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THE ROLE OF U.S. LIQUEFIED NATURAL GAS IN MEETING EUROPEAN ENERGY DEMAND

HEARING

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE

ONE HUNDRED FIFTEENTH CONGRESS

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THE ROLE OF U.S. LIQUEFIED NATURAL GAS IN MEETING EUROPEAN ENERGY DEMAND

THURSDAY, SEPTEMBER 13, 2018

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The Committee met, pursuant to notice, at 10:11 a.m. in Room SD–366, Dirksen Senate Office Building, Hon. Lisa Murkowski, Chairman of the Committee, presiding.

OPENING STATEMENT OF HON. LISA MURKOWSKI, U.S. SENATOR FROM ALASKA

The CHAIRMAN. Good morning, everyone. The Committee will come to order.

As we meet here this morning, everyone is focused on weather and what is coming our way, concerned about the impact of Hurricane Florence on the East Coast, particularly North and South Carolina and closer to Virginia. We have watched very attentively over these past few days, it was characterized as a monster storm, the likes of which we have not experienced in 60 years. It has since been downgraded to Category 2, but I think we all know that you still keep a very, very watchful eye, because a dangerous storm can cause significant damage. There is no doubt that we will see power outages resulting from downed transmission and distribution lines, as well as flooding. The question is how long will people be without power and how quickly will the grid system be back up and running?

This Committee has spent a fair amount of time following this situation in the aftermath of the hurricanes in Puerto Rico and the U.S. Virgin Islands, and a year later, a year later, you still have some folks that are still struggling. So as Hurricane Florence proceeds, know that we are going to be monitoring the situation closely. The utility industry has already mobilized its mutual assistance program, deploying workers from other parts of the country in advance of the storm so that restoration work can start as quickly as possible. I understand that FEMA is also already standing ready to assist.

Next Thursday, the Committee was planning to hold an oversight hearing on "blackstart" capabilities, which is the process for returning energy to the power grid after a system-wide blackout. Unfortunately, we have had to postpone this hearing due to our schedule here in the Senate. When it is rescheduled, we will be able to examine system restoration plans in the utility industry in the wake of Hurricane Florence.

But today's hearing is not about hurricanes and it is not about blackouts, it is focused on the role of the United States in exporting LNG, Liquefied Natural Gas, in meeting Europe's growing energy demand.

Europe is now the biggest importer of natural gas in the world. The continent consumes close to 15 percent of the world's gas, but holds only two percent of the reserves. Europe's reliance on the natural gas resource is increasing as its coal-fired power plants are phased out and nuclear plants are placed out of service.

Russia, we know, continues to be the main supplier of much-needed natural gas to European nations. But as we have seen too often, Russia has used this energy resource as a geopolitical weapon, cutting off supplies to Ukraine in 2006 and 2009 and halting deliveries to Europe. Recent disputes between those two nations only highlight Europe's vulnerability given its dependence on Russian gas.

But with the abundance of our domestic natural gas supplies, the United States is poised to change that equation. Through technological advancements, the U.S. has emerged as the largest gas-producing nation in the world and is fast becoming a global leader in LNG exports.

According to the International Energy Agency (IEA), gas imports to Europe are expected to rise almost 20 percent by 2040. Our nation is well-positioned to assist our allies in diversifying their energy supplies and achieving a level of energy security.

As we examine these global issues today, we are joined by a very impressive panel of experts and we appreciate that. Our witnesses this morning are appearing on behalf of the Department of Energy, ClearView Energy Partners, the Atlantic Council, the Manhattan Institute and Public Citizen. I am interested in their thoughts on the economic and geopolitical implications of a stronger U.S.–EU energy relationship, as well as what actions may be needed to maximize the benefits of LNG exports to our nation and our allies.

With that, I turn to Senator Cantwell for your opening remarks this morning.

STATEMENT OF HON. MARIA CANTWELL, U.S. SENATOR FROM WASHINGTON

Senator CANTWELL. Well thank you, Madam Chair, and I, too, thank all those that are preparing for the storm that is hitting our coast for their hard work and diligence.

I would point out as I watched the TV, I continued to see this information about the European model versus the U.S. model, and I hope that as we continue to move forward we will put more time into supercomputing information that allows us to have good information and modeling about our U.S. storm impacts. I think this is vitally important for us and for many parts of the United States.

I would, if I could, as a point of privilege, say something good about a storm, which is that I want to congratulate the Seattle Storm on winning the Women's WNBA Championship last night and for all the good work that they did. We are very happy about that Storm. Congratulations to all of them and their hard work, and congratulations to Seattle.

Well, Madam Chair, thank you for holding this hearing about the role that U.S. liquified natural gas can play in meeting European energy demand. While it is good to discuss ways to help our allies, I hope we do not lose focus on protecting U.S. consumers.

Driven in large part by technologies developed through R&D by the Department of Energy, there has been a dramatic growth in domestic natural gas production. The growth in U.S. production has driven down natural gas prices for consumers and provided a key U.S. competitive advantage for manufacturers that use natural gas as an energy source and feedstock.

As natural gas production has increased, the volume of natural gas exports has also increased, and the United States became a net natural gas exporter in 2017 for the first time in nearly 60 years. The U.S. LNG exports reached 25 destinations last year, and more than half of those LNG exports were shipped to three countries: Mexico, South Korea and China. Countries in Europe have accounted for the third largest share of U.S. LNG exports.

Several more LNG export projects are expected to be completed in the coming years and, once completed, the U.S. LNG export capacity is expected to reach 9.6 billion cubic feet per day by the end of 2019.

The Department of Energy has approved over 20 billion cubic feet per day in export capacity, with another 30 billion cubic feet per day pending in applications. So when the Department of Energy makes their public interest determination, they should prioritize domestic consumption before exports, and make sure that there are proper environmental mitigations in place when considering the benefits of using natural gas.

The prospects of increased U.S. LNG exports and growing global LNG markets can create opportunities for countries to look to diversify their natural gas supply. For example, countries in Europe are heavily dependent, as the Chair said, on Russia for their natural gas supply, with Russian natural gas accounting for 37 percent of the European imports in 2017.

However, other factors influence LNG cargo delivery and, although Europe has a large number of LNG import facilities, they are currently only operating at 20 to 30 percent of capacity. I am sure we will hear about this.

The International Energy Agency projects that U.S. LNG suppliers will reach a market share of only about 10 percent of the LNG imports to Europe by 2025. So it is clear that the role of U.S. LNG can be particularly impactful, but will be driven by economics, infrastructure, and perhaps a little policy here. I look forward to exploring these topics and hearing from our witnesses today.

Thank you for scheduling this hearing.

The CHAIRMAN. Thank you, Senator.

We will now move to our panel. As I mentioned, we have a good panel this morning. We appreciate you all being here.

We will start off this morning with comments from Steven Winberg, who is the Assistant Secretary of Fossil Energy at the U.S. Department of Energy (DOE). We welcome you.

Mr. Kevin Book has been before the Committee on numerous occasions. He is the Managing Director for ClearView Energy Partners.

Dr. Agnia Grigas, who is the Associate at Argonne National Lab. She is a nonresident Senior Fellow with The Atlantic Council. Welcome.

Mr. Mark Mills is at the end here, kind of out of order, according to my list, but Mr. Mills is a Senior Fellow at Manhattan Institute.

And Mr. Tyson Slocum is the Energy Program Director for Public Citizen.

We will go down the order in the way that you are seated, not in the way that I have introduced you there, so sorry for that little mix-up on the end.

Again, we appreciate that you have made time in your busy day to help educate the Committee on these important and significant issues.

We ask that you try to limit your comments to about five minutes. Your full statements will be incorporated as part of the record.

Assistant Secretary Winberg, if you would like to lead off please?

STATEMENT OF HON. STEVEN E. WINBERG, ASSISTANT SECRETARY FOR FOSSIL ENERGY, U.S. DEPARTMENT OF ENERGY

Mr. WINBERG. Thank you, Chairman Murkowski, Ranking Member Cantwell and members, member, of the Committee.

[Laughter.]

I appreciate the opportunity to be here today.

Increased supplies of U.S. natural gas in Europe help ensure competition in the energy markets, giving our allies a safe and reliable source of energy governed by market forces, not political win. That's exactly the message that Secretary Perry is delivering to his Russian counterparts right now as we speak.

With the United States and Russia as two of the world's largest energy producers, Secretary Perry is re-opening a dialogue with the Russians to help ensure increased competition in the energy markets and to stand firm on U.S. sanctions which prohibit any U.S. participation in energy production and exploration projects in Russia's deepwater, Arctic offshore and shale energy projects. These sanctions are directly related to Russia's actions to undermine our democracy by meddling in our elections.

Secretary Perry has stated that every molecule of energy that the United States exports is exporting freedom to the world. This Administration made a commitment to spreading American energy dominance throughout the world through exports, and we're delivering on that commitment.

DOE has authorized exports of LNG at a rate of over 21 billion cubic feet per day to anywhere in the world not prohibited by U.S. law or policy. These non-free trade agreement authorizations are primarily spread across ten large-scale export projects.

Six of these projects are in various states of construction and operation in Texas, Louisiana, Georgia, and Maryland. Cheniere Energy's Sabine Pass facility in Louisiana has been exporting LNG since February 2016. Dominion Energy's Cove Point facility in Maryland began LNG exports in March 2018, and Secretary Perry had the opportunity recently to participate in the formal ribbon cutting for the facility along with officials from both the Japanese

and Indian governments. Four additional export projects are expected to come online over the next two years.

In support of the Administration's deregulation, deregulatory agenda, DOE proposed a rule to expedite approval of smaller volumes of natural gas exports to non-free trade agreement countries. We call this the Small-Scale Rule, and the final rule went into effect this past August.

DOE's action to increase U.S. LNG exports are critical to ensuring that Europe pursues diversification of its energy supplies. The large-scale facilities currently operating and under construction in the U.S. have long-term authority to export LNG anywhere in the world, including Europe, except where otherwise prohibited by law, for example, if there are sanctions.

As European Union (EU) member states decrease their reliance on electricity generation from coal to comply with EU emission goals, European countries are becoming more dependent on natural gas overall. As a consequence, due to a lack of supply routes and inefficient pipeline buildout, Europe is also becoming more, not less, dependent on Russian natural gas. This does not have to be the case.

Our nation is endowed with vast supplies of natural gas and production is growing rapidly. The U.S. Energy Information Administration (EIA) projects that dry natural gas production will reach 110 billion cubic feet per day by the year 2040, up from the projected production of nearly 80 billion cubic feet per day this year. The EIA also projects U.S. LNG exports to ramp up from 2.8 billion cubic feet per day in 2018 to the rate of 14 billion cubic feet per day in 2040.

The United States has the natural gas supplies to spread freedom throughout the world by giving our allies a safe and reliable energy supply, and we look forward to working with our European allies to bring more U.S. natural gas to the continent moving forward.

I thank you for your attention, and I look forward to your questions.

[The prepared statement of Mr. Winberg follows:]

Statement by Steven E. Winberg
Assistant Secretary for Fossil Energy
U.S. Department of Energy
Before the
Committee on Energy and Natural Resources
United States Senate

September 13, 2018

Introduction

Thank you Chairman Murkowski, Ranking Member Cantwell, and Members of the Committee. I appreciate the opportunity to be here today, and it is my pleasure to appear before you to discuss the opportunities for U.S. liquefied natural gas (LNG) exports to Europe.

Increasing U.S. LNG exports to the world is critical to achieving the administration's goal of American energy dominance. U.S. LNG exports not only give our allies across the world a safe and reliable source of energy but they bring many great economic benefits to the U.S. economy. A recent study commissioned by the Department of Energy (DOE) and prepared by NERA Economic Consulting, shows that increasing U.S. LNG exports will provide benefits to the American economy and the American worker. Additionally, the increased use of natural gas throughout our nation's economy, has lowered carbon emissions to levels not seen in 25 years. Expanding U.S. LNG exports is a win-win scenario for our nation and our allies.

Department of Energy's Statutory Authority

The Department of Energy's (DOE) authority to regulate the export of natural gas arises under section 3 of the Natural Gas Act (NGA), 15 U.S.C. § 717b. This authority is vested in the Secretary of Energy and has been delegated to the Assistant Secretary for Fossil Energy.

Section 3(a) of the NGA sets forth the standard for review of most LNG export applications:

> [N]o person shall export any natural gas from the United States to a foreign country or import any natural gas from a foreign country without first having secured an order of the [Secretary of Energy] authorizing it to do so. The

> [Secretary] shall issue such order upon application, unless after opportunity for hearing, [he] finds that the proposed exportation or importation will not be consistent with the public interest. The [Secretary] may by [the Secretary's] order grant such application, in whole or part, with such modification and upon such terms and conditions as the [Secretary] may find necessary or appropriate.

The Department has consistently interpreted section 3(a) as creating a rebuttable presumption that a proposed export of natural gas is in the public interest. Under this provision, DOE performs a thorough public interest analysis before acting on applications to export natural gas to non-free trade agreement countries. In addition, DOE must give appropriate consideration to the environmental effects of its proposed decisions under the National Environmental Policy Act (NEPA). Typically for LNG facilities planning to export to non-FTA countries, including European countries, DOE acts as a cooperating agency to the Federal Energy Regulatory Commission who leads the preparation of environmental impact statements or environmental assessments for proposed LNG export facilities under NEPA.

In the Energy Policy Act of 1992, Congress enacted section 3(c) to the NGA. Section 3(c) created a different standard of review for applications to export natural gas to those countries with which the United States has in effect a free trade agreement requiring national treatment for trade in natural gas. Section 3(c) requires such applications to be deemed consistent with the public interest and granted without modification or delay.

The Federal Energy Regulatory Commission (FERC) has jurisdiction under the Natural Gas Act over the siting, construction, and operation of onshore LNG export terminals. For offshore LNG export terminals, this authority resides with the Maritime Administration (MARAD) in the U.S. Department of Transportation (DOT).

DOE Authorizations to Export Natural Gas

Since January 2017, DOE has granted authority to export natural gas to several projects including two large-scale liquefied natural gas (LNG) projects – Golden Pass Products in Texas and Delfin LNG, which is proposed for offshore Louisiana; Eagle LNG's small-scale project in Maxville, Florida and additional capacity at the proposed Lake Charles LNG project in Louisiana.

Since DOE began authorizing exports of LNG from the lower 48 states, 21.35 billion cubic feet per day of natural gas has been authorized under section 3(a) of

the Natural Gas Act for export to anywhere in the world not prohibited by U.S. law or policy. These non-free trade agreement authorizations are primarily spread across 10 large scale export projects, six of which are in various states of construction and operation in Texas, Louisiana, Georgia, and Maryland. One facility in the lower 48 states, Cheniere Energy's Sabine Pass facility in Louisiana, has been exporting LNG since February 2016. A second large-scale facility, Dominion Energy's Cove Point facility in Maryland, began exports in March 2018. Four additional export projects are expected to come online over the next two years. After the construction of these facilities is completed, US LNG export capacity is expected to reach approximately 11 billion cubic feet per day.

At present, there are a dozen large-scale export projects, with over 20 billion cubic feet per day of additional export capacity, under review at both FERC and DOE. On August 31, 2018, FERC released review schedules for these export projects. DOE remains committed to taking prompt final action on LNG export applications once FERC completes its review.

Recent Developments in DOE's Natural Gas Regulatory Program

To support DOE's public interest review for applications to export LNG to non-free trade agreement countries, DOE has commissioned five macroeconomic studies to date. These studies have examined the economic impacts of LNG exports at different levels. Most recently, on June 12, 2018, DOE provided notice of the latest study – the 2018 LNG Export Study conducted by NERA Economic Consulting. DOE invited public comment on the 2018 Study and the comment period closed on July 27, 2018.

The 2018 study entitled *Macroeconomic Outcomes of Market Determined Levels of U.S. LNG Exports* examines the macroeconomic effects of varying LNG export levels resulting from 54 combinations of domestic and international supply and demand. The study found that U.S. economic growth resulting from rising levels of LNG exports results in increased well-being of U.S. consumers and higher levels of natural gas exports are met by increases in domestic production over diversion from domestic uses. DOE is currently reviewing public comments received on the study.

Additionally, on August 24, 2018, DOE's rule to provide for faster approval of certain small-scale exports of natural gas came into effect. The "small scale rule" provides a streamlined approval for applicants to export up to 51.75 billion cubic feet per year from U.S. export facilities that do not require an Environmental

Assessment or Environmental Impact Statement under the National Environmental Policy Act. To date, one U.S. company, American LNG, has exported 160 shipments of small-scale LNG from its facility in Florida to both Barbados and the Bahamas over the past two and one-half years.

This final rule is a concrete example of DOE's actions to support both American businesses and the development of the small-scale natural gas market by reducing the regulatory burden for new small-scale export projects.

U.S. LNG Exports to Europe

No free trade agreement requiring national treatment for trade in natural gas is in effect between the U.S. and any European country. Therefore, exports of LNG from the U.S. to Europe are regulated under section 3(a) of the Natural Gas Act, as explained earlier. However, the large-scale facilities operating and under construction in the U.S. already have long-term authority to export LNG anywhere in the world, including Europe, except where otherwise prohibited by law (e.g., sanctions).

Since LNG exports from the lower 48 began in February 2016, U.S. LNG cargos have landed in Europe, Asia, Africa, the Middle East, South America, North America, and the Caribbean – 30 different countries in all. Nine European countries have received a total of 43 shipments of U.S. LNG through June 2018, totaling 136 billion cubic feet of natural gas.[1] The receiving countries are Turkey, Spain, Portugal, Italy, the United Kingdom, Lithuania, the Netherlands, Poland, and Malta. The combined volume of LNG exports to Europe equals about 10 percent of total U.S. LNG exports to date.

Role of U.S. LNG in Europe

The United States is strongly committed to providing Europe with access to strategic, diverse, and reliable energy supplies. According to the European Commission[2], in the fourth quarter of 2017, European Union (EU) natural gas imports increased by 6% compared to a year earlier. For the same period, Russia

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[1] U.S. Dep't of Energy, Office of Oil & Natural Gas, *LNG Monthly* (YTD – through June 2018), *available at*: https://www.energy.gov/sites/prod/files/2018/08/f54/LNG%20Monthly%202018_0.pdf.

[2] European Commission, Quarterly Report on European Gas Markets (fourth quarter 2017), *available at*: https://ec.europa.eu/energy/sites/ener/files/documents/quarterly_report_on_european_gas_markets_q4_2017_final_20180323.pdf.

remained the EU's top supplier of natural gas, accounting for 43% of natural gas imports; LNG accounted for 12% of imports." LNG, including U.S. LNG, provides an important option for Europe as it pursues diversification of energy supply. Particularly as EU Member States decrease their reliance on generation from coal to comply with EU emission goals, European countries are becoming more dependent on gas overall. As a consequence, due to lack of supply routes and insufficient pipeline buildout, Europe is also becoming more, not less, dependent on Russian gas. Exports of U.S. LNG can be part of Europe's solution to diversifying its energy supply. U.S. LNG exports not only serve to increase the volumes of LNG available globally, but helps to diversify fuel types, fuel sources, and delivery routes of natural gas supplies in Europe and elsewhere.

Natural Gas Infrastructure Challenges in Europe

Despite the availability of LNG from the U.S., and other sources, for import into Europe, there are constraints affecting the amount of LNG imported there. The European Union's LNG import capacity is approximately 20 billion cubic feet per day with a modest utilization rate of approximately 20 percent. The vast majority of LNG supplies to the EU are delivered to five Member States (Spain, the United Kingdom, France, Portugal, and Belgium). Spain and Portugal rely on LNG for close to half of their gas supply. LNG accounts for a fifth to a quarter of the gas supply to the United Kingdom.

Most EU Member States in Central and South-Eastern Europe do not have LNG regasification terminals and can rarely access LNG supplies through the EU's collective natural gas distribution network. This inadequate gas interconnection infrastructure between European Union Member States represents a major obstacle preventing LNG from diversifying supply across the EU. Specifically the ability for U.S. LNG to compete with other pipeline gas alternatives in the EU has been slowed by two factors (1) pipeline permitting and (2) resistance to investment/build-out of critical infrastructure from regasification facilities. Storage capacity in the EU is also lacking. A more robust storage capacity would help expand the natural gas market and could also expand the areas where natural gas is currently not a viable option.

DOE is working with the EU and member governments to identify infrastructure and storage issues and to support identification of projects of common interest that

the EU supports to help address the infrastructure issues that are impeding energy supply diversification and security in Europe.

Projections for Future U.S. LNG Exports

The U.S. Energy Information Administration (EIA) is the statistical and analytical agency within DOE. EIA collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment.

EIA publishes outlooks that provide projections for domestic natural gas production and prices, as well as projected natural gas imports and exports. In the *Short-Term Energy Outlook* released on September 11, 2018, EIA forecasts record levels of dry natural gas production in 2018 and 2019, averaging 81.0 and 84.7 billion cubic feet per day, respectively.[3] The U.S. benchmark natural gas price, Henry Hub, was just under $3 per million British thermal units in August 2018.[4]

The *Short-Term Energy Outlook* also shows average U.S. LNG net exports will be 5.0 billion cubic feet per day in 2019. Looking long-term, EIA's Annual Energy Outlook 2018 projects that U.S. LNG net exports will reach an average of 14.4 billion cubic feet per day by 2029, when natural gas production is projected to reach 103 billion cubic feet per day. EIA's long-term projections show continued increases in natural gas production, reaching 110 billion cubic feet per day in 2040 while U.S. LNG net exports will remain at approximately 14 billion cubic feet per day through 2040. [5]

Conclusion

Increasing exports of U.S. LNG to our allies in Europe creates great opportunities for our nation to advance this administration's goal of strengthening our allies' energy security. Further, these exports to Europe will benefit our domestic

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[3] U.S. Energy Info. Admin., *Short-Term Energy Outlook* (Sept. 11, 2018), *available at*: https://www.eia.gov/outlooks/steo/.

[4] U.S. Energy Info. Admin., Natural Gas Data: Natural Gas Spot and Futures Prices (NYMEX) (Sept. 6, 2018), *available at*: https://www.eia.gov/dnav/ng/ng_pri_fut_s1_d.htm.

[5] U.S. Energy Info. Admin., *Annual Energy Outlook 2018* (Feb. 6, 2018), *available at*: https://www.eia.gov/outlooks/aeo/.

economy. There is no doubt that this administration has made this issue a top priority. With U.S. LNG exports on the rise, U.S LNG will increase the liquidity of global LNG trade and enhance supply security for Europe. DOE supports the EU's goal to create an interconnected European energy market, including Europe's efforts to develop LNG infrastructure that will make the region's energy markets more resilient and enhance Europe's energy security.

Thank you again for the opportunity to be here today, and I look forward to your questions.

The CHAIRMAN. Thank you.

Mr. Book, welcome.

STATEMENT OF KEVIN BOOK, MANAGING DIRECTOR, CLEARVIEW ENERGY PARTNERS, LLC

Mr. BOOK. Thank you.

Good morning, Chairman Murkowski, Ranking Member Cantwell, distinguished members of this Committee. My name is Kevin Book. I head the research team at ClearView Energy Partners, an independent firm that examines macro energy trends for institutional investors and corporate strategists. Thank you for inviting me to contribute to your discussion of U.S. LNG exports to Europe.

Our nation is on track to play a major role in global gas markets by the early years of the next decade. Getting there will require much investment, not just financial but also the intellectual investment, in sound energy policy that this Committee continues to make. I'm grateful for the important work you are doing.

I would like to start with a small word that tells a big story. That word is "net."

The Energy Information Administration, or EIA, reported 0.34 billion cubic feet of net natural gas exports in 2017, 0.34. It may not sound that big compared to EIA's latest production forecast. The agency sees 84.1 billion cubic feet per day in 2019, up 14 percent from 2017. But before last year one must go all the way back to 1957 to find another year of net exports. During the six intervening decades, the U.S. was the net importer.

The star of the story is LNG. U.S. LNG exports, year-to-date through June, were up 58 percent over the same interval last year. The U.S. exports natural gas by pipeline too, but LNG has gone from essentially zero percent of the export mix in 2016 to an average of more than 25 percent over the 12 months through June of this year.

Worldwide LNG supplies a growing share of gas demand. The International Energy Agency projects that LNG will account for about 12 percent of global gas demand by 2020.

We are on our way to becoming a decisive player in these global markets and perhaps even a dominant one. U.S. liquefaction capacity is on track to be third behind Qatar and Australia by 2020. If project sponsors end up building every facility that DOE and the FERC have approved so far, our capacity could exceed 18 billion cubic feet per day which would make the U.S. the world's largest LNG exporter.

Today, however, only about eight percent of U.S. LNG goes to Europe. Most of the rest goes to Asia and Latin America. On the other side of the pond, the numbers are similar. Only about four percent of European LNG comes from the U.S. Most of the rest comes from Africa and Qatar.

The reasons for this stand, as the Ranking Member said, from economics, infrastructure and policy.

Economics first. Europe doesn't import that much LNG from anywhere, only about 15.5 percent of net European gas imports came in as LNG last year according to BP data. The rest came in by pipe and much of that, yes, from Russia. Russia supplied about 56 per-

cent of Europe's net pipeline imports, about 47 percent of all net imports and about 36 percent of European consumption.

Second, infrastructure. The International Gas Union estimated last year's worldwide average re-gasification terminal utilization rate at about somewhere between 34 and 41 percent. By contrast, data from Gas Infrastructure Europe show utilization of about 20 percent. This could reflect limited exporter interest in selling cargoes to Europe that could command higher prices elsewhere.

In addition, European re-gas utilization rates vary widely with geography. This could suggest infrastructure gaps, regulatory barriers or both. It also could reflect country specific consumption differentials.

To policy. U.S. supply additions that alleviate LNG imbalances worldwide could narrow price disparities across markets. That has potential to increase LNG imports into Europe. Faster throughput by the FERC which handles federal environmental reviews of LNG export facilities on behalf of the DOE could help. The environmental review schedules FERC released last Friday imply a target average window between draft and final environmental statements of about four months. That would be about one month faster than the average my colleagues have compiled for all comparable projects since 2010. The burden does not fall exclusively on the Commission. Some project sponsors respond faster than others. Under FERC's process, better prepared applicants can move more quickly. This merit-based approach seems appropriate.

To close. The world wants more natural gas and U.S. exporters have LNG to sell. European importers make their own choices, but every additional cargo of LNG that the U.S. puts on the water can give them better choices.

Madam Chairman, this concludes my prepared testimony. I will look forward to any questions you or your colleagues may have at the appropriate time.

[The prepared statement of Mr. Book follows:]

TESTIMONY OF KEVIN BOOK
MANAGING DIRECTOR,
CLEARVIEW ENERGY PARTNERS, LLC

BEFORE THE
U.S. SENATE COMMITTEE
ON ENERGY AND NATURAL RESOURCES

SEPTEMBER 13, 2018

Good morning, Chairman Murkowski, Ranking Member Cantwell and distinguished Members of this Committee. My name is Kevin Book, and I head the research team at ClearView Energy Partners, LLC, an independent firm that serves institutional investors and corporate strategists.

