Impact of LTCs on Spot Prices

Sergei Komlev
Head of Contract Structuring and Price Formation Directorate
Gazprom Export*

9th Annual European Gas and LNG Supply Contracts Forum,
Berlin , June 18-19, 2019

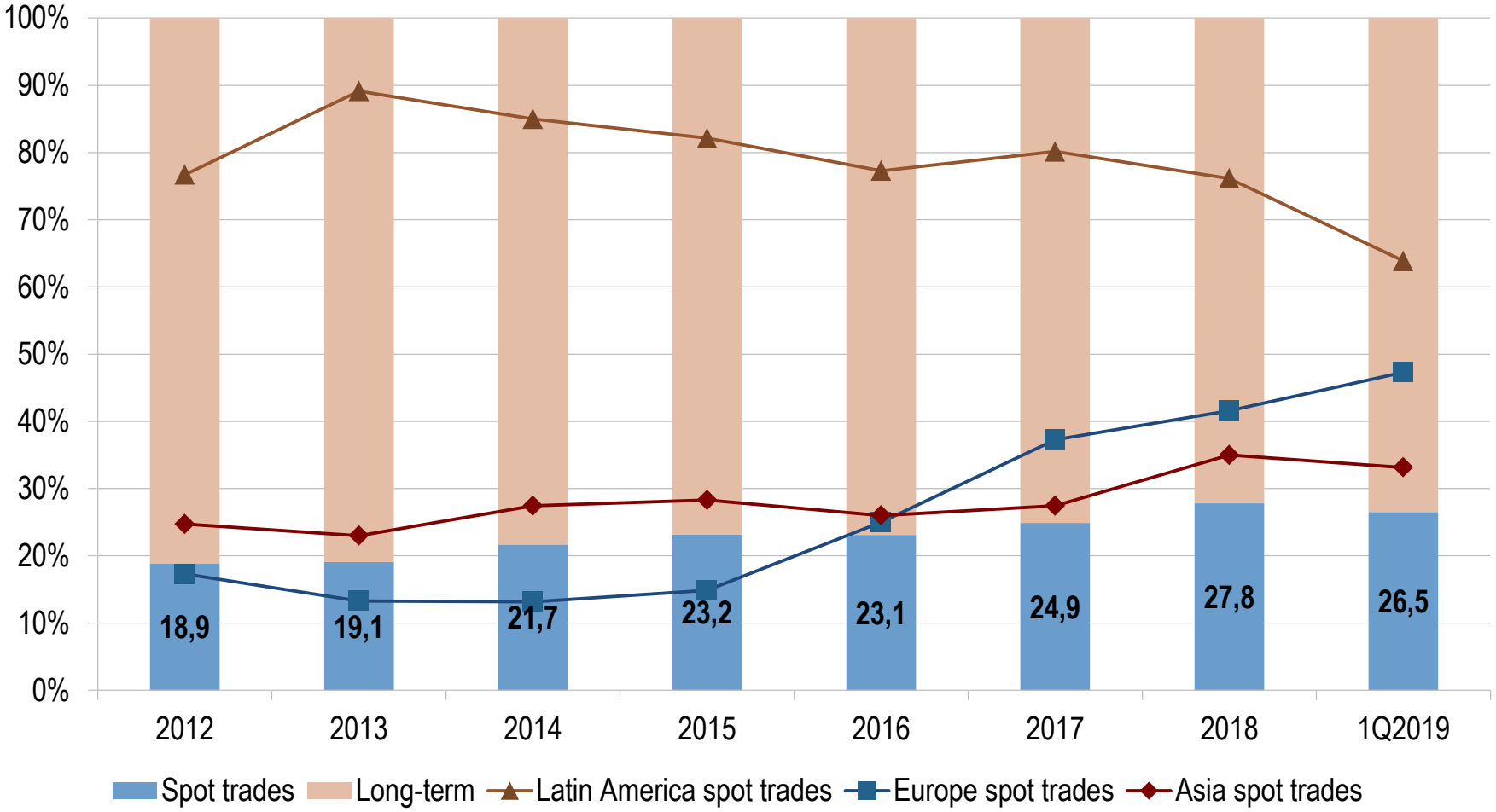
*Views expressed in this presentation are the author's sole responsibility and do not necessarily represent that of Gazprom Export

Agenda: how dominance of LTCs modifies pricing for natural gas

Impact of sales and purchase LTCs on free-range spot prices for natural gas is multidimensional.

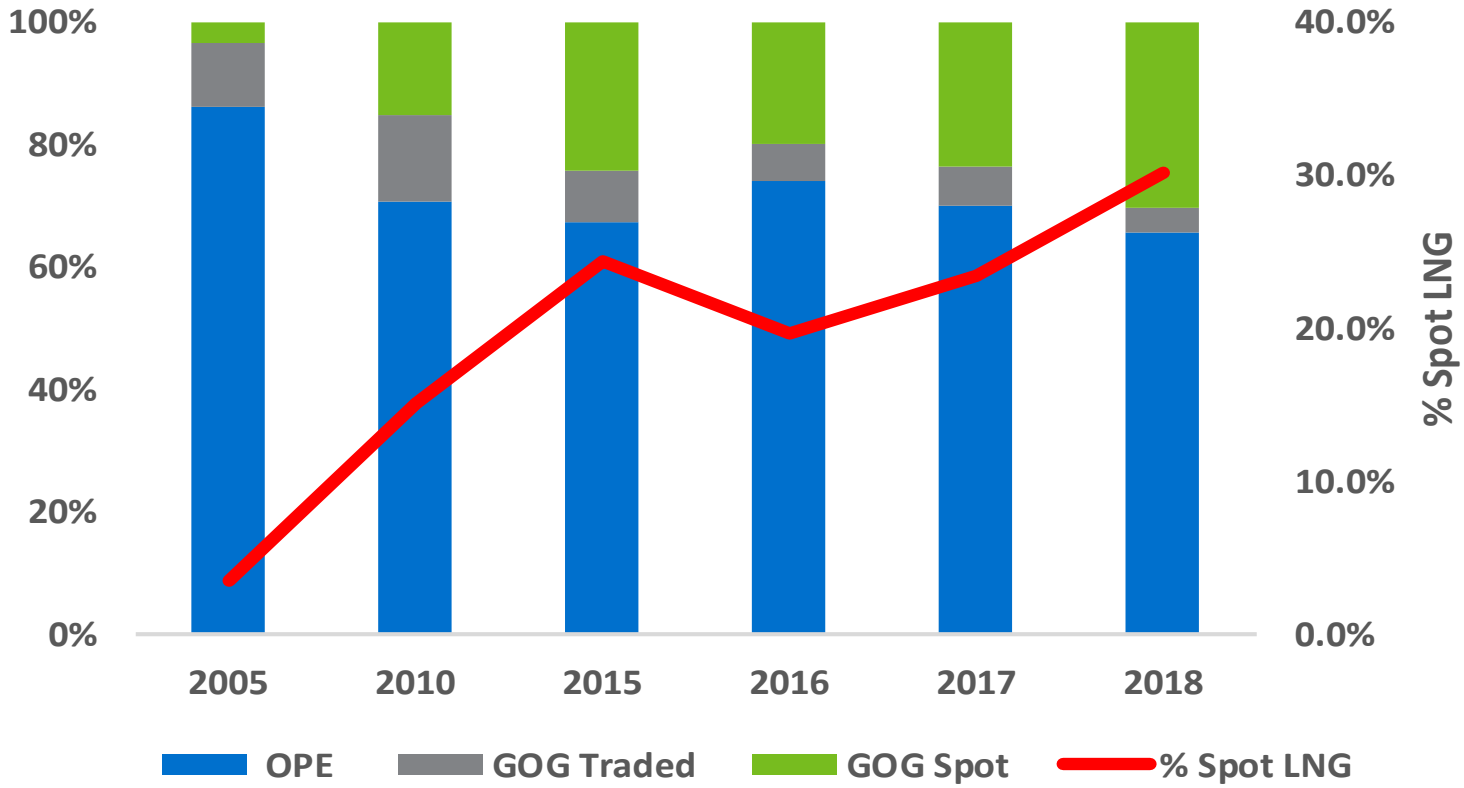
- LTCs set up a key anchor for spot/hub prices, thus creating a new center of gravity.
- Concentration of market imbalances in a relatively small uncontracted segment makes spot prices extremely volatile.
- Overcontracting leads to structural oversupply – real or virtual.
- Hybrid pricing as imminent feature of natural gas pricing.
- Practical implications of the LTCs' impact on spot pricing.

LTCs remain a cornerstone of the global market for natural gas: LNG



Source: IHS Waterborne

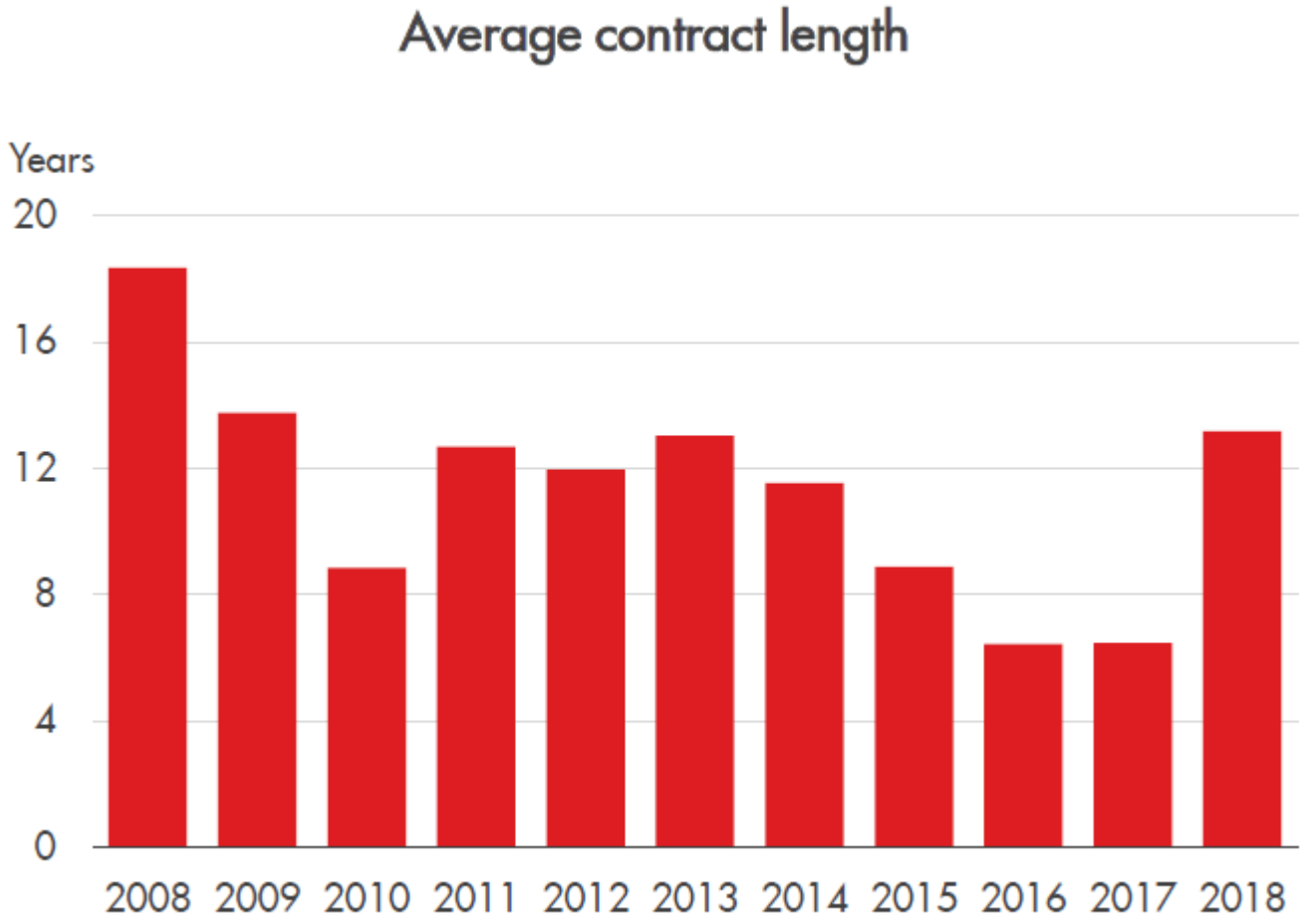
Growth of LNG spot trades occurred between 2005 and 2015



GIIGNL defines spot LNG contracts as cargoes delivered within 90 days from the transaction date and estimates their share to be 25% in 2018. GIIGNL defines volumes delivered on a spot and short-term basis as cargoes delivered under contracts of a duration of 4 years or less and estimates their share to be 32% in 2018. IGU estimate is closer to GIIGNL spot and short-term deliveries.

