Securing America's Future Energy

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Lots of Natural Gas, but No Storage Standards

SUMMARY

- Global gas production is growing rapidly. In fact, while oil production has surged more than 60 percent in the last four decades, gas production has increased by 200 percent over the same period. As this trend continues, it is critical for producers and policymakers to examine the key issues surrounding gas storage.

- Storing natural gas is much more complicated than storing oil. Every stage of the value chain is pressurized, and loss of pressure at any point can lead to tragic consequences. As such, gas storage is more expensive to construct than oil storage facilities.

- Unlike oil, there is no international standard for gas storage. European and Asian countries in particular need to plan to secure future gas supplies as they increase gas consumption and try to diversify their fuel mix away from oil.

ANALYSIS

It will be no surprise to readers that the importance of gas as a fuel has grown tremendously. As mentioned above, over the last 40 years, global gas production has increased by 200 percent. The difference is equally pronounced over the last 10 years, with gas production growing by almost 30 percent while oil production grew by just under 10 percent. This trend is projected to continue into the future, with the International Energy Agency (IEA) predicting gas will grow more than any other fuel in the period to 2035.

These differential growth rates reflect fundamental changes in the way the two commodities are used. In 1971, oil was the fundamental fuel of the entire economy. Coal was used for power generation, and gas was used in a number of local applications, but oil was the proverbial "King of the Hill," and used for everything. The picture has shifted dramatically since then, with gas displacing both coal and oil for power generation. Gas, often called the Prince of Hydrocarbons, has muscled its way into the power generation sector, leaving oil essentially a transportation fuel. In the U.S., gas's share in power generation rose to 23.3 percent in 2009, the highest since 1970, according to the US Energy Information Administration.

Meanwhile, the geography of the global gas market has changed. In the 1970s, natural gas supplies were for all practical purposes a domestic affair with little or no exports to foreign markets. Whereas today, roughly a third of global gas production is traded across borders, of which roughly 60 percent is traded inter-regionally, either as LNG or as pipeline exports from Russia and North Africa into the European Union.

Primitive Gas Storage in the Modern World

So while the role of gas has changed dramatically, the global approach to securing gas supplies has not, and remains more primitive than the oil security system before the first oil shocks occurred. In the wake of the 1970s oil price spikes, a series of oil storage reforms – creation of the Strategic Petroleum Reserve (SPR) in the U.S and formation of the IEA by wealthy, consuming nations – lowered the threat of dramatic supply disruptions.

In contrast, policies for securing natural gas supplies are still determined on a country-by-country basis, with no agreement on international standards for either strategic stocks or stock releases. While this was reasonable when gas was a marginal fuel, it seems increasingly cavalier considering the role of natural gas in the energy system today.

As such, governments, especially in Europe, need to focus attention on securing gas supplies, and do so before there is a crisis on the same magnitude as was seen in 2006 and 2009 with supply disruptions from Russia to Europe.

A Primer on Energy Storage

In order to understand how gas supplies are secured today – and why they may need to be secured differently in the future – it is worth examining the history of energy security policy, especially concerning oil stocks. During the oil crises of the 1970's, two organizations came to dominate international energy policy, the Organization of Petroleum Exporting Countries (OPEC) and the IEA. While OPEC is the more commonly-known of the two, the IEA is the more important organization for understanding the history of strategic oil storage. The IEA was established to allow the major oil consumers of the day, the developed economies of Europe, North America and Japan, to coordinate energy policy. In particular, the IEA coordinates oil stocks policy, and IEA member states are required to maintain oil stocks equivalent to 90 days of net imports. Although it does not appear to have any objective basis, the 90-day requirement has become an article of faith in energy security discussions.

Historically, there has been debate about what metric to use when measuring stock levels: days of imports or days of consumption. If one is primarily concerned about geo-political disruptions overseas, then imports is the best measure. However, as we saw during Hurricane Katrina, domestic events can also have a major impact on oil supplies, and a measure based on days of imports may leave oil-producing countries vulnerable to domestic disruptions. The international standard for oil storage developed following the oil crises of the 1970s is the IEA's requirement that member states hold 90 days of imports. The European Union, however, requires EU member states to hold 90 days of consumption (reduced by a third for oil producing countries). The EU is in the process of transitioning to the IEA's import-based standard by 2015.

