LNG market transformation

How the next 5 years will change the rules

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Transformation:
5 key takeaways

1. Market balance	Impressive Asian demand growth in 2017. Reduces risk of deep glut. But its still a buyer's market.
2. Contracting	Buyer's driving shift to shorter term contracts. Asian portfolio imbalances & increasing trading activity support this.
3. Liquidity	Short term contracting & ramp up in US exports rapidly boosting LNG market liquidity. Commodity trader intermediaries are a catalyst.
4. Managing portfolios	European & US hub price signals increasingly driving pricing & optimisation of LNG volumes. Asian players becoming more active.
5. New supply	Liquefaction FID's needed to prevent squeeze in 2020s. Business models changing. Upstream equity forced to bear more market risk.

‘Big 5’ Asian buyers:
High contract levels disguise imbalances

Demand growth

2017 Asian LNG demand has been strong.

Led by 40% increase in Chinese LNG demand (vs 2016).

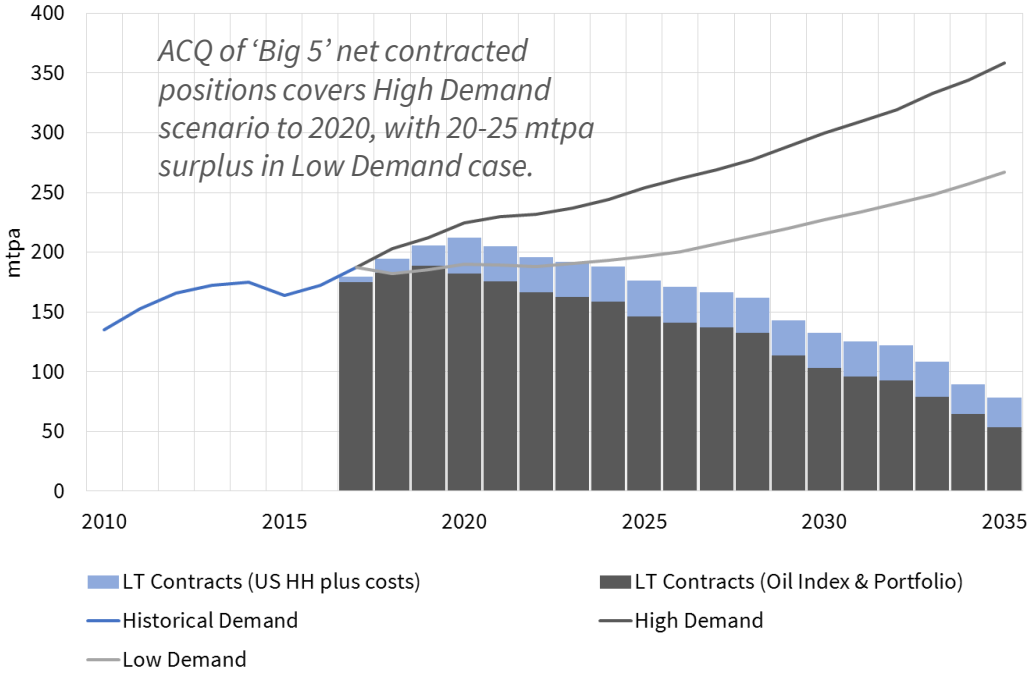
Reduces risk of ‘deep glut’.

Portfolio positioning

Big 5 buyers → 92% of Asian demand (173 mtpa 2016).

Net contract cover levels are high across Big 5 (see chart).

But individual portfolio imbalances are driving shorter term contracting.



‘Big 5’ Asian buyer contract position vs demand (Japan, Korea, Taiwan, China & India)

Source: Timera Energy

‘Next 5’ Asian buyers: Rapid growth & low contract cover

Demand growth

Next 5 buyers → 8% of Asian demand (13 mtpa in 2016).

