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November 6, 2013

Ms. Doreen Friis
Regulatory Affairs Officer / Clerk
Nova Scotia Utility and Review Board
1601 Lower Water Street, 3rd Floor
Halifax, Nova Scotia B3J 3S3

Dear Ms. Friis:

Re: HERITAGE GAS APPLICATION RELATED TO THE REGULATION OF NATURAL GAS STORAGE COSTS

Enclosed please find the Application of Heritage Gas Limited ("Heritage Gas") in regard to the recovery of natural gas storage costs. Within this Application, Heritage Gas is requesting that the Board determine whether the prudently incurred costs of natural gas storage should be regulated by the Board and included within Heritage Gas' cost of service. Once the Board makes a determination on regulating natural gas storage service costs, Heritage Gas intends to submit a detailed description of the costs of gas storage services and the methodology for recovery of those costs in a subsequent application for Board approval of those items, as required.

While the information in this Application is filed on a non-confidential basis, Heritage Gas requests, pursuant to Board Regulatory Rule 12(2), that portions of Attachment 1 filed in support of the Application be held in confidence by the Board.

Attachment 1 is a document prepared by ICF International entitled "Independent Assessment of Alton Natural Gas Storage" ("ICF Report"). The ICF Report contains sensitive financial and commercial information the harm of the disclosure of which outweighs the desirability of the documents being available to the public.

The ICF Report includes detailed information concerning the commercial terms on which Alton Natural Gas Storage Project LP ("Alton") proposes to store natural gas on behalf of Heritage Gas. The disclosure of this information will be detrimental to the commercial interests of Alton in the negotiation of other storage contracts. The disclosure of the commercial terms between Alton and Heritage Gas could also adversely affect Heritage Gas in other commercial negotiations.

The ICF Report also contains advice to Heritage Gas concerning gas purchase strategies. The disclosure of this information will harm Heritage Gas in its negotiations in the market place in regard to gas supply.

For the above reasons, Heritage Gas requests that the portions of Attachment 1 which have been redacted in the public version filed with this Application be held in confidence by the Board.

Yours truly,

HERITAGE GAS LIMITED

Bill Swan
President – Heritage Gas

cc: Phil Payzant – NSUARB
John MacPherson – McInnes Cooper
Chris Smith – Heritage Gas
Michael Johnston – Heritage Gas

Submission to the Nova Scotia Utility and Review Board

Re: APPLICATION RELATED TO THE REGULATION OF NATURAL GAS STORAGE COSTS

November 6, 2013

The following material is in support of this Application:

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1.0 OVERVIEW

The Nova Scotia Utility and Review Board's ("Board") jurisdiction, as set out in s. 22(1) of the Gas Distribution Act, is to "approve or fix just and reasonable rates, tolls or charges for the delivery of gas by a gas delivery system, including related services." Within this application, Heritage Gas is requesting that the Board determine whether the prudently incurred costs of natural gas storage should be regulated by the Board and included within Heritage Gas' cost of service.

Heritage Gas believes that natural gas storage falls within the Board's purview of "related services" and, therefore, the recovery of Heritage Gas' costs associated with using natural gas storage services should be regulated. In advance of Heritage Gas entering into a Tariff and Precedent Agreement with the operator of the Alton Natural Gas Storage Project LP ("Alton"), which will outline the specific terms, rates and costs for natural gas storage services, Heritage Gas is requesting Board approval to recover the costs associated with natural gas storage in Heritage Gas' cost of service.

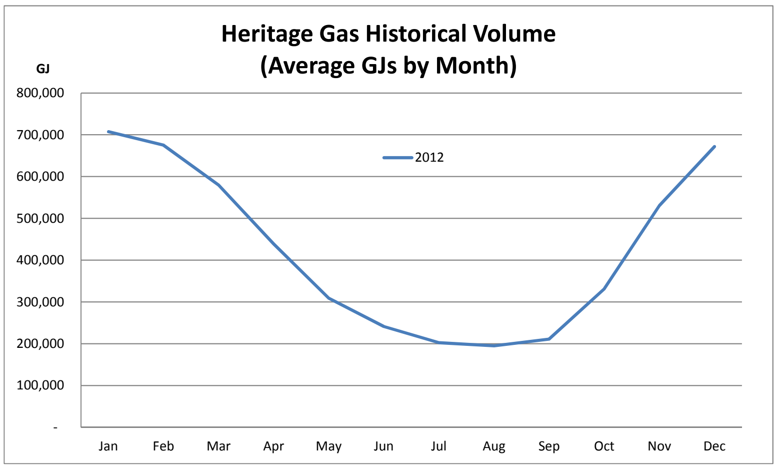
Heritage Gas will describe in this application why the storage capacity provided by Alton is crucial to insuring security of gas supply and provides benefits to Heritage Gas and its customers in the form of enhanced reliability of natural gas delivery during the peak heating season as well as reduced natural gas price volatility.

Once the Board makes a determination on regulating natural gas storage service costs, Heritage Gas intends to submit a detailed description of the costs of gas storage services and the methodology for recovery of those costs in a subsequent application for Board approval of those items, as required.

2.0 NATURAL GAS STORAGE REQUIREMENTS

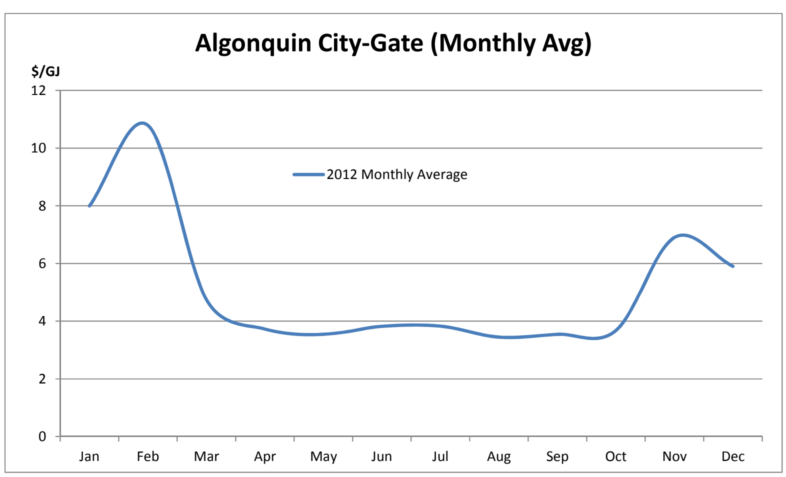
Similar to other Canadian natural gas distribution companies, Heritage Gas' highest demand periods are in the winter and lowest demand periods are in the summer as natural gas is generally used for heating purposes. For illustrative purposes, Heritage Gas has shown the 2012 volume (average GJs by month) in Figure 1 below.

Figure 1:



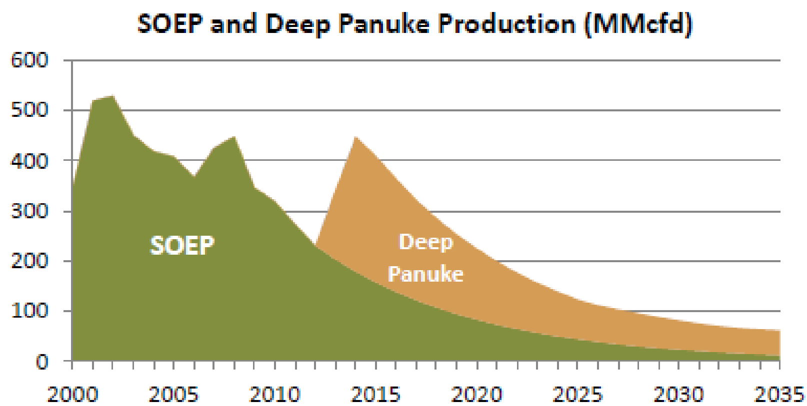
Natural gas storage enables companies to purchase and store natural gas during the summer months, when natural gas prices are generally cheaper, in order to meet the increased demand of the winter months, when natural gas spot prices are generally more expensive. For illustrative purposes, Heritage Gas has shown the Algonquin City-Gate prices for 2012, which is a proxy for Heritage Gas' daily pricing (average by month) in Figure 2 below.

Figure 2:



Heritage Gas has predominately sourced its natural gas supply from offshore Nova Scotia through the Sable Island supply basin. There continues to be a decline in production from the Sable Offshore Energy Project ("SOEP") and an estimated drop in production of the Deep Panuke project over the life-span of that project. The decline in production from both of these projects will have a compounding effect on the declining availability and deliverability of natural gas in the region over the next few years, as shown in Figure 3 below.

Figure 3:

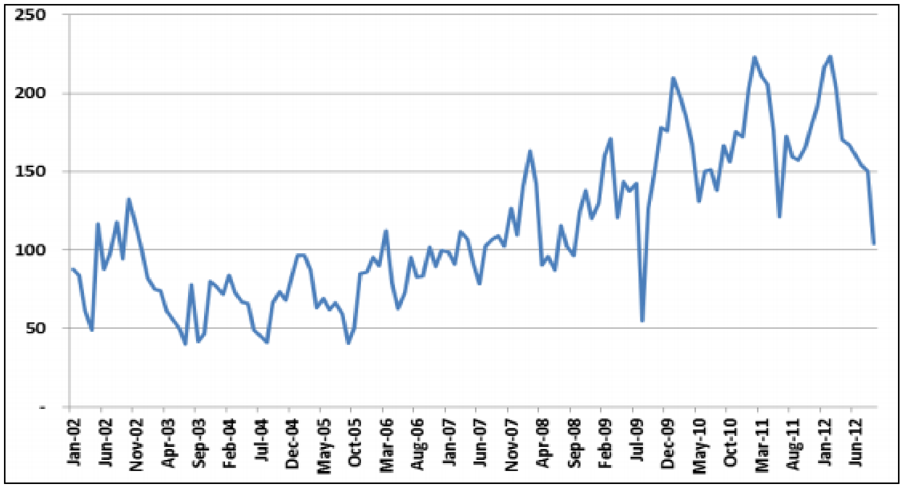


Source: ICF Report & Presentation to Heritage Gas: May-2013

According to a recent ICF Report prepared for the Nova Scotia Department of Energy issued on March 28, 2013, it is likely that the Maritime Canadian production will not be adequate to serve the Maritimes Canada monthly gas consumption in the near future, as current Maritimes consumption already has peak days of over 220 MMcfd, as shown in Figure 4 below.

Figure 4:

Maritimes Canada Monthly Gas Consumption, MMcfd



Source: Statistics Canada

Source: ICF Report - The Future of Natural Gas Supply for Nova Scotia Dept. of Energy (Mar 28, 2013)

Compounding its deliverability challenges is the fact that Heritage Gas' customers' winter gas needs often occur in heavily concentrated periods of several hours or days. During these peak periods, Heritage Gas' customers demand approximately five times the volume of gas they need during lower-use, off-peak, periods in the summer. In order to meet its customers' needs during these peak swings in demand, Heritage Gas must have access to large volumes of natural gas that it can readily deliver to its customers through the distribution system.

