GaffneyCline™
energy advisory

Global LNG Market

Implications for Alaska

House Resources Committee
5th March 2025

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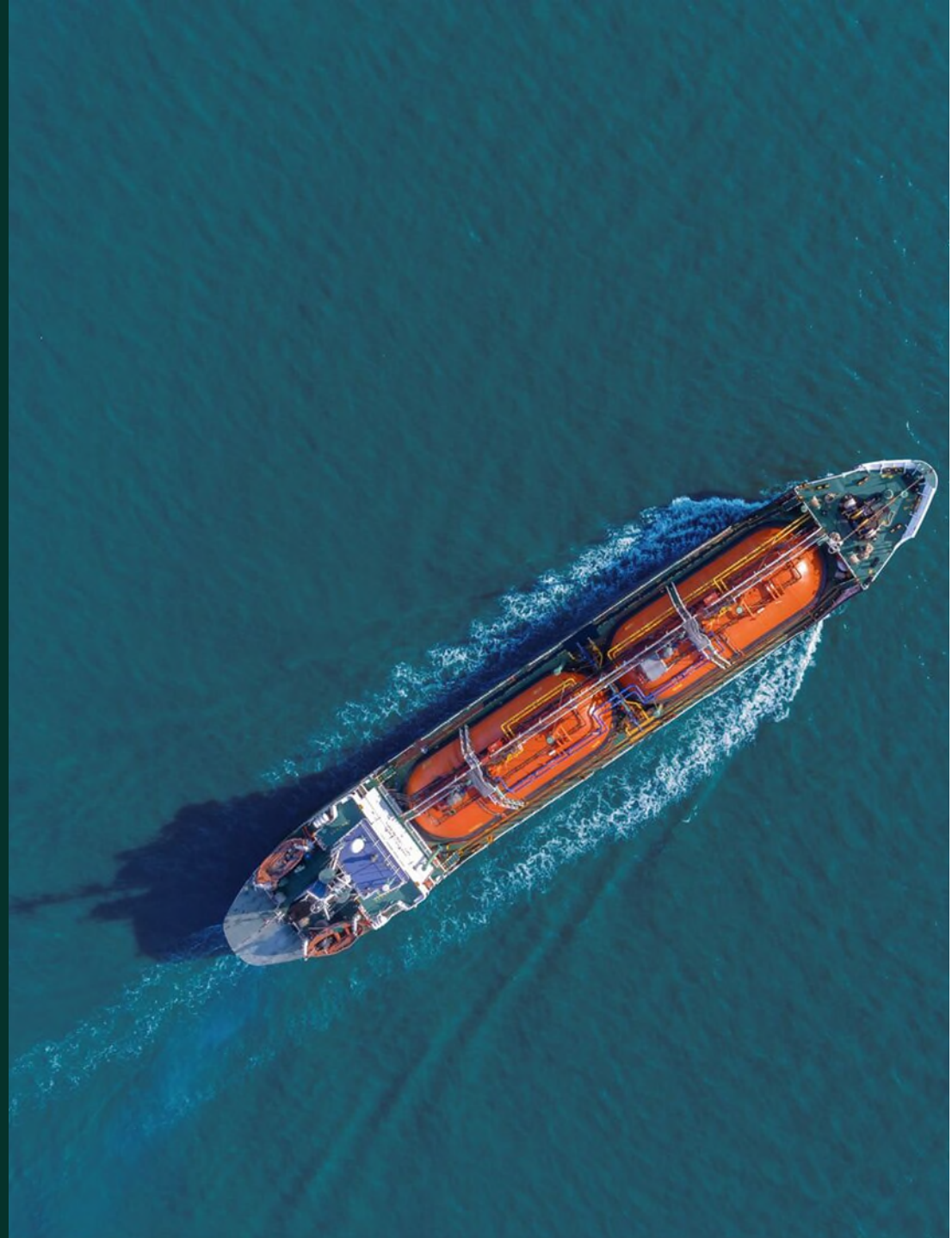
Agenda
Topics to be covered

- Evolution of the LNG Industry
- Supply and Demand
- LNG project evolution
- LNG Economics
- Enabling legislation
- Selected LNG Case Studies



Evolution of the LNG Industry

LNG Basics

Physical Characteristics

- LNG is not LPG
- Natural gas (predominantly methane) that has been refrigerated to the point that it remains liquid at atmospheric pressure
- Liquid phase exists at a temperature of -162°C (-259°F)
- Typically at or slightly below its boiling point with vapour constantly being generated

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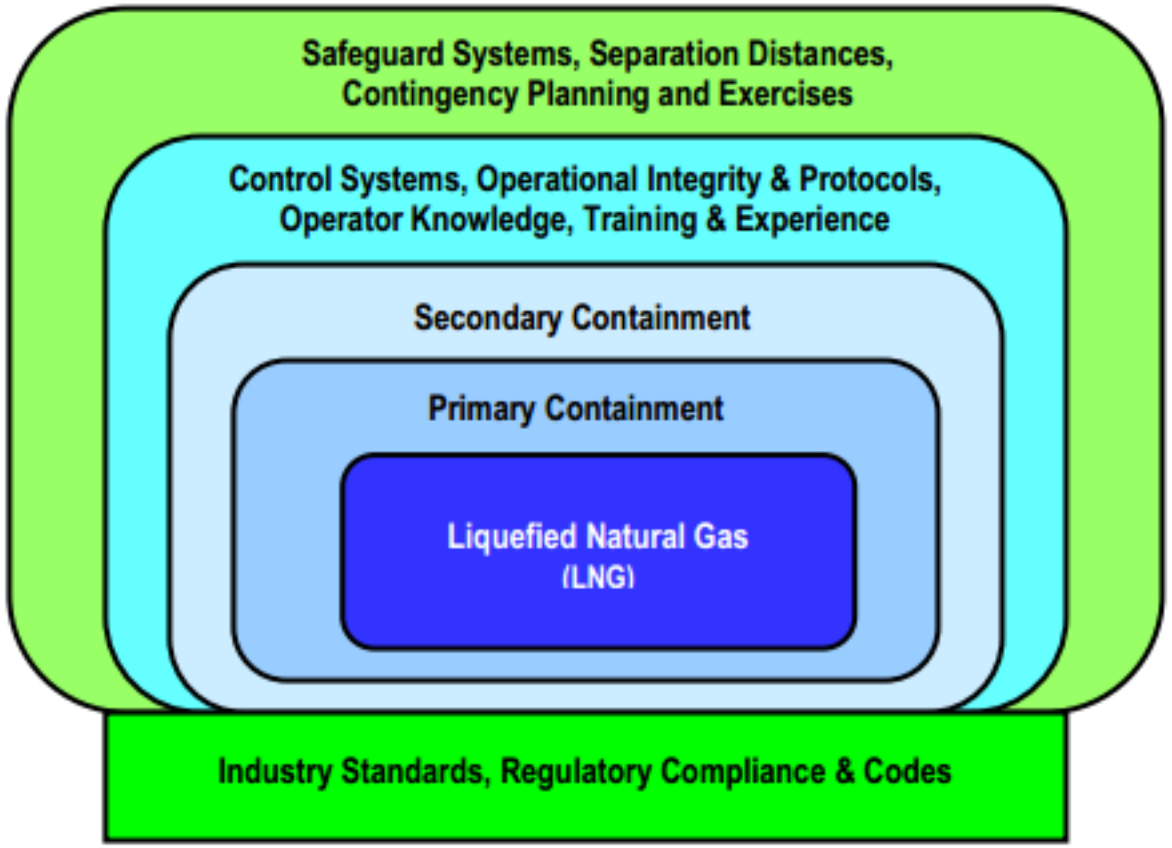
LNG Basics

LNG is a safe and efficient way of moving gas

- Widespread misunderstandings about LNG safety
- Double or triple containment storage tanks
- LNG will evaporate quickly, if spilled
- Industry has an exemplary safety record
- Operators are highly trained and professional
- LNG carriers are very highly specified and maintained
- >150,000 voyages, no major incident

- LNG safety philosophy is a combination of physical containment, controls, and other safeguards



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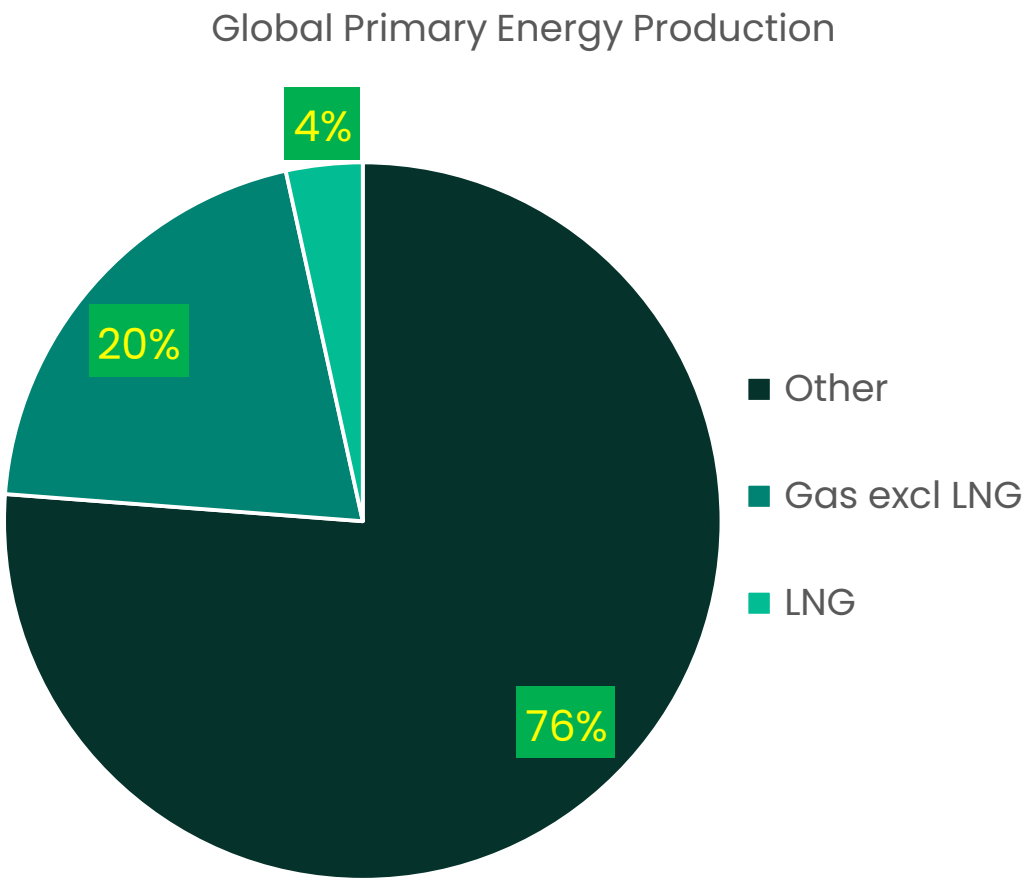
LNG place in Global Primary Energy



