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To:	LNGStudy
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VIA ELECTRONIC DELIVERY

The Honorable Steven Chu
Secretary
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585

RE: 2012 LNG Export Study

Dear Secretary Chu,

Shell Oil Company and its affiliates (Shell) submit these comments in response to the U.S. Department of Energy's (DOE) Office of Fossil Energy request for comments on the 2012 LNG Export Study (LNG Export Study), published in the December 11, 2012 Federal Register notice and appearing at 77 Fed. Reg. 29894.

Statement of Interest

Shell is a global energy and petrochemical group of companies with around 90,000 employees in more than 90 countries and territories. In the United States, Shell employs more than 22,000 people and operates in all 50 states. Shell is one of the world's largest natural gas producers – we have a more diverse portfolio and supply gas to more countries than any other energy company. We are an innovator and leader in natural gas technologies, particularly Liquefied Natural Gas (LNG).

Shell helped design and build the world's first commercial liquefaction plant at Arzew, Algeria. Shell's LNG expertise goes beyond liquefaction plants. We are involved in every stage of the LNG value chain: from the upstream (finding the fields and extracting the gas from them) to the downstream (liquefying the gas, shipping, turning the LNG back into gas and distributing it to customers). Today, Shell manages one of the world's largest fleets of LNG carriers, and is pioneering the use of LNG as a transport fuel in the marine, heavy-duty road transport, and rail sectors.

Introduction

The DOE has invited comment on the LNG Export Study in order to inform the DOE in its public interest determinations of the authorizations sought in pending applications to export LNG to countries with which the United States does not have a Free Trade Agreement in place (non-FTA countries.) The LNG Export Study consists of two parts:

1. An analysis performed by the Energy Information Administration (EIA) and originally published in January 2012, entitled "Effect of Increased Natural Gas Exports on Domestic Energy Markets" (EIA Study), and;
2. An evaluation performed by NERA Economic Consulting (NERA), entitled "Macroeconomic Impacts of Increased LNG Exports From the United States" (NERA Study).

Although Shell does not have an application pending, Shell welcomes the opportunity to comment on the LNG Export Study, and the importance of its observations in the context of the emerging market opportunities driven by massive growth in North American recoverable natural gas resources. Shell is currently assessing export opportunities, at various points in the value chain, both in the U.S. and Canada.

To begin, Shell agrees with the key finding of the NERA Study:

> "Across all these scenarios, the U.S. was projected to gain net economic benefits from allowing LNG exports. Moreover, for every one of the market scenarios examined, net economic benefits increased as the level of LNG exports increases. In particular, scenarios with unlimited exports always had higher net economic benefits than corresponding cases with limited exports."

Shell also associates itself with and endorses the comments filed by the American Petroleum Institute and the Center for Liquefied Natural Gas. However, due to Shell's unique perspective and knowledge base as both a leading natural gas producer and a manufacturer of chemicals and fuels derived from natural gas, we believe that we can additionally comment on some important aspects of the discussion not fully discussed by the LNG Export Study.

As a starting point, it is Shell's view that the United States possesses structural competitive advantages that will be augmented, and not eroded, by participating in the global LNG trade. There are straightforward reasons why the US has led the world in developing its unconventional resources:

- The US permits the private ownership of mineral resources which grants private citizens a stake in ensuring that minerals are developed safely and responsibly.
- The US has a tradition of fostering open and competitive markets that allows the market, and not the government, to determine the value of goods and services within the economy. This encourages private investment in energy infrastructure and has resulted in one of the world's most liquid markets for natural gas.
- Finally, a stable, predictable and transparent regulatory environment allows energy companies to access the substantial capital necessary to advance innovative energy projects.

We believe that these US traditions constitute some of the nation's most important competitive advantages. Permitting the export of LNG would serve to augment these advantages by returning economic benefits to the citizens, encouraging additional private investment, and reinforcing the US tradition of good governance and a commitment to free trade.

Comments

Shell generally concurs with the NERA report's key findings[1] that permitting exports of LNG will accrue to the economic benefit of the United States, and that these benefits will be directly correlated to the value and volume of LNG exported from the United States.

However, the DOE's LNG Export Study fails to fully capture the nature and extent of the economic benefits associated with allowing natural gas to be sold overseas. To enhance this discussion, we will comment briefly on the following:

- The extent of the US natural gas resource base that underpins this discussion;
- The process of exploring for and producing natural gas;
- The manufacturing process of liquefying natural gas and the resultant value added to the raw commodity;
- Forecasts of LNG demand, and the potential role of North America in the global marketplace, and;
- Potential Shell investments that are based on sustained competitive domestic natural gas.