Natural gas storage provides Heritage Gas with supply assurance in the face of declining production from the Sable Island supply basin, deals with deliverability requirements during peak heating season and addresses the desire to mitigate price spikes that occur in natural gas markets along the Eastern seaboard which will impact prices in Nova Scotia.

Natural gas storage will allow Heritage Gas to purchase natural gas during lower demand periods when gas prices may be low (i.e. summer), inject the natural gas into the storage facility, and then withdraw that natural gas during higher demand periods when gas prices may be high (i.e. winter). This will ensure that Heritage Gas has access to sufficient volumes of natural gas to meet its peak winter demand without resorting to the purchase of natural gas on the expensive "spot market".

3.0 BOARD'S JURISDICTION TO REGULATE NATURAL GAS STORAGE

The Gas Distribution Act ("Act") does not directly address the circumstance of a local gas distribution utility incurring costs for gas storage. The only reference to storage in the Act is found in Section 17 which states:

> *17. Subject to such exemptions or conditions as prescribed, the holder of a franchise shall, without delay and with due care and diligence, receive, transport and deliver or **store**, without discrimination, all gas offered to its gas delivery system. (emphasis added)*

The Act therefore appears to have contemplated that the utility might store natural gas but does not provide any explicit direction in regard to the Board's jurisdiction to include the costs associated with such natural gas storage in the cost of service of the utility.

However, Section 2(a) of the Act describes its purpose as follows:

> *"2. The purpose of this Act is to*
>
> *(a) provide a framework for the orderly development and operation of a gas delivery system in the Province; . . ."*

As part of that framework, the Board is provided with regulatory oversight of local distribution companies. In particular, the Board has the authority to approve the rates, tolls and charges for the delivery of natural gas.

Section 22(1) states:

> *"22(1) The Board may, on its own initiative or on the application of a person having an interest, by order in writing, approve or fix just and reasonable rates, tolls or charges for the delivery of gas by a gas delivery system, **including related services**." (emphasis added)*

It is the view of Heritage Gas that the costs associated with the storage of natural gas falls within the jurisdiction of the Board to regulate the "related services" provided by the utility.

In a way, natural gas storage costs are no different from other operating costs incurred by Heritage Gas. Storage service is contracted and expenses are incurred to enable Heritage Gas to deliver natural gas to its customers in a safe and reliable manner. Generally, on a public policy basis, it is in the public interest for operating costs (including natural gas storage costs), to be subject to the overview and scrutiny of the Board. As noted previously, Heritage Gas is of the view that the scope of the Board's jurisdiction pursuant to the Gas Distribution Act is sufficiently broad to allow for this oversight.

4.0 ALTON NATURAL GAS STORAGE PROJECT BACKGROUND

In 2011, Alton Natural Gas Storage LP filed an application with the Board for approval to construct the Alton Natural Gas Storage Cavern Development (NSUARB Matter No. M04172). Within Alton's application, a description of the project was provided in Section 0, Page 2:

> *When developed, the Alton Natural Gas Storage Cavern Development will be an underground natural gas storage facility with a series of engineered salt caverns that is owned equally through a limited partnership, ALTON between AltaGas Natural Gas Storage Ltd. and Veresen Inc. The cavern development consists of multiple caverns being developed by solution mining in underground salt deposits. Solution mining is the process where water is used to dissolve salt deposits to form caverns, which then can be used as storage facilities. These salt deposits are natural geological formations located in the Alton case at depths of over 800 m. The caverns and their accompanying facilities will be capable of safely storing millions of cubic meters of natural gas produced during peak production/low demand periods and delivering it back to the gas pipeline system during periods of supply deficits. Salt cavern natural gas storage has been used extensively in North America for approximately five decades.*

Alton described some of the potential benefits of the project within its IR Responses, filed with the Board on September 28, 2012 (Page 5):

> *The supply of natural gas to the Maritimes & Northeast Pipeline (M&NP) system is from a limited number of sources. Currently, Sable Island provides that vast majority of the gas supply for Halifax and the vast majority of the supply flowing through the M&NP pipeline to the Northeastern US. (Deep Panucke [sic] is forecast to start-up in 2012.) A major failure in the M&NP line or the Sable Island offshore facility would essentially leave a great number of natural gas customers without supply. Long term viability of gas supply is critical to natural gas use in Nova Scotia. All potential outcomes of gas supply need to be considered including scenarios that include the possibility of limited on/offshore Nova Scotia production. This would require US gas supplies entering Nova Scotia to meet demand in the NS markets including the winter months which requires flow capacity on the M&NP system.*

> *The initial maximum flow rates being designed for from [sic] the proposed Alton storage facility are based on making the Alton facility capable of supplying the maximum rates that can be handled by the existing 12" (323.9mm OD) Halifax lateral. This could be sustained for nearly 30 days if the Alton facility was full at the time of the loss of supply. In the case of a total loss of supply to the M&NP system due to an upstream line break or major upset at the Sable Island offshore facility the Alton facility and the Alton Gas Pipeline would be designed to supply up to 300 mmscfd (8500 E3m3/day) to the Halifax lateral, allowing flow in both direction (half towards Halifax and the other half into the M&NP system). Alton could sustain these rates for nearly 10 days with declining rates for another 7-10 days afterwards based on the current design capacity of the facility. These are upset conditions of course and would only occur during an emergency, normal daily rates would be lower. The Alton Storage Facility will*

> *also support pressure and flow conditions that are in excess of what is currently able to flow at Halifax and Dartmouth.*

On September 4, 2013, the Board approved the Alton application, with the Board's issuance of the associated Permit to Construct, stating:

> *NOW THEREFORE, the Board grants to Alton approval to construct the proposed works, subject to … terms and conditions*

5.0 BENEFITS OF NATURAL GAS STORAGE

Heritage Gas engaged an expert consultant, ICF International ("ICF"), to assess natural gas storage in Nova Scotia. Their analysis determined storage would provide multiple benefits to Heritage Gas and its customers, under various scenarios. Heritage Gas has attached the ICF Report to this Application as Attachment 1.

Within the ICF Report, the Executive Summary describes some of the benefits, stating (p. ES-1 of ICF Report):

> *Heritage engaged ICF International (ICF) to provide an independent analysis of the Alton Project and to provide an estimate of its value from Heritage's standpoint. ICF evaluated the value of the proposed storage project based on a variety of alternative storage scenarios and supply portfolio options, as well as for a range of potential weather patterns.* ***<u>ICF's analysis indicates that Heritage Gas customers would benefit from the proposed storage. Our analysis also indicates that it is both a short-and long-term benefit. Based on the current forecast of gas prices, there would not be an identifiable period when storage costs exceed savings realized from storage. Storage can provide Heritage with supply security. Storage should provide Heritage with additional flexibility in future contracting.</u>***
>
> *Based on our analysis, ICF concludes that for the Base Case natural gas market outlook, use of Alton Gas storage by Heritage Gas would significantly reduce the utility's expected supply portfolio cost, reducing costs to Heritage Gas consumers under all scenarios considered. This conclusion is robust across the full range of supply and storage scenarios considered. Based on our analysis, we would expect Heritage to see cost savings from the first year of storage service through the length of the storage contract. The basic conclusion that use of Alton storage capacity would reduce overall supply costs also holds even if Heritage Gas demand growth is slower or faster than projected, although the optimum amount of storage capacity would vary for alternative demand scenarios.* [**Emphasis Added**]

The specific benefits with the utilization of natural gas storage service for Heritage Gas are described in detail below:

- Ensuring security of natural gas supply for the Heritage Gas natural gas distribution system:
  - With declining offshore natural gas reserves at SOEP and Deep Panuke, natural gas storage enables Heritage Gas to access gas supplies from other supply regions over the course of the year, store it underground in the summer and use it during periods of high consumption. Contracting for transportation to access this supply is necessary and storage will allow Heritage Gas to better utilize the transportation during periods of low demand over the year.
  - The majority of Heritage Gas' customer base is located at the end of a transmission system with access to limited supply sources of natural gas making it difficult to source peak day supply during eastern North American peak usage periods. While it is impossible to shift customers' peak demand from winter to summer, how supply is contracted can be changed, smoothing the purchases over the year. Natural gas storage can provide procurement flexibility and the measure of security that natural gas supply will be available when it is most in need.
  - ICF Analysis (p. 26 of ICF Report):

    "Would natural gas storage enhance system reliability? As a general principle, we believe it would, subject to the caveats about the Halifax Lateral, discussed in the previous section. The main enhancement would be the ability to draw gas from storage during times when SOEP and Deep Panuke are curtailed and/or Canaport has no supply or have an unplanned outage. However, given that we have modeled the future supply as coming from the United States, the main security issue may be rare pipeline outages or curtailments due to operational flow orders."

- Natural gas storage will provide Heritage Gas with additional flexibility when contracting for natural gas and mitigates volatility of gas commodity price:
  - Natural gas storage will allow Heritage Gas to execute natural gas supply contracts based on Heritage Gas' average daily loads as opposed to its peak day requirements, which likely coincide with periods of peak pricing.

- Natural gas storage will allow Heritage Gas to access supply basins with significant liquidity, in terms of greater production volumes and number of suppliers, such as the Western Canadian Supply Basin and the burgeoning Marcellus Basin. This will allow Heritage Gas to contract with a significantly greater number of suppliers and provide more flexibility to sell potential excess supply to more market participants when the Heritage Gas demand drops due to weather impacts or when unbundling is available to large users in Nova Scotia.
- ICF Analysis (p. 26 of ICF Report):

  > *What effect would a natural gas storage facility have on future gas supply contracts? Storage should provide Heritage with additional flexibility in future contracting. Without storage, Heritage or any shipper with variable gas requirements would depend on a combination of base load and peaking (or swing) gas supply where the supplier would provide the flexibility. Such flexibility can be costly, since the supplier must manage supply and pipeline nominations in a way to allow swings in service. In addition, the price of gas in New England can experience dramatic intra-monthly volatility which also can contribute to higher costs. By nature, storage reduces these two key price expenses by providing peak supply purchased at more acceptable prices.*

- The ability to store natural gas also serves as an insurance against any unforeseen accidents, disasters, or other occurrences that may affect the production or delivery of natural gas:
  - Heritage Gas is located at the end of the M&NP-CA pipeline system and if there is a disruption, for any reason, gas supply for Heritage Gas' customers will likely be interrupted. Natural gas storage close to Heritage Gas' customer base would provide additional reliability to gas delivery to the Heritage Gas distribution system in the event of disruptions downstream of the M&NP-CA pipeline.
  - ICF Analysis (p. 27 of ICF Report):

    > *Would natural gas storage provide utility customers with an "insurance policy" against supply interruptions? Under the terms of the proposed contract with Alton, we believe storage provides Heritage and its customers with protection against supply disruption.*

- Ensuring a reliable energy service:
  - Natural gas storage will help to mitigate reliability concerns associated with local production and will play an important role in maintaining the reliability of supply needed to meet the demands of consumers.
  - Reliable natural gas delivery is essential to encourage continued growth of natural gas use in Nova Scotia. All else being equal, residential and commercial customers will be more inclined to convert to natural gas for space heating if natural gas supply is assured.
  - ICF Analysis (p. 27 of ICF Report):

    What effect would a storage facility have on the pressure of the lateral within the M&NP line? Storage should enhance the pressures on the Halifax lateral. During winter withdrawal, the additional gas supplied would increase pressure and throughput. During the summer injection season additional deliveries to storage may add to pressure in the line, but it is our understanding that Halifax Lateral pressures are determined by the pressures on the mainline and the draw on the lateral by Tufts Cove and Heritage. ICF recommends consulting with M&NP-CA and Alton to determine what the implications are.

