Day-Ahead Process Alternatives for Gas-Fired Generation

As per the third Deliverable in the **Ontario Working Group Charter**, this report has been created to document the benefits of day-ahead processes both unique to Ontario and drawn from the experiences of other gas and electric jurisdictions, in particular those benefits derived from gas/electricity coordination.

Executive Summary

1. **Enhanced Efficiency and Reliability:**
   The natural gas industry operates on a day-ahead basis in compliance with North American Energy Standards Board (NAESB) rules. The Ontario power market is scheduled differently than its interconnected neighbours, operating as a real-time market. Electricity is dispatched by the Independent Electricity System Operator (IESO) in 5-minute increments with unrestricted bids and offers allowed up to two hours from the dispatch hour.

   NAESB Standards improve efficiency and reliability of the entire North American pipeline network, reduces customers' administrative costs associated with non-standard pipeline practises, and enables shippers to better utilize multiple pipelines for transacting business.

   The natural gas industry believes that the elimination of the mismatch between the operations in the gas and electricity markets will enhance electricity system reliability and that the interaction between the two markets will efficiently serve the needs of Ontario

2. **Gas Industry DAM Preference**:
   The IESO and interested stakeholders have been engaged in discussions regarding a power Day-Ahead Market (DAM) for Ontario. Four models have been proposed by the IESO. As an interim step to address reliability concerns, the IESO is planning on the implementation of *a day-ahead commitment process* in 2006.

   The natural gas industry is supportive of the stakeholdering process to find the best day-ahead model for Ontario. Our current preference is for a fully functioning DAM; one that is both physically and financially binding on market participants.

3. **Gas Industry Asset Requirements**:
   Installed capacity of gas-fired generation is expected to double from about 5,000 MW in 2005 to 10,000 MW by 2010. This will potentially require the construction of a significant amount of new infrastructure by the gas industry to service these power plants including: upstream transmission pipelines, utility distribution pipelines, and storage.

The natural gas industry is capable of delivering the required assets within the expected timeframe to meet Ontario's power requirements from natural gas. The capital cost of the required assets will not be materially impacted by whether a day-ahead power market is implemented in Ontario; assuming that gas distribution companies are not required to provide backstopping of generator gas supplies.

4. **Risk Avoidance**:
   A day-ahead market would provide the means to align generators gas nominations and supply cost of fuel with its offers into the wholesale power market the next day; thereby eliminating both quantity and pricing risk that exists with a real-time market.

   The transfer of risk away from generators should help reduce the costs of power from future RFPs based on the Clean Energy Supply (CES) contract.

   With the introduction of a power DAM, gas pipelines, storage operators, and Local Distribution Companies (LDC) will need to ensure the proper tools and mechanisms exist to help generators manage daily imbalances; the timing of, and the nature of, any power DAM will have an impact on these requirements.

5. **Timing Requirements**:
   Other jurisdictions around Ontario have day-ahead power markets including the New York, New England, the mid-west, and the PJM systems. Each has their own timing requirements for when generators must post their offers into the Dam and when the day-ahead schedule is posted.

   If Ontario does implement a fully functioning DAM for power a critical component will be to ensure the timing of offers and the subsequent posting of schedules fits with the needs of generators; to know their gas supply cost and to be able to nominate their gas supply requirement a day-ahead.

1.0) Introduction

The Independent Electricity System Operator (IESO) manages the Ontario power system by balancing the demand for electricity against available supply through the wholesale market and directing the flow of electricity across the transmission system.

Gas-fired electric generators use day-ahead processes to procure and arrange the transportation of natural gas [see section 2]. In contrast, the IESO operates the current Ontario electricity market in real-time and dispatches resources in increments of 5-minutes. Generators can get advance pre-dispatch schedules and prices a day-ahead for *informational purposes only* as these schedules and prices are not binding commitments to operate in the day-ahead.

1.1) The Need for a Power Day-Ahead Market

The IESO and interested stakeholders have been engaged in an ongoing process to evaluate and develop a Day-Ahead Market (DAM) for electricity in Ontario. The key objectives for the establishment of a DAM as identified by stakeholders[1] participating in the IESO process were:

1. To provide greater assurance of adequate and reliable electricity supply in the operational timeframe by
    a. Being able to commit to Intertie Trades a day-ahead and
    b. Being able to commit to the operation of Ontario resources a day-ahead
2. To improve day-ahead price certainty
3. To permit more efficient use of resources, which is expected to lead to lower costs of electricity supply than would otherwise be the case
4. To provide participants with the option of having greater certainty of dispatch a day ahead.
5. Any DAM processes should be simple for participants to use
6. Any DAM should be able to support active, direct and high-levels of participation from all sectors
7. Intertie trading business processes should be coordinated with those of Ontario's neighbouring jurisdictions
8. The benefits of any DAM or processes must be at least commensurate with the overall costs of development and ongoing operation for both the IESO and participants.

The natural gas industry is very supportive of the stakeholdering process and for the opportunity to participate in it. Objective #4 is of particular interest in the day-ahead objectives as it pertains to and addresses the "*identified need to ensure the interaction between the gas and electricity markets efficiently serves the needs of Ontario"*.

[1] Analysis of Stakeholder Day-Ahead Needs & Priorities
http://www.ieso.ca/imoweb/pubs/consult/dayAhead/da_2005jul_analysis.pdf

It is expected that by providing greater certainty of dispatch a day-ahead for the electricity market, will improve the procurement capabilities of natural gas generators.

