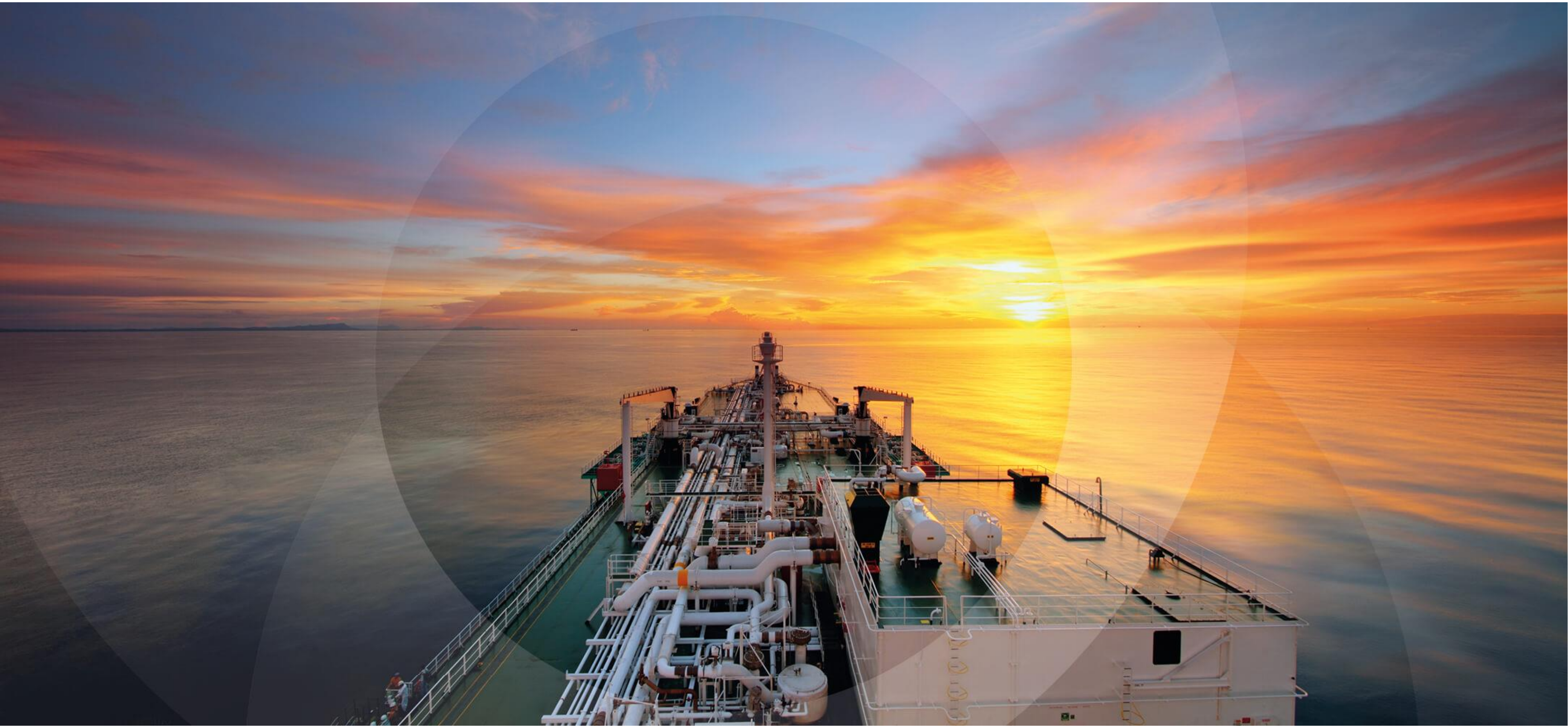
Alaska LNG Competitiveness Analysis

Final Report

21st January 2022



Project Background

Scope of Work

- In 2016, Wood Mackenzie provided AGDC together with BP and ExxonMobil an independent analysis, which:
  - » Established the base cost of supply for Alaska LNG and defined the target range for a competitive cost of supply (CoS) for Alaska LNG;
  - » Identified viable options in addition to base capex and opex reductions to reduce the project's CoS, covering project structure and fiscal terms adjustments; and
  - » Considered the way forward for a globally competitive LNG project in Alaska

- AGDC is now seeking an updated opinion from Wood Mackenzie, comprising:
  - » A review the historical cost of supply based on previous commercial structure and project costs;
  - » Calculation of a new base cost of supply;
  - » Identification of opportunities to optimize the cost of supply;
  - » Updated competitive analysis; and
  - » Updated long term supply/demand projections

The Study is divided into three primary areas

- **1 Cost of Supply**
  - **Objective:** Calculate the current Cost of Supply ("CoS") of Alaska LNG and compare it with the previous commercial structure and project costs to understand how the CoS has evolved
- **2 Cost Optimization Options**
  - **Objective:** Review options to reduce cost or otherwise improve the economic returns for Alaska LNG and quantify their impact versus their ease of applicability
- **3 LNG Market Fundamentals & Competitiveness**
  - **Objective:** Incorporating the results from steps 1 and 2 evaluate the competitiveness of Alaska LNG against a peer group of LNG projects

Content

Executive Summary

- Since Wood Mackenzie's 2016 study, AGDC has acted on the identified recommendations reducing the cost of supply (CoS) delivered to Japan by 43% from US$11.7/mmbtu to US$6.7/mmbtu
  - Using 70% debt financing for Alaska LNG reduces the CoS by ~29%
  - Alaska LNG is now competitive against the US Gulf Coast LNG projects which are expected to act as the long-term marginal supply
- LNG demand remains robust under all scenarios to 2050, despite gas demand peaking in 2040, due to declining indigenous production in key demand regions
- The strong LNG demand is expected to create a gap in supply starting in 2028 which new projects are required to fill
- Alaska LNG is competing to fill the supply gap and with the upward pressure expected on prices – Japan LNG Spot prices rising to ~US$8/mmbtu (DES) in 2030 – higher than the Alaska LNG CoS

Cost of Supply

Cost of Supply

Approach to Analysis

- The basis of our analysis is to determine the breakeven delivered cost of supply for the Alaska LNG project

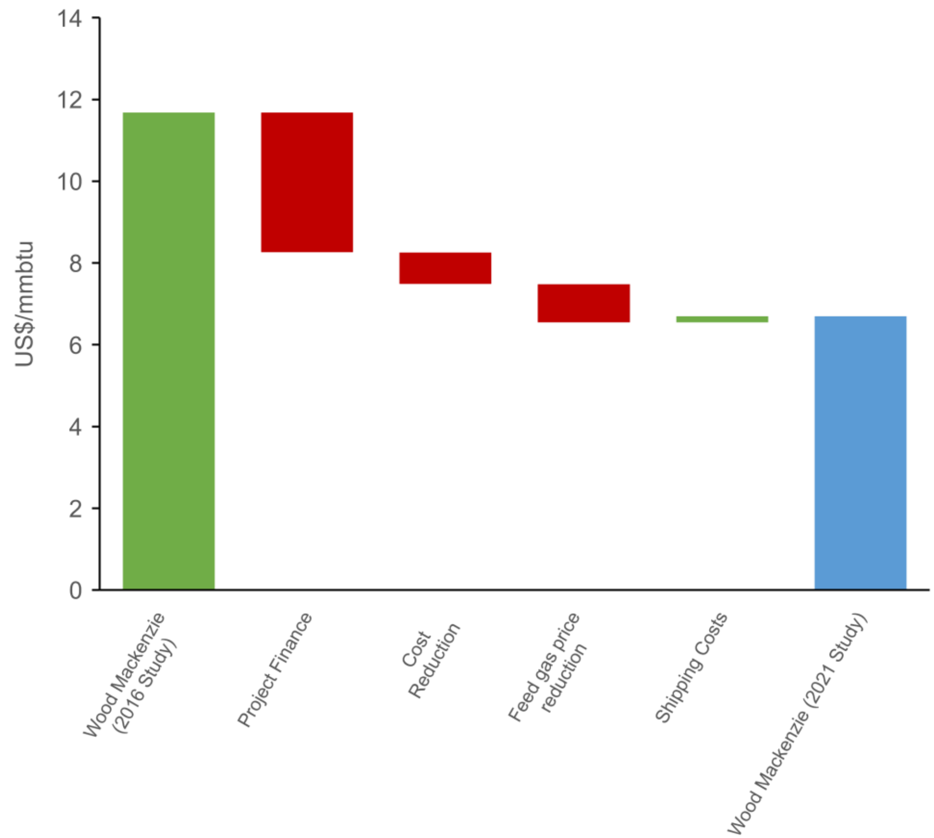
- The analysis provides the price that would be required (in US$/mmBtu) for a project (or different elements of the project) to break even i.e. the price required for the project to generate a deemed rate of return
  - » For the purposes of this analysis a post-tax return of 12% is used in the base case

CoS is now 43% lower vs. 2016 due to lower CAPEX and feedgas price, and the use of a non-recourse debt funded 3rd party tolling structure

