CASTALIA
Strategic advisors

LNG for Bermuda: What's possible, and what are the risks?


Tim Kennedy, June 2016

About Castalia

- Founded in 1980 with assignments in over 90 countries
- Offices in the US, Colombia, Australia, France, and New Zealand
- Experience designing, implementing and evaluating in private sector infrastructure investment models in the developed and developing world

- Experience in energy in Anguilla, Antigua and Barbuda, The Bahamas, Barbados, Belize, Bermuda, The Cayman Islands, Dominican Republic, Grenada, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, and The Turks and Caicos Islands
- Comprehensive study on feasibility of introducing natural gas to the Caribbean
- Developing benchmarking system for over 100 electricity utilities in LAC
- Assessed NG feasibility and provided roadmaps for procuring LNG in Bermuda, Barbados, and Suriname

Sector Experience

- ✓Energy
- ✓Water
- ✓Transport
- ✓Telecommunications

Sample of Our Clients

IFC, BID, KFW Bank aus Verantwortung, JPS, ERA Electricity Regulatory Authority Cayman Islands, New Zealand, The World Bank, AES, Ontario Teachers' Pension Plan, OECS Organization of Eastern Caribbean States

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AGENDA

- LNG supply chain and market
- Likely cost of LNG in Bermuda
- Advantages and risks of LNG for Bermuda

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Natural gas transport options

Level of Feasibility:

Medium/High

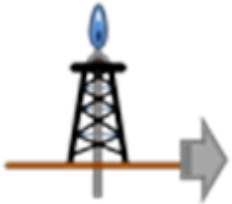
LNG:

Liquefaction

Shipping

Regasification

Low



Natural Gas Supply

CNG:

Compression

Shipping

Expansion

Natural Gas Consumption

Very Low

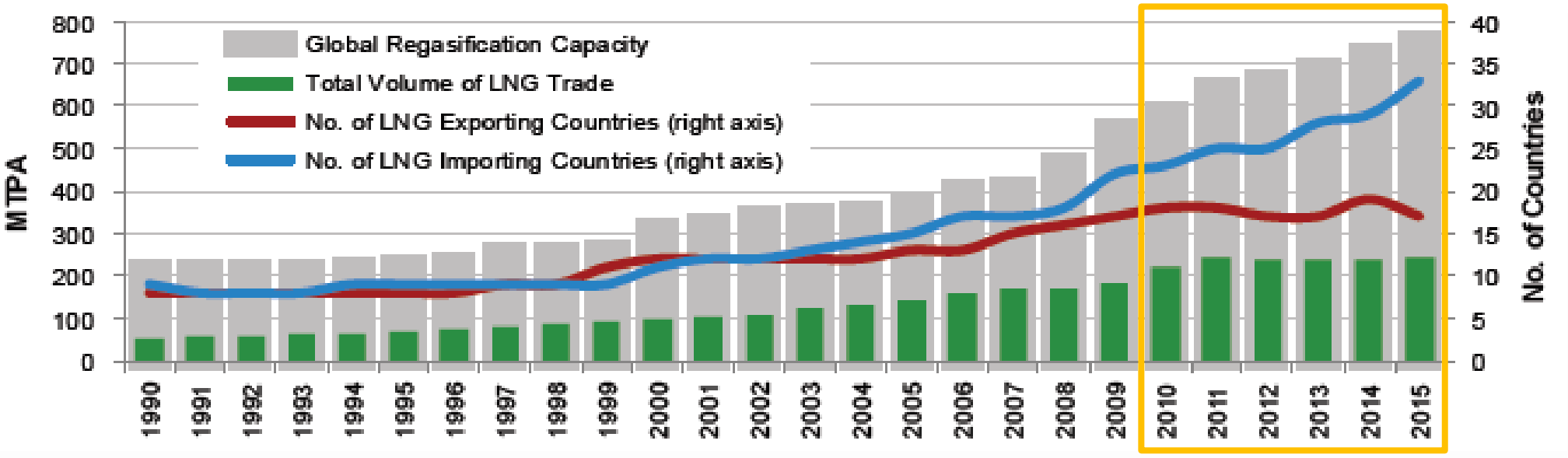
Pipeline:

