

Recent Trends in Infrastructure

A Federal Perspective

IOGCC / PSU - Marcellus Summit
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FEDERAL ENERGY REGULATORY COMMISSION

Why Shale Gas? Why Now?

⇒ Project drivers

- ❖ Market

- ❖ Supply

⇒ Impacts on Existing Infrastructure

Market Drivers

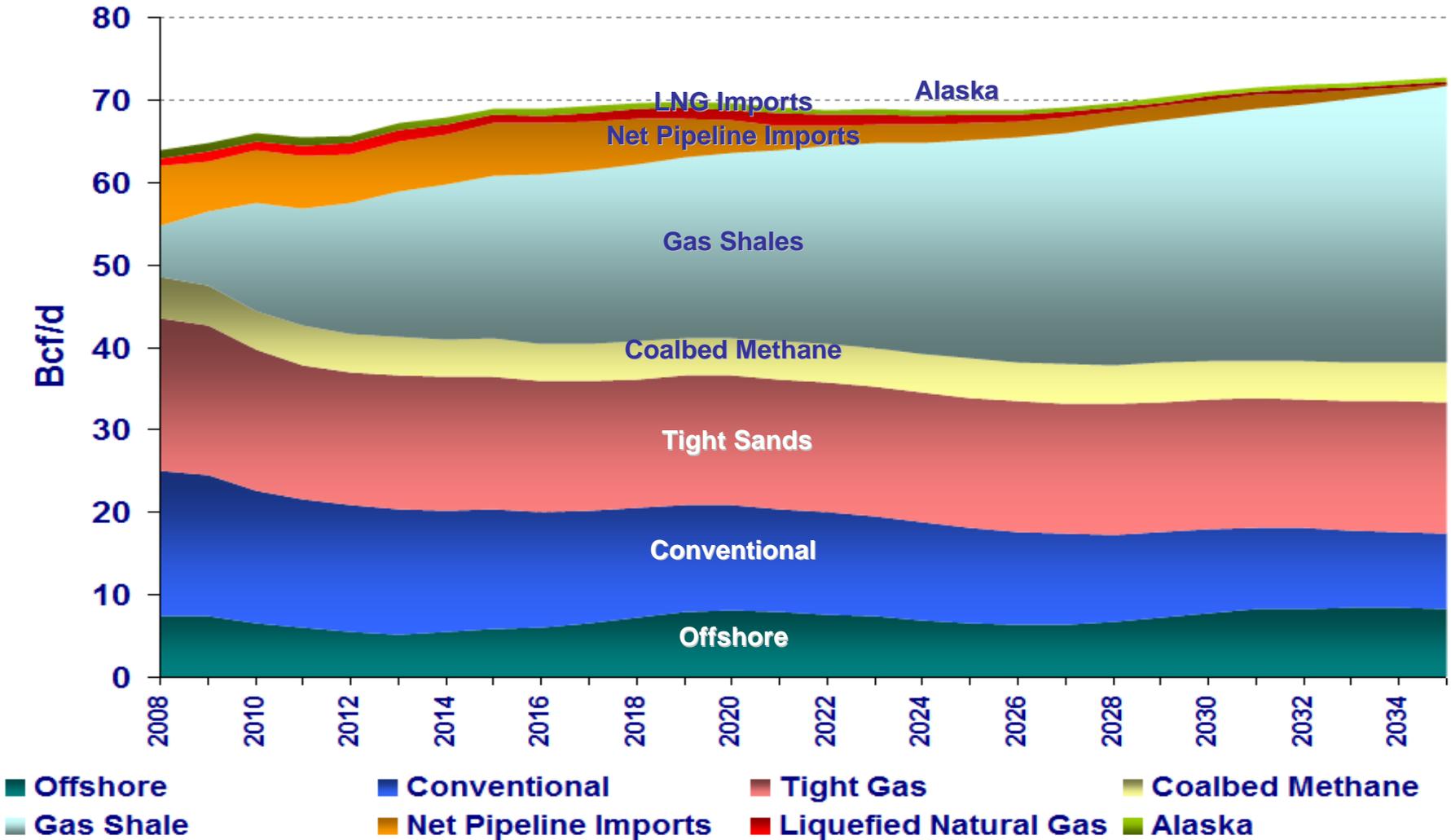
Natural gas is in demand...now more than ever!

- ⇒ **Firming-up Variable Power Generation (RPSs)**
- ⇒ **New Baseload Power Generation**
- ⇒ **Replacing / Converting Retiring Coal-Fired Plants**
- ⇒ **Natural Gas Vehicles**

Supply Drivers

- ⇒ **Shale gas is abundant and is becoming increasingly cheaper to produce**
- ⇒ **Rockies gas can now easily reach markets in the Northeast, and with Ruby, the Pacific Coast**
- ⇒ **Deeper shale formations (e.g., Utica) are now being considered as emerging supply sources**

Future U.S. Gas Supply



Source: EIA Annual Energy Outlook 2011 (April 2011) and EIA spreadsheets.

Technically Recoverable Gas in the U.S.