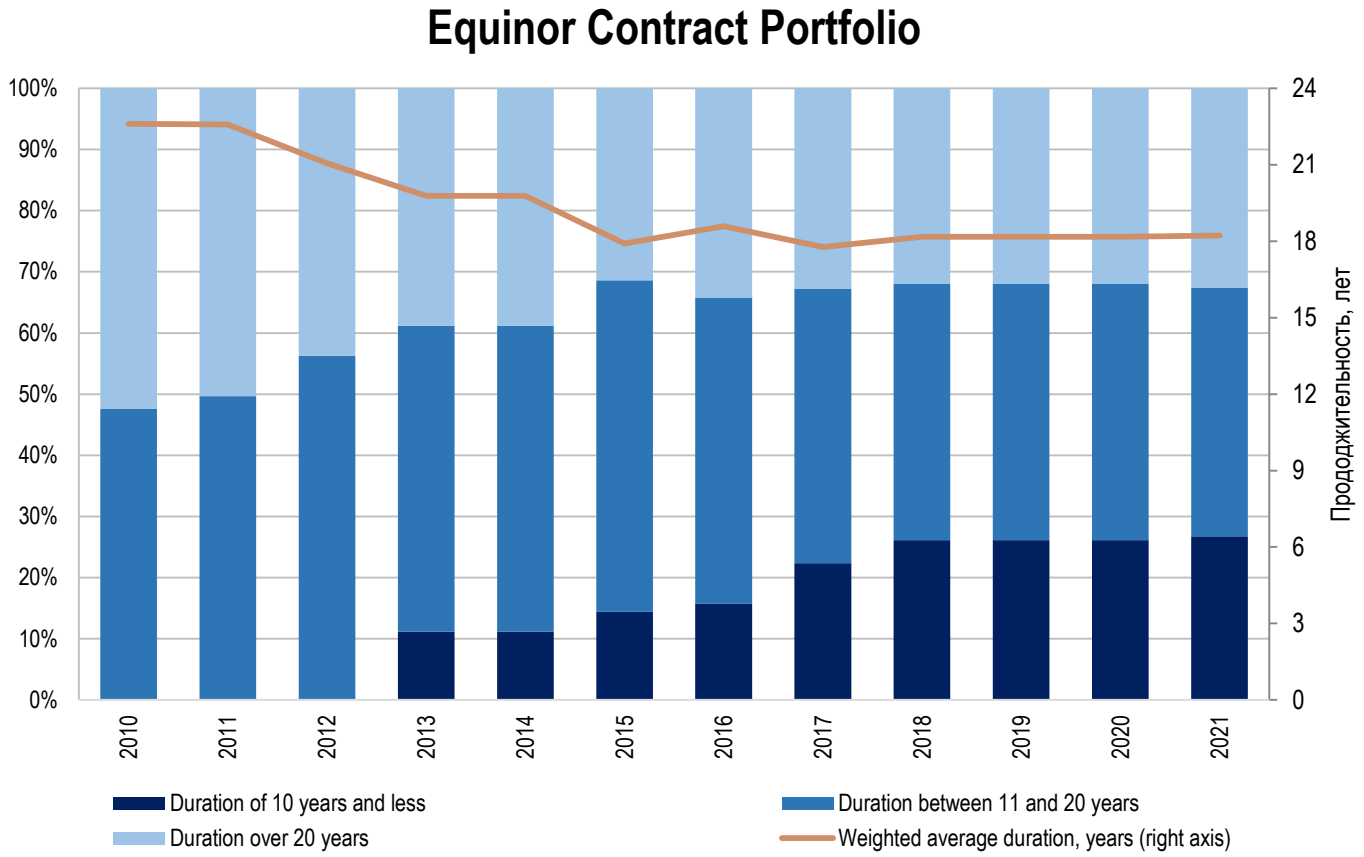
Source: IGU 2018 Price Survey Report

LNG contracts with longer duration came back in 2018 in support of new projects



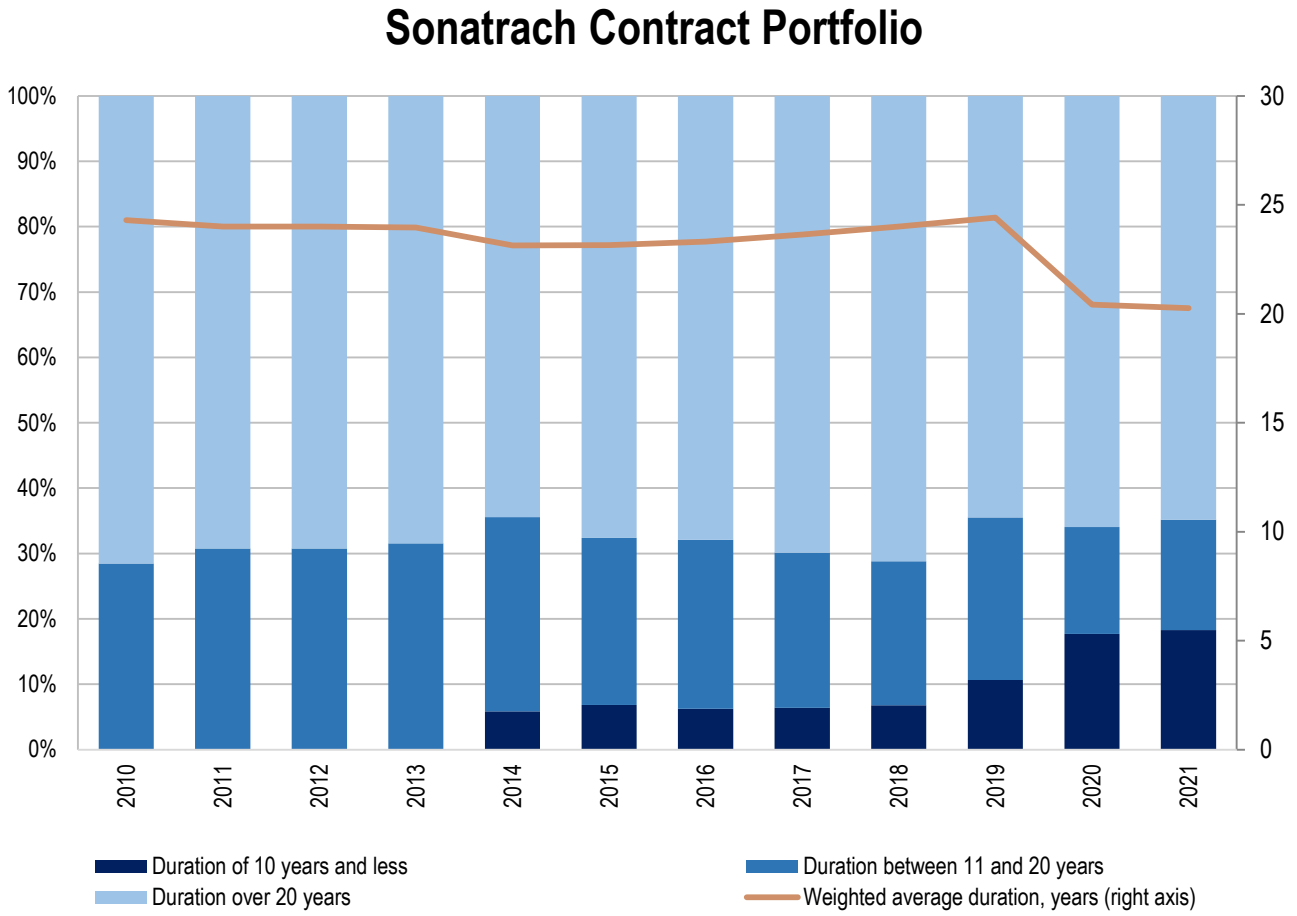
Source: Shell interpretation of IHS Markit Q4 2018 data

LTCs remain a cornerstone of the global market for natural gas: pipeline gas (1)



Source: Cedigaz and Gazprom Export

LTCs remain a cornerstone of the global market for natural gas: pipeline gas (2)

