BROOKINGS

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The Brookings Institution
Testimony to the Subcommittee on Energy Policy, Health Care, and Entitlements
March 19, 2013

Mr. Chairman, Ranking Member Speier, and distinguished Subcommittee members:

Thank you for inviting me here to share my views on U.S. LNG export policy. My name is Charles Ebinger and I am Director of the Energy Security Initiative at the Brookings Institution. These views are mine alone and do not reflect the views of the Brookings Institution, which does not take institutional positions on any policy issue.

The Energy Security Initiative at Brookings has been studying this issue for the past two years, having published an assessment of the case for LNG exports in May 2012 in our report, *Liquid Markets: Assessing the Case for Exports of Liquefied Natural Gas from the United States.*[1] In that report, we focused on two determinants of whether the U.S. should allow exports of LNG: what is the feasibility of exporting LNG, and what are the implications? After assessing both factors, my co-authors, Kevin Massy and Govinda Avasarala, and I came to two primary conclusions: first, the negative implications of LNG exports from the lower 48 states, which we believe to be technically feasible, are marginal and outweighed by the benefits; second, as the lynchpin of the globalized economy the United States must continue to espouse free trade and avoid intervening in a global market. Ultimately we believe, as we stated in our report, "that the United States should neither act to prohibit nor to promote LNG exports."

In the 10 months since the release of this report, more studies and information—some good, some misleading—have surfaced. More opinions are being voiced. Amid the increased volume of debate, however, my opinion has not changed. I still believe that the benefits of U.S. LNG exports are, on balance, a benefit to the United States; that the United States still has the responsibility and the incentive to be an advocate for free trade; and that the U.S. government should not intervene in what should be a market-driven process.

I applaud this Committee for avoiding another acrimonious debate on the pros and cons of LNG exports by spending more time with both the implications of LNG exports and discussing some specifics reforms that might help rationalize the permitting process while clearly protecting the public interest.

[1] Charles Ebinger, Kevin Massy, and Govinda Avasarala, "Liquid Market: Assessing the Case for Exports of Liquefied Natural Gas from the United States," *The Brookings Institution*, May 2012. (Brookings 2012) (http://www.brookings.edu/research/reports/2012/05/02-lng-exports-ebinger)

Part 1: Implications

Any discussion surrounding the implications of U.S. LNG exports will focus on several considerations including the implications for domestic natural gas and electricity prices, the impact on other consumers of natural gas, and the impact on international prices and geopolitics.

Wellhead Prices

There have been a number of studies that have examined the impact of U.S. LNG exports on domestic prices. When analyzing them, policymakers should identify which study's assumptions most resemble the existing natural gas market and its likely direction, and which models are most reflective of the complex nature of domestic and global natural gas trade. For instance, assuming realistic volumes of natural gas exports as well as a reasonable supply response by natural gas producers are two critical considerations. It is also important to note that the supply curves in the various studies reflect different interpretations of the economics of marginal production.

Under the most reasonable assumptions (in this case assuming 6 bcf/day of exports), most reports forecast that natural gas prices will be between 2 and 11 percent higher in 2035 than if the U.S. did not export LNG.[2] There are a number of factors that insulate domestic prices from dramatic increases in price as a result of exports. First, as will be discussed later, there is a market-determined limit on how much the United States can economically export, depending on domestic prices, the international gas market, and the global market for competing fuels. Second, the size of the resource base is substantial, an important factor because the EIA estimates that roughly 63% of the gas required to meet demand for LNG export will come from increased domestic production.[3] Finally, the domestic natural gas sector is very efficient and producers are able to respond rapidly to marginal increases in the domestic price.

[2] Brookings 2012, pg. 33; Pricing studies include "Effect of Increased Natural Gas Exports on Domestic Energy Markets," Energy Information Administration, January 2012; "Made in America: the economic impact of LNG exports from the United States," Deloitte, December 2011; "Resource and Economic Issues Related to LNG Exports," ICF International, August 17, 2011; "Market Analysis for Sabine Pass LNG Export Project," Navigant Consulting, August 23, 2010.; and "Jordan Cove LNG Export Project Market Analysis Study," Navigant Consulting, January 2012. Note that Navigant Consulting's study of the Sabine Pass LNG project forecasted the pricing implications of 2 bcf/day.

[3] Brookings 2012, pg. 33

Figure 1: Study-by-study comparison of the Average Price Impact from 2015-2035 of 6 bcf/day of LNG exports (unless otherwise noted)

Study	Average Price without Exports ($/MMBtu)	Average Price with Exports ($/MMBtu)	Average Price Increase (%)
EIA*	$5.28	$5.78	9%
Deloitte	$7.09	$7.21	2%
Navigant (2010)** (2 bcf/day of exports)	$4.75	$5.10	7%
Navigant (2012)***	$5.67	$6.01	6%
ICF International***	$5.81	$6.45	11%

***** Price impact figure for EIA study reflects the reference case, low-slow export scenario.
** Navigant (2010) did not analyze exports of 6 bcf/day.
*** Navigant (2010 and 2012) and ICF International studies are based on Henry Hub price.
Source: EIA, Deloitte, Navigant, ICF International

Power Sector Implications

LNG exports are likely to have a modest impact on electricity prices as well. In the power sector, natural gas has historically been used as a back up to coal and nuclear base-load generation. For such gas used at the margin, the increase in electricity prices as a result of LNG exports will be limited by its competitiveness relative to other fuels: as soon as it becomes more expensive than the alternative for back up generation, power producers will move away from gas. According to ICF International, a $0.64/MMBtu increase in the price of natural gas will result in an electricity price increase of between $1.66 and $4.97/megawatt-hour (MWh), depending on how often gas is used as the marginal fuel for electricity. Deloitte estimates that the price increase of electricity will not be more than $1.65/MWh. EIA estimates that electricity price impacts will be marginal as well (between $1.40/MWh and $2.90/MWh) except in the "high rapid" export scenario. By contrast, the EIA Annual Energy Outlook 2013 estimates that, in its reference scenario, the average price of electricity (across all fuels) in 2035 will be

$101/MWh, showing clearly the small impact that the rise in domestic electricity prices will have on consumers.[4]