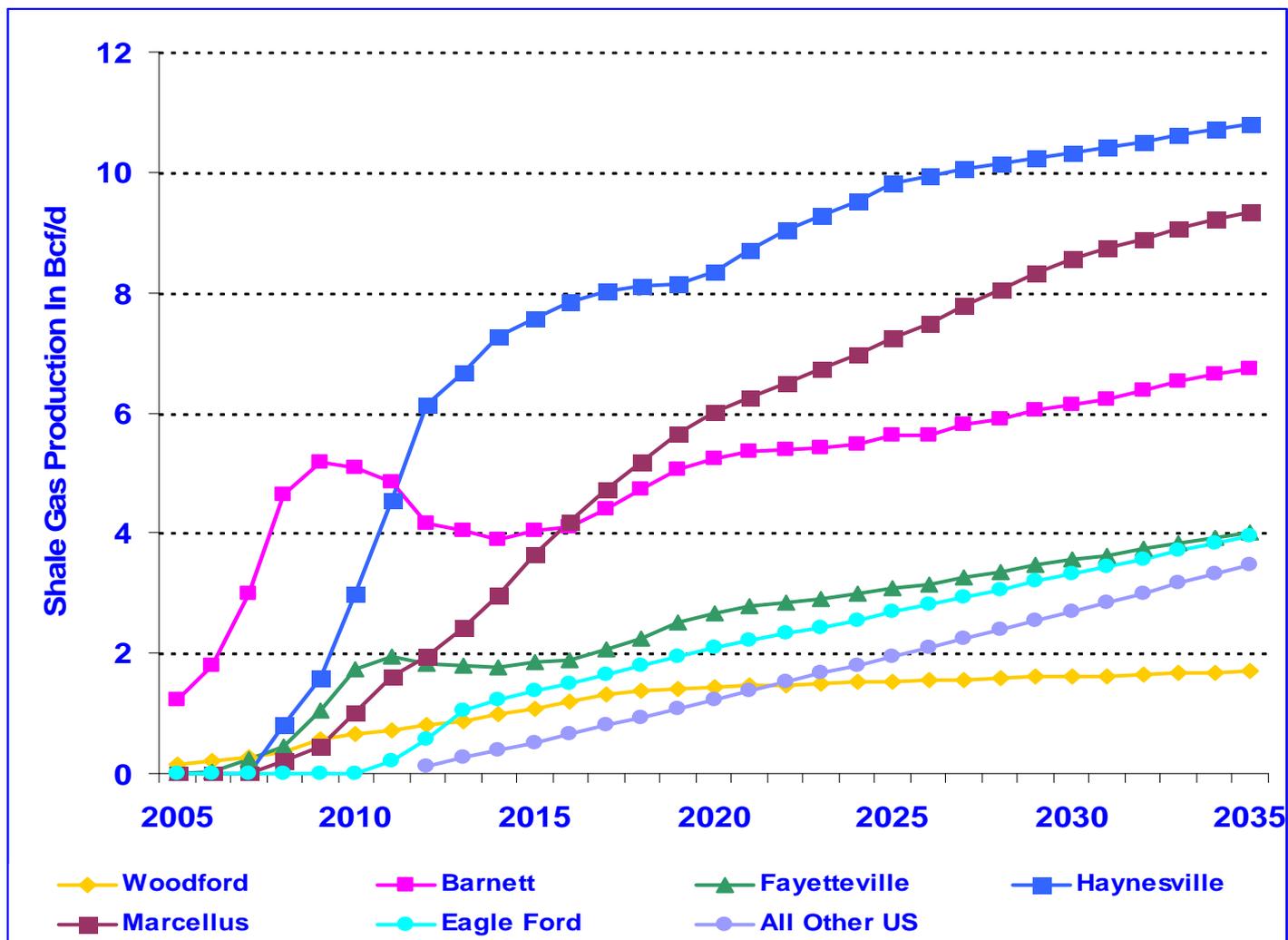
Natural Gas Resource Assessment of the Potential Gas Committee, 2010 (mean values)

Traditional Gas Resources	1,739.2 Tcf
Coalbed Gas Resources	158.6 Tcf
Total U.S. Gas Resources	1,897.8 Tcf
Proved Reserves (EIA)*	272.5 Tcf
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Future Gas Supply	2,170.3 Tcf

* Latest available value (dry gas), year-end 2009

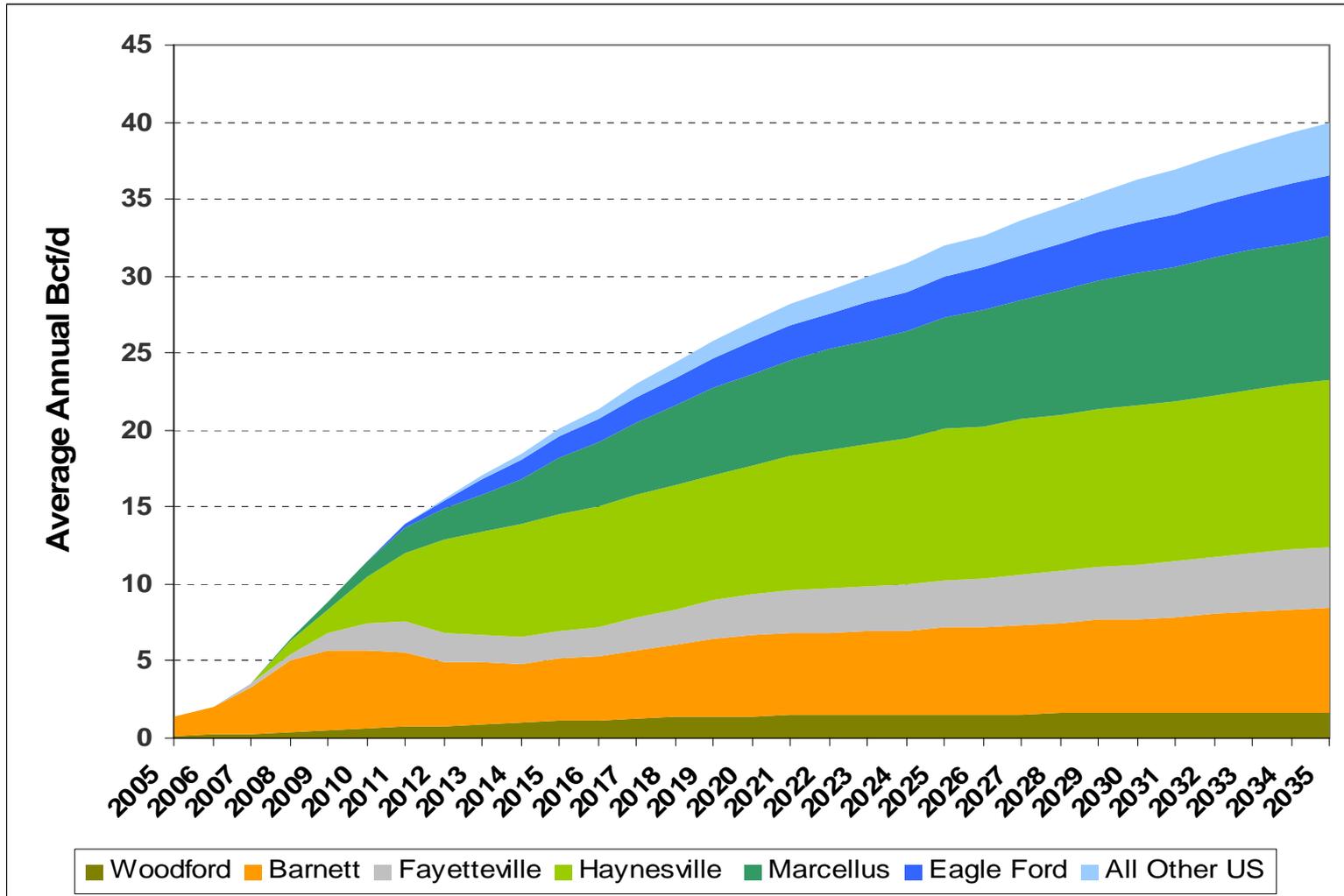
Source: Report of the Potential Gas Committee (December 31, 2010) "Potential Supply of Natural Gas in the United States" April 27, 2011

