OXFORD INSTITUTE FOR ENERGY STUDIES Natural Gas Research Programme

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UNIVERSITY OF OXFORD

Global LNG: Impacts on Fundamentals and Pricing

CEE 2013 Annual Meeting

4th December 2013

Howard Rogers

Themes

- Understanding Today's Gas Market - Near Term Dynamics
- Key Uncertainties Post 2015
- Regional Price Implications - Europe and Asia

Based on the Following Published Research:

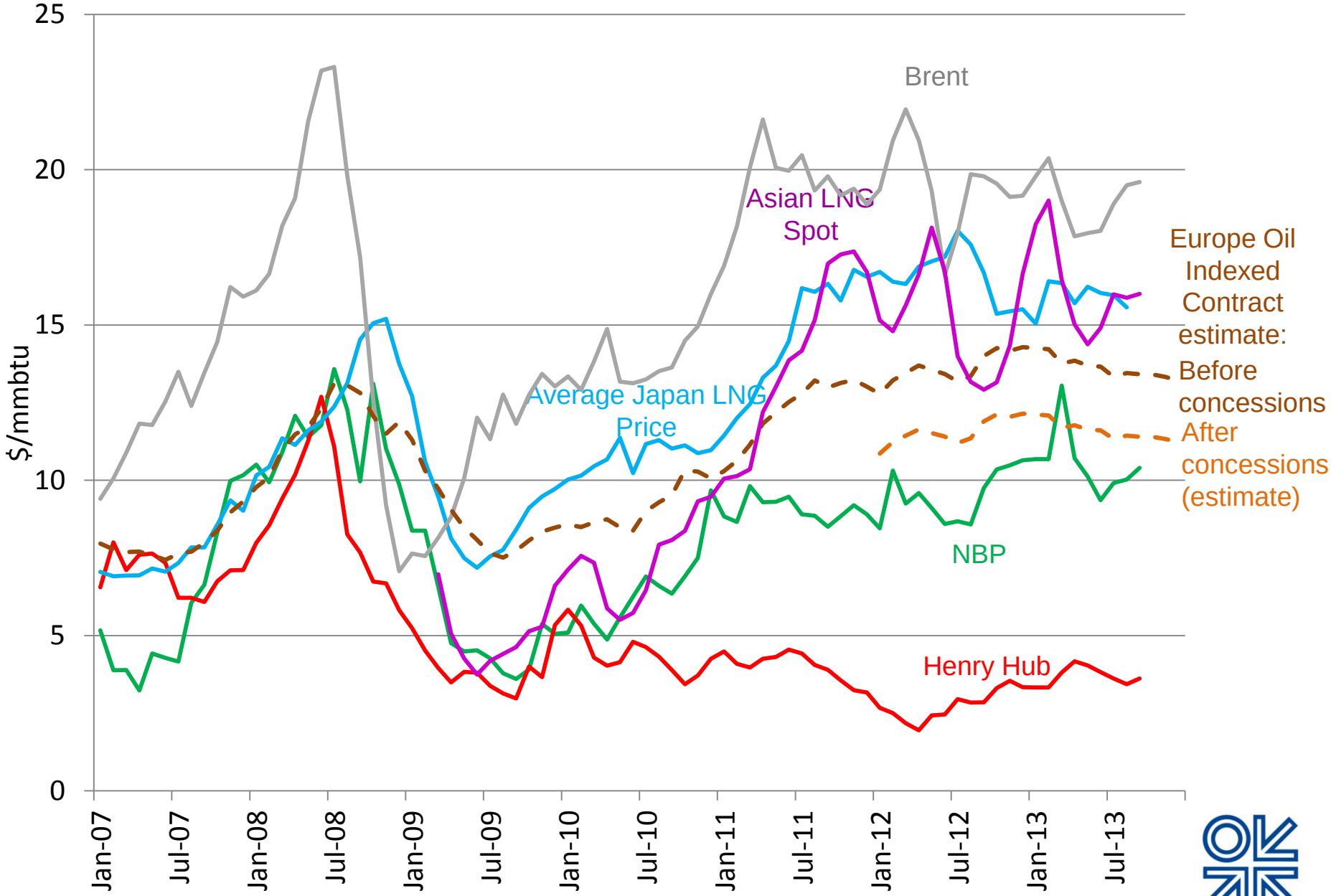
'*The Transition to Hub-Based Gas Pricing in Continental Europe', Jonathan Stern and Howard Rogers, March 2011,* http://www.oxfordenergy.org/wpcms/wp-content/uploads/2011/03/NG49.pdf

'The Impact of a Globalising Market on Future European Gas Supply and Pricing: the Importance of Asian Demand and North American Supply', Howard Rogers, January 2012, *http://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/01/NG_59.pdf*

'The Pricing of Internationally Traded Gas', Chapters 4 and 12, OIES 20012, Editor Jonathan Stern

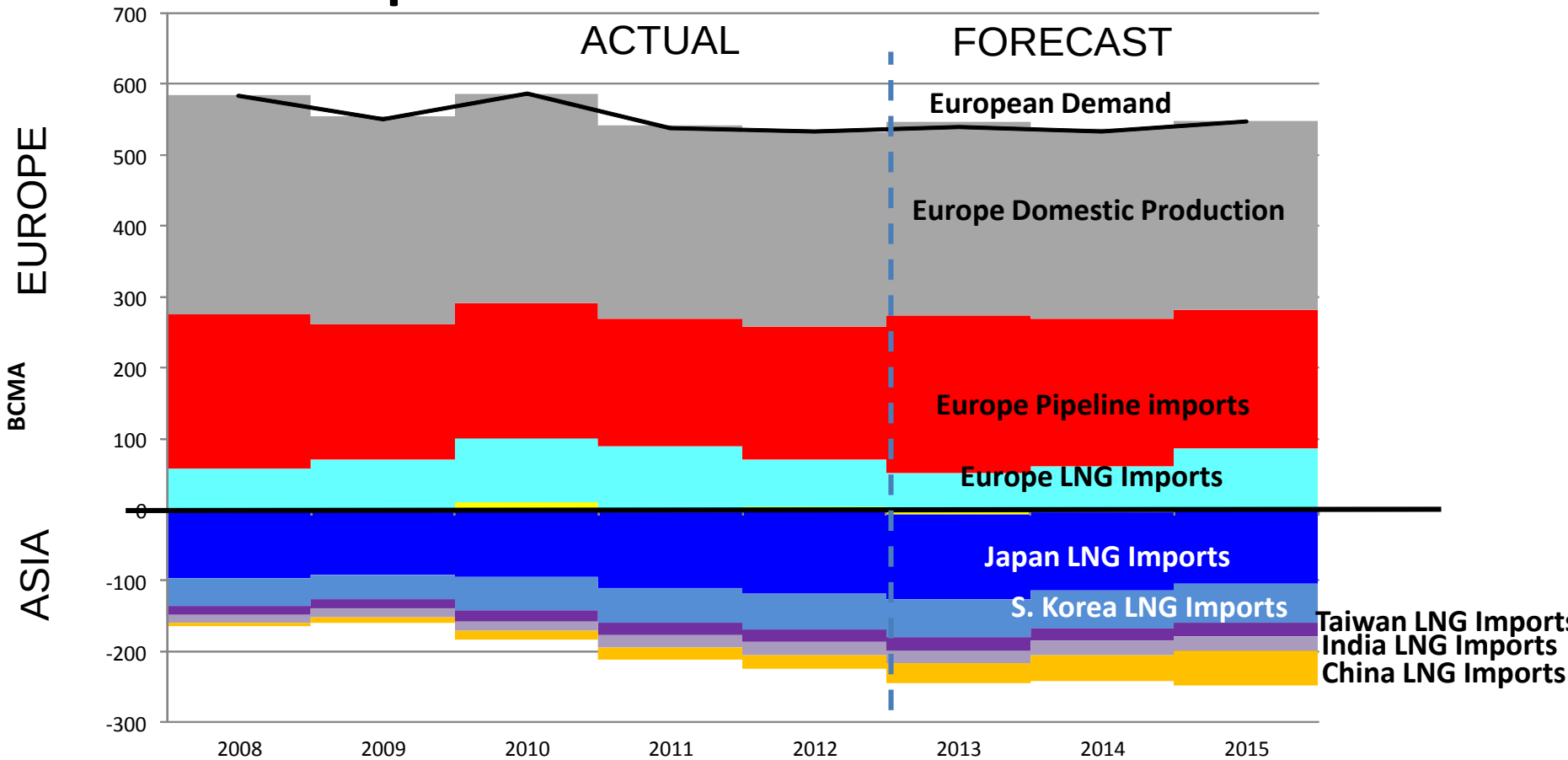
'Challenges to JCC Pricing in Asian LNG Markets' , OIES, Jonathan Stern & Howard Rogers, 2013 Forthcoming.

