Galway Group
Advancing Energy Decisions

Natural Gas Supply, Demand, and the Prospects for North American LNG Exports

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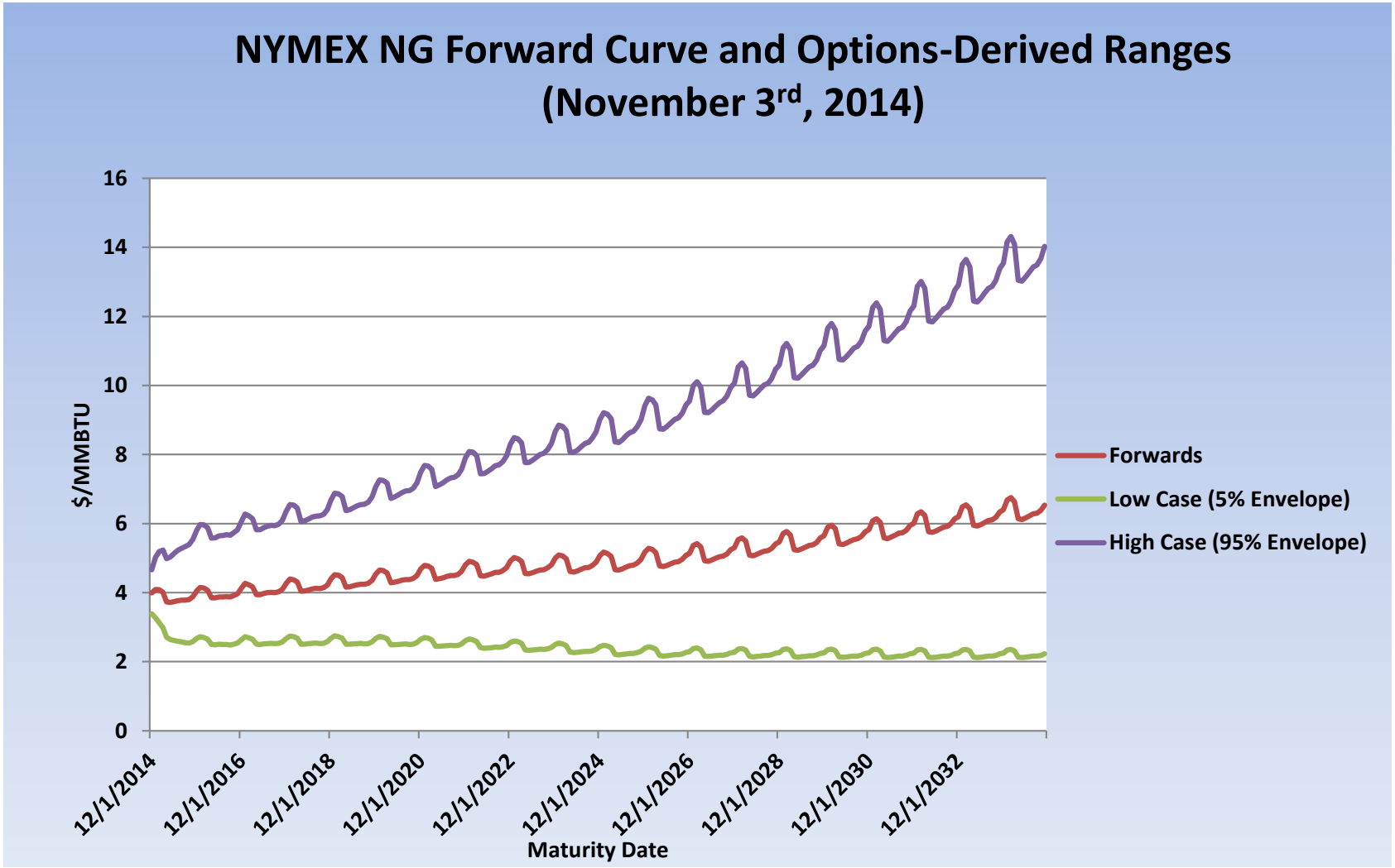
Observations on natural gas prices and project returns

