SUNGARD

ALIGNE
CONFIGURABLE RISK

Integrated energy transaction solutions.
Data | Understanding | Action

SunGard Energy provides an advanced set of risk assessment and risk management tools designed specifically for energy traders, risk managers and credit officers, to measure and manage a number of key energy exposures. This document discusses the process flow of the effective management of standard and non-standard contracts and how SunGard's Aligne Configurable Risk helps to capture, value, assess and optimize them.

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Overview

Energy traders, risk managers and credit officers in energy companies face a diverse range of challenges in environmental constraints that are compounded by the massive changes in the financial industry. SunGard Energy provides an advanced set of risk assessment and risk management tools to address these challenges and to measure and manage a number of key energy exposures.

A wide range of market risks can be measured with Aligne Configurable Risk providing Value at Risk calculation using either non-simulation or simulation based approaches. Building on these risk calculations, Aligne Configurable Risk offers stress test functionality that can help you to understand the impact of extreme market conditions. Additionally, it offers grid-enhanced VaR and EaR calculation to obtain risk metrics for timely decision-making.

Aligne Configurable Risk runs in conjunction with SunGard's Aligne solution suite for trading and risk management. It leverages SunGard's Aligne solution suite's ability to capture, report and value standard and non-standard contracts, various option models, asset valuation and deal deconstruction.

Key Features

1. Measurement of Market Risks

- Value at Risk (VaR)
  - I. Delta
  - II. Historic
  - III. Monte Carlo
- Risk Toolbox
- Earnings at Risk (EaR)
- Cash Flow at Risk (CFaR)

2. Measurement of Additional Market Uncertainties

- Credit VaR
- Volumetric Risk
- Foreign Exchange Risk
- Interest Rate Risk

3. Stress Testing

- VaR Backtesting

4. Grid-enhanced VaR and EaR

1. Measurement of Market Risks

Values at Risk (VaR), Earnings at Risk (EaR) and Cash Flow at Risk (CFaR) have important roles to play in the prudent allocation of capital to cover the market risk arising from trading activities. The following measurement of the following market risk types incorporating price and other market uncertainties in Aligne Configurable Risk will now be discussed in detail:

Value at Risk

The single VaR number provides an estimate of market risk exposure against which adequate capital should be allocated and facilitates the setting and monitoring of trading limits.

The relation of market exposure to a carefully chosen benchmark allows for the meaningful comparison between risk position from one time period to the next and between different trading desks and activities. VaR numbers should be reported daily, so that trends in the company's market exposure become apparent.

VaR uses simulated price changes to create a distribution of possible losses under a particular model and reports percentiles of that distribution. Aligne Configurable Risk helps you to generate multiple market scenarios in order to calculate your VaR.

I. Delta

Parametric VaR is the simplest method to implement. It works by assuming an instrument's sensitivity to the underlying price is linear and also assumes that the extent of the market risk is captured by the volatility (i.e. there is no price evolution). A normal distribution is assumed for all the market variables and pay offs.

Aligne Configurable Risk provides the ability to structure the correlation matrix by combining pricing locations within a definable calendar structure. Non-liquid or low risk positions can be mapped to a location in the correlation matrix to reduce dimensionality and increase performance.

Risk Toolbox[1]

Risk toolbox is an enhancement and complement on the current parametric VaR method. It includes marginal VaR, component VaR and incremental VaR. It helps trading and risk management departments quickly and easily determine the size of the trade and its impact on overall portfolio VaR before having to commit to its execution. Risk toolbox can also help users select the asset that provides the best risk-return trade-off.

II. Historical

Historical VaR is a scenario-based methodology, whereby the user is able to apply a set of historical market conditions to the current portfolio. This allows the risk manager to analyze and understand the implication that a prior market event would have had on their portfolio should it re-occur. For example, the market conditions that existed when a geo-political event occurred can be selected and the portfolio washed through it and studied.

Volatility updating[2]

Volatility updating VaR adjusts historical data on each market variable to reflect the difference between the historical volatility of the market variable and its current volatility and uses this in determining historic VaR.

