Δ Pressure > 100 PSI)
- Following PG&E explosion some pipelines have lowered maximum pressure by > 10%

- Local Distribution residential heating has first priority for gas (winter interruptions are more likely)
- Intrastate gathering pipelines (laterals) do not have the federal right of eminent domain
- Gas production and pipeline network is changing so fast that direction of flow is not known (Rockies Express 1323 Miles $4.5 billion)
- Gas market day does not align with the electricity market day
- Some of the gas pipeline and NG market control centers are not staffed 24x7
- Gas storage is relatively small in geologic formations that are often far from load centers (East Coast and West Coast)
- DOE (CERTs) and FERC action needed on joint infrastructure planning and Gas/Electric market coordination