Industrial Sector Implications

I am similarly skeptical about the negative consequences of exports on our industrial sector. Some of the more vocal industry opponents to LNG exports contend that price increases will reverse the trend of manufacturing investment returning to the United States. I firmly disagree with this assessment. For starters, I don't believe that multi-billion dollar industrial investments in factories that will be a part of the capital stock for decades will be rendered unprofitable by single-digit percent changes to natural gas prices. As one analyst put it, "if your margins are so thin that [modest price increases] could break them, then there isn't much benefit to putting up a plant here. Conversely, if it is so beneficial to do it here, then a small change in price probably won't undermine those benefits."[5]

For the petrochemical sector, the picture is even more positive. The prospects of large volumes of new supply suggest that the industrial sector's competitiveness is stable regardless of U.S. export policy. Today the ratio of the price of oil to the price of natural gas is over 25:1. This is well over the 7:1 oil-to-gas price ratio at which the American Chemistry Council (ACC) believes U.S. petrochemical and plastics producers to be globally competitive. European and Asian petrochemical producers use oil-based products such as naphtha as a feedstock, as they lack access to cheap natural gas liquids (NGLs). Increased drilling will likely result in the greater production of the NGLs. This is one of the principal reasons why petrochemical producers are looking to return to the United States, after spending much of the previous decade relocating facilities overseas. According to a March 2011 report by the ACC, a 25 percent increase in ethane—a natural gas liquid—production will yield a $32.8 billion increase in U.S. chemical production.[6] To the extent that increased gas production linked to exports results in increased production of natural gas liquids, they will benefit the petrochemical industry.

International/Geopolitical Implications

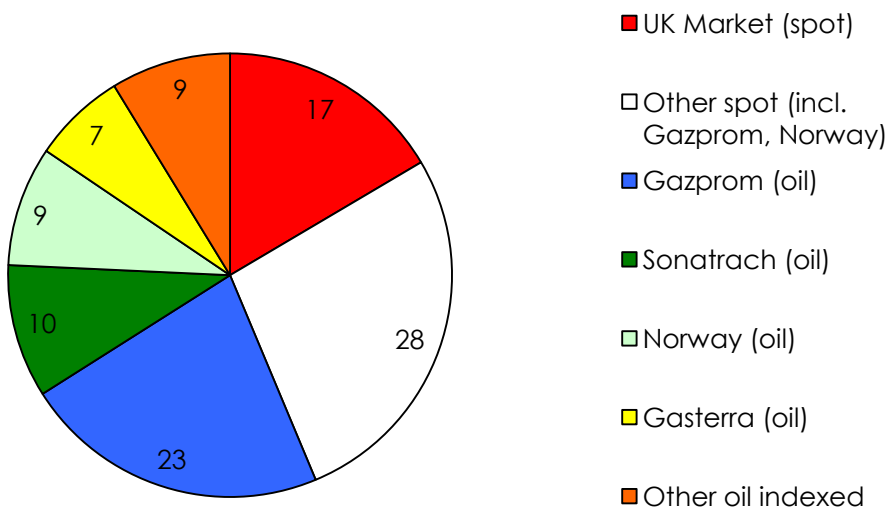
Before diving too deep into the international pricing and geopolitical implications of U.S. LNG exports, it is worth reviewing the structure of the global LNG market, which is informally separated into three markets: North America, the Atlantic Basin (mostly Europe), and the Pacific Basin (including Japan, South Korea, Taiwan, China, and India). These markets are separated because of important technical differences that impact the pricing structure for LNG in each market. The North American natural gas market is competitive and prices are traded in a transparent and open market. The Atlantic Basin is dominated by European LNG consumers such as the United Kingdom, Spain, France, and Italy, and is a hybrid of a competitive U.K. market that was liberalized in the mid-1990s and a Continental European market that is partially dependent on oil-linked, take-or-pay contracts. In recent years, the U.K. hub, the National Balancing Point (NBP), has traded at a premium to the U.S. hub, known as the Henry Hub. The

[4] Brookings 2012, pg. 34.
[5] Comment by Kevin Book, Managing Director, Research, ClearView Energy Partners, at "Liquid Markets: Assessing the Case for U.S. Exports of Liquefied Natural Gas," on May 2, 2012 at the Brookings Institution in Washington, D.C. (http://www.brookings.edu/~/media/events/2012/5/02%20lng%20exports/20120502_lng_exports.pdf)
[6] American Chemistry Council, "Shale Gas and new Petrochemicals Investment," March 2011.

Pacific Basin is a more rigid market that depends heavily on oil-indexed contracts that are more expensive than those used in the Atlantic Basin. While they have no central trading hub, the Pacific Basin consumers such as Japan and South Korea currently import LNG based on a pricing formula known informally as the Japan Crude Cocktail, the average price of custom-cleared oil imports into Tokyo. Many Pacific Basin contracts have a built-in price floor and price ceiling depending on the price of oil.

Without exporting any natural gas, the U.S. shale gas "revolution" has already had a positive impact on the liquidity of global LNG markets. Many LNG cargoes that were previously destined for gas-thirsty U.S. markets were diverted and served spot demand in both the Atlantic and Pacific Basins. The increased availability of LNG cargoes has helped create a more competitive LNG market for other consumers. This in turn has helped apply downward pressure to the terms of oil-linked contracts resulting in the renegotiation of some contracts. In 2010 short-term and spot contracts represented 19 percent of the total LNG market, up from only a fraction one decade earlier. This trend is particularly prominent in Europe, where in 2012 nearly half of its gas supply came on a spot-price basis (see **Figure 2**). As will be discussed later, this trend in the European market towards cheaper oil-indexed rates and increased spot consumption has not only benefited European economies but is also helping loosen the stranglehold of Gazprom, Russia's state gas company, on our east and west European allies and trading partners.