[1] This will be released in Aligne 3.0 Configurable Risk
[2] This will be released in Aligne 3.0 Configurable Risk

III. Monte Carlo

Monte Carlo VaR is the most robust and flexible approach available for handling increasingly complex financial instruments and computing market risk. It uses a non-parametric, multi-factor model for the generation of forward price curves, based on the Heath-Jarrow-Morton framework and makes no assumptions regarding the payoff of the portfolio instrument underliers.

Each instrument is fully re-valued at each simulation step with their specific model. Additionally, the risk manager has the ability to layer additional dimensions of risk or "factors" into the market model by applying jumps to power markets or by smoothing gas markets into seasonal patterns.

Vega VaR[3]

Vega VaR is an enhancement to the Monte Carlo method that can not only simulate the underlying price but also simulate volatility which is used to re-value the option. Vega VaR generates more accurate VaR results for portfolio containing large number of option trades.

Below is a sample output for a European call option on IPE/NBP with/without Vega VaR. The report shows the base underlying price/volatility and simulated underlying price/volatility based on the first and the 500th simulation.

With Vega VaR enabled:

STARTDT	ENDDT	ASOFDT	Under-Base	Under-Sim1st	Under-Sim500th	Vol-Base	Vol-Sim 1st	Vol-Sim500th
20/08/2009	20/09/2009	20/08/2009	1.3312	1.1158	1.9798	233.63%	**73.20%**	**72.24%**
20/09/2009	20/10/2009	20/08/2009	1.1705	4.6001	1.8191	446.41%	**340.24%**	**552.66%**
20/10/2009	20/11/2009	20/08/2009	1.2758	5.6391	2.3746	735.23%	**453.11%**	**300.80%**
20/11/2009	20/12/2009	20/08/2009	1.3550	1.8585	1.7905	467.92%	**263.33%**	**805.53%**
20/12/2009	20/01/2010	20/08/2009	1.2387	2.2369	1.8133	664.30%	**444.79%**	**6.76%**

Without Vega VaR enabled:

STARTDT	ENDDT	ASOFDT	Under-Base	Under-Sim1st	Under-Sim500th	Vol-Base	Vol-Sim 1st	Vol-Sim500th
20/08/2009	20/09/2009	20/08/2009	1.3312	1.1158	1.9798	233.63%	**233.63%**	**233.63%**
20/09/2009	20/10/2009	20/08/2009	1.1705	4.6001	1.8191	446.41%	**446.41%**	**446.41%**
20/10/2009	20/11/2009	20/08/2009	1.2758	5.6391	2.3746	735.23%	**735.23%**	**735.23%**
20/11/2009	20/12/2009	20/08/2009	1.3550	1.8585	1.7905	467.92%	**467.92%**	**467.92%**
20/12/2009	20/01/2010	20/08/2009	1.2387	2.2369	1.8133	664.30%	**664.30%**	**664.30%**

Earnings at Risk & Cash Flow at Risk

Whereas VaR calculations attempt to quantify the risk associated in price fluctuations by constructing sophisticated pricing models, EaR and CFaR are used to quantify and optimize the long-term (order of months or years) economic viability of an organization. Furthermore, VaR looks at the risks inherent in the revenue stream, whereas EaR and CFaR consider other factors including cost and payment dates.

The use of a single EaR and CFaR number facilitates the setting and monitoring of trading limits, defining strategies and understanding the distribution around the gross margin. EaR and CFaR numbers should be reported frequently, so that the trends in the company's market exposure become apparent and trading portfolios can be managed accordingly.

The calculation of an EaR metric would allow an asset owner to answer such questions as:

- How much of a drop in EBIT (earnings before interest and taxes) could I suffer before the stock price would be affected?

[3] This is a new feature in Aligne 2.0 Configurable Risk

- What are our earnings per share at risk?
- How sure can we be that if we continue doing things the same way, we'll achieve our earnings target?

