European midstream gas

Asset value drivers & market evolution

June 2017

Olly Spinks olly.spinks@timera-energy.com
David Stokes david.stokes@timera-energy.com

www.timera-energy.com

TIMERA ENERGY

Contents

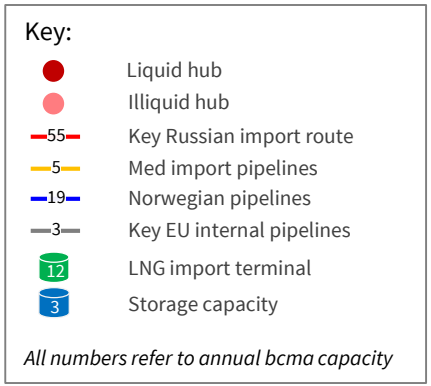
Section	Contents	
European midstream gas infrastructure	Midstream gas infrastructure map	3
	5 key drivers of midstream asset value	4
	Why LNG market interaction is key	5
Key supply sources	Pipeline supply (Russia, Norway, Mediterranean)	6
	LNG imports	9
	Gas storage	10
2 scenarios: Russia vs LNG	Sc1: 'LNG Dominance' of import growth	11
	Sc 2: 'Russian Dominance' of import growth	12
Midstream asset value implications	Pipeline value	14
	Regas terminal value	15
	Gas storage value	16

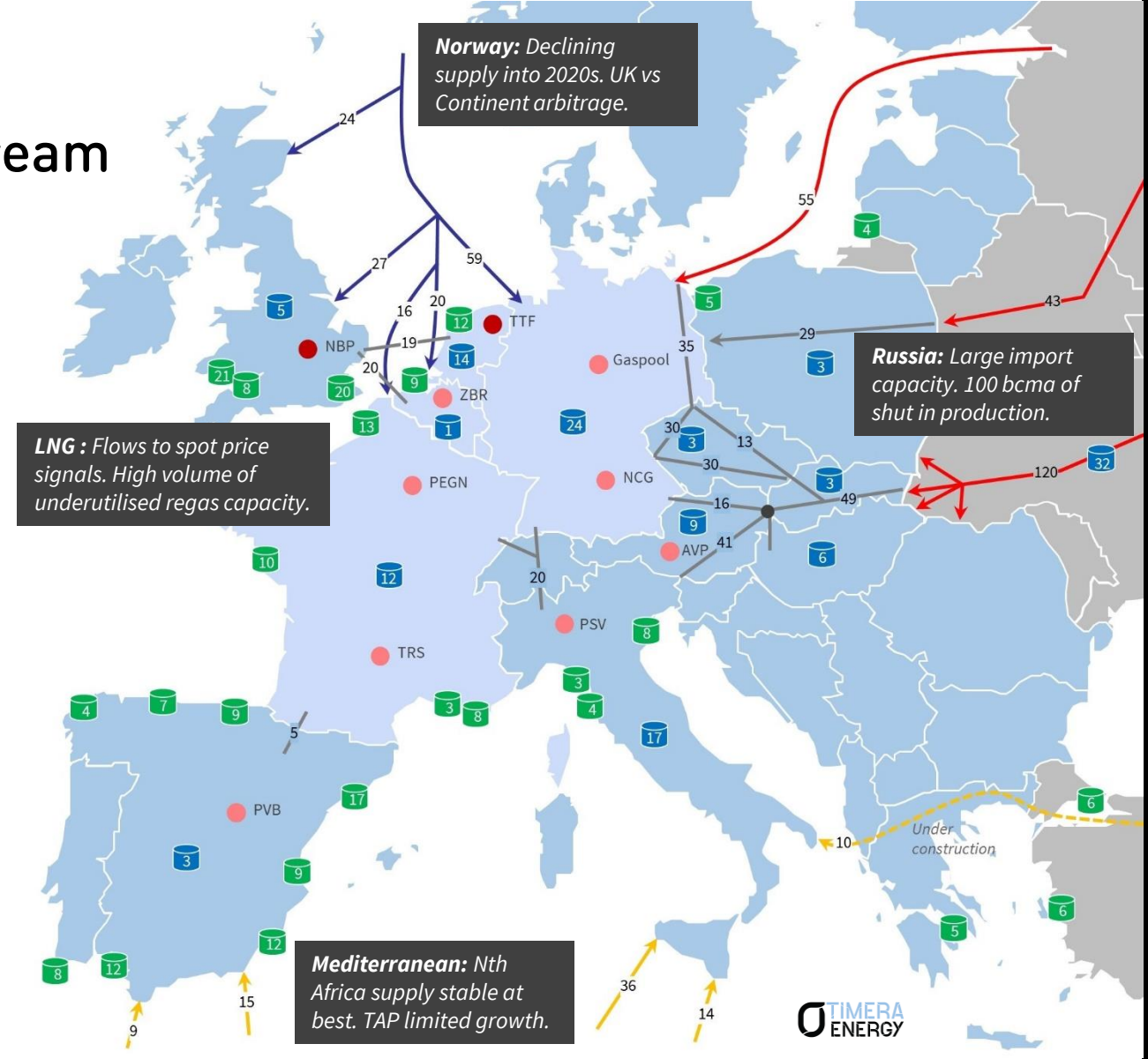
European midstream infrastructure

Domestic European gas production is in terminal decline (NW Europe focus: NO, UK, NL).

