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Lessons from the Natural Gas Market

How Does the Cornell Report Affect Natural Gas Development?

The massive promise of shale gas has been covered here frequently for the last three years, and is now recognized fairly uniformly among energy experts. The promise started in the United States, where the Energy Information Administration has recently recognized a recoverable shale gas resource of 862 trillion cubic feet, bringing its estimate of total U.S. natural gas resources to 2,543 Tcf. By comparison, Navigant's groundbreaking study in 2008 estimated 842 Tcf of shale and 2,247 Tcf of total resource. At the time, there was widespread skepticism about our estimate, but now everyone – even the government – is reaching similar conclusions. The EIA also recently estimated the global recoverable shale gas resource. It came in at 6,622 Tcf, as compared with its prior total existing worldwide reserves number of 6,609 Tcf. In other words, shale is estimated to *double* the global gas resource.

So the globe has a huge new supply of its cleanest and lowest-carbon fossil fuel, right at the time that air quality and particularly greenhouse gases are raising strong policy concerns around the world. What could go wrong? Why can't this stuff just be produced everywhere, used to generate power and fuel a lot of vehicles and industry, and clean up the air?

Natural gas faces several challenges to its full development and deployment to address the world's environmental issues. First, there have to be stable enough markets to develop sufficient infrastructure and to incent sufficient drilling for the gas to come forth when it's needed. Second, of course, shale gas development involves hydraulic fracturing, which is engendering enough public and political concern that resolution of the issues around it has become essential to its unimpaired long-term use. Third, the role of natural gas as the cleanest fossil fuel and a potential major contributor to the reduction of man-made greenhouse gases has been challenged by a guy at Cornell University who hates hydraulic fracturing.

Professor Howarth is completely wrong

This last challenge may be the most important to have resolved quickly. If natural gas is indeed, as is claimed by Professor Robert Howarth in the paper he released in April, a net contributor to greenhouse gases worse than coal, "Houston, we have a problem." As could be expected, Professor Howarth's work has been extensively challenged by the industry. As could be less expected, his work has been extensively questioned by Andrew Revkin, author of "Bloggheads," a *New York Times* opinion blog that has been consistently and strongly critical of hydraulic fracturing and the natural gas industry. It has also been questioned by Abrahm Lustgarten, another very

vocal critic of the industry at ProPublica, the nonprofit, public-interest investigative journalism enterprise. An interesting five-and-a-half-minute excerpt of an interview of Mr. Lustgarten by Mr. Revkin is available at Bloggingheads.tv. Basically, Mr. Revkin points out that Howarth's abstract – which made all the headlines – is vastly more confident and conclusive than is the full report it summarizes, and that the full report owns up to being based on what Mr. Lustgarten calls “a whole bunch of assumptions.”

Various members of the scientific community have also strongly questioned or criticized Professor Howarth's work, but in my view, it is the reaction of these two industry critics, who had previously relied to an extent on Professor Howarth to support their own criticism but now are actively distancing themselves, that is most telling.

Professor Howarth's basic premise is that massive amounts of natural gas, which is mostly methane, are released into the atmosphere during shale gas development and the subsequent transportation and distribution of the natural gas. Because methane is a more potent greenhouse gas in the short term than carbon dioxide, Professor Howarth then concludes that all this massive blasting of gas into the sky more than offsets the carbon dioxide advantage natural gas enjoys over coal. I must admit to having laughed the first time I saw one of Professor

the full report owns up to being based on “a whole bunch of assumptions”

Howarth's studies, but that was before the *New York Times* headline reported the most recent conclusions as fact, not assumption-riddled opinion. So it is worth responding directly and seriously to his assumptions, his approach, and his conclusions.

Is Professor Howarth wrong? Yes, he is completely wrong. He develops startling statistics for the methane that comes out of a well when a portion of the hydraulic fracturing fluid comes back up and is disposed of, deriving (from “numbers teased out of various PowerPoint presentations”) a truly impressive quantity of gas. The most extreme example is in the Haynesville Shale, the massive play in northern Louisiana, where he opines that the average well spits out 250 million cubic feet of methane into the sky. That's about a million and a half dollars' worth of gas at today's prices. As one unnamed producer put it, “I'm not sure how green we are, but we are certainly better business people than that.” I have to wonder whether Professor Howarth has ever seen a working drilling/fracturing operation.

