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IMAGINE A WORLD WITHOUT ENERGY SETTLEMENT RISK

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ABSTRACT

The global energy market is worth about $6 trillion today, and has both financial and physical aspects to it. The supply chains are vast, complicated, and risky. Because of this complexity, and legacy delivery, settlement, and contract conventions dating back to the 19th century, administrative and back-office costs are high. So are the costs of settlement risk, but thanks to innovative new technologies and services, the day is fast approaching when settlement risk will be a distant memory.

EXECUTIVE SUMMARY

Commodity trading and marketing has been around for centuries. Agricultural and metal trading markets are probably the oldest, while energy commodity trading and marketing is a more recent development.[1] And it was very much a physical market back then. Actual bushels of grain and ounces of gold had to be moved from point A to point B. Energy commodities are no different. Crude oil, measured in barrels, must be moved from where it is extracted and gathered to storage and refineries. Natural gas, usually measured in millions of British thermal units ("MMBtu"), also has to be moved from where it is extracted, gathered, and processed to storage, power plants, industrial customers, and retail distribution companies. Electric power, actual electrons usually measured in megawatts ("MW") and megawatt hours ("MWh"), needs to move all around the country from generating plants to end users, while maintaining a balanced grid.

Crude oil and natural gas are the two biggest sources of energy in the U.S. today. Electricity comes in third, but it is a secondary source of energy because it has to be "generated" by using another source, such as coal, natural gas, uranium, wind, or solar energy.[2] Physical markets include the natural resources in the ground, and gathering systems, pipelines, barges, trucks, and the wires used to move actual molecules of energy commodities around the nation.

Today, our modern energy markets also have financial aspects as well. Modern financial markets, like the Chicago Mercantile Exchange and the Intercontinental Exchange ("ICE"), clear the activity of buying and selling specific financial products based on physical energy commodities. The key difference is that physical trades result in the actual movement of commodities, and financial trades result in the movement of money. Physical markets involve a great deal of complexity, given the size of the U.S. and the vast distances involved in the industry.[3] Locations include demarcated regions, nodes, zones, and hubs. Time frames can be as granular as 15 minutes, hourly, daily, monthly, quarterly, or annually. Financial markets involve all of the complexity of the global banking system.

The types of products continue to grow, limited only by human imagination and legal structures. There are products for the actual molecules and volumes, as well as for such things as capacity and storage. This vast energy complex creates a unique form of risk, called settlement risk, which today measures in the hundreds of millions of dollars of exposure. Similar to credit risk, settlement risk refers to delivery failures, as well as the failure to close out and match accurately with counterparties. It often constitutes volume disputes, given the physical nature of the business. Problems translate directly into time and money. Traditionally, settlement risk has been difficult to manage, but recent breakthroughs in financial technology are poised to solve this challenge. If just 1% of settlement risk is mitigated in a $6 trillion market, that represents an annual $60 billion capital risk savings. And far more than 1% can be mitigated.

SETTLEMENT RISK

In order to understand settlement risk, it is essential to understand the evolution of energy contracts. The use of forward and futures contracts in the U.S. dates back to the 19th century. Given its centralized location, Chicago became a natural center for commodity trading, marketing, and settlement. The Chicago Board of Trade was founded in 1848, and in March of 1851, records show, a forward contract for corn was executed.[4] The nature of this first trade is important to grasp in order to see why commodities trade and settle today the way they do. This contract was for 3,000 bushels of corn that had to be physically delivered to Chicago sometime in June. But the price used was the March price. Moving commodities to market took time, and while physical supply and transportation today can be done much faster than it was done in the 19th century, much of how these early contracts worked then lingers to this day.

