



Gas Storage and Swing Report

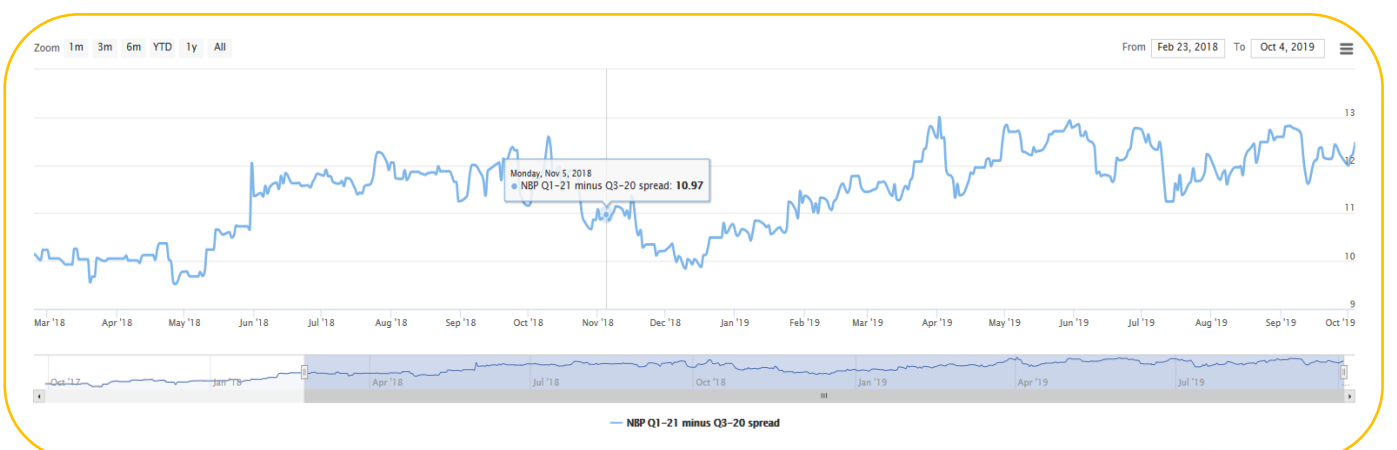
Storage	Market	Product	Period	Cycle Cost	Intrinsic	Rolling Intrinsic		Option	
						Avg	10%	Avg	10%
	TTF	30/30	SY2020	0.50	1.96 ↓	5.11 ↑	3.51 ↑	6.17 ↑	4.87 ↑
	TTF	60/60	SY2020	0.50	1.96 ↓	3.83 ↑	2.92 ↑	4.52 ↑	3.50 ↑
	TTF	60/120	SY2020	0.50	1.92 ↓	3.27 ↑	2.58 ↑	3.74 ↑	2.93 ↑
	NBP	30/30	SY2020	1.00	10.37 ↓	23.60 ↑	18.40 ↑	25.73 ↑	22.13 ↑
	NBP	60/60	SY2020	1.00	10.37 ↓	17.77 ↑	14.90 ↑	18.75 ↑	15.95 ↑
	NBP	60/120	SY2020	1.00	10.37 ↓	15.40 ↓	13.20 ↓	16.05 ↓	13.68 ↑

Swing	Market	Max/day	Min/Max	Period	Price	Intrinsic	Rolling Intrinsic		Option	
							Avg	10%	Avg	10%
	TTF	4	360/360	2020	18.67 ↓	0.30 ↑	0.93 ↑	0.56 ↑	1.11 ↑	0.77 ↑
	TTF	1	0/365	2020	18.67 ↓	0.08 ↑	1.13 ↓	0.36 ↑	1.29 ↓	0.70 ↑
	TTF	4	360/360	2020	MA	-0.02 ↔	0.73 ↑	0.40 ↑	1.41 ↑	1.02 ↑
	NBP	4	360/360	2020	52.48 ↓	-0.01 ↑	2.55 ↑	0.99 ↑	2.95 ↑	2.02 ↑
	NBP	1	0/365	2020	52.48 ↓	0.08 ↑	2.74 ↓	0.58 ↑	2.98 ↓	1.58 ↑
	NBP	4	360/360	2020	MA	-0.02 ↔	2.79 ↓	1.68 ↓	4.32 ↓	3.16 ↑