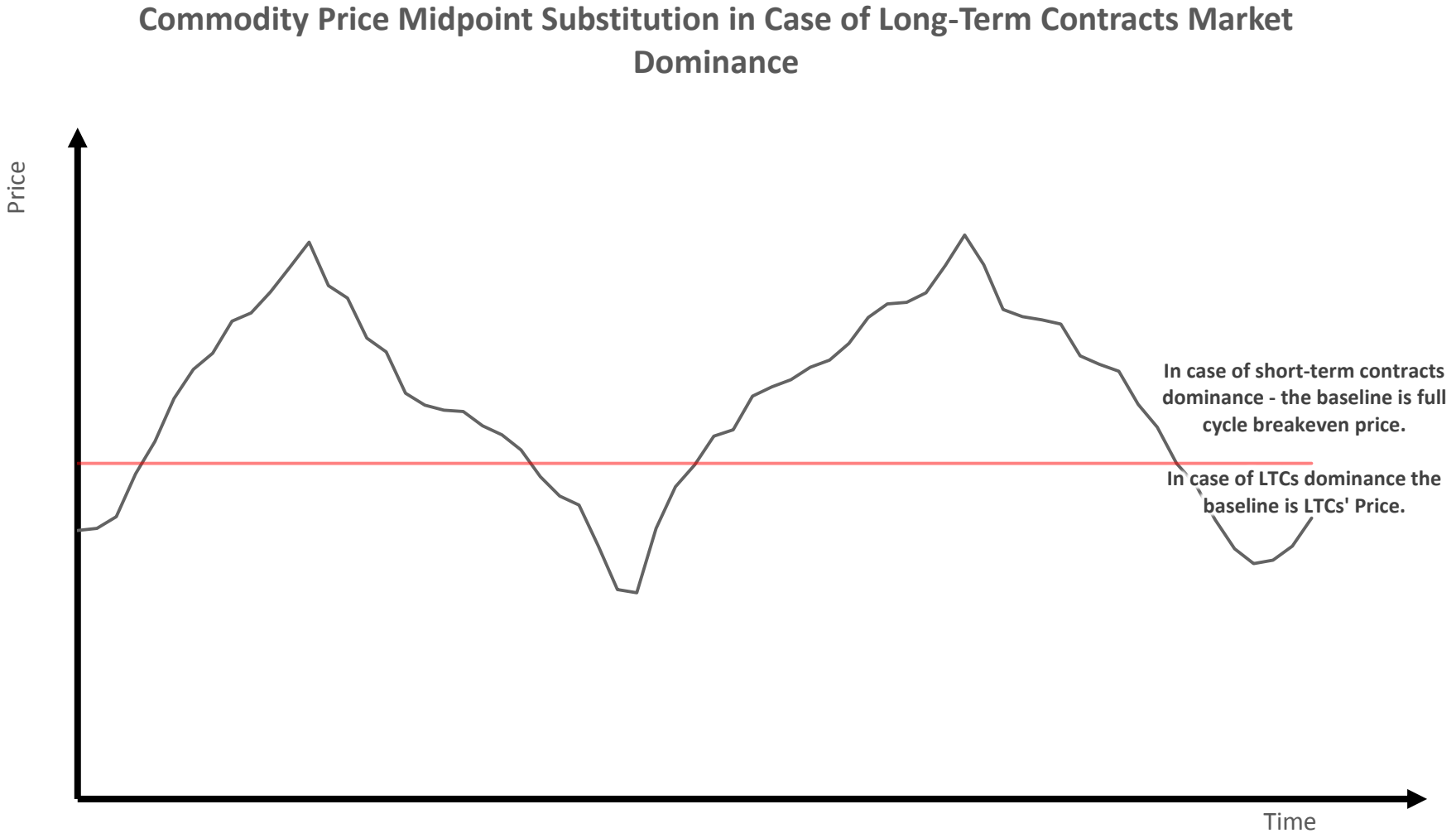


Source: Cedigaz and Gazprom Export

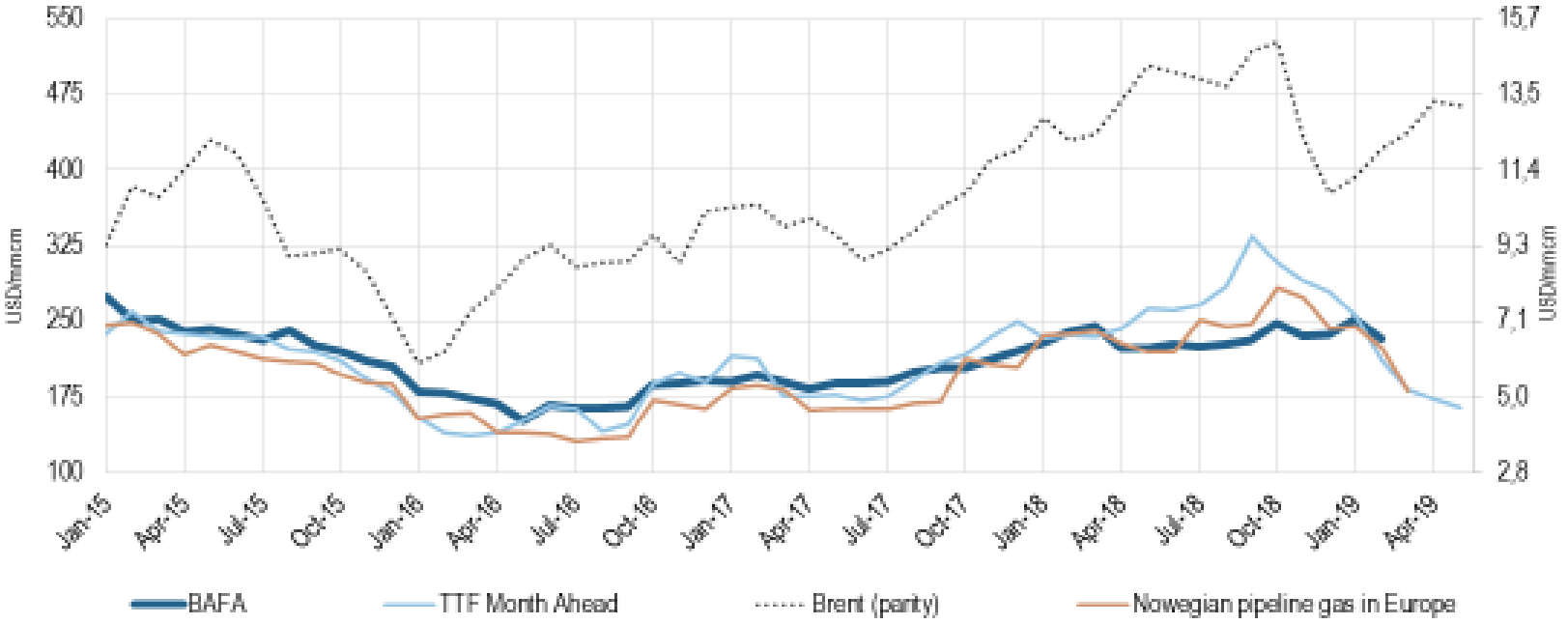
Impact of LTCs on spot prices: changed center of gravity

- Center of gravity in the world of commodities is typically an equilibrium price representing full cycle breakeven costs of production and delivery of the product to the customer.
- However, that is not a case in those industries where the long-term sales a purchase contracts are a dominant form of seller/buyer interaction. Prices of LTCs in this case are emerging as anchor price or center of gravity.
- That does not necessarily mean that prices of LTCs are strongly differ from the "normalized" costs of production and return on capital. They most likely often match, although the latter are harder to measure in a precise way compared to the LTCs prices.
- Prices of LTC nevertheless are different from the "normalized" prices by definition: they represent a long-term value of a commodity rather than its present day value. LTC's prices differ from spot prices because the later represent its up to date, unadjusted short-term value.
- Natural gas (NG) industry is a good example of such a modified center of gravity as long-term arrangements historically dominated here, as these arrangements persist in the gens of the NG industry.

LTCs as center of gravity for spot/prompt hub prices in NG industry

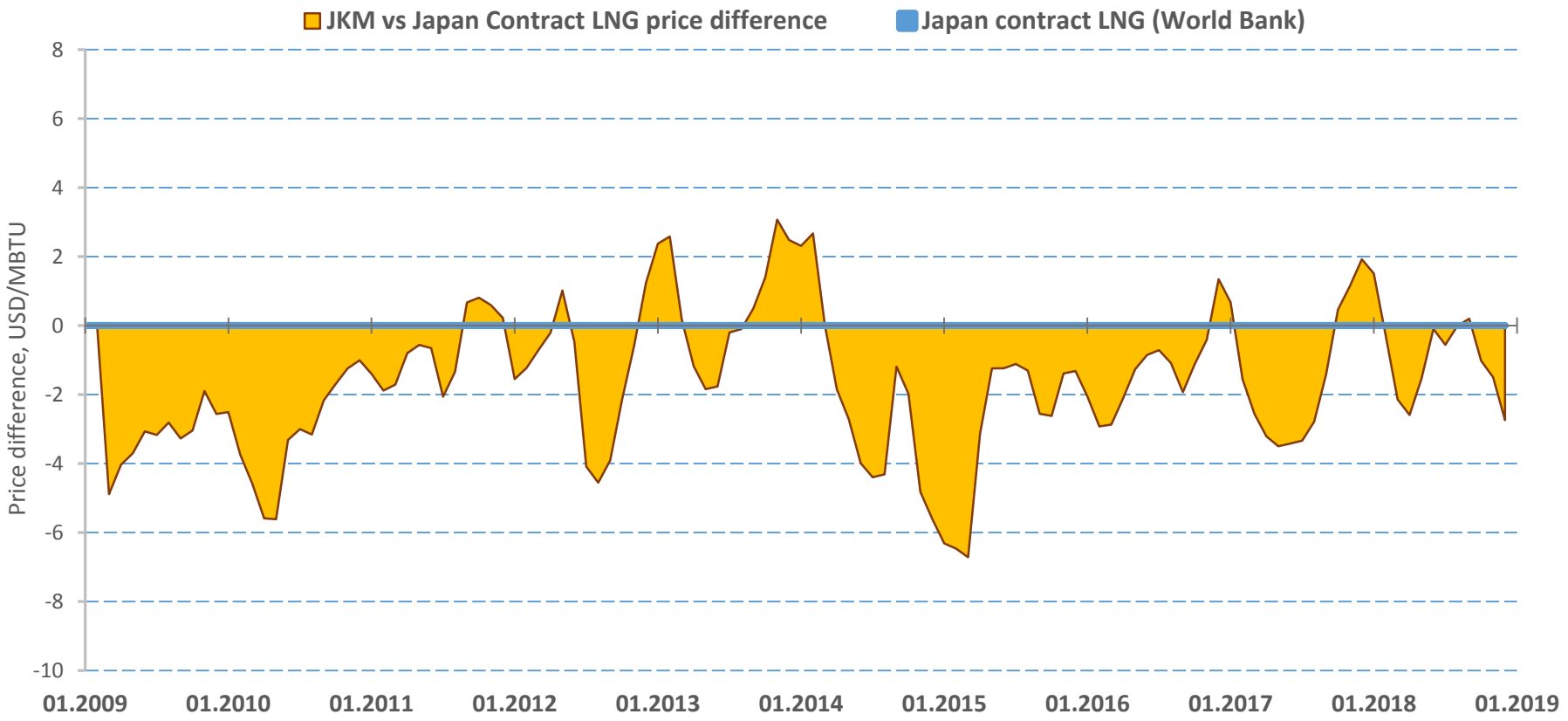


LTCs as center of gravity for spot/prompt hub prices in NG industry: Europe



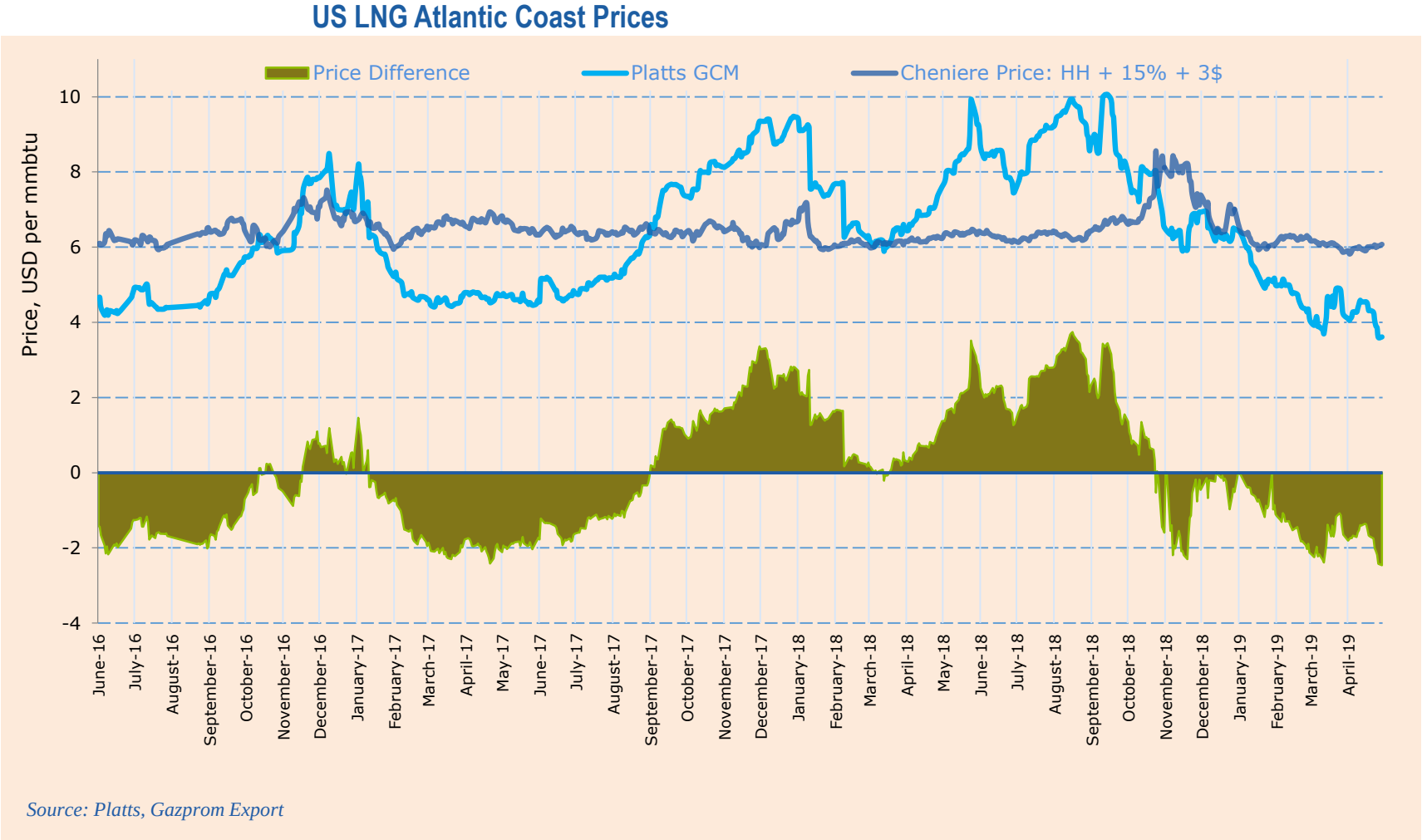
Sources: BAFA, Bloomberg, Norvegian National Statistics

LTCs as center of gravity for spot/prompt hub prices in NG industry: Japan



Source: World Bank, JKM

LTCs as center of gravity for spot prices in NG industry: USA



Source: Platts, Gazprom Export

Source: Platts

Impact of LTCs on spot prices: term contract share determines size of demand available for spot deliveries