Pipeline

LNG is proven and exists at the scale needed for small-island states

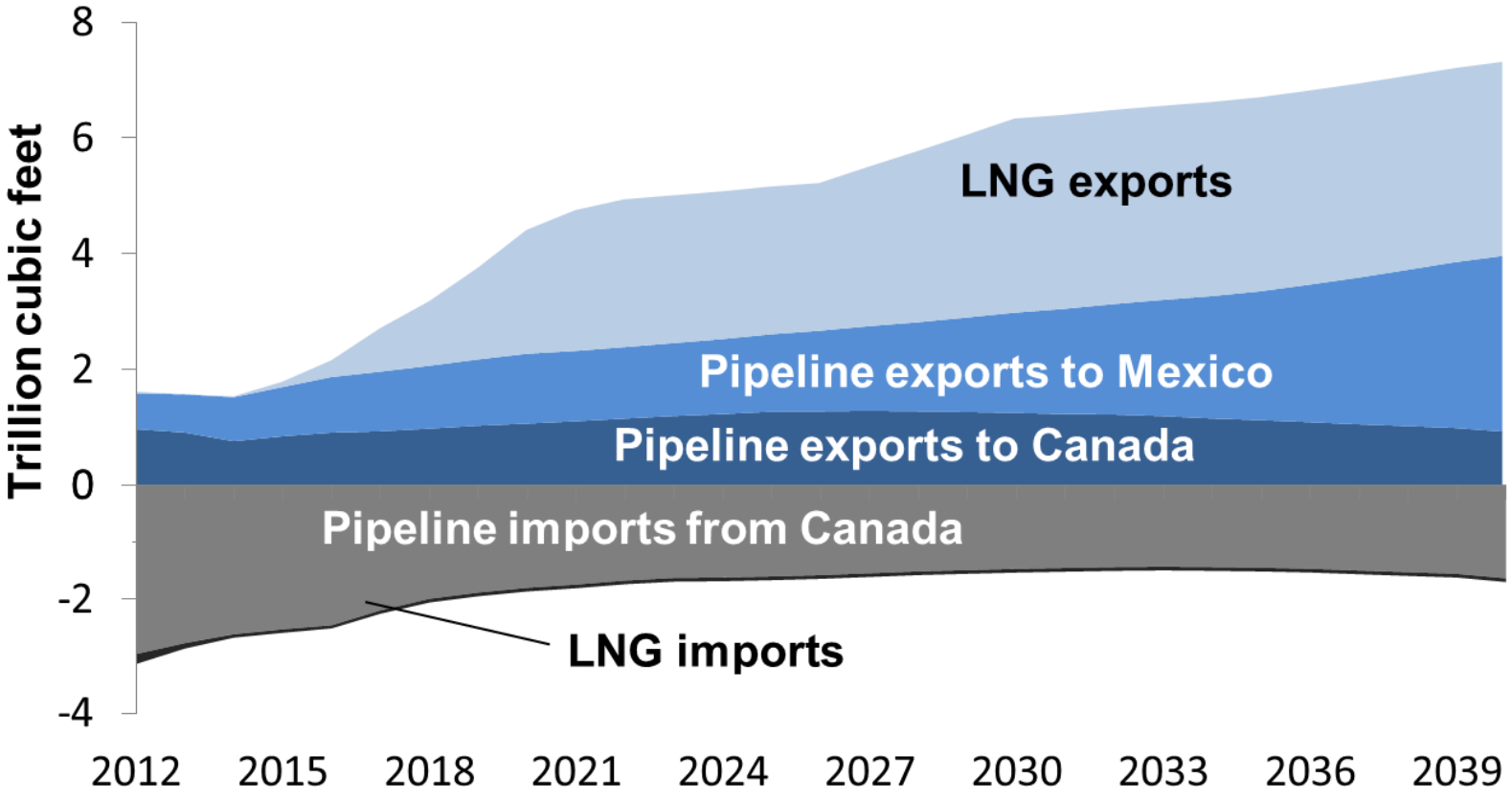
LNG is a proven technology	•LNG has been commercially shipped since 1959 •**Only one purpose-built vessel for CNG in the world**
LNG exists at the scale needed for small-island states	•**Small liquefaction plants** (<1 mtpa): often sell directly to small re-gas plants •**Small ships**: 24 ships had a capacity of 25,000 m3 or less in 2013 (5 ships in 2006) •**Small Re-gas**: in remote areas with low demand in Japan and Scandinavia
Potential Suppliers	•**Most likely**: USA •**Somewhat likely**: Canada, Trinidad and Tobago •**Possible**: Mexico, Venezuela, others

