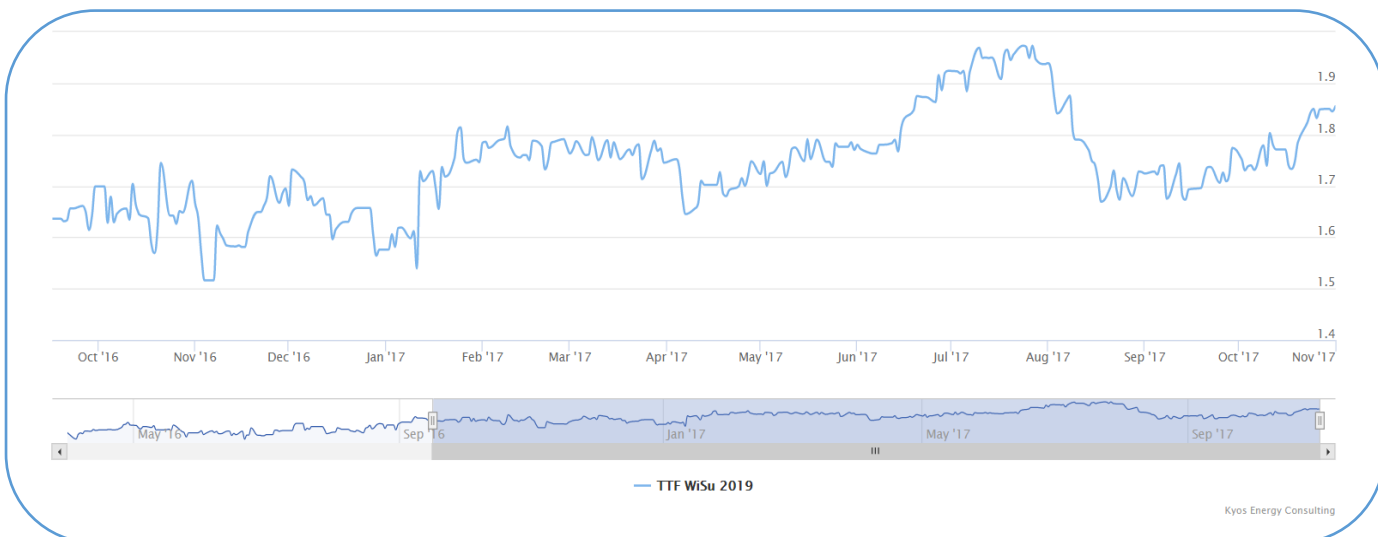
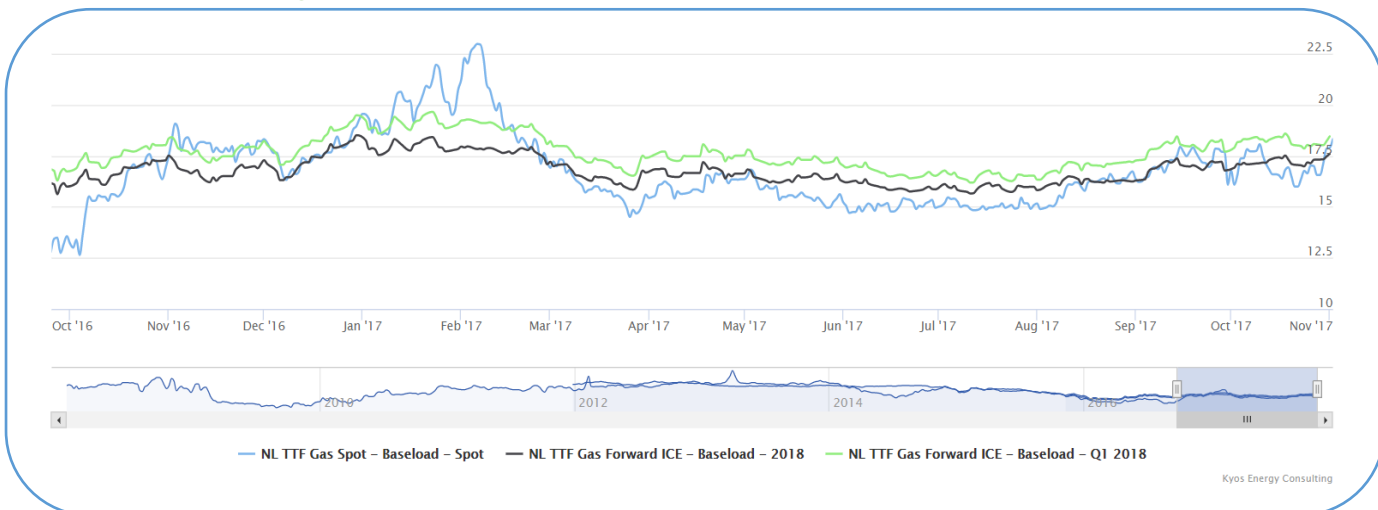


