

**Prepared Testimony of
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Submitted to the
Committee on Foreign Affairs
Subcommittee on Terrorism, Nonproliferation, and Trade
United States House of Representatives
Natural Gas Exports: Economic and Geopolitical Opportunities
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Mr. Chairman and Members of the Subcommittee:

I am honored by your invitation to testify on the economic benefits of free trade in natural gas. I am an economist and Senior Vice President of NERA Economic Consulting. I had the privilege of leading the study of the “Macroeconomic Impacts of U.S. LNG Exports” that was issued by the Department of Energy in December 2012.¹ This was one of the most gratifying experiences of a very long career in policy analysis. I worked with a great team at NERA that developed the model of the U.S. economy and the model of world natural gas markets on which the study was based. I appreciate them but I have that privilege every day. What made this a unique experience was the quality, thoughtfulness, and open-mindedness of the people we worked for in the Department of Energy. They asked us for an objective and independent study and they published exactly what we wrote without spin or alteration.

Statements in this testimony represent my own opinions and conclusions and do not necessarily represent opinions of any other consultant at NERA or any of its clients. I do not speak for the Department of Energy, in particular, but only for myself.

¹ Available at: http://www.fossil.energy.gov/programs/gasregulation/reports/nera_lng_report.pdf

Major Findings of the Macroeconomic Study

I will start with a quick summary of the findings of the NERA study, taken largely from what I think was a rather good executive summary.

Across all the scenarios that we examined in which the global market would take exports from the U.S, there were net economic benefits to the U.S. from allowing LNG exports. Moreover, for every one of the market scenarios examined, net economic benefits increased as the level of LNG exports increased. In particular, scenarios with unlimited exports always had higher net economic benefits than corresponding cases with limited exports. There was no “sweet spot,” and no point where any “balance” was required to gain the greatest benefits.²

In all of these cases, benefits that come from export expansion would more than outweigh the costs of faster increases in natural gas production and slower growth in natural gas demand, so that LNG exports have net economic benefits in spite of higher domestic natural gas prices. This is exactly the outcome that economic theory describes when barriers to trade are removed.

Net benefits to the U.S. would be highest if the U.S. becomes able to produce large quantities of gas from shale at low cost, if world demand for natural gas increases rapidly, and if LNG supplies from other regions are limited. If the promise of shale gas is not fulfilled and costs of producing gas in the U.S. rise substantially, or if there are ample supplies of LNG from other

² A Brookings Institution study released in May 2012 reached the same conclusion as the NERA Study that LNG exports would be a net benefit to the US economy. The Brookings study stated “LNG exports are likely to be a net benefit to the U.S. economy, although probably not a significant contributor in terms of total U.S. GDP. Exports of U.S. natural gas will take advantage of the benefits of the existing producer’s surplus resulting from the pricing differentials between the natural gas markets in the United States, Europe, and Asia.... The benefit of this trade will likely outweigh the cost to domestic consumers of the increase in the price of natural gas as most of the natural gas demanded by exports will come from new natural gas production as opposed to displacing existing production from domestic consumers.” Charles Ebinger, Kevin Passy, Govinda Avasaral, “Liquid Markets: Assessing the Case for U.S. Exports of Liquefied Natural Gas,” Energy Security Initiative at Brookings, May 2012, Policy Brief 12-01, pages 36-37. Available at: <http://www.brookings.edu/research/reports/2012/05/02-lng-exports-ebinger>.

regions to satisfy world demand, the U.S. would not export LNG. Under these conditions, allowing exports of LNG would cause no change in natural gas prices and do no harm to the overall economy.

U.S. natural gas prices increase when the U.S. exports LNG. But the global market limits how high U.S. natural gas prices can raise under pressure of LNG exports because importers will not purchase U.S. exports if U.S. wellhead price rises above the cost of competing supplies. In particular, the U.S. natural gas price does not become linked to oil prices in any of the cases examined.