Actually, though, the largest share of the losses into the sky that Professor Howarth claims are the losses from transmission and distribution systems. He suggests – no, he says – that 39 to 46 percent of his claimed total emissions are leakage from the

nation's million-mile pipeline and distribution system. He bases this on a couple of things: the reported lost-and-unaccounted-for allowances of interstate pipelines, and the reduction of a single study of Texas intrastate service to a number he then extrapolates to the entire national gas network. Let's start with the interstate pipeline “lost-and-unaccounted-for,” or LAUF. Professor Howarth acknowledges that this number includes accounting values unrelated to physical losses, but *assumes* they all wash out over time, so the net effect is zero. He is wrong. LAUF is the measured difference between the receipts into a pipeline and the deliveries out of it, net of measured compressor fuel. If all of the thousands of receipt meters add up to a different value than the few hundred delivery meters, there is an “unaccounted-for” volume. Can they add up to different values? Yes, they always do, and it is within the American Gas Association meter standards accepted throughout the industry for the receipts and deliveries to vary by as much as two percent from each other (about the average value Professor Howarth ascribed to pipeline and distribution losses). In other words, pipelines can have an LAUF percentage of two percent without any methane physically leaking. In my experience, LAUF from meter differences and from things like undermeasurement of compressor fuel or other pipeline

company uses has almost always resulted in a net accounting loss, and does not self-correct over time or vary enough across pipelines for the net impact to be negligible, as Professor Howarth assumes. What about distribution? LAUF on a distribution system includes things like theft of gas by unauthorized taps (sometimes

nothing about Professor Howarth's report should be allowed to impair the development of our national energy resource

a very major issue in large cities and out in the country where nobody's looking). It includes the mismatch between customer meters, which are read over the course of the month, and receipt meters, which are real-time calendar month measurements. Again, Professor Howarth *assumes* that everything works out to zero in the end, and the reported LAUF is all physical loss, which is not how it works at all. He compounds the error of his arguments by using the aforementioned Texas study, then applying it to the entire United States. In other words, he *assumes* that the physical security and integrity of gas lines in New York City are the same as in rural Texas.

Overall, Professor Howarth's study *assumes* gas leakage from transmission and distribution facilities that averages 1.5 billion cubic feet per day, which would be about \$2.7 billion of gas per year. That does not happen, and assuming it insults the operators of the nation's gas grid. Meanwhile, it is hard to see how an average number from existing facilities would have any relevance to marginal activity, especially the development of new gas supplies to fuel power generation. Professor Howarth is essentially using a sloppily determined claim of leakage from urban distribution systems to condemn the transport of natural gas to a new combined-cycle power plant through tight, high-pressure, transmission lines. There is no way this could possibly be relevant.

What else does he do? He has two methodological approaches that are questionable. First, as has been widely pointed out, he measures relative greenhouse-gas impact over 20 years, rather than the standard of 100 years used by the Intergovernmental Panel on Climate Change and other scientific organizations. Because the greenhouse-gas impact of methane declines much more quickly than it does for carbon dioxide, this arbitrary change to the accepted yardstick maximizes the negative impression for meth-

ane. Second, he admits to ignoring the large efficiency advantage that natural gas enjoys in combined-cycle generation as compared with coal burned in steam plants. Professor Howarth has explained this in subsequent statements, saying that the use of natural gas for power generation is just one application, that it is used for many things. But the comparison in his report was with coal, and the only real competition between gas and coal is for electric generation. I seriously doubt he set out to evaluate the greenhouse gas benefits of burning coal in kitchen stoves.

Overall, nothing about Professor Howarth's report should be allowed to impair the development of our national energy resource. Abraham Lustgarten said it best (a statement I never thought I'd make): "But none of this, in my view, undercuts the importance of natural gas as a bridge fuel on the path to a lower-carbon, and more secure, energy menu as humanity sprints toward nine billion people seeking decent lives."