Imported supply can be grouped into 4 key sources (see map).

Battle between Russian & LNG imports will determine pipeline flow patterns, regas utilisation and requirement for storage flex.





5 drivers of midstream asset value

Understanding & quantifying the risk/return impact of these 5 drivers can underpin a midstream asset investment case:

Driver	Dynamics	Example
1. Utilisation	Evolution of supply volumes, routes and flow patterns drive capacity utilisation	LNG import growth will drive regas utilisation and pipeline flow volumes in UK, Netherlands & France
2. Constraints	System constraints, both physical & contractual, drive capacity value premia	Value premia from contractual pipe constraints into Italy and physical pipe constraints into Spain
3. Flexibility value	Interaction between physical asset flex and market price signals drives extrinsic value	Extrinsic value of UK regas & storage capacity set to rise with spot price volatility given Rough closure
4. Liquidity access	Access to liquid hub price signals drives ability to monetise capacity value	Dutch & UK storage assets have clean access to liquid forward curves vs e.g. Czech & Slovak assets
5. Regulation	Regulations on access, tariff structure and security of supply impact capacity value	Regulated tariffs drive competitive variable cost dynamics impacting regas & pipeline throughput

LNG market interaction particularly important

European midstream gas infrastructure value will be driven by the interaction between the European gas market and global LNG market.

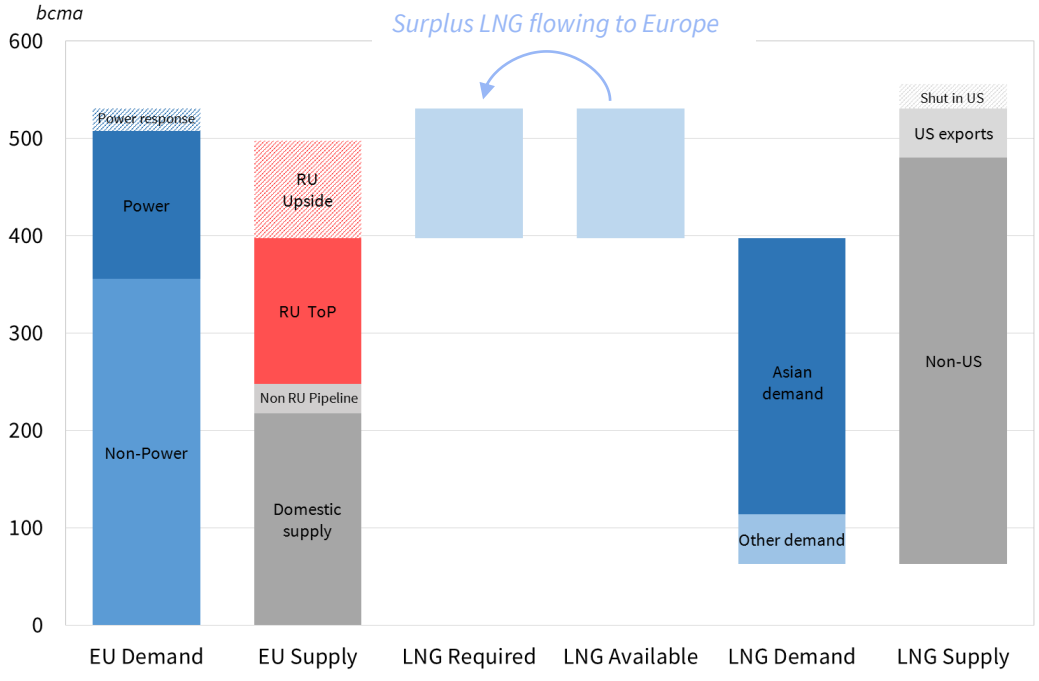
Europe has become LNG market 'swing provider':

- Oversupplied LNG market: European hubs absorb surplus LNG (e.g. 2015-2020)
- Tight LNG market: European market diverts flexible LNG supply to meet shortfall (e.g. post-Fukushima 2011-14)

Two key sources of supply are competing to replace declining European domestic production: (i) Russian pipeline imports vs (ii) LNG imports.

The evolution of Russian vs LNG supply volumes will drive the utilisation and capacity value of pipelines, regas terminals and storage assets.

A lack of consensus creates investor opportunities.



European vs LNG market balance (2019)

Source: Timera Energy

Note: 'Power response' represents incremental power sector switching demand.

