FERC's Role in Developing Shale Infrastructure

Asian Pacific Energy Regulatory Forum

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Washington, DC **August 2, 2012**

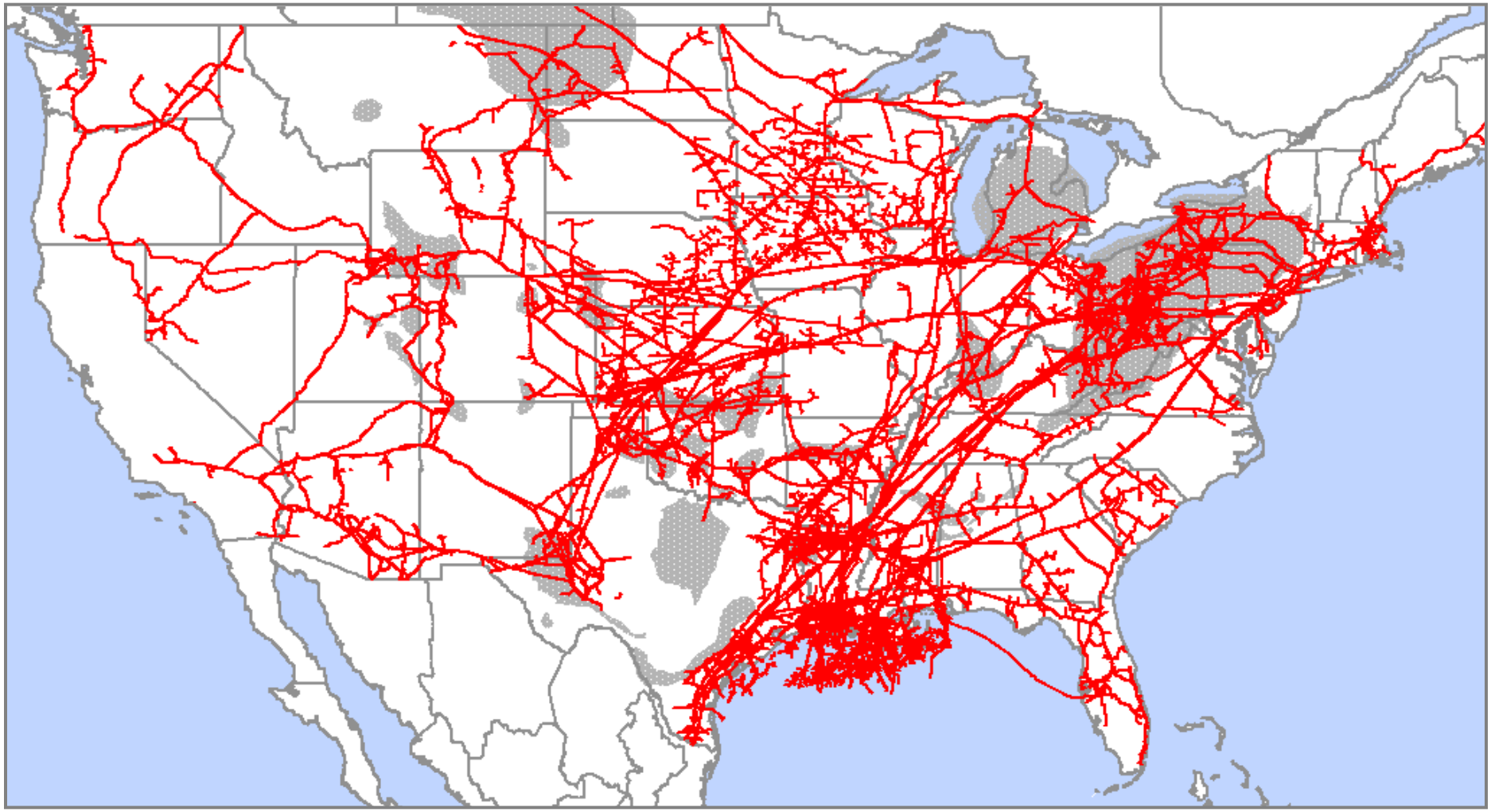
FERC Regulates

- Facilities
  - Interstate Pipeline and Storage Facilities
  - LNG Import/Export Terminals
  - Import/Export Points
- Rates and Terms & Conditions of Service

FERC Doesn’t Regulate

- Production
- Gathering
- Distribution
- Commodity

Interstate Natural Gas Transmission Pipeline and Major Shale Plays



Source: Based on data from Ventyx Global Energy Decisions, Inc., Velocity Suite, April 2012.

Types of Projects Before the FERC

- Incremental Expansions to Traditional Markets
- Enhancements to Provide Bi-Directional Flow
- Exports to Canada
- Supply Attachments

Why Shale Gas? Why Now?

- **Project drivers**
  - ⇨ Market
  - ⇨ Supply
- **Impacts on Existing Infrastructure**

Supply Drivers

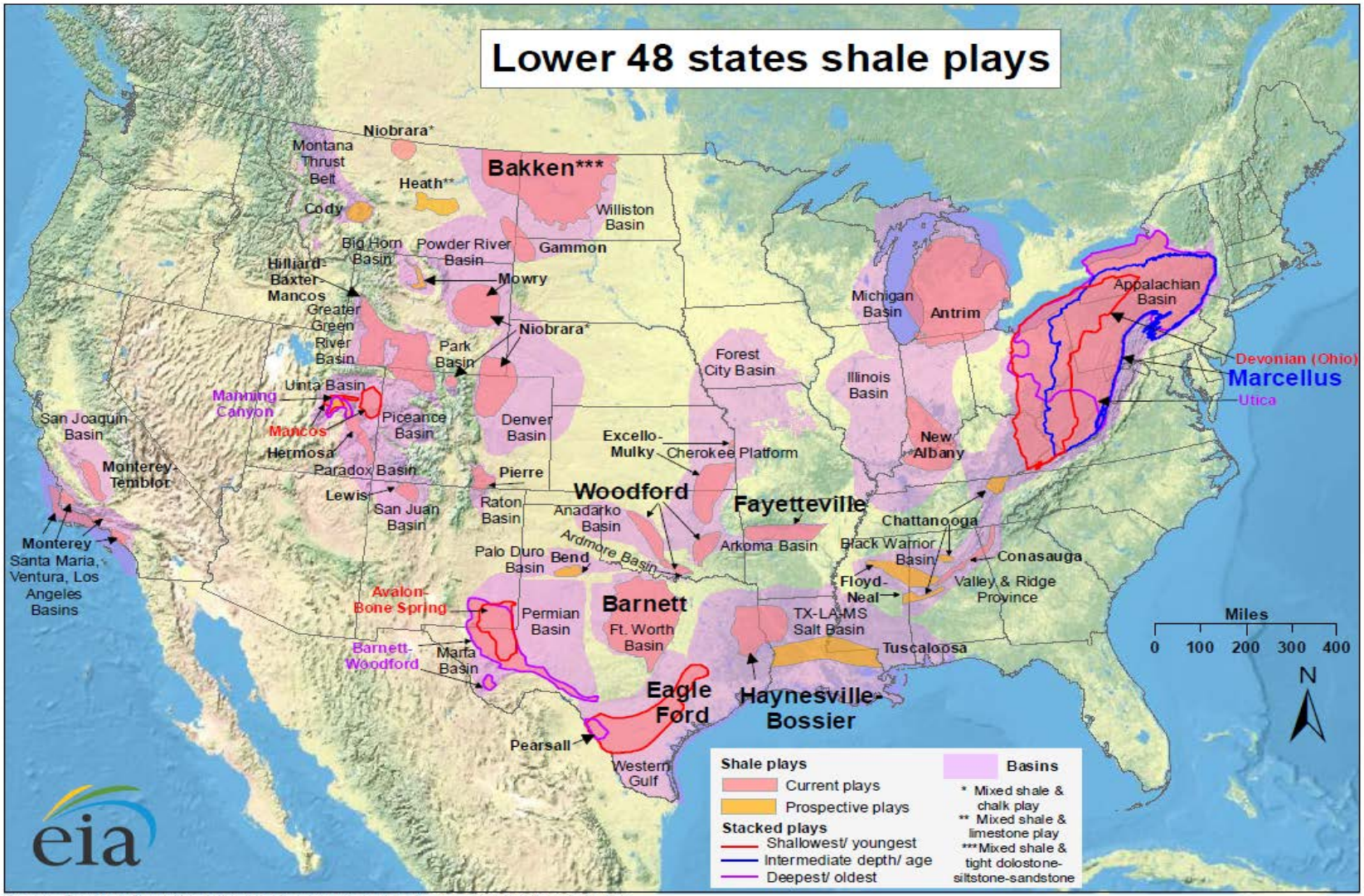
- Shale gas is abundant and is becoming increasingly cheaper to produce
- Rockies gas can now easily reach markets in the Northeast, and with Ruby, the Pacific Coast
- Deeper shale formations (e.g., Utica) are now being considered as emerging supply sources

Market Drivers

Natural gas is in demand…now more than ever!