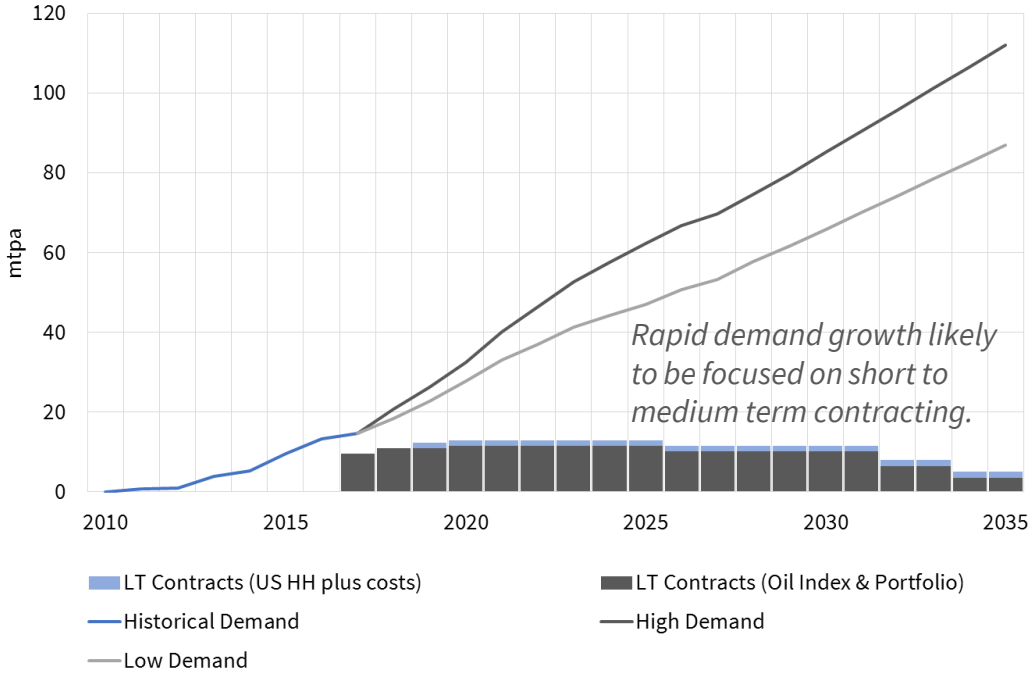
But demand set to increase to between 65 - 85 mtpa by 2030 (i.e. by up to 500%).

Declining domestic production a key factor behind demand growth.

Portfolio positioning

Next 5 have low levels of contract cover. But becoming more active in contract market

Short term contracting focus (e.g. given demand uncertainty, credit issues).



‘Next 5’ Asian buyer contract position vs demand (Thailand, Malaysia, Indonesia, Singapore & Pakistan)

Source: Timera Energy

Japanese over-contracting driving commercial evolution

Demand vs contracts

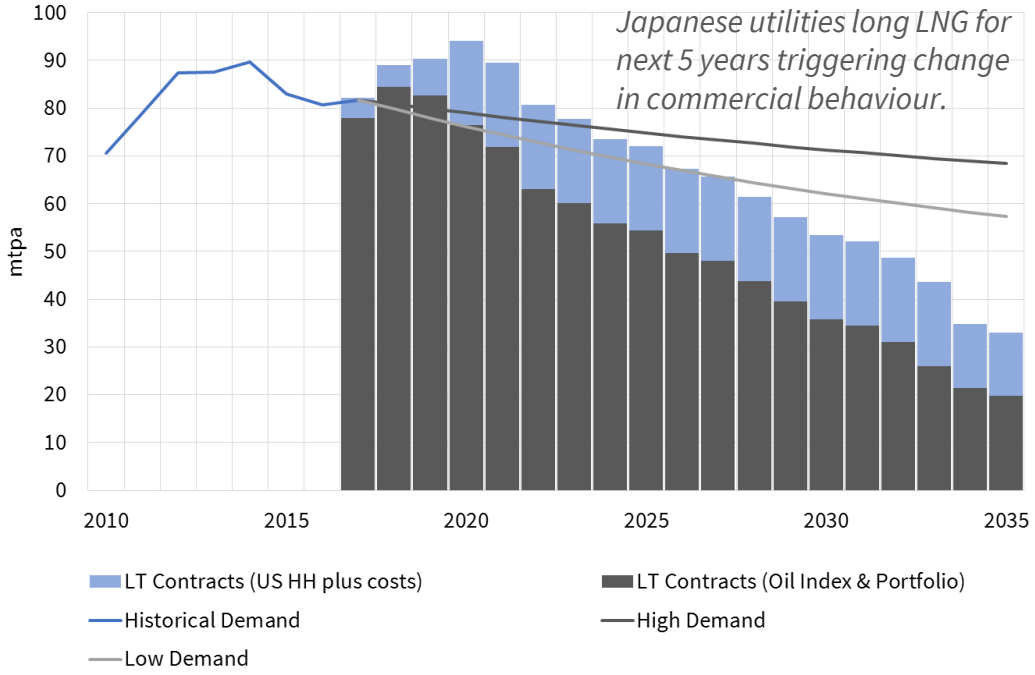
Demand declining (nuke restarts, renewables, efficiency drive).