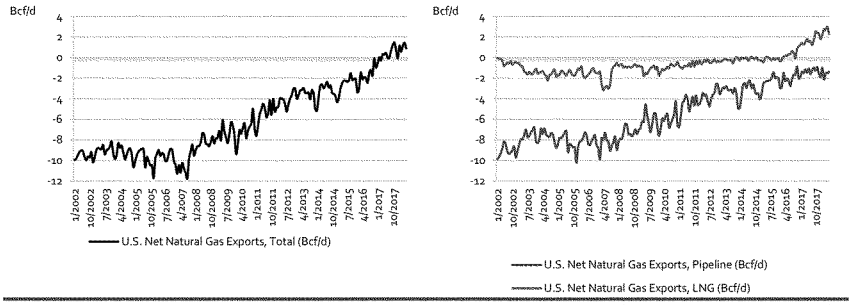
Thank you for inviting me to contribute to your discussion of U.S. liquefied natural gas (LNG) exports to Europe. My testimony considers how U.S. LNG exports can connect dramatic changes in energy facts on the ground here in the U.S. to end-users overseas. I believe our nation is on track to play a major role in global gas markets by the early years of the next decade. But getting there, in my view, will require considerable investment: not just financial investment in energy infrastructure, but also the intellectual investment in sound energy policy that this Committee continues to make. I am grateful for the important work you are doing today.

Sizing the Opportunity

According to data from the Energy Information Administration (EIA), U.S. net natural gas exports averaged ~0.34 billion cubic feet per day (Bcf/d) during calendar year (CY) 2017. That statistic may not sound impressive when one considers that the nation's dry gas production averaged ~73.6 Bcf/d over the course of that year, and I would concede that it might not look as eye-popping as the ~45% increase in U.S. dry gas production between CY 2007 and CY 2017, but one three-letter word can make a big difference: "net."

Prior to last year, the U.S. had not been a net exporter of natural gas on an annual average basis for six decades – the last year of net exports in EIA's annual data set was CY 1957 – and, for the record, I would note that net exports averaged ~0.01 Bcf/d in that year. The black line in the chart on the left-hand side of Figure 1 (below) depicts U.S. net natural gas exports over the 15 years through CY 2017. The chart on the right-hand side of Figure 1 breaks down those net exports into by pipeline volumes (the red line) and liquefied natural gas volumes (LNG, the blue line).

Figure 1 – The U.S. Became a Net Natural Gas Exporter Last Year

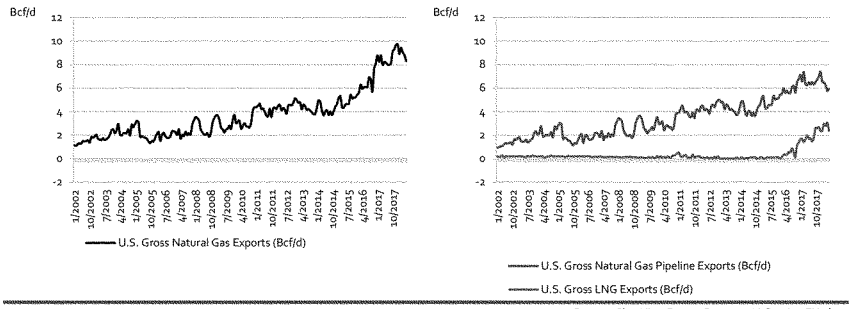


Source: ClearView Energy Partners, LLC, using EIA data

The fact that the red line remains below the x-axis indicates that the U.S. continues to be a net importer of pipeline gas, albeit decreasingly so. The widening gap between blue line and the red line (and the blue line's steep upward slope relative to the red line) indicates that net LNG exports have been more than offsetting net pipeline imports since last year. Putting numbers to the slope of the blue line: year-to-date (YTD) through June 2018, U.S. LNG exports averaged ~2.7 Bcf/d, representing a ~1.0 Bcf/d (~58%) increase relative to a comparable interval during CY 2017. This is not to say that U.S. pipeline gas exports have

stagnated. To the contrary, on a gross basis – that is, counting gas the U.S. sends out without subtracting gas that the U.S. receives – both types of exports have been increasing, as depicted in Figure 2 (below).

Figure 2 – The U.S. Became a Net Natural Gas Exporter Last Year

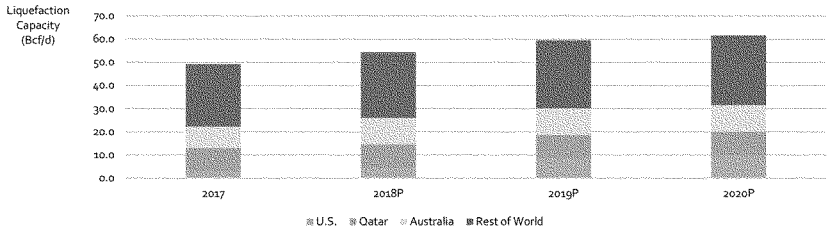


Source: ClearView Energy Partners, LLC, using EIA data

For now, pipeline gas continues to account for the majority of gross U.S. natural gas exports, but LNG's share of gross exports has grown from essentially *nil* in January 2016 to an average of ~22% during CY 2017, and that share looks likely to continue growing even as southbound pipeline exports ramp up. On a trailing, twelve-month (TTM) average basis through June 2018, the latest month of EIA data currently available, LNG accounted for ~27% of gross U.S. natural gas exports.

U.S. LNG export volumes are rising as U.S. liquefaction capacity grows. EIA estimates that aggregate, in-service peak capacity at the two facilities currently operating on a commercial basis in the lower 48 states totals ~3.5 Bcf/d. By early next year, five facilities could be in service, increasing aggregate peak capacity to ~5.7 Bcf/d. By the middle to end of CY 2020, that total could rise to ~10 Bcf/d, making the U.S. the number three global LNG exporter, behind Australia and Qatar (Figure 3).

Figure 3 – By CY 2020, Australia, Qatar and the U.S. Could Account for ~50% of Global Liquefaction Capacity



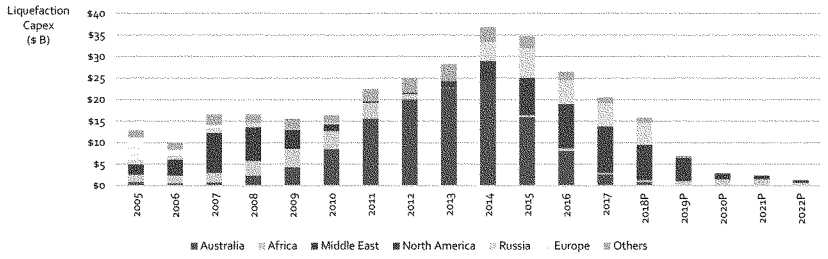
Source: ClearView Energy Partners, LLC, using EIA and IGU data

Dynamics of a Growing Market

The International Energy Agency (IEA) projects that worldwide LNG demand could reach 58 Bcf/d in CY 2020, or ~12% of the agency's estimate for CY 2020 global gas demand as a whole (~501 Bcf/d, inclusive of endogenous production and pipeline trade). U.S. gas production shows little sign of faltering in the meantime, thanks in part to significant associated gas volumes produced in conjunction with fast-growing tight oil production, especially in the Permian Basin. In its August 2018 *Short Term Energy Outlook* (STEO), the EIA projected that U.S. dry gas production would increase by ~7.5 Bcf/d (~10%) to 81.1 Bcf/d during CY 2018 before increasing by another ~3.0 Bcf/d (~4%) to ~84.1 Bcf/d during CY 2019.

Strong global LNG demand growth and continuing U.S. gas production gains could create a need for additional U.S. liquefaction capacity in the 2020s. If project sponsors were to sanction and construct every facility that has already received final approvals from the Department of Energy (DOE) and the Federal Energy Regulatory Commission (FERC), this next generation of U.S. facilities could expand the visible horizon of U.S. capacity to ~18 Bcf/d, a level that – as of now – would make the U.S. the world's largest LNG exporter. Not every analyst thinks further investment is imminent, however. The IEA's *Gas 2018* report, released in June, projected that annual global liquefaction capital expenditures would decline from ~$37 B in CY 2014 to ~$1 B in CY 2022P (Figure 4).

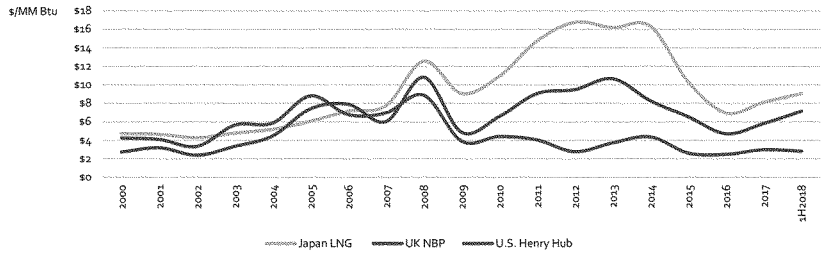
Figure 4 – Global Capital Expenditures on Liquefaction Capacity Have Declined Precipitously Since CY 2014



pSource: ClearView Energy Partners, LLC, using IEA data

This expectation of a stark decline in capital spending appears predicated on an excess of global liquefaction capacity and generally lower global gas prices during recent years. Low prices may also have made it harder for project sponsors to negotiate sales and purchase agreements that generate enough value to secure financing for new facilities (Figure 5).

Figure 5 – Although Global Gas Prices Vary Widely, They Have Been Generally Lower In Recent Years



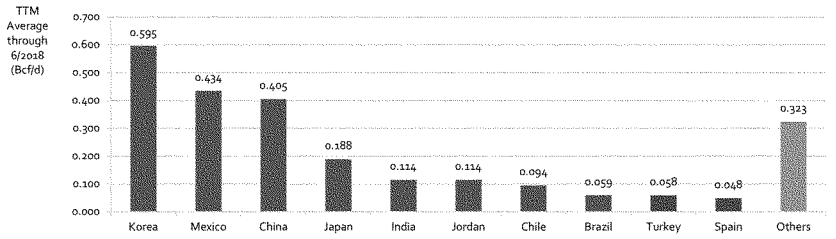
Source: ClearView Energy Partners, LLC, using Bloomberg and BP data

Market balances for energy commodities – and the prices that go with them – can change fast. Moreover, energy infrastructure can be prone to the same sorts of boom-and-bust cycles that typify upstream production, often for the same reasons (i.e., long planning lead-times and supply inelasticity). Because liquefaction facilities take years to permit and build, a period of strong global LNG demand growth amid an enduring investment slowdown could quickly tighten gas markets.

Getting to Europe

The U.S. is on its way to becoming a decisive player in global gas markets and, perhaps even a dominant one. Figure 6, which relies on DOE export data through June 2018, shows that most U.S. LNG exports currently go to Asia and Latin America. On a TTM basis through June 2018, only two European countries – Turkey and Spain – were in the top ten U.S. export destinations.

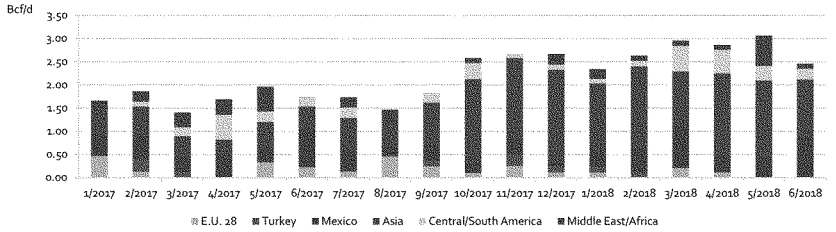
Figure 6 – U.S. LNG Exports by Destination, TTM Through 6/2018



Source: ClearView Energy Partners, LLC, using DOE data

Figure 7 offers another view of the same data set, in this case on a monthly basis between January 2017 and June 2018. Here, the DOE data indicate that only ~10% (~0.2 Bcf/d) of U.S. LNG exports went to Europe during CY 2017, and that share fell to ~6% (~0.14 Bcf/d) on a TTM basis through June 2018. Another ~4% (~0.06 Bcf/d) went to Turkey during CY 2017, and Turkey's also share fell to ~2% (~0.06 Bcf/d) on a TTM basis through June.

Figure 7 – U.S. LNG Exports, by Country or Region Destination, 1/2017 – 6/2018



Source: ClearView Energy Partners, LLC, using DOE data

Figure 8, on the next page, shows the story from the other side of the Atlantic using International Gas Union (IGU) data. During CY 2017, Europe (inclusive of Turkey), received only ~4% of net LNG imports (~0.27 Bcf/d of ~6.14 Bcf/d) from the U.S. Most of Europe's LNG came from African countries (~44%, ~2.7 Bcf/d) and Qatar (~37%, ~2.3 Bcf/d).

Figure 8 – Europe Imported only ~4% of its LNG from the U.S. During CY 2017

Importing Country or Region	Source (Bcf/d)									
	U.S.	Qatar	Norway	Russia	Other Middle East	Asia and Australia	Africa	Central and South America	Net Re-Exports	Net Imports
Belgium	0.000	0.128	0.009	0.000	0.000	0.000	0.000	0.000	0.004	0.141
France	0.000	0.203	0.075	0.000	0.000	0.000	0.772	0.042	-0.099	0.993
Greece	0.000	0.016	0.005	0.000	0.000	0.000	0.126	0.000	0.000	0.147
Italy	0.018	0.629	0.017	0.000	0.000	0.000	0.100	0.030	0.000	0.794
Lithuania	0.018	0.000	0.087	0.000	0.000	0.000	0.009	0.008	0.000	0.122
Malta	0.001	0.000	0.000	0.000	0.000	0.000	0.008	0.024	0.001	0.034
Netherlands	0.008	0.074	0.058	0.009	0.000	0.000	0.016	0.000	-0.066	0.099
Poland	0.009	0.149	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.166
Portugal	0.055	0.058	0.000	0.000	0.000	0.000	0.245	0.000	0.008	0.366
Spain	0.074	0.337	0.088	0.000	0.000	0.000	0.702	0.400	0.003	1.603
Turkey	0.075	0.132	0.088	0.000	0.000	0.000	0.679	0.041	0.017	1.031
United Kingdom	0.009	0.568	0.000	0.009	0.000	0.000	0.032	0.030	-0.023	0.635
Europe	**0.267**	**2.291**	**0.443**	**0.020**	**0.000**	**0.000**	**2.691**	**0.573**	**-0.145**	**6.140**

Source: ClearView Energy Partners, LLC, using IGU data

Why isn't more U.S. gas going to Europe today? The answer probably includes economics, infrastructure and policy.

First, Europe may not be taking much U.S. LNG today because Europe doesn't import that much LNG as a whole. LNG accounted for only ~15.6% of Europe's net natural gas imports during CY 2017, according to data in the *2018 BP Statistical Review of World Energy;* the rest (~32.9 Bcf/d out of ~39 Bcf/d) came in via pipeline. IGU data reveal an uptick in European net imports of LNG last year, but in the context of the five-year IGU data series I have presented in Figure 9, last year's bump looks more like a reversion to CY 2012 levels than a true trend shift to the upside.

Figure 9 – European LNG Import Volumes, CY 2012 – CY 2017 (Bcf/d)

Importing Country or Region	Net Import Volumes (Bcf/d)					
	2012	2013	2014	2015	2016	2017
Belgium	0.25	0.14	0.12	0.25	0.16	0.14
France	0.98	0.76	0.62	0.60	0.74	0.99
Greece	0.14	0.07	0.05	0.06	0.07	0.15
Italy	0.69	0.56	0.44	0.55	0.60	0.79
Lithuania	0.00	0.00	0.01	0.04	0.13	0.12
Malta	0.00	0.00	0.00	0.00	0.00	0.03
Netherlands	0.08	0.04	0.06	0.08	0.05	0.10
Poland	0.00	0.00	0.00	0.01	0.10	0.17
Portugal	0.22	0.17	0.13	0.15	0.17	0.37
Spain	1.87	1.23	1.08	1.17	1.30	1.60
Turkey	0.75	0.56	0.70	0.73	0.73	1.03
United Kingdom	1.37	0.90	1.11	1.29	0.97	0.64
Europe	**6.36**	**4.44**	**4.33**	**4.93**	**5.02**	**6.14**

Source: ClearView Energy Partners, LLC, using IGU data

Second, European regasification terminals are running at relatively low capacity utilization levels. The IGU's *2018 World LNG Report* estimated global average LNG regasification capacity utilization at between 34% and 41% during CY 2017. By contrast, Gas Infrastructure Europe daily capacity and utilization data for E.U. LNG regasification facilities imply a capacity utilization rate of ~20% during the year through September 8, 2018, well below IGU's estimated global averages. This may reflect limited exporter interest in selling cargoes to Europe that could command higher prices elsewhere. In addition, utilization rates at European terminals vary widely with geography. This could suggest infrastructure gaps, regulatory barriers (or both), but disparate utilization rates can also reflect country-specific consumption differentials.

Third, U.S. policy matters. America may not be able to raise gas prices in Europe (nor would that necessarily be desirable), but U.S. supply additions that alleviate LNG imbalances worldwide could narrow price disparities across markets, potentially increasing European LNG import volumes.

In that vein, faster throughput by the FERC, which handles environmental reviews of LNG export facilities under the *National Environmental Policy Act* (NEPA) on behalf of the DOE, could help. After a hiatus, the relatively brisk timelines in the Schedules for Environmental Review (SERs) the FERC released on August 31 for ten new LNG export projects (and its reissue of SERs for two others) may point towards a regulatory debottlenecking. With these new SERs, FERC appears to be targeting a four-month window between draft and final environmental impact statements (EIS). If so, this would mark a faster pace

than the five-month average and three-to-nine-month range my colleagues at ClearView have distilled in their tracking of all reviews related to the *Natural Gas Act* (NGA) since 2010 (Figures 10 and 11).

Figure 10 – FERC's Observed NEPA Review Tempo since 2010 for NGA §3 and NGA §7 Projects Subject to an EIS

Project	Docket	Draft EIS	Final EIS	Draft to Final EIS Interval (days)	NGA §3/§7 Order	Final EIS to Order Interval (days)
Ruby Pipeline	CP09-54	6/19/2009	1/8/2010	203	4/5/2010	87
Bison Pipeline	CP09-161	8/21/2009	12/29/2009	130	4/9/2010	101
APEX Expansion	CP10-14	3/26/2010	7/23/2010	119	9/16/2010	55
NJ-NY Expansion Project	CP11-56	9/9/2011	3/16/2012	189	5/21/2012	66
Transco Rockaway Lateral	CP13-36, *et al.*	10/4/2013	2/28/2014	147	5/2/2014	63
Sierrita Pipeline	CP13-73	10/25/2013	3/28/2014	154	6/6/2014	70
Cameron 1-3	CP13-25	1/10/2014	4/30/2014	110	6/19/2014	50
FLEX LNG	CP12-509	3/14/2014	6/16/2014	94	7/31/2014	45
Constitution	CP13-499	2/12/2014	10/24/2014	254	12/2/2014	39
Corpus Christi	CP12-507	6/3/2014	10/8/2014	127	12/30/2014	83
Algonquin AIM	CP14-96	8/6/2014	1/23/2015	170	3/3/2015	39
Aguirre Offshore Gasport Project	CP13-193	8/7/2014	2/20/2015	197	7/24/2015	154
Lake Charles	CP14-120	4/10/2015	8/14/2015	126	12/17/2015	125
Sabal Trail	CP14-554, *et al.*	9/4/2015	12/18/2015	105	2/2/2016	46
Magnolia	CP14-347	7/17/2015	11/16/2015	122	4/15/2016	151
XOM Golden Pass	CP14-517	3/25/2016	7/29/2016	126	12/21/2016	145
Leach Express/Rayne Express	CP15-514, *et al.*	4/21/2016	9/1/2016	133	1/19/2017	140
Rover Pipeline and Backhauls	CP15-93, *et al.*	2/19/2016	7/29/2016	162	2/2/2017	188
Transco Atlantic Sunrise	CP15-138	5/5/2016	12/30/2016	239	2/3/2017	35
NEXUS Gas	CP16-22, *et al.*	7/8/2016	11/30/2016	145	8/25/2017	268
Mountain Valley Pipeline	CP16-10, *et al.*	9/16/2016	6/23/2017	280	10/13/2017	112
Atlantic Coast Pipeline	CP15-554, *et al.*	12/30/2016	7/21/2017	203	10/13/2017	84
Mountaineer Express	CP16-357	2/27/2017	7/28/2017	151	12/29/2017	154
Penn East	CP15-558	7/22/2016	4/7/2017	259	1/19/2018	287
Midcontinent Supply Header	CP17-458	2/9/2018	6/21/2018	132	8/13/2018	53
			Range	**94-280**	**Range**	**35-287**
			Average	**164**	**Average**	**106**
			Median	**149**	**Median**	**84**

Source: ClearView Energy Partners, LLC based on FERC project Dockets

Figure 11 – FERC's Projected NEPA Review Tempo for Upcoming NGA §3 and NGA §7 Projects Subject to an EIS

Project	Docket	Draft EIS[1]	Final EIS (E)	Draft to Final EIS Interval (days)	NGA §3/§7 Order (E)[2]	Final EIS to Order Interval (days)
Transco NE Supply Enhancement	CP17-101	3/23/2018 A	9/17/2018	178	NA	NA
Calcasieu Pass	CP15-550, *et al.*	6/22/2018 A	10/26/2018	126 E	1/22/2019*	88
Driftwood LNG	CP17-117, *et al.*	9/15/2018 E	1/18/2019	125 E	2-4/2019	NA
Port Arthur LNG and PA Pipeline	CP17-20, *et al.*	9/15/2018 E	1/31/2019	138 E	3-5/2019	NA
Texas LNG	CP16-116	10/15/2018 E	3/15/2019	151 E	4-6/2019	NA
Eagle LNG Partners Jacksonville LLC	CP17-41	11/15/2018 E	4/12/2019	148 E	5-7/2019	NA
Gulf LNG	CP15-521	11/15/2018 E	4/17/2019	153 E	7/16/2019*	90
Annova LNG	CP16-480	12/15/2018 E	4/19/2019	125 E	5-7/2019	NA
Rio Grande LNG	CP16-454, *et al.*	10/15/2018 E	4/26/2019	193 E	5-7/2019	NA
Venture Global Plaquemines LNG	CP17-66, *et al.*	11/15/2018 E	5/3/2019	169 E	6-8/2019	NA
Jordan Cove, Pacific Connector	CP17-494, *et al.*	2/15/2019 E	8/30/2019	196 E	11/29/2019*	91
Alaska LNG	CP17-178	2/15/2019 E	11/8/2019	266 E	2/6/2020*	90
			Range	**123-266**		
			Average	**164**		
			Median	**152**		

[1] The SER issued do not identify a fixed date for the release of the draft EIS, only a target month. We selected the middle of the month to calculate an approximate interval.

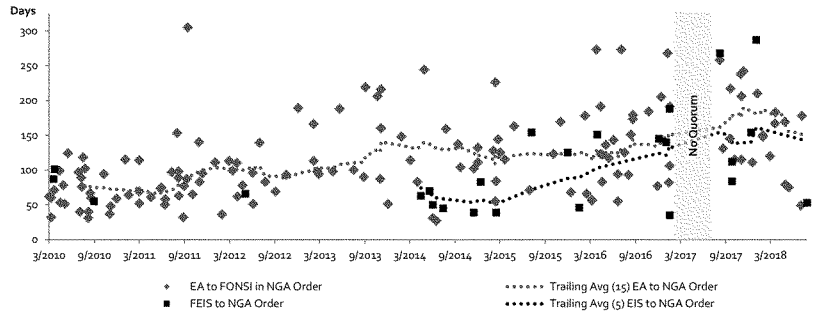
[2] The dates marked with an asterisk were identified by FERC in the August 31, 2018 Notice of Anticipated Schedule of Final Order issued to FAST-41 projects. The balance of the estimates are ours and is based on the 30 to 90-day window we have used in the past when estimating potential final order issue dates.

Source: ClearView Energy Partners, LLC based on FERC project Dockets through August 31, 2018

I would note that the burden does not fall exclusively on the Commission. Our observations indicate that some project sponsors respond more quickly than others. Because FERC does not observe strict linearity in its processing of reviews, better

prepared applicants can move more quickly through the process. This merit-based approach seems appropriate in this context. As Figure 12 shows, since 2010, the Commission has moved forward with final orders for projects reviewed under EIS within 30 to 60 days, suggesting that the 90-day approval window indicated for final order issuance under FAST-41 may prove conservative.

Figure 12 – Interval between EA and FEIS Documents and FERC NGA Order (§3 and §7)



Notes: Between March 2010 and the loss of its quorum in February 2017, FERC averaged 109 days from an Environmental Assessment to issuance of an NGA order containing Finding of No Significant Impact (FONSI) under the *National Environmental Policy Act* (NEPA), and the median review was 98 days. For projects subject to an EIS, the average interval from final EIS to order was 89 days (median of 70 days) since 2010. Toward the end of that period, the intervals for action on completed environmental reviews lengthened. For projects evaluated with an EA, the statutory comment period follows the EA. For projects evaluated with an EIS, the statutory comment period occurs between the draft and final version.

Our analysis does not include evaluation of Environmental Assessment Reports (EARs) which are smaller EAs for minor projects where in the vast majority of cases no adversarial environment review- related comments were filed.

Our data is colored by the 187-day gap where the Commission lacked a quorum to act. However, we would note that many projects were on a review timeline that did not appear to be materially affected by the loss of quorum, and approvals in recent months appear to be consistently within the 50-200 day range that captures most of the data in our observation set.

Source: ClearView Energy Partners, LLC from FERC dockets through August 31, 2018

Madam Chairman, this concludes my prepared testimony. I will look forward to answering any questions you or your colleagues may have at the appropriate time.

The CHAIRMAN. Thank you, Mr. Book.

Dr. Grigas.

STATEMENT OF DR. AGNIA GRIGAS, ASSOCIATE, ARGONNE NATIONAL LABORATORY, AND NONRESIDENT SENIOR FELLOW, ATLANTIC COUNCIL

Dr. GRIGAS. Good morning, Chairman Murkowski, distinguished members of this Committee. My name is Dr. Agnia Grigas, and I'm an Associate at the Argonne National Laboratories and a non-resident Senior Fellow at The Atlantic Council. I'm also the author of this new book, The New Geopolitics of Natural Gas.

American LNG exports to Europe are relatively new. However, they have significant, positive national security, economic, political and geopolitical implications for the United States and its allies.

In terms of national security, the United States, as the largest NATO power and a key security guarantor for a number of European states of alliance, is directly implicated in the security repercussions of Europe's energy dependence on Russia. We well know that Russia and its national gas company, Gazprom, uses gas exports as a means of political influence, coercion and even as an energy weapon, thus directly threatening the national security of European gas importing states.