Figure 2: European Gas Supply by Contract Type (%), 2012



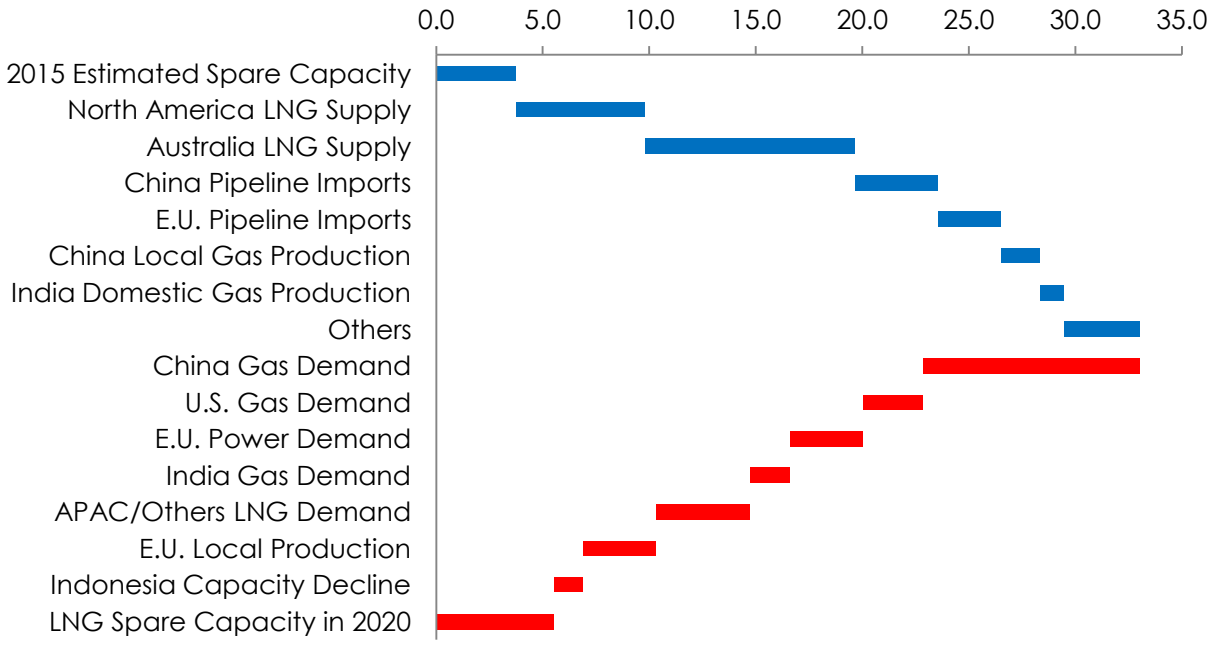
Source: Societe Generale

Although increases in domestic gas production have initiated some changes within the international gas market, any dramatic alterations to the existing structure will depend on the volume that is actually exported. With roughly 37 bcf/day of liquefaction capacity in the global market today, it is unlikely that

the U.S. will export a significant portion of the nearly 30 bcf/day worth of applications currently proposed to the Department of Energy. Building an LNG facility requires billions of dollars in investment and years of planning. Prospective exporters must also undergo an intricate and thorough regulatory process and must be reasonably certain that the economic opportunity for any investment exists for two or more decades.

Given these sobering realities, I don't see very many LNG projects—our estimates predict 4-6 bcf/day's worth—being constructed before their economic opportunity and early-mover advantage is eroded by increased domestic gas prices (resulting from more gas consumption in the electricity and industrial sectors, sources of demand that are emerging faster than export facilities), decreasing international gas prices, and a more balanced global LNG market. This last point about LNG market equilibrium is critical. Our forecast suggests that from 2015 to 2020, the global LNG market will swing to a surplus, mostly aided by the nine Australian projects that already have or are close to reaching final investment decision (see **Figure 3**) as well as other new supplies from East and West Africa. Further, pipeline gas (particularly into China), and a stubborn coal market will also compete with gas in global energy markets, particularly those in Asia. Furthermore, as we move beyond 2025, the possibility of other countries—again, China in particular—developing their own shale gas reserves could begin to have an impact on international gas trade.

Figure 3: Global LNG Supply/Demand Balance, 2015-2020 (bcf/day)



Source: Brookings, IEA, EIA, Morgan Stanley, JP Morgan, Credit Suisse

U.S. LNG exports will therefore have a beneficial but not transformational impact on international LNG prices. The market is still largely dependent on long-term contracts and much of the new liquefaction

capacity emerging in the next decade (largely from Australia) has already been contracted for at oil-indexed rates.[7] The incremental LNG volumes supplied by the United States at floating Henry Hub rates will be small in comparison. Indeed, importing U.S. LNG at Henry Hub rates includes a number of other costs, such as the cost to liquefy the gas and the cost to ship it on specialized tankers. (Depending on the type of contract, regasification is another cost that can be borne by either the buyer or the seller.) These costs range depending on the transportation distance and the size of vessel. As a reference point, it is estimated that shipments of LNG from the U.S. Gulf Coast to Japan will cost $5-6/MMBtu.[8] These additional costs dramatically reduce the arbitrage opportunity available to exporters.

There is also no guarantee that all U.S. exports will be supplied at floating U.S. prices. LNG export facilities are multi-billion dollar investments that require revenue certainty. Moreover, many of the export facilities are owned by producers of natural gas. John Watson, Chevron's Chief Executive, said earlier this week that his company's investments in LNG export facilities does not mean that natural gas will be available to consumers at U.S. rates.[9] Most producers prefer selling long-term supply contracts to reduce the price risk to their investments.

A large increase in U.S. LNG exports will have the potential to increase U.S. foreign policy interests in both the Atlantic and Pacific basins. Unlike oil, natural gas has traditionally been an infrastructure constrained business, giving geographical proximity and political relations between producers and consumers a high level of importance. Issues of "pipeline politics" have been most directly visible in Europe, which relies on Russia for around a third of its gas. Previous disputes between Moscow and Ukraine over pricing have led to major gas shortages in several E.U. countries in the winters (when demand is highest) of 2006 and 2009. Further disagreements between Moscow and Kiev over the terms of the existing bilateral gas deal have the potential to escalate again, with negative consequences for E.U. consumers. The risk of high reliance on Russian gas has been a principal driver of European energy policy in recent decades. Among central and eastern European states, particularly those formerly aligned with the Soviet Union such as Poland, Hungary, and the Czech Republic, the issue of reliance on imports of Russian gas is a primary energy security concern and has inspired energy policies aimed at diversification of fuel sources for power generation. From the U.S. perspective such Russian influence in the affairs of these democratic nations is an impediment to efforts at political and economic reform. The market power of Gazprom, Russia's state-owned gas monopoly, is evident in these countries. Although they are closer to Russia than other consumers of Russian gas in Western Europe, many countries in Eastern and Central Europe pay higher contract prices for their imports, as they are more reliant on Russian gas as a proportion of their energy mixes.