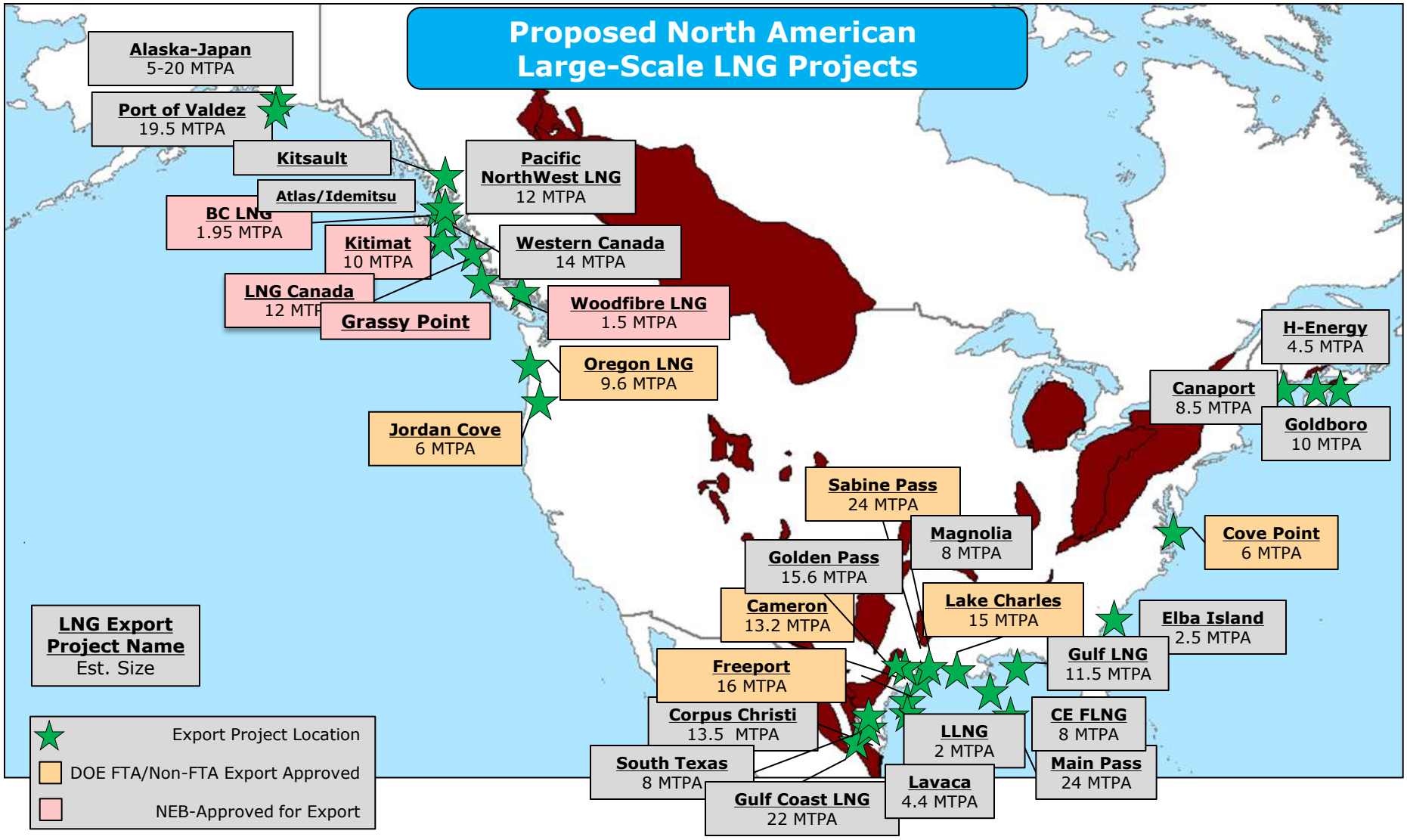
- Price uncertainty is significantly greater than industry forecasts admit
  - Ranges observed in price histories are generally consistent with the forward range of price uncertainty as reflected by futures and options
- Henry Hub (NYMEX) forward prices have been consistently contango
- Near-term Brent prices have dropped with forward prices now also in a contango configuration
  - Circa 2018-20, Brent futures are around $90/bbl
  - This pricing is consistent with a range of $11-15/MMBTU for delivered natural gas depending on location – lower than in the period 2010-13, but not a collapse
  - Australian projects require $14-18/MMBTU to earn their cost of capital (WSJ, 11/7/2014, "Cheap Oil Burns Global Gas")
- Long-term convergence to world natural gas prices could happen in two distinctly different ways, though with the same result
  - Strong demand growth and North America becomes an LNG importer
  - Strong net demand growth because of LNG exports from North America

