Supply Management Perspectives and Implications for increased LNG Export Levels

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1. Background and overview of study

Since low cost natural gas is a contributing factor to supporting a US manufacturing renaissance, the Institute for Supply Management (ISM)™ in conjunction with Spend Matters / MetalMiner, conducted a snap poll study to help provide insight into the potential price and volatility impact on manufacturing companies of unlimited LNG (liquefied natural gas) exports. The study offers an introductory hypothesis as well as a short analysis of current research available in addition to the insights gleaned from the ISM survey.

1.1 Hypothesis

The basic hypothesis assumed that a US LNG price increase could significantly impact manufacturers who make or buy heavy energy intensive products. Other companies wouldn't be significantly impacted since energy costs don't represent proportionately enough in their overall cost structure (the same applies for planned Capex projects). Company size will likely not matter. Finally, we wanted to assess what impact, if any LNG exports might have on US prices—and also LNG price volatility.

1.2 Methodology

Conducted in conjunction with the Institute for Supply Management™ (ISM), an online poll survey ran from October 14 through November 20, 2013. The subject of LNG exports has generated plenty of research (and subsequent controversy). However, none of the studies focused on the end user. Unlike previous LNG studies, only this study examines the potential impact of LNG exports on supply executives.. Fifty-six respondents participated in the survey. Discrete manufacturers followed by those in the resources/metals industries made up the largest subset of survey respondents. We excluded the services sector from the remainder of our analysis.

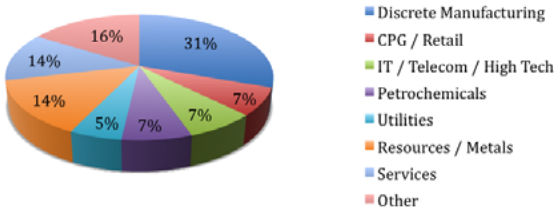

Figure 1—Industry Breakdown for Research Study Population

1.3 Survey Literature

Some of the current research suggests that enough technically recoverable natural gas exists within the United States to last about a century at the pace of current production. However, those estimates are difficult to validate, and consequently, it remains even more challenging to predict what gas prices will look like in future and how changing prices will affect gas production. Economists note that today's low prices render only a portion of the putative natural gas reserves financially viable for extraction. In addition, one can't assume that extraction/production will remain constant since demand will very likely increase in the coming years due to expansions in the domestic market.

Studies that support increased LNG exports point out that exports won't significantly increase domestic prices and that they won't impact the domestic LNG's industry's ability to meet demand. In addition, they argue that exports will have net positive effects on U.S. employment and GDP. Examples of studies supporting LNG exports include: Deloitte study, ICF study, Oxford Institute for Energy Studies and the NERA study.

Studies arguing against increased US gas exports posit that US exports will reduce energy costs in foreign countries while costs for US manufacturers will increase, leaving US industry less competitive compared to foreign industry. Some studies even suggest that LNG exports won't improve US GDP. Examples of studies against LNG exports include: EIA study, Purdue Markal-Macro study and America Energy Advantage's Survey. References for these studies are provided in the appendix of this document.

With regards to the topic of LNG price volatility, while the majority of studies support that LNG exports will impact domestic prices to some extent, the notion that high prices lead to volatility appears unfounded. Our study contradicts this finding though, and as such, more research might be warranted here.

2. Executive Summary

Low cost energy plays an important role in economic growth. US natural gas prices have fallen as shale gas deliveries have begun entering the market. Prior to the rise of shale gas production, most analysts expected the US to become a major importer of LNG. However, the sudden surge in US shale gas production has turned the tables and the US could now become a major LNG exporter.

These exports could increase domestic LNG prices (due to reduced supply stemming from LNG exports) and reduce prices in importing countries. Because LNG exports could increase production costs in the US, this issue becomes tied to broader considerations involving America's competitive advantage. Will the US risk losing its competitive advantage should energy prices increase? This survey seeks to gain a better understanding of how US LNG exports could impact US manufacturers.

Key questions addressed in this report include:

- What manufacturers think will happen with LNG prices and volatility if the US allows unlimited LNG exports
- The importance of low-cost energy for a US manufacturing resurgence and US manufacturing companies in general
- An analysis of the importance of low-cost energy by company size and energy spend
- Manufacturers' position on allowing LNG exports

3. Key Findings

3.1 What do manufacturers think will happen to LNG prices and volatility if the US allows unlimited LNG exports?

Based on the results, respondents think that unlimited LNG exports would clearly impact prices. 78% of respondents felt that we would see a moderate to significant increase (10% to 20% or more) in LNG prices—which is also the estimate that can be generally extrapolated to the entire study population. Over one-third of respondents thought the price increase would exceed 20%. Only 4% thought there'd be no impact.

