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FEA | GSB Historic Multiplier Analysis

Dr Andras Szell

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Outline

- The BERGERMEER Natural Gas Storage
- Valuation method
- The Historical Multipliers
  - Historical Investigation
- Results

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The BERGERMEER Natural Gas Storage

- Capacity
  - Sold via Standard Bundled Units (SBU): 1 SBU = 1,000 kWh
- Injection (Inj): ~112 days
- Withdrawal (Wtd): ~97 days
- Linear “ratchet” schedule:
  - Inj/Wtd ~ [A + B (1 .0 – Level/Capacity)]
- Cost of Inj/Wtd:
  - Related to the average forward electricity price during June, July and August in the year preceding the storage year

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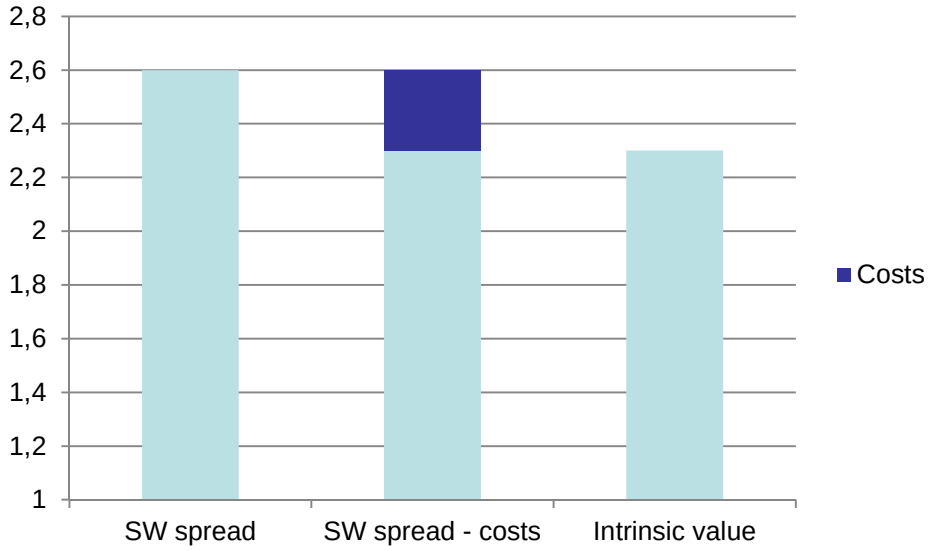
Valuation method

- Minimum Value = INTRINSIC Value
  - Summer – Winter spreads at valuation day on Season, Quarter or Month forward contracts
  - Inj/Wtd constraints
  - Costs



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Valuation method

- Extrinsic Value
  - Depends on the strategy of the storage operation:
  - spot trading / delta hedging, calendar spread option approaches, etc

- Rolling Intrinsic (RI) Valuation
  - Simple strategy, easy to understand, no need for hardcore financial math arguments
  - Easy to backtest
  - Easy to execute
  - High extrinsic value!

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Rolling Intrinsic

- On the first day of storage operation, the intrinsic value of storage is calculated, and intrinsic hedge positions are locked in
- On the next day, the new forward prices in the market are observed and the new intrinsic value of storage is calculated
- If the new intrinsic value of storage, net of unwind costs and transaction costs, is greater than the previous value, then the previous portfolio is unwound and the new intrinsic hedge positions are locked-in
  - Otherwise “stick” with existing positions
- This calculation is repeated on each subsequent day of the storage operation period

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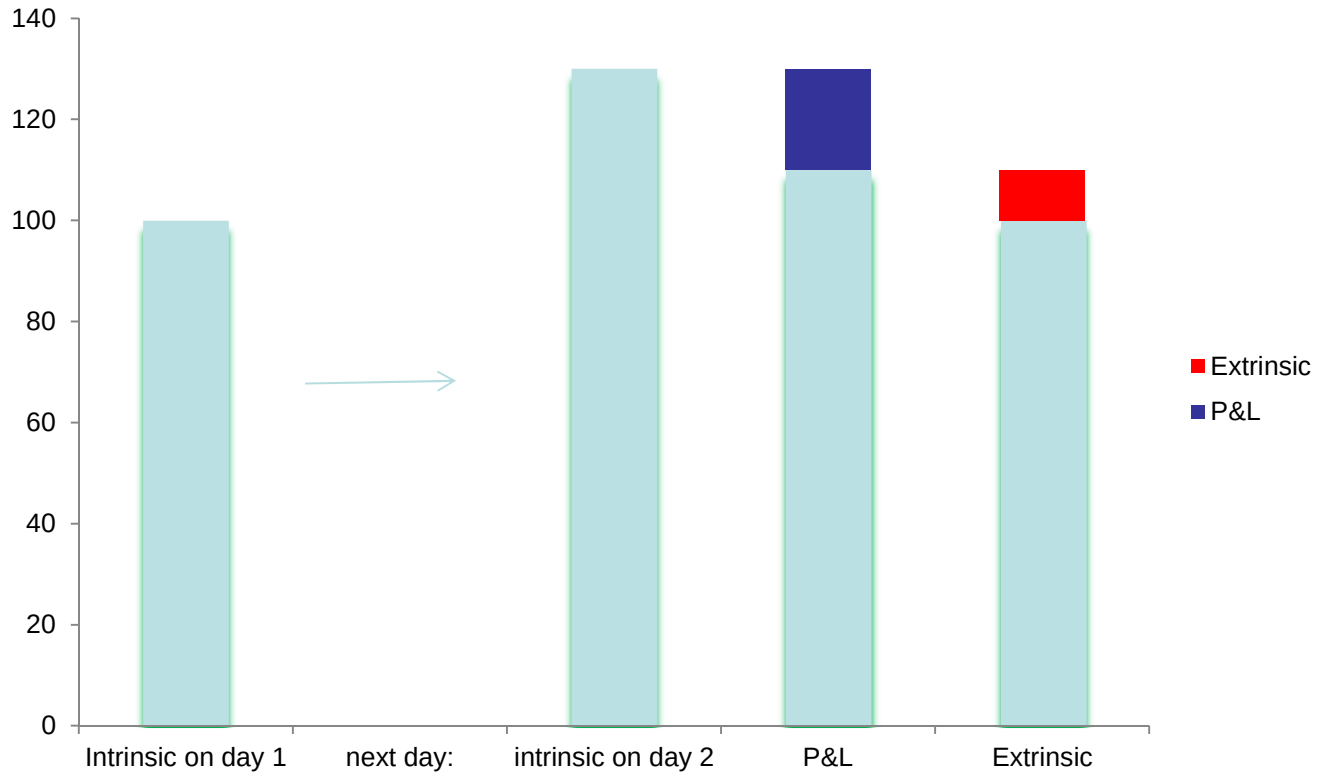
Valuation method