Henry Hub Natural Gas Prices – 20 Year View



North American LNG Export Terminal Landscape

5 approved projects in Canada and 7 in the U.S. with applications pending for over 230 MTPA in U.S. and 85 MTPA Canadian exports

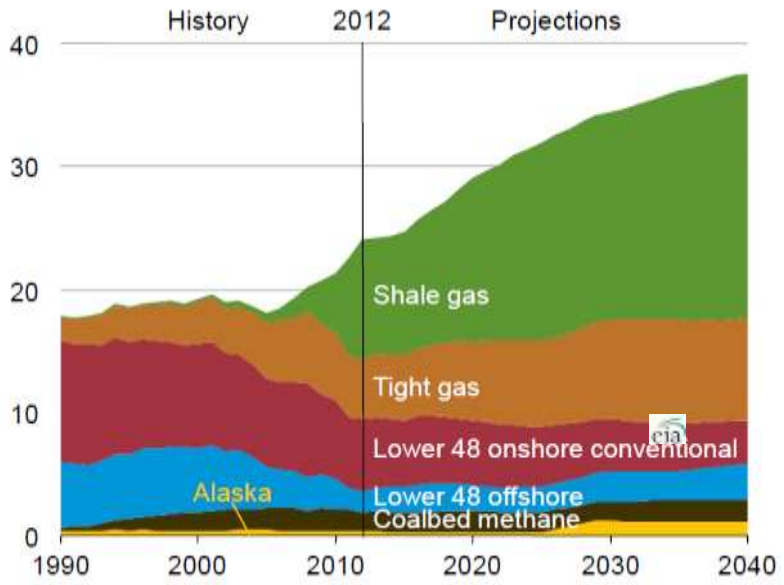


COD for projects in Western Canada have been further delayed while US projects remain on track

Announced North American LNG Export Projects									
Project	**Location**	**Status**	**Probability**						
				2016	2017	2018	2019	2020	2021	2022
Kitimat	NW BC	NEB approved, awaiting FID & Contracts	20%						0.6	1.3
Shell Canada	NW BC	NEB approved, awaiting FID & Contracts	20%						0.7	1.5
BG Canada	NW BC	Approvals in process	10%						0.8	1.8
Petronas Canada	NW BC	Approvals in process	50%						0.7	1.5
Woodfibre LNG	NW BC	Approvals in process	50%				0.3	0.5	0.5	0.5
Sabine Pass	US South	FERC and non-FTA export approvals received	100%	0.6	1.2	1.8	2.4	2.4	2.4	2.4
Freeport	US South	FERC and non-FTA export approvals received	100%			1.7	2.5	2.5	2.5	2.5
Lake Charles	US South	FERC application filed; non-FTA exports approved	85%					1.0	2.2	2.2
Cove Point	US East	FERC application filed; non-FTA exports approved	90%				0.8	0.8	0.8	0.8
Jordan Cove	US PNW	FERC application filed; non-FTA exports approved	40%					0.8	1.2	1.2
Oregon LNG	US PNW	FERC in process; non-FTA export pending	25%						0.8	1.3
Cameron LNG	US South	FERC application filed; non-FTA exports approved	100%			0.6	1.8	1.8	1.8	1.8
Gulf Coast LNG	US South	FERC Pre-filing, non-FTA export approval pending	25%				0.7	1.5	1.5	1.5
Port Lavaca	US South	FERC application filed; non-FTA approval pending	50%				0.6	1.2	1.2	1.2
Corpus Christi	US South	FERC application filed; non-FTA approval pending	75%				0.7	1.4	2.1	2.1
Golden Pass	US South	FERC Pre-filing, non-FTA export approval pending	75%				0.7	1.4	2.1	2.1
LLNG	US South	FERC Pre-filing, non-FTA export approval pending	90%			0.3	0.3	0.3	0.3	0.3
Magnolia	US South	FERC Pre-filing, non-FTA export approval pending	75%				0.5	1.0	1.0	1.0
Misc. US	US	Status of approvals varies by project	20%					3.0	3.0	3.0
Total				0.6	1.2	4.4	11.3	19.6	26.2	30.0
Risked Canada Expectations				0.0	0.0	0.0	0.2	0.3	0.9	1.7
Risked US Expectations				0.6	1.2	4.4	9.6	13.3	15.7	15.8
Total Risked Expectations				0.6	1.2	4.4	9.7	13.5	16.7	17.6