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[7] Brookings 2012, pg. 39

[8] For two estimates, see Ken Medlock, "U.S. LNG Exports: Truth and Consequences," *James A. Baker III Institute for Public Policy, Rice University,* August 10, 2012 (http://bakerinstitute.org/publications/US%20LNG%20Exports%20-%20Truth%20and%20Consequence%20Final_Aug12-1.pdf); and Robert Smith, "Asian Natural Gas: A Softer Market is Coming," Presentation to the U.S. EIA International Natural Gas Workshop, Washington, D.C., August 23, 2012.

[9] Ed Crooks, "Chevron explores first Canada gas exports," *Financial Times,* March 12, 2013. (http://www.ft.com/intl/cms/s/0/aaa61d84-8b3e-11e2-b1a4-00144feabdc0.html#axzz2NeqtOvnR)

In the larger economies of Western Europe, which consume most of Russia's exports, there are efforts to diversify their supply of natural gas. The E.U. has formally acknowledged the need to put in place mechanisms to increase supply diversity. These include market liberalization approaches such as rules mandating third-party access to pipeline infrastructure, and commitments to complete a single market for electricity and gas by 2014, and to ensure that no member country is isolated from electricity and gas grids by 2015.

Despite these formal efforts, there are several factors retarding the E.U.'s push for a unified effort to reduce dependence on Russian gas. National interest has been given a higher priority than collective, coordinated E.U. energy policy: the gas cutoffs in 2006 and 2009 probably contributed to the acceptance of the subsea Nord Stream pipeline, which carries gas directly from Russia to Germany. Germany's decision to phase out its fleet of nuclear reactors by 2022 will result in far higher reliance on natural gas for the E.U.'s biggest economy. The environmental imperative to reduce carbon emissions—codified in the E.U.'s goal of essentially decarbonizing its power sector by the middle of century—mean that natural gas is being viewed by many as the short-to medium fuel of choice in power generation. Ironically, in the near term the phase out of nuclear power has lead to greater reliance on both domestic coal as well as imported coal from the United States.

Finally, the prospects for European countries to replicate the unconventional gas "revolution" that has resulted in a glut of natural gas in the United States look uncertain. Several countries, including France and the U.K., have encountered stiff public opposition to the techniques used in unconventional gas production, while those countries, such as Poland and Hungary, that have moved ahead with unconventional-gas exploration have generally seen disappointing early results. Ukraine is also at a very early stage in developing its potential shale reserves. Collectively, these factors suggest that the prospects for reduced European reliance on Russian gas appear dim.

The one factor that has been working to the advantage of advocates of greater European gas diversity has been the increased liquidity of the global LNG market, discussed above. Russia's dominant position in the European gas market is being eroded by the increased availability of LNG. Qatar's massive expansion in LNG production in 2008, coupled with the rise in unconventional gas production in the United States as well as a drop in global energy demand due to the global recession, produced a global LNG glut that saw many cargoes intended for the U.S. market diverted into Europe. As mentioned previously, with an abundant source of alternative supply, some European consumers, mainly Gazprom's closest partners, were able to renegotiate their oil-linked, take-or-pay contracts with Gazprom.

Increased LNG exports will provide similar assistance to strategic U.S. allies in the Pacific Basin. By adding supply volumes to the global LNG market, the U.S. will help Japan, Korea, India, and other import-dependent countries in South and East Asia to meet their energy needs. The desire on the part of Pacific Basin countries for the U.S. to become a gas supplier to the region has been underlined by the efforts of the Japanese government, which has attempted to secure a free-trade agreement waiver from the United States to allow exports. As with oil price-linked Russian gas contracts in Europe, U.S. LNG

exports—to the extent they occur on a floating Henry Hub basis, have the potential to weaken the market power of incumbent LNG providers to Asia, increasing the negotiating power of consumers and decreasing the price. As U.S. foreign policy undergoes a "pivot to Asia," the ability of the U.S. to provide a degree of increased energy security and pricing relief to LNG importers in the region will be an important economic and strategic asset.

Beyond the basin-specific considerations of U.S. LNG exports, they will provide a source of predictable natural gas supply that is relatively free from unexpected production or shipping disruption. With Qatar representing roughly one-third of the global LNG market, a blockade or military intervention in the Strait of Hormuz or a direct attack on Qatar's liquefaction facilities by Iran would inflict chaos on world energy markets. While the United States government will be unable to physically divert LNG cargoes to specific markets or strategic allies that are most affected (gas allocation will be made by the market players), additional volumes of LNG on the world market will benefit all consumers. Further still, even if the volumes exported from the United States aren't large, there is an ideological geopolitical benefit to U.S. LNG exports. Exports will provide certainty to allies and economic partners around the world that the United States is a steadfast advocate for free trade.

Part 2: Policy Solutions

In that context, I believe a prudent policy is to continue to allow exports. However, there will be a need to reform the existing rules pertaining to LNG exports in order to reduce the risk and uncertainty that is hurting both producers and consumers.

So what does such a policy look like? For starters, I disagree with the two most extreme proposals of a volumetric cap, or a policy where the U.S. automatically approves all applications. Both are treacherous to implement and may increase, rather than decrease uncertainty. A balanced approach is one that doesn't increase the cost of exporting, but accurately reflects the cost of building a facility at the beginning of the process. I suggest a policy that requires a prospective exporter to have successfully gone through FERC's pre-filing process and have a portion of its supply contracts signed before being eligible to be considered by DoE for an application to export to non-FTA countries. Both requirements are costly and will encourage only serious projects to move forward.

There will also need to be more clarity on the "public interest" determination, which is currently too vague and creates investor uncertainty. One possibility is to allow the "public interest" to be dependent on the aforementioned two stipulations. In other words, if a company completes its pre-filing process and contracts out a given percentage of its capacity, the exports are deemed to be in the public interest.

One final consideration is to have an audit of natural gas export policy every five years. This would be an important information-gathering exercise. Such an audit would identify what happened to domestic natural gas supply, demand, and prices, and international markets during each five-year period.

I would like to thank the Subcommittee for giving me the opportunity to provide my views on this important issue, particularly in helping move the debate forward. I look forward to taking the Committee's questions.

Committee on Oversight and Government Reform
Witness Disclosure Requirement – "Truth in Testimony"
Required by House Rule XI, Clause 2(g)(5)

Name:

1. Please list any federal grants or contracts (including subgrants or subcontracts) you have received since October 1, 2010. Include the source and amount of each grant or contract.