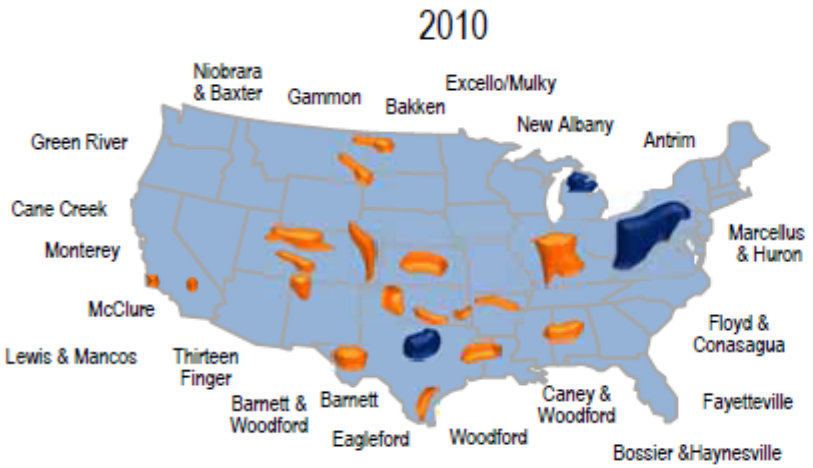
- **Firming-up Variable Power Generation (RPSs)**
- **New Baseload Power Generation**
- **Replacing / Converting Retiring Coal-Fired Plants**
- **Natural Gas Vehicles**

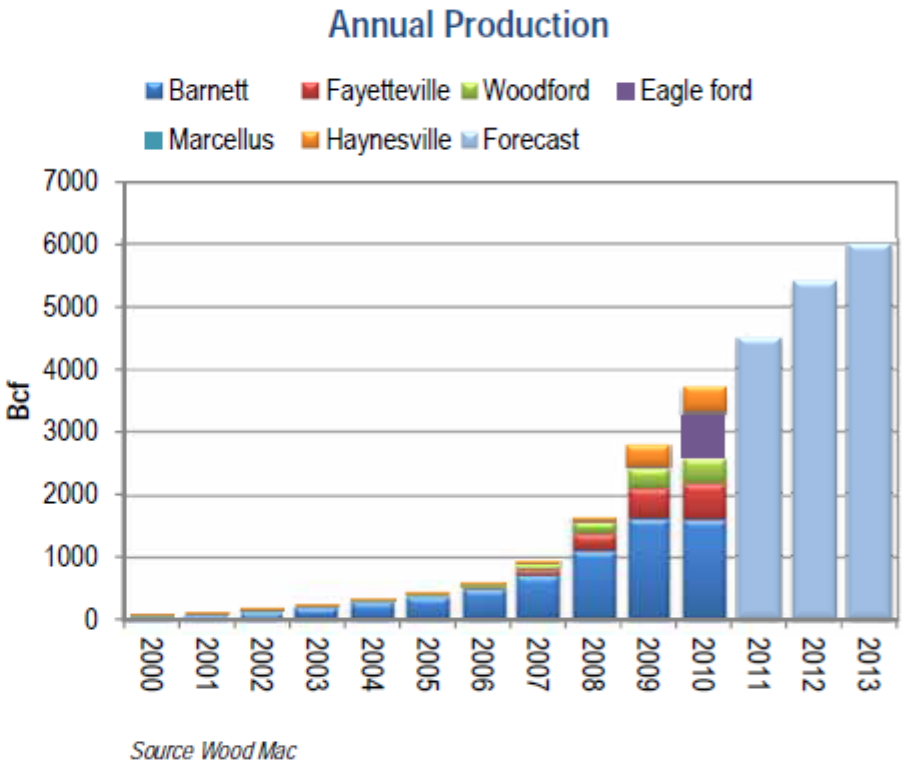
Shale Gas Plays in the United States



Source: Energy Information Administration based on data from various published studies.
Updated: May 9, 2011

Shales have transformed the US Gas Industry





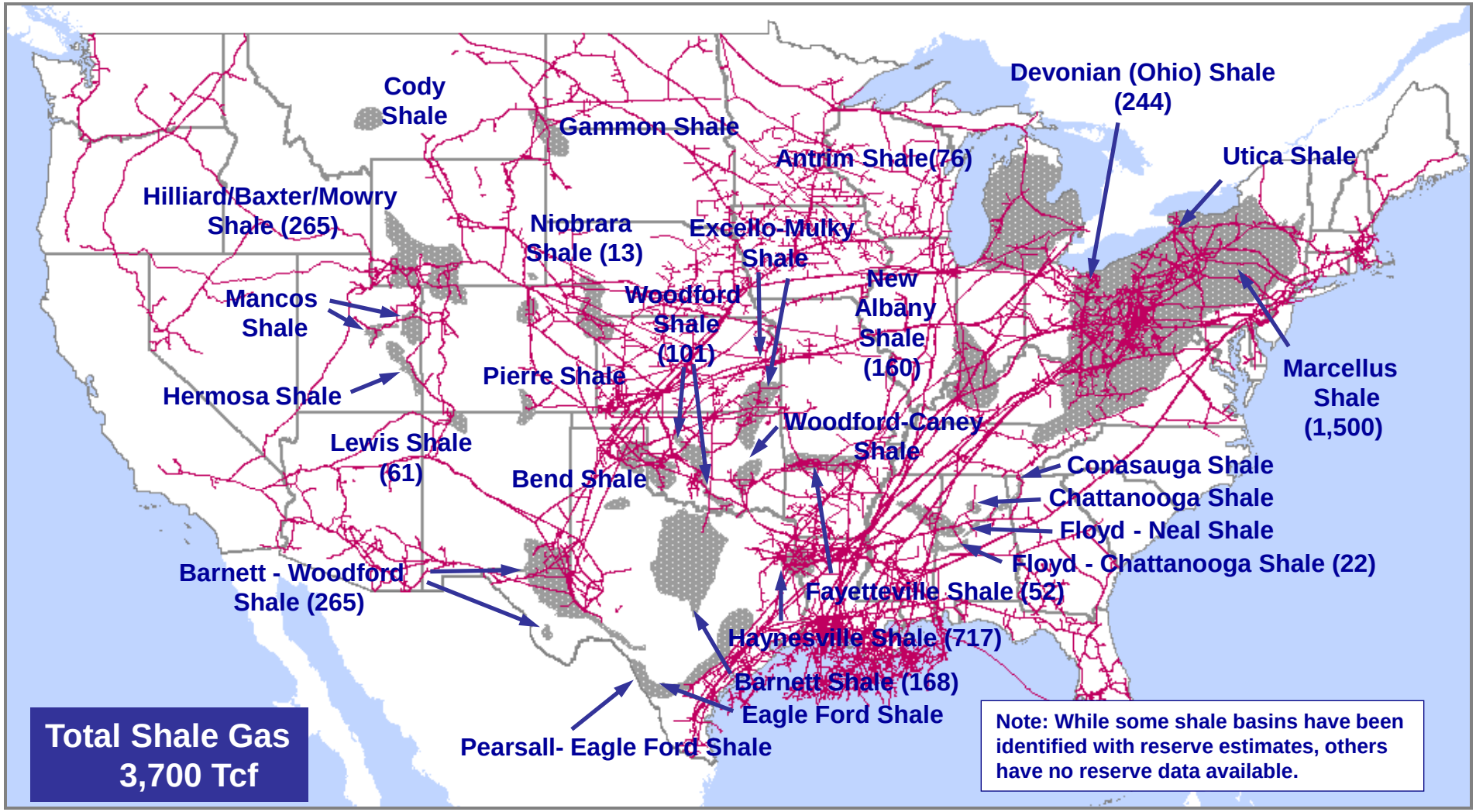
Source Wood Mac

2011 Shale Developments

- Tuscaloosa
- Permian
- Utica
- New Brunswick

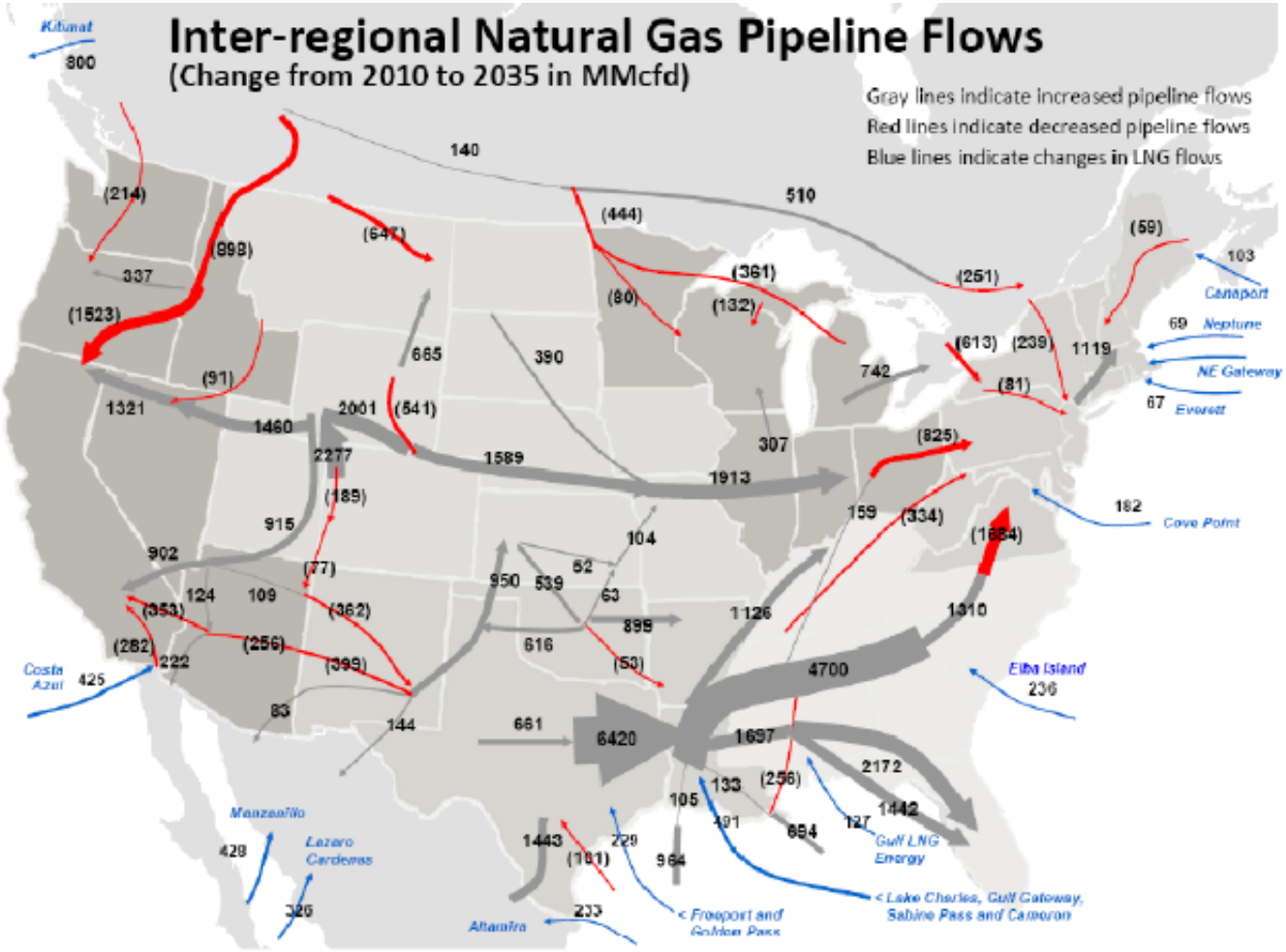
Source: GasMart 2011 Jeff Spath, Ph.D. Technology Advances in Developing Shale Gas Reservoirs