[1] Shell notes that certain assumptions in the NERA report vary from what Shell may assume in a similar analysis, but notes that on balance, differences in Shell's assumptions would strengthen, not weaken, the report's overwhelmingly positive economic findings as regards LNG export scenarios.

The US Natural Gas Resource Base is Abundant

From our vantage point as an experienced energy and petrochemical manufacturer, it is Shell's view that the US resource base is sufficient to support major investments in both domestic industrial uses of natural gas and, simultaneously, investments in efforts to sell substantial amounts of natural gas to overseas markets.

Underpinning North America's newfound abundance of natural gas is the industry's capacity to safely and efficiently develop shale gas. While geologists have known for decades that shale gas existed deep beneath many areas of the North American continent, traditional vertical oil and gas drilling methods were able to access only a small fraction of the gas within these formations. But recently, operational efficiencies and proven technology have come together to make shale gas both accessible and economically competitive. The result is transformative.

Estimates of the remaining US natural gas resource base vary, but all experts concur that the US endowment of natural gas is vastly greater than they had previously understood it to be. The DOE's Energy Information Administration (EIA) currently estimates technically recoverable shale gas resources at 542 trillion cubic feet (TCF) and total recoverable U.S. natural gas resources at 2,203 TCF[2], while the Potential Gas Committee's (PGC) most recent study estimates the shale resource at 687 TCF and total resources at 1,898 TCF.[3] In 2011, the Secretary of Energy's National Petroleum Council (NPC) comprehensive study estimated the natural gas resource base at 2,200 TCF.[4]

Importantly, the NPC's study found that the available resource is able to meet the highest estimates of demand growth, including the development of LNG exports, as well as the emergence of other new markets for natural gas, such as transportation, without stressing the availability or cost of natural gas supply to the United States.[5] A recent study by Deloitte reinforces the NPC finding, as it relates to selling LNG to overseas markets:

> "Vast shale gas resources, that are now economically viable due to technological advancements in recent years, have effectively caused the aggregate U.S. supply curve to flatten, representing greater supply elasticity. Coupled with the market's demonstrated ability to respond to market changes, the availability of large North American supplies mitigates the price impact of exports."[6]

In short, the consensus view is that the US natural gas resource base is sufficient to supply all levels of forecasted demand for decades to come, at moderate cost.

Exploring for and Producing Natural Gas Generates Significant Economic Benefits for the United States

US natural gas resources can and must be developed in environmentally responsible and sustainable ways. Risks can and must continue to be managed and mitigated. Best available technologies and operating practices must be employed. Operators should set, and meet, high standards, and support a regulatory regime that does the same. To that end, Shell has announced five operating principles for our onshore tight oil and gas operations. These provide a framework for protecting water, air, wildlife and the communities in which we operate. We strive for continuous improvement.

Yet the fact is that hydraulic fracturing has been performed more than 1.1 million times in the United States alone over the past 60 years. Documented instances of freshwater contamination have been extremely rare.

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[2] EIA, "Assumptions to AEO 2012," August 2, 2012, p. 113.

[3] See: http://potentialgas.org/press-release and http://potentialgas.org/advance-summary

[4] National Petroleum Council: *Prudent Development - Realizing the Potential of North America's Abundant Natural Gas and Oil Resources*. Page 62

[5] *Ibid.* Page 9

[6] Deloitte, "Exporting the American Renaissance Global impacts of LNG exports from the United States," January, 2013.

That natural gas is being safely and responsibly developed across the United States, is a fact that has significant economic impacts. A recent study by IHS Global Insight estimated that in 2010, the shale gas industry supported 600,000 jobs. By 2015, the study forecasts that shale development will support nearly 870,000 jobs, with that number growing to over 1.6 million by 2035.[7]

The strong job growth associated with natural gas development is particularly important in light of the fact that both the EIA Study and the NERA Study find that US natural gas markets will respond to increased natural gas exports largely through increased natural gas production. Shell concurs with the finding in the EIA Study which estimates that 60 to 70 percent of the gas likely to be sold overseas will be satisfied by increased natural gas production in the United States. Thus the emergence of an LNG export market will directly spur additional investment in natural gas exploration and production activities that would not otherwise occur, generating significant new employment, as well as substantial government revenues.