Global LNG trade is increasing



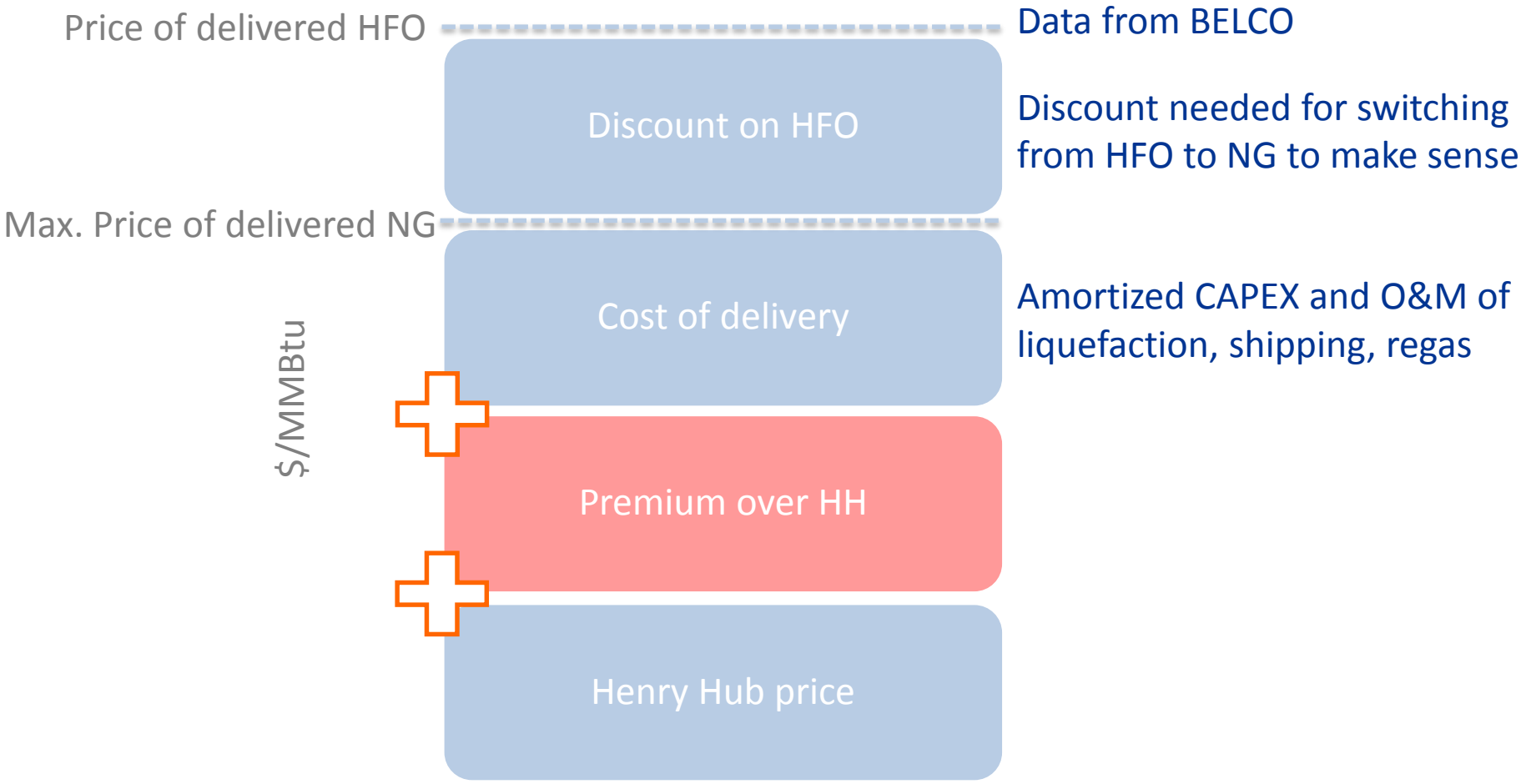
Source of graph: IGU. 2016 World LNG Report. Original Source: IHS, IEA, IGU,