Understanding the difference

- **Project Finance** - introduction of a non-recourse 70% debt-funded third-party tolling structure for the GTP, LNG Facility and Pipeline
- Total **Capital costs** have been reduced from US$45 billion to US$38.7 billion
  - GTP/Pipeline costs have been reduced from US$25 billion to US$21.8 billion
  - LNG Facility costs have been reduced from US$20 billion to US$16.8 billion
- **Feed gas prices** have been reduced from US$2.09/mmbtu to US$1.15/mmbtu
- **Shipping Costs** have increased from US$0.60/mmbtu to US$0.76/mmbtu

Breakeven cost of supply comparison

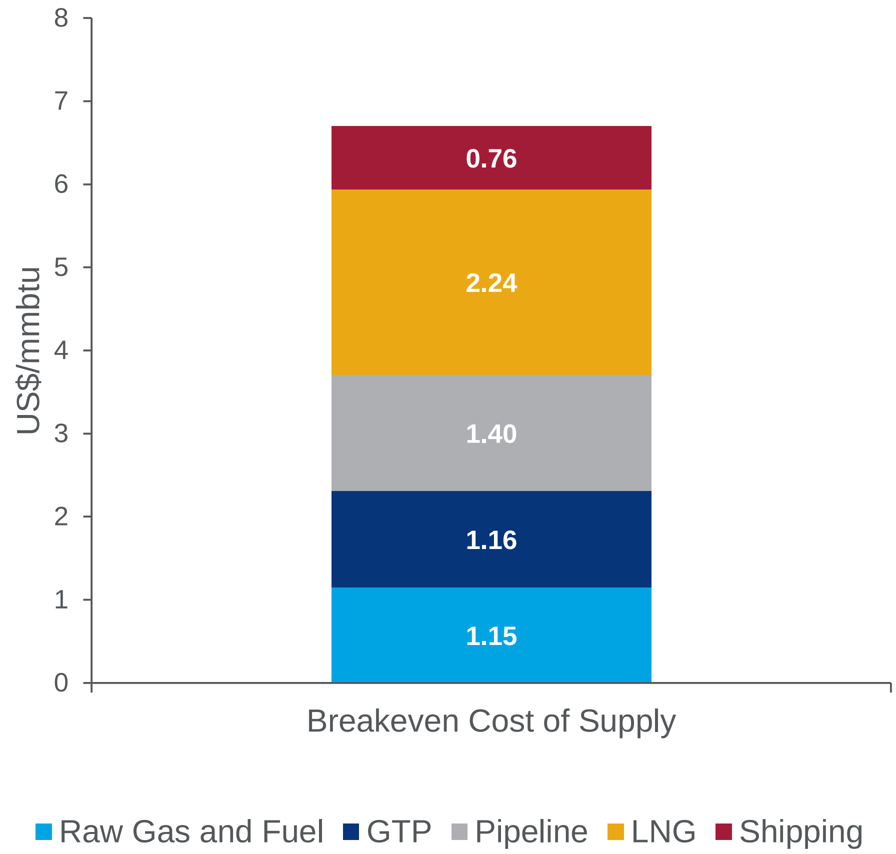


The new optimized CoS is estimated to be ~US$6.7/mmbtu

Assumptions

- The following capital costs in our base case use data provided by AGDC
  - LNG Facility – US$16.8 billion
  - Pipeline – US$12.7 billion
  - GTP – US$9.2 billion
- The capex for the LNG facility, Pipeline and GTP have been financed with a 70:30 debt to equity ratio. Debt has an 18-year term at a 5% interest
- Raw gas purchased from Prudhoe Bay and Point Thomson for US$1.0/mmbtu* with no commodity price link. Assumed to escalate at 2% per year. Including fuel usage this is US$1.15/mmbtu
- Shipping Costs from Alaska to East Asia assumed at US$0.76/mmbtu, which is the average shipping costs of potential destinations in Japan, China, and Thailand
- Volumes of 3 bcf/d with ~13% used as fuel
- Domestic Market allocation: 300 mmcf/day

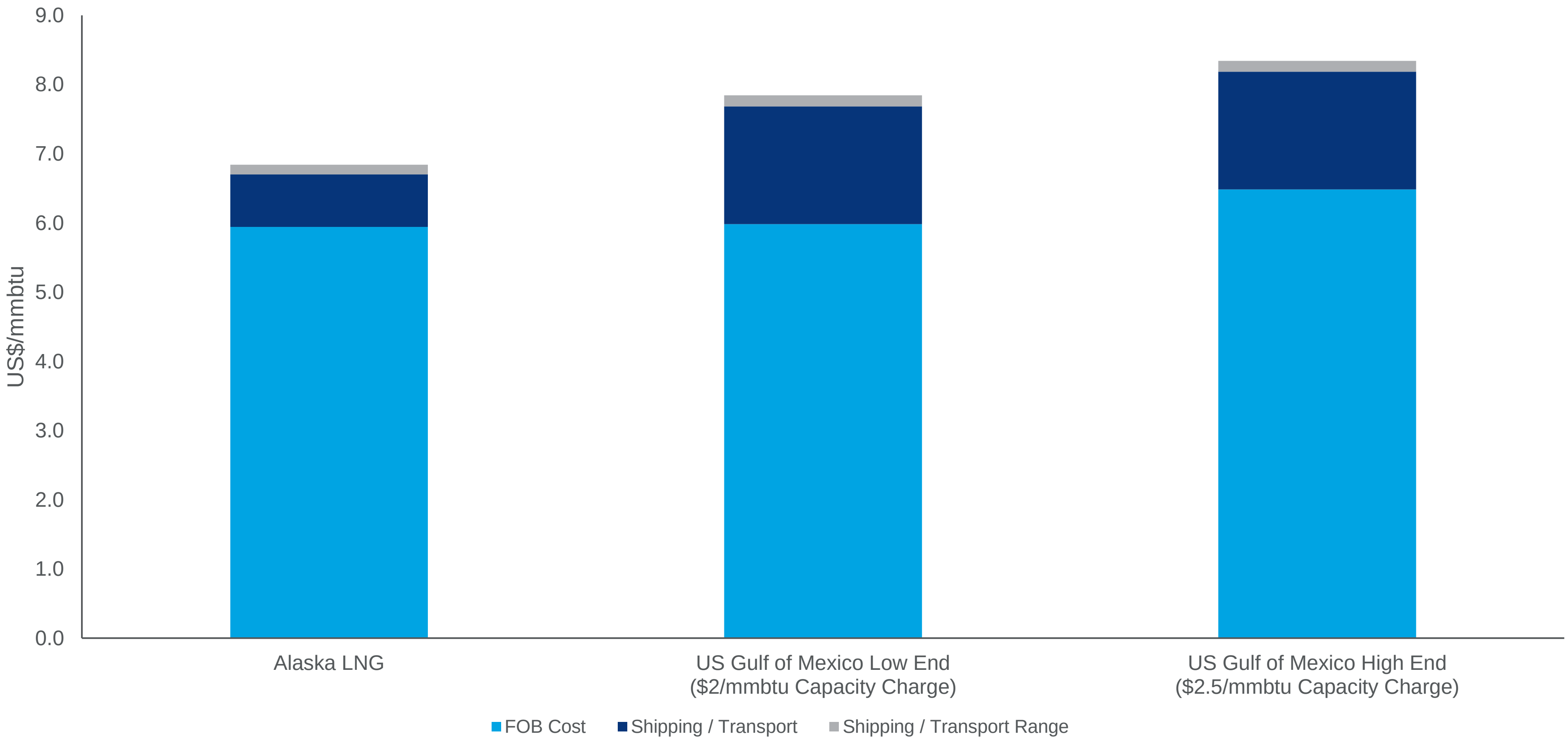
Breakeven cost of supply



Note: Capital costs are in 2019 real terms; Refer to Appendix for shipping costs; *Raw gas prices provided by AGDC and are subject to negotiation

With the cost optimization and new debt structure, Alaska LNG is competitive against US Gulf Coast LNG Projects

Comparison of Breakeven cost of supply for delivery into North Asia



Source: Wood Mackenzie

Cost Optimization Options

Cost optimization options

Approach to Analysis

- We have considered what other options may allow a reduction in the project breakeven

- As a part of this, we have analyzed how changes in the following would impact the breakeven cost of supply
  - » Capex and Opex
  - » Property Tax
  - » Post-tax IRR
  - » Cost of FEED gas
  - » Shipping Costs
  - » Leverage (Debt:Equity Ratio)

- In addition, we have also looked at other factors which may reduce the cost of supply, specifically:
  - » The Federal Loan Guarantee