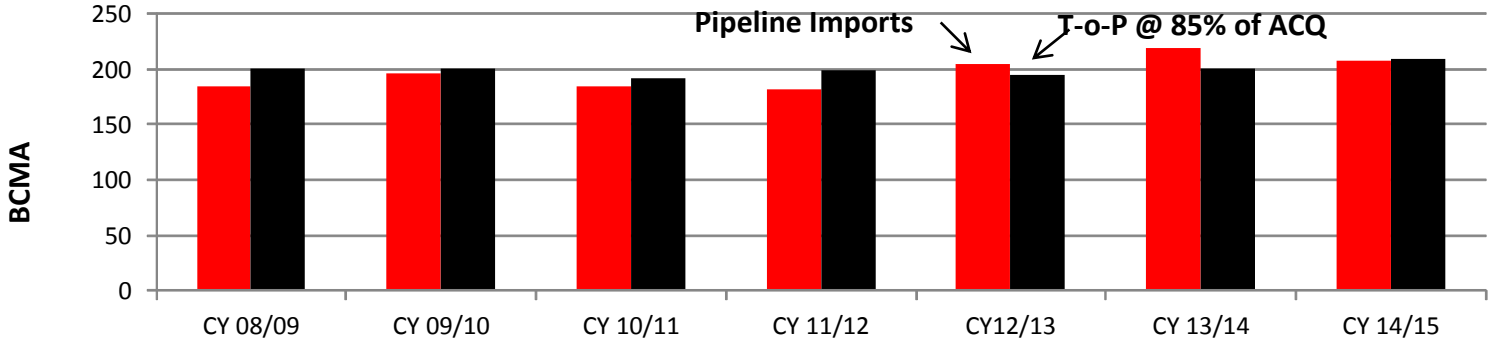
Gas Prices 2007 – September 2013



Source: Platts, EIA, Argus, Own Analysis

Europe – Asia LNG Balance 2008 – 2015



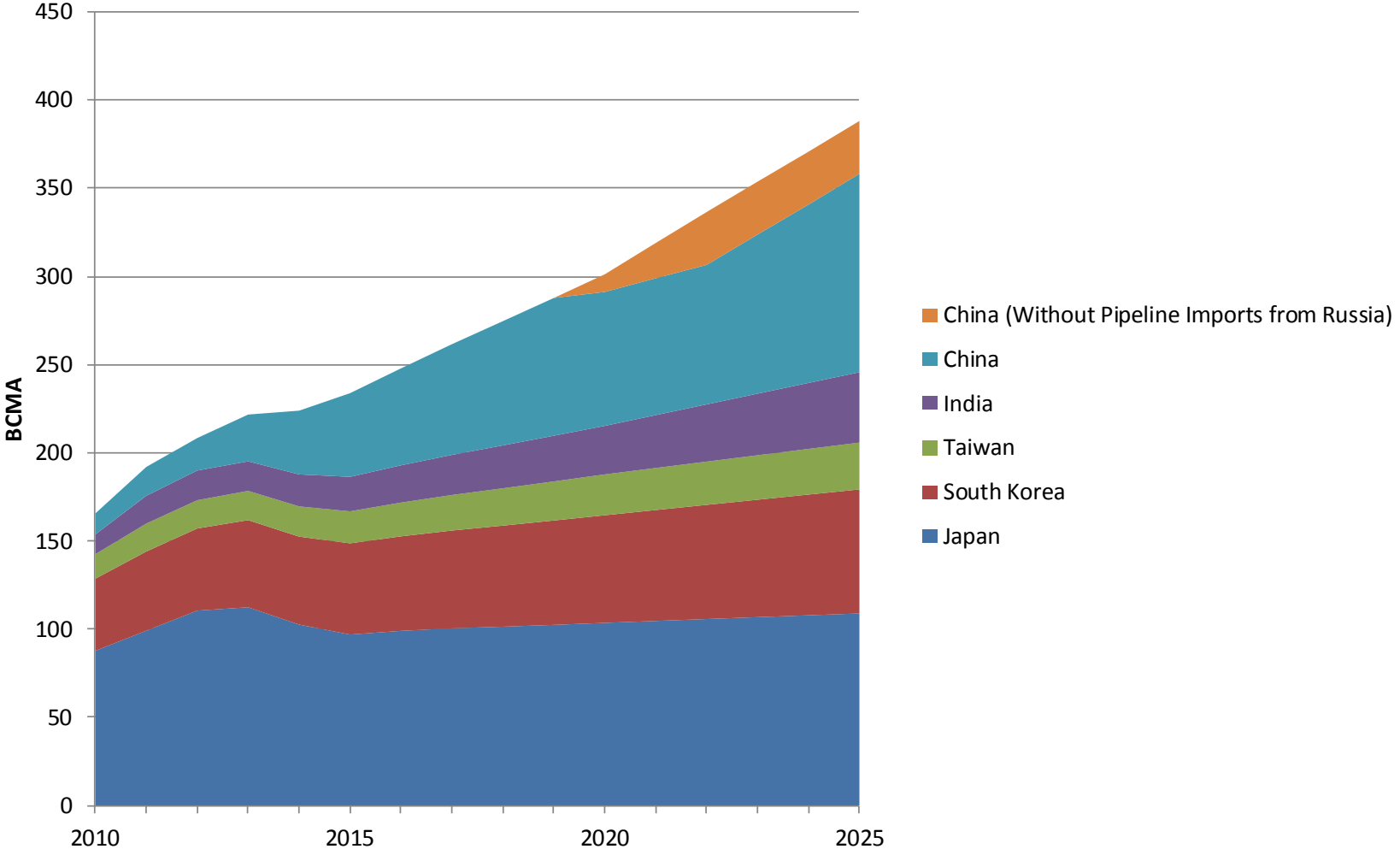


Source: Waterborne LNG, IEA, EIA, Eurostat, Own Analysis

Post 2015: Major Uncertainties

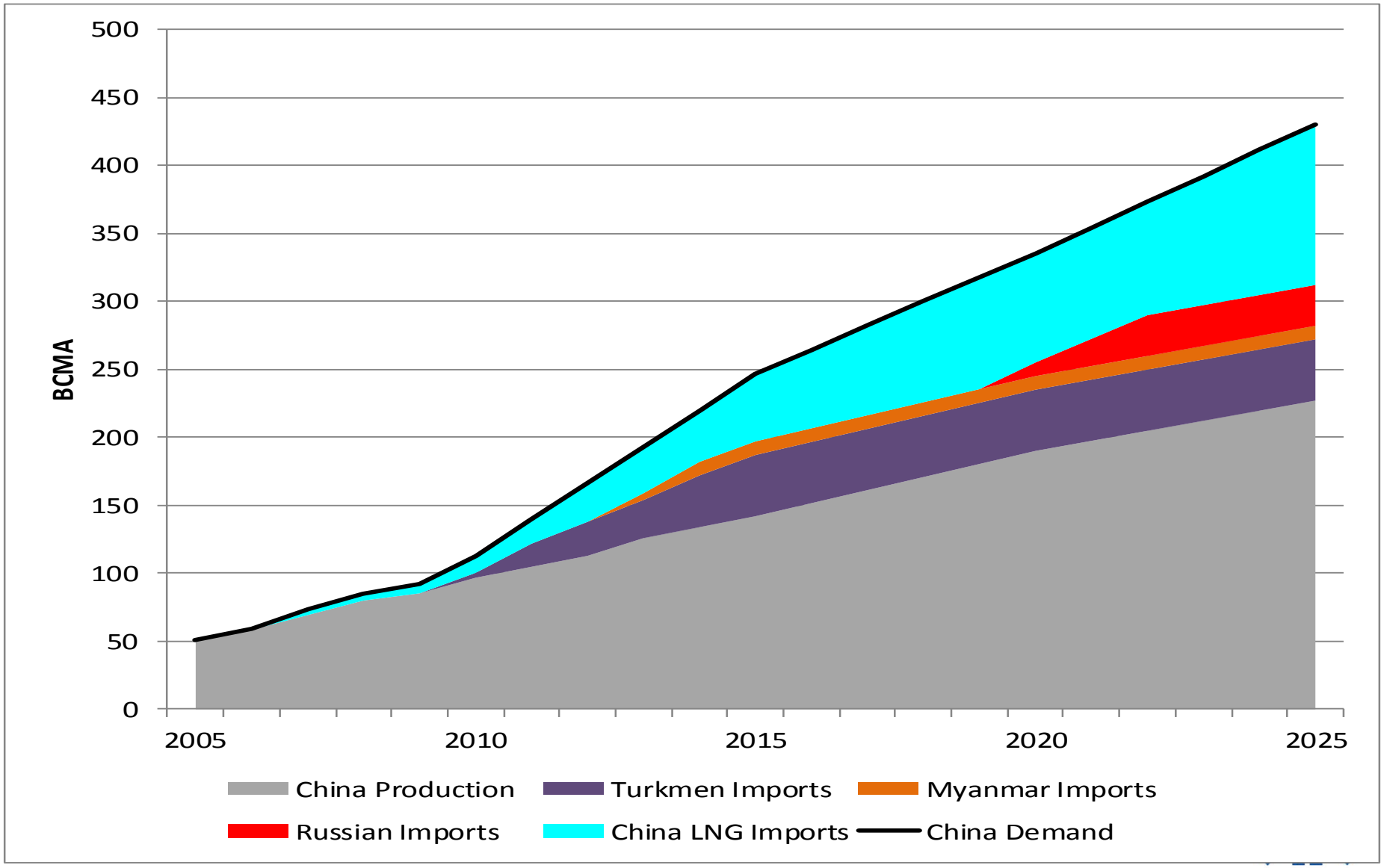
- Asian Natural Gas and LNG Demand.
- Timing/slippage of new non-North American LNG projects.
- US Future Shale Gas Production Growth and potential scale of North American LNG exports.
- Prospects for Shale Development Outside North America
- Production versus pricing policy for Russian pipeline gas to Europe post oil-indexation – ***how does Russia Respond ?***

