Natural Gas and Alternative Technologies: Tools for a New US Gas Security Strategy

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1. Introduction

This discussion will focus on the energy security implications of a global natural gas market and the potential for a suite of technologies to address associated policy concerns of the U.S. government.

United States' policymakers use "oil security" as code for "energy security." This narrow definition is, however, inadequate for the U.S. to effectively address the growing energy security challenges of the 21st century. Global demand for all fossil fuels is rising dramatically, competition for capital to produce and deliver energy to markets is increasing, and global energy trade is rapidly expanding. These trends could alter geopolitical relationships and strategies in very significant ways, requiring a broader energy security policy focus than the "oil-centric" one of the last fifty years.

Natural gas is the most prominent new entrant in the energy security arena. Its elevated status is due to several factors:

- Global growth in energy demand, with natural gas topping the list of energy sources to meet that demand;
- The global abundance of gas as an energy resource, with roughly 6000 tcf of proved reserves;
- The location of proved gas reserves, which are remote from the largest centers of demand growth.

In addition, over the next decade, worldwide environmental concerns and associated national, regional and local regulatory drivers will place additional demand pressures on natural gas, as the cleanest of the fossil fuels. These include: the Kyoto Protocol, the implementation of which will affect different regions in different ways, possibly creating gas demand "sinks" as signatory nations seek to meet pending emissions target deadlines; the contributions of gas combustion to climate change and air pollution; requirements for low sulfur diesel fuel which, by reducing the fungibility of oil-based fuel, will strain global refining capacity and provide new impetus for the development of gas (and coal) based alternatives; and local efforts to mitigate energy-related pollution and associated health impacts, particularly in the emerging megacities of Asia and Latin America.

2. Key Features

The discussion will review:

- Energy, environmental, and natural gas drivers and trends;
- Technology challenges specific to natural gas, and technology pathways, and;
- Illustrative technologies that could help meet fundamental U.S. energy security policy principles.

Natural gas technology challenges to be discussed include:

Development of unconventional gas resources. While the U.S. has no current options to substantial oil imports (it is limited by geology), this is not necessarily the case with natural gas. The magnitude of the US technically recoverable resource base should offer encouragement to those who are concerned about the policy impacts of reliance on high levels of gas imports in the longer-term. The United States has around 1400 tcf of undiscovered technical resources, exclusive of proved reserves. Given the decline curve of conventional production and the need for new technologies to produce technically recoverable resources, it would seem prudent -- as existing fields are depleted -- to invest in developing the technologies that will be required to economically produce technical reserves in the future.

The U.S. National Petroleum Council's report, "*Natural Gas: Meeting the Challenges of the Nation's Growing Natural Gas Demand,*" acknowledged the difficulties of supplying a 30-plus tcf natural gas

market. While the Council concluded that U.S. reserves of natural gas were sufficient to meet demand over the next two decades (perhaps a little optimistic in today's environment), it also noted that major increases in U.S. gas supply – as much as 50% of current consumption – would be, in part, attributable to successful and accelerated R&D investments in technologically difficult production regions such as ultra-deepwater and unconventional formations.

Accessing stranded gas reserves. Natural gas reserves are abundant but markets are limited by the inflexibility and expense of gas transportation. Over 30% of the world's approximately 6000 tcf of proved gas reserves is stranded – these reserves have no access to markets and no commercial value. The longer-term environmental benefits of natural gas will not be fully realized without monetizing these stranded reserves by: increasing natural gas transportation options, such as LNG and long-distance pipelines; decreasing processing and transportation costs; and promoting increased gas use in select economic sectors and geographic regions.

While LNG and gas pipelines involve relatively mature technologies, there are some pressing issues that require technology solutions for each of these segments of the gas industry. Also, longer term but with potential to radically alter the economics of natural gas transportation and the growth of regional markets is research in gas-to-liquids (GTL) technology to transport natural gas in greater quantities over longer distances. Finally, compressed natural gas technologies could fill a niche market and help monetize smaller gas fields, which are currently unattractive targets for LNG investment.

Expanding the gas resource base by developing alternative energy resources. Natural gas is a critical component for meeting global energy demand over the next two decades. Further, the environmental benefits of gas consumption are powerful incentives to use gas over other conventional fuels. There are however vast reserves of coal around the world, much of them in regions that have substantial energy demand growth and insufficient conventional gas to meet demand, such as China and the U.S.