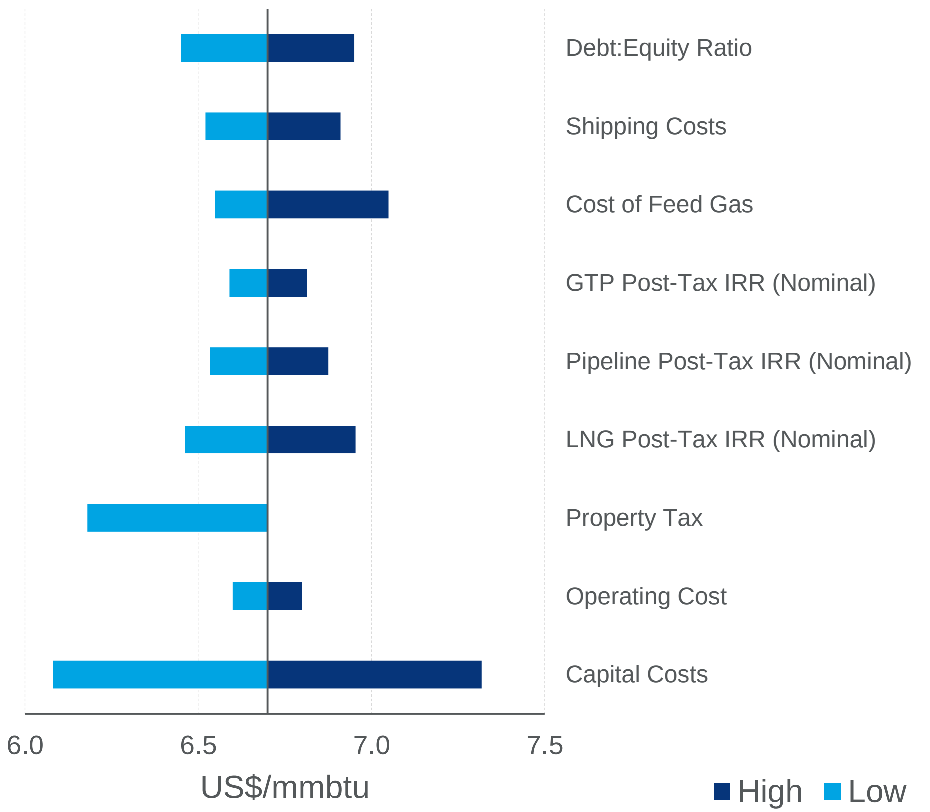
Cost of supply is most sensitive to capital costs and property tax

Cost of Supply - Sensitivities

Assumptions

	Low	Base	High
Leverage – Debt : Equity Ratio	75:25	70:30	65:35
Shipping Costs (US$/mmbtu)	0.58	0.76	0.97
Cost of Feed Gas (US$/mmbtu)	1.00	1.15	1.50
GTP Post-Tax IRR (Nominal)	10%	12%	14%
Pipeline Post-Tax IRR (Nominal)	10%	12%	14%
LNG Post-Tax IRR (Nominal)	10%	12%	14%
Property Tax	0.2%	2%	2%
Operating Cost (US$ billion, 2019 real) (+/- 15%)	14.7	17.3	19.9
Capital Costs (US$ billion, 2019 real) (+/- 15%)	32.9	38.7	44.5

Sensitivities



Source: Wood Mackenzie

Comments on Cost of Supply Sensitivities

- Typical property tax rates for Louisiana and Texas are around 0% and 0.5% respectively. If Alaska LNG were to have a property tax of ~0.2%, being broadly the average of the rates in Louisiana and Texas, it could reduce the Cost of Supply by around 50 cents/mmbtu

- Movements in Capital Costs are likely to have the greatest effect on the Cost of Supply

- The range of shipping costs is based:
  - » on the low side on shipments to Japan;
  - » on the high side shipments to Thailand;
  - » with the base case being the average of potential destinations in Japan, China and Thailand

The Federal Loan Guarantee has the potential to be another option for cost optimization

Federal Loan Guarantee

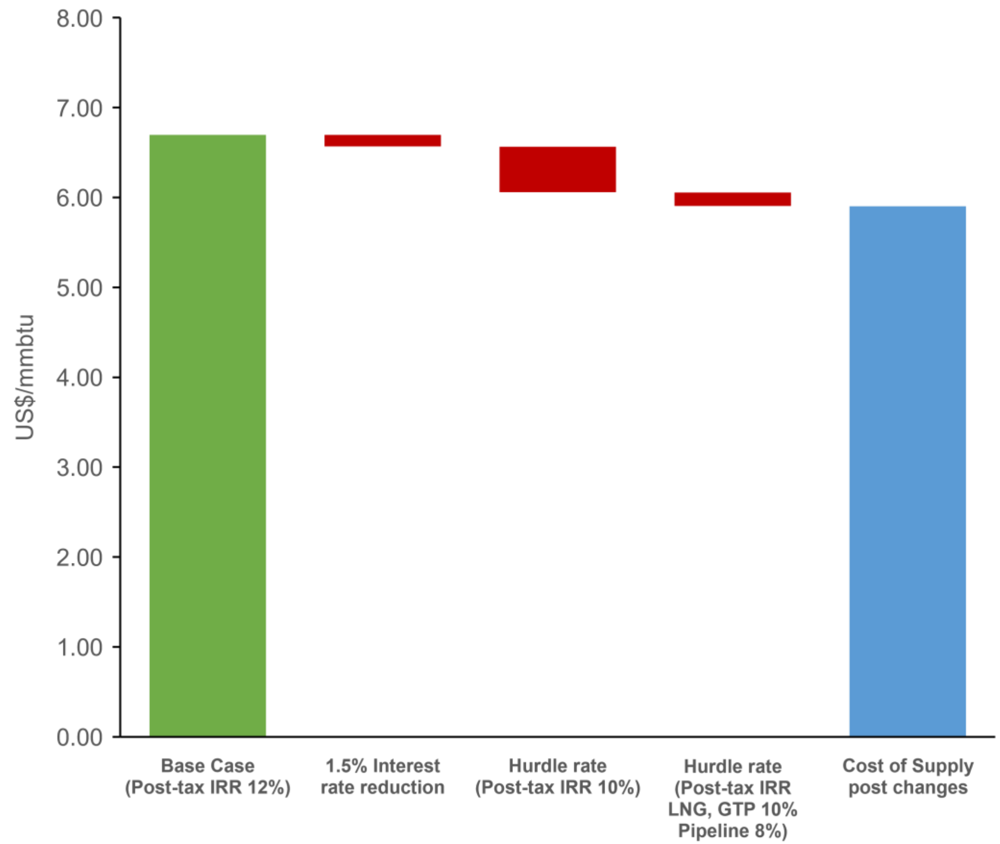
- A loan guarantee is a contractual obligation between the government, private creditors and a borrower—such as banks and other commercial loan institutions — that the Federal Government will cover the borrower's debt obligation if the borrower defaults.*
- A federal loan guarantee provides additional assurances and may be expected to de-risk the project for both lenders and participants
- The $1.2 trillion Infrastructure Bill signed into law in November 2021 will enable Federal Loan Guarantees for the Alaska LNG project
- H.R. 3684 amends the Alaska Natural Pipeline Act to strike the requirements surrounding gas transportation to the "West Coast" and "to continental United States". Based on H.R. 3684 and the Infrastructure Bill:
  - » The Loan Guarantee is limited to 80% of total capital cost including interest during construction
  - » The principal inflated amount as of July 2021 is $25.7 billion
  - » The loan term has a 30-year limit

*Source: https://www.energy.gov/lpo/what-loan-guarantee

The federal loan guarantee would help to de-risk the project and therefore further lower the cost of supply

- A federal loan guarantee should help to de-risk the project
  - The US Government effectively stands behind the debt, supporting up to 80% of the debt
  - Thus, lenders would be expected to be more willing to accept a lower interest rate for loans (although it is difficult to quantify exactly the amount of this reduction)
  - Owners of facilities may therefore reduce their breakeven hurdle rates as a result of this lower interest rate (again exact amounts are hard to quantify)
- We therefore assume that the loan guarantee helps reduce the interest rate and the hurdle rate
- We have considered the impact of the following on the breakeven cost of supply
  - Reduction of borrowing interest rate by 1.5%
  - Reduction in post-tax hurdle rate for GTP, LNG facility and Pipeline from 12% to 10%
  - Reduction in post-tax hurdle rate for GTP and LNG facility to 10% and for Pipeline to 8%
  - The above examples are included to illustrate the effect of changes rather than being predictive