None

2. Please list any entity you are testifying on behalf of and briefly describe your relationship with these entities.

None, My employer the Brookings Institution takes no institutional position on any policy issue

3. Please list any federal grants or contracts (including subgrants or subcontracts) received since October 1, 2010, by the entity(ies) you listed above. Include the source and amount of each grant or contract.

None

I certify that the above information is true and correct.

Signature: Charles K Ebinger

Date: 3/18/2013

CHARLES K. EBINGER

Key Qualifications:

Charles Ebinger, a Senior Fellow and Director of Brookings' Energy Security Initiative, has 30 years experience addressing the security, political, economic, environmental and foreign policy interrelationships surrounding domestic and international energy issues for public and private sector clients. Dr. Ebinger's involvement in energy security commenced in 1975 when, as a Foreign Affairs Officer in the Federal Energy Administration, he helped to establish the International Energy Agency and its oil-sharing mechanism and drafted two National Security Defense Memoranda on the Geopolitics of the Arctic (Svalbard) and the Antarctic. As the Brazil desk officer at the Agency, he followed the crisis arising from Rio's efforts to acquire uranium enrichment and reprocessing facilities. On his own initiative, he produced the first USG report on the Emerging Geopolitics of Chinese Energy, an analysis which won him a Certificate of Superior Service.

From 1976 to 1979, Dr. Ebinger served as Vice President of Conant and Associates, an international oil, gas and electricity political risk consulting company. There, he advised leading European and Japanese energy companies - such as Shell, BP, Total, ENI, VEBA, Statoil, Total, Arabian Oil, Chubu Electric, Kansai Electric, Fuji Oil, Osaka Gas, the Kuwait Petroleum Company and ADNOC - on a host of commercial and strategic issues relating to access to oil, gas and uranium. While at Conant and Associates, he was commissioned by the Georgetown University Center for Strategic and International Studies to write a SAGE Washington Paper on the Geopolitics of Nuclear Energy which took him around the globe to uranium producing and consuming states. He was a founding member of the *Geopolitics of Energy*, a monthly newsletter highly regarded by the highest levels of the international, oil, gas and nuclear industries. At Conant and Associates, Dr. Ebinger was retained by the Asia Society in New York to write a book on how Pakistan had been affected by the first two oil price shocks. The ensuing volume, *Energy Policy Planning in a Strategic Vortex***,** was reviewed by a panel of experts prior to its publication by Indiana University Press in 1981 and has led to Dr. Ebinger's serving as a senior energy advisor to every government in Pakistan since that time.

The nuclear paper's success led CSIS to hire Dr. Ebinger in 1979 as the founding Director of its new Energy and Strategic Resources Program. During his eight year tenure, Dr. Ebinger led a team of experts from the academic, public and private sectors in a major public policy report, *The Critical Link: Energy and National Security in the 1980s*, which examined the energy threats posed to the OECD nations in the decade ahead**.** The book was highlighted in *Forbes* and was the subject of hearings before the International Energy Agency, the European Union**,** NATO, and the French, Belgian and British governments**.** A second report**,** *Energy Access to 2000***,** was undertaken in collaboration with Royal Institute of International Affairs (Chatham House) and the Japan Institute of International Economics**.** Dr. Ebinger also played a leading role in the Soviet gas pipeline dispute with Europe in the 1980s by serving as a voice of moderation in the controversy surrounding the issue**.** Moreover, he was a contributor and co-editor of a volume on Nordic Energy Security and conducted studies on the following topics: the European gas market for Sonatrach, the Algerian National Oil Company; the European gas markets' need for LNG for the American Gas Association; an analysis of comparative end user prices in Europe for imported coal from Botswana, LNG, pipeline gas and nuclear power for EDF. At CSIS, Dr. Ebinger led the first two public policy reports on the national security and environmental implications for ethanol for the Renewable

Fuels Association and CNG for the American Gas Association. In addition, he led two major investigations on the national security implications of rising import dependency for petroleum products which were the subject of hearings before the Senate Armed Services Committee and the International Trade Commission.

In 1987, Dr. Ebinger joined the Washington office of Putnam Hayes and Bartlett, a leading financial and economic advisory firm specializing in the restructuring of public and private companies in the electricity and natural gas industries. While at PHB, Dr. Ebinger advised clients on the strategic issues arising from rulemaking by FERC and other regulatory authorities under the PURPA and PUCHA legislation. In addition, he led PHB's efforts to develop clients affected by the restructuring of the United Kingdom's electricity and natural gas industries.

Since 1988, Dr. Ebinger has served as an officer in three major international consulting companies. From 1988 until 1999, he was Executive Vice President, Energy Group Director and member of the Board of Directors at the International Resources Group, a global consulting company advising governments on energy, environmental and natural resource issues. There, he helped to lead the company from near bankruptcy to one with annual revenues of $32 million. He was employed as Senior Vice President for Global Privatization/ Regulation/ Restructuring at Nexant (Bechtel Consulting) from 2000 until 2004, after serving as Group Director for International Energy at Stone and Webster Management Consultants from 1999 until 2000. In December 2004, Dr. Ebinger returned to IRG as Senior Energy Advisor. He specializes in energy policy formulation; energy pricing reform; demand side management; the restructuring/privatization of formerly state-owned electricity, natural gas and oil companies; the institutional strengthening of government agencies in the energy sector; the creation of regulatory regimes and market forecasting of the oil, natural gas and uranium markets.

Dr. Ebinger has conducted projects for all of the major development banks and the United States Agency for International Development in Afghanistan, Pakistan, India, Egypt, Jordan, the West Bank, Liberia, Romania, Bulgaria, Armenia, Azerbaijan, Nigeria, the Gambia, Iraq, China, Mongolia, Indonesia, Venezuela, Hungary, Poland, Nepal and Saudi Arabia. Most recently during 2007 and 2008 while at IRG, he directed a project examining how to reduce the rising dependency of South East Europe, Turkey and the Caucasus on Russian energy supplies; advisied the Office of the President of Liberia on a national energy policy and the creation of an independent regulatory regime ; established a domestic energy planning model for Saudi Arabia for ARAMCO and advised the Government of Afghanistan on energy trade with its neighbors in Central Asia.