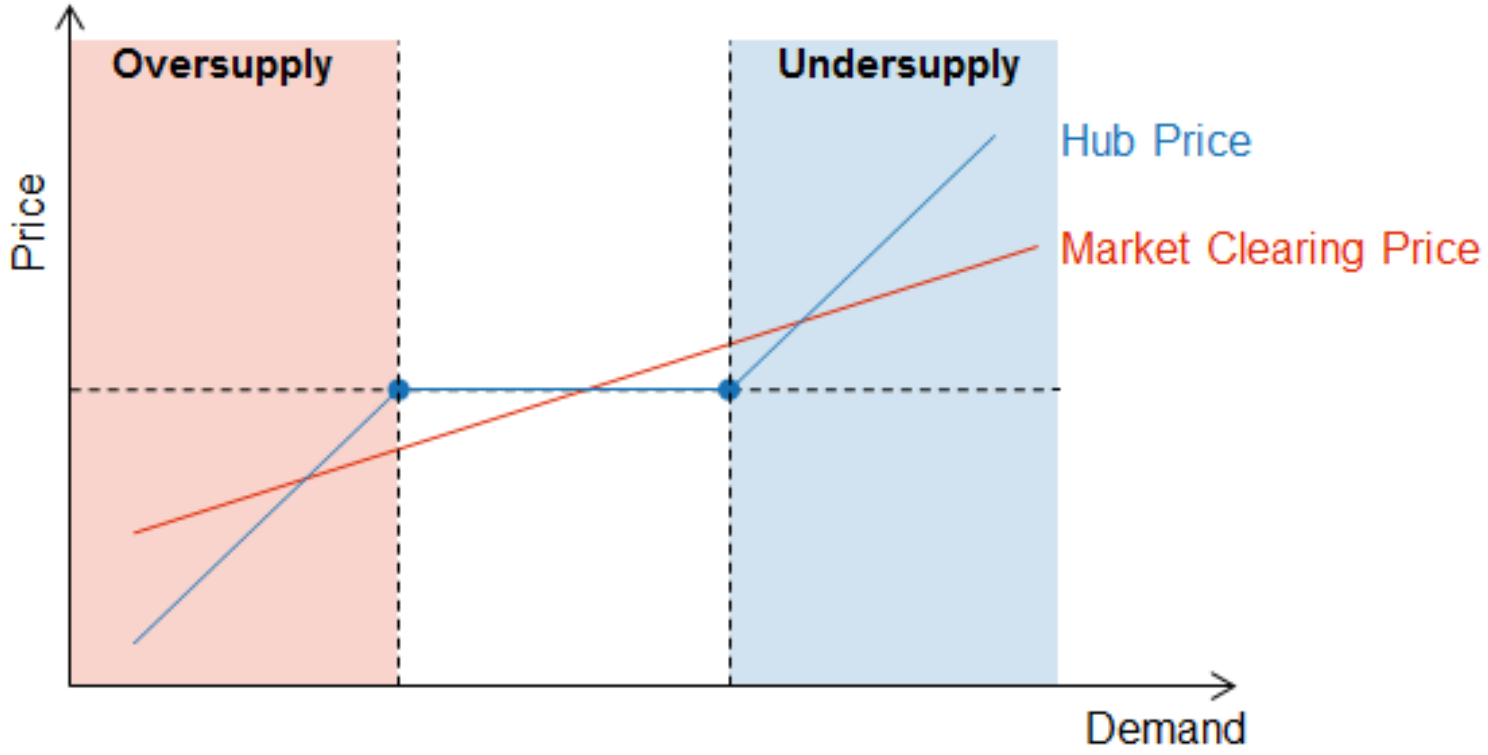
Regional markets for NG typically fall into two uneven segments. One part of the demand is met by LTCs, another part by spot deliveries. Supply/demand balances in the uncontracted market segment determine spot prices.

LTCs in case of their dominance not only generate an anchor price for the spot/hub prices but also directly determine magnitude of deviation from that anchor price by setting the size of demand available for the spot deliveries.

When market is in 'undersupply', the larger is the size of uncontracted market segment is absolute terms the higher is spot price compared to a baseline price of the LTCs.

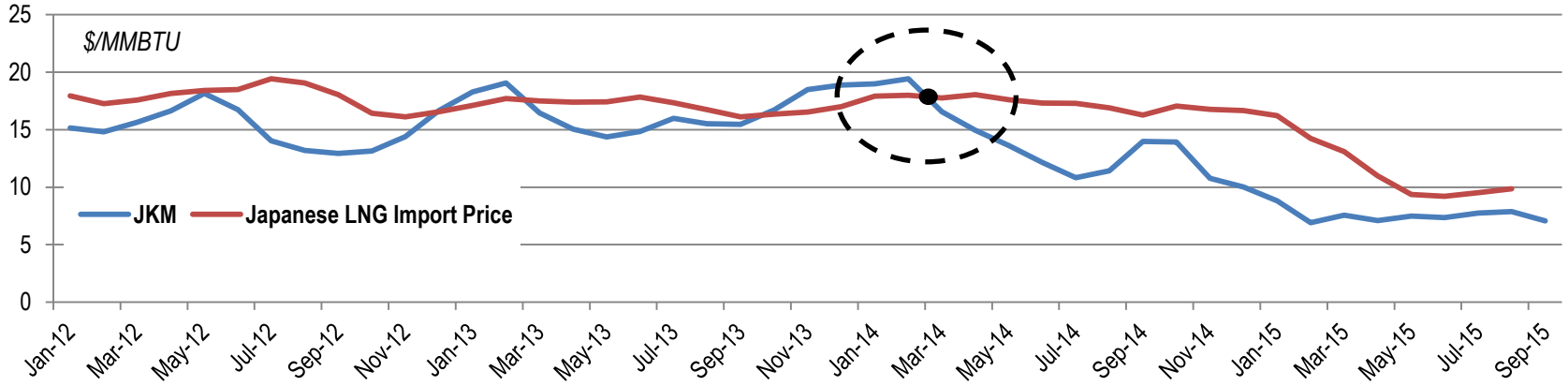
When market is in 'oversupply', the smaller is the size of uncontracted market segment is absolute terms the higher is spot price compared baseline price of the LTCs. Sellers of LNG often push buyers for the larger offtake from the LTCs when contract prices are higher than spot. As a result spot prices drop below LTCs' prices even further as relatively larger uncontracted volumes of gas compete for a smaller sized spot segment of the market.

Spot prices overreact compared to a situation when the whole market is in ‘oversupply’ or in ‘undersupply’

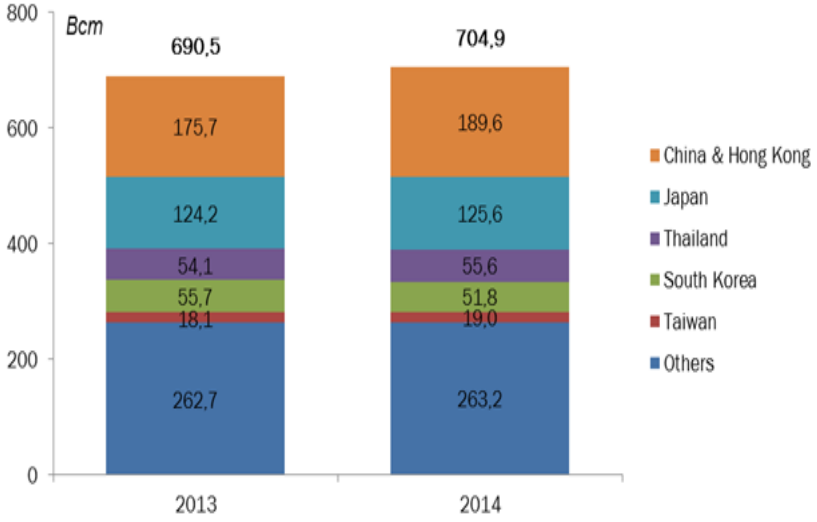


Source: Compass Lexecon

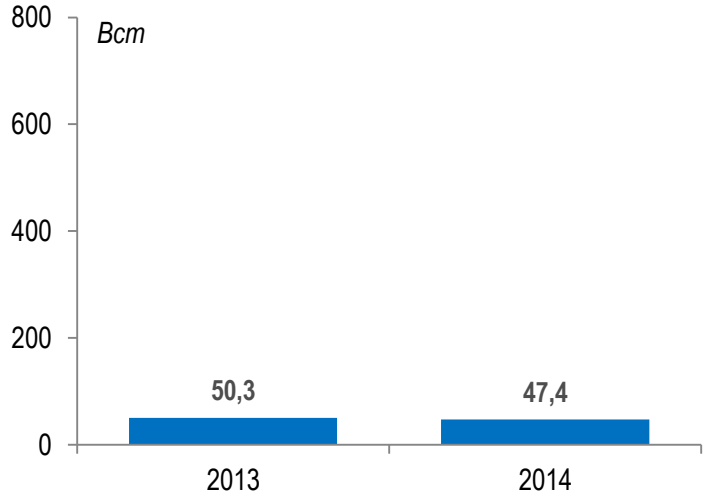
Spot prices in Asia collapsed in March 2014 due to insignificant supply/demand mismatch in uncontracted market segment



Gas Consumption in Asia



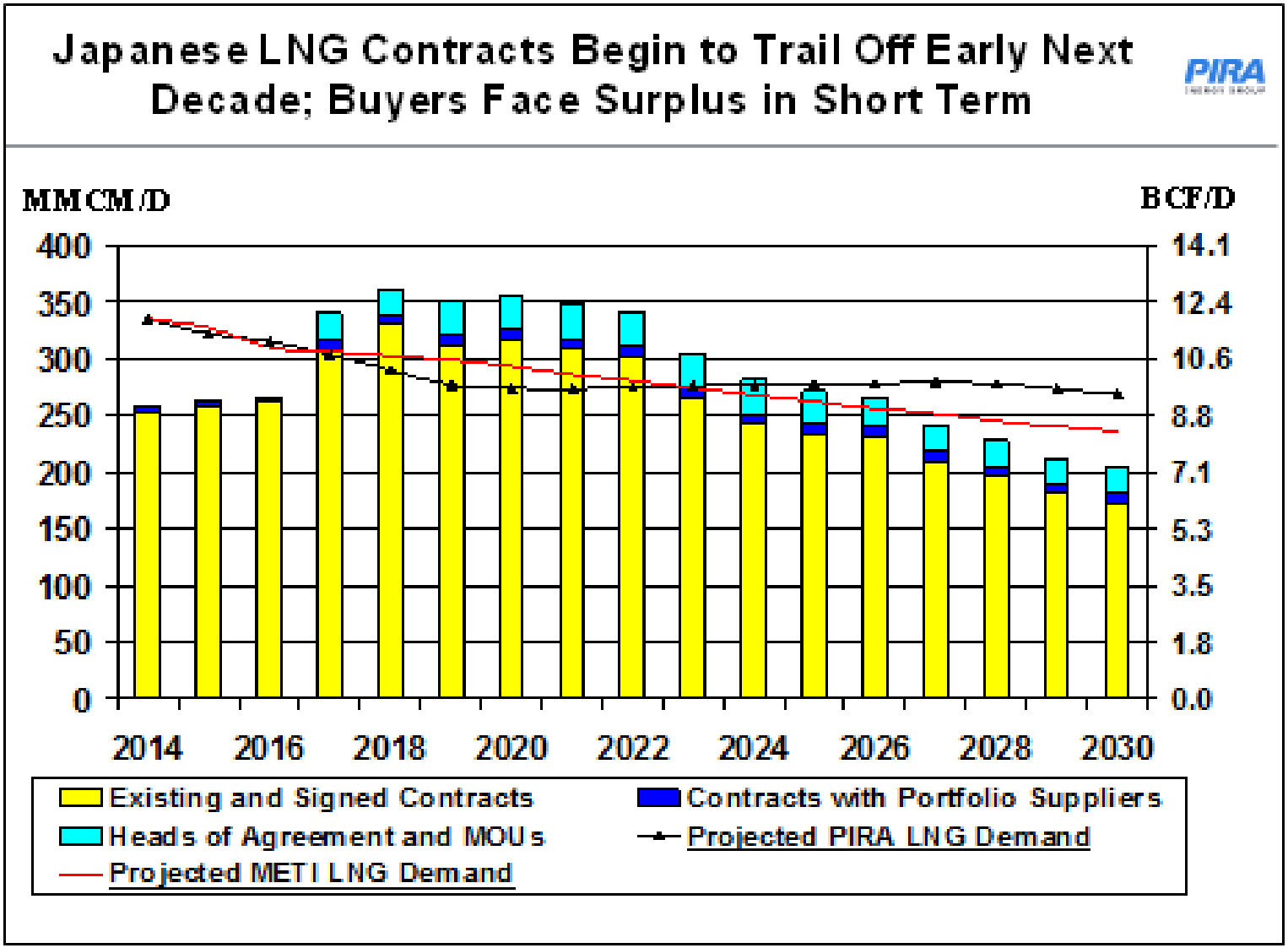
Spot and Short-Term Trade* in Asia



** Contracts of a duration of 2 years or less*

Source: Bloomberg, Cedigaz, IHS, METI

Deviation of spot prices from LTCs prices in Q1 2019 results to a large extend from overcontracting

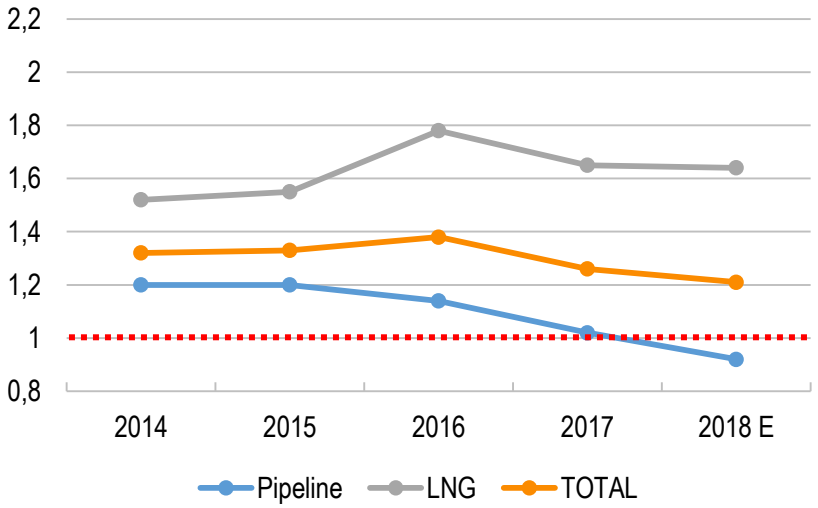


“Contract to import” index by type of supply in 2014-2018

$$\text{“Contract to import index”} = \frac{\text{aggregate contract ACQs}}{\text{natural gas imports}}$$