Russian pipeline supply

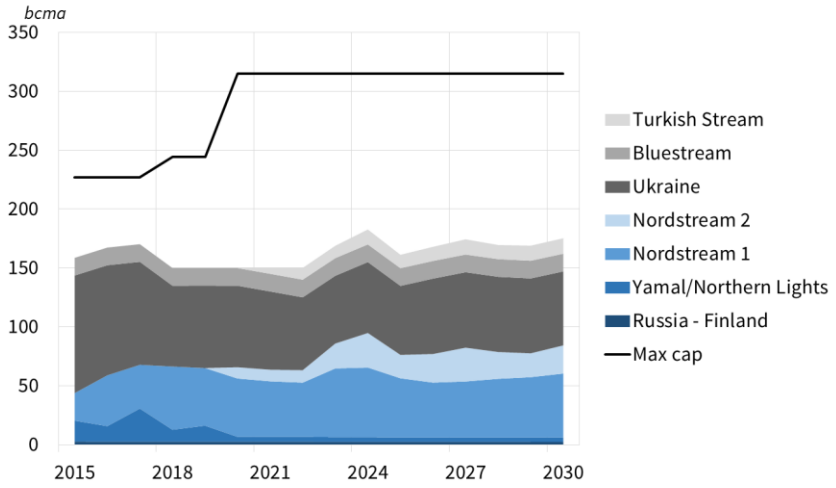
Production: Russia has historically maintained a minimum of 150 bcma of European exports. But additional 'shut in' West Siberian production capacity could support up to 250bcma.

Pipeline routing: Russia has transitioned to favour northern export routes (Nordstream/OPAL) given conflict with Ukraine. Nordstream 2 (55 bcma) is likely to happen (target 2020). That would then support up to 250 bcma of exports.

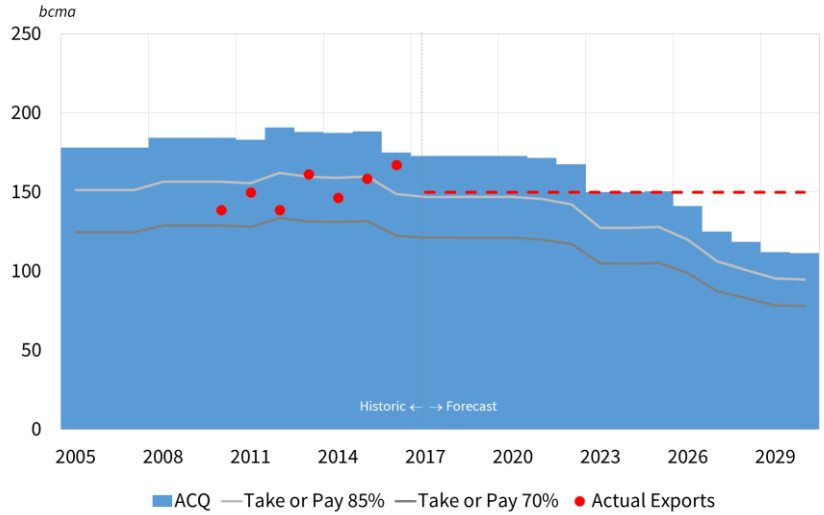
Contractual dynamics: Russia currently has ~150 bcma long term contracted 'take or pay' volume. The majority of this volume is under contract until beyond 2030 (see bottom chart).

Market share gain: Evidence is emerging in 2016-17 of Russia:

1. Looking to expand market share via hub based sales
2. Allowing greater hub indexation in contracts e.g. via TTF price corridor mechanism
3. Moving towards greater supply flex management at hubs.



Russian pipeline flows and capacity (LNG Dominance Scenario)



Long term Russian contract volumes with Europe Source: Timera Energy

Norwegian pipeline supply

Production: Norwegian production is plateauing this decade, then declining in the 2020s. A strong seasonal production pattern provides the European market with a key source of flex in addition to seasonal storage.

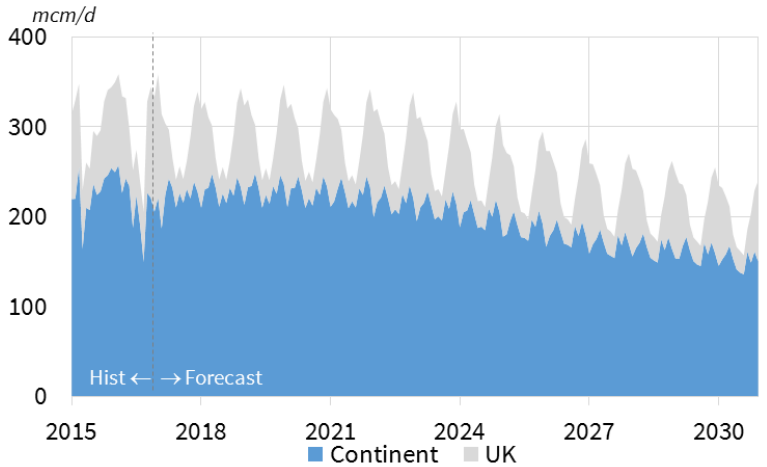
Pipelines: The Norwegian pipeline network allows access to UK, Germany, Belgium & France. There is ample capacity headroom into the UK, but there can be constraints on flows into the Continent.

Contractual dynamics: On average ~75% of Norwegian gas flows to the Continent, predominantly via long term hub indexed contracts. Hub indexation of long term contracts means gas flows are driven by spot price signals.