TTF Price History



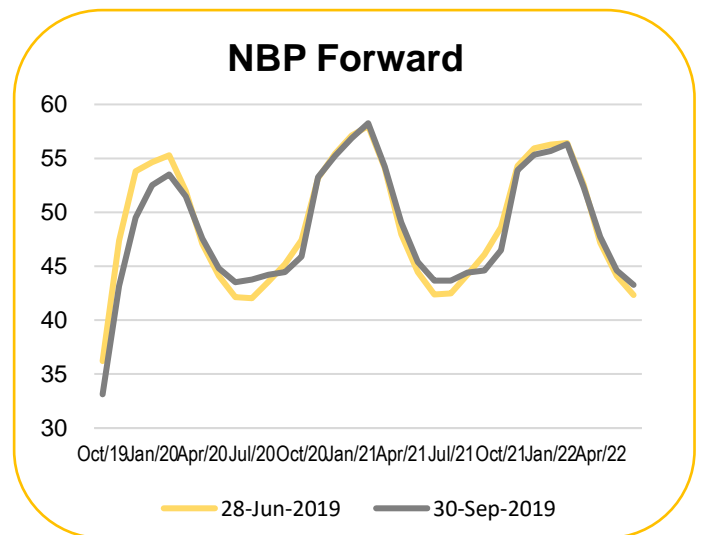
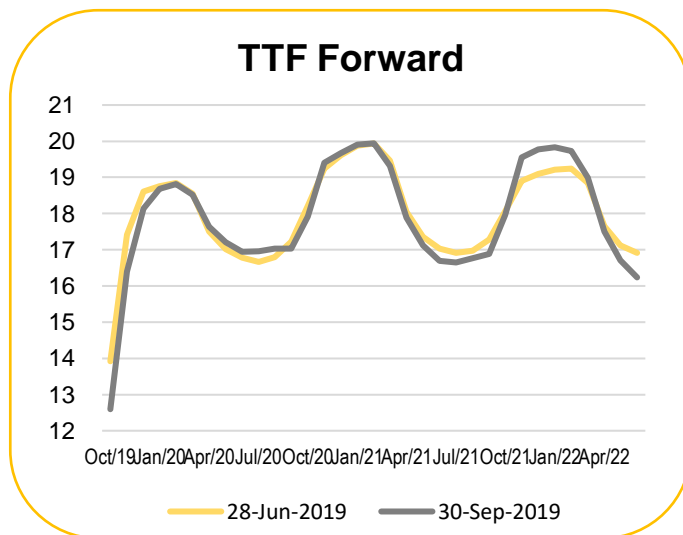
NBP Price History



Volatility

Market	Spot Volatility					Year-ahead Forward volatility				
	1m	3m	6m	12m	KYOS sugg.	1m	3m	6m	12m	KYOS sugg.
TTF	122% ↑	92% ↑	75% ↑	58% ↑	57% ↑	34% ↑	29% ↑	27% ↑	25% ↑	25% ↑
NBP	124% ↑	97% ↑	82% ↑	64% ↑	65% ↑	31% ↑	28% ↑	27% ↑	25% ↑	25% ↑
GPL	132% ↑	100% ↑	85% ↑	66% ↑	64% ↑	33% ↑	28% ↑	25% ↑	24% ↑	24% ↑
NCG	114% ↑	88% ↑	77% ↑	59% ↑	59% ↑	33% ↑	28% ↑	25% ↑	24% ↑	24% ↑
PEG-N	99% ↓	81% ↑	75% ↑	57% ↑	57% ↑	34% ↑	29% ↑	26% ↑	24% ↑	24% ↑

Price Forward Curves



Market Trend

Over the last 3 months of the summer, most trading attention focused again on the prompt. Although the day-ahead prices started and ended this three-month period at almost the same level, we could observe large price swings. The average TTF Day-ahead price over this period was 10.2 €/MWh, but prices peaked at 13 €/MWh and went below 7.50 €/MWh; a level not seen for over 10 years! As a result, the calculated spot volatility increased. As an example, the TTF spot volatility calibrated over Q2-2019 was 70% and this increased to 92% over Q3-2019.

We see the current price volatility as a result of the exceptional situation over the summer. First of all, it started with an unusual low storage demand and a large influx from LNG into Europe. This combined with a nervous CO₂ price, dictating a volatile gas demand for power generation and news/rumors about North-Stream 2 and Ukraine transit situation, led to the observed spot price changes. Furthermore, since volatility is calculated based on relative price changes, the low absolute price level tends to lead to higher calculated volatilities. At low price levels, a 1 €/MWh price change has a larger effect on the calculated volatility than the same 1 €/MWh price change at a higher price level.

The forward gas curve did not change substantially during this period. Summer 2020 TTF stayed basically constant at 17 €/MWh. This reflects the view of the market that the current situation is exceptional and that the underlying fundamentals of the gas market remain intact.

Combining all these facts, we increased the KYOS suggested spot volatility only with 8 percent point to 57%. Due to the increase in spot volatility and the fact that all other relevant parameters remained largely unchanged, the value of basically all our storage and swing contracts went up.

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 29 Sept 2019.
- 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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