Impact of Federal loan guarantee

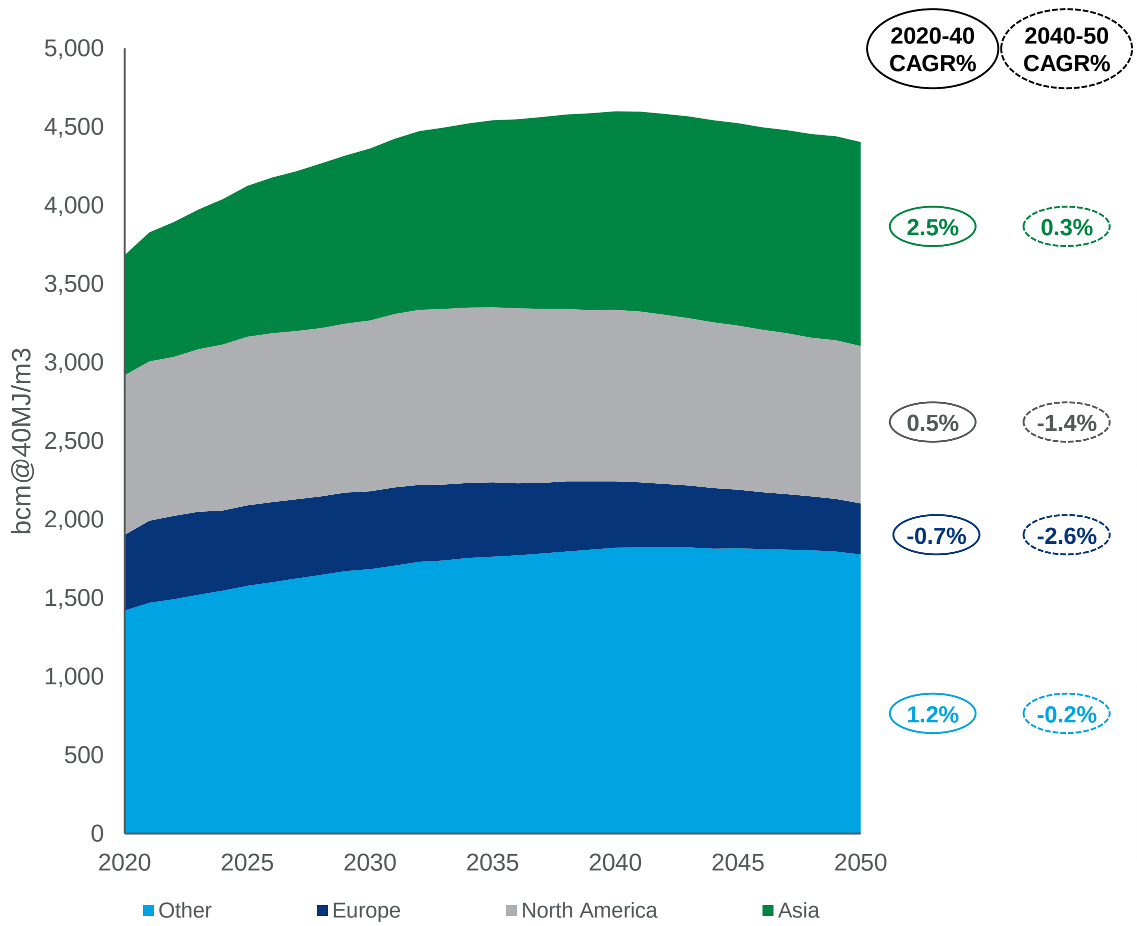


LNG Market Fundamentals and Competitiveness

Under Wood Mackenzie's base case, gas demand peaks in 2040 as the energy transition accelerates

Only Asian gas demand continues to grow to 2050 driven by Southeast Asia

Global gas demand by region



Asia
Japan, Korea and Taiwan (JKT) gas demand declines in the long term while Chinese demand growth plateaus as countries push for net zero. Southeast Asian gas demand grows driven by energy and feedstock needs, but the pace of growth slows in the long term.

North America
Sees decline in local gas demand, driven by high renewable penetration in the power sector and low-carbon hydrogen displacement. Blue hydrogen production represents a growth opportunity for gas demand

Europe
Measures to decarbonise energy use in buildings and hard-to-decarbonise industrial sectors gather pace in the 2030s. Gas will continue to be supported in the power sector by its relative competitiveness to coal into the early 2020s.

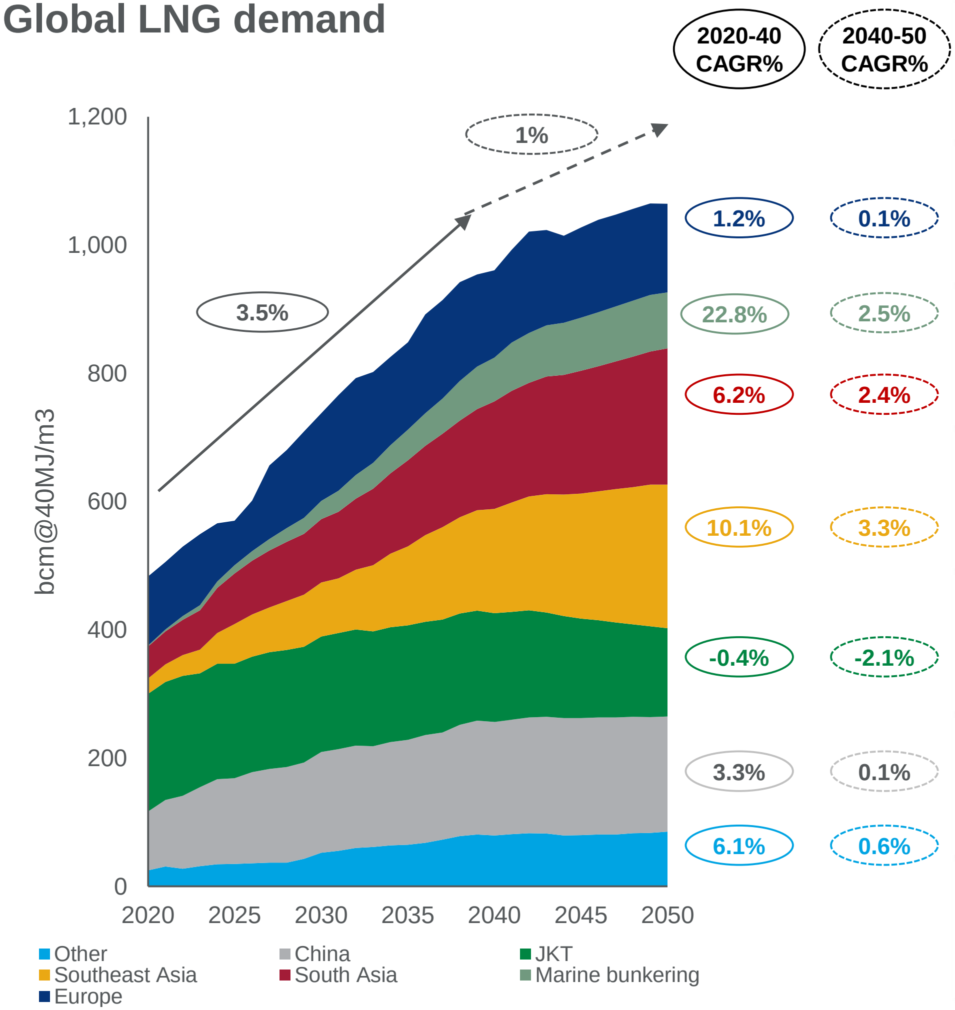
Others
Gas demand remains resilient in legacy rest of the world consuming markets including Russia and the Middle East and North Africa. Blue hydrogen trade presents a growth opportunity

Note: Other includes other major gas consumers including Middle East, Russia, Latin America and North Africa
Source: Wood Mackenzie

Despite gas demand peaking in 2040, LNG demand continues to grow past 2050

Declining indigenous production drives the need for LNG from more distant locations

Global LNG demand



Europe	Import dependency increases as demand is supported by coal retirals, and legacy gas production declines. Longer-term, LNG demand falls fast as demand decline accelerates
Marine bunkering	IMO 2050 requirements boost LNG demand for international marine bunkering through to 2040. Longer-term, improving fuel efficiency and growing pressures from zero-carbon synthetic e-fuels slow down demand
South Asia	Development of gas infrastructure unlocks latent gas demand. Limited number of new indigenous gas production projects create a lot of space for LNG imports
Southeast Asia	Rising power and industrial demand coupled with declining indigenous gas production supports rising LNG demand. New regasification and LNG-to-power projects support market development
JKT	LNG demand under pressure in the power sector from growing nuclear and renewables and battery storage. Long-term demand decline accelerates as gas is displaced by lower carbon options
China	Market liberalisation enables non-NOC players to play an increasingly material role in LNG imports. Regasification capacity reaches over 170 mmtpa by 2025 from current 93 mmtpa.
Other	LNG demand grows in line with gas demand in other regions supported by switching from liquids to gas