The calculation of a CFaR metric would allow an asset owner to answer such questions as:

- What are the distributions around my cash flow periodically?
- How far could cash flows drop before my credit rating gets put at risk?
- How should treasury allocate capital between liquid and non-liquid instruments?

EaR Functionality

This functionality provides you with the ability to capture different types of earnings in your calculation:

- Expected earnings for balance of a year
  - projected trading activity and operational costs until year end
- Unrealized earnings in current book
  - earnings on deals in active trading book
- Realized earnings to date
  - realized P&L on all settled deals from beginning of year to current date
- Cashcost
  - function of total MWH's in expected earnings for balance of year

Benefits include being able to:

- Identify the contributory earnings components that have the capacity to fluctuate (exhibit risk)
- Quantify the fluctuations in the identified components
- Using a Monte Carlo engine, generate N number of possible earnings/spot price scenarios over the chosen horizon using a consistent price simulation framework
- Compile the resultant data set and determination of the earnings-at-confidence and subsequently the earnings at risk
- User can check the simulated forward price and spot price of individual curves.

CFaR Functionality

This functionality helps provide you with the ability to measure your distribution around cash flows at pre-defined intervals of time by capturing contracts with uncertainty around your cash flows and your respective payment details.

Benefits include being able to:

- Identify those contributory contracts that are prone to fluctuating cash flows
- Quantify the fluctuations in the identified contracts
- Using a Monte Carlo engine, generate N number of possible cash flow/spot price scenarios over the chosen horizon using a consistent price simulation framework
- Compile the resultant data set and determine the cash flow-at-confidence and subsequently the cash flow at risk

2. Measurement of Additional Market Uncertainties

Values at Risk, Earnings at Risk and Cash Flow at Risk can have additional uncertainties imposed other than just price uncertainty. Aligne Configurable Risk provides you with the ability to measure the impact of the following uncertainties:

Credit VaR

Since the bankruptcies of large energy companies, like Enron in the early 2000's, the global financial crisis that began in 2007 and the more recent Basel II Accord, credit risk is being recognized as an important source of risk faced by institutions. This form of risk arises from the possibility that borrowers and counterparties in transactions may default or, more generally, that changes in debt value may occur due to changes in obligor credit quality.

The Basel II Capital Accord threatens to impose punitive capital charges for procedural errors, conscious limit violations and other operational risks. Corporations must maintain evidence that they are effectively managing credit risk as credit rating agencies now scrutinize an institution's credit risk operations.

The Credit VaR functionality allows Credit Officers to identify and quantify their credit risk by providing the ability to:

- Calculate and report on several advanced credit-related metrics
- Assess current and potential exposures for the portfolio by including the changes in value caused by possible default events

Managers can then make risk versus return trade-offs with knowledge of not only the expected credit losses, but also the uncertainty of loss.

Key features:

- Correlation of credit quality moves across obligors (allows the direct calculation of the diversification benefits or potential over-concentrations across the portfolio)
- Recovery rates provide an insight into which counterparties contribute the most to potential future credit risk
- Credit mitigation tools such as netting, collaterals and margin cash, third party loan guarantees, letters of credit
- Credit-By-Profiles[4] is an enhancement to Credit VaR. It allows a user to group and analyze similar contracts for a given counterparty that share the same credit line, ratings and netting rule.

Volumetric Risk

Volumetric risk is the exposure faced by generators, retailers and other agents in the industry due to fluctuations in generation output (supply) and retail load uptake (demand). Possible reasons for fluctuations may be:

Unexpected

- Irregular plant output due to environmental effects
- Random generation output
- Inaccuracy of forecasted demand

Planned

- Generation capacities that are utilized only at a given market price
- Delivery commitments depending on market price

[4] This is new feature in Aligne 2.0 Configurable Risk

Unexpected load fluctuations are captured in load volatility curves and jump parameters (random outages). Planned load fluctuations include changes in load due to options, which have been bought or sold at particular strike prices.

Volumetric risk attempts to predict the difference between forecasted and the expected realized load at a given confidence level for a future date. Volume at Risk reports the portfolio's distribution of positions at risk (simulated minus actual position).