Impacts of Shale Gas Development



Projected Change in Gas Flows 2010 – 2035

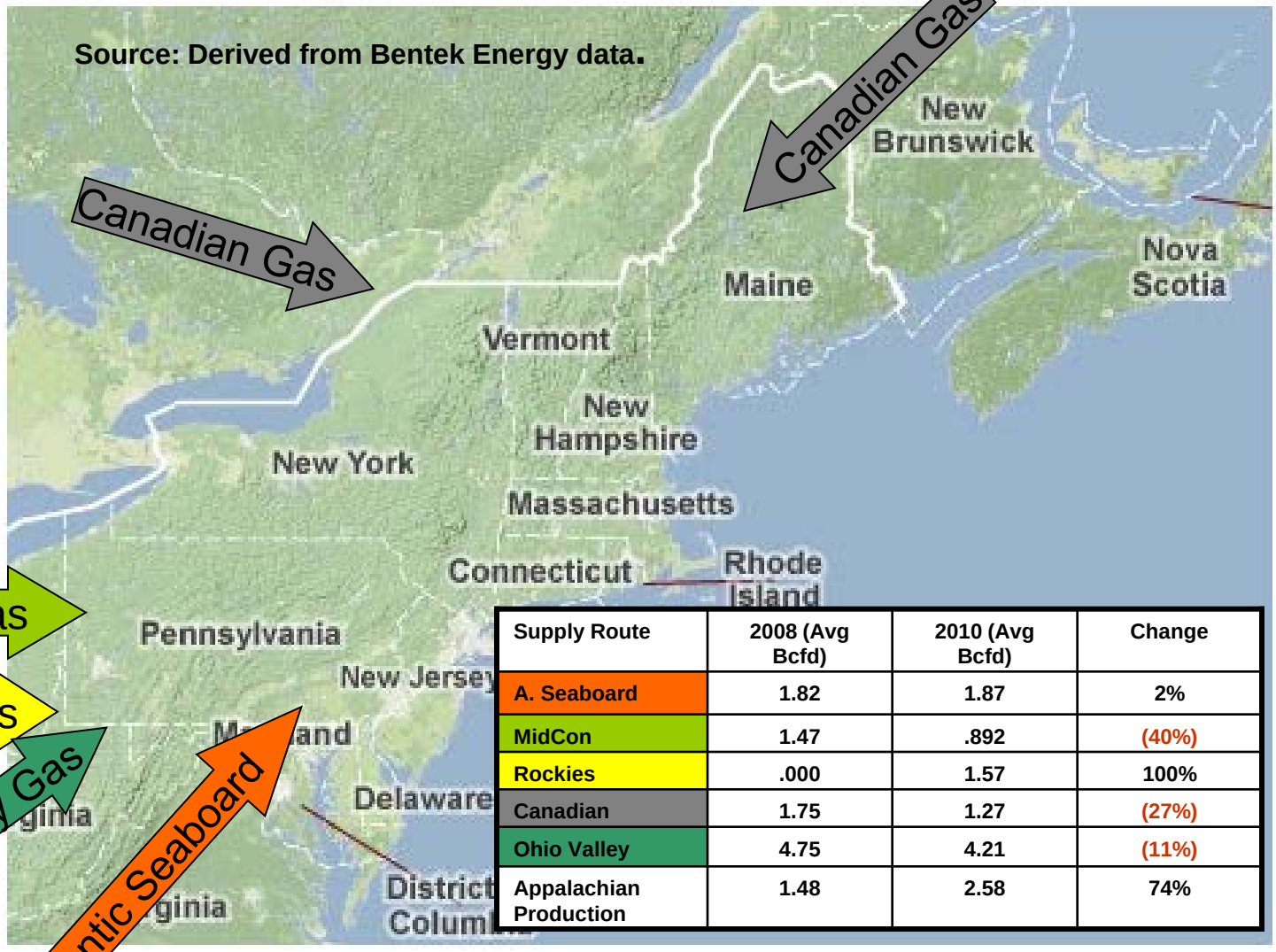
- Substantial increases in flows continue to occur out of the Mid-continent shales and the Rocky Mountain producing basins.
- Marcellus gas productior growth continues to displace gas flows into the Northeast U.S. (Shifts within the Northeast are not depicted on this interregional flow map).
- Flows 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.

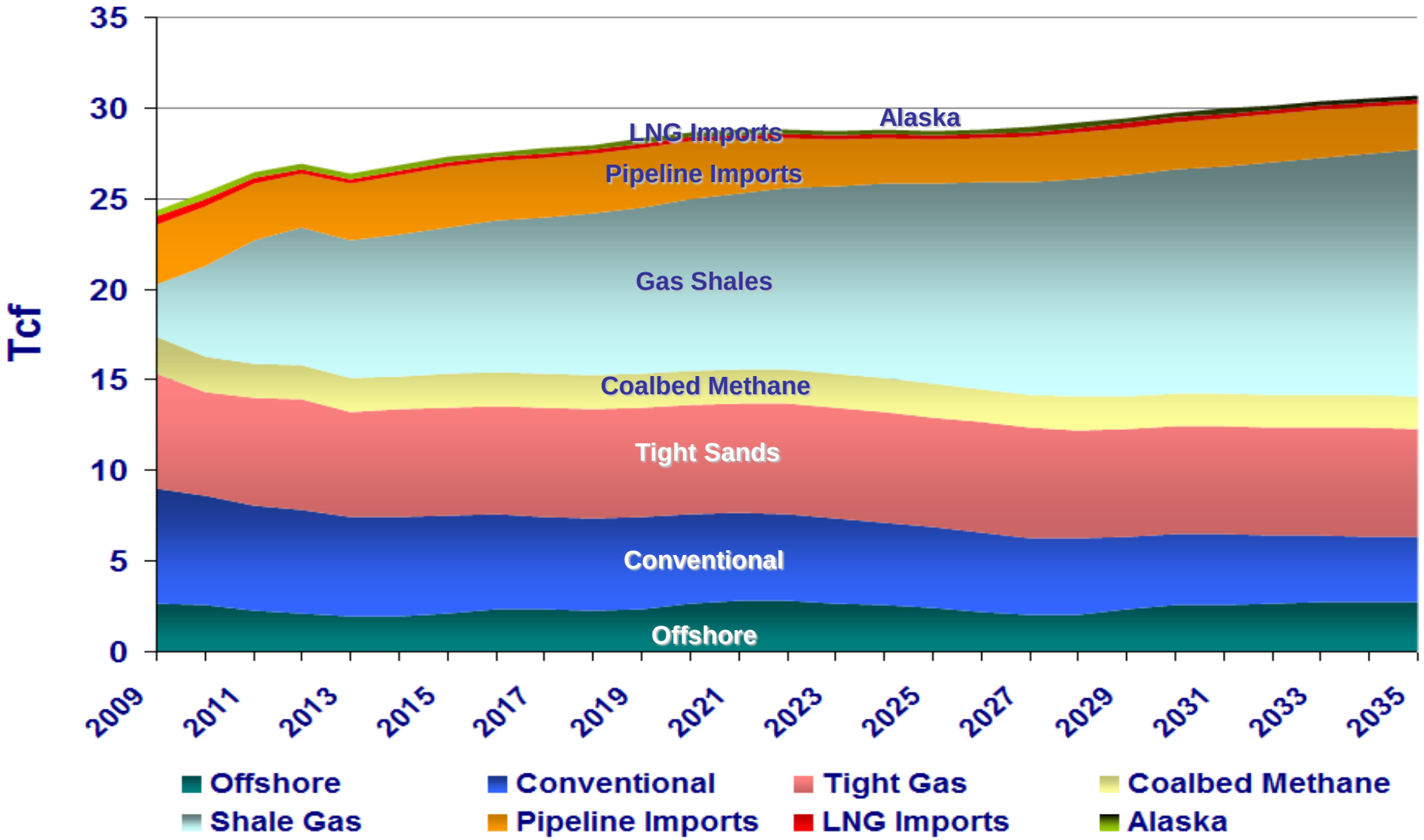
Source: North America Midstream Infrastructure Through 2035 – A Secured Energy Future. Prepared for the INGAA Foundation June 28, 2011