Gas security was not a concern in 1974 when the IEA was established. LNG was an exotic, but marginal technology, and Russian gas exports into Europe would not be commissioned for another decade. A further two decades would take place before the LNG trade developed into a properly internationally traded market.

This lack of attention to gas by the IEA in 1974 was convenient, because gas is a more complex fuel than oil to manage. Oil is a liquid at room temperature, making it relatively straightforward to store. Every refinery, import terminal, pipeline junction, gas station, and gas tank is also an oil storage facility.

Storing gas is much more complicated. Every stage of the value chain, from pipelines to home propane tanks, is pressurized, and loss of pressure at any point in the value chain can lead to tragic consequences. A 2008 European Commission report estimated that gas storage facilities are between 3.6 and 5 times more expensive to construct than oil storage for an equivalent amount of stored energy. The reason for the expense is that all but the most expensive options (above ground storage) depend on favorable geological features to store the gas, usually depleted oil and gas fields or salt caverns.

Improving Gas Storage Policies

In particular, gas security policies tend to focus on ensuring supplies through contracts and increasing flexibility on the demand side, both of which can help to enhance security. Unlike oil, the majority of the world's international gas trade is governed by long-term contracts. While this provides consumers an assurance they will receive physical supplies in the event of a shortage, it does little to help if gas is disrupted for political or physical security reasons. Long-term contracts did not ensure gas deliveries to Southeast Europe during the various Russia/Ukraine disputes during the second half of the last decade, nor have they ensured deliveries when infrastructure has been damaged.

Increasing flexibility on the demand side helps limit the impact of supply disruptions. In the gas system, there are two main options for increasing demand side flexibility: interruptible supply contracts and fuel switching. Interruptible contracts allow gas suppliers to switch off supply to major industrial consumers for a limited period. In return, the industrial consumer may be rewarded with a slightly lower gas price. Interruptible contracts help to cushion the blow of a disruption, but are not a long-term solution.

Fuel switching involves gas-burning power plants switching to another fuel, such as oil, reducing the impact of supply disruptions. Fuel switching provides a longer-term solution than interruptible contracts, as dual-fuel plants can remain on the alternate fuel indefinitely. However like interruptible contracts, it is not a complete solution because only a portion of gas will ever be consumed at dual-fuel plants.

These measures may help cushion some sorts of disruptions, but they are not adequate. Fortunately, because gas demand varies seasonally from summer to winter, there is a built-in commercial incentive to construct gas storage facilities that could store gas during low-price periods for release during periods of high prices. Nonetheless, only one major gas importer, France, has more than 90 days of net imports storage (around 99 days), and only one other major importer Germany (around 82 days) comes close. Japan, which is entirely dependent on LNG imports, has roughly 34 days of storage.

Other countries are not so lucky. The UK, which produces 60% of its gas domestically and only has 15 days of storage, almost ran out of gas following a fire at a storage facility in 2006. Although information about Chinese energy plans is incomplete, it appears China is now building storage equivalent to roughly 90 days of forecast imports in 2015. At the same time, the UK and China are raising their oil stocks to the 90-day minimum. China is not an IEA member and is not bound by the IEA requirement, but has chosen to achieve it. The UK currently has an exemption from its storage requirement based on its status as an oil producer, but the UK will lose this status sometime in the coming decade as production falls.

The cases of China and the UK are important because both countries have decided they need 90 days of oil stocks but are uncertain (the UK rather more than China) about how best to secure their gas supplies. As gas production growth continues to outpace oil, driven by the global spread of shale gas technology, a set of international gas storage standards will become necessary.

Any international standard for gas storage will differ from those of oil. Natural gas security is important in and of itself, and we risk moving towards an energy system where oil disruptions are well provided for but a less resilient gas system is left vulnerable. A first modest step might be to expand the scope of the IEA to include coordination of gas supply security and invite the new major energy consumers, especially China and India, to join.

As natural gas plays a large role in meeting the world's energy needs, it is critical to have gas storage policies in place that lead to greater energy security. This is not a critical issue for the U.S., thanks to its large reserves of natural gas, its ample gas storage capacity, and its isolation from the global gas market. But gas-importing nations across the world don't have the similar luxury. It is therefore necessary for the international community to develop a system to ensure natural gas can meet the needs of each country and provide a safety net during the next energy crisis.