Asian LNG Demand
(Japan, Korea, Taiwan, India, China)



Source: Waterborne LNG, IEA, Own Analysis

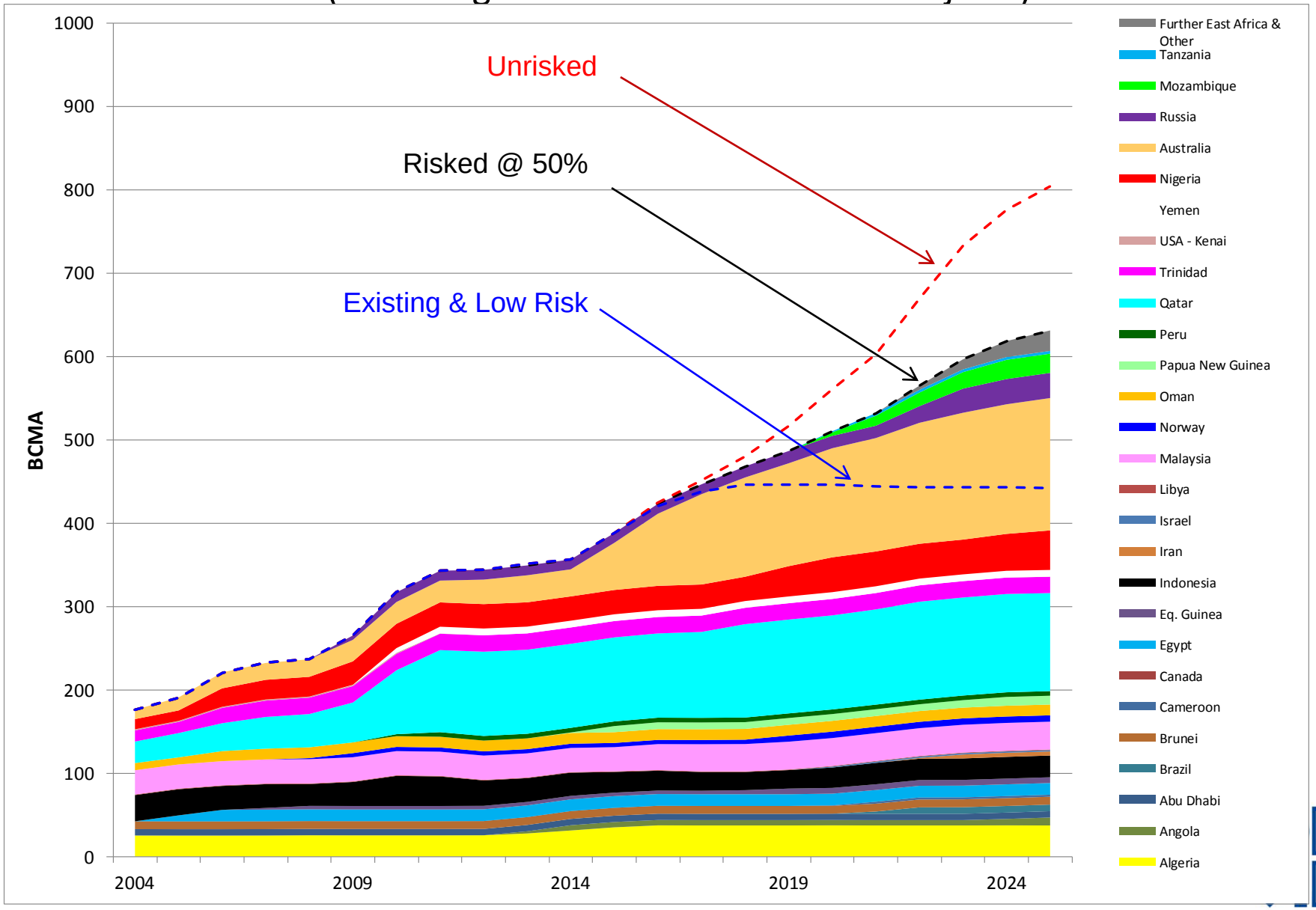
Chinese Demand – (Based on IEA Golden Age of Gas)



Source: IEA, Own Analysis

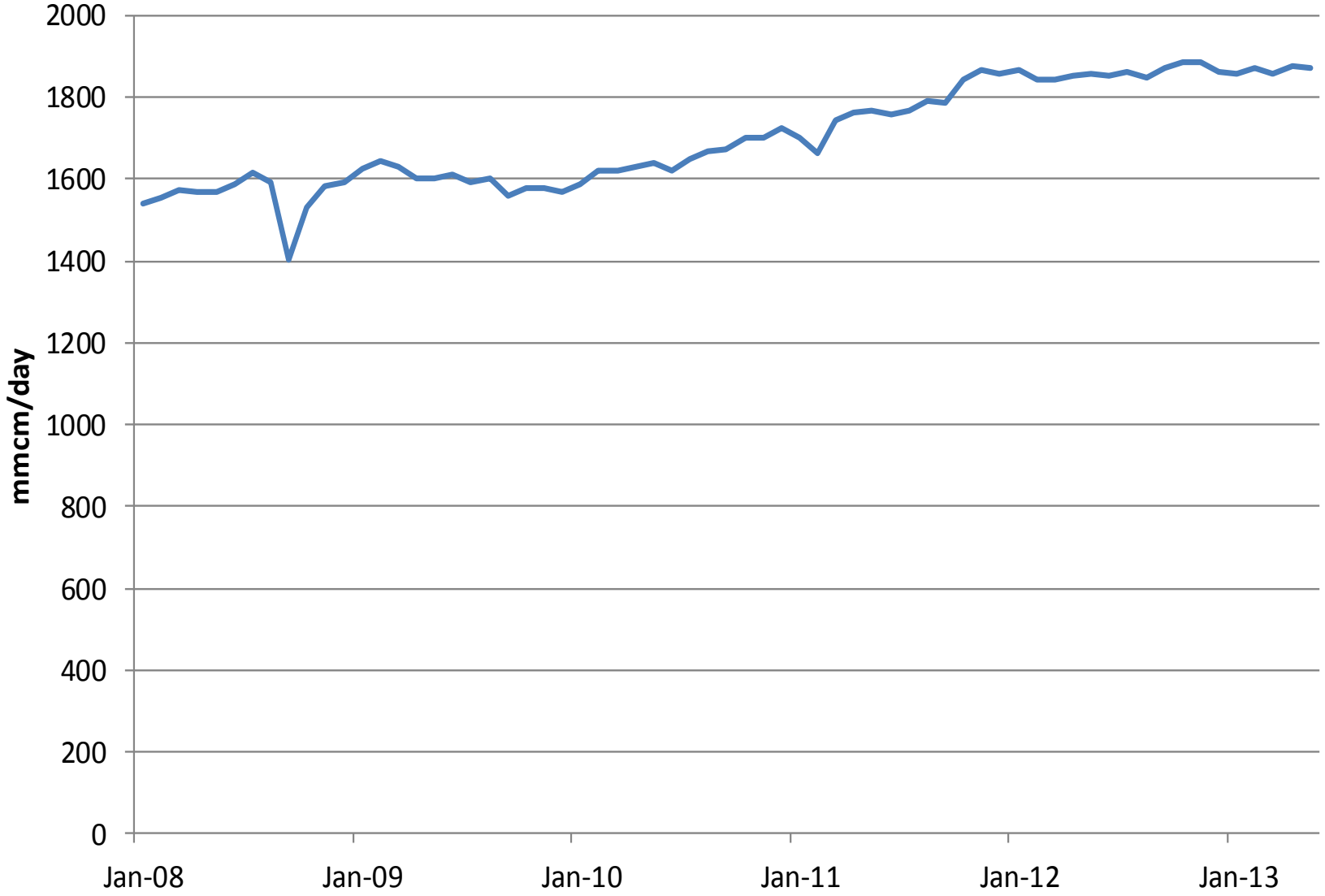
LNG Supply 2005 – 2025

(Excluding Possible US & Canadian Projects)



