From:	sos@saveoursupplies.org
To:	LNGStudy
Subject:	2012 LNG Export Study Comments
Date:	Thursday, January 24, 2013 2:14:29 PM
Attachments:	LNGExportComments.pdf

Mr. Anderson,

Please find attached comments regarding the 2012 LNG Export Study.

Thank You.

January 24, 2013

Mr. John A. Anderson
Manager, Natural Gas Regulatory Activities
Office of Oil and Gas Global Security and Supply
Office of Fossil Energy
Forrestal Building, Room 3E-042
US Department of Energy
1000 Independence Avenue, SW
Washington, DC 2012
(202) 586-0521
LNGStudy@hq.doe.gov

FE Docket No. 10-161-LNG, 11-59-LNG, 11-128-LNG, 11-141-LNG, 11-161-LNG,11-162-LNG, 12-05-LNG, 12-32-LNG, 12-77-LNG, 12-97-LNG, 12-100-LNG, 12-101-LNG, 12-123-LNG, 12-146-LNG, 12-156-LNG

RE: "2012 LNG Export Study"

Mr. Anderson,

SAVE OUR SUPPLIES (SOS) is a private entity representing the interests of concerned Americans dedicated to ensuring that this country's precious natural gas supplies are utilized for the net benefit of the United States. SOS is deeply concerned about the potential economic, energy security and environmental risks that are posed by the proposed LNG exports and therefore urges the Department of Energy (DOE) to conduct further investigation before granting additional LNG export licenses.

SOS has conducted a preliminary analysis of the two part 2012 export study (EIA and NERA) and based upon the substantial flaws and omissions contained within the NERA study, at this time SOS believes that the proposed LNG exports may very well cause net harm to Americans.

The primary issues with the NERA study's conclusions include:

NERA CONCLUSIONS	**ISSUES**
• US LNG exports are not economically feasible under base case conditions?	• **Capital formation already occurring** – the US has already received orders for 5 bcf/d of exports and invested billions in export terminals • **Distortions from Cost Adders**- NERA appears to apply deterministic "cost adders" in order to balance its Global Natural Gas Model (GNGM) - the result of which is to artificially depress the competitiveness of US LNG exports • **Substantiate the Assumptions** – NERA's baseline assumptions for global LNG as well as US natural gas supply/demand appear to deviate materially from observable third party analyses - the result of which is to understate the competitiveness of US LNG exports
• US natural gas prices do not rise to world levels?	• **No Oil Link?** - NERA's methodology appears to ignore the substitution relationship between oil and natural gas (given their physical interchangeability) – leading to a seemingly impossible

	conclusion that US natural gas will be permanently de-linked from oil • **No Stress Case Modeling** - NERA conducted 63 LNG export scenarios but it would appear that not a single case analyzed the impact of higher oil prices • **The Importance of Sunk Costs** - The NERA analysis appears to exclude the impacts of sunk cost economics – once LNG terminals are built the fixed costs of liquefaction and transport won't factor into the dispatch decision, particularly for the fixed price option structures that LNG purchasers are employing in the US
• Consumer Well Being Improves in All Scenarios?	• **Gas Model Deficiencies Can Invalidate Macro Model** - The apparently flawed methodology and assumptions embedded in NERA's GNGM cause the impacts of LNG exports upon US gas prices to be understated and therefor distort the true impact observed in NERA's macroeconomic model (NewEra) • **Linked Oligopolies Can Be Damaging** - NewEra does not capture the inherent linkage of natural gas and oil that can undermine the benefits of free trade given the oligopolistic behavior by market participants • **The Cost of Income Re-Allocation and Volatility**: It appears that the NewEra model does not recognize the lower marginal propensity to consume (MPC) exhibited by those beneficiaries of resource income and the macroeconomic impact of more costly natural gas price volatility caused by LNG exports • **Lower Shale, Higher Price is a Problem** - in NERA's scenario with low shale recoveries (and LNG exports owing to a supply/demand shock) the resulting impact to GDP is actually negative
• There Are Net Benefits for the US?	• **Cannot Substantiate Net Benefits** - The methodology and assumption flaws apparent within NERA's models inhibit the ability to make a net benefit determination regarding LNG exports at this time • **The Dangers of False Precision** - In fact, the substantial uncertainties inherent within a 25 year forecast of dynamic commodity prices renders such a determination virtually impossible • **Security and Environmental Externalities Not Considered -** Additional impacts resulting from LNG exports upon energy security (resource adequacy) and environmental externalities (both of which contribute to long term economic impact) have not been analyzed
• There is a Shift in Resource Income between Sectors?	• **Crowding Out Higher Value Businesses** - Exporting raw materials such as natural gas can create a "comparative disadvantage" to trade - the decreasing returns to scale inherent in a scarce natural resource (eg upward sloping cost curve) can have the effect of crowding out the increasing returns to scale available in manufacturing and technology (eg downward sloping cost curve) and thus undermine the benefits of trade • **Crude Exports Are Prohibited** - The US like many other countries has already made such a determination with regard to crude oil, effectively limiting the export of that raw material until it is

	upgraded into higher value manufactured products such as transportation fuels or petrochemicals

Recommendations

1. Given the extreme importance and complexity of the LNG export decision, substantial additional analysis should be conducted. The DOE should commission additional consultant/academic analysis in order to fully evaluate the impacts of LNG exports and compare those results with the NERA study.
2. The new studies should incorporate a dynamic substitution relationship between competing fuels such as oil, gas and coal (eg effects of $200/bbl oil). Extreme stress case scenarios should be performed such that the impacts of changes in key assumptions (eg commodity prices, demand elasticity, cost of supply, market behavior, etc) can be properly analyzed from the perspective of forecasting global gas markets as well as US macroeconomic impacts. The macroeconomic analysis of LNG exports should also be expanded to reflect the link to oligopolistic market behavior, incremental costs of volatility and the lower MPC of resource owners.
3. The net benefit/harm determination should incorporate the long-term economic effects of LNG exports upon energy security and environmental externalities (utilizing the resources available at the Departments of State and Defense) as well as the comparative disadvantages caused by displacing manufacturing/technology investment.
4. The DOE should strongly consider shortening the term of export licenses, given the fact that applicants have not identified the specific reserves to be exported (US currently only has 13 years of proven reserves remaining) and the implausibility of accurately forecasting multiple commodity market impacts for a period of 25 years

Key Conclusions

Analyzing the net impact of LNG exports upon the US economy is a highly complicated endeavor. Based upon the above issues identified, the lack of definitive analysis completed to date by NERA and the EIA, SOS must conclude at this time that the approval of LNG exports <u>may very well cause net harm to Americans</u> over the next 25 years.

Given the significant complexity of the NERA study and the limited time for review (only 45 days), additional time would be greatly helpful in order to provide further commentary and analysis. Also, given the gravity of the issues at hand and the need for further input SOS believes that opening a new docket related specifically to the net benefit/harm analysis for LNG exports is warranted.

Respectfully,

Save Our Supplies, LLC (SOS)

Email: SOS@saveoursupplies.org

A. APPARENTLY FLAWED NATURAL GAS MARKET ANALYSIS

Apparently Flawed Conclusions Regarding Natural Gas Market Impacts

NERA's GNGM surprisingly concludes that all US LNG exports are uneconomic in the Reference (Base) case, a prediction completely at odds with the economic reality of the billions of dollars already committed to liquefaction terminals, the 5 Bcf/d of LNG orders already received and the dozens of pending applications currently outstanding.

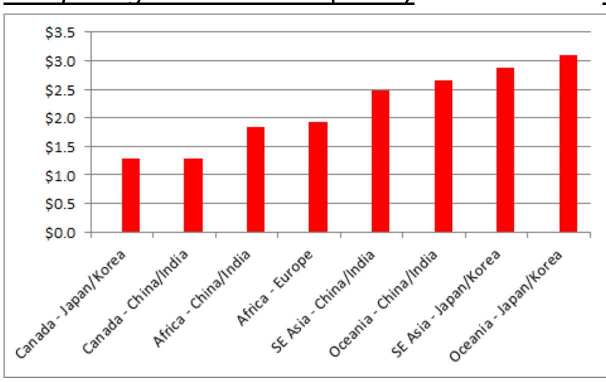
NERA appears to erroneously determine that US LNG would be a high cost producer and therefore would set the marginal price for LNG in an export scenario (in NERA's opinion - high well productivity or an international demand shock). NERA also appears to erroneously conclude that any profit potential created by the spread between US landed LNG costs and regional LNG import prices will not be captured in US wellhead natural gas prices but rather captured by arbitrageurs and therefore cost adders (LNG Cost Adders or Adders) are applied as a model calibration (eg a plug).

As a result of these conclusions NERA believes that US natural gas prices would only be meaningfully impacted in the case of high demand and limited international supply ("Supply/Demand Shock") and in those instances the impact to US reference wellhead natural gas prices would range from approximately $0.50/mmbtu to $1.00/mmbtu or roughly 15-30% in 2020. This impact is not insignificant when the apparent flaws embedded in NERA's base assumptions for LNG supply cost and demand are considered thus indicating that the Supply/Demand Shock case may actually function more like a baseline scenario.

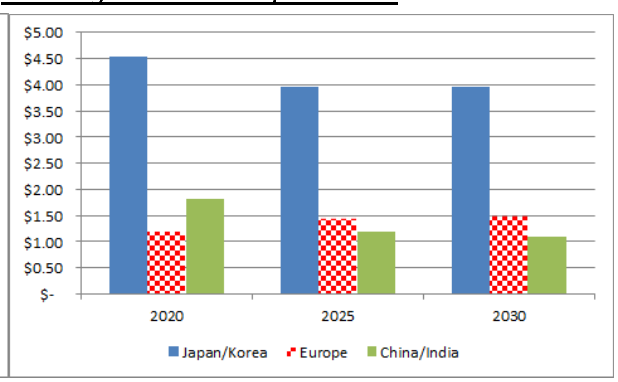
When NERA's cost estimates for new international projects are adjusted to reflect observable information about the cost of those projects (as published by third parties), the cost competitiveness of US LNG becomes readily apparent, a fact consistent with the substantial demand already observed in the marketplace for US LNG exports.

Potential for Increase in US Natural Gas Price ($/MMBtu)

US LNG Landed Cost Advantage Versus Competing Trade Routes (2020)



Differential between US Landed LNG Cost and Regional LNG Import Price



Source: NERA and Sanford Bernstein (SB)

Note: Utilize NERA Baseline Case and Adjust Free-on-Board (FOB) costs for SB LNG Supply Stack. Exclude NERA LNG Adders.

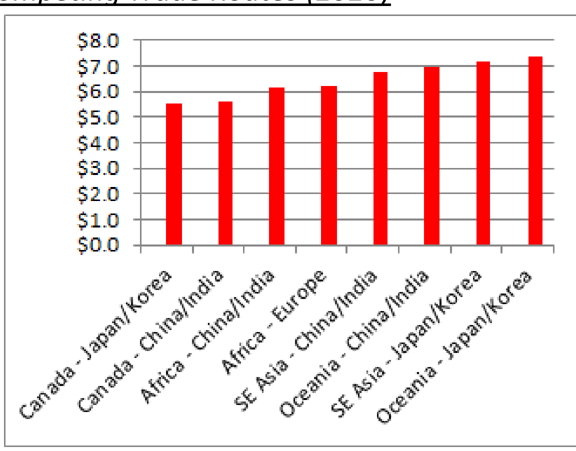
Given the apparent competitiveness of US LNG export projects as compared to new international LNG projects, the US exporters have the potential to capture a spread between their costs and those of their higher cost competitors. An analysis of the cost advantage of US exporters on competing LNG trade routes indicates a potential profit potential of $1.30/mmbtu to $3.00/mmbtu in 2020 with the Japan/Korea routes proving the most attractive. Furthermore the differential between NERA's projected regional LNG import prices and the landed LNG cost for the US indicates a potential profit opportunity of $1.20/MMBtu in Europe ranging to $4.50/mmbtu in Japan/Korea when eliminating NERA's LNG Cost Adders.

It would appear erroneous to conclude that this profit potential for US exports would be completely absorbed by NERA's LNG Cost Adders. The LNG trade has historically functioned as a long-term contracted market for dedicated proven gas reserves with relatively few spot LNG cargoes controlled by a limited number of international trading houses. Those trading houses have been able to utilize their market position to capture profit differentials between landed LNG costs and local LNG import prices.

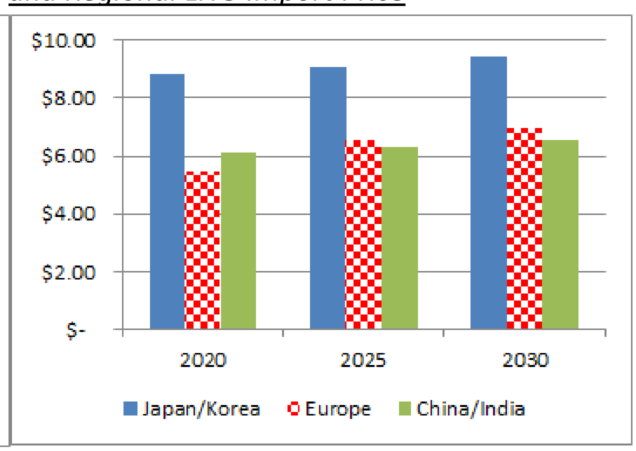
However, the US export situation varies greatly from historical precedent in that purchasers of US LNG exports have fixed neither the price nor even the specific location of their gas supplies but rather are merely purchasing an option to export LNG from the US if international profits provide an incentive. In the case of Cheniere's Sabine Pass, the LNG buyers have promised to pay a long-term annual fixed price premium for that option. Given the 20+ year fixed nature of that commitment, buyers of US LNG exports will have an economic incentive to continue purchasing US natural gas up to an effective wellhead price (the export parity price) that will cause them to break-even on the sale of their LNG at the destination prices (sunk cost dynamics will be discussed below).

