



Margin Methodology Guide

Version 1.5

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Natural Gas Exchange Inc.

Natural Gas Exchange Inc. (“NGX” or the “Exchange”) was incorporated in 1993 and has operated continuously since February 10, 1994. Since beginning operations in February 1994, NGX has developed the AB-NIT (“AECO”) hub into one of the most liquid physically settled futures contracts in the energy markets in North America. In 2008, NGX and ICE launched an operational alliance where by NGX uses ICE’s front end trading technology and provides clearing services for ICE’s US physical gas products. NGX has operated as a wholly owned subsidiary of TMX Group Limited since 2004 (“TMX” or “TMX Group”) or an affiliate whose key subsidiaries operate cash and derivative markets and clearinghouses for multiple asset classes, including equities, fixed income and energy.

NGX is the clearinghouse for all cleared transactions in the NGX markets and ICE’s US physical gas markets. In this role, NGX maintains a secure and efficient clearing operation, managing various risks across market participants and products.

NGX acts as the central guarantor for all cleared transactions, acting as the buyer to every seller, and the seller to every buyer. This provides full cycle anonymity and introduces a neutral third party obligated to ensure the performance on both sides. There is no mutualized or legal relationship amongst counterparties and all collateral is segregated and for owner usage only.

Since each Contracting Party agrees to make NGX the counterparty to the transaction, the Contracting Parties look to NGX to manage risks to the ongoing operation of the clearinghouse. NGX is committed to ensuring the security and integrity of the clearing operation. NGX does not enter into transactions nor take positions in energy products for any reason other than to provide clearing services.

Disclaimer

This document is intended for information purposes only to provide background on NGX and its clearing and settlement operations. This document does not outline, indicate, suggest or form part of, and should in no way be construed to outline, indicate, suggest or form part of, the terms and conditions under which NGX and Contracting Parties agree to conduct business. For such information, parties should refer to the NGX Contracting Party’s Agreement.

Legal and Regulatory

NGX utilizes a standardized legal agreement with all the participating firms that transact through the Exchange. This agreement, called the NGX Contracting Party’s Agreement (“CPA”), outlines the terms and conditions for conducting business with NGX. Both the trading and the clearing components of NGX are governed by the provisions of the CPA. The agreement has currently been executed by over 275 participants (“Contracting Parties”) that comprise a cross-section of the North American energy industry, including producers, electricity generators, storage facility operators, industrial consumers, utilities, pipelines, aggregators, marketing firms, hedge funds and financial institutions.

The ASC is NGX’s lead regulator in Canada. NGX is recognized by the ASC under section 67 of the *Securities Act* (Alberta) as a clearing agency for natural gas, electricity and related contracts by an order issued effective October 9, 2008. The order was subsequently varied on: (i) April 9, 2009 to allow NGX to also offer crude oil commodity contracts; (ii) on July 11, 2012, in connection with the acquisition of NGX’s then parent company, TMX Group Inc., by Maple Group Acquisition Corporation (renamed TMX Group Limited); and (iii) on December 19, 2013 to require NGX to comply with the PFMLs. The Bank of Canada together with the CSA formally recognized NGX as a Qualified Central Counterparty on July 28, 2014.

NGX is also regulated by the Commodity Futures Trading Commission (“CFTC”) in the U.S. as a Derivatives Clearing Organization (“DCO”). The CFTC registered NGX as a DCO on December 12, 2008, which registration order was amended on March 20, 2013 following the implementation of *Dodd-Frank Wall Street Reform and Consumer Protection Act*.

NGX filed an application with the European Securities and Markets Authority (“ESMA”) to be recognized as a third country CCP in accordance with Article 25 of the European Markets Infrastructure Regulation. The application was approved by EMSA on January 28, 2016.



Each NGX Contracting Party is required to enter into the Contracting Party's Agreement ("CPA") which sets out the rules of the NGX clearing system. The CPA is governed by the laws of the Province of Alberta and the federal laws of Canada applicable therein.

2) CLEARING OPERATIONS

Introduction

NGX is a major clearing house for cleared North American physically-settled futures contracts in natural gas, electricity and oil and financially-settled futures contracts in Canadian electricity through the ICE Trading Platform ("Cleared Transactions"). In this role, NGX must maintain a secure and efficient clearing operation, managing various risks across many diverse market participants and products.

NGX acts as the Central Counterparty ("CCP") for all cleared transactions. This makes NGX the buyer to every seller, and the seller to every buyer. This provides for full cycle anonymity on every transaction, and introduces a third party into the transaction that is neutral and obligated to ensure the performance of the transaction.



As each Contracting Party agrees to make NGX the CCP to all cleared transactions, the Contracting Parties must collectively look to NGX to manage any risks to the ongoing operation of the clearing house.

NGX manages clearing risks using a combination of the following items which are explored in further detail in this document:

- Standardized Rules - All Contracting Parties are subject to the same rules under the CPA.
- Settlement Bank - NGX's settlement bank provides daylight and overdraft facilities to support daily and monthly settlements.
- Guarantee Fund - NGX provides a guarantee fund for Contracting Parties to access in the event of an exchange default, backed by a parental guarantee from TMX.
- Backstopping - Physical delivery risks are mitigated through the use of backstopping services.
- Collateral Provisions - Margin Requirements are covered by liquid collateral.
- Liquidation Rights - NGX has liquidation/acceleration rights if a Contracting Party default occurs.

NGX is committed to ensuring the security and integrity of the clearing operation. NGX and its subsidiaries do not enter into transactions nor take positions in energy products for any reason other than to provide clearing services.

CCP Clearing Benefits

CCP clearing facilitates anonymous trading by placing NGX between the buyers and sellers as a common counterparty. In addition to anonymity, CCP clearing affords the following key benefits:

Neutral, Independent Risk Management



NGX is impartial and the nature of the clearing business provides a strong incentive to maintain a default-free clearing operation. Furthermore, NGX is not a market participant, does not take a market view, and earnings are not directed by commodity prices.

Centralized Collateral Requirements

Concentration of capital with NGX affords the most efficient allocation of collateral by providing single point access to a large number of counterparties.