U.S. supply future is projected to be one of abundance

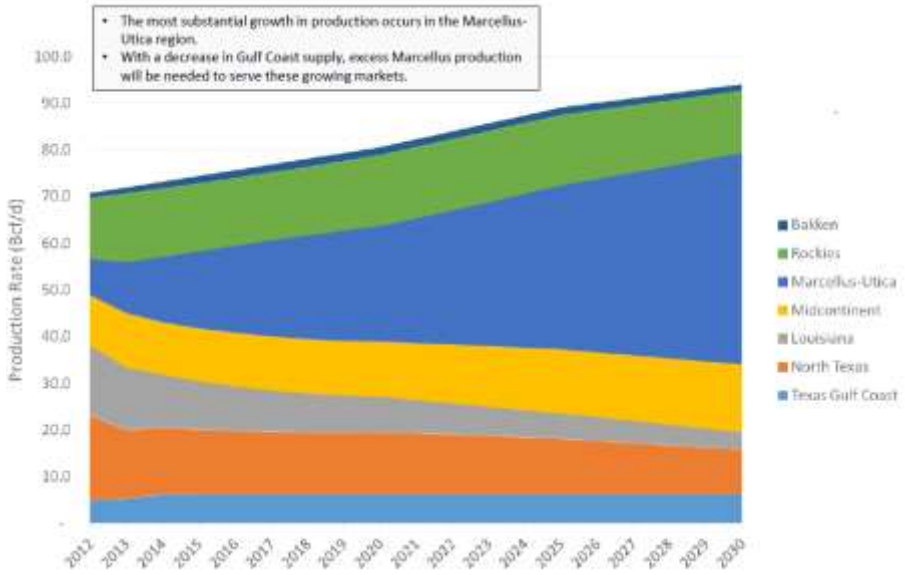
U.S. Dry Gas Production by Type (TCF)



