OTP/MDU EXHIBIT 341

CASE NOS. PU-06-481 & PU-06-482

BEFORE THE NORTH DAKOTA PUBLIC SERVICE COMMISSION

IN THE MATTER OF THE APPLICATION BY OTTER TAIL POWER CORPORATION D/B/A

OTTER TAIL POWER COMPANY

AND

MONTANA-DAKOTA UTILITIES CO., A DIVISION OF MDU RESOURCES GROUP, INC.

FOR AN ADVANCED DETERMINATION OF PRUDENCE

FOR THE BIG STONE II GENERATING PLANT

PREFILED REBUTTAL TESTIMONY

OF

DANIEL KLEIN

PRESIDENT

TWENTY-FIRST STRATEGIES, LLC

APRIL 23, 2008

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Application for Trade Secret Protection/Applicants' Prefiled Rebuttal Testimony
Otter Tail Corporation and Montana-Dakota Utilities Co.
Lindquist & Vennum PLLP by Todd Guerrero

PREFILED REBUTTAL TESTIMONY OF DANIEL KLEIN

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BEFORE THE NORTH DAKOTA PUBLIC SERVICE COMMISSION

PREFILED REBUTTAL TESTIMONY OF DANIEL KLEIN

I. INTRODUCTION

Q: Please state your name and business address.

A: My name is Daniel E. Klein, and my business address is Twenty-First Strategies, LLC, 6595 Terri Knoll Court, McLean, VA 22101.

Q: By whom are you employed, and in what capacity?

A: I am President of Twenty-First Strategies, LLC, a consulting firm founded in 1995 to offer energy and environmental consulting services to electric power companies, industry associations, government agencies, NGOs, and others

Q: What is your educational background?

A: In 1973, I received a bachelor's degree in Urban Studies from the Massachusetts Institute of Technology. In 1975, I received a Masters of Business Administration from the Stanford University Graduate School of Business.

Q: What is your employment history?

A: In the 30-plus years since I completed my graduate studies, I have been a consultant specializing in energy, environmental, and economic analysis. Beginning in 1975, I was employed for over twenty years by the consulting firm ICF Resources Incorporated (originally ICF Inc.), where for several years I was a Senior Vice President and Director. I founded Twenty-First Strategies in 1995 to offer energy and environmental consulting services to electric power companies, industry associations, government agencies, NGOs, and others.

Over the course of my consulting career, I have conducted hundreds of projects related to energy and environmental concerns, energy markets, electric utility fuel use, coal supply, transportation, and antitrust issues. My work in recent years has focused primarily on energy, climate change, and related issues, both on policy issues from the government side as well as strategies for the private sector.

Attached as OTP/MDU Exhibit 349 to this Testimony is my resume, which presents my qualifications and experience in greater detail.

Q: Did you previously submit testimony in this proceeding?

A: This is my first testimony before the North Dakota Public Service Commission. However, related to the Big Stone II project, I submitted testimony before both South Dakota and Minnesota public utility commissions.

II. PURPOSE AND SUMMARY OF TESTIMONY

Q: What is the purpose of your testimony today?

A: My testimony relates to the supplemental direct testimony of David A. Schlissel of Synapse Energy Economics, Inc., on behalf of Mark Trechock and Dakota Resource Council, filed on April 9, 2008. Mr. Schlissel has suggested that as an alternative to Big Stone II, a combination of new natural gas capacity, renewable resources, and energy efficiency could possibly present a less expensive and lower risk option (Schlissel, pp. 4-5). While he agrees that "over-reliance on natural gas can be a concern" (Schlissel, p. 8), he does not see this as a problem of particular concern "in this specific instance and in this specific area of the nation."

In this testimony, I address the following points:

- If Big Stone II is not built, an alternative means of acquiring baseload resources will be required. Likely alternatives to supply 500 MW of baseload power are few, and increased natural gas generation would be a probable result, either as a primary or backup fuel supply, or as power purchased from the pool.
- Natural gas (and petroleum) prices are much more volatile than coal prices. Because of this, regions with more coal-fired power in their generation mix tend to have more stable power rates.
- Natural gas markets are increasingly becoming international, and increasingly subject to many of the same types of price spikes and volatility as seen with petroleum.
- While CO_2 requirements and/or pricing would affect the costs of using coal at Big Stone II, it would also affect the costs of using natural gas. Gas costs would be affected both by the direct effect of CO_2 pricing on natural gas' CO_2 emissions, and also by the potential rise in market price and volatility for the fuel.
- The volatility of natural gas prices creates a highly significant risk factor for an electric generation resource that relies on natural gas. If Big Stone II were replaced with gas-fired capacity, an increase in gas prices of only $1/MMBtu would increase generation costs by as much as $28,000,000 in a single year.
- North Dakota's participation in the Midwest ISO exposes it to a natural gas price volatility risk that is much larger than its actual percentage of generation.
- North Dakota households are at greater risk from natural gas price spikes than most other states. Non-electric residential energy uses in North Dakota indicate higher than average natural gas and petroleum consumption, even while household income is lower than average.

Accordingly, if natural gas supplies are constrained in supply and/or subjected to price spikes, residences can be hit twice – once in their direct consumption of fuel, and again in their use of natural gas-fueled electricity.

III. NATURAL GAS AS A LIKELY ALTERNATIVE TO BIG STONE II

Q: Is increased natural gas use a likely alternative if Big Stone II is not built?

A: Yes. As I understand it, the Big Stone II owners have determined there is a need for baseload resources. Big Stone II has been proposed to meet this increasing demand, and would be a 500-megawatt (MW), coal-fired electric generation plant. The plant's dispatchable, baseload power would increase reliability in the region, as well as add diversity and reduce single-outage risks for the participants.

If Big Stone II is not built, an alternative means of acquiring baseload resources will be required. Likely alternatives to supply 500 MW of baseload power are few, and would likely entail dependence upon expensive and risky supplies of natural gas and/or petroleum fuels. In most parts of the U.S., the primary alternative to a new coal-fired plant would be construction of a large combined cycle natural gas plant. While nuclear energy is edging closer to again becoming a viable option for new capacity, it cannot yet be considered "available" with respect to licensing, timing, and costs. The other primary source of baseload power, large hydroelectric plants, offers no reasonable opportunities for large-scale additions.

In theory, renewable resources such as wind power could substitute for some of the generation that Big Stone II would produce. But because these resources are intermittent and not dispatchable, they make only a limited contribution to meeting peak load capacity needs. These intermittent renewable resources would require back-up capabilities such as natural gas-fired turbines before most of the capacity could be considered dependable. And, because wind power has a capacity factor of about 30% to 40%, some other resource would be needed to provide energy during the other 60% to 70% of the time.

Energy efficiency measures and demand-side management measures may also have potential to substitute for some of the needed generation. However, DSM is typically most cost-effective when peak loads are reduced, lessening the need for building additional peak load capacity. Further, because of the low load factors, the energy savings tend to be relatively low relative to capacity savings. These savings are less applicable to a baseload project such as Big Stone II.

Accordingly, capacity alternatives to Big Stone II entail utilization of natural gas (or petroleum fuels), either as a primary or backup fuel supply. If this capacity is not built and operated by these utilities, it will most likely be in the form of natural gas-fired power purchased from the pool instead.

IV. GREATER VOLATILITY OF NATURAL GAS PRICES

Q: Why is fuel price volatility a concern?

A: Increased reliance on natural gas power entails substantial price and supply availability risks. Oil and natural gas prices have increased sharply in recent years, and now the incremental cost relative to coal is far higher than levels seen in the 1990s. We are also observing much greater volatility in oil and natural gas prices, relative to both earlier years and to coal. The inherent volatility in natural gas prices creates a significant risk factor for an electric generation resource that relies on natural gas. Because of this, regions with more coal-fired power in their generation mix usually have more stable electric power rates.

Q: Are coal price risks significant?

A: Fuel prices are a large part of power generation costs. As such, changes in current and projected fuel prices are important considerations. In recent years, coal prices have risen significantly on a percentage basis. However, since the coal prices are so much lower than natural gas prices, this percentage increase is small in absolute terms relative to the changes seen in the highly volatile natural gas market.

Q: How have forecast prices for natural gas changed?

A: Natural gas (and petroleum) prices have increased sharply in recent years, and now the incremental cost relative to coal is far higher than levels seen in the 1990s. Additionally, the outlook for natural gas supplies has been worsening for consumers. In the last few years, available supplies for both natural gas and petroleum fuels have been much tighter, resulting in sharply higher market prices, volatile price patterns, and rapidly increasing expectations for higher prices well into the future.

Natural gas prices remain high and volatile. While today's prices have eased off some from their highest prices seen in late 2005, they remain at levels far higher than seen just a few years ago. Since the beginning of 2006, the U.S. average price of natural gas delivered to the electric power sector has ranged between $5.76 and $9.15 per thousand cubic feet (mcf).[1] During this brief period there have been at least four months in which the average price rose or fell by over $1.00 per mcf from the previous month.

Longer-term, the price outlook for natural gas consumers continues to worsen. Using the Energy Information Administration's (EIA) *Annual Energy Outlook (AEO)* projections, I

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[1] U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review March 2008*, Table 9.11, "Natural Gas Prices", http://www.eia.doe.gov/emeu/mer/pdf/pages/sec9_17.pdf.

compiled a retrospective of several years' worth of natural gas price forecasts that they had made for the years 2010-2020. In MDU/OTP Exhibit 342, I have taken the *AEO* price forecasts for natural gas delivered to the electric power sector in 2010 through 2030. I have done this for 11 consecutive *AEO* forecasts, extending back to the 1998 *AEO*. Because the forecasts are presented in different year dollars, I have converted all prices into constant year 2000 dollars, using the GDP Implicit Price Deflator. As MDU/OTP Exhibit 342 shows, eleven years' worth of price forecasts have become year-by-year progressively higher, with future prices now more than half again as pricey as had been expected only a few years ago.

Q: In the forecasts, how does natural gas price volatility compare to that of coal?

A: Natural gas price forecasts show far more price volatility compared to coal. This can be seen by examining the absolute changes in future price projections when the forecasts are updated each year.

OTP/MDU Exhibit 343 shows how much more substantial the price changes are for natural gas relative to coal. OTP/MDU Exhibit 343 examines the forecast prices for coal and for natural gas for the forecast years 2010, 2015, and 2020. The price forecasts are drawn from ten years' worth of *AEO* price forecasts, beginning with *AEO 1998* which was the first time 2020 forecasts were published. Part A of OTP/MDU Exhibit 343 shows the coal and natural gas price forecasts as they were published in the respective *AEO*s. I have converted here into real 2000$ for comparability; these year 2000$ prices are shown in Part B of OTP/MDU Exhibit 343. Then, Part C of OTP/MDU Exhibit 343 shows the changes in price forecasts relative to the previous year's *AEO* forecasts.