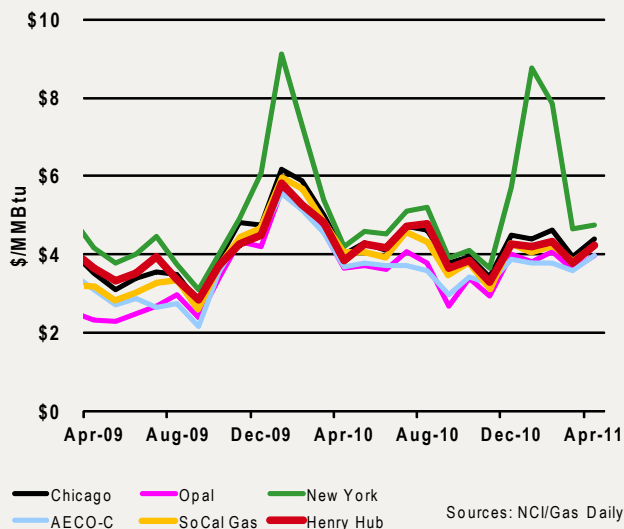
—Rick Smead

About the Author » Rick Smead is a Director in Navigant's Energy Practice.

The opinions expressed in this article are those of the authors and do not necessarily represent the views of Navigant Consulting, Inc.

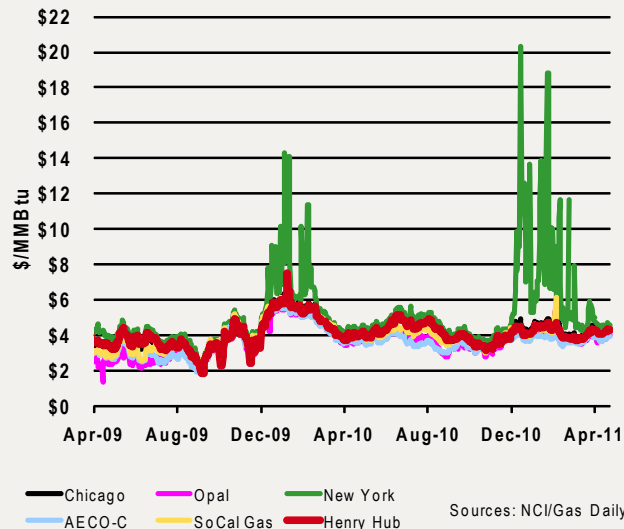
Natural Gas Market Charts

MONTHLY GAS INDEX PRICE



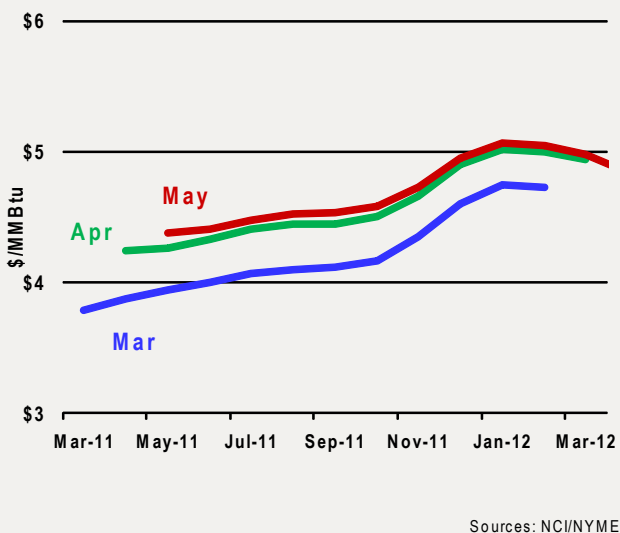
Monthly prices have risen slightly as the injection season is underway.

DAILY GAS PRICE



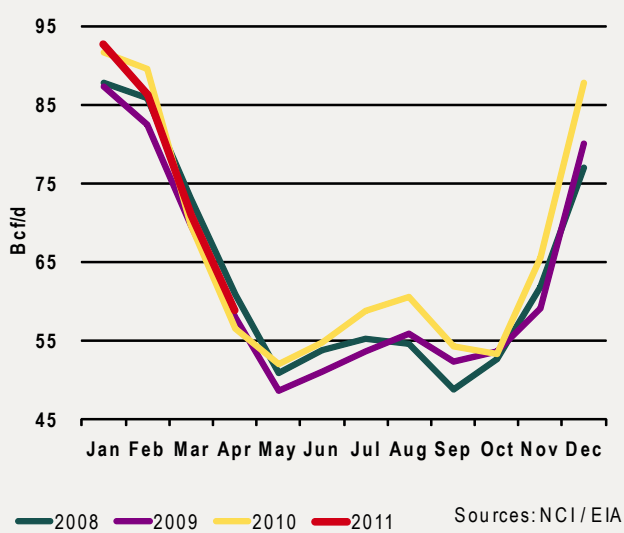
Moderating shoulder-month loads have resulted in lower daily price volatility.