Changing Flow Patterns 2008-2010



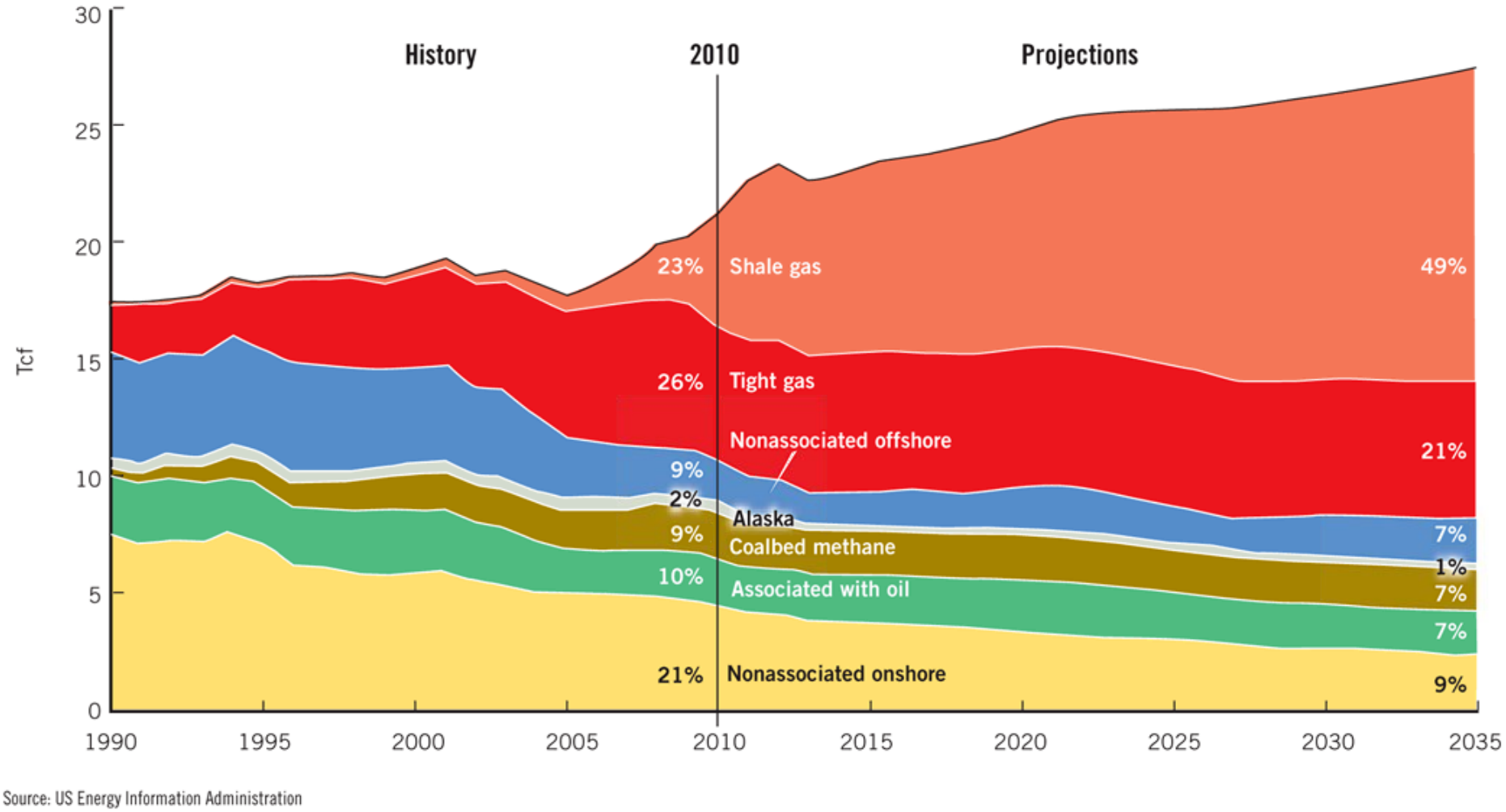
Supply Route	2008 (Avg Bcfd)	2010 (Avg Bcfd)	Change
A. Seaboard	1.82	1.87	2%
MidCon	1.47	.892	(40%)
Rockies	.000	1.57	100%
Canadian	1.75	1.27	(27%)
Ohio Valley	4.75	4.21	(11%)
Appalachian Production	1.48	2.58	74%

U.S. Gas Supply 2012 Outlook



Source: EIA Annual Energy Early Outlook 2012 (January 2012) and EIA spreadsheets.

U.S. Gas Supply Through 2035

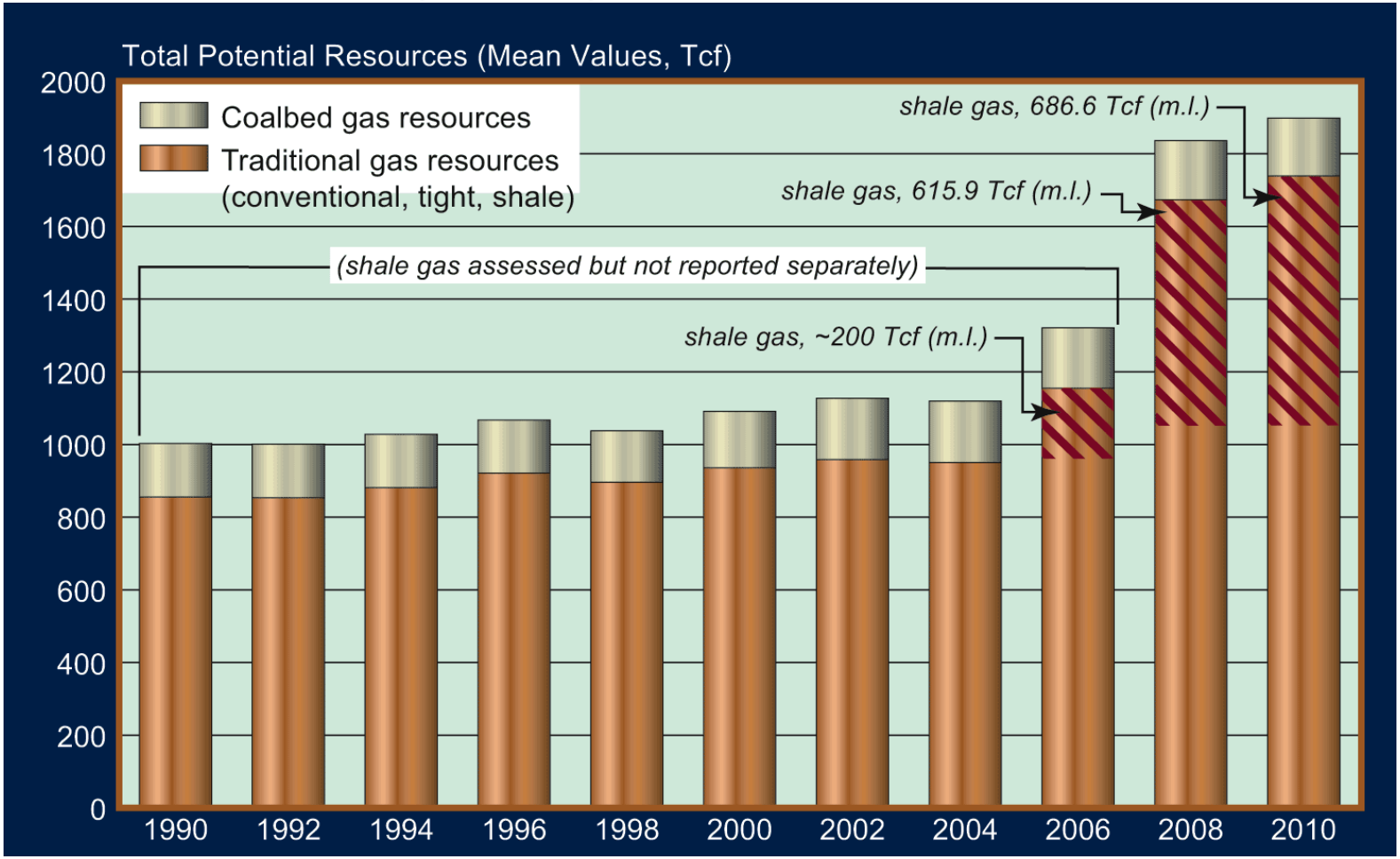


Source: Oil & Gas Journal, April 2, 2012

The growing importance of shale gas is substantiated by the fact that, of the 1,898 Tcf of total potential resources, shale gas accounts for 687 Tcf (36%).

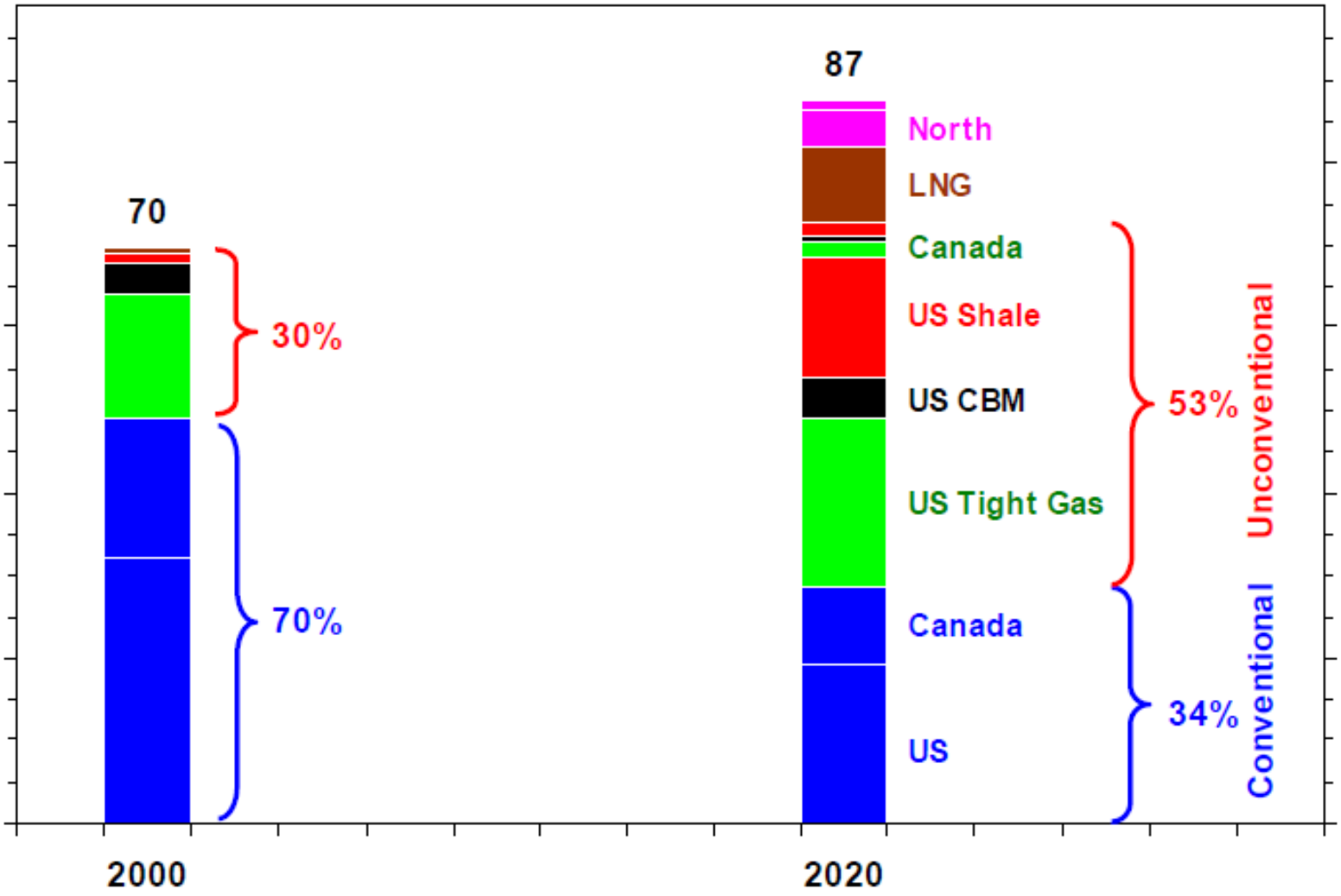
PGC Resource Assessments, 1990-2010

Total Potential Gas Resources (mean values)