Counterparty Netting Facilities

CCP clearing and standardized netting rules create an environment to net physical and financial exposures across multiple counter parties and locations/instruments.

Close Out Procedures

NGX has embedded, and has enforced, rights of acceleration for all contracts traded through the Exchange to mitigate credit default, and delivery risks to all Contracting Parties

Performance Risks

NGX's CCP clearing and risk management structure exists to assure the continued performance of all contractual obligations in the event of a Contracting Party performance default. Contractual defaults are detailed in the CPA, with the key performance risks summarized as follows:

Failure to Make/Take Delivery

For physical natural gas contracts the failure by a Contracting Party to deliver natural gas sold, or the failure to take natural gas bought, results in an NGX imbalance with the pipeline or hub operator. In this event NGX is responsible for procuring alternate gas supplies or alternate gas markets to rectify such an imbalance and prevent the default from affecting any other Contracting Parties.

For physical crude oil contracts the failure by a Contracting Party to deliver crude oil sold, or the failure to take crude oil bought, results in an imbalance with another Contracting Party. In this event NGX will assess a financial penalty to the failing Contracting Party, which will in turn be used to compensate the affected Contracting Party.

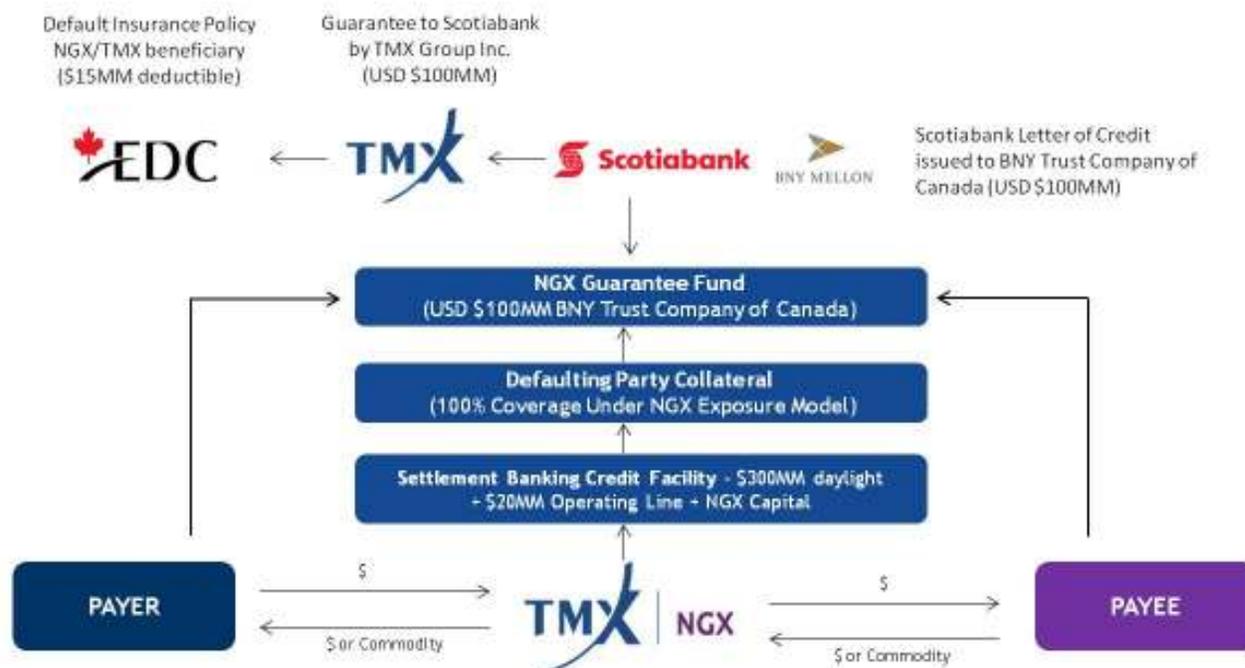
Failure to Pay

The failure by a Contracting Party to pay for natural gas or crude oil purchased or for an out-of-the-money financial contract at the time of settlement would result in an NGX imbalance with its settlement bank. In this event, NGX is responsible for utilizing the collateral provided by the defaulting party to rectify such an imbalance and prevent the default from affecting the settlement bank or any other Contracting Parties.

Failure to Deposit Collateral

The failure by a Contracting Party to deposit collateral with NGX, in the form prescribed by, and acceptable to, NGX, sufficient to ensure that their margin requirement remains below 100% of their collateral balance. In this event, NGX is responsible for ensuring that the defaulting party is unable to increase their risk position to the point where they bring unsecured risk to the clearing operation. This can be rectified through trading restrictions or through liquidation of the Contracting Party's portfolio, where necessary.

Clearing Capital and Settlement Structure



In order to assure Contracting Parties that the clearing operation can withstand a Contracting Party default, NGX has established the non-mutualized clearing capital structure illustrated above. This clearing capital mechanism is in place to provide lines of defense against the default of a Contracting Party or multiple defaults of Contracting Parties. NGX has the following lines of defense against a payment default by a Contracting Party:

Settlement Banking Credit Facility

NGX currently utilizes the services of Toronto Dominion Bank (“TD”) to act as its settlement bank. The role of the settlement bank is to assist NGX with the management of collateral in segregated accounts, to act as custodian over such collateral, to assist in the cash management required for financial settlement of contracts, and to provide overdraft protection against fluctuations in NGX’s settlement account.

TD Bank has authorized a daylight overdraft facility for the NGX settlement account of CAD \$300MM. This overdraft protection allows for variable timing throughout a business day on the deposit of NGX receivables from Contracting Parties and the payment of payables to Contracting Parties. In the event that the facility is overdrawn at the close of business, the overdraft will be paid using the defaulting party’s collateral.

Defaulting Party Collateral

TD administers the collateral that is deposited by Contracting Parties and provides oversight of the disbursements of such collateral. In the event of a shortfall in the NGX settlement account, NGX would instruct TD to disburse the collateral of the defaulting party sufficient to rectify the default. The amount of collateral held by TD Bank on behalf of NGX Contracting Parties generally ranges between CAD \$2.0 Billion and CAD \$4.0 Billion, depending primarily on the prevailing price of natural gas and crude oil.