Statoil arbitrage: Uncontracted Norwegian production is optimised by Statoil based on UK vs TTF/NCG/Zee price signals. Norwegian flows to UK have been 'backfilling' lost storage deliverability since the major Rough outage.

	bcma	mmcm/d
UK - Vesterled	24	66
UK - Langeled	27	74
Total UK	**51**	**140**
Belgium - Zeepipe	17	46
France - Franpipe	20	53
Germany – Norpipe	34	93
Germany - Europipe 1 & 2	25	68
Total Continent	**95**	**259**
Total	**146**	**400**

Norwegian pipeline infrastructure



Norwegian flows (historic and forecast)

Source: Timera Energy

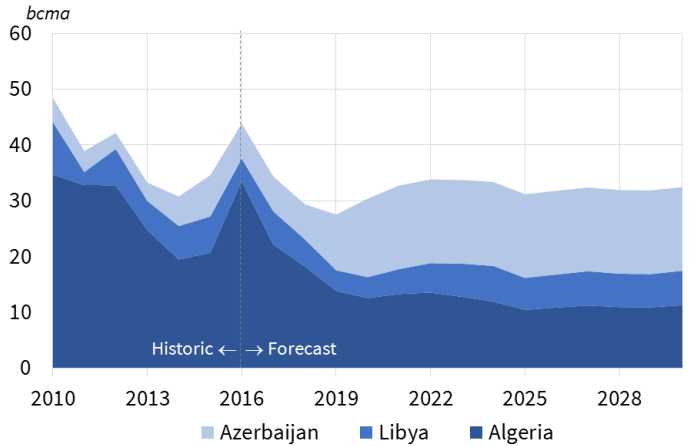
Mediterranean pipeline supply

Algeria: Production static since 2010 while domestic consumption has grown. 'Export surplus' has fallen from 54 bcma in 2010 to 44 bcma in 2015, reducing pipeline exports. Algeria 2016 'jump' in exports may be a temporary impact of 'borrowed gas' from Hassi R'mel in anticipation of upstream investment. We assume combined LNG & pipeline exports stabilise ~30bcma.

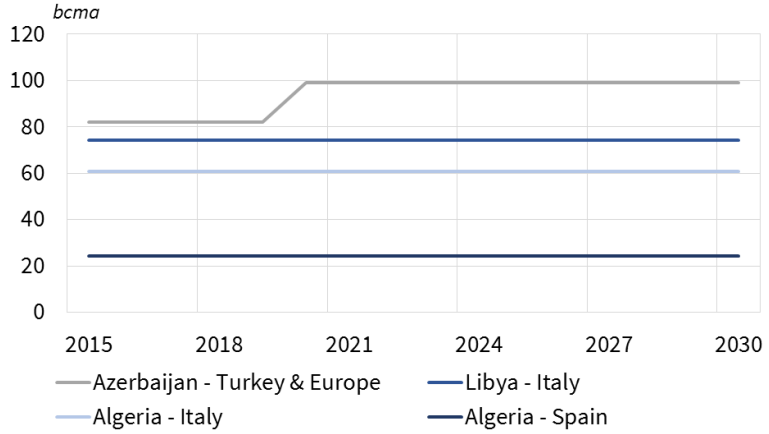
Libya: Social and political instability since the deposition of Colonel Gaddafi in 2011. Pipeline exports to Italy have not regained their 2010 levels and LNG exports have ceased. We assume no further LNG and a tentative growth to previous levels of pipeline exports, rising from 5 to 10 bcma (2020-30).

Southstream: Azerbaijan's export outlook uncertain, but constrained by lack of firm projects other than from Shah Deniz 2 and Azeri-Chirag-Gunashli (associated). Iran broadly in balance. We assume exports from Azerbaijan from 2020 onwards will be: 5 bcma to Turkey, 1 bmca to Bulgaria/Greece and 9bcma to Italy and beyond.

Med supply sources flow available production, providing limited supply flexibility into Europe.



Med pipeline supply (2010-30)



Med pipeline capacity (significant headroom) Source: Timera Energy

LNG supply

UK: Access to liquid hub. Regas developed in response to UK production decline. LNG required in addition to Norway & interconnector flows & plays key 'peaking' role.

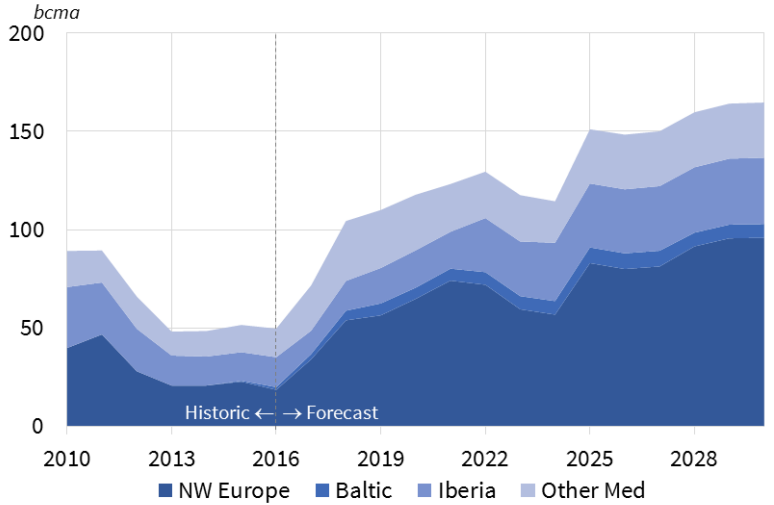
France & Benelux: Access to liquid hubs. Contracted LNG supply compliments pipeline supply.