Transforming Natural Gas into LNG is a Manufacturing Process

The process of extracting, processing, liquefying and transporting natural gas comprises a complex series of expensive manufacturing processes that add significant value to the raw commodity. The world has vast quantities of natural gas, but much of it is in areas distant from where natural gas is in high demand. In order to meet these demands, significant investment must be made in the upstream infrastructure, gathering pipelines, gas processing plants, transportation pipelines of the residue gas, and the liquefaction facilities. Natural gas must be processed and transformed in a variety of ways before it can be shipped overseas.

In brief, natural gas must first be produced from wells, and then transported through pipelines to processing plants. There, water and natural gas liquids are separated, and the recovered natural gas liquids are then processed into their saleable hydrocarbon components – notably ethane, propane and natural gasoline. Substances like CO2 and sulfur are removed, resulting in a gas that is almost pure methane. This gas is then flowed into a liquefaction facility where it is cooled to around -260°F (-160°C), condensing the gas into a liquid state. The end product is a clear, colorless and non-toxic liquid that is 1/600th of its original volume. This dramatic transformation allows it to be shipped safely and efficiently – significantly increasing the value of the product.

In addition to the capital investment throughout the natural gas value chain, the capital investment necessary to design, build, and operate a liquefaction facility are very high. Costs may vary according to many factors, but the initial costs are comparable to those involved with building a major petrochemical facility or refinery – with many analysts forecasting direct investment of roughly $10 billion for a single US-based export facility. Design and construction of such a facility is estimated to take roughly four to five years, a process that will directly employ thousands, and indirectly support many more additional jobs associated with the fabrication of facility components.

Shell's View of the Global LNG Market and the Potential Role of the United States.

Demand**:**

The world's population is expected to grow to over 8 billion by 2030 from 7 billion today. GDP per capita is expected to triple by 2030 in India and China, which will elevate more than 2.5 billion people much higher up the energy ladder in the coming decades.

[7] IHS, "America's New Energy Future: The Unconventional Oil and Gas Revolution and the U.S. Economy, Volume 1: National Economic Contributions," October 2012.

The world will require continued investment in all forms of energy to keep up with demand. The International Energy Agency estimates that we will need to spend $620 billion per year in the oil and gas industry alone to match the demand growth in the coming 20 years.[8]

Natural gas and LNG have a very important role in the global energy picture, and this is going to continue. The growth in gas demand has already led to many new opportunities for LNG, to bridge long distances between supply and demand regions and to unlock remote gas reserves.

Global LNG demand doubled in the first decade of this century, reaching 200 million tons per annum (mtpa) in 2010. That's an annual average increase of 8 percent. We expect the market to double again to 400mtpa by 2020 and perhaps to reach 500mtpa in the middle of the next decade. Our forecast for 5% LNG growth per year drives the LNG share of global gas markets to over 15% by 2030, compared to 10% today.

Supply:
As the pending decisions before the DOE illustrate, the emergence of shale gas has clearly transformed the US supply outlook; import plans are now becoming export plans.

In North America, there are about 130mtpa of exports proposals on the table by the industry, in some 17 projects. If they were all to get built, these projects could account for 30% of the global LNG supply in 2020. However, there are many reasons why that is unlikely to happen. A conservative estimate for the development cost of all of these projects is over $300 billion, and this figure could be far higher, if multiple construction projects were to generate inflationary pressures.

Importantly, however, we estimate that if natural gas from the Henry Hub were exported today, it would cost over $10/MMbtu by the time it landed in Tokyo Bay – which is in the range of prices, not the cost, of LNG there over the last three years. Thus the price delta between the North American market and the Asian market is not as great as it may at first appear. North American LNG can be price competitive in some LNG markets, but we do not expect that North America's participation in the LNG trade will fundamentally change the market pricing.

Therefore, Shell expects that North American LNG exports will increase, but at a far slower rate than the list of pending export applications would imply. In a "high growth" scenario, Shell would expect that the US and Canada to contribute a total of 60 to 70mtpa of LNG supply by 2020. But we believe that 50mtpa by 2020 is more likely.

In summary, Shell offers these observations:

- The United States can play an important role in the global LNG market, but there is competition from other areas, and regulatory delays could allow this opportunity to bypass the United States.
- We do not expect US LNG exports to trigger significant changes to markets domestically or abroad.