NGX Liquid Resources

NGX maintains sufficient liquid resources to cover 12 months of operating costs along with the value of the single potential collateral shortfall based on stresstesting results for extreme but plausible stress case scenarios. In addition, NGX maintains a CASD \$20 million overdraft facility with TD to facilitate daily settlement requirements.

NGX Guarantee Fund

The NGX Guarantee Fund is a separate pool of clearing capital that is backed by TMX Group Inc., however is only accessible by Contracting Parties. The Guarantee Fund is in the form of a letter of credit held by BNY Trust Company of Canada and accessible to Contracting Parties through the CPA and the Deposit Agreement, which was entered into between NGX and BNY Trust Company of Canada (formerly CIBC Mellon Trust Company). In

the event of an NGX default, affected Contracting Parties may make a claim on the Guarantee Fund. The fund is currently capitalized at USD \$100 Million.

In the case of a failure to make/take delivery of natural gas, NGX maintains backstopping arrangements:

Physical Backstopping

Natural gas delivery risks are mitigated through the use of backstopping services provided by various market participants, including storage facilities, large shippers, and pipeline operators. Backstopping is typically an arrangement for immediate provision of supply/market at a pre-determined price (usually based on index).

In the case of a failure to make/take delivery of crude oil, NGX will utilize financial backstopping:

Financial Backstopping

Crude oil delivery risks are mitigated through the use of financial penalties imposed on the defaulting Contracting Party, which is in turn used to compensate the affected Contracting Party.

NGX performs risk management activities to ensure the Emergency Fund is sufficient and the margin model is functioning as expected:

Stresstesting

Stresstesting consists of manipulating hypothetical market conditions to determine results of extreme price movements. NGX conducts stresstesting across 20 scenarios on a daily basis. Should results yield cumulative uncovered losses in excess of NGX Financial Resources, NGX must take immediate steps to rectify through at least one of the following actions:

- a) Raise initial margin rates;
- b) Enforce position limits; and/or
- c) Increase its Financial Resources.

Backtesting

Backtesting compares initial margins against changes in historical settlement prices. NGX conducts backtesting on a daily basis at product, portfolio and collateral levels. The results are reviewed by a third party on a quarterly basis. If backtesting yields unexpected or negative results initial margin rates may be adjusted and/or the model may be adjusted.

3) COLLATERAL PROVISIONS

Collateral Policy

NGX's risk management policy requires that each Contracting Party post sufficient collateral to cover its Margin Requirement utilizing any combination of the eligible forms of collateral. It is important to note that collateral is held to support a specific Contracting Party's traded positions and can only be used to remedy a performance failure by the Contracting Party itself.

Please refer to section 4) for a complete breakdown of the components that make up the Margin Requirement.

Forms of Collateral

The Collateral posted with NGX may take the form of:

- 1) An irrevocable letter of credit issued by a bank acceptable to NGX with a long term credit rating of A or higher;
- 2) A cash amount held in a segregated account by NGX's Primary Settlement Bank, Toronto Dominion Bank;
- 3) A previous month account payable by NGX to the Contracting Party, provided that such previous month account payable will only constitute collateral until the 20th day of the settlement month for physical contracts, and the 1st day of the settlement month for financial contracts;



- 4) A current month accounts payable by NGX to the Contracting Party;
- 5) A positive variation margin amount (i.e. in the money position), until such time as the variation margin is no longer positive, or until the position converts from a variation margin amount to an A/P or A/R.

Request for Collateral by Exchange

Given that the margin requirement changes dynamically as market prices change and additional trades are consummated, NGX manages the collateral requirements of each Contracting Party on a portfolio basis in real time. There are 5 key triggers that NGX uses to manage a Contracting Party's collateral position:

Margin Triggers

- 1) If the Margin Requirement for a Contracting Party reaches 80% of collateral held (i.e. margin requirement / collateral held \geq 80%), NGX may request additional collateral.
- 2) If the Margin Requirement for a Contracting Party reaches 90% of collateral held, NGX may restrict the Contracting Party's trading capabilities until the Contracting Party deposits additional collateral, and/or the margin requirement falls below 80% of collateral held.
- 3) If the Margin Requirement for a Contracting Party reaches 95% of collateral held, and sufficient collateral has not been received, NGX is entitled to invoke the liquidation procedure under the CPA.
- 4) If the Available Margin falls below the minimum \$500 thousand required for gas, \$1 million required for power/ crude oil, or \$2 million required for Option products, NGX may request additional collateral to ensure requirements are upheld.
- 5) If a Contracting Party has an account payable by NGX which no longer constitutes collateral, NGX may request additional collateral.

When requesting additional collateral, NGX will typically recommend a collateral amount which will reduce the Contracting Party's position below 80% of collateral held, and will provide room for further trading activity. The Contracting Party is required to provide additional collateral by the next business day or, if the next business day is a banking holiday that is recognized by major Canadian and/or United States banks, on the first business day that is not a recognized banking holiday following any such request.

Return of Collateral

A Contracting Party may request a return of some or all of its collateral if its Margin Requirement is less than 80% of collateral held. NGX agrees to return any such excess collateral on the next business day or, if the next business day is a recognized banking holiday, as defined above, on the first business day that is not a recognized banking holiday following any such request.

4) MARGIN REQUIREMENT

Margin Requirement

NGX's risk measurement model is based on quantifying the default risk of a Contracting Party as a monetary value. This monetary value is known as the Margin Requirement, which represents a measurement of: *the probable exposure that a Contracting Party's portfolio might bring to the clearing operation in the event of a default by the Contracting Party.*

The Margin Requirement is made up of the sum of the following three components:

1. **Accounts Receivable ("A/R") Risk** - the value of gas/crude already delivered that generates a net amount owing to NGX;



2. **Variation Margin (mark-to-market)** - a calculation of the price at which an open position could be instantaneously liquidated given current market prices;
3. **Initial Margin (liquidation risk)** - a buffer charged to account for potential adverse changes in market prices (i.e. variation margin) during a liquidation scenario.