Japan net long contracted LNG in any demand scenario.

Commercial implications

Japanese utilities:

1. Negotiating increased flex (e.g. destination & resale clauses).
2. Increasing focus on shorter term contracting & portfolio optimisation.
3. Expanding trading capabilities & market activity.



Japan buyer contract position vs demand

Source: Timera Energy

Chinese demand is the key uncertainty

Strong 2017 demand

2017 Chinese LNG imports ~36 mtpa. Up 40% vs 2016*. Key factor boosting Asian & global LNG demand.

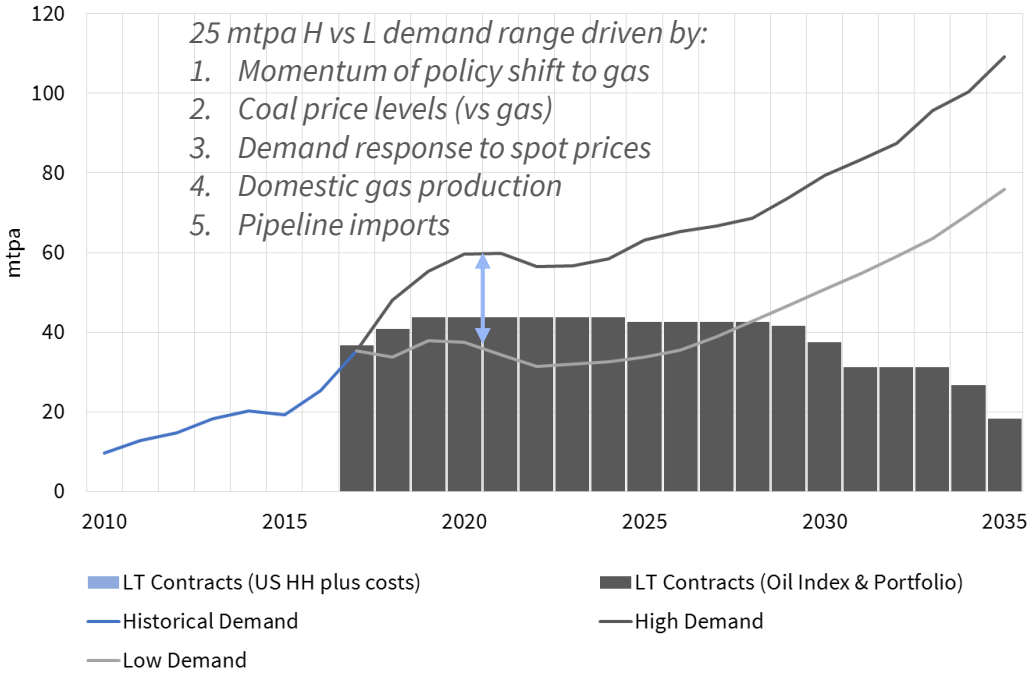
Evidence of successful central policy driven shift to gas. Focused on industry, space heating and some power-generation near key cities.

But what next?

25 mtpa range between High vs Low Chinese demand scenarios by 2021.

High Chinese demand is key to absorbing committed new supply.

Will demand hold up to absorb next 3 years of global supply growth?



