Flame, Amsterdam 12 October 2020 <u>www.kyos.com</u>, info@kyos.com





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Agenda



16:30 – Presentation

- Exploring trends in regional price spreads
- Flexibility along the LNG supply chain in sourcing, liquefaction, transport and storage
- Valuing the LNG flexibility and monetizing the value

16:45 – Q&A 16:50 – End





Exploring trends in regional price spreads



General trends in LNG pricing and trading

EU gas – Asian LNG price correlations have grown Oil correlation with gas and LNG has reduced Globalisation of LNG markets and pricing continues

Currently:

- Exporting countries: 19
- Importing countries: 40
- Total LNG fleet: 550



Several more import and export terminals being constructed/planned and LNG fleet growing further

US versus Europe: Henry Hub and TTF

- 2000-2008, US natural gas was at around 5 \$/mmBtu or 15 €/MWh
- From 2008, US natural gas lost around 50% of its value
- Until mid 2019, TTF was well above Henry Hub (in €/MWh)

Compare prices



US versus Asia: Henry Hub and Japan import

- US Japan price gap has narrowed since 2014
- Spread narrowed further and real buyers market since Covid-19
- Opportunities to buy long-term at low prices, or take a bet on low priced spot cargoes in the future



US versus Asia: Henry Hub and Japan import

- TTF Japan price gap has narrowed since 2015
- Strong price correlation, except for "cold European winters"
- Flexibility to divert cargoes from Asia to Europe or vice versa has become ever more important
- This option was far out-of-the-money in 2013-2014, but more at-the-money and hence valuable in the past 6 years





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Correlation across regions



- Consistently high
 correlation in price
 levels between Japan
 and Europe (TTF), but
 more correlation
 breakdowns of both
 markets with US HH
- Return correlations are much lower
- Longer-term price drivers are quite aligned, but shorterterm much less so



LNG in Europe

- 78% of LNG imports sold on hub-index basis in 2019 (IGU survey)
- 47% of LNG imports to southern Europe still some oil-indexation



- In northwest Europe hub indexation is 100%
 - E.g. TTF discount for regas and transport
 - Flexible contracts with full diversion rights
- LNG had around 25% share in European supply in 2020
- Market players use depth of NBP and especially TTF market to manage their risks: more LNG imports, more TTF trading



Flexibility along the LNG supply chain



Example supply chain: US to Europe/Asia

- 1 2 3 4
- Different sourcing and transportation options to Gulf coast
- Use liquefaction or cancel and sell pipeline gas in the US
- Ship LNG to Europe or to Asia
- Selection of vessel type and shipping route (Asia mainly), maybe even of floating storage
- 5 Selection of exact gasification terminal in the area



US sourcing and liquefaction



- Cheniere concept of tolling deals in liquefaction:
 - First contract in 2016 with BG/Shell at 115% x HH + \$2.25
 - Many similar tolling deals followed, with premiums of \$2-3.5
 - More recently also tolling deals with other indexations
- Clients need to recover fixed fee + transport costs
- Clients may cancel deliveries: about 200 cargoes in Apr-Sept '20



US liquefaction option with Take-or-Pay

- Take-or-Pay conditions are to guarantee minimum income for liquefaction operators, e.g. minimum of 50% utilization
- This can be valued as a swing contract with delivery TTF and indexation to Henry Hub, e.g. using monthly rolling intrinsic trading strategy and Monte Carlo simulations
- Some inputs to the valuation:

Pricing against TTF





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Value of liquefaction with cancellation option

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€ 67 mln

- Intrinsic value (no cancellations): € 54 mln ullet
- Option value (intr + extrinsic): ullet
- Value of option to cancel up to 50% of cargoes: € 13 mln ۲

Trading dates 2020-10-06 × × ×	
Zoom 1m 3m 6m YTD 1y All	From Oct 7, 2020 To Jul 25, 2023
Fixed costs of 1.75 €/MWh	€/MWh
3.25 €/MWh — 1.15 x HH ;	6.00 €/MWh
Jan '21 Apr '21 Jul '21 Oct '21 Jan '22 Apr '22 Jul '22 Oct '22	Jan '23 Apr '23 Jul '23



- 3
- For the valuation of the cancellation option, we assumed highest prices in Europe (TTF)
- However, shipping to Asia may be more attractive, despite lack of liquid trading market
- Can be sold on spot basis, but beware of extra shipping costs
 - 46% of US LNG went to Europe in 1H 2020
 - 33% of global LNG trade in 2019 was spot (ICIS)

This is a diversion option, regional spread option, but only if liquefaction is not cancelled



The role of storage

- Floating storage:
 - Benefit from (steep) contango in market
 - Postpone deliveries and keep option to divert
- On-shore storage:
 - Slower send-out of volumes, so less liquidity impact
 - Underground storage as buffer for LNG flows comes with a cost, directly (storage lease) or indirectly (opportunity cost)





Gas.kyos.com: all about storage of (L)NG in Europe



Choosing the final destination

- Example:
 - First decide between GB (=NBP) and continent
 - If continent, decide between TTF and NCG (future terminal)





Valuing the flexibility and monetizing the value



Valuation of destination flexibility in Europe

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- Joint Monte Carlo price simulations of N markets
- Flexibility to choose port compared to fixed port (Gate, TTF) based on optimal decisions at different points in time



Fixed vs. Flexible Port Value (EUR) \blacksquare



KYOS Analytical Platform

- #1 for valuation & hedging of structured products in (L)NG
- Standard modules:
 - Forward curve builder
 - Monte Carlo price simulations
 - Gas storage
 - Swing contracts
 - Spread options, strips, etc
 - EaR, VaR, risk reporting
- Flexibility:
 - Custom Analytics function to develop own models in Python
 - Market data interfaces, APIs, etc



Edit Prototype

Name	LNG Region Spread (standalone)		
Script	O Predefined		
	File	Uploaded on	
	Ing_location_spread_standalone.py	2020-06-16 11:35:26	×
	Upload python dependencies Bestand kiezen Geen bestand gek	ozen	Show info
Simulation profile	TTF_NCG_NBP [137]		





Questions?