- Natural gas storage will serve as a balancing service once direct purchase is available to distribution customers:
  - Utilizing storage, Heritage Gas will be able to balance the daily supply requirements of customers who arrange their own natural gas supply. On days when customers are short supply i.e. they haven't purchased enough supply to meet their daily demand, Heritage Gas can offer supply from storage to match their actual requirements rather than the customer purchasing potentially high priced intraday supply or incur imbalance charges relating to out of tolerance usage on the transmission pipeline system.
  - ICF Analysis (p. 27 of ICF Report):

    Would natural gas storage provide pipeline load balancing capability? Many storage operators offer specific services to help customers manage pipeline balancing, i.e., "park and loan service." Alton does not, but also Alton appears to allow injections and withdrawals on any gas day which should *provide Heritage the ability to use the storage to avoid imbalance penalties on M&NP.*

As described, there are numerous benefits of natural gas storage service related to security of supply and system reliability for Heritage Gas and its customers in addition to such storage providing more stability in natural gas pricing for customers. The utilization of natural gas storage services helps decrease the amount of natural gas Heritage Gas would need to purchase during high demand periods, which will ultimately provide a benefit to customers by reducing overall costs for customers. Storage also enables Heritage Gas to reliably deliver natural gas to its customers as and when gas is needed despite constraints in the Maritimes natural gas market.

6.0 CONCLUSION

There are numerous benefits to pursuing natural gas storage service for Heritage Gas and its customers. As described in this application, Heritage Gas believes that natural gas storage falls within the Board's jurisdiction under the Gas Distribution Act and that the recovery of Heritage Gas' costs associated with using natural gas storage services should be regulated by the Board.

Heritage Gas respectfully requests Board determination as to whether the prudently incurred costs of natural gas storage should be included within Heritage Gas' cost of service. The precise mechanism by which those costs will be incorporated into Heritage Gas' rates has not yet been determined. When the amount of these costs and the precise mechanism by which they will be incorporated into Heritage Gas' rates are known, the Board will have the opportunity to fully review them in a separate proceeding, as the Board requires.

In support of this Application, Heritage Gas files the following Attachments:

- Attachment 1: ICF Report

Independent Assessment of Alton Natural Gas Storage

May 31, 2013

Submitted to:

Heritage Gas

Submitted by:

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Executive Summary

Heritage Gas (Heritage) has received a proposal from Alton Natural Gas Storage LP (Alton), to provide Heritage with storage services from its proposed Alton Storage Project. The project will be located adjacent to the Maritimes & Northeast Pipeline (M&NP), near Truro, N.S. As proposed, Alton will be a salt dome storage facility which will have a high rate of deliverability capable of as many as 5 to 6 storage injection and withdrawal cycles per year. [redacted]

Heritage engaged ICF International (ICF) to provide an independent analysis of the Alton Project and to provide an estimate of its value from Heritage's standpoint. ICF evaluated the value of the proposed storage project based on a variety of alternative storage scenarios and supply portfolio options, as well as for a range of potential weather patterns. ICF's analysis indicates that Heritage Gas customers would benefit from the proposed storage. Our analysis also indicates that it is both a short-and long-term benefit. Based on the current forecast of gas prices, there would not be an identifiable period when storage costs exceed savings realized from storage. Storage can provide Heritage with supply security. Storage should provide Heritage with additional flexibility in future contracting.

Based on our analysis, ICF concludes that for the Base Case natural gas market outlook, use of Alton Gas storage by Heritage Gas would significantly reduce the utility's expected supply portfolio cost, reducing costs to Heritage Gas consumers under all scenarios considered. This conclusion is robust across the full range of supply and storage scenarios considered. Based on our analysis, we would expect Heritage to see cost savings from the first year of storage service through the length of the storage contract.[1] The basic conclusion that use of Alton storage capacity would reduce overall supply costs also holds even if Heritage Gas demand growth is slower or faster than projected, although the optimum amount of storage capacity would vary for alternative demand scenarios.

The results of the storage analysis reflect the ICF Base Case natural gas market outlook for March 2013. The ICF Base Case forecast includes a long term continuation of the natural gas price volatility observed in New England in the past few years. Due to the difficulties associated with signing long term firm pipeline commitments by power generation customers in New England, The ICF Base Case gas market outlook does not include construction of any major new pipeline capacity projects into New England that would be capable of significantly dampening price volatility in these markets. This is a critical assumption that drives the amount of cost savings associated with the use of storage However, if the structure of New England power generation markets is revised in such a way as to encourage long term contracts by power generators for pipeline capacity, we would expect to see additional construction of pipeline capacity into New England from the Marcellus that could reduce the volatility of natural gas prices in New England and reduce the value of natural gas storage to Heritage Gas.

Cost Savings Associated with Use of Alton Storage

[1] Based on normal weather. Normal year to year variation in weather patterns and natural gas markets can impact the value of storage in any given year.

The supply portfolio costs for each of the alternative scenarios are shown in Exhibit ES-1. [redacted]. The impact of storage on Heritage Gas supply portfolio costs are shown in Exhibit ES-2. Based on our analysis:

1) The use of Alton storage capacity is expected to reduce the average cost of the total Heritage Gas supply portfolio, including gas purchase costs, pipeline transportation and capacity costs, and storage costs by [redacted].

2) Additional storage capacity beyond the [redacted] (See section 3) .

3) Additional injection and deliverability capacity per unit of working gas capacity would enable Heritage Gas to reduce working gas capacity and reduce pipeline capacity requirements. The overall impact of the additional injection and withdrawal deliverability capacity on supply portfolio costs will depend on the costs charged by Alton Gas storage for the additional deliverability will depend on the cost of the additional deliverability, which is unknown at this time. However, using reasonable estimates of the additional cost suggest that higher deliverability storage capacity would further reduce Heritage Gas supply portfolio costs.[2]

Exhibit ES-1: Heritage Gas Supply Portfolio Costs for Alternative Storage and Supply Scenarios [redacted]

[redacted]

[2] The benefits of additional deliverability include displacement of M&NP firm pipeline capacity based on the increased deliverability of storage into the Halifax Lateral. However, reliance on additional storage deliverability to meet design day requirements increases the likelihood of capacity constraints on the Halifax Lateral that would need to be addressed to ensure reliability of storage deliverability.

Exhibit ES-2: Impact of Alton Storage on Heritage Gas Supply Portfolio Costs for Alternative Storage and Supply Scenarios

[redacted]

[redacted]

The analysis also concludes that purchasing gas supply from a diversified portfolio of gas supply sources is likely to reduce overall supply portfolio costs for Heritage Gas relative purchasing gas supply from New England markets. The diversified supply portfolio chooses the lowest total cost source of natural gas from the U.S. Gulf Coast, Marcellus production, and New England purchases.[3] [redacted]

[redacted]

Changes in Gas Purchase Patterns

Exhibit ES-3 shows the average annual gas purchase volumes for each storage option and supply scenario considered.

[3] We did not consider the cost of gas supply from the WCSB due to uncertainty regarding tolls on the TransCanada system and capacity availability on the PNGTS system. The current cost of firm pipeline capacity on TransCanada and PNGTS makes this option uneconomic relative to other supply options. However, this supply option may need to be reconsidered when the uncertainties on these systems are resolved.

Exhibit ES-3: Impact of Alton Storage on Heritage Gas Supply Portfolio Purchase Volumes for Alternative Storage and Supply Scenarios

[redacted]

[redacted]

Most of the cost savings associated with the use of Alton Storage is created by the shift in purchases from the winter period to the summer period. The additional storage capacity in the Optimized Storage scenario allows an additional shift in purchasing from higher price winter periods to lower cost summer periods. The Higher Deliverability storage scenario also shifts additional purchase gallons from the winter periods to the summer relative to the Pro Forma Storage scenario.

[redacted]

[redacted]

1 Introduction

1.1 Purpose of the Study

Heritage Gas (Heritage) has received a proposal from Alton Natural Gas Storage LP (Alton), to provide Heritage with storage services from its proposed Alton Storage Project. The project will be located adjacent to the Maritimes & Northeast Pipeline (M&NP), near Truro, N.S. As proposed, Alton will be a salt dome storage facility which will have a high rate of deliverability capable of as many as 5 to 6 storage injection and withdrawal cycles per year. [redacted]

Heritage has engaged ICF International (ICF) to provide an independent analysis of the Alton Project and to provide an estimate of its value from Heritage's standpoint. ICF was asked to assist Heritage in addressing the following questions.

- Is natural gas storage in Nova Scotia beneficial to Heritage Gas and its customers? If so, is natural gas storage a short-term benefit or a long-term benefit?
- Could natural gas storage be used to mitigate some price fluctuations which ultimately flow to Heritage Gas customers through the Gas Cost Recovery Rate ("GCRR")?
- What would be the gas cost savings from the use of storage (historically and forward looking)?
- What effect would a natural gas storage facility have on future gas supply contracts?
- If Heritage Gas entered into a contract for gas storage, what would be the optimal level of storage for Heritage Gas?
- What would be the optimal withdrawal from storage (percentage by month) based on price variances in winter months? Assuming full winter withdrawal, what daily max withdrawal rights are recommended?
- Would natural gas storage provide operational peaking flexibility?
- Would natural gas storage enhance system reliability?
- What operational concerns are there over the lifetime of the proposed facility (i.e. stooping)?
- Would natural gas storage provide pipeline load balancing capability?
- Would natural gas storage provide utility customers with an "insurance policy" against supply interruptions?
- Based on information about Alton's proposed storage, would Heritage Gas be able to inject & withdraw as needed?
- What would the impact of third party gas marketers have on system supply displacement (i.e. customers seeking their own gas supply)?
- Model and quantify / estimate value of storage for supply security.
- Develop economic model to project the impact of storage assuming: [redacted] This economic modeling will have to factor in the gas supply costs
- What transportation contracting on M&NP is required to use storage [redacted]?
- What effect would a storage facility have on the pressure of the lateral within the M&NP line?