Source: Waterborne LNG, D. Ledesma, Own Analysis

US Gas Production 2008 – May 2013



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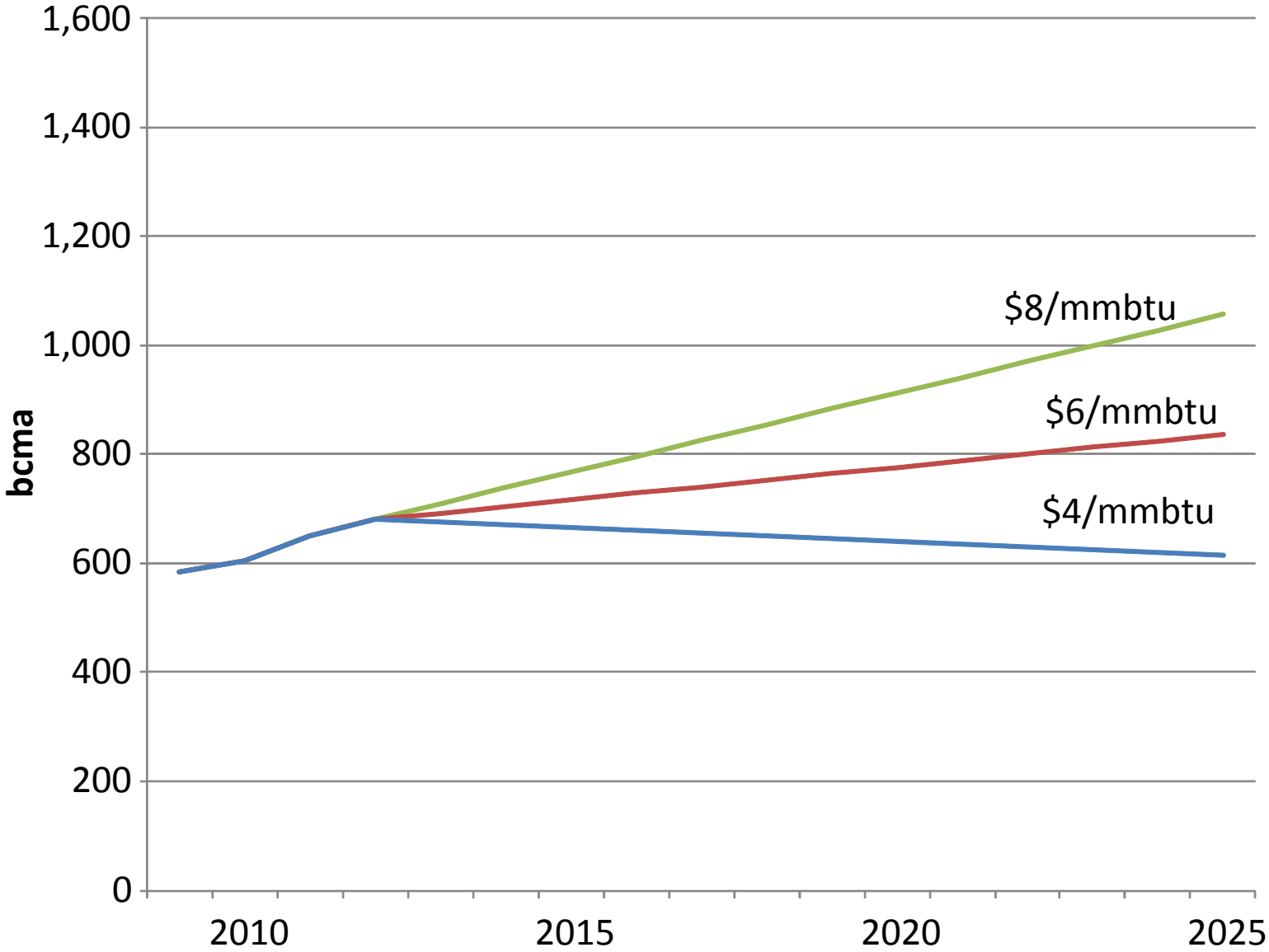
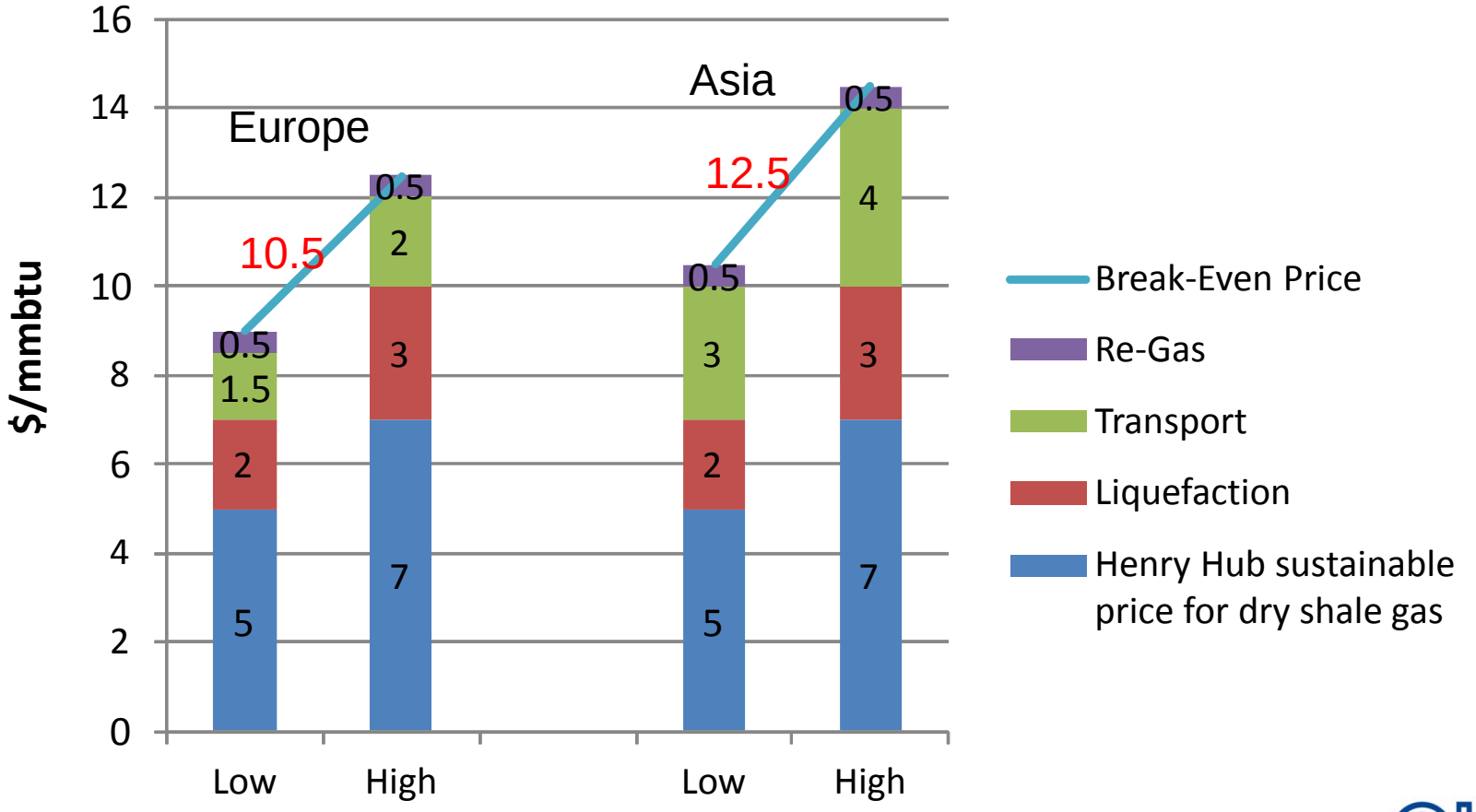
Source: EIA

Hypothetical US Production-Price Dynamics



Source: Author's Illustrative Assumptions

Break-even costs in Europe & Asia



Source: Jim Henderson, OIES

North American LNG Export Projects

US Projects with Offtake Agreements/HOA's

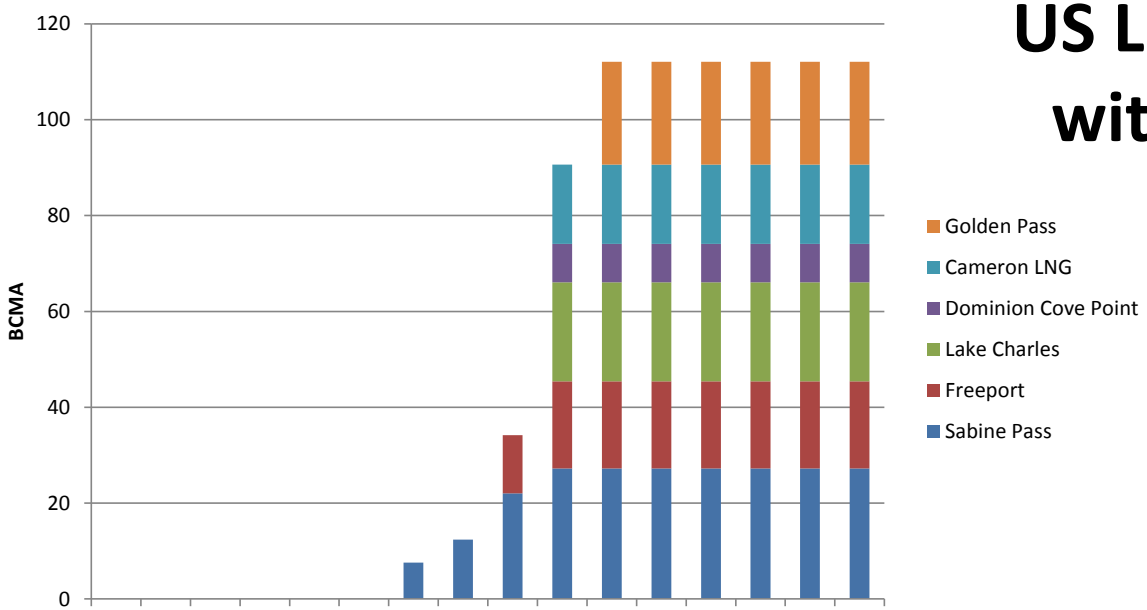
Project	Non-FTA Capacity Approved	Trains	FID	Capacity Owner	Capacity bcma	Start-up Assumed
Sabine Pass	16 mtpa/22.7 bcma	1 to 4	1&2 - under	BG	7.6	2016
			construction	GNF	4.8	2017
			3&4 FID	Kogas	4.8	2018
			May-13	Gail	4.8	2018
	Not Yet Approved	5 & 6		Total	2.8	2019
				Centrica	2.4	2019
Freeport	10 mtpa/14.5 bcma	1 to 2	1&2 1Q2014*	BP	6.1	2018
				Osaka Gas	3.0	2018
				Chubu EPC	3.0	2018
	Not Yet Approved	3	end 2014*	SK E&S	3.0	2019
				Toshiba Corp	3.0	2019
Lake Charles	15 mtpa/20.7 bcma	3	2014*	BG**	20.7	2019
Dominion Cove Point	8 bcma	unknown	2013*	Gail	4.0	2018
				Sumitomo	4.0	2018
Cameron LNG	Not Yet Approved	3	2014*	GDF Suez	5.5	2019
				Mitsubishi	5.5	2019
				Mitsui	5.5	2019
Golden Pass	Not Yet Approved	unknown	unknown	ExxonMobil	6.4	2020
				QP	15.0	2020
Total Capacity Secured under HOA or Contracts					**112.1**	
	Comprising Buyers:	*Portfolio/Aggregators*			*71.3*	
		Japan			*24.1*	
		South Korea			*7.9*	
		Taiwan			*0*	
		China			*0*	
		India			*8.8*	
				Total	***112.1***	
Of Which Non-FTA Approval Granted					**62.8**	
	Comprising Buyers:	*Portfolio/Aggregators*			*39.1*	
		Japan			*10.1*	
		South Korea			*4.8*	
		Taiwan			*0*	
		China			*0*	
		India			*8.8*	
				Total	***62.8***	