Calculating Accounts Receivable Risk

While many NGX products involve physical delivery as a component of settlement, all of the products offered by NGX through the clearing operation culminate in a financial settlement. The financial component of settlement requires the clearing operation to transmit the net settlement payments between Contracting Parties. In the process of this transmission, there is risk that monies owed by any Contracting Party (i.e. A/R) are not paid in full and/or on-time. Measuring the A/R risk resulting from settlement requires isolating the different cycles during which the risk exists.

NGX currently maintains six A/R cycles for which it measures exposures to the payment from Contracting Parties. These cycles are differentiated by the duration of time for which the receivable is a known value.

1. Physical Natural Gas A/R Cycle

Physical Natural Gas contracts are settled on the 25th day of the month following delivery (unless the 25th falls on a weekend or Canadian statutory holiday, in which case the date is the next business day).



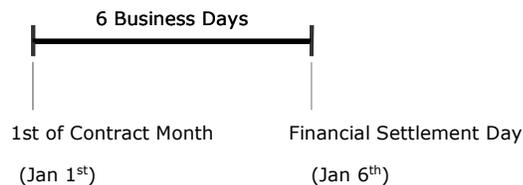
Total Physical Natural Gas A/R

The Total Physical Natural Gas A/R for physical natural gas products is the total value of the gas purchases taken over the course of the Physical Natural Gas A/R Cycle, less the total value of the net sales delivered over the same cycle for each Contracting Party. This is mathematically represented as follows:

$$\text{Total Physical Natural Gas A/R} = (\text{Purchase Quantity} - \text{Sales Quantity}) \times \text{Weighted Average Price} \times \text{Duration (\# days)}$$

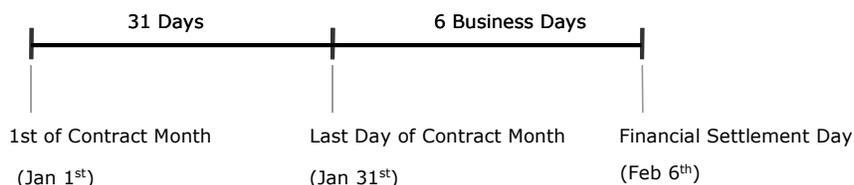
2. Financial Monthly Index A/R Cycle

Financial contracts that are settled against a monthly index are settled in the same month for which they were traded (i.e. a June contract would settle in June). The Financial Monthly Index A/R Cycle begins at the first of a calendar month (or upon publication of the relevant monthly index) and continues until settlement day of that month (which, by NGX rules, occurs on the sixth Canadian business day of the month).



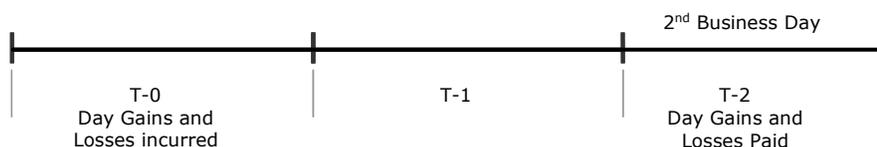
3. Financial Daily Index A/R Cycle

Financial contracts that are settled against a daily index are settled in the month following the month for which they were traded (i.e. a June contract would settle in July). The Financial Daily Index A/R Cycle begins at the first of a calendar month and continues until settlement day of the following month (which, contractually, occurs on the sixth Canadian business day of the following month).



4. Financial Daily Index A/R Cycle – Daily MtM Settlement Power

Mark-to-Market (MtM) for Canadian financial power contracts are settled on the second business day following the date MtM incurred. MtM is settled on a daily basis, so does not accumulate until delivery or expiry like in other NGX products.



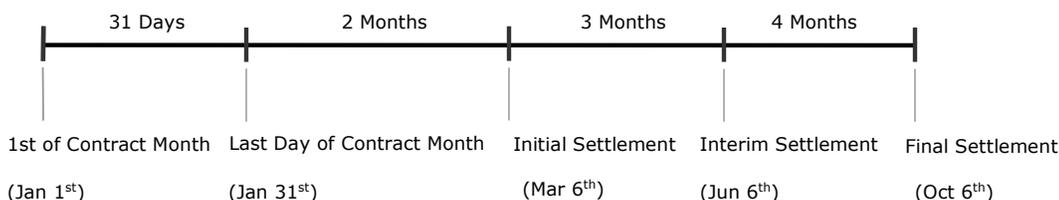
5. Regulated Rate Option (“RRO”) A/R Cycle

RRO contracts are unique from other financial products, as there are three settlement periods (initial, interim, final).

The initial RRO settlement period begins on the first of a calendar month, and continues until settlement day two months later (i.e. a January position would have an initial settlement on the sixth business day in March). This settlement, however, is only a close estimate as to the final contract value, which is why there are two subsequent settlement periods. As there is always a risk to NGX that the initial settlement amount may be insufficient, 5% of the settlement value is held against a customer’s position (as current month A/R) until the final settlement period.

The second (interim) RRO settlement period begins on the first of the month, three months following the initial settlement. Any discrepancies between the initial and interim settlement amounts are settled on the sixth business day of the third month following the initial settlement (i.e. a January position would have an interim settlement on the sixth business day in June).

The third (final) RRO settlement period begins on the first of the month, four months following the interim settlement. At this point, power usage data is finalized and any discrepancies are settled on the sixth business day of the fourth month following the interim settlement (i.e. a January position would have a final settlement on the sixth business day in October).