From 1975 until 2004, Dr. Ebinger taught as an adjunct faculty member in the undergraduate and graduate programs at the Georgetown University School of Foreign Service, where he offered a variety of courses on energy and the global environment. He now teaches at Johns Hopkins' School of Advanced International Studies and again at Georgetown where his courses address global electricity developments and their relationship to climate change as well as courses on international energy developments.Dr. Ebinger is a frequent speaker at industry trade association meetings and has appeared as a commentator on energy issues on McNeil Lehrer, Larry King, Charlie Rose, CNBC, BBC, CNN, and Nightly Business Report. He is the author, and editor of books and articles on US and international energy security; Third World debt and its linkage to the price of oil; South Asian, African and Middle Eastern economic and political issues; nuclear proliferation; and Japanese and Nordic energy security. Dr. Ebinger has testified before state and federal regulatory agencies and the US

Congress on energy security issues and has advised the US intelligence community on Pakistan and Iraq.

Dr. Ebinger has served as a member of the Board of Directors of two energy companies, North Coast Energy and Kokomo Gas Company. His other Board memberships include: Americans for Energy Independence; energy consulting companies; the Chemical and Biological Arms Control Institute as Chairman; and the Washington Chapter of the International Association of Energy Economists as director where he was recently also elected Vice President. Since January 2007, he has been Vice Chairman of the Dubai-based Innovative Energy Group, a company involved in the development of commercial biomass and wind projects. He has been an advisor on two Presidential commissions on US national energy security.

Education:

PhD	Fletcher School of International Law and Diplomacy, Tufts University, 1981
MALD, MA	Fetcher School of International Law and Diplomacy, Tufts University, 1972 and 1973; Awarded Stewart Prize for highest academic honors
BA	Williams College, Phi Beta Kappa, Cum Laude, 1970

Summary Experience Record:

2008-Present	**Senior Fellow and Director,** Energy Strategic Initiative, Brookings
2004- 2008	**Senior Energy Advisor**, International Resources Group (IRG), Washington, DC
2000-2004	**Senior Vice President for Global Privatization/Regulation/Restructuring** (2004), Nexant (Bechtel Consulting), Washington, D.C.
	Senior Vice President for Middle East, Central Asia, and Africa (2001-2004), Nexant (Bechtel Consulting), Washington, D.C.
	Vice President and Director of International Utility Services (2000-2001), Nexant (Bechtel Consulting), Washington, D.C.
1999-2000	**Director of International Energy Practice**, Stone & Webster Management Consultants, Washington, D.C.
1988-1999	**Executive Vice President**, International Resources Group (IRG), Washington, D.C.
1987-1988	**Senior Consultant**, Putnam Hayes & Bartlett, Washington, D.C.
1979-1987	**Director**, Energy and Strategic Resources Program, Georgetown University Center for Strategic and International Studies (CSIS,), Washinton, D.C.
1976-1979	**Vice President of Strategic Planning**, Economic Forecasting and Political Risk Assessment, Conant and Associates, Ltd., Washington, D.C.
1975-1976	**Foreign Affairs Officer**, Office of International Energy Affairs, Federal Energy Administration. Responsible for Caribbean Refineries, Washington, D.C.
1979-2011	**Adjunct Professor**, School of Foreign Service, Georgetown University, Washington, D.C.
2007-2011	**Adjunct Professor**, Nitze School of Advanced International Studies, Johns

Hopkins University, Washington, D.C.

Detailed Professional Experience:

Senior Energy Advisor, International Resources Group (IRG), Washington, DC (2004-2008)

- **Eastern Europe: Director of USAID project (2007-2009)** looking at energy alternatives for the nations of South East Europe, Turkey and the Caucasus to reduce their growing dependence on Russia;
- **Saudi Arabia:** Team member designing a domestic energy planning model of the Kingdom for Aramco-2007-2008.
- Retained by World Bank in December 2007 to review all WB energy lending after 2002 to determine whether climate change concerns were adequately addressed during project design and implementation.
- **Liberia:** Currently member of a two person team preparing a document for the office of the President entitled, *A National Energy Policy for Liberia: An Agenda for Action.*
- **Afghanistan:** Conducted an Institutional Needs and Capacity Building Assessment for five Ministries responsible for the energy sector
- **Afghanistan:** Currently part of a negotiating and advisory team working with the GOA in formalizing Power Purchase Agreements with Uzbekistan, Turkmenistan and Tajikistan.
- **Liberia: Team Leader of a White Paper for the Government of Liberia** highlighting all aspects of Liberia's energy policy. The paper was presented at a World Bank hosted donors conference in January 2007 as reflecting the GOL's new energy policy
- **Nepal: Team Leader of a multiyear project advising HMGN on establishing a regulatory commission for the power sector**, drafting a new electricity law regarding hydroelectric power development and the introduction of private investment for exporting power, and institutional reorganization of the Department of Electricity Development in the Ministry of Water Resources.
- **Hungary: Advisor to the East European Regulators Association (ERRA) in Budapest** on ways to expand its regulatory training program to put itself on a sustainable financing basis following the withdrawal of donor funding.
- **West Bank/Gaza: Team Leader on a World Bank project advising the Palestine Energy Authority** on establishing a regulatory regime for the power sector, reforming electricity pricing and expanding electricity service in the West Bank and Gaza. Involved in drafting a new Electricity Law; a new Ordinance promulgating the Regulatory Authority; the drafting of new generation, transmission and distribution licenses; and a charter for the new Authority.
- **Egypt: Regulatory Advisor to the Chairman of the Egyptian Electric Utility and Consumer Protection Regulatory Agency** designing a new market design, an Implementation Plan to inaugurate it. Also conducted an affordability benchmarking study of the price of electricity to Egyptian consumers against those prevailing in five other countries.

Senior Vice President, Nexant "Bechtel" Consulting (2000-2004)

- **Iraq: Team Leader and Energy Sector Advisor, Coalition Provisional Authority (with the National Security Council and DOD), December 2002-May 2003**. Led a Team (December to January) advising on various proposals to restructure the Iraqi upstream petroleum sector. This analysis involved proposals for restructuring the Iraq Petroleum Company as well as the Ministry. The report was so well received that the Team was asked to conduct a similar report (January-May) on the downstream sector. Key issues addressed in the reports were institutional changes needed to turn Iraq into a world class producing country, an assessment of capital requirements to rebuild and expand the industry, an assessment of the state of the refinery industry and the requirements to rebuild and expand it, the structure of product pricing, an analysis of the wholesale and retail product markets and the human resource requirements needed to revitalize the industry.

