

# Gas Storage Bergermeer historic multiplier calculated by the FEA Storage Model

## Introduction

This paper is the result of a collaboration between FEA (an MSCI Brand) and Gas Storage Bergermeer (GSB) developed and operated by TAQA. We back-tested what GSB would have been worth in the last five storage years using the FEA Storage model and applying inputs that are consistent with the GSB contract. The results provide customers with a starting point on the value of the GSB multiplier.

## Main contractual parameters of the Standard Storage Services Agreement

Capacity in GSB is sold via Standard Bundled Units (SBUs), where one SBU contains 1,000 kWh of space, 0.427 kW injection and 0.579 kW withdrawal capacity. Linear pressure factors curtail injection by 25% and withdrawal by 48% resulting in 112 days of injection and 97 days of withdrawal. The capacity fee is indexed to the average ICE Endex TTF Summer-Winter (SW) spread six months prior to each storage year times an agreed multiplier. Gas intake and delivery takes place at the TTF, freeing customers from paying entry and exit transport tariffs. Injection and withdrawals are subject to a variable fee based on the average forward electricity price during the months June, July and August the year preceding the storage year. The above contractual parameters have all been incorporated in the FEA valuation.

## FEA Storage Model description and assumptions

The simplest possible storage trading strategy is one where on the valuation date forward contracts are bought and sold to maximise profit whilst adhering to inventory requirements, known as 'intrinsic value'. The rolling intrinsic approach essentially involves repeating multiple runs of this intrinsic strategy. For every day the storage facility is operating, the model calculates a new intrinsic value (taking into account fulfilling prior commitments) and its associated intrinsic hedges based on updated market prices. If the newly calculated value plus any potential gains/losses from marking-to-market all outstanding hedge positions is greater than that which would result from taking to terms the latter, an action is taken in favor of the new hedges. This way, the storage value will always be greater than or equal to the value from its previous day while remaining fully-hedged.

We used the rolling intrinsic approach in valuing GSB in combination with the most conservative strategy to not allow overlapping trades. It assumes the user of the storage can dynamically adjust positions in the forward markets and rebalance exposures throughout its tenor. The model can also accommodate spot market trading via DA, WE, BOW, WDNW and/or BOM contracts.

We backtested five consecutive storage years (2009-2013) with historical TTF forward curves based on actual end-of-day Endex forwards using DA, WE, month, quarter and season forward contracts. In addition to this further parameters were set to:

- Bid-ask spread: 0.1 €/MWh
- Injection withdrawal fees: based on actual electricity cost (see results for input per storage year)
- Working capital cost: Euribor + 2%

One of the challenges in valuing the GSB asset is the way the indexed capacity fee is priced in. The fee is based on the average SW spread between 15 October – 15 December and 15 January – 15 March (~90 pricing days). A risk averse hedging strategy would therefore be to hedge 1/90<sup>th</sup> of one's capacity on each single pricing day. Therefore the model also ran 90 iterations in each storage year, calculating the value for each pricing / valuation date and determining the average over the pricing period.

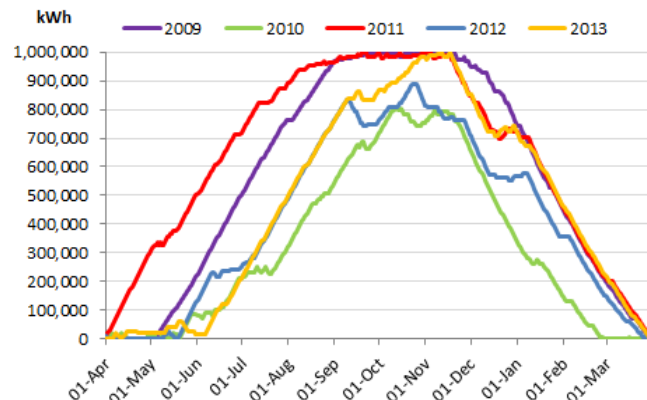
## Results and background on differences between years

Based on the GSB contractual parameters, the rolling intrinsic strategy and the input parameters the resulting multipliers are:

Storage year	Achieved multiplier	Average SW spread during pricing period (€/MWh)	Average gasprice during pricing period (€/MWh)	Combined inj/with fee (€/MWh)	Average total/intrinsic ratio
2009	1.18	6.00	21.71	0.599	1.39
2010	1.33	5.34	15.31	0.347	1.61
2011	1.32	2.69	22.40	0.348	1.52
2012	1.20	3.53	25.74	0.386	1.38
2013	1.27	1.87	27.08	0.344	1.41

The lower multiplier in 2009 can be explained by a high, combined injection and withdrawal fee of 0.599 €/MWh. This was the result of 90 €/MWh electricity prices in the pricing period June, July and August 2008. The high injection and withdrawal fees *directly* decreased the intrinsic value and *indirectly* made frequent injection/withdrawal operations unprofitable for 2009. Therefore volumes and storage levels remained linear as depicted in the chart on the right. It shows the storage facility filled up over the summer period and volumes gradually decreased over the winter period.

Injection and withdrawal profiles were far more dynamic during the other storage years. This is due to the more volatile behavior observed in the forward curves combined with relatively low variable fees. It was therefore possible to realise additional incremental gains from the variance of the spot and forward points in the curve. It is worth noting that in storage years 2010 and 2012 inventory levels never reached full capacity. For those years additional value was created by selling gas on DA and WE around May and September causing storage inventory at the facility to decrease. Existing hedges in the following injection months were not sufficient for the facility to fully fill. The knock on effect was that existing hedges on the following injection months caused the facility not to reach full capacity.



Storage year 2012 showed a slightly lower multiplier again which can be explained by a very low volatility of the overall forward structure during the storage year. The total average volatility of the forwards for 2012 was only 13% (versus 29% and 20% in 2010 and 2011 respectively).

## Conclusion

This analysis provides a starting point on the value of the GSB multiplier. Customers can use this and subsequently include additional items like trading strategy, within-day value, consecutive years value, portfolio value, secondary trading, interruptible capacity, margin requirements, outage risk and expected return on investment. Please note the results are in line with a weighted average multiplier of 1.2 seen during our last auction held in September 2014.

For any questions regarding this valuation please contact [Jody.Strik@taqaglobal.com](mailto:Jody.Strik@taqaglobal.com) for GSB specific questions and [Gerald.Wilson@FEA.com](mailto:Gerald.Wilson@FEA.com) or [Andras.Szell@FEA.com](mailto:Andras.Szell@FEA.com) for valuation specific questions or more information on the FEA storage valuation tool.