NYMEX FUTURES SETTLEMENT PRICES AT CLOSE



The NYMEX forward curve compared to last month is very slightly higher as the May contract rolls off.

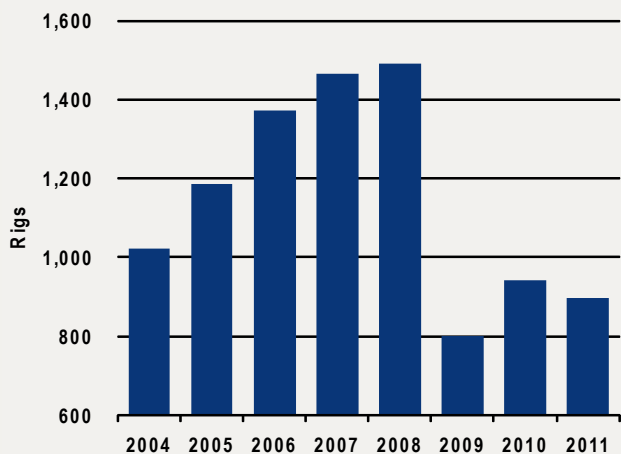
U.S. MONTHLY NATURAL GAS DEMAND



U.S. gas demand remains near the levels of the past two years, and slightly less than 2008.

Natural Gas Market Charts

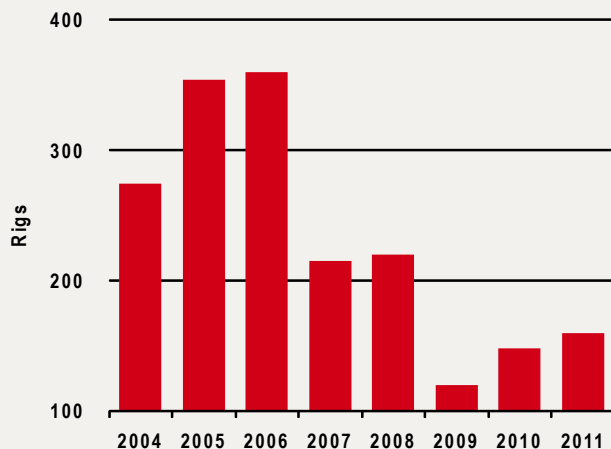
U.S. GAS RIG COUNT AVERAGE



Sources: NCI/Baker Hughes

U.S. rig counts in 2011 are averaging slightly less than they did in 2010.

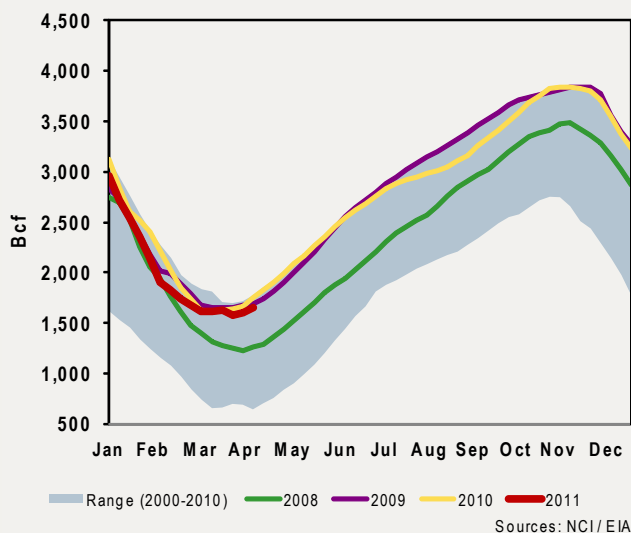
CANADIAN GAS RIG COUNT AVERAGE



Sources: NCI/ Baker Hughes

Canadian rig counts in 2011 are averaging slightly more than they did in 2010.