- **Saudi Arabia: Institutional Development Specialist, Saudi Electricity Regulatory Authority**. Advised the Saudi Electricity Regulatory Authority on institutional, legal, financial and administrative reforms needed to attract over $120 billion from the private sector into the economy over the next 12-15 years. Coordinated with the Ministry of Finance, Ministry of Water and Electricity, SAIGA, the Saudi Electric Company, the Saline Water Conversion Company, the royal court, the Shoura Council, and numerous domestic, regional and international investors as well as regional, local, and international banks.

- **Azerbaijan: WB Team Leader, Ministry of Economic Development.** Advised the Ministry of Economic Development on creating a multi sector Regulatory Commission for electricity, natural gas and water. The project involved a review of all laws affecting these sectors; institutional/organizational design of the Commission; consolidation of existing oversight authority from among several institutions into the new Commission; staffing recommendations; design of tariff principles and development of a tariff structure eliminating subsidies and cross subsidies; and development of a human resources training and development plan.

- **Armenia: WB Team Leader, Commission on Expanding the Armenian Public Utilities Commission**. Served as the team leader and personal advisor to the Chairman of the Commission on Expanding the Armenian Public Utilities Commission from its current regulatory responsibilities for electricity and natural gas to include water, sewerage and telecommunications. The project involved requisite institutional, organizational and staffing changes in the Commission, the drafting of new enabling legislation for the Commission as well as new sector laws, detailed training in tariff formulation and design and an examination of financing options for the Commission to put it on a self-sustaining basis..

- **Bulgaria: Institutional Restructuring Expert, Sofia District Heating Company.** Part of a team advising the Sofia District Heating Company on restructuring its finances and institutional and legal composition prior to privatization.

- **Jordan: Regulatory and Economic Advisor, Aqaba Special Economic Zone.** Advised the Government of Jordan and the Commissioners of the Aqaba Special Economic Zone (ASEZ) on rationalizing the regulatory structure in the ASEZ with existing national regulatory institutions in the transport, power, port, water and telecommunications sectors. In addition, advised ASEZA on the establishment of a

municipal gas distribution company for the zone and the creation of a regulatory regime for the gas sector. In this capacity, coordinated with a number of cabinet officials and the Privatization Office of the Prime Minister as well as the ASEZA Commissioners.

- **India: ADB Team Leader, Power Sector Development Program, Kerala, India.** Led a sixteen person team advising the State Government of Kerala and the Kerala State Electricity Board on the economic, financial, technical and regulatory issues arising from the power sector reform program. Helped to establish a new Regulatory Commission: make recommendations on its staffing, design, internal rules and procedures. Advised on institutional/organizational restructuring of KSEB.
- **Nigeria: Power, Oil, and Gas Sector Reform Specialist.** Advised the Nigerian Electric Power Authority, the Nigerian National Petroleum Corporation and the Petroleum Pricing Regulatory Commission on rationalizing oil and gas pipeline tariffs, and creating a regulatory institution for the oil and natural gas sector. Advised NEPA on institutional and organizational reform.
- **Romania: WB Regulatory Advisor, Gas Regulatory Reform.** Assisted the Romanian Government on establishing a regulatory regime for the gas sector.
- **Egypt: Legal and Regulatory Advisor, Power Sector Reform.** Advised the Egyptian Electric Holding Company on the legal/regulatory issues involved in establishing a power pool and creating a regulatory regime for the power and natural gas sectors.

Director of International Energy Practice, Stone & Webster Management Consultants, Washington, DC (1999-2000)

- **The Gambia: WB Team Leader, Electric Power Privatization and Oil Sector Restructuring, Project.** Led a team representing the Government of Gambia in its negotiations with Eskom to purchase the Gambian electric power and water utility. In addition, advised the Government on restructuring its downstream petroleum operations with special attention to petroleum storage and safety issues.
- **Guyana: Technical Advisor, IDB, Restructuring of the Energy Sector.** Advised the office of the Prime Minister on an institutional strengthening and rationalization program for a number of organizations with conflicting regulatory responsibilities for the energy sector.
- **Indonesia: WB Technical Advisor, Petroleum Sector Restructuring.** Served as part of a three person team drafting a new petroleum policy and oil and natural gas law for the country.

Executive Vice President, International Resources Group, Washington, DC (1988-1999)

Rapidly helped move IRG into the forefront of the privatization of the global utility industry in Pakistan, India, Egypt, Jordan, China, Zambia, Nepal, Mongolia, Bangladesh, and Vietnam. Select projects included:

- **India: Advisor, Regulatory Restructuring Programs, 1996-1998.** Advised the Central Energy Regulatory Commission in India on becoming a fully functioning regulatory institution. Also advised the State Electricity Board in Punjab on restructuring its operations and the State Government of Uttar Pradesh on creating an independent electricity regulatory commission.