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

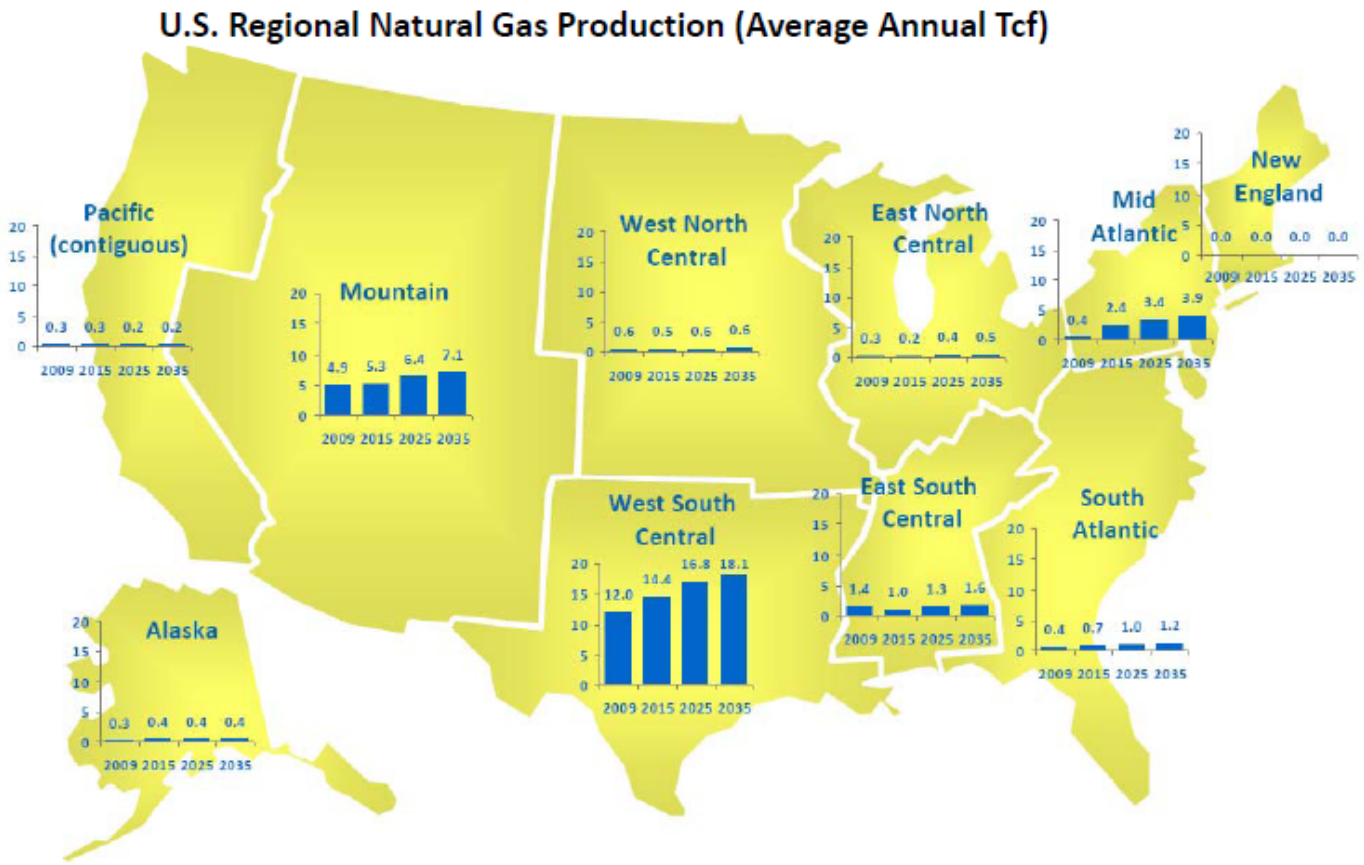
North American Unconventional Gas Growth
(in Bcf/d)



Source: Ziff Energy Group "Shale Gas Outlook to 2020" April 8, 2009

Supply growth is concentrated in areas with growing shale gas production

- Areas with the greatest growth in production are the West South Central and the Mid Atlantic.
  - These areas have high concentrations of shale gas resource development.
- South Atlantic production increases due to growth of the Marcellus shale (in West Virginia). East North Central production increases due to growth of the Utica shale (in eastern Ohio).
- Gulf of Mexico production (included in WSC and ESC) continues a near term decline, but long run increases in Deep Water plays should offset declines in Shallow Water production.



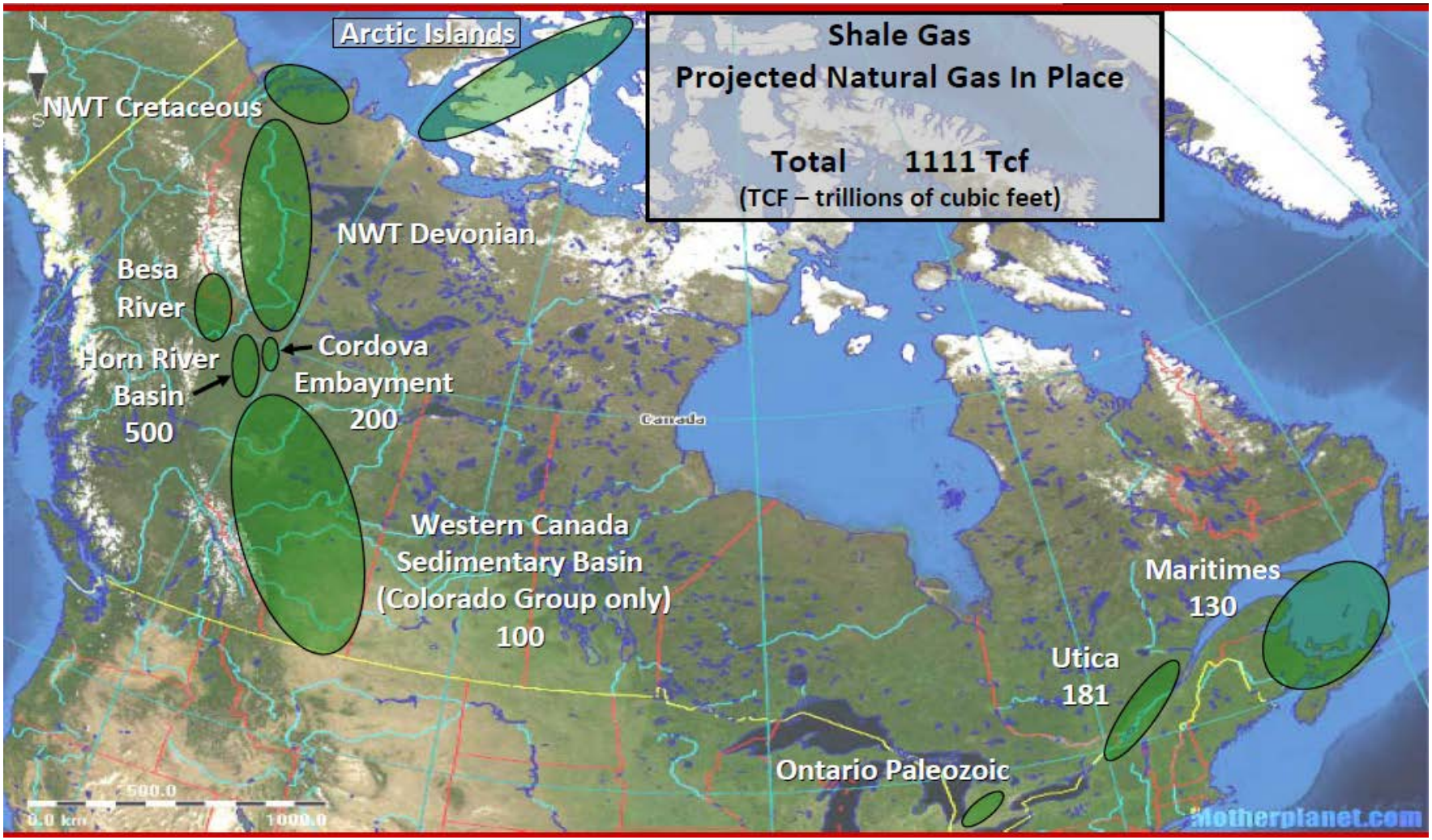
Source: ICF International Compass Report April 2012

Gas Shales Plays in North America

Source: U.S. Energy Information Administration based on data from various published studies. Canada and Mexico plays from ARI.
Updated: May 9, 2011