Natural gas price changes attributable to LNG exports remain in a relatively narrow range across the entire range of scenarios. Natural gas price increases at the time LNG exports could begin range from zero to \$0.33 (2010\$/Mcf). The largest price increases that would be observed after 5 more years of potentially growing exports could range from \$0.22 to \$1.11 (2010\$/Mcf). The higher end of the range is reached only under conditions of ample U.S. supplies and low domestic natural gas prices, with smaller price increases when U.S. supplies are more costly and domestic prices higher.

I would like to comment at this point on the findings of the report about resource rents versus changes in capital income and wages. To be very conservative in our analysis, so that any findings about net economic benefits would be as robust as possible, we attributed all the increased income associated with natural gas exports to owners of natural gas resources. But natural gas in the ground is not the only factor of production required to produce and export additional natural gas. Some of what we called resource income would go to workers with the specialized skills required in natural gas exploration and production, and in infrastructure and

liquefaction facility construction, in the form of higher hourly wages. Some would go to existing investors in businesses that explore for, produce and transport natural gas, and more broadly to firms that build the facilities needed for expanding the natural gas industry. If we had included these wage increases and higher investment returns it could well have turned out that there was no loss in labor income or the average return on capital, and still a net overall economic benefit.

Basic principles of the economics of international trade make this conclusion inescapable

There should be nothing surprising about the conclusion that the U.S. economy is better off with unrestricted trade in natural gas than with any restrictions. The same specific conclusion is reached in recent studies by Charles Ebinger of the Brookings Institution and Kenneth Medlock of Rice University, despite many differences in details of the level of exports and price impacts.³ It is also the logical consequence of the basic economic theory of international trade. The economics of international trade are based on the principle of comparative advantage. This principle states that free trade countries will tend to export those goods and services which they are better at producing and will import those that others are better at producing. Extensive and rigorous theoretical analysis and also on observation of economic progress during periods of free trade and periods with major trade restrictions support the finding that free trade leads more robust economic growth.

There are of course some conditions. The major one that matters in this debate is whether a

³ Charles Ebinger, Kevin Passy, Govinda Avasaral "Liquid Markets: Assessing the Case for U.S. Exports of Liquefied Natural Gas," Energy Security Initiative at Brookings, May 2012, Policy Brief 12-01. Available at: <http://www.brookings.edu/research/reports/2012/05/02-lng-exports-ebinger>, and Kenneth B. Medlock III, PH.D., "U.S. LNG Exports: Truth and Consequence," James A. Baker III Institute for Public Policy, Rice University, August 10, 2012.

country is subsidizing exports – as China is frequently accused of doing. LNG exports from the United States do not need government subsidies to be desired by just about every country that is now importing natural gas – natural gas has become so cheap in the United States because of the investment and technical knowhow of our oil and gas industry, which has made previously unusable natural gas resources economic to produce in abundant quantities. Under these conditions, economic theory and practical experience clearly support the conclusion that free trade in natural gas is better for the U.S. economy than any system that restricts natural gas exports.

The textbook exposition of this point is based on a fairly simple diagram or two. To explain the general economic theory of trade it is useful to begin with a simple illustration of the natural gas market with a closed economy where no trade exists. Consumers and producers interact in the natural gas market with demand and supply establishing a market equilibrium that determines the market price and quantity exchanged.

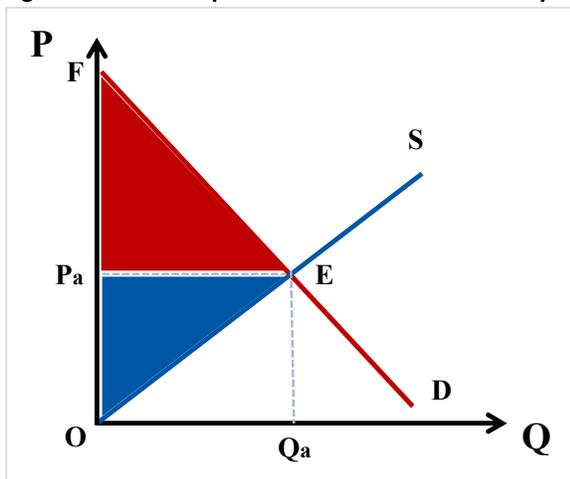
Figure 1 shows a supply and demand diagram where demand for natural gas is represented by a downward-sloping line, D, characterizing decreasing willingness to pay as consumption increases, and supply by an upward-sloping line, S, characterizing increasing marginal cost of production as output increases. For illustrative convenience, we employ straight lines for demand and supply.⁴