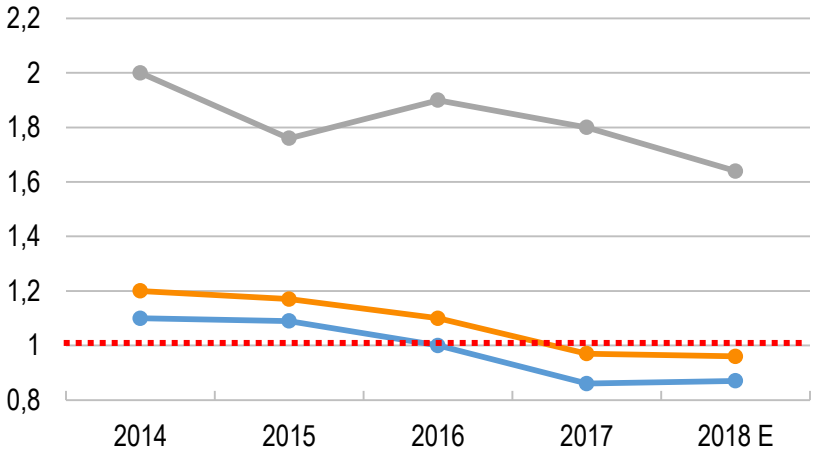
World index

Type of supply	2014	2015	2016	2017	2018 E
Pipeline	1,20	1,20	1,14	1,02	0,92
LNG	1,52	1,55	1,78	1,65	1,64
TOTAL	1,32	1,33	1,38	1,26	1,21



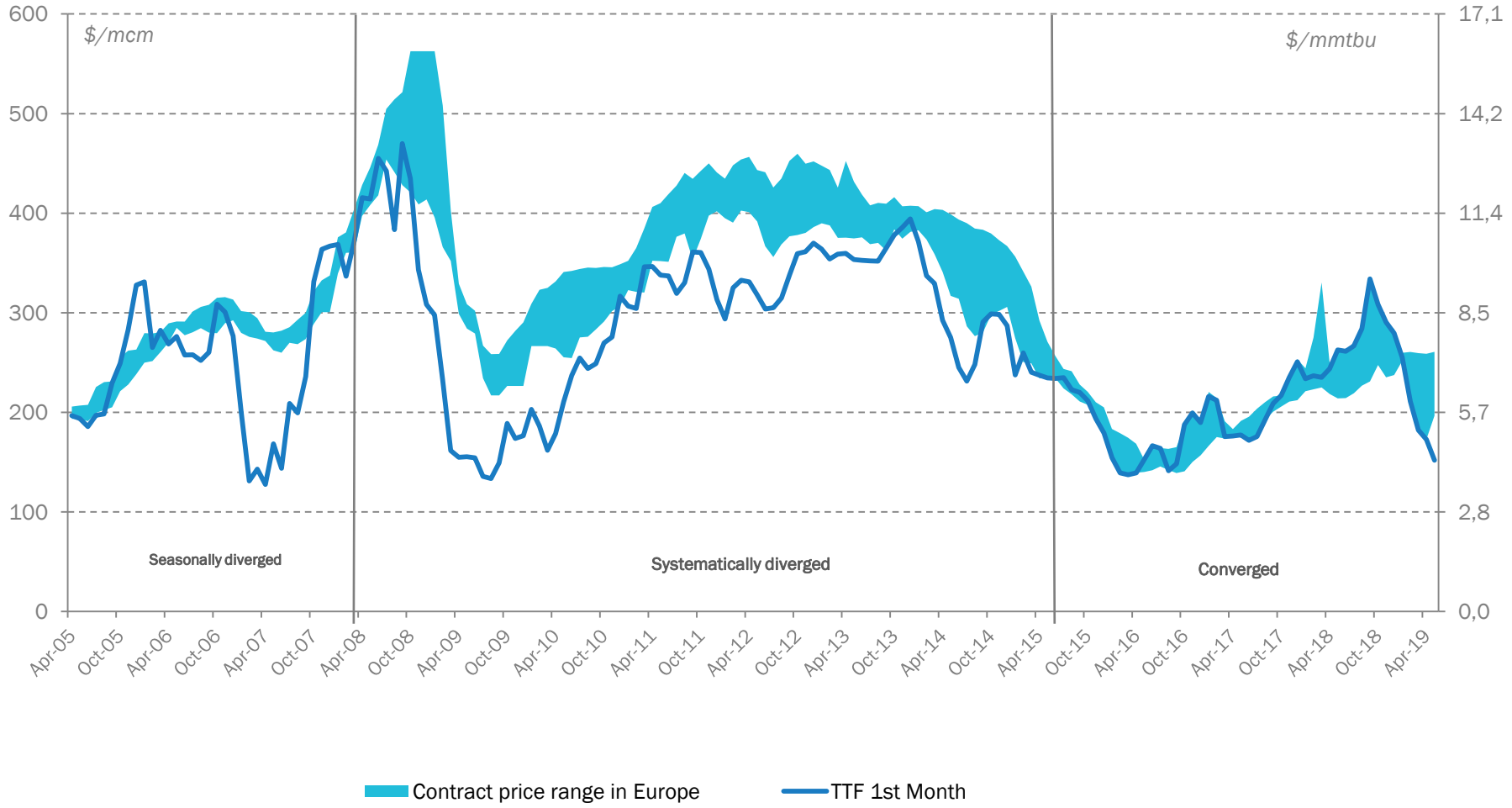
European index

Type of supply	2014	2015	2016	2017	2018 E
Pipeline	1,10	1,09	1,00	0,86	0,87
LNG	2,00	1,76	1,90	1,80	1,64
TOTAL	1,20	1,17	1,10	0,97	0,96



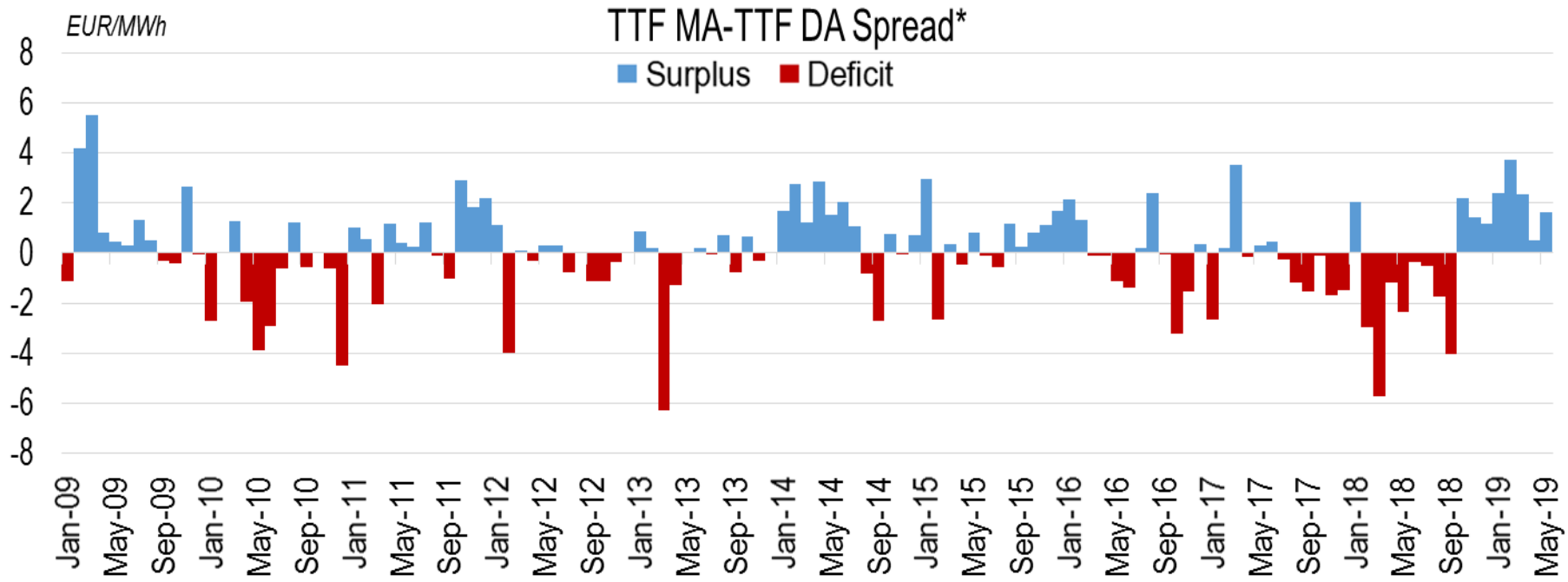
Source: Cedigaz, IHS, GPE calculations for contracts with duration over one year

Demand growth, LTCs adjustment and their expiration led to contract/hub price convergence



Source: Bloomberg, IMF, WB, GPE

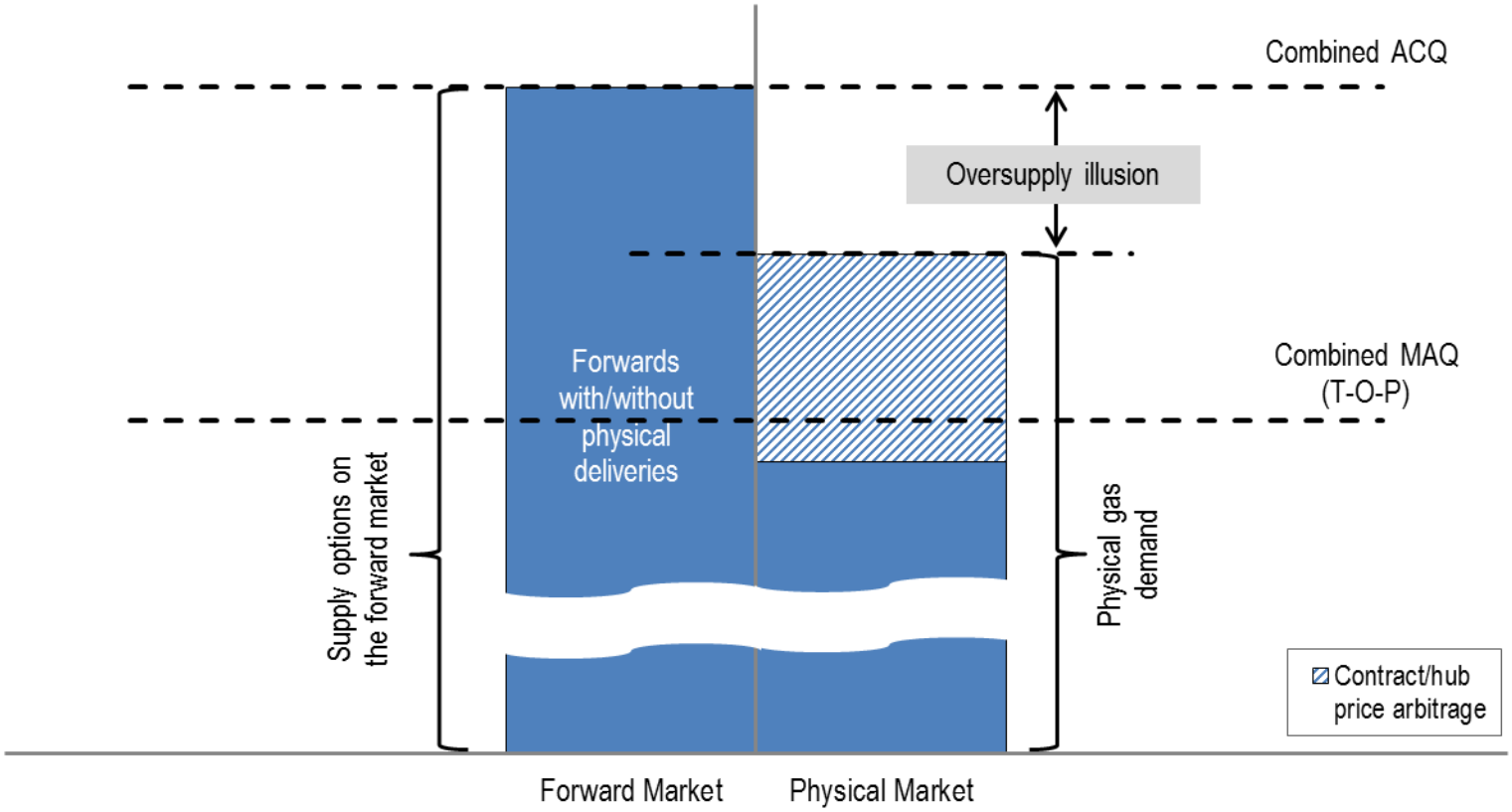
2009-2014 structural oversupply – real or virtual?