In terms of the economic implications, LNG exports, American LNG exports to Europe will be of economic benefit to the United States energy sector, trade balance and the economy overall.

In contrast, however, Russian gas weaponry has been highly detrimental to the welfare of our European states, European ally states. We have seen this from the numerous gas cuts Russia has pursued in Europe in 2005, 2008 and 2014. For instance, in the very cold winter of 2008–2009 when Gazprom cut supplies to Ukraine, they impacted the supplies of six European Union states and, in fact, Poland even experienced ten casualties as citizens froze to death when there was no gas supply in this very cold winter.

Moreover, if U.S. LNG is not exported to Europe, those economic benefits will instead accrue to the Kremlin regime which is very well known for its export of corruption, money laundering and trying to spread the worst types of business practices.

When it comes to the political implications, make no mistake, Russia certainly has used and continues to use the gas exports as a means to form political alliances and to spread its political influence in Europe. If we look at the German-Russian gas relationship that has been ongoing since the late 1960s, as a result today, we see that German companies with strong business ties to Russia have been among the most vocal critics of western sanctions against Russia since 2014.

We've also seen Russia try to enlist some of the most high-profile European politicians via their gas business. For example, ex-German Chancellor, Gerhard Schröeder, who joined as the Chairman of Nord Stream as subsequently as the Chairman of the largest Russian oil company, Rosneft. He's also pursued an anti-American campaign of German politics.

In Italy, a country that has also been increasingly dependent on Russian gas imports, we also see an effort to create a similar type of alliance between the Italian energy company, ENI and Gazprom.

A NATO strategic member, Turkey, has also been increasingly reliant on Russian gas and we've seen the Kremlin try to use its gas relationship as a forum, as a means of creating a closer relationship with Turkey's President Erdogan.

When it comes to the geopolitical implications, the exports of American LNG would serve to strengthen Washington's global leadership and serve as a source of leverage in the currently emerging geopolitical competition between America's rival powers such as China and other revisionist states, such as Russia.

Also, whoever will supply the European continent will have the degree of political and economic influence in key European industrial states and in the politically and economically contested regions of Eastern Europe.

In summary, American LNG exports to Europe would bring strategic, economic and geopolitical benefits to the United States and its European allies.

Thank you, Chairman Murkowski. This concludes my prepared testimony. I look forward to questions.

[The prepared statement of Dr. Grigas follows:]

Dr. Agnia Grigas, Associate, Argonne National Laboratory,
Nonresident Senior Fellow, Atlantic Council,
Author, "The New Geopolitics of Natural Gas" (Harvard UP 2017).

U.S. Senate Committee on Energy and Natural Resources
Subject: US LNG Exports to Europe
September 13, 2018

American Liquefied Natural Gas (LNG) Exports to Europe, made possible only by the recent shale boom and launched in 2016, have significant positive national security, economic, political, and geopolitical implication for the United States and its European allies.

National Security Implications
From a national security perspective, the United States should be concerned about the security implications of Europe's high dependence on Russian natural gas. In the past and today, Russia and its national gas company Gazprom has used gas exports as a tool of political influence, intimidation, coercion, and even as a weapon by threatening and enacting gas supply cuts and gas price increases. Thus, Russian gas exports and their accompanying political strategies directly threaten the national security of European gas importing states. As the largest NATO power and a key security guarantor for many European members of the Alliance, the United States is directly implicated in the security repercussions of Europe's energy dependence.

The European Union (EU) has also been concerned about the security implications of its energy dependence. In 2014, the EU adopted its energy security strategy, which argued that the Union must diversify its energy sources, suppliers and routes. In 2017 Russia accounted for about 30% of the EU's total gas imports most of which was provided by natural gas pipelines. However, this figure may soon rise to 40% if Gazprom implements the Nord Stream 2 gas pipeline. Increasing dependence on Russian gas would sabotage the EU's diversification efforts and its overall energy security strategy by concentrating the bulk of bloc's gas imports via a single Nord Stream I & II route via the Baltic Sea and would boost imports from a single gas source and supplier: Russian Gazprom. Such concentration of imports via a single route and from a single source would have negative implications for Europe's supply security, increasing risks of Russian political pressure and cyber and infrastructural vulnerability.

This is not a new concern for the United States. Since the Cold War era, the U.S. government has pursued a consistent and long-term policy of aiming to prevent Europe's over-dependence on Russian natural gas and on helping its European allies to diversify their energy imports. In late 1981 President Ronald Reagan's administration enacted sanctions against the Soviet Union in response to Soviet imposed martial law in Poland with the aim of blocking the construction of Urengoy-Uzhgorod, the Soviet natural gas pipeline to Europe. By mid-1982, Reagan's administration extended the sanctions to certain American-made or American-licensed energy equipment, specifically so that it would not be used for the Urengoy-Uzhgorod pipeline. However the effort failed due to lack of European support and alternative energy resources. In November 1982

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Washington lifted its sanctions against the Soviets. More recently, the United States sought to prevent the construction of Russian gas pipelines to Germany, such as Nord Stream I (completed in 2011-2012) and the current plans for Nord Stream II (originally set to be completed by the end of 2019). The United States has consistently supported Europe's efforts to diversify their natural gas imports via projects such as the Southern Gas Corridor pipeline system (and its preceding but unfulfilled plans for the Nabucco pipeline) to bring Caspian gas to Europe. The U.S. has also supported the efforts of Central and Eastern European states to build new LNG import terminals in order to access the growing LNG markets instead of continuing to rely on Russian piped gas.

Economic Implications

While America's aims have been consistent, today Washington benefits from a more effective tool kit than previously to help Europe's diversification. Until the mid to late 2000s, the United States was preparing to increase its own dependence on foreign gas imports and there was a build up of LNG import terminals along the American coasts. The shale boom unlocked America's unconventional oil and gas resources and made the United States the largest natural gas producer in the world. The United States emerged as an LNG exporter in 2016. Since then, American LNG has been exported across the globe and in the European markets has reached countries such as Turkey, U.K., Spain, Portugal, Poland, Lithuania, Malta, The Netherlands, and Italy.

Overall Europe received about 10 percent of total U.S. exports in 2017, up from 5 percent in 2016. Since 2016 Europe has imported more than 40 LNG cargoes totaling about 2.8 billion cubic meters, which is still just a fraction of Europe's total demand of 550 billion cubic meters. As the United States is gearing up to be the world's third largest LNG exporter by 2020 according to the forecasts of U.S. Energy Information Administration (EIA), such exports to Europe will benefit to the U.S. energy sector, trade balance, and the overall economy.

In contrast, without (or with limited) American LNG exports to Europe, the risks of unstable of natural gas supplies or hikes in gas prices are detrimental to the welfare of European allies. These risks can be seen from previous episodes when Russia interrupted gas supplies to EU states in 2004 and 2008 and to Ukraine following 2014. For instance, during the Kyiv-Moscow gas tensions of 2008-2009 in the middle of a very cold winter, Gazprom shut off supplies to Europe's gas transit country Ukraine. Gas shortages were felt for two weeks impacting supplies to Czech Republic, Romania, Austria, Poland, Croatia, and Slovakia. As a result there were at least eleven casualties as citizens froze to death including ten in Poland, where temperatures reached minus 20 degrees Celsius. Since Russia's annexation of Crimea of 2014 and its subsequent shadow war in eastern Ukraine, Kyiv has also had difficulty securing gas supplies from Russia at reasonable prices and now the country turned to its European neighbors that deliver the same Russian gas in reverse flows.

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Due to the US shale boom, America's LNG exports, and an overall growth in global LNG trade, the current global gas markets are marked by a transformation where there is greater competition and liquidity. Overtime, however, the U.S. can expect increasing competition both from traditional LNG suppliers such as Australia and Qatar and emerging ones such as Russia. The U.S. is also likely to face more competition as other countries develop their own shale programs. For now, the U.S is the leader in shale development and one of only four countries in the world that has a commercial shale development program including Canada, Argentina, and China.

Thus, the U.S. would be wise to take advantage of its early entrant and strong position in the global gas markets rather than leave these open to its competitors. In fact, Russia's natural gas company Gazprom seeks to secure and lock-in its largest European gas markets of Germany and Turkey with new gas pipeline projects such as Nord Stream II and Turk Stream. On a smaller scale, in the fall of 2017 Gazprom signed a 10 year deal with the national Croatian gas company meeting all of the country's domestic demand, in what could be seen as an effort to reduce Croatia's appetite for building the Krk LNG import terminal which could supply Southeast Europe. Beyond Gazprom, Russian LNG exporter Novatek will increasingly become a competitive player in the European LNG markets via its new Yamal LNG terminal.

If the European states fall short of their diversification aims and U.S. LNG does not become a competitive player in the European markets, economic benefits will accrue to the Kremlin regime. Russia is notorious for widespread corruption and rampant cronyism. Gazprom's close links with the Kremlin's elite drive not only Russian gas exports, but also the worst type of business practices. Russian export of corruption to Europe is well documented. Last year, individuals close to the Kremlin and its state-owned companies were part of a high-profile investigation, where they were suspected of being involved in a financial fraud scheme titled the "Russian laundromat." This money laundering scheme, which also involved numerous European companies, enabled Russia's *kleptocrats* to move some 17–68 billion Euros out of Russia from 2010 to 2014. In another example, the largest Danish bank, Danske Bank, has been implicated in a money-laundering scheme that had $150 billion of Russian and former Soviet Union transactions go through their small Estonian branch.

Political Implications

Russian gas exports have traditionally served the Kremlin not only as a source of revenue but even more importantly as a source of political influence and the basis for political alliances in the European states. Since the Soviets launched their gas exports to Western Europe in the late 1960s, Moscow has a track record of wooing European businesses and lawmakers via the energy business in order to advance its own strategic goals. The oldest Soviet and subsequently Russian gas relationships with Western European states included Germany, Austria, France, Italy, and the UK and later served as the basis for closer commercial and political ties. More recently, following Russia's invasion of Crimea in 2014, large German companies with considerable business ties with Russia, such as chemical giant BASF, engineering group Siemens, Vokswagen, Adidas, and Deutsche

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Bank were among the harshest critics of Western sanctions against Moscow. Moscow has also succeeded in enlisting in high profile politicians such as Gerhard Schröder, Germany's ex-Chancellor. After his departure from government, Schröder has served as the chairman of Nord Stream AG since 2005 and as the chairman of Russia's biggest state-owned oil producer Rosneft since 2017. Though Schröder's political influence has greatly diminished in German politics, he has continued to lobby for Russian business interests and pursued an anti-American campaign in German politics. Similarly the close relationship between Italian Prime Minister Silvio Berlusconi and Russian President Vladimir Putin was also forged due to Gazprom's and Italian energy company ENI energy deals and Italy's growing imports of Russian gas. NATO's strategically important member, Turkey, has also steadily increased imports of Russian gas and represents Gazprom's second largest European market. Similarly, the Kremlin has been trying to woe Turkey's President Recep Erdogan even if the Moscow-Ankara relationship has been fraught with tensions.

Geopolitical Implications

From the perspective of America's global interests, the exports of U.S. LNG would serve to strengthen the Washington's global leadership and serve as a source of leverage in the emerging geopolitical competition for influence among rival and revisionist powers such as China and Russia. As the world's largest natural gas importer, the EU, highly depends on foreign imports. Thus whoever will supply the EU will have a degree of political and economic influence over the continent including among Europe's key industrial nations such as Germany and in the politically and economically contested regions of the former Soviet Union such as Ukraine and in the Southeast Europe. By meeting some of Europe's gas demand via American LNG, could mitigate foreign political influence on the European continent, including the influence stemming from Russian energy exports and hybrid warfare campaigns and from the influx of Chinese investments. With American LNG exports, the U.S. would be able to mitigate the ability of Russia to play the European gas markets against the Asian (and specifically Chinese) markets after the Russian gas pipeline Power of Siberia launches exports to China in late 2019.

In summary, the United States currently has a unique tool at its disposal – the potential to export greater quantities of American LNG to Europe and beyond, which would bring strategic, economic, and geopolitical benefits to the United States and its allies in Europe. Moreover, despite the actual volumes of exports directed at Europe, America's rising global LNG exports would improve liquidity and optionality of the globalizing gas markets and thus would also indirectly accrue notable benefits for European importing states providing them with more liquidity, flexibility, and optionality to diversify away from Russian gas supplies. America's energy diplomacy should take advantage of the rapidly transforming global gas markets and leverage its early entrant position to prevent competing gas suppliers from locking in their market positions and using these positions as a source of political leverage over the European continent and beyond.

The CHAIRMAN. Thank you, Dr. Grigas.

Mr. Slocum, welcome.

STATEMENT OF TYSON SLOCUM, ENERGY PROGRAM DIRECTOR, PUBLIC CITIZEN

Mr. SLOCUM. Thank you very much, Chairman Murkowski, members of the Committee. I'm Tyson Slocum. I'm the Energy Program Director with Public Citizen. We're one of America's largest research and advocacy groups, representing the interests of household consumers across the United States.

The main reason that we're talking about LNG exports is because natural gas producers are demanding that we accelerate the ability for them to export their product. And that's because for natural gas producers, they've been mired in an era of low prices, right?

Gas prices domestically are stubbornly stuck at around $3.00 per million BTU. What this means is that it's limiting the ability of natural gas producers to earn bigger profits. So what their strategy is, is to come up with new markets to sell their U.S. product abroad at higher prices. Understanding that exporting LNG is all about domestic producers getting access to higher prices abroad helps us understand some of the implications for household consumers and for domestic manufacturers. And what that means is, it's going to expose American consumers to higher prices.

That's what the Department of Energy Macroeconomic Study concluded this summer. It predicted that domestic natural gas prices are going to double as a result of increasing LNG exports. They try to claim that that's going to be offset because Americans are going to enjoy the benefits of higher share prices from natural gas producers and LNG exporters, but you have to remember that the ownership of shares in those companies are highly concentrated among the wealthiest Americans. The most people are going to be subjected to the higher prices that we're going to see at the retail level and at the end user level.

The public interest standard as interpreted by the Supreme Court over the years has insisted that exports have to take into account the impact on supply and prices. I think if we're going to be approving a significant increase in export capacity, it's going to conflict with the traditional public interest standard of ensuring that consumers have access to fairly priced commodities.

I think all we have to do is look at the problems going on in Australia today which Australia has embarked on a very aggressive LNG export strategy with disastrous results, especially for the more heavily populated eastern part of that country. We've seen threats of supply shortages and skyrocketing prices for Australia that have been impacted by the significant growth in LNG exports to the point where now Australia is talking about trying to reduce the amount of those exports.

So this whole concept of trying to counter Russian influence in Europe is an admirable one, but I think that there are limits to so-called commodity diplomacy and those limits are market forces. The fact is, is that the U.S. Secretary of State does not dictate where exports go. Markets decide. And Europe, according to the

International Energy Agency, is a constricting market over the next five years. In fact, they term Europe the market of last resort.

Where sales are going is China. Over the next five years, one third of new natural gas demand is going to be from China. Already 45 percent of U.S. LNG exports are going there, and that's only going to accelerate as China's demand continues to increase and because of pricing changes in the way that LNG markets work.

Traditionally, LNG has been financed through the assumption of long-term, typically 20-year contracts. We're seeing a radical change in that financing model, a move toward spot and short-term contracts. That only exacerbates the movement of supplies toward where the demand is and the demand is all going to Asia. And when you look at where the demand growth is in China, it primarily is in the industrial and manufacturing sectors. So exporting LNG from the United States to China is going to be assisting their manufacturing industry at the expense of our own. If we're talking about revitalizing American manufacturing, we have to have access to those raw materials.

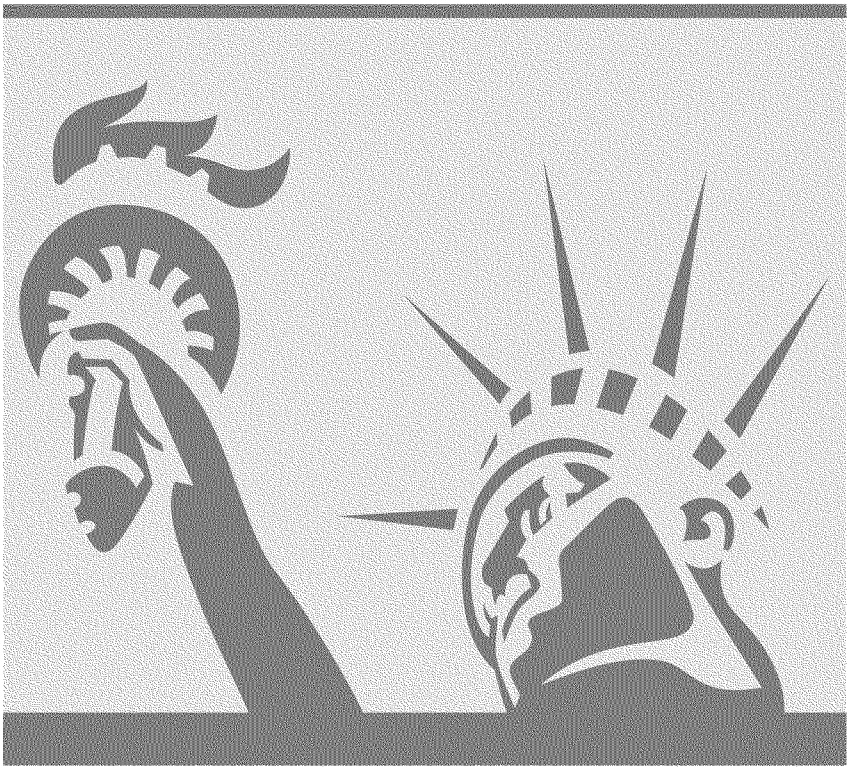
I think that exporting unrefined raw materials is a Nigerian model of economic growth. The United States has consistently led because we focus on value added manufacturing and high tech, and that's what LNG exports threaten to undermine.

And I think, finally, and this is a very important point, that we shouldn't be talking about significantly expanding LNG exports at the same time that we are eviscerating regulations to deal with methane emissions from the oil and gas sector and our lack of federal regulations to deal with climate change.

Gas does have a favorable emissions profile compared to coal, but the fact of the matter is, is that it is a fossil fuel and we have a duty and an obligation to ensure that we have proper regulation. We shouldn't be exporting this product which is going to result in large domestic production increases without having corresponding methane and greenhouse gas emission regulations.

Thank you very much for your time. I look forward to any questions you have.

[The prepared statement of Mr. Slocum follows:]



Can U.S. LNG Meet European Energy Demand? The Case to Limit Natural Gas Exports

Testimony of Tyson Slocum, Energy Program Director, Public Citizen, before the U.S. Senate Energy & Natural Resources Committee

September 13, 2018

Twitter @TysonSlocum • tslocum@citizen.org

I am Tyson Slocum, and I direct the Energy Program at Public Citizen. Public Citizen is a national consumer advocacy organization with more than 400,000 members and supporters across the country. I serve on two advisory committees to the U.S. Commodity Futures Trading Commission (Energy and Environmental Markets Advisory Committee, and the Market Risk Advisory Committee), and am a faculty member at the University of Maryland Honors College.

Testimony summary:

- The campaign to justify expanded LNG exports prioritizes the financial interests of natural gas producers and LNG exporters at the expense of U.S. households and American value-added manufacturing.
- Natural gas producers, frustrated by stubbornly low domestic prices, understand that the easiest path to increase prices—and their profits—is globalizing U.S. benchmarks, which ramping up LNG exports will accomplish.
- LNG exports serving as a foundational economic policy sounds like a Qatari model of growth, latching U.S. GDP to volatilely-priced finite natural resources. What sets America apart is not our aptitude at exporting raw natural resources, but the value-added of our manufacturing and high tech innovation—the very sectors threatened by higher prices exports will cause.
- The ability of LNG exports to increase American influence for geopolitical ills, such as countering Russian natural gas supply to Europe, is limited. Such *commodity diplomacy* ignores the fact that LNG export destinations are determined not by the U.S. Secretary of State, but by whoever will pay the highest price.
- Australia offers an important cautionary tale for the United States. Australia committed to unfettered LNG exports, launching the country to becoming the 2nd largest LNG exporter in the world. But it came at a massive cost: domestic gas prices have skyrocketed, forcing the country to pass a law to attempt to limit exports. In the meantime, four LNG *import* terminals for the east coast have been proposed to alleviate the supply and price emergency.
- The trend of LNG exports shifting away from long-term, fixed price contracts and towards spot and short-term sales amplifies that LNG export destinations will be determined by whichever market is the most expensive. Nations where gas demand is growing and LNG import facilities are near capacity (Asia) will feature higher prices than those regions where demand is falling and LNG import terminals are operating under capacity (Europe).
- European natural gas demand is projected to significantly contract in the coming years, in part because of policies promoting low-cost renewable energy. Shrinking European gas demand is in sharp contrast to where natural gas will continue to

boom: China and Asia. In addition, European LNG import terminals are currently operating at only about 25% capacity due to low demand.

- Chinese gas demand is projected to continue to skyrocket and its gas growth is being primarily driven by increased industrial demand—which means U.S. LNG exports will serve to fuel China's manufacturing industry, at the expense of our own.
- America will remain one of the largest areas of projected natural gas demand growth, and so increasing LNG exports while domestic demand is projected to increase is a recipe for higher domestic prices for households and manufacturers.
- Increasing LNG exports will lead to higher domestic natural gas production, and, absent strong federal methane and climate change regulations, will cause significantly higher greenhouse gas emissions.

FERC and Department of Energy responsibilities

FERC and DOE have jurisdiction over LNG exports.[1] The Department of Energy has responsibility under the Natural Gas Act to regulate the import and export of natural gas, and determine whether the proposals are consistent with the public interest. Amendments in Section 201 of the Energy Policy Act of 1992 [PL 102-486] directed that the "importation of such natural gas [from countries with Free Trade Agreements with the U.S.] shall be deemed to be consistent with the public interest," but there was no language on *exports*. The Energy Policy Act of 2005 [PL 109-58] added Section 311 applying the entire chapter "to the importation or exportation of natural gas in foreign commerce." Eighteen nations have FTAs requiring national treatment for trade in natural gas with the U.S.[2]

Section 311 of the Energy Policy Act of 2005 dictates that FERC "shall have the exclusive authority to approve or deny an application for the siting, construction, expansion or operation of an LNG terminal." This language was aimed at killing a July 2004 lawsuit filed by the State of California claiming that FERC improperly ruled in March 2004 that states have limited jurisdiction over the permitting and siting of LNG facilities inside their borders.[3] FERC is also responsible for issuing certificates of public convenience and necessity for LNG facilities,[4] and is required by the National Environmental Policy Act to determine environmental impacts statements for LNG facilities. FERC recently signed a Memorandum of Understanding with the Pipeline and Hazardous Materials Safety Administration to split jurisdiction over some facets of LNG application reviews.[5]

[1] The U.S. Maritime Agency has jurisdiction over *offshore* LNG.
[2] www.energy.gov/fe/downloads/information-submitting-lng-export-application
[3] FERC Docket No. CP04-58
[4] Section 7 of the Natural Gas Act.
[5] www.ferc.gov/legal/mou/2018/FERC-PHMSA-MOU.pdf

Natural Gas Producers' Push For Greater Profits Is the Primary Reason We're Talking About LNG Exports

Fifteen years ago, natural gas prices were at record highs, and the consensus response was reflected by then-Federal Reserve Chair Alan Greenspan, who argued that the U.S. had to make LNG *imports* easier to permit.[6] Fast forward to today, where fracking has resulted in booming domestic natural gas production, fueling calls to expedite LNG *exports*. Even the smartest among us can fail to predict seismic market changes triggered by technological *disruptive challenges*.

Despite record U.S. natural gas production—America has never produced as much natural gas as we have this year, and no other nation on earth produces more than we do—prices have been low, largely hovering around $3 per million BTU for the last three years.[7] Gone are the pre-2008 days of volatile and expensive domestic natural gas that could bring financial windfalls for gas drillers and unease for consumers.

But natural gas producers are frustrated with the low-price environment, as they're not making enough money. Their gas production has been largely trapped in North America, unable to sell for higher prices in parts of the world where demand is growing faster than in the U.S.

A market solution to pushing prices higher would be to either slow production or increase demand. Dawdling drilling isn't an option, because the companies are valued by the acreage they have and the active wells they're completing. And domestic demand growth simply cannot outpace domestic production capacity.

So the natural gas production industry's solution is to create new demand through LNG exports—globalizing the current fractured state of geographically-disparate pricing, and sell landlocked-cheap U.S. natural gas for much higher prices overseas. While the current level of LNG exports hasn't reached the volumes necessary to push domestic prices out of their $3 cellar, the industry's hope is that a significant expansion of LNG exports will do the trick. Obviously, natural gas producers can't sell LNG exports under the guise that it's needed to increase driller's profits. Instead, alternative justifications are offered to promote expanded LNG exports as beneficial for the public interest.

Increasing non-FTA exports may more than double domestic natural gas prices—in violation of the public interest

[6] www.federalreserve.gov/boarddocs/testimony/2003/20030710/default.htm
[7] www.eia.gov/naturalgas/

As of June 2018, the U.S. is exporting roughly 9% of gross natural gas production, with about one-quarter of this total in the form of LNG (the rest is exported via pipeline to Canada and Mexico), out of just two LNG export facilities: Cheniere's Louisiana Sabine Pass facility, and Dominion's Maryland Cove Point.[8] While LNG exports have gone from virtually nothing pre-2016 to something today, exports remain too small to impact prices.

That's going to change. In the next two years, U.S. LNG export capacity is set to *quadruple* with the additions of Elba Island, Freeport LNG, Cameron LNG and Corpus Christi LNG.[9] The International Energy Agency estimates that new U.S. LNG facilities approved and under development represent *75%* of incremental global LNG exports for the period 2017-2023, placing the U.S. as the 2nd largest LNG exporter in the world by 2023—behind Qatar. This moves the U.S. from having a 4% share of global LNG exports in 2017 to 20% by 2023.[10]

Supply and demand dictates that as demand increases (in this case, through LNG exports), there will be an upward pressure on prices. Indeed, the recent U.S. Department of Energy-commissioned study concludes that domestic natural gas prices will likely double by 2040 as a result of LNG exports.[11]

Despite the study's acknowledgment that exports will give rise to price hikes, the report overstates benefits from exports, alleging advantages to the U.S. economy in terms of the natural gas industry's contribution to GDP and financial benefits to American shareholders of natural gas and LNG export facilities[12]—ignoring the fact that some producers and LNG terminals are privately-owned or controlled by foreign entities.