<u>US Natural Gas Price Export Parity ($/MMBtu)</u>

US LNG Landed Cost Advantage Versus <u>Competing Trade Routes (2020)</u>



Differential between US Landed LNG Cost <u>and Regional LNG Import Price</u>



Source: NERA and SB

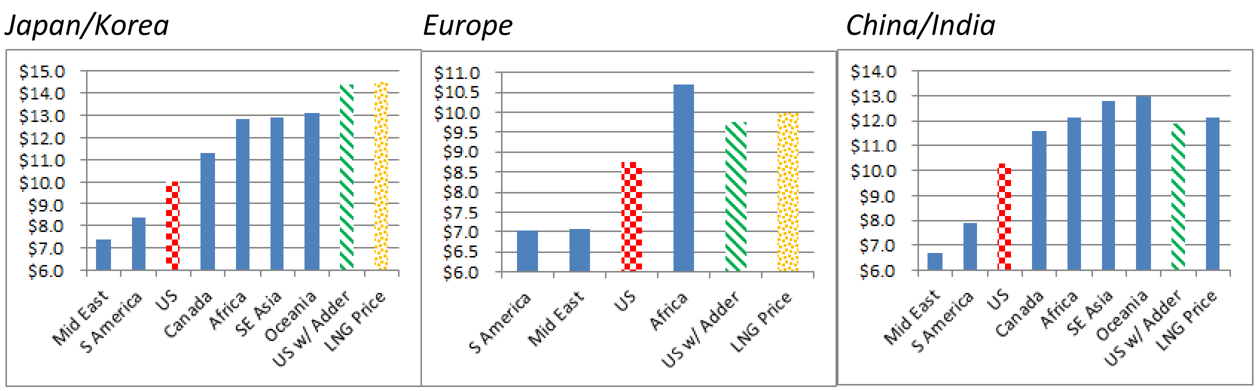
Note: Utilize NERA Baseline Case and Adjust FOB costs for SB LNG Supply Stack. Exclude NERA Adders

Export parity prices on the basis of NERA's Base price estimates range from $5.50/MMBtu to nearly $9.00/MMBtu in 2020, a substantial premium to the natural gas price sensitivities calculated by NERA

Apparently Flawed Methodology

NERA calculates baseline landed LNG Prices (City Gate less regas and pipe transport) for three major LNG destinations: Japan/Korea, Europe and China/India apparently based upon third party estimates and NERA separately develops a landed LNG cost assumption (wellhead plus liquefaction and shipping). The NERA GNGM is a competitive model, however, the global LNG market is not perfectively competitive, therefore NERA applies model calibrations or LNG Cost Adders that are essentially plugs to reconcile differentials between its price and cost forecasts. The Adjusted LNG supply cost curves are detailed below:

Adjusted Regional Cost Curves for Landed LNG Costs in 2020 ($/MMBtu)



Source: NERA and SB

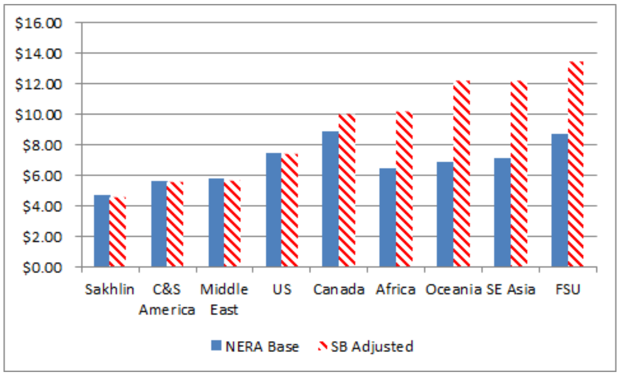
Note: Utilize NERA Reference Case and Adjust FOB costs for SB LNG Supply Stack. Include US FOB cost with and without NERA Adders and compare to regional LNG import price in NERA Base Case.

The result of applying these Adders is to effectively eliminate the profit potential for US LNG exports in most scenarios. When the Adders are removed and the actual US LNG landed cost is compared to NERA's forecast for the LNG price, US exports actually have the opportunity to capture that profit spread (the netback) in each of the major LNG destination regions, a fact consistent with the empirical evidence of foreign orders for US LNG already received.

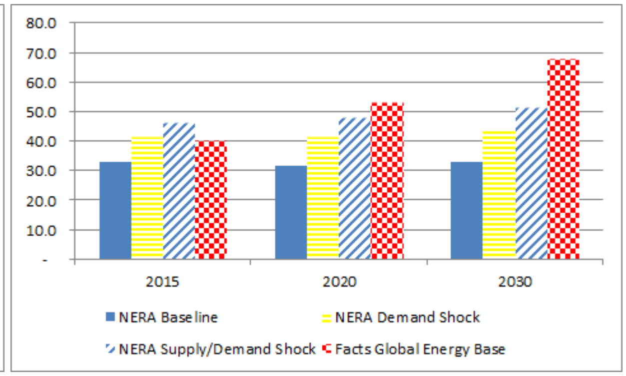
Apparently Flawed Assumptions

NERA appears to meaningfully underestimate the supply cost of international LNG projects and underestimate the magnitude and trajectory of global LNG demand. NERA also appears to underestimate US natural gas demand and potentially the elasticity of the US natural gas supply curve.

Regional FOB LNG Supply Cost 2020 ($/mmbtu)



Global LNG Demand (Bcf/d)



Source: NERA, SB, Facts Global Energy.
Note: Utilize NERA Reference Case and Adjust FOB costs for SB LNG Supply Stack

***International Supply**:* NERA's Base case FOB (excluding shipping) LNG supply costs by region appear to substantially understate the cost pressures likely experienced by currently planned projects. For example NERA assumes that Austalian (Oceania) LNG projects have an FOB cost of less than $7/MMbtu in 2020, however, third party analysis (SB) estimates the fully loaded FOB cost for planned Australian LNG projects (including coal bed methane and off-shore) exceeds greater than $12.00/MMBtu. New projects planned for development off-shore East Africa (Mozambique) are estimated to cost greater than $10/MMbtu. When the global LNG supply curve is adjusted to reflect this observable cost information then the US becomes a much more competitive LNG producer (at wellhead gas prices of ~$4.30/MMbtu) even on long haul routes to Japan/Korea or China/India.

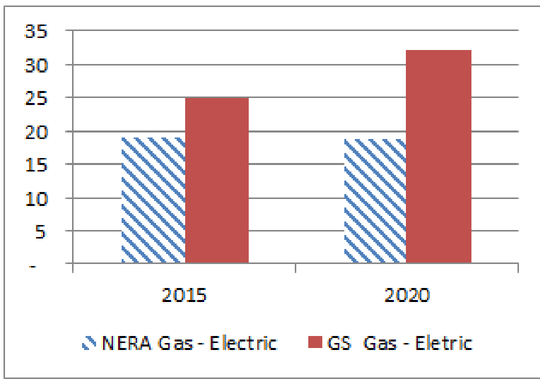
Updating the cost structure of the global LNG curve is extremely meaningful to the LNG export analysis as the opportunity develops for the US to dispatch LNG before international peers and capture incremental profits. Furthermore, NERA's Base forecast for wellhead price growth in the US is higher than all other competing countries (except Canada) therefore NERA believes US export competitiveness will deteriorate over time. While LNG exports should have an impact on US prices over time, the basis for NERA's assumption of greater US price growth in the absence of LNG exports needs to be substantiated.

International Demand: NERA appears to substantially underestimate global LNG demand. NERA's 2015 Base forecast of roughly 32 Bcf/d is not much greater than the actual LNG trade in 2011 before giving effect to the approximately 7 Bcf/d of liquefaction under construction as reported by the International Gas Union (IGU). Despite visible liquefaction and regasification terminals under construction as well as in the planning stage, NERA appears to assume that global LNG demand will remain flat from 2015 going forward. In fact NERA's LNG demand forecast is so pessimistic that even its supply/demand shock scenario is substantially lower that the base case forecast from third parties (such as Facts Global Energy).

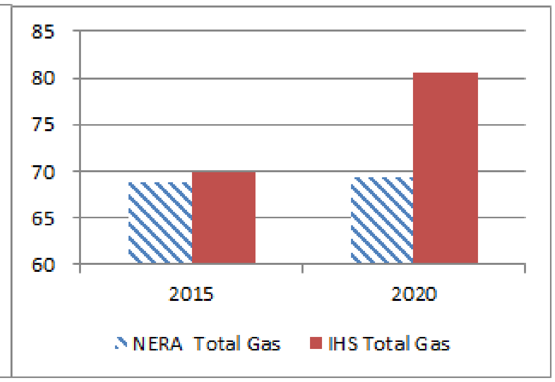
The ramifications of NERA's draconian LNG demand forecast are material given that the supply/demand shock scenarios conducted by NERA resulted in the greatest impact upon US natural gas wellhead prices. If in fact higher LNG demand forecasts are correct then demand for US LNG exports may be much greater and have a much more significant impact upon US wellhead prices, particularly given the potential for a true demand shock in excess of NERA's estimate. NERA should further evaluate the impact of significantly greater LNG demand upon US LNG exports.

US Demand*:* NERA's Base case appears to meaningfully underestimate natural gas demand. NERA's 2015 estimate of approximately 69 Bcf/d is roughly in line with the current run rate level of natural gas demand in the US (even after one of the warmer winters on record). NERA's demand forecast implies zero demand growth going forward despite the fact that US natural gas demand has grown 10% since 2009 and third parties forecast meaningful demand growth for the remainder of the decade.

US Electric Demand for Natural Gas (Bcf/d)



Total Demand for Natural Gas (Bcf/d)



Source: NERA,IHS, Goldman Sachs (GS)
Note: GS forecast is for 2018 and IHS for 2025 but NERA forecasts are generally flat

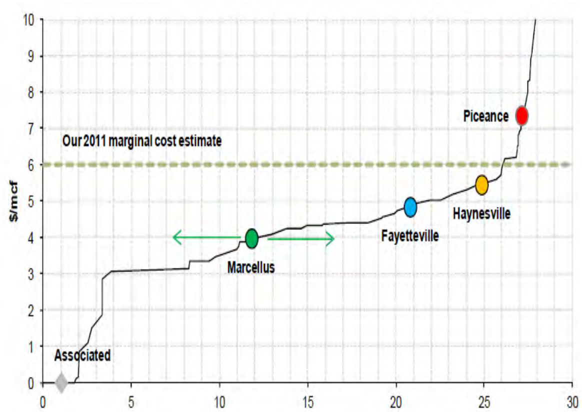
A major component of recent demand growth for natural gas (33% since 2009) has been electric generation. Increasing coal prices owing to demand from exports to China and India combined with declining natural gas prices has dramatically increased the relative competitiveness of natural gas as a fuel for power generation. The NERA base forecast expects electric demand from natural gas to decline meaningfully from current levels through 2015 and then remain flat thereafter. Third party forecasts (such as GS) expect electric demand for natural gas to continue to increase by another nearly 30% going forward owing to continued gains in market share. If the NERA forecast incorporated growth in the outlook for natural gas, then the corresponding impacts from greater LNG export demand could have a greater impact upon the price of natural gas in the US.

US Supply*:* Rather than using identifiable supply cost curves for known US natural gas basins, NERA applies a generalized supply elasticity formula. The ultimate shape of the supply curve will have an incredibly meaningful impact upon the price of natural gas in the US as well as the impact of increased demand for LNG exports.

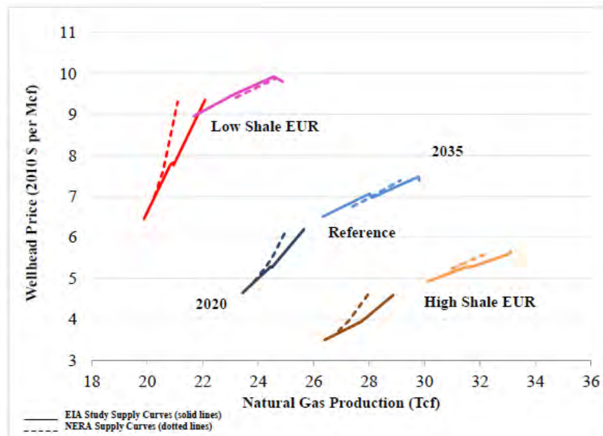
While in recent years the supply curve has flattened as a result of the prolific shale results, the jury is still out on the type curves for these wells given the lack of certifiable production history (shale has really only become prolific over the past several years). Importantly, the industry is awaiting the results of the EPA fracking study in 2014 in order to determine any cost or resource access impacts as the result of any increased regulation.

Third party forecasts (such as SB) apply a steeper cost curve than NERA and the EIA based upon currently known data about the different natural gas basins. While the current level of natural gas demand can be met from lower cost shale plays (such as Marcellus), if demand were to further increase it could begin to approach the steeper part of the curve where several shale and tight gas plays could require materially higher prices (such as Haynesville or even Piceance) to add production.