- Spread between month-ahead price (historic) and monthly average of day-ahead price is a highly important indicator of market tightness/looseness. There are no indications that European gas market was permanently physically oversupplied in 2009-2014. In 2010 and 2012 market was short judging by this indicator.

Sources: Argus

Illusion of oversupply created by monetization of contract commitments on the European forward market



Source: GPE

Hybridization of spot/hub prices means that their price level is determined by dual forces: gas-on-gas competition and gas-on-substitute competition

- Market prices of natural gas are set up by two forms of competition – gas-on-substitute (interfuel) and gas-on-gas competition. No other global commodity is characterized by this duality.
- Hybridization of spot/hub prices takes two forms.
- Directly and independently from the LTCs by setting up price corridor with oil-prices being a ceiling and coal prices a floor.
- Indirectly via the impact of oil-indexed LTCs which set base-line trajectory for their movement.
- Role of the indirect form of spot price hybridization has decreased in Europe while the importance of the direct impact only increased over time.
- LTCs have also become hybrids on a micro level as they include spot price components in the formula on a broader scale.

While in Groningen-Type LTCs outcomes of different forms of competition are deliberately separated in time, spot prices are subject to their simultaneous interaction

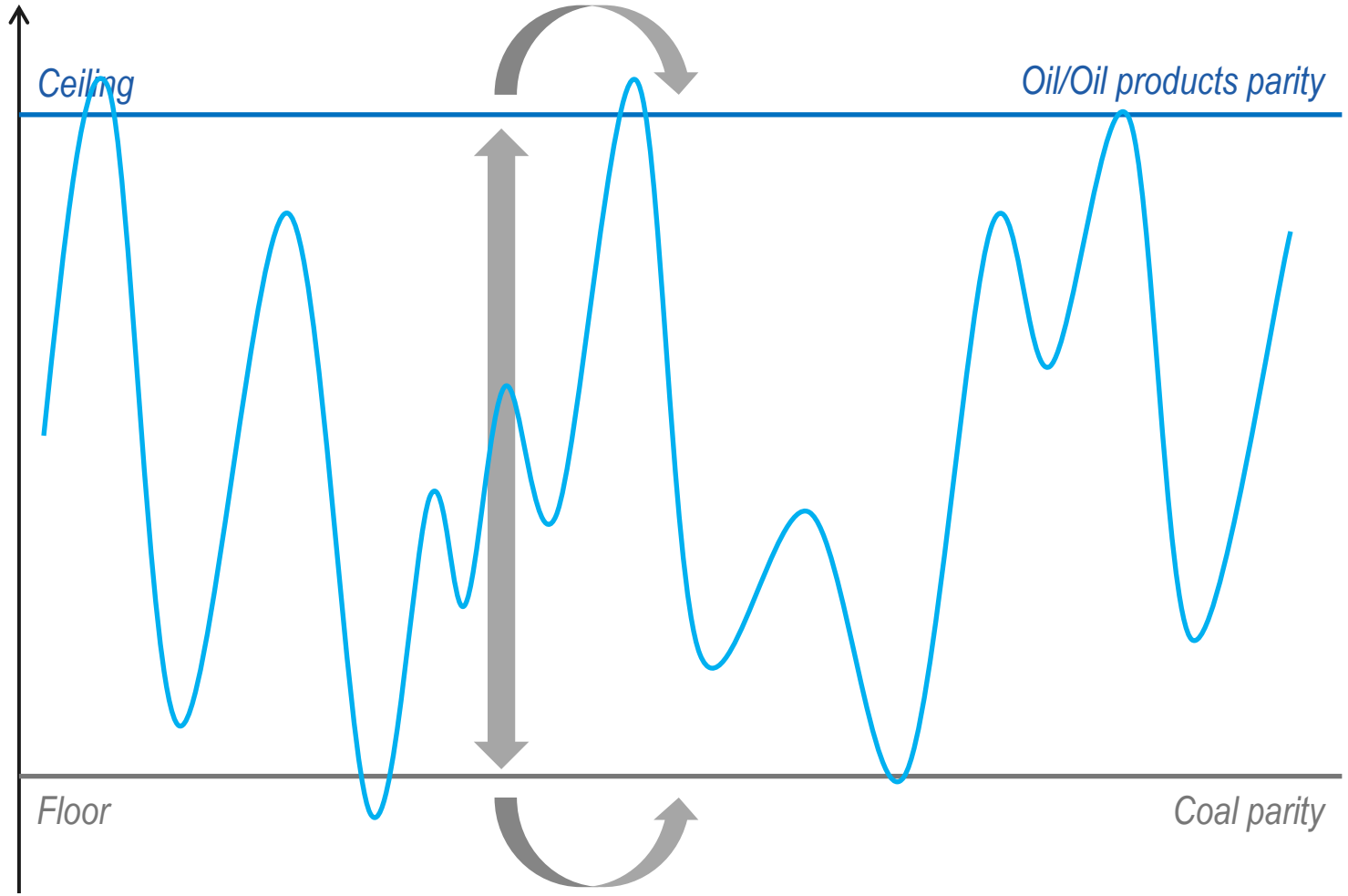
Life Cycle of an LTC

Phase 1	Phase 2	Phase 3
Estimation of P_0 based on benchmarking*	Price escalation in line with price dynamics of the competing fuels	With price renegotiation triggers in place, possible formulae adjustment together with the retroactive payments
Gas-on-gas	Gas-on-substitute	Gas-on-gas

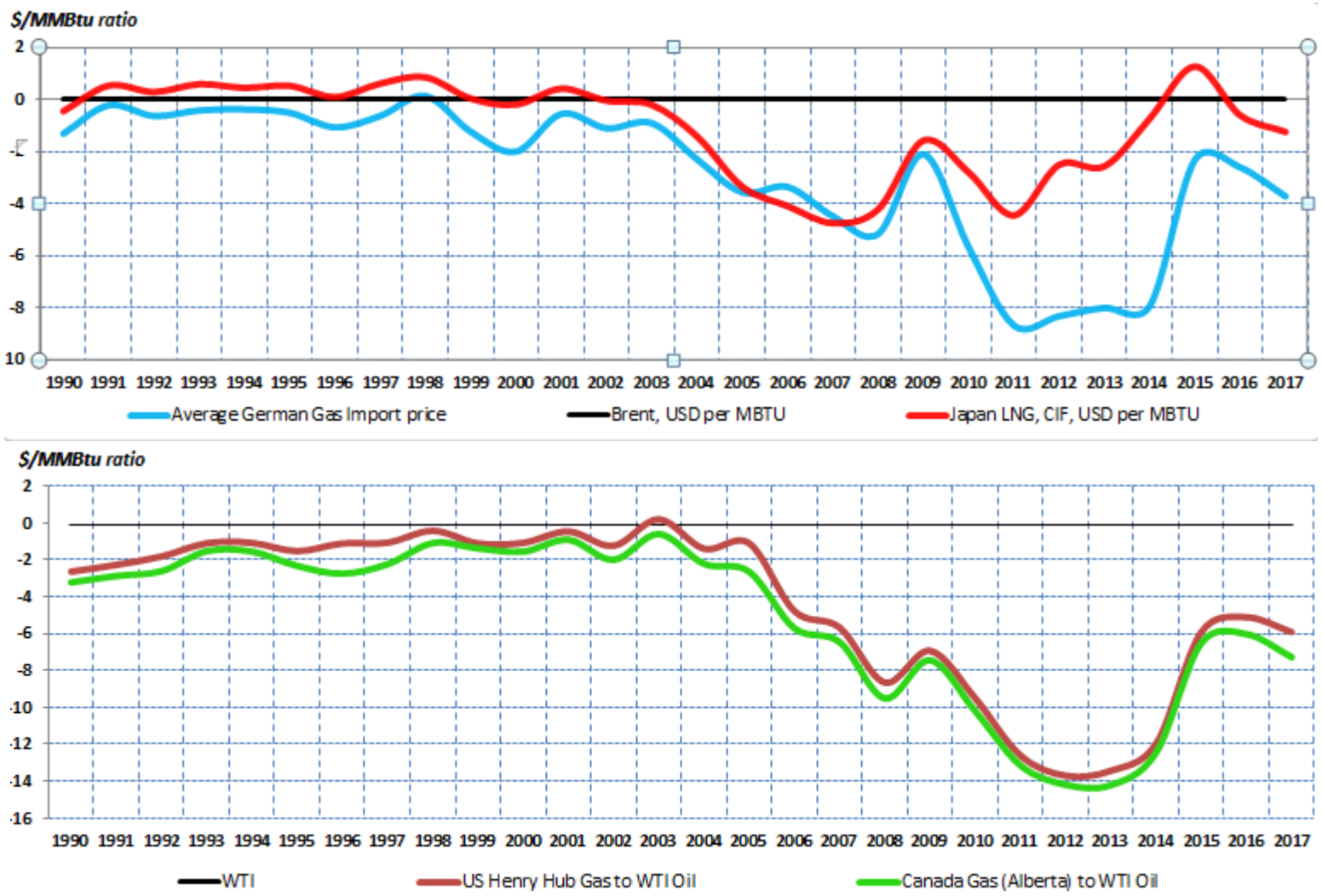
Prevailing form of competition

*benchmarking – comparison of prices of similar size and terms on a country border/beach

Free prices on hubs are range-bound: inter-fuel competition sets up corridor for them

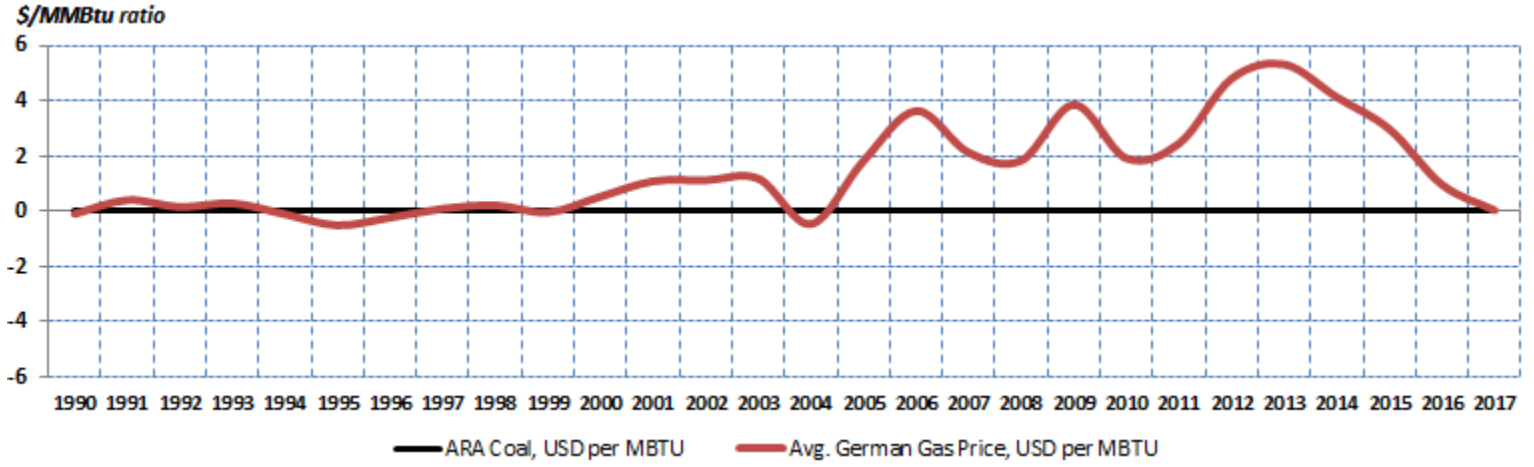


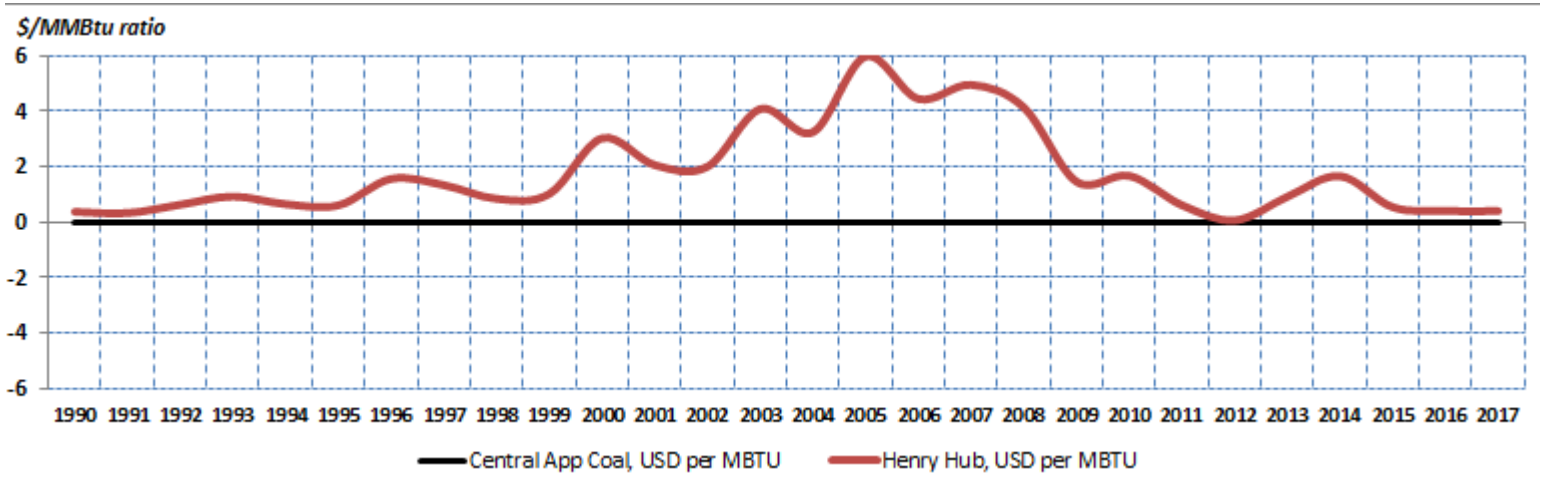
Inter-fuel competition at work: oil price sets resistance level for natural gas prices