- Typical step in RI strategy
  - compare the new intrinsic plus P&L with the existing positions



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Valuation method

- FEA Rolling Intrinsic Pricing model
  - Month, Quarter, Season and Gas Year forward contract
  - Include “spot” trading
    - DA, WE (WD, BOW, WDNW and BOM)
  - Complex optimization tools for accurately include inj/wtd ratchets and exotic constraints

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The Historical Multipliers

- The capacity fee is indexed to the average ICE ENDEX Summer-Winter (SW) spread six month prior to each storage year times an agreed multiplier.
- Loosely speaking, the capacity fee is measured in ICE ENDEX SW spread unit.
- We expect the multiplier to be reasonably stable

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The Historical Multipliers

- Calculation of the Historical Multipliers
  1. Calculate SW spread between 15 October – 15 December and 15 January – 15 March for each working day (~90 days)
  2. Execute Rolling Intrinsic valuation for each of the above day, hence get the full GSB value as of the given valuation days
  3. Calculate the corresponding multipliers for each day:
     - m[given day] = (GSB Value / SW spread) [given day]
  4. Define the Historical Multiplier as the average of the daily multipliers

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Results

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

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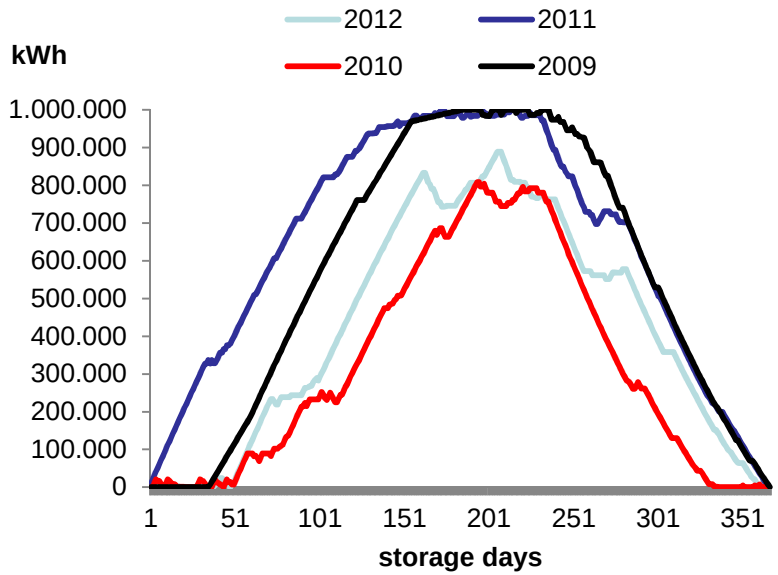
Results

- Lower multiplier in 2009 due to higher inj/wtd fees
- 2010, 2011 higher multipliers due to more volatile DA, WE and forward dynamics
- Lower multiplier for 2012 due to lower volatility levels
- In 2010 and 2012 the storage is never full



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Summary

- Customers can use the presented multipliers as conservative estimations of the BERGERMEER storage extrinsic value
- Additionally, more complex trading items can be added to the model
  - WD, BOW, WDNW or BOM trades
  - Trading available arbitrage between M, Q, S or Y contracts
  - Simulation of outage, overrun or interruption events
  - Applying alternative trading strategies

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Questions

Do you have any questions / comments?

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Contact

Dr Andras Szell
Vice President
FEA an MSCI Brand

Kassák Lajos utca 19-25.
H-1134 Budapest
Hungary
T: +36.1.881.2578
M:+36.70.978.4236
Andras.Szell@fea.com

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