Total Financial A/R

Determining the Total Financial A/R for financial products requires the calculation of the Future Clearing Amount, which results when the fixed amount of the financial contract is subtracted from the floating amount:

$$\text{Future Clearing Amount} = \text{Floating Amount} - \text{Fixed Amount.}$$

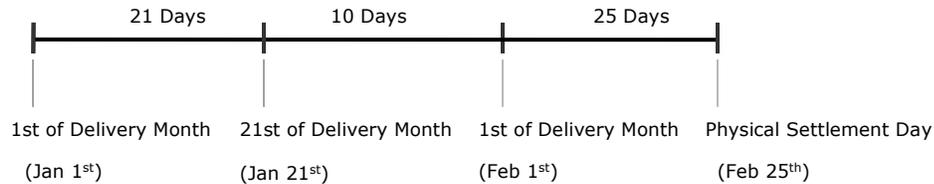
A positive Future Clearing Amount is paid by the buyer and conversely a negative Future Clearing Amount is paid by the seller. The Total Financial A/R is then:

$$\text{Total Financial A/R} = \text{Financial Monthly Index Future Clearing Amount} + \text{Financial Daily Index Future Clearing Amount} + \text{RRO Future Clearing Amount}$$

5. Canadian Physical Crude Oil A/R Cycle

The Canadian Physical Crude Oil A/R cycle applies to the payment for purchases on all Canadian physical crude oil products. The Canadian Physical Crude Oil A/R Cycle begins at the first of a calendar month and continues until settlement day of the following month (which, by NGX rules, occurs on the 25th of the month following the delivery month, unless the 25th falls on a weekend or Canadian statutory holiday, in which case the date is the next business day).





Total Canadian Physical Crude Oil A/R

The Total Canadian Physical Crude Oil A/R for Canadian physical crude oil products is the total value of the oil purchases taken over the course of the Canadian Physical Crude Oil A/R Cycle, less the total value of the net sales delivered over the same cycle, recognizing sales that are covered by the Discretionary Oil Delivery Credit (“DODC”) on the 1st of the month and the remaining sales on the first day of the month following delivery for each Contracting Party. This is mathematically represented as follows:

On the 1st of the delivery Month:

$$\text{Total Physical Crude Oil A/R} = (\text{Purchase Quantity}_{\text{Previous Delivery Month}} - \text{Sales Quantity}_{\text{Previous Delivery Month}}) \times \text{Weighted Average Price}_{\text{Previous Delivery Month}} + (\text{Purchase Quantity}_{\text{Current Delivery Month}} - \text{Sales Quantity}_{\text{Current Delivery Month Covered by DODC}}) \times \text{Weighted Average Price}_{\text{Current Delivery Month}}$$

Calculating Variation Margin (mark-to-market)

All products listed on NGX or that are cleared through NGX, economically contain forward instruments through which buyers and sellers may enter into the economics of forward *purchase* positions (“long positions”) or the economics of forward *sale* positions (“short positions”) for a particular time period in the future.

For every future position, there is a cost of liquidating such trade that is based on the prevailing market price at the time of liquidation (commonly referred to as mark-to-market). NGX accounts for this mark-to-market risk by calculating variation margin. NGX’s variation margin is: *a measurement of the price at which a future position could be instantaneously liquidated given current market prices.*

NGX calculates variation margin on crude oil sales during the month of delivery. The calculation is applied to the entire volume of the contract, and will remain in effect until the first day of the month following delivery. As such, crude oil sales are considered to be open positions until the first day following the delivery month.

NGX settles all variation margin on Canadian financial power products each business day on a T+2 basis.

Variation margin includes two components:

1. Offset Gain/Loss

Any long/short positions that are offset by the opposite short/long position in an equivalent contract for a given day in the future comprise the *offset position*.

Offset positions result in a known (crystallized) gain or loss being applied to the margin requirement for each Contracting Party. If a Contracting Party purchased forward contracts at a price lower than they sold the equivalent contracts, they are marked with a gain in the amount of the difference between the two values. Conversely, if a Contracting Party purchased forward contracts at a price higher than they sold the equivalent contracts, they are marked with a loss in the amount of the difference between the two values. This difference comprises the offset gain/loss portion of the variation margin.

$$\text{Offset Gain/Loss} = \text{Min}(\text{Purchase Quantity}, \text{Sale Quantity}) \times (\text{Selling Price} - \text{Purchase Price}) \times \text{Duration (\# days)}$$

2. Open Variation Margin

The net of the long and short positions for a Contracting Party for a particular day comprises the *net open position* of that Contracting Party for that day.



The exposure to net open positions held by a Contracting Party is calculated by determining the difference between the value of the net open position at the time it was consummated, and its estimated value in the current market (mark-to-market), as follows:

$$\text{Open Variation Margin for Net Buyer} = \frac{(\text{Market Price} - \text{Purchase Price}) \times \text{Quantity} \times \text{Duration (\# days)}}{\text{Duration (\# days)}}$$

$$\text{Open Variation Margin for Net Seller} = \frac{(\text{Sale Price} - \text{Market Price}) \times \text{Quantity} \times \text{Duration (\# days)}}{\text{Duration (\# days)}}$$

Note: For electricity contracts the duration is given in hours.

Net Buyers

If the net open position of a Contracting Party is comprised of purchases, and those purchases were consummated at a price lower than the current market price for that position, the Contracting Party is marked with a gain in the amount of the difference between the two values. A loss will be marked if the net open purchase position is priced higher than the current market price.

Net Sellers

If the net open position of a Contracting Party is comprised of sales, the converse of the above is true; a gain is marked when the sale price is higher than the current market price, and a loss is marked where the sales price is lower than the market price.

Market Prices

The calculation of variation margin requires the establishment of a market price. NGX determines market prices in real-time as instruments are traded through its trading system, or through the establishment of closing (settlement) prices. It is important to note that net open position mark-to-market is an *estimate* of the value of the net open position in the current market, relying on the most current information available as the basis for the estimate.

Calculating Initial Margin (Liquidation Risk)

In the event of a performance failure by a Contracting Party, it may be necessary for NGX to liquidate the portfolio of the failing party. The liquidation process removes the market price risk from the failing party's portfolio of open positions and quantifies the risk into an offset gain or loss.

It is possible that the price at which liquidation trades are made may vary from the estimated current market price that is used in the variation margin calculation. This can be defined as the liquidation risk, or market price risk, that NGX faces during the liquidation of a position. The mechanism used to mitigate this risk is the calculation of initial margin as part of the margin requirement. The initial margin acts as a buffer to account for changes in market prices during a liquidation scenario.