OTP/MDU Exhibit 343 shows dramatically how very much more volatile the price forecasts are for natural gas compared to coal. With three price forecast years (2010, 2015, and 2020) and nine sets of AEO forecasts after 1998, there are 27 price forecast changes shown for both coal and natural gas. As can be seen (in Part C of OTP/MDU Exhibit 343), of the 27 coal-related price changes, 19 are less than $0.10 per MMBtu, and the maximum change is only $0.18 per MMBtu. In sharp contrast, only 7 of the natural gas-related price changes are less than $0.10 per MMBtu, and the maximum change is $0.98 per MMBtu, over five times that of any of the coal price changes. In fact, of the 14 biggest year-to-year price changes in the table (either up or down), all 14 relate to natural gas.

V. INTERNATIONAL TRENDS IN NATURAL GAS SUPPLY AND PRICING

Q: How do international trends affect natural gas supply availability and prices?

A: For many years, the U.S. viewed natural gas mainly as a domestic fuel, insulated from world pressures. For much of the world, that is already no longer the case. For the U.S., those days are rapidly coming to a close. The increasing U.S. reliance on natural gas imports, the growing world trade in liquefied natural gas (LNG), and the tighter linkages to oil prices are making natural gas forecasting an increasingly uncertain exercise.

Q: What risks do we incur by becoming more dependent on imported LNG?

A: As the U.S. comes to rely more and more on LNG to meet its demand for natural gas, market prices will increasingly be set in a world context. In a global market with little excess capacity, a supply disruption anywhere affects prices everywhere.

LNG is a relatively recent addition to the U.S. natural gas supply. Up until the 1990s, domestic production accounted for more than 90 percent of total supplies to the U.S., with pipeline imports from Canada and Mexico comprising most of the rest. High transportation costs and limited pipeline capacities led to widely varying regional patterns of both consumption and prices.

More recently, net pipeline imports of natural gas (mostly from Canada and Mexico) have been declining, and the outlook is for continuing declines. Instead, it is projected that overseas LNG will grow rapidly and offset these projected declines in both domestic production and pipeline imports. These dramatic trends in past and projected U.S. imports of natural gas are shown in OTP/MDU Exhibit 344.

In 2005, net LNG imports to the U.S. amounted to 0.57 trillion cubic feet, about 2.6 percent of the total U.S. supply.[2] But EIA's latest projections point to a fivefold growth in LNG imports in 2030 (to 2.84 trillion cubic feet) while domestic production remains basically flat and pipeline imports decrease, such that by 2030, LNG imports account for 12.5 percent of total U.S. supply.

As dramatic as this growth in LNG is, it was not anticipated just a few years ago. In OTP/MDU Exhibit 345, I have charted gas supply forecasts as developed in EIA's *Annual Energy Outlooks* published between 1998 and 2008. The top half of OTP/MDU Exhibit 345 shows how the forecasts for 2010 have changed over the years, while the bottom half does the same thing for EIA's 2020 forecasts. Several trends can be observed in OTP/MDU Exhibit 345. First, future expectations of total gas supply and demand have generally declined in recent years, especially in the past few years as price expectations have been rising. Second, expectations of

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[2] Source: Energy Information Administration, *Annual Energy Outlook 2008*, Release date March 2008 (Revised to include the impact of H.R.6, Energy Independence and Security Act of 2007 enacted in December 2007), Reference Case Forecast, Table A13, "Natural Gas Supply and Disposition", http://www.eia.doe.gov/oiaf/aeo/pdf/aeotab_13.pdf.

gas supplies from the U.S. and pipeline imports from Canada and Mexico have been falling, even though prices are higher. This leads to a rapidly growing expectation of future LNG exports. Just a few years ago LNG imports were not forecasted to rise much above then-current levels.

Q: How is global competition for LNG showing up in market prices?

A: As LNG grows as a world-traded commodity, its price will become more determined by worldwide supply and demand factors, particularly the price of oil.

A page 1 story in the April 18, 2008 edition of *The Wall Street Journal* describes at length some of these interactions and concerns. In "Surge in Natural Gas Stoked by New Global Trade,"[3] the reporters' lead sentence states that "Americans feeling the pain of record gasoline prices now face the likelihood of another fuel shock, from natural gas." The story continues with the troubling observations that prices in the U.S. have risen 93% since late August as power-hungry nations such as South Korea and Japan compete in a global natural-gas market that scarcely existed a half-decade ago, and that the global appetite for natural gas has profound implications for a U.S. economy already tipping toward recession and struggling against inflation pressures. A copy of the WSJ article is attached as OTP/MDU Exhibit 350.

VI. NATURAL GAS PRICING VOLATILITY FROM CO_2 REQUIREMENTS

Q: How could requirements to reduce CO_2 emissions affect natural gas demand and prices?

A: CO_2 requirements and/or pricing would affect the costs of using both coal and natural gas. Per million Btu, natural gas produces a little more than half the CO_2 emissions that a million Btu of coal does. Pricing these CO_2 emissions would also add to the cost of consuming

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[3] "Surge in Natural Gas Stoked by New Global Trade," by Ann Davis and Russell Gold, *The Wall Street Journal*, April 18, 2008, page 1, http://online.wsj.com/article/SB120847521878424735.html.

natural gas, though by a lesser amount than for coal. Gas costs could also be affected by the potential rise in market price and volatility for the fuel

Q: How could requirements to reduce CO_2 emissions affect the demand for natural gas?

A: For many electric power companies, shifting to natural gas may be the only suitable CO_2 reduction strategy that can be implemented on a large scale. While nuclear energy is edging closer to again becoming a viable option for new capacity, it cannot yet be considered as a dependable near-term strategy because of licensing, timing, and cost factors. The other primary source of baseload power, large hydroelectric plants, offers no reasonable opportunities for large-scale additions. While renewable resources such as wind power might be able to substitute for some of the fossil-fueled generation, they are intermittent and not dispatchable. To some degree, energy conservation can slow the growth in electric power demand, but such energy conservation is unlikely to fully offset the need for new baseload power generation.

Q: What is the net effect of these changes in demand on natural gas prices?

A: When there are more near-term shifts to natural gas than there are defections from natural gas to other emission-reducing activities, the aggregate near-term consumption of natural gas is more likely to rise relative to a scenario not requiring CO_2 reductions. It follows that near-term prices for natural gas could also rise, both in absolute terms and relative to coal prices. The amount that natural gas prices could rise in the near-term is dependent upon a number of factors, in particular the timing and magnitude in which CO_2 emissions reduction requirements are phased in, and the price of natural gas vis-à-vis coal.

Q: How could CO_2 prices affect natural gas price volatility?

A: Natural gas (and petroleum) prices are already much more volatile than coal prices, and this price volatility creates a highly significant risk factor for an electricity generation resource that relies on natural gas. With the introduction of GHG reduction requirements and CO_2 prices, I would expect natural gas price volatility to increase significantly more. Even prior to CO_2 pricing, we have seen that relatively modest changes in the supply and/or the demand for natural gas can trigger large movements in market prices. Under a future with mandatory GHG reductions and CO_2 prices, energy consumers will face a new and different set of costs, and will need to reassess their fuels and process strategies.

The extent of shifts toward or away from gas will depend upon the relative fuel prices, technology costs and availability, extent of required GHG reductions, and CO_2 price levels. Many of these factors will in turn depend upon all the others. With so many changes in the marketplace, and with so much uncertainty as to how others will respond, we can expect to see a very uncertain and volatile market for natural gas for several years as transitions are made to the new GHG requirements.

VII. ENERGY SUPPLY AND SECURITY RISKS OF NATURAL GAS RELIANCE

Q: Does our increasing dependence on foreign supplies of natural gas present energy supply and security risks?

A: Yes. Our increasing reliance on natural gas supplies from overseas sources introduces geopolitical risks that are not seen with coal, an almost entirely domestic fuel source.

It is well known that most of the world's oil reserves are found in the Middle East. As seen in OTP/MDU Exhibit 346, 729 billion of the world's 1,277 billion barrels, or 57 percent, are located in Middle East countries.[4] North America is shown having 215 billion barrels, but over 80 percent of this is noted as being oil sands in western Canada, where extraction poses high costs.

A map of proven world gas reserves, shown in the bottom half of OTP/MDU Exhibit 346, shows a similarly worrisome situation for natural gas. Out of 6,044 trillion cubic feet of proven gas reserves, over 80 percent are located in the Middle East, Eastern Europe and former USSR countries, and Africa. In fact, a look at natural gas reserves by country shows that at the beginning of this year, the U.S. ranked sixth in world gas reserves, with 3.1 percent of proven reserves.[5] The nine other top-ten countries in gas reserves are Russia, Iran, Qatar, Saudi Arabia, Abu Dhabi, Nigeria, Algeria, Venezuela, and Iraq. These other nine countries, several of whom at best are reluctant business partners with the U.S., hold gas reserves that collectively account over three-fourths of the world's total.

With the bulk of world gas reserves concentrated in a few key countries, many of whom are not especially friendly to U.S. interests, this growing dependence poses both economic and national security risks. Added to that the fact that China, India, Japan, and Western Europe are *not* among the large holders of oil and gas reserves, and we can easily appreciate how global competition for oil and natural gas will continue to underlie international trade and security concerns.

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4 Source: Adapted from Kevin R. Petak, Energy and Environmental Analysis, Inc., *Oil and Gas Prices: Will They Stay Linked?*, presented at 2006 EIA Energy Outlook and Modeling Conference, Washington DC, March 27, 2006, http://www.eia.doe.gov/oiaf/aeo/conf/pdf/petak.pdf. Original data source is *Oil and Gas Journal.*

5 Oil and Gas Journal, "Worldwide Natural Gas Reserves by Country (annual) – data thru 2006", http://ogjresearch.stores.yahoo.net/wornatgasres.html. Estimated at January 1, 2006, U.S. reserves totaled 192,513 billion cubic feet, 3.15 percent of the world's total of 6,112,144 billion cubic feet. The other nine top-ten countries held 4,610,020 billion cubic feet, 75.42 percent of the world's total.

VIII. NATURAL GAS RISKS IN THE MIDWEST ISO

Q: What did Mr. Schlissel say regarding over-reliance on natural gas?

A: Mr. Schlissel stated that he agreed "that over-reliance on natural gas can be a concern." (Schlissel, p. 8) However, he stated that "in this specific instance and in this specific area of the nation, it does not appear that the MRO would be overly reliant on natural gas if the Commission rejected OTP and MDU request to build the Big Stone II Project."