Iberia: At the extremity of continent & LNG dependent. Limited pipeline connectivity with rest of Europe. Wary of reliance on Algerian gas.

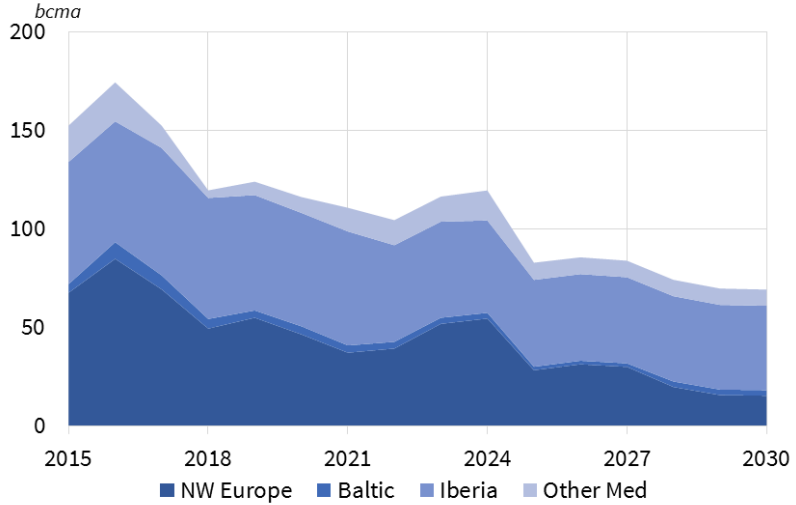
Italy & Greece: LNG imports compliment pipeline supply and provide import capacity headroom.

Turkey: Wary of reliance on Russia. Azerbaijan/Southern corridor has also disappointed. Contract position and pipeline capacities require additional supply via LNG.

Lithuania & Poland: Alternative supply source given wary of Russian price/volume dependence.



LNG imports by region (LNG Dominance Scenario)



LNG import capacity headroom by region

Source: Timera Energy

Note: charts illustrate LNG imports from 'LNG Dominance' Scenario

Role of gas storage

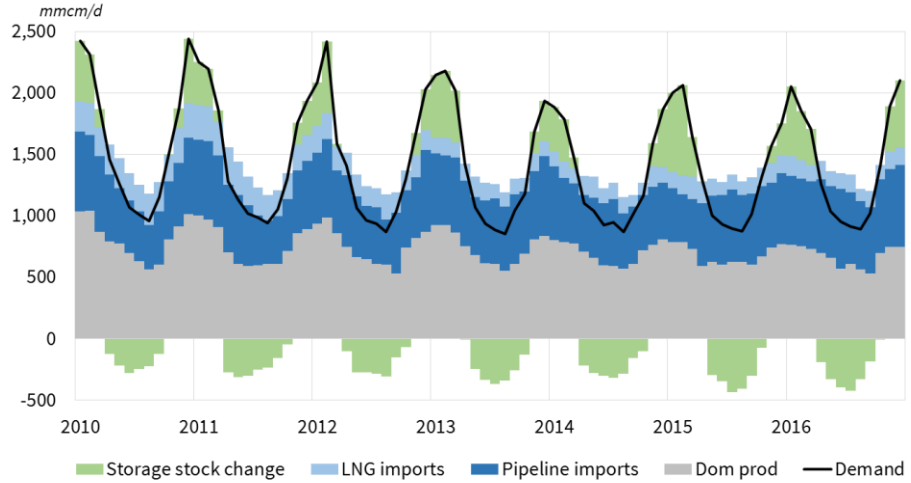
Storage capacity: Europe has ~90 bcma of commercial European storage WG Volume. More than 80% of this is slower cycling seasonal storage capacity.

Supply flex balance: An oversupply of flex has developed this decade given (i) falling gas demand 2010-15 and (ii) alternative sources of flex supply e.g. Norway.

Market price signals: Seasonal price spreads have fallen from levels above 5.0 €/MWh in 2010 to less than 1.5 €/MWh.

LNG impact: European LNG imports influenced by strong seasonal Asian LNG demand profile. But LNG available for Europe is becoming less winter biased as Asian demand increases.

Deliverability key: Increasing power intermittency & import dependency is driving an increased requirement for deliverability vs seasonal flex. Development of new capacity this decade has focused on faster cycling salt cavern assets.