Shale Gas Estimates



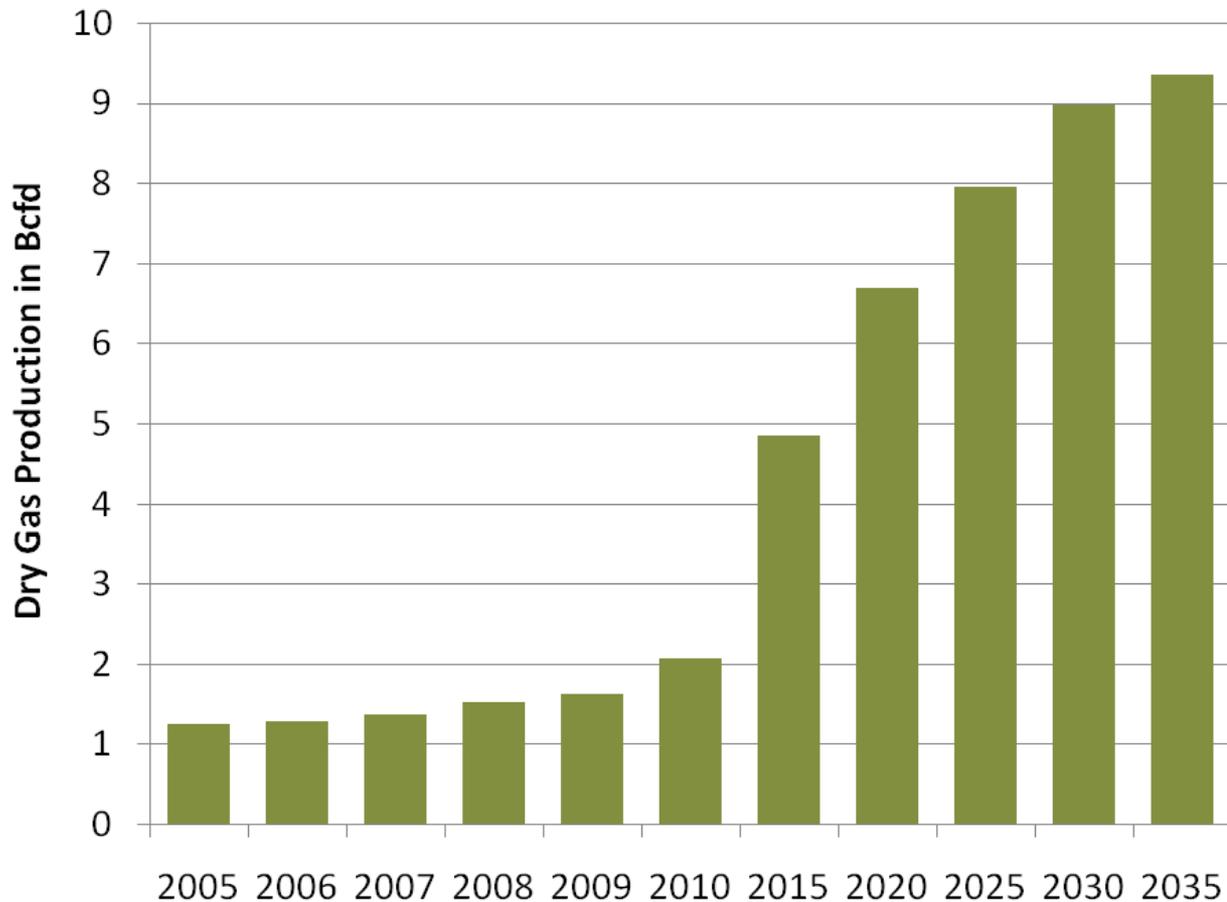
Source: Based on data from ICF International and Compass Report January 2011

Shale Gas Estimates



Source: Based on data from ICF International and Compass Report January 2011

Gas Estimate - Appalachia



- Growth in the Appalachian region of Northeastern U.S. is driven primarily by Marcellus Shale production.
- Regional production by 2035 is projected to grow by 7.7 Bcfd over 1.6 Bcfd in 2009 — an increase of over 475 percent.