US Natural Gas Estimated Supply Stack



NERA/EIA Natural Gas Supply Elasticity Curves



Source: NERA, EIA, SB

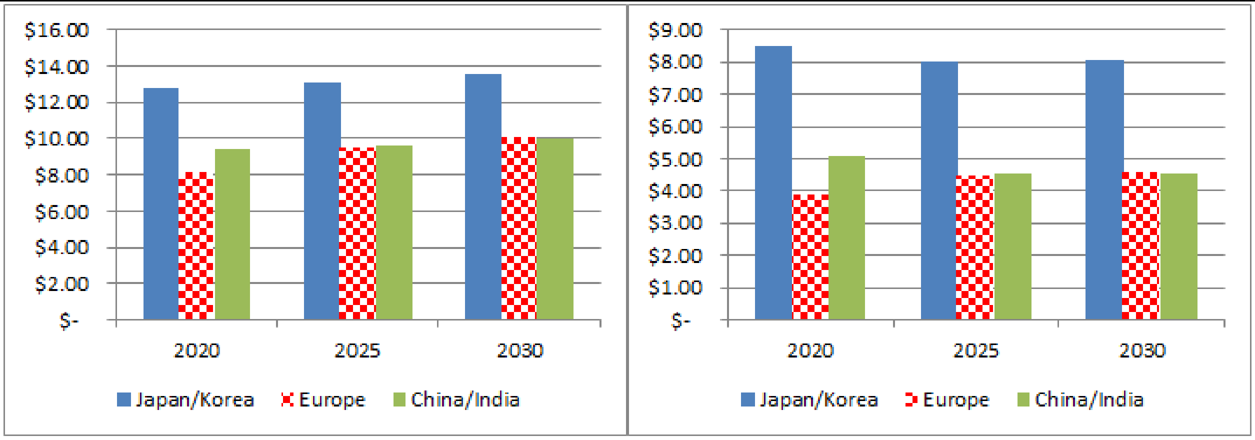
Forecasting the shape of the US supply curve over the next twenty years is virtually impossible given the lack of production history, reserve life and the potential for major regulation. Therefore it would be prudent to utilize a steeper cost curve in evaluating the potential impact of LNG exports on US gas prices and to conduct stress cases if in fact higher cost US supplies would be demanded by the international LNG market (owing to high demand, higher oil prices or otherwise).

Oil Linkage: NERA appears to miss the dynamic impact of changes in oil prices upon the demand and therefore the price of natural gas. In fact NERA declares that US gas prices are permanently de-linked from oil price, a conclusion apparently at odds with the physical reality of the two energy products. In the combined 63 scenarios evaluated by NERA not one contained a sensitivity related to a change in oil prices.

Potential US Natural Gas Impact of High Oil Price ($/MMBtu)

Potential US Export Parity Prices (High Oil Price)

Differential between US Landed LNG Cost and Regional LNG Price (High Oil Price)



Source: NERA and SB
Note: Utilize NERA Baseline Case and Adjust FOB costs for SB LNG Supply Stack. Exclude NERA Adders. In order to illustrate the impact of a high oil price, Baseline landed LNG costs are adjusted to reflect (150/bbl oil, escalated at 1.3%) by linearly applying the same oil relationship as the Baseline case.

Even NERA's model establishes a link between oil prices and US natural gas prices in that NERA appears to incorporate oil-linked Asian LNG forecasts. The netback prices that NERA calculates for US LNG exports are therefore inherently a function of oil price linkage although the relationship is muted through NERA's application of model Adders as well as its assumptions regarding the demand for US LNG exports.

For purposes of illustration, NERA's Base landed LNG prices (before regas and transport) were adjusted to reflect a $150/bbl oil sensitivity. Given the potential for US LNG exporters to capture the differential between their landed LNG supply cost and regional LNG import prices (as discussed previously), a high oil scenario could potentially have the impact of meaningfully increasing US export parity prices (to as high as $8 - $13/MMBtu). Ironically this would be analogous to the situation during the winter of 2007/2008 when the US was forced to compete globally for natural gas imports against the backdrop of high oil prices.

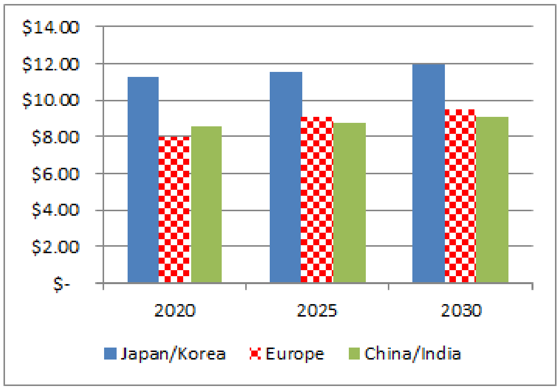
Given the volatility in the oil market and the difficulty in forecasting the commodity it follows that stress tests should be conducted to establish the range of impacts to US natural gas prices under potentially extreme oil price scenarios.

Sunk Cost Dynamics*:* The NERA model suffers from an important limitation in that it does not reflect the economic reality of sunk costs. Once US liquefaction has been built, the considerable fixed costs associated with export (as much as $2-3/MMBtu) should not be included in the exporter's decision regarding dispatch, thus lowering the netback threshold for exports and increasing the demand for US natural gas at higher local prices.

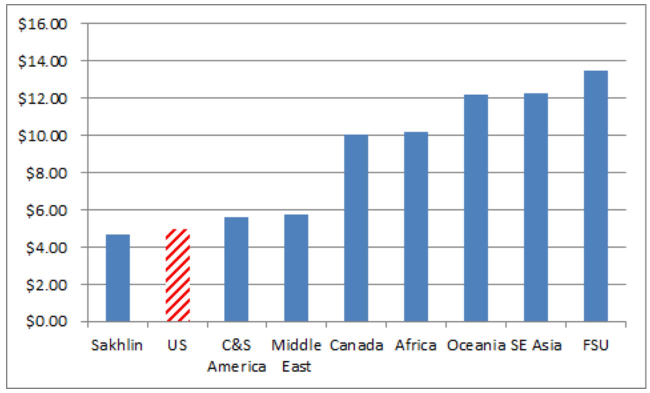
Potential US Natural Gas Impact of Sunk Costs ($/MMBtu)

Potential US Export Parity *Regional FOB LNG Supply Costs (2020)*

Prices (Adjusted for Sunk Costs)



(Adjusted for Sunk Costs)



Source: NERA and SB

Utilize NERA Baseline Case and Adjust FOB costs for SB LNG Supply Stack. Exclude NERA Adders. In order to illustrate the impact of sunk costs, US FOB LNG Base Supply Costs were reduced by $2.50/MMbtu in order to reflect the sunk costs in the dispatch decision.

The sunk cost economic phenomenon is particularly relevant in the case of US LNG exports given the likely structure of the contractual off-take. For example, the LNG orders received for Sabine Pass are structured effectively as an option agreement with the purchaser making a $2.50-$3.00/mmbtu annual payment for the right to export a fixed volume of LNG. Given that the payment is fixed in nature, the purchaser should be willing to purchase US wellhead natural gas up to an export parity price ($8-$12/MMBtu) that allows for a profit on the cost of shipping the natural gas delivered to the liquefaction facility. Therefore if the landed cost of US LNG (based upon at $4.30/mmbtu wellhead) in Japan/Korea would be approximately $10/mmbtu in the NERA base case then from the perspective of the LNG buyer the landed cost would be $7.50/mmbtu as the fixed costs are sunk, thereby increasing the potential pressure on US wellhead prices as the US becomes effectively one of the lowest cost sources of LNG supply globally (see adjusted supply stack above).

This type of arrangement is novel in the LNG market where the price of natural gas and the physical volumes are usually contracted on a long-term basis. This new arrangement introduces a new aspect of optionality for the purchaser that in the case of Sabine is enhanced by the opportunity to import (and regas) LNG to the US in a scenario wherein future US natural gas prices meaningfully increase. It is noteworthy that BG Group, one of the most accomplished LNG trading houses was the first to contract for the export/import option arrangement.

This sunk cost dynamic makes the export authorization decision even more onerous given that once these projects are built they should serve as a permanent source of incremental demand for US natural gas (given their effective low cost position).

B. APPARENTLY INCOMPLETE MACROECONOMIC ANALYSIS

Although NERA concludes that LNG exports would have benefits to the US economy in all scenarios, NERA actually published one case (low well productivity, supply/demand shock, low exports) whereby exports caused a nearly $150 billion negative impact upon GDP. This case is instructive in that it illustrates that an increase in the cost of US wellhead natural gas can easily outweigh the benefits of increased export profits.

As discussed previously, NERA concludes in all of its scenarios that LNG exports would have a minimal impact on the cost of gas thereby limiting the negative macroeconomic consequences. However, if LNG exports were to result in a meaningful increase in US wellhead natural gas prices then the cost increase could outweigh the benefits.

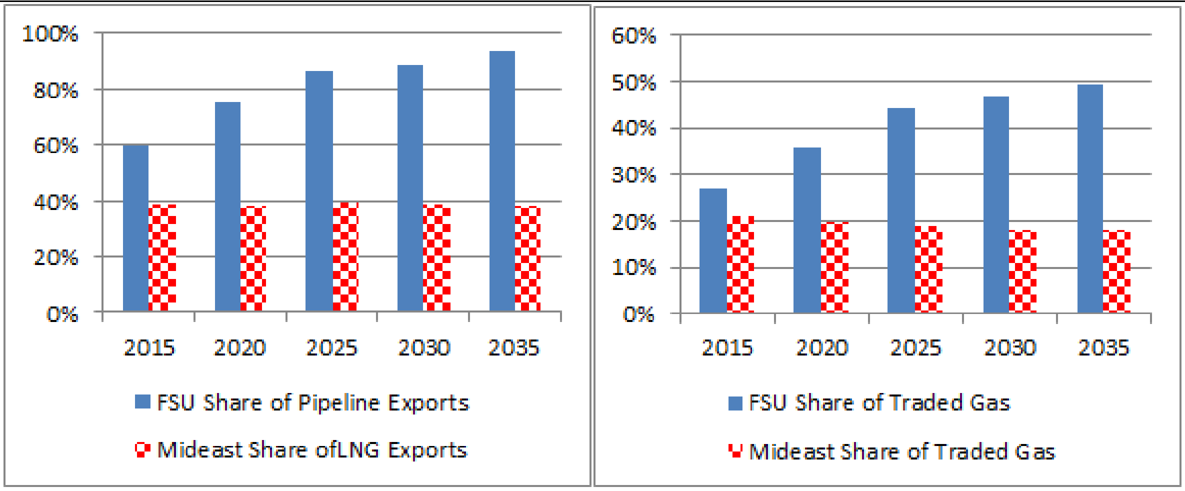
The macroeconomic analysis is therefore dependent upon the accuracy of the global gas forecast. Given the substantial potential flaws in methodology and assumptions it would be prudent to conduct stress test analysis on the macroeconomic model for scenario whereby US natural gas prices responded in a more extreme fashion as a result of LNG exports.

Link to Oligopolistic Market

Natural gas prices inherently link to oil an oligopolistic market given the OPEC cartel's control over more than 30% of global supply and Saudi Arabia's control over most of the world's spare capacity. Furthermore the traded global gas market is heavily concentrated with two regions, the FSU (largely Gazprom) and the Middle East (largely Qatar). While Gazprom and Qatar operate in different markets and don't actively coordinate (despite rumors in recent years about a GPEC cartel) they both have significant market power.

Evidence of supplier market power can be observed in the maintenance of a linkage between natural gas prices and oil in Asian as well as European natural gas markets. NERA implies in its forecast that Russia will meet increasing global traded gas demand by capturing market share from LNG, however, historically Russia has been willing to sacrifice volume to maintain pricing power and thus such an assumption needs to be substantiated.

FSU/Mideast Respective Market Share	*FSU/Mideast Market Share of Traded Gas*



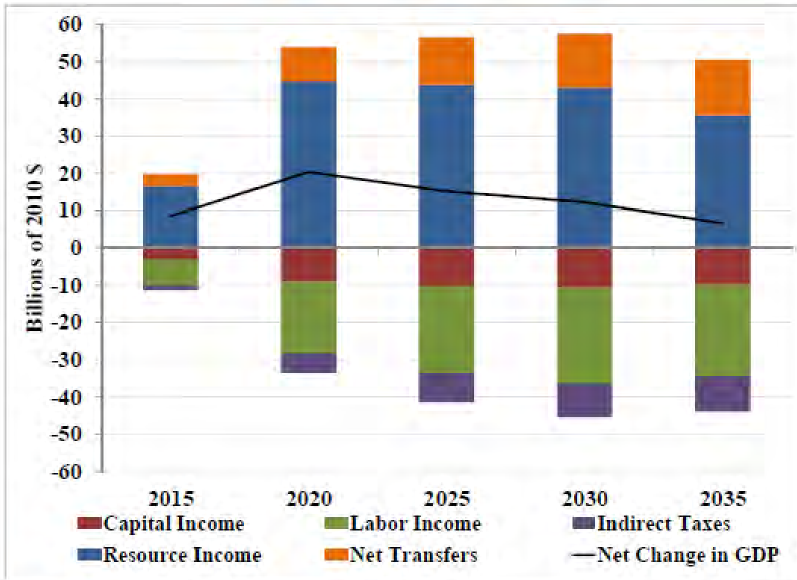
Source: NERA

Given the nature of both the global natural gas and oil markets it is essential to perform sensitivity analysis on a range of stress scenarios related to high oil prices in order to accurately measure the impact on global gas markets as well as the US economy. From a macroeconomic perspective, despite the fact that free trade is generally beneficial for a country, if the trade takes place in an oligopolistic market the costs of imperfect competition can outweigh the benefits of export. In particular in the US, if the oil-linkage causes a large price increase in US wellhead natural gas prices then the costs of higher energy prices may very well outweigh the trade benefits of exports.

Lower Marginal Propensity to Consume

As a result of a rapid increase in LNG exports, NERA concludes that income shifts from labor to resource capital providers. Given the higher economic wealth associated with capital providers (such as energy stockholders) it is likely that they will have a lower marginal propensity to consume than wage earners that have lost purchasing power as result of increased energy costs. For illustrative purposes the differential in the relative Marginal Propensity to Consume (MPC) for resource income earners and labor income earners could offset 10-20% of the GDP benefit assumed by NERA to be achieved in a Supply/Demand Shock scenario with high exports.