Source: GaffneyCline analysis
* Shell Energy Outlook 2025

- LNG represents around 4% of total global energy production
- About one third of exports and imports
- Annual revenues of about $150-300 billion
- Demand could increase by 75% by 2050*
- AK LNG might account for only 7% of the 2025-2050 increased demand

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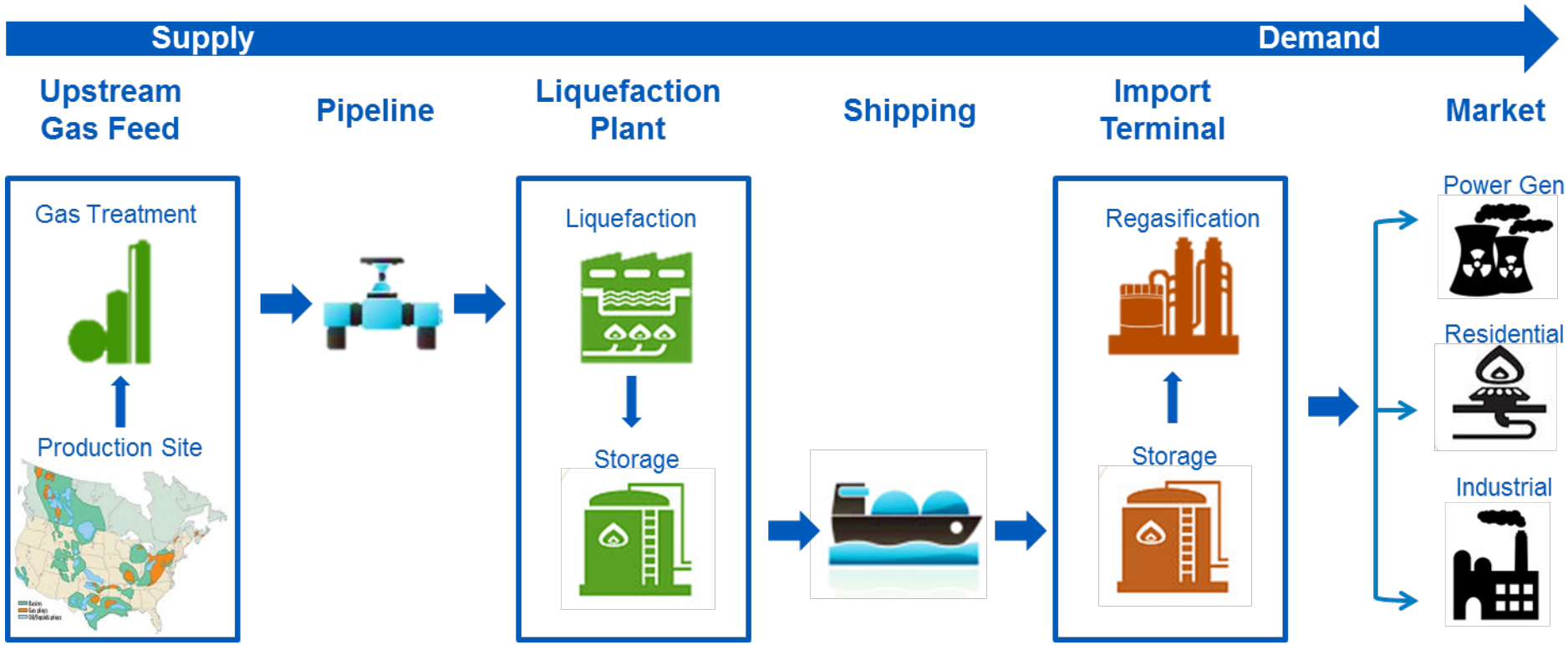
The LNG Supply Chain



- ***Gas Treatment***
  - Remove moisture / condensate, inerts and impurities
- ***Pipeline***
  - Transmission between field and LNG plant
- ***Liquefaction***
  - Successive stages of cooling / liquids removal of impurities
- ***Shipping***
  - Vessels similar size to very large crude carriers
  - Insulated, non-pressurised double containment tanks
- ***Regas***
  - Heat the LNG so that it becomes gaseous and ambient temperature
  - Inject into conventional gas transmission infrastructure

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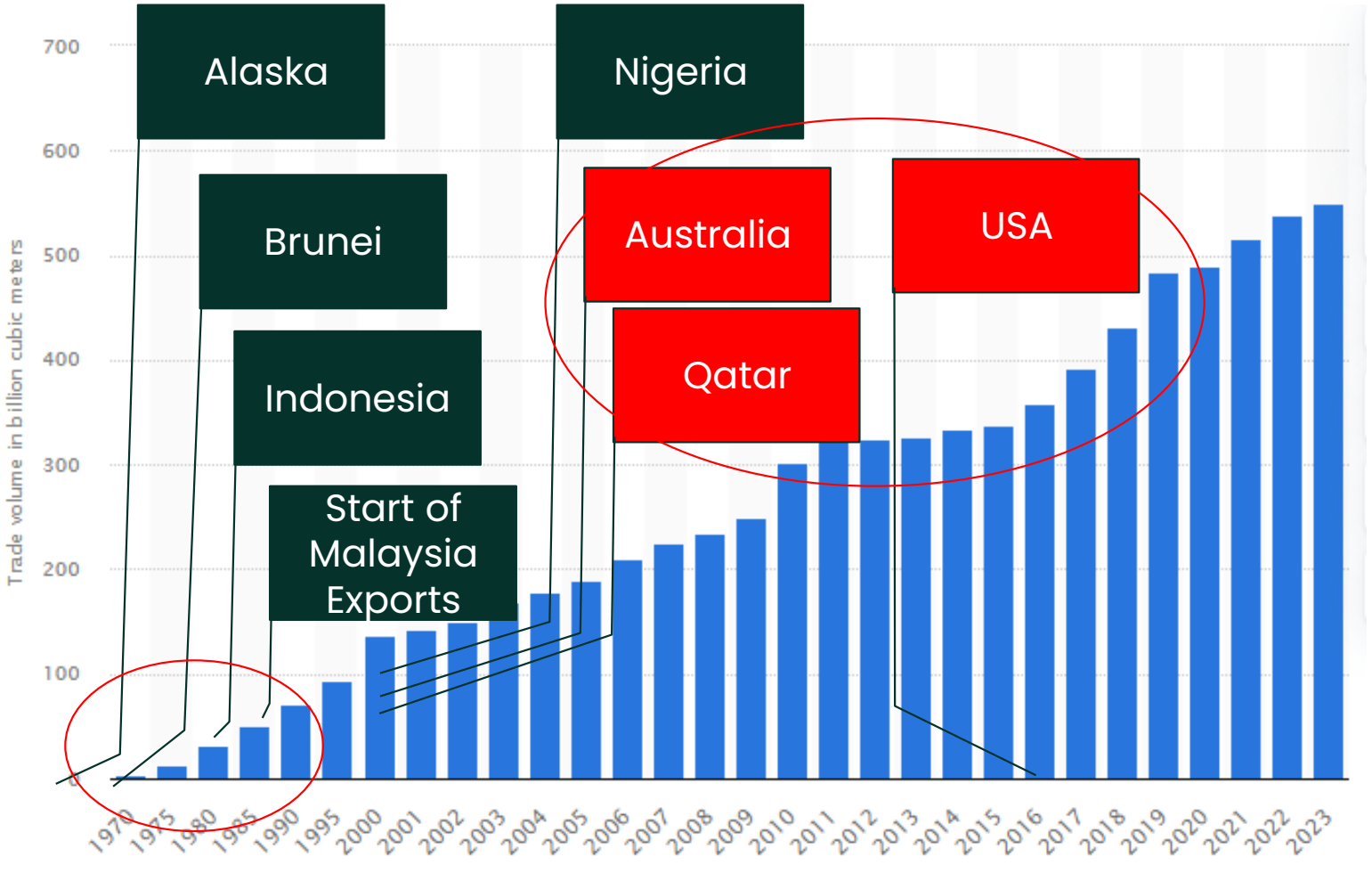
Historical Growth in LNG Trade



Source: Statista/GaffneyCline Analysis

1970's – 2000's
PIONEER PHASE OF THE LNG INDUSTRY

2000 – 2015
INCREASE IN LNG FACILITIES WORLDWIDE DRIVEN BY LNG MARKET DEMAND

2016 – 2020
IMPACT OF UNCONVENTIONAL SHALE AND COAL GAS BOOM

2020 to Date
RUSSIAN/UKRAINE CRISIS AND GROWTH IN LOW CARBON LNG

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Scale has Increased Dramatically

- Vessel size has increased to 266,000 cubic meters
- Fleet size grown to over 700
- Train sizes have increased
- Alaska started as circa. 1 MTPA expanded to 1.5
- 48 importing countries
- 20 exporting countries