China buyer contract position vs demand

Source: Timera Energy

**Note: Lack of sufficient underground gas storage adds to seasonal need for LNG.*

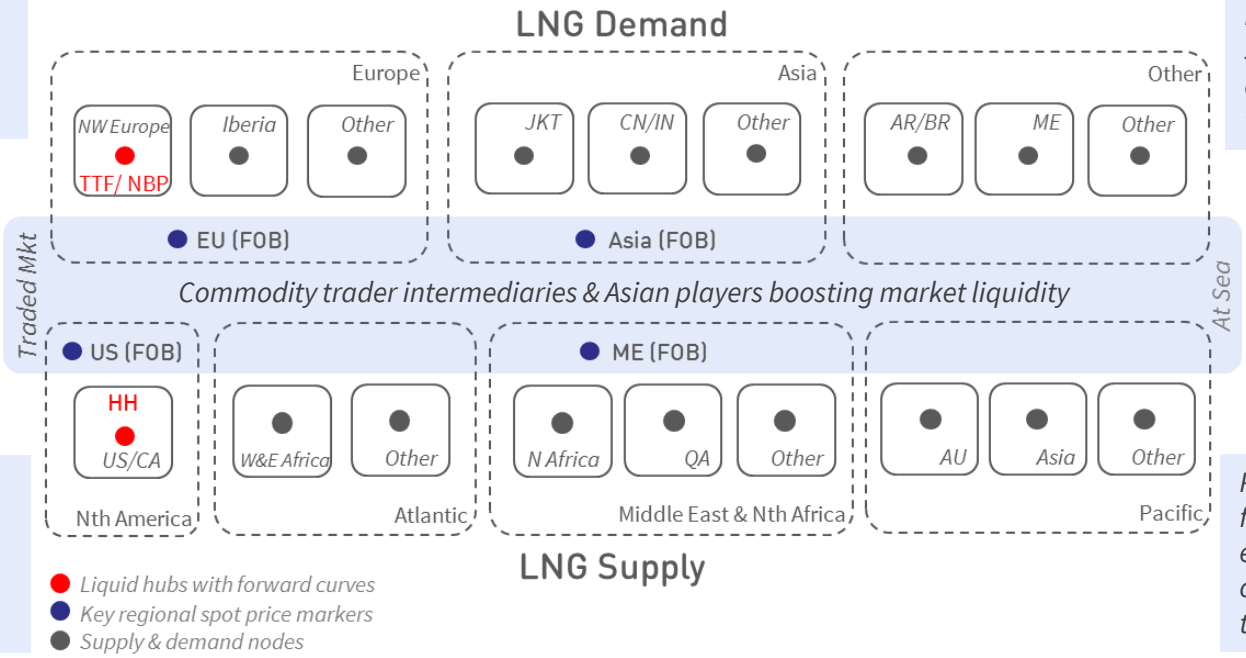
Implications for LNG market evolution to 2020

Key issues & commercial implications for LNG market evolution over the next 3 years.

Issue	Commercial implications
1. Portfolio imbalances	Growth in shorter term contracting to manage & balance portfolios.
2. US exports	Ramp up in flexible contract volumes, optimised against hub price signals.
3. Player evolution	Asian buyers & commodity traders becoming more active in traded market.
4. Liquidity growth	Rise in spot cargo & short term contract liquidity (as a result of 1. to 3.).
5. Hub penetration	Contract pricing & flows underpinned by European & US hub price signals.

LNG transitioning to traded global market

Liquid hub prices driving pricing, hedging and optimisation of LNG volumes



Asian portfolio imbalances driving shorter term contracting & trading activity

Ramp up in flexible price responsive supply from US export volumes

Producers being forced to adapt to evolving market conditions in order to FID new projects

Source: Timera Energy

Hub price penetration is not waiting for an Asian hub

Hubs underpin pricing

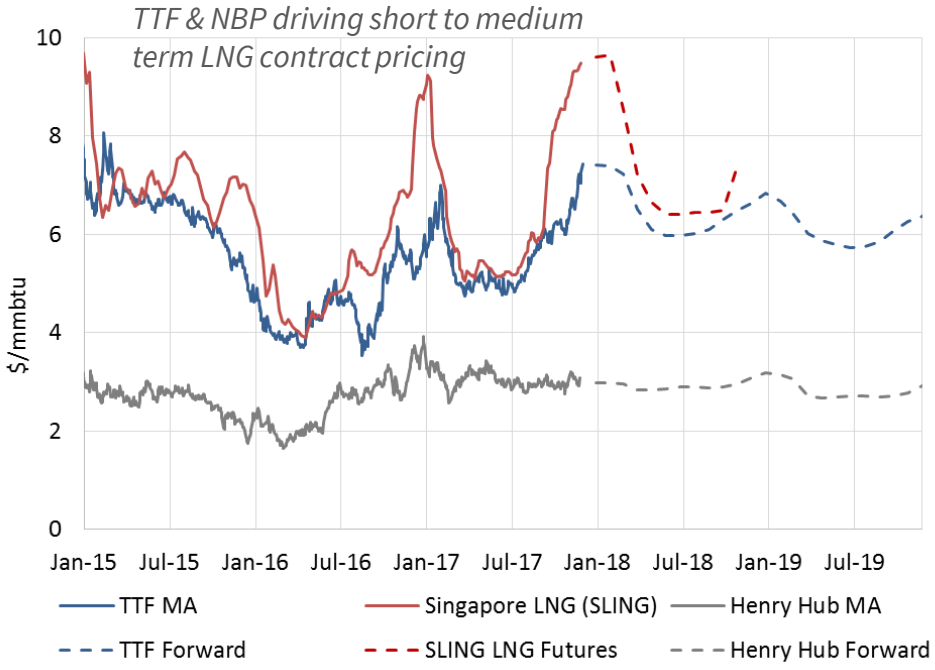
- Shorter term LNG contracts prices are being set off liquid European hub curves…

  … even if contracts are delivered into Asia or contain oil-indexation.

