

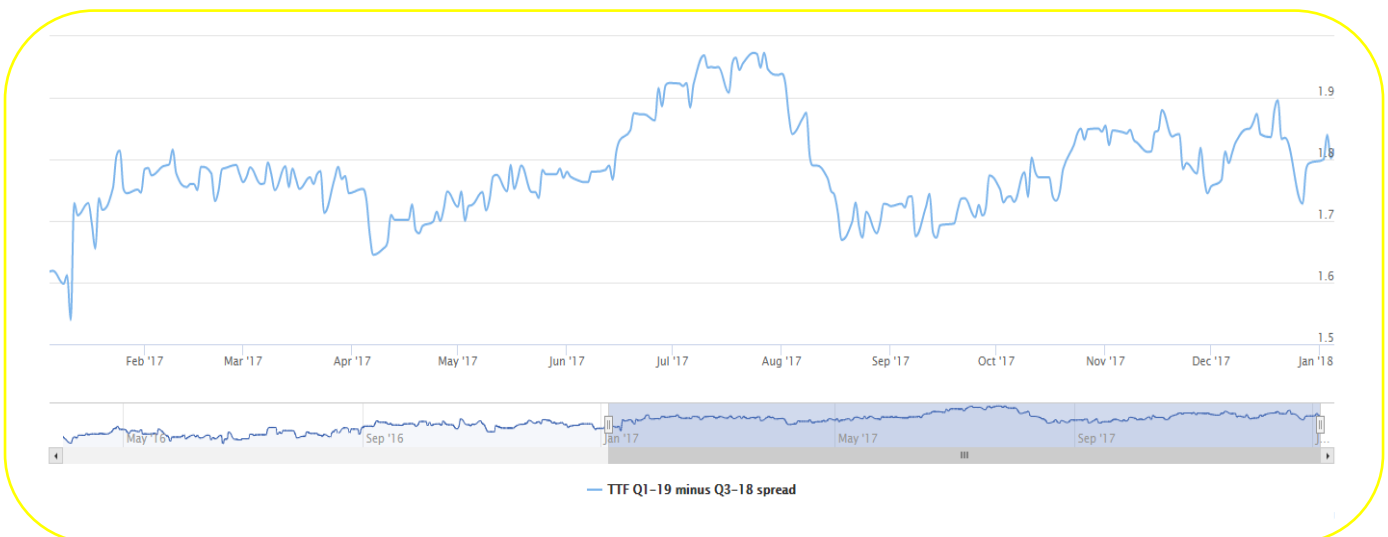
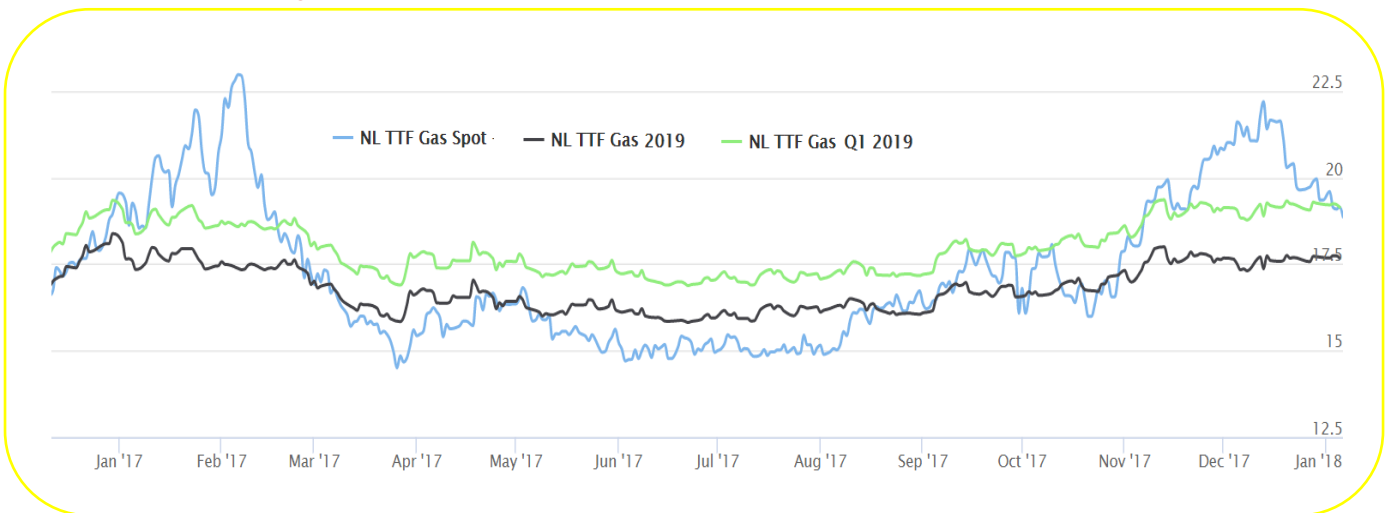