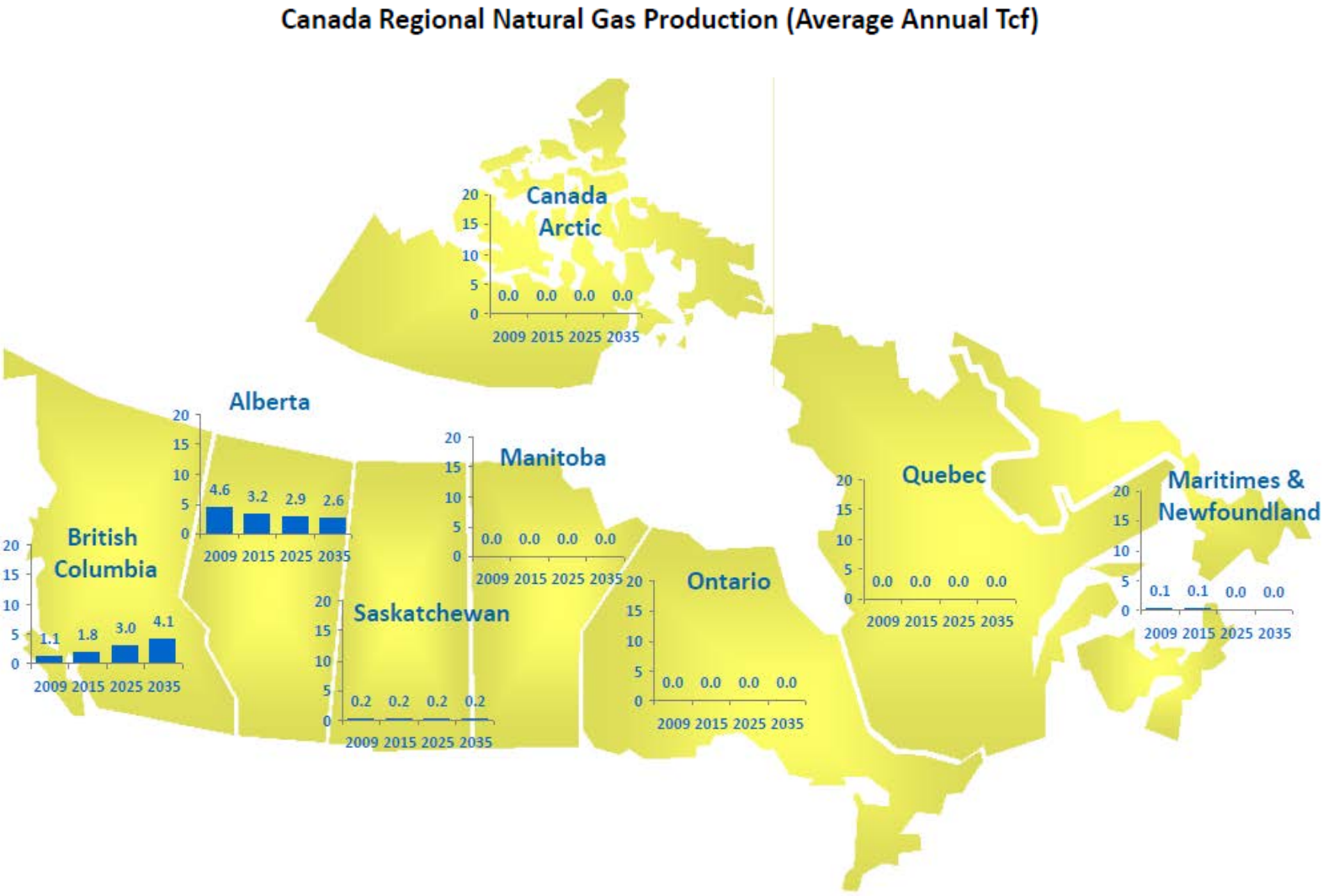
Source: EIA's Shale Gas Plays, North America

Canada's Shale Gas



Source: Canadian Society for Unconventional Gas, CSUG Technical Luncheon, May12, 2010

Canada's Production Growth is essentially constant in the future

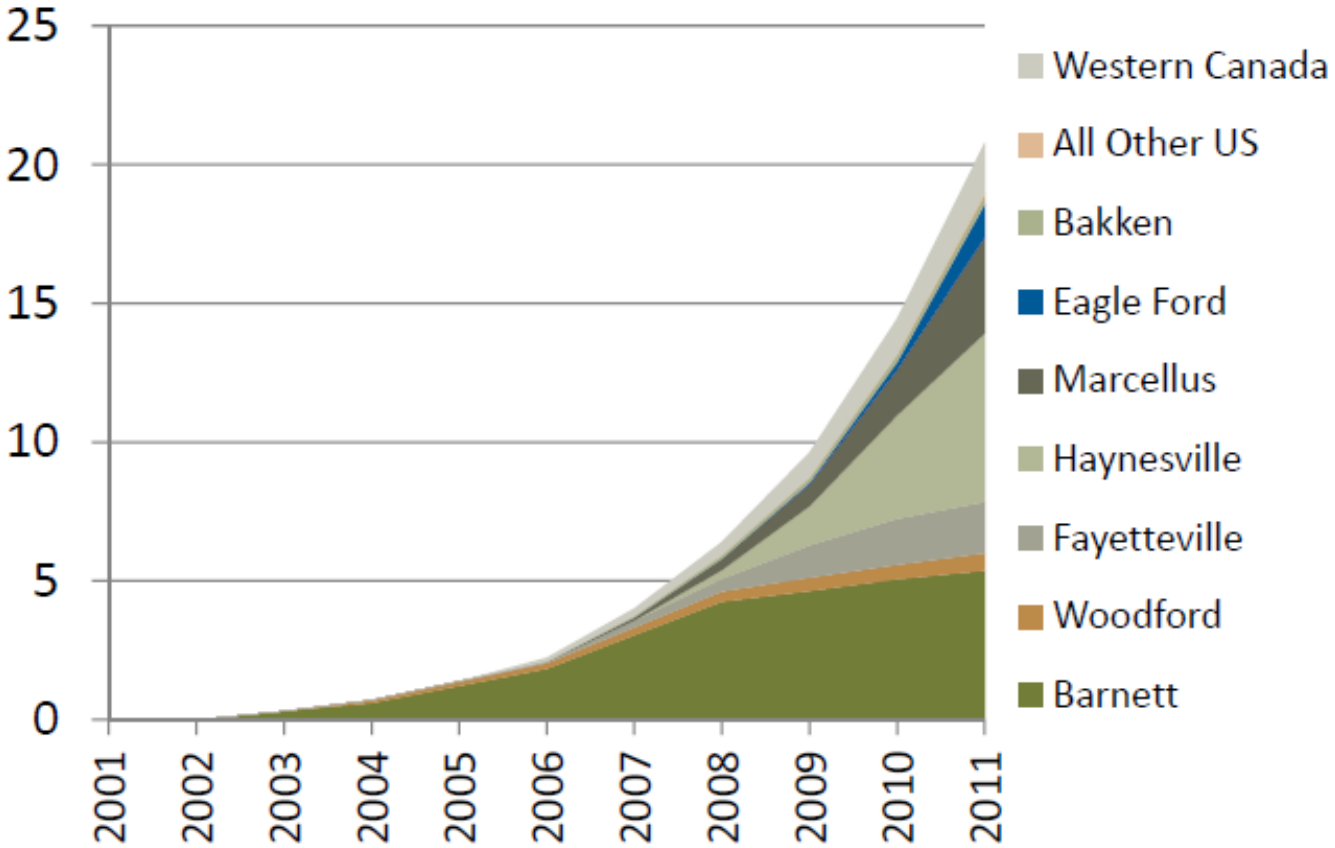


Source: ICF International Compass Report April 2012

U.S. and Canada Shale Gas Production

(Average Annual Bcfd)

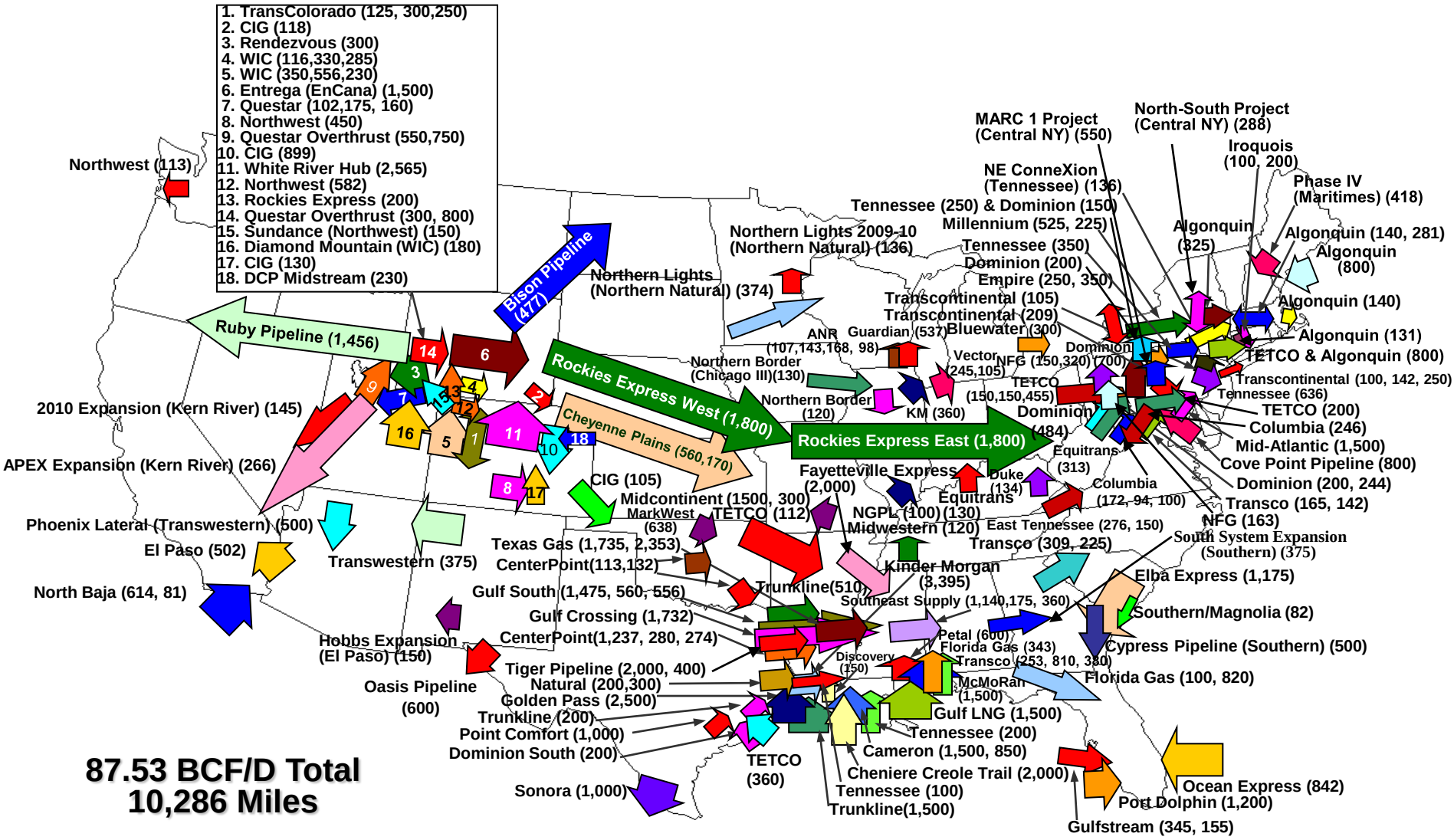
The Big Driver of Gas Production Growth has been Shale Gas Development