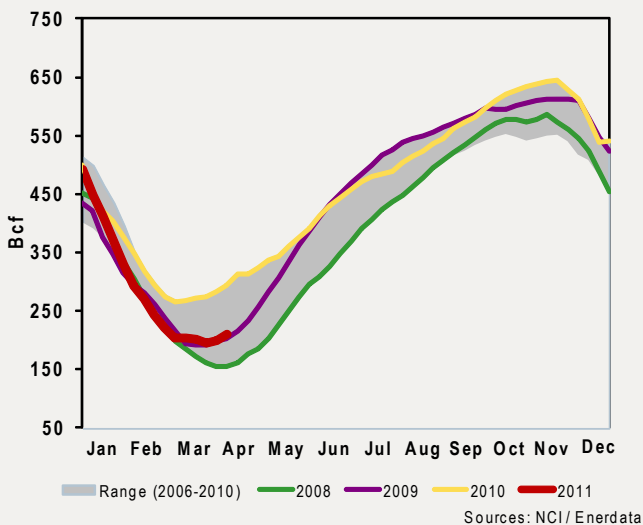
U.S. GAS STORAGE



Sources: NCI/ EIA

U.S. storage inventories are at the high end, as in the past two years.

CANADA GAS STORAGE

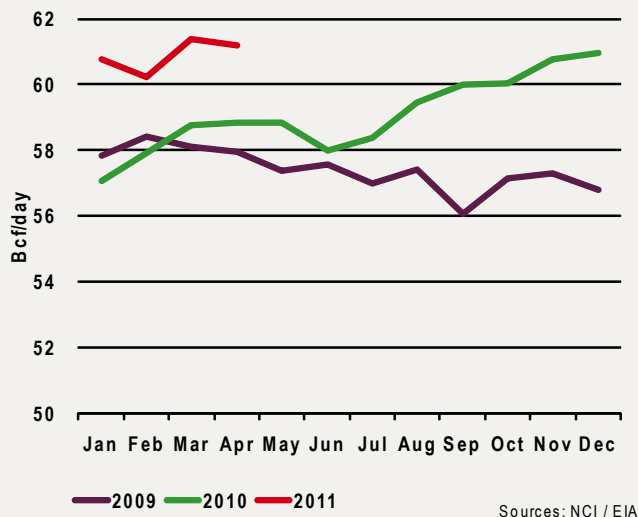


Sources: NCI/ Enerdata

Canadian storage is tracking 2009, an average year, well under the levels of 2010.

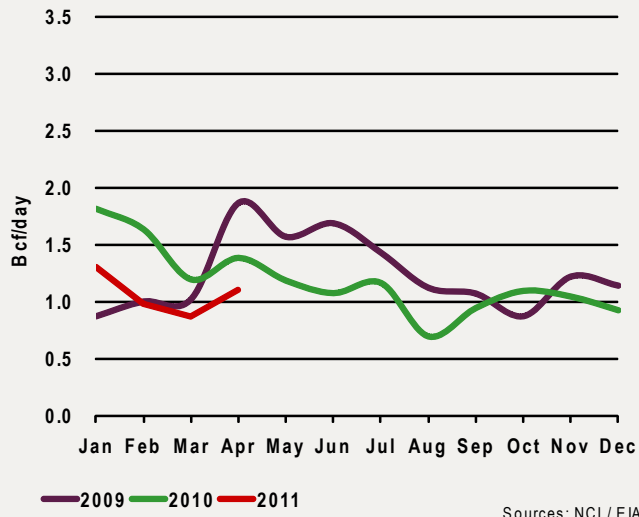
Natural Gas Market Charts

U.S. DRY GAS PRODUCTION



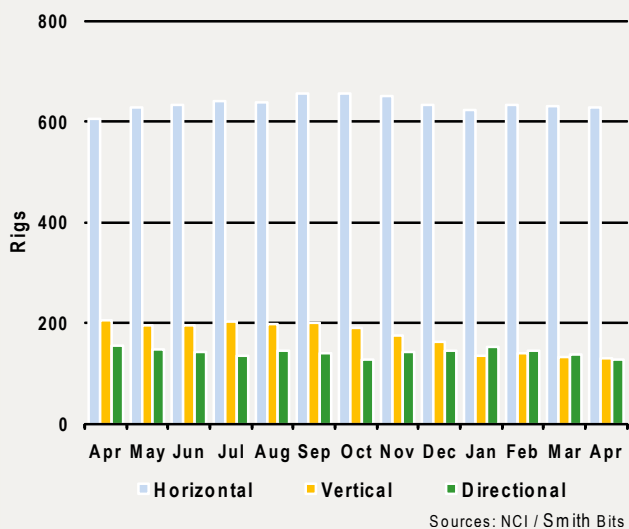
U.S. gas production continues strong.