Aligne Configurable Risk provides a Monte Carlo Volume at Risk measure. A statistically relevant number (user definable) of price/load scenarios are generated with a Monte Carlo engine against which the (stimulated) position of the portfolio is calculated and compared to the portfolio's actual position. Inputs to the Monte Carlo engine include:

- Simulation horizon (future date for which volumetric risk shall be reported)
- Forward volatilities of price and load curves
- Forward correlation between price and load curves
- Jump and / or seasonality parameters (optional)

Foreign Exchange Risk

Most energy companies today have trading activity or assets spread across multiple countries or even continents. The ability to understand this global impact on their risk is essential and Aligne Configurable Risk provides the tools to do this quickly, easily and above all, accurately. The Foreign Exchange component helps to assess the correlated impact of positions in multiple currencies, and allows the risk manager to view the "all-in-risk" including Foreign Exchange, or to strip out just that component for further analysis.

Interest Rate Risk

For positions or instruments that are sensitive to interest rate movements, such as options positions, or even if fluctuations in NPV are to be studied, the interest rate risk component is essential. The interest rate component helps to assess the correlated impact of interest rate fluctuations with the commodity markets, and allows the risk manager to view the "all-in-risk" including interest rate, or to strip out just that component for further analysis.

3. Stress Testing

Stress tests complement simulation based models such as Value at Risk are highly valuable for risk monitoring. The simulation based models forecast worst case losses conditional on markets as they have generally behaved in the past, by using historical market factor returns going back approximately one year or so. Stress tests are exercises to determine the losses that might occur under extreme but plausible circumstances. The essence of stress testing is the creation of user-defined scenarios, fed into a calculation engine to produce estimates of the profits or losses that can be expected under these scenarios.

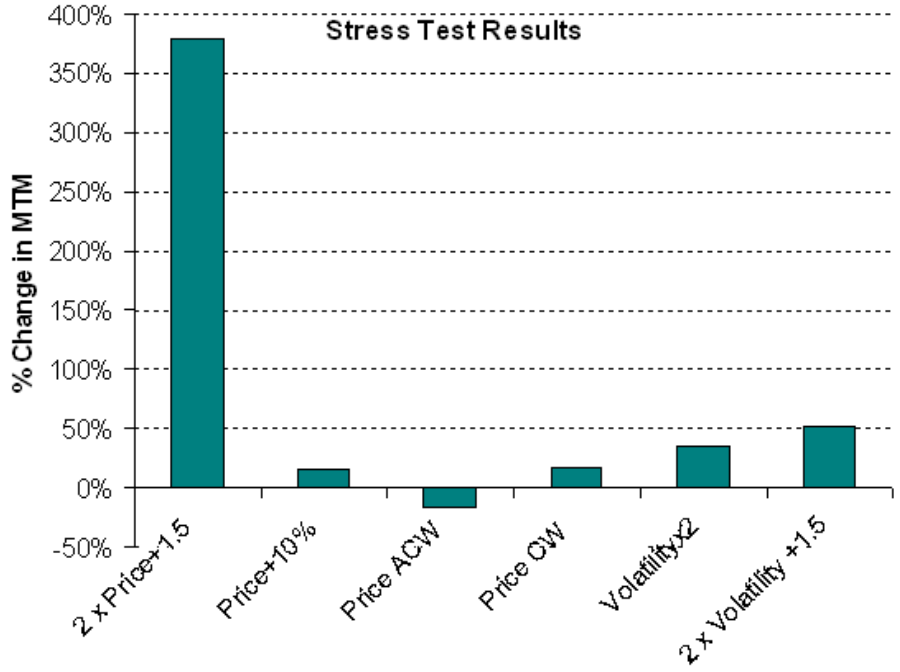
Stress tests are user-created shifts to price and/or volatility curves and/or volumes. Shifts can be additive, multiplicative and substitutive (specific price curves can be replaced with other price curves). The value of a portfolio is recalculated after the application of these shifts and the change in MTM is reported after the stresses have been applied. The goal is to display the resiliency (or lack thereof) of a portfolio to adverse conditions by calculating the effect of shifts on the value of that portfolio.