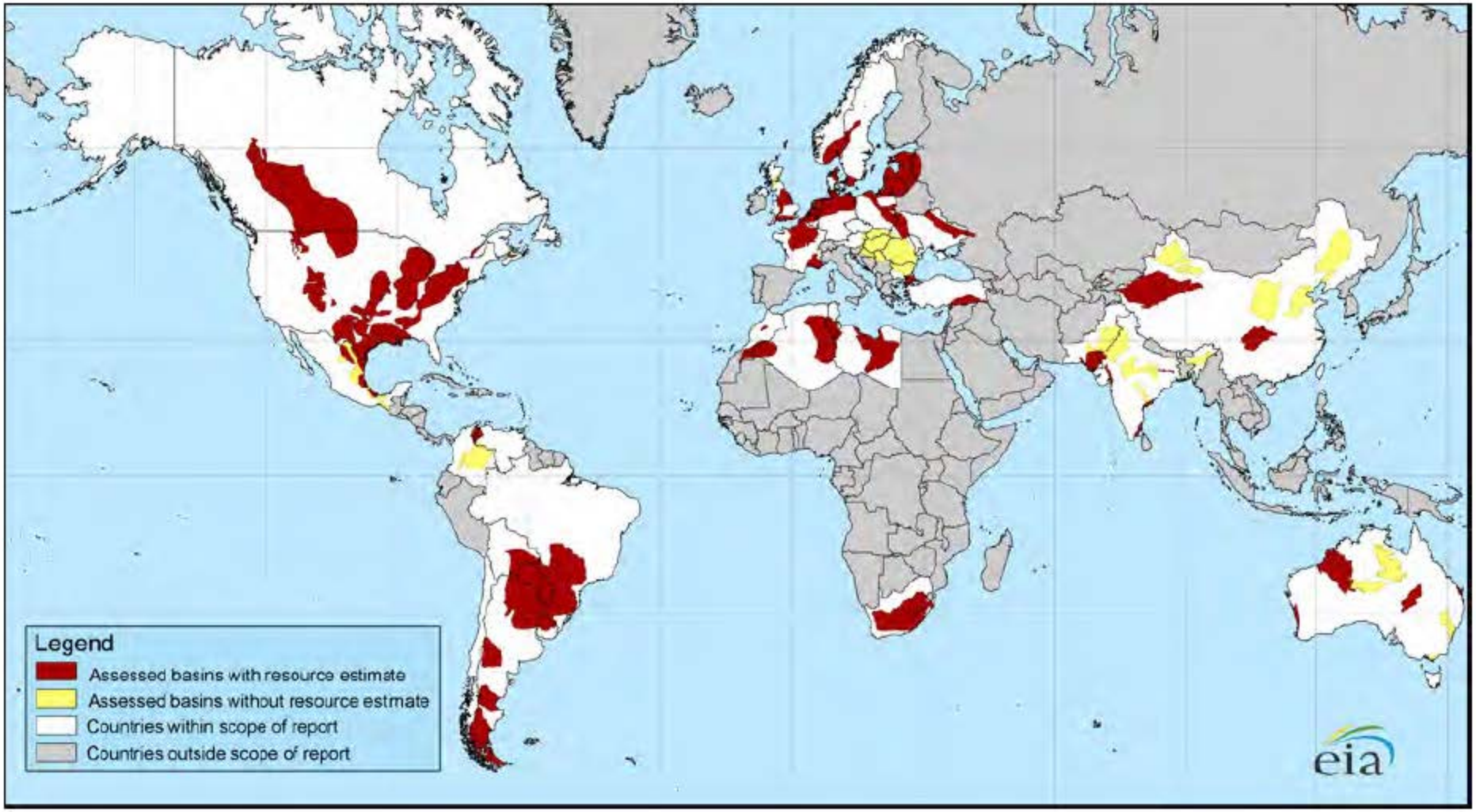
- Large-scale application of horizontal drilling and hydraulic fracturing techniques in the shale plays began in the early 2000s.
- Barnett was the first "horizontal multi-frac" shale play, and production has quickly expanded to other shale plays.
  - More recently developed shale gas plays include the Fayetteville. Haynesville, Woodford, Marcellus, and Eagle Ford.
  - Interest has expanded also to "tight oil" such as the Bakken.
- Since 2005, shale gas production has been increasing by about 50% per year.

Source: ICF International April 2012 Compass Report

Major Pipeline Projects Certificated (MMcf/d) January 2004 to July 2012



48 Major Gas Shale Basins in 32 Countries



Source: EIA's World Shale Gas Resources: An Initial Assessment of 14 Regions Outside the United States, April 2011

Estimated shale gas technically recoverable for selected basins in 32 countries, compared to existing reported reserves, production and consumption during 2009

	2009 Natural Gas Market[1] (trillion cubic feet, dry basis)			Proved Natural Gas Reserves[2] (trillion cubic feet)	Technically Recoverable Shale Gas Resources (trillion cubic feet)
	Production	Consump-tion	Imports (Exports)		
Europe					
France	0.03	1.73	98%	0.2	180
Germany	0.51	3.27	84%	6.2	8
Netherlands	2.79	1.72	(62%)	49.0	17
Norway	3.65	0.16	(2,156%)	72.0	83
U.K.	2.09	3.11	33%	9.0	20
Denmark	0.30	0.16	(91%)	2.1	23
Sweden	-	0.04	100%		41
Poland	0.21	0.58	64%	5.8	187
Turkey	0.03	1.24	98%	0.2	15
Ukraine	0.72	1.56	54%	39.0	42
Lithuania	-	0.10	100%		4
Others[3]	0.48	0.95	50%	2.71	19
North America					
United States[4]	20.6	22.8	10%	272.5	862
Canada	5.63	3.01	(87%)	62.0	388
Mexico	1.77	2.15	18%	12.0	681
Asia					
China	2.93	3.08	5%	107.0	1,275
India	1.43	1.87	24%	37.9	63
Pakistan	1.36	1.36	-	29.7	51
Australia	1.67	1.09	(52%)	110.0	396
Africa					
South Africa	0.07	0.19	63%	-	485
Libya	0.56	0.21	(165%)	54.7	290
Tunisia	0.13	0.17	26%	2.3	18
Algeria	2.88	1.02	(183%)	159.0	231
Morocco	0.00	0.02	90%	0.1	11
Western Sahara	-	-		-	7
Mauritania	-	-		1.0	0
South America					
Venezuela	0.65	0.71	9%	178.9	11
Colombia	0.37	0.31	(21%)	4.0	19
Argentina	1.46	1.52	4%	13.4	774
Brazil	0.36	0.66	45%	12.9	226
Chile	0.05	0.10	52%	3.5	64
Uruguay	-	0.00	100%		21
Paraguay	-	-			62
Bolivia	0.45	0.10	(346%)	26.5	48
Total of above areas	**53.1**	**55.0**	**(3%)**	**1,274**	**6,622**
Total world	**106.5**	**106.7**	**0%**	**6,609**	

Sources:

[1] Dry production and consumption: EIA, International Energy Statistics, as of March 8, 2011.

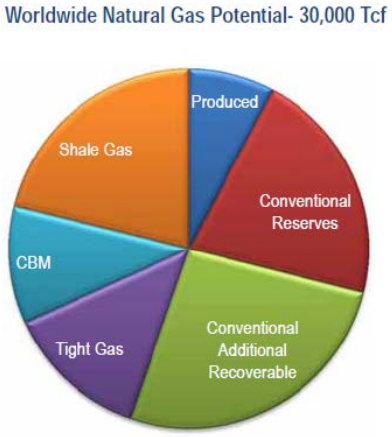
[2] Proved gas reserves: *Oil and Gas Journal*, Dec., 6, 2010, P. 46-49.

[3] Romania, Hungary, Bulgaria.