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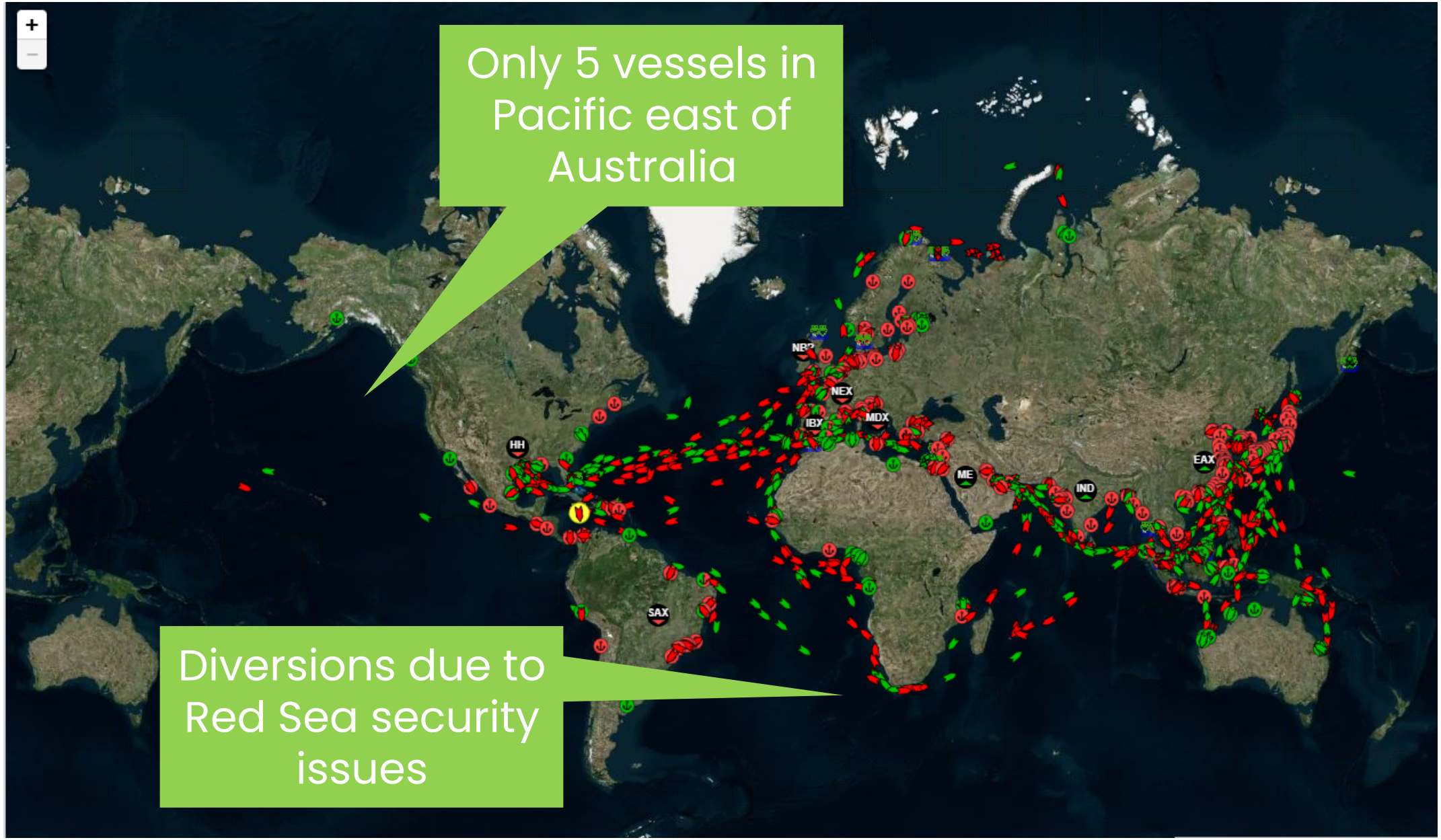
Global Trade Routes (snapshot from Monday 3rd March)



Source: ICIS

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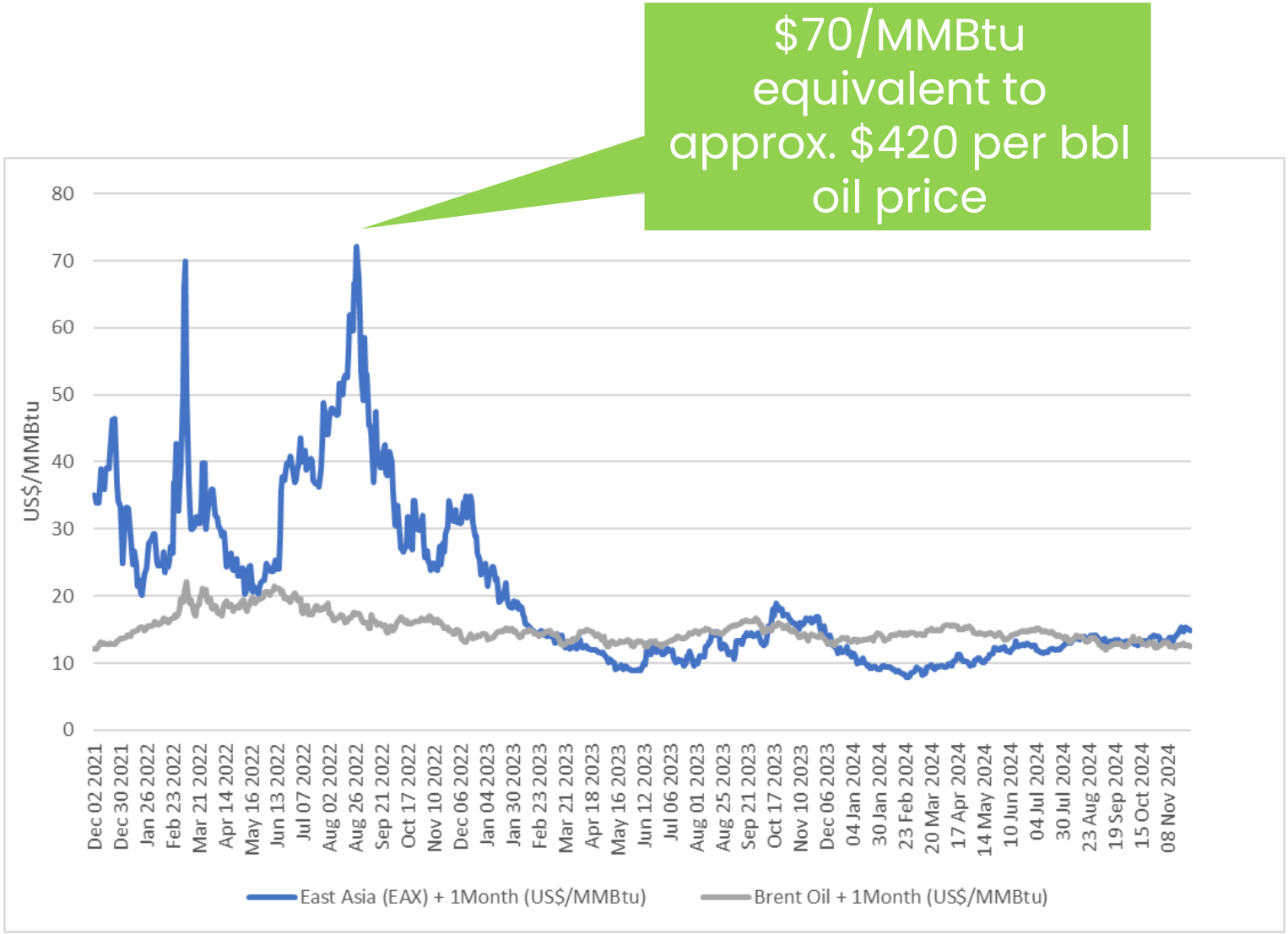
Supply and Demand

Market Turbulence 2022-23

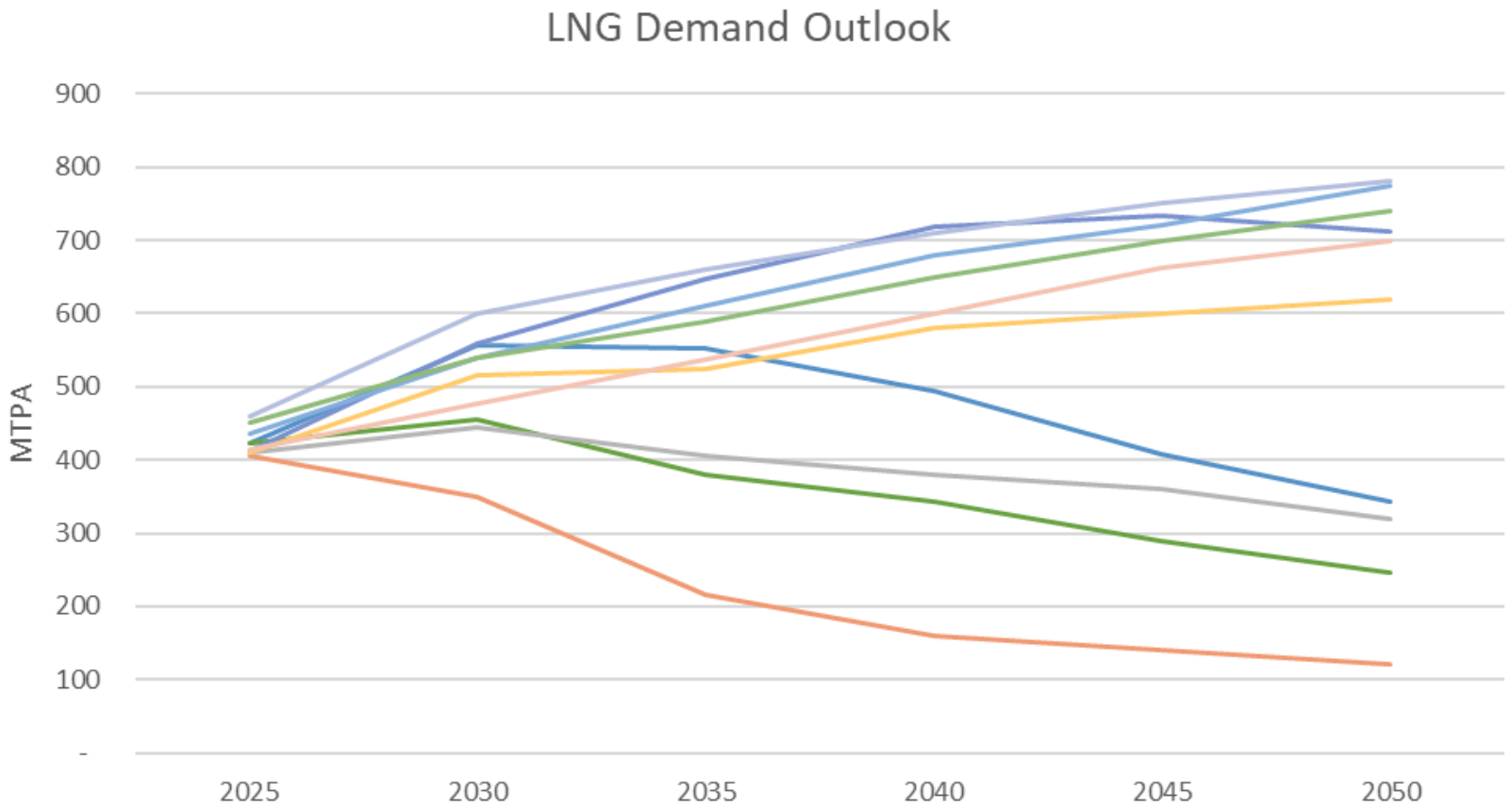
- Demand slump and oversupply in 2018-2020
- Rapid reversal into undersupply and unprecedented prices
- LNG market proved to be resilient and flexible
- Security of supply and supply diversity now key elements in procurement strategy