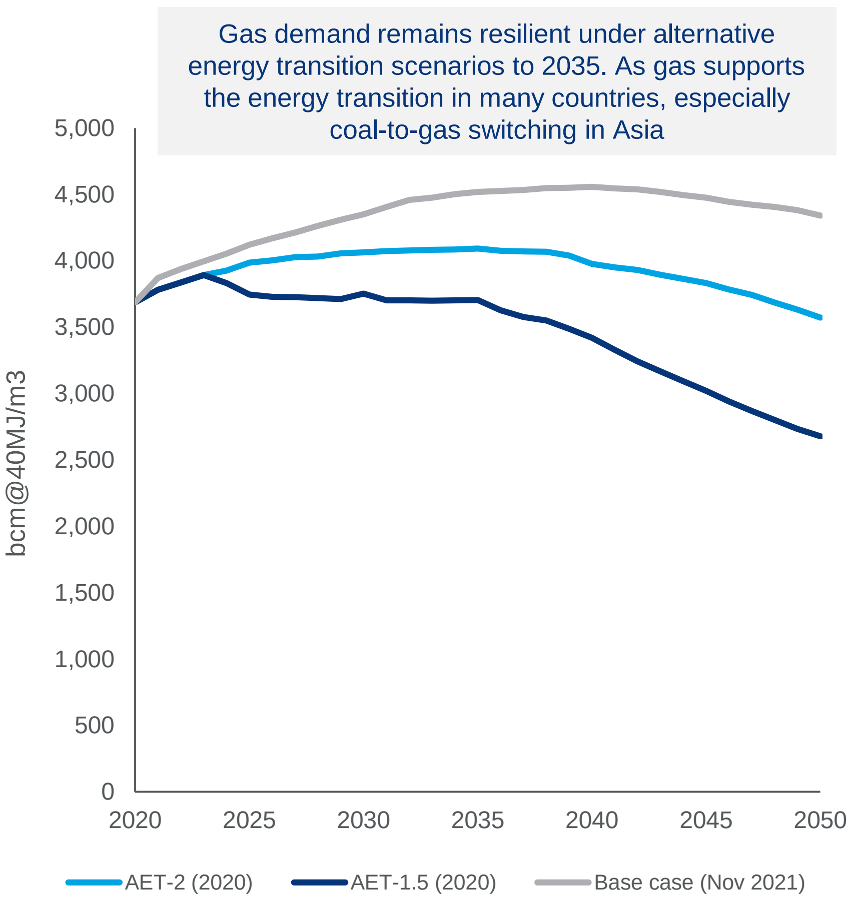
Source: Wood Mackenzie

The base case is WM’s view of the likeliest scenario; the accelerated scenarios are the possible pathway to reach its specific goals

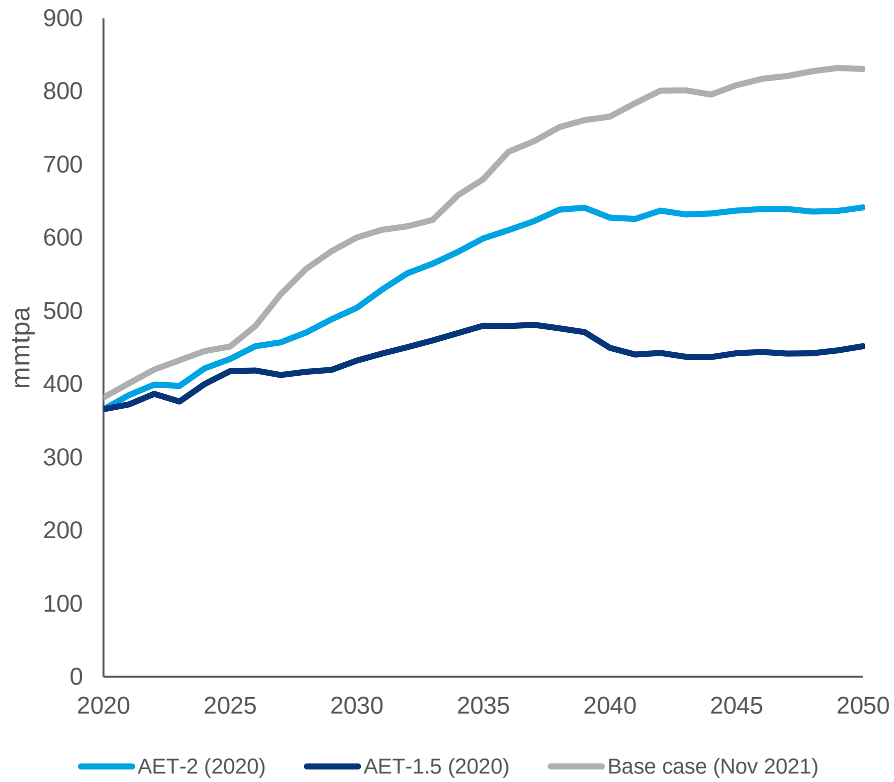
Base Case [~2.8ºC]	It represents our judgement of the most likely outcome, taking into account the expected evolution of policy and technology over the coming decades. The actual outcome could be either higher or lower than in the Wood Mackenzie base case.
Accelerated Energy Transition [2.0 and 1.5ºC]	It shows our view of a possible state of the world that meets the condition of limiting the rise in global temperatures since pre-industrial times to 1.5ºC or 2.0ºC by the end of this century. There could be a multitude of potential pathways to achieve this, and these scenarios are our interpretation of the likeliest route, given the policy drivers and technological innovation required.

Under both Wood Mackenzie Accelerated Energy Transition scenarios LNG demand remains resilient to 2050

Global gas demand under alternative scenarios



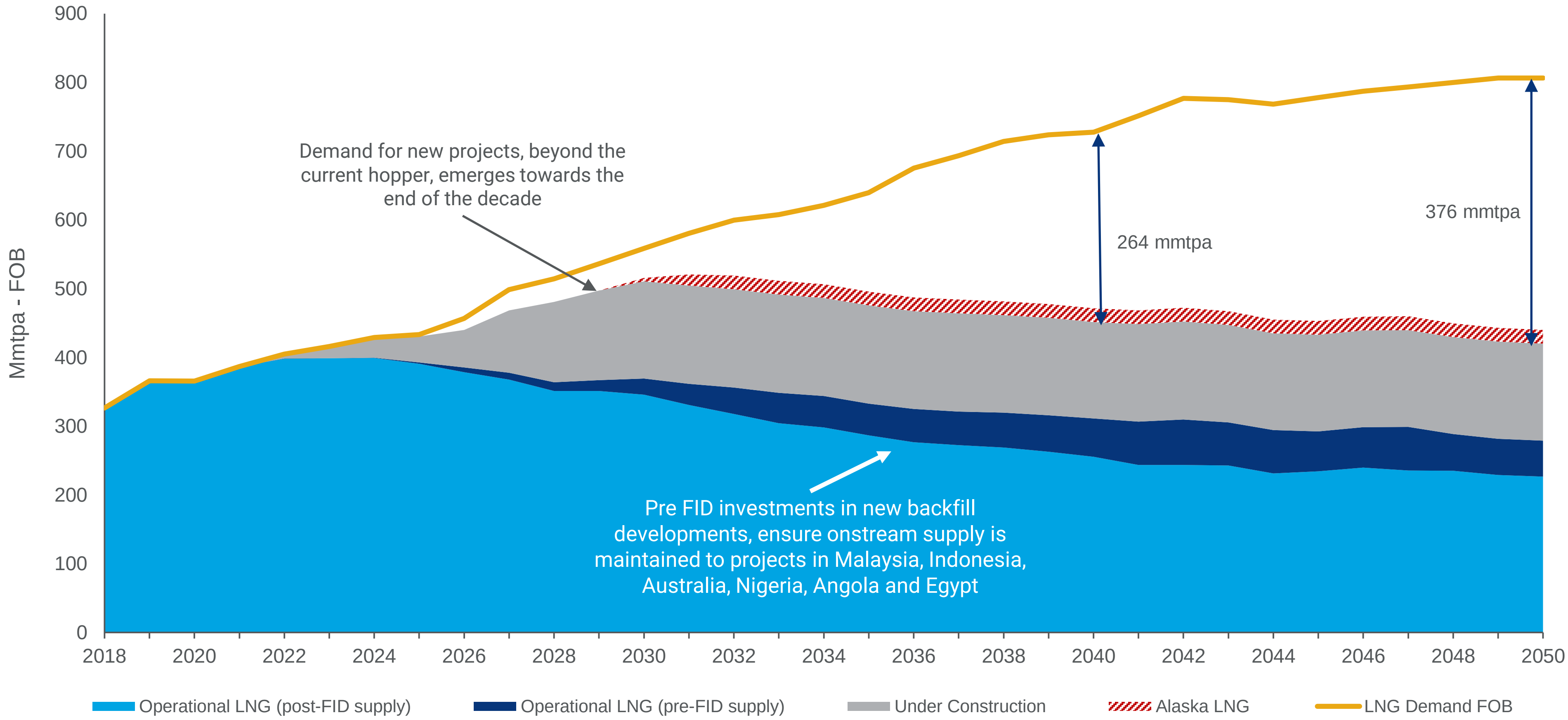
Global LNG demand under alternative scenarios



Note: AET-2 and AET-1.5 refer to Wood Mackenzie's Accelerated Energy Transition 2-degree and 1.5-degree scenarios respectively
Source: Wood Mackenzie