1.2) Development of a Power Day-Ahead Market

The IESO proposed four potential day-ahead alternatives for evaluation by interested stakeholders at a meeting[2] August 11th, 2005. Discussion of these day-ahead models[3] with stakeholders is expected to continue through 2006.

The IESO identified at a meeting[4] September 20th 2005 their concern for the ongoing reliability of electricity supply in Ontario arising from events that occurred during the summer of 2005. Given that this is not a sustainable situation, the IESO intends to identify, design, and implement measures to enhance the reliability of the power system in advance of the summer of 2006; one of these being a *day-ahead commitment process*. The expected design and implementation will allow imports to be scheduled day-ahead in order to address chronic transaction failures near real time and commit generation units day ahead to increase reliability in the operational time frame. While an important first step, this is not the expected end-state for the day-ahead scheduling of electricity.

The adoption of a fully functional DAM for the Ontario power market would amongst other things, address the scheduling mismatch that exists today with the natural gas market. It would also address issues such as the differences that exist between pre-dispatch and real time schedules. Section 4 provides detailed descriptions of the DAM models and the proposed interim day-ahead commitment process.

1.3) The Gas Day-Ahead Market

Most industrial natural gas consumers start up and shut down their processes at roughly the same time each day, which means their gas consumption patterns are relatively predictable. Since their daily consumption patterns are predictable, and for the most part self-controllable, they can order the appropriate amount of natural gas a day-ahead of actually needing it. Upstream pipelines, storage operators, and distribution utilities can thus plan for the delivery and receipt of the required gas on their systems. This allows them to optimize their resources and operations a day in advance of real time. Hourly variations in actual versus scheduled volumes for industrial consumers tend to be relatively minor and can be managed with existing services provided by the LDC's and pipelines. Daily/seasonal variations in usage also tend to be predictable and likewise managed through the use of storage and associated existing services.

[2] Working Session Agenda and Support Materials http://www.ieso.ca/imoweb/consult/consult_dam.asp
[3] For the purposes of this document, any reference to DAM may also refer to a non-market-based day-ahead mechanism for committing generation resources to be available for electricity production in the next day.
[4] Stakeholder Reliability Session Agenda and Support Materials
http://www.ieso.ca/imoweb/consult/consult_isr.asp

Historically industrial customers, served by natural gas LDCs, have relied on the LDC services, to manage and/or limit their risk associated with imbalances between real time usage and day-ahead schedules. Industrial customers' contract for the appropriate level of service they require based on the expected variances in their scheduling and their individual appetite for risk.

Shippers on the transmission systems, bear the risks associated with their imbalances between real time usage and day-ahead scheduling in the natural gas market. This provides the incentive for shippers to manage their variances within their contractual service parameters; for the overall benefit of the gas transmission systems.

1.4) Impact on Generators: Gas Day versus Power Day

In contrast to other industrial customers, generators provide offers to produce energy into the real time wholesale electricity market. Based on the quantity and prices of available supply required to meet prevailing demand, generators will be dispatched accordingly in increments of 5 minutes. For gas-fired generators, their hourly consumption patterns may be less predictable.

Generators currently get an informational pre-dispatch schedule a day-ahead as an indication of their operations for the next day. Hourly thereafter, revised pre-dispatch schedules are issued. However, these schedules are not financially or physically binding and do not lock in price for and quantity of electricity to be produced for the next day. It is not until two hours ahead of the real-time dispatch hour that price and quantity restrictions are placed on bids and offers to buy and sell.

Impact on LDC Distribution systems:
Generators behind the gas LDCs can contract for redelivery, storage, and balancing services that mitigate the risks associated with hourly/daily variations in actual consumption.

Impact on Gas Transmission systems:
Hourly/daily variations in actual consumption versus volumes scheduled on the transmission systems for generators could be significant and may require supplemental pipeline services to manage the imbalances. For instance gas generators run the risk of scheduling gas supply a day ahead and then not being dispatched in real time, which would result in the generator's gas supply packing the pipeline. This can lead to operational reliability problems for the pipeline unless alternate markets for the gas can be found (such as storage), which could in turn lead to increased balancing costs for the generator. Conversely, if the generator does not nominate its gas supply ahead of time, (to avoid the risk of having too much gas), the generator runs the risk that the physical supply and pipeline transmission capacity may not be available when it is dispatched. Further if the gas is available and can be transported, the price could be at a significant premium versus normal day-ahead index pricing. These risks are heightened in the winter, especially on a cold winter day, and seasonally when storage levels are low.

The establishment of a fully functional DAM for the power industry will help minimize the impact on transmission systems' and generators' operations and costs. Reliability and security of supply will be improved in both markets with appropriate contracting of facilities and services and implementation of industry-wide operating procedures (e.g. communication between the pipelines and the IESO and generators). With better and timelier information, the gas industry will be better able to meet the needs of the gas-fired generators.

A key concern for gas-fired generators is to get better operational certainty prior to real-time dispatch from the IESO. During periods of peak system demand for natural gas or seasonal limitations on withdrawals from or deliveries to storage, this information will be of particular importance to generators, the gas transmission systems, storage operators and the distribution utilities.