Source: Based on data from ICF International and Compass Report October 2010

Summary of FERC Related Projects and Potential Projects Impacting the Shale Basins

FERC

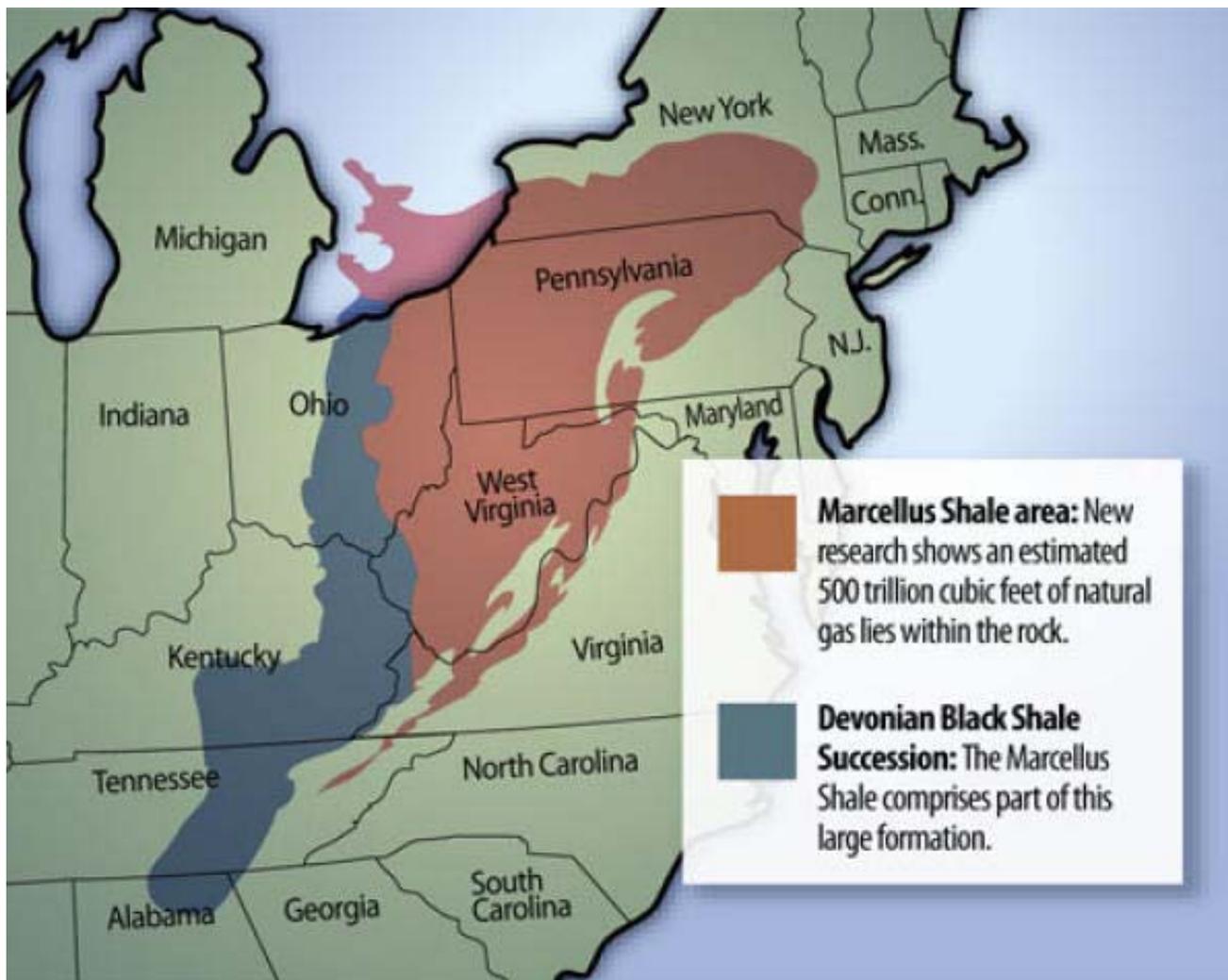
Natural Gas Basin	Capacity (MMcf/d)	Miles of Pipe	Compression (HP)	Cost (Millions)
Total Barnett	2,027	230	91,940	\$602
Total Barnett, Woodford & Fayetteville	3,532	877	290,070	\$3,517
Total Fayetteville	6,032	448	122,107	\$2,240
Total Woodford	638	50	19,500	\$134
Total Haynesville	3,230	196	229,716	\$1,618
Total Marcellus	6,616	634	404,347	\$3,130
Total Various Supplies	3,910	638	283,334	\$2,168
Grand Total	26,164	3,073	1,441,014	\$13,409

Potential

Natural Gas Basin	Capacity (MMcf/d)	Miles of Pipe	Compression (HP)
Total Barnett	2,139	40	9,500
Total Barnett & Woodford	1,800	175	70,000
Total Fayetteville	1,100	346	100,000
Total Bakken	130	100	0
Total Haynesville	1,100	0	20,260
Total Marcellus	4,988	962	0
Grand Total	11,257	1,623	199,760