After a recent run of FIDs a potential window for Alaska LNG production begins to open in 2028 as the supply gap widens

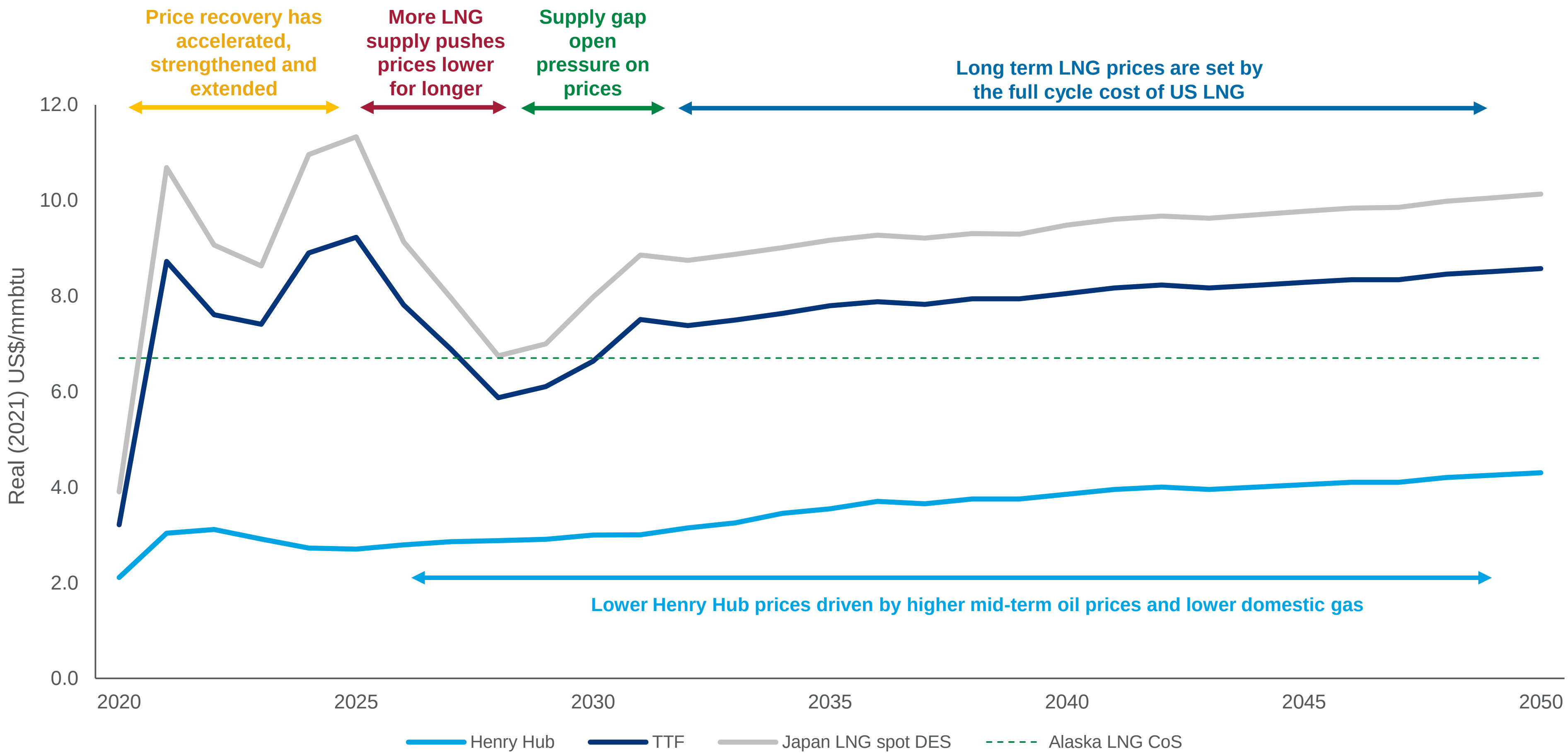
LNG supply and demand by project development status



Source: Wood Mackenzie. Note: 1 mmt LNG is equivalent to approximately 1.36 bcm gas

With the cost optimization and debt financing Alaska LNG is price competitive starting in 2028

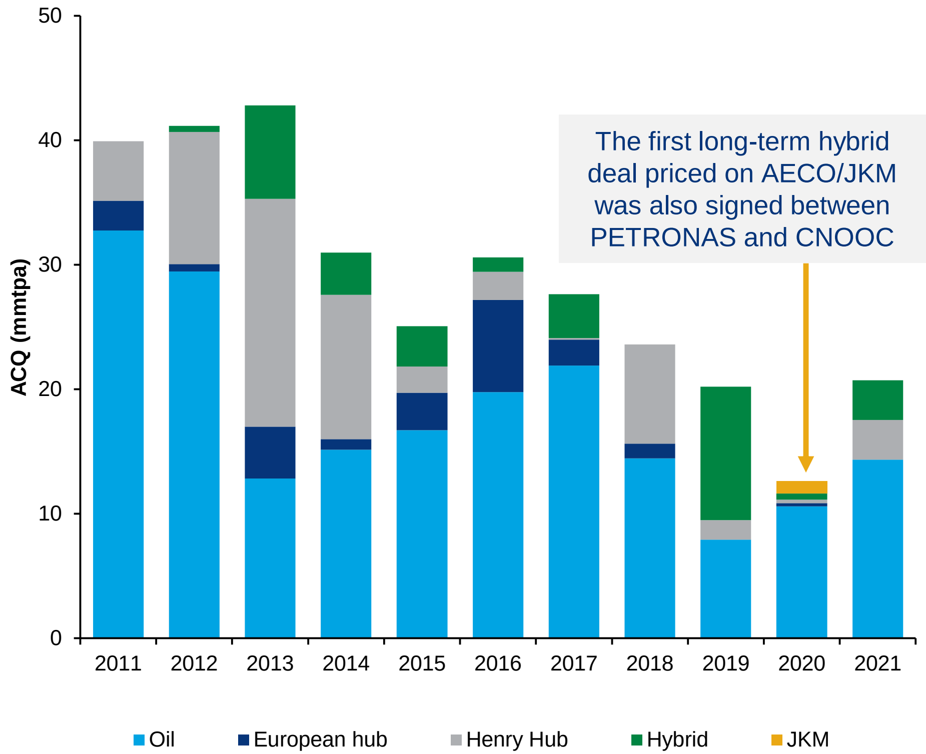
Global gas and LNG prices forecast



Source: Wood Mackenzie

Wood Mackenzie expects the rise of hybrid and Henry Hub-linked contracts to continue at the expense of long-term oil-linked contracts

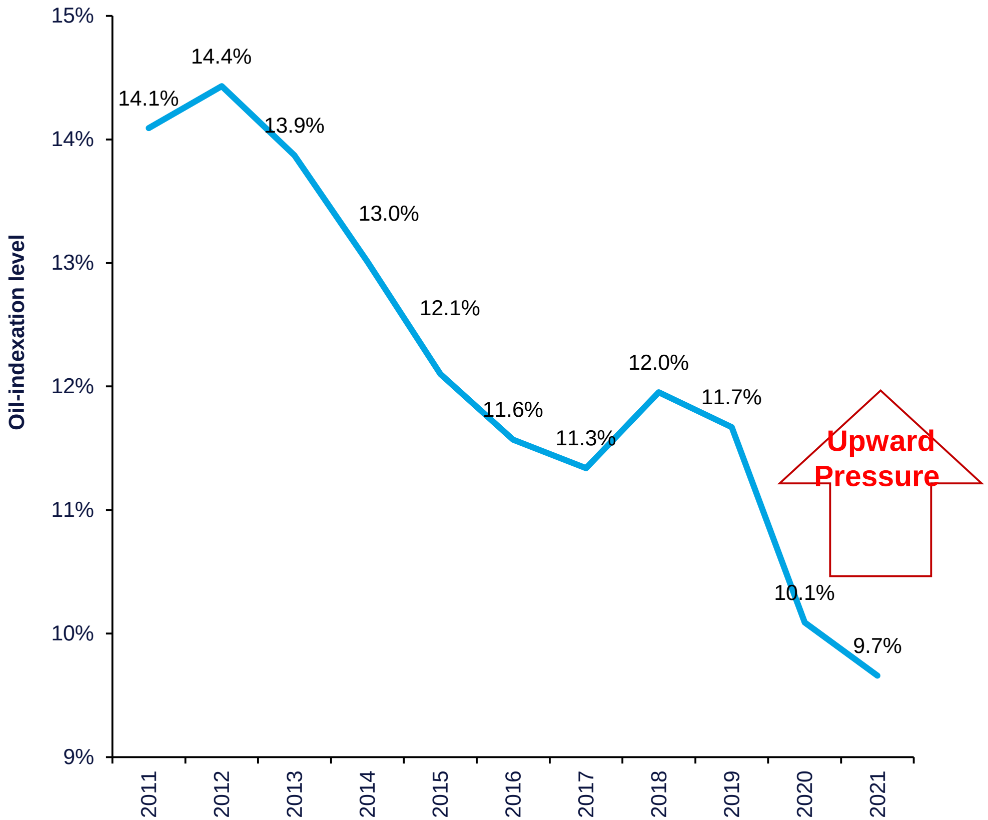
ACQ of contracts by indexation



- About 60% of LNG contracts signed in the last 10 years have been oil-linked
- 2021 saw a rise in the number of hybrid and Henry Hub-linked contracts.
  - These contract types are expected to remain in vogue in 2022 due to the price benefits of Henry Hub contracts and availability of new US supply.
- In contrast, we expect few long-term JKM-linked deals as buyers remain fearful of the associated price volatility.
- Despite high spot prices, long-term contracting for Japan is anticipated to continue softening in the face of energy transition uncertainties and greater confidence in the trading capabilities of the major buyers

Oil-indexed contract prices have trended down over the last decade, however they are expected to rise again to ~11-12% slopes

Average oil indexations in new contracts into Asia + US$0.50/mmbtu constant DES



- The continue fall in oil-linked prices has been driven by Qatar opting for a market share strategy, other sellers holding long uncontracted positions and Japanese legacy buyers being out of the market for long-term volumes.
- However, higher spot prices are already exerting upward pricing pressure.
- We anticipate new long-term contracts being signed with 11-12% slopes.