Source: BP, Gazprom Export

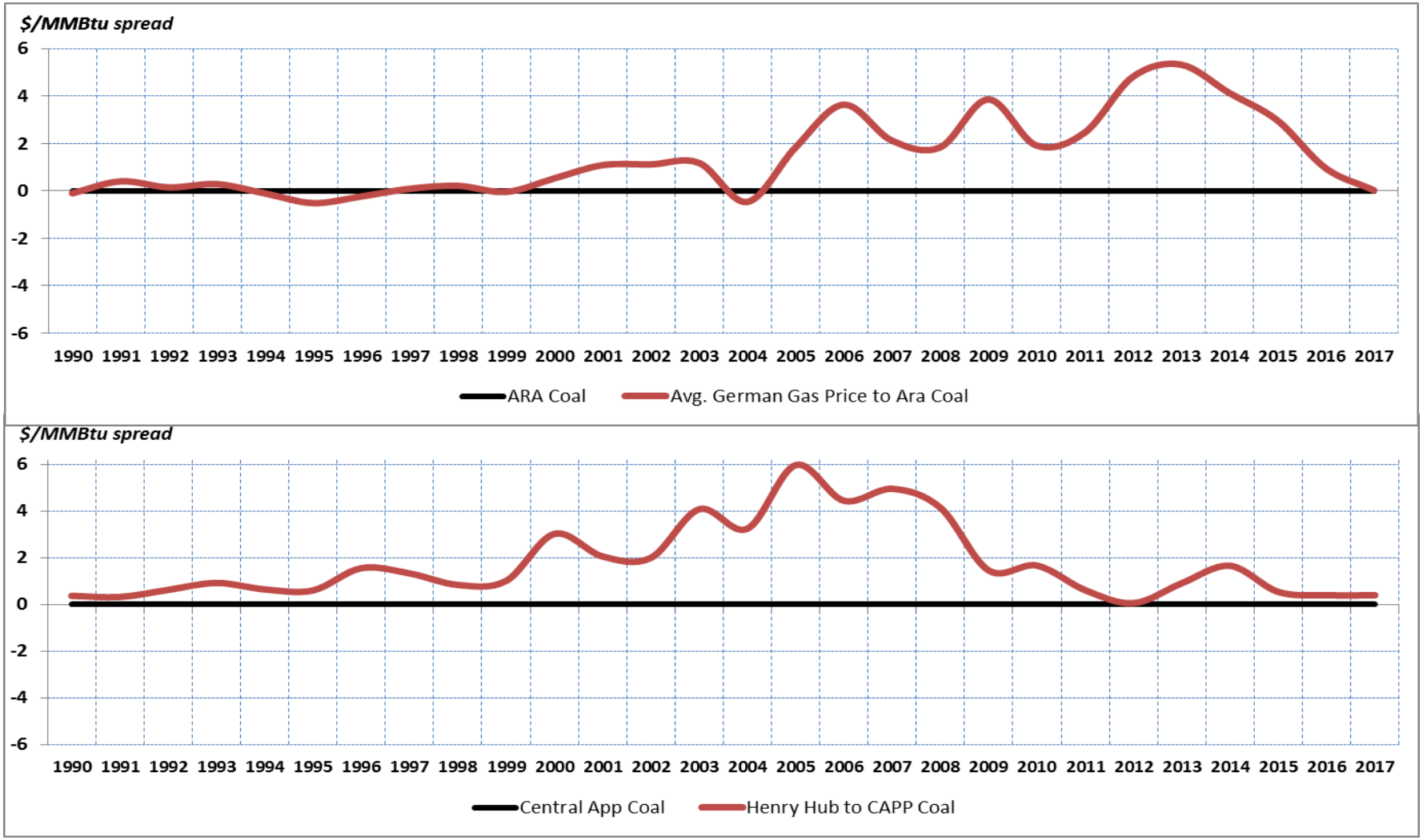
Inter-fuel Competition at Work: Coal Price Sets Support Level for Natural Gas Prices in Europe and US





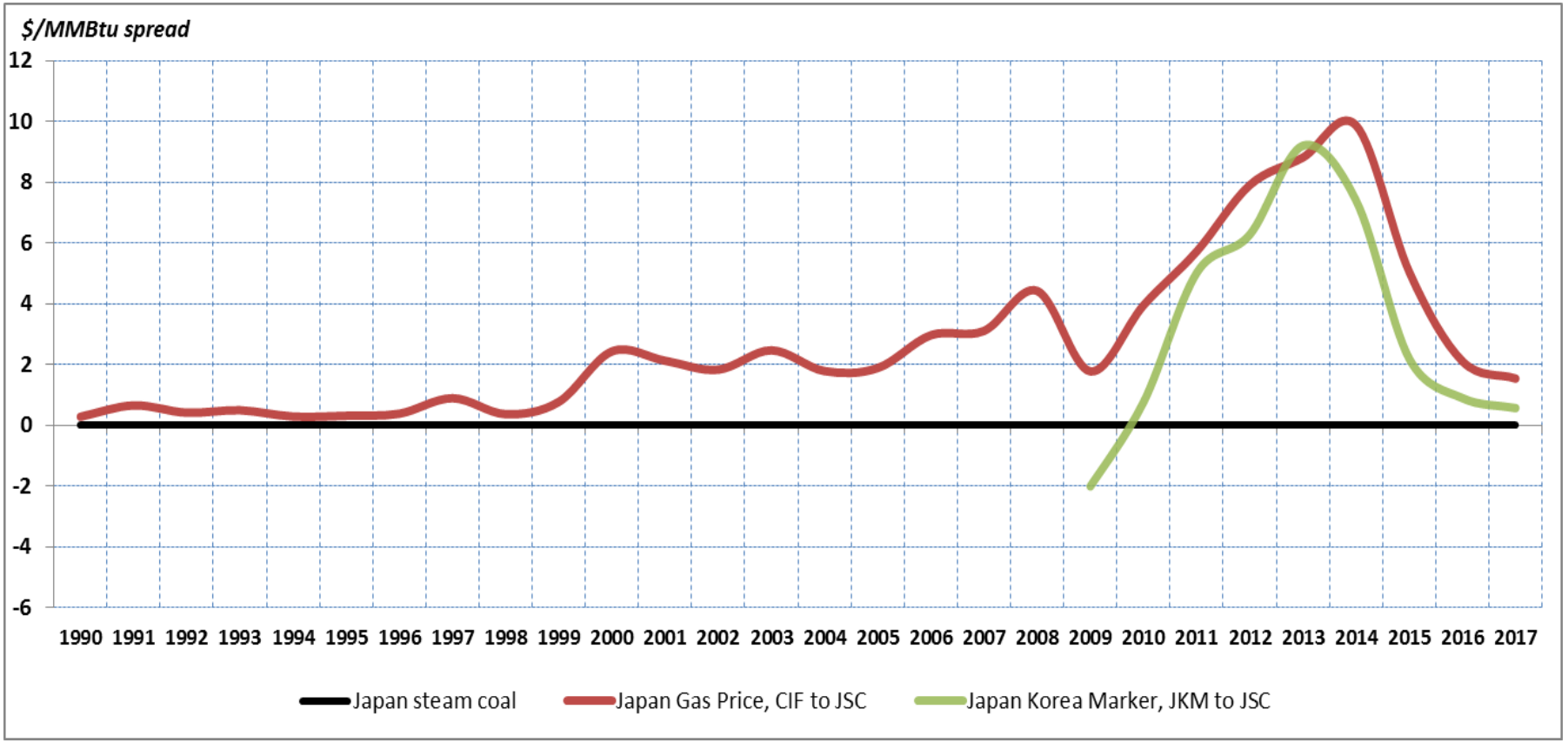
Source: BP, Gazprom Export

Interfuel competition at work: coal price sets a support level for natural gas prices in Europe and the USA



Source: BP, Gazprom Export

Interfuel competition at work: coal price sets a support level for natural gas prices in Japan



Source: BP, Gazprom Export

Direct price hybridization: correlation analysis indicates that TTF price is dependent on prices of gas substitutes

Correlation Ratio	2009-2018	2009-2013	2014-2018	2016-2018
Brent-TTF	82,6%	82,9%	78,1%	90,5%
Brent-TTF 3M	80,2%	77,5%	78,1%	85,6%
Brent-TTF 6M	75,4%	63,5%	81,2%	77,5%
Brent-TTF 9M	70,3%	48,7%	83,2%	69,1%
Brent 3M-TTF	84,8%	84,8%	80,9%	94,0%
Brent 6M-TTF	87,0%	89,8%	81,5%	93,8%
Brent 9M-TTF	86,1%	91,1%	79,2%	92,7%
Brent 6M(+1M)-TTF	86,7%	90,5%	80,1%	91,5%
Brent 6M(+2M)-TTF	85,1%	89,3%	77,8%	88,4%
Brent 6M(+3M)-TTF	82,1%	85,1%	74,9%	84,6%
CIF ARA-TTF	61,3%	52,9%	52,7%	84,8%
CIF ARA-TTF 3M	54,3%	47,3%	40,7%	78,1%
CIF ARAI-TTF 6M	42,2%	33,3%	24,5%	66,6%
CIF ARA-TTF 9M	29,6%	15,5%	12,3%	54,5%

Source: Gazprom Export **** TTF month-ahead price***

All exchange traded goods have strong correlation with oil due to commodity super cycle: not a sound explanation

	Beef	Meat, chicken	Meat, sheep*	Swine (pork)	Bananas, Central American and Ecuador	Orange Juice	Natural gas, Europe
1990-2018	74%	79%	79%	37%	72%	47%	92%
1995-2018	74%	76%	76%	51%	69%	58%	90%
2000-2018	61%	65%	65%	65%	58%	54%	86%
2005-2018	25%	32%	32%	60%	11%	14%	73%
2010-2018	25%	32%	32%	60%	11%	14%	73%
2016-2018	14%	53%	84%	-9%	67%	-3%	90%

Despite commonalities in price behavior over the last 25 years, commodities by few exceptions had a strong momentum of their own after the 2008 crisis

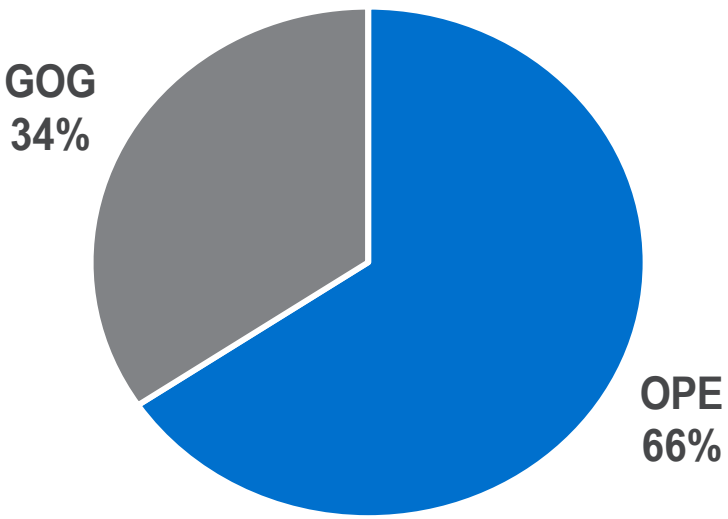
Source: based on IMF and WB data (monthly)

Indirect spot price hybridization

- LTCs objective is to represent long-term value of NG, while spot traded gas targets its present-day value. Different longevity determines difference in pricing preferences for them.
- Preferred option for the spot volumes are prompt prices which are the most sensitive to supply and demand balances.
- Prices in LTCs are largely formulas-based and use various forms on averaging making them less responsible to the supply and demand signals compared to the spot prices. Oil-indexation representing gas-on-substitute form of competition is the best fit for LTCs.
- Even if oil-indexation elements are being substituted by hub ones, prices of LTCs exercise strong influence over hub prices and are setting up a trajectory for their movement by acting as "price anchor".
- Hub prices are therefore not fully independent: they are derivatives of the contract prices that set a baseline trend for their behavior. Supply and demand only mutate their changes.