The International Swaps and Derivatives Association ("ISDA")[5] is an excellent resource to use to understand the complexity of the various settlement processes in the modern energy industry. The most important concept to grasp is that the commodities settlement process is date-driven. Specific dates each month correspond to the settlement of different types of energy products. Sometimes, settlement only occurs once per month. Many traded financial commodities settle five business days after pricing is closed, and in the U.S., financial power contracts settle on the 10th business day of the month. Physical commodities have different and specific settlement dates. North American physical power usually settles on the 20th calendar day of the month following the delivery month, and North American natural gas settles on the 25th calendar day of the month following the delivery month. Specific independent system operators, or "ISOs," often have their own unique conventions. For example, MISO Energy settles seven days after the action, and payment is due 14 days after that.[6] New York Independent System Operator and PJM Interconnection use one settlement convention for the day-ahead power market, and a separate settlement convention for real-time dispatch.[7]

The specific nature of physical energy markets causes settlement times to be longer. It takes time to figure out why there are discrepancies, and to this day physical statements are often still used. Transportation statements, for example, will often come in via fax or email as a PDF. Electric power products are very challenging, because their prices are published on either a 15-minute or an hourly increment. This means that four price changes per hour are needed to be done for each mismatch.

The volumes, dollars, and capital at risk are astonishing. Data from the Energy Information Administration illustrates this clearly:[8]

2016 ICE Power

Total MWh	39,202,800
Number of Trades	61,184
Number of Counterparties	25,010
Wtd avg price $/MWh	$30.18
Dollar Volumes	$1,183,149,871

2016 ICE Natural Gas

Total MMBtu	487,410,300
Number of Trades	78,204
Number of Counterparties	36,967
Wtd avg price $/MMBtu	$2.49
Dollar Volumes	$1,215,849,430

This data does not reflect the entire energy market here in the U.S. for these commodities, but gives an illustration of about 60-70 percent of the power and natural gas markets by size.

THE MATH: MEASURING SETTLEMENT RISK

In the framework of counterparty credit risk, the word "exposure" refers to how much can be lost if a counterparty defaults. This same concept and its associated analytics can be applied directly to settlement risk, as they are very similar in modeling techniques. There are various types of exposure. At any given future time, exposure is the larger between zero and the market value of the portfolio of derivative positions or physical deliveries with a counterparty that would be lost if the counterparty were to default or fail to settle with zero recovery rate. Current exposure (CE) is the current expected value under the exposure to a counterparty. Potential future exposure (PFE) for a given date is the maximum value of exposure at that date with a high degree of statistical confidence. The curve of PFE in time is the potential exposure profile, which runs up to the final maturity of trades with the counterparty.

PFE is usually computed via simulations and the peak of PFE over the life of the transaction and is called maximum potential future exposure. While PFE describes what is going to be lost if default happens, value at risk (the difference between the mean and the percentile — say 99.9% — on the loss distribution associated with the position held by the energy merchant, over a given time horizon, e.g., 1 year) quantifies what the final loss that is not exceeded with a given probability, over a given time horizon, will be.

Expected exposure (EE) gives the average exposure at some future date. The curve of EE in time, as the future date varies, provides the expected exposure profile. The average EE in time up to a given future date is called expected positive exposure (EPE).

A final important measure of exposure, which is possibly the most common, is exposure at default (EAD), which is defined as the exposure valued at the (random) future default time of the counterparty. PFE is mainly used internally to monitor if limits with some counterparty are exceeded. EE is used in combination with other quantities like default probabilities and recovery rate estimates to calculate EAD and the **capital requirements due to counterparty risk**.

The latter mechanism is extensively explained in Basel II regulations (and in the forthcoming Basel III) that provide rules and approximations explaining how such exposure could be estimated and calculated. These very concepts can be applied directly to the energy industry, and used to evaluate the capital and risk savings that merchants gain if they can mitigate, reduce, and ultimately eliminate settlement risk.

