

@ENERGY/StoragePLUS

@ENERGY/StoragePLUS is a real options-based decision support, optimization and valuation tool for aquifer, reservoir and salt dome storage facilities, storage connected to multiple markets and includes an EMEA-style market model. Storage developers, storage operators, energy marketers and private-equity backed firms use @ENERGY/StoragePLUS to value, manage and hedge storage assets dynamically. StoragePLUS comes with well-documented Excel workbook templates that are designed to help users maneuver up the learning curve quickly, and the StoragePLUS functions can also be incorporated into trade-capture and risk management systems via the library version, ErgLib, ensuring consistency between the analytics of desktop and system users.

What makes @ENERGY/StoragePLUS unique?

- » Honors constraints such as transportation capacity, inventory level-dependent injection/withdrawal rates and inventory requirements
- » Honors market structure, including bid/ask forward curves, user-specified settlement dates, monthly contract volatility curve and cash volatility term structure
- » Utilizes a multi-factor forward curve model that accurately capture the dynamics and conventions of North American (e.g. NYMEX) and EMEA (e.g. NBP) physical and financial Natural Gas markets
- » Provides multiple fully-hedged trading strategies, including the industry-standard “Rolling Intrinsic” and “Basket of Spreads”
- » Computes very quickly to provide timely front-office bidding and hedging support

Main Benefits

- » Mark-to-market and quantify expected future profitability
- » Assess the probability and nature of extreme storage scenarios
- » Maximize storage value by deriving the optimal forward hedge positions
- » Support decisions for daily injection/withdrawal and adjusting forward hedges

Key Features

Comprehensive Contract Definition

- » General Specifications — capacity, inventory start level, variable injection/withdrawal intervals
- » Inventory Requirements — a flexible schedule for required minimum and maximum inventory levels
- » Operational Constraints — a flexible schedule for variable injection and withdrawal rates as a function of inventory levels (“ratchets”) and time
- » Operational Costs — time dependent variable and fuel costs for injection and withdrawal as well as penalties and taxes
- » Inventory Payout and Penalty Provisions — variable payout structures for inventory borrowed or loaned at the end of the contract term
- » Transportation constraints — a flexible schedule for maximum daily capacity, associated variable and fuel costs and additional header and must-deliver constraints

Multiple Trading Strategies

- » Intrinsic — trading spot and forward contracts on value date
- » Rolling Intrinsic — trading spot, balance-of-month and forward contracts to add profit incrementally, while maintaining a risk-free intrinsic hedge
- » Basket of Spreads — delta hedge storage value as a basket of calendar spread options with forward contracts, while adding profit incrementally from spot and balance-of-month trading

Multiple Price Process Models

- » Multi-factor forward curve model that captures the seasonal correlation and volatility term structures among different forward contracts, while fully matching market-implied volatilities. Flexible interface for combining user-supplied and model-calibrated market data inputs.

Detailed Valuation Results

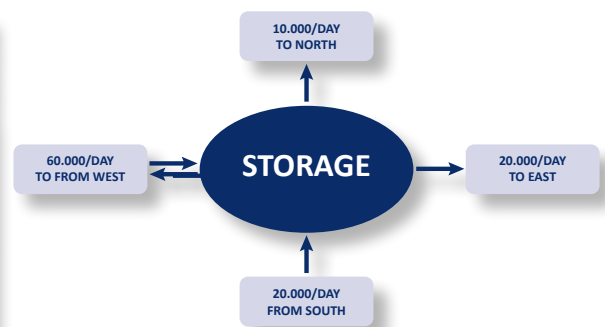
- » Expected contract value, intrinsic value and hedge curve
- » Value histograms (used to pick percentiles for bidding, reserves and risk management, and to monitor storage operations and capital requirements)
- » Day-to-day decision support features
- » Sample trajectories of inventory, cash flow and MTM value
- » All simulated prices and suggested trades

Software Architecture

@ENERGY/StoragePLUS is available in two forms:

Microsoft Excel® Add-In that is written completely in C/C++ providing extremely fast results. It includes customizable Excel templates and documentation. Library for UNIX and Windows (Erglib/Storage) to allow integration of Storage into custom and third-party C, C++, Visual Basic, and SQL database applications.

Forward price curve								
Date	bid price	ask price	bid price	ask price	bid price	ask price	bid price	ask price
	East		West		South		North	
12/1/2013	4.948	4.988	4.948	4.988	4.898	4.938	4.998	5.038
1/1/2014	5.226	5.266	5.226	5.266	5.176	5.216	5.276	5.316
2/1/2014	5.221	5.261	5.221	5.261	5.171	5.211	5.271	5.311
3/1/2014	5.131	5.171	5.131	5.171	5.081	5.121	5.181	5.221
4/1/2014	4.808	4.833	4.808	4.833	4.758	4.783	4.858	4.883
5/1/2014	4.776	4.801	4.776	4.801	4.726	4.751	4.826	4.851
6/1/2014	4.786	4.811	4.786	4.811	4.736	4.761	4.836	4.861
7/1/2014	4.803	4.828	4.803	4.828	4.753	4.778	4.853	4.878
8/1/2014	4.818	4.843	4.818	4.843	4.768	4.793	4.868	4.893
9/1/2014	4.803	4.828	4.803	4.828				
10/1/2014	4.818	4.843	4.818	4.843				
11/1/2014	5.037	5.097	5.037	5.097				
12/1/2014	5.227	5.287	5.227	5.287				
1/1/2014	5.343	5.403	5.343	5.403				
2/1/2014	5.320	5.380	5.320	5.380				
3/1/2014	5.155	5.215	5.155	5.215				



Operation Schedule								
	Date	Inventory level	Injection Rate	In Unit Cost	In Fuel Cost	Withdrawal Rate	Out Unit Cost	Out Fuel Cost
storage	4/1/2014	0%	15.000	0.01	0.75%	18.000	0.01	0.00%
		40%	15.000	0.01	0.75%	20.000	0.01	0.00%
		80%	15.000	0.01	0.75%	25.000	0.01	0.00%
east	4/1/2014	0%	0	0	0.00%	20.000	0.00	0.00%
west	4/1/2014	0%	60.000	0.025	1.00%	60.000	0.00	0.00%
south	4/1/2014	0%	20.000	0.025	1.00%	0	0.00	0.00%
north	4/1/2014	0%	0	0	0.00%	10.000	0.00	0.00%