Natural gas offers huge climate mitigation potential, but assuring demand is key

By Mark Thurber
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Transforming the world's energy supply system to avert dangerous climate change is often posed as a question of replacing dirty coal power with nearly carbon-free renewable energy (or nuclear power), and switching out oil-guzzling cars for electric vehicles. The problem with this vision is that even fast-growing renewable energy—with its challenges of cost-competitiveness and integration into the grid—will require many years to supply a portion of global energy that is anywhere near what we currently get from fossil fuels. Nuclear power can be part of the solution but faces its own problems of plant economics and construction lead times, as cost overruns and delays on Areva's new project in Finland have demonstrated. Capturing and storing carbon dioxide from coal plants may yet prove feasible but remains expensive and unproven at scale. On the transport side, hybrid and electric vehicles will have little positive climate impact if they draw from a carbon-intensive electric grid. These technologies are also difficult to apply to the buses and heavy vehicles that are some of the largest emitters of carbon dioxide.

In fact, it is the neglected stepchild of the climate debate, natural gas, which has the most potential among energy supply options to achieve cost-effective greenhouse gas reductions in the near term. Substituting natural gas for coal in power generation cuts CO_2 emissions by more than 50%. Natural gas vehicles (NGVs) have a greenhouse gas footprint that is 20% reduced relative to their gasoline-powered equivalents. Natural gas burns much more cleanly than either coal or oil—a particular attraction in developing countries where toxic or smog-forming pollutants from power plants or vehicles might not otherwise be controlled.

Making the prospects for natural gas even brighter is a revolution in the last several years in technology for extracting "unconventional" gas that was previously inaccessible.

Unconventional gas resources include gas in coal deposits (coal bed methane, or CBM) or in shale rocks that have too few pores for the gas to move freely and be extracted by conventional wells.

The United States is leading the unconventional gas revolution. According to the International Energy Agency's World Energy Outlook 2009, the US currently accounts for three-quarters of global production of unconventional gas. Domestic gas production that was on the decline in the early 2000s ascended to new heights in 2008 on the back of unconventional drilling in places like the Barnett Shale in Texas. Other promising geology for unconventional gas exists in the neighboring states of Arkansas and Louisiana as well as to the northeast, in West Virginia, Pennsylvania, and New York.

As for the rest of the world, there is still too little known to characterize resources with any certainty. However, it is believed that the new possibilities for unconventional gas will dramatically expand gas supplies elsewhere too, including in the crucial emerging markets of China and India. These countries are acutely concerned about their own energy security and would thus welcome enhanced domestic gas production. Substituting natural gas for coal would also go a long way towards relieving the local air pollution burden for citizens of these rapidly-growing nations.

From the perspective of expanding the role of gas in the energy system, the much improved supply picture for natural gas cuts in two ways. On the one hand, it encourages gas use by lowering prices and reducing perceived risk around long-term supply. On the other hand, a gas glut deters further expansion of supply, as gas project developers worry that the prices they will receive for gas will not justify their massive investments. Developers of expensive liquefied natural gas (LNG) infrastructure have been particularly hard-hit by the evaporation of US demand for LNG imports.

Given the potential for gas to yield environmental benefits at a lower cost than alternatives like renewables and CCS, allowing a gas glut to persist represents a policymaking failure. Because it requires especially costly infrastructure in the form of pipelines or LNG in order to reach consumers, the unique challenge of natural gas has always been to develop demand in concert with supply. Historically, this has never been accomplished at scale without

significant government involvement. Today's situation is no different. Governments worldwide need to support growth in global gas demand through actions in several main areas.

First, governments need to establish market pricing of energy that includes environmental externalities. In the developed world, the first step towards countering biases against natural gas is the creation of a carbon price. Europe already has one, and its Emissions Trading Scheme has indeed had an impact in shifting utility dispatch economics in favor of gas plants. Legislation introduced in the Senate last week by Senators Kerry and Lieberman could be the first step towards putting a price on carbon in the United States, although the immediate political prospects of the bill are uncertain.

Other countries present even more fundamental barriers to the development of a gas market in the form of controls on gas price that ensure that no one will invest in new gas infrastructure. Almost 40% of Nigeria's gas production is uselessly flared because controlled domestic gas prices have discouraged investment in gas infrastructure for the domestic market, while controlled power prices have quashed interest in building gas-fired power plants. Allowing prices to rise to nearer to market values would serve four objectives at once: reducing a climate impact from flared gas equivalent to 10 large coal plants, removing flaring as a source of contention in hydrocarbon-producing communities, yielding more revenue to Nigeria from gas sales, and providing gas to fuel domestic power generators and improve the country's woeful electricity system.

Second, governments need to place greater priority on developing end-use applications for gas and the associated infrastructure for gas delivery. Support for natural gas vehicles (NGVs) and associated refueling infrastructure is one useful step. The International Association for Natural Gas Vehicles estimates that four countries—Pakistan, Argentina, Iran, and Brazil—each have more than 1 million such vehicles (www.iangv.org). The US, with slightly more than 100,000, has significant potential to grow its NGV fleet, with an appropriate initial focus being on expanded NGV use in government and commercial fleets of heavy-duty vehicles that are both easy to refuel and particularly advantaged by the technology. The Kerry-Lieberman climate bill would expand tax incentives aimed at increasing fleet penetration of NGVs. Replacing largely imported oil with natural gas that now appears to be domestically plentiful is a political winner.

Replacing coal with gas for power in developed countries is another needed step; equally important from a climate perspective is to shift new power plant builds in rapidly developing countries like China and India towards gas. In key countries like these where gas availability is a major constraint, foreign governments that care about climate change, supported by multilateral development banks, should be willing to provide financial support for gas pipelines or LNG terminals that might otherwise not be built. And when it comes specifically to the proposed Iran-Pakistan-India gas pipeline, the US should drop its geopolitically-motivated objections and let the project go forward for the climate (and possible regional security) benefits it would provide.

Third, governments and commercial players should act collectively to ensure widespread application of the new technologies to unlock unconventional gas. (Along the way, a key enabling item for such technologies will be the refinement of regulatory frameworks that safeguard against environmental damage during drilling.) The "U.S.-China Shale Gas Resource Initiative" jointly announced late last year by President Barack Obama and President Hu Jintao appears to be one such step in this direction. More win-win alignments of this kind are likely between various actors. Countries like China and India have strong interest in ensuring that limited domestic energy supplies do not crimp their growth. The independent gas companies that have led the unconventional gas renaissance in the US have every incentive to seek out new markets abroad. Oil services companies already thrive in supplying gas production technology to companies around the world, and they can continue to do so for unconventional gas. The oil and gas supermajors offer deep financial capacity to take on risky international projects and the management skills to develop complicated gas supply chains. In general, the very nature of unconventional gas—which requires continuous new drilling to keep the gas flowing—should provide some additional protection for investments around the world relative to conventional gas wells which keep flowing long after the huge initial costs have been sunk.

A gas vision that looked cloudy only several years ago, with US production apparently drying up and Europe fretting about excessive dependence on Russia, now seems much brighter thanks to the potential of unconventional gas. The main thing now that could stop the ideal "transition fuel" to a low-carbon future from making a positive impact is insufficient effort to develop demand. Because of the particular dependence of gas on expensive transport

infrastructure and market-based pricing that incorporates environmental externalities, government policy can help!