ENTER THE BACK OFFICE

This complexity is why the typical energy trading floor, and commercial floor in a corporation, includes three distinct teams, tied together by people and systems. The front office is the commercial team, and it runs the trade floor P&L. This is where the traders and marketers reside. The mid office includes risk professionals who keep track of all market activity executed by the front office traders, while paying close attention to actual market conditions. These risk professionals are generally the people who manage the complex models used in energy market work. The back office includes the accounting and settlements staff, who are responsible for tracking all of the documentation that confirms trades and contracts, and the associated accounting. This team has to match physical volumes of oil, power, gas, and other commodities that come in or go out from the company's assets with the volumes promised by contract. On the financial side, this team also does matching, but focuses more on actual cash flows moving between the company and its counterparties, to settle derivative instruments and other types of contracts.

In short, the back-office function in companies that do commodity and energy trading and marketing is a very complex, time-consuming, and time-critical process. These energy merchants often have many different counterparties, and most industry participants deal in multiple commodities. As mentioned, there are several types of structures: bilateral, internal, physical, financial, ISO, etc. Even some of the largest energy merchants have fragmented access to settlement information, still using legacy platforms such as email, energy trade and risk management systems, MS Excel, and others. Limited reporting, data retrieval, and analysis capabilities are also commonplace.

The problem with lengthened settlement and invoice cycles is that it creates higher levels of unsecured credit exposure and operational risk. This in turn results in multiple payment due dates that require nearly continuous cash monitoring by the treasury and by the back office. Significant amounts of collateral, which is posted to mitigate credit and operational risk, is costly and takes capital away from other parts of the business.

ISDA highlights several processes that occur in the back office that help to reduce settlement risk.[9] Third-party brokers send out confirmations, which can be used to validate trade economics. Sometimes verbal confirmation of trade economics is done to reduce errors and issues. Spot checks of cash flows occurring before settlement date help to catch issues early. And the actual movement of the physical commodity, like oil or natural gas, can be used to track activity before settlement day.

But what do all of these things have in common? They are labor-intensive. They require personnel to complete, and this costs money and reduces, without eliminating, the risk of human error. The use of technology to do confirmation matching electronically has grown in importance over the past 10 years in this industry. Companies including eConfirm, EFET, and SWIFT are examples of service providers. The growth of matching platforms has helped to decrease the number of trades requiring hard-copy confirmations, which in turn decrease the labor component. However, these activities do not mitigate settlement risk, they only ensure that the trades look the same on both sides.

TECHNOLOGY MEETS COMMODITIES

The key to mitigating settlement risk is a combination of advanced matching technology, workflow management, and clear communications. As the industry migrates to cloud technologies, which create settlement networks, three things will happen. First, profitability will go up. Second, risk will go down. And third, capital costs will be lowered.

A good example of this type of thinking is Aquilon Energy's "Energy Settlement Network," or ESN. ESN is software as a service along the lines of eConfirm, but more robust. ESN is a newcomer to the field, and it automates the entire settlement process for commodities and energy. It can handle multiple commodities and energy products, and is scalable for all of the counterparties that a trader/marketer might have. There is no need to make changes to incumbent accounting systems, and ESN can store all settlement data.

ESN uses an Energy Matching Engine that executes sub-hourly ISO energy matching, hourly bilateral power matching, and daily gas matching. Its Settlement Workflow Engine manages a linear process from Draft to Approved to Invoiced to Paid. And its communications module ensures secure counterparty messaging, automated email generation, and complete communication archiving and retrieval.

ESN is one example of a service and technology that fits into the most current themes in technology. Technological advances, particularly in the field of big data and cloud computing have caused substantial disruption in a wide variety of industries in recent years, and the pace of the disruption is accelerating. Perhaps the industry that has been affected the most by rapid technological innovation is the vast financial services industry. Financial technology, or fintech, has started to change the way payments and loans are made in the United States, and is affecting other areas of the banking business as well. Cost reductions, via measurable efficiency enhancements, are generally the lead item in any fintech story. According to a Deloitte study, the movement of money to settle transactions can cost as much as 7.5% of the transaction value, and a 5% reduction of this number would save the economy $16 billion annually.[10] But fintech is not just about costs. It also has proven its ability to enhance quality and customer experiences as well, which is a one-two punch to traditional financial institutions. The big data element creates detailed, granular, and clustered market intelligence that can provide competitive advantages to those players that know how to harvest it. ESN is an example of fintech and the cloud applied to commodities and energy.