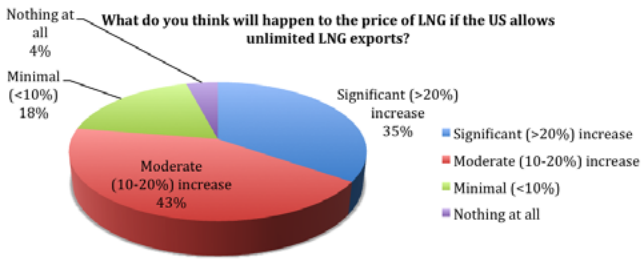

Figure 2—Perceived Impact of increased LNG exports on US LNG pricing

Additionally, a large majority of respondents believe that unlimited LNG exports would create more LNG price volatility, partly because those prices would begin to get linked to not just domestic supply/demand behaviors, but also because of the effects of global energy markets (i.e., in the same way that crude oil on supertankers can be bought/sold multiple times based on global crude oil prices).

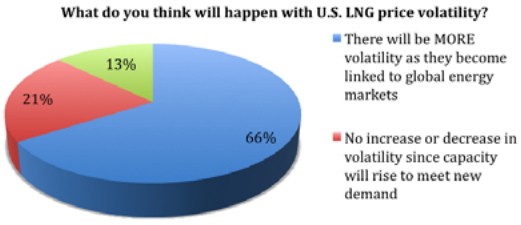

Figure 3—Perceived Impact of increased LNG exports on US LNG price volatility

3.2 The importance of low-cost energy for a US manufacturing resurgence

60% of respondents agree that low-cost energy is very important for a US manufacturing resurgence while 26% believes it is important. The study population was split roughly 50/50 between US based firms and those who were not (e.g., multi-national firms), and there is a slight survey sample bias in terms of the US-based supply executives at manufacturing firms being aware of the impact of energy prices on their overall cost structures.

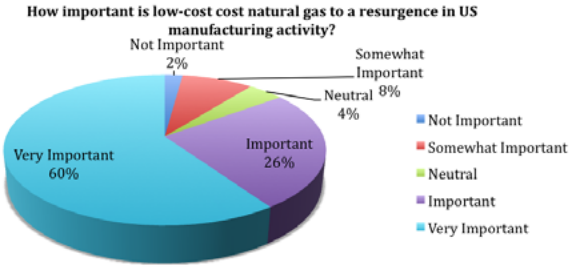

Figure 4—Perceived relationship between low LNG pricing and US manufacturing resurgence

We anticipated that executives would feel this issue to be important, so we wanted to understand why, and to help quantify the impact. To analyze the importance of energy on their business, we asked participants to weigh in on the effects of energy costs on their ability to implement economical Capex projects and also on their global competitiveness.

Respondents indicated that low cost energy appears quite important to maintaining competitiveness within the global market (42% very important, 30% important)

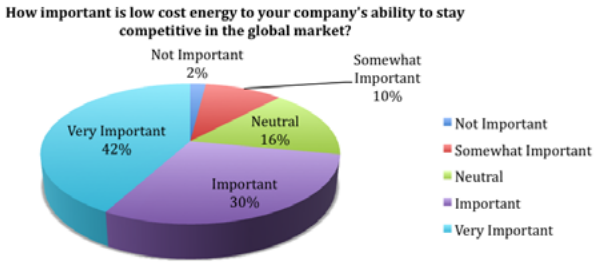

Figure 5—Perceived correlation between low cost energy to global competitiveness

On the other hand, respondents gave less credence to low cost energy when it comes to Capex projects. This is likely due to the fact that energy costs are only one deciding factor in terms of capital investment relative to other factors such as needed capacity, technology re-tooling, geographic expansion, and other strategic factors. Even so, a majority (52%) of respondents do believe that low cost energy plays a very important or important role in Capex projects. One of the reasons for this is likely because manufacturers who are using existing capital assets are often using less energy-efficient assets and therefore are more sensitive to higher energy input costs.