Regardless, the Supreme Court ruled that to give "meaning to the words 'public interest' as used in the Power and Gas Acts, it is necessary to look to the purposes for which the Acts were adopted. In the case of the Power and Gas Acts it is clear that the principal purpose of those Acts was to encourage the orderly development of plentiful supplies of electricity and natural gas at reasonable prices."[13] The Supreme Court had earlier determined that the "primary aim" of the Natural Gas Act was "plainly designed to protect the consumer interests against exploitation at the hands of private natural gas companies . . . We cannot find in the words of the Act or in its history the slightest intimation or suggestion that the

[8] www.eia.gov/dnav/ng/ng_move_expc_s1_m.htm
[9] *Insurgent shale: prospects and perils for US LNG exports*, June 2018, Platts, plattsinfo.platts.com/rs/325-KYL-599/images/US_LNG_America%20report_June%202018.pdf
[10] Gas Market Report 2018, page 113-114.
[11] *Macroeconomic Outcomes of Market Determined Levels of U.S. LNG Exports*, June 7, 2018, pages 54-56, www.energy.gov/sites/prod/files/2018/06/f52/Macroeconomic%20LNG%20Export%20Study%202018.pdf
[12] *Macroeconomic Outcomes of Market Determined Levels of U.S. LNG Exports*, June 7, 2018, page 67, www.energy.gov/sites/prod/files/2018/06/f52/Macroeconomic%20LNG%20Export%20Study%202018.pdf
[13] *NAACP v. FPC*, 425 U.S. 662 (1976)

exploitation of consumers by private operators through the maintenance of high rates should be allowed to continue provided the producing states obtain indirect benefits from it."[14]

The DOE's 2018 study on the impacts of LNG exports on domestic energy prices was simply the latest in a series of such government reports confirming that exports will result in higher domestic prices. In October 2014, the U.S. Energy Information Administration released *Effect of Increased Levels of Liquefied Natural Gas Exports on U.S. Energy Markets.*[15] The study concluded that LNG exports will lead to higher domestic natural gas prices for residential consumers of between one and five percent.

The Department of Energy contracted a prior macroeconomic evaluation of LNG exports in 2012.[16] The report found that, since U.S. natural gas wellhead prices are significantly lower than prices in export destination countries, domestic gas prices will rise with increased levels of LNG exports.

Australia's Cautionary Tale: Ramping Up LNG Exports Leads to Domestic Price Hikes
Proponents of increasing U.S. LNG exports should look no further than the disaster unfolding Down Under. Australia embarked on an ambitious plan to prioritize unfettered LNG exports. The gambit worked to boost Australia's standing as the 2nd largest LNG exporter in the world. But unregulated LNG exports have come at great cost: domestic natural gas prices, particularly for the more-populated east coast, have skyrocketed. Australia's Federal Resources minister Matt Canavan this week warned the country's LNG exporters that he may need to utilize the Domestic Gas Security Mechanism to force a reduction in LNG exports to address looming domestic supply shortages and price spikes "driven in part by high LNG export levels."[17]

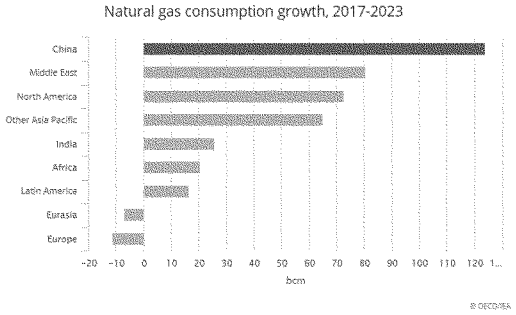
In an effort to counteract the price-hiking impact of LNG exports from Australia's west coast, new LNG *import* terminals are planned for the east coast. "Only LNG imports can save the Australian government from a nightmare scenario of having to choose between breaking gas export contracts with Asian buyers or subjecting the east coast to real supply shortages . . . Four LNG import terminals are being proposed along the south-eastern coast,

[14] *FPC v. Hope Nat. Gas Co.*, 320 U.S. 591 (1944)
[15] www.eia.gov/analysis/requests/fe/pdf/lng.pdf
[16] http://energy.gov/sites/prod/files/2013/04/f0/nera_lng_report.pdf
[17] Cole Latimer, "Canavan warns industry gas export trigger on the table," *The Sydney Morning Herald*, September 12, 2018.

drawing criticism about the absurdity of importing gas at the same time as the country is becoming one of the world's biggest exporters."[18]

Utilization of LNG Exports for *Commodity Diplomacy* to Meet European Energy Demand Conflicts with Market Forces That Point to China and Asia As Destinations

Fracking has transformed America into the largest natural gas producer in the world, so it is understandable that some believe our new natural gas export opportunities can be utilized as a form of *commodity diplomacy* to strengthen alliances while containing our adversaries' efforts do the same. But we are in an area of disruptive challenges for the entire energy sector that mutes the importance of control over fossil fuel supplies compared to two generations ago.



Let's take Europe, the subject of today's hearing. Europe is one of only two regions in the world forecast to have negative growth in natural gas demand over the next five years. One of the driving factors curtailing natural gas demand is the EU's decision to reduce the number of carbon allowances available under the region's greenhouse gas emissions control program, thereby establishing an increase in the carbon floor price. This has the policy effect of promoting renewables while requiring fossil fuels to include a price on their emissions.[19]

Indeed, 75% of the capacity of Europe's existing LNG import terminals is unused, reflecting low demand.[20] Granted, this is also attributed to utilization of pipeline capacity from the Caspian Sea region of producers, and from Russia, but even at projected U.S. gas prices, it

[18] Angela Macdonald-Smith, "Only LNG imports can save east coast gas market," *Australian Financial Review*, July 24, 2018.
[19] IEA Gas Market Report 2018.
[20] *An Overview of LNG Import Terminals in Europe*, King & Spalding, 2018.

will be nearly impossible for U.S. LNG to compete with in-service pipeline capacity. There is legitimacy to U.S. efforts to oppose Russia's Nord Stream 2 pipeline through the application of sanctions, but existing pipeline capacity still carry significant financial advantages compared to U.S. LNG.

While natural gas demand constricts in Europe, appetite for gas in the Asia and the People's Republic of China is growing at an astronomical level. *Half* of global gas demand over the next five years will come from Asia, with *one-third of total global gas demand growth* through 2023 coming from China alone. The demand increase has been so great it forced the Chinese government to take emergency action to avoid supply shortages over the last year.[21]

While some of China's massive demand growth is attributable to its "Blue Skies" clean air initiative, the single largest source of demand growth over the next five years will be from the industrial and manufacturing sectors.[22]

This stark trend—constricting demand in Europe, booming demand in China and Asia—comes at the same time as financing changes for LNG export markets. As the *Financial Times* reports: "An increasingly significant factor for US LNG exporters is the shift in the global market away from long-term contracts towards flexible short-term sales. Last year 27 percent of LNG worldwide was sold on a spot basis or on a contract of four years or less, up from 19 percent in 2010."[23] This means that LNG exporters are more sensitive than ever to price changes—and regions with high demand will feature the highest prices.

Indeed, from February 2016 through May 2018, 45% of U.S. LNG exports were delivered to Asian markets, in part due to the more "flexible" market structure of U.S. LNG.[24] "China's LNG demand is expected to outstrip growth in contracted LNG obligations over the next five years, leaving about a quarter—17 million mt—uncontracted. This implies much greater reliance on spot trade. Chinese LNG demand will become a major factor in global LNG price formation."[25]

While some believe trade tensions between the U.S. and China may threaten current and future U.S. LNG exports to China—citing China's decision last month to include U.S. LNG on a

[21] Gas Market Report 2018, IEA, Pages 23-25.
[22] *A Natural Gas Giant Awakens: China's Quest for Blue Skies Shapes Global Markets*, Columbia Center on Global Energy Policy, June 2018.
[23] Ed Crooks, "US prepares for next wave of LNG exports," June 21, 2018.
[24] Platts, plattsinfo.platts.com/rs/325-KYL-599/images/US_LNG_America%20report_June%202018.pdf
[25] *The Chinese Dream: Energy and commodities in an era of change*, S&P Global/Platts, May 2018, Page 23, https://secure.viewer.zmags.com/publication/fd6eaeea#/

new list of goods subject to a possible 25% punitive tariff[26]—many observers see the recent inclusion of U.S. LNG on the list as a negotiating tactic. After all, China has few affordable options to meet its demand without U.S. LNG, and President Trump has a pretty big incentive to preserve U.S. access to China's LNG market: Trump supporter and former "special advisor to the President on Regulatory reform" billionaire Carl C. Icahn[27] controls nearly 14% of Cheniere Energy, the only major firm holding long-term sales agreements announced so far between a U.S. exporter and a Chinese buyer.

U.S. LNG Exports to China Will Largely Fuel Its Manufacturing Sector—at the Expense of America's

It's no secret that the Chinese economy—particularly its manufacturing sector—is the biggest economic competitor to the United States. Because of a series of key decisions by the Chinese national government, the Chinese manufacturing industry is the nation's largest source of current and future gas demand. In June 2017, China's National Development and Reform Commission and National Energy Administration issued its 13th Five-Year Plan for natural gas, focusing on a transition away from industrial coal-fired boilers to natural gas, essentially setting a compound average annual growth rate for gas of 15.5% through 2020. "China's LNG imports over the first five months of 2018, up around 55% compared to the same period last year, provide indication that this target is likely to be achieved and could be exceeded . . . Natural gas in the [Chinese] industrial sector is used in various furnaces (drying, heating, hot treatment, roasting and smelting furnaces). The manufacturing industry, including raw chemical materials, chemical products and construction materials (e.g. glass) are currently the main industries with natural gas demand."[28]

The Chinese plan to rely more heavily on access to affordable natural gas is the cornerstone of its future manufacturing growth. So too with the United States: facilitating LNG exports forces natural gas price-sensitive industrial customers to compete with foreign markets for US produced gas, undermining their current competitive advantage.

The U.S. chemical sector accounts for 44% of total industrial demand in 2017. Three new ammonia production facilities—OCI in Iowa, Koch Fertilizer in Oklahoma and Simplot's Wyoming facility—require access to inexpensive natural gas. In addition, America's four major methanol facilities—including OCI's Texas facility and Louisiana's IGP Methanol, G2X Energy and Yuhuang Chemical facilities—are expected to significantly increase natural gas

[26] www.spglobal.com/platts/en/market-insights/latest-news/oil/080318-china-adds-us-lng-to-list-of-products-for-potential-25-import-tariff
[27] www.citizen.org/sites/default/files/icahn-complaint-march-2017.pdf
[28] Gas Market Report 2018, IEA, Pages 26-28.

demand.[29] Paradoxically, increased LNG exports could harm the economics of China Energy Investment Corp's planned multi-billion dollar petrochemical manufacturing complex in West Virginia.

Expanding LNG Export Capacity Absent Federal Climate Change Regulations, GHG Lifecycle Analysis for Proposed Facilities and Improved Federal Oversight of Fracking Is Reckless

For the first time in history, Natural gas passed coal as the second largest source of energy-related greenhouse gas emissions in the United States, behind only petroleum. [30] While in the short term natural gas' replacement of coal in the electric power sector has resulted in reduced GHG emissions, the lack of any effective federal regulations on both CO2 and methane emissions from natural gas production, transportation, consumption and export risk increases in U.S. greenhouse gas emissions, threatening the climate.

The Trump Administration unfortunately just moved to repeal methane emissions for the oil and natural gas industry. In unveiling the methane emission rollback, the EPA admitted it would result in an increase in the equivalent GHG emission of putting an extra 260,000 cars on the road.[31] Methane, the principle component of natural gas, is far more potent a greenhouse gas than carbon dioxide: 84 to 87 times worse than CO2 after 20 years from when it enters the atmosphere, and 28 to 36 times greater after 100 years, and methane emissions from oil and gas operations are likely 60% higher than official government estimates.[32]

Furthermore, FERC's environmental reviews of natural gas infrastructure, including LNG export facilities, fail to include a lifecycle GHG emission analysis.[33]

Failure to account for the significant, unregulated climate impacts of reviewing the need for new natural gas infrastructure including LNG export facilities is inconsistent with the public interest; with the EPA's requirement under the 2007 Supreme Court decision *Massachusetts v EPA* to regulate harmful pollutants under its existing Clean Air Act authority; and with FERC's responsibilities under NEPA.

Increasing LNG exports directly correlates to increases in domestic gas production, mostly through hydraulic fracturing. There are considerable, well documented problems with

[29] Gas Market Report 2018, IEA, Page 42-43.
[30] www.eia.gov/todayinenergy/detail.php?id=36953
[31] www.epa.gov/newsreleases/epa-proposes-oil-and-gas-targeted-improvements-package-advance-president-trumps-energy
[32] Ed Crooks, "Gas leaks worse for climate than thought, study says," *Financial Times*, June 21, 2018.
[33] www.ferc.gov/media/statements-speeches/glick/2018/06-15-18-glick.asp

hydraulic fracturing's impacts on water resources, seismic activity associated with fracking fluid wastewater wells,[34] and human health contamination from exposure to chemicals and other pollutants associated with fracking. There is a need for effective federal regulatory oversight over all of these public health risks posed by fracking.

Recommendations

1. LNG exports should be deemed to be in the public interest only if such exports will not raise prices for American consumers. Supreme Court interpretations of the Natural Gas Act's public interest criteria discount alleged indirect benefits from larger natural gas industry profits or contributions to GDP.
2. New LNG export terminals cannot be approved absent federal regulations of natural gas industry greenhouse gas emissions. Furthermore, additional federal oversight is needed for environmental and public health problems associated with natural gas hydraulic fracturing production.

[34] https://earthquake.usgs.gov/research/induced/overview.php

The CHAIRMAN. Thank you, Mr. Slocum.

Mr. Mills, welcome.

STATEMENT OF MARK P. MILLS, SENIOR FELLOW, MANHATTAN INSTITUTE

Mr. MILLS. Madam Chairman, thank you for inviting me back. Members of the Committee, thank you for the opportunity to testify.

As the Committee is well aware, in recent months the President has elevated the issue of Europe's dependency on Russia for natural gas and, collaterally, elevated the opportunity and the discussion about the role of the United States in taking a larger role for European supplies. But a number of European officials, as you know, have said that they believe this is all about, and I quote, "American self-interest." I think we can be honest. Of course, it is. It's also in Europe's self-interest.

And these—so let me outline very quickly, three underlying facts that illustrate the opportunities that are inherent in mutual self-interests because that's when allegiances and good relationships can be established, when we have mutual self-interests.

First, Europe, as has been said here earlier, is becoming increasingly dependent on imports for natural gas. Its own production is in rapid and, in fact, faster than forecast, decline. And at the same time, Europe's needs domestically for natural gas are rising, in fact, as a direct consequence of its policies to promote wind and solar. So, as you know, modern digital economies are very dependent on reliable power, and that combined with the push to electrify the transportation sector will accelerate the need for what can only be called, 24 by 7 power which wind and solar cannot deliver. It's simply a fact and indisputable that completion of Gazprom's controversial Nord Stream II will increase Europe's reliance on Russia to about 40 percent of its gas imports.

Which leads me to my second point which is, interestingly, a recent Pew Global Survey found that 78 percent of Europeans don't trust Russia to do the right thing. And the quote is, "to do the right thing when it comes to world affairs." As the European Council on Foreign Relations recently put it, the EU is, and I quote, "in open battle with Russia over the norms of international conduct" which, the Council cautioned, won't be won by "countering Russia" but rather from "improving Europe's resilience."

So my third point then is that Europe has a remarkably easy path, of course, for increasing its resilience, in particular, in critical energy markets. This has been noted earlier by the Secretary, the EU's existing—and by you, Madam Chairman—the existing LNG import capacity is operating at about 27 percent utilization. Putting those terminals to work at full capacity would provide nearly threefold more gas than the Nord Stream II pipeline will deliver if it's completed. Some European officials which have indicated receptivity to buying more American LNG, they say so at what they call, "competitive prices" but it bears noting that EU policymakers have demonstrated an appetite and willingness to embrace other energy policies for important non-price attributes and security and resilience, I would submit, are such attributes.

The current price, it's interesting to note, that the current price premium between U.S. LNG and, of course, low cost Gazprom gas, if Europe were to use all of its idle import capacity to buy American LNG, that would raise the cost of Europe's overall energy imports, but it would only do it by a total of 10 percent, probably less, more like 6 percent. That could be the cheapest resilience hedge that the European policymakers could buy.

However, as you know, LNG and energy policy, both, are long-term issues and long-term gains. And LNG, in particular, involves infrastructure when it comes to exports that require long-term, major capital commitments from patient and risk-taking investors.

In order to reduce uncertainty and market friction and encourage the necessary long-term investments, there is one specific feature of U.S. LNG export policy that, I think, Congress could address and that is the requirement that American businesses seek permission in the first place from the Department of Energy to export gas. This is an antiquated legislative artifact that stipulates that it has to be, "in the national interest," as you know, but I think it's demonstratively the case that it is de facto in the national interest for any and all businesses willing to invest in such exports.

Insofar as adequacy of American supply to fuel those increased LNG terminals, I would just want to note for the record that there is no forecast for domestic demand uptake for any use of natural gas, including accelerating CNG vehicles that could come close to absorbing half of the expected increase in domestic gas production from the productive shale fields. We just are going to have too much gas production capacity.

Now I know there are legislative efforts underway to require that DOE expeditiously consider and grant such permissions, but I don't think that approach is enforceable over the long-term, nor does it solve the core issue of potential future capriciousness and I don't think it's responsive to the new energy realities that exist both in America on the supply side and Europe on the demand side.

So I'm suggesting it's time that Congress consider removing what could only be called sand in the gears of commerce and eliminate these kind of political uncertainties in the long-term with respect to export policies. And I think Congress should, in fact, repurpose DOE's role here from one of permission granting to export assistance which is what we do with agriculture, at the Department of Agriculture. I think those actions would be powerful and productively impact both domestic markets and send a very powerful signal of the geopolitical status quo.

Let me conclude that by noting that the President of the EU just last month also cited the importance of, in his words, "eliminating the red tape restrictions" around the uncertainties about U.S. LNG exports.

Thank you, Madam Chairman.

[The prepared statement of Mr. Mills follows:]

Testimony of
Mark P. Mills, Senior Fellow, Manhattan Institute
Before
U.S. Senate Committee on Energy and Natural Resources
On
The Role of U.S. LNG in Meeting European Energy Demand

September 13, 2018
Dirksen Senate Office Building, Washington D.C.

Good morning. Thank you for the opportunity to testify before this Committee. I'm a Senior Fellow at the Manhattan Institute where I focus on the policy implications at the intersection of technology and energy, and where I have advocated for years that America's energy policy posture should reflect the new realities of technology and respect the enduring realities of geopolitics.

I am also a Faculty Fellow at the McCormick School of Engineering at Northwestern University where my focus is on the technology and the future of manufacturing. And I note for the record that I'm a strategic partner in a boutique venture fund dedicated to startup companies creating digital oilfield technologies. You will of course notice that the theme in all these pursuits is the role of technology, a key force in our economy and in geopolitics, the impact of which has changed the energy landscape in ways that have still not been fully reflected in national policy.

In that regard, permit be to begin my observations with a summation of the state of energy affairs by quoting someone the Committee is familiar with:

> "[America is] now the world's largest producer of natural gas. We've gone from debating how many import terminals will line our coasts to conversations about how much we can export. Our mindset has changed from a deep-seated fear of scarcity, to the incredible possibilities of abundance. And that has opened new doors for us and for the world."

This brief and accurate distillation of what can only be called a "new world energy order" was delivered by this Committee's chairman, Senator Murkowski, at the opening of the 27th World Gas Conference here in Washington D.C. this past June. My only modest disagreement with the chair's observation is that there are still some laggards in regards to the change in "mindset" with regard to the new energy realities.

In my remarks today I will briefly elaborate on the relevance of the new reality as it relates specifically to the opportunity for the United States to export far more LNG to our European allies. First, if I may note, details and additional geopolitical implications of America's dominant role in global natural gas markets are contained in my new Manhattan Institute policy paper titled, *Natural Gas: The Real Fuel Of The Future*, which, while slated for release next week, I request be submitted for the record today as part of my testimony.

As the Committee is well aware, in recent months President Trump has substantially elevated awareness on both sides of the Atlantic about the state of Europe's dependencies on Russia for natural gas, and collaterally the potential for the United States to take a larger role in supplying Europe with that fuel.

Now, however, a variety of European officials have said they believe promoting U.S. LNG sales is all about American "self-interest." Recent polls show most European citizens share

that view. We can be honest: of course it is in America's self-interest. But it is also in the self-interest of Europe. And it is precisely when counter-parties have mutual, even if differently motivated self-interests, that sensible trade and business relations can be forged.

Permit me to summarize the state of affairs in terms of three key underlying facts that argue that both American and Europe should embrace the new energy reality.

First, for the foreseeable future, Europe will be critically dependent on increasing imports of natural gas. Europe's own internal production of natural gas is in imminent and radical decline. At the same time, its need for additional gas supplies is rising as a direct consequence of policies to promote the use of wind and solar.

The production of natural gas from North Sea is dropping even faster than originally forecast. Within a few years, Europe will lose domestic supply greater than the capacity of the Nord Stream 1 pipeline from Russia. There are no plans or expectations to replace that supply within Europe's borders. At the same time, increased reliance on episodic sources of power from wind and solar, combined with Germany's abandonment of nuclear energy, increases the need to ensure adequate electric generating capacity to produce power 24x7. That reality puts more pressure on natural gas power plants. Modern digital economies are critically dependent on reliable power, and the push to electrify the transportation sector will further accelerate reliance on 24x7 generation.

With the completion of Gazprom's controversial Nord Stream 2 pipeline, it is simply a fact that Europe's reliance on Russian gas will rise, forecast to become 40% of all imports. Germany's Defense Minister's response to that fact has been to assert that they are "an independent country." German Chancellor Angela Merkel has observed in this context that the old Soviet Russia no long controls East Germany. History has of course seen a change in some borders, but some things have not changed.

This brings me to my second point: Europeans don't trust Russia. As a recent PEW survey revealed, 78% of Europeans expressed lack of confidence that Russia would "do the right thing" when it comes to world affairs. Perhaps unsurprisingly then, Russian President Vladimir Putin has been on what has been called a "charm offensive" with many European leaders. In late August, for example, Mr. Putin attended the wedding of Austrian Foreign Minister Karin Kneissl, bringing flowers and a troupe of Cossack singers, and waltzed with the bride.

Without regard to President Putin's charm offensive, or the episodically offensive Tweet from President Trump, there is the undeniable underlying fact that, as recently pointed out by the European Council on Foreign Relations, the EU and Russia are in "an open battle over the norms of international conduct… a clash between liberal universalism and authoritarian statism." And, as the European Council on Foreign Relations has also observed, winning this on-going battle won't come so much from "countering Russia" but from "improving Europe's resilience."

Which brings me to my third point, that Europe has a remarkably easy and low-cost path to increasing resilience in critical energy markets. There is no need for Europe to build new LNG import facilities since those that already exist there are only operating at 27% of capacity. Using those existing ports at full capacity could bring in nearly three times as much natural gas as the Nord Stream 2 pipeline is designed to carry.

Recently, various European officials have indicated receptivity to purchasing LNG from America at what they term as "competitive" prices. There is no denying that gas delivered by Gazprom pipelines can arrive in Europe at lower cost than even the record low prices now associated with shipping U.S. LNG there. But it bears noting that the EU, as have many nations, frequently embracing policies that require paying a premium for some energy supplies based on key non-price attributes – security and resilience are attributes worth something. In that regard, it bears noting that based on the current price spread between U.S. LNG and Russian natural gas, even if Europe were to use all of its idle LNG import capacity to buy American gas, Europe's *overall* annual energy import costs would rise by less than 10%. In the long run, that could be the cheapest resilience hedge EU leaders could buy.

As I noted at the outset, all of this is, self-evidently, in America's self-interest too. Increasing domestic natural gas production has the potential to add millions of jobs and hundreds of billions of dollars to the GDP over the coming years. But in the new realty, it is clear that the scale of growth in domestic gas production coming can't possibly get absorbed by any growth in U.S. domestic demand. In all likelihood, not even half of the expected rise in output from the profoundly productive American shale fields can be taken up domestically. Exports of LNG will become an increasing critical if not the primary vector for new gas production.

However, as this committee knows, the infrastructures associated LNG are very capital intensive and require long-term and forward-looking commitments from investors. Thus, any friction, impediment or uncertainties in related regulatory domains can significantly diminish willingness of both domestic and foreign investors to make those bets in American infrastructure.

In that regard, there is one specific and unique feature of U.S. LNG exports that I believe Congress should address – and that is the requirement that American businesses must seek permission from the Department of Energy in order to sell a product to foreign buyers.

This requirement is anchored in legislation that is nearly a century old, and stipulates that such permission is granted when it is determined that gas exports are in "the national interest." In the new energy reality it is demonstrably the case that it is now *de facto* always in the "national interest" for any and all businesses willing to invest in such exports. While there are a number of legislative efforts underway to require that DOE expeditiously consider and grant such permissions, this approach is neither enforceable nor does it solve the core issue of potential capriciousness. And it is not responsive to the nature of the new energy reality.

Hence, it is now time for Congress to amend the legislation to completely remove this 'sand' from the gears of that part of our economy, to eliminate the political uncertainty about energy export policies that could come from some future Administration. I am not recommending that Congress eliminate that particular DOE office *per se*, but rather it should be repurposed to become an office of export assistance – much as the Department of Agriculture does for that industry. Not only would such an action send a strong signal to markets and investors, but it would also be a very powerful geopolitical signal.

Finally, permit to conclude by noting that a number of European officials this past August have specifically mentioned the need to address this particular issue – the long-term uncertainties associated with U.S. firms needing to seek political permissions to export. <>

The CHAIRMAN. Thank you, Mr. Mills, and thank you to each of you for your comments, your testimony, this morning. We greatly appreciate it.

As I sit here listening, you mention the new energy reality. We have just come so far. I have been privileged to be on this Committee now for 15 years and to think how this country has changed in terms of our position as an energy supplier, not only to meet our needs, but to be in the position and in that role where other can actually look to us.

It was not too many years ago we were working the initiative to remove the 40-year policy that prohibited oil exports outside of the State of Alaska and our opportunity to export oil, and we were basically sitting in the back seat. It has been interesting because when that debate was going on there was a great deal of discussion about well, if we are allowed to move forward with oil exports, the price of oil is going to go sky high.

The question I would like to start off with today, Mr. Slocum, you have shared a view with the Committee that is, perhaps, not endorsed by the rest of the panel here in stating the position that domestic and natural gas prices will double because of exports.

I do not know who wants to jump in here on this, but I would appreciate a rebuttal or a response to that. Obviously, there has been discussion here about the national interest finding that has to, at this point in time, move forward to make sure that the determination to allow for additional exports does not unduly impact prices.

Assistant Secretary, would you like to speak to this as an issue that is under consideration today?

Mr. WINBERG. Sure, I'd be happy to and thank you.

