

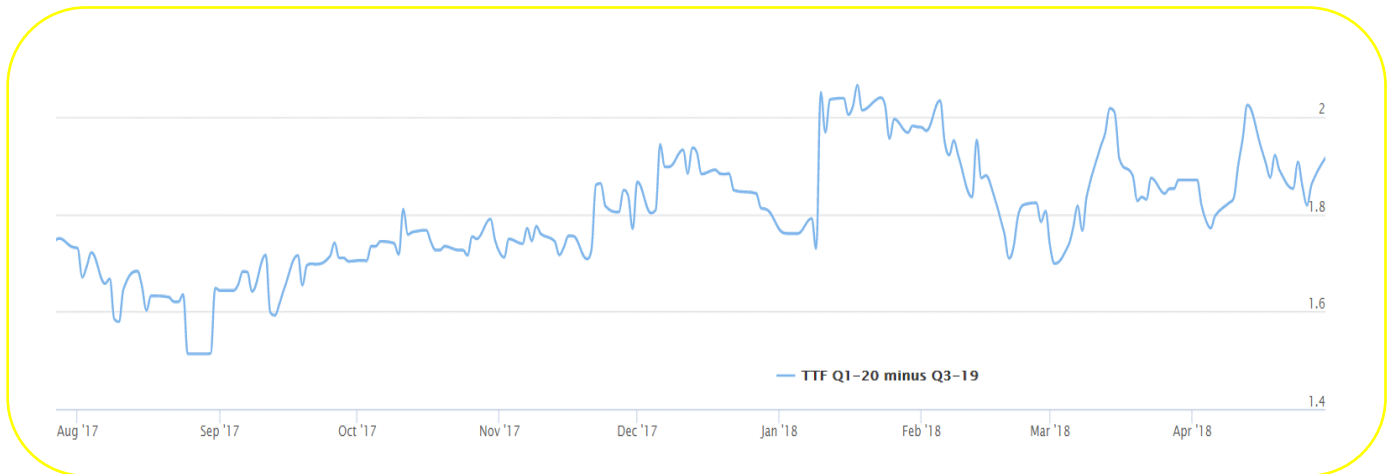


Gas Storage and Swing Report

Storage	Market	Product	Period	Cycle Cost	Intrinsic	Rolling Intrinsic		Option	
						Avg	10%	Avg	10%
	TTF	30/30	SY2019	0.50	1.13 ↑	3.91 ↑	2.65 ↑	5.31 ↑	4.38 ↑
	TTF	60/60	SY2019	0.50	1.13 ↑	2.76 ↑	2.03 ↑	3.52 ↑	2.85 ↑
	TTF	60/120	SY2019	0.50	0.98 ↑	2.21 ↑	1.71 ↑	2.80 ↑	2.31 ↑
	NBP	30/30	SY2019	1.00	9.90 ↑	22.00 ↑	17.43 ↑	24.43 ↑	21.57 ↑
	NBP	60/60	SY2019	1.00	9.90 ↑	16.60 ↑	13.78 ↑	17.87 ↑	16.02 ↑
	NBP	60/120	SY2019	1.00	9.23 ↑	14.08 ↑	12.63 ↑	15.07 ↑	13.42 ↑

Swing	Market	Max/day	Min/Max	Period	Price	Intrinsic	Rolling Intrinsic		Option	
							Avg	10%	Avg	10%
	TTF	4	360/360	2019	21.57 ↑	-0.02 ⇔	0.02 ↓	-0.02 ⇔	0.12 ↓	-0.19 ↓
	TTF	1	0/365	2019	21.57 ↑	0.02 ↑	0.41 ↓	0.07 ↑	0.49 ↓	0.07 ↓
	TTF	4	360/360	2019	MA	-0.02 ⇔	0.67 ↑	0.42 ↑	1.25 ↑	0.88 ↑
	NBP	4	360/360	2019	61.41 ↑	-0.02 ⇔	0.10 ↓	-0.02 ⇔	0.39 ↓	-0.53 ↓
	NBP	1	0/365	2019	61.41 ↑	0.12 ↑	1.08 ↓	0.24 ⇔	1.15 ↓	0.38 ↓
	NBP	4	360/360	2019	MA	-0.02 ⇔	2.99 ↑	2.02 ↑	4.48 ↑	3.21 ↑