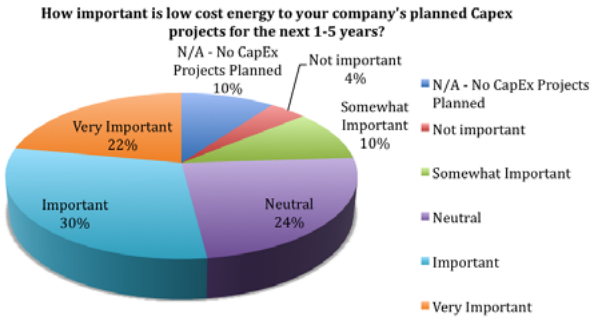

Figure 6—Perceived importance of low cost energy to planned CapEx projects

3.3 Importance of low-cost energy by company size and energy spend

In order to help ascertain the financial impact of energy price increases on our study population, we asked for a few descriptive quantitative metrics:

- **COGS as a percentage of revenue.** 44% had COGS/revenue greater than 50%. Another 40% have COGS/revenue between 20% and 50%. Obviously, when a large percentage of revenue is dedicated to covering COGS, it makes great sense to focus on the costs of inputs, such as energy.
- **Percentage of COGS represented by natural gas and electricity costs.** While 17% of firms had more than 20% of their COGS represented by gas/electricity costs, the rest of the population had a smaller percentage. 35% were in the 5-20% range and the remaining 32% of those who knew these figures indicated that gas/electric costs were less than 5% of COGS.
- **Percentage of material costs going to energy-intensive commodities such as steel or glass.** We asked this because the direct costs for energy paid by the manufacturer do not tell the whole story. Energy costs paid by suppliers should also be considered. Nearly a third of firms had greater than 60% of their material costs in such commodities and

another 40% stated that energy intensive commodities accounted for 20%–60% of their material costs. Clearly, energy costs paid by manufacturers hidden within material costs are a key factor to include in a total energy cost analysis.

We then used these metrics and other metrics such as company size and industry type to see if there were meaningful differences in study results based on these attributes (e.g., the "importance of low cost energy" question).

We found no statistically significant differences in the data based on a company's size and their view of the importance of low-cost energy for their business. Moreover, we didn't even find correlation between energy spend as a percent of sales and importance of low-cost energy for their business. We would have expected that companies with high energy spend, as a percent of sales would find low-cost energy critical for their business.

The only meaningful correlation found was between increasing perception that low cost energy is key to global competitiveness and increasing percentage of energy intensive materials used. There may be other correlations, but additional sample size would be warranted to draw more definitive conclusions. Consumers of larger quantities of energy-intensive commodities are clearly more worried about the effect of increased energy pricing to themselves—and to their commodity suppliers!

3.4 Manufacturers' position on LNG exports

As previously discussed, respondents stated that low cost energy remains important to their companies and that LNG exports will increase LNG price and price volatility. However, when we asked them what was their overall perception of the LNG issue, the qualitative comments supported a fairly balanced view on exporting LNG.

Certainly, there were opponents. They felt that the US should find ways to utilize LNG domestically rather than selling it overseas and that everyone in the US will benefit from not exporting, as they will have lower energy costs and a competitive advantage versus other countries.

- "It will cost too much to build the infrastructure to support it. There is enough domestic demand to create a market with fair prices for both consumers and producers."
- "If the LNG exports are allowed to happen unchecked it will only drive the cost of natural gas in the US up until we are on an even playing field with Europe and Asia."
- "Would be great if we stabilized energy prices in the US to provide for low cost manufacturing."
- "I feel that we should keep our natural resources here to help maintain the low cost of gas fired power generation."
- "With the growing demand of energy in the US, exports will only increase the prices to meet the global demand. "
- "Exports would help balance our trade imbalance. But, as far as LNG exports, I have to question if the natural resources should not be used for American manufacturing. After all, manufacturing creates wealth and the middle class."
- "Exporting LNG will enrich certain parties in the U.S.; keeping more at home will benefit all, as we'll have lower energy costs and a competitive advantage vs. other countries."
- "This is strictly a way for the industry to manipulate LNG pricing. Very similar to oil and derivative markets- plastics, etc."