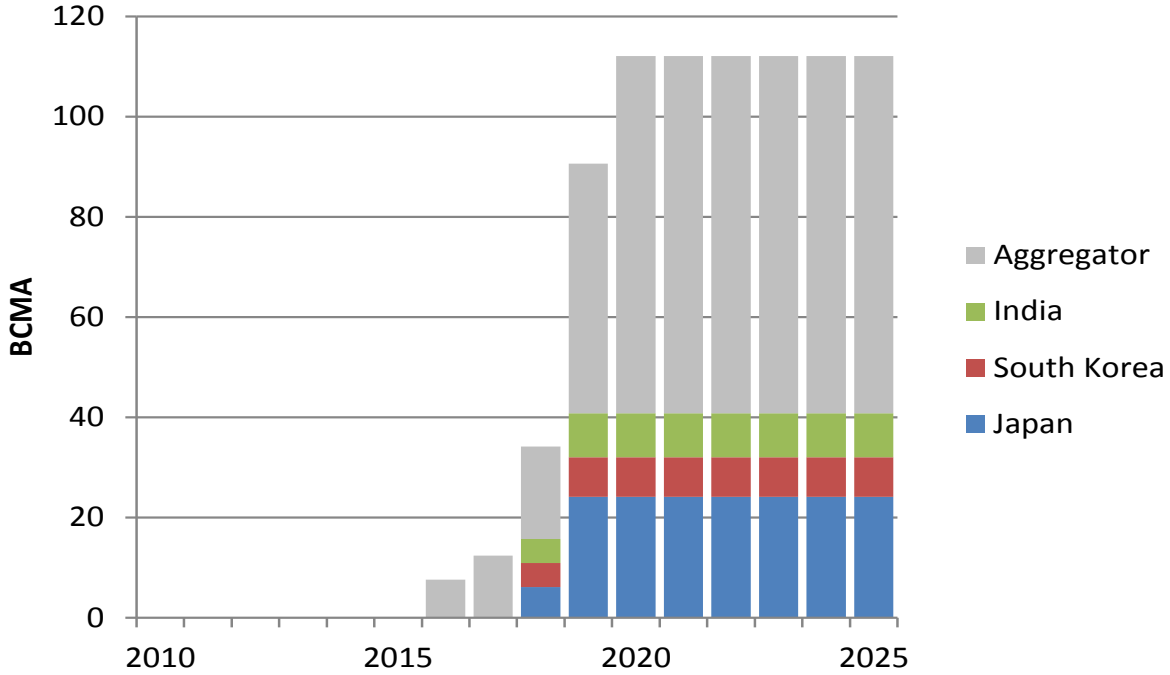
Canadian Projects

Sponsor	Location	Capacity, bcma
Proposed		
Apache Canada Ltd	Kitimat, BC	7.2
BC LNG Export Cooperative	Douglas island, BC	2.6
LNG Canada	Kitimat, BC	33.4
	Sub-Total	**43.2**
Potential		
Pieridae Energy Canada	Goldborough, NS	6.9
BG Group	Prince Rupert Island, BC	43.4
H-Energy	Melford, NS	18.6
Pacific Northwest LNG	Prince Rupert Island, BC	25.8
ExxonMobil - Imperial	Prince Rupert Island, BC	39.3
Woodfibre LNG Export	Squamish, BC	2.8
	Sub-Total	**136.8**
	Total	**180.0**

Source: Company Reports, https://www.ferc.gov/industries/gas/indus-act/lng/lng-proposed-potential.pdf

US LNG Export Projects with secured offtake

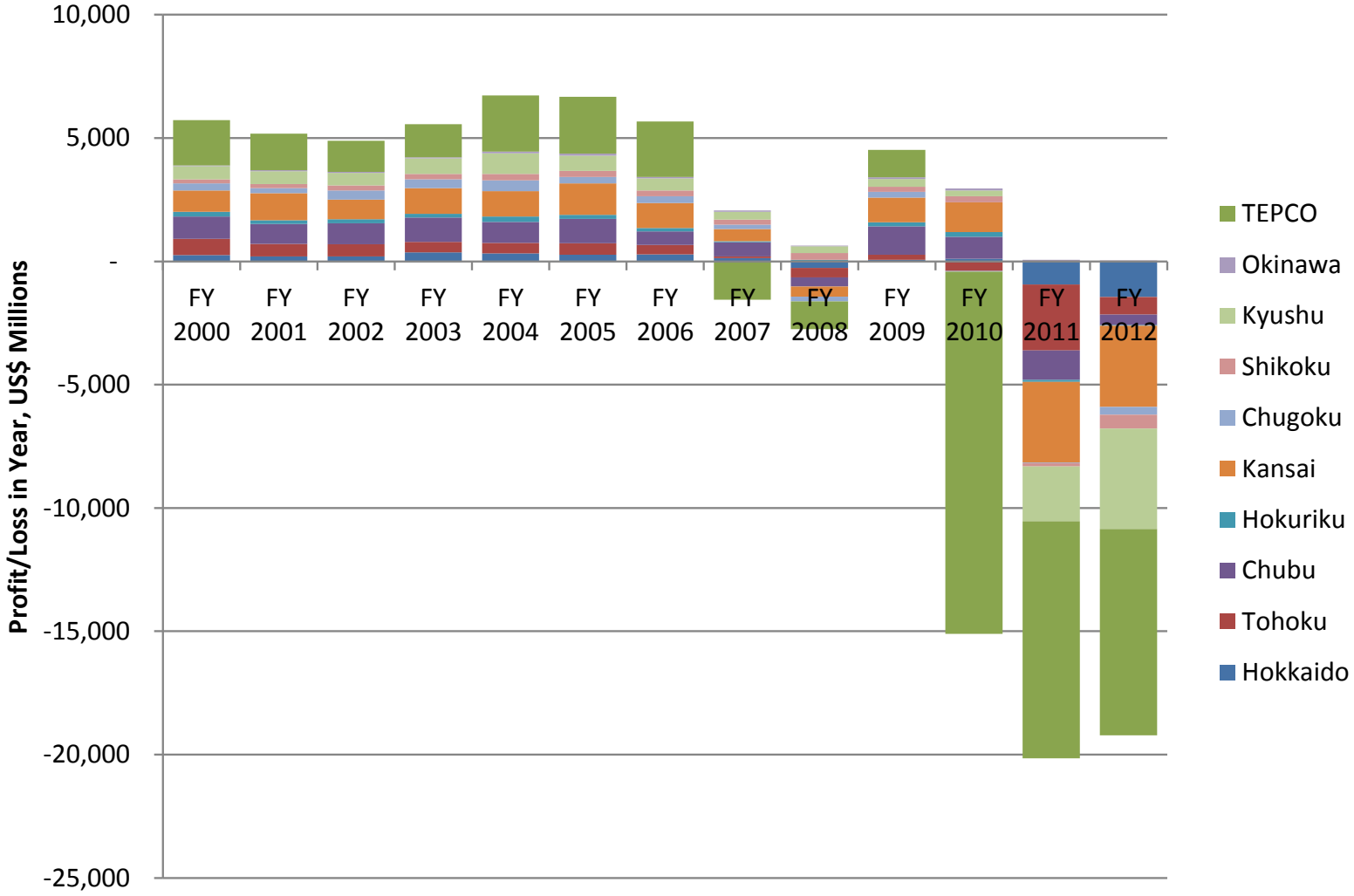




Note that Golden Pass and Cameron await non-FTA approval as do expansions of Sabine Pass & Freeport.