Change to Income Components in
Supply/Demand Shock, High Exports Scenario

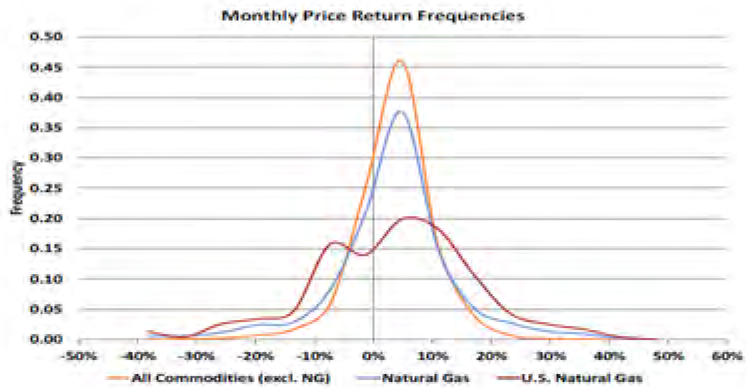


Source: NERA

Increased Volatility

Natural gas has historically been a relatively volatile commodity given fluctuations in demand driven by weather. The highest demand month for natural gas can be 75% higher than the lowest demand month, a variation that has been managed through storage. If the US joins the global LNG market, then the US storage will serve as global storage potentially managing coincident winter peaks across major Asian and European markets. There are a number of costs due to volatility including a decline in investment confidence (although greatly benefitting speculators) and the requirement for the market to pay for incremental storage additions.

Relative Price Distribution for Commodities



Note: Monthly gas price returns from 1990-2010

Furthermore, the disproportional increase in regional demand caused by LNG export facilities can create regional volatility. For example, the Cove Point planned export demand would comprise 65% of total Virginia/Maryland natural gas demand while the Gulf Coast plants (Sabine/Cameron/Freeport) would comprise nearly 40% of total Texas/Louisiana natural gas demand combined. It is crucially important to model the regional impacts of these large demand swings to measure potential natural gas price impacts

Comparative Disadvantage

Exporting raw materials such as natural gas can create a "comparative disadvantage" to trade - the decreasing returns to scale inherent in a scarce natural resource (eg upward sloping cost curve) can have the effect of crowding out the increasing returns to scale available in manufacturing and technology (eg downward sloping cost curve) and thus undermine the benefits of trade.   The US could potentially earn much greater economic benefits through investing that capital in higher value added technology or manufacturing (perhaps by even exporting shale drilling/completion technology instead of the underlying raw material).

The US like many other countries has already made such a determination with regard to crude oil, effectively limiting the export of that raw material until it is upgraded into higher value manufactured products such as transportation fuels or petrochemicals. There is however, no corresponding prohibition on the export of those higher value products.

<u>Limitation on US Crude Exports</u>

“Limitations on Export

“(u) Any domestically produced crude oil transported by pipeline over rights-of-way granted pursuant to section 28 of the Mineral Leasing Act of 1920…..shall be subject to all of the limitations and licensing requirements of the Export Administration Act of 1969 …..before any crude oil subject to this section may be exported ….the President must make and publish an express finding that such exports will not diminish the total quantity or quality of petroleum available to the United States, and are in the national interest and are in accord with the provisions of the Export Administration Act of 1969.

Source: Trans-Alaska Pipeline Authorization Act, 1973

Illustrative Economic Sensitivity

Given the apparent incomplete nature of the NERA macroeconomic analysis, for illustrative purposes only, several sensitivities were applied to the NERA model in order to gauge the potential impact on the economy. The assumptions for these sensitivities are described below.

Comparison of GDP Impacts from LNG Exports

Note: Illustrative impacts not intended to represent actual adjustments but rather highlight importance of applying additional sensitivities to NERA model

		Base Reference 2020	Low Shale SD Shock Slow LNG 2020	High Shale SD Shock Rapid LNG 2020	Comments
Wellhead Price	$/MMBtu	$4.65	$6.82	$4.61	
LNG Exports	Bcf/d	-	2.1	12.0	
GDP	$ bn ($2010)	17,862	17,719	18,012	
GDP Benefit / (Cost)			(143)	150	Low EUR export case is negative for GDP
Illustrative impact of ~$4/MMBtu price increase due to higher oil prices				(162)	Assume 50% of proportional GDP impact observed in Low EUR Reference case
Illustrative impact of applying 15% marginal propensity to consume (MPC)				(23)	Assume net resource income earned by savers
Illustrative 0.50/MMBtu increased storge cost for higher gas price volatility				(20)	Assume 50% of proportional GDP impact observed in Low EUR Reference case
Illustrative impact of leakage to foreign investors in LNG and upstream				(8)	Assume 50% of export income goes to foreigners
Other potential impacts include decline in energy-intense exports, stronger FX, labor friction					
Illustrative Adjusted GDP Benefit / (Cost)				(63)	

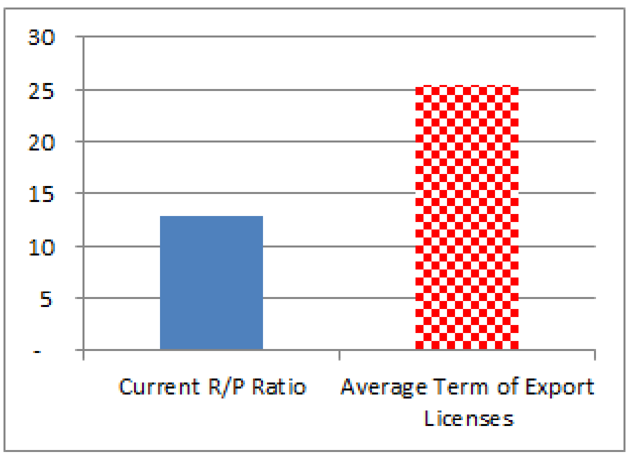
C. FAILURE TO EVALUATE EXTERNALITIES

Energy Security

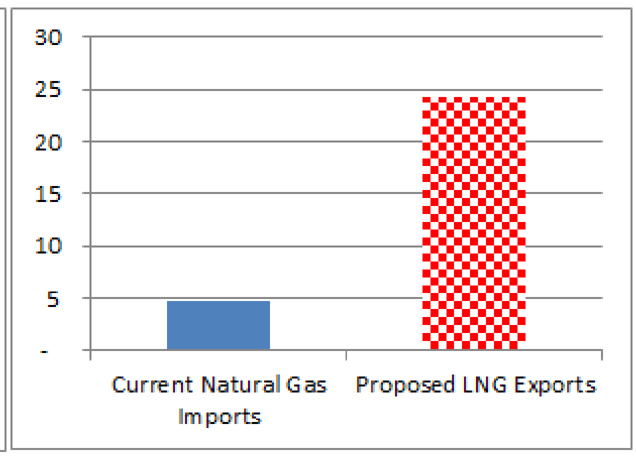
While shale technology is promising, the new resources have not yet established enough production history to be classified as proven. Export applicants have thus far been unable to identify the specific resources to be exported throughout the license period given the fact that the total US reserve/production (R/P) ratio is only 50% of the proposed term for export licenses, again begging the question as to why such lengthy export licenses are granted.

The DOE has already approved exports to Free Trade countries totaling more than 75% of total proven reserves and 40% of current demand. The US is currently still a significant importer of natural gas with net imports of nearly 7% of current demand. Approximately five years ago the EIA still predicted that the US would require substantial natural gas imports.

Comparison of Current Proved R/P Ratio of Reserves to Term of Export Licenses (Yrs)



Comparison of Proposed LNG Exports to Current Natural Gas Imports (Bcf/d)



Source: EIA, DOE

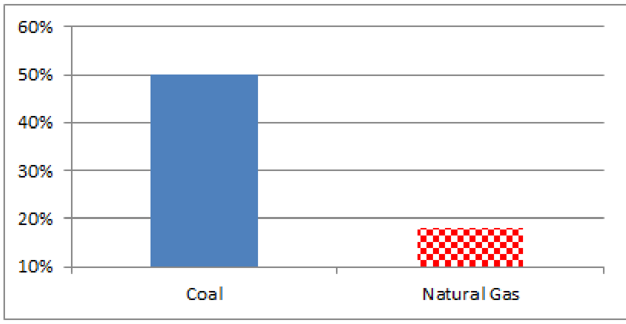
Given the prospects for substituting natural gas for oil products, the increased US production of natural gas has the potential to reduce US dependence upon oil markets. Natural gas can increasingly be utilized for heating, industrial manufacturing and even transportation. While US production of oil has been recently increasing, merely increasing the supply of domestic oil does not lessen US exposure to the volatility and price impacts of the oil market given its oligopolistic structure and ease of transportation.

The DOE may benefit from additional review provided by the Departments of Defense and State given the significant potential energy security impacts for LNG exports.

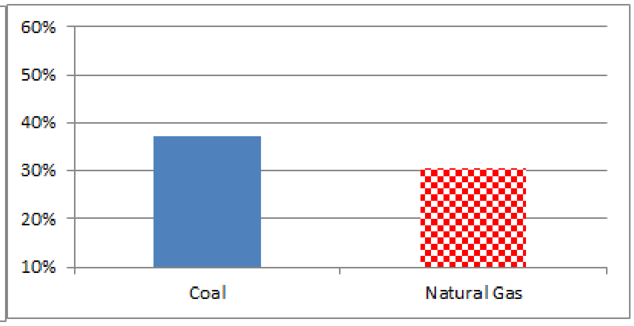
Environmental

The EPA is currently conducting a study regarding the environmental impacts of fracking shale resources (expected to be released in 2014). Given the importance of cost effective shale resources to the determination regarding the net impact of LNG exports it would follow that the DOE should wait until the EPA study is completed and analyzed before granting long-term export license. If the EPA adopts regulations that impact the cost and/or availability of shale that may have a drastic impact upon the outlook for US natural gas and the corresponding impact of exports.

Coal vs Gas % of Electric Generation (2002)



Coal vs Gas % of Electric Generation (2012)



Source: EIA, DOE

Over the past ten years, natural gas has rapidly been gaining market share from coal as an electric generation fuel source increasing from less than 20% in 2002 to nearly 30% in 2012. Based upon the current trajectory natural gas could overtake coal as the largest source for US power generation over the next decade. Natural gas produces considerably fewer carbon dioxide, particulate and other air emissions than coal for generation. In addition the waste products from the coal generation process are considered hazardous materials.

If the demand for US LNG exports increases the net effect could be for coal to regain market share in the electric generation mix and increase the net air emissions and hazardous waste impact upon the US.

D. OTHER ISSUES FOR CONSIDERATION

Regional Impacts

The NERA analysis does not perform regional analysis upon the GNGM. For example, the Cove Point proposed liquefaction terminal is located on the East Coast. The East Coast terminal would have a shipping cost advantage when sending LNG exports to Europe and therefore may be more competitive than contemplated by the GNGM against other international facilities. A similar conclusion may be reached regarding Jordan Cove in Oregon with its potential shipping cost advantage into the Japan/Korea or China/India markets.

Material changes to regional demand can stress infrastructure and resources such that short term bottlenecks can develop and prices can spike to provide an economic signal for the necessary infrastructure support. Numerous historic examples (such as Rockies gas basis in the WTI-Brent spread) exist that demonstrate the pricing volatility that can be created by rapid and material changes in supply/demand. Introducing a 1-2bcf/d LNG export terminal that turns on in one day is relatively unprecedented and can introduce a significant amount of volatility into a regional market.

Foreign Income Leakage

NERA assumes all of the investment in the liquefaction value chain is performed by domestic participants. However, several of the companies that are pursuing export license include substantial foreign ownership, including but not limited to Qatar's investment in Golden Pass. Furthermore, publicly owned corporations also may have substantial foreign ownership present within their share owner base.

Corporate Taxes

The Sabine Pass LNG terminal is structured as a master limited partnership and therefore qualifies for exemption from corporate income taxes. Several other terminals are exploring this organizational structure. As a result the income tax captured as part of the macroeconomic model may not be as large as anticipated. The potential income tax savings for LNG terminals could total billions of dollars annually.

Labor Friction

NERA appears to assume full employment for the US economy. In a circumstance whereby investment dollars shift from manufacturing to resources as a result of LNG export economics, there would likely be a period of temporal unemployment as displaced manufacturing workers must be retrained in order to fulfill the requirement of the resource industry jobs.

Foreign Exchange

If a substantial increase in LNG exports by foreign nations increases the demand for dollars any strengthening impact on the dollar may result in increased demand for imports thus causing the trade balance to deteriorate correspondingly.

If US monetary policy continues to favor low interest rates then a relatively weak dollar can increase the competitiveness of US landed LNG cost in comparison to international competitors.

Limited LNG Market Depth

The NERA analysis appears to group the entire global LNG trade into three destinations (Japan/Korea, China/India and Europe). NERA does not appear to incorporate increasing demand from the Central and South American region into the analysis. Furthermore, large and rapidly growing markets such as China and India have unique dynamics and logistical differences (eg they are far apart) that limit the effectiveness of combining them into a single market.

Furthermore, the dynamic impacts of Canada building liquefaction capability and the resulting impact upon the price and availability of Canadian pipeline supplies should be evaluated in greater depth. The US decision as to whether to export additional pipeline supplies to Mexico or export LNG is another dynamic analysis that should be considered.

E. ADDITIONAL DETAILED COMMENTARY ON KEY ISSUES

Apparently Flawed Methodology

Despite the fact that billions of dollars in US liquefaction facilities are under construction (including a terminal funded by Blackstone, one of the world's most sophisticated investors) and 5 bcf/d of 20 year LNG orders have already been agreed, surprisingly NERA concluded that the US would not be able to economically export LNG to the global market under Base case conditions.

The practical reality of the situation is that 15 applications totaling more than 24 bcf/d or 40% of current US gas production and 75% of proven reserves have been submitted to the DOE. The competiveness of US LNG can further be inferred from Japan's active lobbying in the US to access LNG resources.

NERA's fundamental conclusion is at odds with empirical evidence and could call into question the validity of the results of GNGM as a practical forecasting tool.