Demand and supply cross at point E, which denotes market equilibrium or competitive

⁴ Iso-elastic curves characterize demand and supply more realistically. There is always some demand when price is low and marginal cost grows at increasing rate.

equilibrium. At the competitive equilibrium, consumers' willingness to pay is equivalent to producers' cost of production. Neither side of the equilibrium is stable. Producers incur losses if they choose to produce additional output, which costs more than consumers' willingness to pay; to the left of the equilibrium, producers can earn more on additional output given that consumers are willing to pay more than what it costs to produce. Therefore, the market stabilizes at the equilibrium with associated equilibrium price P_a and quantity Q_a .

Figure 1: Market Equilibrium in a Closed Economy



Economic surplus refers to monetary gains or “welfare.” Consumer surplus denotes the value consumers receive from consumption for which they did not pay. Graphically, this is the red triangle in

Figure 1 which sits above the price and below the demand line. Likewise, producer surplus represents the value producers gain in excess of the cost of production. The area below the price and above the supply line (blue triangle) in

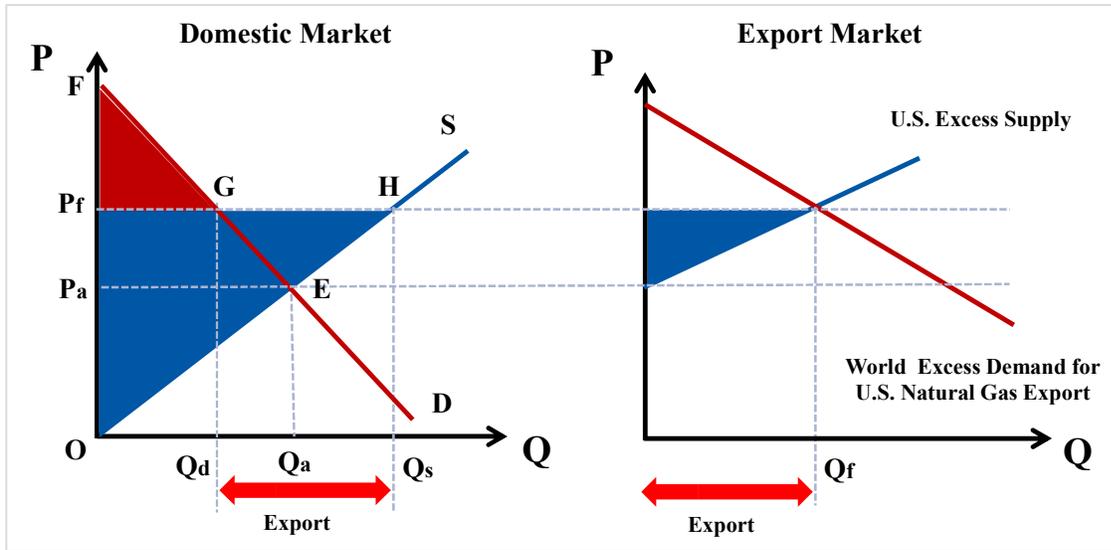
Figure 1 denotes the producer surplus. Total surplus or social welfare is the sum of consumer surplus and producer surplus. Social welfare should also include tax revenue or quota rent, if any is involved.

Free trade equates domestic prices with world prices. When an economy has a comparative advantage and thus can produce at a lower cost than the rest of the world, moving from a no trade to a free trade position implies an increase in domestic price. Analogously, the domestic price falls when the country becomes an importer and substitutes more costly domestic production with cheaper imports.

For the case of U.S. natural gas industry, we include a diagram for the export market along with the one for the domestic market to illustrate the changes when the U.S. moves from a no trade to a free trade position (see

Figure 2). The export market is represented by the U.S. excess supply of natural gas and the world excess demand for the U.S. natural gas export. The competitive equilibrium in the export market finds a price (P_f) that equates the world excess demand with the U.S. excess supply and at which the excess supply, the amount of natural gas U.S. producers are willing to produce in excess of the amount of domestic consumption ($Q_s - Q_d$), is equal to the equilibrium export in the export market (Q_f).