Buyers, lenders and regulators are increasingly focused on the carbon footprint of energy supplies

Favored LNG projects are using emissions as a differentiator for the marketing of LNG

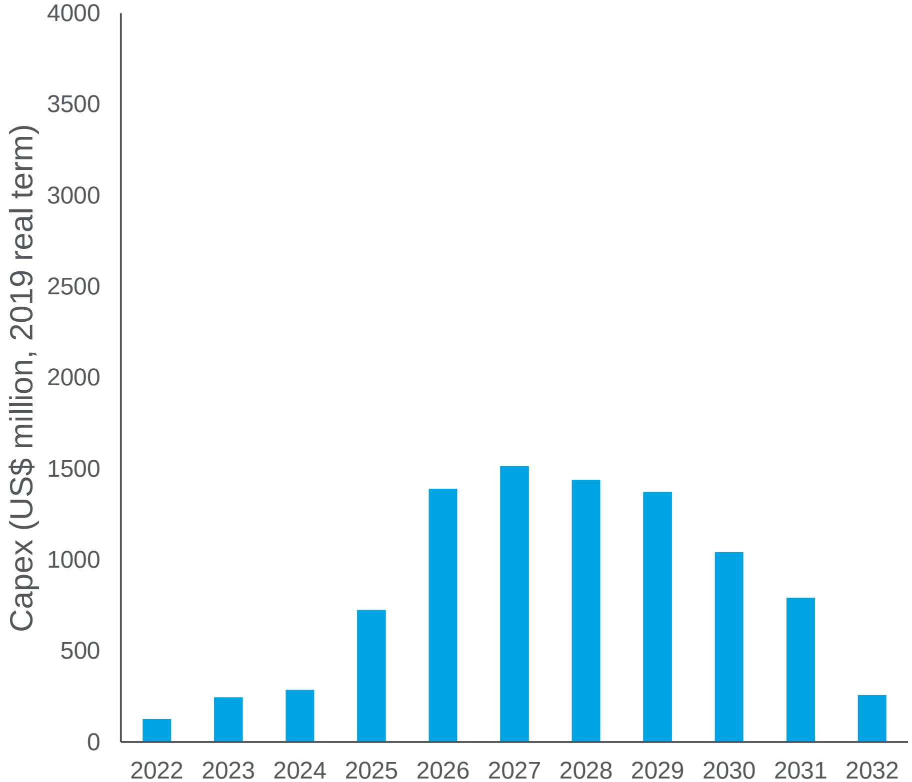
- Emissions along the LNG value chain are coming under significant scrutiny by the industry and governments
- As well as demonstrating transparency of value chain emissions, there is a strong desire to see evidence of emissions mitigation and reduction
  - » The capture and sequestration of CO2 from the feedstock gas on the North Slope will position Alaska LNG well with buyers/regulators
- Demonstrating “top quartile” performance with regards emissions intensity (per tonne of LNG) from well to tank will be a differentiator from competitor projects
  - » Particularly against L48 competitors where emissions are generally higher
- Comparisons with alternative fuels in the power sector, demonstrates that gas has significantly lower carbon emissions than coal and in many energy transition scenarios gas plays an important role in satisfying energy demand well into the future
  - » Indeed, the European Commission has set out proposals to add natural gas to its sustainable finance taxonomy which would give added confidence to the gas sector as a legitimate element of the transition

Appendix

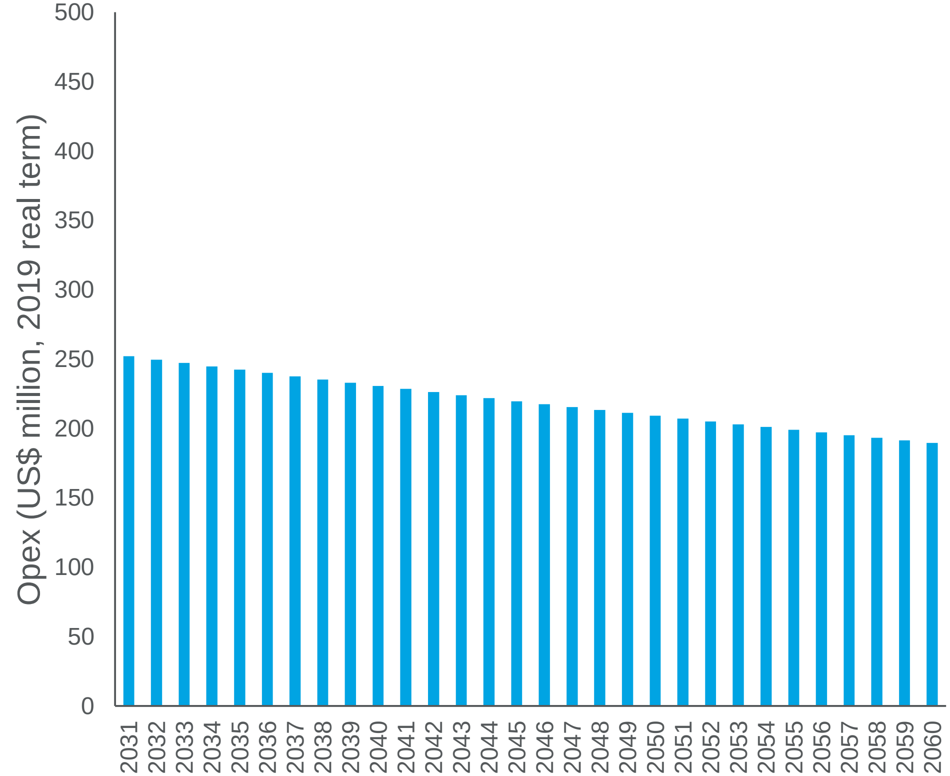
Gas Treatment Plant

Cost Profiles

Capex Profile (2019, real terms)



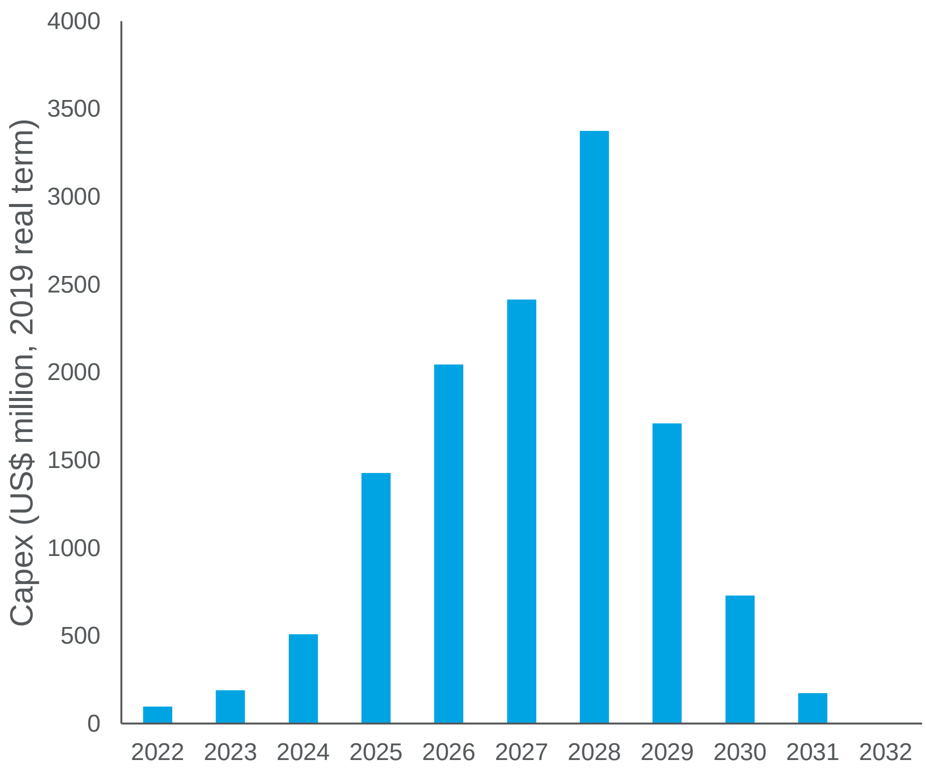
Opex Profile (2019, real terms)