I think there's several facets here that we need to consider, and let me start with the first one, which is the technology. We're still climbing the learning curve on producing both oil and natural gas from unconventional resources, often called shale plays. And there's, as we climb that learning curve, as the producers understand how to get more of the resource out of a frack zone and we're going to make some pretty significant strides as we move forward on that, as we climb the learning curve.

The second thing that the Department is doing, the Fossil Energy Office and Senator Cantwell raised the issue of supercomputers or high-performance computing. We're now, we have about a decade worth of data that we have amassed from the producing community in unconventional oil and gas and that data, combined with our, the Department's high-performance computing capability at our national labs, combined with physics-based modeling, we believe that we're going to be able to increase production. So we're going to be able to go beyond what they currently produce which is only about 10 percent, by the way, within the frack zone. So that's one point.

The second point is that EIA projects that we're going to be at 110 billion cubic feet per day by 2040, but only 14 billion cubic feet per day in LNG exports. And just to put this into perspective—right now, we're at about 3.5 billion cubic feet. We have four projects coming on in the next two years that will take us to about 11 billion cubic feet, and we've approved 21 billion cubic feet. So

there is an enormous amount of head room here. And when you combine the learning that's going on in the fields in the unconventional gas space along with the build out of these terminals, there is sufficient gas for us to send to our allies and friends over in Europe.

The CHAIRMAN. Other comments?

Dr. Grigas.

Dr. GRIGAS. So, regarding—I'd like to follow up on the price issue because the figures I have, actually, are different.

So the DOE did a series of studies on the impact of exports on gas pricing, and the figures I have is that they anticipate a gas price increase of somewhere between 4 to 12 percent. And the conclusion of that study, not doubling, and the conclusion was that an increase in production, overall, should balance the market effect of exports and, in fact, that GDP growth will offset any negative effects of these gas price increases for the U.S. economy.

The CHAIRMAN. Thank you.

Mr. Mills, and then we will go to Senator Cassidy here. Go ahead.

Mr. MILLS. Just to add, I take the technology perspective, if I might, Madam Chairman.

The interesting thing about natural gas markets is that I was on the front lines because of our, my involvement, in a technology venture fund that's working with the shale producers and midstream folks.

The cost of natural gas in parts of the Permian these days in West Texas is negative, which is kind of interesting. There aren't many critical commodities that are produced in a high volume. I mean, they produce tremendous quantities of it, for which, in effect, you're being, it's not leaking methane. This is, natural gas, you're effectively paying somebody to take away.

It's clear that that's not an aberration. That's a consequence of the nature of this particular resource. So as demand for oil, and you're an oil producer, you co-produce natural gas and you're not interested, particularly, in the fact that it's not generating a profit for you. So you have these odd negative prices.

The other thing is in the Marcellus in the Pennsylvania region, the production of gas, like Alaska, is astonishing. I mean, the quantities of gas that can be produced, technically, technologically, are utterly astonishing. The only question that you have as a technologist is, you know, the technologies around this domain getting better fast enough to keep driving the cost curve down, the cost of producing it?

Every engineer I talk to on the front lines answers, yes, not even close to an acid tone. What that refers to is, with all due respect to my friends at DOE who make forecasts at EIA, they have consistently demonstrated an inability to understand the price dynamics of these markets. And it's not a criticism that's an insult. It's because it's very difficult.

One thing we do know is the productive capacity is astonishing which benefits American consumers. Domestic consumers will benefit from global competition because LNG can't be exported unless it's cheap when it goes onto the train that liquifies it. It has to be very, very cheap. It's always going to be cheaper to buy in America

which is why there's something like $100 billion of capital construction, private money, building chemical processing plants and plastic plants to use the cheap domestic gas. They're making these bets on the assumption that gas will be cheap in America for a very long time.

The CHAIRMAN. Let's go to Senator Cassidy.

Thank you.

Senator CASSIDY. Thank you, Madam Chair.

Thank you all for your testimony.

I will just tell you. My observation in our study is that LNG and increased natural gas production is good for the economy, good to decrease greenhouse gas emissions and good for international trade.

We actually have a White Paper about the release that hits this, among other things, showing that our greenhouse gas emissions have declined precipitously because of natural gas replacing coal and, frankly, elsewhere where they have used natural gas instead of coal, you have seen that same precipitous drop. Not only does it cause it by direct substitution but also by enabling the deployment of renewables which, as you say, Mr. Mills, do not have a certain volatility. When you deploy one unit of natural gas, studies show that you end up deploying about 0.88 units of renewables. So it enables the renewable, if you will.

With that said, I kind of lost who said this, but the point was, and I think you said, Mr. Slocum, on this point that most of our gas is going to China because you have a better price in the spot market there than in the EU.

Now I get that, but let me ask. There's a lot of pipeline gas coming from Kazakhstan, from Azerbaijan and potentially from Israel going over to the Mediterranean coast of Europe. Will that supplant the potential for a market of LNG? Let me first ask that, when all that is fully online, and will it diversify their energy source away from the Russian preponderance right now? Anybody want to take that? Anyone?

Dr. GRIGAS. So the southern gas corridor which is coming online which will bring about 25 BCM of Caspian gas into Europe, this is a new development. But this is still a very small amount, given Europe's overall gas demand. I mean, again, Europe today is the largest gas importer in the world. Its total gas demand is about 550 BCM.

So I think there's still a lot of appetite for American LNG in Europe. And we can see that already from the fact that——

Senator CASSIDY. Even despite, even if the Israelis and the Caspian come over, they will still be——

Dr. GRIGAS. Well, the Caspian is certainly coming online. The Israeli, that's something that's a work in progress.

Another element to consider here is that I think the U.S. could really use right now and take advantage of its leading position and its, you know, first mover position as a shale producer and LNG exporter, rather than leave these markets to competitors. Again, since 2016 American LNG has gone to a wide variety of countries all across the European continent and I'll give you the list. Some of these countries——

Senator CASSIDY. Well then, hang on. Let me hold off on that just because I have such limited time, although I do suspect I could have a second round.

[Laughter.]

But if the price point is better in South America and Asia, there is going to be, just from the way markets work, it is going to disproportionally go there as opposed to Europe even though that potential market is there.

Yes sir, Mr. Book.

Mr. BOOK. If, Senator, I may offer? Yes, of course the market that has the greatest scarcity and commands the greatest price premium will be the most attractive, but it's not the only market at all times.

One of the ways to think about it is that the differentials that exist today are a function of an undersupplied, global inventory of LNG to satisfy the demand that's being——

Senator CASSIDY. So the point you made, the more supply there is, the more those price differentials would——

Mr. BOOK. They will start to narrow, yeah.

Senator CASSIDY. So then, let me ask. Is the amount that is coming on both from the Caspian as well as from our XL, our production, will that be adequate to decrease that differential between Asia and in the EU?

Mr. BOOK. I think it would be premature to expect that the amount that we're bringing on now will do all of the work. It will do some of the work, and it's not the only work being done.

Senator CASSIDY. Yes, the Aussies are doing it. The Canadians are doing it.

Mr. BOOK. As you add to the global supply, those differentials will start to tighten.

Senator CASSIDY. One more thing. One thing I have heard, but I do not know it to be true. And ma'am, this might be your answer. When the Germans are bringing that gas in and selling it to the rest of the EU, are they putting a premium on that or will say France get it at the same price as the Germans purchase? Mr. Mills, you are kind of laughing. Do you know the answer to that?

Mr. MILLS. I apologize. I don't know the intricacies of the German market, but I appreciate the motivation in the question.

Senator CASSIDY. Yes.

[Laughter.]

Dr. GRIGAS. Well, I'll say here, Germany has an incentive to become a gas hub of Europe. So basically, directly receiving gas from Russia via Nord Stream I and Nord Stream II and subsequently using its pipeline system, its infrastructure to distribute that gas to the rest of Europe. So, for Germany they have, you know, domestic, economic incentives to eliminate other transit states and become, again, the gas hub.

Senator CASSIDY. That would suggest that they would not put a premium because they would want to become the hub. On the other hand, unless they put a premium there is really no advantage to being the hub.

Dr. GRIGAS. I think their industry and their energy sector will be making money from being the distributor of gas for the rest of Europe.

Senator CASSIDY. Gotcha, which may end up creating a market opportunity for others if the Germans charge too much a premium, I would think.

I yield.

The CHAIRMAN. Senator Daines.

Senator DAINES. Chair Murkowski and Ranking Member Cantwell, thank you for holding this hearing today. This is a topic that I am very interested in.

In fact, I want to thank the Chair for inviting me for visit that we made at the Hammerfest LNG facility in Norway a year ago. In fact, very helpful. We were able to discuss some of these issues on the ground there regarding LNG.

I think this is very important. It is important for the U.S. to continue to grow as a global energy leader in order to strengthen our allies in Europe as well as our national security. When I think about energy, I am not sure there is a more important geopolitical issue on the table than energy. I have said it before. I will say it again. The less the U.S. and Europe rely on oil and gas from hostile or volatile countries, the safer and stronger they are.

The U.S. has the unique ability to play a larger role in the global energy economy. I just saw the news that came out in the last 24 hours, and we are now officially the world's largest producer of oil. I believe we need to make this final push to really, truly move, as has been said by the Trump Administration, move us from independence to global dominance as it relates to energy.

Dr. Grigas, I recently sent a letter to Secretary Mattis with some of my colleagues on this Committee, including Senators Manchin and Sullivan, discussing the importance of lessening the United States Armed Forces in Europe dependence on Russian sourced energy. We also recently passed legislation that is part of the NDAA directing the Secretary to do just this. At the very least, the U.S. should be supplying our own troops and not relying on a country that is known for playing political games with energy.

My question is, what do you see as the geopolitical concerns with relying too heavily on foreign, especially Russian, sourced energy for our troops as well as our NATO allies?

Dr. GRIGAS. This is an excellent point you bring up. I think this is absolutely detrimental and dangerous for the U.S. military to rely on foreign sourced energy, especially energy from hostile countries.

We know what Russia does with their energy supplies in peace time, so we can only imagine what type of tactics they could rely on during times of conflict.

And it's certainly a paradox for NATO which, you know, seeks to defend European country states from hostile countries to then at the same time, you know, send revenues to Gazprom and other such Russian energy companies.

I think there should be more work done in this area and I'd like to highlight that there is an institution, a NATO Center of Excellence for Energy Security, located in Lithuania that has done some work on this question, essentially ensuring the energy security supply of NATO military troops. And I think they should be tasked to doing more work on this subject.

Senator DAINES. Thank you.

I want to shift gears here, Assistant Secretary Winberg.

I just read this morning the good news that the Department of Energy recently authorized 2.14 billion cubic feet per day of LNG exports from the Freeport project in Texas. I am excited to see multiple other LNG projects ramping up in the next few years. I believe there are four more projects currently under construction.

A question is, are these projects on track for approval by DOE and how much LNG exports would that represent?

Mr. WINBERG. Well, the Freeport project we announced yesterday, and they have an authorization for 2.14 billion cubic feet per day. That will get them to their startup and also for short-term sales.

The total four projects that will be coming on will take us from 3.4 billion cubic feet per day which is what we have with Cove Point and Sabine Pass, and it will take us up to 11 billion cubic feet per day.

I should mention that those are, all of those projects, so all six of those, the two operating and the four coming online here in the next couple of years, can deliver LNG to both free trade and non-free trade agreement countries. And so, moving gas into Europe, moving gas into Asia is available to all of those six——

Senator DAINES. Do you anticipate and foresee a large portion of those exports headed to Europe?

Mr. WINBERG. I think that's difficult to say.

Right now, we have sent some 50 or 43 cargos to nine countries in Europe. I expect some of that will continue, but I don't know that that majority of the LNG will be going into the European market. These are private companies, and so they're free to move that gas where they want.

Senator DAINES. I am a big believer in Milton Friedman and free to choose, so I understand.

Mr. Book, one last question. Your written testimony spoke a lot about the increase in U.S. exports. Exports are increasing sharply. We are building more terminals. We are producing more natural gas with this shift. Can the U.S. meet Europe's demand for LNG?

Mr. BOOK. Well, Europe's demand for LNG, arguably, is met when Europe buys the LNG it needs. The question, I guess, is what they need it for.

As a substitute for all of their imported gas, no. The U.S. isn't going to be able to do that with LNG, nor would it necessarily be in Europe's interest to make an undiversified commitment to another single supplier. But can we help close the gap?

Senator DAINES. Right.

Mr. BOOK. In growth? Yes.

Senator DAINES. So, let me ask you this. What is that gap back to, you said we cannot replace all of it. What is the gap and what could we do with that gap?

Mr. BOOK. Think about this. Europe net imports about 39 billion cubic feet per day, roughly 36 percent, 37 percent, come from Russia. So, 14 billion cubic feet per day of gas.

Start with one. Every single one you add diversifies and provides more opportunity for Europe. They may not choose to buy U.S. gas. All that matters is that U.S. gas goes into the world and that other

LNG, wherever it might be found, that the U.S. gas might displace——

Senator DAINES. Right.

Mr. BOOK. Can go to Europe.

Senator DAINES. Maybe the better question is, do you think the U.S. has the ability to replace Russia as the largest supplier of LNG to Europe?

Mr. BOOK. Well certainly as the largest supplier of LNG, we've got them beat cold because they're not sending much LNG to Europe.

As gas goes, Senator, I think we're a long way from displacing all 14 BCF a day, but we can cut it down.

Senator DAINES. Okay, thank you.

The CHAIRMAN. Senator Gardner.

Senator GARDNER. Thank you, Chairman Murkowski. Thanks to all of you for your testimony today.

On Tuesday I had the opportunity to hold a roundtable in Grand Junction, Colorado, which is on the Western Slope. We were joined by county commissioners from across Western Colorado as well as a county commissioner from Oregon. We also were joined by Assistant Secretary of State, Frank Fannon from the Department of State who handles energy issues at the Department of State and Assistant Secretary Joe Balash who is in charge of the mineral department over at Department of the Interior.

We discussed the issue of Jordan Cove, the opportunity to have a West Coast outlet for Rocky's natural gas and the importance of Asia as an expanding market, a region of the world that will soon have 50 percent global population, 50 percent global GDP. And Jordan Cove represents an opportunity for us to have an access to those markets, countries that look toward the United States for energy security because they know our rules, our transparency, our environmental standards, are far higher than turning to China or other nations for those gas supplies.

We also talked about Russia and the possibility that if a state like Colorado, I will give you an example, the Mancos Shale in the Piceance Basin. In 2003, USGS estimated that there were 1.3 trillion cubic feet of natural gas, shale natural gas, in the Mancos formation. In 2016, they revised the estimate, 66 trillion cubic feet in the Mancos Shale in Colorado in the Piceance Basin. In just 13 years from 1.3 trillion to 66 trillion cubic feet, the opportunity for us to play a part, Colorado's role in geopolitics is pretty incredible.

When it came to Russia though, I believe it was the Assistant Secretary of State who said, "Russia uses its natural gas for power and it uses its oil for money." I mean, he is certainly not talking about electrical power. He is talking about state power. Would you agree with that statement, Mr. Winberg?

Mr. WINBERG. Well, I think they gain quite a bit of money on both oil and gas but I think, certainly, the ability to turn the valve off in the middle of winter into the European market gives them a certain amount of power and as we've talked about here this morning, the LNG, the opportunity to export LNG out of the United States and out of the great State of Colorado into other markets helps alleviate that ability of Russia to utilize that power.

Senator GARDNER. Does anyone on the panel disagree that Russia is using its natural gas as a political tool?

[No response from panel members.]

No one disagrees. Let the record reflect that no one disagrees with that statement.

If we see policies in the United States that lessen our ability to produce natural gas or to export natural gas—Mr. Book, you talked about the fact while natural gas may not be going directly to Europe, if it displaces a Russian sale somewhere that means somebody is freed up to sell to a European nation, Germany as an example.

If we pursue policies that lessen our ability to enter the world market, lessen production here, that empowers Russia. Would you agree with that, Mr. Winberg?

Mr. WINBERG. Absolutely.

Senator GARDNER. Dr. Grigas?

Dr. GRIGAS. Absolutely, and I would also like to highlight that Russia is also aggressively looking to enter the LNG markets. So if we don't move now, we can expect more competition from Russia in the future.

Senator GARDNER. There was a 2014 New York Times article about Russia funding anti-hydraulic fracturing efforts in Europe. There have been studies and concerns in the United States that the same activity has been used here.

Russia's continued use of information/disinformation campaign hybrid warfare to fund division of the United States has been used to help depress, destroy and divide Americans on our energy production.

Are you familiar with these efforts, Dr. Grigas?

Dr. GRIGAS. Yes, absolutely.

Senator GARDNER. And they have occurred? This is a real thing?

Dr. GRIGAS. Yes.

Senator GARDNER. There is an initiative in Colorado, Proposition 112 I believe it is, that would essentially take 85 percent of land off of production potential, out of production potential, banning, essentially, energy production on 85 percent of state and private land in Colorado.

Colorado is one of the highest natural gas producers in the country. If something like that were to pass, we know that money has been used by Russians to fund anti-energy initiatives in the United States and around the globe. Does it empower Vladimir Putin when he is able to shut down energy production or, if we pass initiatives that shut down production in the United States, does that give him greater leverage over world markets and energy manipulation?

Mr. Winberg?

Mr. WINBERG. Absolutely, the less natural gas that we can produce in the United States means less natural gas we can export over to Europe or other places around the globe.

Senator GARDNER. Dr. Grigas?

Dr. GRIGAS. Yes, absolutely.

Senator GARDNER. Thank you.

I am very concerned that while we are rightfully focused on Russia and the activities Russia is pursuing, their malign activity around the globe, that states could unwittingly fall into a trap of

allowing its initiative processes to be used to further the power and grip of Vladimir Putin over global energy supplies.

Thank you, Madam Chair.

The CHAIRMAN. Senator Gardner, I will share with you a copy of a press release that was released this morning from the U.S. Department of Energy on Secretary Perry's visit with the Russian Minister of Energy. It states that Secretary Perry made clear that while the U.S. welcomes competition with Russia in energy markets across Europe, Asia and elsewhere, Moscow can no longer use energy as an economic weapon. The United States is now in a position to offer these nations an alternative source of supply.

[The information referred to follows:]

ENERGY.GOV

Department of Energy

U.S. Secretary of Energy Rick Perry Meets With Russian Minister of Energy, Alexander Novak

SEPTEMBER 13, 2018

MOSCOW, RUSSIA- Today, **U.S. Secretary of Energy Rick Perry** met with the **Minister of Energy of the Russian Federation, Alexander Novak.** During the meeting, the two leaders discussed ways in which America and Russia, two of the world's top producers of natural gas and leading producers of oil can work together to ensure world energy market stability, transparency, and sustainability. Secretary Perry also expressed his disappointment and concern about Russia's continued attempts to infiltrate the American electric grid. Finally, he discussed the mutual responsibility the two nations have to ensure that nuclear power is managed for peaceful purposes.

Secretary Perry made clear that while the United States welcomes competition with Russia in energy markets across Europe, Asia and elsewhere, Moscow can no longer use energy as an economic weapon. The United States is now in a position to offer these nations an alternative source of supply. Just this week, the Energy Information Agency (EIA) announced that the United States is now the largest crude oil producer in the world. This summer, U.S. production exceeded Russian output for the first time since 1999. President Trump has made clear that the United States staunchly opposes

the Nordstream 2 Pipeline, which would expand a single-source gas artery deep into Europe. The U.S. supports the desire of European nations to minimize their dependence on Russia as a single energy supplier, and look forward to increasing LNG exports to the region, as announced by President Trump and EU President Juncker in June.

Perry underscored that, as two of the world's top producers of natural gas and oil, the United States and Russia have a joint responsibility to further international energy security and global stability. Both Secretary Perry and Minister Novak agreed to continue this previously dormant energy dialogue and to search for ways to work together, within the guidelines and limitations of our current bilateral relationship. The future of our energy relations is predicated on successfully addressing our broader disagreements.

The CHAIRMAN. It goes on, indicating that we all look forward to continuing this previously dormant energy dialogue and searching for ways to work together. I think it has been clear that the relationship has been less than stellar for a host of different reasons for far too long. But the use of energy, particularly LNG, as a political tool when you cut nations off, when you cut communities off from their power source in the middle of the winter to gain their political attention, that is absolutely unacceptable.

Where we have an opportunity to make a difference, when we can weigh in—I think we recognize that this is not only an opportunity, but to use your term, Mr. Mills, it is mutual self-interest here and so, how we are able to advance that.

I wanted to ask about infrastructure in Europe right now. Obviously there is a great deal of discussion and focus on Nord Stream, on the pipeline side and pipeline capacity, but I am more curious now as to the import terminals. We can talk a lot about what we need to do to work with the FERC to advance more export opportunities here, but if you do not have the ability to receive things on the other end, it doesn't pair up.

I don't know who wants to field this question, but it is pretty broad. Is there sufficient capacity right now in Europe? If not, what LNG import projects are being considered at this point in time? How do we make sure that dovetails with what we are doing here with increased production, with their ability to receive on the other continent there?

So, I throw that out. We will go to the Assistant Secretary, and then we will go to you, Mr. Mills.

Mr. WINBERG. Thank you.

Europe is constrained on their ability to import LNG. Currently, they're limited to about 20 BCF per day. They're only using about 20 percent of that capacity that they have.

I think there are three challenges with Europe. Number one is limited distribution, pipeline distribution capacity. Number two, there is resistance to pipeline build out, similar to what we see in the United States, in different parts of the United States. It's fairly prevalent across Europe. And then number three, they're lacking storage facilities. And so, the Department of Energy is working with our European allies on those issues. As you mentioned, Secretary Perry is over in Russia, but also Deputy Secretary Dan Brouillette is in Berlin. And so, we're working with Europeans to create ways to reduce some of those constraints.

I think there's an investment opportunity on that side of the Atlantic Ocean for U.S. companies to come in and invest in the very much needed infrastructure.

The CHAIRMAN. Mr. Mills?

Mr. MILLS. Well Madam Chairman, I think the Secretary is absolutely right. I mean, the pipeline distribution system, to my understanding, is the critical impediment to expanding the use of the existing LNG terminals. Although they do face some challenges there, they're far less challenging in terms of capital formation than building an LNG facility, obviously. And as you know, there are quite a few under construction. Even Germany has now announced its—plans for its first LNG import facility.

I would just make the high-level point of the transformation back to what you said at the outset and what you said at the World Gas Conference. There's been a transformation of the fundamental structure of this market, and we need to participate in unleashing that full transformation so that private capital takes the private risks, by and large, for these kinds of projects.

Obviously, there are government permissions involved with building pipelines pretty much everywhere in the world. But the market price for gas collapsed before our first LNG exports happened. It was in anticipation in markets that this was coming. There was a glut coming.

If we recognize that this glut is such a permanent, then what we need to do is figure out ways to let capital markets function efficiently. That was my main point is that we put impediments here at the state level or federal level to the U.S. really fully functioning in this new commodity market the way we do with many other markets will depress the appetite to build what's required in Europe and the rest of the world.

The CHAIRMAN. Let me ask on the capital investment side, because we all recognize that it is substantial. How do the LNG contracts play into that?

We have moved from a situation where about 10 years ago the average LNG contract for large volumes was 18 years. This year the average contract has dropped to 5 years. Is that having any play or any influence in terms of ability to secure the capital necessary to make these long-term investments in this infrastructure?

Mr. Mills and then Mr. Book.

Mr. MILLS. So, just to finish the point. Of course it does, because these are very expensive, as you know, capital projects. So that's essentially what's driving my proposition that we need to find ways to take whatever other risks exist in the market. We've added a new risk to an LNG facility, instead of 18-year contracts, 5-year contracts and even spot markets.

So, when you look at broad capital markets at the level of abstraction which is realized in practice, people make decisions based on what they think the risks are. If there's a risk we can remove, which is what I've coined the "permissions risk," and if America were not involved in permissioning but encouraging and facilitating actively over a long time, it's signaling that today is a permanent change, that can be a countervailing factor to offset these kinds of decisions and encourage investment for these shorter cycles.

The CHAIRMAN. Mr. Book.

Mr. BOOK. Well, I absolutely agree that the faster that you can get things approved, the sooner you can get them on the water. That's a compelling case for investors who are looking at committing capital to a project.

The infrastructure challenges in terms of raising money because of contract life are part of this story. Shorter contract life means there's less cash to take to the bank to get the loan, basically, in colloquial terms because you don't have as long to guarantee. On the other hand, low prices were a factor too in making some of the financing issues more challenging.

The nature of energy infrastructure is very much like the nature of upstream production, comes in booms and busts and more or less

for the same reason. You have a, sort of, inelastic supply and long lead times to projects. And so, things overshoot and undershoot and then periodically balance.

But the world can move very quickly from surplus to scarcity. And in those opportune moments, financing opens back up. So contract life won't be the only constraint because price was part of the story and price won't stay the constraint for long because when a higher price comes, financing will come back.

The CHAIRMAN. Okay, thank you.

Mr. Slocum, did you want to weigh in?

Mr. SLOCUM. I did.

I don't think that the move toward short-term or spot contracts is any detriment to financing. It's the market that is moving this direction. And in fact, right now if you've got a long-term supply commitment contract, that might be an impediment because that might be locking you in at prices below what the spot market can provide you.

There is a reason that LNG terminals in the United States are moving, aggressively, toward spot market because that is where the market is moving. And they are simply following where the market is. And so, in terms of developing these, that is absolutely a benefit. And I think that the long-term contracting model is not going to provide any assistance.

And getting to the issue of siting that was touched on. It was commented that it's tougher to site pipelines, maybe, in the United States and Europe. Nobody talks about how tough it is to site pipelines in China because in China no one has any rights.

I am extremely proud to live in a country where we've got a variety of different constitutional protections that ensure that landowners have lots of ability to have a say in what goes on in their community. And so, I don't think that we should be negatively talking about constitutional due process rights of American citizens to have a say in potentially sited infrastructure projects on their property or in their communities.

The CHAIRMAN. Thank you.

Senator Cassidy, we are at round two.

Senator CASSIDY. Oh, great, thank you.

Mr. Slocum, I was intrigued by your testimony so I had my staff go pull a Department of Energy study and let me just, kind of, go through some highlights, and then I will try and address some of the other issues you raised.

Mr. Winberg, I am probably stealing your thunder.

But that said, the DOE study is all about exporting natural gas and, by the way, in Louisiana there is so much prosperity that has come from developing natural gas resources, down to the parish level where DeSoto Parish has more money for its police department and for its school board because it gets one-sixteenth of the royalties.

Let me just say, I have seen that prosperity. A prosperity that has filtered out to the working family who over the last eight years really suffered but now, because of high-paying energy jobs, actually has a better life, a better future. So it is with that perspective, the empiric perspective, I say this.

But here is the Department of Energy study.

[The information referred to is available at:
https://www.energy.gov/sites/prod/files/2018/06/f52/Macroeconomic%20LNG%20Export%20Study%202018.pdf]

Households will benefit from the additional wealth transferred into the U.S., all related to LNG exports, which increases the value of the dollar and reduces cost of imported goods.