Mr. Schlissel's conclusion seems to be based on figures drawn from the NERC *2007 Long-Term Assessment Reliability Assessment 2007-2016*. Those figures showed little projected change in the shares of coal and gas-fired capacity over the next few years, and that the replacement of Big Stone II by natural gas would not significantly change those figures. He concludes that "there is no real danger of over-reliance on natural gas in the upper Midwest. There could be a concern in other regions of the nation but not in the upper Midwest."

Q: Do you agree with Mr. Schlissel that the Big Stone II partners have no real danger of over-reliance on natural gas?

A: No. In looking only at capacity shares by fuel, Mr. Schlissel ignores the Applicants' participation in coordinated regional operations, and how that already exposes them to larger gas risks. Further, this exposure is expected to grow dramatically.

The Midwest Independent Transmission System Operator, Inc. (Midwest ISO, or MISO) serves a large region that covers all or most of North Dakota, South Dakota, Nebraska, Minnesota, Iowa, Wisconsin, Illinois, Indiana, Michigan and parts of Montana, Missouri, Kentucky, and Ohio. The Applicants are members of MISO.

Established in 2002 as a regional reliability organization, MISO provides a number of services that provide economic and reliability benefits to its members. Since April 2005, MISO has administered a two-settlement (day ahead and real-time) energy market known as the Day-2 market. As described by FERC, in real-time market operations MISO centrally dispatches wholesale electricity and transmission service throughout much of the Midwest.

Q: As members of MISO, are the Applicants exposed to natural gas availability and pricing?

Yes. The MISO market produces Locational Marginal Prices (LMP) for five-minute intervals in the MISO market footprint. Because of line losses and potential congestion, prices are set for five hubs, with the one in Minnesota being the closest one to North Dakota. Locational Marginal Pricing provides price transparency for users of the wholesale bulk electric system, and indicates the cost of conducting business based on current system conditions. If natural gas use is growing, it will more often be the marginal resource that sets the LMP price. And with the higher volatility seen in natural gas prices, both historically and projected, it is reasonable to expect that the LMP price would be similarly more volatile. Natural gas-fired generation is becoming a significant driver of the pricing in the MISO energy market.

Q: How will the region's increasing dependence on natural gas for power generation affect customers of Big Stone II?

A: As natural gas use for power generation increases, it will more often be the marginal resource that sets MISO's LMP price. Gas prices and price volatility will increasingly affect Big Stone II customers via the prices in MISO's wholesale power transactions.

If Big Stone II were to be replaced by a natural gas-fired alternative, this exposure to gas prices and price volatility would be further exacerbated. For Big Stone II customers, the exposure would now be in the generating mix as well as purchases in the MISO markets.

Further, when there are problems with the availability, deliverability, and/or price of natural gas, it will affect a broader portion of the area, and the diversity that coal would have provided would be lost. Accordingly, looking only at the generating assets of a single utility provides a misleading picture. It is appropriate to consider the mix of assets in the broader reliability system in which it operates.

IX. IMPACTS ON ELECTRICITY CONSUMERS AND HOUSEHOLDS

Q: What is the potential magnitude of price changes in the context of this project?

A: Since a 500 MW unit consumes such large quantities of fuel, even small changes in fuel prices amount to very large changes in annual costs. For illustration, assume that if instead of coal, a natural gas combined cycle (NGCC) plant was proposed. If the NGCC plant was 500 MW, had a 7200 Btu/kWh heat rate, and operated at an 88% capacity factor, then each year it would generate about 3.85 million MWh and consume about 28 million MMBtu of gas. For this single unit, then, a change in gas prices of only $0.01 per MMBtu over the course of a year would change total costs by about $280,000. If future natural gas prices are uncertain by $1.00 per MMBtu (or more), then total annual costs for a gas-fueled alternative to Big Stone II may vary by about $28 million dollars per year. And, as noted earlier, just since the beginning of 2006, there have been at least four months in which the U.S. average price of natural gas delivered to the electric power sector has risen or fallen by over $1.00 per mcf from the previous month.

Q: Are Big Stone II customers at greater than average risk for fuel price volatility?

A: Yes. In addition to electricity, we use substantial amounts of natural gas and petroleum in the residential sector. Nationally, this direct consumption of natural gas and petroleum in the residential sector is substantially greater than the electrical energy consumed. It follows that if this non-electric residential energy consumption is weighted heavily toward price-volatile energy sources, then the reliance upon those same energy sources for Big Stone II could exacerbate the overall volatility risks for the Applicants' customers.

Households in North Dakota and other West North Central states have higher than average consumption of natural gas and petroleum. This greater consumption is related to higher winter heating needs that largely utilize natural gas and petroleum fuels. Using data on heating and cooling degree-days, as reported by the Energy Information Administration, we can see that the West North Central region (comprised of Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota) is substantially colder than average in the winter, and somewhat cooler on average in the summer.[6] For heating degree-days over the 1971-2000 period, the West North Central region averaged more heating degree-days than any other Census region, 49.2 percent higher than the U.S. average. Conversely, the somewhat cooler-than-average summers led to the West North Central having 23.6 percent fewer cooling degree-days than the U.S. average.

Whereas summer cooling needs are typically met using electricity-driven air conditioners and fans, winter heating needs are more often met by direct household use of natural gas and

[6] Energy Information Administration, *Annual Energy Review 2006*, Tables 1.9 and 1.10, at http://www.eia.doe.gov/emeu/aer/.

petroleum fuels. It would tend to follow that the colder regions of the country would have greater household consumption of natural gas and petroleum fuels.

The Energy Information Administration, in its periodic *Residential Energy Consumption Survey (RECS)*, develops state-wide estimates of energy consumption by type of fuel. EIA's most recent published estimates are for calendar year 2001. By dividing these estimates by the number of housing units in these states for 2001 (using Census Bureau data), we can attain per-household estimates of energy consumption, by state and by type of fuel.

OTP/MDU Exhibit 347 summarizes these per-household calculations of residential energy use. As can be seen, North Dakota had both a higher-than-average consumption of non-electrical residential energy consumption and a greater proportion of that as natural gas and petroleum fuels. For non-electric energy consumption, the average North Dakota household in 2001 consumed 76.3 MMBtu, thirty percent more than the national average of about 58.5 MMBtu per household. Nearly all of this was natural gas and petroleum fuels.

The heavy reliance on natural gas and petroleum fuels in the residential sector brings with it another risk of natural gas as a power plant fuel for North Dakotans. If natural gas is used as an energy source instead of coal at Big Stone II, there is an overall loss of fuel supply diversity. If natural gas supplies are constrained in supply and/or subjected to price spikes, residences can be hit twice – once in their direct consumption of fuel, and again in their use of natural gas-fueled electricity.

Q: Are Big Stone II customers exposed to relatively greater risk to electricity price increases?

A: Yes. Big Stone II customers are at relatively greater risk in two ways. First, they consume greater than average amounts of electricity. Second, household income is generally lower than average.

In OTP/MDU Exhibit 347, it was seen that North Dakota has a higher-than average per-household consumption of both electricity and non-electric energy. Electricity consumption, at 40.7 MMBtu per household in 2001, was 17 percent above the national average. It follows that an increase in the electricity rate will result in comparably higher monthly bills.

At the same time, North Dakota tends to have household incomes that are lower than the national average. In OTP/MDU Exhibit 348, I have compiled data from the U.S. Census Bureau on median household incomes for the U.S. and the North Dakota counties to be served by Big Stone II. The Census Bureau data consists of model-based estimates of poverty and income for states and counties, and is developed from its Small Area Income and Poverty Estimates (SAIPE) program. The latest estimates are for calendar year 2005, and can be referenced at http://www.census.gov/hhes/www/saipe/county.html. The staff at Otter Tail Power Company helped me to match the customers' communities to their respective counties. In all, Otter Tail will serve portions of 12 of North Dakota's 53 counties from Big Stone II, and for each I compared the median household income in 2005 to the U.S. average.

As seen in OTP/MDU Exhibit 348, U.S. median household income was $46,242 in 2005. North Dakota ranked 38th among states (including the District of Columbia); at $40,818 per household, North Dakotans' median household income was only 88 percent of the U.S average. And of the 12 North Dakota counties to be served by Otter Tail from Big Stone II, for instance, all but one were below the U.S. average, and nine were below the North Dakota average.

This combination of higher household energy use and lower household income is a risky situation for consumers. Higher electricity rates would be applied to more kWh, and with less disposable income to pay for it. Accordingly, the higher energy costs reduce the disposable income available for other purposes, and this impact would be disproportionately felt on higher consuming, lower income households.

X. CONCLUSION

Q: Does this conclude your testimony?

A: Yes.