LNG Cost Adders

NERA forecasts City Gate natural gas prices of nearly $16/MMBtu in 2020 (all prices in 2010 dollars) for Korea and Japan as compared to US Wellhead prices of $4/MMBtu. Despite this $12/MMBtu spread between prices in NERA's reference case, even with no export constraints, the GNGM concludes that no US exports would be economic.

NERA calculates that total LNG transportation costs from US Wellhead to Korea/Japan City Gate would be $7/MMBtu. Assuming for a moment that the assumptions are correct, that would still leave a profit potential of $4.50/MMBtu for US exports, yet the GNGM concludes that there is no profit potential for US LNG exports.

The differential is that the GNGM assumes an LNG Cost Adder of $4.50/MMBtu for all US exports to Korea/Japan (in 2020). NERA describes the cost adder as a "model calibration" to reflect that if the GNGM assumes the global gas market is perfectly competitive without the adders or calibration the model's results "would be unable to match the EIA's forecasts". Said more simply, the GNGM model is not set up to adequately explain the real world dynamics of the global natural gas market. This issue severely limits its effectiveness in determining the impacts of the global gas market upon US natural gas prices.

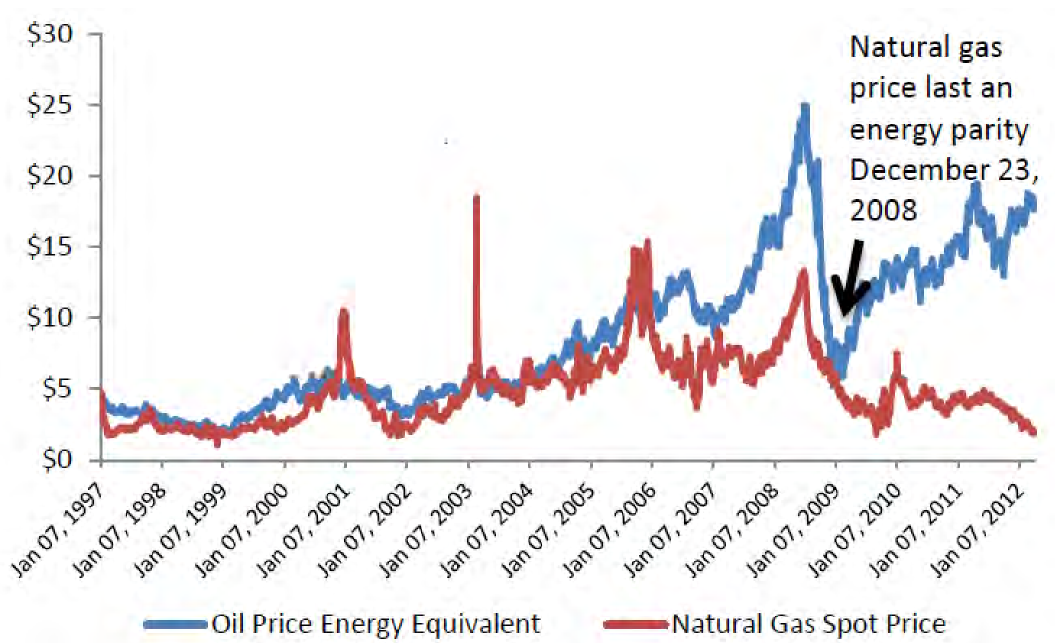
The GNGM plugs in LNG Cost Adders in every year of the model forecast for all exports to Korea/China, China/India and Europe. It is the incremental costs of these LNG Cost Adders that apparently result in zero US export profit potential in all years of the US and International Reference Cases.

Another indicator that the distorted predictive value of the GNGM can be gleaned by examining the destination of the US LNG exports predicted by the model. In the High EUR (high shale production) case with International Reference (Base Case) demand, NERA estimates that Japan and Korea would average less than 10% of total US exports in an unconstrained scenario, less than 1 bcf/d. This base assumption is wholly inconsistent with the current commercial reality of US LNG export projects. Per SB, nearly 60% of total US long-term liquefaction orders already announced originated specifically from Japanese and Korean utility buyers (~3 bcf/d), other global traders such as BG may be planning to serve that region as well. A reference case prediction that is so disconnected from the reality already witnessed may be limited in value.

No Oil Linkage?

Despite the fact that for many years leading up until 2009, US natural gas prices were linked to oil prices, NERA appears to conclude that the gas/oil price linkage is broken forever, regardless of the level of US exports and the productivity of US supply.

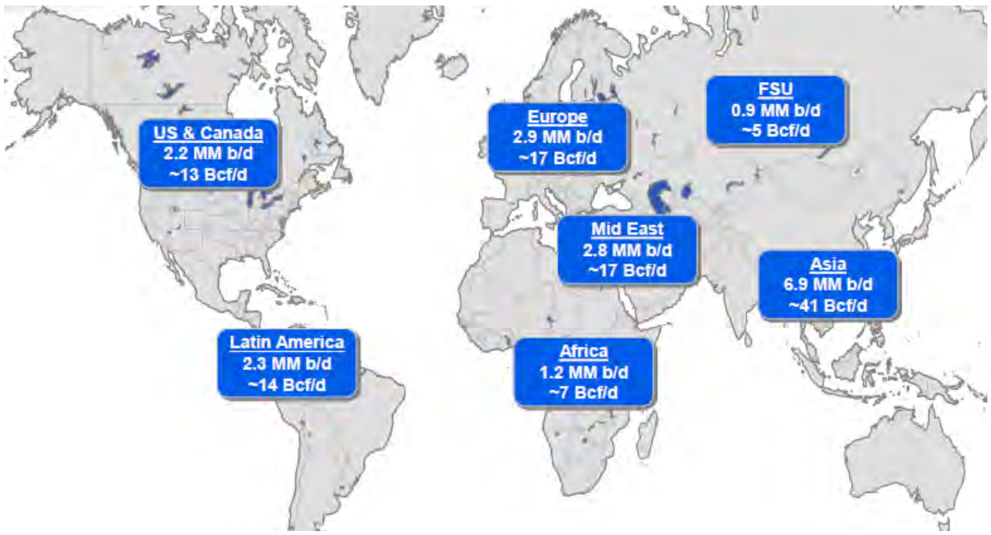
Oil/Gas Linkage



Source: Carlyle

There are several fundamental flaws with this conclusion, the first of which is the fact that natural gas and oil can be substituted as an energy fuel, a fact noted by NERA in its description of the Asian LNG market. Natural gas can be used as a substitute for oil in many applications including but not limited to heating, industrial, power generation and transportation. Consulting firm PIRA (as reported by Cheniere) estimates there are 114 Bcf/d of stationary sources (industrial, power and heating) globally that could be switched from oil to natural gas more than 50% of which are located in potential US LNG export destinations of Europe and Asia (a level which is could more than double the existing global LNG market). Natural gas is also used globally as a substitute for oil in the transportation industry through the use of CNG and LNG for vehicles as well as through the GTL process.

Global Petroleum Demand Stationary Sources



Source: PIRA

The NERA GNGM model utilizes a fixed demand elasticity of -.1 to -.2 for all global regions excluding the US (for which NERA uses the EIA assumptions) essentially judging natural gas demand globally to be relatively inelastic. While this may represent a historical relationship during a time when oil and gas prices were linked, this static assumption does not make logical sense in a world where pricing for oil and gas have diverged yet the two are substitutes.

It appears that the NERA GNGM model evaluates a static oil price scenario, combined with utilizing a fixed elasticity function for global natural gas and applies LNG Cost Adders , obfuscating the natural linkage that occurs between oil and natural gas prices because of their substitution relationship. A practical economic analysis should determine changes to global natural gas demand based upon the relative spread between oil and natural gas prices. Given the size of switching demand identified by PIRA, it is difficult to imagine that global demand for natural gas would not increase at a greater rate than the 1.6% compound annual growth rate (CAGR) from 2010-2035 assumed in the reference case or the 1.8% CAGR assumed in the supply/demand shock case. The "LNG Cost Adders" utilized by the GNGM, which are essentially a model calibration tool and not based upon any fundamental assumptions, further mute the impacts of oil price movements.

Despite evaluating 63 different cases to evaluate the impacts of US LNG exports under different global gas market conditions, NERA apparently failed to conduct even one sensitivity case based upon a change in oil prices. NERA cites "a number of data sources" for developing its world natural gas price assumptions and cites the IEA's World Energy Outlook (WEO) 2011 crude oil forecasts as supporting its prices for Asian natural gas. Given the observed volatility in world oil prices it would seem that assuming one static oil price projection in all 63 cases would prove insufficient in concluding that US LNG exports would completely de-linked from global oil prices.

NERA appears to assume that Asian LNG import prices (before regas and transport charges) would average between 12-13% of the IEA's WEO 2011 oil forecast. The WEO forecast for 2015 of $106/bbl (in 2010 dollars) is below the current oil price and only escalates at 1.4% thereafter. The EIA in its 2011 Annual Energy Outlook (AEO) conducts a "High Oil" price scenario that forecasts a 2015 oil price of $146/bbl (in 2010 dollars) and escalates at 1.6%. Relaxing for a moment the hypothesis that the elasticity of gas demand would increase with a greater spread between oil and gas prices, simply the increase in oil-linked natural gas prices in Asia by more than 30% to over $20/MMBTU (~13% of $146/bbl + regas and transport) should create sufficient incentive to attract incremental US LNG exports and therefore increase US natural gas prices, therefore establishing an implicit US oil link even in the Base Case.

Sunk Cost Economics

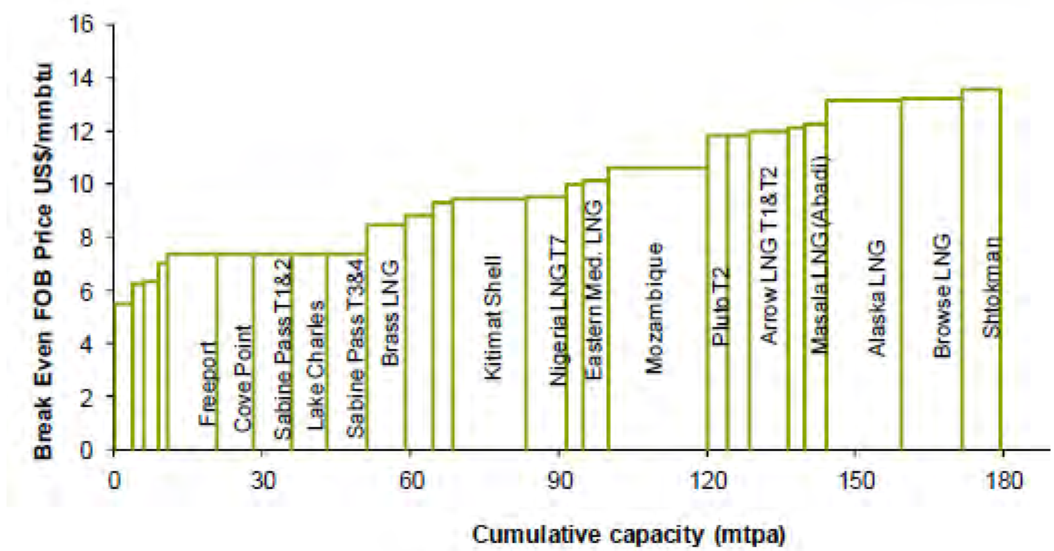
The dynamics of sunk cost economics are a crucial real world factor in determining future natural gas prices, particularly in the US if substantial LNG export capacity is permitted to be constructed. Once the US liquefaction facilities are constructed thegoing forward economics change materially. Fixed charges associated with the liquefaction capacity and potentially certain pipeline capacity are no longer considered in the terminal capacity's decision whether to dispatch natural gas into the global market. Therefore the effective netback for US LNG export terminals will increase by the total fixed costs in determining whether to consume US natural gas for export. For example, NERA estimates that the FOB cost of export for a US LNG terminal in 2020 is approximately $7.50/MMBtu with US wellhead gas prices of ~$4.30/MMBtu. Once the project has been constructed a substantial portion of the $3.20/MMBtu in liquefaction and transport costs are fixed (for illustrative purposes assume $2.50) therefore the effective FOB cost if US LNG for purposes of the export decision would be $4.75/MMBtu and as such the likelihood of US natural gas being exported to Japan or Europe increases materially (thereby increasing US prices and discouraging the development of competing supply in other countries). The GNGM assumes that US LNG exporters wait for a full return on capital to dispatch into the global market even after the projects have been built, however, this behavior would be economically irrational.

The sunk cost dynamics are particularly acute in the case of US exports given the previously discussed dynamic of fixed annual option payments from LNG purchasers that entitle them to dispatch US exports into the global market. The impact of sunk cost economics can also be very important in the case of Low EUR as the reduced fixed costs would offset the NERA forecast for higher well head prices (in a no export case) thereby increasing the relative competitiveness of US exports and putting pressure on the US well head price.