Fintech refers to innovative technology that improves and enhances the way in which financial services are delivered to customers. In general, it is software- rather than hardware-focused, and usually uses shared, networked, or cloud concepts. For example, bitcoin is a type of fintech, and it is managed on an electronic accounting ledger called blockchain. Blockchain is a decentralized, cloud-based accounting network that ties together all of its participants into a single network. The broad categories that fintech has affected thus far include such areas as the payments system itself, which traditionally has been the domain of money-center commercial banks. Digital payments between people and/or companies that do not pass through a bank are a clear example of fintech. The evolution of crowdfunding is another example, as it removes traditional banks from the investing and lending process.

Predictive modeling and big data analytics are perhaps the most powerful byproducts of the fintech revolution. Analyzing customer service data, and so-called churn, which refers to how fast customers come and go, can be done much faster and more accurately due to product breakthroughs in fintech. Powerful processors, innovative code and software, coupled with cloud or network systems, give companies the ability to be more customer-focused on an account-by-account basis.

Fintech can reduce physical infrastructure costs and at the same time reduce headcount costs. Some studies suggest that there might be as much as $4 billion in potential yearly savings just from trade processing on Wall Street alone.[11] According to McKinsey, fintech lenders can achieve as much as 400 basis points, or 4 percent, cost advantage over traditional banks because they have not invested in physical plant and large headcounts.[12] Using a hypothetical energy company back-office team's structure, based on our actual experience, annual cost savings with a settlements automation and matching system, like ESN, can be substantial.

Fair Value Mid Office Team	$206,863
Fair Value Back Office Team ***No ESN***	$576,984
ESN Value Cost Savings	$370,121

But it's not just a cost story. Technological breakthroughs in hardware processing speed coupled with innovative software, attached to cloud networks, mean that customer-by-customer detail and specifics can be isolated. This need not be limited to banking customers, either. It will start to be used more and more in the energy industry.

The settlements area could be dramatically improved with the application of fintech ideas. To this day, a great deal of the back-office settlements work is still manual, and still uses faxes and emails to match up physical commodity volumes and dollar values for trading and marketing firms. Fintech concepts that are now being used by banks to match trades exactly and quickly can be applied to commodity and energy transactions with little difficulty. The algorithms, code, and other technology to do this already exist, regardless of the type of commodity, and in such a way that the exceptions and errors can be identified very quickly and captured by the mid office team for rapid response. This is one way that fintech can reduce both credit risk and settlement risk throughout the energy complex, because it identifies issues faster and more accurately. This in turn will reduce the amount of capital that has to be set aside for risk management support.

This is a critical point, because there tends to be an assumption that capital adequacy is only a banking concept, and highlighted by such regulatory frameworks as Basel III and the Dodd-Frank Wall Street Reform and Consumer Protection Act. But corporations set aside capital for risk management purposes, and they ensure that they have liquidity in their credit facilities for defaults and other failures. Just because this is not reported for regulatory purposes, such as with banks, does not mean that it is not there; and in the commodity and energy business it is often very significant. Lowering this capital level frees up resources to invest in the business itself. In simple corporate finance terms, every dollar that does not have to be held in reserve or available in revolvers or other credit facilities has a value of WACC * K.

Lastly, just as companies like Amazon and Google use complex algorithms to provide more accurate services to their customers, fintech enables financial firms to do such things as move more quickly to review loans, make payments, run credit checks, and provide detailed customer data to corporate clients. Energy is the next big thing in the fintech revolution.