Source: FERC

Marcellus Shale Area



Source: Marcellus Natural Gas Field Map on marcellusshale.com

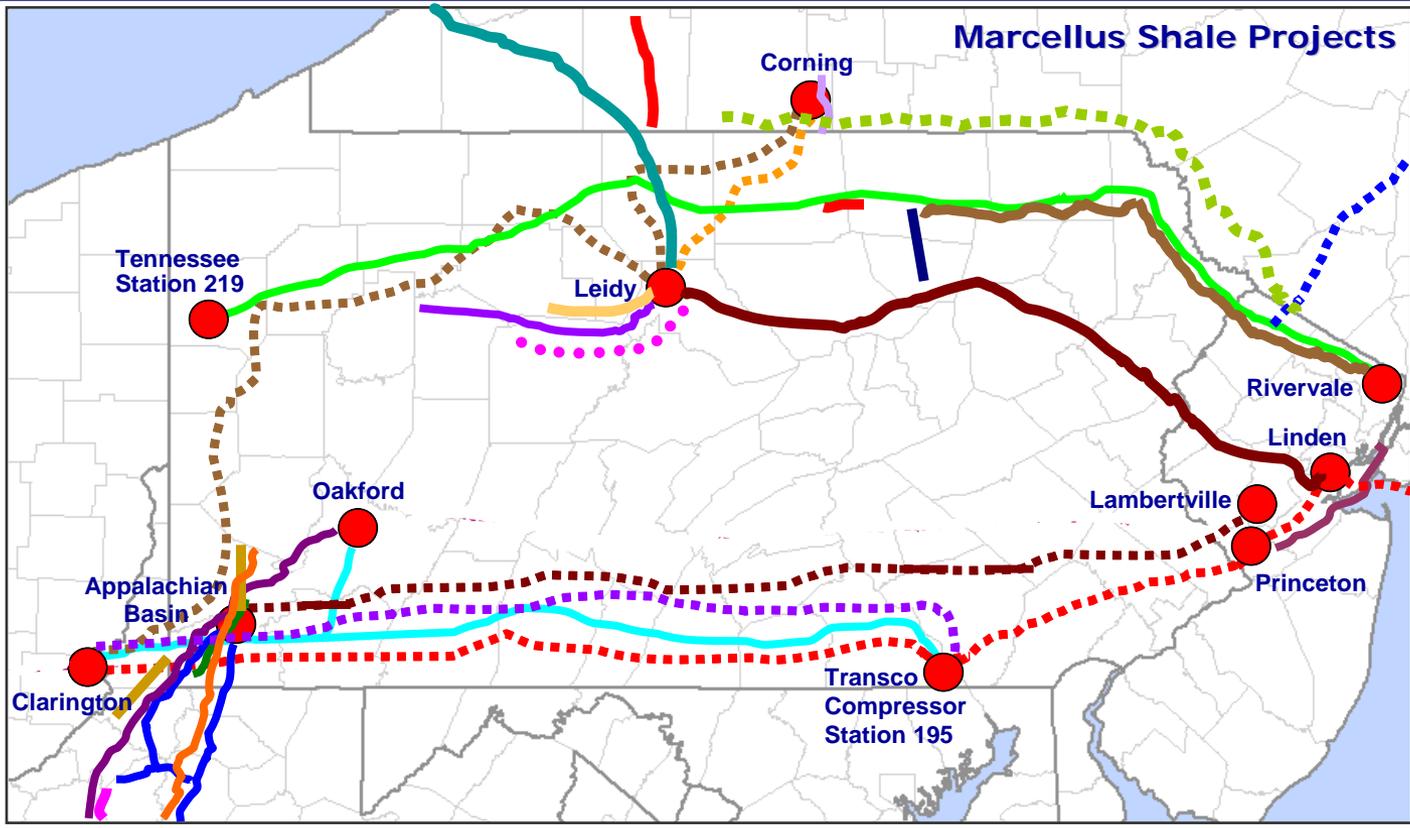
Marcellus Shale in the Appalachian Basin



- The Marcellus Shale spans six states in the northeastern U.S.
- Covers an area of 95,000 square miles at an average thickness of 50 ft to 200 ft
- Estimated depth of production is between 4,000 ft and 8,500 ft
- As of September 2008, there were a total of 518 wells permitted in Pennsylvania and 277 of the approved wells have been drilled
- The average well spacing is 40 to 160 acres per well
- The technically recoverable resources is estimated to be from 262 Tcf to 489 Tcf
- The amount of gas in place is estimated to be from 1,500 Tcf to 2,445 Tcf

Source: Exhibit 19 and text - Marcellus Shale in the Appalachian Basin, DOE's Modern Shale Gas Development in the United States; A Primer, dated April 2009; and "Marcellus 2008: Report card on the breakout year for gas production in the Appalachian Basin" by Terry Engelder, Ph.D., Professor of Geosciences, PennState University

Marcellus Shale Projects



Approved or Pending Projects

Potential Projects

- Appalachian Expansion (NiSource)
- Line 300 Exp (Tennessee)
- NiSource/MarkWest & NiSource
- N Bridge, TIME 3, TEMAX (TETCO)
- Appalachian Gateway (Dominion)
- Line N, R & I Project (NFG)
- Tioga County Extension (Empire)
- NSD Project (Tennessee) & Ellisburg to Craigs (Dominion)
- Northern Access & Station 230C (NFG & Tennessee)
- Sunrise Project (Equitrans)
- TEAM 2012 Project (TETCO)
- Northeast Upgrade (Tennessee)
- Marc I (Central NY)
- Low Pressure East-West (Equitrans)
- East-West - Overbeck to Leidy (NFG)
- NJ-NY Project (TETCO & Algonquin)
- Northeast Expansion (Dominion)
- Northeast Supply Link (Transco)

- - - NYMarc (Iroquois)
 - - - New Penn (NiSource)
 - - - Marcellus to Manhattan (Millennium)
 - - - Appalachia to Market Expansion & TEAM 2013 (TETCO)
 - - - Keystone (Dominion/Williams)
 - - - West to East Connector (NFG)
 - - - NiSource & UGI
 - - - Northeast Supply (Williams)*
- * Combined Transco's Rockaway Lateral and Northeast Connector Projects

Source: Based on data from Ventyx Velocity Suite, October 2010 & FERC applications