APPENDIX A

EXHIBITS

PREFILED REBUTTAL TESTIMONY

OF

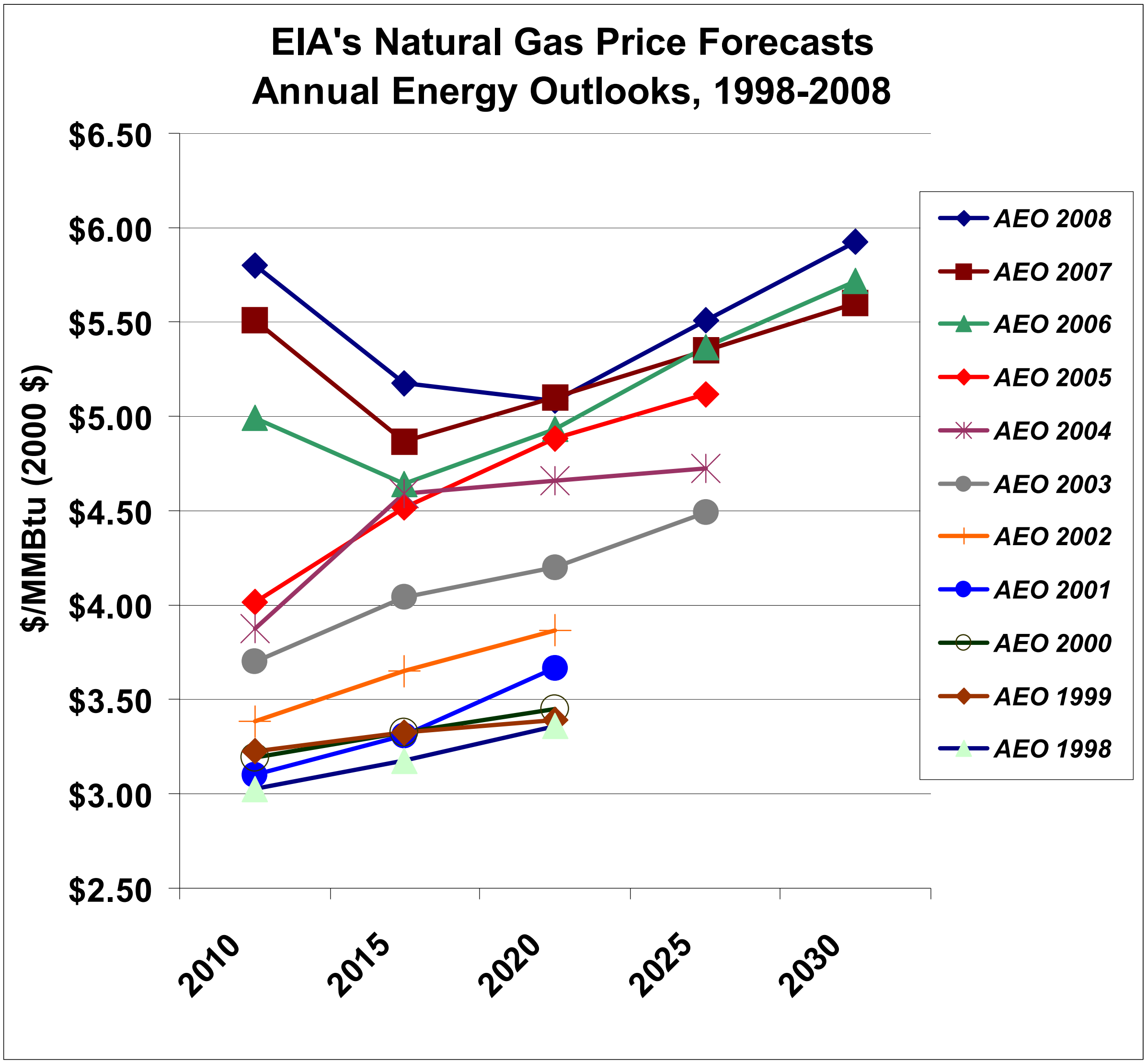
DANIEL KLEIN

PRESIDENT

TWENTY-FIRST STRATEGIES, LLC

APRIL 23, 2008

OTP/MDU EXHIBIT 342
HISTORY OF NATURAL GAS PRICE FORECASTS MADE BY THE ENERGY INFORMATION ADMINISTRATION ($/MMBtu, in year 2000 dollars)



Source: Compiled from U.S. Dept. of Energy, Energy Information Administration, *Annual Energy Outlook*, yearly publications, 1998 through 2008. Reference Case Tables' prices converted from various year dollars to 2000 dollars by dividing by a GDP Implicit Price Deflator, based on U.S. GDP data, as reported in U.S. Department of Commerce, Bureau of Economic Analysis, *National Economic Accounts: Gross Domestic Product, Current-dollar and "real" GDP*, spreadsheet at http://www.bea.gov/national/xls/gdplev.xls, last updated 27-Sep-2007.

OTP/MDU EXHIBIT 343

CHANGES IN COAL AND NATURAL GAS PRICE FORECASTS TO ELECTRIC GENERATORS, AS COMPILED FROM *ANNUAL ENERGY OUTLOOK*, 1998-2006

A. Forecast prices in real $ per MMBtu, using $ base year as given in that year's *AEO*

			Coal			Natural Gas		
Source	Table/Page	Year $	2010	2015	2020	2010	2015	2020
AEO 1998	Table A3, Page 104	1996	$ 1.09	$ 1.03	$ 0.97	$ 2.84	$ 2.98	$ 3.15
AEO 1999	Table A3, Page 116	1997	$ 1.06	$ 0.99	$ 0.93	$ 3.08	$ 3.17	$ 3.24
AEO 2000	Table A3, Page 121	1998	$ 1.07	$ 1.03	$ 0.98	$ 3.08	$ 3.21	$ 3.33
AEO 2001	Table A3, Page 131	1999	$ 1.05	$ 1.01	$ 0.98	$ 3.03	$ 3.24	$ 3.59
AEO 2002	Table A3, Page 129	2000	$ 1.05	$ 1.01	$ 0.97	$ 3.38	$ 3.65	$ 3.87
AEO 2003	Table A3, Page 123	2001	$ 1.17	$ 1.15	$ 1.12	$ 3.79	$ 4.14	$ 4.30
AEO 2004	Table A3, Page 137	2002	$ 1.22	$ 1.20	$ 1.17	$ 4.04	$ 4.78	$ 4.85
AEO 2005	Table A3 , Page 143	2003	$ 1.25	$ 1.23	$ 1.25	$ 4.27	$ 4.81	$ 5.20
AEO 2006	Table A3, Page 137	2004	$ 1.48	$ 1.40	$ 1.39	$ 5.46	$ 5.08	$ 5.40
AEO 2007	Table A3, Page 140	2005	$ 1.71	$ 1.60	$ 1.58	$ 6.22	$ 5.50	$ 5.76

B. Forecast prices in real $ per MMBtu, using year 2000 dollars

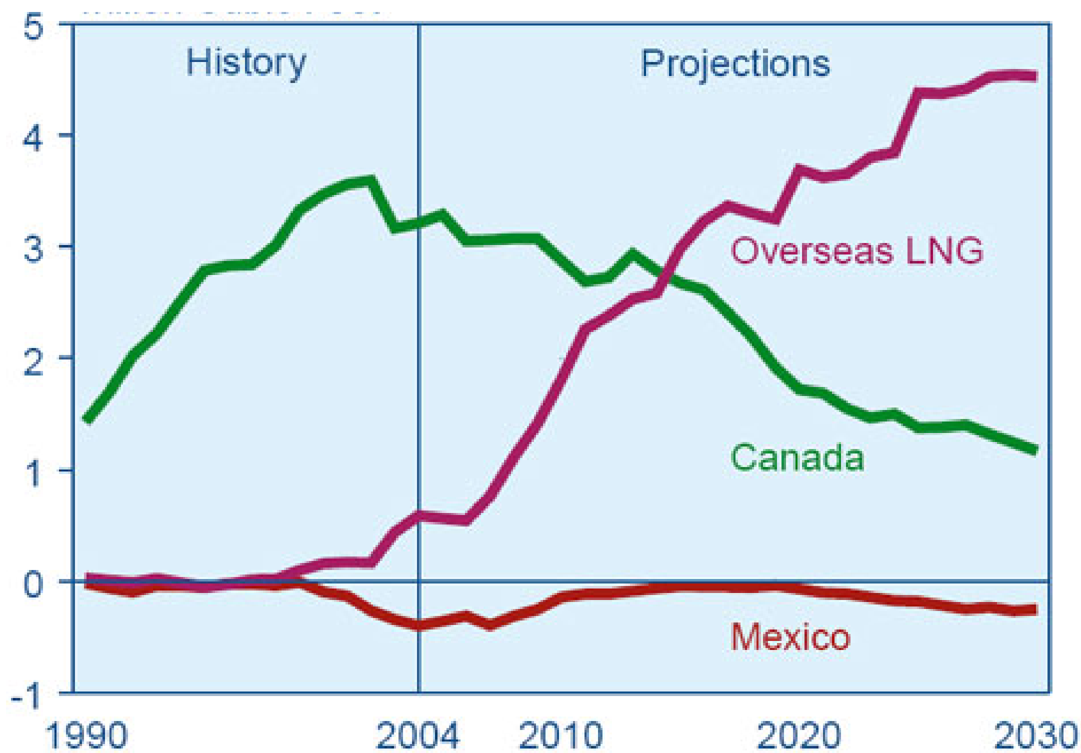
			Coal			Natural Gas		
Source	Table/Page	GDP Price Deflator	2010	2015	2020	2010	2015	2020
AEO 1998	Table A3, Page 104	0.9385	$ 1.16	$ 1.10	$ 1.03	$ 3.03	$ 3.18	$ 3.36
AEO 1999	Table A3, Page 116	0.9541	$ 1.11	$ 1.04	$ 0.97	$ 3.23	$ 3.32	$ 3.40
AEO 2000	Table A3, Page 121	0.9647	$ 1.11	$ 1.07	$ 1.02	$ 3.19	$ 3.33	$ 3.45
AEO 2001	Table A3, Page 131	0.9787	$ 1.07	$ 1.03	$ 1.00	$ 3.10	$ 3.31	$ 3.67
AEO 2002	Table A3, Page 129	1.0000	$ 1.05	$ 1.01	$ 0.97	$ 3.38	$ 3.65	$ 3.87
AEO 2003	Table A3, Page 123	1.0240	$ 1.14	$ 1.12	$ 1.09	$ 3.70	$ 4.04	$ 4.20
AEO 2004	Table A3, Page 137	1.0419	$ 1.17	$ 1.15	$ 1.12	$ 3.88	$ 4.59	$ 4.66
AEO 2005	Table A3 , Page 143	1.0641	$ 1.17	$ 1.16	$ 1.17	$ 4.01	$ 4.52	$ 4.89
AEO 2006	Table A3, Page 137	1.0946	$ 1.35	$ 1.28	$ 1.27	$ 4.99	$ 4.64	$ 4.93
AEO 2007	Table A3, Page 140	1.1300	$ 1.51	$ 1.42	$ 1.40	$ 5.50	$ 4.87	$ 5.10

C. Change in forecast prices from previous year's *AEO*

			Coal			Natural Gas		
Source	Measure	Year $	2010	2015	2020	2010	2015	2020
AEO 1998	--	2000	--	--	--	--	--	--
AEO 1999	Change from *AEO 1998*	2000	$ (0.05)	$ (0.06)	$ (0.06)	$ 0.20	$ 0.15	$ 0.04
AEO 2000	Change from *AEO 1999*	2000	$ (0.00)	$ 0.03	$ 0.04	$ (0.04)	$ 0.01	$ 0.06
AEO 2001	Change from *AEO 2000*	2000	$ (0.04)	$ (0.04)	$ (0.01)	$ (0.10)	$ (0.02)	$ 0.22
AEO 2002	Change from *AEO 2001*	2000	$ (0.02)	$ (0.02)	$ (0.03)	$ 0.28	$ 0.34	$ 0.20
AEO 2003	Change from *AEO 2002*	2000	$ 0.09	$ 0.11	$ 0.12	$ 0.32	$ 0.39	$ 0.33
AEO 2004	Change from *AEO 2003*	2000	$ 0.03	$ 0.03	$ 0.03	$ 0.18	$ 0.54	$ 0.46
AEO 2005	Change from *AEO 2004*	2000	$ 0.00	$ 0.00	$ 0.05	$ 0.14	$ (0.07)	$ 0.23
AEO 2006	Change from *AEO 2005*	2000	$ 0.18	$ 0.12	$ 0.10	$ 0.98	$ 0.12	$ 0.05
AEO 2007	Change from *AEO 2006*	2000	$ 0.16	$ 0.14	$ 0.13	$ 0.52	$ 0.23	$ 0.16