- Regional spot prices temporarily diverge from hubs. But prices are converged to NBP/TTF + transport on a forward basis.

Player evolution reinforcing hub signals

- Asian portfolio balancing vs hub signals.
- Traders (e.g. Gunvor, Vitol, Trafigura) managing exposures against hubs.
- This is creating a virtuous cycle supporting hub price penetration.



Global LNG price benchmarks

Source: Timera Energy

LNG portfolio value being managed against hubs

Hubs provide liquid benchmark

- LNG portfolio exposures are being hedged & optimised against hub price signals.
- Forward liquidity is focused on TTF & NBP.
- Flexible LNG contracts are then optimised against regional spot price signals (or value is left on table).

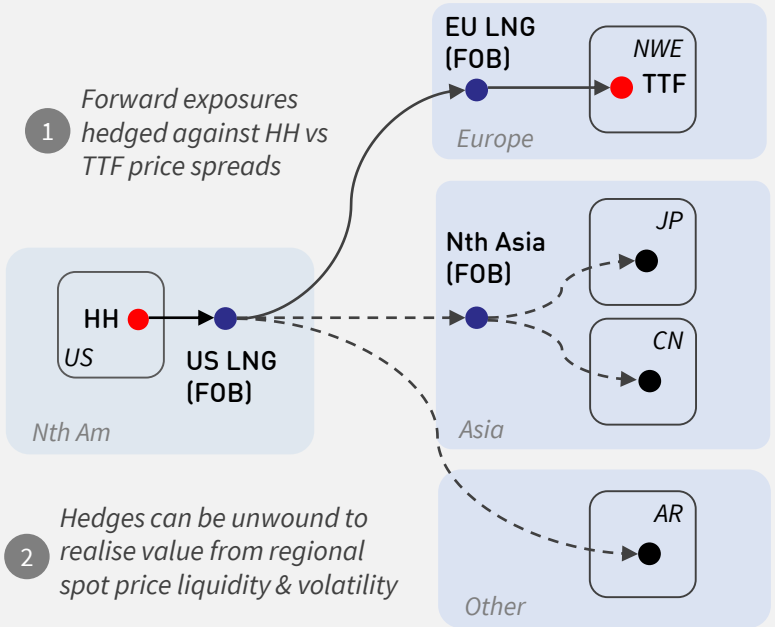
Commercial evolution

- LNG players are rapidly expanding value & risk management capabilities to support portfolio management (particularly in Asia).
- Commodity traders are acting as a catalyst.
- US export ramp up to rapidly boost shorter term trading & optimisation of LNG supply (diagram).

Case study: US export value management

$$MAX\begin{pmatrix} 0 \\ P_{EU\ Hub} - P_{HH} - (P_{HH} \times 0.15 - shipping - regas) \\ P_{Asia\ (FOB)} - P_{HH} - (P_{HH} \times 0.15 - shipping) \end{pmatrix}$$

US export contract "spread" option pay off (simplified)



US export contract hedging and optimisation

Source: Timera Energy

Implications for new LNG supply beyond 2020

Key issues & commercial implications impacting delivery of next wave of supply in 2020s

Issue	Commercial implications
1. Shorter contracting	Tough for producers to sign long term contracts to underpin new projects.
2. Market recovery	Upstream equity will need to bear market risk (recovery a buyer's problem).
3. Project costs	Lower market prices creating downward pressure on liquefaction capex.
4. Financing	Contracting, risk & cost issues → large balance sheets to reduce cost of capital.
5. Marketing	Shorter term contracting → supply chain presence required to monetise LNG.

Where will new LNG supply come from?

Qatar has cheapest source of new supply. But limited volume (23 mtpa targeted in next 5-7 years). Sub 5.0 $/mmbtu LRMC.