Seasonal balancing role of European storage flexibility

Steady decline in seasonal hub price spreads

Source: Timera Energy

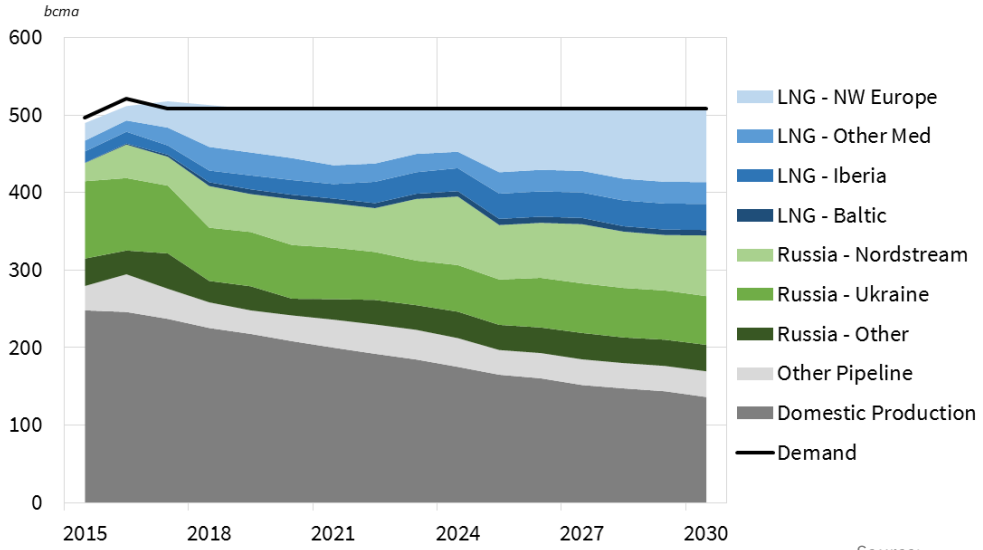
Scenario 1: 'LNG Dominance'

Scenario overview: LNG supply growth dominates European import growth as a result of (i) surplus LNG supply (ii) less aggressive Russian pursuit of market share at the expense of price.

LNG market: The LNG market rebalances in the mid 2020s as Asian demand draws volumes away from Europe. New LNG projects come onstream from the early to mid 2020s onwards but high-cost projects are excluded on the basis of market affordability.

European LNG imports: Lower Asian demand growth in this scenario results in significant LNG surplus volumes being directed to Europe. LNG import volume growth is mainly in NW Europe (where domestic production is declining). Iberia LNG imports increase as Algeria pipeline exports fall off.

Russian imports: Russia sees some growth in export volumes once the LNG glut is cleared (~170 bcma in 2020s). Flow focus on Nordstream & Turkish stream routes. But Ukraine retains a level of ~60 bcma of flow.



Russia vs LNG volumes by routing: LNG Dominance Scenario

Source: Timera Energy

Note: For simplicity in the scenario shown, demand is assumed to be flat. In reality demand is likely to vary e.g. with higher power sector demand due to gas vs coal switching during the 2017-21 supply glut phase. See here for more detailed scenario analysis of the evolution of LNG supply and demand balance and pricing.

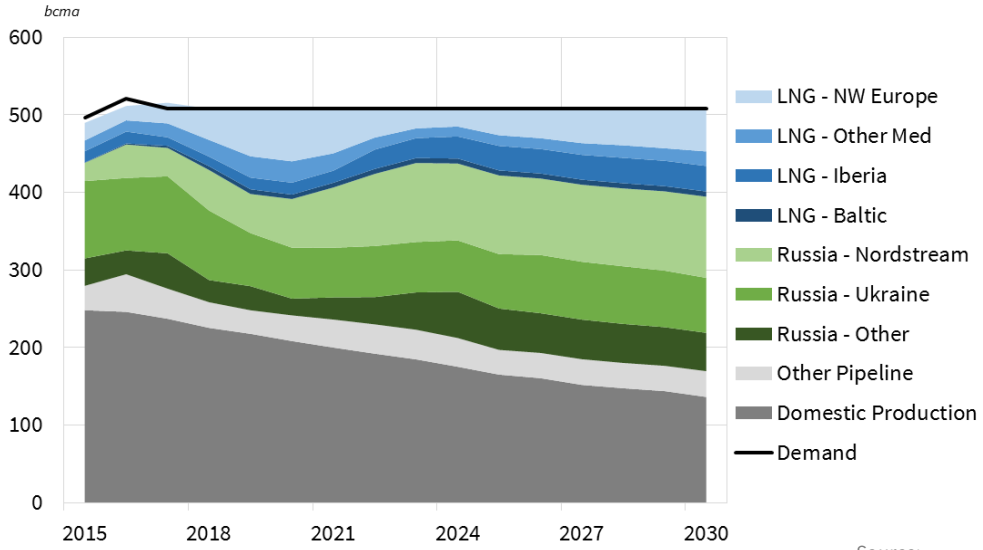
Scenario 2: ‘Russian Dominance’

Scenario overview: Higher Asian demand reduces surplus LNG into Europe and Russia accepts price concessions to aggressively pursue market share and block development of higher-cost new LNG supply.

LNG market: LNG market rebalances sooner (early to mid 2020s) as higher Asian LNG demand draws volumes away from Europe more rapidly. New LNG projects come onstream from the early to mid 2020s.

European LNG imports: LNG import volume growth is mainly in NW Europe (given liquid hubs and declining domestic production). LNG also replaces Algerian imports in Iberia. LNG imports play a greater flexibility role vs LNG Dominance Scenario.