1.5) Changing Circumstances

There exists within Ontario today about 5,000 MW[5] of installed gas-fired generation;

- About 1,600 MW of this capacity is under long-term power sale contracts with the Independent Power Producers (IPP). Typically this capacity is run as baseload generation (at a very high load factor i.e.> 70%) have long-term gas supply and transportation agreements in place and self-schedule[6] their output into the wholesale power market. IPP generators are more likely to manage their gas supply (nominations, supply, and daily balancing) in a similar manner to a large industrial customer due to the relative predictability of their business.
- About 2,100 MW of the capacity is dual-fuelled (gas and heavy fuel oil) represented by the Lennox generating station. Lennox operates as a peaking plant (at a low load factor i.e. < 25%), has relatively short-term gas supply and interruptible transportation agreements and offers its output into the hourly Ontario wholesale power market. When gas transportation is available Lennox has a choice of fuel. They can choose to burn natural gas or oil, based on price. When transport is not available, they are forced to rely on oil. Lennox manages their gas supply arrangements in a similar manner as other industrial customers that have back-up fuel capability. Lennox is a unique alternate fuel customer in that when operating at high load factors and fully on gas, it is the largest customer on the Union Gas system.
- About 150 MW of the capacity is single cycle gas turbines (SCGT) that operate as peaking plants. Typically they operate on interruptible gas transportation and could be restricted from operating during winter peak periods, as they do not have back-up fuel capability.

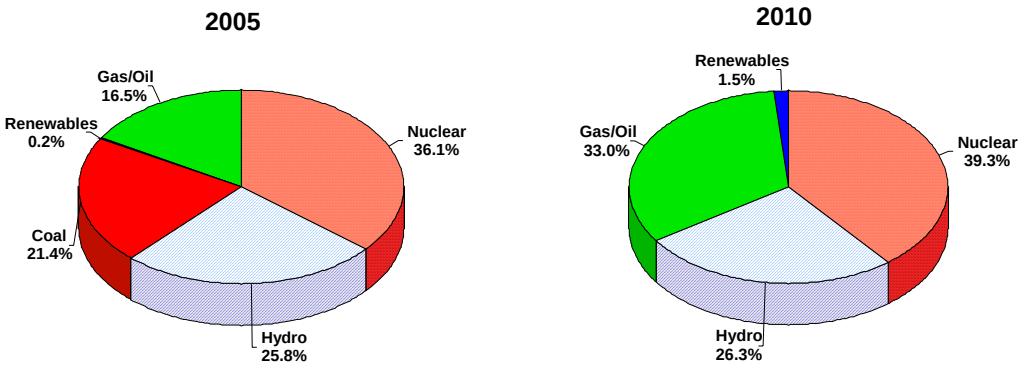
[5] Excluding generation embedded within industrial or commercial plants that are not dispatched by the IESO

[6] Generators that estimate their production and for the most part can deliver what ever they produce into the wholesale market.

- The remaining 1,100 MW of capacity is combined cycle gas turbines (CCGT). Some of this capacity provides steam and power to industrials under contract and thus has some degree of certainty and control over scheduling and balancing natural gas supply. The remainder is pure merchant capacity that is more likely to run during the hours when power demand is the highest (16 hours of the day, 5 days a week), is subject to two hour-ahead dispatch windows, and are dispatched in 5 minute increments. This class of generator needs firm LDC distribution services in order to respond when their output is needed. This output may be required with little or no advance notice. Scheduling and balancing their gas supply versus their daily consumption is the most challenging of the installed gas-fired capacity.

As Chart 1 illustrates, over the next five years the percentage of gas-fired generation is expected to increase as a percentage of overall capacity. This will evolve as the province replaces existing coal-fired generation, meets the growing demand for peak power, and replaces aging generation. Installed gas-fired and dual-fuelled generation is likely to double to just over 10,000 MW by 2010. The impact is that the merchant CCGT component will be the portion of capacity that increases; from 1,100 MW now to potentially 6,300 MW in 2010.

Chart 1: Ontario's Changing Generation Mix[7]



The new efficient CCGT merchant plants, under the CES Contract and after the coal-fired generation is closed, should operate at load factors potentially in excess of 50%[8]. This means that the volume of gas consumed will increase due to the increase in installed gas-fired capacity as well as higher load factors; supplanting coal-fired generation as the marginal supplier[9] to the Ontario power market.

Because the natural gas consumption patterns of these generators will differ from those of traditional natural gas consumers, new processes such as a DAM for the power industry,

[7] Based on IESO 10-Year Outlook, Ontario Government June 15, 2005 Press Release "McGuinty Government Unveils Bold Plan to Clean Up Ontario Air, and assumptions as to fuel mix of required new generation to replace Ontario coal-fired generation.
[8] The 2,500 MW RFP expects the new capacity under CES contract to operate as intermediate generation
[9] Taking the operational swings in demand over the course of the day as well as being the primary price setter for the wholesale power market

as well as new services and processes from the gas industry, will be required to ensure they operate reliably.

2.0) Day-Ahead Processes in the Gas Industry

The North American natural gas industry operates on a day-ahead planning paradigm governed under North American Energy Standards Board (NAESB) rules. The gas industry has been operating under this paradigm since de-regulation in 1986.

NAESB Standards provide consistency of pipeline practises and information services for the entire North American pipeline network. FERC mandated all U.S. Interstate pipelines adopt these Standards which cover: Transacting in Energy, Gas Day, Nominations Schedules & Intraday Nominations, Accounting Issues, Electronic Delivery Mechanisms, and Capacity Release.