Source: EIA 2014 AEO, April 2014

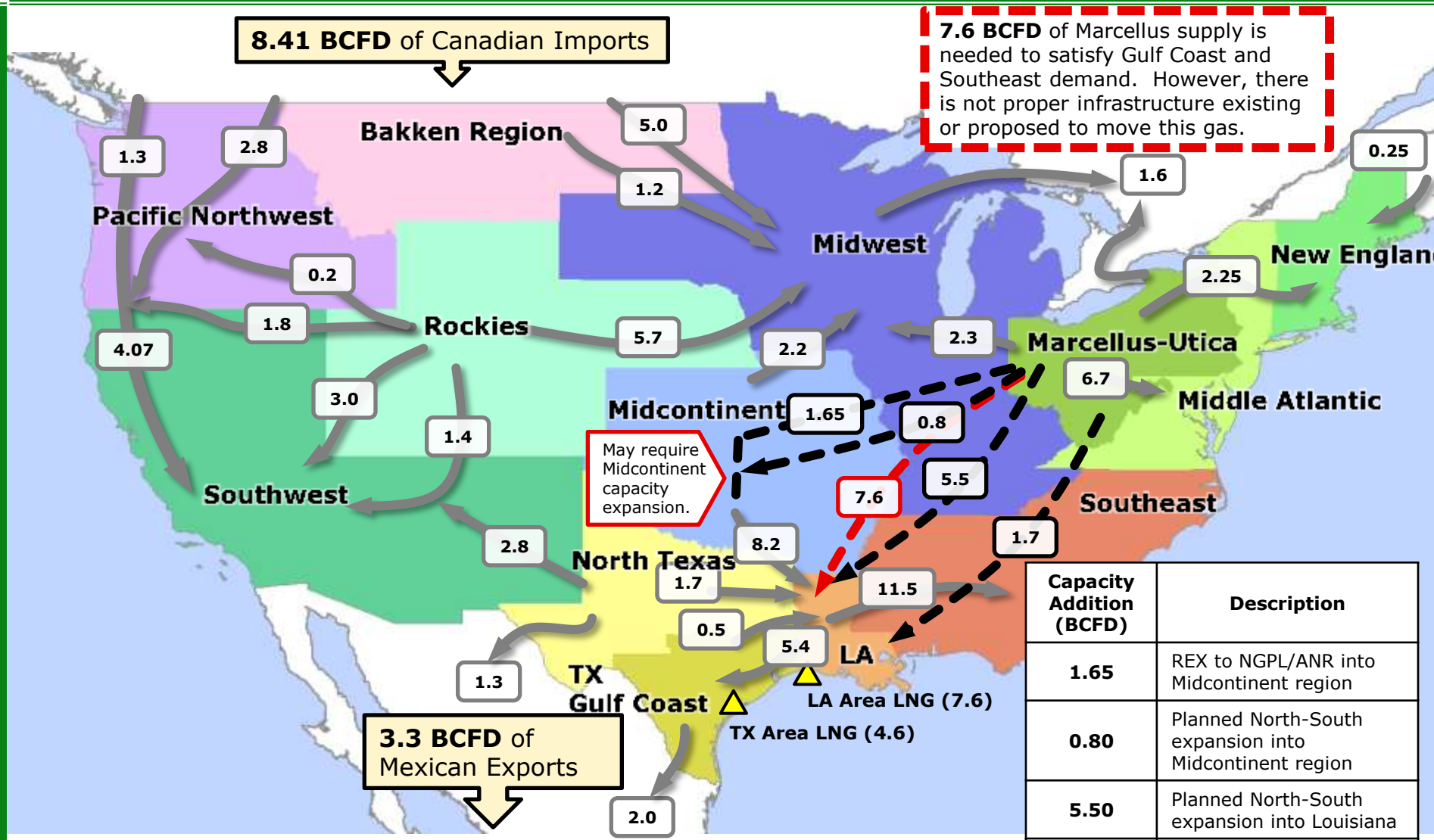
- **Since 2007, natural gas reserves have increased substantially and prices have continued to decrease**
- **Shale gas is driving the change, and by 2030, shale gas output is projected to double to account for 65% of total gas supply**
- **EIA forecasts production growth reaching 37.5 TCF/year in 2040**

U.S. Dry Gas Production by Region (TCF)



2025 North American Anticipated Pipeline Flows

New north/south pipelines need to be built in the eastern USA



Capacity Addition (BCFD)	Description
1.65	REX to NGPL/ANR into Midcontinent region
0.80	Planned North-South expansion into Midcontinent region
5.50	Planned North-South expansion into Louisiana
1.70	Transco backhaul to Sta.65