Source: GaffneyCline analysis, ICIS

LNG Demand Uncertainty

- Forecasts range from a doubling in demand to a 75% reduction by 2050
- Lower demand forecasts based on rapid decarbonization, electrification, and switch to renewables/hydrogen
- Market signals suggest growth in LNG continues to be the core assumption
- Many IECs are basing their future growth plans on major LNG focus

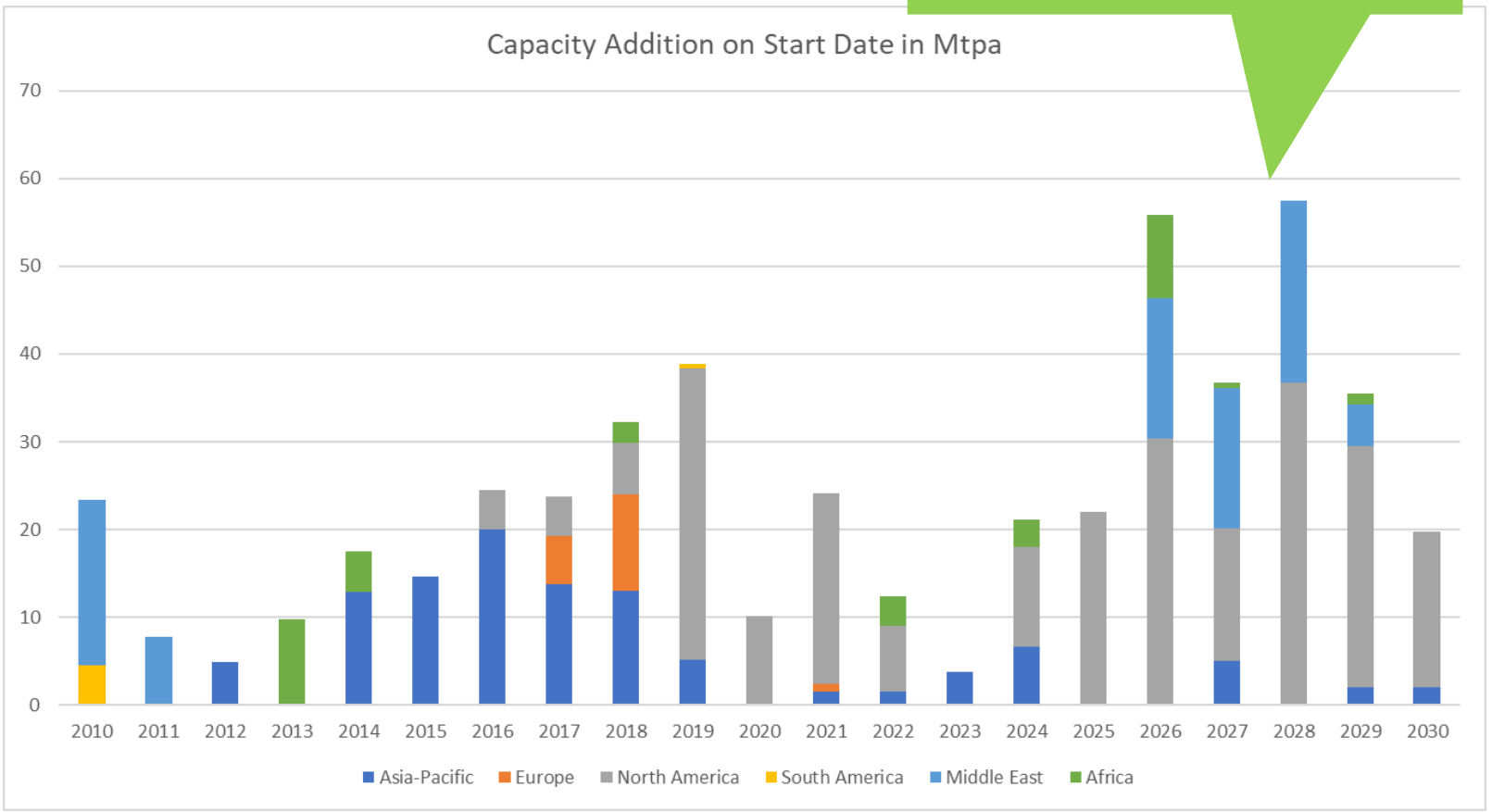


Source: GaffneyCline analysis of a sample of ten demand forecasts in 2024

Supply Outlook

- Significant new capacity under construction in US Gulf Coast
- However, regulatory delays and legal challenges appear to be growing.
- Qatar is undergoing major expansion later this decade
  - Very low-cost LNG due to oil/condensate revenues

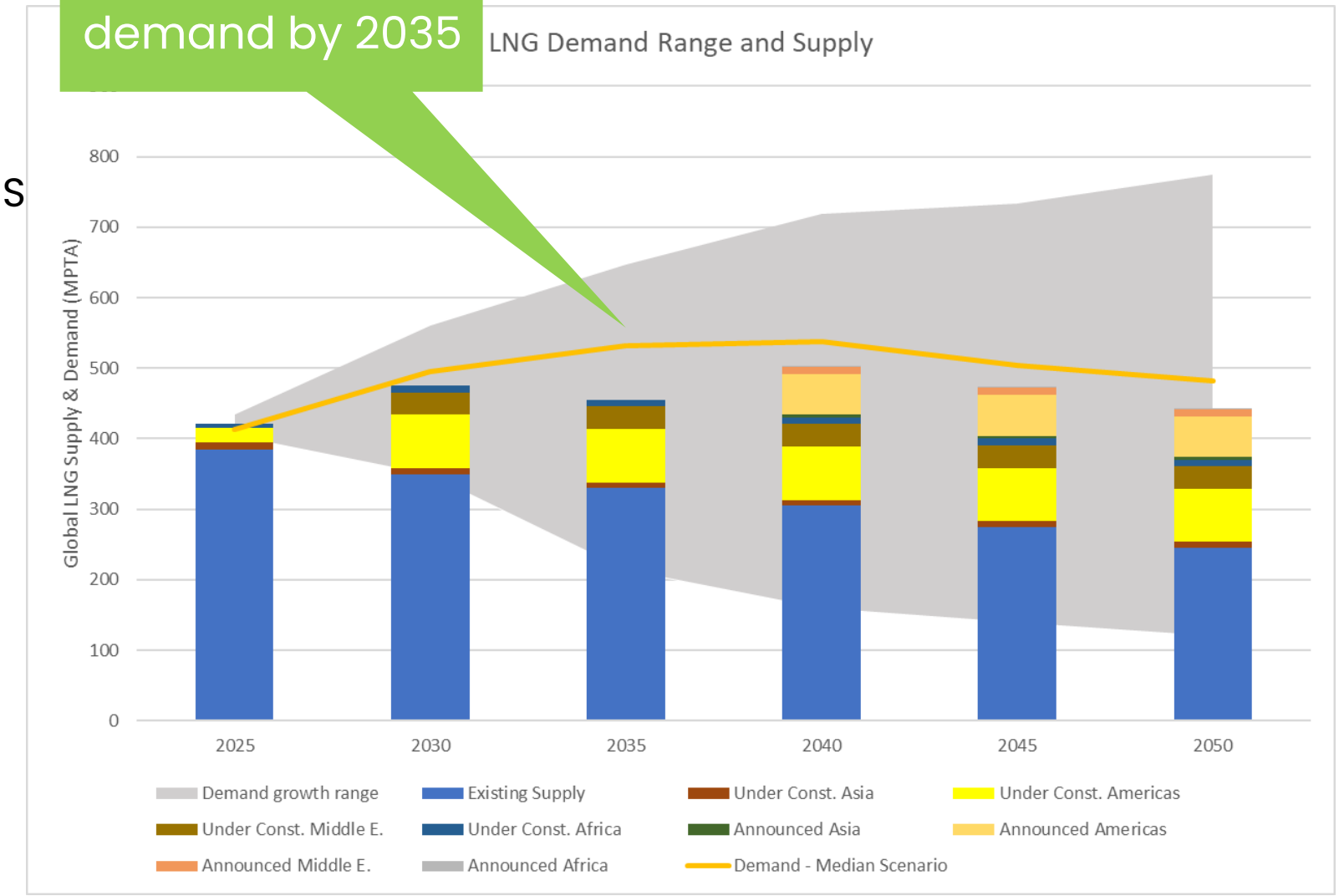
Majority of new capacity comes from US and Qatar