1.2 Principal Analytic Issues

Heritage provides gas distribution services to consumers in the Halifax Dartmouth metropolitan area and in other locations in Nova Scotia. Halifax and Dartmouth account for the vast majority of sales. Heritage has more than 4,500 customers, representing over 20,000 homes and businesses. Gas consumption on the Heritage system is seasonal because the heating load is driven by weather. Total annual consumption for the last 12 months (Mar. 2012-Feb. 2013) was 5.34 million GJs. Average daily sendout was [redacted] with a peak day sendout of [redacted]. The minimum day sendout was [redacted]

For a local distribution company (LDC) with a strong seasonal consumption pattern, natural gas storage is a logical choice for economically supplementing gas supply during winter peak demand. Storage can allow Heritage to purchase a portion of the winter supply requirements in the summer when gas prices are low, and storing the gas for withdrawal in the winter when gas prices are high. The quantifiable benefit would be the difference between winter and summer gas costs, inclusive of storage costs. Storage can also provide supply security, which has been an issue in Nova Scotia with the frequent outages of Sable Offshore Energy Project (SOEP) or other interruptions on the Maritimes & Northeast Pipeline (M&NP). The supply security benefit would depend on the timing of the supply disruption and the amount of gas needed to be withdrawn from storage to avoid having to buy replacement volumes on the open market when prices during an outage could be very high.

The storage decision is really a set of decisions around the amount and operational conditions of storage. These include:

- How much firm pipeline capacity should Heritage acquire to meet the system load, storage injection requirements, and storage withdrawal requirements?
- From which market should the supply of gas be accessed? SOEP is declining rapidly and Deep Panuke has yet to come on line, and in any event appears have a short production life. Heritage has several options for buying gas that involve more or less long-line pipeline transportation. Other markets include New England (at Dracut or Algonquin or Tennessee trading hubs), or Marcellus production (at Dominion South Point or other hub), or Dawn. Each market implies a different pipeline route and capacity purchase decision.
- How much storage capacity should be acquired? This depends on the winter gas demand and the amount of pipeline capacity that is contracted for.
- What are the appropriate injection and withdrawal rates, i.e., GJs/day? This is normally dictated by the storage company as a function of the stored gas volumes.
- Should Heritage seek more than one storage cycle option? Normally a LDC needs only a single storage cycle; but if storage is to also provide some supply security, multiple cycles may be desirable.

As a local distribution company, Heritage is primarily focused on the intrinsic value of storage. The questions presented in the RFP reflect this interest. A number of factors contribute to the intrinsic value of storage. The key drivers of storage value include the following:

- Gas market price differences across seasons, months, and price volatility to the extent that Heritage buys some portion of its supply on the spot market
- Heritage's annual daily, weekly, and monthly sendout and sendout patterns, seasonality of send-out, customer characteristics (e.g., firm v. interruptible), and sendout forecast
- Pipeline access, capacity, operating costs, balancing charges
- Alternative fuel costs (fuel oil, propane) – this is relevant for interruptible customers
- Gas supply contract terms – basically the pricing of gas but also the delivery options

- Storage service characteristics: injection and withdrawal timing and limits, storage capacity, storage capacity ratchets (e.g., rates of allowed draw-down over time), pipeline interconnectivity and costs of pipeline service, storage costs (injection rate, withdrawal rate, storage rate), cycles of injection and withdrawal (i.e., multiple cycles or one).

To be beneficial to Heritage's ratepayers, storage must operate and be priced in a way that it provides lower cost gas in the winter withdrawal period, even considering carrying costs, than would be the case if Heritage were to buy incremental supply in the market during winter. This is the intrinsic value of storage. In addition, storage should provide reliability benefits sufficient to justify a small premium.

A challenge in this study has been what to assume about future gas supply arrangements, which will be different from those that Heritage currently operates under. [redacted]

1.3 Alton Storage Proposal

Alton Natural Gas Storage is being developed by AltaGas Ltd. and Veresen Inc. The facility is proposed for a location 65 km north of Halifax, Nova Scotia near the community of Alton, Nova Scotia at about the half-way point of the M&NP-CA Halifax Lateral. It will be developed from underground salt formations that will involve creating a cavern in the salt through solution mining techniques. The project received its environmental permits in 2007. In 2011, Alton filed its application to construct the facility with the Nova Scotia Utility and Review Board (UARB). It will have an initial storage capacity of 4-6 Bcf with the capability to expand to 20+Bcf. Besides the underground caverns and associated facilities, the project includes a 10 km 12 inch pipeline connecting to the M&NP Halifax Lateral. The project is expected to enter service in [redacted] Based on the Precedent Agreement provided to ICF, the elements of the gas storage service are as follows:

Exhibit 1: Summary of Alton Storage Service Proposal

[redacted]

Exhibit 2: Annual Cost of Alton Storage Service Proposal

- [redacted]

- [redacted]

- [redacted]

The cost of pipeline transportation into and out of storage is not a part of the Alton proposal. For purposes of this analysis, ICF assumes that Heritage will pay the current M&NP-CA toll for delivery to storage and the current M&NP-CA toll for "Storage Transportation Service" for redelivery from storage. [redacted].

2. Approach

Heritage Gas intends to use the potential Alton Gas storage capacity to meet seasonal natural gas demand. Gas purchased during off-peak periods will be put into storage and withdrawn during peak demand periods. As a result, the value of natural gas storage to Heritage is based on the seasonal spread in natural gas prices. This is often referred to as the intrinsic value of storage. The Intrinsic value of storage is a measure of expected difference in the seasonal value of the gas commodity (volume weighted withdrawal price minus the volume weighed injection price) minus the variable costs of storage (injection and withdrawal charges and fuel charges) adjusted for the time value of money.

The seasonal value of natural gas held in storage (withdrawal price – injection price) in New England is currently the highest of any major region in North America. The magnitude of the seasonal value is driven by the pipeline constraints for delivery of gas into New England during periods of peak demand. A number of pipeline projects are proposed that would add capacity into the Northeast United States that, if completed, would reduce the constraint and lower the seasonal price difference that underlies storage value. However, all of these projects face major difficulties that will need to be resolved prior to implementation, including determining who will sign up for the new capacity. The ICF Base Case used in this analysis includes only enough new pipeline capacity into New England to meet growth in firm LDC demand. As a result, the seasonal natural gas price basis in New England is projected to remain relatively stable at near today's levels for the full time period of the analysis. (Exhibits 3 and 4).[4]

[redacted]

[redacted]

[4] This assumption is important for this analysis. One of the key questions facing policy makers in the United States is over the coverage of firm pipeline capacity for independent power projects. LDCs can recover pipeline charges in their rates but power generators selling power into unregulated power markets are price takers. Therefore they have depended on interruptible gas transportation service. Expansion of pipelines into New England depends largely on who bears the cost of expansion. If an expansion were to exceed the requirements of LDCs and meet IPP demand, the basis shown here would decline.

The seasonal variation in natural gas prices in New England creates a significant difference between winter and summer prices, leading to a high intrinsic value of storage.

Exhibit 4: ICF Forecast of Seasonal Natural Gas Price Basis in New England

[redacted]

While the intrinsic value of storage is generally positive, as shown in Exhibit 4, weather and market conditions can result in a negative intrinsic value of storage when natural gas prices during the summer injection season are higher than natural gas prices during the winter withdrawal season. This typically occurs during periods when natural gas prices are falling rapidly, as occurred during the 2008/2009 storage season, and can also occur if winter weather is much warmer than normal as in 2011/12 storage season.

In the ICF forecast, natural gas price seasonality generally increases slowly over time as gas prices increase. The increase in natural gas prices is due to a combination of slow increases in real North American natural gas prices resulting from growth in natural gas demand and LNG exports, and inflation. However, the pattern fluctuates from year to year. During periods when prices are increasing more rapidly due to growth in LNG exports and other factors, the seasonal gas price spread increases more rapidly than average. During periods when gas prices stabilize or decline, such as 2017-2019 and 2026-2028, the seasonal gas price spread can decrease.

2.1. Analytic Approach

ICF used two proprietary natural gas market forecasting models to conduct the analysis:

1) The ICF Proprietary Gas Markets Model (GMM) was used to provide monthly natural gas price projections for all of the potential natural gas purchase points considered viable by Heritage. Appendix B provides a summary description of the GMM.

   ICF used the March 2013 ICF Base Case forecast from the GMM for this analysis. The ICF Base Case represented our most likely gas market scenario at the time it was developed based on normal expected weather. The ICF GMM was also used to evaluate the expected impact of weather uncertainty on natural gas prices. The GMM was run 30 different times with 30 different weather scenarios for the forecast period from April 2017 through March 2020. Each weather scenario was based on three years of historical North American weather. The first weather scenario used historical weather from the period starting April 1980 and ending March 1983. The 30th weather scenario used historical weather from the period starting April 2009 and ending March 2012.

The monthly natural gas price forecasts from the ICF GMM were used to develop daily natural gas price scenarios for each key market center. The daily gas price scenarios reflect daily natural gas price volatility for the period from April 2010 through March 2013.

2) The ICF proprietary Natural Gas Storage and Supply Portfolio Optimization Model was used to optimize natural gas commodity and storage capacity requirements on an annual basis, based on daily load requirements and daily natural gas prices over a wide range of potential weather conditions. The optimization was based on lowest overall portfolio cost, where portfolio costs include gas, pipeline, and all storage costs, including cushion gas.

   The monthly natural gas price forecasts from the ICF GMM were used to develop the daily natural gas price scenarios for each key market center. The daily gas price scenarios reflect daily natural gas price volatility for the last three years.

The analysis considered the range of reasonable supply portfolio options for a set of potential price and weather conditions for 15 one year periods starting [redacted] with and without the use of Alton Storage capacity. The analysis considered daily dispatch requirements, daily natural gas prices, design day capacity requirements, pipeline capacity options, and storage space and deliverability options, and optimized the supply portfolio on an annual basis for 15 years. ICF also evaluated the impact of 30 alternative weather scenarios for the three-year period from [redacted].

No optimization modeling approach can consider all of the factors that go into the storage contracting decision by an LDC. Hence, the results of the optimization analysis should be viewed as one additional source of information during the portfolio development process.

Like all optimization analyses, this analysis includes several fundamental simplifications that must be considered when evaluating the modeling results. These simplifications include:

1) The optimization modeling approach relies on perfect foresight considering weather conditions and natural gas prices. This tends to increase the value of supply options that facilitate daily and seasonal flexibility in natural gas purchasing and storage utilization decisions relative to options that rely on longer term decisions such as monthly gas purchase contracts.

2) The optimization approach used in this analysis selected the least cost option. There can be a difference between the “least cost” and the “best” option due to such factors as market risk, company operational guidelines, regulatory policy, environmental and sustainability concerns, and other issues that are difficult to quantify.

3) The supply portfolio was optimized on an annual basis, and each different weather scenario considered in the analysis resulted in a different optimized portfolio. We have summarized the results of the analysis across the range of scenario results and provided the range of optimized solutions for key elements of the analysis. However, selection of final portfolio

from among the range of optimized solutions depends on a range of factors including risk tolerance and other issues.