U.S. LNG IMPORTS



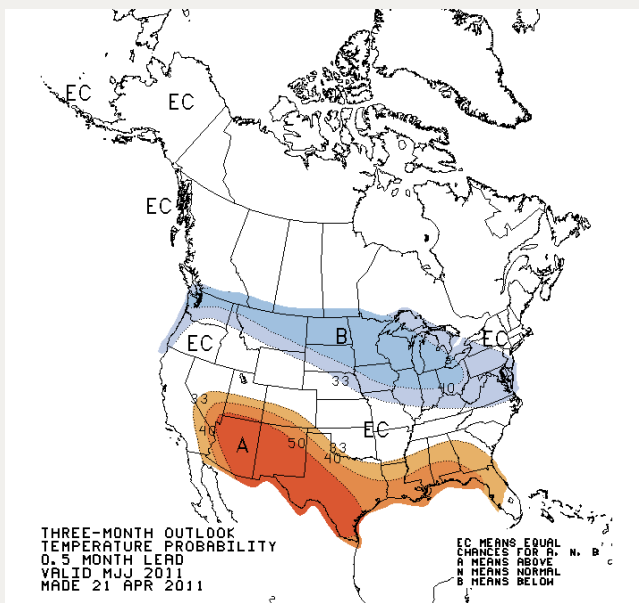
LNG imports continue to fluctuate around the 1.0 Bcf/day mark.

U.S. GAS RIG COUNT AVERAGE 2010 - 2011



Horizontal rig count remains steady, while vertical and directional drop off slightly.

U.S. TEMPERATURE OUTLOOK



The May-June-July weather outlook calls for below-normal temperatures in the Pacific Northwest and from the Rockies to the Great Lakes and Middle Atlantic states. Above-normal temperatures are expected for the Southwest states.

Legislative and Regulatory Highlights



California

CPUC Approves PG&E Gas Transmission and Storage Settlement

A.09-09-013

The California Public Utilities Commission approved the settlement submitted by PG&E and the parties, informally known as Gas Accord V. The Sempra utilities (Southern California Gas and San Diego Gas & Electric) objected to the settlement. They contended that PG&E had signed a contract allowing them to deliver into the PG&E system from off-system contracts. They further asserted that PG&E should be required to post expanded storage data on its website. The Commission disagreed.

The new rates are effective as of May 1, 2011, with the revenue requirement retroactive to January 1, 2011. A balancing account will capture small rate adjustments that result from the General Rate Case, to be decided May 5. The settlement features a sharing mechanism whereby ratepayers bear 75 percent of the risk of under and overcollections of the revenue requirement for transmission services, and 75 percent of any overcollections of storage revenue. PG&E bears 100% of the risk for undercollection of storage revenue.

The decision also requires PG&E to file a report twice a year on how it implements budgeted pipeline maintenance. This is in reaction to the San Bruno explosion of September 2010, in which eight people were killed.

Central Valley Gas Storage Begins Construction

D.10-10-001

Central Valley Gas Storage LLC has begun construction of its 11 Bcf high-deliverability facility, which will connect to PG&E's Redwood transmission system in the general vicinity of the Wild Goose Storage facility. CVGS will have injection and withdrawal capacity of 300 million cubic feet per day. The project should be completed by year-end.

Central Valley Gas Storage LLC is a subsidiary of Nicor, Inc.

Pacific Northwest

Gas Transmission Northwest Open Season

Gas Transmission Northwest conducted an open season to solicit interest in firm southbound transportation capacity. GTN has a significant quantity of capacity with primary firm receipt points at Kingsgate and Stanfield available. The bidding closed on April 18. No acceptable bids were received.