Gas Storage and Swing Report

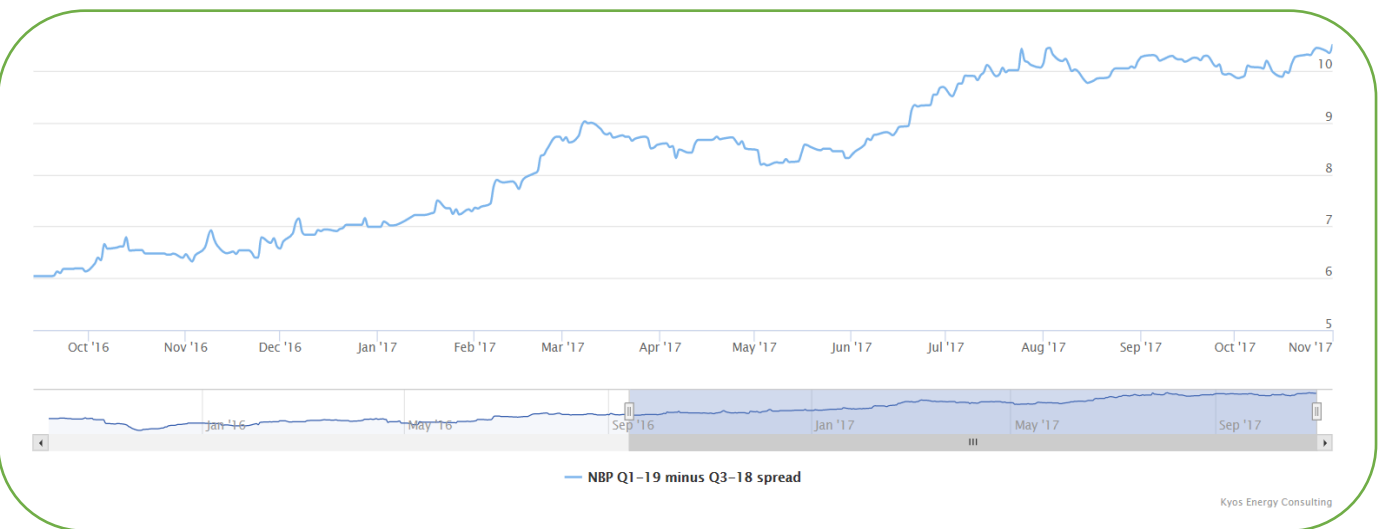
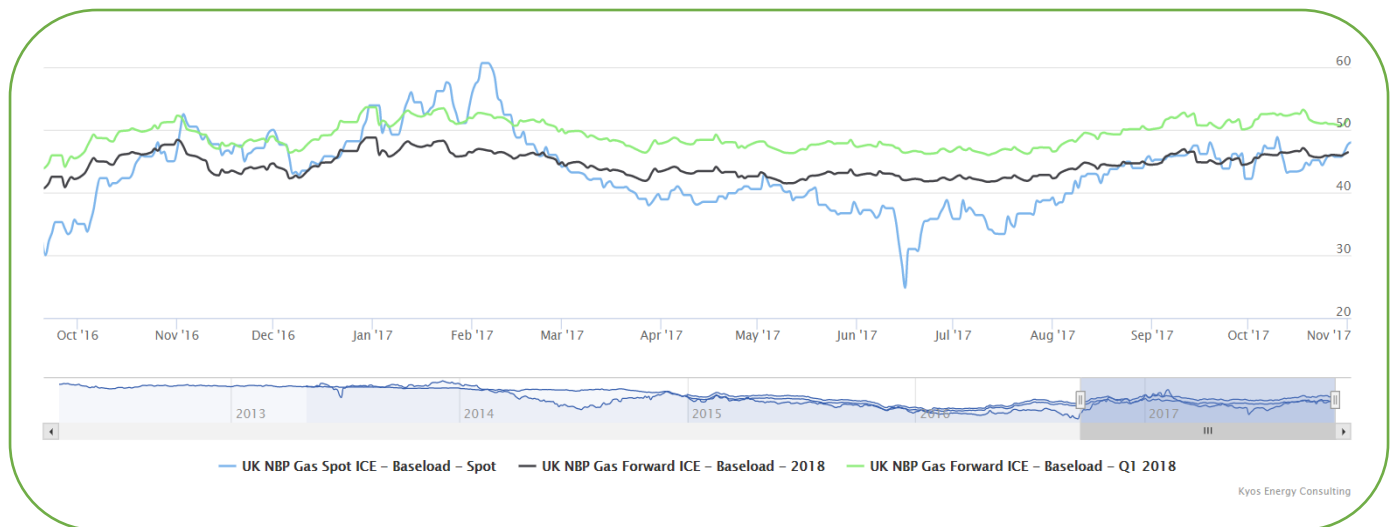
Storage	Market	Product	Period	Cycle Cost	Intrinsic	Rolling Intrinsic		Option	
						Avg	10%	Avg	10%
	TTF	30/30	SY2018	0.75	0.87 ↑	1.12 ↑	1.04 ↑	2.39 ↑	2.01 ↑
	TTF	60/60	SY2018	0.75	0.87 ↑	1.02 ↑	0.97 ↑	1.76 ↑	1.52 ↑
	TTF	60/120	SY2018	0.75	0.83 ↑	0.96 ↑	0.92 ↑	1.46 ↑	1.26 ↑
	NBP	30/30	SY2018	1.50	9.00 ↑	10.53 ↑	9.80 ↑	18.80 ↑	16.50 ↑
	NBP	60/60	SY2018	1.50	8.65 ↑	9.50 ↓	9.10 ↓	13.68 ↑	12.43 ↑
	NBP	60/120	SY2018	1.50	8.48 ↑	9.33 ↑	9.08 ↑	11.72 ↑	10.82 ↑