But, supply executives are generally global free market advocates, and just as many supported LNG exports. Supporters argued that growing LNG exports would boost economic growth in the US, that the abundant LNG supplies are sufficient to meet both domestic and external demand, and that the US should allow free energy markets. These comments include:

- "It is necessary to complete a position in this market and continual association in the energy supply to the world."
- "The benefits are not focused on the cost of goods manufactured in the U.S."
- "There are many reasons why we need to participate in the global natural gas industry, though the short term may be problematic, in the long run, we will be stronger as a result of our participation."
- "It appears we have an abundance of LNG and we should strengthen our country by exporting it."
- "I am not opposed to exports, I only wish we would use more domestically."
- "The US is not using enough of the supply. There are more reserves than demand. I don't see a reason not to export it."
- "I don't think it will be as big of a deal as everyone is making it out to be."
- "Let the markets determine the overall price. Let factors of supply and demand work."
- "Needs to be done. Free markets."

But, like any issue, there are moderate and thoughtful positions about the topic, and many of the supply executives had some fair and balanced views on the topic, especially as it relates to the broader global market:

- "This is an important issue. While exporting a product improves the nations GDP, given the nature of the US energy production capacity we must be careful that we are maintaining supplies for use by internal business."
- "I am not sure if exporting LNG will significantly affect global markets however you can bet the minute it starts [increasing global LNG pricing], US prices will also start increasing."
- "If exporting LNG will help increase demand (not steal from current internal resources), then I am for it. We need GDP growth however we can get it. "
- "The window [of LNG supply deficits] will be short lived as shale gas production technics spread across the globe driving higher levels of natural gas production that are closer to the end consumer. "
- "[LNG prices are] a natural outcome of supply and demand. I think it will put pressure on closing coal power plants, and as LNG prices rise to set a global commodity price, nuclear power plant value will rise."

Generally, qualitative comments suggested that participants were in favor of exporting LNG overseas as long as the domestic needs were satisfied and prices do not increase too much. There were also concerns regarding the ability to develop the domestic infrastructure needed for increased LNG exports (especially in light of other infrastructure priorities). For example, a procurement executive from a large engineering and construction supplier to the oil and gas market said: "The biggest hurdle right now is infrastructure. North America doesn't have enough compression capacity to convert the available shale gas, plus no or limited pipeline capacity. On the receiving end, there isn't enough expansion capacity, plus the pipeline issues."

Interestingly, we did uncover an issue that we didn't know would be so front-of-mind: the frustration surrounding US policy (or lack thereof) regarding LNG exports:

- "Prices are partially dependent on the continuing expansion of the infrastructure to store [the LNG], process and move the products ex-US continuing to expand. This may be

offset by the potential negative effects of US EPA regulation and increased US protectionism."
- "The oil and gas industry is capitalizing on new found resources for short term gain. The lack of an energy policy is certainly an issue on this matter."
- "It is another issue where government is ill equipped to formulate policy"
- "[The LNG issue is] strictly political today changing to economic (business) within 3-5 years"
- "We need clear leadership from our government for this very important issue so that the private sector knows 'The Plan' and can act accordingly to met our country's goals and also make money. I do not see that happening, unfortunately."

4. Next steps

The qualitative comments above lead naturally to the issue of how best to solve the problem. The purpose of this research was to elicit from the procurement and supply chain community the "wisdom of the crowd." Perhaps the best comment we received came from a company literally and figuratively in the middle of this issue:
- "We are located in the heart of the Marcellus shale. I feel that a cap should be instituted on the exporting of LNG at least in the short term. As more industry converts to gas and as power plants move in that direction to meet EPA emission standards, that demand will increase significantly. Maybe a re-evaluation of the cap can be done in 5-year intervals to determine the impact on natural gas supplies
- We should keep as much as possible within the US and limit exports to ~15% of total volume currently extracted via shale plays."

With so much at stake, and with such strong support on both sides of the issue, combined with frustration over a lack of a clear US policy, the solution will likely strike a balance between the two sides.

4.1 Additional Analyses

Moving forward, we asked study participants what additional information or research they would like to see on this topic. The following areas were cited most often:
- Forecast models for domestic LNG prices, with and without exports
- The environmental impact of fracking and how this may drive future regulation, and thus supply/demand/pricing
- How government regulation does affect and might/will affect the cost of extraction and export of LNG

Some of the studies provided in the appendix of this document have models that touch on these issues, but we certainly expect continued research and interest on these topics. For those interested in developing their own models, the reports in the appendix are a good start, as well as the US government website http://www.eia.gov/naturalgas/.