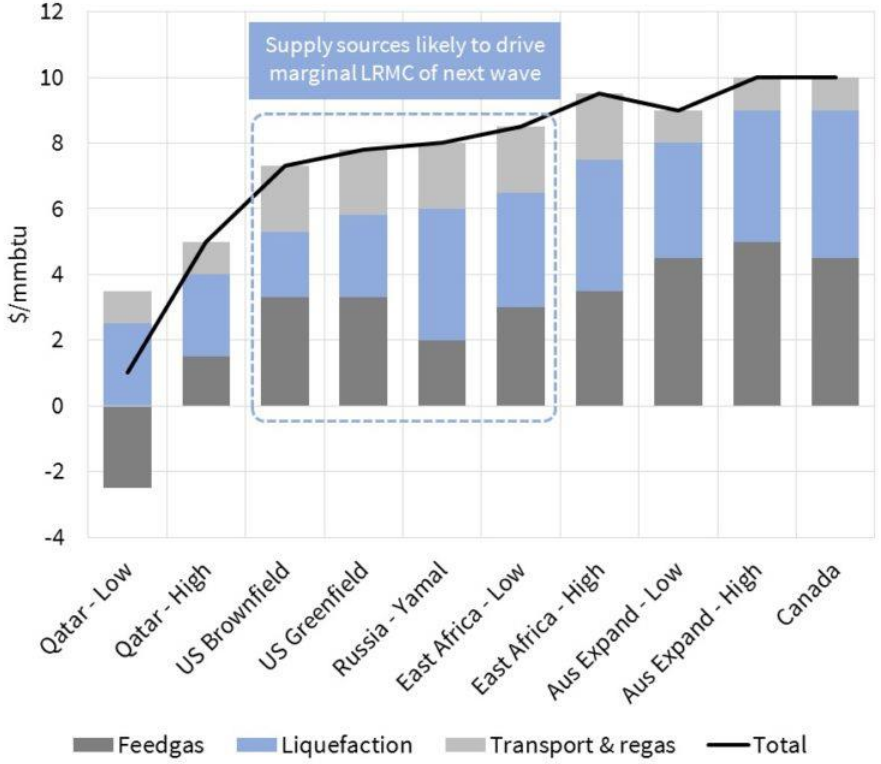
US 2nd wave projects benefiting from falling capex costs & expected feedgas prices. 48 mtpa FERC approved. 100+ mtpa of potential, but only a subset competitive. LRMC $7.5 – 8.0.

Russia benefits from large onshore Yamal arctic fields (Russia's core expertise). 17 mtpa Yamal (+ 18 Artic LNG?). LRMC ~$8.0.

East Africa looks best of the rest. Huge dry gas discoveries but only advantaged projects likely to make it. LRMC $8.5 – 9.0.

Australia & Canada suffer from relatively expensive labour, environmental & feedgas/infrastructure issues. LRMC $9.0-10.

Note: Analysis below relates to breakeven costs for generic projects by location. There are also a number of specific projects likely to benefit from unique characteristics that give them a cost advantage.



Long Run Marginal Cost (LRMC) of new supply sources
(generic project breakevens delivered to North Asia) Source: Timera Energy

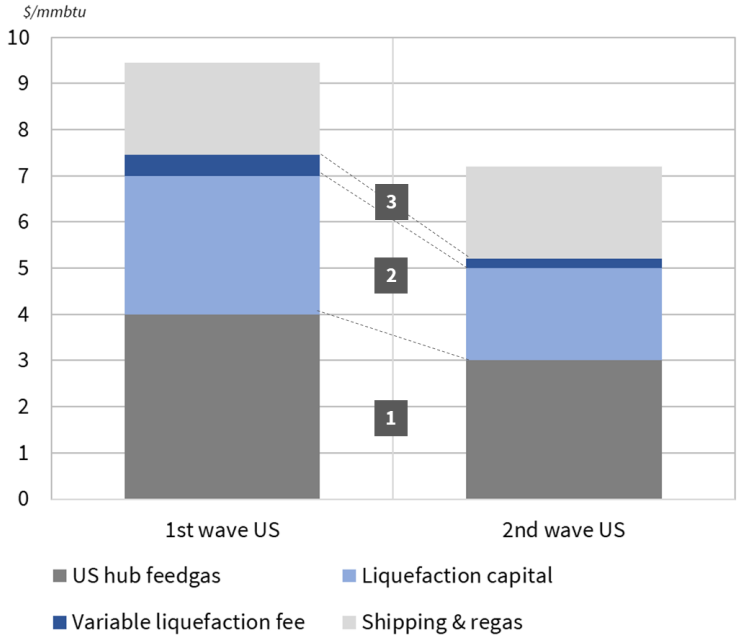
Producer business models evolving with market

Drivers of next wave advantage

- Success down to low costs & high flex. Shift towards merchant marketing.
- Points to oil & gas majors and large LNG portfolio players with an existing supply chain presence.