Next, the consumer. As increased demand pull due to changes in international market induces more LNG exports, consumer welfare measured in dollars also increases.

Next, under these export scenarios, they did low, intermediate and high exports. As U.S. LNG exports increase, U.S. households receive additional income, et cetera, et cetera.

Overall, GDP improves as LNG exports increase. There is greater gain in GDP as LNG export volume increases.

Obviously, I am excerpting.

Restrictions on LNG exports would forego the additional GDP to be gained by allowing exports to respond to market conditions.

And to your point about it doubling, the reference they have here to price increases, the slightly higher price of natural gas with higher levels of LNG exports is, you know, go along, but that is the phrase to emphasize.

And then lastly, the conclusion. The results from this analysis suggest that there is no support for the concern that LNG exports would come at the expense of domestic natural gas consumption. In fact, a large share of the increase in LNG exports is supported by an increase in domestic natural gas production leading to a modest increase in natural gas prices and additional income from export revenues.

The other thing you mentioned is about the methane leakage issue and whether or not this Administration is addressing the methane rule is affecting that. Again, our White Paper which we have, we have been looking at this. I am going to quote from that. Let's see if I, shoot—you live by technology, you die by technology. Here we have—in ours we show that from 2005 to 2014 that our methane life-cycle from well head to use that the methane leakage has decreased an absolute amount while the amount of gas has improved dramatically.

I had it pulled up and I lost it. Let me just go there real quickly. Jack Cramton, who is sitting in that back row, actually helped write it—I should have him quote it.

Our current methane leakage in the United States is 1.4 percent and over various timelines that has to be less than 3 or 5.5 percent. We're at 1.4 percent. And so, the U.S. is dramatically lower than the threshold. That is according to the International Energy Agency. And since 2005, natural gas production has increased 49 percent while the absolute amount of methane emissions from natural gas systems has decreased by 3.3. Now that is, frankly, without the methane leakage rule because all this pre-dated methane leakage.

And then if you say okay, absolute amounts were down this much leakage and we are up that much gas, there is an inverse relationship between the amount of gas being produced and the amount being leaked.

Lastly, I will say that if you look at charts, because you mentioned it all going to Asia, if you look at charts of SOx and NOx

and greenhouse gases blowing on to our Pacific Coast, it comes from coal-fired energy in the Pacific Coast of China blowing over.

I think it is a good thing that China is substituting out their coal with our gas. It is a good thing for our economy, for our workers, but also for our environment because the SOx and NOx in Washington, Oregon and California is coming from China. If we replace that with clean burning gas which does not have SOx or NOx and has a lower carbon footprint, then the air quality in those states will be far cleaner. And that is all from the academic literature. There is no questioning that.

But there is a lot of stuff from the objective literature that, I think, needed to be used in this discussion.

Thank you, Madam Chair.

I yield.

The CHAIRMAN. Thank you, Senator Cassidy.

Senator Barrasso has joined us. Welcome.

Senator BARRASSO. Thank you, Madam Chairman. Thank you for bringing together this august group to have this discussion.

Russia continues to undermine peace and security in Europe as we have talked through a variety of mechanisms including its use of energy as a weapon. It uses its energy sector as a weapon to intimidate, to influence and to coerce other nations, and Russia continues to be Europe's main energy supplier. It also has significant ownership in Europe's energy infrastructure, including pipelines, distribution and storage facilities.

I believe it is in the national security interest of the United States to help our allies reduce their dependence on Russian energy. If America does not step up to the plate now, then Russian influence is only going to grow and continue to grow and they will continue to use energy as a weapon.

There was a story in the Economist last week, Madam Chairman, about Russia and its nuclear dominance. It is a nuclear power and they are exporting that technology and keeping countries connected to Russia as a result of all sorts of different energy.

Due to technological advances and a newfound abundance of natural gas, the United States really now has capability and capacity to be a strategic energy supplier to Europe. The United States can help Europeans meet their energy demands and diversify their energy imports away from countries that use energy as a weapon against them.

So I think our LNG exports create jobs across America, they assist in reducing our nation's trade deficit, they help our allies and strategic partners across the globe and we have plenty of natural gas to meet our own needs while helping our country's allies.

There are a couple of export facilities right now in the United States able to ship natural gas overseas, one in Maryland, one in Louisiana. Three more are due to be operational by the end of the year and at least 20 additional projects are awaiting federal permits. I think we have to expedite these approvals to give our allies alternatives to Russian energy.

On July 18th of this year I introduced what is called the ESCAPE Act. It stands for Energy Security Cooperation with Allied Partners in Europe Act. It is going to improve energy security and help end the political manipulations by Russia through its energy

resources. It does require the State Department, USAID, and the Department of Energy to create a transatlantic energy strategy focused on enhancing the energy security of our NATO allies and increasing American energy exports to these countries. The bill also requires the Secretary of Energy to expedite approvals of natural gas exports to NATO allies and other foreign countries where exports to that country would promote our national security interests.

I think it is time for Congress to clear away regulatory hurdles and make the changes necessary to give Americans, as well as our European allies, a better energy option.

So, Dr. Grigas, I would like to start with you because I thought your testimony, the written testimony, was very compelling. The United States natural gas infrastructure, to me, is still inadequate. There are groups and members of Congress wanting it to stay that way to prevent our resources from ever being developed. But is it appropriate to keep this incredible resource locked in the ground and what do you think we should be doing?

Dr. GRIGAS. I think the United States today has an incredible resource at its disposal, a resource that could be used for America's economic gains, its geopolitical gains. It's an incredible resource that should be used.

And as we discussed with the panel, the global gas markets are currently transforming. There's a lot more supply coming online. There are a lot more competing countries.

The U.S. is a leading player right now in the gas markets, the largest gas producer, and it should maintain that position and it should actually improve its position. It should really emerge as one of the leading LNG exporters so it cannot only secure a lot of allied countries which happen to be dependent on energy imports. Both in Europe our allies are dependent on energy imports and in Asia our allies such as Japan, South Korea and others are also dependent on energy imports. So, this is, you know, an economic and geopolitical benefit for the United States.

Senator BARRASSO. Okay.

Mr. Book, anything you would like to add to that?

Mr. BOOK. Well, I think that one of the issues that came up, Senator, while you were out is the question of whether or not we're imperiling other economic sectors in the United States. And I think Mr. Slocum's comments are reasonable. We should be concerned. We are Americans. We're all here. And he brought up the example of Australia. But look, you can wrap Crocodile Dundee in American flag pajamas, but it doesn't make him the President. That is a very different circumstance. If you have infrastructure on the West and East Coast connected together, you have a different situation in Australia.

Here in the U.S., our problem is that we have too much gas, not too little infrastructure. And the goal is to try to get it to market to make value for the American people. And so, if that produces dividends in the form of freedom and international benefits with our allies, even better. There's a lot to be had all around but very different situation, not—it's a very flat supply curve here in the U.S.

Senator BARRASSO. Mr. Mills, anything you would like to add?

Mr. MILLS. Well, no. I think the—I would echo again, I mean, with Mr. Slocum and Mr. Book, the domestic features are critical. They obviously are.

We are, all of us, sensitive to economic, domestic economic impacts are negative because it's not, economics, as you know, it's like the proverbial analogy to the balloon. You squeeze one part, it inflates other places. But that's life.

However, the technological fundamentals that I study and have for years with respect to the underlying resource bases are so remarkable, so different than what anybody imagined before, that we are literally gushing gas. We need to find places to use it.

The part that I would like to emphasize. We've talked a lot about Russia's overt negative behaviors. The issue is actually, I think, more subtle than that. We all know this. The nature of international relations that attend to what's called "soft power" have to do with the postures of all the counter parties. When you're in a weak position, it profoundly affects the nature of a negotiation or a treaty.

For the United States to be in a profoundly powerful position has benefits that are difficult to categorize in ways that somebody might turn off the gas. We don't have to make overt threats when you have such dominant positions in Europe as Russia now has.

Senator BARRASSO. Well, it is interesting because we had a Foreign Relations Committee hearing specifically on this and talked about Russia. Russia has basically three sources of power. They have energy, they have a military, and they have the cyber. And other than that, not at all.

So thank you very much.

Thank you, Madam Chairman.

The CHAIRMAN. Thank you, Senator Barrasso.

I have one final question here. It was somewhat hinted to, Dr. Grigas, when you talked about, you know, we have this global supply that is coming on. In Alaska, obviously, we are very keenly interested in the opportunities to be able to export our enormous volumes of natural gas.

We are not looking to the European market. We are looking to the Asian market. I believe there is considerable opportunity there, but as we know, if you supply one corner of the globe over here it frees up supply in other areas.

But as Alaska has been working through our process, over decades, to advance our natural gas opportunities, we have seen windows open and we have seen windows close. There was a time when our focus was on supplying the Lower 48. That was a limited window.

As I have mentioned, this is a new world when it comes to domestic energy supply and what technology has allowed us to do. You mentioned the Permian, Mr. Mills. But our reality is that Alaska's gas is probably further away from the Lower 48 than it is from our partners in the Asian market. So we look to that. But we are very acutely aware that windows come and windows go.

So, the question is, are we looking at that here in the United States when it comes to this window of opportunity with Europe? Is this a situation where you will have others that will be able to fill this need which is clearly a demonstrated need in a way that

not only provides them with the supply that they need but the political stability that they are also seeking? Are we in a race with others to gain this market share in Europe?

I will start with you, Dr. Grigas.

Dr. GRIGAS. We certainly are in a race. And if we look at the actions today of Gazprom, we see that they're trying to see the competition that they see. They're trying to secure their European markets. Specifically, they're trying to secure Germany which is their largest natural gas market by building the second line of the Nord Stream II pipeline which would bring additional 55 BCM, billion cubic meters, of Russian gas to Germany.

And they're also trying to secure the markets of Southeast Europe, essentially through their plans of TurkStream, a pipeline that would bring Russian gas directly to Turkey which is their second largest, the second largest Gazprom market in Europe.

So, again, this is a race. They're trying to secure these markets before American LNG, I think, really comes online with full force.

The CHAIRMAN. Let me, if I can interrupt there though and just ask, outside of Russia. Let's just say that Europe rejects, they say, we do not want to be partnering with Russia. We have seen this resource used as a political weapon in the past. We reject that.

Now I am not suggesting that that is actually going to happen, but let's just consider it for discussion sake here. Who else in this global market could be that supplier?

Mr. Book and Mr. Winberg?

Mr. BOOK. Well, Senator, today the world's largest supplier is Qatar and Australia is right behind. And Qatar has talked about expanding capacity during the conflict they had with Saudi Arabia, that was one of the plans they outlined. They have not yet developed or released additional information to suggest that they would expand capacity, but they have very low-cost gas, very, very cheap gas. So expanding capacity and entering into the world market they would have some of the advantages that adhere to the Permian associated gas Mr. Mills mentioned and the advantages here in the U.S. of exporting it.

To the extent that there's a time window or there's a time horizon, the spot market is still 30 percent of LNG today, give or take. And so, there is actually a contract opportunity to be had in a world that is still predominantly a contracted market. If you think about it that way, then yes, there is a time window because of contracts. If you think about the shorter contract life then it's not necessarily that the window stays closed forever. We'll get a second bid at some of that same market either in next contract or more spot future.

The CHAIRMAN. Assistant Secretary.

Mr. WINBERG. Just to expand a little bit on what Mr. Book said. Qatar does about 39 billion cubic feet a day. Australia about 11. I said earlier that within the next year and a half we're going to be up to that 11 billion cubic feet. That means that we are going to be surpassing Indonesia, Nigeria, and Malaysia and, in fact, we probably already have passed at least a couple of them. So we're moving up that chain very quickly. Qatar at 39 billion. It will take a while to eclipse them, but we can get right behind them.

And as LNG becomes more liquid it becomes very much a commodity play out there. And so, there are opportunities as there is more liquidity built into the market because of supply. There are market—there are opportunities for short-term, mid-term and long-term contracts to meet whatever market need the customer has. So I think we're not behind. We're, well, maybe we are a little behind, but we're catching up very quickly.

And as I mentioned, once we get beyond the 11 billion cubic feet that's coming on in the next year and a half, we still have another 10 billion cubic feet that the DOE has authorized. So, that gives us a lot of head room to play in this global market.

The CHAIRMAN. Mr. Slocum.

Mr. SLOCUM. Yeah, I think, in thinking about just about how quickly things have changed that you alluded to there were very few that predicted the fracking boom in the United States. And we're in the middle of a number of disruptive changes within the energy sector and particularly in the electric power sector.

And so, I think when you talk about a window of opportunity, we have to keep in mind that things are moving very quickly. And what I'm talking about is renewables actively displacing gas in the electric power sector.

In two big U.S. power markets, Texas and California, we have seen owners of natural gas generators make formal requests to change market rules because they are claiming that there is so much abundant, inexpensive renewable energy in the California and Texas markets that it's rendering superefficient, combined cycle natural gas power plants to become uneconomic. And that's not even with energy storage advancements that are being predicted in the next couple of years.

And so, if it's happening in big disparate markets in the United States, it's going to be happening in Europe and China. And I think we have to think long and hard before we make legal changes to public interest standards, before we commit to significant capital investment for natural gas exports. Are we already missing that window of looking into what role renewables are going to have in displacing gas in the next several years in electric power markets?

Thank you.

The CHAIRMAN. It is a dynamic world out there, isn't it? It just is. Wow. Which is why this is so great. These are extraordinary opportunities for our country right now. And there is so much in flux. I think we recognize that.

But to be in a position to be a player, to be in a position to wield some influence for good. I think back to several years back when a first initial shipment of LNG came into, I believe, was it Lithuania?

Dr. GRIGAS. Lithuania.

The CHAIRMAN. Lithuania. And they dubbed the LNG tanker the Freedom because they said this represented, to them, freedom from reliance on, not necessarily reliance, but that first step toward having a more secure, more friendly supply of a resource that they desperately needed.

So it is an interesting time, an important time for the United States when it comes to recognizing our energy abundance and how

that can be used for the good, for the good of those here in this country and our friends and our allies, the good of our environment and that is why it is good to be part of the Energy Committee.

I appreciate the time that you have given us all this morning, and I will continue this conversation later, but we now stand adjourned.

[Whereupon, at 11:43 a.m. the hearing was adjourned.]

APPENDIX MATERIAL SUBMITTED

U.S. Senate Committee on Energy and Natural Resources
The Role of U.S. Liquefied Natural Gas in Meeting European Energy Demand
Questions for the Record Submitted to Mr. Steven E. Winberg

September 13, 2018

QUESTION FROM RANKING MEMEMBER MARIA CANTWELL

Q1. Does DOE's public interest determination for LNG export facilities account for where the LNG cargos will be delivered? Is there any accounting for helping our allies in Europe?

A1. The Department of Energy's (DOE) authority to regulate the export of natural gas arises under section 3 of the Natural Gas Act (NGA), 15 U.S.C. § 717b. This authority is vested in the Secretary of Energy and has been delegated to the Assistant Secretary for Fossil Energy.

Section 3(a) of the NGA sets forth the standard for review of most LNG export applications:

"No person shall export any natural gas from the United States to a foreign country or import any natural gas from a foreign country without first having secured an order of the [Secretary of Energy] authorizing it to do so. The [Secretary] shall issue such order upon application, unless, after opportunity for hearing, [he] finds that the proposed exportation or importation will not be consistent with the public interest. The [Secretary] may by [his] order grant such application, in whole or part, with such modification and upon such terms and conditions as the [Secretary] may find necessary or appropriate."

The Department has consistently interpreted section 3(a) as creating a rebuttable presumption that a proposed export of natural gas is in the public interest. Under this provision, DOE performs a thorough public interest analysis before acting on applications to export natural gas to non-free trade agreement countries. As part of the public interest analysis, DOE considers the international consequences of its decisions. The United States' commitment to free trade is one factor bearing on that review. An efficient, transparent international market for natural gas with diverse sources of supply provides both economic and strategic benefits to the United States and our allies. Increased production of domestic natural gas has significantly reduced the need for the United States to import LNG. In global trade, LNG shipments that would have been destined to U.S. markets have been redirected to Europe and Asia, improving energy security for

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many of our key trading partners. To the extent U.S. exports can diversify global LNG supplies, and increase the volumes of LNG available globally, it will improve energy security for many U.S. allies and trading partners. As such, authorizing U.S. exports may advance the public interest for reasons that are distinct from, and additional to, the economic benefits identified in the macroeconomic studies DOE has commissioned that examine the economic impacts of LNG exports.

Our allies across the globe, including those in Europe, will benefit from increased amounts of U.S. LNG exports on the world market, which will help Europe diversify its energy supplies and reduce dependence on natural gas supplies from nations such as Russia that have used natural gas supplies as a political weapon.

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QUESTIONS FROM SENATOR DEBBIE STABENOW

Q1. It is my understanding that the Chinese government intends to build up to seven high-capacity ethane crackers, and that the United States is the only country that exports ethane. Where do you think China will get its ethane? Is it reasonable to conclude that the United States could better use this ethane to support American jobs and domestic manufacturing?

A1. According to data reported by the U.S. Energy Information Administration (EIA), the three largest importers of U.S. ethane exports are Canada, India, and the United Kingdom. China has not received ethane exports from the U.S.[1] DOE cannot speculate on where China will get its supply of ethane moving forward.

Increased domestic ethane production, driven by the shale revolution, has led to new investments in the domestic petrochemical sector. From a recent "This Week in Petroleum" released by EIA:

"Between 2012 and 2016, EIA estimates that more than 2.1 million metric tons per year (MMmt/yr) of new U.S. petrochemical cracking capacity came online, all in the form of plant restarts or capacity expansions, translating into approximately 130,000 barrels per day (b/d) of new ethane demand. In 2017, two new cracking facilities in Texas, combined with multiple expansions at existing cracking facilities elsewhere along the U.S. Gulf Coast, increased demand for ethane as a petrochemical feedstock by an estimated 160,000 b/d. So far in 2018, 3.0 MMmt/yr of additional cracking capacity has come online on the U.S. Gulf Coast, adding approximately 180,000 b/d of ethane demand.[2]"

Q2. My primary interest is in ensuring Michigan families and manufacturers have abundant and affordable supplies of gas to warm their homes and power their businesses.

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[1] U.S. Energy Information Administration. "Exports by Destination." Accessed September 28, 2018. Available at https://www.eia.gov/dnav/pet/pet_move_expc_a_EPLLEA_EEX_mbblpd_m.htm.
[2] U.S. Energy Information Administration. "This Week in Petroleum." September 26, 2018. Available at https://www.eia.gov/petroleum/weekly/.

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Right now, U.S. natural gas prices are low as compared to almost any other country in the world. Henry Hub prices are around $3 per MMBtu, meanwhile spot LNG goes for $11 or $12 in Asia. The United States is currently not exporting enough LNG volume to connect our prices to the higher global market; and thus, domestic supply and demand is the primary determinant of our prices.

I am concerned about this Administration's readiness to ramp up LNG exports and expose U.S. prices to the global market. The Department of Energy's recent study, Macroeconomic Outcomes of Market Determined Levels of U.S. LNG Exports, seems to suggest this Administration is willing to let the global LNG market determine demand rather than limit exports to a level that would protect U.S. prices from the global market. Would you please explain how a "market determined" export level is in the public interest when it will result in connecting U.S. prices to higher global prices and volatility? Would the Department of Energy support a policy that ensures LNG exports are limited to levels that ensure U.S. prices are insulated from the global market? If the answer is no, please explain why.

A2. Numerous studies, commissioned by DOE and others, have shown that scenarios with increased U.S. LNG exports will have a marginal impact on U.S. natural gas prices. The most recent study commissioned by DOE was completed by NERA Economic Consulting this year. This 2018 LNG Export Study (2018 Study) examined the probability and macroeconomic impact of various U.S. LNG export scenarios and includes baseline scenarios based on the U.S. Energy Information Administration's (EIA) Annual Energy Outlook 2017. The 2018 Study judged the more likely range of LNG exports in 2040 to range from 8.7 to 30.7 billion cubic feet per day (Bcf/d). This assessment was based on a probabilistic analysis of 54 different scenarios that were constructed for the study. Under Reference case supply assumptions, prices are in a narrow range when international LNG demand varies across the scenarios considered.

The 2018 Study also shows that any higher levels of natural gas exports are met by increases in domestic production over diversion from domestic uses which should serve to further insulate the U.S. market from price impacts due to exports.

The vast supplies of natural gas currently being produced in the United States and the greater production levels expected in the future support low and stable Henry Hub natural

gas prices for the foreseeable future. The Energy Information Administration's (EIA) most recent *Annual Energy Outlook 2018* (AEO), released on February 6, 2018, shows steady increases in the level of dry natural gas production out to 2050, reaching 117 billion cubic feet per day in 2050 in the Reference Case, when LNG export levels are expected to be at 14 Bcf/d and Henry Hub prices at just $5.01/MMBtu in 2017 constant dollars. In fact, in the period examined in AEO 2018 in the Reference Case, Henry Hub natural gas prices grow only an average 1.5% annually out to 2050. At $5.01 in 2050 in 2017 constant dollars, the Henry Hub price in 2050 is projected to be less than the price of natural gas at Henry Hub in 2008, $8.86.[i]

Finally, allowing market-based LNG export levels is self-regulating as higher U.S. gas prices will serve to make U.S. LNG exports less competitive in the global market and thus reduce export levels.

Q3. As you are aware, China is the third largest buyer of U.S. LNG. According to the Energy Information Administration, U.S. LNG exports to China increased six-fold from 2016 to 2017. China accounted for nearly 15 percent of U.S. LNG exports in 2017, and the EIA anticipates U.S. LNG exports to China will continue to increase to meet the country's growing natural gas demand. In that case, what is to say additional U.S. LNG exports will not be shipped to China as opposed to our European allies? Is it possible that increased LNG exports would play a greater role in contributing to China's manufacturing advantage than promoting Europe's energy security?

A3. U.S. LNG export destinations are driven by commercial arrangements. Through the end of July 2018, 56 cargos of U.S. lower 48-states domestically produced LNG, totaling 189.5 billion cubic feet of natural gas, landed in China. During the same period, 44 cargos of U.S. LNG, totaling 142.4 billion cubic feet of natural gas, landed in Europe. Increased amounts of U.S. LNG on the world market will displace natural gas supplies available globally to the benefit of all importing countries. Increased supplies of U.S. natural gas on the world market will help ensure that Europe has a more diversified supply of energy.

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Q4. What is the single greatest factor for whether and how much LNG is exported by the United States? Is it the FERC review process or market dynamics such as price?

A4. Market dynamics will ultimately determine the amount of LNG that will be exported from the United States. To date, DOE has approved 21.35 billion cubic feet of natural gas that can be exported to any country in the world not prohibited by U.S. law or policy. This approved amount is primarily spread across 10 large-scale projects: six of these projects are in various states of construction and operation, and four have not yet secured financing to support a final investment decision.

[i] https://www.eia.gov/dnav/ng/hist/rngwhhdA.htm

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Questions for the Record Submitted to Mr. Kevin Book

Questions from Chairman Lisa Murkowski

Question 1: What other regulatory, non-trade barriers exist that would slow or prevent the U.S. increasing LNG exports to Europe, or to any other country for that matter?

Thank you for the question, Madam Chairman. Section 3(a) of the *Natural Gas Act* (NGA) states that the Department of Energy shall issue orders authorizing natural gas exports to foreign countries that do not have free trade agreements (FTAs) with the United States "upon application, unless, after opportunity for hearing, it finds that the proposed exportation or importation will not be consistent with the public interest."

During the relatively short history of LNG exports from the lower 48 States, questions as to whether – and how – the Department might evaluate the public interest implications of LNG exports have emerged from project sponsors, investors and would-be overseas buyers. Some of these parties have, from time to time, expressed concerns that uncertainties associated with this permitting process and/or changes to the Department's practices could negatively impact financing, construction or trade. In practice, however – notwithstanding intervals of uncertainty – the Department's public interest determinations to date have been affirmative, and therefore would not appear to have imposed binding constraints on project development.

The Department might be able to move more expeditiously by continuing to contract for, complete and disseminate studies of LNG exports well in advance of anticipated non-FTA export applications. Alternatively, the Department might be able to forego them entirely. While the Department's solicitation of macroeconomic analyses from consulting firms and the Energy Information Administration (EIA) to inform public interest decisions seems prudent, repeated studies conducted to date have validated the economic case for exports well in excess of those likely in the intermediate term. It may be that empirical data – especially if export volumes continue to rise in the absence of untoward domestic price impacts – could offer an evidentiary basis that makes future studies unnecessary.

Consummation of a trade deal between the European Union and the U.S., such as the one conceived in the July 25 meeting between European Commission President Jean-Claude Juncker and President Donald Trump, could also simplify LNG exports to the E.U., because such exports would be deemed to be consistent with the public interest under Section 3(c) of the NGA.

In any case, much of the real-world regulatory latency to date has emerged in conjunction with environmental reviews for LNG facilities conducted by the Federal Energy Regulatory Commission (FERC). As I noted in my testimony, faster throughput by the FERC can help speed up project development and – when projects with completed environmental reviews receive affirmative final investment decisions (FIDs) – export volumes. As I also noted, the relatively brisk timelines in the Schedules for Environmental Review (SERs) the FERC released on August 31 for ten new LNG export projects (and its reissue of SERs for two others) may point towards a regulatory debottlenecking.

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Long-term infrastructure decisions require parties at every stage of the value chain to make capital commitments in the absence of perfect information. As a result, any significant uncertainty can lead project sponsors to delay FIDs or to abandon projects entirely in favor of other investment opportunities that exhibit higher risk-adjusted returns. In this context, efforts by U.S. Government agencies or state oversight bodies to improve the transparency of the permitting for facilities and related/supporting infrastructure upstream of liquefaction terminals themselves could increase the speed and volume of U.S. LNG exports.

Question 2: What are the benefits that have accrued to our economy since 2016 when the U.S. began exporting larger volumes of LNG?

Madam Chairman, our firm does not maintain a sufficiently precise model of the U.S. economy as a whole for me to specifically quantify the benefits, but I believe I may be able to describe some of them anecdotally. According to U.S. Census data, the nominal value of gross monthly LNG exports (HS code 271111) from all ports between January 2016 and August 2018 totaled approximately $7.9 billion. There are several ways one might interpret that number.

On a cursory, financial basis, those $7.9 billion reflect revenues realized by U.S. businesses and overseas businesses operating in the U.S. that feed back into local economies – not just in states with nexus to production, transportation, liquefaction and shipping – but also more broadly, due to the interconnected nature of interstate commerce and distributed value chains. On a second-order basis, dollars recycled within those economies contribute further to economic expansion through a "multiplier effect." On a third-order basis, the U.S. federal government, state governments derive tax revenue from those revenues over and above severance taxes, royalties and associated fees. Finally, although economists may hold differing views regarding the extent to which trade deficits help or hurt the U.S. economic security, LNG exports contribute towards the narrowing of goods trade deficits, albeit in a limited fashion (exports of higher-value commodities, such as crude oil and refined products can make a bigger dent).