Canadian pipelines have voluntarily adopted the NAESB Standards to better align with their U.S. counterparts recognizing that:

- More than 50% of Canadian gas produced is shipped to U.S. consumers,
- Some Canadian gas is delivered to Canadian consumers through U.S. pipelines
- Some Canadian consumers utilize imported U.S. gas and
- Canadians hold capacity on U.S. pipelines.

NAESB Standards improve efficiency and reliability of the entire North American pipeline network, reduce customers' administrative costs associated with non-standard pipeline practises and enables shippers to better utilize multiple pipelines for transacting business.

The NAESB Standard for the Gas Day in Ontario is 10:00 am [calendar day of] to 10:00 am [calendar day following] eastern clock time (ECT). The Tuesday Gas Day therefore starts Tuesday at 10:00 am and ends Wednesday at 10:00 am.

2.1) Scheduling Gas a Day-Ahead

Natural gas Local Distribution Companies (LDCs) forecast next-day gas demand based on weather forecasts, day of the week (e.g. weekday vs. weekend), and other market intelligence. Sufficient gas supplies, transportation services and storage operations are nominated (requested) a day ahead (with various service providers) to meet that demand. There are opportunities to make intraday operational plan modifications in order to react to changes in weather and demand, but these modifications are minor in nature.

The major benefits of the gas industry operating on a day-ahead basis are not dissimilar to the needs of the Ontario electricity market;

- ***To ensure reliability of supply***, which is paramount, and
- ***To plan the most efficient use of asset*s**, such as running compressors & making deliveries to/from storage, to the benefit of all natural gas customers.

There are occasions where a market may require more gas than was originally nominated, but the combination of sufficient line pack, firm transportation and storage services can be used to provide hourly and daily balancing services.

However, gas molecules do not travel instantaneously from supply basins and/or storage fields to market areas. Storage activities, and required transportation, must be arranged in advance to ensure the gas is physically deliverable where and when it is needed.

Sudden, large, and unexpected increases in gas consumption may draw down gas line pressure before the storage and transportation systems can react. Conversely, a similar sudden and unexpected decrease in gas consumption could increase line pressure. In both instances significant operational problems might develop if corrective action is not promptly taken. This is why gas supply arrangements are made in advance and the major reason daily planning for natural gas operates in a day-ahead paradigm rather than in real-time.

The natural gas industry works in a day-ahead market to better ensure safe operations and security of supply while optimizing the use of gas transmission, storage, and distribution assets. Optimization of these assets leads to more efficient operations and contributes to reductions in rates.

3.0) Benefits of a DAM for the Power Industry (From a Gas Industry Perspective)

From a gas industry perspective a fully functional DAM for the power market would:
a. Align with the timing of the gas market DAM
b. Optimize generator dispatch over 24 hours rather than increments of an hour.
c. Physically and financially bind consumers and generators to a day-ahead schedule

a) Align with the timing of the gas market DAM
The current day-ahead gas market has four nomination windows (scheduling opportunities) for natural gas pipelines in Ontario based on eastern clock time (ECT):
- ***Timely***: 13:00 deadline (day ahead) for Gas Day
- ***Evening***: 19:00 deadline (day ahead) for Gas Day
- ***Intraday 1:*** 11:00 deadline (day of) effective for the last 16 hours of the Gas Day
- ***Intraday :2*** 18:00 deadline (day of) effective for the last 12 hours of the Gas Day

The first major benefit of aligning a power DAM with the timing of the natural gas DAM would be to ensure generators have natural gas index pricing on which to base their day-ahead power offers. For example, the NGX Dawn Index is a weighted average of all reported transaction ending at 12:15 pm clock time the day before the relevant gas day. That is for the Tuesday gas day that starts at 10:00 on Tuesday; the NGX Dawn Index price could be calculated and known shortly after 12:15 pm on Monday.

The second major benefit is to provide generators the opportunity to align their gas day nominations with their power market dispatch schedule to lock-in initial gas flows; if generators have their DAM dispatch schedule in sufficient time to meet the 19:00 Evening noms window. The other two nom windows would provide opportunities to make changes based on expected and real-time variances to the initial DAM schedule.

b) Optimize generator dispatch over 24 hours
A DAM scheduling process that can utilize a 24-hour optimization algorithm would be an improvement over the current process that looks out over a much shorter time frame for resource optimization. The expected benefit is that generators will be dispatched much more efficiently; i.e. generator sequencing and unit ramping up and down. Generators will benefit from better operational certainty and therefore better able to manage their physical gas supply requirements.

c) Physically and financially bind consumers and generators to the DAM schedule
If the power market DAM is both physically and financially binding, then much the same as in the gas market, the schedule will become more relevant. Industrial customers will manage consumption to their day-ahead forecasts taking prompt and appropriate action when large imbalances threaten. Imports will be incorporated into the DAM schedule resolving a major cause of the current variance in pre-dispatch versus real-time dispatch. Generators will have a better schedule on which to make their gas nominations to ensure physical availability of fuel.

With a DAM in place that provides for some type of binding dispatch, generators will be better able to schedule their power generation a day ahead, and consequently will be able to better schedule their gas supply a day ahead.