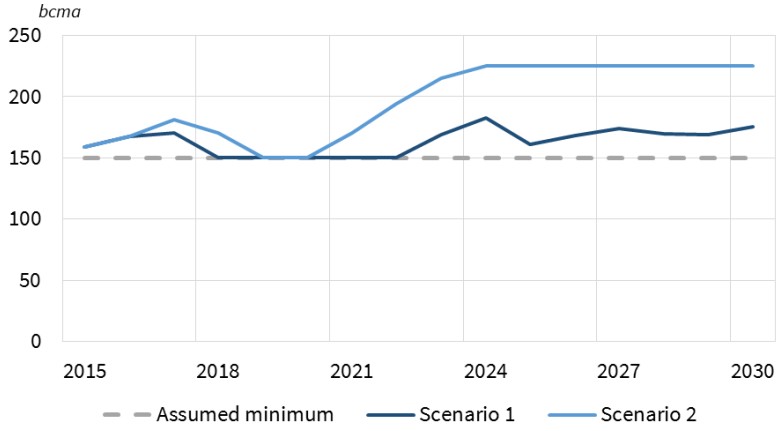
Russian imports: Russian imports benefits from lower LNG import volumes. Volumes into Europe rise significantly towards 225 bcma by mid 2020s. Import growth focused on unutilised Ukraine route capacity.



Russia vs LNG volumes by routing: Russian Dominance Scenario

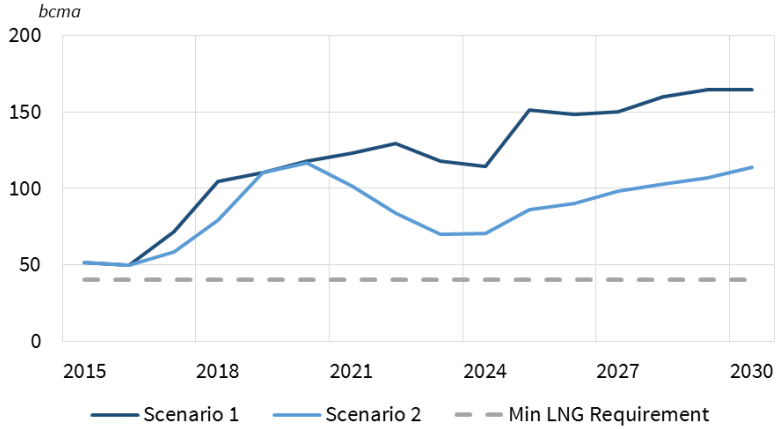
Source: Timera Energy

Russia vs LNG: Scenario Comparison



Russian imports (Sc 1 vs Sc 2) Source: Timera Energy

- Russian ability to gain market share over the next 5 years is strongly influenced by the LNG glut surplus.
- Higher Russian volumes in 2020s depend on Asian LNG demand recovery and Russian willingness to compete (through European hub price influence) against FID of higher cost new LNG volumes.



LNG imports (Sc1 vs Sc2) Source: Timera Energy

- Glut driving near term increase in LNG imports under both scenarios. Structural increase from mid 2020s as European domestic and Norwegian production declines.
- After the glut subsides, the scale & pace of LNG import growth strongly depends on extent Asian LNG demand growth and scale of new LNG FID's.

The dominance of LNG vs Russian gas in the European import mix is key to determining asset flow/utilisation volumes, constraints, supply flexibility requirements and capacity value.

Pipeline asset value implications

Scenario impact	Investment considerations
LNG Dominance: • LNG import growth 'backfills' declining domestic production in Norway, UK & Netherlands. • This supports pipe flows from NW Europe to east (e.g. to Germany) and south (e.g. to Italy). • LNG share of supply mix grows in France & Italy. **Russian Dominance:** • As domestic production declines, flows from Russia increase to dominate NW Europe & Italy. • Underutilised capacity on Ukraine route capacity key to supporting Russian import volume growth. • Role of Austria grows as key transit & storage market.	**Entry strategy:** Direct pipeline equity vs stake in TSO? Bilaterally negotiated vs sales process? **Margin protection:** Existing contracts? Regulated tariff base? Robust flows under both market Scenarios? Structural flow or system constraint value? **Competition:** Variable cost structure? Ability for competing assets to bypass or erode margin? **Pricing flex:** Regulated tariff levels vs flexibility to competitively structure capacity products & pricing? **Value upside:** Utilisation upside? Extrinsic value from asset flexibility? Insurance/access value premia (e.g. UK, IT)? Interaction with adjacent assets? Ability to oversell?

Regas asset value implications

Scenario impact	Investment considerations
LNG Dominance: • Robust growth in aggregate European utilisation, with focus on NW European terminals with liquid hub access. • Likely to be a structural requirement for new regas capacity by mid 2020s to support LNG import growth. • Higher LNG mkt share in Med region (e.g. IT, FR, TR, ES). **Russian Dominance:** • LNG glut still supports significant regas utilisation growth 2017-20; then steady growth from mid 2020s. • LNG imports play a greater flexibility role e.g. providing swing/peaking capacity through send-out flexibility. • New terminal development focused on small scale LNG.	**Entry strategy:** Existing terminal equity vs development options? Large scale vs small scale/FSRU? **Margin protection:** Legacy contracts? Dedicated supply? Structural demand (e.g. ES, UK)? Reload infrastructure? **Competition:** Liquid hub access? Variable cost/tariff structure? Direct competition from other terminals? **Pricing flex:** uncompetitive regulated tariffs (e.g. IT)? Flex to structure products/prices e.g. ability to sell 'liquid hub put options' to LNG portfolio players. **Value upside:** Capacity headroom? Security of supply premia (e.g. UK)? Ability to capture extrinsic value e.g. broader LNG supply chain presence? Expansion options?