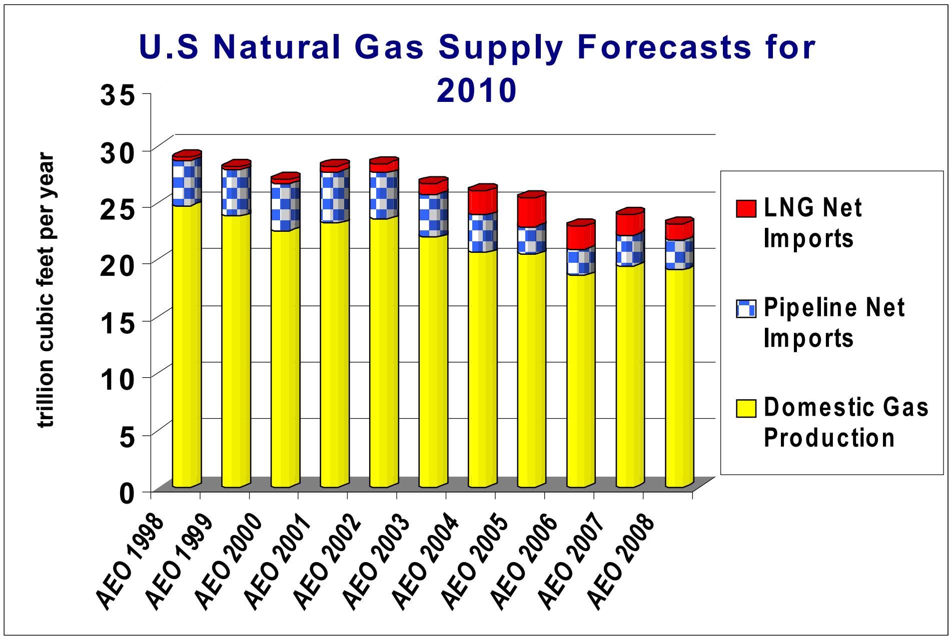
Source: U.S. Dept. of Energy, Energy Information Administration, *Annual Energy Outlook*, yearly publications, 1998 through 2007. Reference Case Tables' prices converted from various year dollars to 2000 dollars by dividing by a GDP Implicit Price Deflator, based on U.S. GDP data, as reported in U.S. Department of Commerce, Bureau of Economic Analysis, National Economic Accounts: *Gross Domestic Product, Current-dollar and "real" GDP*, spreadsheet at http://www.bea.gov/national/xls/gdplev.xls, last updated 27-Sep-2007.

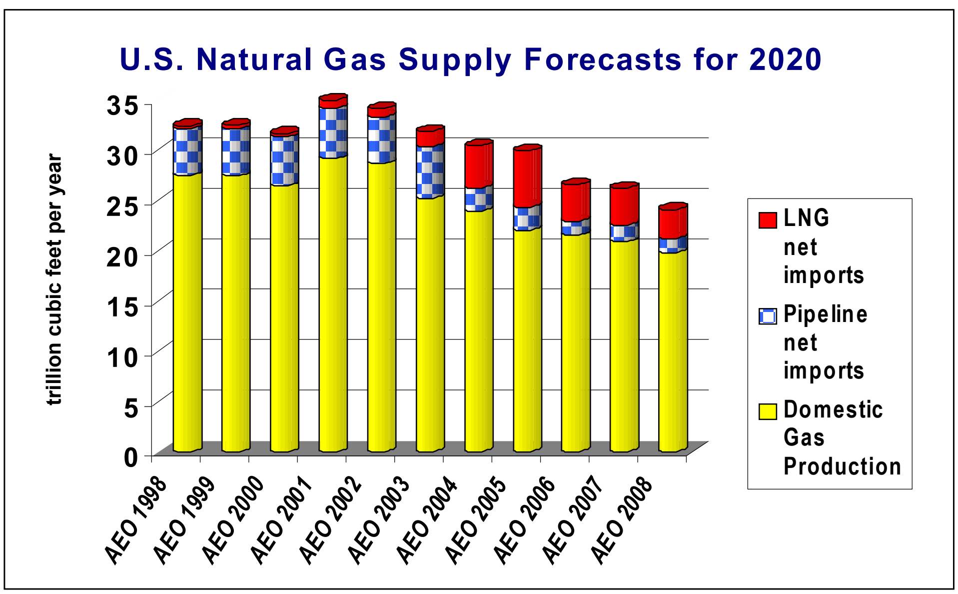
OTP/MDU EXHIBIT 344
U.S. NET IMPORTS OF NATURAL GAS BY SOURCE, 1990-2030
(trillion cubic feet)



Source: U.S. Department of Energy, Energy Information Administration, *International Energy Outlook 2007*, Report #DOE/EIA-0484(2007), May 2007, Figure 46. http://www.eia.doe.gov/oiaf/ieo/figure_46.html. Figure developed using historic data in *Annual Energy Review 2005* and forecasts in *Annual Energy Outlook 2007.*

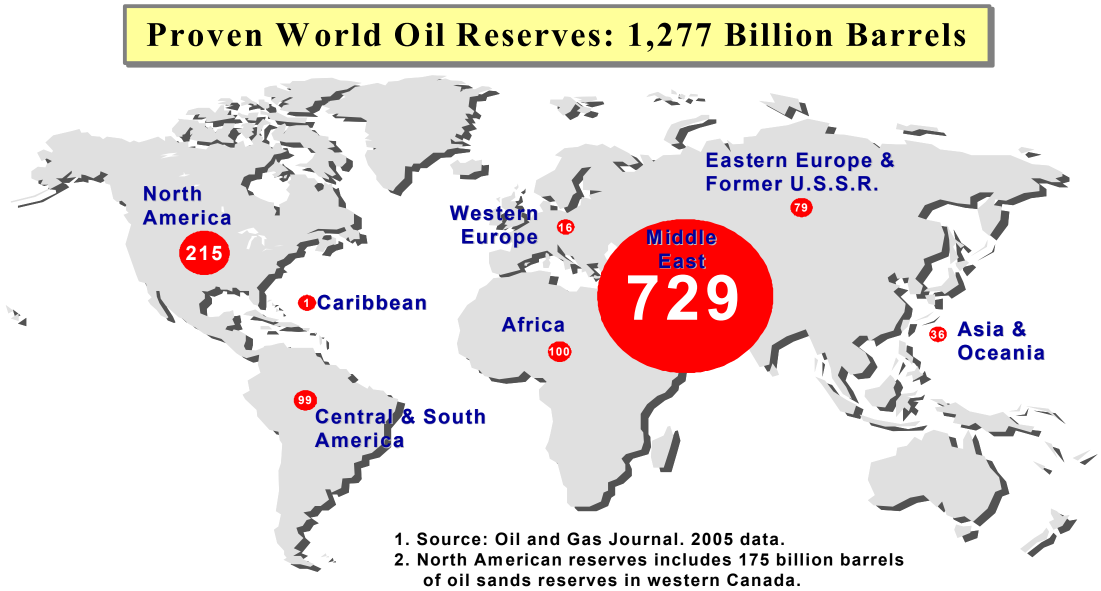
OTP/MDU EXHIBIT 345
HISTORICAL COMPARISON OF NATURAL GAS SUPPLY FORECASTS

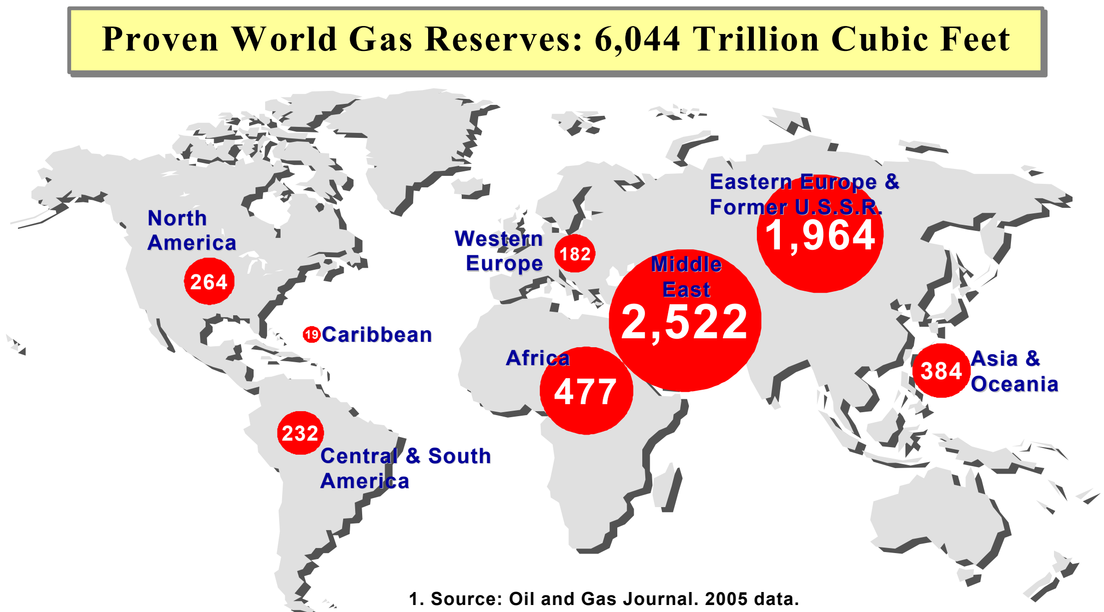




Source: Developed from Energy Information Administration, *Annual Energy Outlook*, various editions 1998 through 2008, Reference Case Forecast, Table A13, "Natural Gas Supply and Disposition", archive listings available at http://www.eia.doe.gov/oiaf/archive.html#aeo.