Initial margin is calculated by assessing the actual price movements that have occurred in recent history of each product, then applying a Value at Risk ("VAR") model to determine the probability of those price movements occurring during a liquidation period. Initial margin is the result of applying this probability to the current market price of each product for each forward date, and is an estimate of the risk within a certain confidence level.

1. Model Description

NGX has transitioned the parametric VaR calculations previously performed at the product level to a weighted historical simulation based VaR calculation at the portfolio level. The portfolio VaR calculation will be repeated for each commodity class within a portfolio. Commodity classes provide the ability to segment certain product categories to limit cross-commodity offsetting. Chargebacks will be added for conservatism to account for correlation breaks, low liquidity and new markets.

$$\text{Portfolio Final Margin Requirement} = \sum_{j=1}^{\text{all commodity classes}} (\text{Portfolio level VaR}_j + \sum_{i=1}^5 \text{CB}_i)$$

Positions (product-tenor combinations) must individually meet NGX specified minimum data quality standards to be included in the portfolio VaR calculations. For positions excluded from the portfolio-level VaR calculation, a

product-level VaR will be determined and added to the total margin requirement. For excluded positions no margin reductions will be provided for risk reductions toward other positions.

2. Model Configuration

NGX configures settings within the model tools to ensure an appropriate amount of conservatism exists to ensure consistently high standards of portfolio margin performance will continue to be met. NGX configures the model parameters to target portfolio-level performance not less than 99% for all 12 month periods within the reviewed historical data set. The historical data set consists of not less than 2 years of price history and a period of stress (currently the “Polar Vortex” in Q1 2014). The data is refreshed at least twice monthly.

3. Portfolio-level VaR Calculation

NGX utilizes a non-parametric VaR calculation at the portfolio level based on an age-weighted historical simulation approach widely known as the BRW model (Boudoukh, et al., 1998). Daily portfolio value changes are estimated given current portfolio composition and historical returns for each product and future tenor within the portfolio.

The Historical VaR is estimated directly using the percentile of the empirical distribution, 99%. NGX prorates the result to a 2-day holding period.

Margin Example 1 (Natural Gas)

The following example illustrates how NGX’s margin model applies to a specific set of trades.

Example Trade – Fixed Price Contract

- On March 27, 2017, BUYCO (buyer) purchases 5,000 GJ/Day of the NGX AB-NIT month of April 2017 physical contract from SELLCO (seller) at a price of CAD \$3,000/GJ.

Position Management

- As soon as the transaction is matched, BUYCO shows a net long position of 5,000 GJ a day from April 1 to April 30, 2017, thus a total net long position of 150,000 GJ (5,000 GJ/Day x 30 days).
- Conversely, SELLCO shows a net short position of 5,000 GJ a day from April 1 to April 30, 2107, thus a total net short position of 150,000 GJ (5,000 GJ/Day x 30 days).

Initial Margin

- Immediately following the creation of the long and short positions, initial margin is applied.
- Initial margin calculation will be applied at the portfolio level. All natural gas positions that qualify NGX’s portfolio margining standards will be considered together.
- The initial margin requirement will remain in place, unchanged, until one of the following events occurs:
 - Either BUYCO or SELLCO offset all or part of their open long/short position, thus reducing their initial margin requirement, or;
 - The April long/short position becomes a current month position on April 1st, or;
 - Initial margin rates change (typically once a month).

For the simplicity of the discussion, we will assume the trade is the only position BUYCO and SELLCO have.

March 27 to March 31, 2017 - Margin Requirements

- The following table illustrates the margin requirements for the April position through each remaining day in March:

DATE	Settlement Price	BUYCO MTM	SELLCO MTM	BUYCO Initial Margin	SELLCO Initial Margin
March 27 th	3.100	\$15,000	(\$15,000)	(\$45,000)	(\$45,000)

March 28 th	3.250	\$37,500	(\$37,500)	(\$45,000)	(\$45,000)
March 29 th	3.200	\$30,000	(\$30,000)	(\$45,000)	(\$45,000)
March 30 th	3.000	\$0.00	\$0.00	(\$45,000)	(\$45,000)
March 31 st	2.900	(\$15,000)	\$15,000	(\$45,000)	(\$45,000)

April 1 to April 30, 2017 - BUYCO's Margin Requirements

- The following table illustrates BUYCO's margin requirements for the April position through each remaining day in April:

DATE	RM – April Settlement Price	BUYCO AP / AR	BUYCO RM Initial Margin*	BUYCO Variation Margin	BUYCO Total Margin
April 1 st	2.800	\$0	(\$45,000)	(\$30,000)	(\$75,000)
April 2 nd	2.750	(\$15,000)	(\$43,500)	(\$36,250)	(\$94,750)
April 3 rd	2.900	(\$30,000)	(\$42,000)	(\$14,000)	(\$86,000)
April 4 th	3.100	(\$45,000)	(\$40,500)	\$13,500	(\$72,000)
April 5 th	3.150	(\$60,000)	(\$39,000)	\$19,500	(\$79,500)
▼ CONTINUE ▼					
April 30 th	3.500	(\$435,000)	(\$1,500)	\$2,500	(\$434,000)
May 1 st	3.500	(\$450,000)	\$0.00	\$0.00	(\$450,000)

April 1 to April 30, 2017 – SELCO's Margin Requirements

- The following table illustrates SELCO's margin requirements for the April position through each remaining day in April:

DATE	RM – April Settlement Price	SELCO AP / AR	SELCO RM Initial Margin*	SELCO Variation Margin	SELCO Total Margin
April 1 st	2.800	\$0	(\$45,000)	\$30,000	(\$15,000)
April 2 nd	2.750	\$15,000	(\$43,500)	\$36,250	\$7,750
April 3 rd	2.900	\$30,000	(\$42,000)	\$14,000	\$2,000
April 4 th	3.100	\$45,000	(\$40,500)	(\$13,500)	(\$9,000)
April 5 th	3.150	\$60,000	(\$39,000)	(\$19,500)	(\$1,500)
▼ CONTINUE ▼					
April 30 th	3.500	\$435,000	(\$1,500)	(\$2,500)	\$431,000
May 1 st	3.500	\$450,000	\$0.00	\$0.00	\$450,000

Margin Example 2 (Power – Daily-Settle Financial)

The following example illustrates how NGX's margin model applies to a specific set of trades.