Gas Storage and Swing Report

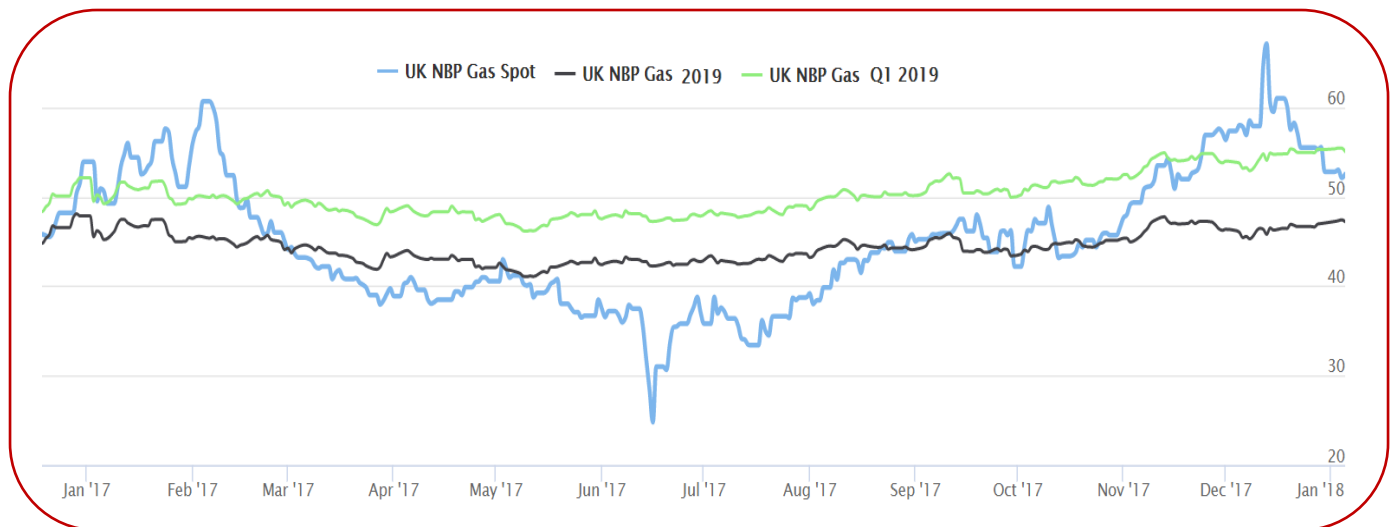
Storage	Market	Product	Period	Cycle Cost	Intrinsic	Rolling Intrinsic		Option	
						Avg	10%	Avg	10%
	TTF	30/30	SY2018	0.75	0.87 ↑	1.82 ↑	1.53 ↑	2.37 ↓	1.83 ↓
	TTF	60/60	SY2018	0.75	0.83 ↑	1.45 ⇔	1.27 ↑	1.76 ↓	1.41 ↑
	TTF	60/120	SY2018	0.75	0.80 ↑	1.23 ↑	1.10 ↑	1.47 ↓	1.03 ↓
	NBP	30/30	SY2018	1.50	9.87 ↑	18.17 ↑	14.73 ↓	20.00 ↑	17.07 ↑
	NBP	60/60	SY2018	1.50	9.73 ↑	13.95 ↑	12.65 ↑	14.82 ↑	13.22 ↑
	NBP	60/120	SY2018	1.50	9.13 ↑	11.93 ↑	11.02 ↑	12.62 ↑	11.42 ↑