OTP/MDU EXHIBIT 346
LOCATION OF WORLD OIL AND NATURAL GAS RESERVES





Source: Adapted from Kevin R. Petak, Energy and Environmental Analysis, Inc., *Oil and Gas Prices: Will They Stay Linked?*, presented at 2006 EIA Energy Outlook and Modeling Conference, Washington DC, March 27, 2006, http://www.eia.doe.gov/oiaf/aeo/conf/pdf/petak.pdf. Data source for chart is *Oil and Gas Journal.*

OTP/MDU EXHIBIT 347
AVERAGE PER-HOUSEHOLD ENERGY CONSUMPTION, 2001
(MMBtu per household)

				Non-electric Energy			
State	Census Region	Net Energy	Electricity	Total Non-electric	Natural Gas	Petroleum	Other
Alabama	ESC	83.2	47.5	35.7	25.4	7.4	2.9
Alaska	PAC	141.4	24.7	116.7	64.6	43.7	8.4
Arizona	MTN	63.0	39.5	23.5	16.5	1.9	5.2
Arkansas	WSC	86.0	43.2	42.8	31.6	8.6	2.4
California	PAC	68.9	21.3	47.5	42.1	1.4	4.1
Colorado	MTN	102.2	26.3	75.8	66.1	5.3	4.4
Connecticut	NE	125.3	29.3	96.0	29.8	61.1	5.0
Delaware	SA	95.7	36.4	59.3	27.2	28.4	3.7
District of Columbia	SA	77.5	20.7	56.7	48.4	4.4	4.0
Florida	SA	55.3	46.2	9.1	2.2	1.9	4.9
Georgia	SA	88.5	44.5	44.0	36.5	3.9	3.6
Hawaii	PAC	28.1	20.6	7.5	1.3	3.4	2.8
Idaho	MTN	95.5	43.6	51.9	36.0	12.0	4.1
Illinois	ENC	122.8	28.9	94.0	88.2	3.5	2.3
Indiana	ENC	107.7	38.9	68.8	58.5	7.7	2.6
Iowa	WNC	107.3	34.0	73.3	57.2	12.0	4.1
Kansas	WNC	107.0	35.9	71.1	61.5	6.2	3.4
Kentucky	ESC	88.0	45.4	42.6	33.2	6.1	3.4
Louisiana	WSC	80.1	47.1	33.0	26.9	4.1	2.0
Maine	NE	113.1	24.6	88.5	1.7	82.0	4.9
Maryland	SA	94.9	37.6	57.2	36.7	16.8	3.8
Massachusetts	NE	122.4	23.2	99.1	42.3	52.0	4.9
Michigan	ENC	126.0	25.7	100.4	82.5	15.6	2.3
Minnesota	WNC	110.1	31.4	78.6	60.0	15.0	3.6
Mississippi	ESC	88.3	48.5	39.8	24.1	12.8	2.9
Missouri	WNC	106.6	41.5	65.1	47.2	14.2	3.6
Montana	MTN	96.0	32.0	64.0	49.6	10.6	4.1
Nebraska	WNC	117.1	40.2	76.9	64.6	8.7	3.5
Nevada	MTN	84.6	37.9	46.8	38.6	3.7	4.5
New Hampshire	NE	103.8	23.3	80.6	13.0	62.6	4.7
New Jersey	MA	112.8	25.9	86.8	65.1	19.3	2.4
New Mexico	MTN	86.5	21.5	65.0	44.8	15.7	4.4
New York	MA	110.8	19.5	91.4	50.3	31.5	9.5
North Carolina	SA	78.6	43.4	35.2	16.3	15.3	3.7
North Dakota	WNC	117.0	40.7	76.3	37.3	34.6	4.4
Ohio	ENC	109.2	33.4	75.8	66.5	7.1	2.3
Oklahoma	WSC	95.1	44.1	51.0	43.3	5.9	1.8
Oregon	PAC	79.5	40.4	39.0	26.7	6.5	5.8
Pennsylvania	MA	108.8	29.9	78.9	47.6	28.5	2.8
Rhode Island	NE	117.2	20.8	96.4	41.9	49.8	4.8
South Carolina	SA	72.6	47.2	25.4	15.8	5.9	3.6
South Dakota	WNC	99.7	37.1	62.6	37.4	21.6	3.6
Tennessee	ESC	86.9	50.6	36.3	28.4	4.9	3.1
Texas	WSC	80.0	47.9	32.1	25.5	5.3	1.2
Utah	MTN	111.6	28.9	82.8	73.3	5.3	4.1
Vermont	NE	108.7	23.2	85.4	9.4	71.7	4.7
Virginia	SA	88.7	42.9	45.8	24.6	17.3	3.9
Washington	PAC	91.4	43.2	48.3	35.0	7.9	5.4
West Virginia	SA	95.2	39.3	55.9	41.9	10.1	3.6
Wisconsin	ENC	103.3	29.5	73.8	53.5	17.9	2.4
Wyoming	MTN	100.9	32.3	68.6	51.3	11.9	5.3
United States		**93.3**	**34.8**	**58.5**	**41.6**	**13.1**	**3.8**

Source: Residential energy consumption data from Energy Information Administration, "*State Data: Table S4: Residential Sector Energy Consumption Estimates, 2001*, http://www.eia.doe.gov/emeu/states/sep_sum/html/sum_btu_res.html. Household data from U.S. Bureau of the Census, "*Annual Estimates of Housing Units for the United States and States: April 1, 2000 to July 1, 2004,*" Publication HU-EST2004-01, at http://www.census.gov/popest/housing/tables/HU-EST2004-01.xls.

OTP/MDU EXHIBIT 348
MEDIAN 2005 HOUSEHOLD INCOME FOR NORTH DAKOTA COUNTIES TO BE SERVED BY BIG STONE II

State	County	Companies Serving	Median household income (2005$)	% of U.S. Income
United States			**$46,242**	**100.00%**
North Dakota *(ranked #38 among States & D.C.)*			**$40,818**	**88.27%**
	Barnes County	**MRE, OTPC**	**$39,627**	**85.69%**
	Burleigh County	**MDU, OTPC**	**$47,080**	**101.81%**
	Dickey County	**MDU, OTPC**	**$35,211**	**76.15%**
	Grand Forks County	**MRE, OTPC**	**$41,507**	**89.76%**
	Kidder County	**MDU, OTPC**	**$30,393**	**65.73%**
	Logan County	**MDU, OTPC**	**$31,899**	**68.98%**
	McLean County	**MRE, OTPC**	**$37,652**	**81.42%**
	Mountrail County	**MDU, OTPC**	**$34,541**	**74.70%**
	Nelson County	**MRE, OTPC**	**$31,715**	**68.58%**
	Pembina County	**MRE, OTPC**	**$37,531**	**81.16%**
	Renville County	**MDU, OTPC**	**$36,748**	**79.47%**
	Traill County	**MRE, OTPC**	**$42,577**	**92.07%**

Source: Tabulated from U.S. Census Bureau, *Small Area Income & Poverty Estimates (SAIPE): Median household income, in dollars, 2005*, http://www.census.gov/hhes/www/saipe/county.html. Staff of Otter Tail Power Company identified the counties with communities to be served by Big Stone II.

Code to Company names: MRE=Missouri River Energy, MDU=Montana-Dakota Utilities, OTPC=Otter Tail Power Company.

APPENDIX B

RESUME OF DANIEL E. KLEIN

Twenty-First Strategies

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6595 Terri Knoll Court
McLean, VA 22101
phone (703) 893-8333
fax (703) 893-8813
dklein@21st-strategies.com

RESUME

DANIEL E. KLEIN

EDUCATION

1975	M.B.A., Graduate School of Business, Stanford University
1973	S.B., Urban Studies, Massachusetts Institute of Technology

EXPERIENCE

Daniel E. Klein, President of Twenty-First Strategies, has over 30 years of consulting experience in energy, environmental, and economic analysis. For many years a Senior Vice President and Director of ICF Resources Incorporated, he founded Twenty-First Strategies in 1995 to offer energy and environmental consulting services to energy companies, government agencies, and others.

Over the course of his consulting career, Mr. Klein has conducted hundreds of projects related to energy and environmental concerns, energy markets, electric utility fuel use, coal supply, transportation, and antitrust issues. His work in recent years has focused primarily on climate change, electric power, and related issues, both on policy issues from the government side as well as strategies for the private sector. Mr. Klein earned a Bachelor's degree from MIT and an MBA from the Stanford Graduate School of Business. Selected examples of his recent work include the following:

Environmental Policy and Analysis

- ***Global Climate Change and Electric Utilities.*** Mr. Klein has directed efforts with electric utilities and government agencies to develop data and methods for assessing and planning for potential climate change initiatives. These efforts include developing new analytic frameworks for estimating potential impacts on electric power systems, and evaluating risk mitigation strategies. He directed efforts to assist the Administration develop and implement portions of the Climate Change Action Plan in the 1990s, and is continuing a variety of analytic efforts related to the Global Climate Change Initiative. In the electric utility/DOE Climate Challenge program, he was responsible for recruiting new member utilities and for helping measure and report on progress made. He is presently working with electric utilities and others to identify and implement voluntary programs to reduce greenhouse gas emissions as part of their efforts under the Power Partners[SM] program.
- ***Environmental Externalities.*** Mr. Klein has directed several efforts supporting the U.S. Department of Energy in matters related to the use of environmental externalities. For DOE's Fossil Energy office, he directed an assessment of the socioeconomic impacts associated with potential rate increases that may result from the inclusion of externalities in electric power resource planning. He

has provided internal critiques and analytic support to efforts to use the damage function approach for quantifying externalities. Working with private sector groups, he has developed a framework for evaluating mortality implications stemming from income effects of changes in power costs, and has used this framework in testimony.

- ***Carbon Sequestration.*** Mr. Klein has provided numerous support efforts to DOE's Carbon Sequestration Program since its inception. He has co-authored over 20 papers and conference presentations communicating the potential for carbon sequestration and DOE's activities in this area. He has additionally co-authored several book chapters and industry journal articles on the topic. He assisted DOE in its review of the recent draft IPCC Special Report on Carbon Dioxide Capture and Storage. He developed, compiled, and maintains what has become the most comprehensive database of carbon sequestration R&D activities available, and made this available via the Internet at http://carbonsequestration.us.

- ***Clean Air Act Analyses.*** In numerous studies for public and private sector clients, Mr. Klein has analyzed the impacts of acid rain mitigation proposals, New Source Performance Standards, NO_x restrictions, and several other Clean Air Act issues on the electricity, coal, transportation, and labor markets. He developed state-of-the-art models and approaches for estimating impacts on electric utilities, coal mining, and transportation industries.

- ***Climate Change Mitigation Strategy in Eastern Europe.*** Mr. Klein led the U.S. portion of a multinational team to create a climate change strategy for the city of Donetsk, Ukraine. Under funding provided by U.S. Agency for International Development, Twenty-First Strategies partnered with the Ecology and Environment Department of the Donetsk City Council and the U.S.-based Center for Clean Air Policy. The project developed a GHG inventory for the city of Donetsk, and identified potential GHG mitigation activities and the associated cost and effectiveness.