Aligne Configurable Risk allows various types of shifts (or stresses) to be set up to address your different business requirements. For example:

- Prices, volumes or volatilities can be shifted using multiplicative shifts to move upwards such that higher amounts increase at a faster rate than the lower amounts or vice versa
- Likewise, using the additive shifts prices, volumes or volatilities could be shifted in parallel upwards or downwards
- Combinations of different kinds of shifts on prices along with volumes and volatilities can be generated. Shifts can be set on prices and/or quantities and/or volatilities of multiple market-component combinations simultaneously

Stress Test Reports

Standard stress test report displays change in MTM of each stress test scenario; it is part of the overall Monte Carlo VaR report. The following graph shows the stress test results:



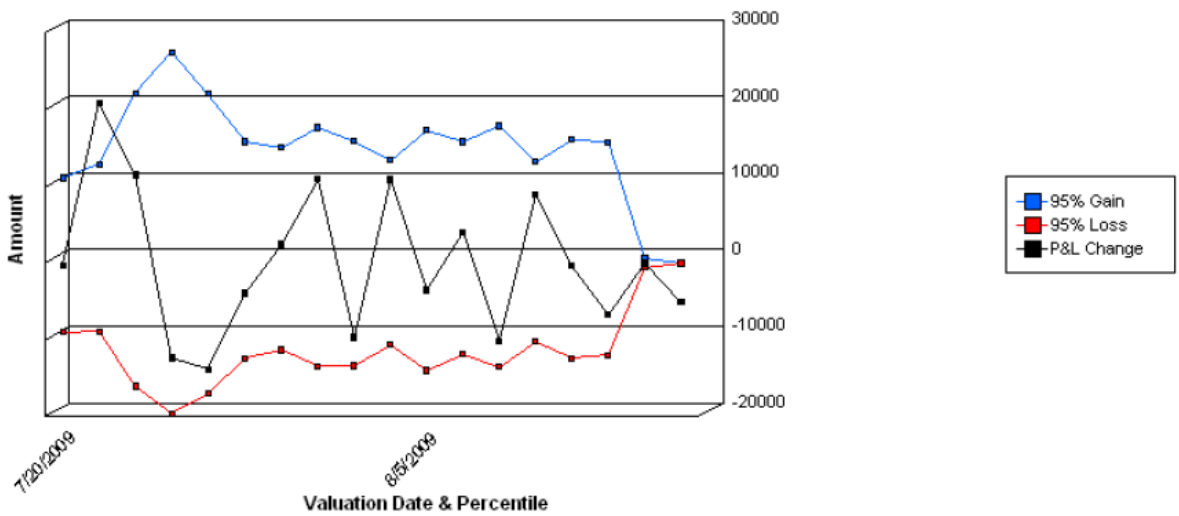
If a user wants to drill down to see the shifted price curve, “stress test curve” offers a detailed report of price before and after customised shift.

Aligne’s front and middle office provides advanced reporting functionality with which a user can build sophisticated reports combining various stress test scenarios. They employ different types of output format and may also feed into a customer’s reporting tool.