Figure 2 : Market Equilibrium with Free Trade



Social surplus changes along with the price movement. When a country becomes an exporter, a domestic price increase reduces domestic consumption, resulting in a loss of consumer surplus.

In the domestic market diagram of

Figure 2, consumer surplus shrinks from P_aEF to P_fGF . Producers receive more profit on every unit of output sold to both the domestic and world market, generating a gain in producer surplus, which not only offsets the loss in consumer surplus (the trapezoid P_aEGP_f) but also adds a net gain on each unit sold to the world market (the triangle EHG). From the social welfare perspective, part of consumer surplus transfers to producer surplus and producers gain more profits from exporting. It is worth noting that the net gain, shown as the triangle EHG in the domestic market diagram, is equivalent to the blue triangle in the export market diagram that represents the gain to exporters. It is earned by producers who are able to export and obtain a higher netback price than would be available in the domestic market without exports. These references to producers, consumers and exporters, by the way, should not be taken to imply that these are distinct people – as the NERA report discussed at length, through stock ownership both producers and exporters contribute to the income of households (not to mention paying taxes).

A Natural Gas Theory of Value

The loud dissent from this basic principle that has been heard since December repeats an old and repeatedly exploded economic fallacy. For example, a recent study commissioned by the leading opponent of free trade in natural gas claims that every Btu of natural gas used to manufacture basic chemicals generates 8 times the GDP that is generated by exporting that same amount of natural gas. This is completely bogus, and is so far off base that any refutation sounds like lecturing to first year economics students. So here it goes. Value added in manufacturing is created by the labor and capital at work in the industry, not by physical inputs like natural gas. The value of natural gas is fully captured by the willingness of customers to purchase the natural gas – and if overseas purchasers are willing to pay more for natural gas than domestic producers from whom some gas might be bid away, then clearly natural gas generates more value as an export than when used domestically. That is the basis for NERA’s conclusions, and it is true whether or not there was some revolutionary change in the structure of industry over the past few years.

If, indeed, it were only possible to produce enough natural gas to meet domestic needs and natural gas were more valuable here than abroad, then there would be no exports even under free trade because foreign buyers would be unable to bid it away from U.S. suppliers. This is in fact one of the scenarios we discussed in the NERA report for DOE – the reference case for global demand combined with low EUR (e.g. low estimated ultimate recovery of natural gas) from EIA’s scenario for U.S. supply. Exports of LNG did not cause higher prices or problems for the chemicals industry in this scenario, because there were none. However, because of limited supply, natural gas prices were much higher and more threatening to the chemicals industry than

they would be in scenarios with ample supply and free trade. In such cases, there was ample gas for both exports and the chemicals industry at reasonable prices.

The claim that more GDP will be lost in chemical manufacturing than gained from natural gas exports is based on the fallacy that every Btu of gas that is exported will be taken away from the chemicals industry, and that there is a fixed proportion between chemicals output and natural gas input. Neither is true but both types of claims have been made by Cassandras of disastrous shortages since at least the 1950s, where my knowledge of the subject begins. We called this in the 1970s the “energy theory of value,” that there was a fixed, lockstep proportion between energy use and GDP. This led to numerous predictions of the collapse of Western Civilization when energy ran out, as the Club of Rome and others were sure it would. Yet somehow we now consume only a fraction of the energy per dollar of GDP that was needed in 1970 and we have more goods and more energy.

Another way to see the fallacy of the proposition that trade in basic materials like natural gas should be restricted in order to provide cheap feedstocks for downstream industries is by asking which downstream industry should be allowed to export freely? Chemicals are intermediate goods – made with natural gas as one component but then used in several subsequent manufacturing steps to make plastics, manufactured goods, and then consumer products like cars, computers, and houses. Since some of those final goods have far greater value added per Btu of natural gas used, why should not trade in all intermediate goods be restricted to maximize the GDP produced by natural gas? The answer is not that there is a sweet spot, but that all restrictions on exports of natural gas will prevent natural gas from reaching its highest valued use and deprive the U.S. economy of the benefits of using its resources in the most advantageous way for the people of the United States.