2.2 Demand Forecast

For a utility such as Heritage Gas that intends to use storage to meet utility demand, the value of natural gas storage is closely linked to the seasonal demand forecast. To develop the demand forecast for this analysis, ICF used Heritage Gas customer and demand growth assumptions to determine the long term demand trend. [redacted].

ICF reviewed Heritage Gas sendout data to allocate demand between weather sensitive and non-weather sensitive load on a per customer basis. Non-weather sensitive load per customer was estimated based on average per customer demand during the summer month (July or August) with the lowest demand per customer from each of the last three years of demand data. The remaining load was considered to be weather sensitive. For this analysis, we have assumed that weather sensitive load changes in direct proportion to the change in heating degree days during each period. [redacted] The percent of weather sensitive load is projected to remain unchanged during the forecast time period. The base case demand forecast is shown in Exhibit 5.

Exhibit 5: Heritage Gas Demand Forecast (Normal Weather)

[redacted]

ICF developed daily sendout requirements for input to the model from historical daily weather volatility based on 20 years of actual weather data for the Heritage service territory. ICF projected daily sendout based on algorithms developed from the Heritage load forecasts.

2.2.1 Design Day Demand

Design day demand is based on the coldest winter day observed in the last 30 years. For two of the three supply scenarios, including the "Status Quo" supply scenario and the "Diversified Supply Scenario", ICF has assumed that Heritage Gas would plan to meet design day demand with a combination of firm annual pipeline capacity plus storage deliverability. In the third supply scenario, ICF has assumed that Heritage Gas would plan to meet design day demand with a combination of storage deliverability and daily gas supply, without holding firm annual pipeline capacity.

2.2.2 Weather Scenarios

For the long term analysis [redacted]), ICF used normal weather in each year based on the average of 20 years of data from 1992 through 2011. We also conducted the storage analysis for the first three years of the analysis [redacted] for 30 different weather patterns based on three years of actual heating degree day data. The first weather scenario used weather data from the three year period from April 1981through March 1984. The final weather scenario used weather data for the three year period from April 2010 through March 2013.

The actual heating degree day scenarios resulted in a range of different demand scenarios summarized in Exhibit 6.

Exhibit 6: Impact of Alternative Weather Scenarios on Annual Demand (GJ/Year)

[redacted]

2.3 Alternative Gas Supply Scenarios

The analysis considered three different supply strategies:

1) **Status Quo Supply Scenario:** Heritage will purchase all gas supplies at New England pricing points. Purchases will include both monthly and daily purchases. For the status quo supply scenario, ICF is assuming that Heritage Gas will hold sufficient pipeline capacity on M&NP (US) and M&NP (Canada) to deliver New England purchases to the Heritage service territory on a firm basis. We have also assumed that the combination of pipeline capacity and storage deliverability will be sufficient to meet design day demand.

2) **Daily Purchase Scenario**: Heritage will purchase all gas supplies as daily purchases at the New England pricing point, without any firm pipeline commitments. Gas will be transported on M&NP to Heritage Gas based on a daily transportation cost. This scenario most closely approximates the current Heritage supply purchasing strategy, which relies on daily purchases at New England prices, combined with daily transportation costs to meet incremental swings in demand. However, as the Heritage system continues to grow, and as changes in Atlantic Canada gas supply continue to decrease reliability of daily purchases, ICF believes that the risks of relying on daily purchases to meet incremental demand will continue to grow, decreasing the attractiveness of this supply portfolio option.

3) **Diversified Supply Portfolio Scenario**: The diversified supply portfolio scenario includes options to purchase monthly and daily purchases from the Gulf Coast at Henry Hub and from the Marcellus region, as well as purchasing gas supplies at New England market centers. For

the diversified supply portfolio, we have assumed that Heritage will hold sufficient firm pipeline capacity and storage deliverability to meet design day demand. Hence, all of the supply options in the diversified supply portfolio scenario include firm pipeline capacity from the point of purchase to the Heritage service territory.

Marcellus purchases are transported to New England based on firm transportation on the Tennessee System from zone 4 to zone 6. Gulf Coast purchases are transported to New England based on firm transportation on the Tennessee System (zone 1 to zone 6). All gas transportation on M&NP is based on firm transportation tolls.

The use of firm transportation tolls on the Tennessee Gas Pipeline is intended to reflect representative transportation cost of providing firm service from the alternative supply basins to New England, and does not represent a recommended transportation path. In addition, firm transportation service on the Tennessee Gas Pipeline or other pipelines into New England may not be available at current tolls.

Additional supply scenario parameters include:

- Withdrawals from Alton Gas storage will be delivered to the Heritage service territory under the existing M&NP storage delivery tariff, which does not provide firm service on M&NP.
- In the Status Quo and Diversified Supply scenarios, Heritage is assumed to hold sufficient annual firm pipeline capacity to transport gas from the point of purchase to the Heritage Gas service territory or to Alton Gas storage.
- In the Daily Purchases Scenario, gas is purchased at a New England market center (e.g., Dracut) and transported to Heritage Gas service territory or Alton Storage on M&NP. Pipeline capacity costs are assumed to be 1/365th of the annual M&NP firm service tariff for M&NP U.S. and M&NP Canada.
- Pipeline transportation costs are held constant at current rates. Rates on U.S. pipelines are converted from U.S. units (U.S. $/MMBtu) to C$/GJ. The currency exchange rate is held constant at 1.0 to 1.0.
- [redacted].

Transportation costs for all scenarios are shown in Exhibit 7. The ICF forecast of natural gas commodity prices for New England, Marcellus, and Gulf Coast (Henry Hub) are included in Appendix B.

Exhibit 7: Natural Gas Transportation Costs for Alternative Supply Options

[redacted]

2.4 Gas Storage Scenarios

The analysis looked at four different storage capacity and deliverability scenarios for each of the three gas supply scenarios:

1) No Storage Scenario: Total supply portfolio cost without the use of storage.
2) Alton Pro Forma Storage Scenario: Total supply portfolio cost based on the storage proposal put forward by Alton Gas Storage, including cushion gas, fixed storage capacity at [redacted]
3) Optimized Storage Capacity Scenario: Total supply portfolio cost based on the storage proposal put forward by Alton Gas Storage, but allowing storage capacity to change each year in order to minimize overall supply portfolio cost. In this scenario, Injection and withdrawal capacity and cushion gas requirements change in proportion to the change in working gas capacity.
4) Increased Deliverability Scenario: The Increased Deliverability Scenario is used to assess the value of additional injection and withdrawal capacity. This scenario is based on the Optimized Storage Capacity Scenario with 50 percent more storage injection and deliverability relative to working gas capacity (and including the cushion gas). Alton storage has not provided a cost estimate for additional storage injection and withdrawal capability. For the purposes of this analysis we have assumed that storage costs are allocated 50 percent to space and 50 percent to deliverability. Hence the cost of storage with an increase of 50 percent in injection and withdrawal capacity will cost 25 percent more per GJ of storage space than the pro forma storage option.

3 The Value of Alton Gas Storage to Heritage Gas

3.1 Value of Alton Gas Storage Proposal to Heritage Gas

Based on our analysis, ICF concludes that for the Base Case natural gas market outlook used in the analysis, use of Alton Gas storage by Heritage Gas would significantly reduce the utility's expected supply portfolio cost, reducing costs to Heritage Gas consumers under all scenarios considered.

3.1.1 Cost Savings Associated with the Use of Storage

The supply portfolio costs for each of the alternative scenarios considered are shown in Exhibit 8.

Exhibit 8: Impact of Alton Storage on Heritage Gas Supply Portfolio Costs for Alternative Storage and Supply Scenarios

[redacted]

The values in this exhibit reflect the average annual supply portfolio costs, by major component of supply for the [redacted]
Based on our analysis:

1) The use of Alton storage capacity, as proposed by Alton storage, is expected to reduce the average cost of the total Heritage Gas supply portfolio, including gas purchase costs, pipeline transportation and capacity costs, and storage costs by [redacted]

2) Additional storage capacity beyond the [redacted]

[redacted]

3) Additional injection and deliverability capacity per unit of working gas capacity would enable Heritage Gas to reduce working gas capacity and reduce pipeline capacity requirements. The overall impact of the additional injection and withdrawal deliverability capacity on supply portfolio costs will depend on the costs charged by Alton Gas storage for the additional deliverability will depend on the cost of the additional deliverability, which is unknown at this time. However, using reasonable estimates of the additional cost suggest that higher deliverability storage capacity would further reduce Heritage Gas supply portfolio costs. [5]

The analysis also concludes that purchasing gas supply from a diversified portfolio of gas supply sources is likely to reduce overall supply portfolio costs for Heritage Gas relative purchasing gas supply from New England markets. The diversified supply portfolio chooses the lowest total cost source of natural gas from the U.S. Gulf Coast, Marcellus production, and New England purchases.[6]

The analysis indicates that gas purchases from [redacted] will provide the lowest cost option for meeting basic requirements, including storage injections and winter base load purchases. Overall, the diversified supply portfolio is expected to reduce supply portfolio costs by [redacted]

Exhibit 9 shows the average annual supply portfolio costs with and without the use of natural gas storage as proposed by Alton Gas for the alternative supply scenarios evaluated for each five year period from [redacted]. Annual results for the analysis are included in Appendix A.

For the status quo supply portfolio, the use of storage would reduce the total supply portfolio cost by [redacted]

For diversified supply portfolio, [redacted]

Storage also decreases the overall supply portfolio cost for the Daily Supply Portfolio. Use of Alton pro forma storage would reduce total supply costs by [redacted]

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[5] The benefits of additional storage deliverability include displacement of M&NP firm pipeline capacity. However, additional storage deliverability into the Halifax Lateral increases the likelihood of capacity constraints on the Halifax Lateral when Tufts Cove is drawing substantial gas volumes and that would need to be addressed to ensure reliability of storage deliverability. See also discussion in section 4.3, p. 27.

[6] We did not consider the cost of gas supply from the WCSB due to uncertainty regarding tolls on the TransCanada system and capacity availability on the PNGTS system. The current cost of firm pipeline capacity on TransCanada and PNGTS makes this option uneconomic relative to other supply options. However, this supply option may need to be reconsidered when the uncertainties on these systems are resolved.

Exhibit 9: Average Annual Supply Portfolio Cost Savings from Use of Alton Gas Storage As Proposed by Alton Gas

	Average Annual Supply Portfolio Cost ($/year)
[redacted]	

Exhibit 10: Supply Portfolio Costs for Alternative Storage Scenarios for the Status Quo Supply Portfolio

[redacted]

Exhibit 11: Supply Portfolio Costs for Alternative Storage Scenarios for the Diversified Supply Portfolio

[redacted]

Exhibit 12: Supply Portfolio Costs for Alternative Storage Scenarios for the Daily Supply Portfolio

[redacted]

Based on this analysis, ICF concludes that the use of Alton Gas storage by Heritage Gas would significantly reduce the utility's expected supply portfolio cost, reducing costs to Heritage Gas consumers for all of the storage scenarios evaluated.