This suggests the need to enable the use of coal (as well as biomass and other renewables) to natural gas, assuming that these fuel sources can achieve levels of environmental performance that are on par with, or exceed those of natural gas. Unfortunately, global energy demand is pressing up against this environmental imperative, without corresponding market penetration of technology solutions to affordably and substantially mitigate the environmental impacts of coal combustion.

Mitigating the environmental impacts of gas consumption. Mitigating the environmental impacts of fossil fuel consumption, including natural gas, takes on an added level of urgency with increased overall energy demand, patterns of energy use, in which 86% of total primary consumption is fossil fuels, and the abundance and location of coal reserves in high demand locations in the developing and industrialized world. The health and economic impacts of energy consumption on the world's megacities and the security implications of global climate change places additional pressure on policy makers to marshal the resources, technologies and policies to adopt measures to reduce air pollution and to dramatically slow the rate of growth of greenhouse emissions sufficient to avoid the destabilizing "doubling" of pre-industrial emission levels.

Finally, the discussion will review and identify gaps and opportunities in comprehensive energy legislation passed by the Congress last year and in subsequent budget requests by the Bush Administration.

3. Conclusions

The discussion will conclude with a brief review of four world scenarios for 2020, outlined in the National Intelligence Council's, *Mapping the Global Future* in late 2004. Each of these scenarios suggests a different portfolio of U.S. energy security policy and investment choices, informed by the technology challenges of natural gas. These choices will be outlined and discussed.

4. References and Bibliography

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4. Prindle, B., 2003, "Energy Efficiency Solutions to the Nation's Natural Gas Problems," Washington, D.C., American Council for an Energy Efficient Economy.

Speaker's Biography

Melanie A. Kenderdine joined GTI in March 2001 as the Vice President of GTI's Washington Operations Office, USA. At GTI, Ms. Kenderdine is involved in major initiatives to increase domestic natural gas supply, enhance energy efficiency and security, and promote the research needs of the natural gas industry. She is the principal architect of the Ultra-deepwater and Unconventional Natural Gas Supply Research and Development Program, a $500 million R&D trust fund included in the Energy Policy Act of 2005 and a co-founder of the Research Partnership to Secure Energy for America, a non-profit natural gas research management organization.

Prior to joining GTI, from 1993 to 2001, Kenderdine served in several key posts at the U.S. Department of Energy (DOE). Her last position at DOE was Director of the Office of Policy. She was a key advisor to the Secretary on a variety of issues, including: negotiations with oil-producing nations to increase oil production; the California electric power crisis; establishment of a home heating oil reserve for the Northeastern United States; and the Strategic Petroleum Reserve. Concurrently, Kenderdine served as the Senior Policy Advisor to the U.S. Secretary of DOE for oil, gas, coal and nuclear issues, and was the primary architect of: R&D initiatives for ultra-clean fuels and energy grid reliability; the Strategic Petroleum Reserve royalty-in-kind initiative; and creation of the National Energy Technology Laboratory, including a Strategic Center for Natural Gas Studies. Kenderdine also managed the DOE response to the Japan nuclear accident in 1999. Prior to joining DOE, she worked as chief of staff and legislative director for then-New Mexico Congressman Bill Richardson, who was later named US Secretary of Energy.

Ms. Kenderdine has served on a variety of energy advisory bodies, including a Council on Foreign Relations Task Force to develop a national energy strategy; on a Task Force to advise the Taiwanese Government on energy R&D; and on the Consumers Energy Council of America Working Group on Distributed Energy. She is on the Board and Executive Committee of the Research Partnership to Secure Energy for America, the Colorado School of Mines Energy Advisory Board, and the Keystone Energy Board.

Kenderdine has testified before the U.S. Congress on numerous occasions, most recently before the Science Committee of the House of Representatives, to discuss alternative energy research models for the US Department of Energy. Kenderdine has published articles in *Harts E&P* and *Physics Today*, and recently co-authored a chapter in "*Energy Security in the 21st Century: A New Foreign Policy Strategy,*" entitled "Technology Development and Energy Security" published by the Woodrow Wilson Center. She is a frequent speaker on energy issues at conferences that include: the World Petroleum Congress in Johannesburg, South Africa; the OPEC Conference on Sustainable Development in Vienna; the Sixth Annual International Energy Experts Conference in Abu Dhabi; the Baker Botts Energy Symposium in London; the Oxford Energy Institute; the IEA Oil Data Conference in Bangkok; the Montreux Energy Roundtable in Switzerland; the 10/50 Conference at Pew Center for Climate Change; and the Energy and Nanotechnology Conference at Rice University's Baker Institute.