- ***Utility Coal Combustion By-Products.*** Mr. Klein has analyzed issues related to disposal practices and potential standards for electric utility ash and sludge wastes. These efforts have included estimating past and future waste disposal volumes, identifying current regulatory requirements, and evaluating the costs and other potential impacts of alternative waste management practices. Working with the American Coal Ash Association, Utility Solid Waste Action Group, and others, he has directed studies and made conference presentations concerning beneficial use of coal combustion by-products and associated reductions in greenhouse gas emissions.

- ***Environmental Aspects of Coal Mining and Transportation.*** Mr. Klein has led numerous studies of the impacts of strip mining regulations, fugitive dust limits for surface coal mining, federal coal leasing policies, environmental impacts of rail deregulation, and related issues.

- ***Oil Spill Environmental Impacts.*** On behalf of several Alaskan Native Corporations, Mr. Klein directed litigation support efforts related to the Exxon VALDEZ oil spill. These efforts have included field and technical studies, economic impacts, and impacts on land values.

Economic and Market Analysis and Forecasting

- ***Energy Market Forecasting.*** For 20 years, Mr. Klein directed major portions of ICF Resources' extensive efforts in forecasting short- and long-term conditions in the fuel and power markets. He developed forecasting methodologies and related data bases, developed and enhanced ICF's Coal and Electric Utilities Model, and designed its successor models. These models and methodologies were used in dozens of market and strategic studies for private clients and policy analyses for the public sector.

- ***Antitrust Market Analysis.*** In major antitrust cases, Mr. Klein has served as an expert witness in the identification of relevant coal and transportation markets. In work with the Department of Justice and major coal companies, he tested and implemented new market delineation techniques based upon demand cross-elasticities; this work currently serves as the basis for Department of Justice policy. Mr. Klein has also testified as a witness before the ICC on issues regarding railroad transportation markets, and in private antitrust cases.

- ***Energy and Mineral Appraisals.*** Rapid swings in energy and minerals markets over the past two decades have led to sharp changes in the value of reserves and producing operations. Appraisals have often been needed to set property values at different points in time for tax basis determination, prudence of procurement decisions, losses resulting from federal takings, property tax assessments, and other purposes. Mr. Klein has led numerous projects relating to reconstructing appraisals appropriate to past market conditions and knowledge. These efforts have included oil, gas, coal, geothermal, and various metals and mineral properties.

Energy and Transportation Issues

- ***Energy Security.*** As oil and gas prices reach historically high levels, our dependence on foreign sources creates massive economic outflows to countries that are often unfriendly to our interests. The continuing high level of oil imports, together with our growing reliance on imported liquefied natural gas, create security concerns as well as economic ones. Together with growing pressures to act on climate change, we face a "perfect storm" of intertwined energy, security, and climate problems – a once-in-a-generation set of challenges and opportunities. In testimony, presentations, and analyses, Mr. Klein has explored numerous aspects of these issues.

- ***Adequacy of Energy Data.*** Mr. Klein is a recognized expert on the use and misuse of coal and other energy data, particularly as they apply to modeling and forecasting efforts. He has developed new approaches toward incorporating disparate sources of information, and has been published at length on the pitfalls of using public data. For the Department of Justice, Mr. Klein directed the development of the coal reserve data base now used in DOJ's competition review procedures. He has testified as an expert witness in an intellectual property case regarding originality of methods for data collection and application in forecasting models.

- ***Federal Coal Leasing Policies.*** In several studies for public and private sector clients, Mr. Klein has evaluated impacts of leasing moratoriums, approaches to determining levels of leasing, concepts of fair market value, impacts of diligence and royalty requirements, and many other aspects of this complex regulatory program. He testified as an expert witness before the Commission on Fair Market Value Policy for Federal Coal Leasing.

- ***Transportation Policy.*** Mr. Klein has led studies evaluating impacts of rail rate deregulation, economic and energy impacts of coal slurry pipelines, railroad leasing of federal coal, coal transportation costs for different modes, and many others. In efforts with DOE, he conducted studies of the effects of the Staggers Rail Act on coal and electricity markets. He has testified before the Interstate Commerce Commission on market dominance issues.

- ***Transportation Strategies.*** Mr. Klein has worked with shippers to formulate strategies for enhancing their competitive alternatives and improving their bargaining position. Working with carriers, law firms, investment bankers, and others, he has developed market forecasts of rail traffic and revenues, analyzed impacts of economic and legislative uncertainties, and helped to develop approaches for enhancing market share and contribution.

SELECTED PUBLICATIONS AND PRESENTATIONS

"Progress and New Developments in CO_2 Capture and Storage" (co-authored with Robert L. Kane (DOE), Sean I. Playsynski (DOE/NETL), and Rameshwar D. Srivastava (SAIC)), presented at the 11th

Electric Utilities Environmental Conference: Air Quality & Global Climate Change, Tucson, Arizona, January 29-31, 2008.

"Use of Coal Combustion Products and Implications for GHG Emissions," presented to the EUCU Conference on New Business Opportunities in Coal Combustion Products, Charlotte NC, July 16, 2007.

"Use of Coal Combustion Products and Implications for GHG Emissions," presented to the Flyash Concrete & GHG Reductions Workshop, Wal-Mart Sustainable Value Initiative, Durham NC, May 4, 2007.

"A Perfect Storm for Energy, National Security, & Climate," presented to the National Hydropower 2007 Annual Conference, Washington DC, March 17, 2007.

"New Developments in Carbon Capture and Storage" (co-authored with Robert L. Kane (DOE), Sean I. Playsynski (DOE/NETL), and Rameshwar D. Srivastava (SAIC)), presented at the 10th Electric Utilities Environmental Conference: Air Quality & Global Climate Change, Tucson, Arizona, January 22-24, 2007.

"Climate Change: Reporting Responsibilities under the Climate VISION Memorandum of Understanding," presented to the American Public Power Association 2006 National Conference, Chicago IL, June 13, 2006.

"Climate Vision, Power Partners℠, & GHG Activities for Public Power," presented to the American Public Power Association seminar on "Climate Change: Making Community-Based Decisions in a Carbon-Constrained World," Washington DC, Feb. 28, 2006.

"New Developments in Carbon Capture and Storage" (co-authored with Sean Playsynski, DOE/NETL), presented at the 9th Electric Utilities Environmental Conference: Air Quality & Global Climate Change, Tucson, Arizona, January 23-25, 2006.

"Prospects for Participation of Methane Sectors in Emissions Trading Programs in California," prepared for the Center for Clean Air Policy, October 2005, http://www.climatechange.ca.gov/documents/2005-10-14_CCAP_REPORTS/CCAP_REPORT_METHANE.PDF

"Suitability of Methane Sources for Greenhouse Gas Emissions Trading," prepared for the Center for Clean Air Policy, Washington D.C. Draft report dated August 2005; report publication upcoming.

"New Developments in DOE's Carbon Sequestration Program" (co-authored with Robert L. Kane, DOE), presented at the 8th Electric Utilities Environmental Conference: Air Quality & Global Climate Change, Tucson, Arizona, January 24-26, 2005.

"Climate VISION Update: Policy Drivers for Climate Change and Energy Security" (co-authored with David Berg, DOE), presented at the 8th Electric Utilities Environmental Conference: Air Quality & Global Climate Change, Tucson, Arizona, January 24-26, 2005.

"CCP Use and Their Impact on Greenhouse Gases," presented to American Coal Ash Association, Canadian Industries Recycling Coal Ash, Midwest Coal Ash Association, Dearborn, Michigan, June 8, 2004.

"Climate VISION & the Administration's Global Climate Change Initiative" (co-authored with David Berg, DOE), presented at the 7th Electric Utilities Environmental Conference: Air Quality & Global Climate Change, Tucson, Arizona, January 20-22, 2004.

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EMPLOYMENT HISTORY

Twenty-First Strategies, LLC	President	1995-present
ICF Resources Incorporated	Senior Consultant	1995-1997
	Senior VP & Director	1988-1995
ICF Incorporated	Vice President	1980-1988
	Associate—Project Manager	1975-1980
City of Palo Alto, California	Operations Analyst	1974-1975
Federal Energy Administration, Office of Data Policy	Data Analyst	1974
Atlanta (GA) Board of Education	Systems Programmer	1970-1973

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PAGE ONE

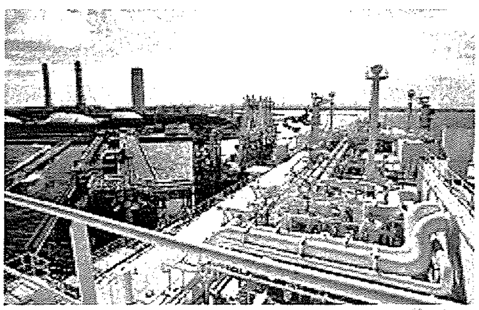
Surge in Natural-Gas Price Stoked by New Global Trade

Further Gains Likely Despite 93% Spike; Bidding With Japan

By ANN DAVIS and RUSSELL GOLD
April 18, 2008; Page A1

Americans feeling the pain of record gasoline prices now face the likelihood of another fuel shock, from natural gas.

Prices in the U.S. have risen 93% since late August as power-hungry nations like South Korea and Japan compete in a global natural-gas market that scarcely existed a half-decade ago. Still, U.S. prices are as low as half the level of some overseas markets, suggesting they have much further to rise.



Reuters

Tokyo Electric Power Co.'s Futtsu Thermal Power Station seen from aboard the LNG Pioneer, a liquefied-natural-gas carrying ship.

The global appetite for natural gas has profound implications for a U.S. economy already tipping toward recession and struggling against inflation pressures. The fuel heats half of U.S. homes, generates 20% of the country's electricity and is used to make everything from fertilizer to plastic bags. In March, rising natural-gas prices contributed to a higher than expected 1.1% increase in producer prices, according to the Labor Department.

U.S. natural-gas output has actually been rising in recent months, and not everyone agrees that prices are destined to surge. However, a significant number of financial players are now betting on an increase.

On Thursday a report by the Barclays Capital unit of Barclays PLC warned that, partly because of rising natural-gas prices, the U.S. could start to see spikes in electricity costs in as little as a year. "Power is at the cusp of its next boom cycle," analysts said. "When power markets tighten, prices do not notch up, they skyrocket."

On Thursday, natural-gas prices on the New York Mercantile Exchange fell five cents per million British thermal units, or 0.5%, to settle at $10.383, ending a three-day upward march. That's 33% shy of the record close of $15.378 on Dec. 13, 2005, when a cold snap jolted the market.

What's new is the global price competition. Prior to 2003, gas was primarily a regional commodity, consumed near where it was produced and transported by pipelines. Often, it would be simply

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burned off as waste at oil wells, since transportation was so difficult.

That changed with development of cheaper methods for supercooling and transporting the fuel across the ocean in liquefied form, which requires 1/600th the space. The global trade took off.