The cost savings associated with the proposed Alton Storage are consistent throughout the time period of the analysis [redacted] Exhibits 13 through 15 show the year to year changes in annual gas portfolio costs with and without the use of storage capacity based on the Alton Storage Pro Forma storage proposal for the three different natural gas supply portfolios considered.

Exhibit 13: Heritage Gas Supply Portfolio Costs – Status Quo Supply Portfolio

[redacted]

Exhibit 14: Heritage Gas Supply Portfolio Costs – Daily Supply Portfolio

[redacted]

Exhibit 15: Heritage Gas Supply Portfolio Costs – Diversified Supply Portfolio

[redacted]

3.1.2 Change in Gas Purchasing Patterns Associated with the Use of Storage

Most of the cost savings associated with the use of Alton Storage is created by the shift in purchases from the winter period to the summer period. The additional storage capacity in the Optimized Storage scenario allows an additional shift in purchasing from higher price winter periods to lower cost summer periods. The Higher Deliverability storage scenario also shifts additional purchase volumes from the winter periods to the summer relative to the Pro Forma Storage scenario. Exhibit 16 shows the average annual gas purchase volumes for each storage option and supply scenario considered.

Exhibit 16: Impact of Alton Storage on Heritage Gas Supply Portfolio Purchase Volumes for Alternative Storage and Supply Scenarios

[redacted]

In the Status Quo supply portfolio volatility in prices also supports a continuation of the current Heritage Gas practice of purchasing part of the supply portfolio on a daily basis and part of the portfolio on a monthly basis.

In the Diversified Supply Portfolio scenario, the ICF storage model has the option of purchasing natural gas at New England markets delivered to Heritage or Alton Storage on M&NP, from the Marcellus, delivered via Tennessee Gas Pipeline and M&NP, or from the Gulf Coast delivered via Tennessee Gas Pipeline and M&NP. Based on the ICF forecast of natural gas prices, and assumptions related to transportation costs, the ICF indicates [redacted].

3.2 Optimum Storage Capacity

For the Alton Pro Forma storage scenario, ICF specified the amount of Alton Gas storage capacity included in the Heritage Gas supply portfolios. However, ICF also used the Natural Gas Storage and Supply Portfolio Optimization Model to determine the level of storage capacity that would result in the lowest overall supply portfolio cost for each year of the analysis. Based on the ICF analysis, the optimum amount of storage capacity for Heritage Gas is [redacted]

The average optimal storage capacity level for each supply scenario for each year is shown in Exhibit 17. The optimum storage capacity increases annually as Heritage Gas demand increases. [redacted]

[redacted] The cost savings associated with the increase in storage capacity for each supply portfolio are shown in Exhibit 19.

Exhibit 17: Optimum Level of Storage Capacity

[redacted]

[redacted]

3.3 Impact of Alternative Sources of Supply on Supply Costs

In the Diversified Supply Scenario, [redacted]

Based on the supply cost analysis, ICF concludes that purchasing gas supply from a diversified portfolio of gas supply sources is likely to significantly reduce overall supply portfolio costs for Heritage Gas relative purchasing gas supply from New England Markets. The diversified supply portfolio includes summer purchases of gas from [redacted]. Winter purchases included both [redacted]

The costs of the Diversified Supply Portfolio scenario and the Daily Purchase scenario are roughly equivalent. The cost savings in the Daily Purchase Scenario are due to the use of non-firm pipeline capacity to transport New England purchases to the Heritage service territory.

The Daily Purchase Scenario is similar to current Heritage purchasing strategy, which relies on daily purchases at New England prices, combined with daily transportation costs to meet incremental swings in demand. However, as the Heritage system continues to grow, and as changes in Atlantic Canada gas supply continue to decrease reliability of daily purchases, ICF believes that the risks of relying on daily purchases to meet incremental demand will continue to grow, decreasing the attractiveness of this supply portfolio option for meeting peak period demands.

3.4 Impact of Additional Storage Withdrawal and Injection Capacity

We understand that the Alton storage facility is designed to be a high deliverability facility capable of multiple storage cycles each year. The Alton Gas pro forma storage offer to Heritage Gas is roughly equivalent to single cycle storage. In order to maximize storage utilization of the contracted storage capacity, Heritage Gas will be required to inject roughly the same amount of gas each day during the injection season, and withdraw roughly the same amount of gas each day during the withdrawal season.

Heritage does not intend to use the Alton storage facility to arbitrage natural gas markets, rather as it will use storage to supplement winter supply. As such, Heritage would forego any benefits from contracting for high deliverability storage which would provide some flexibility to reduce injections during potential high price periods during the summer injection season, and to take advantage of low price periods during the winter withdrawal season to purchase additional gas supplies. As a result, a modest increase in storage injection and withdrawal capacity relative to working gas capacity would be expected to reduce Heritage gas purchasing costs. The increase in storage deliverability might also allow Heritage to hold less storage working gas capacity.[7]

In order to evaluate the impact of additional storage injection and withdrawal capacity, ICF evaluated the impact on supply portfolio costs of increasing withdrawal and injection capacity by 50 percent relative to the Alton Gas pro forma proposal. [redacted]

[7] This view reflects our understanding of how Heritage intends to use storage and the fact that as a LDC, Heritage would not engage in market arbitrage. Nevertheless our review of the pro forma tariff suggests that Heritage will have some flexibility in injections and withdrawals, which could enhance Heritage's ability to respond to market developments. See discussion in section 4.1 on this issue.

Alton storage has not provided a cost estimate for additional storage injection and withdrawal capability. For the purposes of this analysis we have assumed that storage costs are allocated 50 percent to space and 50 percent to deliverability. Hence the cost of storage with an increase of 50 percent in injection and withdrawal capacity will cost 25 percent more per GJ of storage space than the pro forma storage option.

Depending on the cost of the additional injection and withdrawal capacity, additional injection and deliverability capacity per unit of working gas capacity allows Heritage Gas to reduce working gas capacity, and reduce overall supply portfolio costs. The results of the analysis are shown in Exhibit 20. The overall supply portfolio cost for the Status Quo supply portfolio declines by [redacted] The largest cost savings is associated with a decline in pipeline capacity costs facilitated by the increase in deliverability.

[redacted]

3.5 Impact of Weather Uncertainty on Storage Value

Extreme weather can have a significant impact on the optimum level of storage capacity. In years with very warm winters, or when falling gas prices result in winter prices that are lower than summer prices, storage value can be minimal, while in extremely cold winters the value of storage increases substantially.[8]

For the long term analysis [redacted]), ICF used normal weather in each year based on the average of 20 years of data from 1992 through 2011. In order to evaluate the impact

[8] The range in optimum storage capacity values for different weather patterns is based on an assumption of perfect foresight with respect to weather and prices. In the real world, storage decisions are made on weather and price expectations rather than perfect foresight. In addition, contracts for new storage capacity typically require a 10 to 20 year commitment for a specific level of storage capacity.

of weather volatility on the value of storage, we also conducted the storage analysis for the first three years of the analysis (April 2017 through March 2020) for 30 different weather patterns based on three years of actual heating degree day data. The first weather scenario used weather data from the three-year period from April 1981 through March 1984. The final weather scenario used weather data for the three year period from April 2010 through March 2013.

The optimum storage capacity for the three different supply portfolio options for each of the 30 different weather scenarios for three storage seasons is shown in Exhibit 21.

Exhibit 21: Average Optimum Storage Capacity for 30 Alternative Weather Scenarios (GJ)

[redacted]

The optimum level of storage capacity varies widely depending on the supply scenario and weather year. (Exhibit 22). The range in storage capacity values is largest for the daily purchase supply scenario, which ranges from no storage capacity to almost 7,000,000 GJ of working gas capacity depending on weather. The diversified supply scenario results in the smallest variation in optimum storage capacity.

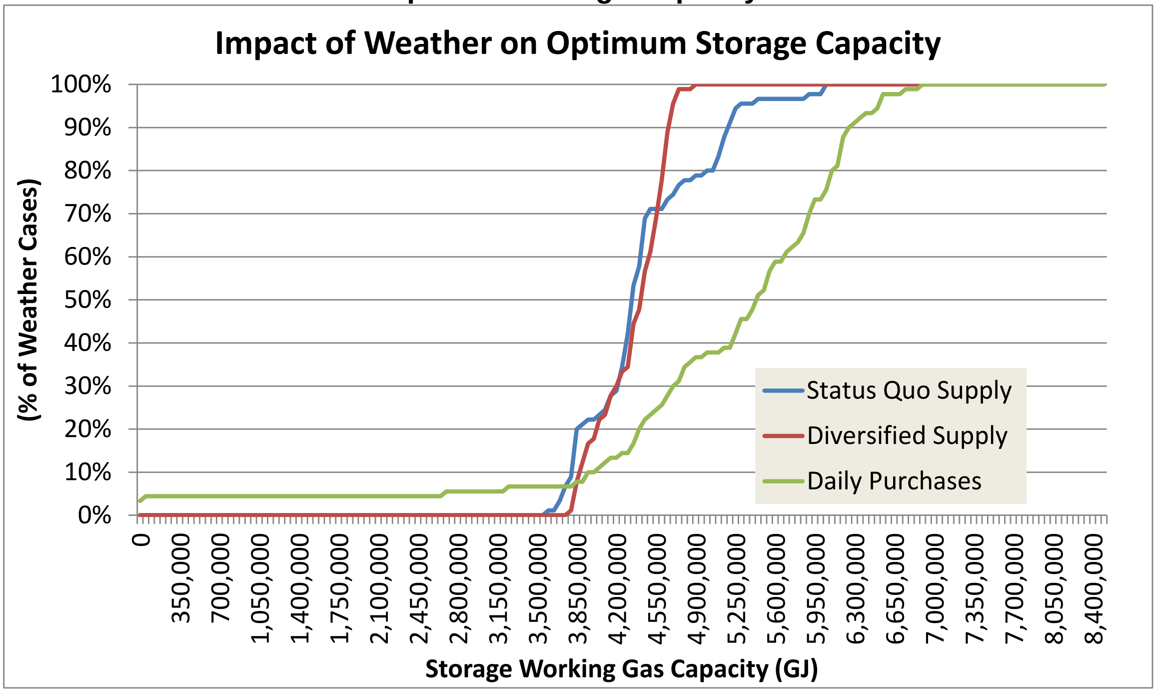
Exhibit 22: Impact of Weather on Optimum Storage Capacity

[redacted]

The optimum level of storage capacity for most of the weather cases falls within a fairly narrow range. (Exhibit 23). For the diversified supply scenario, more than 80 percent of the weather scenarios result in optimum storage capacity between [redacted] The range is slightly larger for the Status Quo scenario, with only about 66 percent of the weather cases evaluated falling within the same range.