Cost Competitiveness of US LNG Exports

While the NERA report concludes there would be zero exports in the Base Case, in their high demand scenario, an increase in global LNG demand of 9.3 Bcf/d in 2020 caused by the complete shutdown of Japan's nuclear industry (incidentally a scenario that is consistent with their current policy), NERA concludes that only 2.6 bcf/d of that incremental high case demand would be satisfied by US LNG exports. NERA does not specifically identify the specific sources of that incremental LNG supply (information that should be disclosed for completeness) but the report does indicate that in the US Reference High Demand scenario that other sources of planned LNG are more cost competitive than US LNG. This conclusion seems to derive from the assumptions utilized by NERA for its cost of wellhead gas, transportation costs and liquefaction costs for international supply regions. In fact, NERA assumes that the US is the second least competitive delivered LNG supplier to Japan/Korea (only Canada is less competitive). However, NERA's generalized assumptions for free-on-board LNG (FOB – eg buyer pays shipping costs) are highly inconsistent with the cost estimated for visible planned projects by third parties (such as SB) that indicate that the US is a low cost supplier (a conclusion consistent with empirical observation)

Global LNG Cost Curve



Source: SB

SB has estimated the break-even FOB price for the current group of planned liquefaction facilities globally and has concluded that the planned US liquefaction plants are among the lowest cost planned projects (at roughly $4.50/mmbtu natural gas). Utilizing NERA's assumptions for wellhead, transport and liquefaction costs (together FOB cost) for 2015, NERA would conclude that Australian LNG (Oceania) projects product LNG at an FOB cost of $6-$7/MMBtu as compared to third party estimates of $12-$14/MMBtu for identifiable projects such as Pluto, Arrow and Browse). Even after including NERA's assumption for a shipping cost advantage of between $1.50-$2.00/MMBtu from Oceania to Japan/Korea at face value, US LNG exports would be substantially more cost competitive than Australian LNG. LNG projects in Australia are very capital intensive because labor is expensive, multiple projects are being developed in the same time, there is limited infrastructure and the Australian dollar is strong, all combining to create substantial cost overruns for Australian LNG developers.

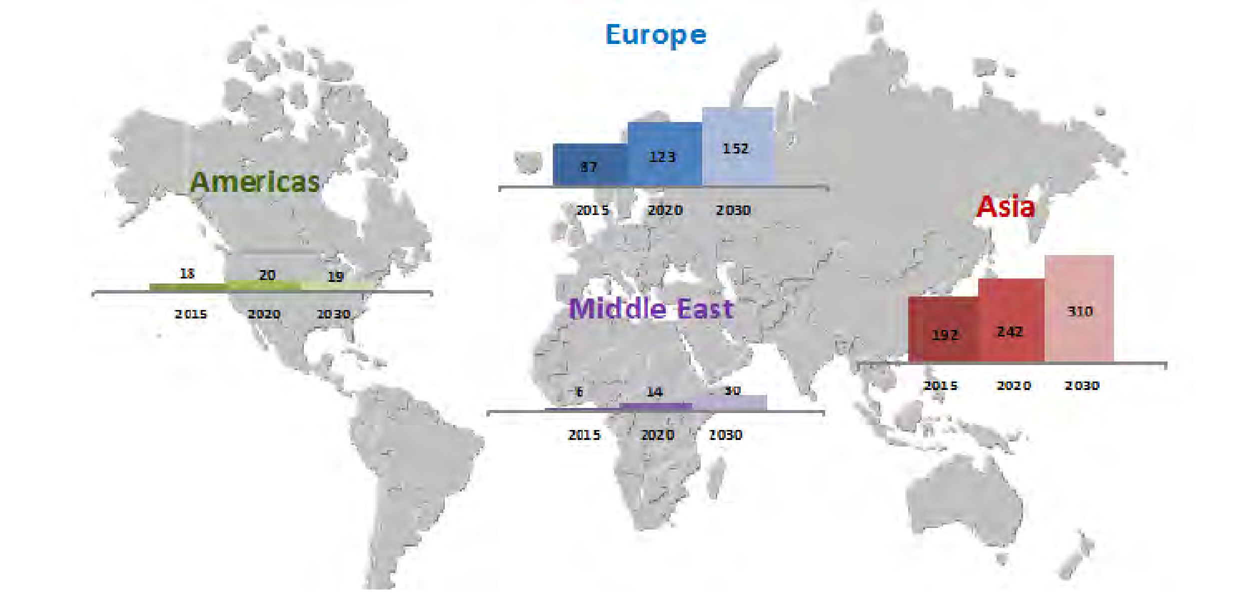
Recent large discoveries in East Africa create the potential for LNG exports from Mozambique, however those projects are nowhere close to being sanctioned and existing infrastructure in East Africa is very limited. The FOB cost of Mozambique LNG is estimated to be in the range of $10-$11/MMBtu as compared to the roughly $9/MMBtu FOB cost for Africa embedded in the NERA forecasts. Again, US LNG exports would be considerably more cost competitive. The Indonesian Abadi LNG project is estimated to have an FOB cost of $12/MMBtu as compared to NERA's generalized assumption of $7-$8/MMBtu for SE Asian LNG.

NERA's apparent conclusion that in the US reference case (even with high demand, from NERA's perspective) that the substantial majority of increased LNG demand would be satisfied by international exports is inconsistent with the relative cost competitiveness of US LNG exports.

Global LNG Demand

NERA's baseline assumption for LNG flows appears to be inconsistent with historical data and the trajectory of visible projects under construction. NERA assumes that 2010 Baseline LNG demand totals 27 Bcf/d (10 Tcf), however IGU reports that LNG traded flows for 2010 totaled more than 32 Bcf/d. When liquefaction projects currently under construction (as reported by IGU) are combined with existing supply and a conservative capacity factor (83%) is applied, 2015 traded LNG would exceed NERA's estimate by more than 20% (7 Bcf/d). There is reason to believe that NERA has substantially underestimated the likely demand for traded LNG.

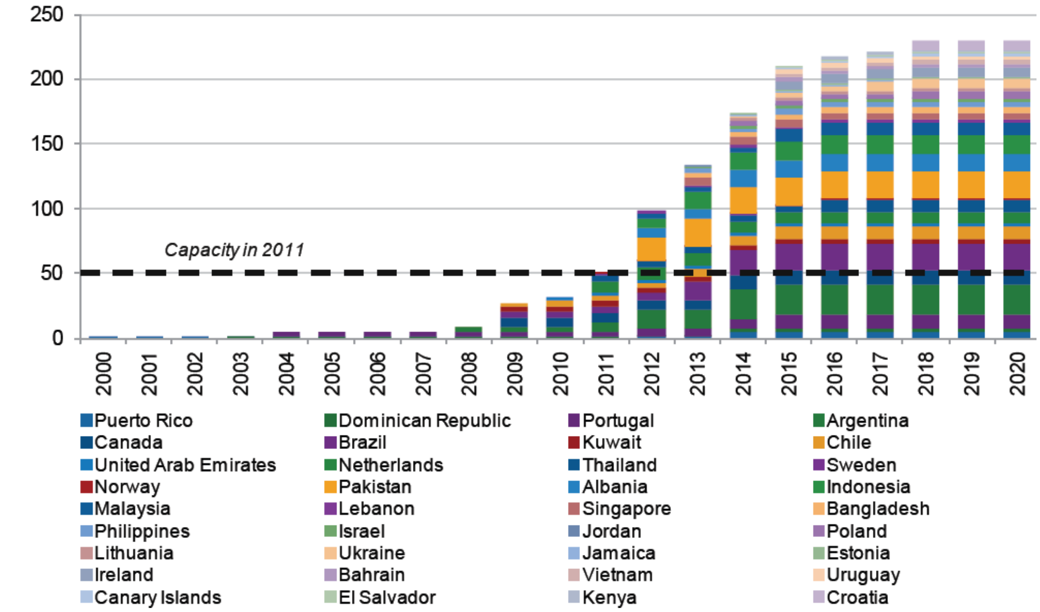
Global LNG Demand (MMTPA)



Source: Facts Global Energy

Consistent with the IGU report, Facts Global Energy (as reported by Cheniere Energy) estimates that global demand for LNG will be greater than 40 bcf/d in 2015 and grow to more than 50 bcd/d in 2020 and to 68 bcf/d by 2030 (SB also forecast LNG demand of greater than 53 Bcf/d in 2020). In contrast, NERA's baseline forecast is for LNG demand to remain essentially flat from 2015 through 2035 at 33 Bcf/d a level. As a result, NERA's Supply/Demand shock case would only bring LNG demand in line with the base case forecasted by Facts. The High Demand case would actually result in nearly 20% and nearly 40% lower demand than the Fact estimates for 2020 and 2030, respectively.

Planned LNG Import Capacity (MMTPA)



Source: International Gas Union

It is not clear that the NERA GNGM reflects the recent developments related to an increasing number of countries planning LNG import terminals. According to IGU, 32 countries already have LNG import capacity while 32 additional countries have announced plans to do so potentially increasing global import capacity by nearly 50% (existing LNG regas capacity has a 40% utilization rate). In addition to China and India, LNG imports and import capacity have been growing in other parts of SE Asia such as Singapore, Malaysia and Indonesia as well as Central and South America (Chile and Argentina) and the Middle East. It is not apparent how the GNGM treats this incremental demand.

Given the competitiveness of natural gas in comparison to oil and the concerned initiative on the part of Asian countries such as China to increase the usage of natural gas in their fuel mix, NERA's apparent assumption of flat LNG demand at a level below the current existing capacity (plus construction) doesn't make logical sense. According to Hydrocarbon Asia and Petronet, China and India are planning to add more than 16 Bcf/d of LNG import capacity by 2020 (nearly 6 Tcf) while NERA forecasts that China and India will together import less than 7 Bcf/d of LNG in 2020.

The GNGM also assumes that FSU pipeline imports to Europe increase substantially nearly doubling market share over the forecast period from 9% to 17% of total European imports in the US/International Reference (Base Case). NERA also assumes in the Base Case that FSU pipeline imports displace LNG imports as LNG declines from nearly 20% of Europe's supply mix to only 13% (an absolute decline of 25%). The increase in FSU as a percentage of Europe's supply mix appears inconsistent with Europe's stated goal of increasingly diversifying away from Russian gas imports as indicated by continued construction and planned additions in LNG import capacity (as reported by IGU). Facts Global energy forecasts Europe LNG demand to increase from a little over 12 Bcf/d in 2015 to greater than 30 bcf/d in

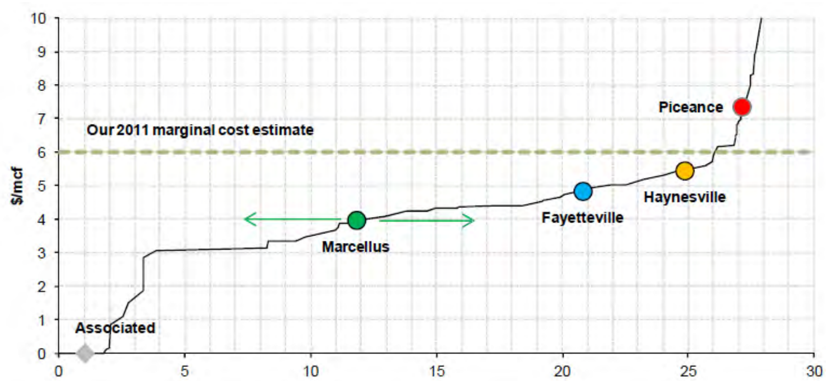
2030 while NERA forecasts that Europe LNG imports will drop nearly 2.7 Bcf/d during that period. The NERA assumption that FSU pipeline imports will displace LNG should be tested and examined.

Furthermore nearly 1/3 of the US LNG purchase contracts already announced (per SB) are from companies that are based in Europe (although these companies could divert cargoes to other regions). In fact, in the GNGM, in cases of High Demand or in the International Reference Case with High EUR, Europe represents the largest export destination for US LNG exports.

Supply Curve

The cost of supply is an important driver in measuring the impact of increased LNG Export demand upon the well head price in the US. The EIA developed supply elasticity curves for the 2011 AEO and applied those curves in EIA's LNG export study. Both the EIA and NERA elasticity-driven supply curves may deviate from known information about the existing actual cost of production in the US. According to third party (SB) marginal cost supply curve, the cost of production may steepen meaningfully once demand exceeds 70 Bcf/d.

US Natural Gas Cost of Supply Curve



Source: Sanford Bernstein (November 2012). Note bottom axis denominated in Tcf/year

While the demand curve may extend if more supply is added in low cost shale plays such as the Marcellus, the supply elasticity functions applied by NERA imply higher cost plays such as the Haynesville and Piceance cease to exist. However, in any given year if a sudden increase in demand (particularly related to LNG exports) is not matched with increased supply from shale, the marginal cost can increase rapidly in order to access higher cost plays and therefore the US price for natural gas is susceptible to price spikes. NERA should conduct a scenario applying known information about the existing natural gas resource base rather than implied and adjusted elasticity functions. A high volatility scenario should also be conducted to capture the potential price swings caused by the shape of the supply curve, particularly for periods with large potential swings in demand.

US Natural Gas Demand

NERA, in its US Reference (International Reference) case utilizes a 2020 US natural gas demand estimate of approximately 69 Bcf/d, a figure that is essentially equal to the actual natural gas demand in the US over the past 12 months (as reported by the EIA), one of the warmest years on record. NERA also forecasts US demand in the reference case to remain essentially flat throughout the forecast thereby suggesting the US experiences no growth in natural gas demand from today forward. This assumption seems inconsistent with the recent trend of growth in natural gas demand, particularly for electric generation and industrial consumers.

GS estimates that US natural gas demand should increase by over 30% (~16 bcf/d) between 2012 and 2018. The primary driver for US natural gas demand growth is an increase in natural gas for electric power demand. According to GS, US electric generation demand for natural gas should increase to more than 32 Bcf/d as a result of planned coal plant retirements and increasing market share for natural gas as electricity demand grows. The report also states that industrial natural gas demand growth is expected to grow nearly 30% by 2018. Drivers for industrial demand growth likely related to planned manufacturing investments in petrochemicals, fertilizers, etc that have been announced in response to the increased availability of natural gas in the US.

If the baseline expectation for natural gas demand utilized by NERA is too low then the impacts of LNG export demand are likely understated. The cost of incremental supply required to meet the incremental LNG demand would likely be higher and/or natural gas would be competitively disadvantaged as a generation fuel versus coal thus resulting in either coal production displacing natural gas or increased coal prices. Although natural gas represents approximately 30% of the supply mix for electric generation (according to the EIA), natural gas power plants set the electricity price the majority of hours in a numbers of markets across the US such as Texas, New England, the South East and California.