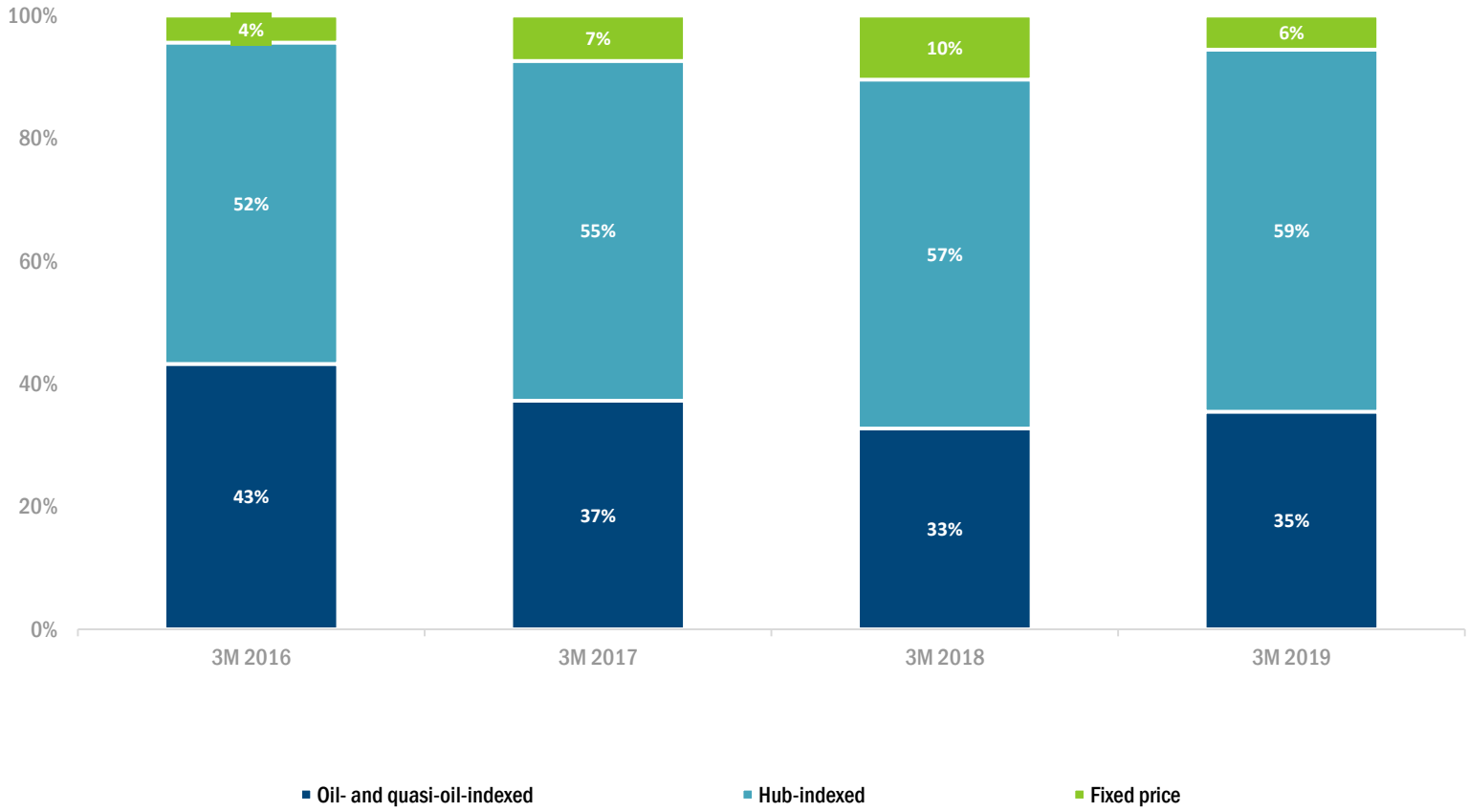
Indirect hybridization: impact of oil-indexed LTCs on LNG spot prices

2018 LNG Imports

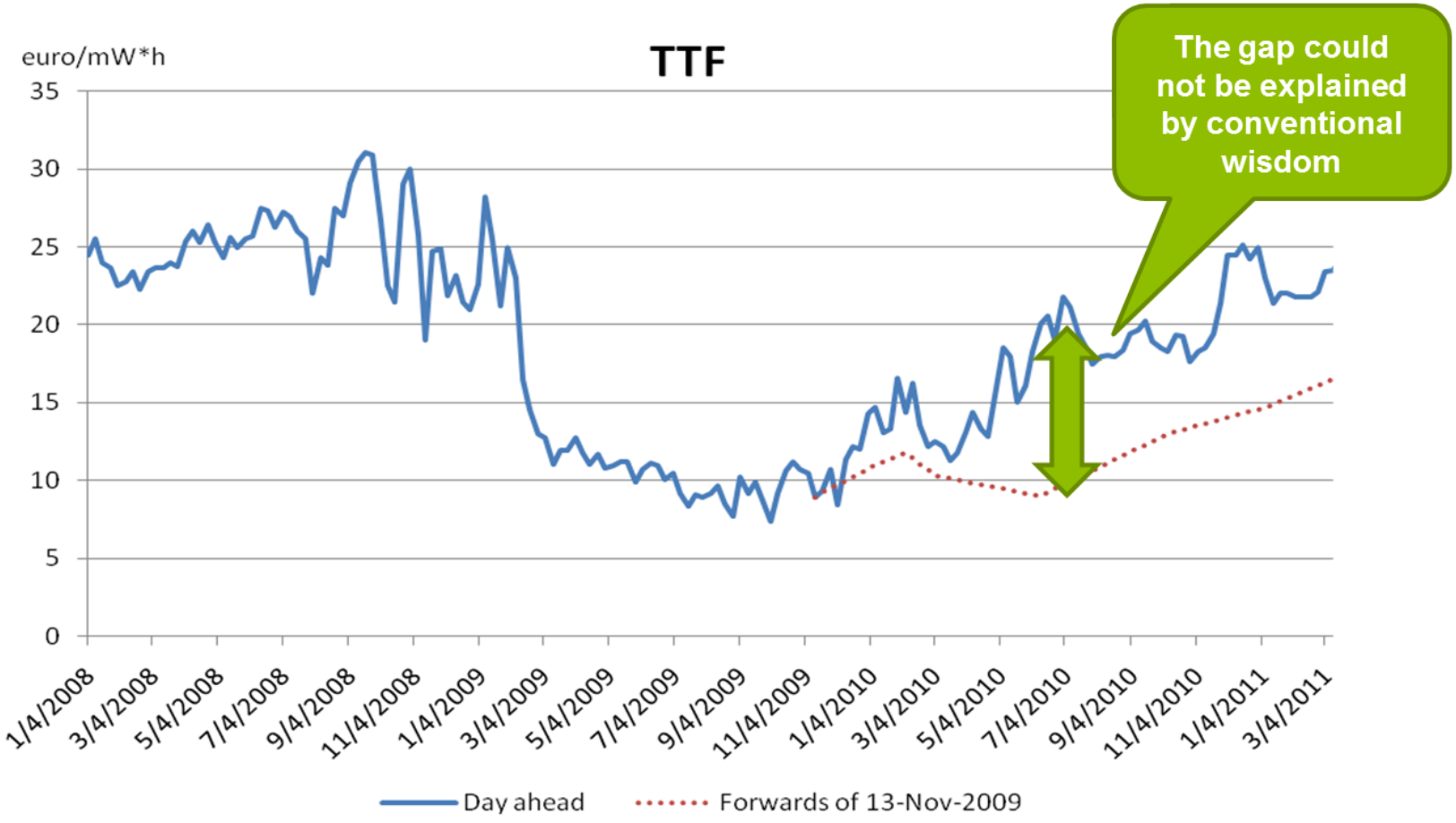


Source: IGU

Indirect price hybridization: oil-indexed prices still important in EU gas imports

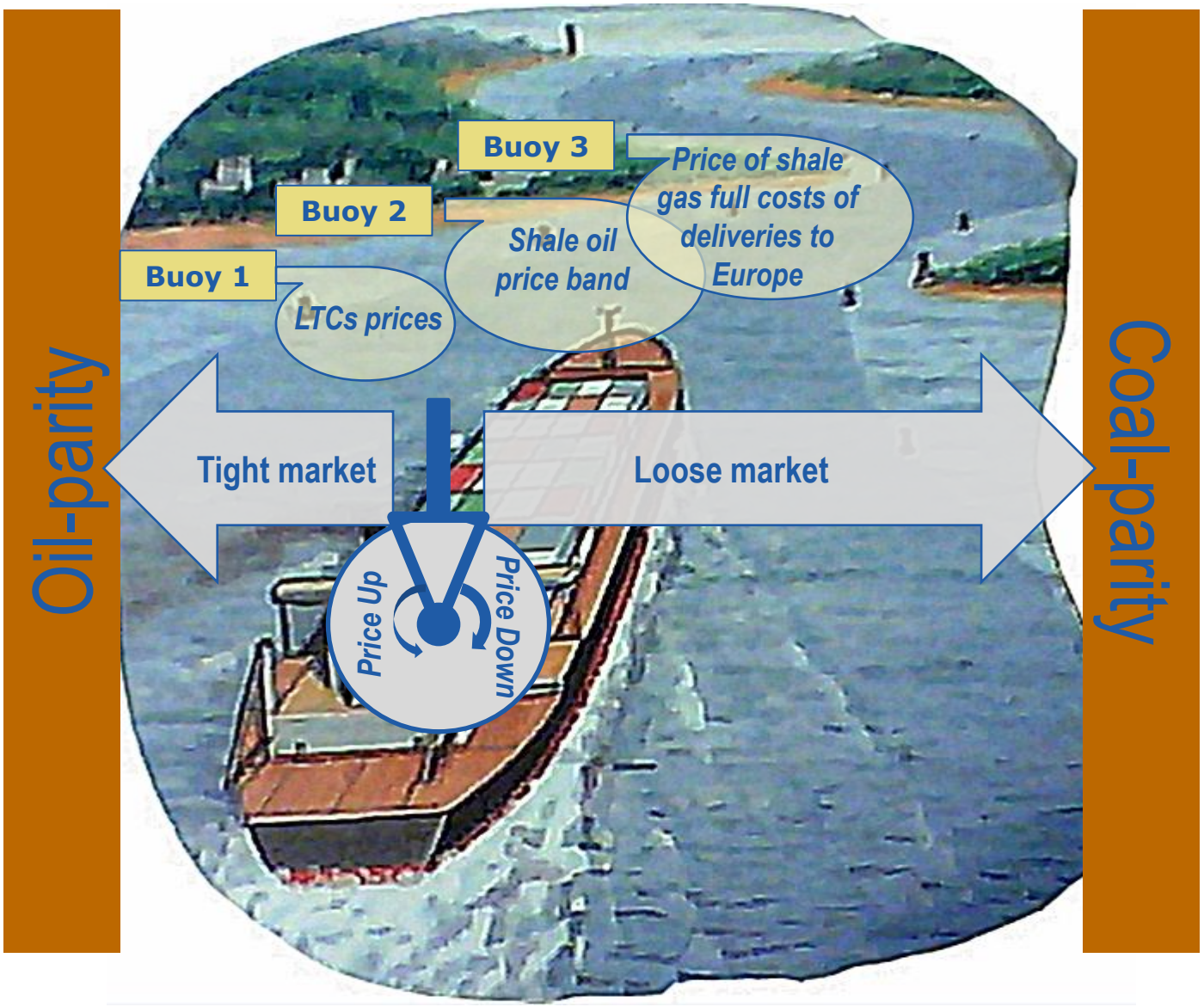


LNG glut in 2010-2011 could not prevent hub prices from steep rise driven by oil indexes



Source: Bloomberg

Hub natural gas price navigation in Europe





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