Swing	Market	Max/day	Min/Max	Period	Price	Intrinsic	Rolling Intrinsic		Option	
							Avg	10%	Avg	10%
	TTF	4	360/360	2019	19.22 ↑	-0.02 ⇔	0.02 ↓	-0.02 ⇔	0.09 ↓	-0.25 ↑
	TTF	1	0/365	2019	19.22 ↑	0.00 ⇔	0.50 ↓	0.08 ↓	0.64 ↓	0.05 ↓
	TTF	4	360/360	2019	MA	0.00 ⇔	0.41 ↑	0.24 ↑	0.86 ⇔	0.59 ↑
	NBP	4	360/360	2019	55.43 ↑	-0.02 ⇔	0.25 ↓	-0.02 ⇔	0.57 ↓	-0.36 ↓
	NBP	1	0/365	2019	55.43 ↑	0.00 ⇔	1.28 ↓	0.27 ↓	1.39 ↓	0.36 ⇔
	NBP	4	360/360	2019	MA	-0.02 ⇔	2.48 ↑	1.64 ↑	3.75 ↑	2.60 ↑

TTF Price History



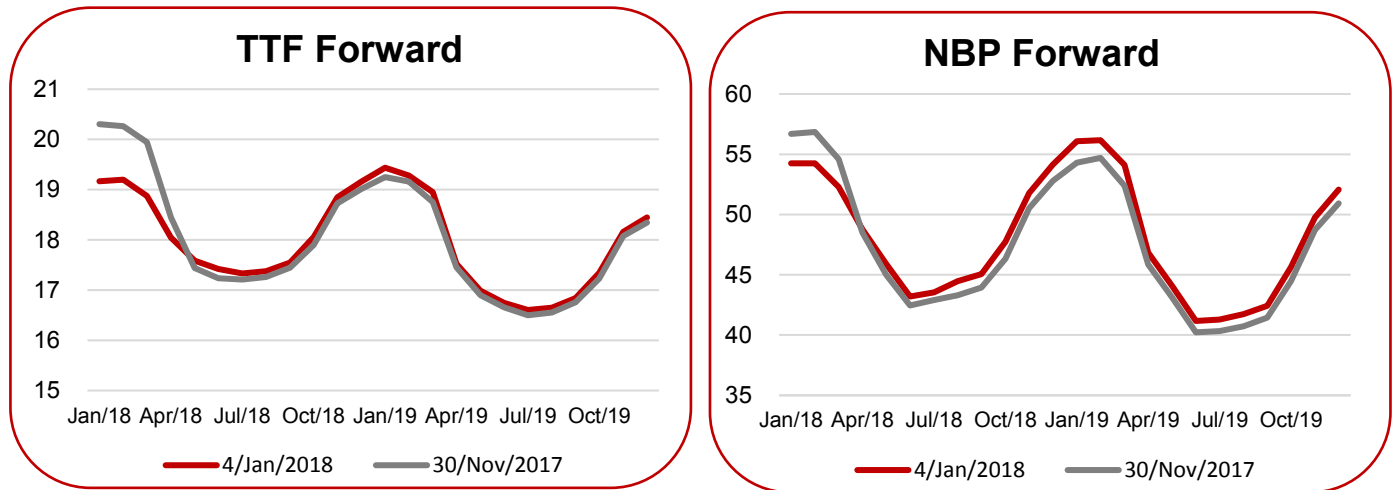
NBP Price History



Volatility

Market	Spot Volatility					Year-ahead Forward volatility				
	1m	3m	6m	12m	KYOS sugg.	1m	3m	6m	12m	KYOS sugg.
TTF	39% ↑	40% ↓	38% ↑	39% ↑	40% ↑	9% ↓	13% ↓	13% ⇔	14% ↓	13% ↓
NBP	62% ↑	55% ↑	54% ↓	59% ↑	60% ↑	12% ↓	14% ↓	14% ⇔	14% ↓	13% ↓
GPL	48% ↑	47% ↑	40% ↑	41% ↑	40% ↑	10% ↓	13% ↓	13% ⇔	15% ↓	13% ↓
NCG	46% ↑	43% ↑	40% ↑	42% ↑	40% ↑	10% ↓	13% ↓	13% ⇔	15% ↓	13% ↓
PEG-N	69% ↑	59% ↑	51% ↑	48% ⇔	53% ↑	11% ↓	13% ↓	12% ↓	15% ↓	13% ↓

Price Forward Curves



Market Trend

Gas storage

Winter forward prices for 2019 have been on the rise again. Compared to the previous reporting date of 30 Nov 2017, this has led to an increase in the Jan-19 versus Jul-18 spread of 1.12 p/th on NBP. On TTF the Jan-19 versus Jul-18 spread increase was limited to 0.06 EUR/MWh. Consequently, intrinsic storage values are higher.

For readers comparing the results of this report with previous reports, it is important to note that we have made a change to the price simulation model which generally leads to higher option and rolling intrinsic values. First of all, until recently the KyStore model's main simulation parameter was the spread between spot and month-ahead forward price; this is now the spot price itself. Secondly, the decrease in forward price volatility is no longer derived from the spot mean-reversion rate, but set at a much lower level, more in line with the forward volatility term structure in the market. The second change is the main reason for higher rolling intrinsic values.

Swing

The option value of the month-ahead (MA) indexed contracts are primarily driven by spot price volatility and mean-reversion rate. Due to slightly higher spot volatility levels, their values went up a bit.

The values of the two fixed-price contracts are primarily dependent on the price spread between Q1-19 (the strike level) and the last delivery quarter (Q4-19). Because this price spread has widened since the date of the previous report, 30 November 2017, the fixed-price swing values came down.