Trade Restriction is Self-Defeating

The Department of Energy has authority to withhold permission only for exports to countries with which the U.S. does not have a free trade agreement. Canada and Korea are two countries with which we do have free trade agreements, and that fact implies that the only effect of restricting exports to non-Free Trade Area countries will be that the U.S. will bear all the costs of doing so but get none of the benefits. In particular, Canada has just authorized a major LNG export facility in British Columbia and both the Federal and Provincial governments are firmly behind exports. There is no restriction on exports of natural gas to Canada, and existing pipelines could be reversed to take shale gas from the U.S. to Eastern Canada. If the U.S. is successful in producing cheap and plentiful natural gas but prohibits LNG exports to non-FTA countries, a most likely outcome is that Canada will ship its domestically produced natural gas west by pipeline and export it to the coveted Asian markets, and import natural gas from the U.S. for its domestic use. This will drive up the price of natural gas in the U.S. just as much as would free LNG exports, but the U.S. will get none of trade advantages of participation in the profits from selling to the higher valued market in Asia.

Korea's discussion of the possibility of creating an Asian hub for LNG trade also suggests that U.S. exports to Korea could through displacement and transshipment also meet a much larger market, with little benefit to the U.S. from the high prices at which it might be sold in Asia.

The administrative nightmare that any attempt to restrict trade would cause should also be seen as a self-defeating outcome for the nation as a whole, if not for the specific industries that would benefit from restricting the ability of their suppliers to sell to higher valued uses. Even if a limit

is intended to be non-binding, it will still be necessary for DOE to devise some method of deciding which applicant should get a permit, thus substituting administrative action that will encourage rent-seeking behavior and political influence on the process that has not yet warped outcomes. The result of using administrative action as a substitute for the due diligence of private investors has become quite clear in the failures of the DOE loan guarantee programs. Based on this history, administrative allocation of export licenses would likely lead to politically-significant developers getting permits even if they could not pass scrutiny by private sector investors, leading in turn to project failures, wasted resources, and sacrifice of even the export opportunities that are allowed as U.S export capacity falls further and further behind our competitors for the world LNG market.

Exaggerations

Four claims made in opposition to free trade in natural gas are based on gross exaggerations of potential impacts. I address each of the four in turn:

1. The US will not have exports equal to 25 – 50% of domestic natural gas use in the near future

As DOE officials themselves explain, it is easy to apply to DOE for a license and necessary to have one in order to start the approval process at the FERC. But only three projects have officially begun the FERC process, and no expert familiar with the industry expects even a small fraction of the total capacity that has made application to DOE will be built in the next decade. It is an exaggeration that ignores the role of the market to talk about exports on the scale of 25 to

50% of domestic demand by 2030.

2. U.S. prices will not rise to levels now seen in Asian markets, or even to the netback price based on current prices in Asian markets

First, there will always be a difference of \$6 to \$8 between Asian prices and U.S. prices, since that represents the cost of inland transportation, liquefying, shipping, and regasifying natural gas to get it from the U.S. to Japan or Korea. Asian buyers have no incentive to buy gas in the U.S. if it is not cheaper than their prevailing domestic price by that amount.

Assuming that current, larger LNG pricing differentials will persist in a world in which LNG exports increase at a rapid rate ignores everything we know about supply and demand, and is the fallacy that has led to the demise of many bubbles of energy investment. Increasing LNG exports will exert a downward pressure on Asian prices and raise prices in exporting countries, so that the current premium that Asian buyers now pay is likely to be unsustainable. But even then, prices in exporting countries will be lower than in importing countries by the cost of liquefaction, shipping and regasification. NERA's analysis used a comprehensive model of global natural gas supply and demand to investigate many scenarios for how much LNG could be exported by the U.S. and how the netback to the U.S. would vary with the level of exports. Many competing suppliers are better positioned to serve growing LNG demand in Asia than the United States, and the prices they offer in the future in response to market competition will determine U.S. netbacks. These are the effects that NERA's analysis captures and that are ignored by any comparison to current Asian pricing.