3.1) Benefits to the Gas Industry of a Power DAM

Once the generators have scheduled their gas supply for the day through the nomination process, the pipelines and LDC's will have a "road map" showing the next day's gas demand for the generators. The pipelines will have an idea of where they are expected to deliver gas for various generators, and the quantity of gas that is expected to be consumed over the day. This will greatly help in the planning of their next day's operations; how to meet the overall demand on their respective systems in the most secure and cost effective way possible. While the generator's actual load may not be an exact match to the day-ahead nomination, this variance should be less than what would be encountered without a DAM scheduling mechanism. Further, costs associated with managing any gas supply imbalances should be recoverable from the market; relieving generators from this risk.

3.2) Mitigating Risk

With the introduction of a DAM for the electricity market, the pipelines and LDC's will need to provide adequate tools or mechanisms to help the generators manage any daily imbalances, e.g. providing a means for a generator to move its gas supply to another market point,, such as storage or a liquid market hub. These hubs and services exist now. The form these tools take may depend on the extent to which the DAM is tied to the physical operation of the power plant. If a plant commits in the DAM and has a reasonable chance of being dispatched when it does so, then it may not require as many services to mitigate imbalances.

As noted above a DAM for electricity will allow the generator to better plan their gas supply. This in turn allows the generator to better match their electricity offer price into the power market with their gas supply pricing.. The DAM provides the means to align the generators gas nomination and supply cost of fuel with its offers into the wholesale power market the next day; thereby eliminating both quantity and pricing risk that exists with a real-time market.

Implementation of a DAM should help reduce the costs of power from future RFPs based on the Clean Energy Supply Contract by the reduction of generator risk. Better forecasting of gas supply requirements and reduced risk for daily imbalances should be reflected in future bids.

4.0) Day Ahead Models Under Consideration by the Ontario IESO

The IESO currently has 4 day-ahead models[10] under consideration. The models consist of the following:

- Model 1 - Day-Ahead Commitment Process with Reliability Guarantees,
- Model 2 - Energy Forward Market (EFM) added to Model 1,
- Model 3 - Day-Ahead Financially-Binding Pre-Dispatch added to Model 1, and
- Model 4 - Comprehensive Day-Ahead Market.

Model 1 addresses reliability concerns associated with balancing supply and Ontario demand. Features of this model include:

- Using the existing pre-dispatch scheduling process to select Ontario resources and imports to meet tomorrow's forecast Ontario demand,
- Providing day-ahead financial guarantees to imports selected in the day-ahead commitment process, and
- Allowing those Ontario resources that are selected in the day-ahead commitment process to have the option of accepting a reliability guarantee that will cover the costs of starting their generators (or reducing their consumption).

[10] Detailed information on IESO day-ahead models can be found at: http://www.ieso.ca/imoweb/consult/consult_dam.asp

Model 1 is not a day-ahead market and hence does not in itself give participants an opportunity to lock in a price for the next day. Model 1 could be expanded to include a new unit commitment engine to optimise commitment decisions over the entire 24-hours of the dispatch day. From a gas industry perspective, Model 1, could provide some operational certainty by allowing gas-fired generators to voluntarily commit to day-ahead schedules and be compensated with reliability guarantee should their real-time revenues not cover their costs. This model enhances operational certainty for generators by unit commitment decisions, but does not provide certainty for volumes of output beyond minimum levels. A disadvantage of this model is that there is no day-ahead price for participants to lock in.

Model 2 builds on Model 1 by adding a separate voluntary Day-Ahead Energy Forward Market (EFM). The forward market would give participants the option of locking-in a price and quantity for the next day. Features of Model 2 include:

- An improved price signal from the EFM and from subsequent pre-dispatch runs to better plan their real-time operations and trading, and
- Ability for participants to define their level of participation in the EFM without regard to physical facilities.

For gas-fired generators, Model 2 has all the same capabilities of Model 1. The added EFM may also provide some price certainty for generators to lock in a price for energy to be sold the next day. But, any energy volume sold in the EFM serves only as a financial hedge and does not mean physical dispatch of the same amount of energy.

Model 3 builds on Model 1 by adding a voluntary Day-Ahead Financially-Binding Pre-Dispatch. This forward energy market is very similar to the EFM in Model 2 and would give participants the option of locking-in a price and quantity for the next day at the facility level. It has the same features of Model 2 with the exception that only participants with physical facilities can participate. For gas-fired generators, Model 3 has the same capabilities as Model 1. As in Model 2, the added forward energy market may also provide some price certainty for generators to lock in a price for energy to be sold in the next day. Also, similarly to Model 2 any energy volume sold in the forward energy market serves only as a financial hedge and does not mean physical dispatch of the same amount of energy.