US exports have started, more are coming

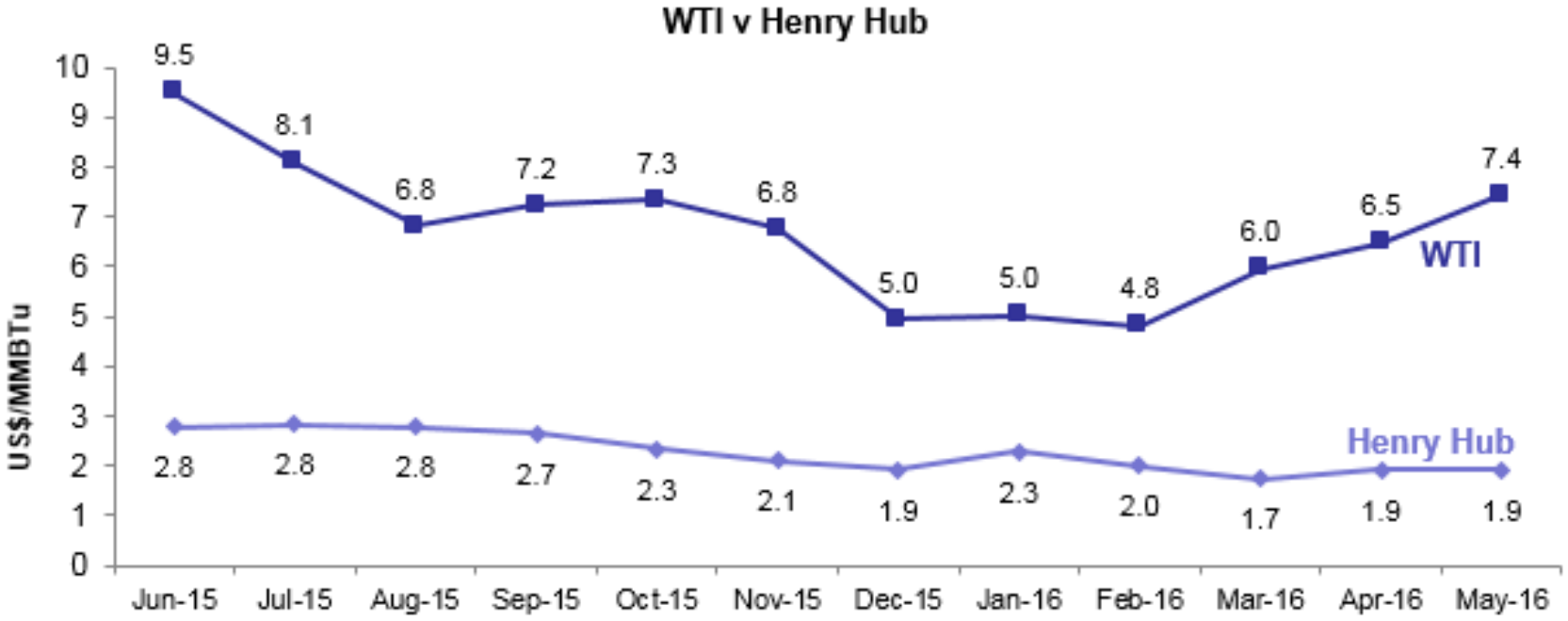


	FTA	Non-FTA
Under DOE Review	55 MTPA	281 MTPA
Approved	351 MTPA	104 MTPA

How we determine if NG is feasible



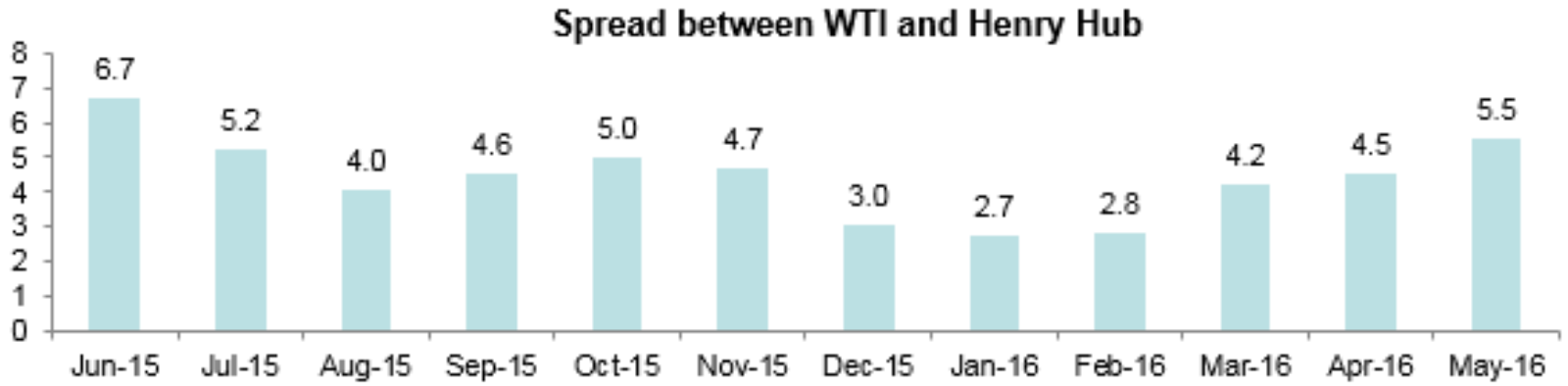
Changes in oil and gas prices: June 2015 to now