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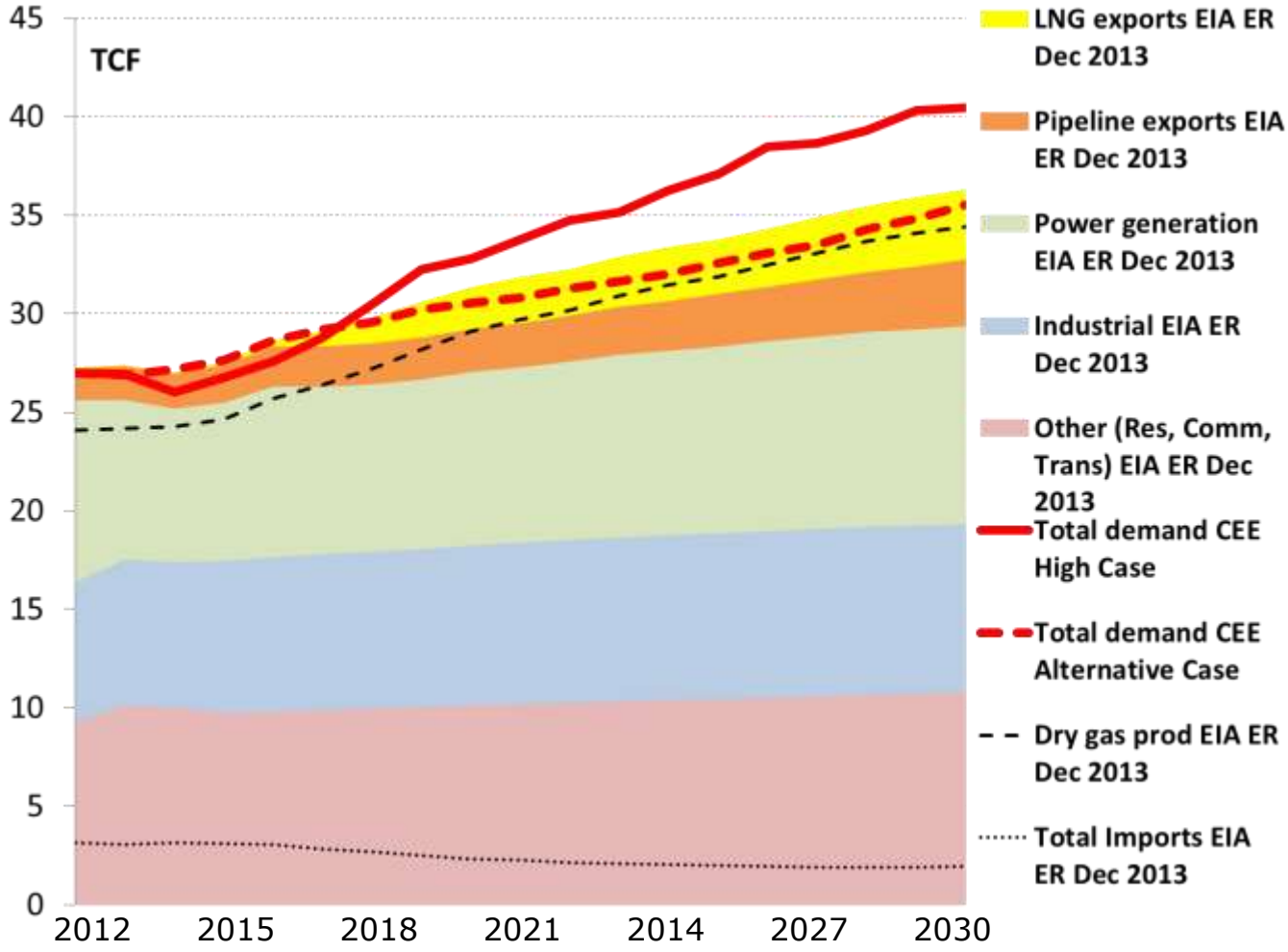
A 40 TCF US Market? UT Center for Energy Economics research suggests a more bullish demand scenario



EIA's "demand stack" to 2030 with dry gas production and imports.

CEE High Case and a slightly lower Alternative Case <u>both</u> exceed EIA's projected gas production.

"EIA ER" refers to EIA Early Release, Dec. 2013 (reference case)