Advantage	Driver
1. Equity that can bear market risk	Absence of LT offtake contracts
2. Low cost of capital (big balance sheet)	Capex cost reduction
3. LNG supply chain presence	Requirement to market uncontracted offtake
4. Gas and terminal access	Competitive feedgas
5. Unique project advantages	Competitive edge

Case study: 2nd wave US exports



1 *Decline in long run Henry Hub price expectations reducing US feedgas costs. Some gas 'stranded' with negative HH pricing basis.*

2 *Liquefaction terminal costs internalised (vs outsourced via tolling fee including margin). Cost reductions from standardisation, technology improvements and lower cost of capital.*

3 *Variable liquefaction costs internalised and reduced given lower expected HH feedgas costs.*

1st wave vs 2nd wave expected LRMC structure

Source: Timera Energy

10 recent Timera Energy credentials

Project	Client	Summary
1. LNG portfolio exposure	***LNG major***	*Advice/analysis of pricing & exposure management of LNG supply contracts*
2. LNG supply contract	***Oil major***	*Advice/analysis to support renegotiation of long term LNG supply contract*
3. LNG asset investment	***SW Fund***	*Analysis of impact of evolving global gas market dynamics on LNG portfolio value*
4. Regas acquisition	***Fund***	*Advice on UK regas asset valuation and contracting strategy*
5. Storage/regas build	***Developer***	*Commercial advisor to developer of a UK fast cycle storage & LNG regas project*
6. Portfolio management	***Utility***	*Commercial & risk management advice on large portfolio of gas & power exposures*
7. Supply flex value	***PE Fund***	*Analysis of gas flexibility value (price spreads, volatility) at European hubs*
8. Pipeline sale	***Infra Fund***	*Valuation analysis to support large Central European pipeline transaction*
9. Pipeline monetisation	***Utility***	*Advice on capacity sales strategy, product structuring and capacity value*
10. Storage acquisition	***Infra Fund***	*Commercial advisory & due diligence to support purchase of CEE storage portfolio*

Timera Energy offers expertise on value & risk in energy markets

Specialist energy consultancy
Focus on LNG and European gas & power assets

Extensive industry expertise
Practical knowledge from senior industry roles

Pragmatic commercial focus
Investment, valuation, contracting & mkt analysis

Strong client base
leading energy companies (producers, utilities, funds)

Leading industry blog
15,000+ regular readers, publications, conferences

Our clients include

Statoil
RasGas
e·on
FLUXYS
OSAKA GAS
bp
TEMASEK HOLDINGS
MACQUARIE
GAZPROM MARKETING & TRADING
petroineos REFINING AND TRADING

Timera Energy gas team members

Our team members have extensive senior industry experience and practical commercial knowledge.

Olly Spinks

20 years energy industry experience
Expert in commercial and risk analysis
Ran BP's LNG, gas & power commercial analytics function

Howard Rogers

30+ years gas industry experience (BP, OIES)
Expert in fundamental analysis of energy markets
Chairman of Gas Research Programme at OIES

Sonia Youd

25+ years of energy industry experience.
Expert in gas commercialisation, regulation and trading.
Commercial Director for Centrica Storage.

David Stokes

20 years energy/commodity market experience
Expert in value/risk management of flexible assets
Industry roles with Origin, Williams, JP Morgan

Nick Perry

30+ years industry experience (Amoco, Exxon, Enron)
Expert in commercial & risk management strategy
Board level experience (Director Enron Europe)

Henry Crawford

7 years experience in energy & capital markets
Strong commercial & market analytics experience
Industry trading & analytics background (Nova Energy)

Olly Spinks olly.spinks@timera-energy.com
+44 (0) 7525 724 461

David Stokes david.stokes@timera-energy.com
+44 (0) 7957 656 337

Address: 110 Bishopsgate, London, EC2N 4AY, UK
Tel: +44 (0) 207 961 0805

www.timera-energy.com

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