Summary of Natural Gas Facilities Impacting the Marcellus Shale Basin

Natural Gas Basin	Status	Company/ Project	Capacity (MMcf/d)	Miles of Pipe	Compression (HP)
Marcellus	In-Service 11/10	Texas Eastern Trans., LP (TEMAX & TIME III projects)	455	62	84,433
Marcellus	In-Service 10/09	Texas Eastern Trans., LP (Northern Bridge Project)	150	0	10,666
Marcellus	In-Service	Columbia Gas Trans., LLC (Appalachian Exp. Proj.)	100	0	9,470
Marcellus	Under Construction	Tenn. Gas Pipeline Co. (Line 300 Expansion)	350	129	59,158
Marcellus	Prior-Notice In-Service	Columbia Gas Trans., LLC (Majorsville Compressor/ MarkWest Upgrade)	250	4	0
Marcellus	Prior-Notice In-Service	Columbia Gas Trans., LLC Equitrans, LP (Low Pressure East and West Upgrade Project)	150	6	0
Marcellus	Prior-Notice In-Service	Dominion Trans., Inc. (Appalachian Gateway Project)	92	0	0
Marcellus	Pending	Dominion Trans., Inc. (Appalachian Gateway Project)	484	107	17,965
Marcellus	Pending	Central NY Oil and Gas Co. (MARC I Project)	550	39	31,660
Marcellus	Under Construction	National Fuel Gas Supply Corporation (Line N R & I Project)	150	20	4,740
Marcellus	Pre-Filing	National Fuel Gas Supply Corporation (E-W / Overbeck to Leidy)	425	82	25,000
Marcellus	Pending	Texas Eastern Trans. & Algonquin Gas Trans. (NJ-NY Project)	800	20	0
Marcellus	Pending	Equitrans, LP (Sunrise Project)	314	47	14,205
Marcellus	Pending	Texas Eastern Trans., LLC (TEAM 2012 Project)	190	18	20,720
Marcellus	Pre-Filing	Tenn. Gas Pipeline Co. (Northeast Upgrade Proj.)	636	37	20,620
Marcellus	Pending	Tenn. Gas Pipeline Co. (Northeast Supply Diversification Project)	250	7	0
Marcellus	Pending	Dominion Trans., Inc. (Ellisburg to Craig Project)	150	0	10,800
Marcellus	Pending	Dominion Trans., Inc. (Northeast Expansion Project)	200	0	32,440
Marcellus	Pre-Filing	Transco (Northeast Supply Link)	250	39	36,000
Marcellus	Pending	National Fuel Gas Supply Corporation (Northern Access Project)	320	0	14,210
Marcellus	Pending	Tennessee Gas Pipeline Company (Station 230C Project)	0	0	12,260
Marcellus	Pending	Empire Pipeline, Inc (Tioga County Extension)	350	16	0
Total			6,616	633.9	404,347

Natural Gas Basin	Status	Company/ Project	Capacity (MMcf/d)	Miles of Pipe	Compression (HP)
Marcellus	Potential	Nisource (New Penn)	500	82	
Marcellus	Potential	TETCO (Appalachia to Market Expansion- TEAM)	500		
Marcellus	Potential	Dominion/Williams (Keystone Connector)	1,000	240	
Marcellus	Potential	Williams (Northeast Supply)	688	250	
Marcellus	Potential	NFG (West to East Connector)	625	324	
Marcellus	Potential	Iroquois Gas Transmission System LP (NYMarc System Project)	500	66	
Marcellus	Potential	Millennium Pipeline (Marcellus to Manhattan)	675	0	
Marcellus	Potential	NiSource Gas Transmission and Storage & UGI Corporation	500	0	
Total			4,988	962	0

Source: FERC

Changing Supply Dynamics

Emerging shale gas plays and Rockies gas (via REX) have resulted in a change in the traditional flows on pipelines that historically have brought gas from the gulf to markets in the northeast.

The impact??

- ⇒ **a glut of gas in the Market Area**
- ⇒ **underutilized pipeline facilities**
- ⇒ **loss of traditional transportation revenue**

Impacts on Existing Infrastructure

So...what's a pipeline to do...

- ⇒ **File a rate proceeding?**
- ⇒ **File to modify existing infrastructure?**
- ⇒ **File to abandon certificated facilities?**
- ⇒ **File to construct new facilities?**
- ⇒ **All of the above?**

Rate Proceedings

- ⇒ **Columbia Gulf Transmission Company – Docket No. RP11-1435-000**
- ⇒ **Tennessee Gas Transmission – Docket No. RP11-1566-000**

Both seek to make their recourse rates less “distance sensitive”...Columbia Gulf is proposing a postage stamp rate, while Tennessee proposes to shift costs from mileage to non-mileage.

Columbia Gulf Transmission Company

Docket No. RP11-1435-000

From Testimony Filed in the Proceeding:

- The flattened basis differential between the price of gas near the Gulf of Mexico and the price of gas in the Midwest and Northeast due to the increase in new gas supplies means there is less economic incentive to transport Gulf of Mexico gas to northern points.
- CGT's customers are now increasingly sourcing gas from the shale production areas to the west of CGT's system. This means that CGT's customers are now using receipt points near Delhi, Louisiana instead of traditional points on CGT's Onshore and Offshore laterals resulting in decreased throughput on the Onshore zone.
- In general, the new pipelines that provide takeaway capacity from the Texas, Oklahoma, Louisiana, and Arkansas shale plays have helped integrate the pipeline system in the Eastern U.S. These pipelines allow significant volumes to flow west-to-east, which has decreased the differential that once existed between the price of gas in Texas and Louisiana and the price of gas in eastern markets. The market is therefore no longer as reliant on CGT to bring supplies to the market. As a result, demand for transportation capacity on CGT's system has decreased as the pipeline system has grown more integrated. The declining production costs associated with developing shale gas supplies along with the increased production from the Marcellus Shale will likely cause a further flattening of the price differential between Gulf of Mexico supply and northern markets.

Tennessee Gas Transmission

Docket No. RP11-1566

From Testimony Filed in the Proceeding:

- CGT may lose some of its northern LDC customers who can access the Marcellus Shale or gas supplies from the Rockies without using CGT's system.
- Tennessee is now receiving approximately 30% of its supply from the middle of its system (Zone 4), up from 5% in 2009. (TPG-132, page 20, lines 1-3).
- In the past, supply shortages often resulted from damage to offshore facilities due to hurricanes. Today, such shortages would not have the same operational impact because Tennessee has more supply being delivered directly into its market are from REX and Marcellus. (TGP-132, page 29, lines 5 -10).
- Natural gas from REX and Marcellus has displaced receipts from traditional sources in south Texas and the Gulf of Mexico. For example, physical receipts of Marcellus gas into Tennessee's 300 Line located in Pennsylvania have increased from zero in 2008 to nearly 1 Bcf/d by November 2010. (TGP-141, page 10 line 17 – page 11, line 2).
- In recognition of the increased Marcellus shale gas and other supplies entering into the Tennessee system in Zone 4, Tennessee proposes to modify the location of existing pooling points. By moving the pools there will be a reduced likelihood of a restriction into the pool due to constrained segments of pipe. (TGP-141, page 46, line 13 – page 47, line 18).