Source: GaffneyCline analysis, ICIS

Demand /Supply

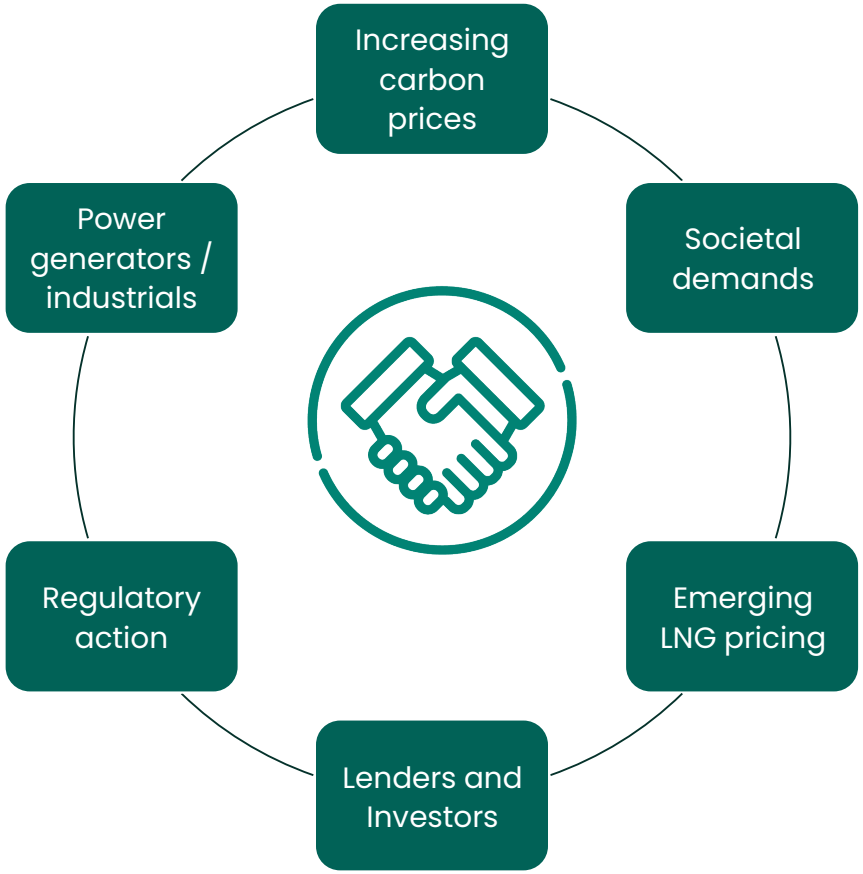
- Competition for 2035 supply will come largely from announced US Gulf Coast projects
- Reaching FID is a key milestone
- Alaska could benefit from existing permits



Source: GaffneyCline analysis, ICIS

Lower carbon intensity likely to become major driver for future LNG

....gas and power consumers are demanding more of their suppliers



The challenge...

50kg of CO2 per MMBtu
burning natural gas emits

High cost
for LNG producers

Increasing
options for offsets and carbon caputre

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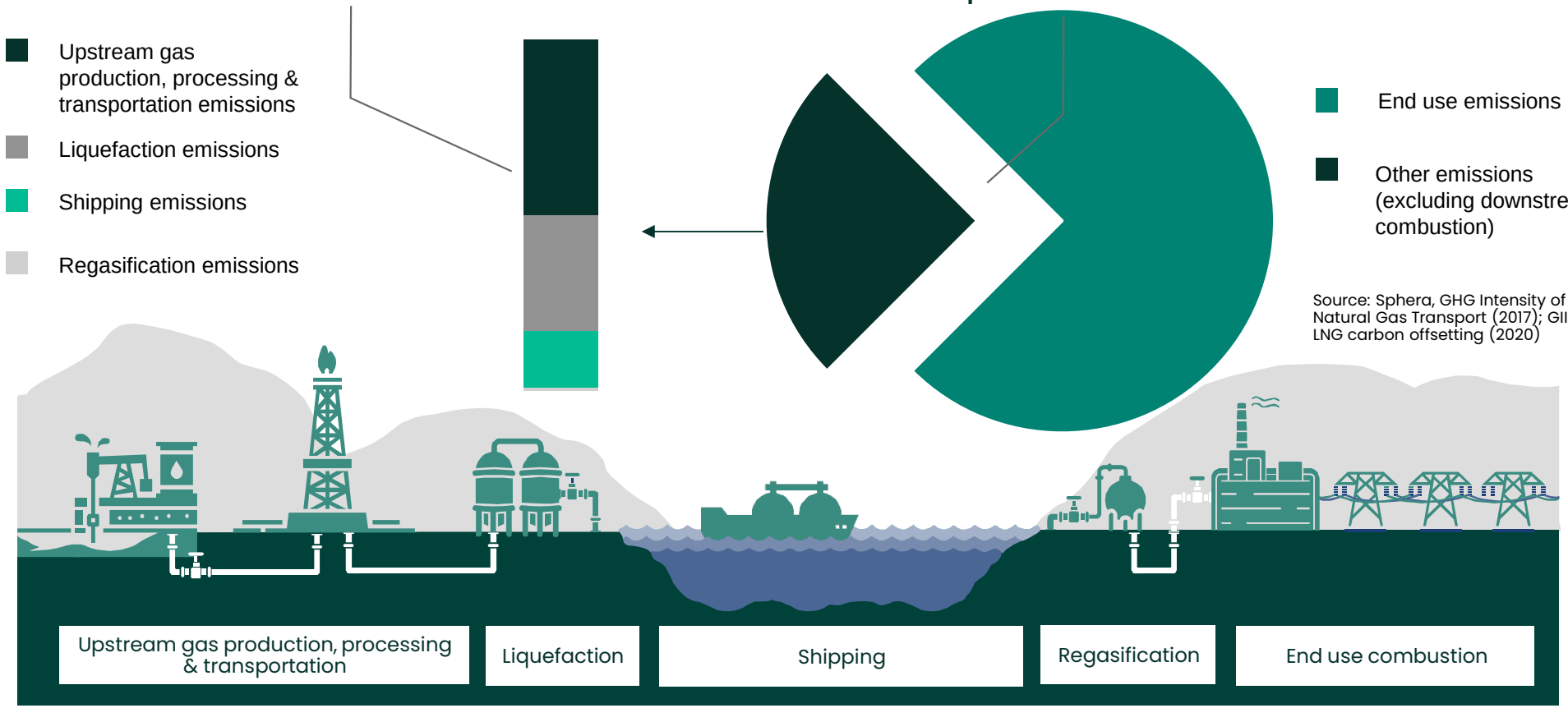
The carbon equation for LNG

Upstream operations contribute heavily to Carbon Intensity of LNG

Emissions from liquefaction are measurable and controllable



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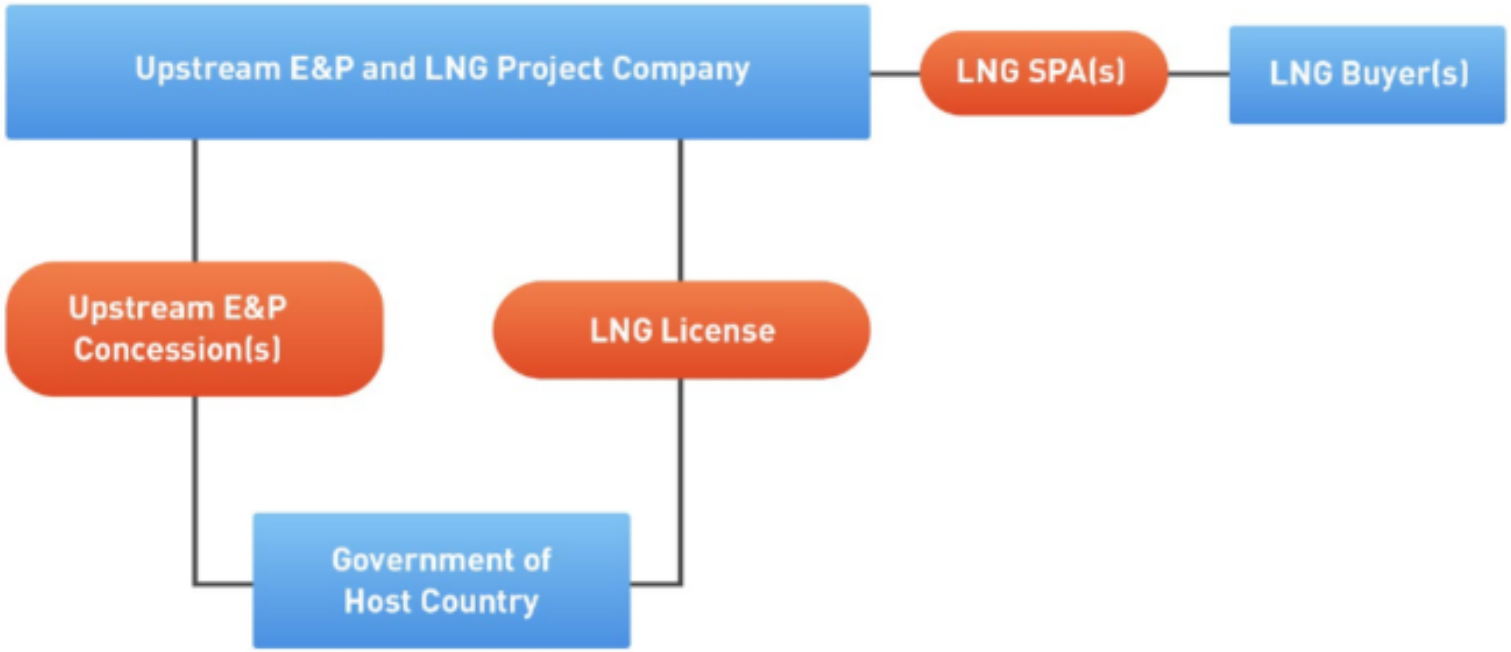
LNG Project Evolution