Example Trade

- On March 27, 2017, BUYCO (buyer) purchases 50 MW of Alberta Flat hours for month of April 2017 financial contract from SELCO (seller) at a price of CAD \$60.00/MWh.

Position Management

- As soon as the transaction is matched, BUYCO shows a net long position of 50 MW per hour for each day from April 1 to April 30, 2017, thus a total net long position of 36,000 MWh (50 MW x 24 hours/day x 30 days).
- Conversely, SELCO shows a net short position of 50 MW per hour for each day from April 1 to April 30, 2017, thus a total net long position of 36,000 MWh (50 MW x 24 hours/day x 30 days).

Initial Margin

- Immediately following the creation of the long and short positions, initial margin is applied.
- Initial margin calculation will be applied at the portfolio level. All Alberta power positions that qualify NGX's portfolio margining standards will be considered together.
- The initial margin requirement will remain in place, unchanged, until one of the following events occurs:
 - Either BUYCO or SELCO offset all or part of their open long/short position, thus reducing their initial margin requirement, or;
 - The April long/short position becomes a current month position on April 1st, or;
 - Initial margin rates change (typically once a month).

For the simplicity of the discussion, we will assume the trade is the only position BUYCO and SELCO have.

March 27 to March 31, 2017 - Margin Requirements

- The following table illustrates the margin requirements for the April position through each remaining day in March:

DATE	Settlement Price	Daily MTM T-0	Daily MTM T-1	Daily MTM T-2	BUYCO MTM (T-0 to T-2)	SELCO MTM (T-0 to T-2)	BUYCO Initial Margin	SELCO Initial Margin
March 27 th	\$61.00	\$36,000	N/A	N/A	\$0	(\$36,000)	(\$360,000)	(\$360,000)
March 28 th	\$65.00	\$144,000	\$36,000	N/A	\$0	(\$180,000)	(\$360,000)	(\$360,000)
March 29 th	\$60.50	(\$162,000)	\$144,000	\$36,000	(\$162,000)	(\$180,000)	(\$360,000)	(\$360,000)
March 30 th	\$60.00	(\$18,000)	(\$162,000)	\$144,000	(\$180,000)	(\$144,000)	(\$360,000)	(\$360,000)
March 31 st	\$50.00	(\$360,000)	(\$18,000)	(\$162,000)	(\$540,000)	\$0	(\$360,000)	(\$360,000)

Notes:

- Daily MTM represents gains and losses occurring during respective trading day, where T-0 is current day, T-1 is yesterday, T-2 is second preceding day. Total MTM is the sum of the two outstanding daily invoices (T-1 and T-2) and current day MTM (T-0). Invoices are paid on second day following the trading date gains and losses generated.



- To facilitate payment of daily settlement invoices, credits are not provided for customer gains since they are paid within the next two business days. Daily losses require collateralization.

April 1 to April 30, 2017 – BUYCO's Margin Requirements

- The following table illustrates BUYCO's margin requirements for the April position through each remaining day in April:

DATE	RM – April Settlement Price	Daily MTM T-0	Daily MTM T-1	Daily MTM T-2	BUYCO Variation Margin	BUYCO Initial Margin	BUYCO Total Margin
April 1 st	\$51.00	\$36,000	(\$360,000)	(\$18,000)	(\$378,000)	(\$1,440,000)	(\$1,818,000)
April 2 nd	\$53.00	\$69,600	\$36,000	(\$360,000)	(\$360,000)	(\$1,392,000)	(\$1,752,000)
April 3 rd	\$56.00	\$100,800	\$69,600	\$36,000	\$0	(\$1,344,000)	(\$1,344,000)
April 4 th	\$55.00	(\$32,400)	\$100,800	\$69,600	(\$32,400)	(\$1,296,000)	(\$1,328,400)
April 5 th	\$59.00	\$124,800	(\$32,400)	\$100,800	(\$32,400)	(\$1,248,000)	(\$1,280,400)
▼ CONTINUE ▼							
April 30 th	\$65.00	(\$6,000)	(\$7,200)	\$15,000	(\$13,200)	(\$48,000)	(\$61,200)

April 1 to April 30, 2017 – SELCO's Margin Requirements

- The following table illustrates SELCO's margin requirements for the April position through each remaining day in April:

DATE	RM – April Settlement Price	Daily MTM T-0	Daily MTM T-1	Daily MTM T-2	SELCO Variation Margin	SELCO Initial Margin	SELCO Total Margin
April 1 st	\$51.00	(\$36,000)	\$360,000	\$18,000	(\$36,000)	(\$1,440,000)	(\$1,476,000)
April 2 nd	\$53.00	(\$69,600)	(\$36,000)	\$360,000	(\$105,600)	(\$1,392,000)	(\$1,497,600)
April 3 rd	\$56.00	(\$100,800)	(\$69,600)	(\$36,000)	(\$206,400)	(\$1,344,000)	(\$1,550,400)
April 4 th	\$55.00	\$32,400	(\$100,800)	(\$69,600)	(\$170,400)	(\$1,296,000)	(\$1,466,400)
April 5 th	\$59.00	(\$124,800)	\$32,400	(\$100,800)	(\$225,600)	(\$1,248,000)	(\$1,473,600)
▼ CONTINUE ▼							
April 30 th	\$65.00	\$6,000	\$7,200	(\$15,000)	(\$15,000)	(\$48,000)	(\$63,000)

Notes:

- Current month initial margin is calculated using unique rates for D0 to D5 and RM or for monthly contracts the M0 rate, see Initial Margin Rates report for current posted rates. This exhibit assumes all current month initial margin rates set to a M0 rate of \$40/MWh.
- To facilitate payment of daily settlement invoices, credits are not provided for customer gains since are paid within the next two business days. Daily losses require collateralization.

Margin Example 3 (Crude Oil)

The following example illustrates how NGX's margin model applies to a specific set of trades.