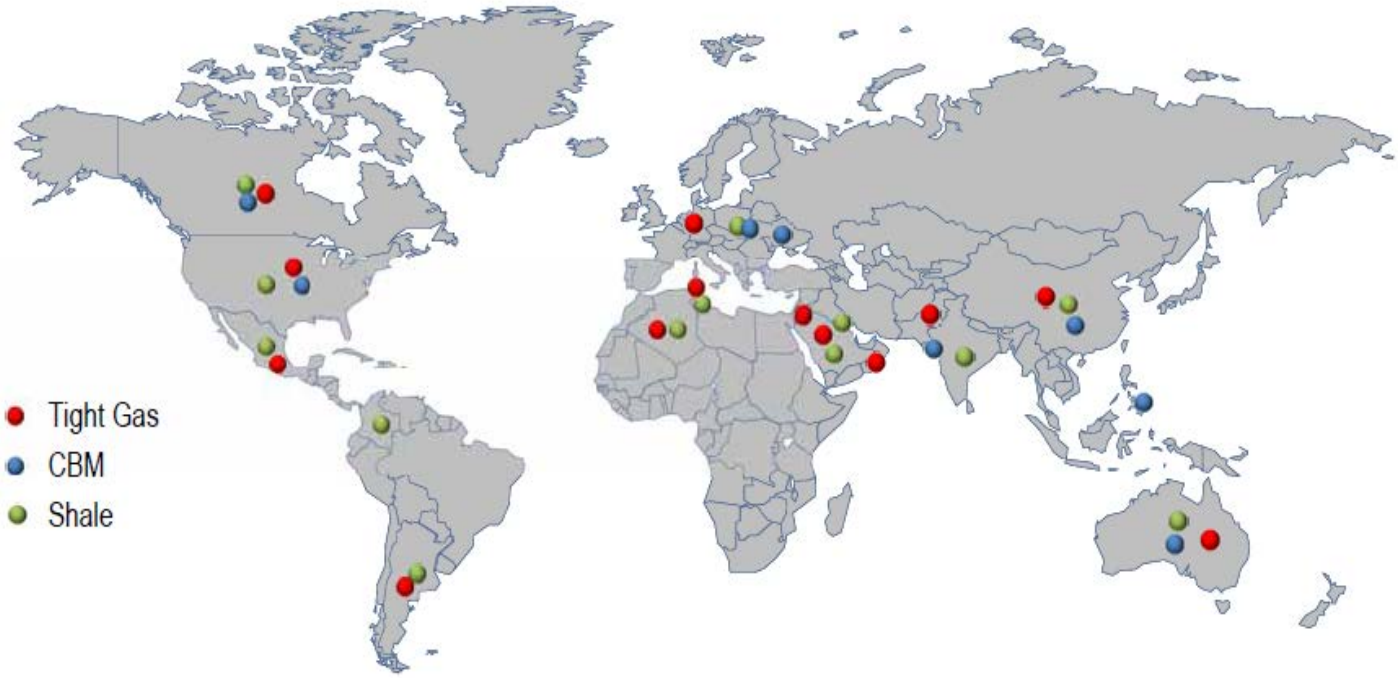
[4] U.S. data are from various EIA sources. The proved natural gas reserves number in this table is from the U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves, 2009 report, whereas the 245 trillion cubic feet estimate used in the Annual Energy Outlook 2011 report and cited on the previous page is from the previous year estimate.

Source: EIA's World Shale Gas Resources: An Initial Assessment of 14 Regions Outside the United States, April 2011, Table 1

The potential for Unconventional Gas is high

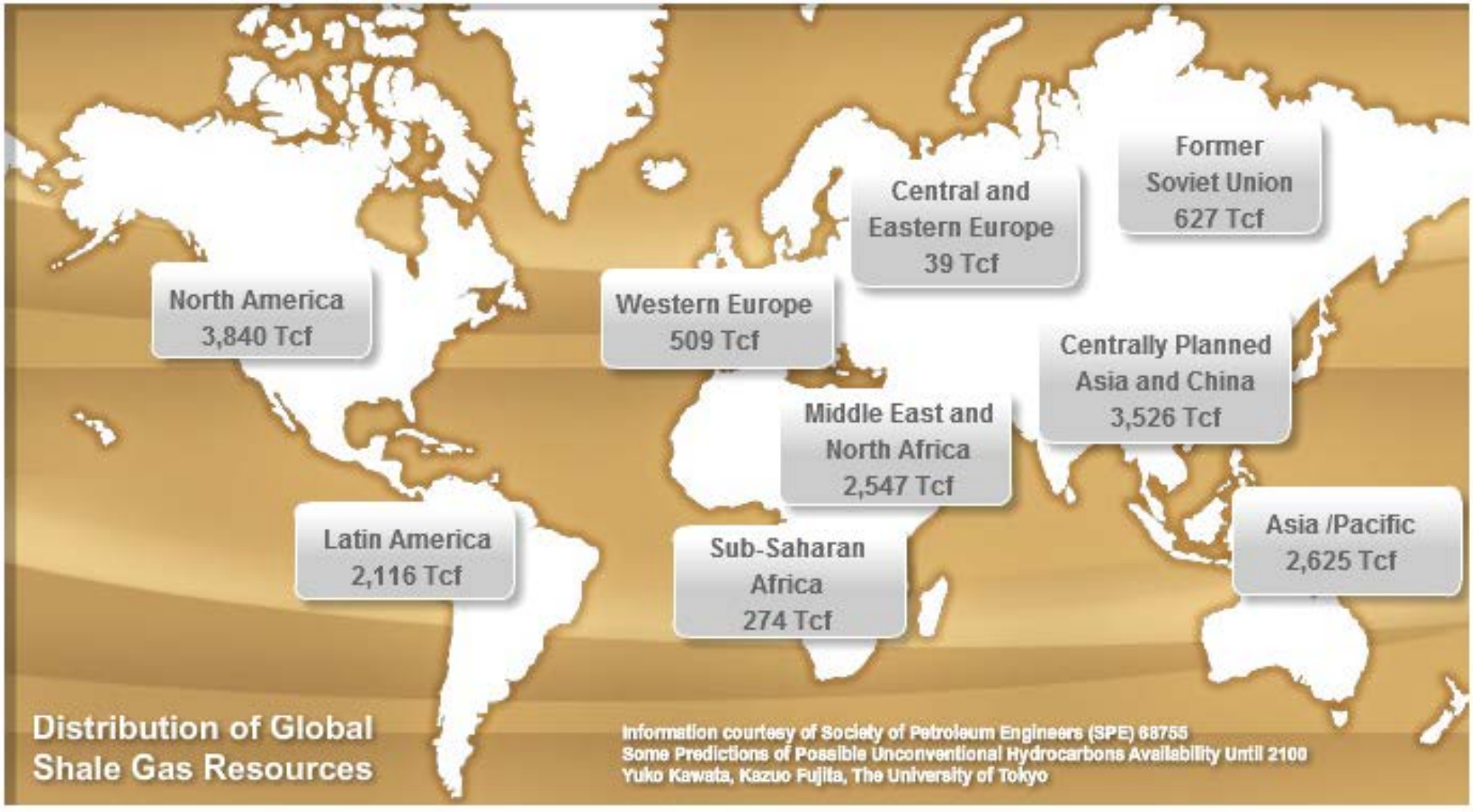


Source: Cedigaz, IEA



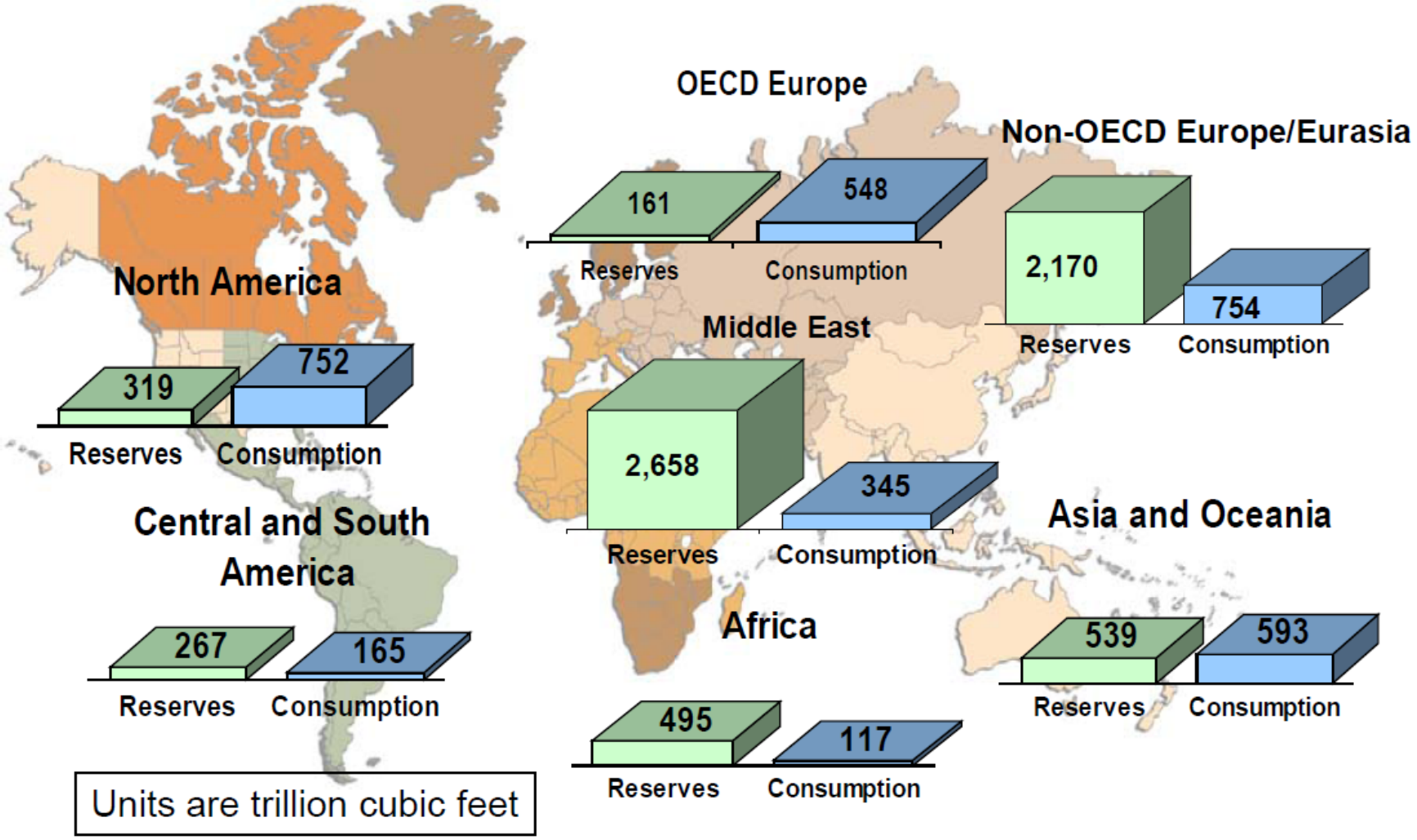
Source: GasMart 2011 Jeff Spath, Ph.D. Technology Advances in Developing Shale Gas Reservoirs

Global Shale Gas



Source: Halliburton.Com

The largest gas markets are not located in the same regions as most of the world's gas reserves



Source: EIA's Natural Gas Markets: U.S. Markets in a Global Content – 2010 Energy Confernece