Explanation

Storage

- Product: 60/120 means 60 days of withdrawal and 120 days of injection capacity.
- The storage values are expressed per MWh (or therms) of working volume.

Swing

Product:

- Max/day is the maximum daily take
- Min/Max are the minimum and maximum annual take

Price

- A fixed price put at Q1-level or
- Month-ahead indexed price (MA)

The swing values are per MWh or therms of contract volume, which is 365 for the daily callable options (max 1 per day) and 360 for other contracts (max 4 per day).

Volatilities

The volatilities are derived from the end-of-day settlement prices of gas spot and futures exchanges. They are calculated with a history of 1, 3, 6 and 12 months. The 'KYOS suggested' volatilities are our expert view, considering the historical estimates as well as recent market developments. These estimates are used for the valuations.

Valuation Methodologies

- All valuations have been performed with KYOS software and models, KyStore and KySwing. They are expressed in €/MWh (TTF) or p/th (NBP). Inputs include the spot and forward volatilities from the table in this report, as well as forward curves and some other settings.
- The trading date for all values is 4 Jan 2018.
- A discount rate of 2% has been applied.
- Intrinsic values are derived from the tradable products in the market.
- Rolling intrinsic and option values are derived from Monte Carlo simulations of spot and forward prices:
 - Rolling intrinsic: the intrinsic value is locked in initially with tradable products; then this position, including spot, may be adjusted daily to capture extra value.
 - Option value: the spot trades are optimized, taking into account the optionality of the asset, based on the least-squares Monte Carlo method. In addition, the position is delta hedged in the forward market to minimize the risk.
 - Of the rolling intrinsic and option value, the table shows the average across the simulations and the 10th percentile, which is a more conservative value estimate.
 - In all trading strategies, the model takes into account transaction costs of 0.02 €/MWh (TTF) or 0.02 p/th (NBP).

Contact us for more information about the models and assumptions underlying this report, or to request a demonstration of the KYOS software.

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