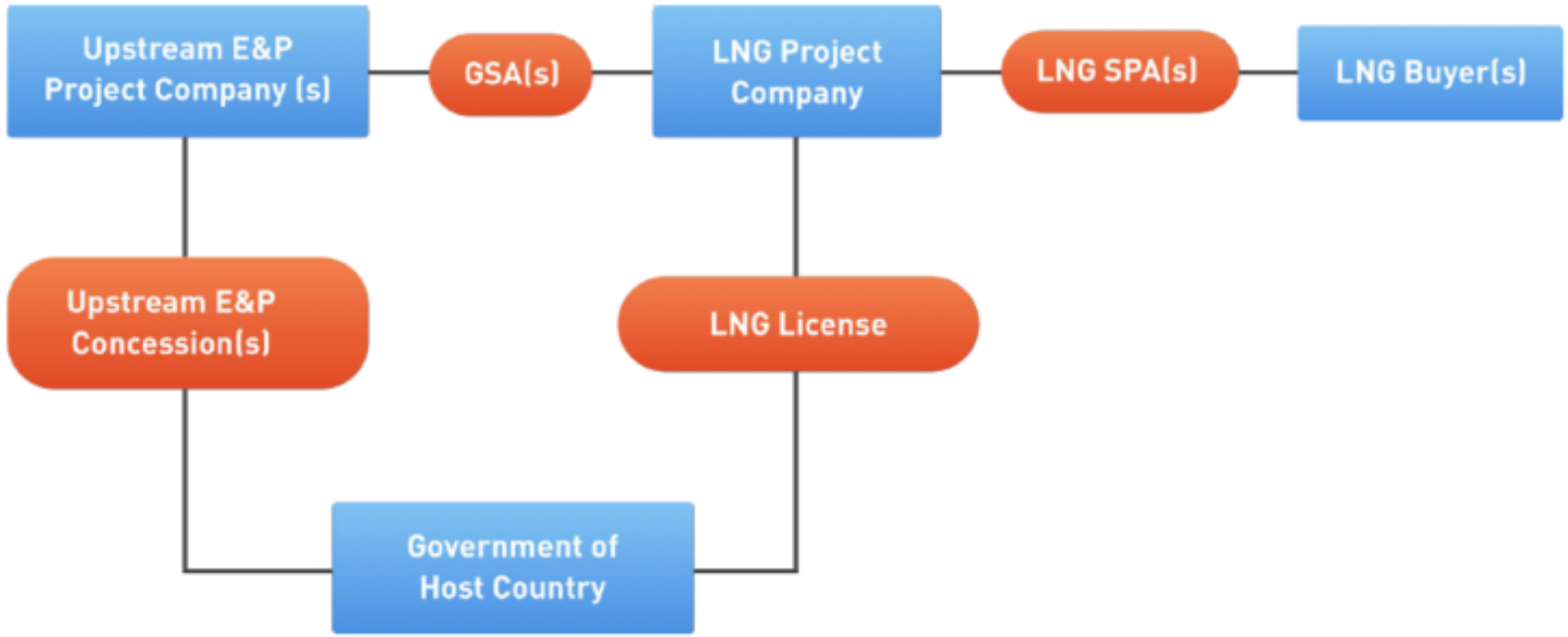
Project Commercial Structure Choices (integrated model)

- Equity participation from wellhead to vessel loading
- Creates strong alignment between parties
- Transfer pricing largely driven by fiscal arrangements
- Examples in Qatar, Sakhalin, Northwest Shelf, Darwin and Tangguh
- Model followed by AK LNG in 2014/15 timeframe (assuming state exercised TAG and RIK)



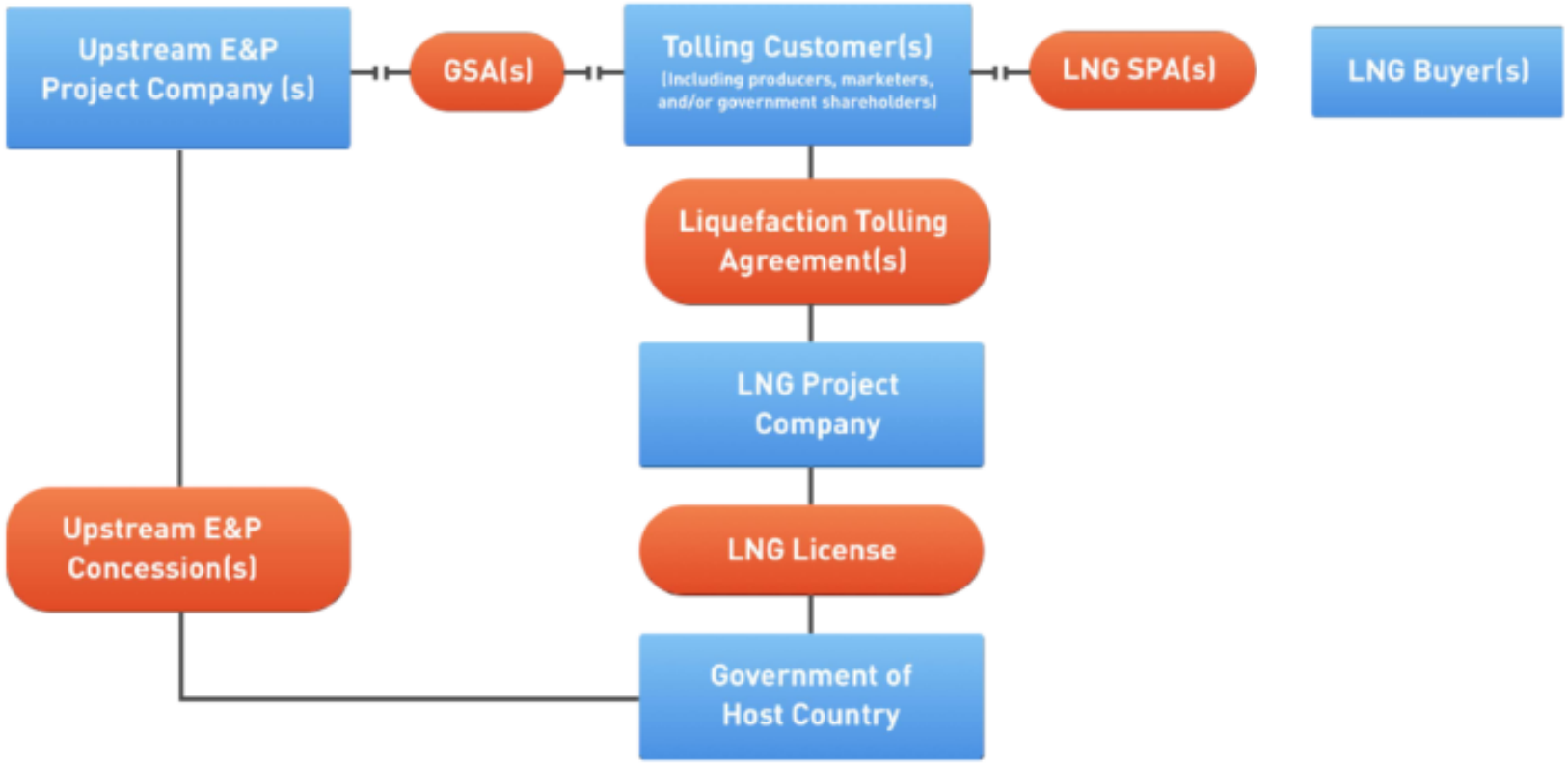
Project Commercial Structure Choices (merchant model)

- Equity participation can differ along the LNG value chain
- Often used where upstream partners do not all participate in midstream and downstream
- Transfer price into LNG facility typically heavily negotiated
- Examples in Trinidad (1-3), Angola, Nigeria, Equatorial Guinea and Malaysia
- Potential use for AK LNG



Project Commercial Structure Choices (tolling model)

- Fee for service model
- LNG plant returns can be isolated from commodity price fluctuations
- Akin to a toll road, airport, or other infrastructure based on long term revenue from service contracts
- Examples include many of the US Gulf Coast projects, Trinidad 4, Damietta and Bontang.
- Potential use for AK LNG