Attracting Imports

Today, a tanker of liquefied natural gas, or LNG, pulling into port in Japan can command close to $20 per million BTUs, roughly double the price of the U.S. benchmark. As a result, the U.S. is having trouble attracting the imports it needs to supplement homegrown production.

Last weekend, Cheniere Energy Inc. inaugurated a massive new LNG terminal on the Texas-Louisiana border capable of accommodating six tankers a week, making it the largest terminal in the U.S. However, observers expect few tankers to dock there until they can obtain higher prices for their cargo. Cheniere's stock is down 70% from its 52-week high; earlier this year, it put itself up for sale.

For the moment at least, the import slowdown means the U.S. has a glut of LNG import terminals like these. From California to New England, proposals for such facilities have faced staunch community opposition. This month New York Gov. David Paterson said the state wouldn't issue a permit for a proposed terminal in the Long Island Sound, arguing that it wasn't appropriate for the environmentally sensitive area.

Overall, U.S. imports of LNG have slid over the past nine months to a five-year low, and natural-gas inventories are running relatively low. Deutsche Bank commodities chief David Silbert says that if the U.S. is unable to attract LNG supply this summer, prices could spike up sharply within a few months if a hot summer were to reduce the ability to build a cushion of gas going into next winter.

As the odds increase that the U.S. will pass climate-change regulations that raise financial penalties for burning coal, cleaner-burning natural gas is gaining favor as the fuel to power electric plants.

Overall, gas demand from the U.S. power sector grew by 10% last year, according to the Energy Information Administration. By 2025, the U.S. could see domestic production lag demand by 15 billion to 20 billion cubic feet a day, Linda Cook, executive director of gas and power for Royal Dutch Shell PLC, told a recent energy conference.

The increased global trade in natural gas was driven partly by huge investments since 2003 in facilities to liquefy gas for export -- chilling it to negative-260 degrees Fahrenheit -- as big Western oil companies saw a business opportunity and ramped up spending on LNG infrastructure. This created economies of scale and further drove down the price of producing and shipping LNG long distances.

This triggered a revolution in gas markets. Previously, countries like Nigeria, which has ample natural gas, had no easy way to sell it due to a lack of pipelines to markets needing the fuel. Same was true for Qatar, also home to enormous gas reserves.

Early thinking assumed the globalized market would cause prices to fall because countries tight on supplies could more easily import. Former Federal Reserve Chairman Alan Greenspan, in 2003, predicted LNG would create a "price-pressure safety valve" to stabilize prices in the U.S.

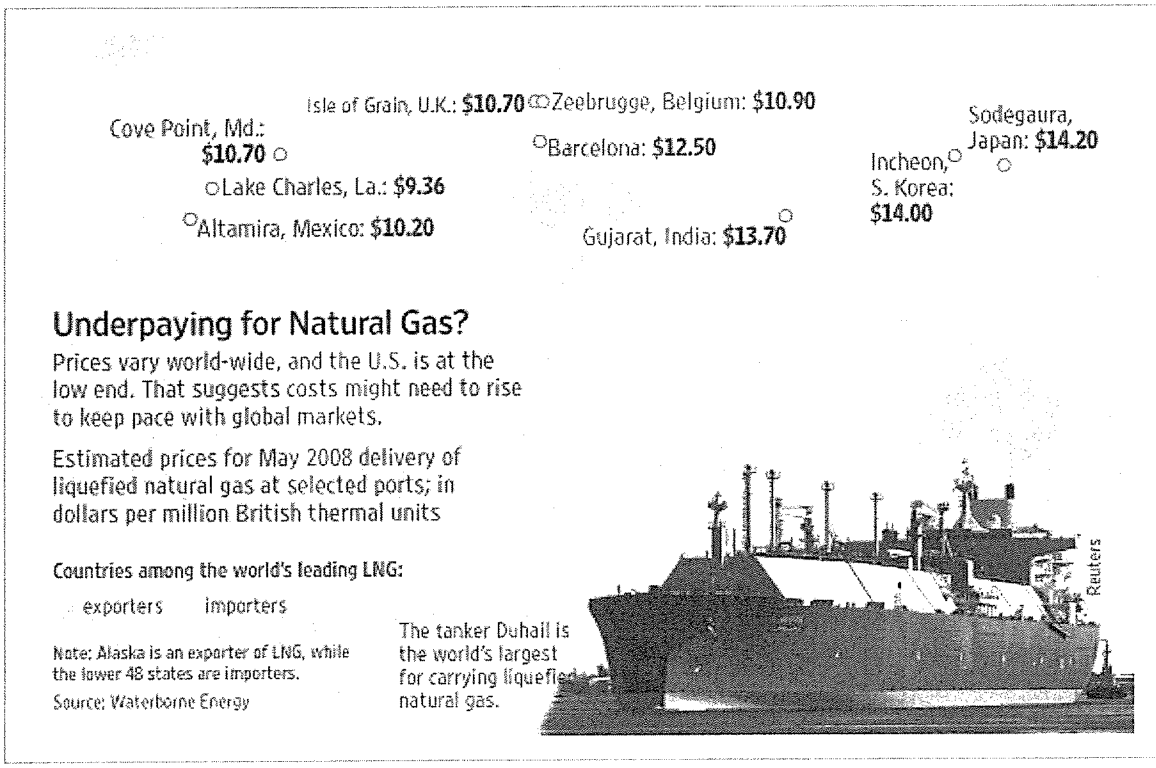
Sellers With Clout

But the market is evolving differently. One key change involves the way LNG sales contracts are written. Until recently, buyers were in the driver's seat: They were able to strike long-term deals and lock in their costs for many years. A seller like Indonesia, for instance, might have agreed to ship LNG to Japan for 10 years at relatively rigid prices.

Today, however, sellers have the clout. They are demanding that contracts be loosened to let them divert their output to markets where prices are higher. (In return they generally agree to share the profits with the customer.)

Free-for-All

This free-for-all has let suppliers shop their product to the highest bidder, adding to price volatility.



One example: When an earthquake last summer forced a massive Japanese nuclear plant to close, utilities there ramped up natural-gas use. Prices soared in Japan, which in turn drove up prices in far-off European countries, including the United Kingdom.

This kind of situation can trigger domino effects world-wide. Late last year, the global scramble for scarce LNG worsened as a drought hit Spain, cutting its ability to use hydroelectric power. Spain normally leans on neighboring Algeria and Egypt for LNG imports -- but in February those countries were busy shipping to Japan where prices were twice as high as Spain.

Turning to Trinidad

Spain turned to Trinidad for imports. But that has meant less gas for the closer -- but lower-priced -- U.S. market, which in the past has taken most of Trinidad's output. Trinidad's shipments to the U.S. through the first two months of the year are down 31% from the year-earlier period, according to government data.

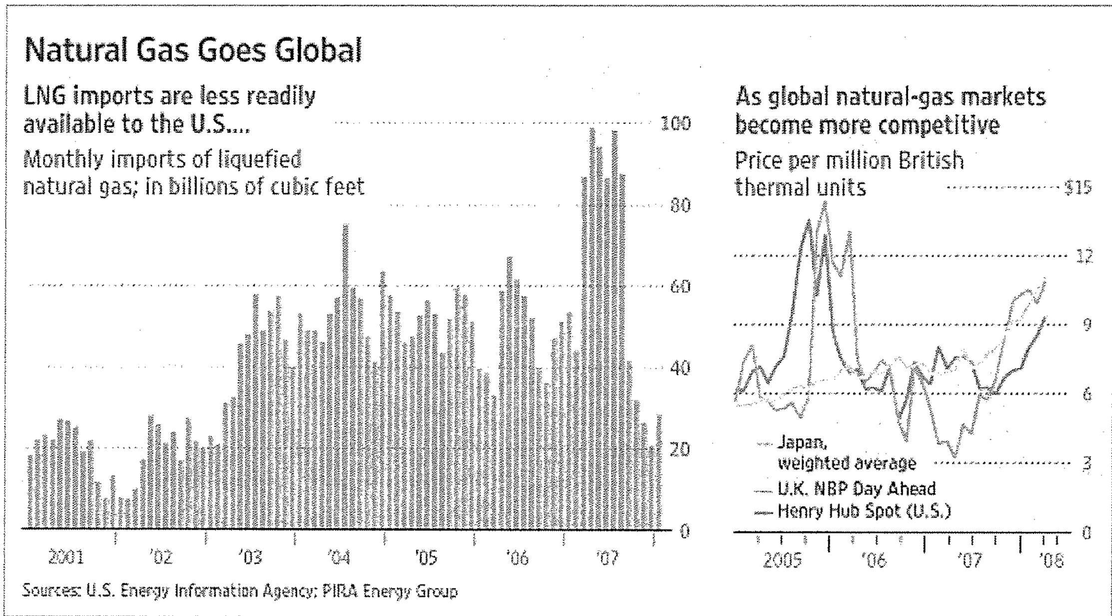
Not everyone agrees U.S. natural-gas prices are certain to rise. Domestic producers such as Chesapeake Energy Corp. have made significant strides tapping into new sources of natural gas, sending U.S. gas production up 7% in January from a year earlier, to 68 billion cubic feet a day.

Chesapeake Chief Executive Aubrey K. McClendon sees production continuing to grow, holding U.S. gas prices between $7 to $10 per million BTUs and avoiding the need to increase imports. And Michael Stoppard, a senior director of energy consultant CERA, predicts world LNG supply will grow by 30% in the next two years, making more chilled gas available for the U.S.

Nevertheless, more financial players are lining up against the bears, saying low prices won't last. They point out that, even as U.S. production increased in 2007, prices still rose 19%.

Meantime, as Asian buyers grab more LNG from the Atlantic basin, U.S. prices, though at 27-month highs, still look cheap. Energy hedge funds in Houston and New York have placed a flood of bullish bets on U.S. gas prices for delivery several years from now, say some of the traders and their Wall Street brokers.

One argument underpinning that bet: U.S. gas is far cheaper than it has historically been relative to crude oil. Until 2004, the price for a barrel of oil was roughly the same as the price of 6,000 cubic feet of gas, the equivalent amount of energy. Now oil is almost double the price of gas on that basis, Lehman Brothers analysts point out.



In a twist, the effort to build alternative-energy projects like solar arrays and wind farms also boosts construction of gas-fired plants. Because wind is unpredictable, it's often necessary to build back-up generators, and gas-fired plants have an advantage in that they can be started up relatively quickly, says Doug Kimmelman, senior partner with Energy Capital Partners, a private-equity firm focused on the power sector.

In addition, regulatory approval and construction times are shorter for gas plants than coal or nuclear. For reasons like these, new gas-fired power plants continue to be built or planned.

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