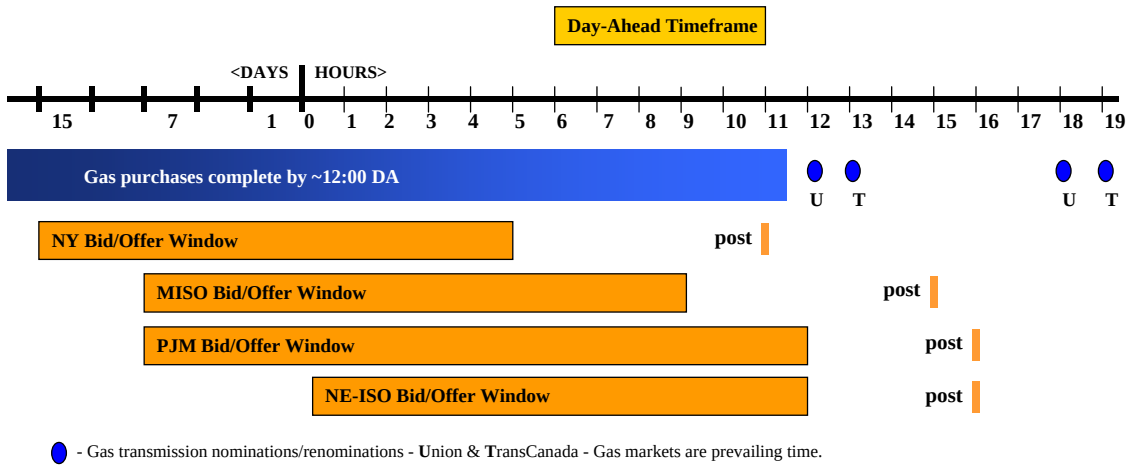
Model 4 is a true day-ahead market, providing participants an opportunity to lock in a price and quantity for the next day. This allows suppliers and consumers to hedge against real-time variations in price. Model 4 takes into account a resource's ability to physically deliver the energy. Therefore, this model provides a high degree of confidence that the day-ahead financial results would translate to the physical dispatch in real-time, allowing participants to better plan real-time operations. For gas-fired generators, Model 4 provides binding schedules and prices day-ahead providing both operational and financial certainty.

4.1) Day-Ahead Commitment Process

To address the reliability needs for Ontario's power system in 2006, a day-ahead commitment process with reliability guarantees has been proposed by the IESO[11]. This day-ahead commitment process is similar to the Model 1 day-ahead alternative described above. The existing pre-dispatch process is used to commit resources for the next day and resources have the option to accept reliability guarantees to ensure that their commitment costs are covered if needed. For gas-fired generators, this day-ahead commitment process could provide some operational certainty by allowing them to voluntarily commit to running at their minimum loading points for their minimum run-times for the next day. This commitment process does not provide a day-ahead price for participants to lock in.

5.0) Day-Ahead Market Timelines in Other Jurisdictions

Other jurisdictions around Ontario including NYISO, MISO, ISO-NE, and PJM have DAMs where generators can get binding day-ahead schedules and prices. One important aspect of any DAM design to the gas sector is the when gas-fired generators can offer energy into the DAM and when DAM schedules will be posted. The figure below shows timelines of DAMs in other jurisdictions in comparison to the day-ahead gas nomination times. The NYISO DAM is the only day-ahead market that posts schedules and prices in advance of the first nomination time. As the IESO and stakeholders consider what day-ahead model to proceed with, the aspect of the bid/offer and posting timing will need to be carefully thought through.



[11] Details are available at the IESO webpage at http://www.ieso.ca/imoweb/consult/consult_isr.asp.

6.0) Current and Future Capability of Ontario Gas Pipelines & LDC's to Serve Gas-Fired Generation

This portion of the report focuses on the "current state" capability of Union Gas, TransCanada PipeLines and Enbridge Gas Distribution to serve Ontario gas-fired generation, and also examines the "future state" capability to serve this market with or without a Day Ahead Mechanism in place.

Despite the difference in the way the gas and electric systems are balanced and the absence of a DAM for the power industry, existing gas-fired generation in Ontario is being served effectively by gas transmission systems and LDC's today. This section of the report examines the following:

- Current processes and issues facing the two industries in the current operating environment
- How the Ontario gas industry meets the needs of gas-fired generators today:
  - Serving the Lennox Generating Facility
  - Union's T-1 service
- Future facility and service considerations in the absence of a DAM for power

6.1) Current Processes & Tools for Gas-Fired Generators

If a gas generator were to contract Firm Transportation (FT) service with TransCanada, or Union and firm distribution/storage services from Union or Enbridge, it would be contracting for the most reliable transmission and distribution/storage services available. ***Firm distribution service provides for guaranteed no-notice hourly/daily delivery of gas***. On the other hand, firm transmission and storage services must be nominated and scheduled in advance. These services can only be interrupted in the event of an operational upset (Force Majeure).This is an extremely rare occurrence. The transmission, storage, and distribution providers design their systems to ensure that they can meet their firm delivery obligations each and every day.

A generator contracting for firm service with transmission, storage, and distribution providers will have a secure source of fuel supply and would have no need for an alternative fuel source.

As described earlier under Section 3.0, firm transmission allows the generator to request service on the pipelines as per the North American Energy Standards Board (NAESB) nomination timelines, which are as follows:

Nomination Window	Must Submit Nomination By	Effective Time of Physical Gas Flow
Timely	13:00 ET (prior day)	10:00 ET (next gas day)
Evening	19:00 ET (prior day)	10:00 ET (next gas day)
Intra-Day 1	11:00 ET (current day)	18:00 ET (current gas day)
Intra-Day 2	18:00 ET (current day)	22:00 ET (current gas day)

Essentially, the generator has two opportunities to nominate its gas supply and transportation service the day prior to gas flow, and two opportunities to adjust the nominations during the day. As can be seen from the table above, the nominations are submitted well before the gas physically has to flow. This gives the pipelines time to effectively and safely adjust their operations to meet the requested changes.