LNG exports can also contribute to job creation in several ways. Due to their vast scale and engineering complexity, LNG facilities can provide multi-year, well-paying jobs to hundreds to thousands of skilled laborers, with attendant tax benefits and multiplier upside. Pipeline construction to support LNG facilities can offer similar opportunities. In addition, transporting and liquefying associated gas from oil-prone wells can generate value for lessors and lessees of resource-bearing lands (including federal lands), not just by monetizing a resource that might otherwise be stranded (or flared), but also by enabling liquids production that might be constrained by gas takeaway limitations. Both of these revenue streams also contribute to employment in the oil and gas industry and in supporting sectors, including oilfield services, lodging and hospitality.

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Question 3: Based on your testimony, there appears to be a "window" of opportunity and some hurdles that need to be cleared in order to strengthen our energy relationship with Europe.

- Is one of the limitations right now how quickly our liquefaction capacity can grow to meet this window of opportunity?
- How long will this window be open for the United States before another country with the ability to export gas seizes this opportunity? Who are our competitors for the European market?

Whether one uses projections furnished by the EIA, the International Energy Agency (IEA) or industrial players who publish their intermediate- and long-term outlooks, growing global natural gas consumption points towards additional LNG demand opportunities in the five-to-eight-year timeframe (i.e., calendar years 2022-2025), and potentially much sooner. Absent a significant and/or sustained global economic slowdown or without the advent of unanticipated new technologies, this window of opportunity seems likely to remain open until demand or supply dynamics close it.

As a gross generalization, energy investment cycles tend to last roughly five years as a function of project complexity and technology diffusion latencies. Thus, if LNG were to command a sustained premium, destination countries might begin to source natural gas by alternative means (e.g., endogenous production or pipeline imports). Similarly, a flood of new market entrants could erode premiums and once again eliminate the financial case for U.S. investment.

Any country building incremental liquefaction capacity theoretically has potential to satisfy new demand opportunities – in Europe or elsewhere – subject to the willingness of suppliers to deliver LNG at prices that destination markets offer. In addition, any country with sufficient gas resources and access to adequate capital can theoretically compete to play in these LNG markets of the future. In short, the only countries with resources and capital that sure to miss the window of opportunity are those that are unwilling or unable to expeditiously add export capacity.

Qatar is home to a low-cost resource and currently the largest LNG supplier to the world, and also one proximate to Atlantic and Pacific Basin markets. As such, Qatar could emerge as a fierce competitor. Last month, Qatar Petroleum announced plans to expand production from 77 MM t/Y (~10.1 Bcf/d) to 110 MM t/Y (~14.5) by the middle of the next decade, upping its original plans. The shorter tenor of recent-vintage LNG contracts also may favor sovereign exporters, because they do not need to source capital from private investors.

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Questions from Ranking Member Maria Cantwell

Question 1: Why is European LNG import capacity utilization around 20-30%?

Thank you for the question, Senator Cantwell. Europe's low capacity utilization relative to global averages appears to stem, in part, from the Continent's significant ongoing reliance on contracted pipeline imports, not just from Russia, but also from Norway. The lower LNG utilization also tends to reflect lower landed prices for gas in Europe relative to other LNG destination markets. Simply put, some sellers of LNG cargoes may not be willing to sell to European buyers at prices those buyers are willing to pay, or to sell according to contract terms proffered by those buyers.

At the same time, as I mentioned in my testimony, this low average utilization rate glosses over a fairly broad variability. For example, Italy's Adriatic LNG Terminal averaged approximately 78% capacity utilization in the twelve months through September 2018, according to Gas Infrastructure Europe (GIE) data. The Rotterdam Gate terminal in the Netherlands, by contrast, averaged roughly 4.5% capacity utilization over the same interval. This variability sometimes reflects gaps or bottlenecks in European gas transmission infrastructure. It also sometimes reflects regulatory barriers and different country-level consumption and/or consumption growth.

Question 2: What are the largest factors that drive the destination of LNG exports from the United States?

The competitiveness of U.S. LNG exports tends to be a function of both price and proximity (which factors into price). U.S. exporters generally price their cargoes based on the natural gas price at the Henry Hub, in Erath Louisiana, the delivery point for the CME Group natural gas futures contract. Contracted prices usually include an energy surcharge (often 15%), exclusive of shipping and regasification costs. By contrast, LNG contracts from other destinations often price in proportion to agreed-upon crude oil benchmark prices. For example, contracts for Tokyo Harbor deliveries frequently price relative to the Japanese Customs-Cleared crude price (JCC) using a coefficient that varies with crude price so that it flattens at extreme highs and lows (sometimes called an "S-curve" because of its shape).

In this context, U.S. exports may look more competitive to buyers when global crude prices are high and Henry Hub prices are low and less competitive when the reverse is true. When oil prices are low, shipping distances can make a difference, too. Even when U.S. LNG cargoes traverse the Panama Canal, the maritime distance from the Gulf of Mexico to the Tokyo Harbor is about twice as far as the route from Western Australia (and Panama Canal fees add to the differential cost of shipping from the U.S.). Notably, several first-wave U.S. LNG facilities pursued financing for their construction at a time shortly after the March 2011 Fukushima nuclear accident created a substantial Asian LNG premium and high crude oil prices helped to make Henry Hub-priced contracts look highly competitive.

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Questions from Chairman Lisa Murkowski

Question 1: You have mentioned that the Nord Stream II and Turk Stream pipelines and the new Yamal LNG export terminal will allow Russia to further expand its role in European gas markets. In your opinion, does the U.S. have the regulatory policy and infrastructure in place to significantly ramp up LNG exports to Europe? Does Europe currently have the LNG import terminals they need to accept more American energy? If not, does Europe have enough LNG import projects under development?

Dr. Grigas: There are numerous new U.S. LNG export terminals in the planning stages and ones that will be completed in the coming years. More domestic pipeline infrastructure will be needed to connect the gas producing regions, collect the currently flared gas and deliver to regions with export facilities.

In Europe, access to LNG import infrastructure is uneven. For example, Spain has numerous LNG import terminals, with some underutilized, while the largest gas importing country of Germany does not have one. Southeast Europe has limited access to LNG import infrastructure; the planned terminal on the Island of Krk in Croatia would be a significant development. Outside of LNG import structure, European states that do not have coastal access would need to develop pipeline interconnectors with neighboring coastal states in order to access LNG from the global markets. As a contractor to a national lab, I cannot comment on the question of U.S. regulatory policy.

Question 2: What regulatory, non-trade barriers exist that would slow or prevent the U.S. increasing LNG exports to Europe, or to any other country for that matter?

Dr. Grigas: Currently, federal law requires the approval of natural gas exports to countries that have an FTA (free trade agreement) with the United States. For countries that do not have an FTA with the U.S., the Natural Gas Act directs the Department of Energy to grant export authorizations unless the exports are not deemed to be "consistent with public interest" in this case. The following countries have are U.S. FTA Partner Countries: Australia, Bahrain, Chile, Colombia, DR-CAFTA (Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Nicaragua), Israel, Jordan, Morocco, NAFTA (Canada & Mexico), Oman, Panama, Peru, Singapore, South Korea. The countries that are currently eligible to receive U.S. LNG exports either because they FTA countries or because they have received authorization by the DOE are: *Australia*, Argentina, *Bahrain*, Brazil, *Canada*, Chile, China, Colombia, *Costa Rica*, Dominican Republic, Egypt, *El Salvador, Guatemala, Honduras*, India, Israel, Italy, Japan, Jordan, Kuwait, Lithuania, Malta, Mexico, *Morocco*, Netherlands, *Nicaragua, Oman*, Pakistan, Panama, *Peru*, Poland, Portugal, *Singapore*, South Korea, Spain, Taiwan, Thailand, UAE, UK.[1] As a contractor to a national lab, I cannot evaluate U.S. regulatory policy.

[1] Italicized countries represent ones that are eligible but have not yet received US LNG cargo.

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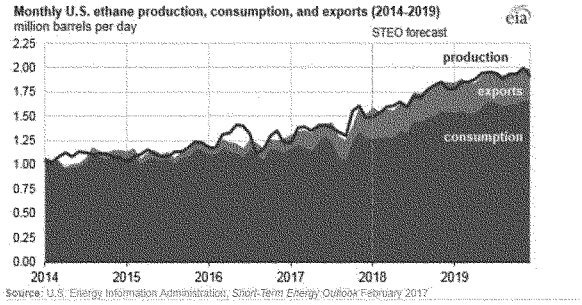
Questions from Senator Debbie Stabenow

Question 1: It is my understanding that the Chinese government intends to build up to seven high-capacity ethane crackers, and that the United States is the only country that exports ethane. Where do you think China will get its ethane? Is it reasonable to believe that the United States could better use this ethane to support American jobs and U.S. manufacturing? Lastly, do you think the Department of Energy's public interest determination sufficiently considers U.S. consumer pricing and U.S. competitiveness for domestic manufacturing?

Dr. Grigas: According to data (see graph below) of the U.S Energy Information Administration (EIA), over the past few years the United States has produced more ethane than it has consumed domestically, resulting in the export of some of that production. According to forecasts, this trend is expected to grow. The recent U.S. industrial revival has been driven at least in part by shale boom, which has made natural gas and natural gas liquids (NGL), including ethane, more abundant and affordable. The growth of America's natural gas industry and the NGL industry depends on having broad and deep markets both domestic and globally. The robustness of America's natural gas industry, which lowers natural gas and NGL prices, makes the U.S. manufacturing industry (including among others, domestic chemical, fertilizer, and plastics industries) competitive in domestic and global markets. It is true that some natural resources do have economic, political, and geopolitical significance that influences export decisions.



Question 2: As you are aware, China is the third largest buyer of U.S. LNG. According to the Energy Information Administration, U.S. LNG exports to China increased six-fold from 2016 to 2017. China accounted for nearly 15 percent of U.S. LNG exports in 2017, and the EIA anticipates U.S. LNG exports to China will continue to increase to meet the country's growing natural gas demand. In that case, what is to say additional U.S. LNG exports will not be shipped to China as opposed to our European allies? Is it possible that increased LNG exports would

play a greater role in contributing to China's manufacturing advantage than promoting Europe's energy security?

Dr. Grigas: Forecasts show that China's demand for natural gas and LNG imports will only continue to grow in the coming decade and the country will eventually surpass Europe as the largest natural gas importer. A number of countries are currently supplying China and will continue to meet China's demand by piped gas and by LNG: Russia (pipeline and LNG), Turkmenistan (pipeline), Myanmar (pipeline), Australia (LNG), Qatar (LNG), and the United States (LNG).

As stated in the response to Senator Stabenow's Question 1, growth in demand for LNG exports will increase domestic production of dry natural gas and lead to an increased production of NGLs which in turn would encourage the continued abundant supply of NGLs for use in the U.S. manufacturing sector. This is regardless of where the U.S. produced LNG is exported. A new demand outlet for dry gas, such as LNG exports, encourages continued investment in overall production. Therefore, through LNG exports we can further this substantial increase in NGL supply that benefits our domestic manufacturers.

Furthermore, LNG supply in the global marketplace promotes price competition and stability, including in the U.S. Whether the U.S. ships LNG directly to Europe or elsewhere, Europe still benefits. For Europe to benefit, the US export terminals need not satisfy all of Europe's natural gas demand. Europe has multiple sources of supply, including pipelines from Norway and Algeria, coming supply from Azerbaijan, domestic production and storage facilities, and LNG from various origins in addition to piped Russian gas and coming Russian LNG. In the case of a sudden disruption to Europe's supplies, it would take time for American LNG to make its way to Europe. Even if already on the water, tankers require days to redirect and reach new destinations. In the short term, Europe would need to rely solely on resources it has on tap, like own storage caverns, LNG already in terminal tanks, and other pipeline imports - as well as conservation methods.

Over the longer term, however, U.S. LNG serves to safeguard Europe's supplies. Additional supply of LNG from the U.S. into the global gas markets creates greater liquidity and optionality for importers. It gives all gas purchasers, including those in Europe, additional pricing power as consumers, a reliable supply source in case of a prolonged outage, and a new supply source on the margin where prices are set.

Question 3: What is the single greatest factor for whether and how much LNG is exported by the United States? Is it the FERC review process or market dynamics such as price?

The United States energy sector is driven by commercial enterprises. As a result, market dynamics, specifically price, are the greatest factor determining America's LNG exports. As a contractor to a national lab, I cannot comment on regulatory review processes.

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October 11, 2018

U.S. Senate Committee on Energy and Natural Resources
September 13, 2018 Hearing
The Role of U.S. Liquefied Natural Gas in Meeting European Energy Demand

Answers for the Record Submitted by Tyson Slocum

Questions from Ranking Member Maria Cantwell

Question 1: Do you believe DOE's public interest determination prioritizes domestic consumption benefits enough, particularly for maintaining U.S. competiveness?

Answer 1: I do not believe that the current DOE public interest determination prioritizes domestic consumption benefits enough. It appears as though the Department of Energy is trying to justify exports by claiming the higher domestic prices that will result from increased exports will be offset by increased stock prices of natural gas companies—despite the fact that shareholders are concentrated in the wealthiest one percent of Americans. Ignoring the impact on consumer prices runs counter to Supreme Court precedent. The Supreme Court ruled that to give "meaning to the words 'public interest' as used in the Power and Gas Acts, it is necessary to look to the purposes for which the Acts were adopted. In the case of the Power and Gas Acts it is clear that the principal purpose of those Acts was to encourage the orderly development of plentiful supplies of electricity and natural gas at reasonable prices."[1] The Supreme Court had earlier determined that the "primary aim" of the Natural Gas Act was "plainly designed to protect the consumer interests against exploitation at the hands of private natural gas companies . . . We cannot find in the words of the Act or in its history the slightest intimation or suggestion that the exploitation of consumers by private operators through the maintenance of high rates should be allowed to continue provided the producing states obtain indirect benefits from it."[2]

Question 2: Do you believe enough is being done to mitigate the environmental effects, such as methane leaks, of natural gas production? Do you believe that DOE is properly accounting for these environmental issues when considering if LNG exports are in the public interest?

Answer 2: The Trump Administration just moved to repeal methane emission regulations for the natural gas industry. In unveiling the methane emission rollback, the EPA admitted it would result in an increase in the equivalent GHG emission of putting an extra 260,000 cars on the road.[3] For the first time in history, natural gas passed coal to become the second largest source of energy-related greenhouse gas emissions in the United States, behind only petroleum.[4] The

[1] NAACP v. FPC, 425 U.S. 662 (1976)
[2] FPC v. Hope Nat. Gas Co., 320 U.S. 591 (1944)
[3] www.epa.gov/newsreleases/epa-proposes-oil-and-gas-targeted-improvements-package-advance-president-trumps-energy
[4] www.eia.gov/todayinenergy/detail.php?id=36953

lack of any effective federal regulations on methane emissions from natural gas production, transportation, consumption and export risks further increases in U.S. greenhouse gas emissions. FERC's environmental reviews of natural gas infrastructure, including LNG export facilities, fail to include a lifecycle GHG emission analysis.[5] Failure to account for the significant, unregulated climate impacts of methane emissions from LNG infrastructure is inconsistent with the public interest; with the EPA's requirement under the 2007 Supreme Court decision *Massachusetts v EPA*; and with FERC's responsibilities under NEPA.

Question 3: What are some of the reasons why European natural gas consumption is expected to shrink? Should we be focusing more on policies that reduce fossil fuel consumption like prioritizing clean energy and efficiency?

Answer 3: Europe is one of only two regions in the world forecast to have negative growth in natural gas demand over the next five years. One of the driving factors curtailing natural gas demand is the EU's decision to reduce the number of carbon allowances available under the region's greenhouse gas emissions control program, thereby establishing an increase in the carbon floor price. This has the policy effect of promoting renewables while requiring fossil fuels to include a price on their emissions.[6]

Questions from Senator Debbie Stabenow

Question 1: It is my understanding that the Chinese government intends to build up to seven high-capacity ethane crackers, and that the United States is the only country that exports ethane.

Where do you think China will get its ethane? Is it reasonable to believe that the United States could better use this ethane to support American jobs and U.S. manufacturing? Lastly, do you think the Department of Energy's public interest determination sufficiently considers U.S. consumer pricing and U.S. competitiveness for domestic manufacturing?

Answer 1: Much depends on how quickly the current trade dispute with China is resolved. But I believe that when the trade issues are resolved, which I think will happen sooner rather than later, the U.S. will likely emerge as the significant supplier of ethane to China. Facilitating LNG exports forces natural gas price-sensitive U.S. industries to compete with foreign markets for U.S. produced natural gas, undermining the current U.S. competitive advantage.

No, I do not think the Department of Energy's public interest determination sufficiently considers U.S. consumer prices and U.S. competitiveness for domestic manufacturing. As I articulated in Question 1 from Ranking Member Maria Cantwell, it is wrong for the Department of Energy to prioritize the economic impact of increased stock values for natural gas companies over the impact of domestic price increases on households, small businesses and U.S. industry.

Question 2: My primary interest is in ensuring Michigan families and manufacturers have abundant and affordable supplies of gas to warm their homes and power their businesses. Right now, U.S. natural gas prices are low as compared to almost any other country in the world. Henry Hub prices are around $3 per MMBtu, meanwhile spot LNG goes for $11 or $12 in Asia. The United States is currently not exporting enough LNG volume to connect our prices to the higher global market; and thus, domestic supply and demand is the primary determinant of our prices.

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[5] www.ferc.gov/media/statements-speeches/glick/2018/06-15-18-glick.asp
[6] IEA Gas Market Report 2018

I am concerned about this Administration's readiness to ramp up LNG exports and expose U.S. prices to the global market. The Department of Energy's recent study, Macroeconomic Outcomes of Market Determined Levels of U.S. LNG Exports, seems to suggest this Administration is willing to let the global LNG market determine demand rather than limit exports to a level that would protect U.S. prices from the global market. Do you believe that a "market determined" export level is in the public interest when it will result in connecting U.S. prices to higher global prices and volatility? Do you think the Department of Energy should support a policy that limits LNG exports to levels that ensure U.S. prices are insulated from the global market?

Answer 2: I do not believe that a "market determined" export level is in the public interest, as it will absolutely lead to higher U.S. prices, increased price volatility, and will harm America's current industrial competitive advantage. I do believe that the Department of Energy should support a policy that limits LNG exports to levels that ensure U.S. prices are insulated from the global market.

Question 3: As you are aware, China is the third largest buyer of U.S. LNG. According to the Energy Information Administration, U.S. LNG exports to China increased six-fold from 2016 to 2017. China accounted for nearly 15 percent of U.S. LNG exports in 2017, and the EIA anticipates U.S. LNG exports to China will continue to increase to meet the country's growing natural gas demand. In that case, what is to say additional U.S. LNG exports will not be shipped to China as opposed to our European allies? Is it possible that increased LNG exports would play a greater role in contributing to China's manufacturing advantage than promoting Europe's energy security?

Answer 3: I believe that once the current trade spat between the U.S. and China is resolved—and it will be sooner rather than later—U.S. LNG exports will indeed by shipped to China rather than our European allies. Europe is one of only two regions in the world forecast to have negative growth in natural gas demand over the next five years. Indeed, 75% of Europe's existing LNG import terminal capacity is unused, reflecting low demand.[7] While natural gas demand constricts in Europe, appetite for gas in the Asia and the People's Republic of China is growing at an astronomical level. Half of global gas demand over the next five years will come from Asia, with one-third of total global gas demand growth through 2023 coming from China alone. The demand increase has been so great it forced the Chinese government to take emergency action to avoid supply shortages over the last year.[8]

And yes—increased U.S. exports to China will contribute to China's manufacturing advantage rather than promote Europe's energy security. The ability of LNG exports to serve as a form of *commodity diplomacy* is limited because the destination of LNG exports is determined not by the U.S. Secretary of State, but by market forces. With the natural gas market forecast to grow in China and contract in Europe, U.S. LNG exports will therefore "follow the money" and increasingly supply the Chinese manufacturing sector.

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[7] An Overview of LNG Import Terminals in Europe, King & Spalding, 2018.
[8] Gas Market Report 2018, IEA, Pages 23-25

U.S. Senate Committee on Energy and Natural Resources
September 13, 2018 Hearing
The Role of U.S. Liquefied Natural Gas in Meeting European Energy Demand
Questions for the Record Submitted to Mr. Mark P. Mills

Question from Chairman Lisa Murkowski

Question: What other regulatory, non-trade barriers exist that would slow or prevent the U.S. increasing LNG exports to Europe, or to any other country for that matter?

Answer: In addition to the market-dragging impediment that I identified in my testimony – i.e., that legacy legislation requires market participants to get permission (from DOE) to export a domestic product like LNG – the central other drags on speeding up natural gas exports are centered around regulations and the attendant costly delays associated with building pipeline and port infrastructures. Substantial and rapid expansion of both are essential.

Questions from Senator Debbie Stabenow

Question 1: It is my understanding that the Chinese government intends to build up to seven high-capacity ethane crackers, and that the United States is the only country that exports ethane. Where do you think China will get its ethane? Is it reasonable to believe that the United States could better use this ethane to support American jobs and U.S. manufacturing?

Answer: Given that China is a net importer of natural gas, that means on average the feedstock for any new Chinese ethane crackers necessarily comes from other nations, including LNG from the U.S. The same is obviously true for the ethane itself. And, on average, any exporting nation derives greater economic value exporting "value added" product (e.g., ethane) rather than a 'raw' product (e.g., LNG). Given global demand for ethane, there's a good argument for removing barriers to facilitate capital investment in more U.S. ethane crackers. In practice, both can and should happen: more LNG and more ethane exports. The U.S. production capability is more than big enough to accommodate expansion of both.

Question 2: As you are aware, China is the third largest buyer of U.S. LNG. According to the Energy Information Administration, U.S. LNG exports to China increased six-fold from 2016 to 2017. China accounted for nearly 15 percent of U.S. LNG exports in 2017, and the EIA anticipates U.S. LNG exports to China will continue to increase to meet the country's growing natural gas demand. In that case, what is to say additional U.S. LNG exports will not be shipped to China as opposed to our European allies? Is it possible that increased LNG exports would play a greater role in contributing to China's manufacturing advantage than promoting Europe's energy security?

Answer: As LNG becomes, increasingly, a commodity, whether U.S. LNG exports go to China or Europe will have the same general macro-economic effect, and confer on the U.S. the same economic and geopolitical benefits. As for guaranteeing where a commodity will be sold, in all commodity markets there are also counter-parties that often engage in long-term contracts for specific deliveries: one should expect more of that with LNG in both European and Chinese markets. A certain share is and will be designated/contracted for shipment to specific markets.

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As for the competitive advantage issue: U.S. manufacturers have a permanent advantage on gas price compared to any natural gas importing country. Domestic U.S. gas costs to U.S. manufacturers will always be cheaper than LNG delivered to any nation because of the obvious fact of the additional costs of liquefying and transporting natural gas.

Question 3: What is the single greatest factor for whether and how much LNG is exported by the United States? Is it the FERC review process or market dynamics such as price?

Answer: The single biggest factor driving LNG exports is that the U.S. is already producing so much natural gas, and will almost certainty produce far more, that exports constitute the only market that can absorb the output: there are no scenarios in which domestic demand can come close to absorbing the magnitude of existing and future U.S. production. The biggest factor in determining the magnitude and velocity of capital markets ability to build the necessary infrastructures for exports, on the other hand, is mainly in the FERC (and DOE) and environmental review processes.

HEARING TO EXAMINE THE ROLE OF U.S. LNG IN MEETING EUROPEAN ENERGY DEMAND

SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES

SEPTEMBER 13, 2018

FOR THE RECORD

PAUL N. CICIO
INDUSTRIAL ENERGY CONSUMERS OF AMERICA
1776 K STREET, NW, SUITE 720
WASHINGTON, DC 20006
WWW.IECA-US.ORG

SUMMARY POINTS

1. **It is NOT in the public interest to approve LNG export volumes to levels which will connect domestic prices to global LNG market prices, like crude oil is today and which increases U.S. gasoline prices. The U.S. Department of Energy (DOE) has not given this concern any consideration.**

If we do, demand by countries, not domestic supply and demand, will determine U.S. prices. We will have lost our national advantage and our citizens will no longer benefit from these valuable non-renewable resources.

2. **Shipments of U.S. LNG to the EU reduces U.S. manufacturing sector competitiveness relative to the EU manufacturing sector.**

The EU wants access to U.S. natural gas but does not want to give U.S. manufacturing products access to their markets. The U.S. should NOT surrender our competitiveness and to EU demands to remove the Natural Gas Act (NGA) public interest.

3. **The NGA and its non-free trade agreement (NFTA) public interest provision has not been a deterrent to LNG exports going to the EU or anywhere else.**

The DOE has already approved 11 LNG export terminals with nameplate export capacity of 21.4 Bcf/day, an equivalent of almost 29 percent of U.S. demand. Export terminal volume with pending approval is another 32.7 Bcf/d or 44 percent of U.S. demand. Of concern to consumers is that DOE has never declined an export application that has completed the Federal Energy Regulatory Commission (FERC) NEPA process.

4. **The U.S. delivered LNG price to the EU sets a price ceiling for Russia, Qatar, and Norway from which to reduce their price and ensure their market shares. Their costs are lower.**

5. **Although ample EU LNG import capacity already exists, the EU has purchased only 10.6 percent of all cargos from the U.S.**

6. **Availability of U.S. LNG export capacity gives the EU (our allies) the assurances of supply without the obligation to purchase.**

Chairwoman Murkowski, Ranking Member Cantwell, and members of the Senate Committee on Energy and Natural Resources, thank you for this opportunity to provide comments for the record on this important and timely issue.

It is important that the voice of the industrial consumer is heard on this timely public policy debate which negatively impacts our competitiveness long-term. IECA supports exports of LNG as long as export volumes do not connect U.S. prices to global LNG prices. This is what has happened in Australia. Even though they have an abundant supply of natural gas, consumers are paying the net back global LNG price. Prices there were historically in the $3.50 to $4.00/GJ price range and are now $9.00/GJ and suddenly becoming $10.00, $11.00 or $12.00.[1] Australian manufacturing jobs have decreased by almost 17 percent, since Australia started exporting LNG (see figure 1 in the appendix).

What is especially unique about LNG exports is that decisions made today regarding the approval of LNG export terminals will not impact the U.S. for several years out. This is why the U.S. should NOT overcommit on how many terminals are approved. Commitments by the DOE to approve LNG export terminals for 20 to 30 years adds significant financial risk to manufacturers that can impact U.S. investment decisions. It is low-cost shale gas that saved us and has resulted in tremendous investment and job creation and it would be irresponsible public policy to give that competitive advantage away, thereby harming the manufacturing sector.