3. Growth of the chemical industry and manufacturing as a whole will not end because of increases in natural gas prices that might be attributable to market-determined levels of

LNG exports

Economists who analyze how changes in energy costs affect energy-intensive, trade-exposed industries have reached a consensus that only narrowly-defined segments of manufacturing are at risk from higher energy costs. These sectors have relatively small employment and value added compared to manufacturing as a whole, so that even large impacts on these narrow segments translate into negligible impacts on manufacturing and the U.S. economy as a whole. The only chemical sector that is held out as evidence of widespread harm from higher natural gas prices is the nitrogenous fertilizer industry, which according to the Census Bureau employed about 4000 workers in 2007.⁵ This subsector of chemicals is not typical of the chemicals sector as a whole, it is a unique outlier based on turning cheap natural gas into cheap fertilizer with low profit margins and little significance for the overall economy. It has experienced ups and downs in the past as natural gas prices rose and fell, with no detectable benefit to the rest of the economy when it grew or harm when it declined.

Moreover, claims of the vulnerability of any chemical sector to increased U.S. prices appear to ignore the fact that even with unrestricted trade, U.S. natural gas prices will be lower than in countries that must import natural gas, including Europe, China, India and other Asian economies. The basis differential that will be sustained by the cost of transportation, liquefaction and regasification of LNG will maintain a clear natural gas price advantage for U.S. chemical manufacturers over these competitors.

As to manufacturing as a whole, as prior NERA studies have shown, the real threat for manufacturing is growing government regulation, of which export restrictions would be another

⁵ See <http://www.census.gov/econ/industry/hierarchy/i325311.htm>

added burden. The one thing about LNG exports that is certain is that they will grow slowly due to the timelines for financing and constructing highly capital-intensive liquefaction terminals, and the only impact that LNG exports could have would be a small change in the rate at which manufacturing expands. With the possible exception of a very small slice of the chemical industry, there is no chance that LNG exports could turn robust manufacturing growth into decline.

4. NERA's use of AEO 2011 forecasts does not invalidate its findings of net benefits for the U.S. economy.

The current natural gas outlook has changed dramatically for the better since 2011. According to the U.S. Energy Information Administration's current projection, in every future year more natural gas will be available for the same price than it projected in its 2011 forecast. Our analyses show clearly that net benefits to the U.S. would be larger if more natural gas were available for domestic use at the same level of LNG exports. Hence, if we used the current EIA projections which include greater natural gas supply at every price, we would find even larger net benefits.

Natural gas price risks

The scenarios examined in the NERA report that yielded high natural gas prices even without exports remind us that natural gas prices have been volatile and will remain uncertain even under the most restrictive export policy. However, the one thing that we should have learned over the past three decades is that except for localized problems (like the lack of capacity to ship gas to California in 2000) there will not be generalized natural gas shortages. The flip side of price

volatility is that markets have the flexibility to respond to and eliminate potential shortages, and that curtailments have not been necessary since we eliminated regulation of the wellhead price of natural gas in the 1980s.

Thus even firm all-events contracts to supply natural gas to foreign buyers are not at all likely to produce natural gas shortages in the U.S., even if some groups are successful in their efforts to prevent use of our immense shale gas resources. If U.S. prices rise due to shortages of natural gas, it will become more profitable for those foreign buyers to resell their contracted gas in the U.S. market than to liquefy and export it. Thus producing natural gas for export in periods of low natural gas prices in the U.S. will provide a natural buffer against domestic supply shortages, and the more gas is exported in normal times, the more production capacity there will be for domestic needs.

Thus, natural gas price uncertainty will remain under all circumstances, and is as likely to be increased as to be decreased by banning LNG exports. Indeed, comparing scenarios with no LNG exports but restricted supplies of shale gas to scenarios with no LNG exports but plentiful supplies of natural gas reveals that restricting shale gas production could raise domestic natural gas prices by over \$3/MMbtu in 2025, while the largest difference that LNG exports could make is one-third of that amount, or about \$1/MMbtu.

Prudent investors will consider all the scenarios for how natural gas prices might evolve in evaluating investments in any project whose economics are sensitive to natural gas prices. Fortunately, these investors have the same opportunities to hedge price risks and obtain firm supply commitments as do purchasers of natural gas for export.