As described in the Lennox example below, TransCanada also offers a Storage Transportation Service (STS), which is primarily used by LDC's in conjunction with TransCanada's long-haul FT and provides for an additional three nomination windows:

Nomination Window	**Must Submit Nomination By**	**Effective Time of Physical Gas Flow**
Timely	13:00 ET (prior day)	10:00 ET (next gas day)
Evening	19:00 ET (prior day)	10:00 ET (next gas day)
STS 1	**10:00 ET (current day)**	**12:00 ET (current gas day)**
Intra-Day 1	11:00 ET (current day)	18:00 ET (current gas day)
Intra-Day 2	18:00 ET (current day)	22:00 ET (current gas day)
STS 2	**23:00 ET (current day)**	**02:00 ET (current gas day)**
STS 3	**04:00 ET (current day)**	**06:00 ET (current gas day)**

Because most natural gas consumption is relatively predictable, and because intra-day changes are relatively subtle, these windows are effective for scheduling natural gas service across North America. However, as noted in the introduction, the relative unpredictability of gas-fired generation demand means that the four nomination windows that exist today are not as effective for scheduling service for this market.

To ensure its transportation capacity can be utilized, a generator must nominate its gas supply and firm transportation within the Timely Window. Otherwise, the pipelines can offer that unutilized capacity for interruptible (IT) service. On a peak winter day, there is a good chance that pipeline capacity would indeed be sold as IT. Therefore, the Timely Window is the only window that provides a guaranteed opportunity to successfully nominate firm service. After that, the nomination is subject to available capacity.

Of course, the issue for the generator is that even if it nominates its gas supply and transportation ahead of time, it does not know for certain if or when it will be dispatched. If it is not dispatched, then it has a limited number of windows to change its nomination and find a new home for its gas (alternate market or storage). If the generator cannot successfully change its nomination, it will be subject to pipeline balancing fees, and will be required to get the gas off of the pipeline system as soon as possible.

There is also a risk that a generator may not be dispatched at the start of the day, will nominate its gas into storage or to another market, and then suddenly be dispatched later in the day. In that case, the generator may not be able to revise its nomination and will be scrambling to find new supply and transportation, which may not be available on peak demand days.

The pipelines offer other transportation services, such as Park and Loan Services (PALS) and IT, which can help generators temporarily store their imbalance gas on the pipelines

(for a fee) or move the gas to alternate markets, but these services tend to be of lower priority on the pipelines systems, and therefore cannot be guaranteed.

7.0) Serving Gas-Fired Generation in Ontario – Current Services

7.1) Serving the Lennox Generating Station

The Lennox Power Plant is a 2,140 MW dual-fuel fired (natural gas & residual oil) power generation facility located near Kingston, Ontario. The plant was originally built to run on residual oil, and was modified in 1999 to allow it to run on natural gas as well. Its daily load factor ranges from 0% to 100%, while its monthly load factor ranges from 0% to 30%. The Lennox facility is connected to the TransCanada Mainline via a Union Gas-owned-and-operated lateral, located in what is referred to as TransCanada's "Union EDA (Eastern Delivery Area)", which is Union's Eastern franchise area as it relates to the TransCanada system.

TransCanada and Union work together to serve the Lennox facility using operational coordination and a combination of firm service, interruptible service and load balancing. On the TransCanada side, the Lennox facility is served with both FT (a 10,666 GJ/d contract held by Ontario Power Generation Inc.) and IT that is provided by Lennox's suppliers (due to a low load factor, the plant relies on IT for the majority of its natural gas supply; the plant is more likely to run on natural gas in the summer, when IT is more likely to be authorized to the Union EDA). On Union's side, the plant is primarily served under Rate 25, which is its high volume, interruptible service. Because Lennox can run on residual oil as well as natural gas, Lennox can still run even when interruptible transportation is not available on the TransCanada and Union systems. A generation facility of this size, with a relatively low load factor, might find the "reservation cost" or "demand charge obligation" of firm services to be uneconomical.. Interruptible transport (IT)may be a more cost effective option. Inherent within IT service is the risk of being interrupted.

As noted previously, the generator who contracts for firm services to meet his hourly and daily demands would not need an alternate fuel source.

The Lennox facility also holds a Customer Balancing Service agreement (CBS) with Union, which helps to cover the costs that Union incurs when balancing the facility using its TransCanada Limited Balancing Agreement (LBA). Union's LBA with TransCanada is in place for those situations when Union's physical takes in the Union EDA do not match the nominated volumes (which can happen when Lennox is dispatched or ramps down; after nominations have been placed for the day). Union's LBA applies to the Union EDA as a whole, not just the Lennox interconnect, which provides Union with greater balancing flexibility.

To help it balance the Lennox account, Union uses its TransCanada Storage Transportation Service (STS) contract, along with operational coordination with TransCanada at Parkway. The STS service allows customers to operate their long-haul Firm Transportation (FT) contracts at relatively high load factors by putting gas into storage when it is not needed and withdrawing the gas from storage when it is needed. STS also includes extra nomination windows (three in addition to the standard four NAESB windows as noted previously). This helps the STS customer fine-tune its supply to demand throughout the day and enables it to minimize exposure to imbalances and associated fees.

When the Lennox facility is set to run, the Lennox operators will contact Union's gas controllers, who in turn call TransCanada to make sure both systems are set up to handle any increase in gas demand (note that both Union and TransCanada monitor the forecast power demand in Ontario to get a sense of whether or not it's likely that Lennox will run on gas). From TransCanada's perspective, this means moving as much line-pack as possible into the EDA to serve the plant when it fires up. Union then adjusts its flow at Parkway (delivering more gas into TransCanada's system at Parkway to help supply the Lennox facility). The appropriate nominations (FT, IT, and STS) are then submitted as intra-day nominations, if they have not been submitted already.

