

**NYS Smart Grid and the Energy Economy
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Draft: David Manning & Ann-Marie Scheidt
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Good morning and thank you for giving me the opportunity to speak to you today about the future of natural gas in our national energy economy for the U.S. and New York State.

I want to congratulate the Manhattan Institute on selecting this very important topic for today's program and for bringing together such a knowledgeable panel to discuss it. I know that I will have learned a lot when the program ends later this morning and I am confident the members of the audience will have as well.

By way of background, I have recently retired after 50-years in the energy utility business.

I grew up in Brooklyn, attended New York City public schools and received both bachelor and master degrees in mechanical engineering from the City College of New York.

Upon graduation, I went to work for AT&T and quickly realized that I could get lost in a company employing hundreds of thousands of people, and left to go to work for a small natural gas distribution company in Brooklyn.

The Brooklyn Union Gas Company had about 2,000 employees and 500,000 gas customers in Brooklyn, Queens, and Staten Island when I joined them. Natural Gas had arrived in the New York metropolitan area in the early 50's and over the next 20 years Brooklyn Union grew to over 1-million gas customers, by converting oil heat users to natural gas.

In the seventies it was believed we were running out of gas in the U.S. and domestic supplies were supplemented by imports of liquefied natural gas (LNG) from Algeria and methane produced from petroleum products. Once the price of natural gas was deregulated, at this wellhead, drilling increased, resulting in a surplus of natural gas, the "gas bubble" which lasted through the early 80's.

Concern about gas supply surfaced again in the 1980s and a move was made to increase imports of natural gas from Canada to provide as much as 20% of U.S. supplies.

In 1994 when I became Chairman of the American Gas Association, my theme was "Natural Gas, a bridge to a clean environment."

Its emphasis was on the fact that natural gas was the cleanest burning fossil fuel and had the potential to displace oil and coal and significantly reduce emissions resulting in a cleaner environment. A concept that is perhaps even more valid today.

Unfortunately, due to concerns about supply and price volatility, natural gas, with the exception of its use in electric generation, has not had the opportunity to expand usage in gas-fueled vehicles, distributed generation and other applications.

The development of highly efficient gas turbine technology by General Electric and Siemens has led to the construction of a number of combined cycle electric generating plants, which can be permitted and constructed in a relatively short period of time, 18-24 months, and are particularly suitable to meeting the increased peak electric demand.

In the late 90s concern was again raised about domestic natural gas supplies and plans were made for dozens of liquefied natural gas import projects which would, if constructed, provide about 20% of U.S. natural gas supplies. As it has turned out, only 2 or 3 of these import terminals will be completed as it was realized that there were tremendous reserves of natural gas right here in the United States, with some estimates being as much as a hundred year supply.

What has happened to so dramatically change the natural gas supply picture?

The ability to supplement domestic natural gas production with imported gas from Canada and LNG, substitute gas from coal, landfill and biogas remains, but the major difference is the tremendous estimated natural gas resource potential attributed to natural gas produced from shale.

New drilling and completion technologies have allowed the inclusion of this significant resource volume in the U.S. undiscovered resource base. At current levels of natural gas consumption, it is estimated that this resource potential has the ability to meet our increased needs for as much as 100 years.

There are a number of factors which have contributed to this increase in natural gas reserves.

- Improvements in directional drilling / fracking technology (the process whereby natural gas producers fracture shale rock formations to liberate new sources of natural gas trapped within) reduced the cost of shale formation natural gas production by about 200%.
- A few short years ago, the National Petroleum Council study in 2003 missed the shale play due to its then high cost. That study anticipated a ramp-up in the use of LNG in the

U.S. Pulitzer Prize winning Daniel Yurgen said in a speech that year that LNG could represent 25% of U.S. supply by 2020.

- The current global recession has dramatically impacted energy pricing. With the emergence of an expanded global market for LNG and newly counted shale reserves, natural gas in the domestic market is very affordable.

This is the substance of the bonanza. According to the U.S. Energy Information Administration, the United States uses about 23 TCF of natural gas per year. At current rates of consumption, the Marcellus gas resource alone may be large enough to supply the needs of the entire nation for some 15 years.

For New York, which has among the highest costs for electric power in the nation, a fuel that is not only significantly lower cost at the wellhead but whose wellhead is within the state, this is a very attractive proposition.

At the national level, a study by energy consultant Navigant for the Chesapeake Energy-funded Clear Skies Foundation concluded that the total national shale gas supply may amount to as much as 100 years worth of national need – again, at current rates of consumption. On the numbers, this is good news.

After spending a career in the energy business, I have a hard time believing that current rates of consumption will remain stable. It is also unlikely that when consumption rates change, the change will be a decline: at least in the short term, electric energy consumption alone will continue to increase.

Where I live on Long Island, our public utility is projecting a 50% increase in consumption by 2019 before demand reduction. That is what the good news is about: we will be able to keep the lights on, keep people warm in winter, and we will be able to move towards independence from imported sources while doing it.

But the good news is not undiluted, and it is not a permanent, long-term solution to our state's or our nation's or our world's energy needs. We need to be mindful of another warning: the devil is in the details. The Institute has assembled a well-informed panel that will be addressing these details and I would like to point out a few of the details, which are not small, before turning this over to the experts.