NERA should examine the impacts of incremental LNG exports utilizing a scenario with a higher reference case for natural gas.

Market Behavior

Natural gas prices inherently link to oil which is an oligopolistic market given OPEC control over marginal supplies and active management of volumes to support price objectives. Furthermore, two major participants (Qatar and Russia) control nearly50% of total natural gas exports and have historically demonstrated oligopolistic pricing behavior. Given the role of natural gas as a substitution for oil and the oligopolistic behavior in both markets it is logical to apply an oil price sensitivity to the macroeconomic analysis of LNG impacts. As illustrated by NERA's analysis of the Low EUR export case, higher prices have a negative impact on GDP.

Implicit in NERA's assumptions regarding FSU pipeline exports to Europe displacing LNG volumes is that Gazprom (the Russian export monopoly) will trade off price for the purpose of growing volumes. NERA's assumption regarding Gazprom's behavior is inconsistent with the company's historical pricing strategy. Gazprom export contracts to Europe are priced based upon a formula linked to the market prices of alternative fuels (primarily oil). In fact, NERA's assumptions regarding FSU wellhead prices and pipeline costs would yield a delivered cost to Europe of approximately $6.00/MMBtu in 2020 as compared to NERA's Europe City Gate forecast of nearly $12.00/MMBtu. However, NERA applies a roughly $6.00/MMBtu model calibration called a "Pipeline Cost Adder" that eliminates this differential. The Pipeline Cost Adder obfuscates the fact that Gazprom (FSU) manages volumes (instead of maximizing) in order to maintain the profitability of exports, a key driver of the Russian economy. For the FSU to gain share against LNG, as predicted in the NERA model, the FSU (likely Gazprom) would have to undercut LNG imports on price which would be a departure in strategy for the largest participant in the market.

NERA estimates that total FSU pipeline exports in 2015 comprise approximately 27% of the global natural gas export market while the Middle East (largely Qatar) comprises approximately 21% of the market. The two largest players thus combine to produce nearly 50% of total natural gas exports, a market actually more concentrated than OPEC (with much less liquidity). NERA already assumes that Qatar, as a dominant market player, restricts its production to the current level throughout the forecast, however, NERA assumes that the larger FSU will dramatically increase its share of the total global natural gas export to nearly 50% by 2035. If NERA assumed that the FSU's market behavior would be consistent with Qatar, as well as past practice, the demand for US LNG exports could be substantially larger (this is a scenario that NERA should perform). It is also noteworthy that Qatar is applying to build liquefaction in the US.

Volatility

Natural gas has historically been a relatively volatile commodity given fluctuations in demand driven by weather. The NERA report is completely silent on the topic of the impact of LNG exports upon the volatility of US natural gas prices. A number of LNG export advocates have commented that increased LNG exports should dampen volatility. However, their references to volatility relate primarily to the dry gas rig count which has dropped materially in the past 3 years (they fail to cite the fact that the overall rig count has increased materially). Furthermore, the volatility of US natural gas prices has actually declined materially over the past four years as a result of the increased natural gas supply.

As discussed earlier, oil and natural gas are substitutable goods and exporting US LNG should strengthen the linkage between natural gas and oil. Given the volatility of the oil market, the resulting impact on natural gas should increase volatility. In addition, each planned LNG export project represents a material change in the local market. For example the Sabine Pass terminal volumes represent nearly 20% of Texas and Louisiana combined demand. Including the planned Cameron and Freeport terminals would represent nearly 150% of Louisiana demand and over 40% of combined Texas and Louisiana demand. Cove Point demand would represent nearly 65% of total Virginia and Maryland natural gas demand.

NERA should include in its analysis the potential for US natural gas price volatility as a result of planned exports.

F. RECOMMENDATIONS

Process/Timing

1. Given the extreme importance and complexity of the LNG export decision, substantial additional analysis should be conducted. The DOE should commission additional consultant/academic analysis in order to fully evaluate the impacts of LNG exports and compare those results with the NERA study.
2. The new studies should incorporate a dynamic substitution relationship between competing fuels such as oil, gas and coal (eg effects of $200/bbl oil). Extreme stress case scenarios should be performed such that the impacts of changes in key assumptions (eg commodity prices, demand elasticity, cost of supply, market behavior, etc) can be properly analyzed from the perspective of forecasting global gas markets as well as US macroeconomic impacts. The macroeconomic analysis of LNG exports should also be expanded to reflect the link to oligopolistic market behavior, incremental costs of volatility and the lower MPC of resource owners.
3. The net benefit/harm determination should incorporate the long-term economic effects of LNG exports upon energy security and environmental externalities (utilizing the resources available at the Departments of State and Defense) as well as the comparative disadvantages caused by displacing manufacturing/technology investment.
4. The DOE should strongly consider shortening the term of export licenses, given the fact that applicants have not identified the specific reserves to be exported (US currently only has 13 years of proven reserves remaining) and the implausibility of accurately forecasting multiple commodity market impact for a period of 25 years

Key Conclusions

Analyzing the net impact of LNG exports upon the US economy is a highly complicated endeavor. Based upon the above issues identified, the lack of definitive analysis completed to date by NERA and the EIA, SOS must conclude at this time that the approval of LNG exports <u>may very well cause net harm to Americans</u> over the next 25 years.

Given the significant complexity of the NERA study and the limited time for review (only 45 days), additional time would be greatly helpful in order to provide further commentary and analysis. Also, given the gravity of the issues at hand and the need for further input SOS believes that opening a new docket related specifically to the net benefit/harm analysis for LNG exports is warranted.

APPENDIX – ECONOMIC PRINCIPLES

Perfect Substitutes of Oligopolies and the Comparative Disadvantage of US LNG Exports

The NERA report submitted, employing the N_{ew}Era model, GNGM and EIA models (AEO 2011, IEO), did not sufficiently evaluate the macroeconomic impact of LNG exports due to flaws in assumptions, problematic econometric methods and errors in economic theory. Firstly, the conclusions fail to appropriately endogenize the crude oil prices in the aggregate demand function for natural gas. Second, US welfare from LNG exports is a comparative **disadvantage** due to the crowd out effect from industries with increasing returns to scale (technology/manufacturing). The market structure of oil and international gas is not a model of competition (or even dominant player competition) but an oligopoly (OPEC and "GPEC").

OIL DE-LINKAGE: A FALLACY

Perfect Substitutes

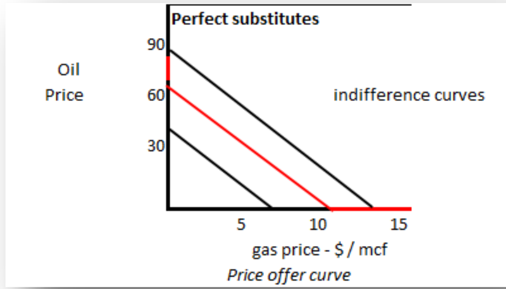
The first design flaw in the NERA methodology is the failure to adequately calculate natural gas as a perfect substitute to oil (and coal) and therefore the price of global natural gas is a function of the price of oil. The energy equivalency point between oil and natural gas is one barrel of oil = 6,000 cubic feet of natural gas[i]. Therefore in energy equivalent terms $100 / bbl oil should equal $16.67 / mcf of natural gas in perfect competition. This fundamental energy relationship suggests the United States market with oil at $93 and natural gas at $3.35 is a *short term frictional arbitrage*. What leads to this large arbitrage? The capital cycle of energy technology is not immediately self-correcting – but will correct after years of calculated investment and planning. Indeed a long list energy companies are looking to monetize this "energy arbitrage" (note investments by virtually every global Super Major and SOE in US natural gas). The switching point between oil and natural gas is a function of the energy technology required to use natural gas as a substitute for current demand for oil. The current demand for oil is globally a function of a) transportation b) power c) heating d) industrial use. To further highlight this point of substitution, BP one of the largest energy companies described their methodology in their 2030 report.[ii] BP starts with an assumption of "world primary energy consumption". According to this BP report:

"…among fossil fuels, natural gas grows the fastest (2.1% p.a.). The three fossil fuels are **expected to converge on market shares of 26–27%,** and the major non-fossil fuel groups on market shares of around 7% each. In our outlook, oil continues to suffer a long run decline in market share (falling from 46% of total energy consumption in 1970 to 39% in 1990 and 34% in 2010), while natural gas steadily gains."

It follows the global natural gas price can be expressed in terms of the oil supply and demand and the gas supply and demand :

$$\mathbf{P_{GNG} = F(\ D_{GNG}\ (f\ (D_{oil},\ P_{oil}),\ S_{GNG})}$$

Or as a simplified graphical representation, the market should be indifferent between natural gas at $10 / mcf and oil at $60 / bbl holding all technology and transportation factors to zero. However, at an oil price of $60/ mcf and a gas price of $5/ mcf, the demand for oil would be 0 and consumers would only purchase natural gas, in this scenario.



The natural gas price is a function of its btu competition – oil and coal. However, the rate of natural gas demand growth is a function of the energy technology capital cycle and therefore capital investment is required for a consumer to purchase natural gas instead of alternative fuels. In response to the decline in US natural gas prices, investments in natural gas for electricity, industrial manufacturing, heating and transportation have been occurring to capture the energy arbitrage.

Empirically, the technology mix has changed significantly in the post-World War II era between coal, gas and oil inputs. At the early part of the 20th century coal was the primary source for power and industrial use but began losing market share in transportation to a more competitive btu – oil. In the 1940 – 1960s the natural gas pipeline network was built across the United States taking further share from coal. Natural gas usage from 1950 to 1960 increased by 2.3x. Natural gas market share of total energy usage has increased dramatically from (17%) in 1950 to (33%) today while oil's market share has declined over the past 40+ years. Natural gas has certainly been a more powerful tool in the energy mix and BP projects natural gas to grow to be the same market share globally as oil. While the overall energy supply may grow in relation to GDP the relationship between the commodities has been more dynamic and endogenous. In forecasting the future of natural gas demand and price the historical statistical relationship between oil and US natural gas should be considered (see below correlation matrix).[iii]

Table 3: Price Correlation Matrix for Selected Commodities, 1990-2010

	ALUM	COPPER	IRON	LEAD	CORN	NG-GER	NG-JPN	NG-USA	NG-UK	NICKEL	OIL	SOYBEANS	WHEAT
ALUM	1.00												
COPPER	0.89	1.00											
IRON	0.67	0.84	1.00										
LEAD	0.79	0.91	0.80	1.00									
CORN	0.61	0.71	0.72	0.73	1.00								
NG-GER	0.70	0.78	0.86	0.72	0.69	1.00							
NG-JPN	0.81	0.87	0.86	0.81	0.67	0.87	1.00						
NG-USA	0.70	0.59	0.54	0.54	0.39	0.67	0.77	1.00					
NG-UK	0.71	0.67	0.67	0.61	0.59	0.78	0.80	0.77	1.00				
NICKEL	0.86	0.87	0.66	0.82	0.56	0.65	0.74	0.62	0.50	1.00			
OIL	0.84	0.91	0.87	0.86	0.70	0.85	0.97	0.76	0.79	0.77	1.00		
SOYBEANS	0.54	0.69	0.74	0.75	0.89	0.67	0.68	0.41	0.53	0.50	0.73	1.00	
WHEAT	0.67	0.75	0.69	0.80	0.88	0.71	0.71	0.49	0.69	0.60	0.75	0.84	1.00

The changing energy mix is a function of three key components 1) price, 2) price expectations and 3) energy sector capital investment technologies. History demonstrates that that while overall energy usage is predictable, the energy composition is determined by the cost of technology. In general technology has progressed over time due to specialization and economies of scale.

Natural gas is a relatively homogenous good similar to the characteristics of oil[iv]. The Law of One Price indicates that goods sells for the same price worldwide or

$$\mathbf{P = EP^f}$$

As is with the case with crude oil or refined products there is one world price. This world price for oil is traded in US dollars but the demand for which is a function of purchasing power parity. "PPP". As seen in recent years, the price of oil has increased due to the increased demand in countries as the US dollar has decreased in value. Over the long run, natural gas should follow the same fundamental rule which therefore should link natural gas both to oil prices and therefore exchange rates (Law of One Price). Equilibrium should be achieved through the process of Reciprocal Demand "the process of international interaction of demand and supply necessary to produce an equilibrium international price". As the capital cycle evolves, the international price of gas will be a function of the supply and demand for oil and the supply for natural gas.

Specification Bias

The demand for natural gas is therefore, not a correlation, but deterministic of other technologies and the oil price. It is determined by the capital cycle of substitution and the relative value with oil and other fossil fuels. However, in NERA's GNGM model, the demand for global LNG is a function of fixed value domestic price and demand + transportation (shipping, liquefaction and regas) + in country shipping. The model attempted to explain the price differential as a function of a constant price – ie correlation, not deterministic one.

On page 96 of the NERA report, the study states *" We developed a least squares algorithm that solved fort the shipping cost adders subject to matching the EIA natural gas production, consumption, wellhead and city gas prices for each region."*

These cost adders for the US range from $6.42 / mcf (Japan / Korea) to 0 (Us to Europe). This "cost adder" should be characterized as the benefit to investors / traders / companies on the transport chain and should not be attributed to "frictional costs" and added to the transportation benefit. The use of a statistical relationship as opposed to a "deterministic" relationship presents serious estimation errors. Btu equivalency is a functional relationship, not a statistical one.

This can best be described as "…the dependent variable is assumed to be statistical, random or stochastic, that is, to have a probability distribution. The explanatory variables, on the other hand, are assumed to have fixed values". The model then, as assumed by NERA, states that international gas price is dependent on US gas + shipping + a constant rate rather than an endogenous variable (international gas price) as a function of the price of substitutes compared with market price. Also the cost adder (as indicated) as (up to 50% final price) should not be considered an "unexplained" function. Indeed, it means precisely that economic rent is being captured somewhere (either gov't or trader) and therefore that fixed relationship should require more analysis.