4.2 Impact on Procurement

Whether LNG exports will significantly impact gas prices or not depends on a myriad of factors, but it still basically boils down to supply and demand:
- **Expansion of LNG domestic demand:** Natural gas will very likely continue to grow as a feedstock for electricity generation (driven by increasing use of electric vehicles, technology, etc.), and for use in transportation, residential/commercial heating, plastics

and chemical production. When the price of a commodity is low, end users are enticed to buy more. This effect is compounded when government policies are in place to encourage use (e.g., state policies that facilitate switching from oil heating to high efficiency natural gas heating). Because prices are relatively low today, increased demand will increase prices if supply is not able to keep up. If one believes that traded commodity markets are generally efficient, the movements of the LNG futures market should not be discounted and provide an indication of where the market will likely go. Much of this has to do with supply.

- **Limitations on supply (e.g., regulatory constraints):** Although there is clearly a natural gas boom going on right now, due mainly to increased exploration and the utilization of fracking technology, continued growth is by no means guaranteed, especially in light of the increasing scrutiny being paid to the effects of the fracking process on groundwater quality and other environmental concerns (e.g., see the Duke University study referenced in the appendix of this document as the latest example). A tightening of environmental policy regarding fracking could potentially not only threaten existing supply lines, but more realistically slow the approval of new gas wells.

Even though only a portion of electricity generated in the US comes from natural gas, electricity prices and natural gas prices remain highly correlated since natural gas generators are usually the marginal units called upon by the grid operator, setting pricing in the wholesale markets.

However, natural gas use is increasing in electric power generation. Electric utilities continue to switch over from coal-fired generation to natural gas, especially given the current regulatory environment in the US with regard to coal-fired plants. Coal has dropped from 46% of the power mix in 2007 to 35% in 2012 (source: http://www.eia.gov), and the future mix is unclear based on the current regulatory environment in multiple regimes.

5. Conclusions

In the coming years, companies, especially manufacturers, need to keep an eye on energy costs. Reviewing electricity supply pricing regularly remains key to securing future contract prices when market rates are low. Extended planning horizons, increased contracts optionality, reduced consumption, increased conversion efficiencies, adoption of renewable energy, supply chain re-structuring (e.g., buying energy on the wholesale market), and long-term supplier relationships serve as proven practices that manufacturers should certainly consider adopting—especially with the wealth of third party energy management firms that can help manufacturers extract more value from such energy spending.

In this study, we have shown that the manufacturing industry clearly believes that cheap energy is vital to a resurgence in US manufacturing activity and profitability. Survey respondents clearly have a concern about the impact that exports will have on LNG price and price volatility.

On the other hand, supply executives also acknowledge that LNG exports will improve the nation's GDP. As long as domestic LNG supply can meet demand without significant price increases due to exports, industry remains unopposed to exporting LNG.

It remains a challenge to predict whether exports will impact domestic natural gas prices. But either way, manufacturers should expect prices to increase from the relatively low levels that

we have today. Therefore, robust energy sourcing strategies and improved energy procurement practices to reduce energy costs and mitigate risks remain critical capabilities to build and demonstrate.

6. Appendix Supporting Data

- **Deloitte Study (October 2012):** http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/Energy_us_er/us_er_GlobalImpactUSLNGExports_AmericanRenaissance_Jan2013.pdf
- **ICF Study (May 2013):** http://www.api.org/~/media/Files/Policy/LNG-Exports/API-LNG-Export-Report-by-ICF.pdf
- **Oxford Institute (October 2012):** http://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/10/NG-68.pdf
- **Nera Study (December 2012):** http://energy.gov/sites/prod/files/2013/04/f0/nera_lng_report.pdf
- **EIA (January 2012):** http://energy.gov/sites/prod/files/2013/04/f0/fe_eia_lng.pdf
- **Purdue Markal-Macro study (January 2013):** http://webcache.googleusercontent.com/search?q=cache:MrHCz9t4WWEJ:www.purdue.edu/apps/dpmanage/Resource/1e4d257722644001b7b0323e45288da8.pdf+&cd=1&hl=en&ct=clnk&gl=us
- **America Energy Advantage's Survey (January 2013):** http://www.americasenergyadvantage.org/blog/entry/american-voters-say-no-to-unrestricted-natural-gas-exports
- **Duke University Study:** http://blogs.scientificamerican.com/plugged-in/2013/10/07/duke-study-finds-radium-and-elevated-salinity-in-treated-oil-and-gas-wastewater-highlights-need-for-revised-water-quality-regulations/