Let's start with the environment. Natural gas is environmentally attractive because it is a clean-burning fuel. It emits the lowest amount of carbon dioxide per calorie of any fossil fuel. In the national scheme of things, shale gas offers both greater energy independence and a greener supply of energy.

But, because of the large amounts of water required for hydraulic fracturing, extracting natural gas from shale also poses environmental challenges, including, but not limited to:

- Supplying water for well construction without affecting local water resources,
- Avoiding degradation of small watersheds and streams as substantial amounts of heavy equipment and supplies are moved around on rural roads, and
- Safely disposing of the large amounts of potentially contaminated wastewater that will be recovered from the wells.

As an engineer, I approach these issues as engineering challenges and I believe they can be met and they have to be met.

More importantly, U.S. energy policy, which will be tracked by Canada, creates a bullish environment for natural gas for the following reasons:

- A vigorous debate around climate change could well result in legislation this year which establishes a cost of carbon through a sector-specific cap-and-trade system. Officially, the Democrats continue to pursue an economy-wide trading system with EPA regulation as a fallback.
- Regardless of the outcome of the GHG debate, an energy bill driving increased energy efficiency and renewables has good support. This is driven by the popular quest for energy independence from difficult geo-political supplies, and the hope for increased employment within a green energy economy.
- Any moves to mandate or incent any energy-efficiency and renewables will inevitably be a positive for natural gas. There are a host of current technologies requiring natural gas that have not been fully deployed because of threshold cost and the availability of cheap power from coal. Examples include:
 - Combined Heat & Power – a technology that ranges from heat recovery in massive power stations and manufacturing facilities to micro applications from home use. A McDonald's French fry factory in Oregon operates on waste heat from a Canadian gas-fired combined-cycle generating station built to replace dams on the Columbia River.

The Honda “FreeWatt” unit operates a single cylinder power generator for the home, which captures nearly 100% of its waste heat for the home furnace or hot water system.

- Let’s talk about energy storage – this is the biggest challenge to interruptible power such as large solar and wind. While batteries, salt storage, and other technologies are pursued, the best support to balance interruptible power is the availability of gas-fired generation, which is efficient and available on short notice.
- What about Natural Gas Vehicles – California recently introduced a low-carbon fuel standard, and the 11 RGGI states of the U.S. Northeast entered an MOU on December 30th, 2009, to replicate that effort. While the long-term vision is the electrification of the transportation fleet, natural gas vehicles represent current technology appropriate for fleet use.

Recent technological improvements have increased the performance and reliability of large engines for large bus and major transport use.

- What about Coal-fired generation – America gets over 50% of its power from coal-fired generation and in many states jobs are dependent on coal, either as producing regions or for the very affordable power it generates. Earlier attempts by the current administration to reduce coal use now translate into “clean coal technology”.

Carbon capture and storage, and coal gasification are developing technologies but remain very expensive, with an uncertain outcome.

- Progress Energy recently decided against a \$330 million scrubber investment at a North Carolina coal plant, instead opting to repower another coal plant to natural gas at a cost of \$900 million. A 950 MW gas unit replaced a 397 MW coal unit, driven in part by the fall in natural gas prices. The company’s CEO was quoted: “it was like deciding whether to put a catalytic converter on a ’52 Chevy. When you can buy a new car?”
 - The EPA has a massive and aggressive regulatory calendar, impacting “maximum available control technologies” for hazardous air pollutants, a CAIR (Clean Air Interstate Rules) replacement for Criteria Pollutants (ozone, particulate matter, SO₂, NO_x), a greenhouse gas cap-and-trade system under the Clean Air Act or by legislation, new source review reform, and multiple other regulations such as mercury and lead. A very ambitious agenda, which will need natural gas as part of the solution.

- The natural gas industry, upstream petroleum producers and refiners were largely left out of the Waxman-Markey process as they neglected to engage. They are now working overtime with senators, regional members of Congress, and lobbyists, to engage with the process and demonstrate that “you can’t get there from here” without natural gas.

Therefore, while the Waxman-Markey process shows a reduction in the use of natural gas, more recent statements have embraced increasing supplies of domestic energy.

Bringing this closer to home, what does this mean for New York?

The Marcellus Shale formation is believed to extend from West Virginia to upper New York State. Production of this gas from the shale formation in an environmental sensitive way can mean significant income to land owners through lease payments and royalties.

New industries can be developed based on this economic energy supply resulting in thousands of jobs in an economically depressed region.

The final point I would like to make is that what we are talking about here is transition. Whether the transition lasts for 15 years or 50 years, the pattern of economic and societal behavior that our country has pioneered, in which a single country that represents less than 5% of the world’s population uses almost 25% of the world’s energy resources, isn’t sustainable.

The fastest growing petroleum user in the world is China, despite its commitment to coal power, and it is far from the only country in the developing world that is on that trajectory. We all hope for a world in which energy is abundant, cheap and environmentally friendly.

We need to get from here to there, and natural gas offers an excellent pathway if we produce and use it wisely.

All of this can result in natural gas providing that bridge to a cleaner environment.