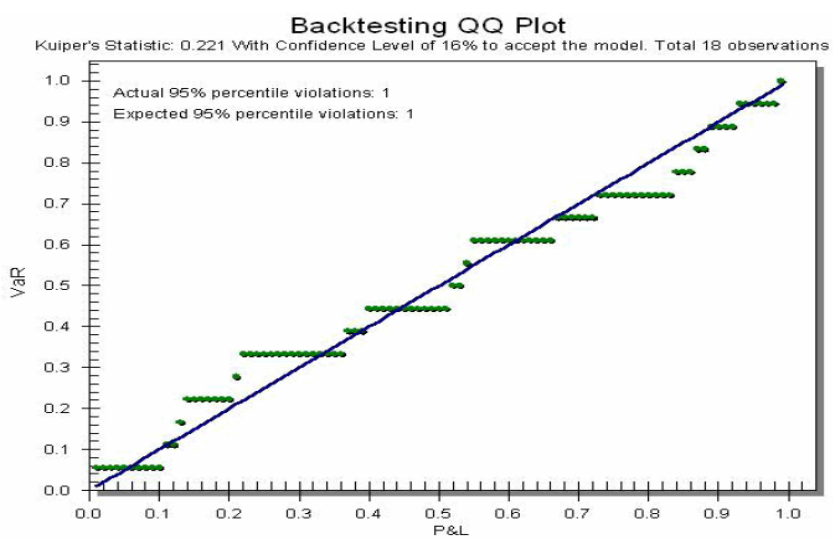
VaR Backtesting

Aligne Configurable Risk uses backtesting to assess the accuracy and performance of a VaR model. It offers the ability to perform three market recognized backtesting methods:

a. *VaR backtesting report/graph* - a very intuitive way to check the model performance is the visual inspection of how many P&L violations occurred in the past for a given percentiles:



b. *Kuiper’s Test with quantile-quantile plot (Q-Q plot)* tests whether the P&L distribution matches that modeled by the VaR method. It also considers the quality of the VaR simulation based on the whole distribution instead of just one point. Generally, a Q-Q plot is used to determine if two datasets have a common distribution. The Q-Q plot is a visual illustration of precisely where in the distribution deviations from expectations occur:



4. Grid-enhanced Monte Carlo VaR & EaR

Calculating VaR or EaR helps you to understand the impact of energy market changes on your company's financial position, but it can be a challenge to complete them as transaction volumes grow or portfolio complexity increases. Monte Carlo VaR follows a simulation based approach to derive the VaR number. This simulation based approach is very demanding on the available computing resources of an energy company.

To take an example of a 1,000 simulations calculation, the maximum calculation time is consumed in an effort to revalue the entire portfolio 1,000 times once for each simulation. The precision of the valuation number output by Monte Carlo VaR increases by increasing the number of simulations. However, at the same time, increasing the number of simulations also increases the processing time. Furthermore, as the portfolio size increases, the time to run these simulations also continues to increase.

SunGard recognizes the need for risk managers to have timely and accurate information to support next day decision making and offers grid-enhanced Monte Carlo VaR and EaR to help you to achieve these goals. Grid computing is a form of distributed computing, which can solve larger, more complex problems in a shorter time and also makes better use of existing hardware.

Major benefits:

- Greatly reduces the calculation's processing time allowing you to spend more time conducting important risk analysis tests such as stress testing and backtesting
- Allows errors to be caught such as a missing or incorrect price curves in time to re-run the analysis for the next business day
- Provides the ability to run more simulations for more precise valuations
- Handles increased transaction volumes or complexity with existing resources to deliver performance gains of up to 10X over standard architectures
- Allows you to run the analyses during the day rather than being constrained to end-of-day batch processing.

The GridServer Execution Platform

To achieve the performance needed to complete more iterations of risk analytics within an acceptable window of time, the SunGard Energy Monte Carlo VaR and EaR solutions execute multiple simulations and calculations in parallel. This is enabled by GridServer software that provides a service execution platform for the applications.

The GridServer enables fully-functional "services" and the business logic of the VaR and EaR applications to be deployed to and execute on a grid. The GridServer service execution platform, transforms your "hardware platform" into a virtual grid of network, processing and data resources to optimize computing speed, efficiency, flexibility and resilience and streamline service lifecycle management.

About SunGard Energy Solutions

SunGard's energy solutions help energy companies, industrials and financial services, to efficiently compete in global energy markets by streamlining and integrating the trading, risk management and operations of physical commodities and their associated financial instruments. These solutions provide front to back-office support for capturing deals, delivering market data for valuation, clearing and reconciliation of transactions, invoicing and accounting for transactions, analysis and management of risk, and physical transmission or delivery of commodities.

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