Contracting model evolution

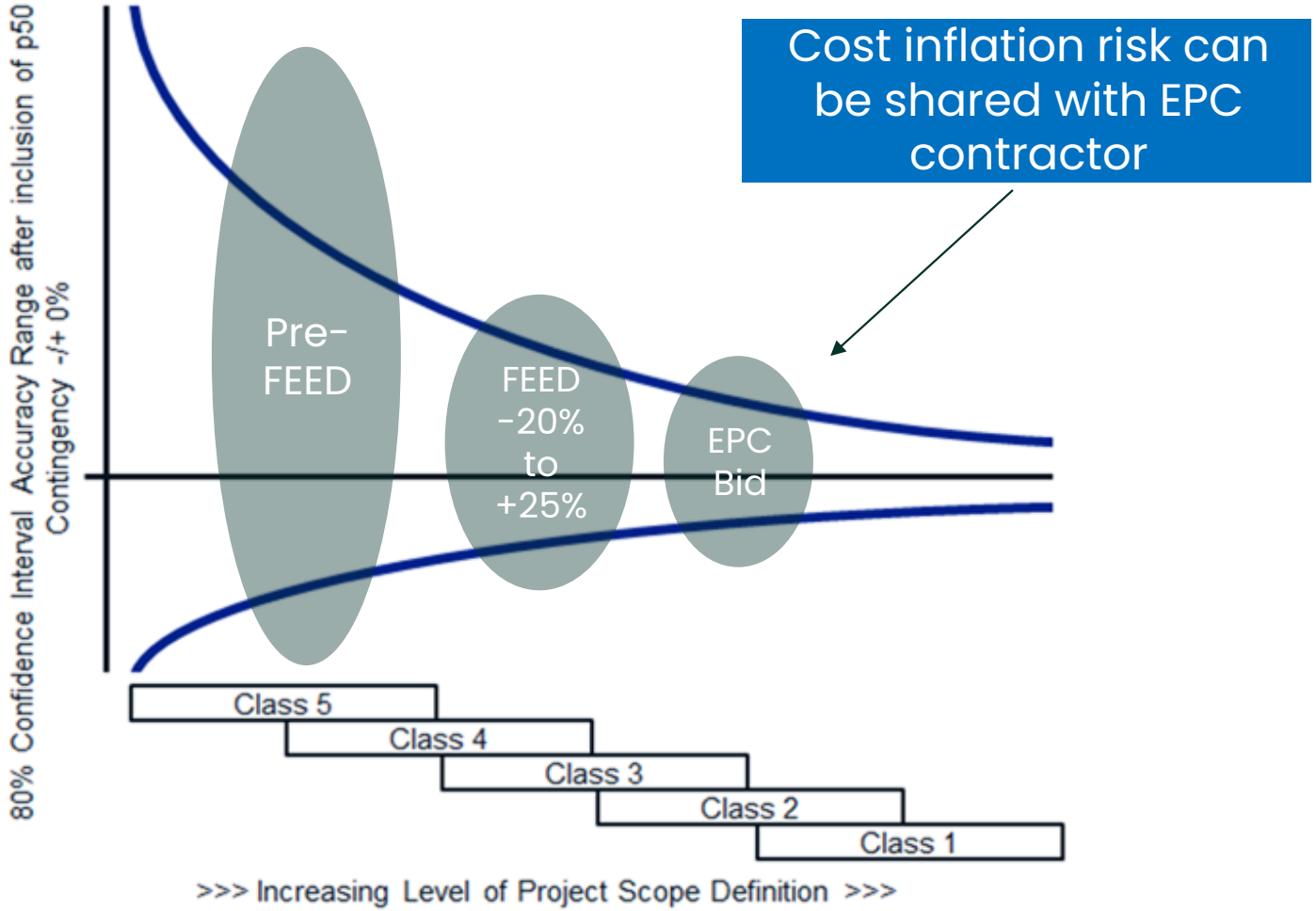
- The LNG trading profit center has become significant for many players
- Using an LNG marketing affiliate to purchase offtake (fob) moves economic rent to LNG marketing, but provides credit for financing
- Equity marketing has become a popular model where large LNG buyers or portfolio players are also project investors.

Pre-2000 model (destination clauses)

Portfolio based model (equity marketing no destination restrictions)

Evolution of Cost Estimates

- Cost estimates for AK LNG are currently in the Class 5 range
- FEED would bring cost uncertainty into a range of -20% to +25%
- Following bid negotiations with EPC contractors cost uncertainty will improve
- Given scale of project, limited scope for cost guarantees from EPC contractor.



Source: AACE® International Professional Guidance Document No. 01

Comparison of cost performance

(select LNG mega projects that achieved between 2007 and 2020)

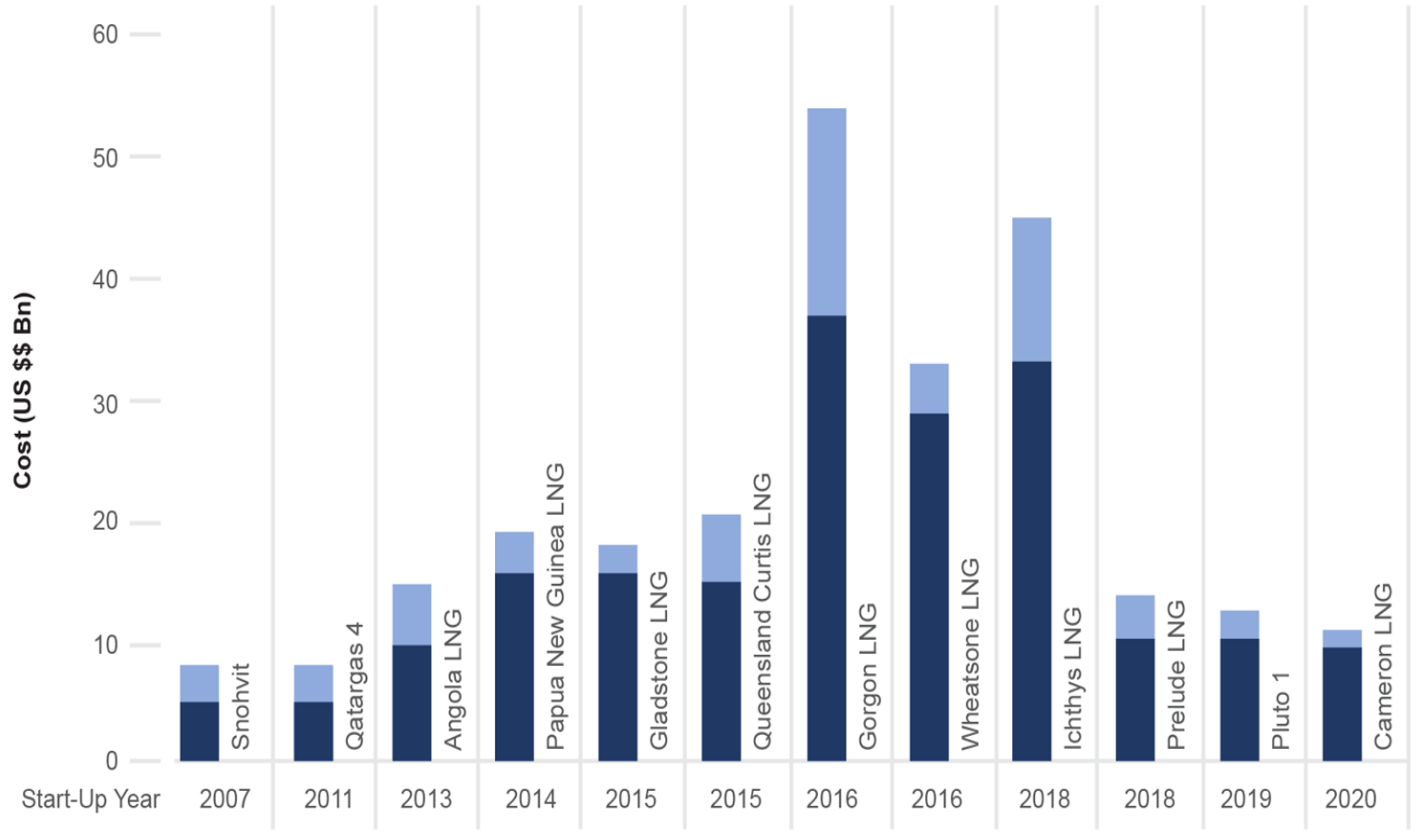
- In general, costs have been higher than budgeted
- Actual capacity is higher than performance guarantee
- De-bottlenecking can add another 10-15%

*USGC – US Gulf Coast

Sources:

SPE-180134-MS

Various



#Trains	1.0	1.0	1.0	1.0	2.0	2.0	2.0	3.0	2.0	1.0	2.0	3.0
Total Mtpa – Planned	4.2	7.8	4.3	5.2	6.9	7.8	8.5	15.6	8.6	3.6	8.9	12.0
Total Mtpa –Actual	4.2	7.8	4.9	5.2	8.3	7.8	8.5	15.6	8.9	3.6	8.9	13.5

Comparison of schedule (FID to Start Up)

(select LNG mega projects that achieved start up between 2007 and 2020)