Geopolitical Issues

In addition to the economic benefits to the United States from exports of natural gas, there are a number of potential geopolitical benefits that were not covered in the NERA study.

1. A policy of unlimited U.S. LNG exports would limit Russia's ability to raise natural gas prices to Europe by creating a credible alternative supply that would defeat any attempt by Russia to raise prices above the landed cost of LNG. In contrast, if the U.S. limits exports it will send a signal to Russia that it can raise prices without fear of effective competition from the exporter most favorable located to undercut its prices to Europe.
2. LNG exports to India and other energy-poor countries considering nuclear power could contribute to non-proliferation goals by providing them with a more economical source of energy than nuclear power. Denying LNG exports to countries that have a choice between natural gas and nuclear power would weaken U.S. efforts to limit the spread of nuclear capability.
3. LNG exports could potentially contribute toward reducing global emissions by allowing coal intensive economies to use less carbon content fuel (natural gas) instead of high coal, a high carbon content fuel without impeding their economic growth. Availability of natural gas for the emerging economies increases their willingness to support a global policy on climate change. Moreover, modeling done by my team of global climate policies invariably shows that more flexible markets reduce the cost of meeting global concentration targets.
4. Restrictions on LNG exports would undermine the credibility of the position in support of free trade taken by the U.S. in controversies over limits placed on exports to the U.S.

by other countries, including oil from OPEC and strategic minerals from China.

Need for Additional Analysis

Some commenters on the NERA study suggested the need for updated or expanded analysis. Therefore I would like to offer my thoughts on developments and data since the NERA study was completed.

First, newer information suggests that the NERA study probably underestimated the net benefits to the U.S. economy from LNG exports. The outlook for U.S. natural gas supply found in EIA's 2013 Annual Energy Outlook is significantly more bullish than it was in 2011, and also implies that increased supplies will be forthcoming with smaller price increases than found in the 2011 report. If NERA's assumptions for U.S. natural gas supply had been based on the 2013 AEO, estimated impacts of LNG exports on U.S. natural gas prices would most likely have been quite a bit smaller and net benefits to the U.S. economy correspondingly larger. The same would be true if the NERA study were to adopt supply assumptions more like those used in studies by Professor Medlock and Deloitte.⁶

Second, U.S. companies appear to be taking more interest in the downstream value chain than was assumed in the NERA study. Every dollar earned by U.S. companies from shipping LNG to overseas locations and marketing natural gas in importing countries would increase net benefits to the U.S. economy relative to what NERA estimated. In the NERA study we estimated that if U.S. companies take the risks associated with merchant ownership of liquefaction capacity and marketing natural gas worldwide, the net benefits to the U.S. economy could be tripled.

⁶ Medlock, *op. cit.* and Made in America: The Economic Impact of LNG Exports from the United States: A report by the Deloitte Center for Energy Solutions and Deloitte MarketPoint LLC. Available at: http://www.deloitte.com/view/en_US/us/Services/consulting/9f70dd1cc9324310VgnVCM1000001a56f00aRCRD.htm

Finally, there is always something to learn from continued analysis, but I do not believe that newer data or refinement of the calculations will change the qualitative conclusion that LNG exports provide net benefits to the U.S. economy. We know from basic economic principles of comparative advantage that free trade in natural gas will provide greater net benefits to the U.S. economy than trade restrictions designed to benefit a narrow slice of industries. By incorporating both trade benefits and the domestic costs of making gas available for export, the NERA study confirms this expectation.⁷ Updating data and further disaggregating industry impacts will not change this conclusion, though it may show that the net benefits are larger and more widely distributed than the conservative approach we took in the study implied.

⁷ The one actual modeling study that reached a different qualitative conclusion, by Dr. Wallace Tyner of Purdue University, used a model (Markal-MACRO) that includes all the domestic costs of increasing natural gas supply and slowing growth in demand but none of the trade benefits of selling natural gas to foreign purchasers at elevated market prices and obtaining increased quantities of imports as a result. Thus it naturally found a reduction in GDP, since the sources of increased GDP and net improvement in economic welfare were left out.