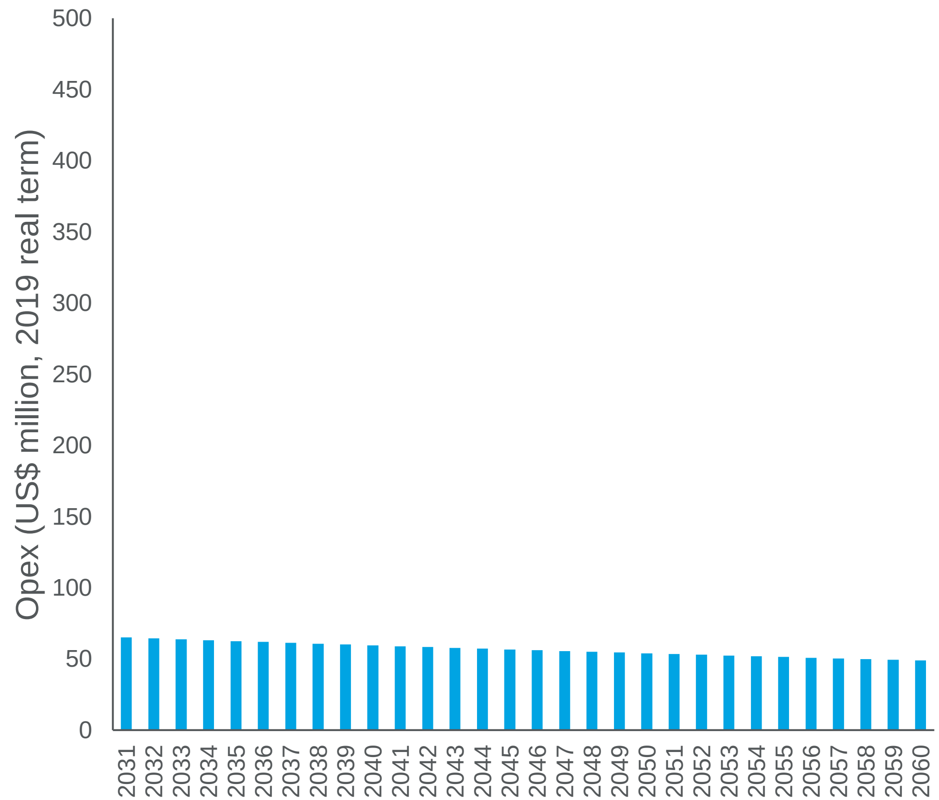
Pipeline

Cost Profiles

Capex Profile (2019, real terms)



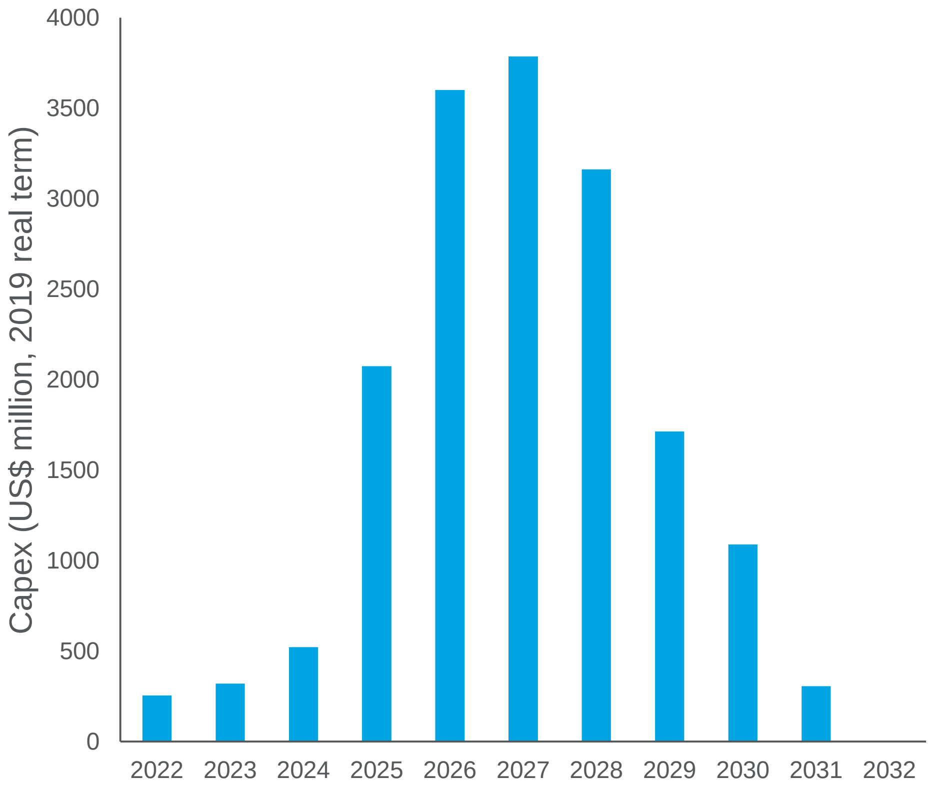
Opex Profile (2019, real terms)



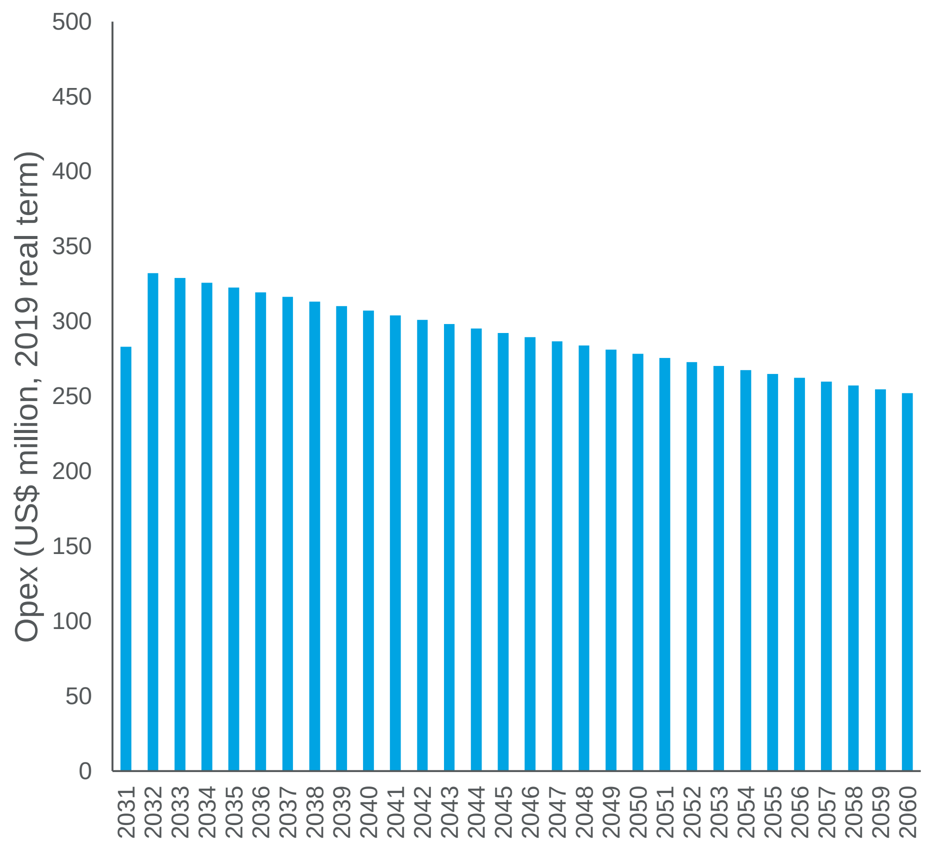
LNG Plant

Cost Profiles

Capex Profile (2019, real terms)



Opex Profile (2019, real terms)



Shipping Costs

Average shipping costs estimates from Alaska LNG to Asia is ~ US$0.76/mmbtu

Terminal	Country	Vessel	Shipping Cost (US$/mmbtu)
Guangxi LNG	China	174,000m³ Mem (SSGI)	0.83
Shandong LNG	China	174,000m³ Mem (SSGI)	0.69
Tianjin LNG (Sinopec)	China	174,000m³ Mem (SSGI)	0.72
Higashi-Ohgishima	Japan	174,000m³ Mem (SSGI)	0.58
EGAT FSRU	Thailand	174,000m³ Mem (SSGI)	0.97

Source: Wood Mackenzie LNG Tool

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