- **Nepal: Advisor, His Majesty's Government of Nepal, 1998.** Advised the Nepalese Government on institutional issues relating to the development of private power hydel projects in the country.
- **Mongolia: Team Leader, Power Sector Regulatory Restructuring Program, 1998.** Served as an advisor to the Government of Mongolia on restructuring the power sector in Mongolia and creating an independent regulatory commission.
- **India: WB Team Leader, Bihar Power Sector Restructuring Program, India.** Directed a fifteen person team advising the State Government of Bihar and the Bihar State Electricity Board on restructuring the State Electricity Board to make it run as a commercial enterprise based on market principles.
- **Pakistan: Member of WB Natural Gas Sector Mission to Pakistan (1997)** examining gas pricing issues/ institutional organization of the sector and the relative economics of natural gas imports from Turkmenistan, Iran and Qatar.
- **China: WB Team Leader, Power Sector Restructuring and Tariff Reform Project.** Assisted the Shanghai Municipal Electric Power Company (SMEPC) on the restructuring of its power system and the divestiture of its corporate assets; advised SMEPC on restructuring its relationships with the East China Power Group and other entities serving the Shanghai power system.
- **Bangladesh**: **WB Advisor, Development of Policy Framework for Private Power Generation.** Advised the government of Bangladesh on establishing an independent power policy and to establish the Private Power Cell as the lead Government agency to evaluate IPP proposals submitted to the Government. Dr. Ebinger helped draft the "security package" for the country's first IPP project which will be put out for competitive bid in 1997.
- **Egypt: Team Leader, Institutional Development of the Egyptian Electricity Authority, 1996-1998.** Managed the USAID-funded effort in Egypt to restructure the power sector and strengthen the national electricity authority. Drafted a revised charter for the Egyptian Electricity Authority (EEA), worked to establish an independent regulatory regime for the power sector, and participated in drafting a new business plan for EEA.
- **Guyana: Power Restructuring Specialist, Guyana Electricity Company, 1995.** Participated in the institutional review of the Guyana Electricity Company in order to recommend appropriate reforms for its corporatization.
- **Jordan: WB Team Leader, World Bank, Institutional and Financial Restructuring of the Energy Sector, 1994-1995.** Directed a team of fifteen professionals advising the Government of Jordan on: reorganizing and institutionally strengthening the Ministry of Energy and Natural Resources, "corporatizing" the Jordan Electricity Authority, reorganizing the electricity distribution sector, reforming wholesale and retail electricity tariffs; establishing a National Regulatory Authority, putting the energy sector on a sound financial basis, and restructuring the Natural Resources Authority.
- **Pakistan**: **USAID Team Leader, Pakistan Private Sector Power Project, 1990-1994.** Managed a four-year, $15 million project and led team composed of IRG and four subcontractors. Coordinated technical assistance efforts with counterparts in various ministries in the Government of Pakistan, as well as officials of donor agencies. Total

level of effort in this project included 48 months each for 4 long-term resident advisors, as well as 200+ months of short-term technical assistance.

- **Pakistan**: **Team Leader, National Electric Power Regulatory Authority (NEPRA), 1994.** Led the team which designed the structure and functions of the proposed National Electric Power Regulatory Authority (NEPRA). NEPRA's responsibilities will be to: maintain competition; control monopoly activities; authorize the utilization of land and water resources for private power production; and regulate the prices charged by government-owned hydel companies.
- **Pakistan**: **Member of WB Team (1995)** examining WAPDA's Tariff structure and making recommendations for reform.
- **Pakistan**: **WB Team Leader** of a natural gas pricing study for the Sui Northern Natural Gas Pipeline Company (1996).
- **Pakistan**: **Member of ADB Team** (**1996**) advising the Sui Southern Gas Company on reforming its gas pricing policies; project also was engaged by the Ministry of Petroleum and Natural Resources on creating a Gas Regulatory Authority (GRA).
- **Kyrgyzstan/Kazakhstan, (1991-1992) USAID Team Leader** of two projects conducting demonstrations of energy efficiency equipment in the district heating plants in Almaty and Bishkek. Following these pilot projects, seminars were held bringing together officials from district heating companies throughout both countries to show the benefits of no cost/low cost energy options.
- **Poland/Bulgaria, (1989-1990) USAID Team Leader** of energy efficiency demonstrations of the opportunities afforded by low cost/no cost options in a variety of commercial and industrial facilities.
- **Indonesia: Member of WB Team** examining the impact that fuel subsidies were having on the Indonesian macro-economy and making recommendations for reform.
- **Morocco:, 1988 Member of USAID Team** examining (1) reform of the petroleum product pricing system; (2) the opportunities to reduce fuel wood consumption in the household sector by the introduction of LPG and (3) opportunities for utilizing solar power in commercial buildings in southern Morocco.

Senior Consultant, Putnam Hayes & Bartlett (1987-1988)

Helped to develop a client base with both the London Electricity Board and the Electricity Council that led PHB to become one of the major players in the privatization of the UK's electricity and natural gas markets. Deeply involved in PURPA, FERC and PUCHA reform issues in the United States.

Director, Energy and Strategic Resources Program, Center for Strategic and International Studies (CSIS), Washington, DC (1979-1987)

Directed a major public policy report, *The Critical Link: Energy and National Security*, in the 1980s involving numerous domestic and international oil, gas and electric utility companies. This report was the subject of an article in *Forbes* and led to briefings before NATO, the IEA and the British, French, Belgian and Japanese governments. Conducted major public policy reports on a variety of energy issues. Testified frequently before Congressional, state and

administrative agencies. Conducted two major reports for the Domestic Refiners Coalition, which were the subject of congressional hearings on the national security issues raised by rising imports of petroleum products.

Served as the US Director of another major public policy study, done in association with Chatham House and the Japan Institute of International Economics – *Energy Access to 2000* (Gower Press) – examining the critical energy challenges confronting the OECD nations in the decades ahead. Dr. Ebinger turned CSIS into a major forum for policy debate on energy issues and won support from the energy industry for being fair and objective to all parties on politically charged energy issues.

Vice President, Strategic Planning, Economic Forecasting and Political Risk Assessment, Conant and Associates Ltd. (1976-1979)

Co-founded Conant and Associates. During the next sixteen years it became one of the premier oil and energy consulting companies with clients principally in the European and Japanese energy industries.

Foreign Affairs Officer, Office of International Energy Affairs, Federal Energy Administration (1975-1976)

Involved at staff level in the establishment of the International Energy Agency representing the United States in many of the international energy fora arising from Algeria's call for A New International Economic Order. Served as Desk Officer for the Caribbean and Latin America where he became an expert on the international residual fuel oil market. Became the Far Eastern Desk Officer and was awarded an Agency Certificate for Superior Service for a pioneering study on the emerging Geopolitics of Chinese Oil.

Adjunct Professor, Georgetown University School of Foreign Service (1979-2011)

Served as an adjunct professor in the School of Foreign Service teaching courses that were cross listed in Arab Studies, Economics, law and business schools and the International Business Diplomacy programs. Courses centered on teaching energy and environmental economics, critical policy issues, the world energy market and the Middle East. Many of his former students hold significant energy and foreign policy positions in international investment houses, governments, oil companies, and bilateral and multilateral investment houses. Dr. Ebinger consistently received among the highest student evaluations.

Adjunct Professor, Nitze School of Advanced International Studies, Johns Hopkins University, Washington, DC, (2007-2011)

Teaching a course on global electricity markets and policies focusing on electricity sector reform around the globe; the development of regulatory regimes in formerly state-owned energy sectors; heavy versus light handed regulation; changing views of utility regulation; the development, operation and oversight of power pools; electricity and climate change; electricity pricing.