GNGM is described as:

$$\mathbf{\sum CS + PS - TS}$$

Where the CS = ∫ CityGasPrice(d) x D / D0 (1/ pt/pto) or the elasticity of demand.

CES Demand Curve – $Q_t / Q_{0,1}$

NERA notes that the US demand is based upon "AEO reference scenarios and the different shale gas scenarios". The AEO describes its different scenarios for natural gas demand as being interrelated to capital and oil price changes:

"A stronger price linkage in the United States could occur with the development of new markets, such as GTL production, natural gas vehicles, or LNG exports" (AEO)

"Beyond those questions, the level of future domestic natural gas production will also depend on the level of natural gas demand in key consuming sectors, which will be shaped by prices, economic growth, and policies affecting fuel choice. (AEO)

Therefore the US demand should be f(C, P_{oil}); where C = capital investment (GTL, LNG etc) and therefore CS is a f($P_{oil,}$)

TS = **∑ [ship cost+ pipeline+ regas + liquifaction].**

The demand for LNG in international markets is a function of oil prices as many contracts are linked to oil. Indeed NERA states "the demand curves for natural gas capture the change in utility from consuming natural gas". The change in utility from consuming natural gas is at least in part a function of a better price for natural gas amongst other benefits including emissions. Indeed the TS is therefore also a function of oil prices.

Rational Expectations and Lagged Variables

The "adder" may be questioned due to issues of specification bias (ie there is an important variable that is omitted – the projected oil price). Additionally, a more elaborate time series data should be used to account for the time periods between long capital cycles vs t0 – t1 and q1, 10 and should be incorporated via changes in the forward price of oil and natural gas. An autoregressive model, given the relevance of a history of varies lagged variables, would account for technology and psychological reasons not captured in the "adder". Also there is typically a lag between R&D and productivity. Nerlove's stock adjustment or partial adjustment model – flexible accelerator model may better handle that degree of detail.

In the GNGM NERA concludes that under- various scenarios, the US will not export to Korea / Japan due to the high adder. Does this make "logical sense" given the empirical evidence of Japanese/Korean orders for US LNG?

"For the scenarios which combined the International Reference and US reference cases there were no US LNG exports. In part, this is due to the fact that the EIA scenarios upon which they are based assume that global natural gas demand is met by global supplies without US LNG exports"

NERA suggests that <u>regardless</u> of the operating efficiencies of companies, supply and demand will be fixed as fixed and the US will not crowd out other a fossil fuels or sources of supply? Such an approach violates the above mentioned economic laws.

Just show the sensitivities

In the IEO report the EIA notes three scenarios for oil prices $200/bbl, $ 100/bbl, and $50/bbl. On a BTU equivalent basis 200$ oil = $35 MMBtu or nearly 10x current gas prices. What are the conditions that would bring natural gas energy equivalence? If Tapis oil price (Asian light crude) rises to $200/bbl at what ratio does it make sense to build substitute product? It follows in such a scenario, the Chinese, India and the better part of Asia would heavily invest in GTL products, CNG projects and other oil-substitution projects. Indeed, many of the largest energy players are betting on the capital formation decision – BG, Shell, Total, Exxon, etc are looking to invest tens of billions of capital globally in an effort to transport natural gas to countries that are paying an oil linked price. They are not committing this capital to a small market with no substitutes, they are committing this capital because the "energy technology factor mix" in Asia has a long way to go before it can be saturated. Indeed Chinese plans to build LNG terminals totaling up to 13 bcf/d by 2020. Recent emissions related issues in China have only served to continue to increase demand for natural gas in the Chinese energy mix. The NERA report indicated that Chinese shale gas and "Russian / Central Asian projects" will be largely sufficient to meet Chinese increased demand however empirical evidence indicates capital is being deployed to deliver increased LNG to China in order to capture the energy arbitrage.

WELFARE ECONOMICS: THE UPCOMING US COMPARATIVE DISADVANTAGE.

NERA is supporting the net economic welfare benefits to natural gas exports and therefore this conclusion is made irrespective of the end price of natural gas. Therefore natural gas exports at any price are a pareto improving condition, according to NERA. The contrasting basis for the comparative disadvantage is a three-fold function of 1) volatility effect and the risk premium on income distribution 2) crowd-out of higher value-add businesses and 3) the reduction in the Marginal Propensity to Consume (MPC) (and the resulting multiplier effects) plus a decrease in investment from all non-correlated energy businesses that in aggregate outweigh positive effect from increased investment from energy and the multiplier effect of new job creation and it's resulting lower MPC.

The Cost of Volatility

The US natural gas market has traditionally been volatile, however the large relative storage presence, has somewhat mitigated relative volatility. Currently storage represents ~ 19% of annual consumption with a maximum working capacity of 4.3 Tcf. The creation of a global LNG market should add to volatility as *the rate of storage growth is not necessary commensurate with the rate of relative peak consumption increases / decreases*. Indeed as "…in a world with a global LNG trade, US storage becomes the world's storage."[v] The volatility charts below show the fatter tails of US natural gas relative to other commodities. Storage had historically tempered the volatility, now it likely will increase the height of the return frequencies due to oil linkage while keeping the same dimensions of the tail.

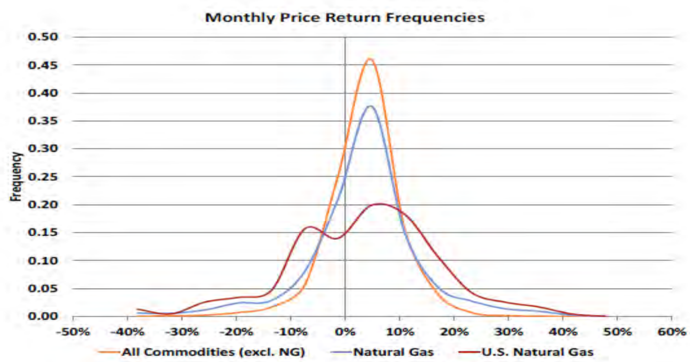


Chart 4: Monthly Price Returns for Natural Gas and Other Commodities, 1990-2010.

U.S. natural gas prices have "fatter tails" than other commodities and the whole basket of natural gas prices. Natural gas on the whole is more likely to experience larger monthly price movements than other commodities.

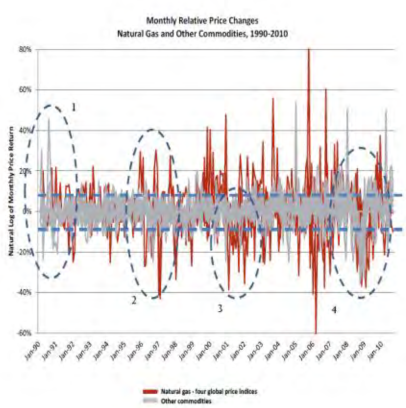


Chart 3: Monthly Price Changes, Selected Commodities, 1990-2010.

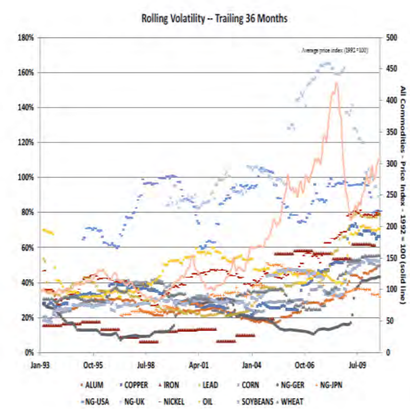


Chart 5: 36-month Rolling Price Return Volatility, Selected Commodities

Volatility in commodity price damages the ability of investors to forecast prices and therefore decreases confidence in capital allocation. Some businesses may elect to hedge their exposure. The more volatile a commodity, the more costly it is to hedge. Finally the higher the volatility the greater the discount rate on intermediate use markets (manufacturing and petrochemicals) and for electricity inputs (technology and commercial). If these businesses pass those costs on to consumers, consumer welfare goes down. If these businesses internalize the cost, their profits go down. All else equal, less volatility in commodity input, the better it is for businesses to add jobs and invest capital. Who captures the volatility? The volatility will be captured largely by the resource provider (or intermediate speculators), however, while that results in higher profits on the energy (or speculative) side of the ledger, it will result in the lost profit to consumers. Price volatility can explain why the capital cycle takes longer – but the overwhelming challenge in using natural gas for export it is due to its increasing returns to scale.

Increasing Returns to Scale vs Decreasing Returns to Scale: the Comparative Disadvantage

Increasing terms of trade are typically believed to increase the standard of living for both trading countries, however, those benefits can be undermined by imperfect competition** (NERA utilizes a perfect competition model). If free trade results in an overall contraction in the production of goods subject to increasing returns to scale then trade can actually be harmful.

Natural gas (as any depleting natural resource commodity) has a cost curve that most argue is flat for a period of time, however, the slope of which most agree will become steeper as quantity demanded increases. However, in manufacturing industries, the slope of the supply curve is fundamentally different. The fixed start-up costs are high – ie one would never manufacture one car. However the more automobiles computers manufactured by the supplier the more the supply curve actually slopes downward (for a period of time) as assembly lines and factories build out and productivity is maximized. The slope of the supply curves for natural resource suppliers and energy intensive manufacturers are different. The more expensive natural gas becomes the less energy-intensive manufacturing that will take place. Such a scenario is precisely what trade economists argue causes a "harmful" result – when an industry that that exhibits increasing economics of scale is crowded out by decreasing economies of scale. "If free trade leads to an overall contraction in the production of goods subject to increasing returns to scale, then trade can be harmful.[vi]

Indeed this is why even large Middle Eastern countries well-endowed with oil are investing in the production of "higher end" products. Even the US upgrades crude oil into products before export.

Marginal Propensity to Consume: Emissions Trading Analysis as an Indicator of Economic Winners and Losers

The following Marginal Propensity to Consume Analysis is taken from the EIA

"These figures suggest the following rule of thumb for the year 2010. Each 10-percent increase in the level of aggregate prices for energy may lead to a 1.5-percent increase in producer prices and a 0.7-percent increase in consumer prices.

- First, the direct impact of higher energy prices is a reduction in energy demand, particularly for coal with its high carbon content. The consequences are reductions in output from the mining sector and from all services connected to the production and distribution of coal.
- Second, higher energy prices disproportionately increase the cost of production for energy-intensive industries. As energy price increases are passed along by industry through higher prices for their products, consumers will tend to substitute away from the relatively expensive energy-intensive products to less energy-intensive products and services. The consequences are reductions in gross output from the energy-intensive sectors of the economy, principally, chemicals and allied products; stone, clay, glass, and concrete; and primary metals.
- Third, the changing composition of macroeconomic final demand will alter the composition of sectoral output. In the cases considered here, all the carbon permit revenues are assumed to be returned to consumers through personal income tax rebates, moderating the projected impacts on disposable income. Consequently, in percentage terms, consumer spending falls by less than GDP, while investment falls by more. This change in the composition of final demand decreases the output from consumer-related sectors, such as services and retail trade, by less than the

average drop for all economic output, while decreasing the output from the construction and manufacturing sectors by more than the average.

- Finally, because the carbon emissions restrictions are placed only on Annex I countries, industries with high levels of imports, particularly those with imports from non-Annex I countries, will see larger reductions in domestic output than industries with low import penetration. If imports are already competitive, increasing the cost of production for the domestic industry and not for non-Annex I importers will tend to increase imports, leading to a drop in domestic output. For this reason, output from manufacturing sectors such as leather and leather products, electronic and other electrical equipment, and miscellaneous manufacturing will fall by more than the output for the manufacturing sector as a whole."

Source: EIA

Negative Impact of Transitory Shocks

"it is important to distinguish between the effects of these various types of shocks because, according to the theory, consumption should change almost one for one in response to permanent shocks (positive\ or negative), but it may react asymmetrically if shocks are transitory. Indeed, if households are credit constrained (i.e., they can save but not borrow), they will cut consumption strongly when experiencing a negative transitory shock but will not react much to a positive one."

Source: Stanford

It's not perfect competition when the substitute is an Oligopoly

David Ricardo, Malthus and others have long espoused the virtues of free trade in a perfectly competitive market. The theory of free trade should benefits both sides. **However the oil market is not a free trade market**. OPEC control 35% of production and Saudi effectively controls the price through the control of spare capacity. There is no resource visibility, shy of a few "technical papers" the late Matt Simmons retrieved from Saudi Aramco's technical file. Venezuela, Iran and others have refused access on true resource availability and assessment – so in short the total amount of resources is an unknown. Secondly in a true competitive market, there would be fewer barriers to entry, however, most of the largest oil production nations have significant barriers to foreign capital. Super majors have time and again had their investments nationalized (Saudi, Kuwait, Russia, Venezuela, Libya). International natural gas supply nations have challenges as well. The NERA report designates Qatar as the dominant marketer, but Russia and Iran have a substantial presence as well. Algeria, a major gas exporter to Europe, is currently suffering from political risk. Most of gas producing countries will only allow investment in partnership with the country's National Oil & Gas company or ministry. Free trade is supposed to be about countries specializing and competing, natural gas and oil are quite far from a competitive paradigm. Natural gas, given its supplier concentration and link to the oligopolistic oil market should "harm" the terms of trade.

[i] CHK website. http://www.chk.com/naturalgas/pages/terminology.aspx

[ii] BP IAEE

[iii] Natural Gas Price Volatility, Report for the American Clean Skies Foundation. Austin Whitman, M.J. Bradley & Associates. January 2011.

[iv] Note oil has different qualities and grade which are used in different refineries but similar sulfur / acid / weight resorts to the same price.

[v] http://bipartisanpolicy.org/sites/default/files/Natural%20Gas%20Price%20Volatility%20-%20Lessons%20from%20Other%20Markets.pdf m.j. Bradley and associates page 12.

[vi] Hustead & Melvin, International Economics Chapter 5 – Tests of Trade Models.