Modifications to Existing Infrastructure / Change in Flow Patterns

The following pipeline companies have sought FERC approval to make facility changes to existing infrastructure, and amend Presidential Permits to allow transportation and exportation of shale gas into Canada:

- ⇒ Empire**
- ⇒ Iroquois**
- ⇒ Maritimes and Northeast**
- ⇒ National Fuel**
- ⇒ Tennessee**
- ⇒ Vector**

Existing Pipelines are Eyeing Backhauls in Response to Marcellus Growth

Existing pipelines are mulling the option to backhaul gas as the rapid growth of shale gas production redraws the map for pipeline flows across North America:

- The growing market chatter regarding offering backhaul capacity on Rockies Express Pipeline has been increasing, with the pipeline company even mentioning it as an area of growth for next year in an investor presentation in January 2010.
- Tennessee Gas Pipeline announced recently that it has contracted for some 400,000 Mcf/d of backhaul capacity from the Marcellus Shale to Southeastern markets this year and projects to have about 936,000 Mcf/d in 2012.
- Transcontinental Gas Pipe Line officials announced that the pipe has the ability to move gas west to Leidy, Pennsylvania, and even back down to Transco zone 5 in the Mid-Atlantic.

Abandoning Existing Infrastructure

The following pipelines have sought FERC authority to abandon certificated facilities, typically in historic production areas (including offshore) and on parts of their systems with low throughput:

- ⇒ **ANR**
- ⇒ **Columbia Gulf**
- ⇒ **Florida Gas Transmission**
- ⇒ **Northern Natural**
- ⇒ **Southern Star**
- ⇒ **Tennessee**
- ⇒ **Texas Eastern**
- ⇒ **Transco**

Construction of New Facilities

The following pipelines have sought to construct new facilities to transport Marcellus shale gas:

- ➔ **Equitrans**
- ➔ **National Fuel**
- ➔ **Tennessee**
- ➔ **Texas Eastern**
- ➔ **Transco**
- ➔ **Dominion**

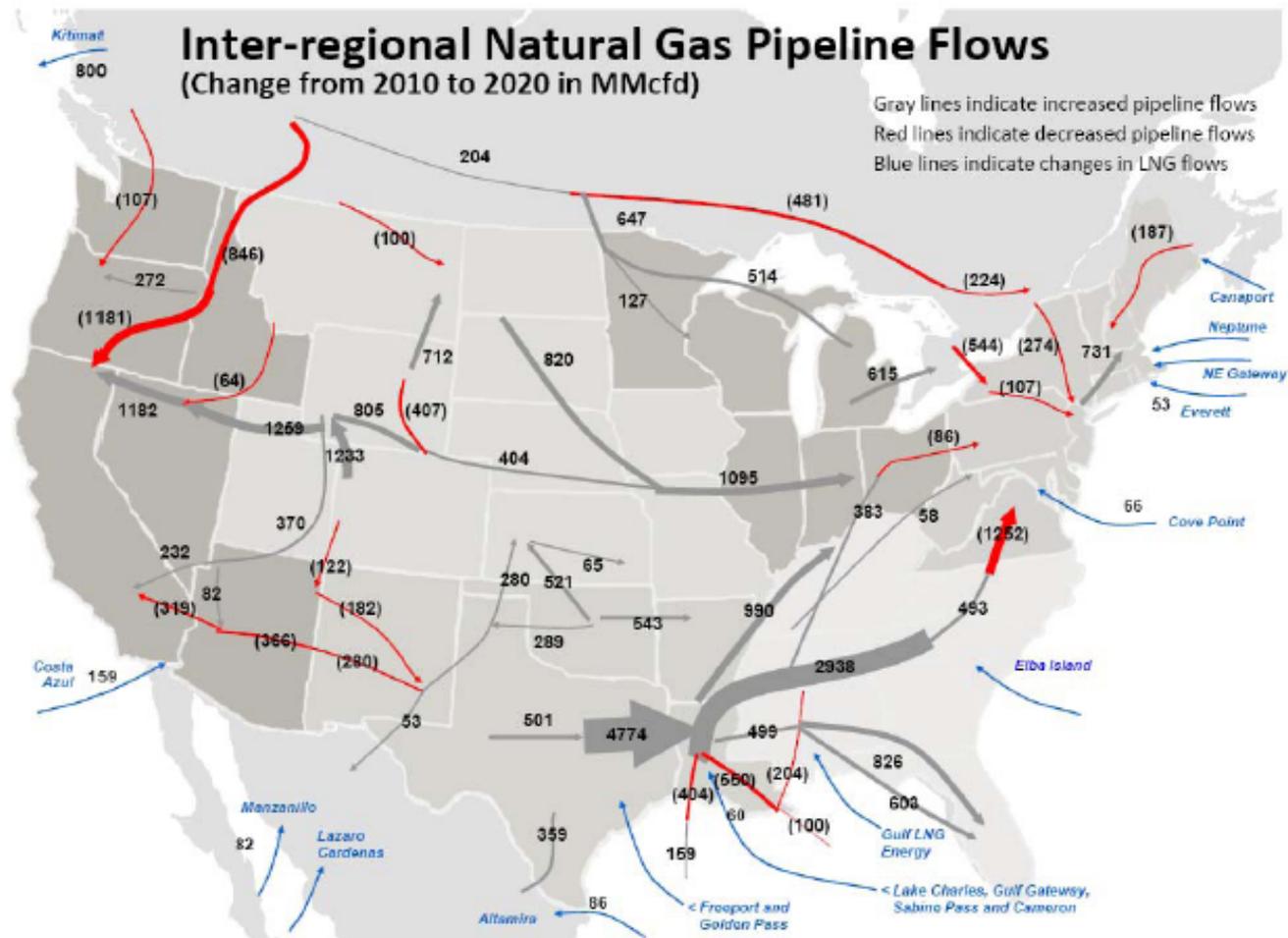
All of the Above? Sorta!!

