

Recent developments in the financial markets coupled with ensuing rethinking of strategic plans in the energy industry are leading market participants to a déjà-vu perspective: Physical assets constitute a key building block, in fact a corner stone, for a stable competitive energy company. The “asset-light” strategy that emerged shortly after the introduction of competition to the energy utility industry in the 1990s, has proven to be a very risky approach that is dangerously prone to swings in commodity prices under a constantly evolving business environment. Similarly the “build it and they will come” approach adopted by some market participants, mostly new entrant merchant players, did not prove to be a viable strategy either and led to major restructuring and consolidation activities that served as another reminder of the validity and importance of one of the most basic economic concepts, the balance of supply and demand.

## Lessons Learned

A thoughtful analysis of the last ten years leads to the rather simple yet very important observation that the power industry, much like other commodity industries, is moving toward a balanced convergence of two fundamental market building blocks: Physical assets and trading. The lack of needed integration between physical asset management and energy trading was a leading contributor to the turbulent times experienced by many energy players in the last decade. Looking forward, industry analysts agree on the need for improved management strategies and supporting tools to achieve stable and sustainable operations. More specifically, market participants in the power industry need improved tools in four key business areas:

- ✓ Generation management
- ✓ Trading management
- ✓ Risk management
- ✓ Integration.

## Improved Generation Management

Management of generation assets in the regulated power industry focused on cost minimization methods within a cost recovery environment. These tools, often called *production costing* systems, fail to properly address market dynamics and commodity price volatilities and therefore under-estimate risk analysis and management. The tools introduced during the post deregulation environment focused on energy trading and treated generation assets as spark spreads, a modeling solution that proved to be very limited and inadequate to address operational details and limitations. Increased competition and thinning margins create pressing needs for new more advanced tools that facilitate improved decision making under complex operational considerations and volatile commodity prices. Modeling requirements of improved generation asset management tools include:

- ✓ Operational limits including annual maximum operating hours and/or maximum number of on/off cycles.
- ✓ Production allocation (often called co-optimization) among competing energy and ancillary services (spinning reserves, regulation, other).
- ✓ Fuel management including fuel contract management with minimum and/or maximum volumetric limits, fuel delivery contracts including capacity limits and penalties, and multi-fuel blending and selection (for coal fired generation).
- ✓ Multiple emission considerations (SO<sub>2</sub>, NO<sub>x</sub>, CO<sub>2</sub>, other) including emission allowance prices and emission plant and/or portfolio limits.

## Improved Trading Management

The emergence of trading in the energy industry led to the introduction of a set of tools needed to facilitate the processing of an increased number of transactions. These tools, often called Energy Trading and Risk Management (ETRM) systems, focus mostly on transactional requirements including trade capture, confirmation workflow, commodity logistics, scheduling, and trade settlement. Most ETRM systems include only very basic valuation capabilities, often limited to simple closed form financial engineering methods (such as Black-Scholes option valuation). Modeling requirements of improved trading management tools include:

- ✓ Simulation valuation methods including ability to determine trade value under different market scenarios.
- ✓ Rigorous analytics that support multi-commodity physical and financial trades.
- ✓ Flexible and scalable reporting that meets internal corporate management needs and facilitates compliance with increased reporting requirements instigated by emerging regulations.
- ✓ Trade monitoring including market manipulation detection, trading practices, position limit monitoring, and counterparty analytics.

## Improved Risk Management

Most ETRM systems include only very basic and limited risk management capabilities, often limited to commonly used Greeks (such as Delta, Gamma, Vega, Rho, etc.), Mark-to-Market, and Value-at-Risk. Improved risk management requires tools, processes, and people to address all relevant risks and exposures. Risk management gained more prominence after a series of multi-billion dollar financial losses in the 1990s including Metallgesellschaft (1993), Orange County (1994), Barings Bank (1995), Daiwa Bank (1995), and Sumitomo Corp (1996). Modeling requirements of improved risk management tools include:

- ✓ Full simulation valuation including simulating market prices, trader decisions, and system operator decisions under different market scenarios to estimate trade values.
- ✓ Expanded risk metrics including profit at risk, earnings at risk, cash flow at risk, and several other financial and volumetric metrics at risk.
- ✓ Credit management including current and potential financial and economic business risks associated with various trading activities (contracts, counterparties, exposures, settlements, and collaterals) including current and potential future exposure, risk concentration and mitigation analysis, economic adequacy (economic capital), and financial liquidity analysis (CELA, MCELA).
- ✓ Standard Portfolio Analysis of risk (SPAN), a common simulation-based framework developed by the Chicago Mercantile Exchange in 1988 to create different risk cases that include various changes in market price, volatility, intra-commodity and inter-commodity spreads.
- ✓ Comprehensive risk assessment and management including market risk (absolute and basis; linear and nonlinear), supply risk (generation, fuels, other), operational risk (systems, infrastructure, management, fraud, human), strategic risk (market dynamics, disruptions), and legal risk (regulatory, compliance).

## Improved Integration

Improved methods and tools for generation management, trading management, and risk management require seamless integration to facilitate improved and informed decisions. Integrating actionable information across different key areas is a key requirement; the building blocks of an integration solution include:

- ✓ Generation management capability to simulate the operations of a fleet of power plants under different market prices and various unit, plant, and portfolio operating limits and availability scenarios.
- ✓ Risk management tools to enable rigorous assessment and management of inter-related risks.
- ✓ Trade valuation to enable both on-command and full simulation valuation of various trade types and commodities.
- ✓ Load analysis to estimate gas and electric loads for a set of customer classes in one or multiple locations.
- ✓ Financial analysis to estimate revenues, costs, profits, and various key financial measures for different scenarios.
- ✓ Asset valuation tools to assess alternative return and risk metrics for generation units, trades, loads, and other assets.
- ✓ Optimization methods to identify realistic and practical changes that can increase portfolio return and/or reduce its risk.
- ✓ A computational infrastructure to enable the performance of needed simulations and analysis within a reasonable time.

Recent advances in hardware and software technologies enable implementing needed highly integrated applications including advanced generation management, trading management, and risk management tools. Legacy silo-focused simplistic methods are no longer adequate to meet emerging needs and challenges. The energy industry is no longer the “safe” business it used to be during the regulated environment; it is becoming increasingly competitive and will most certainly witness additional “survival of the fittest” shakeouts.

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