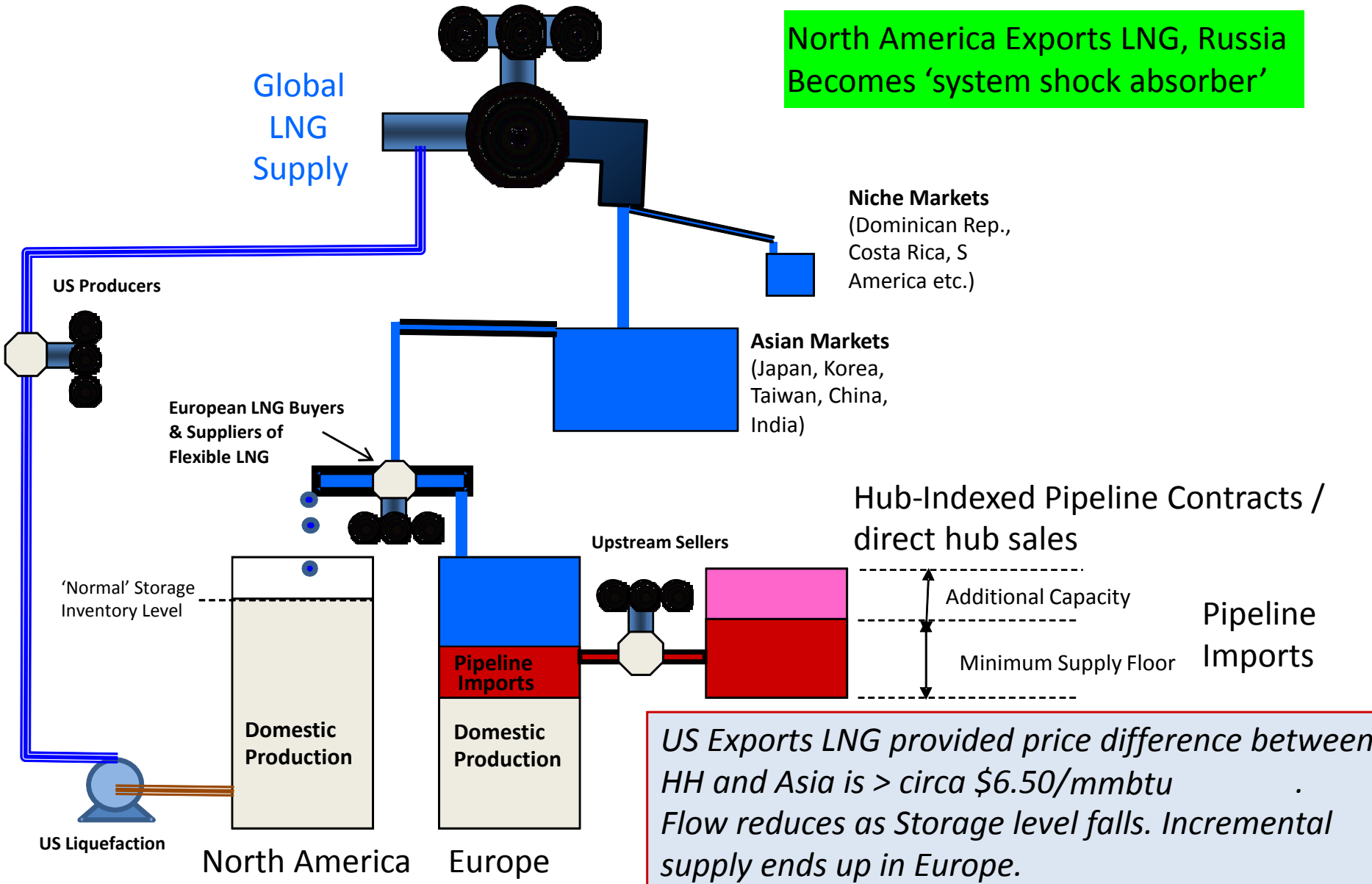
Sources: Company & Media Reports, Author's Assumptions

Drivers for Change – Japan 10 largest Power Company Financials



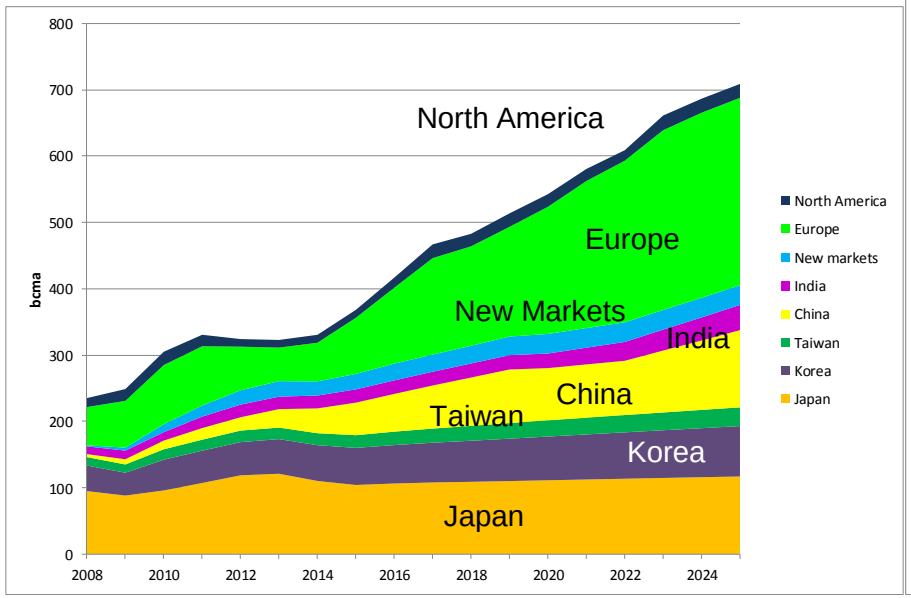
http://www5.fepc.or.jp/tok-bin-eng/kensaku.cgi

Global LNG System 2015+:

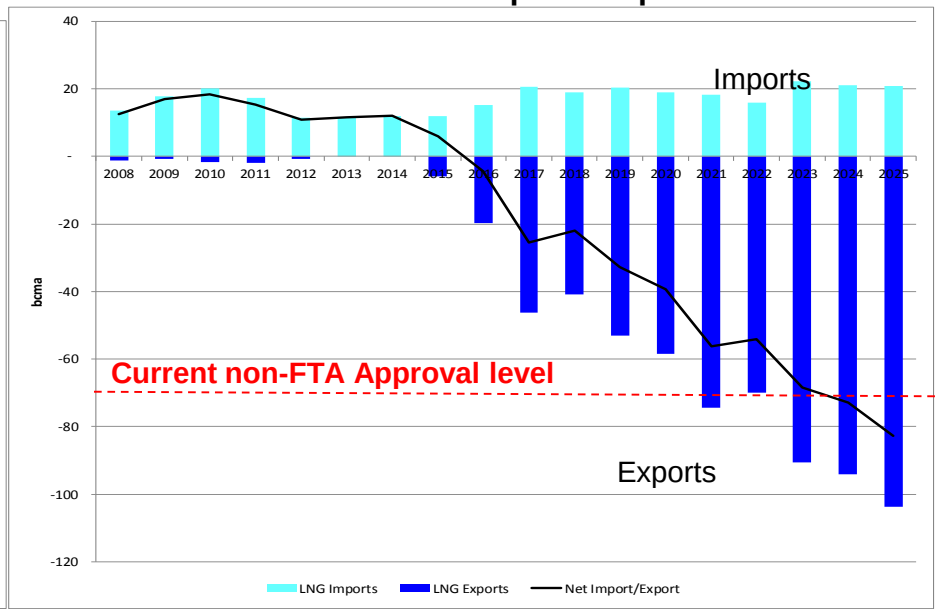


US LNG Exports & Global Interaction (to 2025) (Hypothetical US production – price relationship)