IN CONCLUSION

Applying some of the recent technological breakthroughs like big data, the cloud, and fintech concepts to commodity and energy markets will produce astonishing cost savings, improved service quality, and enhanced business and market analytics. It is also likely to provide more stability in markets and on exchanges. In fact, fintech concepts, applied to energy markets, have the potential of making an even bigger impact than they do in banking markets, due to the fact that commodity prices are so volatile. Because of this volatility, it is often challenging to accurately quantify credit and settlement risk. Commodity and energy exposures change more rapidly than equity and fixed income exposures change. Commodities experience 30-40 percent annual volatility, vs. 13-15 percent for equities and 4-7 percent for fixed income assets. In settlement terms, there is a Day 0 exposure on both sides of a trade, based on the value of the physical commodity or derivative instrument. On Day 0+1, if there is a settlement or credit issue, the exposure calculation takes into account volatility, which can lead to a meaningful value even for just one day if the notional amount is large.

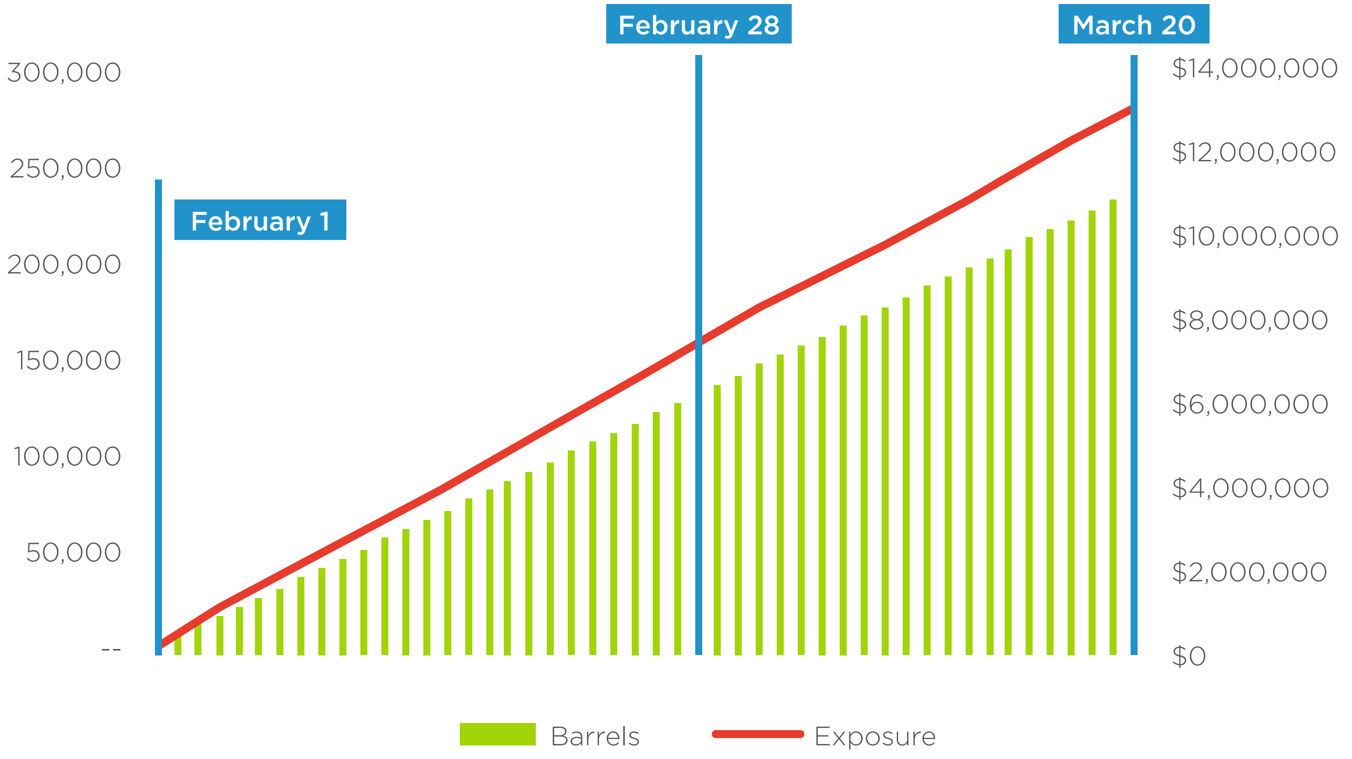
CASE STUDY OF CRUDE OIL

An excellent way to illustrate the value of eliminating settlement risk is to use an actual crude oil example. The standard text found in an "ISDA U.S. CRUDE OIL AND REFINED PETROLEUM PRODUCTS ANNEX" to an ISDA Master Agreement states as follows:

> "With respect to deliveries of crude oil, payment shall be made no later than the 20th day of the month **following the month of delivery**, subject to Buyer's receipt of notice of the amount due based on delivery effected, along with supporting documentation acceptable in industry practice, at least two Local Business Days prior to such 20th day, failing which payment shall be made no later than the 20th day of the following month. If the payment due date falls on a Saturday or a day that is neither a Local Business Day nor a Monday, payment shall be made on the preceding Local Business Day. If the payment due date falls on a Sunday or a Monday that is not a Local Business Day, payment shall be made on the following Local Business Day."

This means that if our company is shipping crude oil, say 5,000 barrels per day to another company, the exposure builds not just in the current month, but also in the following month. If we start on Feb. 1, 2017, then by Feb. 28, we will have shipped 140,000 barrels of oil, and not been paid yet. We continue to ship into March, and expect cash settlement on March 20. By this time, we will have shipped 240,000 barrels of oil to the counterparty. The settlement amount is for the February deliveries. Assuming a price of $55 per barrel for the oil, this means we are due $7,700,000 on March 20. Since we have been shipping since Feb. 1, the total exposure on March 20 is not $7,700,000 but $13,200,000. A settlement failure on March 20 might lead us to cut off deliveries, but we are already exposed to $13,200,000, which is $5,500,000 more than is owed to settle on March 20. Using a simple concept, WACC * K, the capital cost of a failure on March 20 if our WACC is 10%, will be $1,320,000. This is just one trade or contract, but if settlement risk is eliminated by a service such as ESN, then there is a savings of $1,320,000 in capital cost that can be invested elsewhere. If a service and technology like ESN can be combined with a fintech payments service, then simultaneous daily settlement and payment can be made, eliminating the risk entirely.

EXPOSURE



ABOUT THE AUTHOR

Tom McNulty is an energy industry expert, with a rare combination of deep and broad experience in banking, government, and in industry. Located in Houston, Texas, he is part of Navigant's Transaction Advisory Services team, and he solves the financial, restructuring, transaction, and valuation challenges that his clients are faced with in these rapidly changing energy markets. As an adviser, and in his corporate career, he has valued more than $43 billion in energy assets, businesses, and transactions. He has also advised on or executed $10 billion in M&A and principal investment deals, and is a frequent contributor on CNBC, Fox Business, and Bloomberg TV.

He studied military and diplomatic history at Yale University, where he was a varsity football letterman. Following graduation, he went to work on Wall Street with Brown Brothers Harriman and Co. ("BBH"), the nation's oldest private bank. He was a federal funds and eurodollar trader, and also worked in the bank's international treasury department. During his time with BBH he was selected for training in the elite U.S. Foreign Service, and was commissioned a Foreign Service Officer in November 1990. He volunteered for critical threat duty, and served tours of duty in Southeast Asia, Russia, and in Washington, D.C. He left the Foreign Service to pursue his MBA at Northwestern University.

Following business school, Tom moved to Houston and worked at three Fortune 100 energy companies; Enron International, Duke Energy, and Plains All American Pipeline. His corporate experience, in particular, enhances his ability to advise clients with complex transaction, valuation, and strategy issues. At all three companies, he worked on the M&A teams and in corporate treasury, and also had substantial experience in strategic planning, risk management, and market analysis. Specifically, in the context of this article, he had responsibility for credit and settlement risk across multiple commodities at both Duke and Plains.

END NOTES

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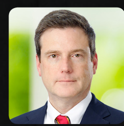
CONTACTS



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