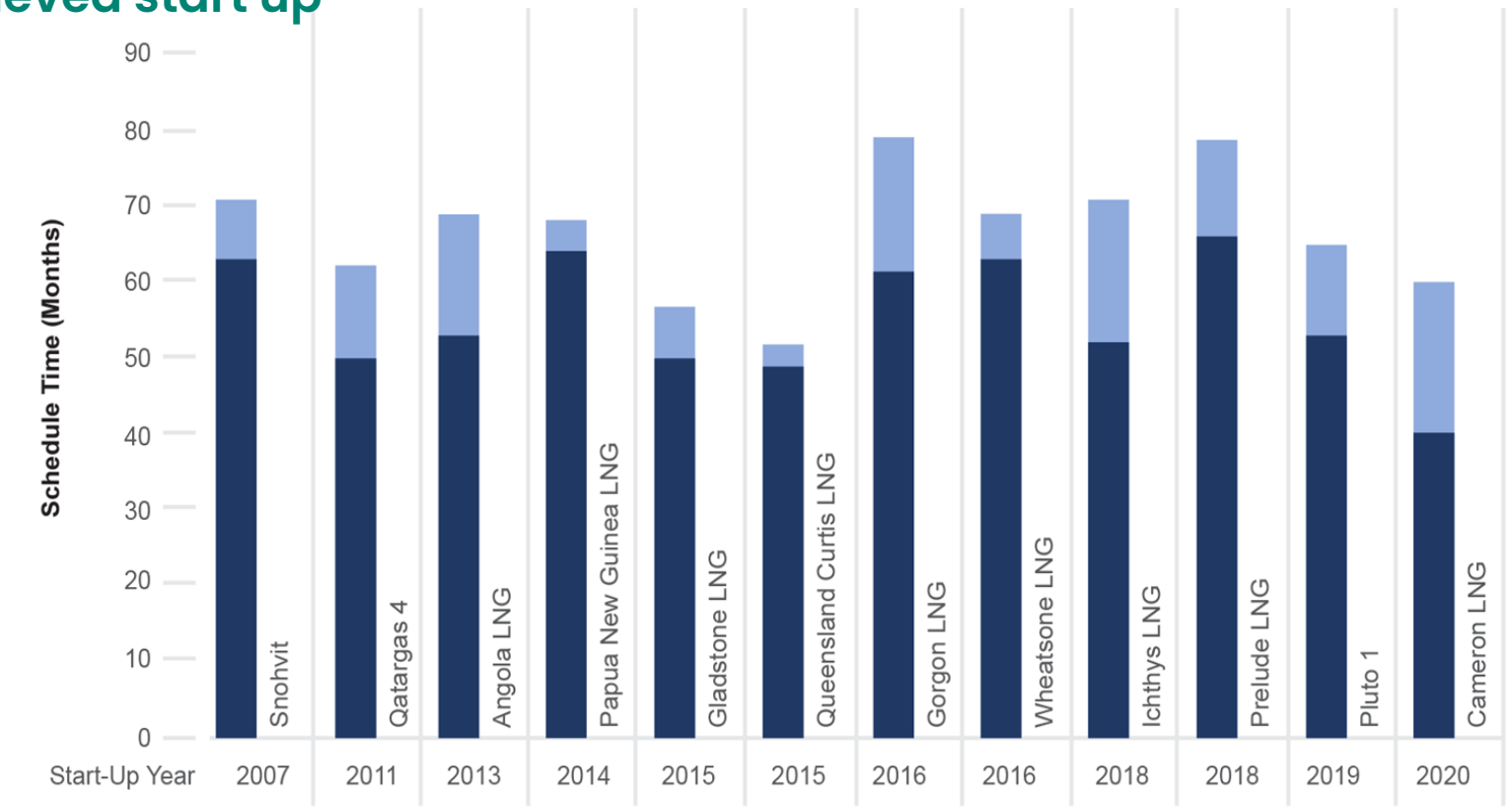
*USGC – US Gulf Coast

Sources:

SPE-180134-MS

Various

- Construction schedule has typically slipped
- Delayed startup and cashflow have a disproportionate impact on NPV
- Use of prefabricated modules appears to have mitigated this risk
- Some Gulf Coast projects have achieved accelerated construction times



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LNG Economics

Sources of Economic Return

1

Upstream Gas production

- Smallest element of LNG value chain
- A facilitator for LNG
- Important for host country

- ***Alaska***: 25% Royalty and Tax on upstream circa. $250m annually

2

Investment in Infrastructure

- Very large capital investment drives large cashflow
- Returns at risk
- Longer term cashflows are attractive.

- ***Alaska***: 25% participation in project circa. $2-$3 bn free cashflow, once plant fully amortized. Upside potential.

3

LNG Trading

- LNG trading profits are very material
- ***ExxonMobil***:. "By 2030, we anticipate the cash flow out of the LNG business will be around about $8 billion per year."
- ***ConocoPhillips*** is looking to sign more LNG offtake deals and to secure additional regasification capacities, as it continues to expand its LNG portfolio.

- ***Alaska***: Participation in global LNG trades not available.

Delivered Cost Scenarios
(note: for illustrative purposes only)

USCG Vulnerable to Henry Hub

	WM		WM+30%	
	Gulf Coast	Alaska	Gulf Coast	Alaska
Feedstock	$ 3.00	$ 1.15	$ 4.30	$ 1.50
Fuel charge	$ 0.45		$ 0.65	
Processing tariff		$ 1.16		$ 1.62
Pipeline tariff		$ 1.40		$ 1.82
Liquefaction*	$ 2.40	$ 2.24	$ 2.40	$ 2.91
Freight cost	$ 2.00	$ 0.76	$ 2.00	$ 0.76
Total delivered	**$ 7.85**	**$ 6.71**	**$ 9.35**	**$ 8.61**

Sources: WM 2022 report, ICIS and GaffneyCline analysis

Alaska Vulnerable to Capital inflation

- Alaska LNG has very high pre-productive capital needs
  - In addition to liquefaction circa. $22bn of additional investment
    - GTP
    - Pipeline
- However, project has potential benefit of low cost feedstock and low freight charges
- If forecast Henry Hub increases materialise, and capital cost controls are achieved Alaska could become very competitive

Delivered Cost Scenarios
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Synergies and tax revenue from Oil Economics

Tax credit from 45Q

Federal Loan Guarantee

Value Enhancement from Low Carbon LNG Options

Use of Alaskan credits to offset LNG

Lower carbon intensity natural gas production

- Control of fugitive emissions

Use **of lower emissions technology** for liquefaction and marine transportation

Potential for CO2 Imports and Sequestration

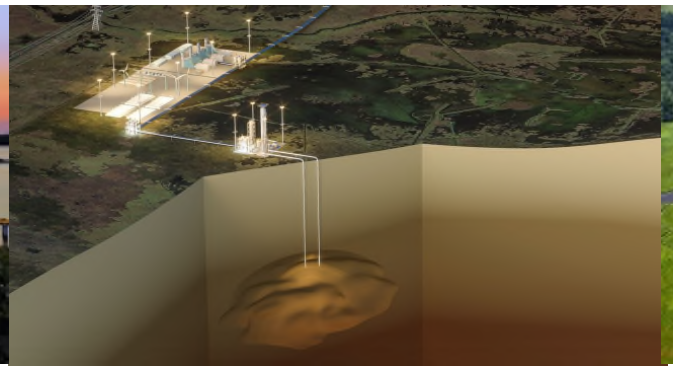
Incorporation of **carbon capture and sequestration** (CCS)

- Gas pre-treatment
- Post-combustion

Nature-based solutions and voluntary carbon market

- Renewable Natural Gas (RNG)



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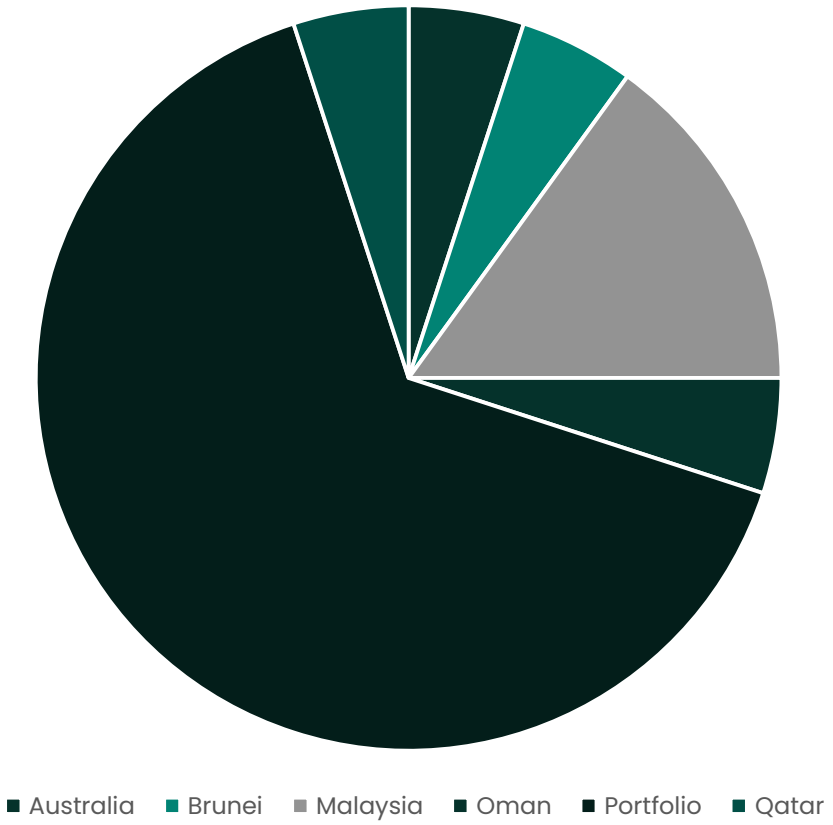
Offset LNG Cargoes

China - source of offset 20 LNG Cargoes 2019-2022



Source: GaffneyCline analysis

- 53 offset cargoes 2019 – 2022
  - about 4 million tones of net zero LNG
- China imported most offset cargoes
- Cost of about $2-3m per offset cargo (~$10-15/tonne of CO2)
- A framework has been developed for reporting and verifying emissions and carbon offsets for LNG cargoes*

* GIIGNL Monitoring, Reporting, and Verification (MRV) and GHG Neutral LNG Framework

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Enabling Legislation

Features of Enabling Legislation

1

Fiscal Stability Clause

- LNG requires upfront major capital investment
- Subsequent tax changes are a major risk for investors
- Long term nature of fiscal stability guarantees can be complex
- Constitutional implications

2

Scale usually requires tailor-made legislation

- Can include upstream fiscal changes.
- Features can include:
  - Special income tax provisions
  - Mechanisms to provide "minimum return" for investors
  - Accelerated depreciation
  - Tax holidays

3

Host country provisions

- May include sliding scale of upside/downside risk sharing.
- Can involve a "carry" for host government, supported by major investors
- Sometimes features in government to government trade deals or treaties.

Selected Case Studies

Project Case Studies

AK Denotes low risk for Alaska

Project	Risk	Outcome	Comment
Eastern Australia	Reserves inadequacy	Gas feedstock challenge from coal seam gas (early in project)	Created upward cost pressures for AU economy AK
Ichthys (Aus) and Angola LNG	Hostile environment	Technical cost and potential suspension	Design spec and choice of contractor AK
Mozambique LNG	Host nation security	Force Majeure declared, construction halted.	Rovuma LNG has pursued floating LNG concept AK
Algeria US Exports	Regulatory change	Take or Pay contracts dissolved	Focus on credit and default AK
Trinidad	Reserves	Insufficient feedstock to extend LNG exports at capacity	Regional sources of gas being examined AK
Egypt	Priority given to domestic supply over LNG	LNG exports suspended and curtailed	Need for clearly defined domestic supply rules AK