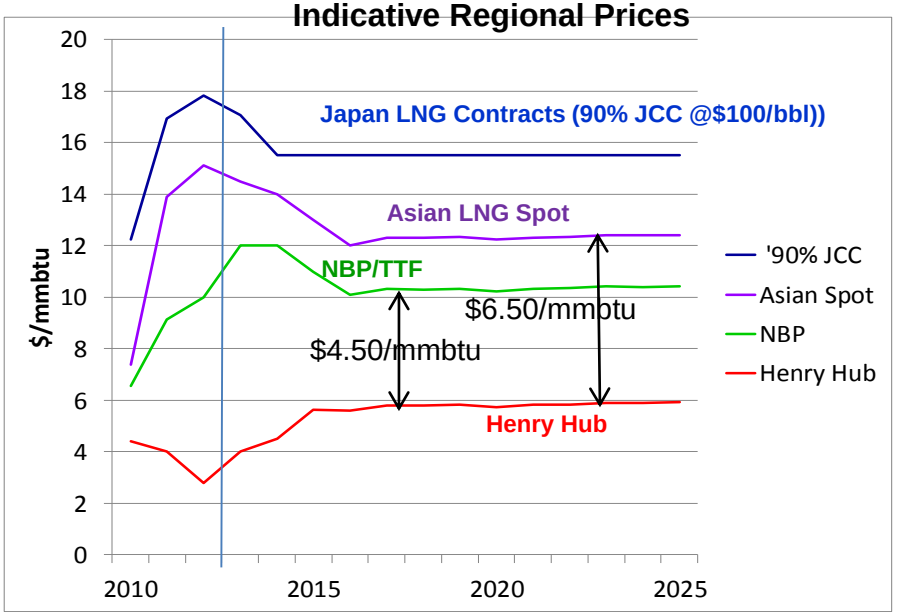
Global LNG Consumption



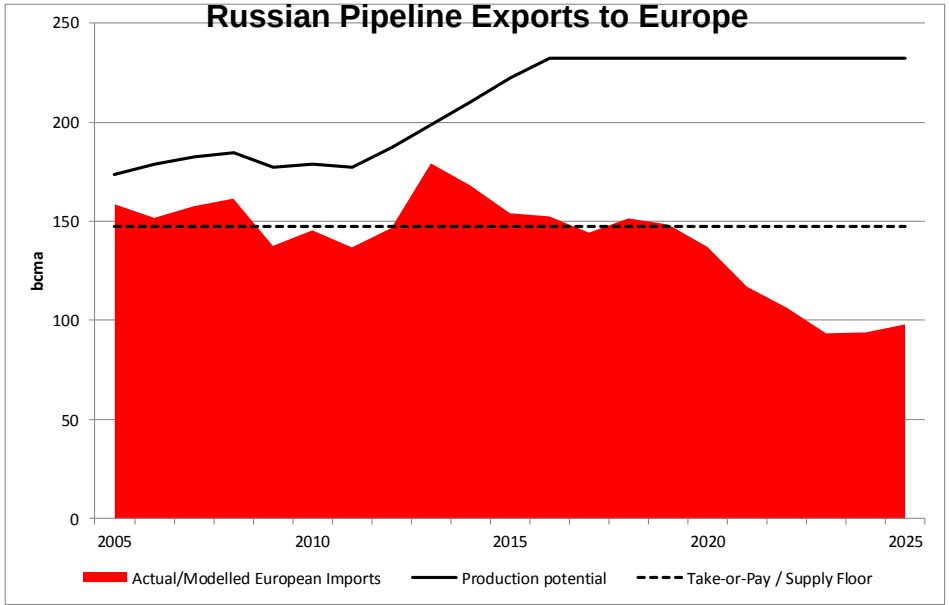
North American LNG Imports/Exports



Indicative Regional Prices

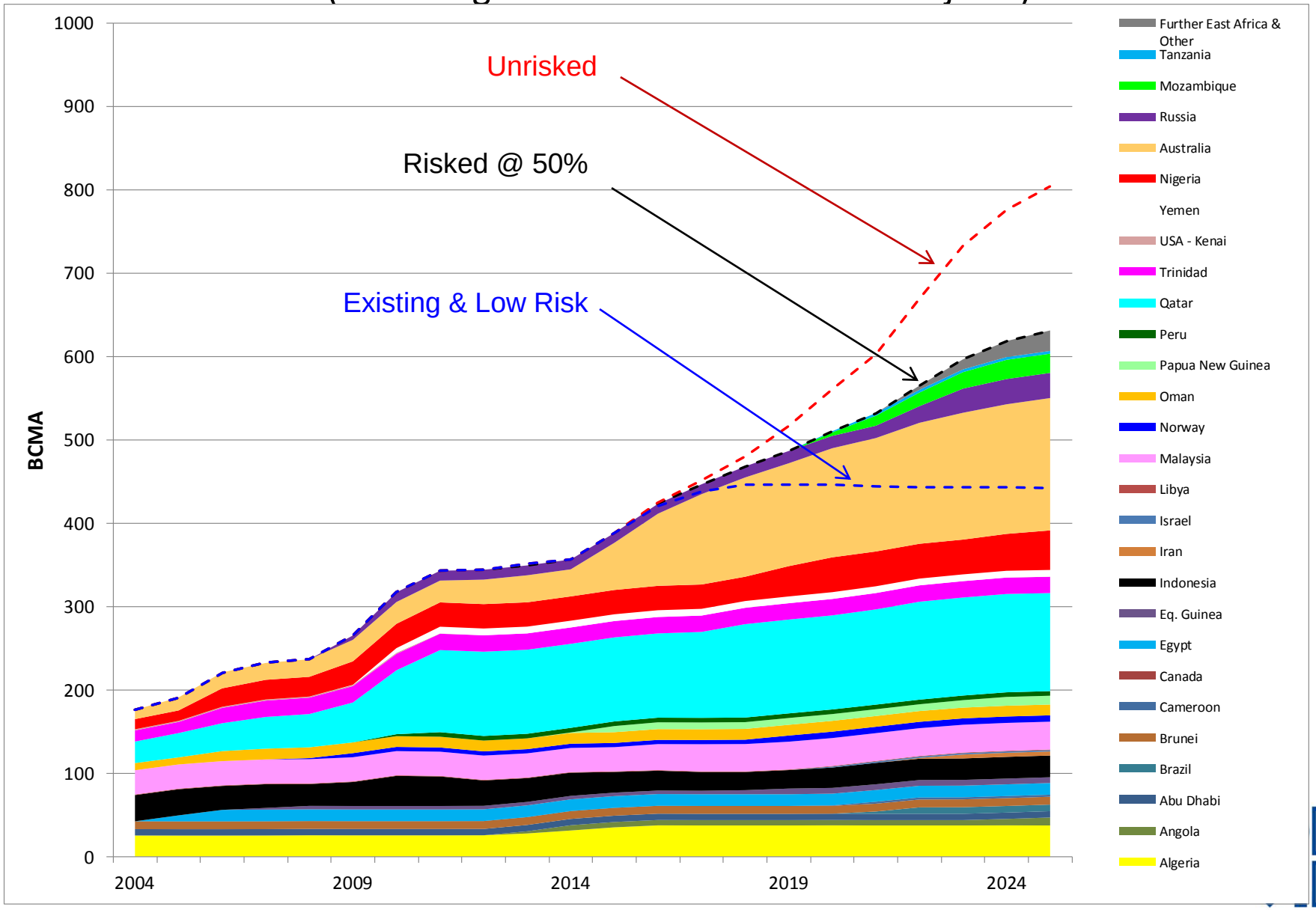


Russian Pipeline Exports to Europe



LNG Supply 2005 – 2025

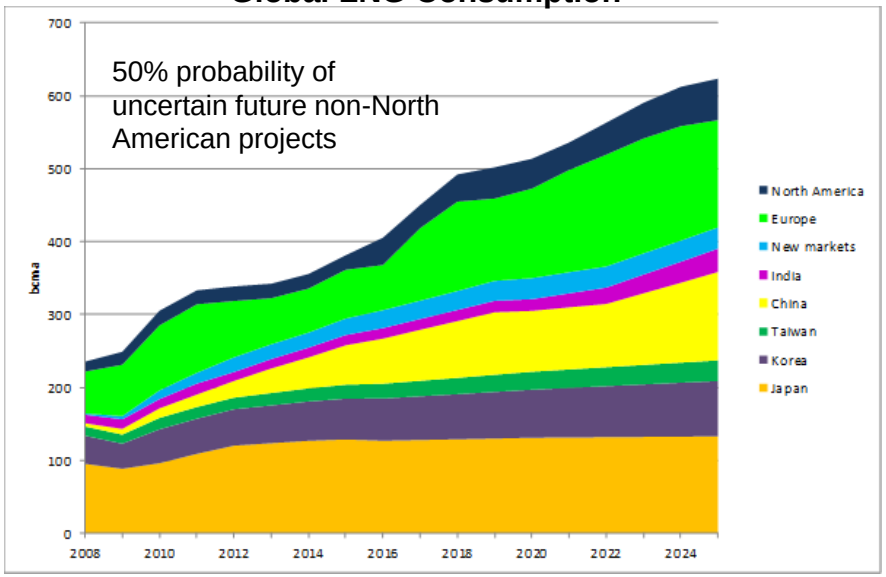
(Excluding Possible US & Canadian Projects)



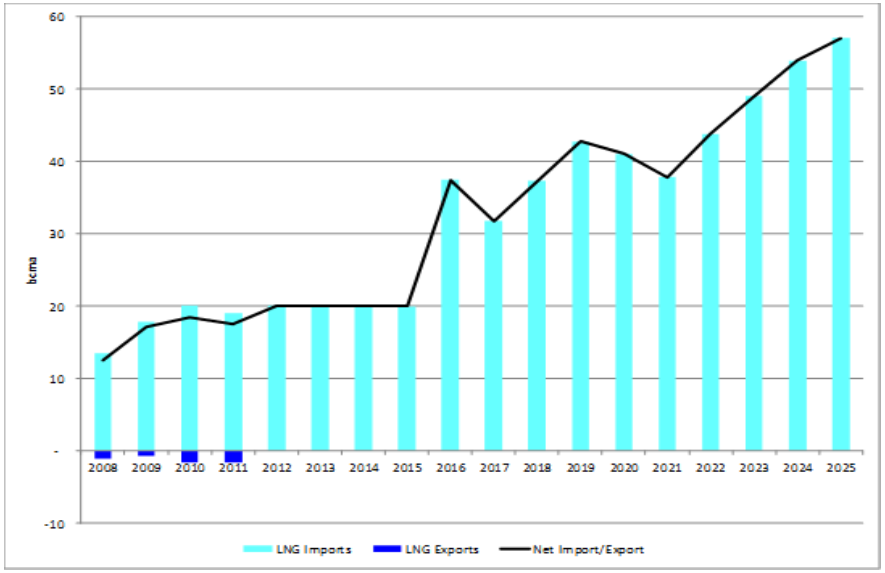
Source: Waterborne LNG, D. Ledesma, Own Analysis