Price on 20 June 2016

7.8 - WTI

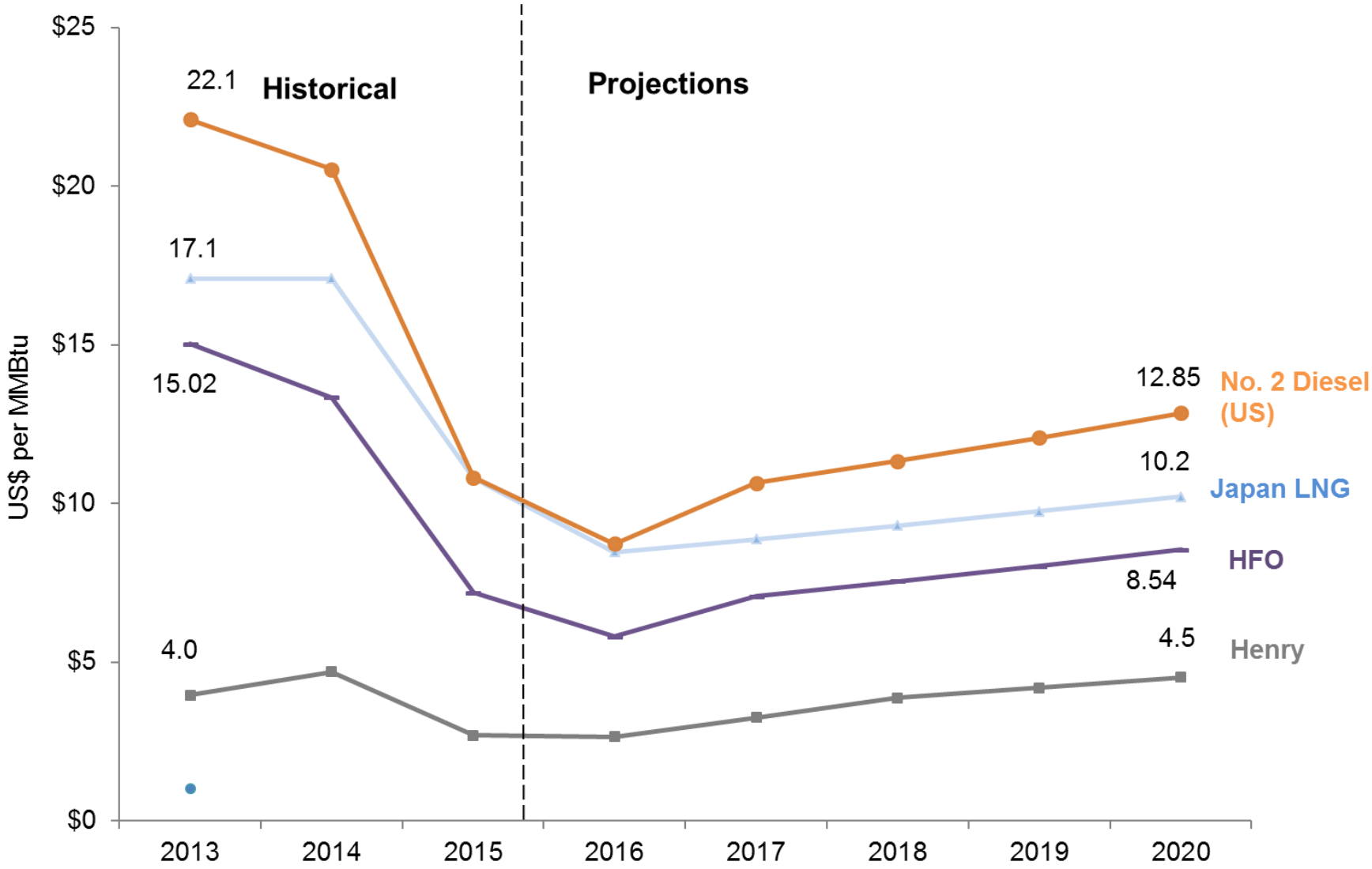
2.7 - NG



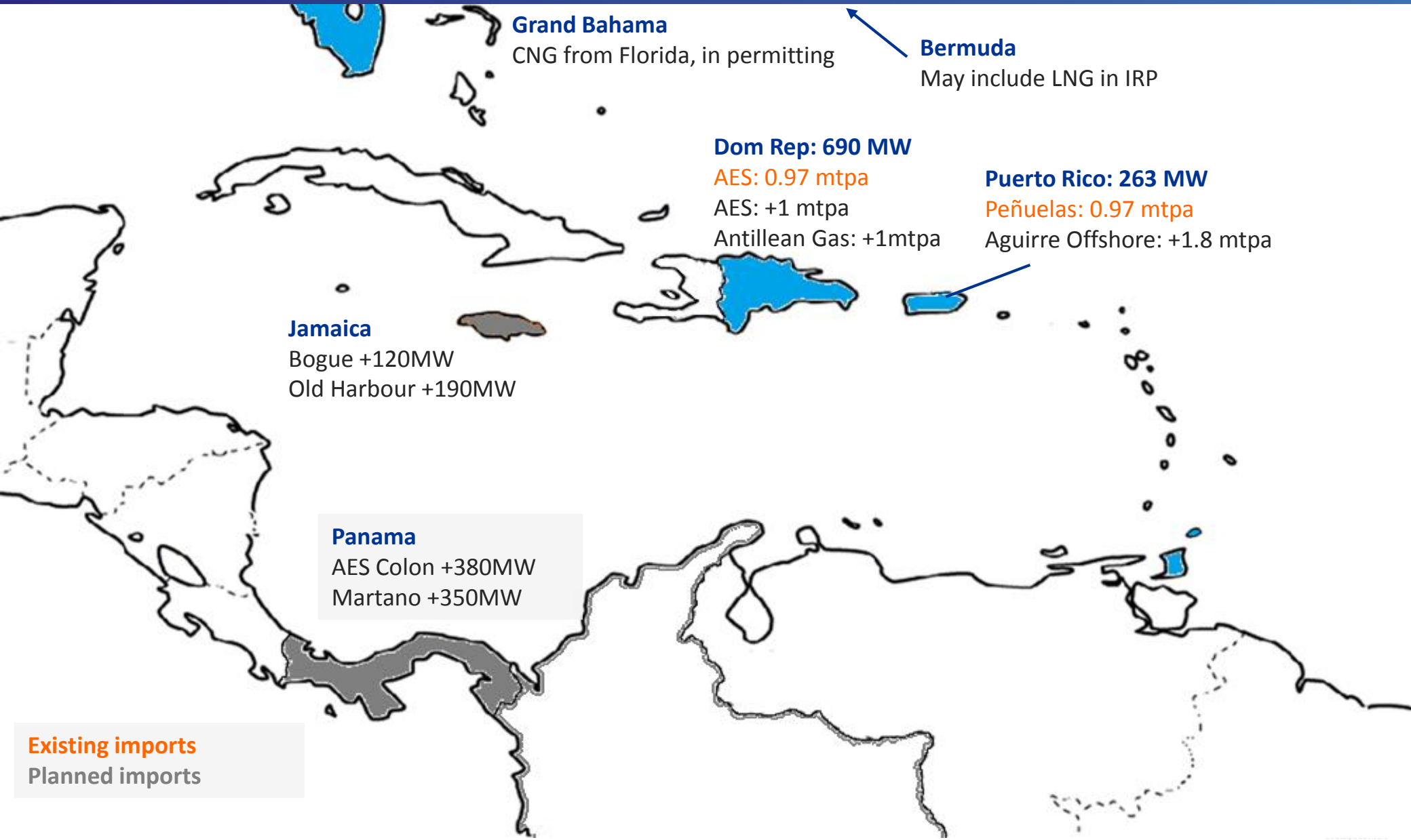
5.1 - Spread

Source: U.S. Energy Information Administration

Price forecasts… but prices are always uncertain



Natural gas import projects in the region



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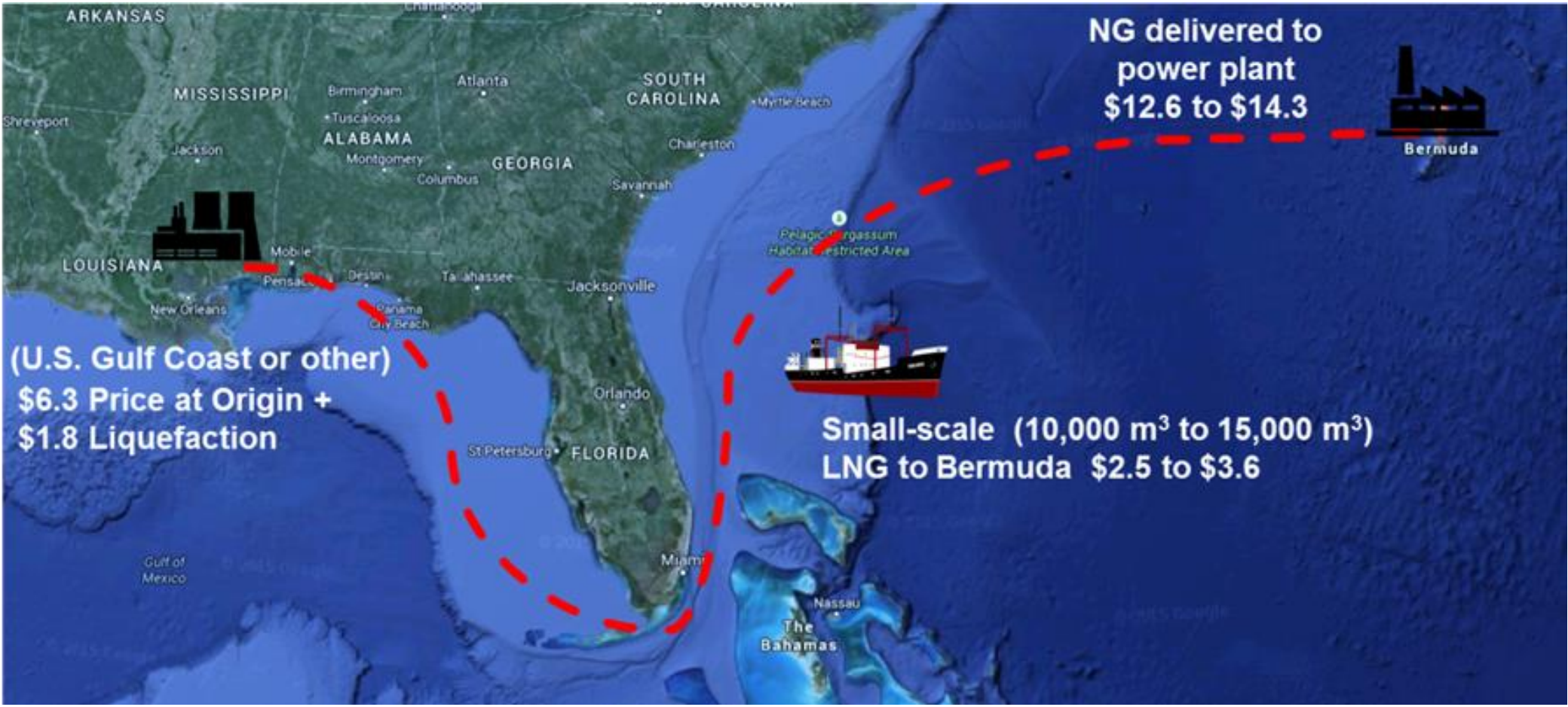
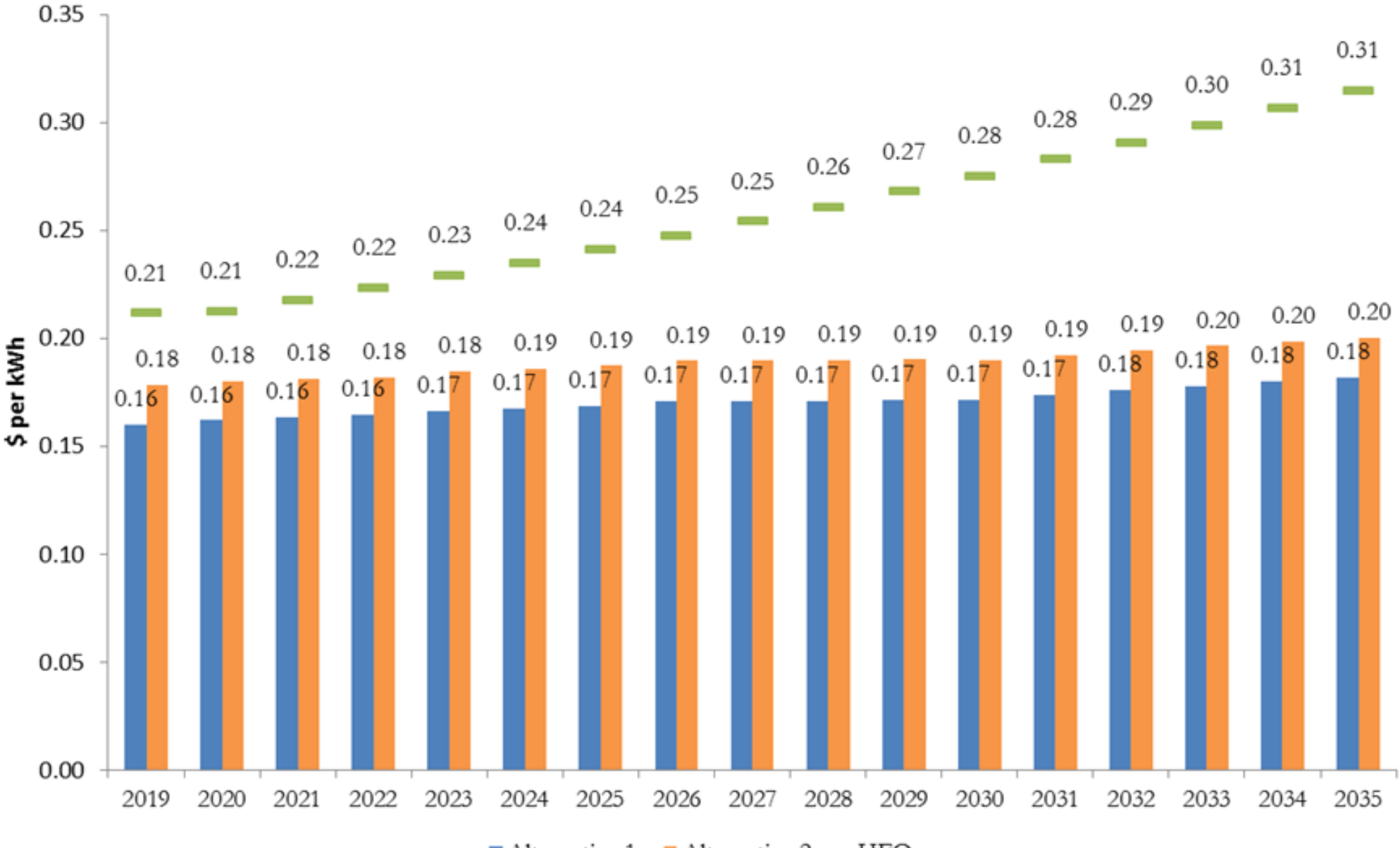
Delivered cost of NG to Bermuda ($/MMBtu)



Estimated cost of electricity generation



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LNG is viable for Bermuda, with three large advantages

Likely cheaper than oil products, with savings passed on as lower electricity prices

Reduced emissions: very low NOx and SOx, nearly 40 percent less CO than oil products

Baseload power needed to ensure system reliability

Risks to importing LNG

- Large investment costs: $258-$318 million is the Castalia estimate, depending on location
  - Paid off over 20 to 25 years
  - Existing generation capacity must be replaced anyway—prefer to invest in oil or natural gas?
  - Consistent with Electricity Sector Policy, Aspirational Matrix
- Fuel price risk

Testing the market, getting it right

- Must test market to see best option for Bermuda—prices, technologies
- Make a decision on best-available information, but there will always be fuel-price risk
- Transaction must be done well, since there will only be one deal and one terminal