The range of optimum storage capacity is greatest for the Daily Purchase supply scenario, which does not require the utility to hold firm capacity to meet design day demand. As a result, the value of storage deliverability is substantially reduced.

Exhibit 23: Optimum Storage Capacity Distribution



3.6 Assessment of Uncertainty in Analysis Results

The assessment of the value of Alton Gas storage to Heritage Gas is based on a long term forecast of Heritage Gas demand growth, North American and New England and Atlantic Canada natural gas market conditions, and seasonal and annual natural gas market prices.

The basic conclusion that use of Alton Gas storage as part of the Heritage Gas supply portfolio will reduce the total portfolio supply costs is robust across the full range of supply and storage scenarios considered. Based on our analysis, we would expect Heritage to see cost savings from the first year of storage service through the length of the storage contract.[9] The basic conclusion that use of Alton storage capacity would reduce overall supply costs also holds even if Heritage Gas demand growth is slower or faster than projected, although the optimum amount of storage capacity would vary for alternative demand scenarios.

However, the cost savings associated with the use of storage are based on a continuation of the natural gas price volatility observed in New England in the past few years. Construction of significant new pipeline capacity into New England from the Marcellus would be expected to reduce the volatility of natural gas prices in New England and reduce the value of natural gas storage to Heritage Gas.

[9] Based on normal weather. Normal year to year variation in weather patterns and natural gas markets can impact the value of storage in any given year.

4 Other Storage Issues and Next Steps

4.1 Pro Forma Tariff

[redacted]

ICF has included in our analysis the costs of the cushion gas. The provision for cushion gas is found in Sec. 5 of the General Terms and Conditions. The customer is to provide to Alton at no cost the cushion gas. Upon the end of the contract term, Alton may return the gas to the customer or pay the customer for the gas at the future price of gas at then prevailing gas price, Commodity Price Index. There are other storage services where customers provide the base gas (e.g., Stagecoach in New York) where the general terms of the base gas are similar to these for Alton. Most pipeline-owned storage services do not require a contribution of base gas, but then the rates reflect cost recovery.

[redacted]

Heritage has asked ICF to opine, based on information about Alton's proposed storage, whether Heritage Gas would be able to inject and withdraw as needed. We note the following passage in Schedule A. Firm Storage Service Schedule of the Pro Forma Alton Tariff:

> [redacted]

We interpret this language to allow injections and withdrawals when needed.

The tariff provides for an injection and a withdrawal demand charge, which is not included in the Alton offer or is set at zero for this proposed service. It is possible that if Heritage were to use its injection and withdrawal rights as needed, a demand charge could be imposed.

We did not find in the Pro Forma Alton Tariff a provision for how customers' rights are handled when service is extended beyond the term of the original agreement. We would recommend that Heritage seek right-of-first-refusal for extensions and expansions of service if in the future the Alton service becomes more valuable and to avoid being out-bid for service.

4.2 Pipeline Transportation Issues

Pipeline transportation is a major component of the value of any storage service. ICF has modeled the storage service where the injection of gas is at the current M&NP-CA tariff toll of [redacted]

[redacted]

[redacted]

4.3 Other issues

ICF has been asked to opine on the following questions raised by Heritage. These are addressed below.

Is natural gas storage in Nova Scotia beneficial to Heritage Gas and its customers? If so, is natural gas storage a short-term benefit or a long-term benefit? ICF's analysis indicates that customers would benefit from storage. Our analysis also indicates that it is both a short-and long-term benefit. Based on the current forecast of gas prices, there would not be an identifiable period when storage costs exceed savings realized from storage.

Would natural gas storage provide operational peaking flexibility? Flexibility will arise from the ability of the users of storage to inject and withdraw from storage as needed. The Pro Forma Alton Tariff provides that injections and withdrawals can occur on any gas day. That indicates that the proposed storage would provide flexibility for meeting gas demand.

What effect would a natural gas storage facility have on future gas supply contracts? Storage should provide Heritage with additional flexibility in future contracting. Without storage, Heritage or any shipper with variable gas requirements would depend on a combination of base load and peaking (or swing) gas supply where the supplier would provide the flexibility. Such flexibility can be costly, since the supplier must manage supply and pipeline nominations in a way to allow swings in service. In addition, the price of gas in New England can experience dramatic intra-monthly volatility which also can contribute to higher costs. By nature, storage reduces these two key price expenses by providing peak supply purchased at more acceptable prices.

Would natural gas storage enhance system reliability? As a general principle, we believe it would, subject to the caveats about the Halifax Lateral, discussed in the previous section. The main enhancement would be the ability to draw gas from storage during times when SOEP and Deep Panuke are curtailed and/or Canaport has no supply or have an unplanned outage. However, given that we have modeled the future supply as coming from the United States, the main security issue may be rare pipeline outages or curtailments due to operational flow orders.

What effect would a storage facility have on the pressure of the lateral within the M&NP line? Storage should enhance the pressures on the Halifax lateral. During winter withdrawal, the additional gas supplied would increase pressure and throughput. During the summer injection season additional deliveries to storage may add to pressure in the line, but it is our understanding that Halifax Lateral pressures are determined by the pressures on the mainline and the draw on the lateral by Tufts Cove and Heritage. ICF recommends consulting with M&NP-CA and Alton to determine what the implications are.

Would natural gas storage provide pipeline load balancing capability? Many storage operators offer specific services to help customers manage pipeline balancing, i.e., "park and loan service." Alton does not, but also Alton appears to allow injections and withdrawals on any gas day which should provide Heritage the ability to use the storage to avoid imbalance penalties on M&NP. (See discussion above.)

Would natural gas storage provide utility customers with an "insurance policy" against supply interruptions? Under the terms of the proposed contract with Alton, we believe storage provides Heritage and its customers with protection against supply disruption. It would depend on the length of the service interruption and when it would occur. As configured at present, with [redacted]

What would the impact of third party gas marketers have on system supply displacement (i.e. customers seeking their own gas supply)? This question concerns the obligations concerning peak day delivery by third-party marketers in light of Heritage holding gas storage capacity. Gas LDC programs for the delivery of third-party gas differ markedly. Each utility's approach is developed through a collaborative process that the LDC, marketers, consumer advocates, and the staff of regulators. The approaches taken can differ by customer type (e.g., large industrial, small industrial, large commercial, small commercial and residential) within an individual utility program.

Third-party gas transportation programs will specify how and where gas will be delivered to the utility for transport to the customer. In some instances, the gas will be delivered at a uniform rate with the utility managing daily, monthly, or seasonal variation in consumption. In these instances, the costs associated with managing the variation, including storage, are included in the transportation rate. This can include a portion of the costs of storage. The gas itself may be owned by the third party marketer who would have provided it to the LDC in advance; or sometimes the LDC provides the gas as well and bills the marketer.

In other instances, the transportation customer is assigned a "slice" of the transportation and storage assets of the utility. In this instance, the utility can recall the transportation and storage assets in the event that the third-party marketer of the gas commodity does not perform or that the customer migrates back to utility sales service. Often, the utility will design a "stand-by service" that specifies the method and price (usually a formula price that utilizes a gas index price at a relevant location).

At the other end of the spectrum, some jurisdictions design a "pure-play" transportation agreement; the utility has no obligation to deliver gas to a customer if the marketer/supplier fails to deliver gas into the system.

Some programs require a "certification" of eligible marketers. These requirements are most often imposed for companies that are active in residential and small commercial markets.

4.4 Next Steps

ICF has proposed that the analysis of rate design for storage service be addressed as a follow up to this analysis of the value of the storage service. This includes an analysis of how should costs associated with storage be recovered (through Regulated distribution rates or unregulated GCRR rates or another method). If it is decided that regulated rates should be used to recover storage costs, then what methodology should be used to recover all Alton storage costs and related delivery and redelivery costs (i.e. M&NP incremental costs). Another question to address is whether the costs of gas storage should be allocated across all customers and therefore all rate classes.

Appendix A: Annual Gas Supply Portfolio Costs for Alternative Scenarios

Exhibit A-1: Heritage Gas Supply Portfolio Costs

[redacted]

[redacted]

[redacted]

Exhibit A-2: Portfolio Costs and Storage Capacity for the Optimized Storage Capacity Scenario

[redacted]

Exhibit A-3: Portfolio Costs and Storage Capacity for the Optimized Storage Capacity Scenario with Higher Deliverability

[redacted]

[redacted]

[redacted]

Appendix B: ICF Natural Gas Price Forecast for Heritage Storage Analysis

[redacted]

Exhibit B-2. Monthly Forecast Prices for New England, Marcellus, Henry Hub

Shaded portions of the tables are historical.

[redacted]

[redacted]

[redacted]

Exhibit B-3. Annual Basis Forecast for Marcellus and New England

[redacted]

Appendix C: ICF's Gas Market Model (GMM®)

ICF's Gas Market Model (GMM) is an internationally recognized modeling and market analysis system for the North American gas market. The GMM was developed by Energy and Environmental Analysis, Inc., now a wholly owned business unit within ICF International, in the mid-1990s to provide forecasts of the North American natural gas market under different assumptions. In its infancy, the model was used to simulate changes in the gas market that occur when major new sources of gas supply are delivered into the marketplace. For example, much of the initial work with the model in 1996-97 focused on assessing the impact of the Alliance pipeline completed in 2000. The questions answered in the initial studies include:

- What is the price impact of gas deliveries on Alliance at Chicago?
- What is the price impact of increased takeaway pipeline capacity in Alberta?
- Does the gas market support Alliance? If not, when will it support Alliance?
- Will supply be adequate to fill Alliance? If not, when will supply be adequate?
- What is the marginal value of gas transmission on Alliance?
- What is the impact of Alliance on other transmission and storage assets?
- How does Alliance affect gas supply (both Canadian and U.S. supply)?
- What pipe is required downstream of Alliance to take away "excess" gas?