GTN Proposes Lateral to Proposed New Generating Station

PF11-5-000

GTN has requested the Federal Energy Regulatory Commission review a proposed gas lateral to Portland General Electric's proposed 415 MW Carty Generating Station near Boardman, Oregon, the site of an existing coal-fueled power plant. The Carty plant would be the second gas-fired plant at the Boardman location.

GTN proposes to file a certificate application for the project in December 2011, and to place the lateral in service in October 2014.



National Energy Board

NEB Approves Spectra Energy Transmission's North Expansion Project

File OF-Fac-Gas-W102-2010-06-01

The NEB issued Order XG-W102-05-2011 on April 21 approving Spectra Energy Transmission's North Expansion Project for transport of sweet natural gas in the Peace River Regional District of British Columbia. The project includes 24 kilometers of 36-inch pipe for the Fort Nelson Mainline N4 Loop, and 20 kilometers of 36-inch pipe for the Stewart Lake Pipeline, as well as several new and modified compressor stations.

NOVA Gas Transmission Proposes Northwest Mainline Extension and Loops

NOVA Gas Transmission Ltd. filed a project description with the NEB on April 8 with respect to proposed extensions and loops on its Northwest and Horn River Mainline natural gas systems. The project includes a 100-kilometer extension of the Horn River Mainline (the 36-inch pipe Komie North Section), a 54-kilometer loop of 42-inch pipe (the Townsoitoi Creek Section), and 30-kilometer and 33-kilometer loops of 48-inch pipe (the Pyramid Section and the Chinchaga Section, respectively, in Alberta). NOVA plans to file a Section 52 application for a Certificate of Public Convenience and Necessity with NEB in the third quarter of 2011, with a proposed in-service date of April, 2014.

British Columbia

Quicksilver Resources to Create Midstream Entity for Horn River Basin Production

Quicksilver Resources announced on April 14 that it is creating a separate midstream entity to support the company's 130,000 acre project in the Horn River Basin. The first piece of the strategy for the new venture was the creation of a 20-mile gathering line awaiting tie-in to the Spectra system, expected in May, to initially serve as the spine of Quicksilver's transportation from its acreage; the new connection to Spectra will allow Quicksilver to fully utilize its 30 MMcfd production capacity, up from a currently

restricted 20 MMcfd. The second piece of the strategy was initiated via an April 11 agreement with NOVA Gas Transmission Ltd. to connect Quicksilver's proposed CO₂ removal facility at Fortune Creek to NOVA's proposed Horn River pipeline extension; Quicksilver's treatment facility will have capacity to deliver 125 MMcfd of natural gas to TransCanada and be operational by mid-2014.

Alberta

Direct Energy Acquires Wildcat Hills Assets

Direct Energy announced on April 1 that it had acquired natural gas assets located in the Wildcat Hills area of Alberta for \$47 million in cash from Shell Canada Energy. The acquisition includes production of about 10 MMcfd and proven and probable reserves of about 45 Bcfe, increasing Direct Energy's production to 172 MMcfd and reserves to 617 Bcfe.

Energy Resources Conservation Board Seeking Comment on Draft Revised Edition of Directive 059

The Alberta ERCB issued a draft revision to Directive 059 (Well Drilling and Completion Data Filing Requirements) on April 12. Feedback on the revision will be accepted until June 11, 2011 at Directive059Help@ercb.ca. In addition, on April 18, the ERCB issued a Revised Edition of Directive 017 (Measurement Requirements for Oil and Gas Operations), effective on that date.

NOVA Gas Transmission Ltd. Expansions

NOVA Gas Transmission Ltd. notified NEB on April 12 of its proposal to construct pipeline expansion projects in the Cheecham area of eastern Alberta. The elements include the Kettle River North Lateral Loop (12 kilometers of 24-inch pipe) and the Cheecham West Crossover (14 kilometers of 20-inch pipe). A Section 58 application is expected to be filed with the NEB in the second quarter of 2011; pending regulatory approval, construction is scheduled to begin in the fourth quarter of 2011 and be completed by the second quarter of 2012.