Moving the “Heavies” to Market:

- ➔ Several traditional “Long Haul” pipelines are exploring ways to take Ethane and other liquids to the gulf coast region from Marcellus
- ➔ This would involve reversal of flow on segments of existing pipeline facilities
- ➔ Could be accomplished by modifying existing compression to handle pumping liquids, and possibly uprating operating pressures to handle liquids
- ➔ Would require abandonment authority from FERC

Projected Change in Gas Flows 2010 – 2020

- Increases in flows from the Gulf Coast to the Southeast are due to increases in Mid-continent shale gas production.
- REX Pipeline enables increasing flow from the Rocky Mountains eastward.
- Marcellus gas production growth displaces gas flows into the Northeast U.S. (Shifts within the Northeast are not depicted on this interregional flow map).
- Declining conventional production in Alberta and increasing gas consumption for oil sands development causes flows from Western Canada to decline.

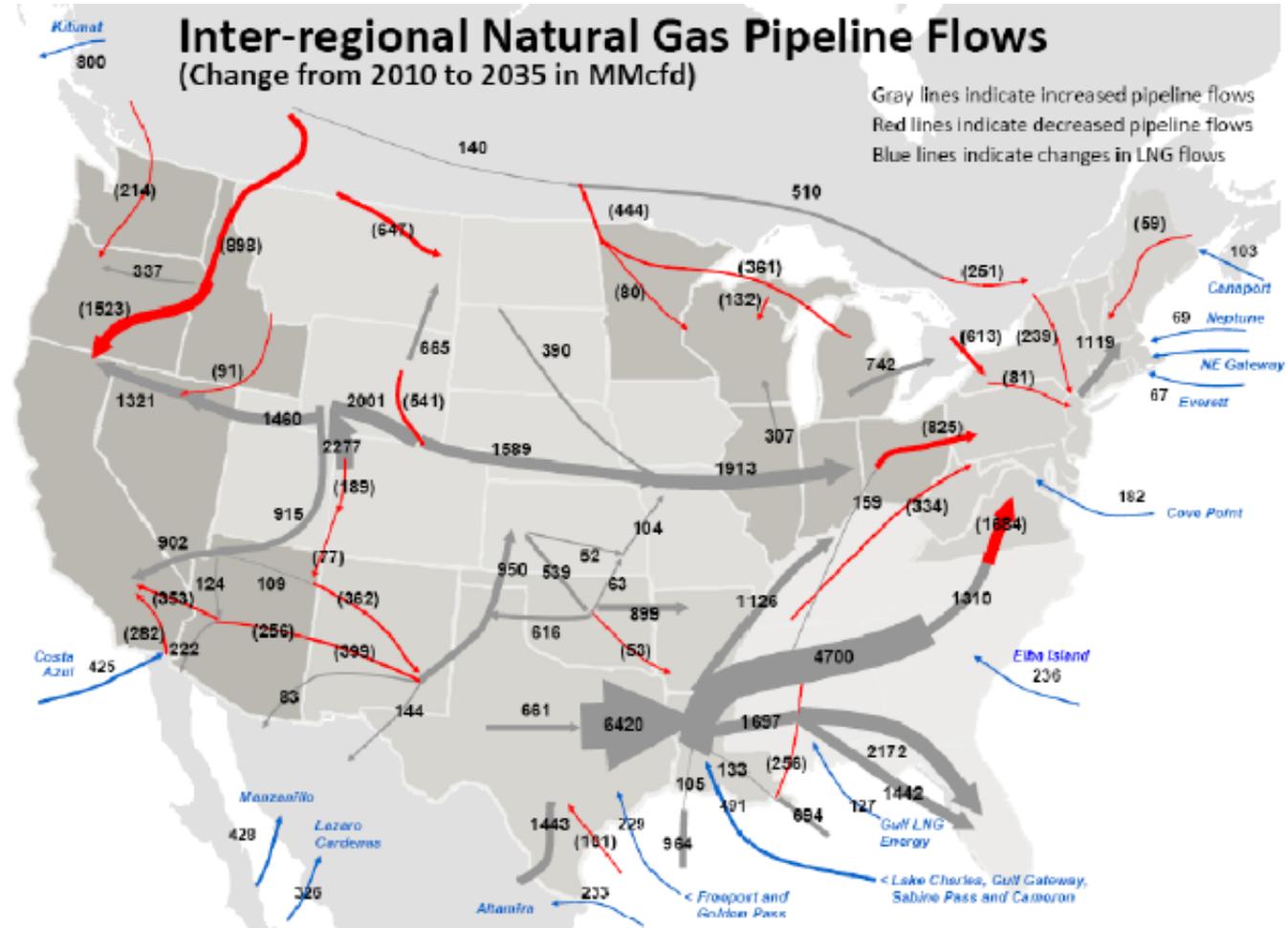


Note that this map does not generally show intra-regional pipeline expansions such as those that occur in the Marcellus shale production area.

Source: North America Midstream Infrastructure Through 2035 – A Secured Energy Future. Prepared for the INGAA Foundation June 28, 2011

Projected Change in Gas Flows 2010 – 2035

- Substantial increases in flows continue to occur out of the Mid-continent shales and the Rocky Mountain producing basins.
- Marcellus gas production growth continues to displace gas flows into the Northeast U.S. (Shifts within the Northeast are not depicted on this interregional flow map).
- Flows on TCPL to eastern markets recover slightly, but remain down in the longer term.



Note that this map does not show generally intra-regional pipeline expansions such as those that occur within the Marcellus shale production area.

Source: North America Midstream Infrastructure Through 2035 – A Secured Energy Future. Prepared for the INGAA Foundation June 28, 2011