Contact us

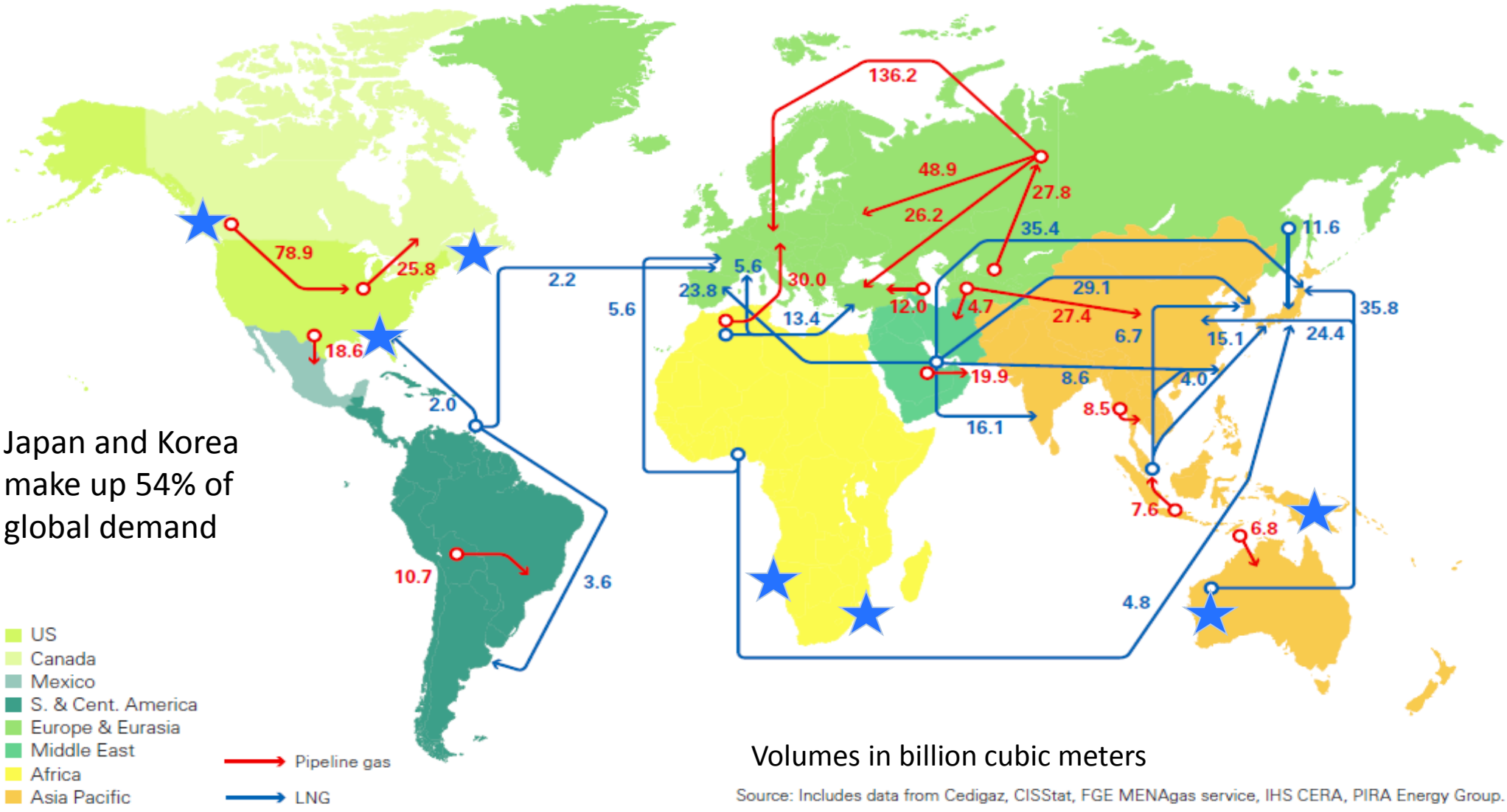
Tim Kennedy

Manager

Tim.Kennedy@Castalia-Advisors.com

Annexes

LNG is globally traded



Japan and Korea make up 54% of global demand

Volumes in billion cubic meters

Source: Includes data from Cedigaz, CISStat, FGE MENAgas service, IHS CERA, PIRA Energy Group.

Planned additional LNG export projects

Using NG has positive environmental and social impacts

	Environmental impact and risk	Social impact and risks
Business as usual (fuel oil) 	• Oil spills that damage environment and human health • Spills have occurred in the Caribbean, causing millions of US$ in damage and killing at least 26 people • 0.79 tonnes of CO_2 per MWh	• High and volatile electricity prices bad for households and businesses • Higher local pollutants endanger people's health
Natural gas	• Spills are lower risk to environment than fuel oil • No reported leaks from ships in 30 years • Globally, only one accident with fatalities since 1980 at onshore facilities • 0.49 tonnes of CO_2 per MWh	• Potential reduction in electricity prices and price volatility • Job creation from construction of infrastructure