Example Trade

- On March 27, 2017, BUYCO (buyer) purchases 30,000 bbl of the Husky Hardisty WCS WTI month of April 2017 physical contract from SELCO (seller) at a price of USD (\$10.00)/bbl.

Position Management

- As soon as the transaction is matched, BUYCO shows a net long position of 30,000 bbl from April 1 to April 30, 2017.
- Conversely, SELCO shows a net short position of 30,000 bbl from April 1 to April 30, 2017.

Initial Margin

- Immediately following the creation of the long and short positions, initial margin is applied.
- Initial margin calculation will be applied at the portfolio level. All crude oil positions that qualify NGX's portfolio margining standards will be considered together.
- The initial margin requirement will remain in place, unchanged, until one of the following events occurs:
 - Either BUYCO or SELCO offset all or part of their open long/short position, thus reducing their initial margin requirement, or;
 - Delivery is deemed to occur, at which point the full notional value of the contract is charged to the buyer, and credited to the seller. Once treated as delivered, initial margin and variation margin charges are no longer charged;
 - for buyers, the full month's delivery is deemed to occur on April 1, 2017,
 - for sellers, if Crude Delivery Netting insurance has been arranged, the full month's delivery is deemed to occur on April 1, 2017 (up to insurance limit), otherwise the month's delivery and resulting sales credit will not be recognized until May 1, 2017.
 - Initial margin rates change (typically once a month).

For the simplicity of the discussion, we will assume the trade is the only position BUYCO and SELCO have.

March 27 to March 31, 2017 - Margin Requirements

- The following table illustrates the margin requirements for the April 2017 position through each remaining day in March:

DATE	Settlement Price	BUYCO MTM	SELCO MTM	BUYCO Initial Margin	SELCO Initial Margin
March 27 th	(\$10.50)	(\$15,000)	\$15,000	(\$150,000)	(\$150,000)
March 28 th	(\$10.75)	(\$22,500)	\$22,500	(\$150,000)	(\$150,000)
March 29 th	(\$10.00)	\$0.00	\$0.00	(\$150,000)	(\$150,000)
March 30 th	(\$9.75)	\$7,500	(\$7,500)	(\$150,000)	(\$150,000)
March 31 st	(\$10.25)	(\$7,500)	\$7,500	(\$150,000)	(\$150,000)

April 1 to April 30, 2017 – BUYCO's Margin Requirements

- The following table illustrates BUYCO's margin requirements for the April position through each remaining day in April:

DATE	RM – April Settlement Price	BUYCO AP / AR	BUYCO RM Initial Margin	BUYCO Variation Margin	BUYCO Total Margin
April 1 st	(\$11.00)	(\$2,400,000)	\$0.00	\$0.00	(\$2,400,000)

April 2 nd	(\$10.75)	(\$2,400,000)	\$0.00	\$0.00	(\$2,400,000)
April 3 rd	(\$10.50)	(\$2,400,000)	\$0.00	\$0.00	(\$2,400,000)
April 4 th	(\$10.25)	(\$2,400,000)	\$0.00	\$0.00	(\$2,400,000)
▼ CONTINUE ▼					
April 21 st	(\$9.50)	(\$2,400,000)	\$0.00	\$0.00	(\$2,400,000)
▼ CONTINUE ▼					
May 1 st	(\$10.00)	(\$2,400,000)	\$0.00	\$0.00	(\$2,400,000)

April 1 to April 30, 2017 – SELCO's Margin Requirements (WITH Crude Delivery Netting Insurance)

- The following table illustrates SELCO's margin requirements for the April position through each remaining day in April. Initial margin and Variation margin continue to be calculated on sales until after the delivery month.

DATE	RM – April Settlement Price	SELCO AP / AR	SELCO RM Initial Margin*	SELCO Variation Margin	SELCO Total Margin
April 1 st	(\$11.00)	\$2,400,000	(\$150,000)	\$30,000	\$2,280,000
April 2 nd	(\$10.75)	\$2,400,000	(\$150,000)	\$22,500	\$2,272,500
April 3 rd	(\$10.50)	\$2,400,000	(\$150,000)	\$15,000	\$2,265,000
April 4 th	(\$10.25)	\$2,400,000	(\$150,000)	\$7,500	\$2,257,500
▼ CONTINUE ▼					
April 21 st	(\$9.50)	\$2,400,000	(\$150,000)	(\$15,000)	\$2,235,000
▼ CONTINUE ▼					
May 1 st	(\$12.00)	\$2,400,000	\$0.00	\$0.00	\$2,480,000

April 1 to April 30, 2017 – SELCO's Margin Requirements (WITHOUT Crude Delivery Netting Insurance)

- The following table illustrates SELCO's margin requirements for the April position through each remaining day in April. Initial margin and Variation margin continue to be calculated on sales until after the delivery month.

DATE	RM – Jan Settlement Price	SELCO AP / AR	SELCO RM Initial Margin*	SELCO Variation Margin	SELCO Total Margin
April 1 st	(\$11.00)	\$0	(\$150,000)	\$30,000	(\$120,000)
April 2 nd	(\$10.75)	\$0	(\$150,000)	\$22,500	(\$127,500)
April 3 rd	(\$10.50)	\$0	(\$150,000)	\$15,000	(\$135,000)
April 4 th	(\$10.25)	\$0	(\$150,000)	\$7,500	(\$142,500)
▼ CONTINUE ▼					
April 21 st	(\$9.50)	\$600,000	(\$150,000)	(\$15,000)	\$435,000
▼ CONTINUE ▼					
May 1 st	(\$12.00)	\$2,480,000	\$0.00	\$0.00	\$2,480,000

Notes:

- Initial margin is calculated using M0 rate of \$5.00/bbl, see Initial Margin Rates report for current posted rates.
- April settlement price assumes the WTI Index settled at USD \$90.00 for April 2017

Clearing Contact Information

For Clearing related questions please email Clearing@ngx.com.

General Contact Information

For further information, please contact the NGX Help Desk at (403) 974-4357, or see the NGX website at www.ngx.com.