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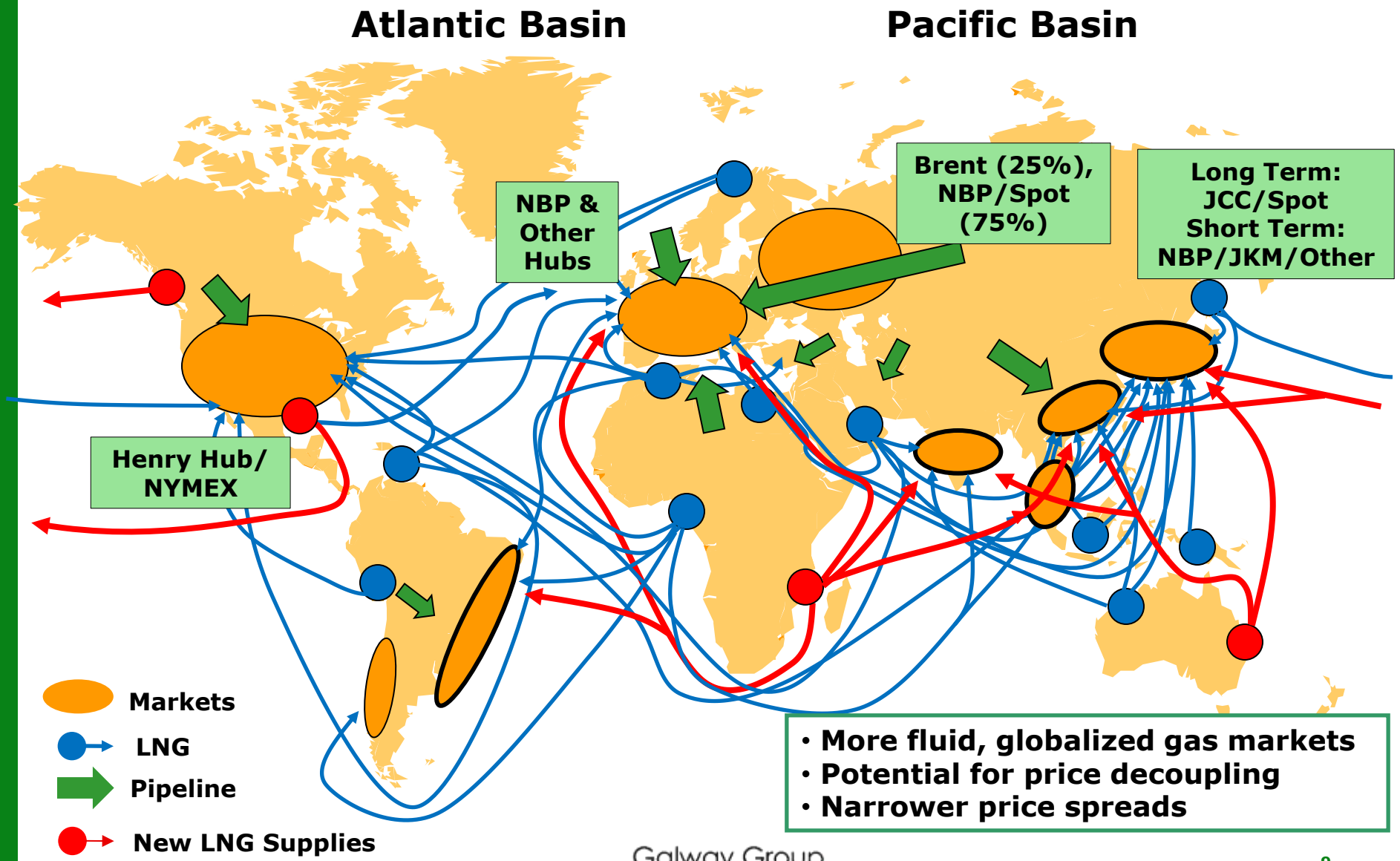
Global LNG Flows (2020)

350+ MTPA market; many supply-side and market entrants; sustained demand growth from emerging economies, Asia



North American export/import capacity additions has implications for linkage to broader world gas markets

- Several scenarios (or aspects of scenarios) to consider:
  - High North American demand growth and full-cycle marginal cost of North American natural gas too high to sustain ex ante profitability of North American LNG export projects
  - High worldwide demand growth supports higher natural gas price levels
  - Full-cycle marginal cost of natural gas decreasing everywhere with improving technology; resource base exceeding current estimates; North American LNG export projects built and remain online down to marginal operating cost
  - Shale gas development proceeds in other parts of the world (e.g. Argentina, China, Poland) and prices at NBP, HH, and Asian delivery points are decoupled from crude and all converge to a uniform world gas price – possibly, though not necessarily, at a lower level