North America's Gas Abundance is Driving Major Investments in the United States
The domestic abundance of natural gas is driving investment in the United States. Shell alone is considering several significant domestic investments – all founded on our sustained confidence in the robust and affordable US natural gas supply outlook. These concepts and their associated investment risks would not be under consideration if Shell believed that LNG exports – clearly favored under longstanding public law – would somehow create a major supply shortage or an unsustainable pricing environment. On the contrary,

[8] See the 2011 presentation at the 20th World Petroleum Congress by Maria van der Hoeven, Executive Director of the International Energy Agency: http://www.iea.org/newsroomandevents/speeches/doha.pdf Slide 8.

Shell is committed to major upstream investments across US basins. These will help directly sustain and expand the domestic production necessary to support continued opportunities to put natural gas to economic use.

Shell is currently assessing export opportunities, at various points in the value chain, both in the U.S. and Canada. However, in the United States, we're also evaluating several other potential new lines of investment including:

1. **Gas to Chemicals:** In Pennsylvania, Shell recently announced that we are evaluating construction of a world-class facility that will manufacture base chemicals, including ethylene, in the Marcellus shale region – the first construction of its kind in decades. Seven other companies have indicated that they may also construct similar facilities in the U.S.

   Rising gas supplies are giving the U.S. chemical industry a new lease on life and creating thousands of jobs in the process. A recent study by the American Chemistry Council noted the potential for 17,000 new knowledge-intensive, high-paying jobs in the U.S. chemical industry, another 400,000 jobs outside the chemical industry and more than $132 billion in U.S. economic output – all associated with the massive growth in natural gas supply.

2. **LNG for use as a transport fuel**: Recently, Shell announced a plan to make LNG available for heavy-duty fleet and trucking companies to use as a transportation fuel beginning in 2012 in Western Canada. By making LNG available on the area's heaviest truck route, we are creating an infrastructure opportunity for the market to choose LNG as a sustainable transportation fuel. In June 2012, Shell announced the signing of a memorandum of understanding with TravelCenters of America LLC to sell liquefied natural gas (LNG) to heavy-duty road transport customers in the U.S. Shell also anticipates the possibility of increased LNG use in marine shipping applications as operators seek cleaner and more affordable fuels.

3. **Gas-to-Liquids (GTL):** This technology converts natural gas into products used for transportation fuel, lubricants and the raw materials for chemicals and detergents. GTL products can be used through existing logistics channels, infrastructure and equipment. They also deliver enhanced performance and produce fewer local emissions when burned than traditional fuels. Shell is a global leader in GTL technology. We built our first commercial GTL facility in Malaysia in 1993, and the world's largest facility in Qatar, which began production in 2011. Shell is now seriously evaluating GTL opportunities on the U.S. Gulf Coast.

Shell is not alone in exploring these opportunities. Multiple ventures are advancing proposals for similar projects across the nation. While it is unlikely that every firm with an interest in taking advantage of the massive natural gas resource will be able to commercialize their plans, it is telling that so many are placing their confidence in the lasting viability of the resource itself.

As with the projects listed above, the emergence of an LNG export market could spur greater investment in U.S. supply and infrastructure; create domestic jobs; and position the U.S. as a net energy exporter.

Importantly, Shell must make investment decisions based on the best available information and based on *existing*, not speculative or hopeful, legal and regulatory regimes. Shell understands the favorable disposition towards natural gas exports under federal law. And our confidence in the abundance of North American supply means that exports can be pursued in addition to expanding domestic uses of natural gas -- adding balance of trade benefits to domestic economic benefits.

Conclusion

Developing markets for natural gas is a clear long-term, sustainable win for the United States. Shell is making significant investments in this area because we believe in natural gas' potential to be among the most promising and sustainable energy sources for decades to come. But to realize its full potential, we must bolster and maintain public confidence in tight gas as a safe and sustainable energy resource.

It is this issue wherein lies the true risk to the gas-driven industrial resurgence: if natural gas resource development is constrained or made otherwise uneconomic through new and overly burdensome regulatory or legal barriers; then the currently abundant supply picture would likewise contract drastically. This would translate to investments underperforming or outright failing in all natural gas-intensive sectors of the economy – with significant consequences to domestic security, employment, and GDP. It is with reasonable expectations of known and existing laws, regulations, policies, and resource availability that Shell and others will achieve the certainty and comfort necessary to advance and develop the huge and capital intensive projects to bring natural gas resources to their many new and existing markets.

We stand ready to work with our fellow operators, regulators, customers, and competitors to safely and responsibly realize the manifold opportunities and benefits made possible by this domestic gas bounty. Thank you for the opportunity to provide comments on this important matter.

Respectfully submitted,

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Shell