ATCO Pipelines Contract Transition to NGTL Approved

Decision 2011-160

On April 20, 2011 the Alberta Utilities Commission approved the application filed in July 2010 by ATCO Pipelines (AP), a division of ATCO Gas and Pipelines Ltd., pertaining to the transition of AP customers and con-

tracts to Nova Gas Transmission Ltd. subject to the directions of the AUC (in decision 2011-160) and receipt of all necessary NEB and Competition Bureau approvals. Transition is to occur on the "Integration Effective Date" which is estimated as 12 months from the date of receipt of approvals from both the AUC and the NEB. AP is directed to inform the Commission when AP contracts cease to exist and all customer contracts have been transitioned to NGTL.

The application follows Decision 2010-228 of May 2010 which concluded that the proposed integration of the regulated Alberta gas transmission services of AP and NGTL was in the public interest but that more information was required before contract transitioning could be approved. This related to concerns expressed by interveners with respect to straddle plant delivery, non-standard agreements, the future transportation agreement between NGTL and ATCO Gas, and AP's purchase of line pack from its customers.

As a consequence of the contract transition, NGTL will be the party that interfaces contractually with customers for regulated gas transmission services within Alberta using the combined AP and NGTL transmission systems (the "Alberta System"). The total Alberta System revenue requirement will be composed of the AP revenue requirement approved by the AUC, which will be charged to NGTL, and the NGTL revenue requirement approved by the NEB. This will form the basis for the determination of the rates and tariffs for all customers.

Results of Drilling Rights Auction Suggest Alberta Gas Shale Play Could Be Looming

Two parcels near Fox Creek auctioned by the Alberta government in March brought in \$135 million. For one parcel, anonymous buyers paid more than \$11,000 a hectare and a total of \$97 million for the right to drill deep wells. That constitutes one of the most expensive drilling licenses ever sold in the province. In an adjacent parcel rights were sold for \$8,225 a hectare. Both prices are well above the average for such sales. One geologist commented that since the rights are so deep producers are likely targeting the Duvernay formation. The Duvernay shale is known for liquids rich natural gas but could also hold oil.

Ontario

Demand Side Management Guidelines for Natural Gas Utilities

Consultation Processes (EB-2008-0346) and EB- 2008-0150)

Via letter dated March 29, 2011 the Ontario Energy Board outlined its views and considerations regarding the role of ratepayer-funded demand-side management (DSM) activities during the next three years. Having determined that the budgets for ratepayer-funded DSM activities by Ontario's natural gas utilities should not be expanded, the Board requested responses to the following questions:

1. How should DSM budgets with respect to low-income consumers be set and should they continue to be funded solely from the residential rate class? Further, is a different set of DSM programs appropriate for low-income natural gas consumers and should they be coordinated with similar programs aimed at low-income electricity consumers?
2. Do industrial and commercial DSM programs with significant incentives create competitive advantages for the participants of the programs relative to their competitors? Also with respect to these sectors, should DSM programs focus on energy audits and efficiency training or case studies in order to highlight best practices and new technologies, rather than on financing equipment and installation costs for specific DSM projects?
3. Should natural gas utility DSM education and training programs that are funded through distribution rates focus on contractors, trades and professional associations?
4. Should the gas utilities undertake R&D and pilot DSM programs that are funded by ratepayers?

Transition to International Financial Reporting Standards Discussion Paper

EB-2008-0408

On March 31, 2011 the Ontario Energy Board posted a staff paper focused on implementation of International Financial Reporting Standards (IFRS) in an incentive regulation mechanism environment. The OEB invites comments on the applicability of the recommendations and alternatives put forward in the paper from all entities with rates regulated by the Board. Written comments are requested by May 5, 2011.

Fuels Practice

Gordon Pickering, Director
 916.631.3249
gpickering@navigant.com
 3100 Zinfandel Drive
 Suite 600
 Sacramento, CA 95670

Rick Smead, Director
 713.646.5029
rsmead@navigant.com
 2 Houston Center, 909 Fannin
 Suite 1900
 Houston, TX 77010

Ray Welch, Associate Director
 415.399.2176
ray.welch@navigant.com
 1 Market Street
 Spear St. Tower., Suite 1200
 San Francisco, CA 94105

Bob Gibb, Associate Director
 512.493.5407
bob.gibb@navigant.com
 98 San Jacinto Boulevard
 Suite 900
 Austin TX 78701

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