Swing	Market	Max/day	Min/Max	Period	Price	Intrinsic	Rolling Intrinsic		Option	
							Avg	10%	Avg	10%
	TTF	4	360/360	2018	18.21 ↑	-0.02 ↓	0.25 ↑	0.16 ↑	0.36 ↑	0.16 ↑
	TTF	1	0/365	2018	18.21 ↑	0.01 ⇔	0.38 ↓	0.08 ↑	0.49 ↓	0.15 ↑
	TTF	4	360/360	2018	MA	0.00 ⇔	0.36 ↓	0.21 ⇔	0.85 ⇔	0.54 ↑
	NBP	4	360/360	2018	51.02 ↑	-0.02 ↓	1.03 ↑	0.28 ↑	1.45 ↑	0.75 ↑
	NBP	1	0/365	2018	51.02 ↑	0.11 ↑	0.96 ↓	0.42 ↑	1.05 ↓	0.49 ↑
	NBP	4	360/360	2018	MA	-0.02 ⇔	2.30 ⇔	1.47 ↓	3.64 ↑	2.56 ↑

TTF Price History



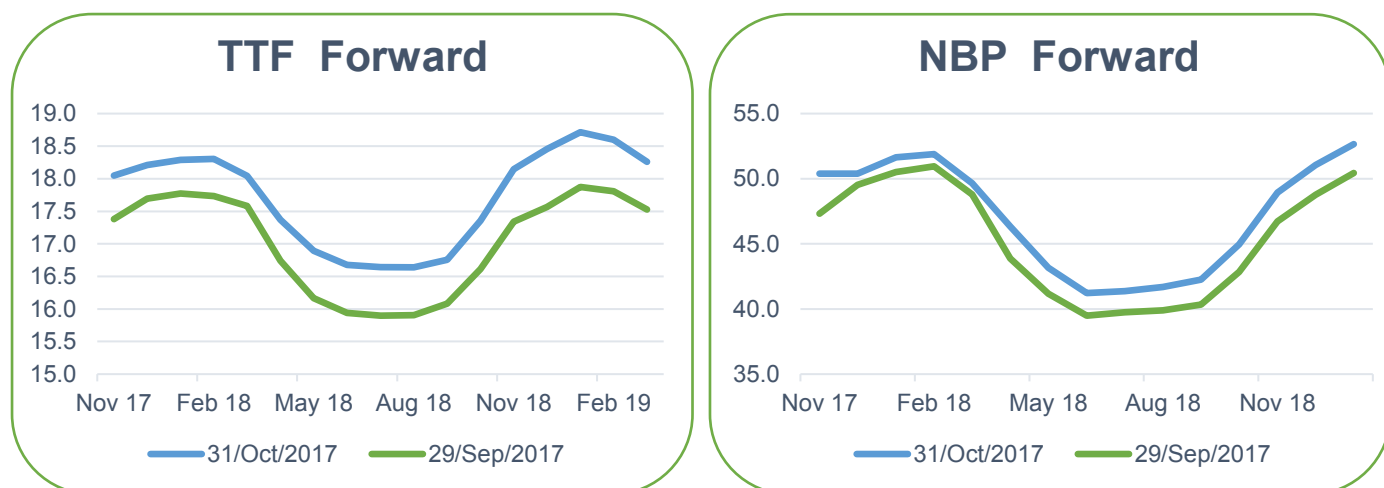
NBP Price History



Volatility

Market	Spot Volatility					Year-ahead Forward volatility				
	1m	3m	6m	12m	KYOS sugg.	1m	3m	6m	12m	KYOS sugg.
TTF	44% ↑	40% ↑	35% ↑	39% ↓	40% ↑	11% ↓	12% ↔	12% ↓	17% ↓	13% ↓
NBP	43% ↑	47% ↑	66% ↑	57% ↓	60% ↔	11% ↓	14% ↑	13% ↔	18% ↓	13% ↓
GPL	44% ↑	38% ↑	34% ↑	41% ↓	40% ↑	11% ↓	12% ↔	12% ↓	17% ↓	13% ↓
NCG	40% ↑	40% ↑	36% ↑	41% ↓	40% ↑	11% ↓	12% ↔	12% ↓	16% ↓	13% ↓
PEG-N	56% ↑	48% ↑	43% ↑	48% ↔	48% ↑	12% ↓	12% ↔	12% ↓	16% ↓	13% ↓

Price Forward Curves



Market Trend

Gas storage

Winter forward prices (Q1) have been on the rise in both 2018 and 2019. For example, on NBP this led to an increase in the Jan-19 versus Jul-18 spread of 0.59 p/th. On TTF the winter-summer spread increase was limited to 0.10 EUR/MWh. This is reflected in the higher intrinsic storage values. The option values (spot optimization with delta hedging) also increased, but were also sensitive to spot volatility changes, which was a few percentage points higher on TTF.

Swing

On each market we value two swing contracts with flexibility in the total offtake (0/365), and one with a fixed total offtake (360/360). The values of the more flexible contracts hardly moved compared to last month. However, the more restricted contracts (360/360) moved up in value as a result of a different shape in the forward curve.

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

- Either a fixed price (e.g. 18) 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 31 Oct 2017
- 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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