7.2) Serving Power Generators in Union's Southern Franchise Area – T1 Service

Union Gas' T-1 (Contract Carriage Service) Gas Distribution service is a semi-unbundled service with contractual parameters which are tailored to a specific customer's needs. T-1 service is offered to Union's largest contract rate customers, including the power generators in the Southern delivery area of Union's franchise. The service incorporates storage, transportation and distribution elements to meet the customer's needs.

The service allows for the daily balancing of the customer's deliveries to Union with the consumption at its facility at the customer's chosen level of risk. The customer delivers gas to Union at a particular receipt point (Dawn or Parkway, depending on plant location), and that gas is subsequently re-delivered by Union to the customer's plant each day. A customer using T-1 service is not required to nominate consumption at the facility or injections and withdrawals into or out of storage. An end of day true-up results in either an automatic injection into storage or withdrawal from storage depending on whether too much or too little gas was delivered in comparison to plant consumption. Union Gas continues to evolve the T-1 service. New customers with an appropriate load profile are no longer required to commit to an obligated DCQ ("Daily Contract Quantity"). The obligated DCQ traditionally is the amount of gas a customer must deliver to Union Gas at Dawn or Parkway that is then re-delivered to the customer's plant. Customers were required to deliver 1/365 of their forecasted annual usage to Union each and every day. Under the non-obligated DCQ arrangement, a new customer does not have an obligation to deliver a set amount of gas to Union each day. The customer has the right to deliver to Union and Union has the obligation to receive gas up to the consumption of that plant on any given day.

Union can also provide high levels of storage deliverability (injection and withdrawal capability) at the Dawn storage facility under the T1 rate. If contracted appropriately the customer will have the option of meeting its daily need wither using their non-obligated DCQ as described above or by withdrawing from storage or by using a combination of both deliveries and storage deliverability.

The key benefit of the T1 service is that because consumption is not required to be nominated, there is no risk of the firm redelivery capability being sold as IT. The no -notice elements of the T1 service are therefore very valuable to generators.

8.0) The Future – Serving Gas-Fired Generation With or Without a Day Ahead Mechanism

Based on the IESO's 10 year forecast, new gas-fired generation will be required West of Toronto, as well as in downtown Toronto. Furthermore, a new gas-fired plant is expected to be developed in the Thunder Bay region, and up to 1,000 MW of new co-generation projects are expected to be constructed throughout the province of Ontario. The result is that new facilities may be required on the Enbridge, Union Gas, and TransCanada systems to serve these plants. The expected cost of the facilities that may be required to serve this new load were provided to the Ontario Energy Board as part of its Natural Gas Electric Interface Review (NGEIR), and can be viewed on the OEB's web site.

The pipelines and LDC's will, as required, add facilities to meet the peak hourly/daily demands of new generators. Pipeline facilities costs, are expected to be the same with or without a DAM in place for generators. . Whether the generators plan their business on a day-ahead basis or not is not expected to significantly change the facility requirements. However, in a non-DAM case it is the view of Union Gas, Enbridge, and TransCanada that there may be an increase in operating and maintenance (O&M) costs due to the possible need for sudden operational adjustments to balance load when generators start up or shut down unexpectedly.

In the non-DAM case there may be greater variation between pre-dispatch and dispatch. Generators may choose to arrange for slightly higher levels of storage services to handle these greater variations in a non-DAM regime, but differences are expected to be minor given that generators likely do not want to hold high levels of storage,

In the non-DAM regime generators themselves could incur higher supply costs if forced to transact (i.e. buy or sell gas) in the intra-day gas market, which in general has fewer active participants, is consequently less liquid and therefore more volatile than the day ahead market.

The conclusion that the facilities will be predominantly the same, regardless of a DAM being in place or not, is premised on the assumption that gas-fired generators will procure their own gas supplies, transmission services, and LDC distribution and storage services. It is further assumed that the LDCs will not be required to provide backstopping gas supplies for the generators.

If however LDCs <u>were</u> required to backstop gas supplies for gas-fired generators, then it is possible there would be incremental facilities required to provide such service. The amount of incremental facilities would depend on the level of backstopping gas supplies required.

8.1) The Future – New Service Considerations

As was previously noted, Union Gas, Enbridge, and TransCanada ("the utilities") currently serve approximately 5,000 MW of gas fired generation in the province of Ontario with their existing services.

Driven by the need for new generation in and around the Greater Toronto Area, the utilities have recognized the need for new services or modifications of existing services to help meet the needs of these gas-fired generators.

Depending on how they operate, the services required by gas fired generators may include:

- A mix of firm and interruptible services
- Flexible gas delivery obligations
- Balancing services
- Access to a liquid gas acquisition hub
- No or short notice service for storage injection/withdrawals
- No or short notice service for delivery from storage to the plant

Ontario utilities have a variety of services either in place or in development that provide the flexibility to allow gas generators to meet their obligations to produce electricity. As noted above, some of these services are already in use in Ontario (although not in all franchise areas). They are provided by either a single utility or by the combined efforts of more than one utility (e.g. Union and TransCanada working together to serve the Lennox facility).