TTF Price History



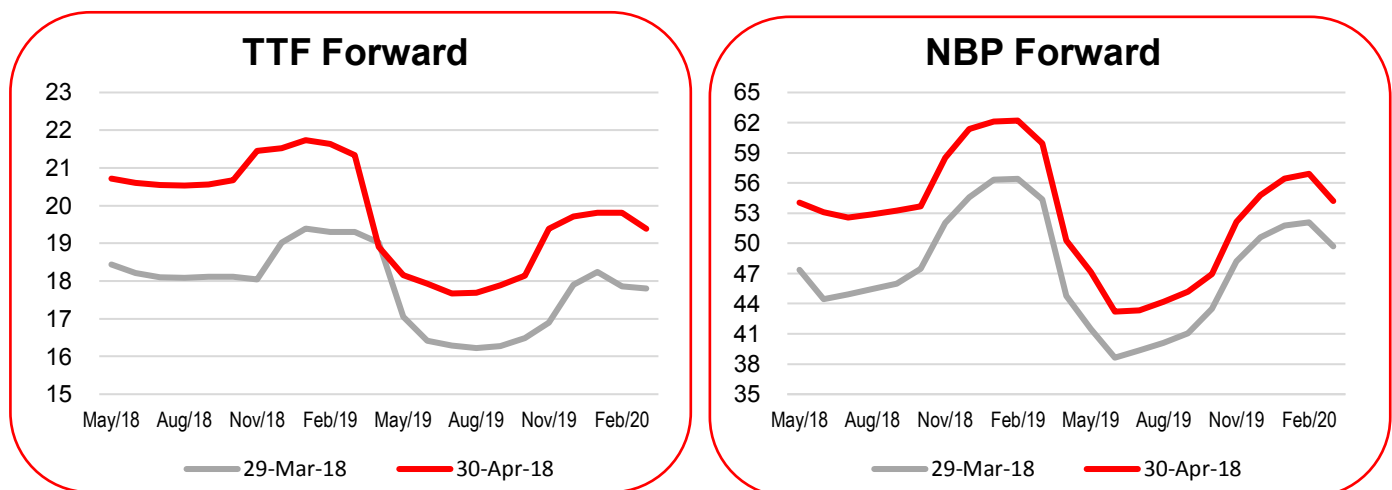
NBP Price History



Volatility

Market	Spot Volatility					Year-ahead Forward volatility				
	1m	3m	6m	12m	KYOS sugg.	1m	3m	6m	12m	KYOS sugg.
TTF	35% ↓	96% ⇔	73% ↓	58% ⇔	56% ↓	10% ↓	13% ↓	15% ↑	13% ↓	13% ↓
NBP	42% ↓	87% ↑	73% ↓	70% ⇔	67% ↓	11% ↓	13% ↓	16% ↑	14% ⇔	13% ↓
GPL	31% ↓	97% ↓	76% ↓	59% ↓	56% ↓	11% ↑	13% ⇔	14% ↑	13% ⇔	13% ↓
NCG	32% ↓	91% ⇔	71% ↓	57% ↓	56% ↓	9% ↓	13% ⇔	14% ↑	13% ↓	13% ↓
PEG-N	44% ↓	81% ↑	68% ↓	58% ↑	56% ↓	10% ⇔	14% ↑	14% ⇔	13% ⇔	13% ↓

Price Forward Curves



Market Trend

In the gas forward market there was a clear upward trend during April. On TTF the forward prices shifted by 2-2.5 €/MWh, and on NBP by 6-7 p/th, with the largest shift in the first 12 months. This is visible in the forward curve graphs, but also reflected in the higher strike prices for the Q1-19 indexed swing products: a rise of 2.36 €/MWh for the TTF strike prices and of 6.00 p/th for the NBP strike prices. Because the spread between this Q1-19 and the calendar 2019 forward prices was rather constant, and volatilities as well, we observe roughly the same swing values as last month.

For storage values the trend was upwards. Whereas the recent upward trend was driven by spot volatilities, this time it is the more pronounced shape in the forward curve, leading to higher intrinsic storage values. The gain in intrinsic value offset the slight decrease in spot volatility, resulting in overall higher assessments of storage value.

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 30 April 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.

Contact information: www.kyos.com/contact

KYOS energy asset optimization and valuation: www.kyos.com/energy-asset-optimization

E-mail: info@kyos.com