Storage asset value implications

Scenario impact	Investment considerations
LNG Dominance: • Spot price volatility supported by rising import dependency, ageing flex infrastructure & intermittency. • Ebbs & flows in LNG import volumes and supply chain response time also supportive of price volatility. • US LNG export flex may cap NBP/TTF seasonal price spreads, if US export capacity not fully utilised. **Russian Dominance:** • Import dependency, ageing infrastructure & intermittency provide structural support for volatility (as in LNG Dominance scenario). • Declining production flex may increase need for 'near hub' (e.g. CEE) storage to manage flex requirement.	**Entry strategy:** Fast cycle vs distressed price seasonal assets? Existing asset vs development options (e.g. UK)? **Margin protection:** Legacy contracts? Regulatory support/mandates? Cushion gas value? Fixed cost hurdle? **Competition:** Cycling speed? Variable cycling cost? Hub access costs? Locational advantage? **Pricing flex:** Flexibility to competitively structure capacity products & pricing? Regulated tariff structure? **Value upside:** Asymmetric upside exposure to volatility? Commodity value of cheap cushion gas? Incremental expansion costs (e.g. salt caverns)? Ability to oversell capacity?

10 recent Timera Energy credentials

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

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

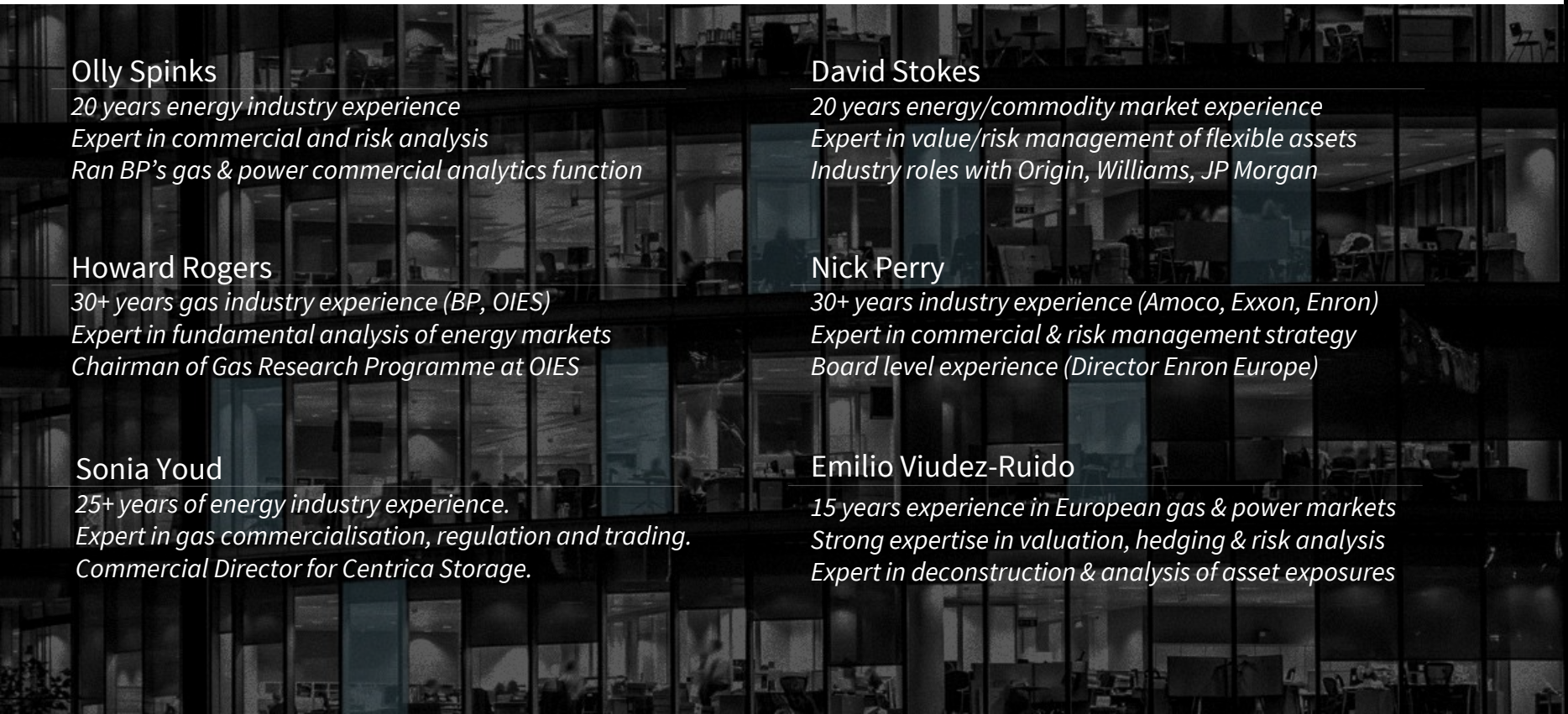
Strong client base
leading energy companies (producers, utilities, funds)

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

Our clients include

Timera Energy key 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 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)

Emilio Viudez-Ruido

15 years experience in European gas & power markets
Strong expertise in valuation, hedging & risk analysis
Expert in deconstruction & analysis of asset exposures

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

TIMERA ENERGY