The U.S. manufacturing sector is in competition with the world's manufacturing complex. And, U.S. production of shale natural gas, natural gas feedstock, and natural gas-fired electric generation is a competitive advantage. The U.S. manufacturing sector consumes 29 and 25 percent of U.S. natural gas and electricity, respectively. According to the Energy Information Administration (EIA), 90 percent of U.S. manufacturing does not have the ability to switch from natural gas, as the dependency upon gas continues to increase (see figures 2 and 3).

IECA member companies are mostly from energy-intensive trade-exposed (EITE) industries. According to EIA, EITE industries consume upward of 80 percent of U.S. manufacturing energy consumption. They are energy price sensitive and produce much of the products that are used by other industries to produce essentially all of the products that consumers use daily.

The Industrial Energy Consumers of America is a nonpartisan association of leading manufacturing companies with $1.0 trillion in annual sales and with more than 1.7 million employees. IECA membership represents a diverse set of industries including: chemicals, plastics, steel, iron ore, aluminum, paper, food processing, fertilizer, insulation, glass, industrial gases, building products, automotive, independent oil refining, and cement.

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[1] Australia Financial Review. "Renewed threat of LNG export curbs as CEOs face fresh grilling. August 30, 2018

COMMENTS FOR THE RECORD

1. **It is NOT in the public interest to approve LNG export volumes to levels which will connect domestic prices to global LNG market prices, like crude oil is today. The U.S. Department of Energy (DOE) has not given this concern any consideration.**

Crude oil provides an important lesson for policymakers on what NOT to do with U.S. LNG export policy. The U.S. has an abundant supply of crude oil. Production continues to increase yet consumers are hurting from the high cost of crude oil and resulting high gasoline prices. U.S. consumers are no longer benefiting from the vast crude oil resources.

The reason is that the domestic price of crude oil is connected to global prices. As global crude oil demand increases from countries across the globe, even though domestic production is increasing, U.S. prices rise. We also import price volatility driven by global political, military, and economic upheavals. And, the LNG market that is even more troublesome.

First, the global LNG market is not a real market. The U.S. natural gas market is a real market. U.S. prices are determined by domestic supply versus demand. Suppliers are publicly owned-companies with shareholders and transparency versus several global LNG suppliers are state owned enterprises. U.S. prices are transparent on exchanges, hubs, or pricing basis points throughout the country, which gives all buyers and sellers equal access to market and price information from which decisions are made. There are lots of sellers and buyers. No one has market power and federal agencies provide market oversight to prevent manipulation. There is no manipulation of price or tying agreements to the price of other commodities. There are no memorandums of understanding between large groups of buyers to work together to purchase at lower prices as there is in the global LNG market.

Second, global LNG buyers are countries, not companies like a manufacturer that are accountable for a profit or loss and no automatic cost pass through. The entities who purchase the LNG are either state-owned enterprises (SOEs) or fully regulated utilities with automatic cost pass-through. This will be especially troublesome longer term when we shift from an oversupply of global LNG capacity to a short fall of capacity because these entities have the capability to pay any price, no matter how high, to purchase LNG to keep their country's lights on and manufacturing humming. They operate with the full backing of their governments.

As these global LNG buyers pull on U.S. supply of natural gas, U.S. prices of natural gas and electricity will increase. The same effect that global demand on crude oil is having on gasoline prices. This will be especially troublesome in the winter. The majority of LNG dependent countries have winters when we do. In some countries, natural gas is government subsidized so that the high global LNG market price is never fully passed onto their manufacturing and electric generation companies. So, while our domestic price would increase, others may not.

Given the above, manufacturers have every reason to be concerned that the DOE will wrongfully accept an approach of letting markets determine the levels of approved LNG

exports, rather than limiting approval of applications to export in order to ensure that U.S. domestic prices will not be connected to global prices.

This is the approach taken in the DOE's most recent LNG export study entitled, "Macroeconomic Outcomes of Market Determined Levels of U.S. LNG Exports."[2] We can only assume that this study will be used to justify approval of more LNG export terminals.

Based upon what has happened with the crude oil/gasoline markets and the realities of the global LNG market, letting the market determine the levels of U.S. LNG exports is a recipe for economic failure. A public policy failure. A failure of the DOE to live up to the responsibilities it has under the NGA, which states to put the public interest first. U.S. policymakers should not relinquish control of our natural gas resources to government-controlled state-owned enterprises and utilities.

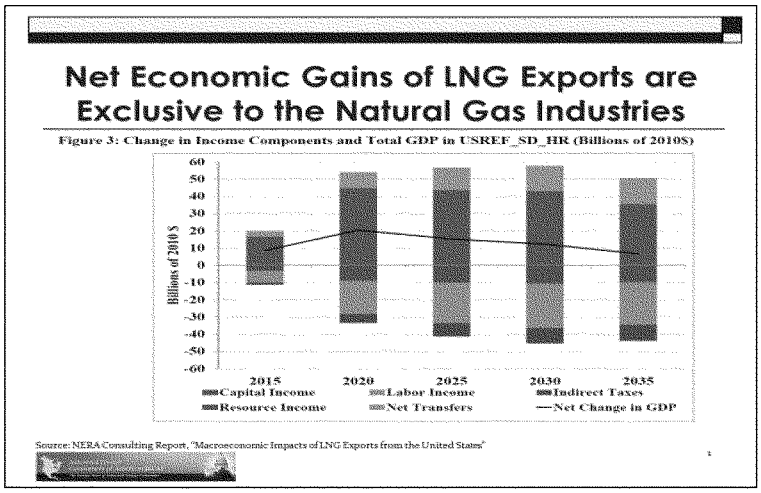
2. Shipments of U.S. LNG to the EU reduces U.S. manufacturing sector competitiveness relative to the EU manufacturing sector.

The EU wants access to U.S. natural gas, but does not want to give U.S. manufacturing products access to their markets. The U.S. should NOT surrender our competitiveness to EU demands to remove the NGA's public interest. It was the wisdom of Congress which concluded that shipments of LNG to countries with free trade agreements (FTA) could have unfettered access to our natural gas, but that LNG shipments to NFTA countries should not, unless it can be proven that such shipments are in the public interest.

Every study conducted by the DOE shows that LNG exports increase U.S. prices, reduces wages, reduces investment (other than investment in natural gas-related business), reduces relative manufacturing competitiveness, and reduces the price of natural gas to other nations (thereby reducing the price of natural gas to their manufacturing sector).

Macroeconomic conclusions that LNG exports provide a net economic benefit prove our point that LNG exports to NFTA countries are not in the public interest. See figure below which is copied directly from the DOE study entitled "Macroeconomic Impacts of LNG Exports from the United States". All DOE studies show there is a small net economic benefit of roughly 0.05 percent of GDP. All of the economic benefits go to only one segment of the economy, the natural gas production and export entities, and all other parts of the economy lose net economic benefits. It is not possible that this interpretation of the NGA public interest is what Congress intended, that one industry become a winner and everyone else, including homeowners, farmers, and the manufacturing sector become losers.

[2] https://www.federalregister.gov/documents/2018/06/12/2018-12621/study-on-macroeconomic-outcomes-of-lng-exports



3. The NGA and its non-free trade agreement (NFTA) public interest provision has not been a deterrent to LNG exports going to the EU or anywhere else.

The U.S. DOE has already approved 11 LNG export terminals with nameplate export capacity of 21.4 Bcf/day, an equivalent of almost 29 percent of U.S. demand. Export terminal volume with pending approval is another 32.7 Bcf/d or 44 percent of U.S. demand. Of concern is that DOE has never NOT approved an application that has completed the FERC NEPA process. The prospects of the DOE approving the combined approved and pending volume of 54.1 Bcf/day is extremely concerning (see figure 4).

4. The U.S. delivered LNG price to the EU sets a price ceiling for Russia, Qatar, and Norway from which to reduce their price and ensure their market shares. Their costs are lower.

Russia, Qatar, and Norway have lower delivered natural gas costs to the EU than the U.S. They are government-based entities that have the unique ability to conduct themselves differently in the market place in order to assure a revenue stream for their governments. Combined, this means that U.S. LNG exporters will have a difficult time competing with them.

As long as Russia, Qatar, Norway, and the world have spare natural gas capacity, they will likely keep their prices below U.S. delivered prices. And, as long as Russia and Qatar cannot sell their gas for higher prices elsewhere, it will likely be difficult for the U.S. to gain significant market shares.

The above points provide further evidence that IECA consistently makes about the LNG market, in that it is not a market. Major LNG suppliers and buyers are government-based entities that under certain market conditions disadvantage U.S. producers and consumers.

5. Although ample EU LNG import capacity already exists, the EU has purchased only 10.6 percent of all cargos from the U.S.

Since the U.S. began shipping LNG in February of 2016, the EU has purchased only 42 cargos of 396 or 10.6 percent of all shipments (see figures below). And, it is not because the EU does not have LNG import capacity. The World Gas LNG Report states that the EU has 20.3 Bcf/day of import capacity. The U.S. DOE has already given final approval of 21.4 Bcf/day to export to NFTA countries, a volume that is greater than the EU's total import capacity.

Shipments of Domestically-Produced LNG Delivered (cumulative starting from February 2016 through May 2018)

Country	# of Cargos	Volume (Bdf/d)	% of Total Exports
FTA Countries			
Mexico	72	0.68	18.8%
South Korea	69	0.65	18.1%
Chile	24	0.20	5.6%
Jordan	20	0.18	5.1%
Dominican Republic	6	0.04	1.1%
Panama	2	0.009	0.3%
Israel	1	0.009	0.2%
Colombia	1	0.004	0.1%
FTA Totals	**195**	**1.77**	**49.3%**
NFTA Countries			
China	53	0.49	13.7%
Japan	28	0.27	7.6%
India	18	0.17	4.8%
Argentina	16	0.13	3.6%
Turkey	12	0.11	3.1%
Brazil	12	0.09	2.6%
Kuwait	10	0.09	2.6%
Spain	11	0.09	2.5%
Portugal	8	0.07	2.0%
Egypt	5	0.05	1.3%
U.A.E.	5	0.05	1.3%
Pakistan	5	0.04	1.2%
Taiwan	5	0.04	1.2%
Italy	3	0.03	0.8%
United Kingdom	3	0.03	0.7%
Lithuania	2	0.02	0.5%
Netherlands	2	0.02	0.5%
Poland	1	0.009	0.3%
Thailand	1	0.008	0.2%

Country	# of Cargos	Volume (Bdf/d)	% of Total Exports
Malta	1	0.002	0.1%
NFTA Totals	**201**	**1.81**	**50.7%**
Grand Totals	**396**	**3.58**	**100.0%**

Source: LNG Monthly, U.S. Department of Energy, https://www.energy.gov/fe/listings/lng-reports

EU LNG Receiving Terminals by Capacity

Country	Terminal	Start Year	Capacity (MTPA)
UK	South Hook	2009	15.6
UK	Grain LNG	2005	15.0
Spain	Barcelona	1969	12.8
France	Dunkirk	2017	9.5
Spain	Huelva	1988	8.9
Spain	Cartagena	1989	8.9
Netherlands	GATE	2011	8.8
France	Montoir-de-Bretagne	1980	7.3
Spain	Saggas (Sagunto)	2006	6.7
Belgium	Zeebrugge	1987	6.6
France	Fos Cavaou	2010	6.0
Portugal	Sines	2004	5.8
Italy	Adriatic	2009	5.8
Spain	El Musel	2013	5.4
Spain	Bahia de Bizkaia Gas	2003	5.1
UK	Dragon	2009	4.4
Poland	Swinoujscie	2016	3.6
Greece	Revithoussa	2000	3.3
Lithuania	Klaipeda	2014	3.0
Italy	FSRU Toscana	2013	2.7
Spain	Mugardos	2007	2.6
Italy	Panigaglia	1971	2.5
France	Fos Tonkin	1972	2.2
Total Capacity			**152.5 MTPA (20.3 Bcf/d)**

Source: World Gas LNG Report – 2018 Edition, International Gas Union (IGU)

6. Availability of U.S. LNG export capacity gives the EU (our allies) the assurances of supply without the obligation to purchase.

The DOE approved LNG export volumes of 21.4 Bcf/day for shipment to NFTA countries, which is a lot of volume, especially when compared to EU's capacity to import. Exporting more LNG to the EU is a price issue.

APPENDIX

Figure 1

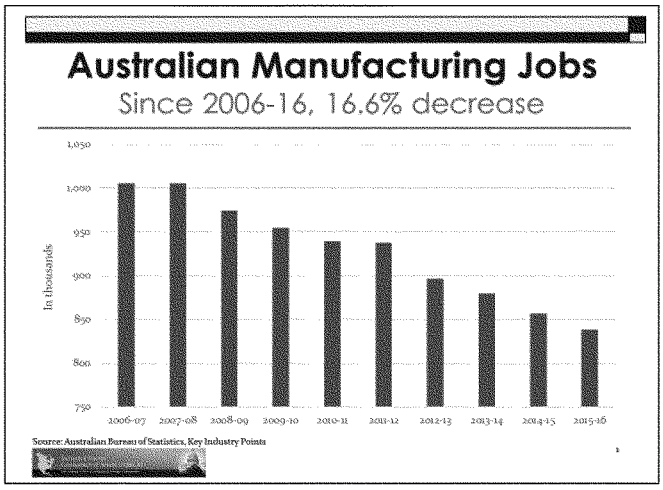


Figure 2

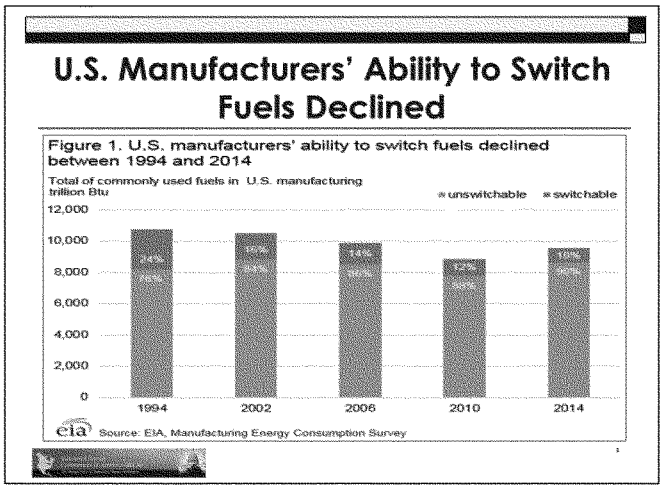


Figure 3

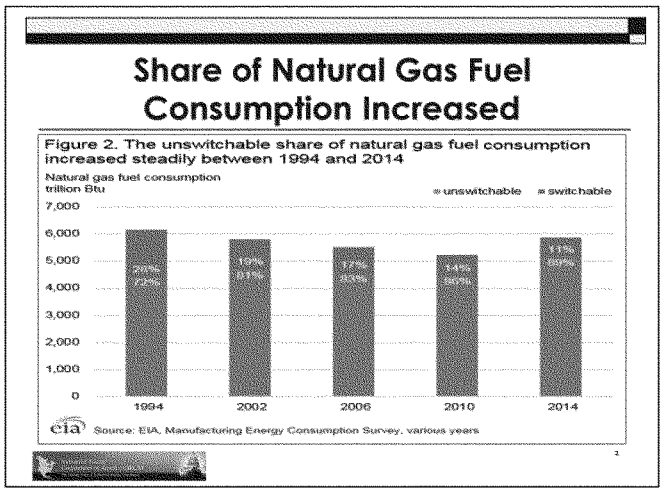


Figure 4

Status of LNG Exports at the Department of Energy (DOE):

- Non-Free Trade Agreement (NFTA) Countries
  Volume approved: 21.4 Bcf/day, 28.8% of 2017 U.S. demand
  Volume pending approval: 32.7 Bcf/day, 44.1% of U.S. demand
  Total applications: 51

- Free Trade Agreement (FTA) Countries
  Volume approved: 57.1 Bcf/day, 76.9% of 2017 U.S. demand
  Volume pending approval: 4.3 Bcf/day, 5.8% of U.S. demand
  Total applications: 55
  *Note: FTA and NFTA amounts are not additive.

Figure 5: Operating terminals with NFTA approval.

Terminals	Capacity (Bcf/d)
Sabine Pass	3.50
Dominion Cove Point	1.80
Total	**5.30 Bcf/d (7.1% of 2017 demand)**

Source: Company websites, 2017 U.S. natural gas demand was 74.22 Bcf/d.

Figure 6: Export terminals under construction with NFTA approval.

Terminals Approved, Under Construction	Capacity (Bcf/d)
Sempra-Cameron	2.10
Freeport	2.14
Cheniere-Corpus Christi	2.14
Sabine Pass	1.40
Southern LNG Company	0.35
Total	**8.13 Bcf/d (11.0% of 2017 demand)**

Source: LNG, Federal Energy Regulatory Commission, https://www.ferc.gov/industries/gas/indus-act/lng/lng-approved.pdf (as of July 13, 2018), 2017 U.S. natural gas demand was 74.22 Bcf/d.

Figure 7: Export terminals with NFTA approval and not under construction.

Terminals Approved, Not Under Construction	Capacity (Bcf/d)
Southern Union-Lake Charles LNG	2.20
Magnolia LNG	1.08
Sempra-Cameron LNG	1.41
ExxonMobil-Golden Pass	2.10
Total	**6.79 Bcf/d (9.1% of 2017 demand)**

Source: LNG, Federal Energy Regulatory Commission, https://www.ferc.gov/industries/gas/indus-act/lng/lng-approved.pdf (as of July 13, 2018), 2017 U.S. natural gas demand was 74.22 Bcf/d.

Figure 8: Applications to export in the process of NEPA approval at FERC.

Terminals	Capacity (Bcf/d)
Gulf LNG Liquefaction	1.50
Venture Global Calcasieu Pass	1.41
Texas LNG Brownsville	0.55
Rio Grande LNG	3.60
Annova LNG Brownsville	0.90
Port Arthur	1.86
Eagle LNG Partners	0.13
Venture Global LNG	3.40
Driftwood	4.00
Freeport	0.72
Jordan Cove	1.08
Cheniere-Corpus Christi	1.86
Commonwealth LNG	1.18
Port Fourchon LNG	0.65
Delfin LNG	1.80
Total	**24.64 Bcf/d (33.2% of 2017 demand)**

Source: LNG, Federal Energy Regulatory Commission, https://www.ferc.gov/industries/gas/indus-act/lng/lng-proposed-export.pdf (as of July 13, 2018), 2017 U.S. natural gas demand was 74.22 Bcf/d.

Figure 9: Applications to export approved by DOE for shipment to both FTA and NFTA countries.

Terminals Given Final Approval by DOE	Capacity (Bcf/d)	
FTA and NFTA volumes not additive.	**FTA**	**NFTA**
Sabine Pass	2.20	2.20
Freeport	1.40	1.40
Lake Charles	2.00	2.00
Carib Energy	0.03	0.04
Dominion Cove Point	1.00	0.77
Cameron LNG	1.70	1.70
Freeport	1.40	0.40
Southern LNG Company	0.36	0.36
Golden Pass	2.00	2.20
Cheniere-Corpus Christi	2.10	2.10
Sabine Pass	0.28	0.28
Sabine Pass	0.24	0.24
Sabine Pass	0.86	0.86
Delfin LNG	1.80	1.80
Magnolia	0.54	1.08
Sabine Pass	0.56	0.56
Cameron	0.42	0.42
Air Flow North America	N/A	0.002
American LNG Marketing	0.008	0.008
Cameron	1.41	1.41
Floridian Natural Gas Storage	0.04	0.04
Flint Hills Resources	0.01	0.01
Carib Energy	N/A	0.004
Freeport	N/A	0.34
Lake Charles	0.33	0.33
Eagle LNG Partners	0.01	0.01
Jordan Cove	1.20	0.80
Gulf LNG Liquefaction	1.50	Under review
SB Power Solutions	0.07	N/A
CE FLNG	1.07	Under review
Magnolia	0.54	N/A
MPEH	3.22	Under review
Venture Global Calcasieu Pass	0.67	Under review
Advanced Energy Solutions	0.02	N/A
Argent Marine Management	0.003	N/A
Eos LNG	1.60	Under review
Barca LNG	1.60	Under review
Annova LNG	0.94	N/A
Strom Inc.	0.08	Under review
SCT&E LNG	1.60	Under review
Venture Global Calcasieu Pass	0.67	Under review
Venture Global Calcasieu Pass	0.36	Under review

Terminals Given Final Approval by DOE	Capacity (Bcf/d)	
***FTA and NFTA volumes not additive.**	**FTA**	**NFTA**
American LNG Marketing	0.08	N/A
G2 LNG	1.84	Under review
Port Arthur LNG	1.42	Under review
Texas LNG Brownsville	0.55	Under review
Corpus Christi Liquefaction	1.41	Under review
Rio Grande LNG	3.61	Under review
Eagle LNG Partners	0.14	Under review
Venture Global Plaquemines	3.40	Under review
Driftwood LNG	4.10	Under review
Fourchon LNG	0.71	Under review
Galveston Bay LNG	2.15	Under review
Blue Water Fuels	0.007	N/A
Totals	**55.26**	**21.4**

Source: Long Term Applications Received by DOE/FE to Export, U.S. Department of Energy, https://www.energy.gov/sites/prod/files/2018/06/f53/Summary%20of%20LNG%20Export%20Applications_0.pdf (as of June 26, 2018)

Figure 10

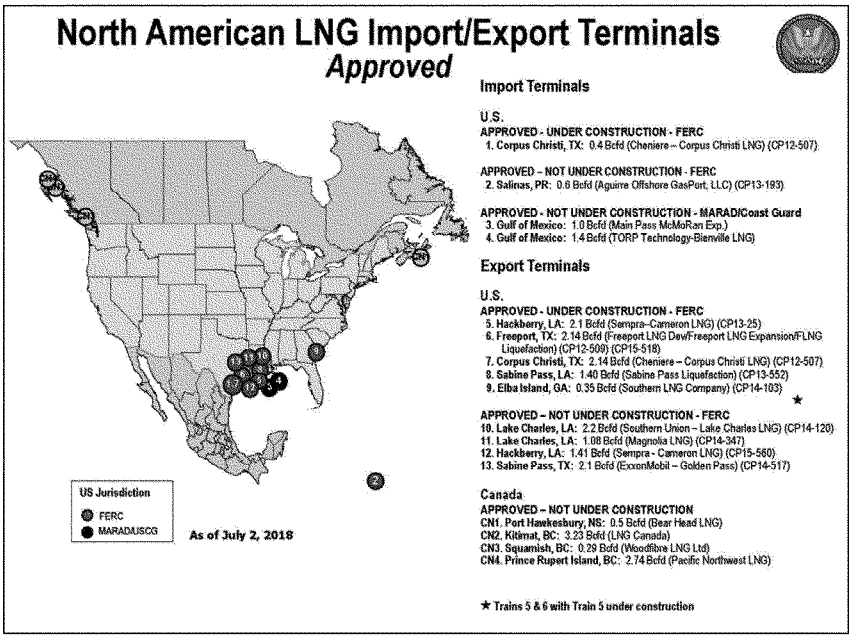
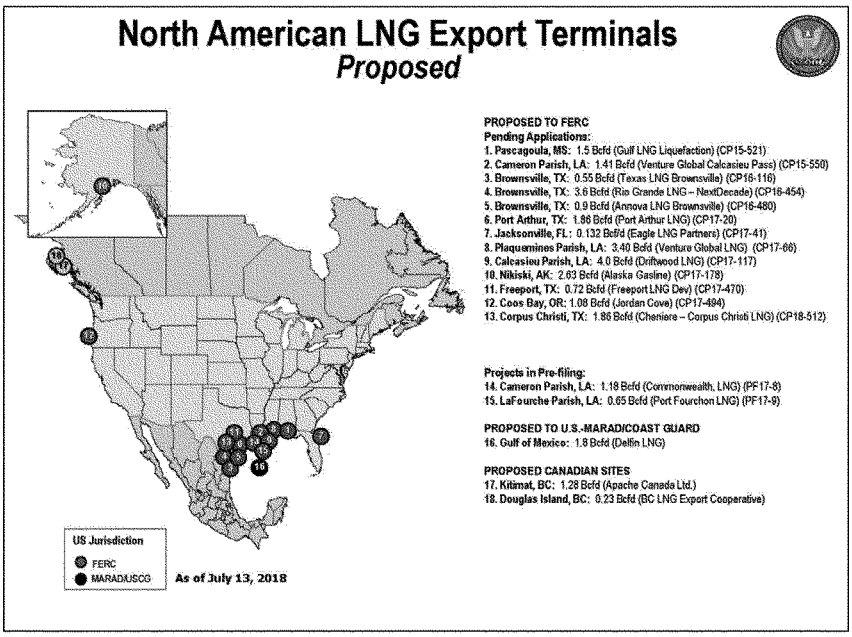


Figure 11


North American LNG Export Terminals
Proposed
PROPOSED TO FERC
Pending Applications:
1. Pascagoula, MS: 1.5 Bcfd (Gulf LNG Liquefaction) (CP15-521)
2. Cameron Parish, LA: 1.41 Bcfd (Venture Global Calcasieu Pass) (CP15-550)
3. Brownsville, TX: 0.55 Bcfd (Texas LNG Brownsville) (CP16-116)
4. Brownsville, TX: 3.6 Bcfd (Rio Grande LNG – NextDecade) (CP16-454)
5. Brownsville, TX: 0.9 Bcfd (Annova LNG Brownsville) (CP16-480)
6. Port Arthur, TX: 1.86 Bcfd (Port Arthur LNG) (CP17-20)
7. Jacksonville, FL: 0.132 Bcf/d (Eagle LNG Partners) (CP17-41)
8. Plaquemines Parish, LA: 3.40 Bcfd (Venture Global LNG) (CP17-66)
9. Calcasieu Parish, LA: 4.0 Bcfd (Driftwood LNG) (CP17-117)
10. Nikiski, AK: 2.63 Bcfd (Alaska Gasline) (CP17-178)
11. Freeport, TX: 0.72 Bcfd (Freeport LNG Dev) (CP17-470)
12. Coos Bay, OR: 1.08 Bcfd (Jordan Cove) (CP17-494)
13. Corpus Christi, TX: 1.86 Bcfd (Cheniere – Corpus Christi LNG) (CP18-512)
Projects in Pre-filing:
14. Cameron Parish, LA: 1.18 Bcfd (Commonwealth, LNG) (PF17-8)
15. LaFourche Parish, LA: 0.65 Bcfd (Port Fourchon LNG) (PF17-9)
PROPOSED TO U.S.-MARAD/COAST GUARD
16. Gulf of Mexico: 1.8 Bcfd (Delfin LNG)
PROPOSED CANADIAN SITES
17. Kitimat, BC: 1.28 Bcfd (Apache Canada Ltd.)
18. Douglas Island, BC: 0.23 Bcfd (BC LNG Export Cooperative)
US Jurisdiction
FERC
MARAD/USCG
As of July 13, 2018