Russia's 'Plan A' – Shale Disappoints, US needs LNG Imports

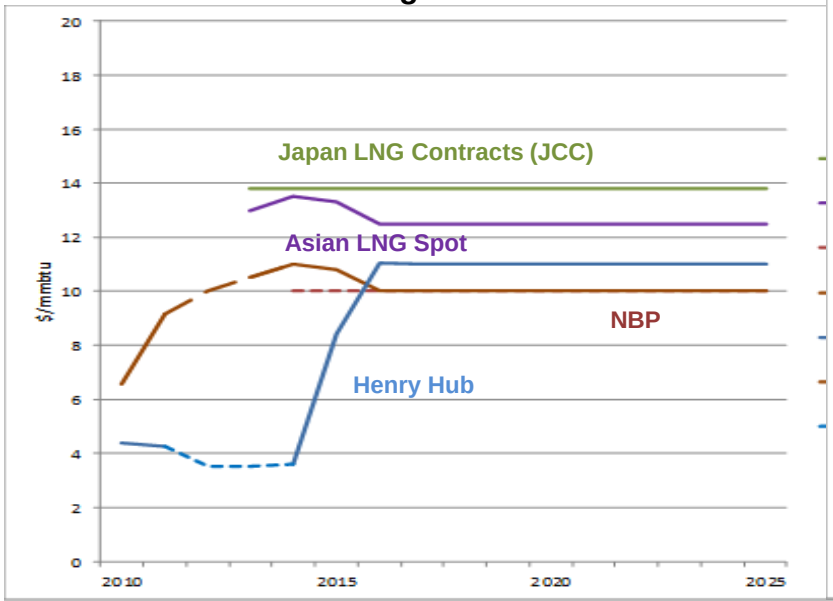
Global LNG Consumption



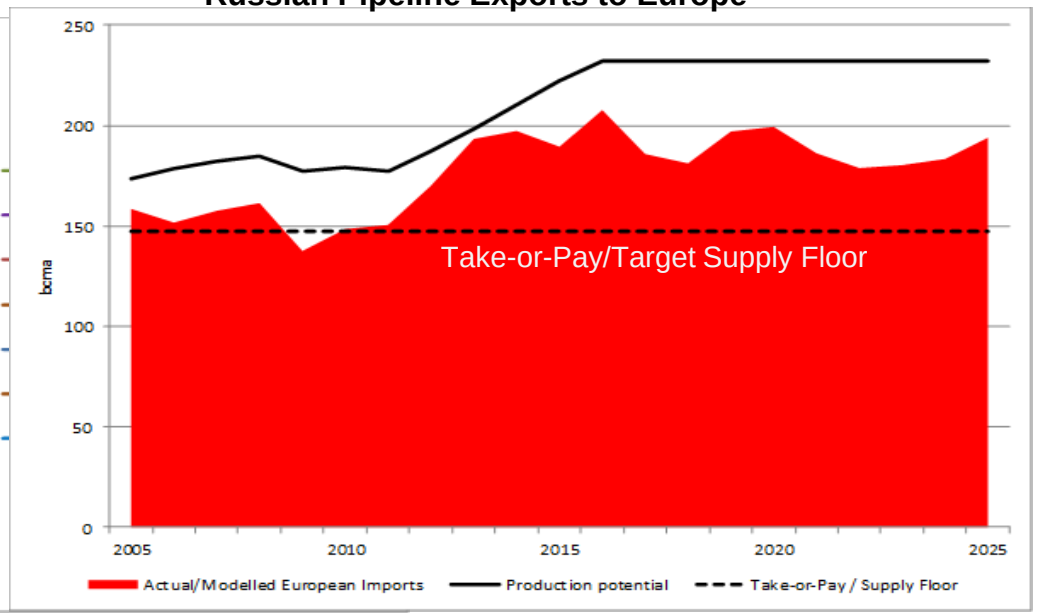
North American LNG Imports/Exports



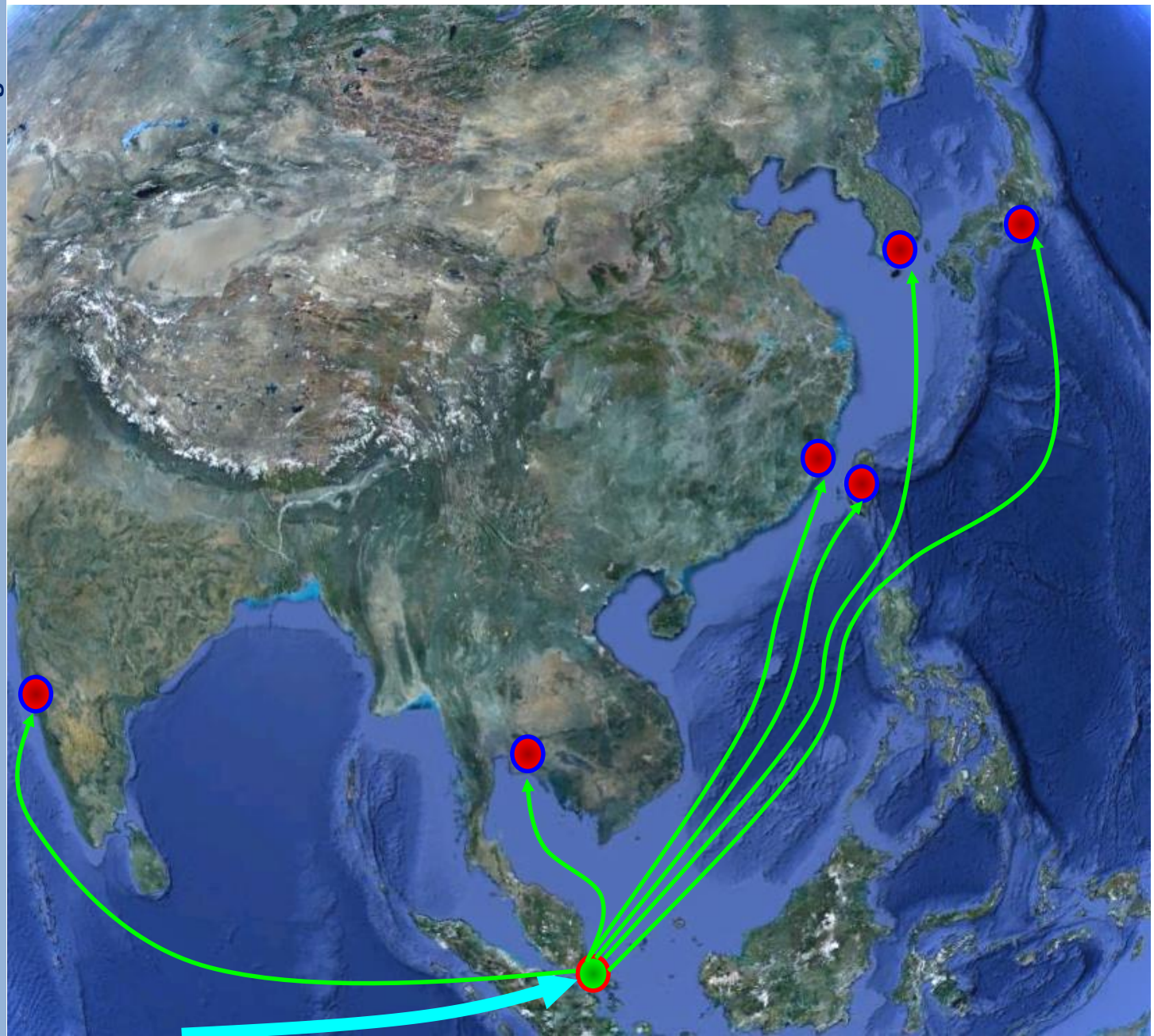
Regional Prices



Russian Pipeline Exports to Europe



A Future Asian LNG Hub?



Summary

- US Shale Gas (and the lack of US LNG import needs) was an important factor which undermined oil indexation for European gas post 2009.
- Strong possibility that US shale production and LNG Exports may undermine oil indexation in Asia post 2015 BUT…
- Many uncertainties in post 2015 fundamentals:
  - Uncertainties on future Chinese gas & LNG demand, US LNG export volumes, scale/slippage/deferral of non-US LNG projects make for great difficulty in projecting LNG balances.
  - How much LNG 'spills over' to Europe?
  - Will Asian LNg spot market liquidity improve/prices re-link with European hubs ?
- Changes in Russian price/volume policy will be very important in determining European/Asian pricing and future of US LNG exports

Thank You

for your attention.

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