Subsequently, GMM has been used to complete strategic planning studies for many private sector companies. The different studies include:

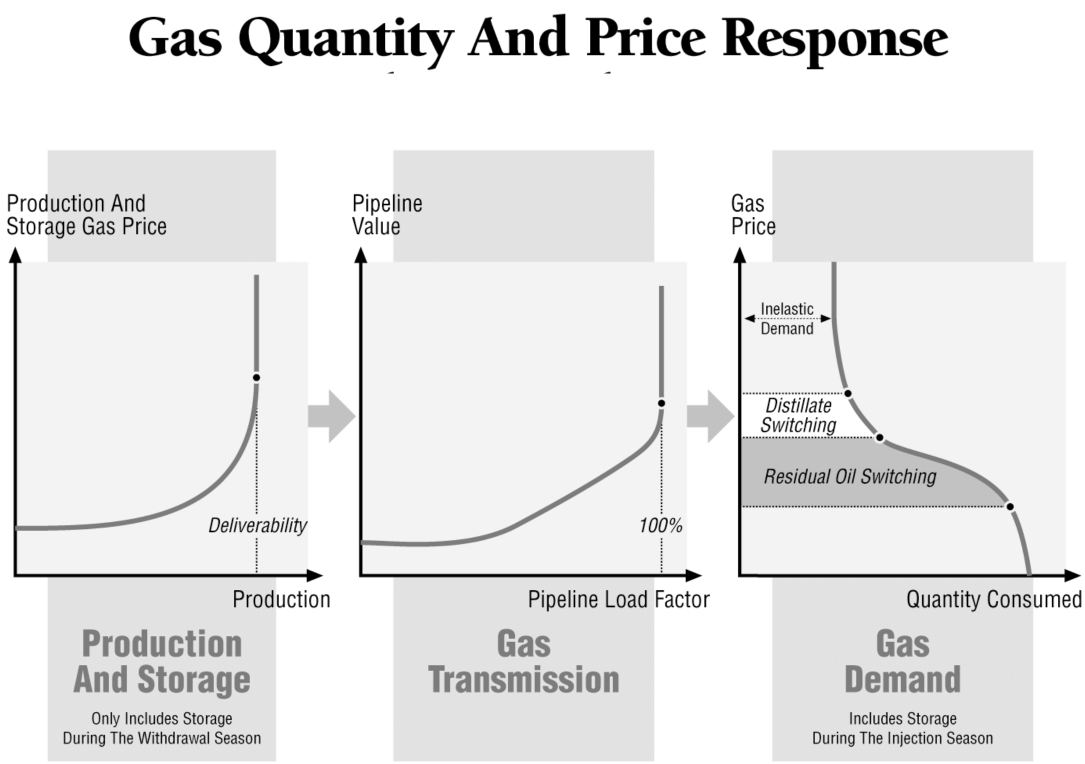
- Analyses of different pipeline expansions
- Measuring the impact of gas-fired power generation growth
- Assessing the impact of low and high gas supply
- Assessing the impact of different regulatory environments

In addition to its use for strategic planning studies, the model has been widely used by a number of institutional clients and advisory councils, including the Interstate Natural Gas Association of America, which relied on the model for the 30 Tcf market analysis completed in 1998 and again in 2004. The model was also the primary tool used to complete the widely referenced study on the North American Gas market for the National Petroleum Council in 2003.

GMM is a full supply/demand equilibrium model of the North American gas market. The model solves for monthly natural gas prices throughout North America, given different supply/demand conditions, the assumptions for which are specified by the user.

Overall, the model solves for monthly market clearing prices by considering the interaction between supply and demand curves at each of the model's nodes. On the supply-side of the equation, prices are determined by production and storage price curves that reflect prices as a function of production and storage utilization (Exhibit C-1). Prices are also influenced by "pipeline discount" curves, which reflect the change in basis or the marginal value of gas transmission as a function of load factor. On the demand-side of the equation, prices are represented by a curve that captures the fuel-switching behavior of end-users at different price levels. The model balances supply and demand at all nodes in the model at the market clearing prices determined by the shape of the supply and curves. Unlike other commercially available models for the gas industry, ICF does significant backcasting (calibration) of the model's curves and relationships on a monthly basis to make sure that the model reliably reflects historical gas market behavior, instilling confidence in the projected results.

Exhibit C-1: Natural Gas Supply and Demand Curves in the GMM

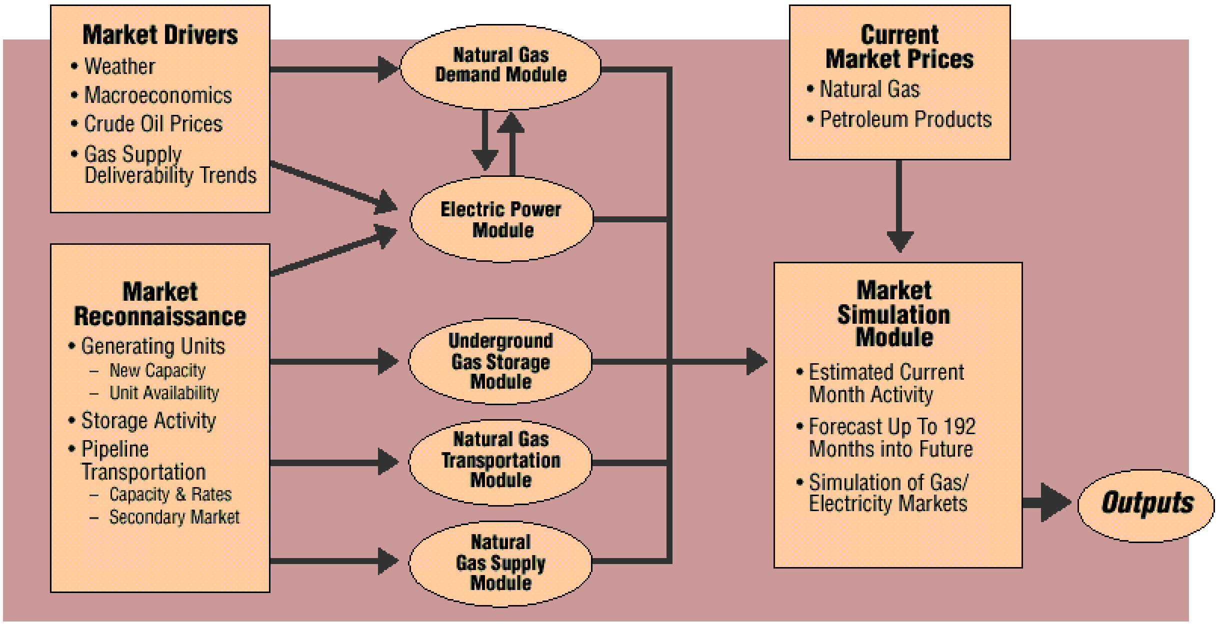


Source: ICF GMM®

There are nine different components of ICF's model, as shown in Exhibit C-2. The user specifies input for the model in the "drivers" spreadsheet. The user provides assumptions for weather, economic growth, oil prices, and gas supply deliverability, among other variables. ICF's market reconnaissance keeps the model up to date with generating capacity, storage and pipeline expansions, and the impact of regulatory changes in gas transmission. This is important to maintaining model credibility and confidence of results.

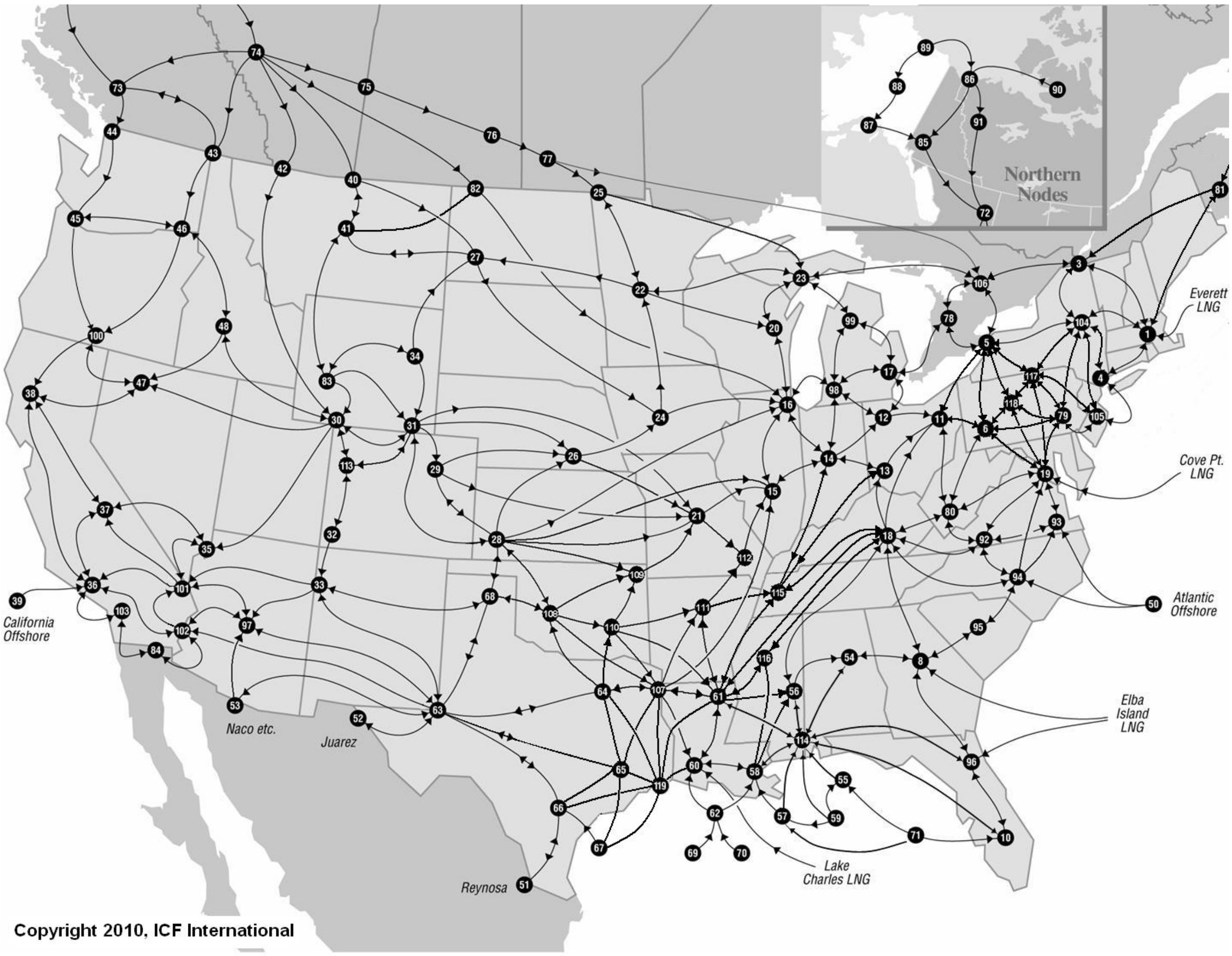
The first model routine solves for gas demand across different sectors, given economic growth, weather, and the level of price competition between gas and oil. The second model routine solves the power generation dispatch on a regional basis to determine the amount of gas used in power generation, which is allocated along with end-use gas demand to model nodes. The model nodes are tied together by a series of network links in the gas transportation module. The structure of the transmission network is shown in Exhibit C-3. The gas supply component of the model solves for node-level natural gas deliverability or supply capability, including LNG import levels. The Hydrocarbon Supply Model may be integrated with the GMM to solve for deliverability. The last routine in the model solves for gas storage injections and withdrawals at different gas prices. The components of supply (*i.e.*, gas deliverability, storage withdrawals, supplemental gas, LNG imports, and Mexican imports) are balanced against demand (*i.e.*, end-use demand, power generation gas demand, LNG exports, and Mexican exports) at each of the nodes and gas prices are solved for in the market simulation module.

Exhibit C-2: GMM Structure



Source: ICF GMM®

Exhibit C-3: GMM Transmission Network



Source: ICF GMM®